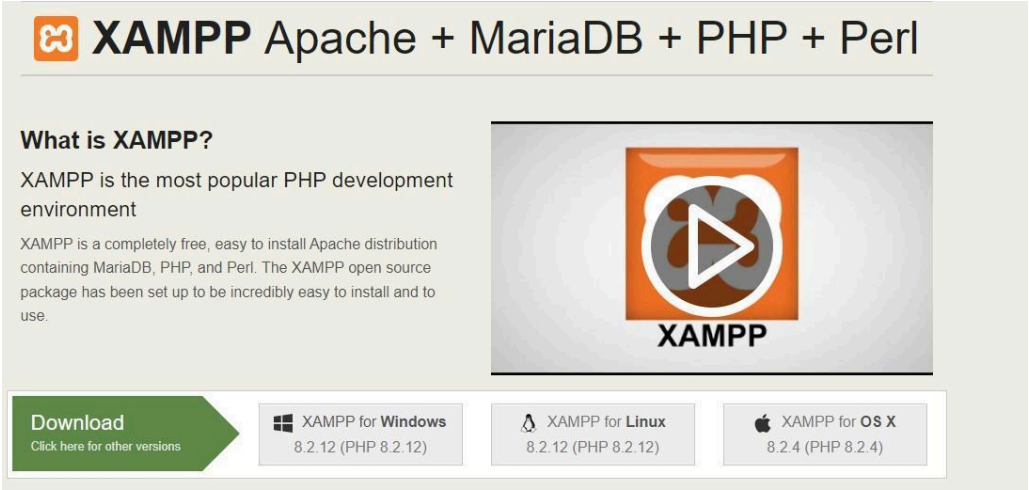
NAME: HIMANSHU NAIK
DIV:D15C
ROLL NO :63

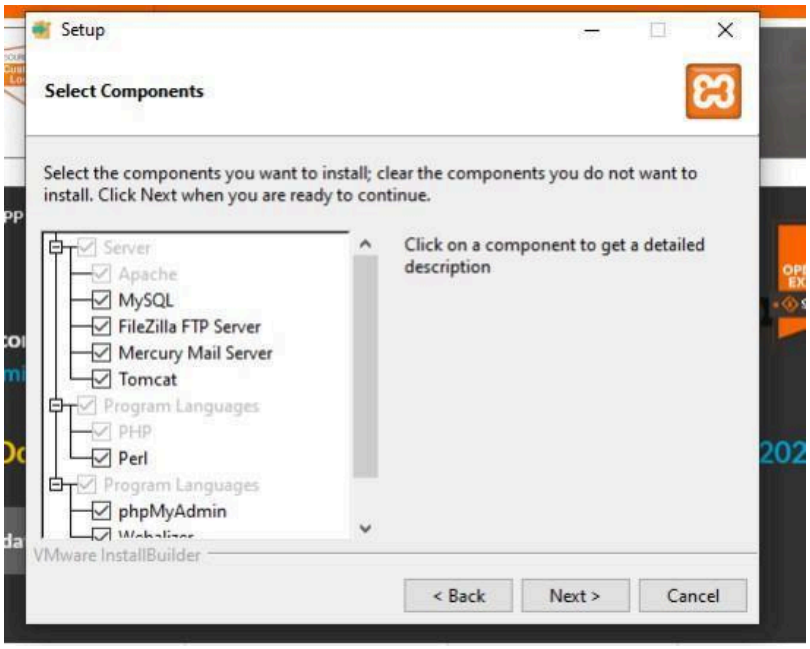
Exp 1A :Static Hosting:

1) On local server (XAMPP) Step 1: Install XAMPP

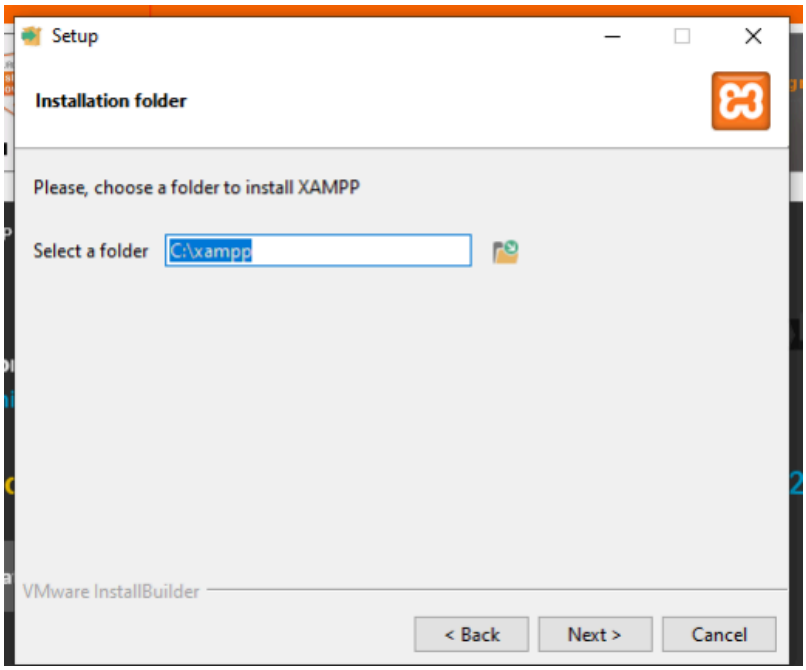
1) Select your OS. It will automatically start downloading.



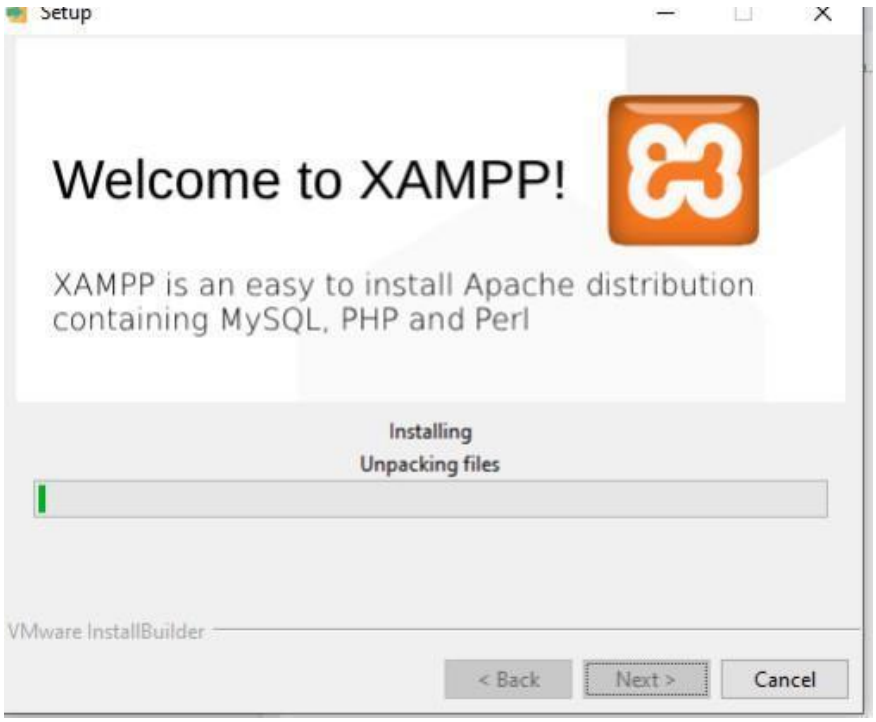
2) Open the setup file. Select all the required components and click next



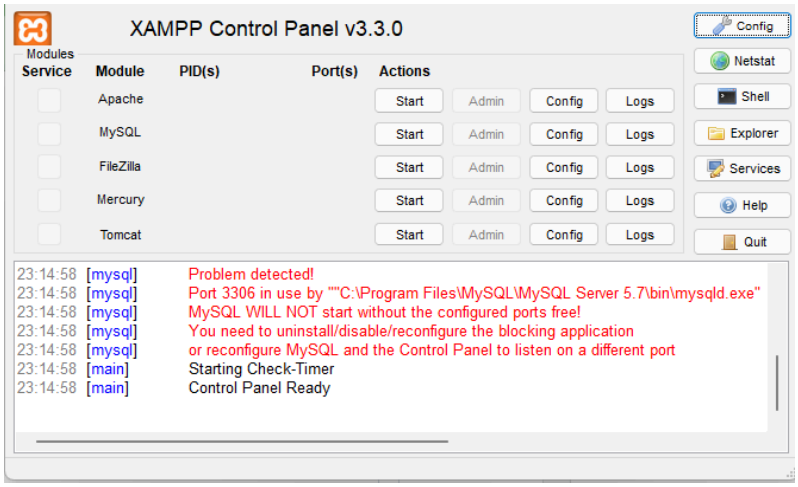
3) Choose the folder to install XAMPP in. Make sure the folder is empty. Click next



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



Open XAMPP Control Panel, start the Apache service (Required) and mySQL service



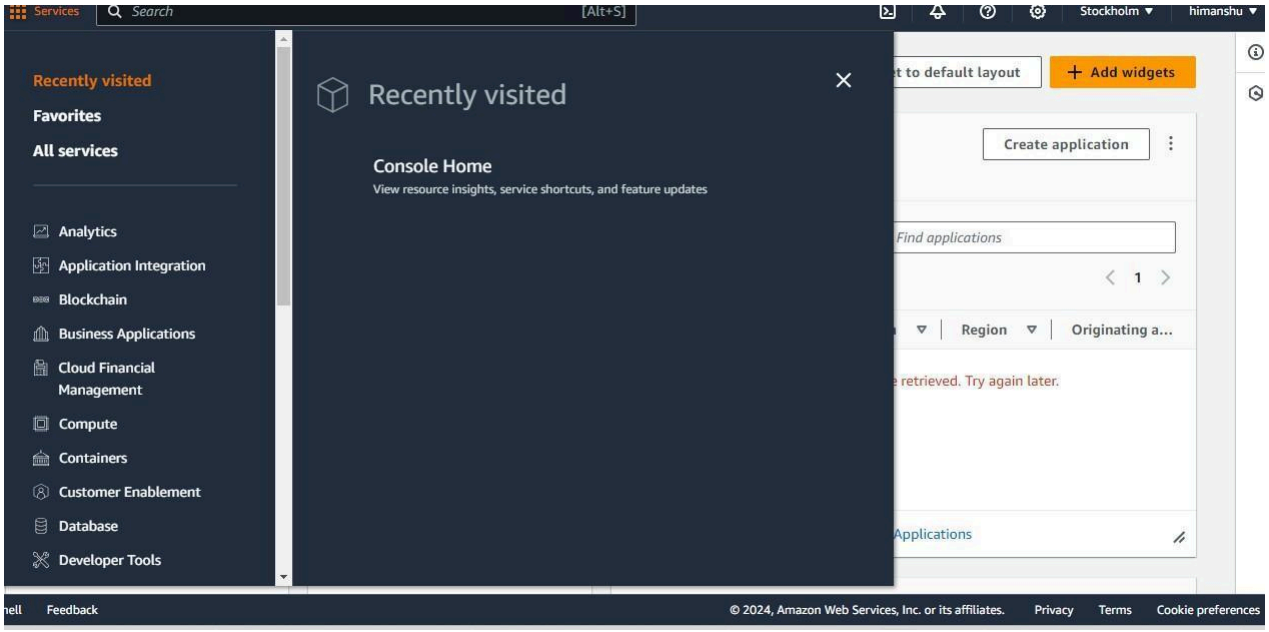
Go in the browser and type localhost and hit enter you will get to see the file you created like in this case index1.php

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

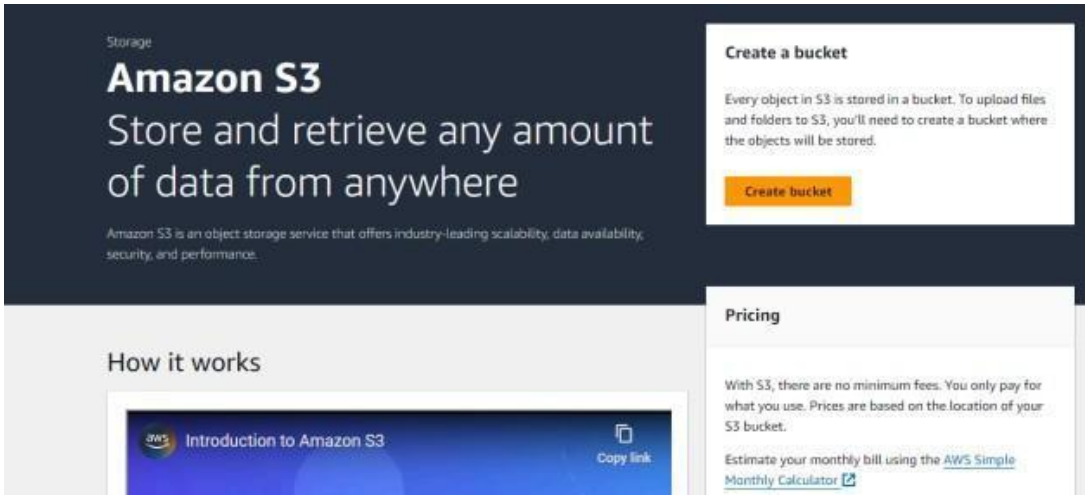
Hosting a static website on Amazon S3

After creating the bucket on AWS add the file in it that is to be hosted and configure the visibility as public and add /* at the end of the resource key.

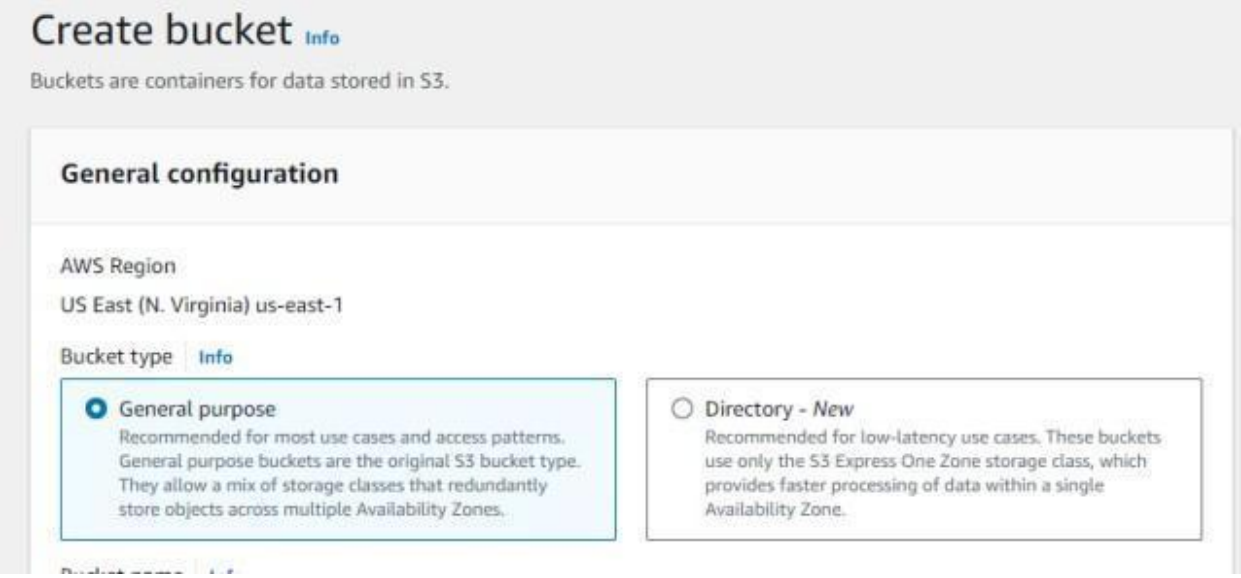
2) AWS S3 Step 1: Login to your AWS account. Go to services and open S3



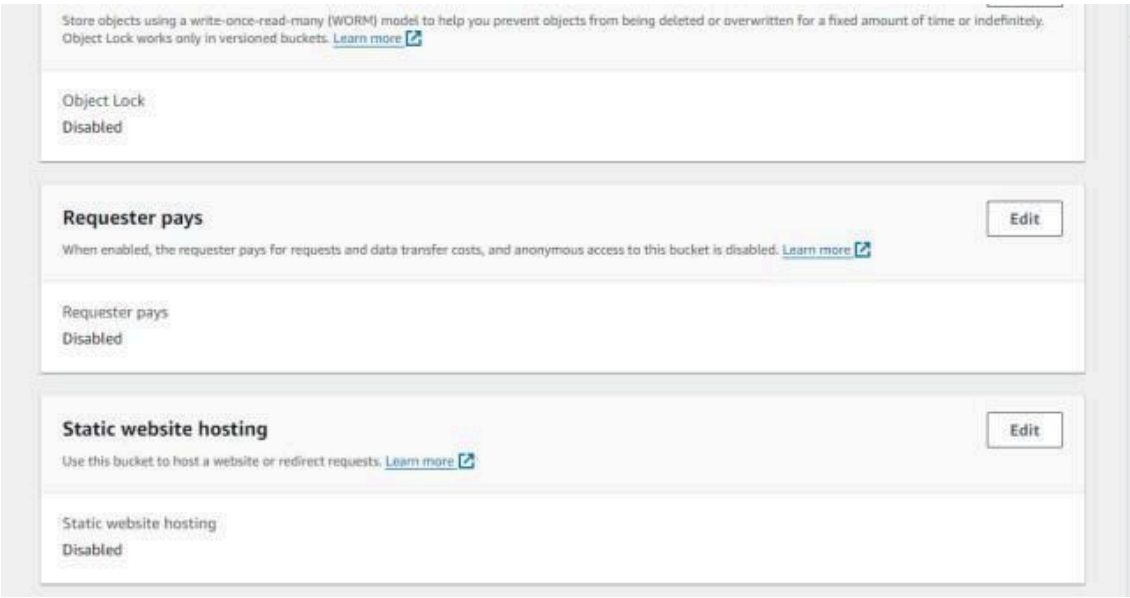
Step 2: Click on Create Bucket



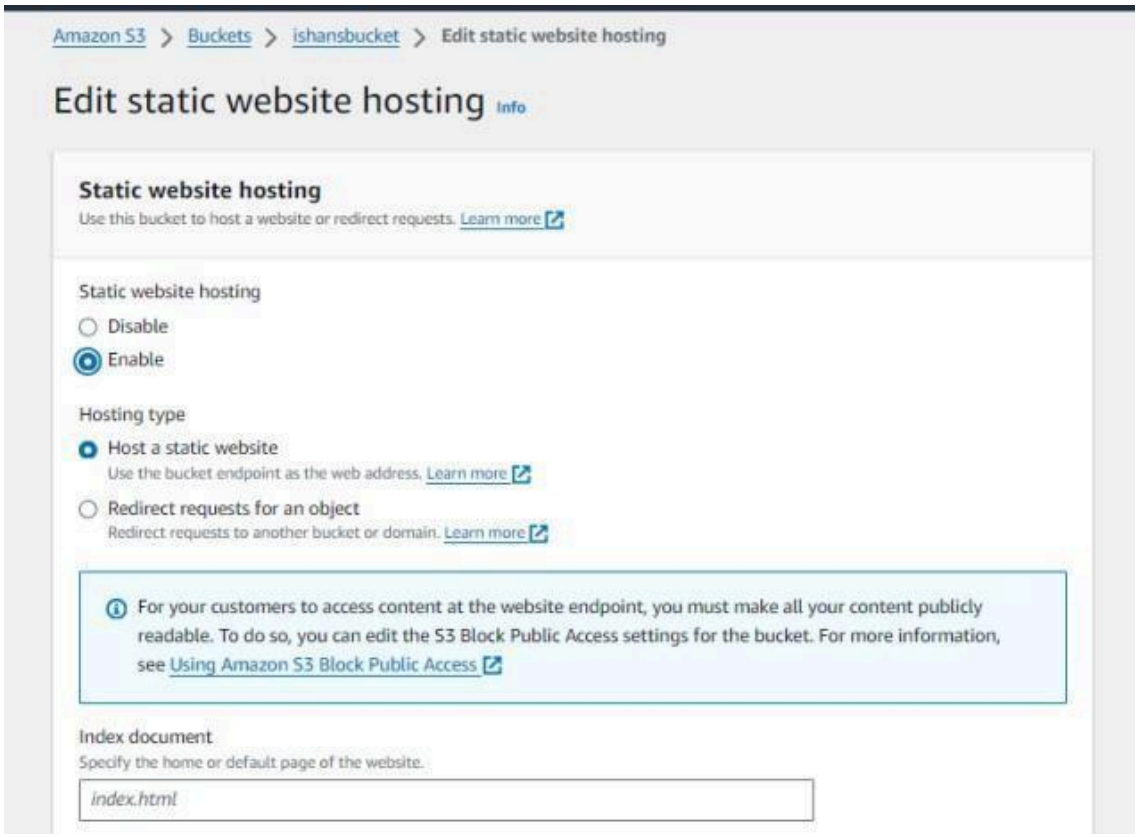
Step 3: Give a name to your bucket, keeping other options default, scroll down and click on Create Bucket



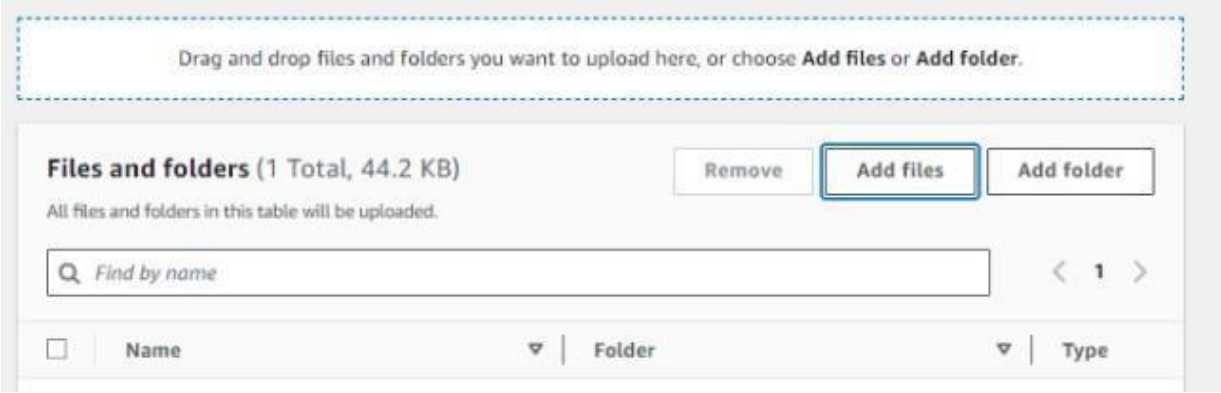
Step4: Scroll down till you find Static website hosting, click on edit



Step 5: 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 6: Go to Objects tab and click on upload file



Step 7: 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 8: 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 9: Uncheck the Block all public access checkbox and click on save

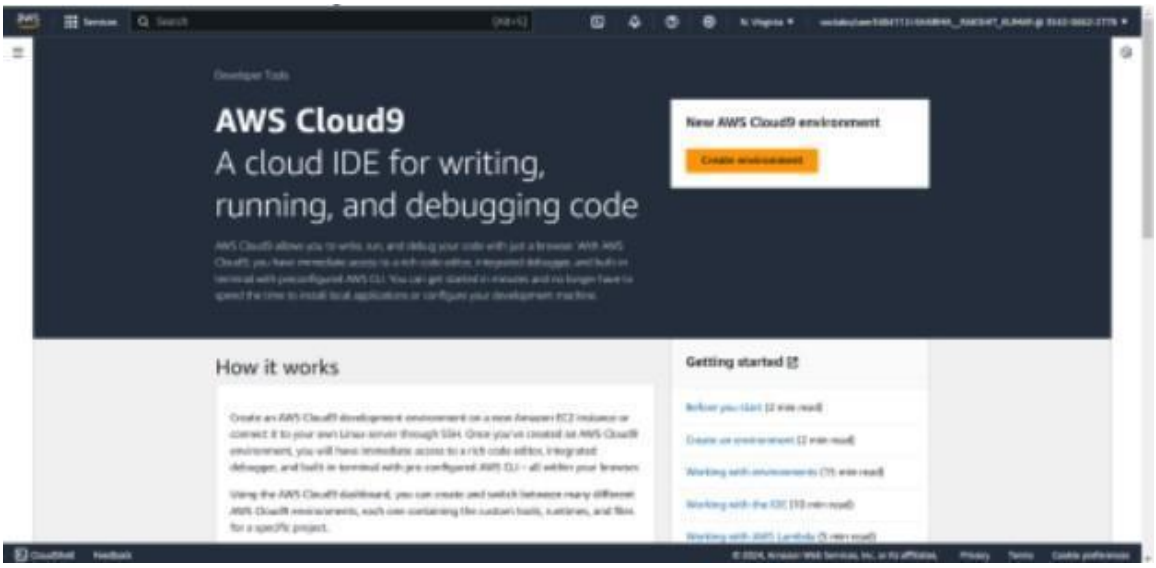
```
{
"Version": "2012-10-17",
 "Statement": [
{
"Sid":
"PublicReadGetObject",
"Effect": "Allow",
"Principal": { "AWS": "*"
 },
"Action": "s3:GetObject",
"Resource": "arn:aws:s3:::YOUR-BUCKET-NAME-HERE/*" }
]
}
```

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

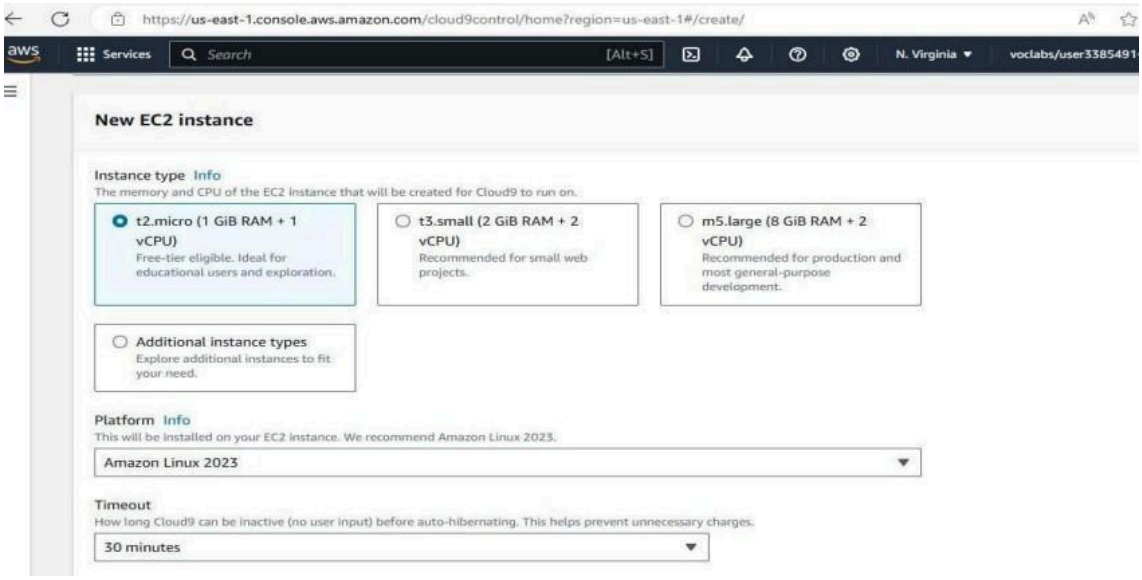
Save the changes.

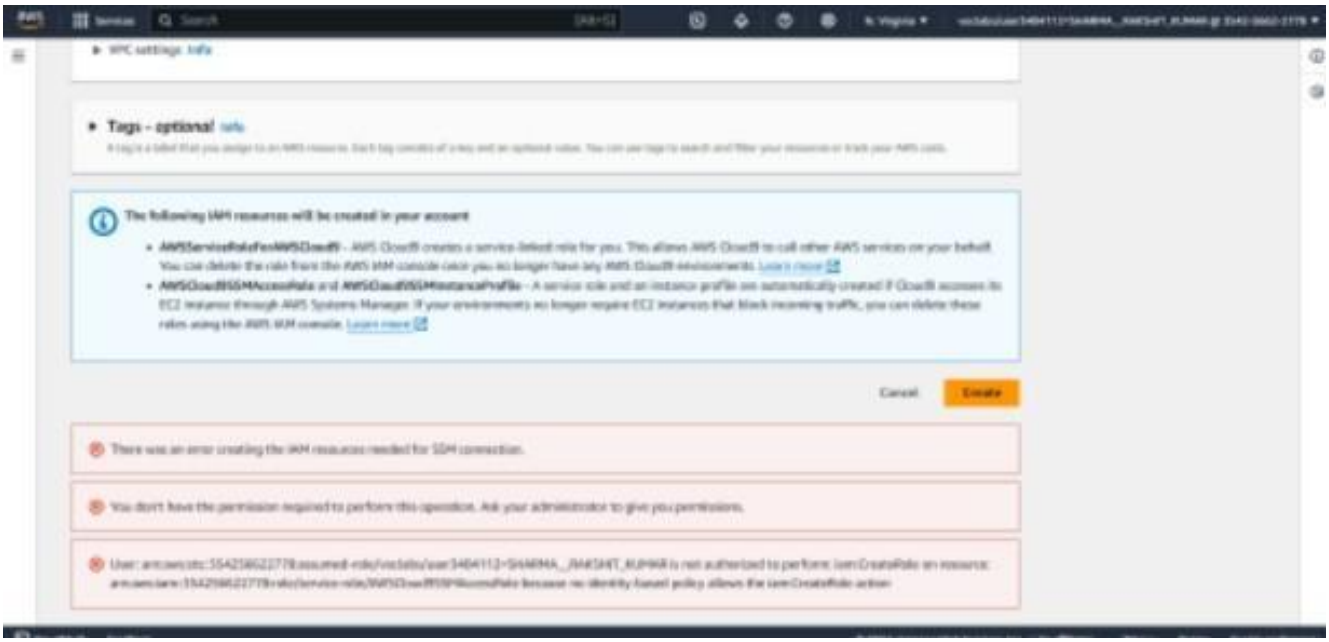
Experiment 1B: IAM and cloud9

1. Open the AWS account and search for Cloud9.

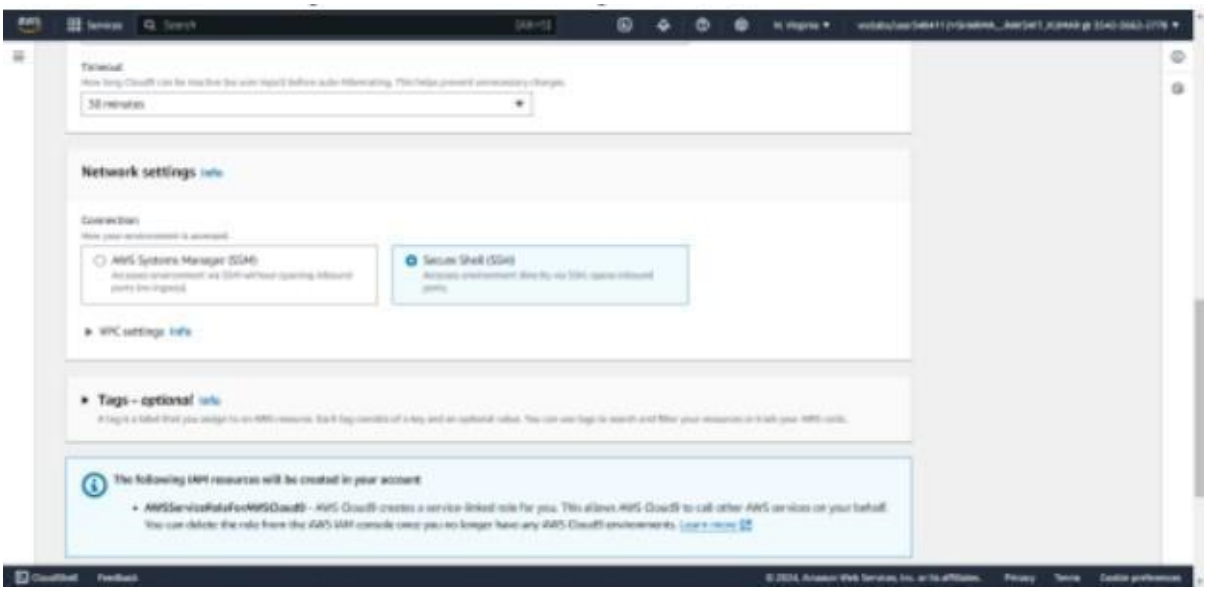


2. Enter the name and other required configuration for creating an environment. In network settings, using the AWS system manager gives an error while creating the environment

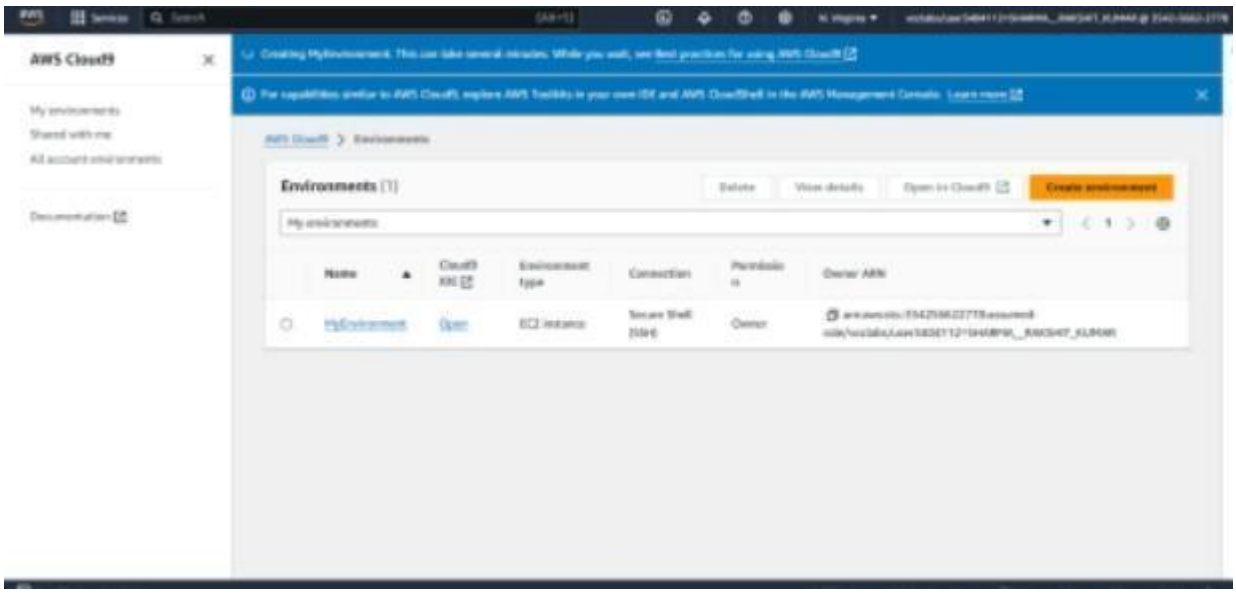




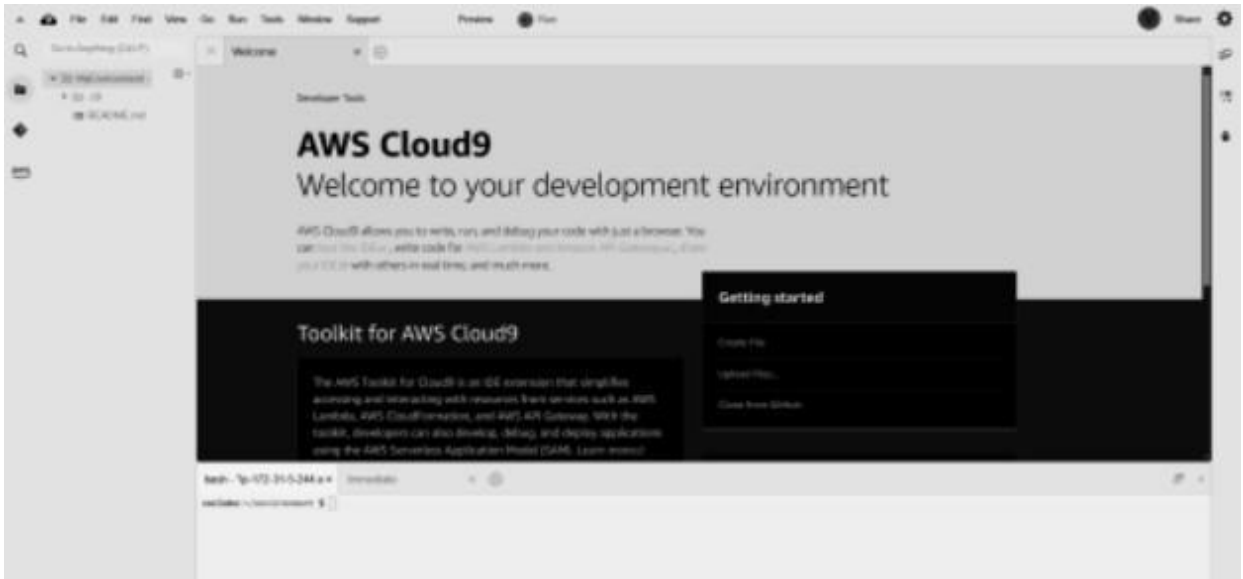
3. Use the Secure Shell option in Network settings.



4. Once the configuration is complete, click on create environment to create a Cloud9 environment.

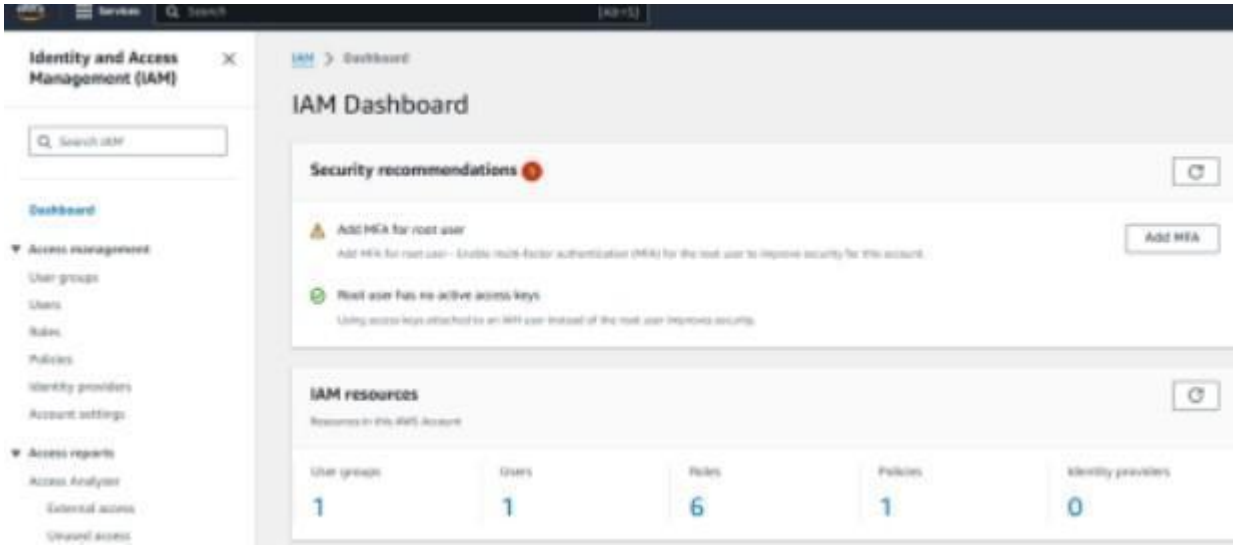


5. Cloud9 Environment.is opened when u click on the environment name



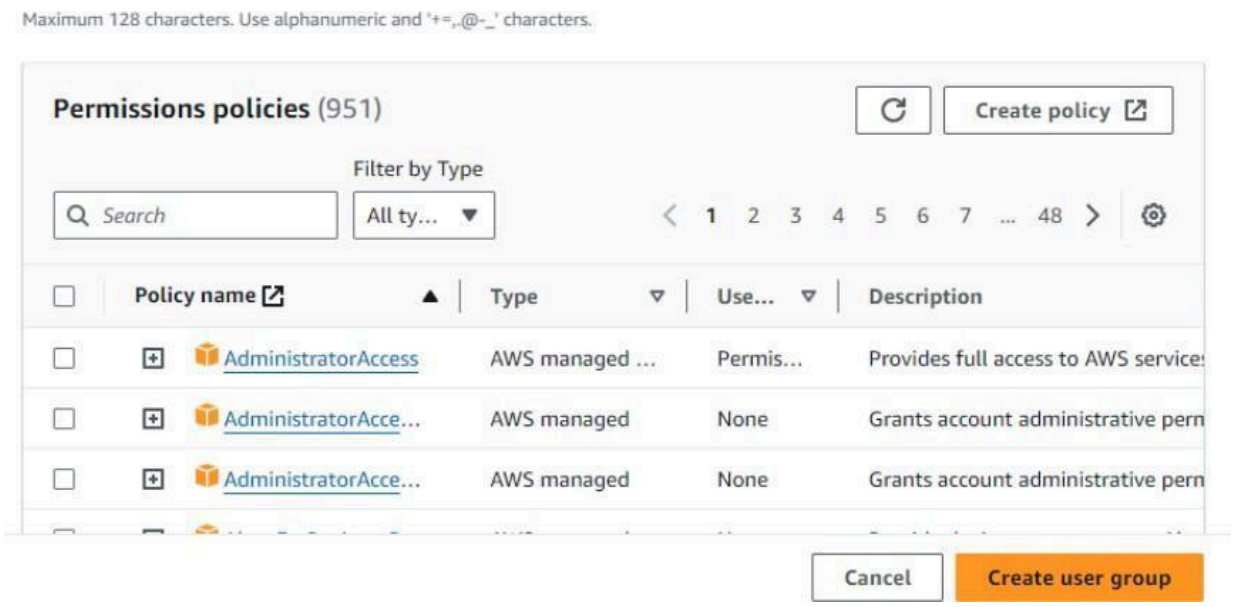
IAM user creation steps

1. Open the aws account and search for IAM in service.

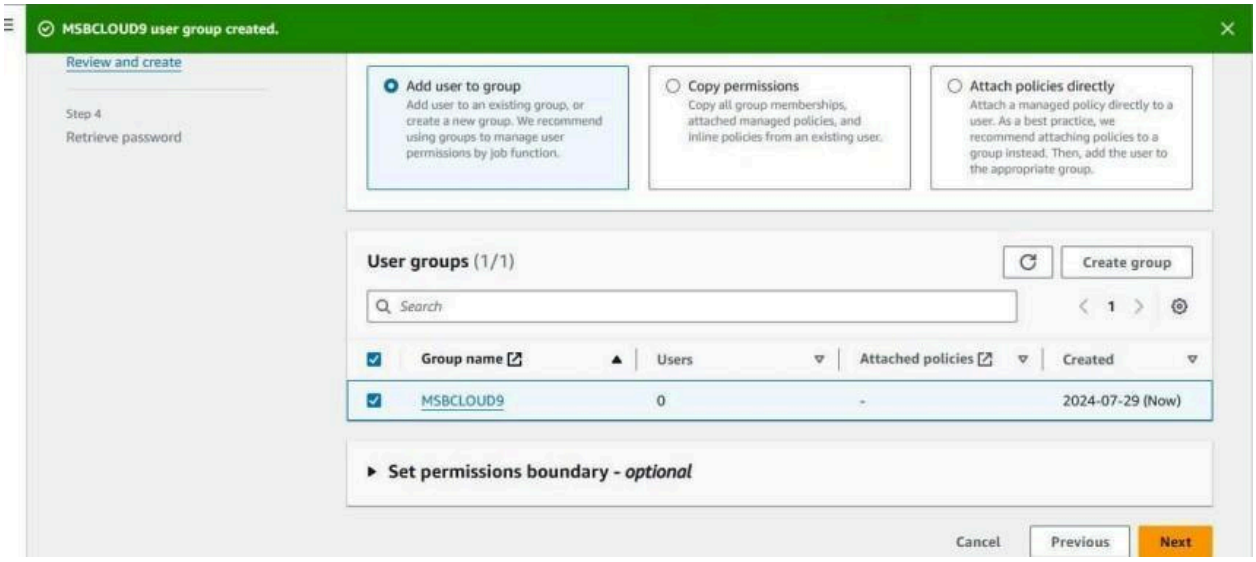


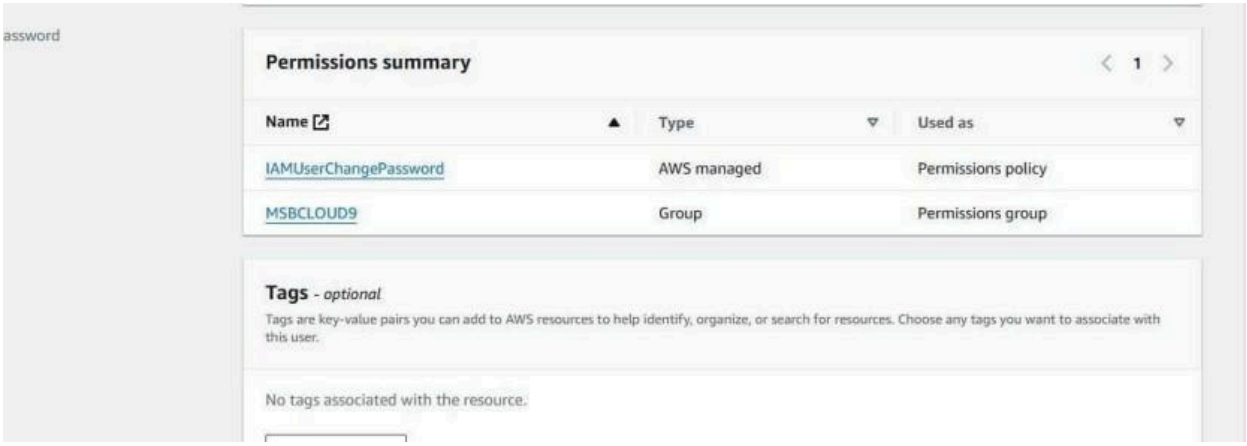
2. Select the users option from the left panel and click on create user button.Give the user name

3. Click the add user option if you don't have an existing user group

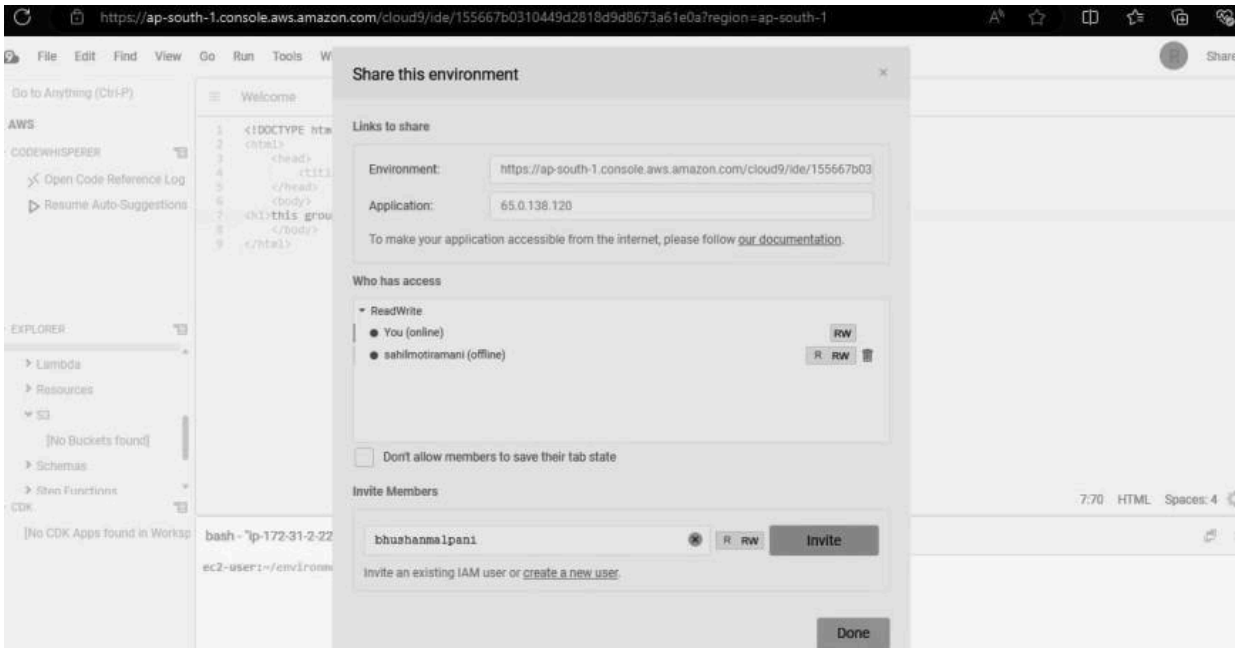


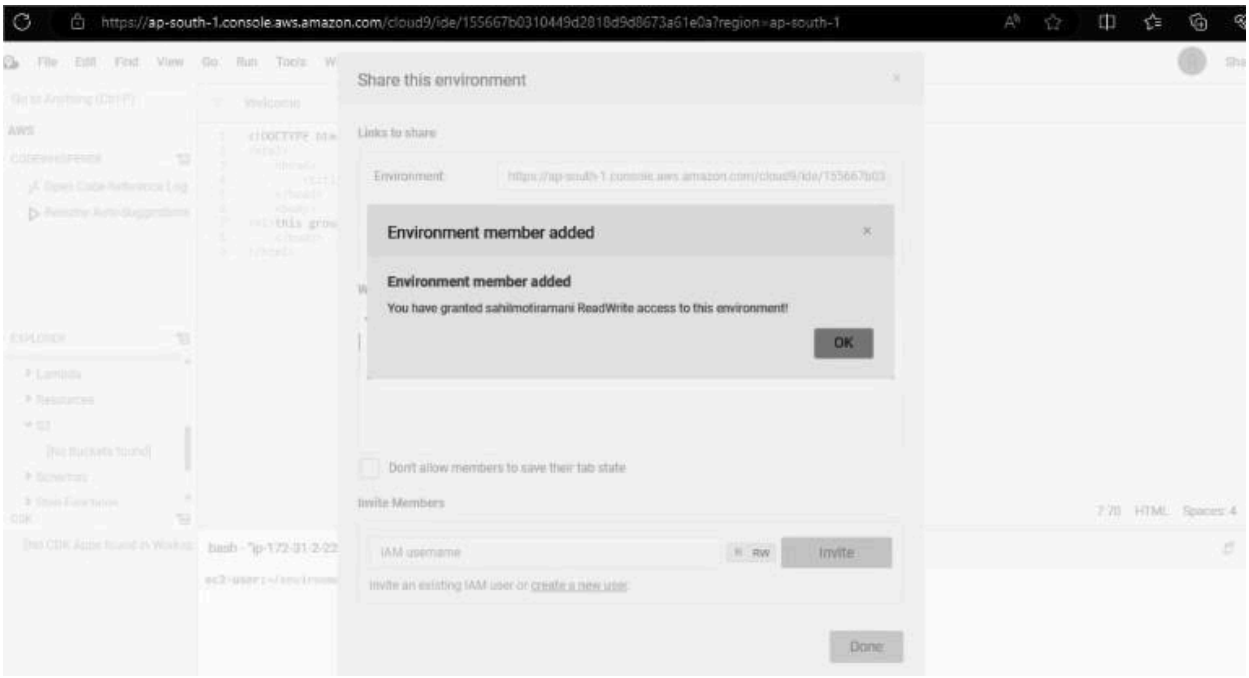
Similarly, create a new group and provide a suitable name for them. Include the IAM users in this group together for our convenience, that is, to provide similar kinds of permissions to the entire group rather than an individual user





Go back to the cloud9 environment. Click on the share this environment option so as to allow other collaborators to access your environment. Include your newly made IAM user in this environment and enable Read/Write permissions for it.

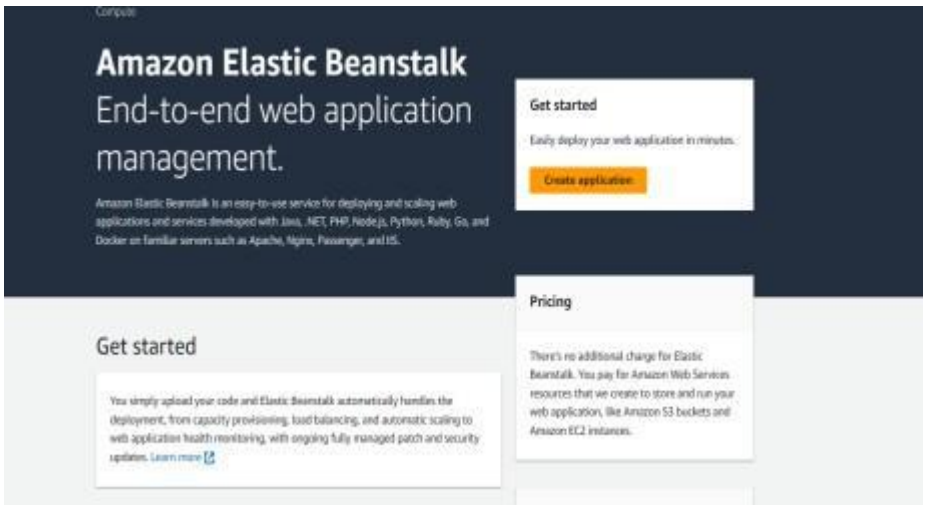




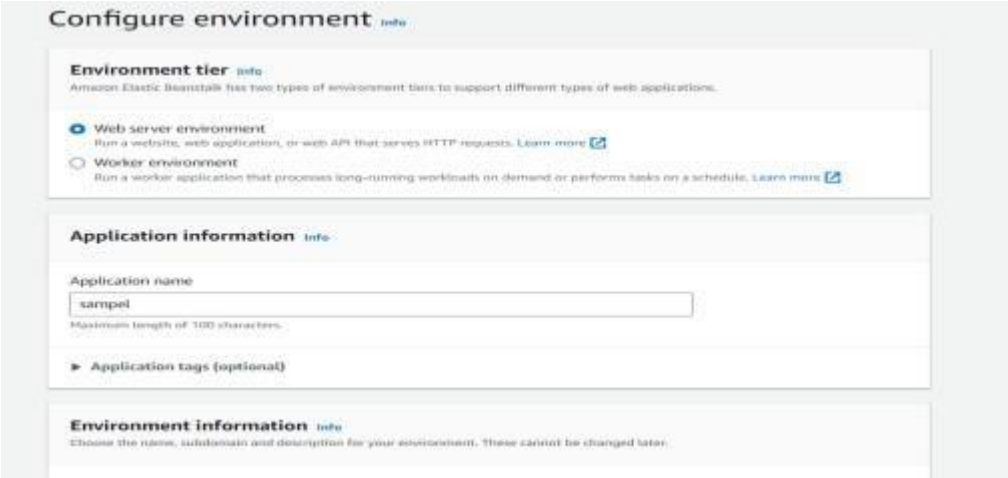
Further, we are supposed to login from another browser using the credentials of the IAM user, to access the shared cloud9 environment with us. These steps could not be completed because Cloud9 services have been disrupted and there is no access to the IAM user from the remote login.

EXPERIMENT NO:2

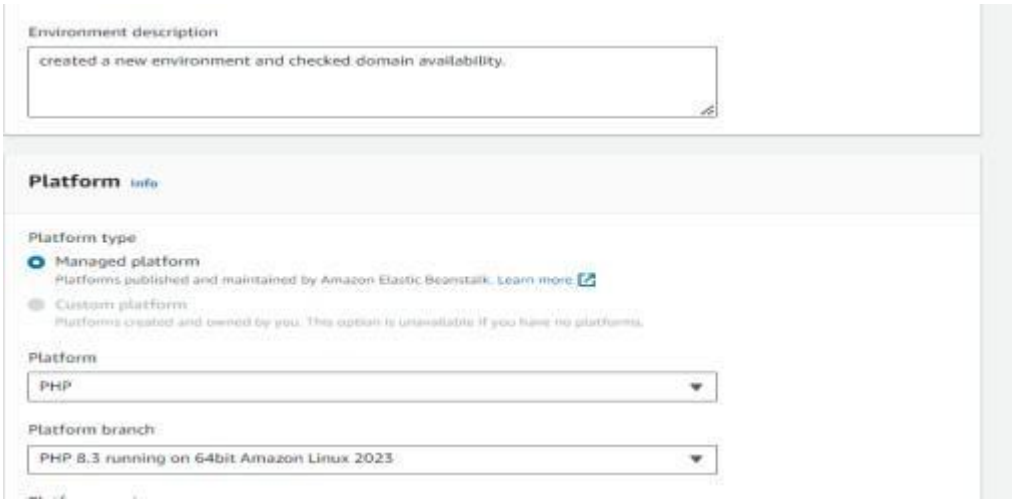
1) Go to services and choose elastic Beanstalk. following page will appear



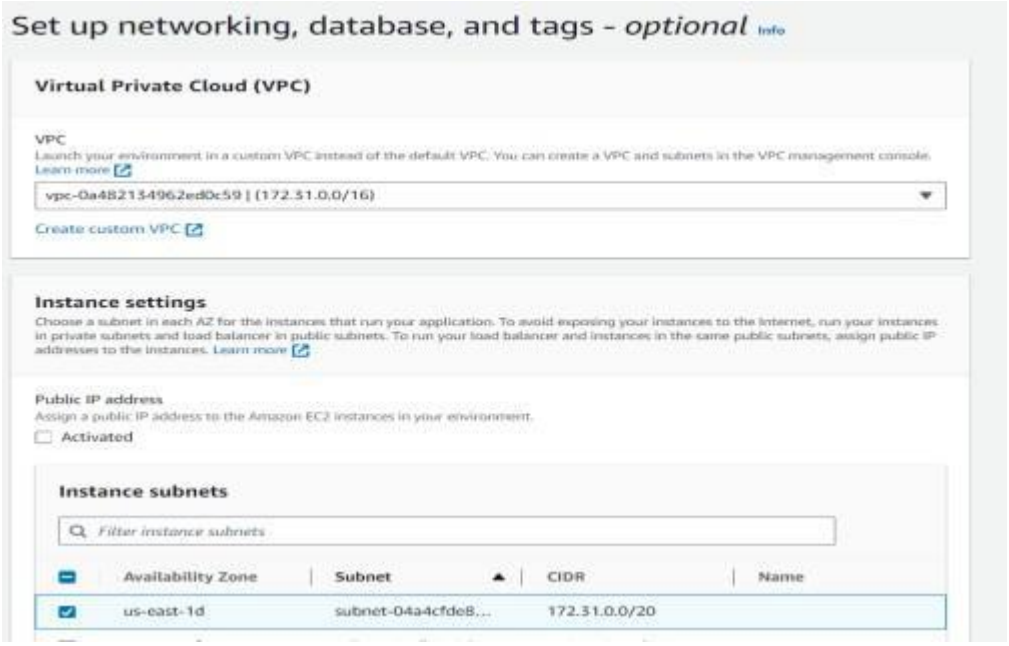
2) Configure the environment. Give the application name, check domain availability and choose PHP as platform.Then click next.



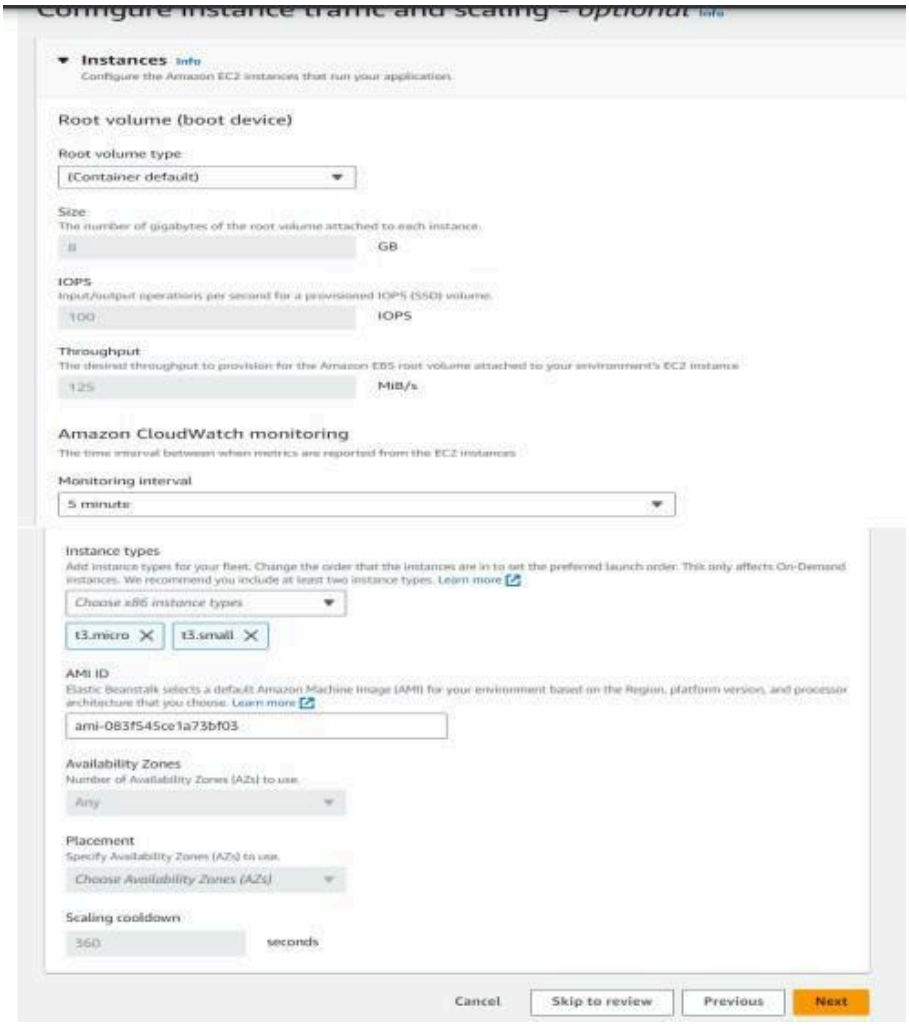
3) Configure the service access



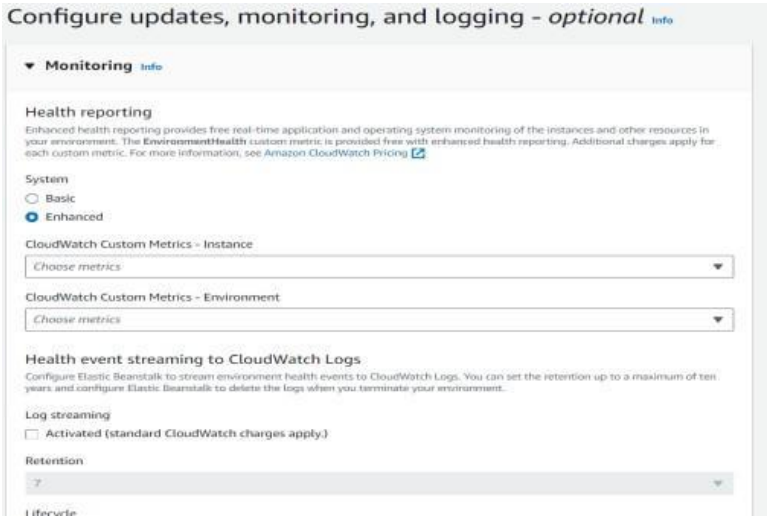
4) Choose one of the available VPC and instance subnet. Click next

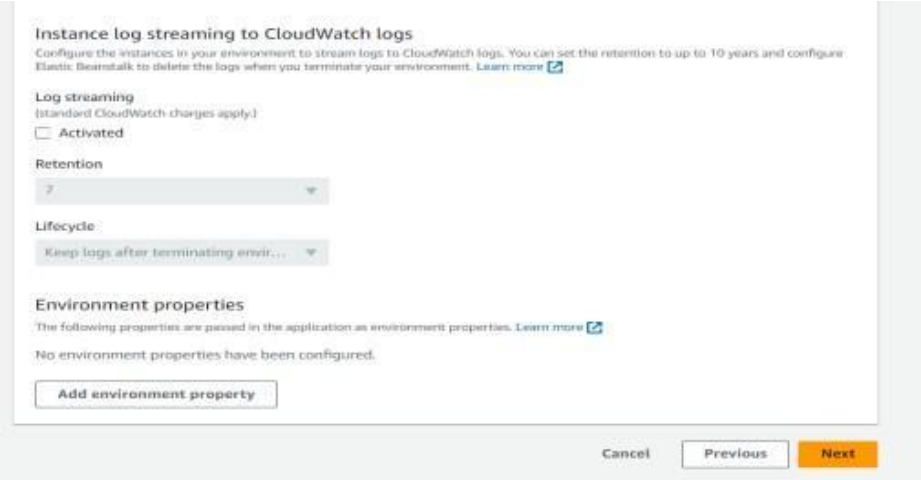


5) Configure instance traffic and scaling. Keep all the options as default

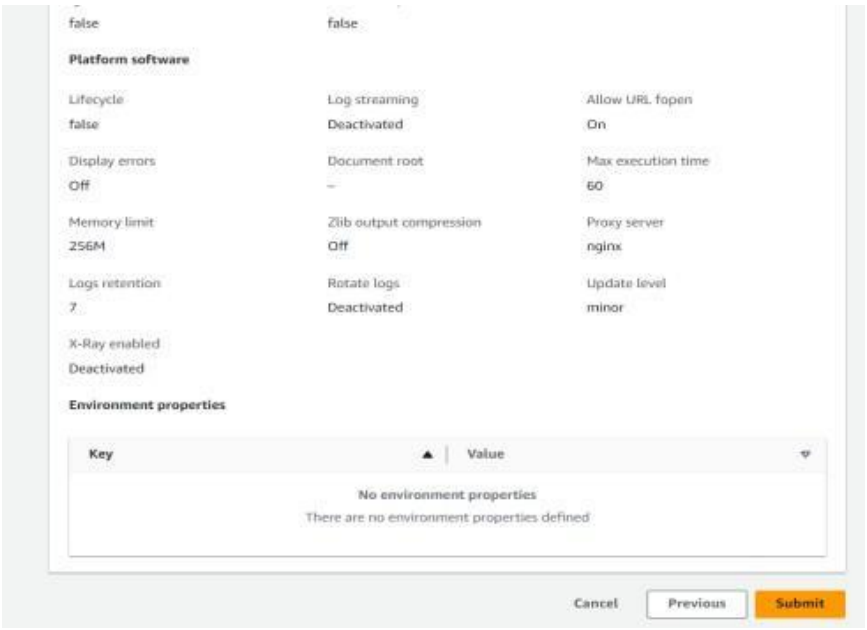


6) Configure updates, monitoring, and logging. Keep everything as default and click next.

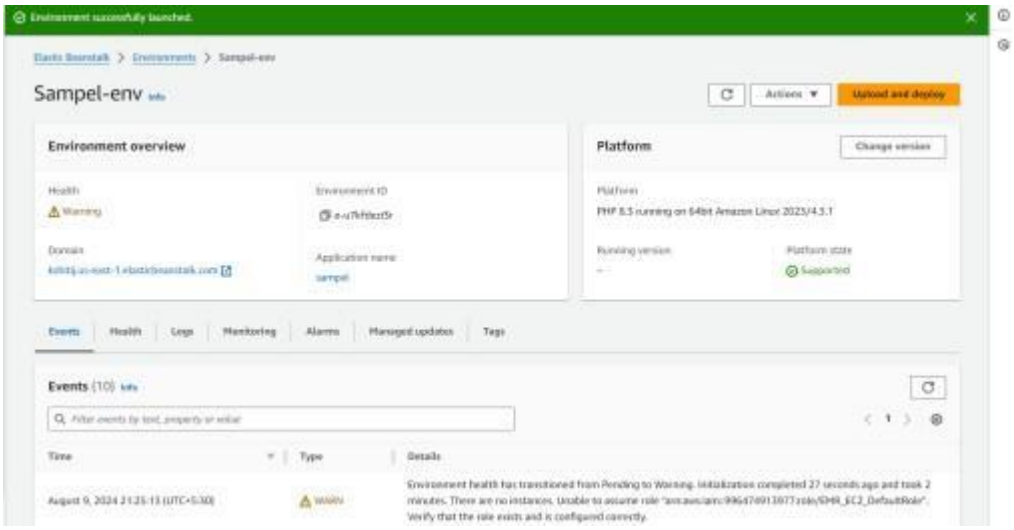




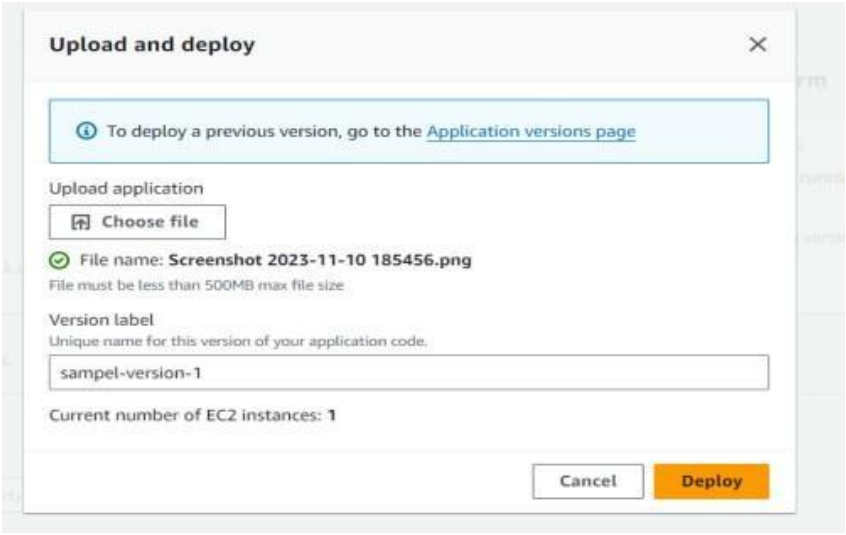
7) Click submit.

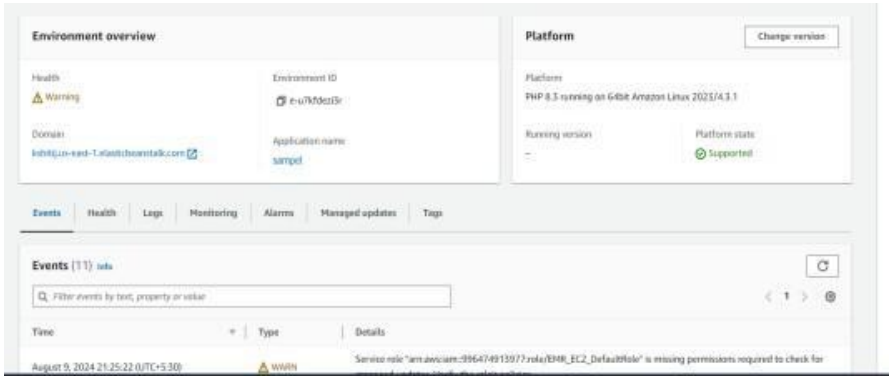


8) Environment has been created successfully.



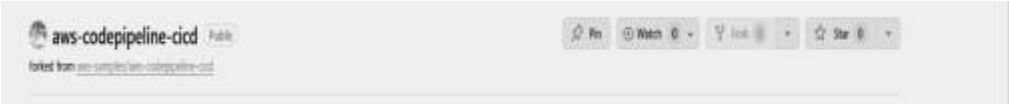
9) Deploy something on the recently created environment



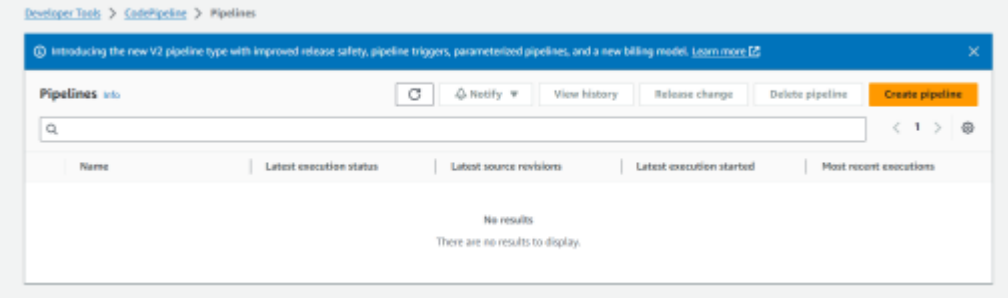


Pipeline Creation:

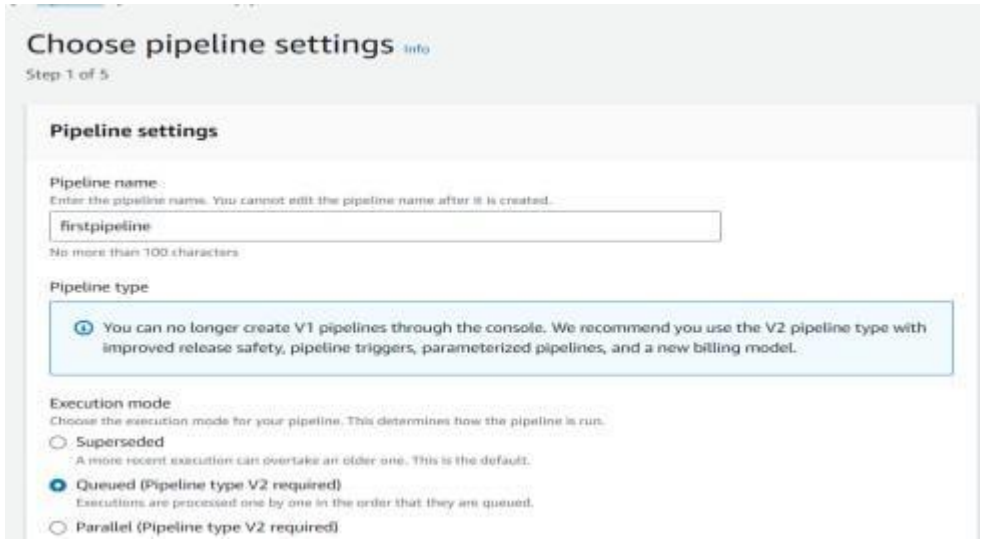
1) Fork a git-hub repository. This forked repository will act as source for your code pipeline.

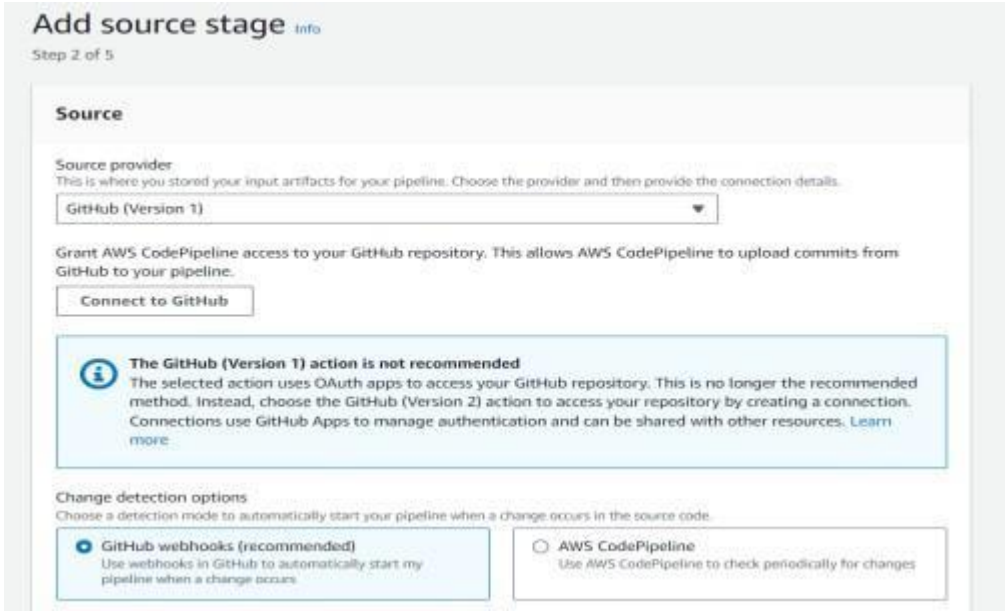


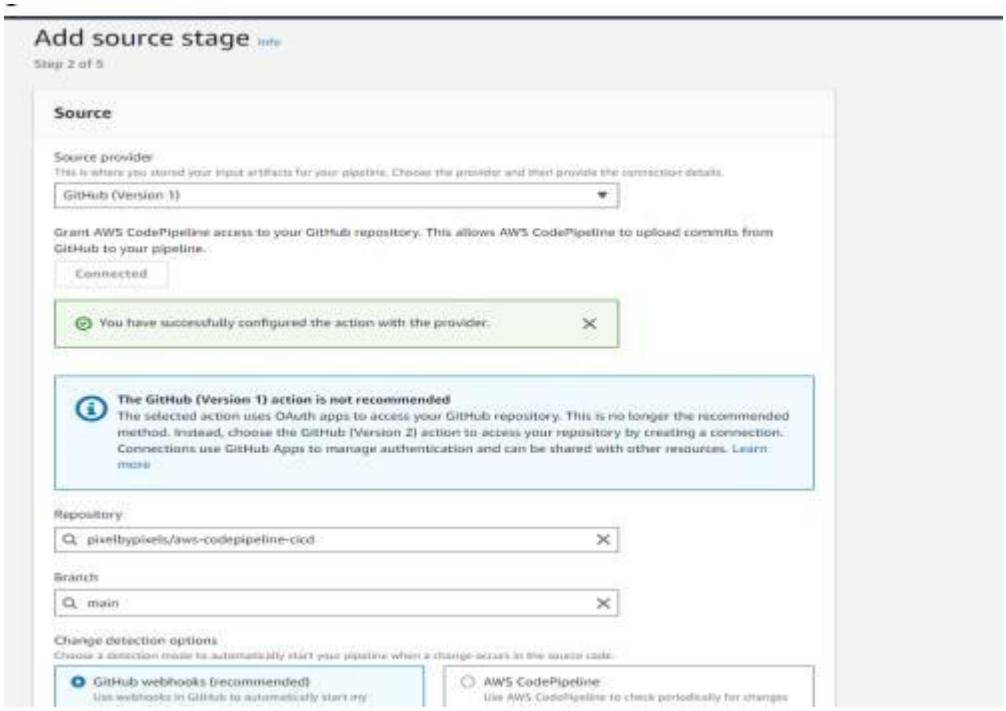
2) Go to developer tools and select CodePipeline and create a new pipeline



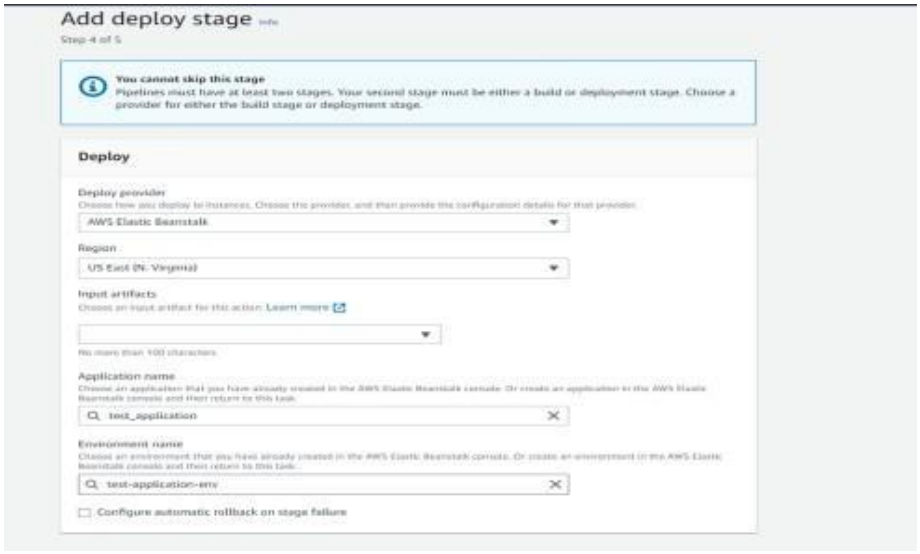
3) Create a pipeline:


Choose pipeline settings Info
Step 1 of 5
Pipeline settings
Pipeline name
Enter the pipeline name. You cannot edit the pipeline name after it is created.
firstpipeline
No more than 100 characters
Pipeline type
You can no longer create V1 pipelines through the console. We recommend you use the V2 pipeline type with improved release safety, pipeline triggers, parameterized pipelines, and a new billing model.
Execution mode
Choose the execution mode for your pipeline. This determines how the pipeline is run.
Superseded
A more recent execution can overtake an older one. This is the default.
Queued (Pipeline type V2 required)
Executions are processed one by one in the order that they are queued.
Parallel (Pipeline type V2 required)

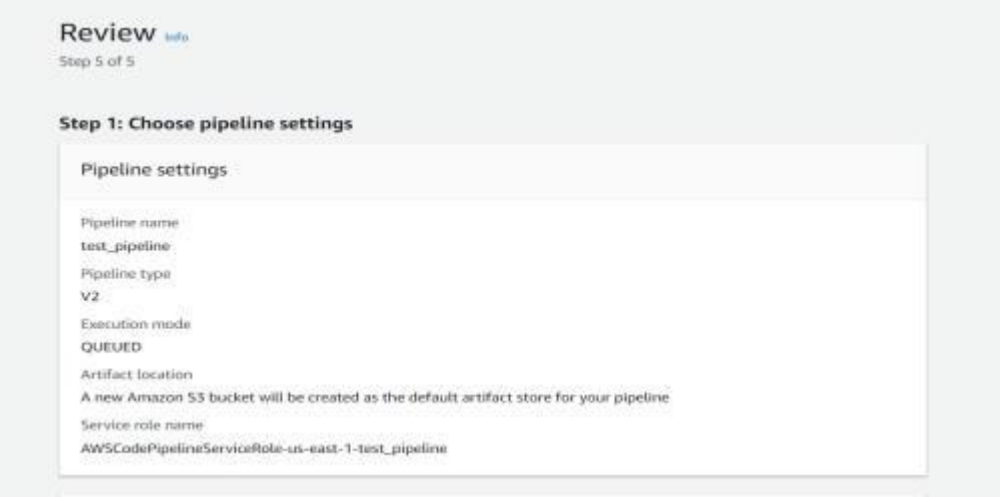

Add source stage Info
Step 2 of 5
Source
Source provider
This is where you stored your input artifacts for your pipeline. Choose the provider and then provide the connection details.
GitHub (Version 1)
Grant AWS CodePipeline access to your GitHub repository. This allows AWS CodePipeline to upload commits from GitHub to your pipeline.
Connect to GitHub
The GitHub (Version 1) action is not recommended
The selected action uses OAuth apps to access your GitHub repository. This is no longer the recommended method. Instead, choose the GitHub (Version 2) action to access your repository by creating a connection. Connections use GitHub Apps to manage authentication and can be shared with other resources. Learn more
Change detection options
Choose a detection mode to automatically start your pipeline when a change occurs in the source code.
GitHub webhooks (recommended)
Use webhooks in GitHub to automatically start my pipeline when a change occurs
AWS CodePipeline
Use AWS CodePipeline to check periodically for changes



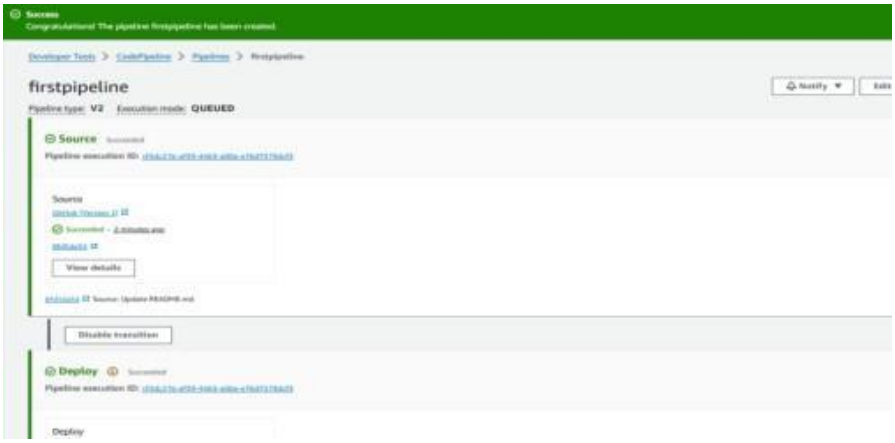
5) Go to the deploy stage and ensure the following settings



6) review the pipeline settings.



7) Then go ahead and check the URL provided in the EBS environment.



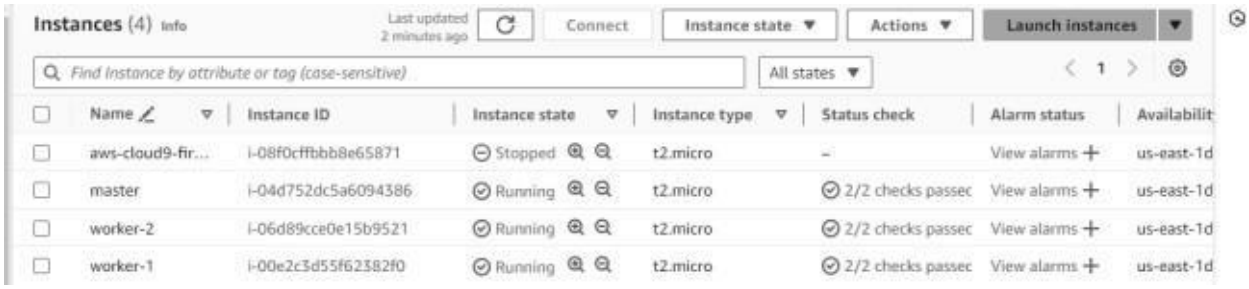
8) Go to the repository and make the changes in the index.html file and commit them

9) To view the changes made, ensure they are committed and visible in the source panel in real time. After confirming that the deployment section indicates success, refresh the URL to see the updates reflected on your site or application.

Experiment:
3

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

1. Create 3 EC2 Ubuntu Instances on AWS. (Name 1 as Master, the other 2 as worker-1 and worker-2)



2. Edit the Security Group Inbound Rules to allow SSH and do it for all the three machines

```
$ ssh -i "server.pem" ec2-user@ec2-54-174-206-93.compute-1.amazonaws.com
The authenticity of host 'ec2-54-174-206-93.compute-1.amazonaws.com (54.174.206
93)' can't be established.
ED25519 key fingerprint is SHA256:T+tsGyI15gAvUvjeAZ7GjDIWXHOaI4EPF5g5oICrkoQ.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added 'ec2-54-174-206-93.compute-1.amazonaws.com' (ED25519)
 to the list of known hosts.
  ,     #_
  ~\_  ####_        Amazon Linux 2023
 ~~  \_#####\
 ~~     \###|
 ~~       \#/ ___   https://aws.amazon.com/linux/amazon-linux-2023
```

3. From now on, until mentioned, perform these steps on all 3 machines. Install Docker for all the 3 machines

```
[root@ip-172-31-90-172 ec2-user]# yum install docker -y
Last metadata expiration check: 0:21:16 ago on Fri Aug 30 04:01:12 2024.
Dependencies resolved.
```

Package	Architecture	Version
Installing:		
docker	x86_64	25.0.6-1.amzn2023.0.1
Installing dependencies:		
containerd	x86_64	1.7.20-1.amzn2023.0.1
iptables-libs	x86_64	1.8.8-3.amzn2023.0.2
iptables-nft	x86_64	1.8.8-3.amzn2023.0.2
libcgroup	x86_64	3.0-1.amzn2023.0.1
libnetfilter_conntrack	x86_64	1.0.8-2.amzn2023.0.2
libnfnetlink	x86_64	1.0.1-19.amzn2023.0.2
libnftnl	x86_64	1.2.2-2.amzn2023.0.2
pigz	x86_64	2.5-1.amzn2023.0.3

Start the docker by running the command systemctl start docker in the terminal of all the ec2 instances.

```
Complete!
[root@ip-172-31-82-133 ec2-user]# systemctl start docker
[root@ip-172-31-82-133 ec2-user]#
```

Install the kubernetes

On all 3 machines by searching for kubeadm and clicking on install kubernetes.
Select the red hat based distribution. This process will automatically disable SELinux before configuring kubelet so no need to run it separately in the terminal.

Debian-based distributions | Red Hat-based distributions

Without a package manager

1. Set SELinux to `permissive` mode:

These instructions are for Kubernetes 1.31.

```
# Set SELinux in permissive mode (effectively disabling it)
sudo setenforce 0
sudo sed -i 's/^SELINUX=enforcing$/SELINUX=permissive/' /etc/selinux/
```

Copy the below script, to install kubernetes we need a kubernetes repo so this script helps us in getting that and paste it in the terminal.

```
# This overwrites any existing configuration in /etc/yum.repos.d/kubern
cat <<EOF | sudo tee /etc/yum.repos.d/kubernetes.repo
[kubernetes]
name=Kubernetes
baseurl=https://pkgs.k8s.io/core:/stable:/v1.31/rpm/
enabled=1
gpgcheck=1
gpgkey=https://pkgs.k8s.io/core:/stable:/v1.31/rpm/repodata/repomd.xml.
exclude=kubelet kubeadm kubectl cri-tools kubernetes-cni
EOF
```

```
Installed:
  containerd-1.7.20-1.amzn2023.0.1.x86_64       docker-25.0.6-1.amzn2023.0.1.x86_64      iptables-libs-1
  iptables-nft-1.8.8-3.amzn2023.0.2.x86_64      libcgroup-3.0-1.amzn2023.0.1.x86_64      libnetfilter_cc
  libnfnetlink-1.0.1-19.amzn2023.0.2.x86_64     libnftnl-1.2.2-2.amzn2023.0.2.x86_64     pigz-2.5-1.amzn
  runc-1.1.11-1.amzn2023.0.1.x86_64

Complete!
[root@ip-172-31-90-172 ec2-user]# systemctl start docker
[root@ip-172-31-90-172 ec2-user]# sudo su
[root@ip-172-31-90-172 ec2-user]# yum repolist
repo id                                                    repo name
amazonlinux                                                Amazon Linux 2023 repository
```

Run the command yum repolist to check whether the kubernetes repo has installed or not if successful installed then you can see a repo named as kubernetes

```
[root@ip-172-31-90-172 ec2-user]# yum repolist
repo id                                                    repo name
amazonlinux                                                Amazon Linux 2023 repository
kernel-livepatch                                           Amazon Linux 2023 Kernel Livepatch repository
kubernetes                                                 Kubernetes
[root@ip-172-31-90-172 ec2-user]#
```

Do the above steps for all the instances i.e for worker-1 and worker-2

5. Perform this ONLY on the Master machine. Initialize the Kubecluster
sudo kubeadm init --pod-network-cidr=10.244.0.0/16
--ignore-preflight-errors=all

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

Your Kubernetes control-plane has initialized successfully!

To start using your cluster, you need to run the following as a regular user:

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

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 172.31.12.28:6443 --token 4bqwb8.lua2ud01lr02uu55 \
    --discovery-token-ca-cert-hash sha256:b4edc7948be9bca50767f623b58e0612feedc144a7364f95be8dbd8c4614a169
```

Copy the join command and keep it in a notepad, we'll need it later. Copy the mkdir and chown commands from the top and execute them

```
[ec2-user@ip-172.31.12.28 docker]$ mkdir -p $HOME/.kube
sudo cp -i  /etc/kubernetes/admin.conf  $HOME/.kube/config
sudo chown $(id -u):$(id -g) $HOME/.kube/config
```

Then, add a common networking plugin called flannel file as mentioned in the code. kubectl apply -f
https://raw.githubusercontent.com/coreos/flannel/master/Documentation/
k ube-flannel.yml

```
[ec2-user@ip-172.31.12.28 docker]$ kubectl apply -f
https://raw.githubusercontent.com/coreos/flannel/master/Documentation/kube-flannel.yml
```

Check the created pod using this command Now, keep a watch on all nodes using the following command - watch kubectl get nodes 6. Perform this only on the worker machines Run the following command sudo yum install iproute-tc -y sudo systemctl enable kubelet sudo systemctl restart kubelet Check the status of the pods using the following command This command will show the status of all the pods. kubectl get pods -n kube-system

Following command will show the status of the pod named daemonset.
kubectl get daemonset -n kube-system

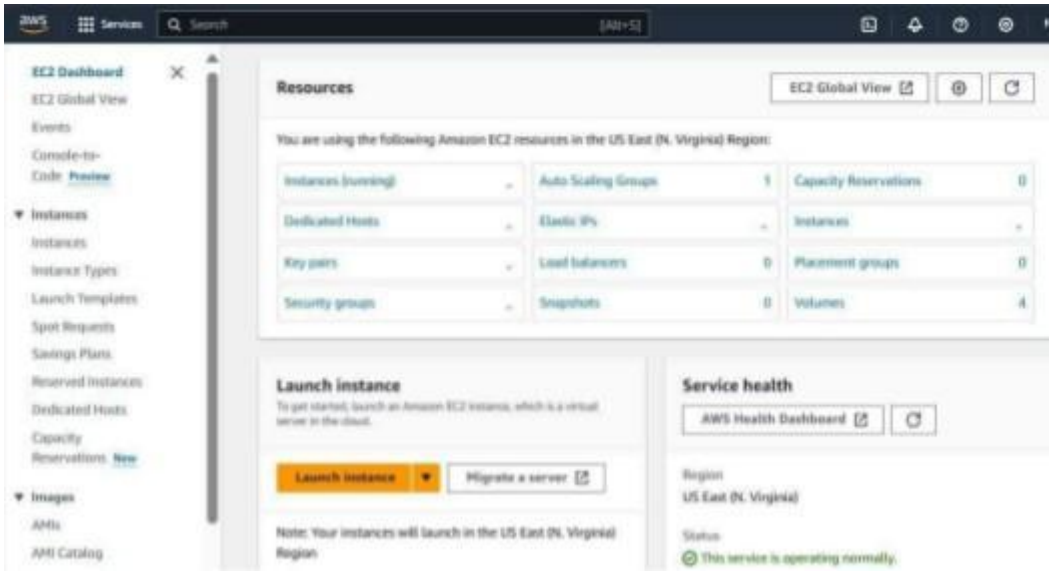
```
[ec2-user@ip-172.31.12.28 docker]$ kubectl get pods -n kube-system
NAME                                                READY   STATUS             RESTARTS   AGE
coredns-55cb5b8774-fx12f                            1/1     Running            0          100s
coredns-55cb5b8774-xn14v                            1/1     Running            0          100s
etcd-ip-172.31.12.28.ec2.internal                   1/1     Running            0          75s
kube-apiserver-ip-172.31.12.28.ec2.internal         1/1     Running            1          2m
kube-controller-manager-ip-172.31.12.28.ec2.internal 0/1 CrashLoopBackOff   1          70s
kube-proxy-4dv8m                                    1/1     Running            2          100s
kube-scheduler-ip-172.31.12.28.ec2.internal         1/1     Running            1          76s

[ec2-user@ip-172.31.12.28 docker]$ kubectl get daemonset -n kube-system
NAME         DESIRED   CURRENT   READY   UP-TO-DATE   AVAILABLE   NODE SELECTOR            AGE
kube-proxy   1         1         1       1            1           kubernetes.io/os=linux   3m
```

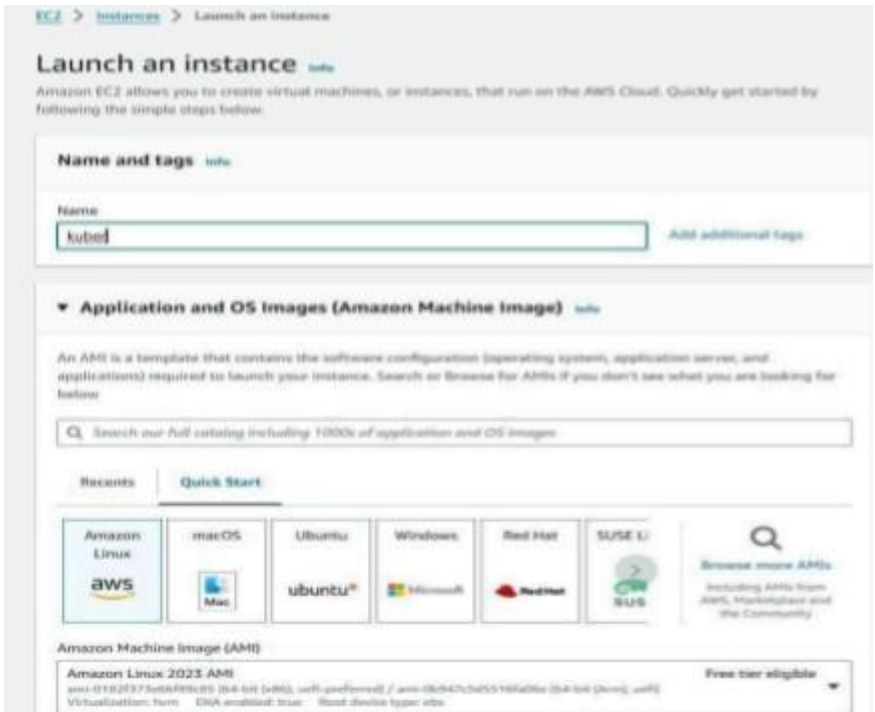
Conclusion:.

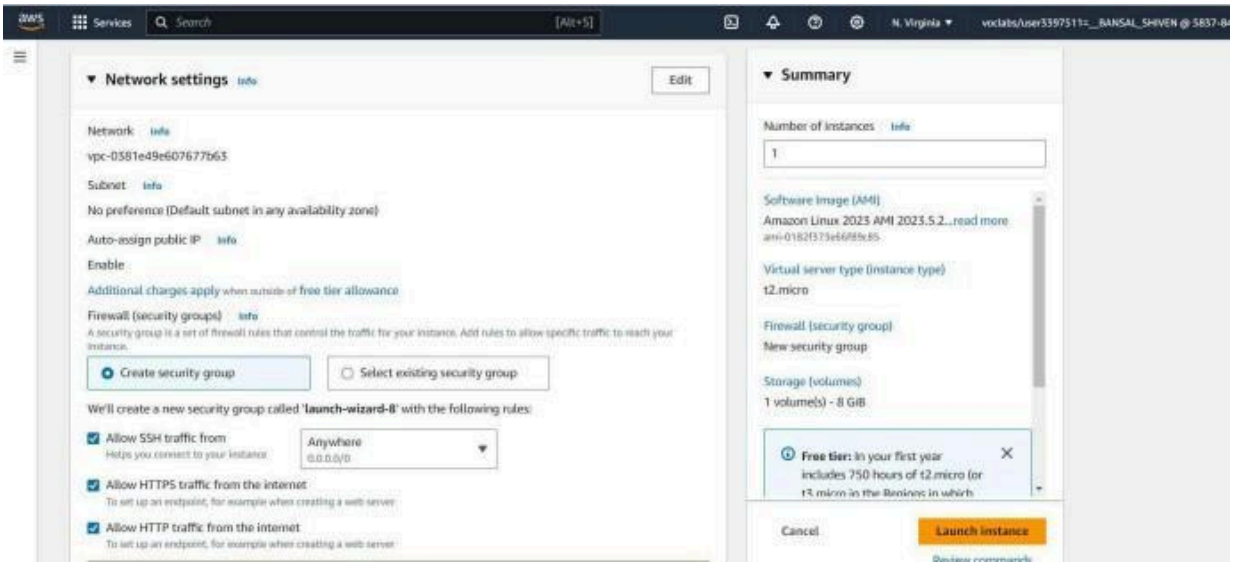
The process began with the creation of instances and configuration of settings to begin the communication. Docker was installed on all machines followed by the installation of Kubernetes components and the necessary repositories. The Master node was initialized with the `kubeadm init` command, and a plugin called Flannel was deployed to enable pod communication. Performing correct commands on the Worker nodes ensured they joined the cluster effectively. Also necessary commands confirmed the status of pods which indicated the proper working. Overall, the experiment provided information about working of the deployment and management of containerized applications in a distributed environment.

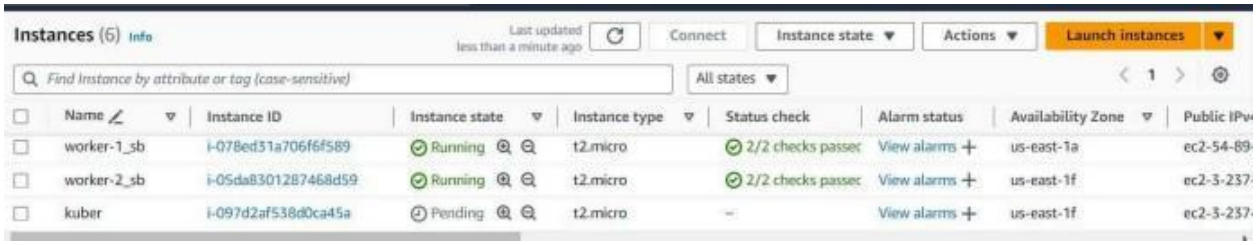
Aim: To install Kubectl and execute Kubectl commands to manage the Kubernetes cluster and deploy Your First Kubernetes Application.

Procedure: 1. **Creation Of EC-2 instance** ● Create an EC2 AWS Linux instance on AWS .also edit the Security Group Inbound Rules to allow SSH. then select the t2.micro instance type

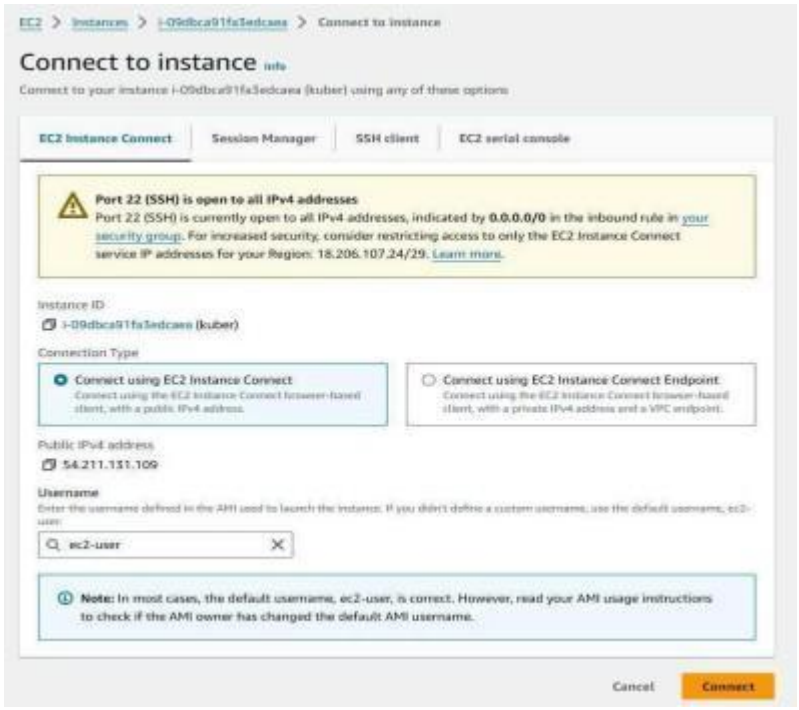








- Thus Kuber named -instance gets created.Then click on Id of that instance then click on connect button you will see this:



Then go into SSH client where you will get this command “keyname.pem”
ubuntu@ copy it and then connect it and run the following command for establishing connection.(I have entered this command on git bash where i entered in downloads where server.pem is stored then as the key is not accessible hence we need to change its mode using “key name.pem”. Then use the given command for making connections).

Installation of Docker 1.

. For installation of Docker into the machines run the following command: sudo yum install docker -y

```
[ec2-user@ip-172-31-65-181 ~]$ sudo yum install docker -y
Last metadata expiration check: 0:08:49 ago on Sat Sep 14 11:42:25 2024.
Dependencies resolved.
================================================================================
 Package                 Arch     Version                    Repository     Size
================================================================================
Installing:
 docker                  x86_64   25.0.6-1.amzn2023.0.2      amazonlinux    44 M
Installing dependencies:
 containerd              x86_64   1.7.20-1.amzn2023.0.1      amazonlinux    35 M
 iptables-libs           x86_64   1.8.8-3.amzn2023.0.2       amazonlinux   401 k
 iptables-nft            x86_64   1.8.8-3.amzn2023.0.2       amazonlinux   183 k
 libcgroup               x86_64   3.0-1.amzn2023.0.1         amazonlinux    75 k
 libnetfilter_conntrack  x86_64   1.0.8-2.amzn2023.0.2       amazonlinux    58 k
 libnfnetlink            x86_64   1.0.1-19.amzn2023.0.2      amazonlinux    30 k
 libnftnl                x86_64   1.2.2-2.amzn2023.0.2       amazonlinux    84 k
 pigz                    x86_64   2.5-1.amzn2023.0.3         amazonlinux    83 k
 runc                    x86_64   1.1.13-1.amzn2023.0.1      amazonlinux   3.2 M

Transaction Summary
================================================================================
Install  10 Packages

Total download size: 84 M
Installed size: 317 M
Downloading Packages:
(1/10): iptables-libs-1.8.8-3.amzn2023.0.2.x86_ 4.5 MB/s | 401 kB     00:00
(2/10): iptables-nft-1.8.8-3.amzn2023.0.2.x86_6 4.5 MB/s | 183 kB     00:00
(3/10): libcgroup-3.0-1.amzn2023.0.1.x86_64.rpm 3.9 MB/s |  75 kB     00:00
(4/10): libnetfilter_conntrack-1.0.8-2.amzn2023 2.6 MB/s |  58 kB     00:00
(5/10): libnfnetlink-1.0.1-19.amzn2023.0.2.x86_ 1.2 MB/s |  30 kB     00:00
(6/10): libnftnl-1.2.2-2.amzn2023.0.2.x86_64.rp 2.2 MB/s |  84 kB     00:00
(7/10): pigz-2.5-1.amzn2023.0.3.x86_64.rpm      2.8 MB/s |  83 kB     00:00
(8/10): runc-1.1.13-1.amzn2023.0.1.x86_64.rpm    30 MB/s | 3.2 MB     00:00
(9/10): containerd-1.7.20-1.amzn2023.0.1.x86_64  38 MB/s |  35 MB     00:00
(10/10): docker-25.0.6-1.amzn2023.0.2.x86_64.rp  34 MB/s |  44 MB     00:01
--------------------------------------------------------------------------------
Total                                            62 MB/s |  84 MB     00:01
Created symlink /etc/systemd/system/sockets.target.wants/docker.socket → /usr/lib/systemd/system/docker.socket.
```

```
Created symlink /etc/systemd/system/sockets.target.wants/docker.socket → /usr/lib/systemd/system/docker.socket.

  Verifying        : containerd-1.7.20-1.amzn2023.0.1.x86_64
  Verifying        : docker-25.0.6-1.amzn2023.0.2.x86_64
  Verifying        : iptables-libs-1.8.8-3.amzn2023.0.2.x86_64
  Verifying        : iptables-nft-1.8.8-3.amzn2023.0.2.x86_64
  Verifying        : libcgroup-3.0-1.amzn2023.0.1.x86_64
  Verifying        : libnetfilter_conntrack-1.0.8-2.amzn2023.0.2.x86_64
  Verifying        : libnfnetlink-1.0.1-19.amzn2023.0.2.x86_64
  Verifying        : libnftnl-1.2.2-2.amzn2023.0.2.x86_64
  Verifying        : pigz-2.5-1.amzn2023.0.3.x86_64
  Verifying        : runc-1.1.13-1.amzn2023.0.1.x86_64

Installed:
  containerd-1.7.20-1.amzn2023.0.1.x86_64        docker-25.0.6-1.amzn2023.0.2.x86_64                iptables-libs-1.8.8-3.amzn2023.0.2.x86_64
  libcgroup-3.0-1.amzn2023.0.1.x86_64            libnetfilter_conntrack-1.0.8-2.amzn2023.0.2.x86_64 libnfnetlink-1.0.1-19.amzn2023.0.2.x86_64
  pigz-2.5-1.amzn2023.0.3.x86_64                 runc-1.1.13-1.amzn2023.0.1.x86_64
```

Then, configure group in a daemon.json file by using following commands cd /etc/docker

cat <<EOF | sudo tee /etc/docker/daemon.json

{

"exec-opts":

["native.cgroupdriver=systemd"],

"log-driver":

"json-file", "log-opts":

{

"max-size": "100m"

},

"storage-driver": "overlay2"

EOF

```
[ec2-user@ip-172-31-65-181 docker]$ cat <<EOF | sudo tee /etc/docker/daemon.json
{
"exec-opts":
["native.cgroupdriver=systemd"],
"log-driver": "json-file",
"log-opts": {
"max-size": "100m"
},
"storage-driver": "overlay2"
}
EOF
{
"exec-opts":
["native.cgroupdriver=systemd"],
"log-driver": "json-file",
"log-opts": {
"max-size": "100m"
},
"storage-driver": "overlay2"
}
```

Then after this run the following command to enable and start docker and also to load the daemon.json file. sudo systemctl enable docker sudo systemctl daemon-reload sudo systemctl restart docker

```
[ec2-user@ip-172-31-81-216 docker]$ sudo systemctl enable docker
Created symlink /etc/systemd/system/multi-user.target.wants/docker.service → /us
r/lib/systemd/system/docker.service.
[ec2-user@ip-172-31-81-216 docker]$ sudo systemctl daemon-reload
[ec2-user@ip-172-31-81-216 docker]$ sudo systemctl restart docker
```

docker -v

3. **Then Install Kubernetes with the following command.** ● SELinux needs to be disable before configuring kubelet thus run the following command sudo setenforce 0 sudo sed -i 's/^SELINUX=enforcing$/SELINUX=permissive/' /etc/selinux/config

```
[ec2-user@ip-172-31-65-181 docker]$ sudo setenforce 0
[ec2-user@ip-172-31-65-181 docker]$ sudo sed -i 's/^SELINUX=enforcing$/SELINUX=p
ermissive/' /etc/selinux/config
```

4. **Initialize the Kubecluster** sudo kubeadm init --pod-network-cidr=10.244.0.0/16

```
Your Kubernetes control-plane has initialized successfully!

To start using your cluster, you need to run the following as a regular user:

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

Alternatively, if you are the root user, you can run:

  export KUBECONFIG=/etc/kubernetes/admin.conf

You should now deploy a pod network to the cluster.
Run "kubectl apply -f [podnetwork].yaml" with one of the options listed at:
  https://kubernetes.io/docs/concepts/cluster-administration/addons/

Then you can join any number of worker nodes by running the following on each as
 root:

kubeadm join 172.31.26.174:6443 --token pv0yyi.xhllqhclfjr50pt8 \
        --discovery-token-ca-cert-hash sha256:8293b2f6d29de466bd859007f5adbcdb3a
ecb0c446ba09033d32a5846b3d434f
```

```
copy the token and save for future use .
kubeadm join 172.31.26.174:6443 --token pv0yyi.xhllqhclfjr50pt8
\--discovery-token-ca-cert-hash
sha256:8293b2f6d29de466bd859007f5adbcdb3aecb0c446ba09033d32a5846b
3d434f
```

5. Now that the cluster is up and running,we can deploy our nginx server on this cluster. Apply deployment using this following command: kubectl apply -f

```
[ec2-user@ip-172-31-26-174 docker]$ kubectl apply -f https://k8s.io/examples/pods/s
imple-pod.yaml
pod/nginx created
```

Then use kubectl get nodes to check whether the pod gets created or not.

```
[ec2-user@ip-172-31-26-174 docker]$ kubectl get pods
NAME    READY   STATUS    RESTARTS   AGE
nginx   0/1     Pending   0          12s
```

To convert state from pending to running use the following command: kubectl describe pod nginx This command will help to describe the pods it gives reason for failure as it shows the taints which need to be untainted.

```
[ec2-user@ip-172-31-26-174 docker]$ kubectl describe pod nginx
Name:             nginx
Namespace:        default
Priority:         0
Service Account:  default
Node:             <none>
Labels:           <none>
Annotations:      <none>
Status:           Pending
IP:
IPs:              <none>
Containers:
  nginx:
    Image:        nginx:1.14.2
    Port:         80/TCP
    Host Port:    0/TCP
    Environment:  <none>
    Mounts:
      /var/run/secrets/kubernetes.io/serviceaccount from kube-api-access-k4lj6 (ro)
```

```
Conditions:
  Type           Status
  PodScheduled   False
Volumes:
  kube-api-access-k4lj6:
    Type:                     Projected (a volume that contains injected data from m
ultiple sources)
    TokenExpirationSeconds:   3607
    ConfigMapName:            kube-root-ca.crt
    ConfigMapOptional:        <nil>
    DownwardAPI:              true
QoS Class:                    BestEffort
Node-Selectors:               <none>
Tolerations:                  node.kubernetes.io/not-ready:NoExecute op=Exists for 3
00s
                              node.kubernetes.io/unreachable:NoExecute op=Exists for
 300s
Events:
  Type     Reason            Age   From               Message
  ----     ------            ----  ----               -------
  Warning  FailedScheduling  7s    default-scheduler  0/1 nodes are available: 1 no
de(s) had untolerated taint {node-role.kubernetes.io/control-plane: }. preemption:
0/1 nodes are available: 1 Preemption is not helpful for scheduling.
[ec2-user@ip-172-31-26-174 ~]$ kubectl taint nodes --all node-role.kubernetes.io
/control-plane-
node/ip-172-31-26-174.ec2.internal untainted
```

7. Lastly, mention the port you want to host. Here I have used localhost 8081 then checked it. kubectl port-forward nginx 8081:80

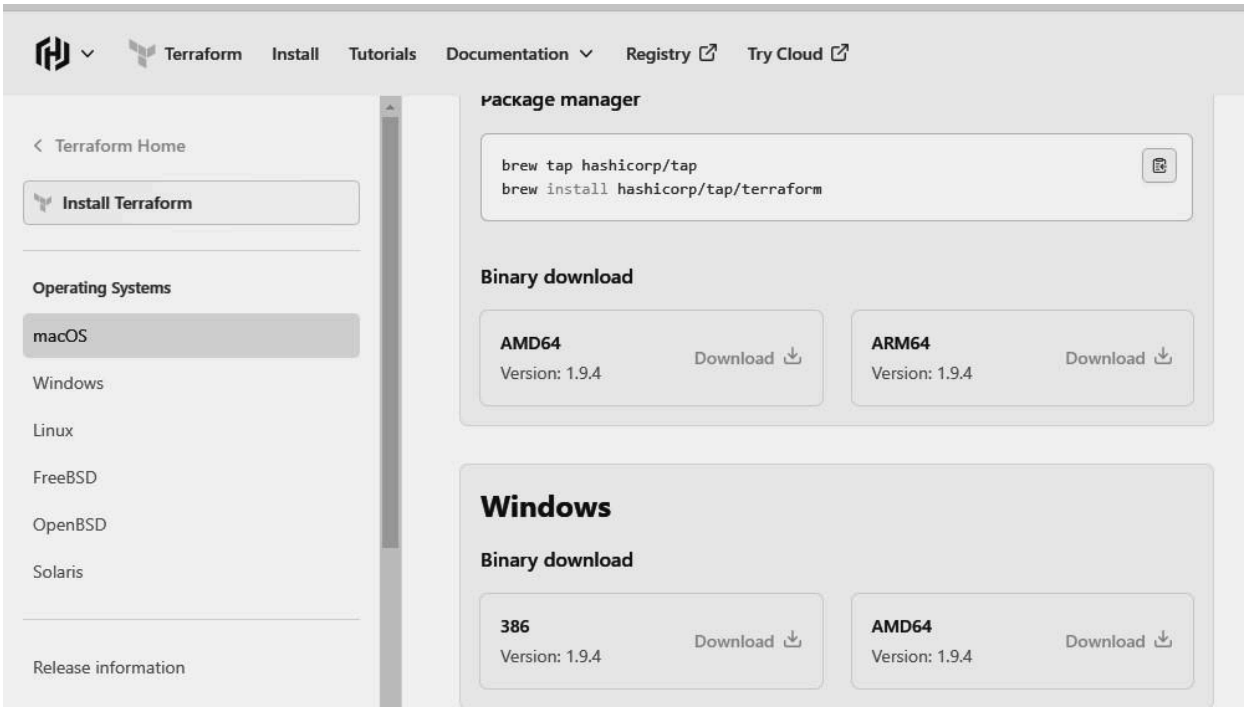
```
[ec2-user@ip-172-31-26-174 ~]$ kubectl port-forward nginx 8081:80
Forwarding from 127.0.0.1:8081 -> 80
Forwarding from [::1]:8081 -> 80
```

8. **Verify your deployment:** Open up a new terminal and ssh to your EC2 instance. Then, use this curl command to check if the Nginx server is running. curl --head http://127.0.0.1:8080 If the response is 200 OK and you can see the Nginx server name, your deployment was successful. We have successfully deployed our Nginx server on our EC2 instance.

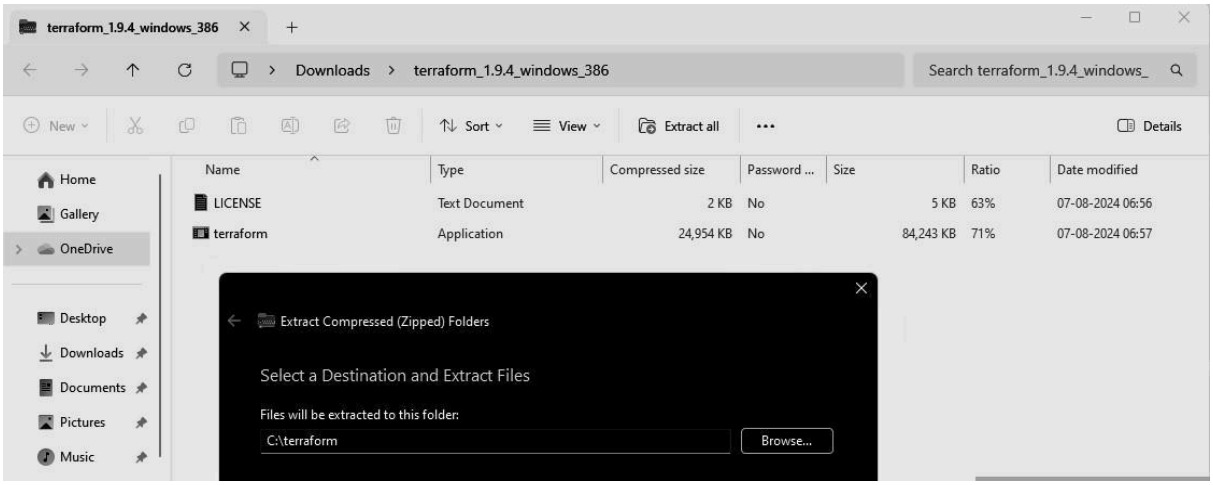
Conclusion: First, I successfully launched an AWS EC2 instance running Amazon Linux. After that, I installed Docker and Kubernetes on the instance. Following the installation, I initialized the Kubernetes cluster, which provided me with a token, along with chown and mkdir commands. I then executed both the mkdir and chown commands successfully. Next, I installed the Flannel networking plugin without any issues. Initially, there was an error while deploying Nginx, but after correcting it, I successfully deployed Nginx using a simple-pod.yml file. I confirmed its deployment with the get pods command and hosted it locally , which worked as expected.

1: Download terraform

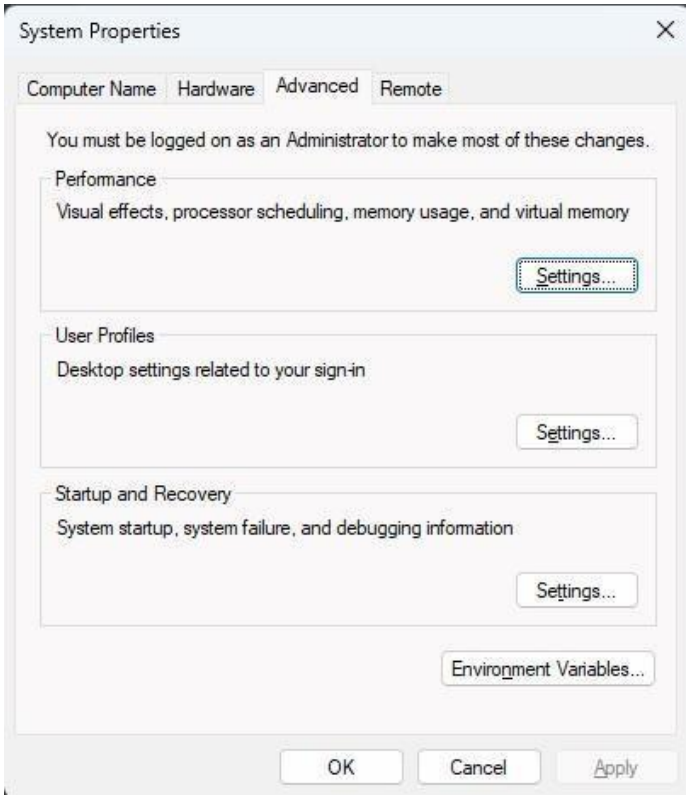
To install Terraform, First Download the Terraform Cli Utility for windows from terraforms official website https://www.terraform.io/downloads.html Select the Operating System Windows followed by either 32bit or 64 bit based on your OS type.

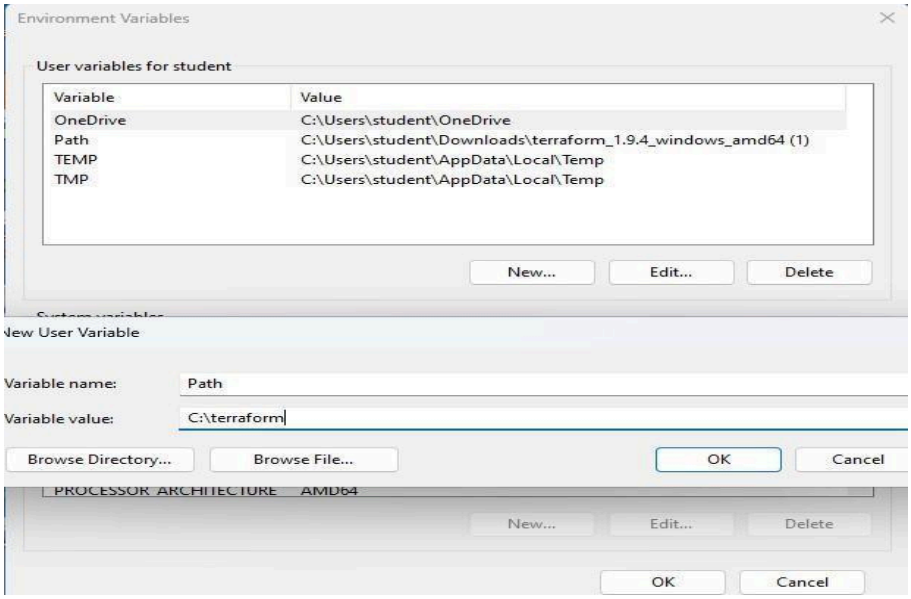


Step 2: Extract the downloaded setup file Terraform.exe in C:\Terraform directory

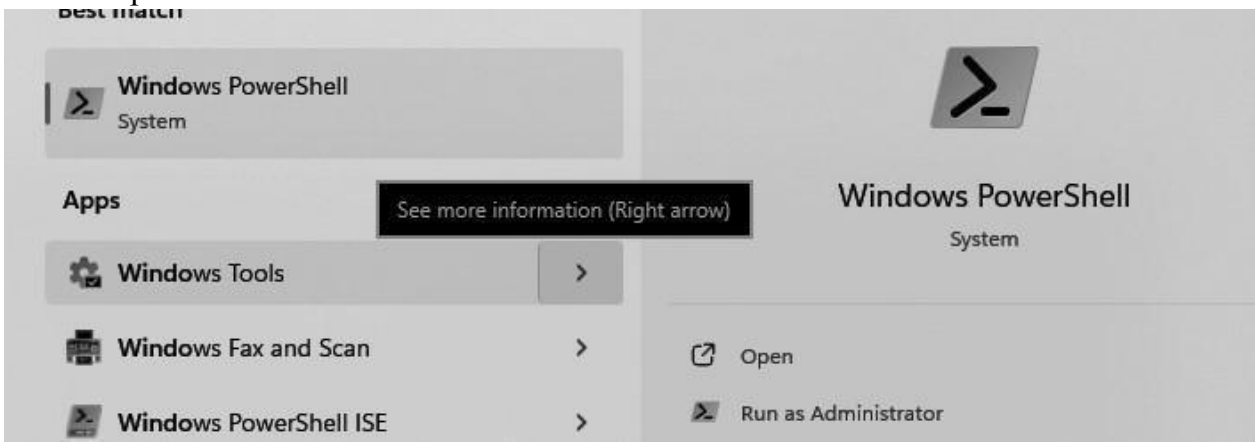


3: Set the System path for Terraform in Environment Variables





4: Open PowerShell with Admin Access



Step 5 : Open Terraform in PowerShell and check its functionality

```
PS C:\Users\student> terraform
Usage: terraform [global options] <subcommand> [args]

The available commands for execution are listed below.
The primary workflow commands are given first, followed by
less common or more advanced commands.

Main commands:
  init          Prepare your working directory for other commands
  validate      Check whether the configuration is valid
  plan          Show changes required by the current configuration
  apply         Create or update infrastructure
  destroy       Destroy previously-created infrastructure

All other commands:
  console       Try Terraform expressions at an interactive command prompt
  fmt           Reformat your configuration in the standard style
  force-unlock  Release a stuck lock on the current workspace
  get           Install or upgrade remote Terraform modules
  graph         Generate a Graphviz graph of the steps in an operation
  import        Associate existing infrastructure with a Terraform resource
  login         Obtain and save credentials for a remote host
  logout        Remove locally-stored credentials for a remote host
  metadata      Metadata related commands
  output        Show output values from your root module
  providers     Show the providers required for this configuration
  refresh       Update the state to match remote systems
  show          Show the current state or a saved plan
  state         Advanced state management
```

Experiment No:6

Implementation:

A. Creating docker image using terraform

Prerequisites:

1. Download and install Docker Desktop from
Website: https://www.docker.com.

```
C:\Users\excel>docker --version
Docker version 27.1.1, build 6312585
```

```
C:\Users\excel>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
```

Step 1:To Verify Docker Functionality

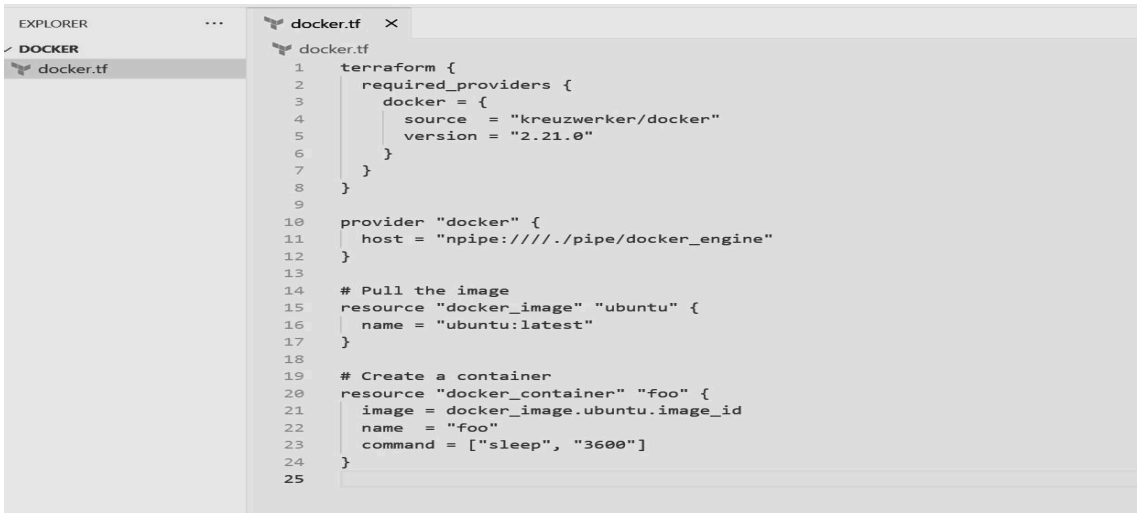
1. Create a folder named `Terraform Scripts` to store various scripts for this experiment.

Step 2:To Set Up Terraform Configuration

1. Inside the `Terraform Scripts` folder, create a new folder named `Docker`.
2. Within the `Docker` folder, create a file named `docker.tf` using Atom editor and insert the following content to configure an Ubuntu Linux container:

```
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:To Initialize Terraform
Run the command `terraform init` to initialize the Terraform configuration.

```
C:\Users\excel\Documents\college\Terraform scripts\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:To Review Terraform Plan
Execute `terraform plan` to preview the resources that will be created.

```
C:\Users\excel\Documents\college\Terraform scripts\docker>terraform plan

Terraform used the selected providers to generate the following execution plan. Resource actions are indicated with the
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",
        ]
      + 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)
      + ip_prefix_length = (known after apply)
      + ipc_mode         = (known after apply)
      + log_driver       = (known after apply)
      + logs             = false
      + must_run         = true
      + name             = "foo"
      + network_data     = (known after apply)
      + read_only        = false
      + remove_volumes   = true
      + restart          = "no"
      + rm               = false
      + runtime          = (known after apply)
      + security_opts    = (known after apply)
      + shm_size         = (known after apply)
      + start            = true
```

```
      + 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:To Apply Terraform Configuration
Run `terraform apply` to apply the configuration and create the Ubuntu Linux container.

```
C:\Users\excel\Documents\college\Terraform scripts\docker>terraform apply

Terraform used the selected providers to generate the following execution plan. Resource actions are indicated with the following symb
  + 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",
        ]
      + 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)
      + ip_prefix_length = (known after apply)
      + ipc_mode         = (known after apply)
      + log_driver       = (known after apply)
      + logs             = false
      + must_run         = true
      + name             = "foo"
      + network_data     = (known after apply)
      + read_only        = false
      + remove_volumes   = true
      + restart          = "no"
      + rm               = false
      + runtime          = (known after apply)
      + security_opts    = (known after apply)
      + shm_size         = (known after apply)
      + start            = true
```

```
      + 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.

Do you want to perform these actions?
  Terraform will perform the actions described above.
  Only 'yes' will be accepted to approve.

  Enter a value: yes

docker_image.ubuntu: Creating...
docker_image.ubuntu: Still creating... [10s elapsed]
docker_image.ubuntu: Still creating... [20s elapsed]
docker_image.ubuntu: Still creating... [30s elapsed]
docker_image.ubuntu: Still creating... [41s elapsed]
docker_image.ubuntu: Creation complete after 43s [id=sha256:edbfe74c41f8a3501ce542e137cf28ea04dd03e6df8c9d66519b6ad761c2598aubuntu:latest]
docker_container.foo: Creating...
docker_container.foo: Creation complete after 1s [id=71bffb28b5cee3d1699c27dbcceb992b931000a847e6dfb219b3ca85ce5c6131]

Apply complete! Resources: 2 added, 0 changed, 0 destroyed.
```

Before executing `terraform apply`, list the Docker images.

```
C:\Users\excel\Documents\college\Terraform scripts\docker>docker images
REPOSITORY   TAG        IMAGE ID   CREATED   SIZE
```

After executing `terraform apply`, list the Docker images again.

```
C:\Users\excel\Documents\college\Terraform scripts\docker>docker images
REPOSITORY   TAG        IMAGE ID       CREATED       SIZE
ubuntu       latest     edbfe74c41f8   3 weeks ago   78.1MB
```

Step 6: Clean Up

To delete the created Ubuntu container, run `terraform destroy`.

```
C:\Users\excel\Documents\college\Terraform scripts\docker>terraform destroy
docker_image.ubuntu: Refreshing state... [id=sha256:edbfe74c41f8a3501ce542e137cf28ea04dd03e6df8c9d66519b6ad761c2598aubuntu:latest]
docker_container.foo: Refreshing state... [id=71bffb28b5cee3d1699c27dbcceb992b931000a847e6dfb219b3ca85ce5c6131]

Terraform used the selected providers to generate the following execution plan. Resource actions are indicated with the 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
      - dns               = [] -> null
      - dns_opts          = [] -> null
      - dns_search        = [] -> null
      - entrypoint        = [] -> null
      - env               = [] -> null
      - gateway           = "172.17.0.1" -> null
      - group_add         = [] -> null
      - hostname          = "71bffb28b5ce" -> null
      - id                = "71bffb28b5cee3d1699c27dbcceb992b931000a847e6dfb219b3ca85ce5c6131" -> null
      - image             = "sha256:edbfe74c41f8a3501ce542e137cf28ea04dd03e6df8c9d66519b6ad761c2598a" -> null
      - init              = false -> null
      - ip_address        = "172.17.0.2" -> null
      - ip_prefix_length  = 16 -> null
      - ipc_mode          = "private" -> null
      - links             = [] -> null
      - log_driver        = "json-file" -> null
      - log_opts          = {} -> null
      - logs              = false -> null
      - max_retry_count   = 0 -> null
      - memory            = 0 -> null
      - memory_swap       = 0 -> null
      - must_run          = true -> null
      - name              = "foo" -> null
```

```
      - network_data      = [
          - {
              - gateway                     = "172.17.0.1"
              - global_ipv6_prefix_length   = 0
              - ip_address                  = "172.17.0.2"
              - ip_prefix_length            = 16
              - network_name                = "bridge"
              # (2 unchanged attributes hidden)
            },
        ] -> null
      - network_mode      = "bridge" -> null
      - privileged        = false -> null
      - publish_all_ports = false -> null
      - read_only         = false -> null
      - remove_volumes    = true -> null
      - restart           = "no" -> null
      - rm                = false -> null
      - runtime           = "runc" -> null
      - security_opts     = [] -> null
      - shm_size          = 64 -> null
      - start             = true -> null
      - stdin_open        = false -> null
      - stop_timeout      = 0 -> null
      - storage_opts      = {} -> null
      - sysctls           = {} -> null
      - tmpfs             = {} -> null
      - tty               = false -> null
      # (8 unchanged attributes hidden)
    }

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

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

```
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=71bffb28b5cee3d1699c27dbcceb992b931000a847e6dfb219b3ca85ce5c6131]
docker_container.foo: Destruction complete after 0s
docker_image.ubuntu: Destroying... [id=sha256:edbfe74c41f8a3501ce542e137cf28ea04dd03e6df8c9d66519b6ad761c2598aubuntu:la
docker_image.ubuntu: Destruction complete after 0s

Destroy complete! Resources: 2 destroyed.
```

After executing `terraform destroy`, list the Docker images one more time.

```
C:\Users\excel\Documents\college\Terraform scripts\docker>docker images
REPOSITORY   TAG       IMAGE ID   CREATED   SIZE
```

Step 7:To check correctness of configured files.
Execute `terraform validate` to check the correctness of your Terraform configuration files.

```
C:\Users\excel\Documents\college\Terraform scripts\docker>terraform validate
Success! The configuration is valid.
```

Step 8:To verify the details.

Run `terraform providers` to list the providers used in your configuration and verify their details.

```
C:\Users\excel\Documents\college\Terraform scripts\docker>terraform providers

Providers required by configuration:
.
└── provider[registry.terraform.io/kreuzwerker/docker] 2.21.0
```

Step 9:To generate visual representation.
Generate a visual representation of the dependency graph of your Terraform resources.

```
C:\Users\excel\Documents\college\Terraform scripts\docker>terraform graph
digraph G {
  rankdir = "RL";
  node [shape = rect, fontname = "sans-serif"];
  "docker_container.foo" [label="docker_container.foo"];
  "docker_image.ubuntu" [label="docker_image.ubuntu"];
  "docker_container.foo" -> "docker_image.ubuntu";
}
```

Experiment 7

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

Theory:

What is SAST?

Static application security testing (SAST), or static analysis, is a testing methodology that analyzes source code to find security vulnerabilities that make your organization's applications susceptible to attack. SAST scans an application before the code is compiled. It's also known as white box testing.

What problems does SAST solve?

SAST takes place very early in the software development life cycle (SDLC) as it does not require a working application and can take place without code being executed. It helps developers identify
vulnerabilities in the initial stages of development and quickly resolve issues without breaking builds or passing on vulnerabilities to the final release of the application.

SAST tools give developers real-time feedback as they code, helping them fix issues before they pass the code to the next phase of the SDLC. This prevents
security-related issues from being considered an afterthought. SAST tools also provide graphical representations of the issues found, from source to sink. These help you navigate the code easier. Some tools point out the exact location of vulnerabilities and highlight the risky code. Tools can also provide in-depth
guidance on how to fix issues and the best place in the code to fix them, without requiring deep security domain expertise.

It's important to note that SAST tools must be run on the application on a regular basis, such as during daily/monthly builds, every time code is checked in, or during a code release.

Why is SAST important?

Developers dramatically outnumber security staff. It can be challenging for an organization to find the resources to perform code reviews on even a fraction of its applications. A key strength of SAST tools is the ability to analyze 100% of the codebase. Additionally, they are much faster than
manual secure code reviews performed by humans. These tools can scan millions of lines of code in a matter of minutes. SAST tools automatically identify critical

vulnerabilities—such as buffer overflows, SQL injection, cross-site scripting, and others—with high confidence. Thus, integrating static analysis into the SDLC can yield dramatic results in the overall quality of the
code developed.

What are the key steps to run SAST effectively?

There are six simple steps needed to perform SAST efficiently in organizations that have a very large number of applications built with different languages, frameworks, and platforms.

1. **Finalize the tool.** Select a static analysis tool that can perform code reviews of applications written in the programming languages you use. The tool should also be able to comprehend the underlying framework used by your software.
2. **Create the scanning infrastructure, and deploy the tool.** This step involves handling the licensing requirements, setting up access control and authorization, and procuring the resources required (e.g., servers and databases) to deploy the tool.
3. **Customize the tool.** Fine-tune the tool to suit the needs of the organization. For example, you might configure it to reduce false positives or find additional security vulnerabilities by writing new rules or updating existing ones. Integrate the tool into the build environment, create dashboards for tracking scan results, and build custom reports.
4. **Prioritize and onboard applications.** Once the tool is ready, onboard your applications. If you have a large number of applications, prioritize the high-risk applications to scan first. Eventually, all your applications should be onboarded and scanned regularly, with application scans synced with release cycles, daily or monthly builds, or code check-ins.
5. **Analyze scan results.** This step involves triaging the results of the scan to remove false positives. Once the set of issues is finalized, they should be tracked and provided to the deployment teams for proper and timely remediation.
6. **Provide governance and training.** Proper governance ensures that your development teams are employing the scanning tools properly. The software security touchpoints should be present within the SDLC. SAST should be incorporated as part of your application development and deployment process.

Integrating Jenkins with SonarQube:

Prerequisites:

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

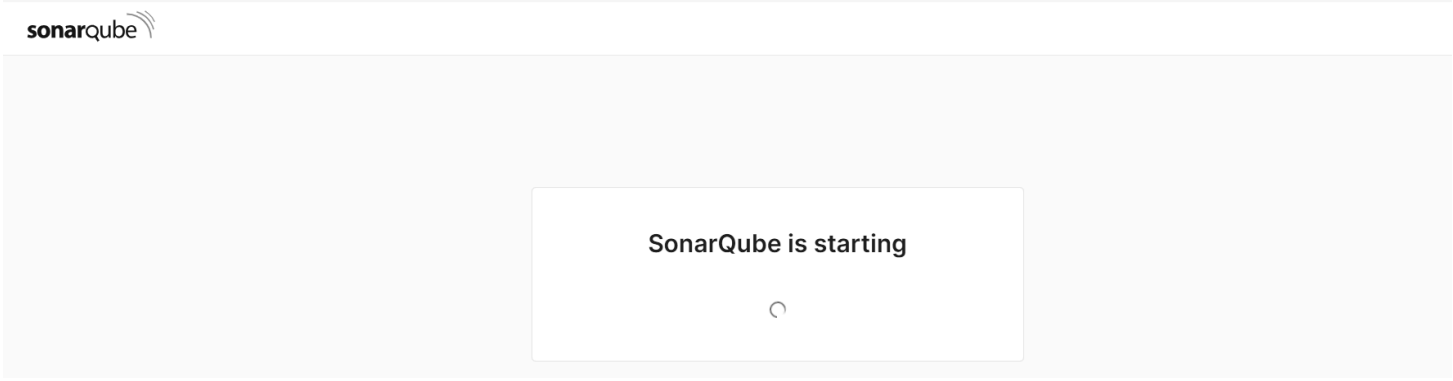
Steps to integrate Jenkins with SonarQube

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

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

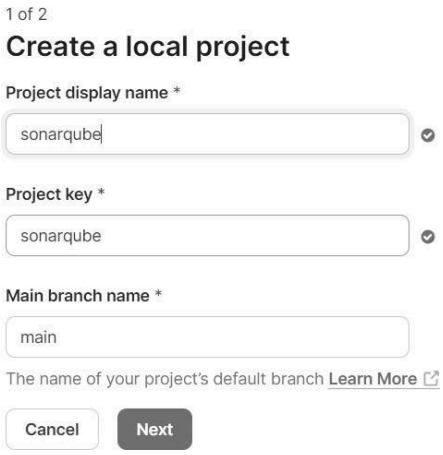
```
C:\Users\ADMIN>docker run -d --name sonarqube -e SONAR_ES_BOOTSTRAP_CHECKS_DISABLE=true -p 9000:9000 sonarqube:latest
Unable to find image 'sonarqube:latest' locally
latest: Pulling from library/sonarqube
7478e0ac0f23: Pull complete
90a925ab929a: Pull complete
7d9a34308537: Pull complete
80338217a4ab: Pull complete
1a5fd5c7e184: Pull complete
7b87d6fa783d: Pull complete
bd819c9b5ead: Pull complete
4f4fb700ef54: Pull complete
Digest: sha256:72e9feec71242af83faf65f95a40d5e3bb2822a6c3b2cda8568790f3d31aecde
Status: Downloaded newer image for sonarqube:latest
de76efbeef2054aeb442b86ba54c2916039b8757b388482d9780ffc69f5d8bbe
```

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



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

5. Create a manual project in SonarQube with the name **sonarqube**

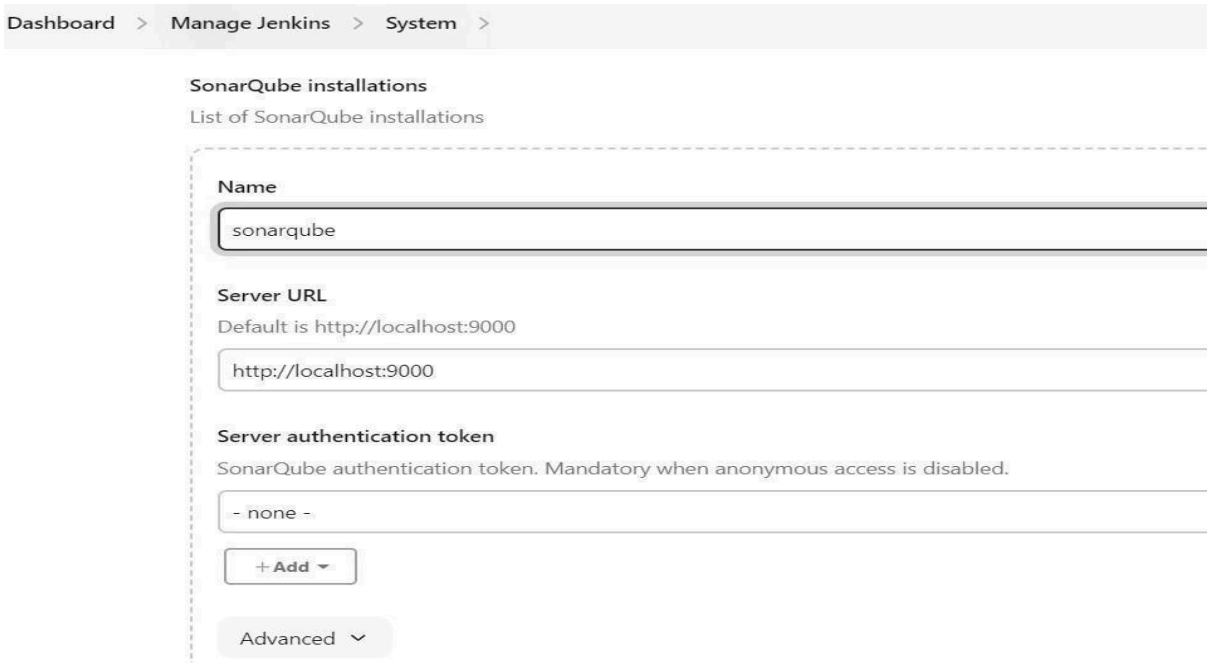


Setup the project and come back to Jenkins Dashboard.

6. Go to Manage Jenkins and search for SonarQube Scanner for Jenkins and install it.

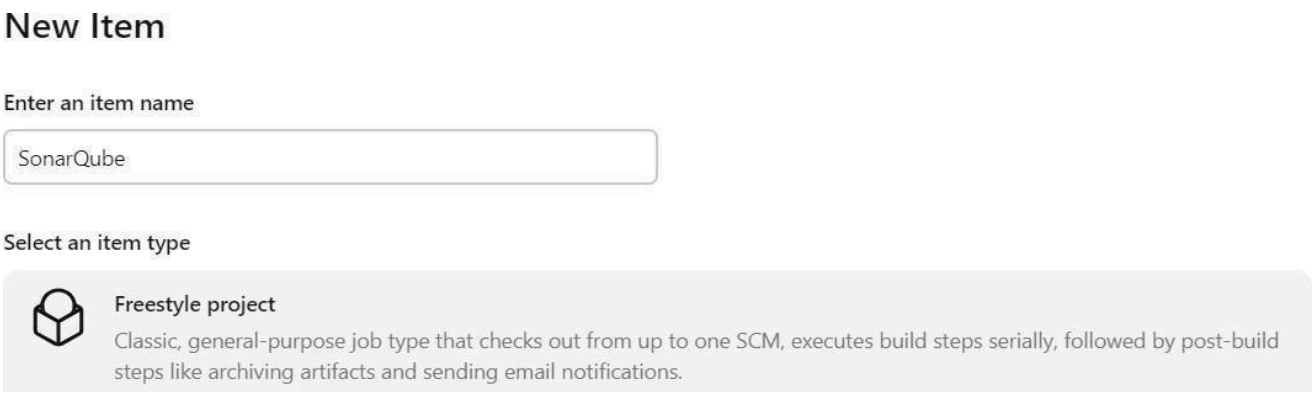
7. Under Jenkins 'Configure System', look for SonarQube Servers and enter the details.

   Enter the Server Authentication token if needed.

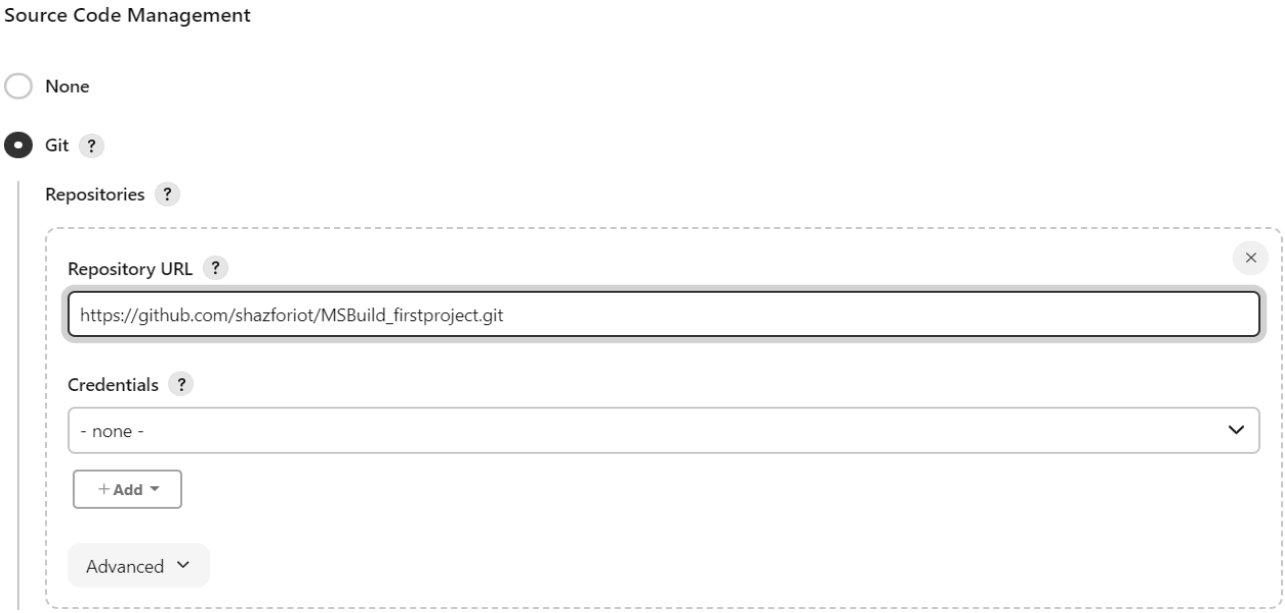


8. Search for SonarQube Scanner under Global Tool Configuration. Choose the latest configuration and choose Install automatically.

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

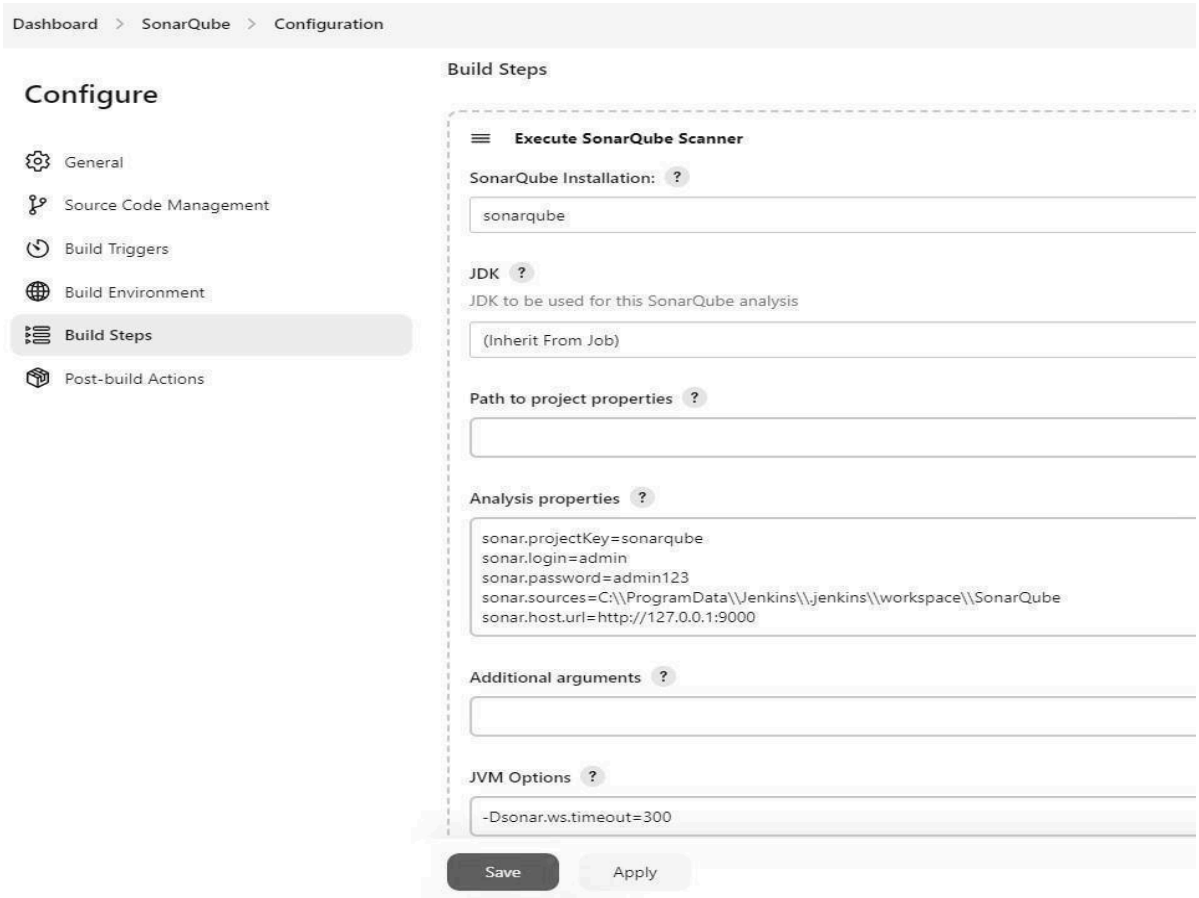


10. Choose this GitHub repository in Source Code Management.
https://github.com/shazforiot/MSBuild_firstproject.git

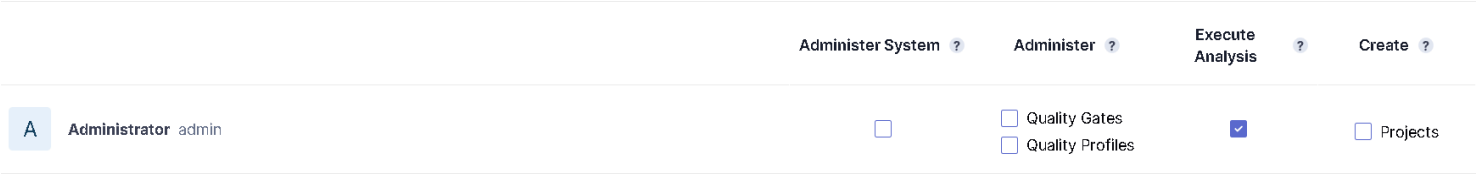


It is a sample hello-world project with no vulnerabilities and issues, just to test the integration.

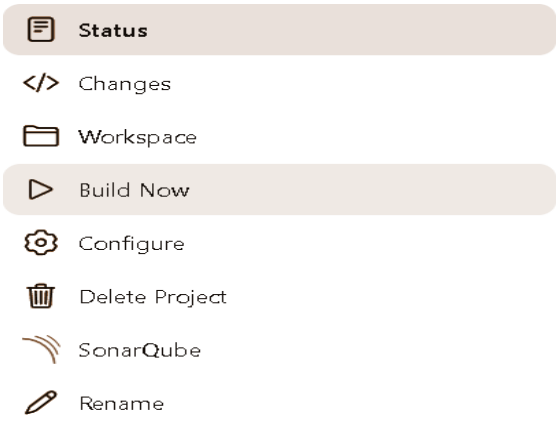
11. Under Build-> Execute SonarQube Scanner, enter these Analysis properties. Mention the SonarQube Project Key, Login, Password, Source path and Host URL.



12. Go to http://localhost:9000/<user_name>/permissions and allow Execute Permissions to the Admin user.



13. Run The Build.



Check the console output.

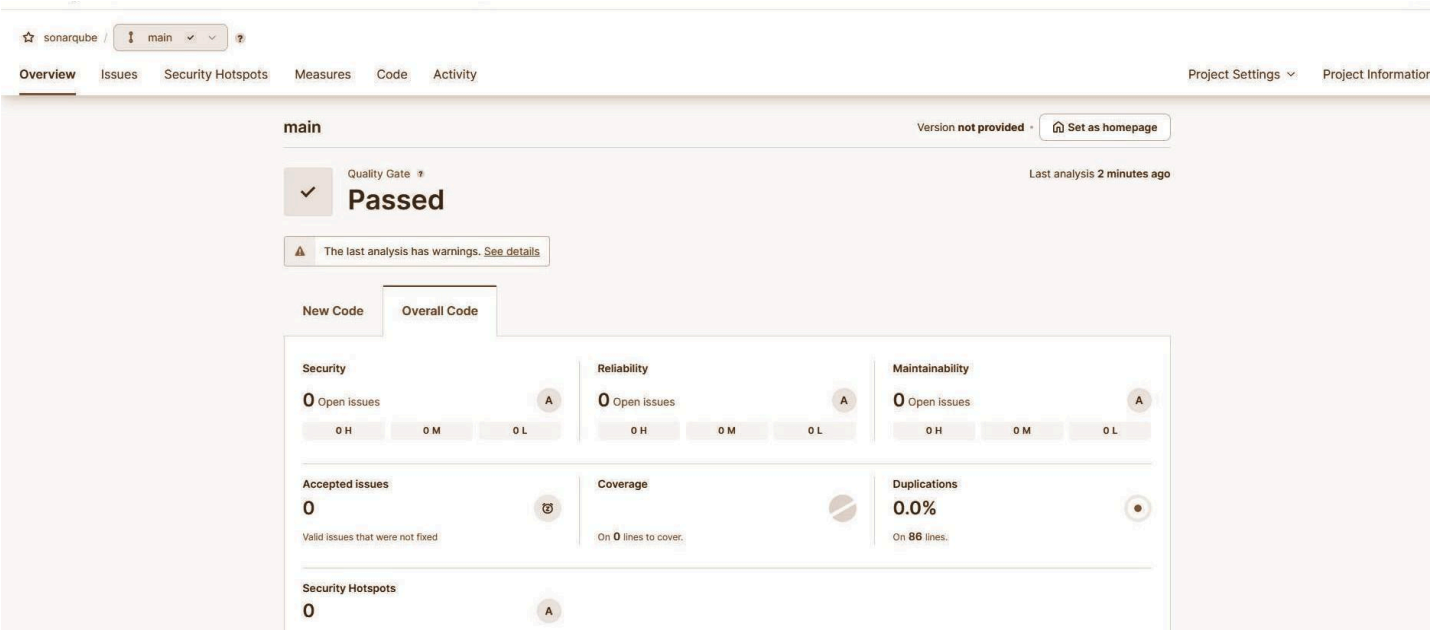
Console Output

Download Copy View as plain tex

```
Started by user Shiven Bansal
Running as SYSTEM
Building on the built-in node in workspace C:\ProgramData\Jenkins\.jenkins\workspace\SonarQube
The recommended git tool is: NONE
No credentials specified
 > git.exe rev-parse --resolve-git-dir C:\ProgramData\Jenkins\.jenkins\workspace\SonarQube\.git # timeout=10
Fetching changes from the remote Git repository
 > git.exe config remote.origin.url https://github.com/shazforiot/MSBuild_firstproject.git # timeout=10
Fetching upstream changes from https://github.com/shazforiot/MSBuild_firstproject.git
 > git.exe --version # timeout=10
 > git --version # 'git version 2.45.2.windows.1'
 > git.exe fetch --tags --force --progress -- https://github.com/shazforiot/MSBuild_firstproject.git +refs/heads/*:refs/remotes/origin/* # timeout=10
 > git.exe rev-parse "refs/remotes/origin/master^{commit}" # timeout=10
Checking out Revision f2bc042c04c6e72427c380bcaee6d6fee7b49adf (refs/remotes/origin/master)
 > git.exe config core.sparsecheckout # timeout=10
 > git.exe checkout -f f2bc042c04c6e72427c380bcaee6d6fee7b49adf # timeout=10
Commit message: "updated"
 > git.exe rev-list --no-walk f2bc042c04c6e72427c380bcaee6d6fee7b49adf # timeout=10
[SonarQube] $ C:\ProgramData\Jenkins\.jenkins\tools\hudson.plugins.sonar.SonarRunnerInstallation\sonarqube\bin\sonar-scanner.bat -Dsonar.host.url=http://localhost:9000 -Dsonar.projectKey=sonarqube -
Dsonar.login=admin -Dsonar.host.url=http://127.0.0.1:9000 -Dsonar.sources=C:\ProgramData\Jenkins\.jenkins\workspace\SonarQube -Dsonar.password=admin123 -
Dsonar.projectBaseDir=C:\ProgramData\Jenkins\.jenkins\workspace\SonarQube
16:16:39.198 WARN  Property 'sonar.host.url' with value 'http://localhost:9000' is overridden with value 'http://127.0.0.1:9000'
16:16:39.206 INFO  Scanner configuration file: C:\ProgramData\Jenkins\.jenkins\tools\hudson.plugins.sonar.SonarRunnerInstallation\sonarqube\bin\..\conf\sonar-scanner.properties
16:16:39.206 INFO  Project root configuration file: NONE
16:16:39.230 INFO  SonarScanner CLI 6.1.0.4477
16:16:39.230 INFO  Java 21.0.4 Eclipse Adoptium (64-bit)
16:16:39.230 INFO  Windows 11 10.0 amd64
16:16:39.230 INFO  SONAR_SCANNER_OPTS=-Dsonar.ws.timeout=300
16:16:39.254 INFO  User cache: C:\Windows\system32\config\systemprofile\.sonar\cache
```

```
16:16:58.734 INFO  Using git CLI to retrieve untracked files
16:16:58.791 INFO  Analyzing language associated files and files included via "sonar.text.inclusions" that are tracked by git
16:16:58.856 INFO  14 source files to be analyzed
16:16:59.154 INFO  14/14 source files have been analyzed
16:16:59.154 INFO  Sensor TextAndSecretsSensor [text] (done) | time=1306ms
16:16:59.163 INFO  ------------ Run sensors on project
16:16:59.373 INFO  Sensor C# [csharp]
16:16:59.373 WARN  Your project contains C# files which cannot be analyzed with the scanner you are using. To analyze C# or VB.NET, you must use the SonarScanner for .NET 5.x or higher, see
https://redirect.sonarsource.com/doc/install-configure-scanner-msbuild.html
16:16:59.373 INFO  Sensor C# [csharp] (done) | time=0ms
16:16:59.373 INFO  Sensor Analysis Warnings import [csharp]
16:16:59.379 INFO  Sensor Analysis Warnings import [csharp] (done) | time=0ms
16:16:59.379 INFO  Sensor C# File Caching Sensor [csharp]
16:16:59.379 WARN  Incremental PR analysis: Could not determine common base path, cache will not be computed. Consider setting 'sonar.projectBaseDir' property.
16:16:59.379 INFO  Sensor C# File Caching Sensor [csharp] (done) | time=6ms
16:16:59.379 INFO  Sensor Zero Coverage Sensor
16:16:59.389 INFO  Sensor Zero Coverage Sensor (done) | time=10ms
16:16:59.389 INFO  SCM Publisher SCM provider for this project is: git
16:16:59.389 INFO  SCM Publisher 4 source files to be analyzed
16:16:59.838 INFO  SCM Publisher 4/4 source files have been analyzed (done) | time=449ms
16:16:59.846 INFO  CPD Executor Calculating CPD for 0 files
16:16:59.846 INFO  CPD Executor CPD calculation finished (done) | time=0ms
16:16:59.854 INFO  SCM revision ID 'f2bc042c04c6e72427c380bcaee6d6fee7b49adf'
16:17:00.121 INFO  Analysis report generated in 120ms, dir size=201.1 kB
16:17:00.195 INFO  Analysis report compressed in 57ms, zip size=22.4 kB
16:17:00.393 INFO  Analysis report uploaded in 195ms
16:17:00.394 INFO  ANALYSIS SUCCESSFUL, you can find the results at: http://127.0.0.1:9000/dashboard?id=sonarqube
16:17:00.395 INFO  Note that you will be able to access the updated dashboard once the server has processed the submitted analysis report
16:17:00.395 INFO  More about the report processing at http://127.0.0.1:9000/api/ce/task?id=acd819f5-9e70-42ab-bff7-3cc893e2cae4
16:17:00.405 INFO  Analysis total time: 18.743 s
16:17:00.408 INFO  SonarScanner Engine completed successfully
16:17:00.494 INFO  EXECUTION SUCCESS
16:17:00.494 INFO  Total time: 21.288s
Finished: SUCCESS
```

14. Once the build is complete, check the project in SonarQube.



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

Conclusion:

In this experiment, I learned how to integrate Jenkins with SonarQube for performing Static Application Security Testing (SAST). I set up SonarQube in a Docker container and configured Jenkins to use the SonarQube scanner. By creating a manual project in SonarQube and configuring the necessary authentication and tools in Jenkins, I established a seamless connection between Jenkins and SonarQube for static code analysis.

I tested the integration with a sample GitHub repository, successfully running a build and analyzing the project's code quality through SonarQube. This hands-on experience enhanced my understanding of the SAST process, Jenkins automation, and SonarQube's capabilities for identifying potential code vulnerabilities.

Experiment - 8

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.

Theory:

What is SAST?

Static application security testing (SAST), or static analysis, is a testing methodology that analyzes source code to find security vulnerabilities that make your organization's applications susceptible to attack. SAST scans an application before the code is compiled. It's also known as white box testing.

What problems does SAST solve?

SAST takes place very early in the software development life cycle (SDLC) as it does not require a working application and can take place without code being executed. It helps developers identify vulnerabilities in the initial stages of development and quickly resolve issues without breaking builds or passing on vulnerabilities to the final release of the application.

SAST tools give developers real-time feedback as they code, helping them fix issues before they pass the code to the next phase of the SDLC. This prevents security-related issues from being considered an afterthought. SAST tools also provide graphical representations of the issues found, from source to sink. These help you navigate the code easier. Some tools point out the exact location of vulnerabilities and highlight the risky code. Tools can also provide in-depth guidance on how to fix issues and the best place in the code to fix them, without requiring deep security domain expertise.

It's important to note that SAST tools must be run on the application on a regular basis, such as during daily/monthly builds, every time code is checked in, or during a code release.

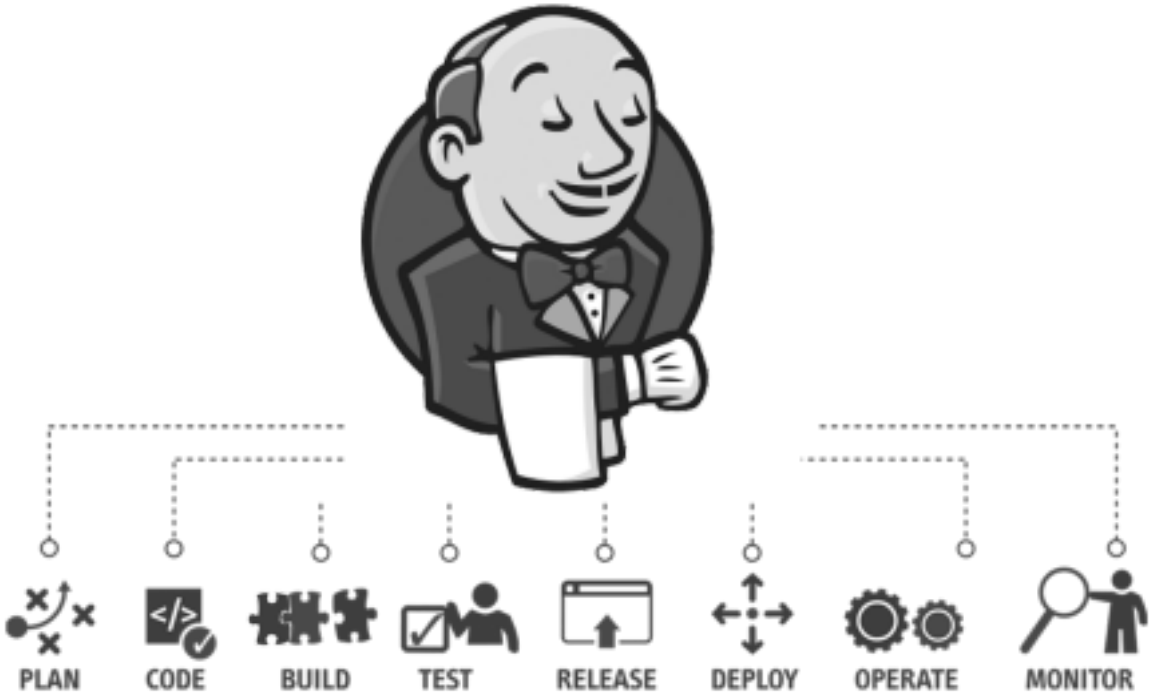
Why is SAST important?

Developers dramatically outnumber security staff. It can be challenging for an organization to find the resources to perform code reviews on even a fraction of its applications. A key strength of SAST tools is the ability to analyze 100% of the codebase. Additionally, they are much faster than manual secure code reviews performed by humans. These tools can scan millions of lines of code in a matter of minutes. SAST tools automatically identify critical vulnerabilities—such as buffer overflows, SQL injection, cross-site scripting, and others—with high confidence.

What is a CI/CD Pipeline?

CI/CD pipeline refers to the Continuous Integration/Continuous Delivery pipeline. Before we dive deep into this segment, let's first understand what is meant by the term ‘pipeline’?

A pipeline is a concept that introduces a series of events or tasks that are connected in a sequence to make quick software releases. For example, there is a task, that task has got five different stages, and each stage has got some steps. All the steps in phase one have to be completed, to mark the latter stage to be complete.



Now, consider the CI/CD pipeline as the backbone of the DevOps approach. This Pipeline is responsible for building codes, running tests, and deploying new software versions. The Pipeline executes the job in a defined manner by first coding it and then structuring it inside several blocks that may include several steps or tasks.

What is SonarQube?

SonarQube is an open-source platform developed by SonarSource for continuous inspection of code quality. Sonar does static code analysis, which provides a detailed report of bugs, code smells, vulnerabilities, code duplications.
It supports 25+ major programming languages through built-in rulesets and can also be extended with various plugins.

Benefits of SonarQube

- **Sustainability -** Reduces complexity, possible vulnerabilities, and code duplications, optimizing the life of applications.
- **Increase productivity -** Reduces the scale, cost of maintenance, and risk of the application; as such, it removes the need to spend more time changing the code
- **Quality code -** Code quality control is an inseparable part of the process of software development.
- **Detect Errors -** Detects errors in the code and alerts developers to fix them automatically before submitting them for output.
- **Increase consistency -** Determines where the code criteria are breached and enhances the quality
- **Business scaling -** No restriction on the number of projects to be evaluated
- **Enhance developer skills -** Regular feedback on quality problems helps developers to improve their coding skills

Integrating Jenkins with SonarQube:

Prerequisites:

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

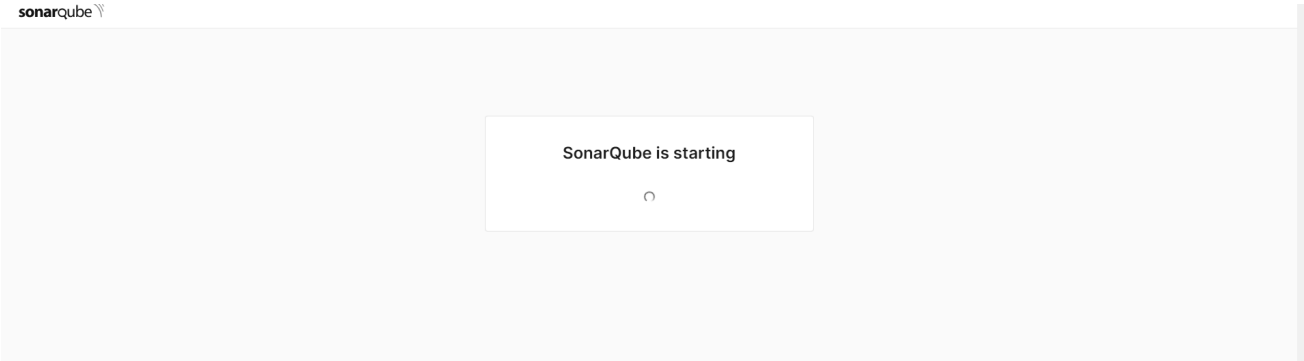
Steps to create a Jenkins CI/CD Pipeline and use SonarQube to perform SAST

1. Open up Jenkins Dashboard on localhost, port 8080 or whichever port it is at for you.
2. Run SonarQube in a Docker container using this command -

```
C:\Users\ADMIN>docker run -d --name sonarqube2 -e SONAR_ES_BOOTSTRAP_CHECKS_DISABLE=true -p 9001:9000 sonarqube:latest
fda86b00e3989f3eb5aca8396b29b2a0adc95bcfe0fc5d85cf1237491e7678b9
```

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

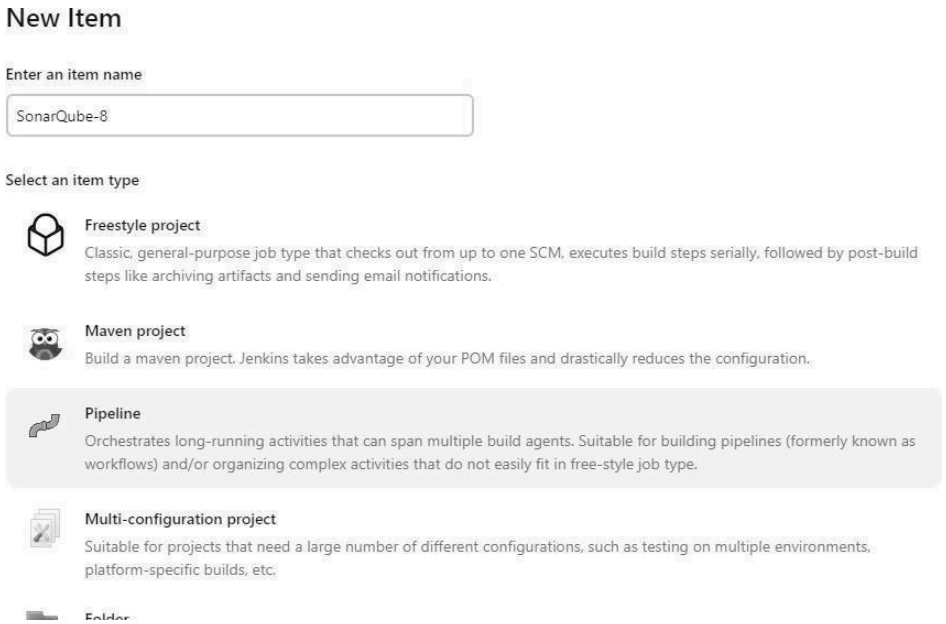
4. Login to SonarQube using username *admin* and password *admin*.



5. Create a manual project in SonarQube with the name **sonarqube-test**

Setup the project and come back to Jenkins Dashboard.

6. Create a New Item in Jenkins, choose



Pipeline.

7. Under Pipeline Script, enter the following

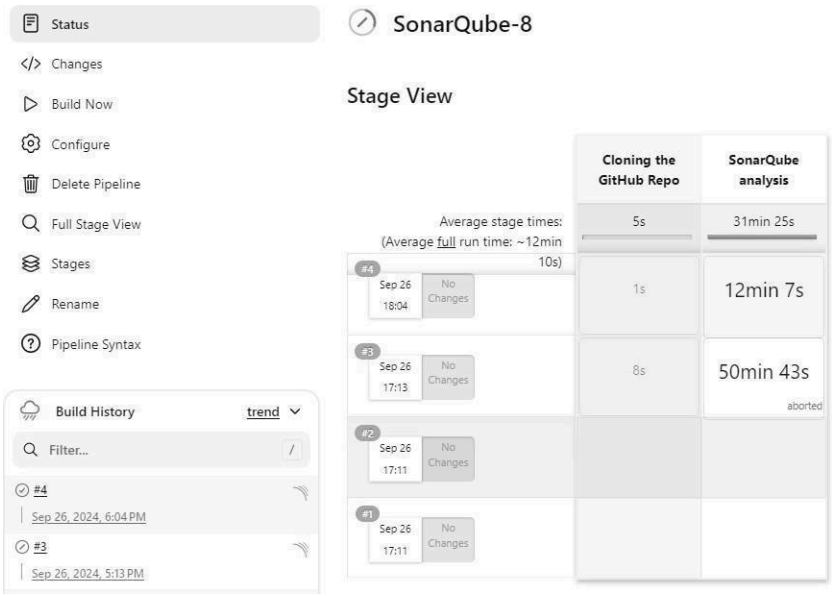
-

```
node {
  stage('Cloning the GitHub Repo') {
    git 'https://github.com/shazforiot/GOL.git'
  }
  stage('SonarQube analysis') {
    withSonarQubeEnv('sonarqube') {
      sh "<PATH_TO_SONARQUBE_FOLDER>//bin//sonar-scanner \
      -D sonar.login=<SonarQube_USERNAME> \
      -D sonar.password=<SonarQube_PASSWORD> \
      -D sonar.projectKey=<Project_KEY> \
-D sonar.exclusions=vendor/**,resources/**,**/*.java \
      -D sonar.host.url=http://127.0.0.1:9000/"
    }
  }
}
```

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

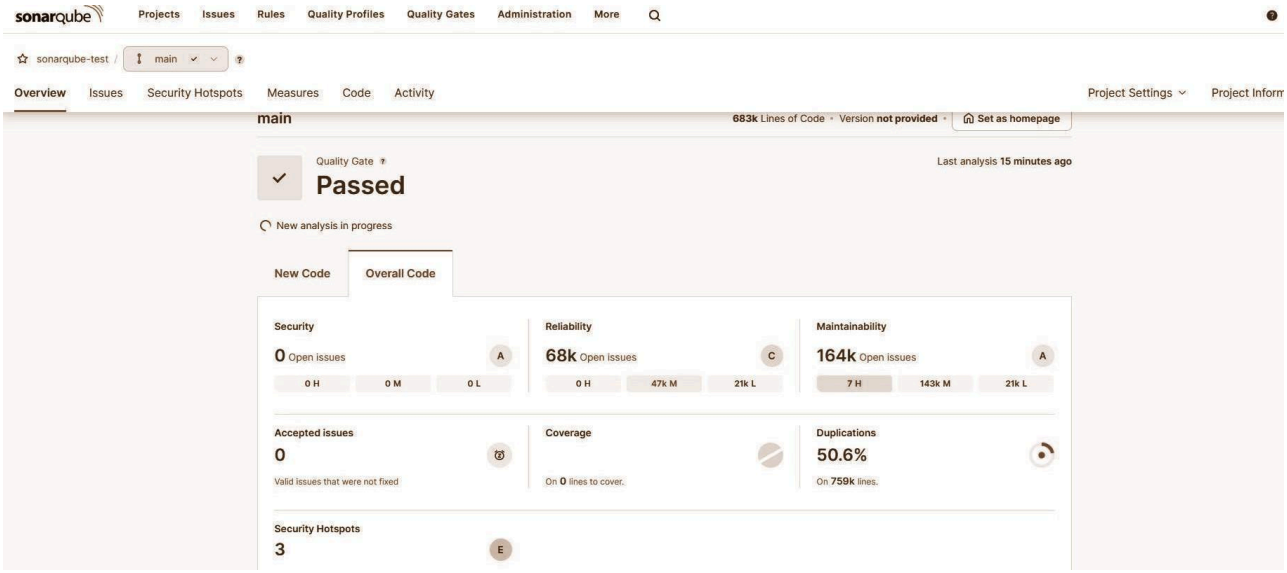
8. Run The Build.

9. Check the console output once the build is complete.



```
references.
18:13:39.657 WARN  Too many duplication references on file gameoflife-web/tools/jmeter/docs/api/org/apache/jmeter/gui/util/TextAreaCellRenderer.html for block at line 75. Keep only the first 100
references.
18:13:39.657 WARN  Too many duplication references on file gameoflife-web/tools/jmeter/docs/api/org/apache/jmeter/gui/util/TextAreaCellRenderer.html for block at line 41. Keep only the first 100
references.
18:13:39.657 WARN  Too many duplication references on file gameoflife-web/tools/jmeter/docs/api/org/apache/jmeter/gui/util/TextAreaCellRenderer.html for block at line 17. Keep only the first 100
references.
18:13:39.657 WARN  Too many duplication references on file gameoflife-web/tools/jmeter/docs/api/org/apache/jmeter/gui/util/TextAreaCellRenderer.html for block at line 296. Keep only the first 100
references.
18:13:39.657 WARN  Too many duplication references on file gameoflife-web/tools/jmeter/docs/api/org/apache/jmeter/gui/util/TextAreaCellRenderer.html for block at line 75. Keep only the first 100
references.
18:13:39.657 INFO  CPD Executor CPD calculation finished (done) | time=158971ms
18:13:39.674 INFO  SCM revision ID 'ba799ba7e1b576f04a4612322b0412c5e6e1e5e4'
18:15:49.696 INFO  Analysis report generated in 5022ms, dir size=127.2 MB
18:16:08.759 INFO  Analysis report compressed in 19048ms, zip size=29.6 MB
18:16:09.884 INFO  Analysis report uploaded in 1125ms
18:16:09.887 INFO  ANALYSIS SUCCESSFUL, you can find the results at: http://127.0.0.1:9001/dashboard?id=sonarqube-test
18:16:09.887 INFO  Note that you will be able to access the updated dashboard once the server has processed the submitted analysis report
18:16:09.887 INFO  More about the report processing at http://127.0.0.1:9001/api/ce/task?id=6f22c333-3777-4a21-b058-0ab4c049625c
18:16:22.970 INFO  Analysis total time: 12:02.242 s
18:16:22.975 INFO  SonarScanner Engine completed successfully
18:16:23.699 INFO  EXECUTION SUCCESS
18:16:23.706 INFO  Total time: 12:05.758s
[Pipeline] }
[Pipeline] // withSonarQubeEnv
[Pipeline] }
[Pipeline] // stage
[Pipeline] }
[Pipeline] // node
[Pipeline] End of Pipeline
Finished: SUCCESS
```

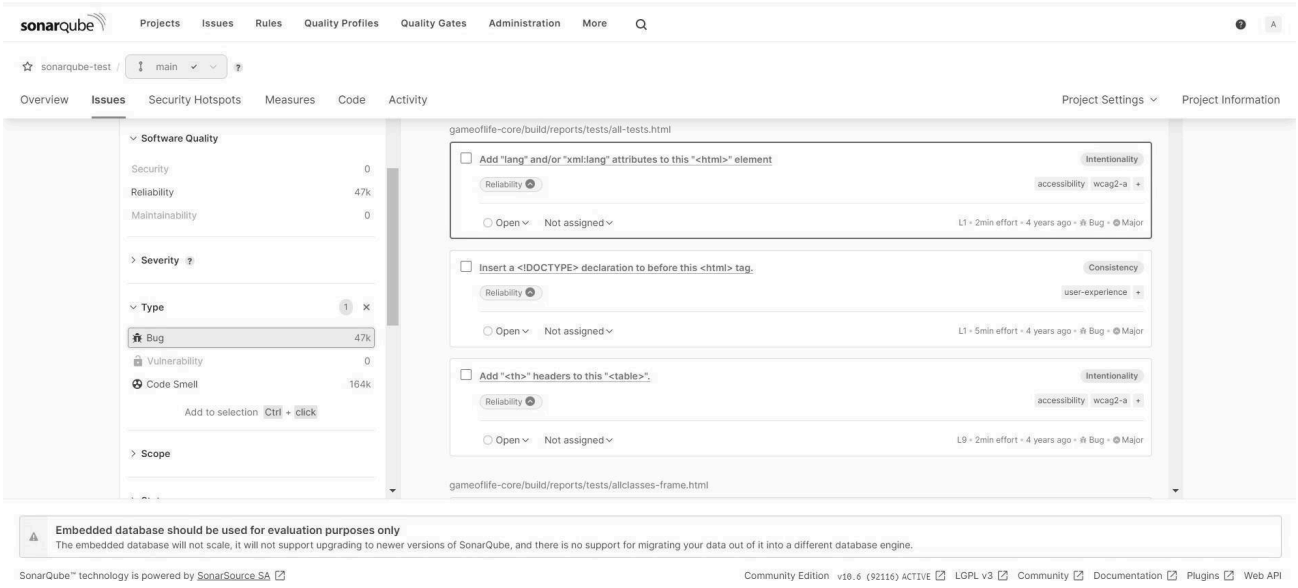
10. After that, check the project in SonarQube.



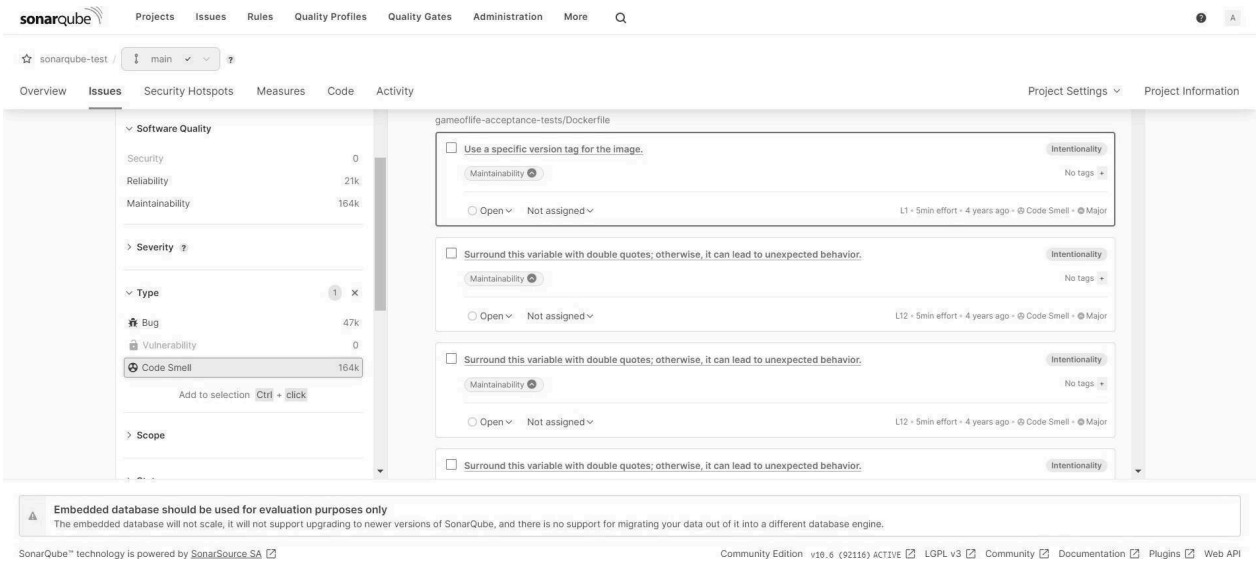
Under different tabs, check all different issues with the code.

11. Code Problems -

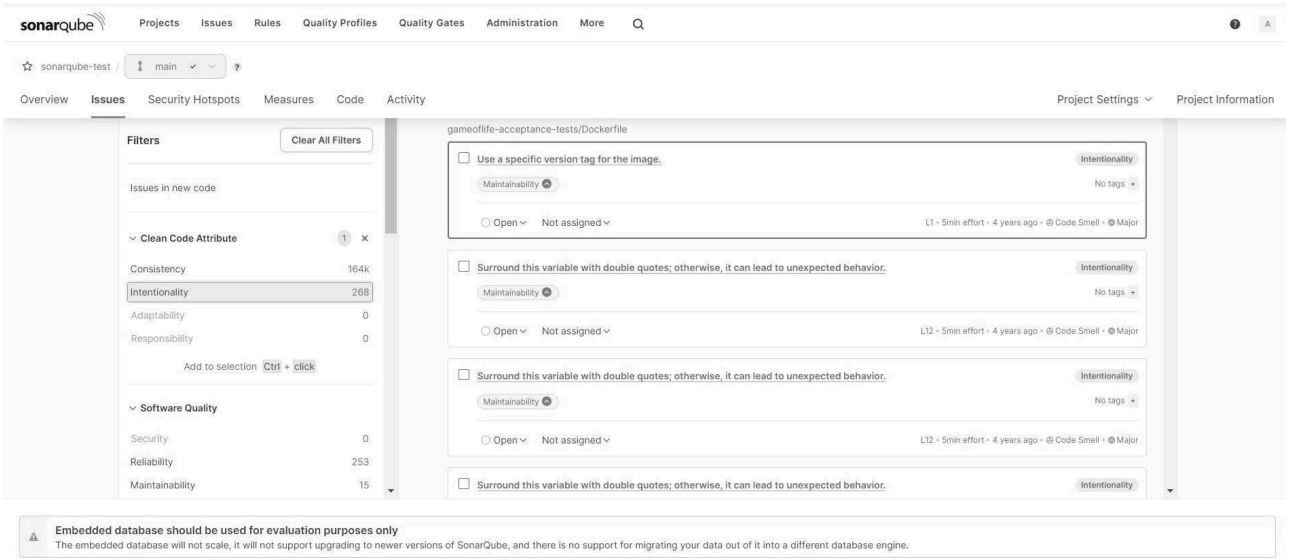
Bugs



Code Smells

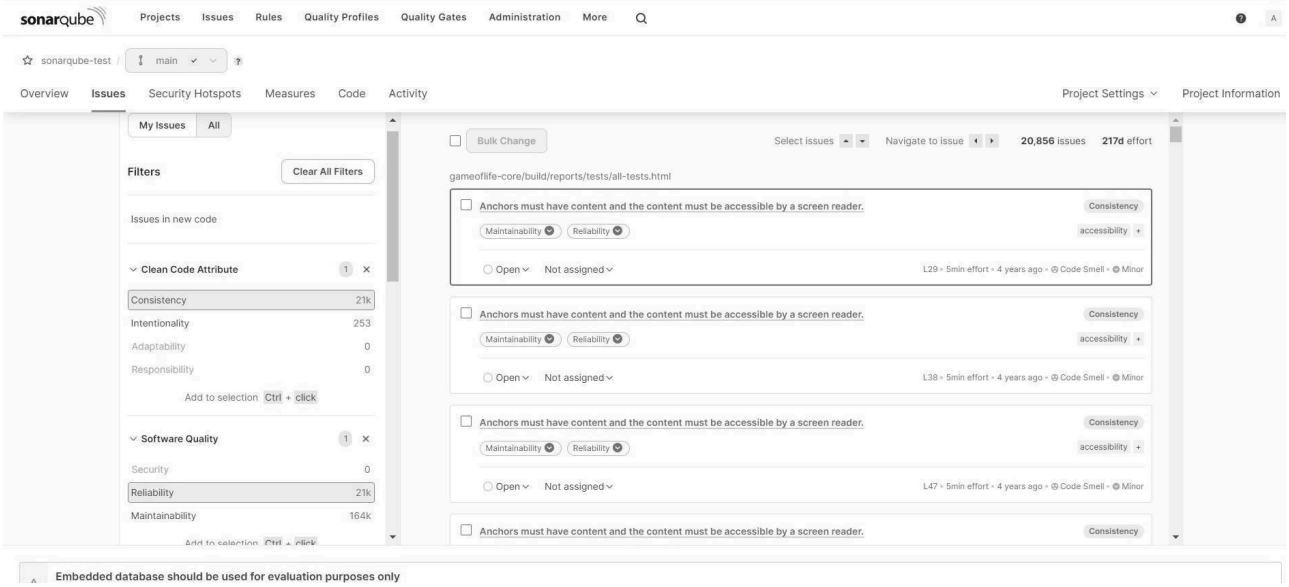


Intentional Issues



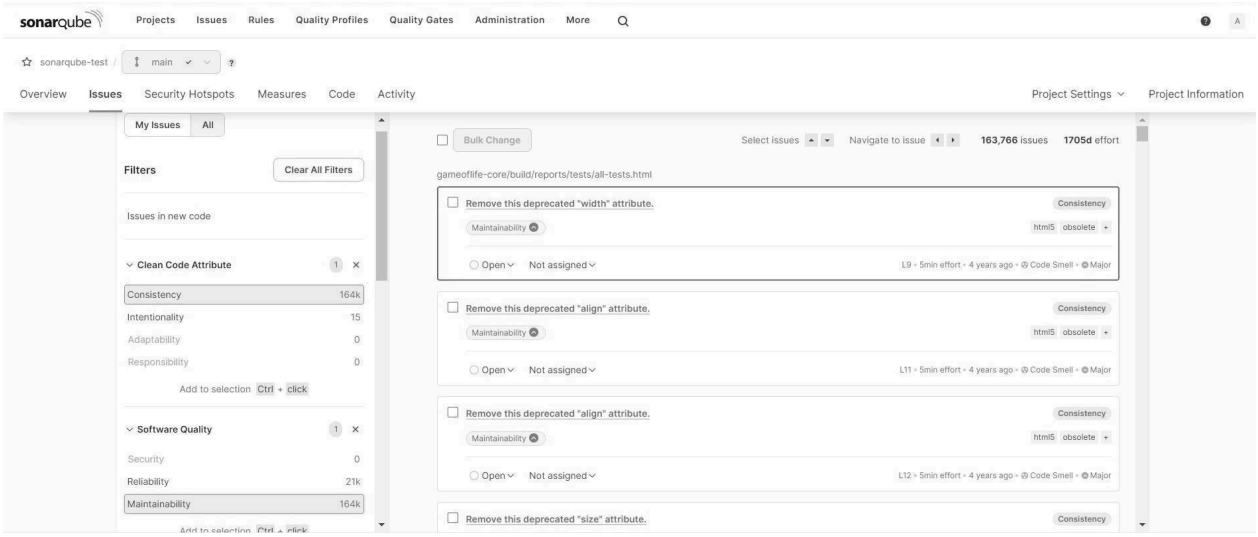
Embedded database should be used for evaluation purposes only
The embedded database will not scale, it will not support upgrading to newer versions of SonarQube, and there is no support for migrating your data out of it into a different database engine.

Reliability Issue

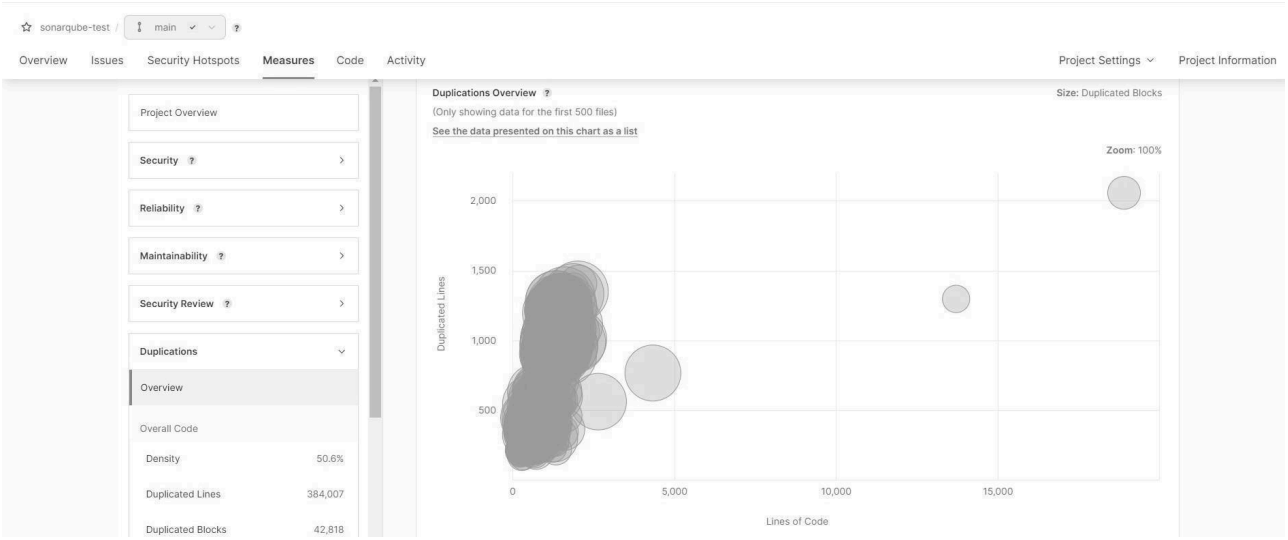


Embedded database should be used for evaluation purposes only

Maintainability Issue



Duplicates



In this way, we have created a CI/CD Pipeline with Jenkins and integrated it with SonarQube to find issues in the code like bugs, code smells, duplicates, cyclomatic complexities, etc.

Conclusion:

In this experiment, I successfully created a CI/CD pipeline using Jenkins integrated with SonarQube for static code analysis on a sample Java application. I set up SonarQube in a Docker container and configured Jenkins to clone the GitHub repository and perform the analysis. The pipeline detected various issues, including bugs, code smells, and security vulnerabilities, which I reviewed in SonarQube. This experience enhanced my skills in configuring CI/CD tools and highlighted the importance of maintaining code quality through automation. Overall, I gained valuable insights into integrating tools for effective software development practices.

Adv DevOps Practical 9

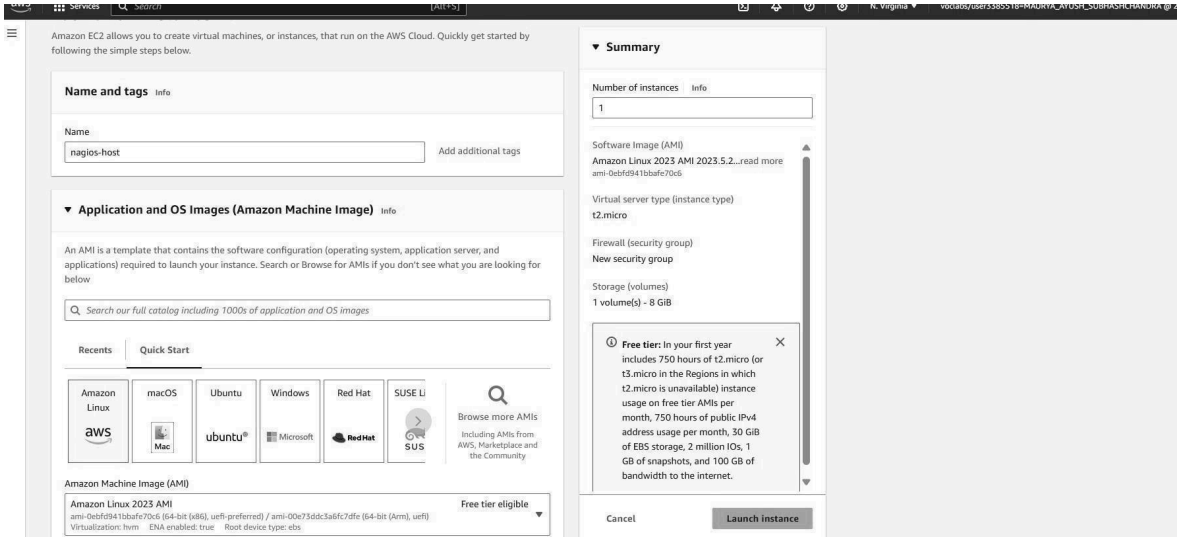
Aim: To Understand Continuous monitoring and Installation and configuration of Nagios Core, Nagios Plugins and NRPE (Nagios Remote Plugin Executor) on Linux Machine.

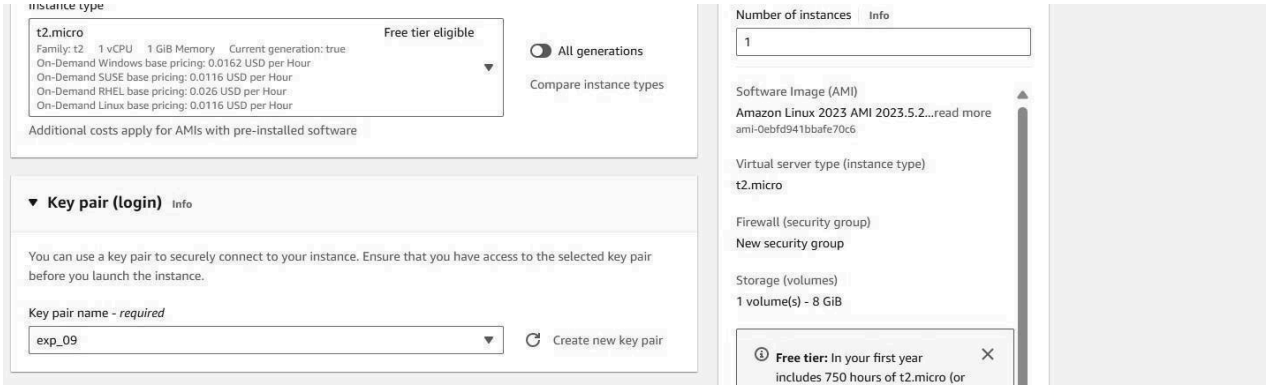
Theory:

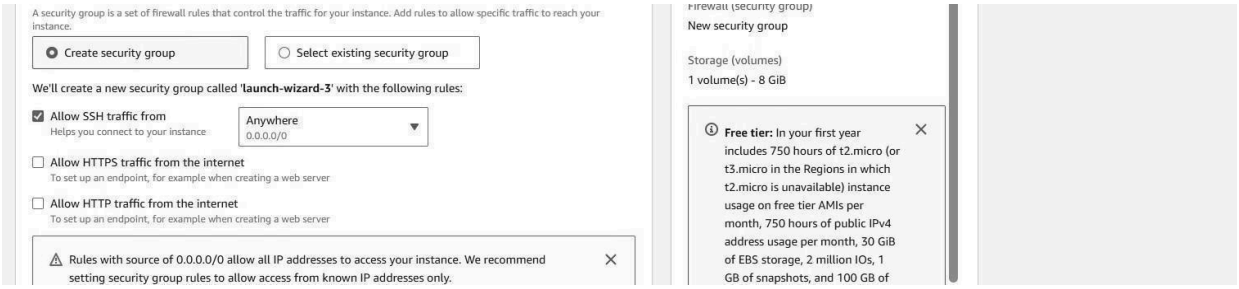
What is Nagios?
Nagios is an open-source software for continuous monitoring of systems, networks, and infrastructures. It runs plugins stored on a server that is connected with a host or another server on your network or the Internet. In case of any failure, Nagios alerts about the issues so that the technical team can perform the recovery process immediately.
Nagios is used for continuous monitoring of systems, applications, service and business processes in a DevOps culture
.
Installation of Nagios Prerequisites: AWS

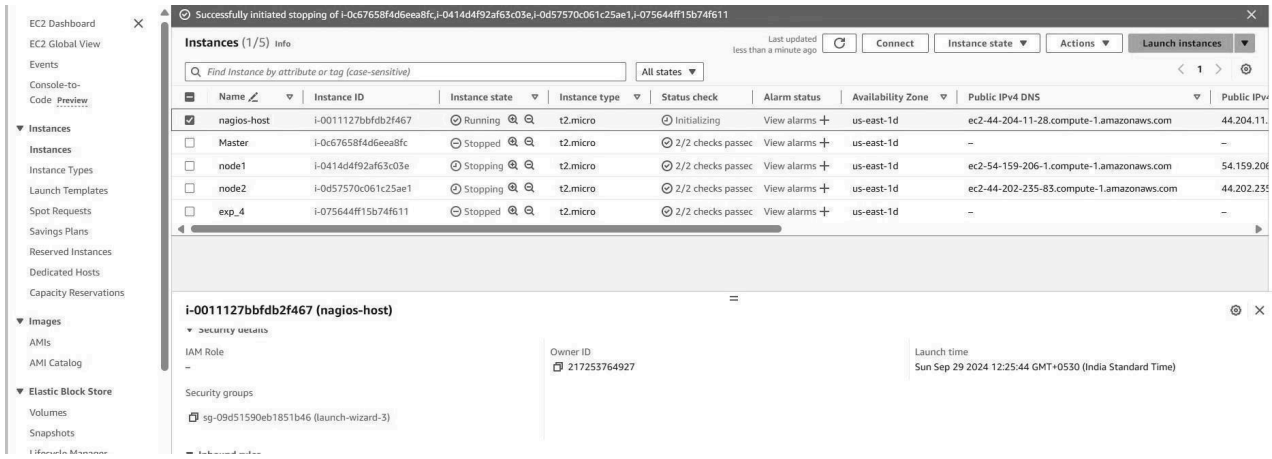
Free Tier

Steps:
1. Create an Amazon Linux EC2 Instance in AWS and name it - nagios-host

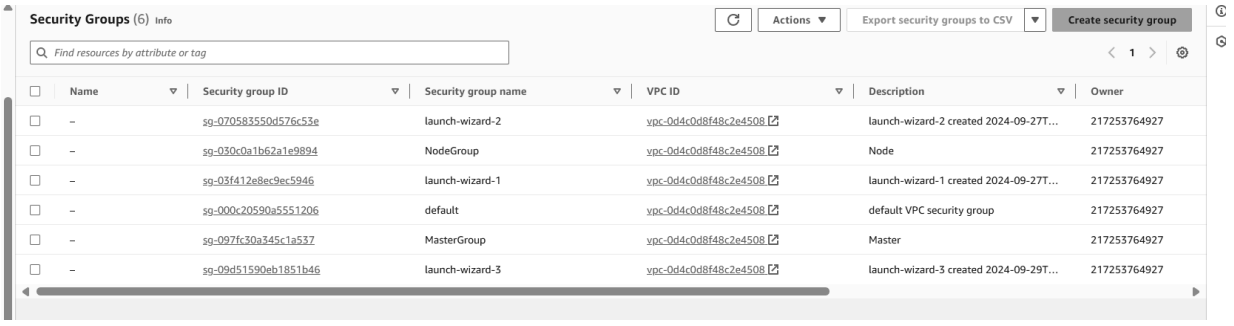


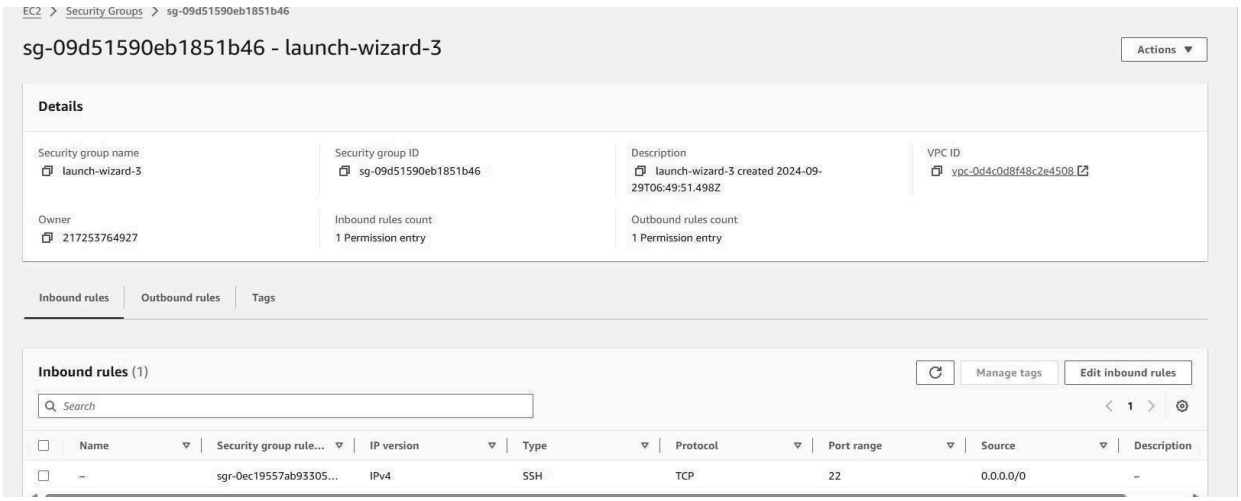


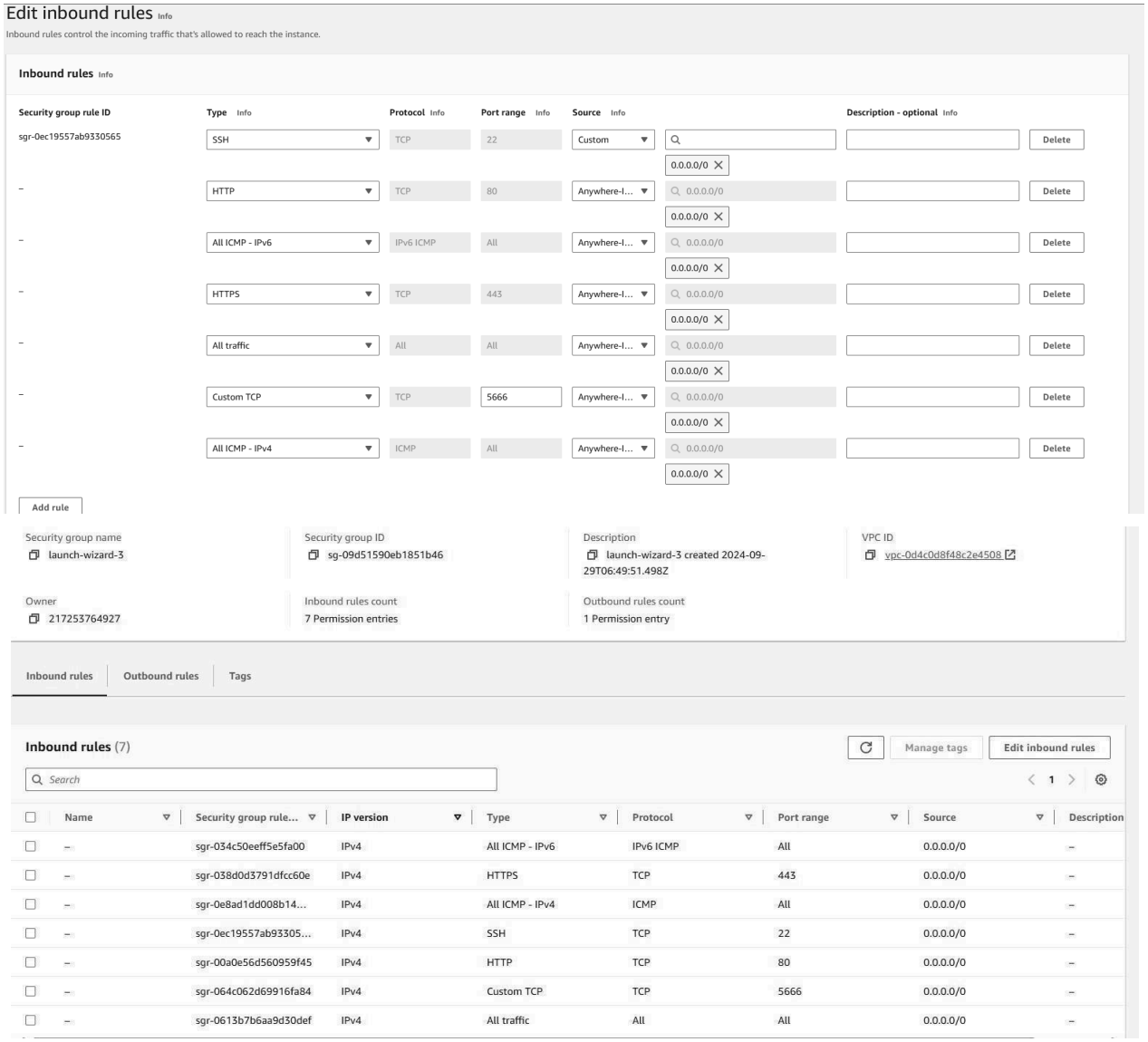




2. Under Security Group, make sure HTTP, HTTPS, SSH, ICMP are open from everywhere.

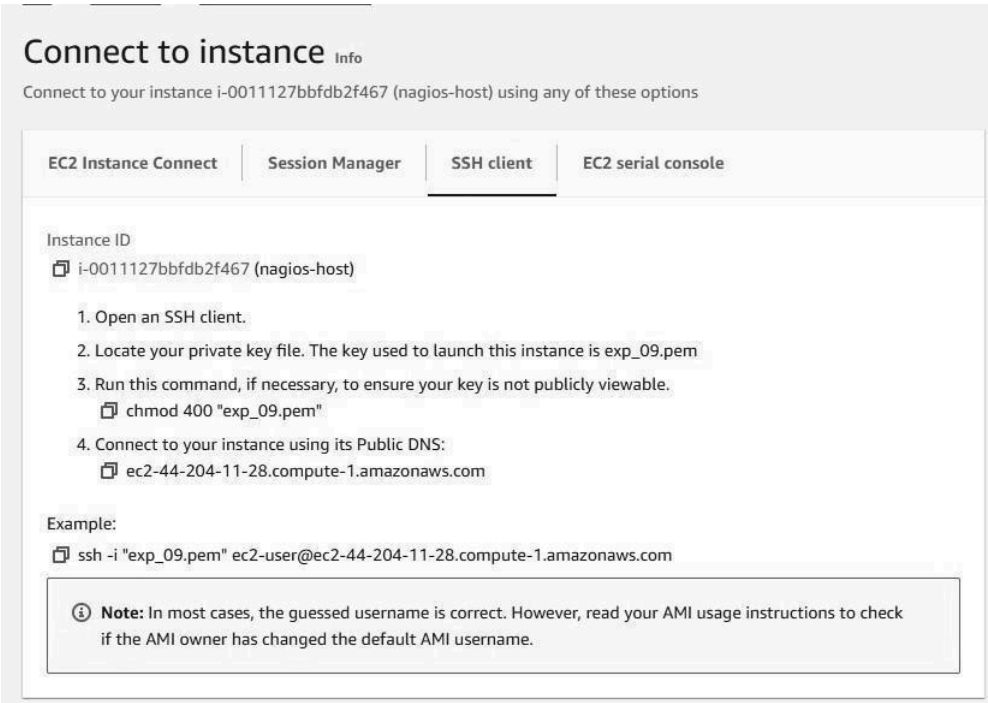






You have to edit the inbound rules of the specified Security Group for this.

3. SSH into Your EC2 instance or simply use EC2 Instance Connect from the browser.



Or open command prompt and paste ssh command.

```
Microsoft Windows [Version 10.0.22631.4169]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Ayush Maurya>ssh -i "Downloads/exp_09.pem" ec2-user@ec2-44-204-11-28.compute-1.amazonaws.com
The authenticity of host 'ec2-44-204-11-28.compute-1.amazonaws.com (44.204.11.28)' can't be established.
ED25519 key fingerprint is SHA256:v2OKH/ezl9iu7/RT6m8LWkgWzEJnnQIqrG9gKWzwC14.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added 'ec2-44-204-11-28.compute-1.amazonaws.com' (ED25519) to the list of known hosts.
   ,     #_
   ~\_  ####_        Amazon Linux 2023
  ~~  \_#####\
  ~~     \###|
  ~~       \#/ ___   https://aws.amazon.com/linux/amazon-linux-2023
   ~~       V~' '->
    ~~~         /
      ~~._.   _/
         _/ _/
       _/m/'
Last login: Sun Sep 29 07:11:40 2024 from 18.206.107.27
[ec2-user@ip-172-31-91-91 ~]$
```

sudo yum update

```
[ec2-user@ip-172-31-91-91 ~]$
sudo yum update
Last metadata expiration check: 0:19:03 ago on Sun Sep 29 06:56:15 2024.
Dependencies resolved.
Nothing to do.
Complete!
[ec2-user@ip-172-31-91-91 ~]$
```

```
[ec2-user@ip-172-31-91-91 ~]$ sudo yum install httpd php
Last metadata expiration check: 0:19:29 ago on Sun Sep 29 06:56:15 2024.
Dependencies resolved.
================================================================================================================================
 Package                          Architecture       Version                                 Repository                  Size
================================================================================================================================
Installing:
 httpd                            x86_64             2.4.62-1.amzn2023                       amazonlinux                 48 k
 php8.3                           x86_64             8.3.10-1.amzn2023.0.1                   amazonlinux                 10 k
Installing dependencies:
 apr                              x86_64             1.7.2-2.amzn2023.0.2                    amazonlinux                129 k
 apr-util                         x86_64             1.6.3-1.amzn2023.0.1                    amazonlinux                 98 k
 generic-logos-httpd              noarch             18.0.0-12.amzn2023.0.3                  amazonlinux                 19 k
 httpd-core                       x86_64             2.4.62-1.amzn2023                       amazonlinux                1.4 M
 httpd-filesystem                 noarch             2.4.62-1.amzn2023                       amazonlinux                 14 k
 httpd-tools                      x86_64             2.4.62-1.amzn2023                       amazonlinux                 81 k
 libbrotli                        x86_64             1.0.9-4.amzn2023.0.2                    amazonlinux                315 k
 libsodium                        x86_64             1.0.19-4.amzn2023                       amazonlinux                176 k
 libxslt                          x86_64             1.1.34-5.amzn2023.0.2                   amazonlinux                241 k
 mailcap                          noarch             2.1.49-3.amzn2023.0.3                   amazonlinux                 33 k
 nginx-filesystem                 noarch             1:1.24.0-1.amzn2023.0.4                 amazonlinux                9.8 k
 php8.3-cli                       x86_64             8.3.10-1.amzn2023.0.1                   amazonlinux                3.7 M
 php8.3-common                    x86_64             8.3.10-1.amzn2023.0.1                   amazonlinux                737 k
 php8.3-process                   x86_64             8.3.10-1.amzn2023.0.1                   amazonlinux                 45 k
 php8.3-xml                       x86_64             8.3.10-1.amzn2023.0.1                   amazonlinux                154 k
Installing weak dependencies:
 apr-util-openssl                 x86_64             1.6.3-1.amzn2023.0.1                    amazonlinux                 17 k
 mod_http2                        x86_64             2.0.27-1.amzn2023.0.3                   amazonlinux                166 k
 mod_lua                          x86_64             2.4.62-1.amzn2023                       amazonlinux                 61 k
 php8.3-fpm                       x86_64             8.3.10-1.amzn2023.0.1                   amazonlinux                1.9 M
 php8.3-mbstring                  x86_64             8.3.10-1.amzn2023.0.1                   amazonlinux                528 k
 php8.3-opcache                   x86_64             8.3.10-1.amzn2023.0.1                   amazonlinux                379 k
 php8.3-pdo                       x86_64             8.3.10-1.amzn2023.0.1                   amazonlinux                 89 k
 php8.3-sodium                    x86_64             8.3.10-1.amzn2023.0.1                   amazonlinux                 41 k

Transaction Summary
```

```
 Total                                                                                                  22 MB/s |  10 MB     00:00
 Running transaction check
 Transaction check succeeded.
 Running transaction test
 Transaction test succeeded.
 Running transaction
   Preparing        :                                                                                                        1/1
   Installing       : php8.3-common-8.3.10-1.amzn2023.0.1.x86_64                                                             1/25
   Installing       : apr-1.7.2-2.amzn2023.0.2.x86_64                                                                        2/25
   Installing       : apr-util-openssl-1.6.3-1.amzn2023.0.1.x86_64                                                           3/25
   Installing       : apr-util-1.6.3-1.amzn2023.0.1.x86_64                                                                   4/25
   Installing       : mailcap-2.1.49-3.amzn2023.0.3.noarch                                                                   5/25
   Running scriptlet: httpd-filesystem-2.4.62-1.amzn2023.noarch                                                              6/25
```

```
[ec2-user@ip-172-31-91-91 ~]$ sudo yum install gd gd-devel
Last metadata expiration check: 0:21:30 ago on Sun Sep 29 06:56:15 2024.
Dependencies resolved.
================================================================================================================================
 Package                          Architecture       Version                                 Repository                  Size
================================================================================================================================
Installing:
 gd                               x86_64             2.3.3-5.amzn2023.0.3                    amazonlinux                139 k
 gd-devel                         x86_64             2.3.3-5.amzn2023.0.3                    amazonlinux                 38 k
Installing dependencies:
 brotli                           x86_64             1.0.9-4.amzn2023.0.2                    amazonlinux                314 k
 brotli-devel                     x86_64             1.0.9-4.amzn2023.0.2                    amazonlinux                 31 k
 bzip2-devel                      x86_64             1.0.8-6.amzn2023.0.2                    amazonlinux                214 k
 cairo                            x86_64             1.17.6-2.amzn2023.0.1                   amazonlinux                684 k
 cmake-filesystem                 x86_64             3.22.2-1.amzn2023.0.4                   amazonlinux                 16 k
 fontconfig                       x86_64             2.13.94-2.amzn2023.0.2                  amazonlinux                273 k
```

```
Installed:
  brotli-1.0.9-4.amzn2023.0.2.x86_64                  brotli-devel-1.0.9-4.amzn2023.0.2.x86_64                  bzip2-devel-1.0.8-6.amzn2023.0.2.x86_64
  cairo-1.17.6-2.amzn2023.0.1.x86_64                  cmake-filesystem-3.22.2-1.amzn2023.0.4.x86_64             fontconfig-2.13.94-2.amzn2023.0.2.x86_64
  fontconfig-devel-2.13.94-2.amzn2023.0.2.x86_64      fonts-filesystem-1:2.0.5-12.amzn2023.0.2.noarch           freetype-2.13.2-5.amzn2023.0.1.x86_64
  freetype-devel-2.13.2-5.amzn2023.0.1.x86_64         gd-2.3.3-5.amzn2023.0.3.x86_64                            gd-devel-2.3.3-5.amzn2023.0.3.x86_64
  glib2-devel-2.74.7-689.amzn2023.0.2.x86_64          google-noto-fonts-common-20201206-2.amzn2023.0.2.noarch   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
  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

Complete!
```

5. Create a new Nagios User with its password. You'll have to enter the password twice for confirmation.

sudo adduser -m
nagios sudo passwd
nagios (password :

```
Complete!
[ec2-user@ip-172-31-91-91 ~]$ 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:
Sorry, passwords do not match.
New password:
BAD PASSWORD: The password contains the user name in some form
Retype new password:
Sorry, passwords do not match.
New password:
Retype new password:
passwd: all authentication tokens updated successfully.
[ec2-user@ip-172-31-91-91 ~]$
```

ayushmau)

6. Create a new user group

sudo groupadd nagcmd

```
[ec2-user@ip-172-31-91-91 ~]$ sudo groupadd nagcmd
[ec2-user@ip-172-31-91-91 ~]$
```

7. Use these commands so that you don't have to use sudo for Apache and Nagios

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

```
[ec2-user@ip-172-31-91-91 ~]$ sudo usermod -a -G nagcmd nagios
sudo usermod -a -G nagcmd apache
[ec2-user@ip-172-31-91-91 ~]$
```

8. Create a new directory for Nagios downloads

mkdir
~/downloads cd

```
[ec2-user@ip-172-31-91-91 ~]$ mkdir ~/downloads
cd ~/downloads
```

~/downloads

9. Use wget to download the source zip files.

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

```
[ec2-user@ip-172-31-91-91 downloads]$ cd ..
[ec2-user@ip-172-31-91-91 ~]$ cd ~/downloads
[ec2-user@ip-172-31-91-91 downloads]$ wget https://assets.nagios.com/downloa
ds/nagioscore/releases/nagios-4.5.5.tar.gz
--2024-09-29 09:11:59--  https://assets.nagios.com/downloads/nagioscore/rele
ases/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... con
nected.
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.g 100%[=================>]   1.97M  5.07MB/s    in 0.4s

2024-09-29 09:11:59 (5.07 MB/s) - 'nagios-4.5.5.tar.gz' saved [2065473/20654
73]

[ec2-user@ip-172-31-91-91 downloads]$
```

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

```
[ec2-user@ip-172-31-91-91 nagios-4.5.5]$ cd ..
[ec2-user@ip-172-31-91-91 downloads]$ wget https://nagios-plugins.org/downlo
ad/nagios-plugins-2.4.11.tar.gz
--2024-09-29 09:14:28--  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-2.4 100%[=================>]   2.62M  6.92MB/s    in 0.4s
```

10. Use tar to unzip and change to that directory. tar zxvf nagios-4.5.5.tar.gz

```
[ec2-user@ip-172-31-91-91 downloads]$ tar zxvf nagios-4.0.8.tar.gz
nagios-4.0.8/
nagios-4.0.8/.gitignore
nagios-4.0.8/Changelog
nagios-4.0.8/INSTALLING
nagios-4.0.8/LEGAL
nagios-4.0.8/LICENSE
nagios-4.0.8/Makefile.in
nagios-4.0.8/README
nagios-4.0.8/README.asciidoc
nagios-4.0.8/THANKS
nagios-4.0.8/UPGRADING
nagios-4.0.8/base/
nagios-4.0.8/base/.gitignore
```

11. Run the configuration script with the same group name you previously created.
./configure --with-command-group=nagcmd

Here we go an error

```
[ec2-user@ip-172-31-91-91 downloads]$ ./configure --with-command-group=nagcmd
-bash: ./configure: No such file or directory
[ec2-user@ip-172-31-91-91 downloads]$
```

Solution

Navigate to nagios folder in downloads

```
[ec2-user@ip-172-31-91-91 downloads]$ ls
nagios-4.0.8  nagios-4.0.8.tar.gz  nagios-plugins-2.0.3.tar.gz
[ec2-user@ip-172-31-91-91 downloads]$ cd nagios-4.0.8
[ec2-user@ip-172-31-91-91 nagios-4.0.8]$
```

Error 2: Cannot find SSL headers.
Solution: Install openssl dev library

Steps:
sudo yum install openssl-devel

```
[ec2-user@ip-172-31-91-91 nagios-4.5.5]$ sudo yum install openssl-devel
Last metadata expiration check: 2:24:05 ago on Sun Sep 29 06:56:15 2024.
Dependencies resolved.
================================================================================
 Package           Arch      Version                     Repository      Size
================================================================================
Installing:
 openssl-devel     x86_64    1:3.0.8-1.amzn2023.0.14     amazonlinux     3.0 M

Transaction Summary
================================================================================
Install  1 Package

Total download size: 3.0 M
Installed size: 4.7 M
Is this ok [y/N]: y
Downloading Packages:
```

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

```
             Event Broker:  yes
         Install ${prefix}:  /usr/local/nagios
     Install ${includedir}:  /usr/local/nagios/include/nagios
                 Lock file:  /run/nagios.lock
    Check result directory:  /usr/local/nagios/var/spool/checkresults
            Init directory:  /lib/systemd/system
   Apache conf.d directory:  /etc/httpd/conf.d
              Mail program:  /bin/mail
                   Host OS:  linux-gnu
          IOBroker Method:  epoll

 Web Interface Options:
 ------------------------
                 HTML URL:  http://localhost/nagios/
                  CGI URL:  http://localhost/nagios/cgi-bin/
 Traceroute (used by WAP):  /usr/bin/traceroute


Review the options above for accuracy.  If they look okay,
type 'make all' to compile the main program and CGIs.

[ec2-user@ip-172-31-91-91 nagios-4.5.5]$
```

12. Compile the source code.

make all

```
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 ./nagios.c
gcc -Wall -I.. -I. -I../lib -I../include  -I../include -I..  -g -O2  -DHAVE_
CONFIG_H -DNSCORE -c -o broker.o broker.c
```

13. Install binaries, init script and sample config files. Lastly, set permissions on the external command directory.

sudo make install

sudo make install-init

sudo make install-config

sudo make install-commandmode

```
[ec2-user@ip-172-31-91-91 nagios-4.5.5]$ make all

sudo make install
sudo make install-init
sudo make install-config
sudo make install-commandmode
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 ./nagios.c
gcc -Wall -I.. -I. -I../lib -I../include  -I../include -I..  -g -O2  -DHAVE_
CONFIG_H -DNSCORE -c -o broker.o broker.c
gcc -Wall -I.. -I. -I../lib -I../include  -I../include -I..  -g -O2  -DHAVE_
CONFIG_H -DNSCORE -c -o nebmods.o nebmods.c
gcc -Wall -I.. -I. -I../lib -I../include  -I../include -I..  -g -O2  -DHAVE_
CONFIG_H -DNSCORE -c -o ../common/shared.o ../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 query-handler.c
gcc -Wall -I.. -I. -I../lib -I../include  -I../include -I..  -g -O2  -DHAVE_
CONFIG_H -DNSCORE -c -o workers.o workers.c
In function ‘get_wproc_list’,
    inlined from ‘get_worker’ at workers.c:277:12:
workers.c:253:17: warning: ‘%s’ directive argument is null [-Wformat-overflo
w=]
  253 |                 log_debug_info(DEBUGL_CHECKS, 1, "Found specialized
worker(s) for '%s'", (slash && *slash != '/') ? slash : cmd_name);
      |                 ^~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
gcc -Wall -I.. -I. -I../lib -I../include  -I../include -I..  -g -O2  -DHAVE_
CONFIG_H -DNSCORE -c -o checks.o checks.c
gcc -Wall -I.. -I. -I../lib -I../include  -I../include -I..  -g -O2  -DHAVE_
CONFIG_H -DNSCORE -c -o config.o config.c
gcc -Wall -I.. -I. -I../lib -I../include  -I../include -I..  -g -O2  -DHAVE
```

14. Edit the config file and change the email address.

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

```
#
# CONTACTS
#
###############################################################################

# 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 (defined above)
    alias                   Nagios Admin            ; Full name of user
    email                   2022.ayush.maurya@ves.ac.in ; <<***** CHANGE THIS TO YOUR EMAIL ADDRESS ******
}



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

# We only have one contact in this simple configuration file, so there is
# no need to create more than one contact group.

define contactgroup {

    contactgroup_name       admins
    alias                   Nagios Administrators
    members                 nagiosadmin
}

^G Help          ^O Write Out     ^W Where Is      ^K Cut           ^T Execute       ^C Location      M-U Undo         M-A Set Mark     M-] To Bra
^X Exit          ^R Read File     ^\ Replace       ^U Paste         ^J Justify       ^/ Go To Line    M-E Redo         M-6 Copy         ^Q Whereis
```

And change email with your email

15. Configure the web interface.

sudo make install-webconf

```
[ec2-user@ip-172-31-91-91 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/nagi
s.conf; \
fi

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

[ec2-user@ip-172-31-91-91 nagios-4.5.5]$
```

16. Create a nagiosadmin account for nagios login along with password.

You'll have to specify the password twice.

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

```
[ec2-user@ip-172-31-91-91 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-172-31-91-91 nagios-4.5.5]$
```

Password: Ayushmau

17. Restart Apache

sudo service httpd restart

```
Adding password for user nagiosadmin
[ec2-user@ip-172-31-91-91 nagios-4.5.5]$ sudo service httpd restart
Redirecting to /bin/systemctl restart httpd.service
[ec2-user@ip-172-31-91-91 nagios-4.5.5]$
```

18. Go back to the downloads folder and unzip the plugins zip file.

cd ~/downloads

tar zxvf nagios-plugins-2.4.11.tar.gz

```
[ec2-user@ip-172-31-91-91 downloads]$ cd ~/downloads
[ec2-user@ip-172-31-91-91 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/
nagios-plugins-2.4.11/build-aux/snippet/_Noreturn.h
nagios-plugins-2.4.11/build-aux/snippet/arg-nonnull.h
nagios-plugins-2.4.11/build-aux/snippet/c++defs.h
nagios-plugins-2.4.11/build-aux/snippet/warn-on-use.h
nagios-plugins-2.4.11/build-aux/test-driver
nagios-plugins-2.4.11/config_test/
```

19. Compile and install plugins

cd nagios-plugins-2.4.11

./configure --with-nagios-user=nagios --with-nagios-group=nagios

```
[ec2-user@ip-172-31-91-91 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)
checking dependency style of gcc... gcc3
checking how to run the C preprocessor... gcc -E
checking for grep that handles long lines and -e... /usr/bin/grep
checking for egrep... /usr/bin/grep -E
checking for Minix Amsterdam compiler... no
checking for ar... ar
checking for ranlib... ranlib
```

make

```
[ec2-user@ip-172-31-91-91 nagios-plugins-2.4.11]$ make
sudo make install
make  all-recursive
make[1]: Entering directory '/home/ec2-user/downloads/nagios-plugins-2.4.11'
Making all in gl
make[2]: Entering directory '/home/ec2-user/downloads/nagios-plugins-2.4.11/
gl'
rm -f alloca.h-t alloca.h && \
{ echo '/* DO NOT EDIT! GENERATED AUTOMATICALLY! */'; \
  cat ./alloca.in.h; \
} > alloca.h-t && \
mv -f alloca.h-t alloca.h
rm -f c++defs.h-t c++defs.h && \
sed -n -e '/_GL_CXXDEFS/,$p' \
  < ../build-aux/snippet/c++defs.h \
  > c++defs.h-t && \
mv c++defs.h-t c++defs.h
rm -f warn-on-use.h-t warn-on-use.h && \
sed -n -e '/^.ifndef/,$p' \
  < ../build-aux/snippet/warn-on-use.h \
  > warn-on-use.h-t && \
mv warn-on-use.h-t warn-on-use.h
rm -f arg-nonnull.h-t arg-nonnull.h && \
sed -n -e '/GL_ARG_NONNULL/,$p' \
  < ../build-aux/snippet/arg-nonnull.h \
  > arg-nonnull.h-t && \
mv arg-nonnull.h-t arg-nonnull.h
/usr/bin/mkdir -p arpa
```

```
make[1]: Entering directory '/home/ec2-user/downloads/nagios-plugins-2.4.11'
make[2]: Entering directory '/home/ec2-user/downloads/nagios-plugins-2.4.11'
make[2]: Nothing to be done for 'install-exec-am'.
make[2]: Nothing to be done for 'install-data-am'.
make[2]: Leaving directory '/home/ec2-user/downloads/nagios-plugins-2.4.11'
make[1]: Leaving directory '/home/ec2-user/downloads/nagios-plugins-2.4.11'
[ec2-user@ip-172-31-91-91 nagios-plugins-2.4.11]$
```

```
[ec2-user@ip-172-31-91-91 nagios-plugins-2.0.3]$ sudo /usr/local/nagios/bin/nagios -v /usr/local/nagios/etc/nagios.cfg

Nagios Core 4.0.8
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Last Modified: 08-12-2014
License: GPL

Website: http://www.nagios.org
Reading configuration data...
Error in configuration file '/usr/local/nagios/etc/nagios.cfg' - Line 452 (Check result path '/usr/local/nagios/var/spool/checkres
lts' is not a valid directory)
   Error processing main config file!
```

Solution:

 # <u>Create the missing directory</u><u>: If the directory is missing, create it with the necessary permissions:</u>

sudo mkdir -p /usr/local/nagios/var/spool/checkresults

sudo chown nagios:nagios /usr/local/nagios/var/spool/checkresults

sudo chmod 775 /usr/local/nagios/var/spool/checkresults

```
[ec2-user@ip-172-31-91-91 nagios-plugins-2.0.3]$ sudo mkdir -p /usr/local/nagios/var/spool/checkresults
sudo chown nagios:nagios /usr/local/nagios/var/spool/checkresults
sudo chmod 775 /usr/local/nagios/var/spool/checkresults
```

Now run again

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

```
[ec2-user@ip-172-31-91-91 nagios-plugins-2.4.11]$ sudo /usr/local/nagios/bin/nagios -v /usr/local/nagios/etc/nagios.cfg

Nagios Core 4.5.5
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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 8 services.
        Checked 1 hosts.
        Checked 1 host groups.
        Checked 0 service groups.
        Checked 1 contacts.
        Checked 1 contact groups.
        Checked 24 commands.
        Checked 5 time periods.
        Checked 0 host escalations.
        Checked 0 service escalations.
Checking for circular paths...
        Checked 1 hosts
        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
```

sudo service nagios start

```
[ec2-user@ip-172-31-91-91 nagios-plugins-2.4.11]$ sudo service nagios start
Starting nagios (via systemctl):                           [  OK  ]
```

21. Check the status of Nagios

sudo systemctl status nagios

```
[ec2-user@ip-172-31-91-91 nagios-plugins-2.0.3]$ sudo systemctl status nagios
● nagios.service - LSB: Starts and stops the Nagios monitoring server
     Loaded: loaded (/etc/rc.d/init.d/nagios; generated)
     Active: active (running) since Sun 2024-09-29 08:04:30 UTC; 37s ago
       Docs: man:systemd-sysv-generator(8)
    Process: 68037 ExecStart=/etc/rc.d/init.d/nagios start (code=exited, status=0/SUCCESS)
      Tasks: 6 (limit: 1112)
     Memory: 2.0M
        CPU: 47ms
     CGroup: /system.slice/nagios.service
             ├─68059 /usr/local/nagios/bin/nagios -d /usr/local/nagios/etc/nagios.cfg
             ├─68061 /usr/local/nagios/bin/nagios --worker /usr/local/nagios/var/rw/nagios.qh
             ├─68062 /usr/local/nagios/bin/nagios --worker /usr/local/nagios/var/rw/nagios.qh
             ├─68063 /usr/local/nagios/bin/nagios --worker /usr/local/nagios/var/rw/nagios.qh
             ├─68064 /usr/local/nagios/bin/nagios --worker /usr/local/nagios/var/rw/nagios.qh
             └─68065 /usr/local/nagios/bin/nagios -d /usr/local/nagios/etc/nagios.cfg

Sep 29 08:04:30 ip-172-31-91-91.ec2.internal nagios[68059]: wproc: Registry request: name=Core Worker 68063;pid=68063
Sep 29 08:04:30 ip-172-31-91-91.ec2.internal nagios[68059]: wproc: Registry request: name=Core Worker 68062;pid=68062
Sep 29 08:04:30 ip-172-31-91-91.ec2.internal nagios[68059]: wproc: Registry request: name=Core Worker 68064;pid=68064
Sep 29 08:04:30 ip-172-31-91-91.ec2.internal nagios[68059]: wproc: Registry request: name=Core Worker 68061;pid=68061
Sep 29 08:04:30 ip-172-31-91-91.ec2.internal nagios[68059]: Warning: Could not open object cache file '/usr/local/nagios/var/objec>
Sep 29 08:04:30 ip-172-31-91-91.ec2.internal nagios[68059]: Error: Unable to create temp file '/usr/local/nagios/var/nagios.tmpx2N>
Sep 29 08:04:30 ip-172-31-91-91.ec2.internal nagios[68059]: Successfully launched command file worker with pid 68065
Sep 29 08:04:39 ip-172-31-91-91.ec2.internal nagios[68059]: Error: Unable to create temp file '/usr/local/nagios/var/nagios.tmpTmg>
Sep 29 08:04:49 ip-172-31-91-91.ec2.internal nagios[68059]: Error: Unable to create temp file '/usr/local/nagios/var/nagios.tmpAfy>
Sep 29 08:04:59 ip-172-31-91-91.ec2.internal nagios[68059]: Error: Unable to create temp file '/usr/local/nagios/var/nagios.tmpCtQ>
lines 1-26/26 (END)
```

Error:
The log messages suggest that Nagios is unable to create temporary files, particularly in the directory /usr/local/nagios/var/. This is typically caused by permission issues, or the directory might not exist.
Solution:

Firstly check whether /usr/local/nagios/var/ is there or not. If yes.....

ls -ld /usr/local/nagios/var/

Change ownership: Set the correct ownership for the Nagios user and group:

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

Set permissions: Ensure the directory has the right permissions:

sudo chmod -R 775 /usr/local/nagios/var

Restart Nagios: After adjusting the ownership and permissions, restart the Nagios service:

sudo systemctl restart nagios

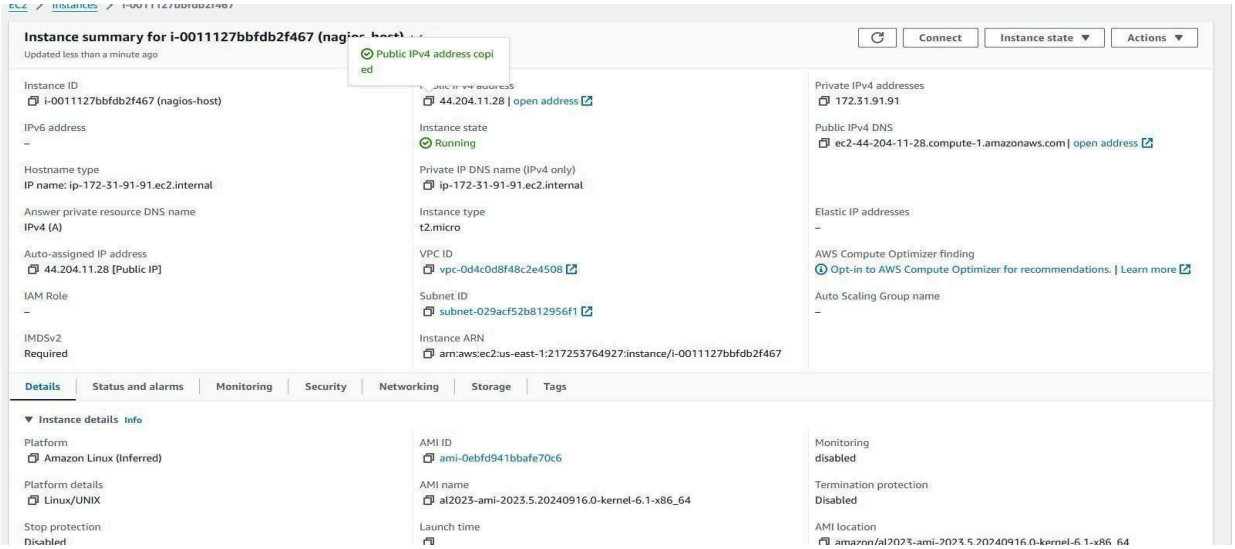
```
drwxr-xr-x. 4 root root 112 Sep 29 08:04 /usr/local/nagios/var/
[ec2-user@ip-172-31-91-91 nagios-plugins-2.0.3]$ sudo chown -R nagios:nagcmd /usr/local/nagios/var
[ec2-user@ip-172-31-91-91 nagios-plugins-2.0.3]$ sudo chmod -R 775 /usr/local/nagios/var
[ec2-user@ip-172-31-91-91 nagios-plugins-2.0.3]$ sudo systemctl restart nagios
[ec2-user@ip-172-31-91-91 nagios-plugins-2.0.3]$
```

Now run again

```
[ec2-user@ip-172-31-91-91 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 Sun 2024-09-29 08:51:47 UTC; 42min ago
       Docs: https://www.nagios.org/documentation
    Tasks: 6 (limit: 1112)
     Memory: 2.9M
        CPU: 562ms
     CGroup: /system.slice/nagios.service
             ├─71188 /usr/local/nagios/bin/nagios -d /usr/local/nagios/etc/nagios.cfg
             ├─71190 /usr/local/nagios/bin/nagios --worker /usr/local/nagios/var/rw/nagios.qh
             ├─71191 /usr/local/nagios/bin/nagios --worker /usr/local/nagios/var/rw/nagios.qh
             ├─71192 /usr/local/nagios/bin/nagios --worker /usr/local/nagios/var/rw/nagios.qh
             ├─71193 /usr/local/nagios/bin/nagios --worker /usr/local/nagios/var/rw/nagios.qh
             └─71194 /usr/local/nagios/bin/nagios -d /usr/local/nagios/etc/nagios.cfg

Sep 29 08:51:47 ip-172-31-91-91.ec2.internal nagios[71188]: wproc: Registry request: name=Core Worker 71191;pid=71191
Sep 29 08:51:47 ip-172-31-91-91.ec2.internal nagios[71188]: wproc: Registry request: name=Core Worker 71190;pid=71190
Sep 29 08:51:47 ip-172-31-91-91.ec2.internal nagios[71188]: Successfully launched command file worker with pid 71194
Sep 29 08:59:22 ip-172-31-91-91.ec2.internal nagios[71188]: SERVICE ALERT: localhost;HTTP;WARNING;HARD;4;HTTP WARNING: HTTP/1.1 403 Forbidden - 319 bytes in
Sep 29 09:11:52 ip-172-31-91-91.ec2.internal nagios[71188]: SERVICE NOTIFICATION: nagiosadmin;localhost;Swap Usage;CRITICAL;notify-service-by-email;SWAP CR
Sep 29 09:11:52 ip-172-31-91-91.ec2.internal nagios[71188]: wproc: NOTIFY job 10 from worker Core Worker 71192 is a non-check helper but exited with return
Sep 29 09:11:52 ip-172-31-91-91.ec2.internal nagios[71188]: wproc:   host=localhost; service=Swap Usage; contact=nagiosadmin
Sep 29 09:11:52 ip-172-31-91-91.ec2.internal nagios[71188]: wproc:   early_timeout=0; exited_ok=1; wait_status=32512; error_code=0;
Sep 29 09:11:52 ip-172-31-91-91.ec2.internal nagios[71188]: wproc:   stderr line 01: /bin/sh: line 1: /bin/mail: No such file or directory
Sep 29 09:11:52 ip-172-31-91-91.ec2.internal nagios[71188]: wproc:   stderr line 02: /usr/bin/printf: write error: Broken pipe
lines 1-25/25 (END)
```

22. Go back to EC2 Console and copy the Public IP address of this instance

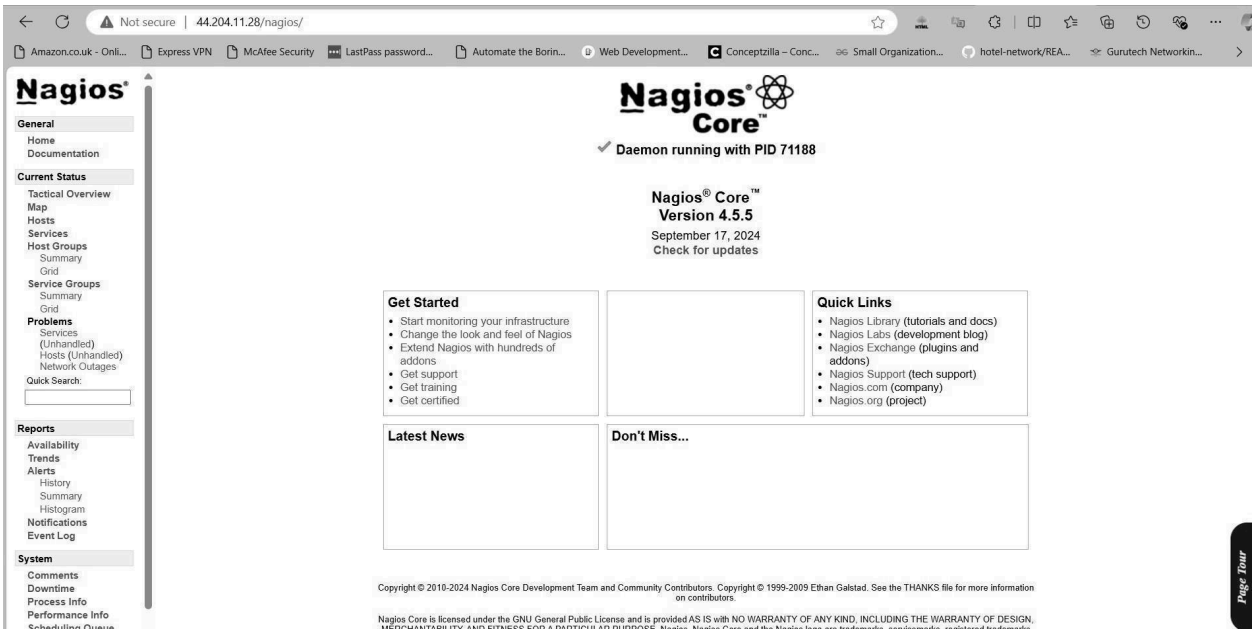


23. Open up your browser and look for

http://<your_public_ip_address>/nagios Enter username as nagiosadmin

and password which you set in Step 16.

24. After entering the correct credentials, you will see this page.



This means that Nagios was correctly installed and configured with its plugins so far.

Conclusion:

In this practical, we successfully installed and configured Nagios Core along with Nagios plugins and NRPE on an Amazon EC2 instance. We created a Nagios user, set up necessary permissions, and resolved common installation errors. Finally, we verified the setup by accessing the Nagios web interface, confirming that our monitoring system was fully operational.

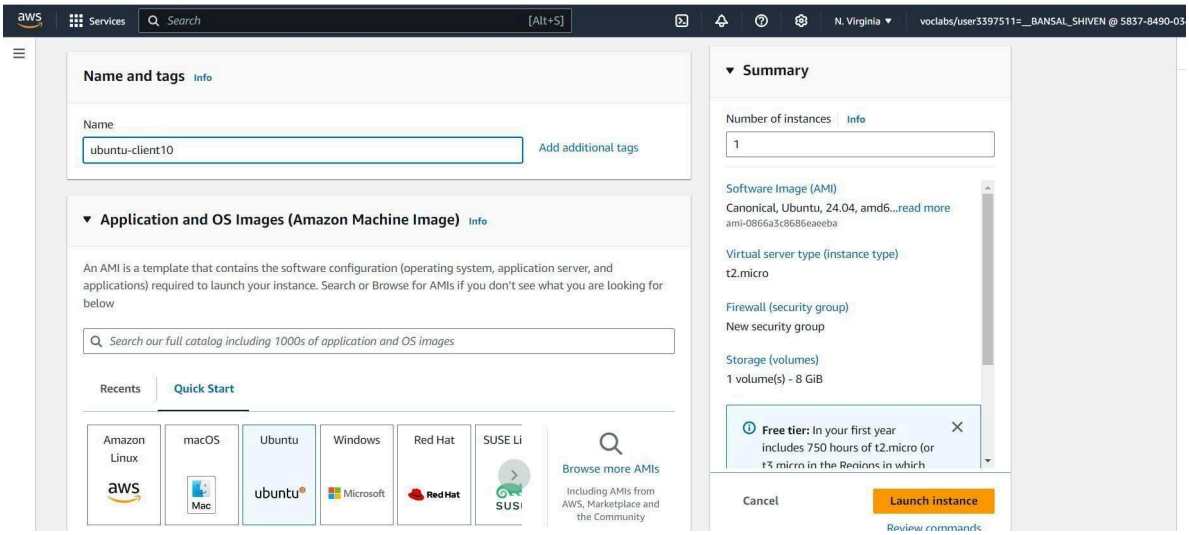
Experiment 10

Aim: To perform Port, Service monitoring, Windows/Linux server monitoring using Nagios.

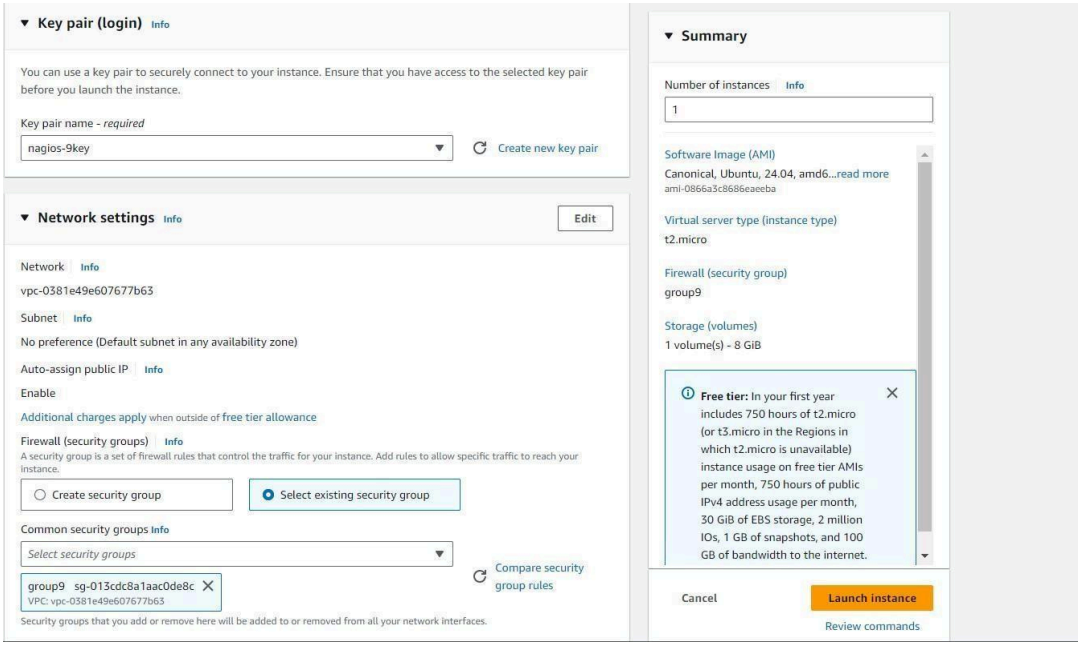
Prerequisites: An Amazon Linux instance with nagios (nagios-server) is already set up.

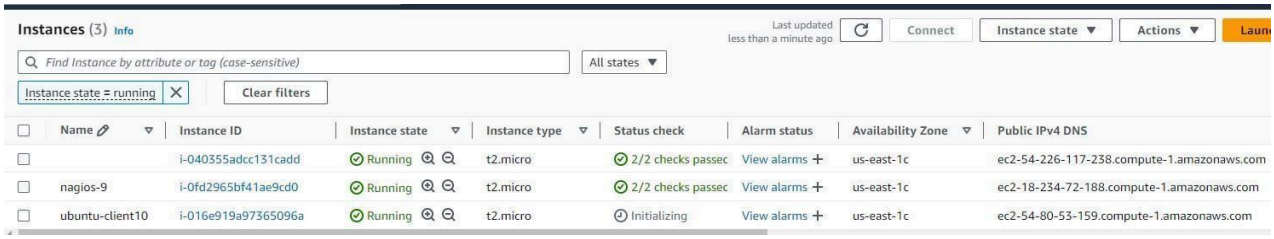
Steps:

Step 1: Navigate to EC2 on the AWS console using the ‘Services’ section and click on ‘Create instance’. Give your instance a name and choose ‘Ubuntu’ as the instance type.



Ensure that you choose the same key pair and security group for the Ubuntu client instance as you did for the Nagios host instance. Then, click on ‘Create instance’.





Your Ubuntu client instance gets created along with the Nagios host instance.

Step 2: Click on the instance ID of your nagios-server instance and click on ‘Connect’. Then, click on ‘SSH client’ and copy the command under ‘Example’. Then, open the terminal in the folder where the .pem file for your instance’s key pair is located and paste the SSH command that you just copied. This connects your instance to your local terminal using SSH.

Step 3: ps -ef | grep nagios
Run the above command on the nagios-host instance. This verifies whether the nagios service is running or not.

```
[ec2-user@ip-172-31-35-113 ~]$ ps -ef | grep nagios
nagios     64399       1  0 13:48 ?        00:00:00 /usr/local/nagios/bin/nagios -d /usr/local/nagios/etc/nagios.cfg
nagios     64401   64399  0 13:48 ?        00:00:00 /usr/local/nagios/bin/nagios --worker /usr/local/nagios/var/rw/nagios.qh
nagios     64402   64399  0 13:48 ?        00:00:00 /usr/local/nagios/bin/nagios --worker /usr/local/nagios/var/rw/nagios.qh
nagios     64403   64399  0 13:48 ?        00:00:00 /usr/local/nagios/bin/nagios --worker /usr/local/nagios/var/rw/nagios.qh
nagios     64404   64399  0 13:48 ?        00:00:00 /usr/local/nagios/bin/nagios --worker /usr/local/nagios/var/rw/nagios.qh
nagios     64447   64399  0 13:48 ?        00:00:00 /usr/local/nagios/bin/nagios -d /usr/local/nagios/etc/nagios.cfg
ec2-user   65271   65245  0 14:01 pts/0    00:00:00 grep --color=auto nagio
[ec2-user@ip-172-31-35-113 ~]$
```

Step 4: sudo su
mkdir -p /usr/local/nagios/etc/objects/monitorhosts
mkdir -p /usr/local/nagios/etc/objects/monitorhosts/linuxhosts
This makes you the root user and creates two folders with the above paths.

```
[ec2-user@ip-172-31-35-113 ~]$ sudo su
mkdir -p /usr/local/nagios/etc/objects/monitorhosts
mkdir -p /usr/local/nagios/etc/objects/monitorhosts/linuxhosts
[root@ip-172-31-35-113 ec2-user]#
```

Step 5: We need to create a config file in this folder. So, copy the contents of the existing localhost config to the new file ‘linuxserver.cfg’.
cp /usr/local/nagios/etc/objects/localhost.cfg
/usr/local/nagios/etc/objects/monitorhosts/linuxhosts/linuxserver.cfg

```
[root@ip-172-31-88-33 ec2-user]# cp /usr/local/nagios/etc/objects/localhost.cfg /usr/local/nagios/etc/objects/monitorhos
ts/linuxhosts/linuxserver.cfg
```

Step 6: We need to make some changes in this config file. Open it using nano editor:-
nano /usr/local/nagios/etc/objects/monitorhosts/linuxhosts/linuxserver.cfg

1. Change hostname and alias from ‘hostname’ to ‘linuxserver’.
2. Change address to the public ip address of the ubuntu-client instance.

```
  GNU nano 5.8                          /usr/local/nagios/etc/objects/monitorhosts/linuxhosts/linuxserver.cfg
##############################################################################
# LOCALHOST.CFG - SAMPLE OBJECT CONFIG FILE FOR MONITORING THIS MACHINE
#
#
# NOTE: This config file is intended to serve as an *extremely* simple
#       example of how you can create configuration entries to monitor
#       the local (Linux) machine.
#
##############################################################################



##############################################################################
#
# HOST DEFINITION
#
##############################################################################

# Define a host for the local machine

define host {

    use                     linux-server            ; Name of host template to use
                                                    ; This host definition will inherit all variables that are defined
                                                    ; in (or inherited by) the linux-server host template definition.
    host_name               linuxserver
    alias                   linuxserver
    address                 54.80.53.159
}
```

Change hostgroup_name to ‘linux-servers1’.

```
define hostgroup {

    hostgroup_name          linux-servers1          ; The name of the hostgroup
    alias                   Linux Servers           ; Long name of the group
    members                 linuxserver             ; Comma separated list of hosts that belong to this group
}
```

Change all the subsequent occurrences of hostname in the file from ‘localhost’ to ‘linuxserver’.

Step 7: Open the Nagios config file using the following command:
nano /usr/local/nagios/etc/nagios.cfg
Then, add the following line to the config file:
cfg_dir=/usr/local/nagios/etc/objects/monitorhosts/

```
  GNU nano 5.8                                  /usr/local/nagios/etc/nagios.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/


^G Help          ^O Write Out     ^W Where Is      ^K Cut           ^T Execute       ^C Location      M-U Undo         M-A Set Mark
^X Exit          ^R Read File     ^\ Replace       ^U Paste         ^J Justify       ^/ Go To Line    M-E Redo         M-6 Copy
```

Step 8: Now we verify the configuration files and check that they contain no errors using the following command:
/usr/local/nagios/bin/nagios -v /usr/local/nagios/etc/nagios.cfg

```
[root@ip-172-31-35-113 ec2-user]# /usr/local/nagios/bin/nagios -v /usr/local/nagios/etc/nagios.cfg

Nagios Core 4.5.5
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Last Modified: 2024-09-17
License: GPL

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

```
Checking objects...
        Checked 8 services.
        Checked 2 hosts.
        Checked 2 host groups.
        Checked 0 service groups.
        Checked 1 contacts.
        Checked 1 contact groups.
        Checked 24 commands.
        Checked 5 time periods.
        Checked 0 host escalations.
        Checked 0 service escalations.
Checking for circular paths...
        Checked 2 hosts
        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
```

Step 9: Once the files are verified and it is confirmed that there are no errors, we must restart the server.
service nagios restart

```
[root@ip-172-31-88-33 ec2-user]# service nagios restart
Redirecting to /bin/systemctl restart nagios.service
```

Step 10: systemctl status nagios

Using the above command, we check the status of the nagios server and ensure that it is active (running).

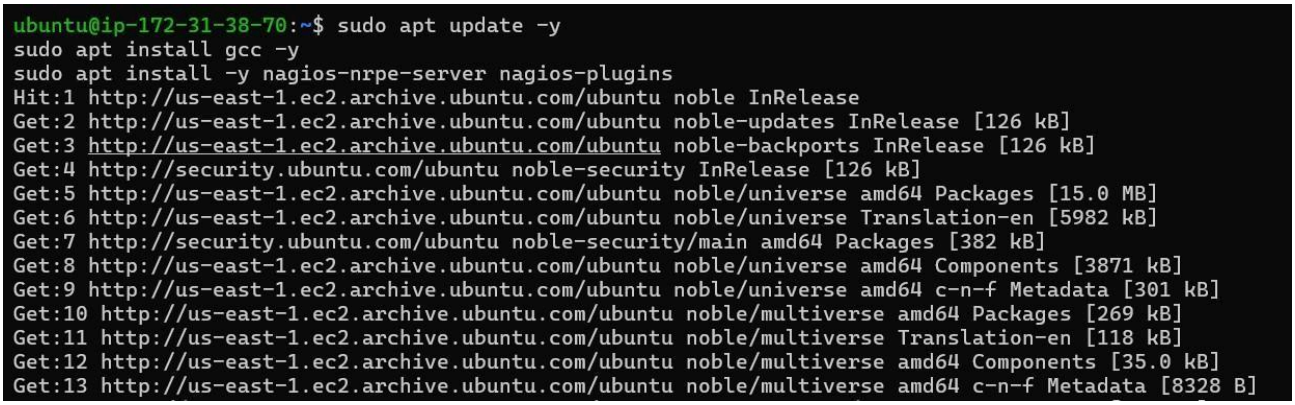
```
[root@ip-172-31-88-33 ec2-user]# systemctl status nagios
● nagios.service - Nagios Core 4.5.5
     Loaded: loaded (/usr/lib/systemd/system/nagios.service; enabled; preset: disabled)
     Active: active (running) since Sun 2024-09-29 12:11:40 UTC; 1min 12s ago
       Docs: https://www.nagios.org/documentation
    Process: 70244 ExecStartPre=/usr/local/nagios/bin/nagios -v /usr/local/nagios/etc/nagios.cfg (code=exited, status=0>
    Process: 70245 ExecStart=/usr/local/nagios/bin/nagios -d /usr/local/nagios/etc/nagios.cfg (code=exited, status=0/SU>
   Main PID: 70246 (nagios)
      Tasks: 6 (limit: 1112)
     Memory: 4.0M
        CPU: 38ms
     CGroup: /system.slice/nagios.service
             ├─70246 /usr/local/nagios/bin/nagios -d /usr/local/nagios/etc/nagios.cfg
             ├─70247 /usr/local/nagios/bin/nagios --worker /usr/local/nagios/var/rw/nagios.qh
             ├─70248 /usr/local/nagios/bin/nagios --worker /usr/local/nagios/var/rw/nagios.qh
             ├─70249 /usr/local/nagios/bin/nagios --worker /usr/local/nagios/var/rw/nagios.qh
             ├─70250 /usr/local/nagios/bin/nagios --worker /usr/local/nagios/var/rw/nagios.qh
             └─70251 /usr/local/nagios/bin/nagios -d /usr/local/nagios/etc/nagios.cfg

Sep 29 12:11:40 ip-172-31-88-33.ec2.internal nagios[70246]: qh: Socket '/usr/local/nagios/var/rw/nagios.qh' successfull>
Sep 29 12:11:40 ip-172-31-88-33.ec2.internal nagios[70246]: qh: core query handler registered
Sep 29 12:11:40 ip-172-31-88-33.ec2.internal nagios[70246]: qh: echo service query handler registered
Sep 29 12:11:40 ip-172-31-88-33.ec2.internal nagios[70246]: qh: help for the query handler registered
Sep 29 12:11:40 ip-172-31-88-33.ec2.internal nagios[70246]: wproc: Successfully registered manager as @wproc with query>
Sep 29 12:11:40 ip-172-31-88-33.ec2.internal nagios[70246]: wproc: Registry request: name=Core Worker 70250;pid=70250
Sep 29 12:11:40 ip-172-31-88-33.ec2.internal nagios[70246]: wproc: Registry request: name=Core Worker 70249;pid=70249
Sep 29 12:11:40 ip-172-31-88-33.ec2.internal nagios[70246]: wproc: Registry request: name=Core Worker 70248;pid=70248
Sep 29 12:11:40 ip-172-31-88-33.ec2.internal nagios[70246]: wproc: Registry request: name=Core Worker 70247;pid=70247
Sep 29 12:11:40 ip-172-31-88-33.ec2.internal nagios[70246]: Successfully launched command file worker with pid 70251
```

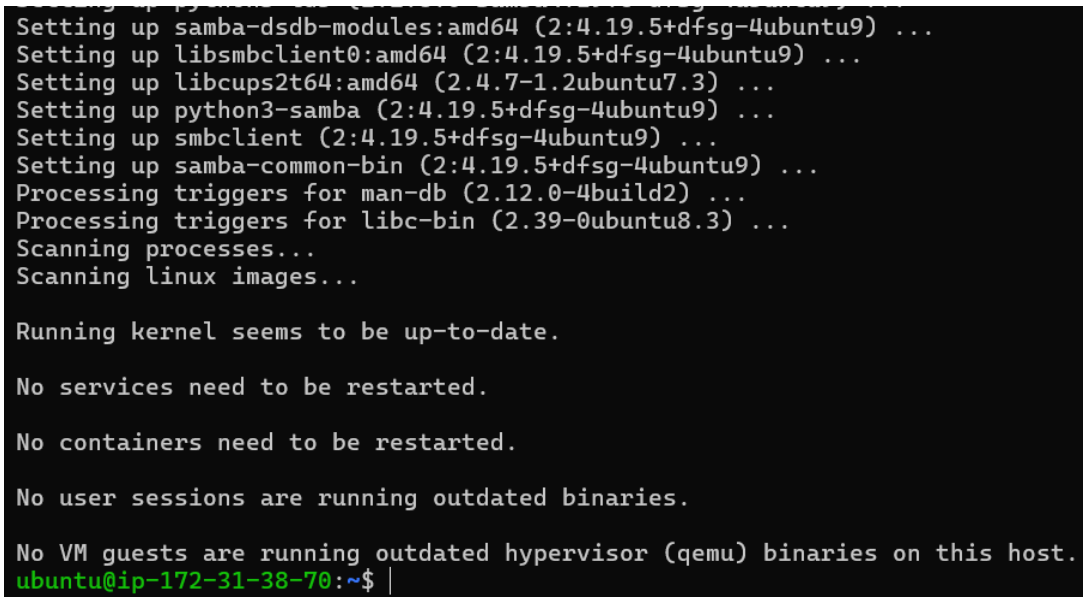
Step 11: Connect your ubuntu-client instance to your local terminal using SSH in the same way as you connected the nagios-host instance to your local terminal using SSH (follow Step 2)

```
PS C:\Users\ADMIN> cd .\Downloads\
PS C:\Users\ADMIN\Downloads> ssh -i "nagios-9key.pem" ubuntu@ec2-54-80-53-159.compute-1.amazonaws.com
The authenticity of host 'ec2-54-80-53-159.compute-1.amazonaws.com (54.80.53.159)' can't be established.
ED25519 key fingerprint is SHA256:ictbLzP1p2YFXqDXkAH4CzoAWhCOQfhqnoXYFJGZ5q8.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added 'ec2-54-80-53-159.compute-1.amazonaws.com' (ED25519) to the list of known hosts.
Welcome to Ubuntu 24.04.1 LTS (GNU/Linux 6.8.0-1016-aws x86_64)

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

 System information as of Mon Oct  7 14:15:43 UTC 2024

  System load:  0.0               Processes:             104
  Usage of /:   22.8% of 6.71GB   Users logged in:       0
  Memory usage: 20%               IPv4 address for enX0: 172.31.38.70
  Swap usage:   0%
```

```
Expanded Security Maintenance for Applications is not enabled.

0 updates can be applied immediately.

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


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


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-172-31-38-70:~$
```

Step 12: On your ubuntu-client instance, run the following commands:-
sudo apt update -y
sudo apt install gcc -y
sudo apt install -y nagios-nrpe-server nagios-plugins
The above commands check for any new updates and then install gcc, Nagios NRPE server and Nagios plugins.

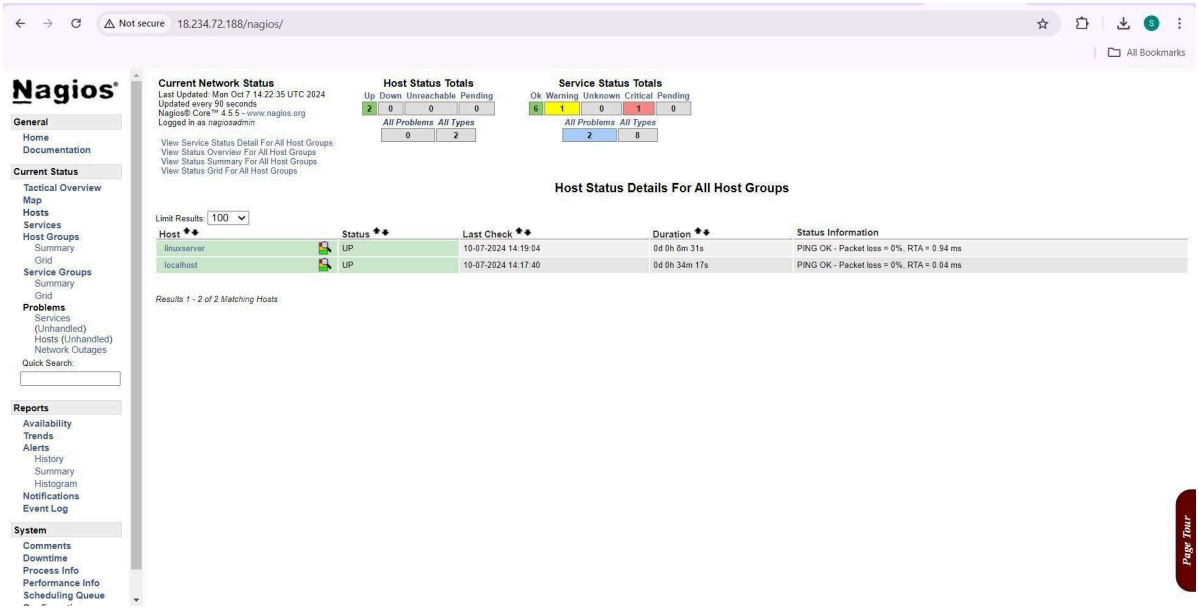




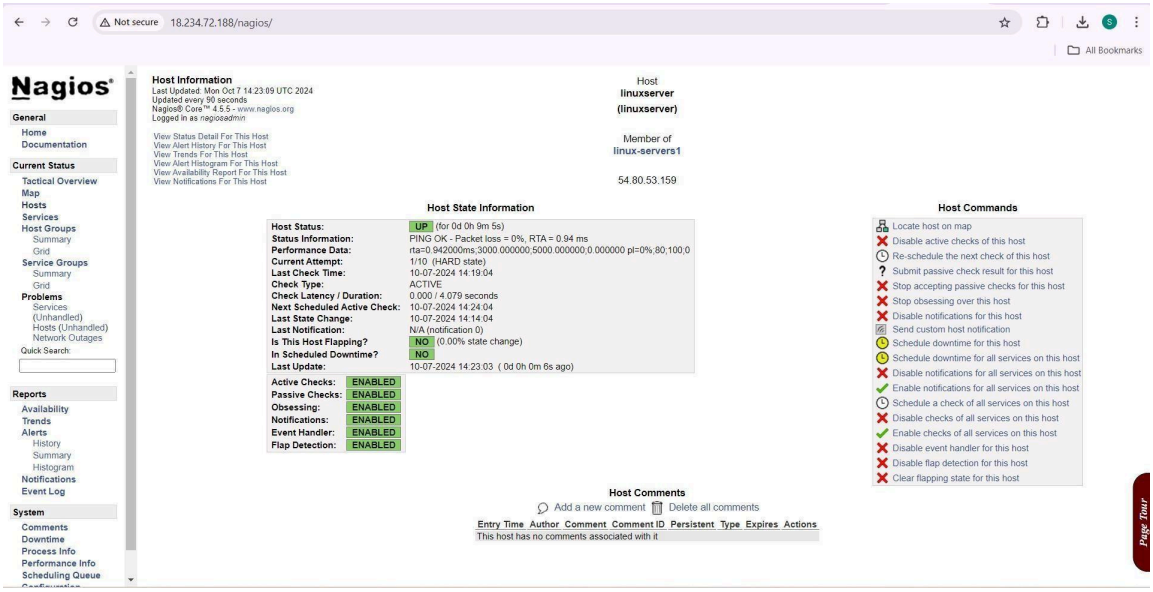
Step 13: Run the following command:
sudo nano /etc/nagios/nrpe.cfg
The above command opens the NRPE config file. Here, we need to add the public IP address of our host nagios-host instance to the NRPE configuration file.
Under allowed_hosts, add the nagios-host public IPv4 address.

```
  GNU nano 7.2                                                  /etc/nagios/nrpe.cfg *
# NOTE: This option is ignored if NRPE is running under either inetd or xinetd

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 mask
# (i.e. 192.168.1.0/24) are also supported. Hostname wildcards are not currently
# 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 xinetd

allowed_hosts=127.0.0.1,18.234.72.188



# COMMAND ARGUMENT PROCESSING
# This option determines whether or not the NRPE daemon will allow clients
# to specify arguments to commands that are executed.  This option only works
# if the daemon was configured with the --enable-command-args configure script
# option.
```

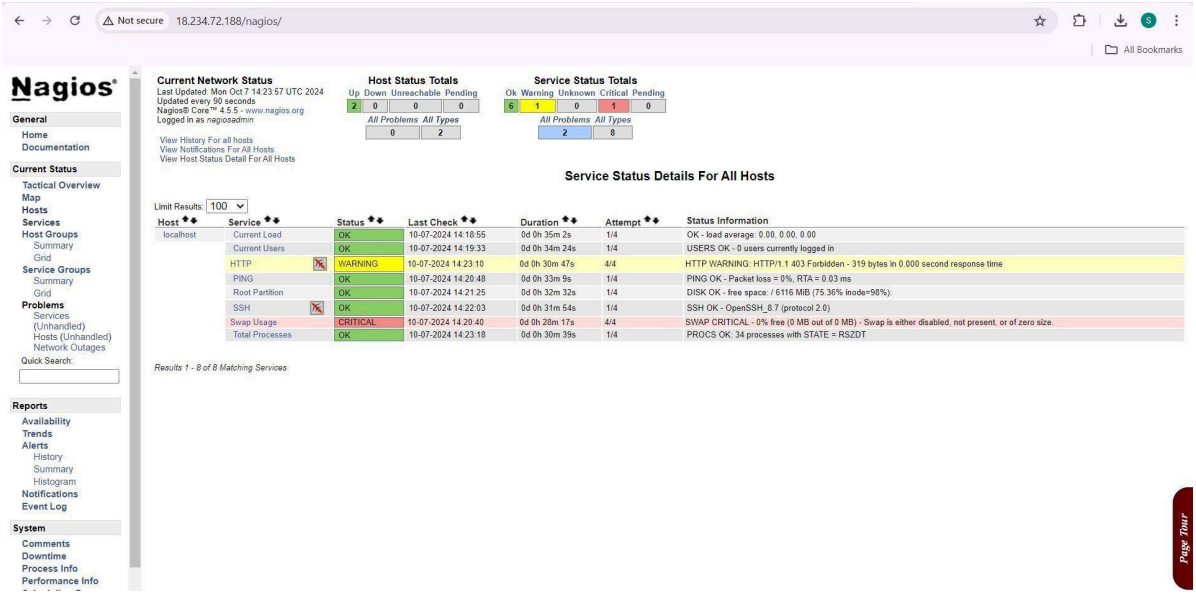
Step 14: Navigate to the Nagios dashboard. Click on ‘hosts’. We see that linuxserver has been added as a host.



Click on ‘linuxserver’. Here, we can access all information about the ‘linuxserver’ host.



Click on ‘Services’. Here, we can see all the services that are being monitored by ‘linuxserver’.



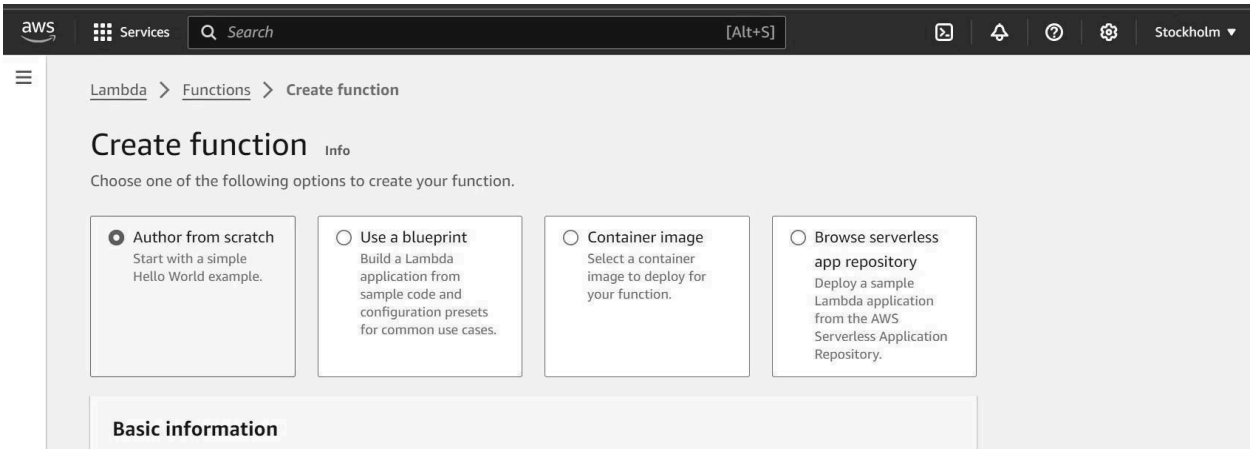
Conclusion : In this experiment, we explored how to monitor ports, services, and both Windows and Linux servers using Nagios. To achieve this, we launched a Nagios-hosted EC2 Linux instance, which served as the platform for running the Nagios server and dashboard. Additionally, we deployed an Ubuntu client instance that connected to the Nagios host.

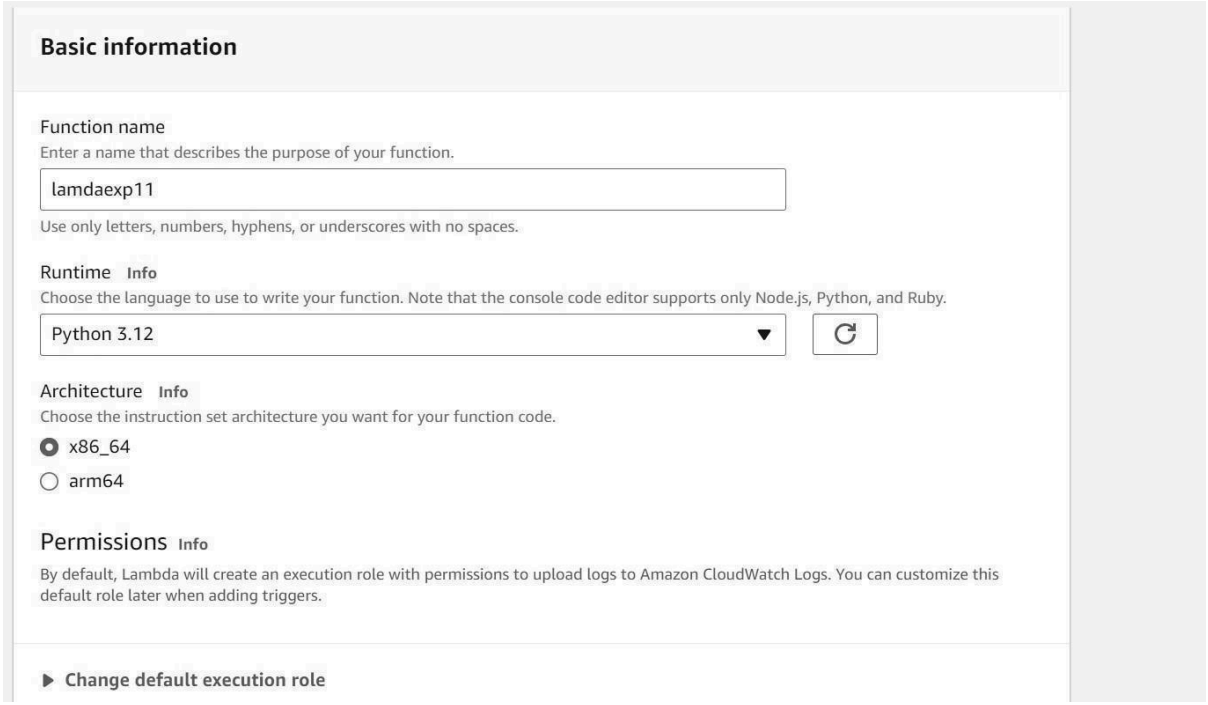
We configured the necessary settings on the Linux instance, including adding the Ubuntu client’s public IP address. Similarly, we made configuration changes on the Ubuntu client, where we added the IP address of the Nagios-hosted Linux instance. We also ensured that the Linux server instance was permitted as an authorized host on the Ubuntu client. After restarting the NRPE service, we verified that the ‘linuxserver’ host was successfully added for monitoring.

AIM:To understand AWS Lambda, its workflow, various functions and create your first Lambda

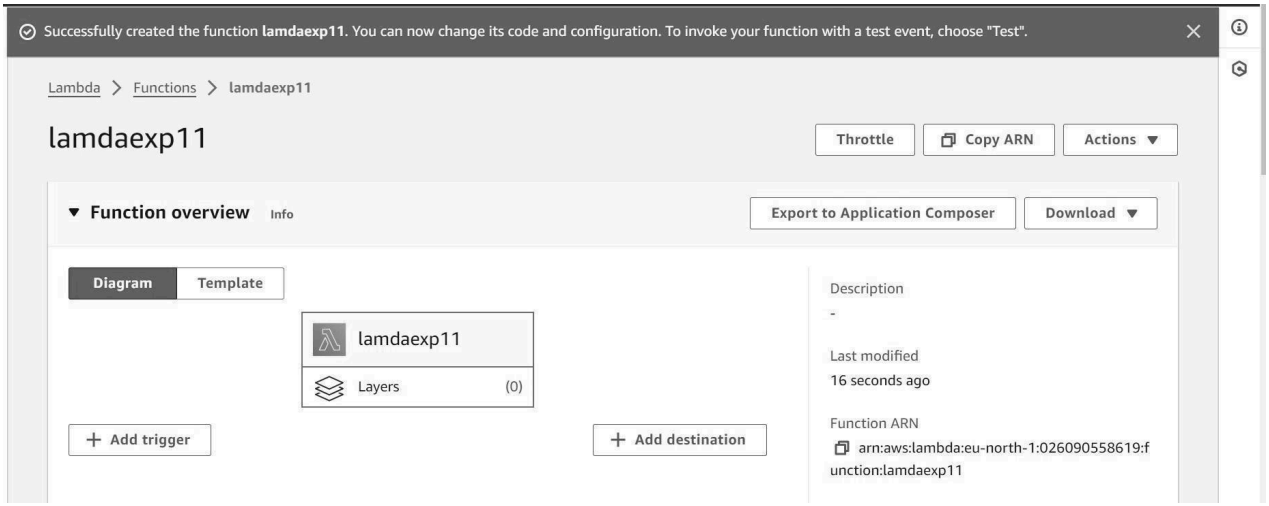
functions using Python / Java / Nodejs.

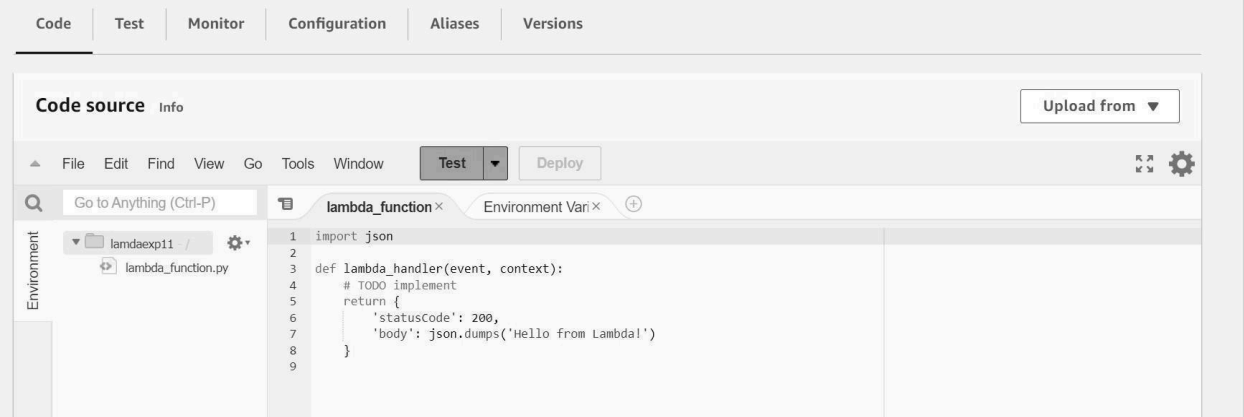
STEP1:Go on your AWS console account and search for lamba and then go on create function Select the author from scratch, add function name and then, choose a runtime env for your function, under the dropdown, you can see all the options AWS supports, Python, Nodejs, .NET and Java being the most popular ones.



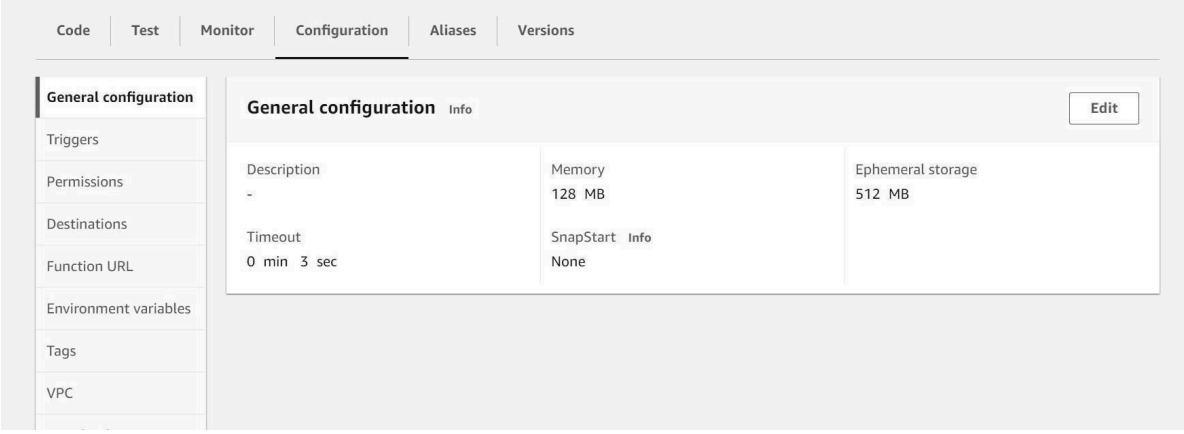


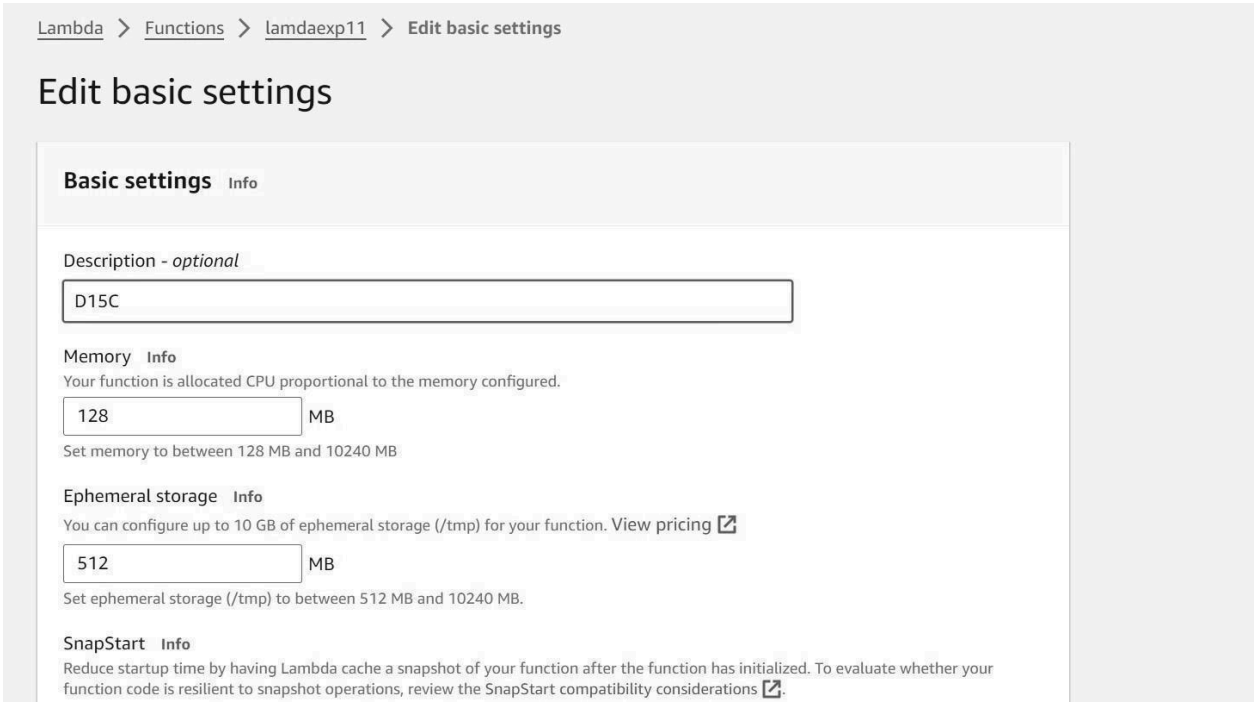
STEP 2:After the function is created successfully go on code write the default code and then configure them.



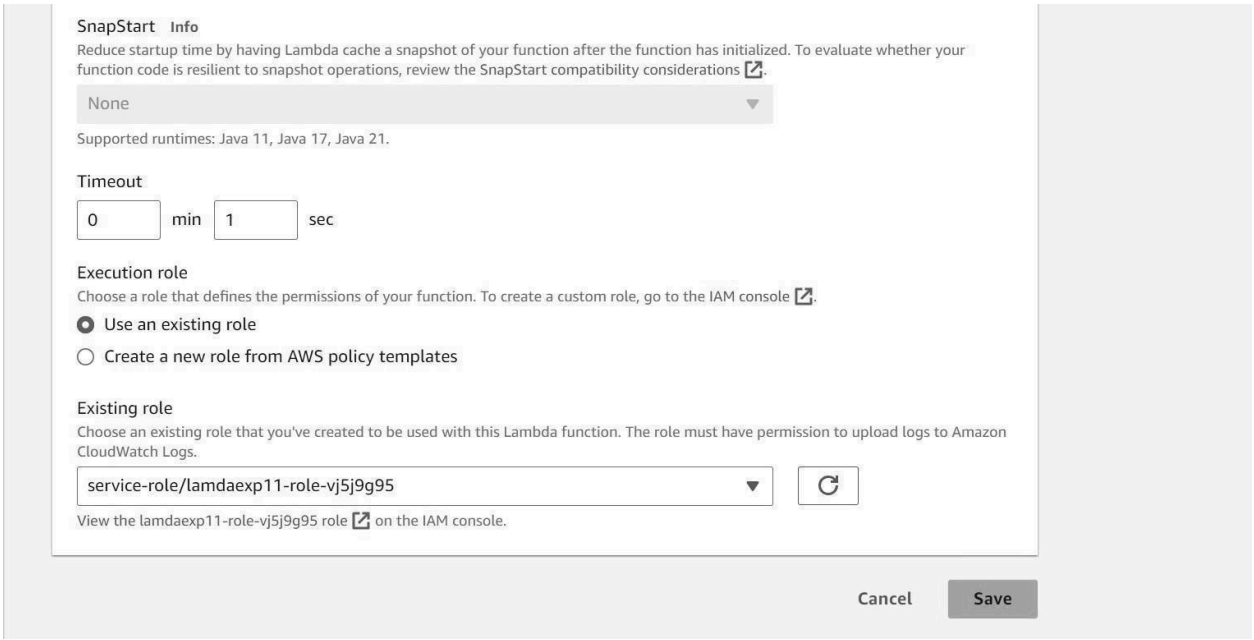


STEP 3: Then go on edit basic settings and add the description and then save it .

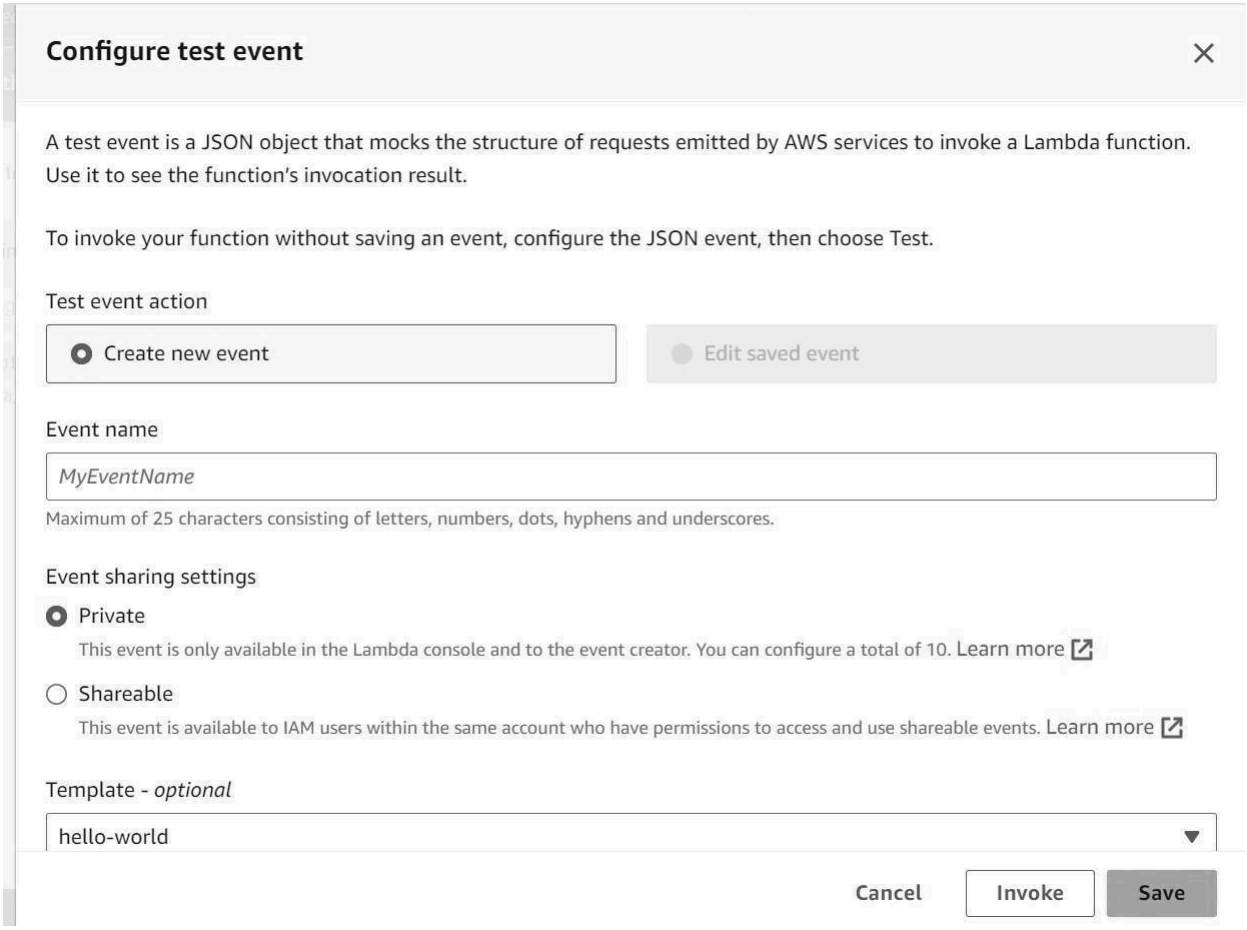




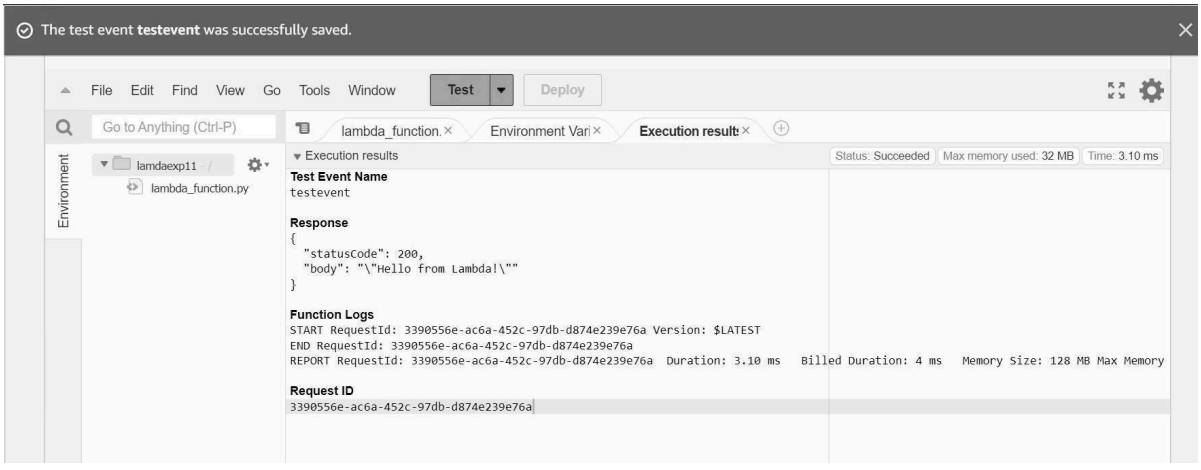
STEP 4:Click on “use an existing role “option and then ahead add the role and save it.

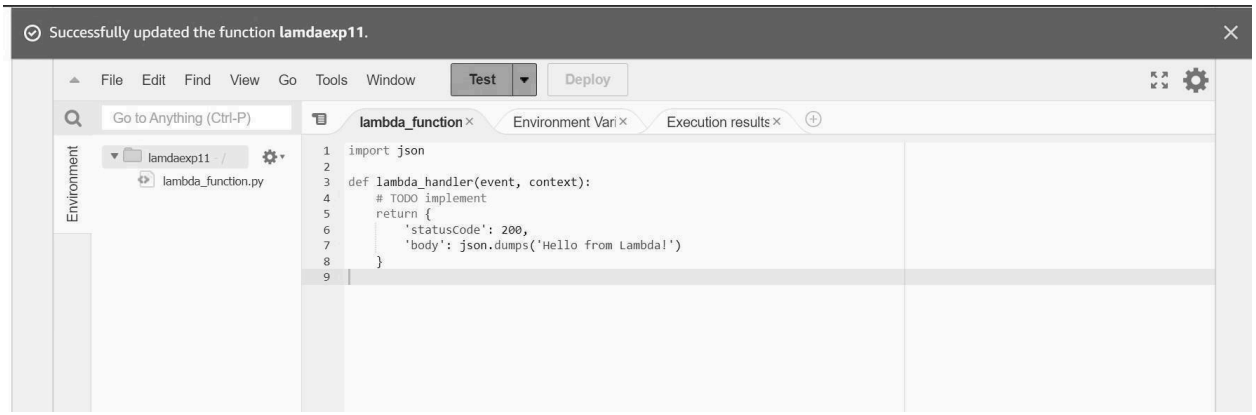


STEP 5:Go on configure test event click on “create new event” edit the event sharing accordingly and select hello world template for template option and then save it.



STEP 6: Click on the test and test the code.
STEP 7: The function is successfully added .

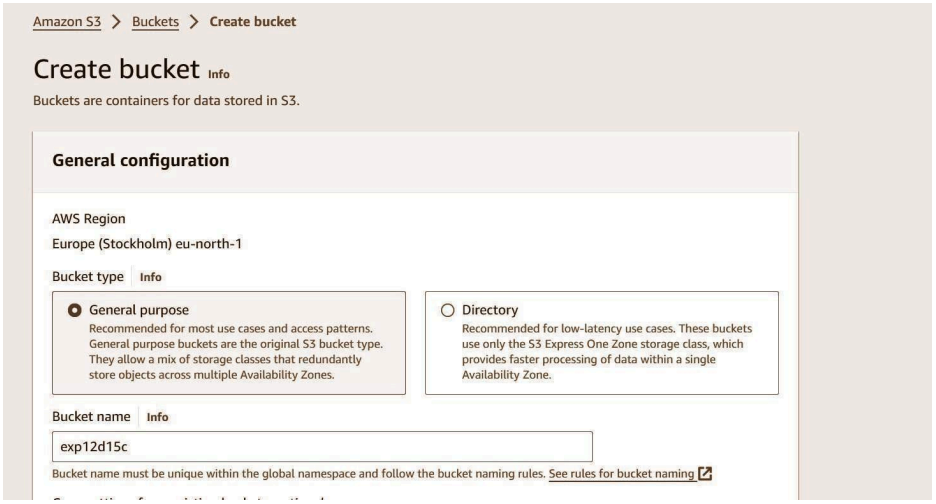




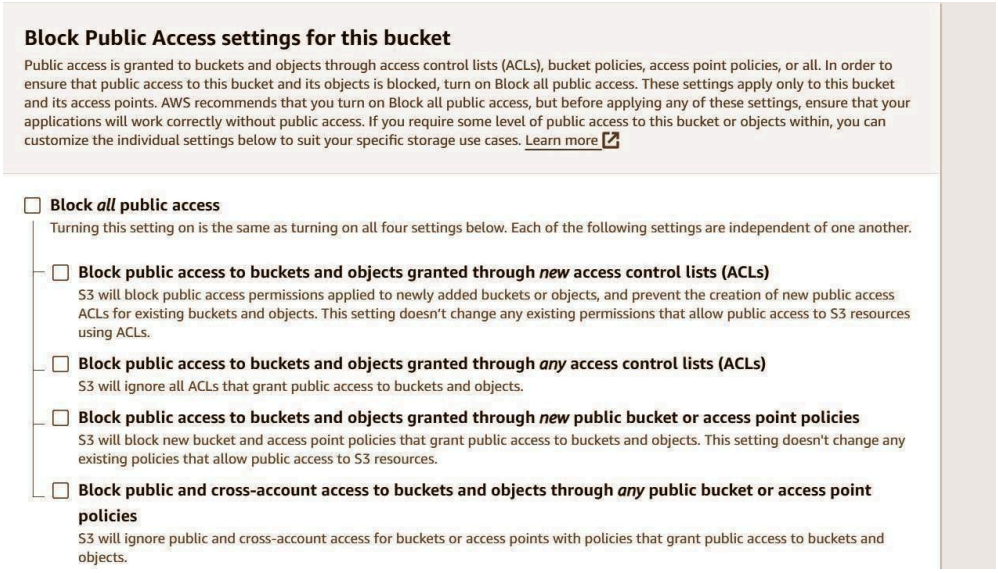
Conclusion:In conclusion, the experiment successfully involved the creation, coding, and deployment of AWS Lambda function. By writing and refining the source code, we demonstrated the ability to implement specific functionality within the Lambda environment. The successful testing of the function confirmed its operational integrity and effectiveness in executing the desired tasks

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 STEPS:

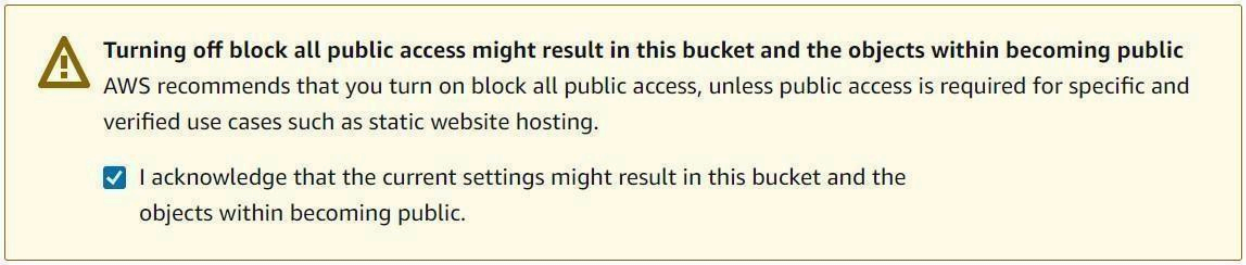
1. Create a S3 bucket and give it a bucket name



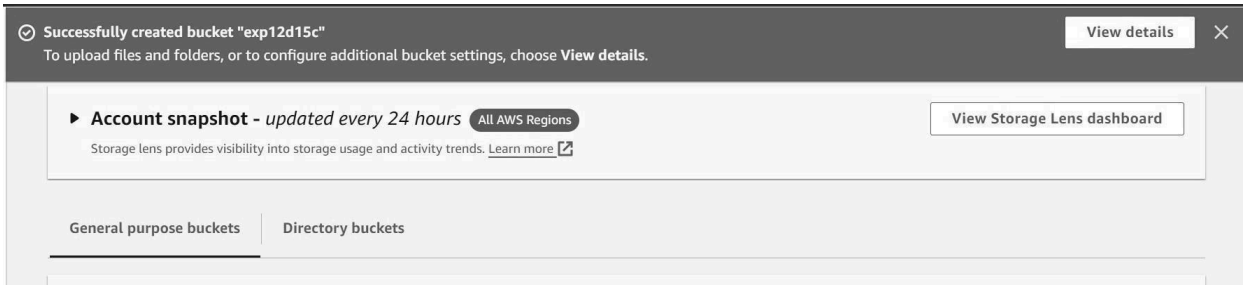
2. Allow public access to the bucket as we are going to add this bucket as a trigger for our lamda function



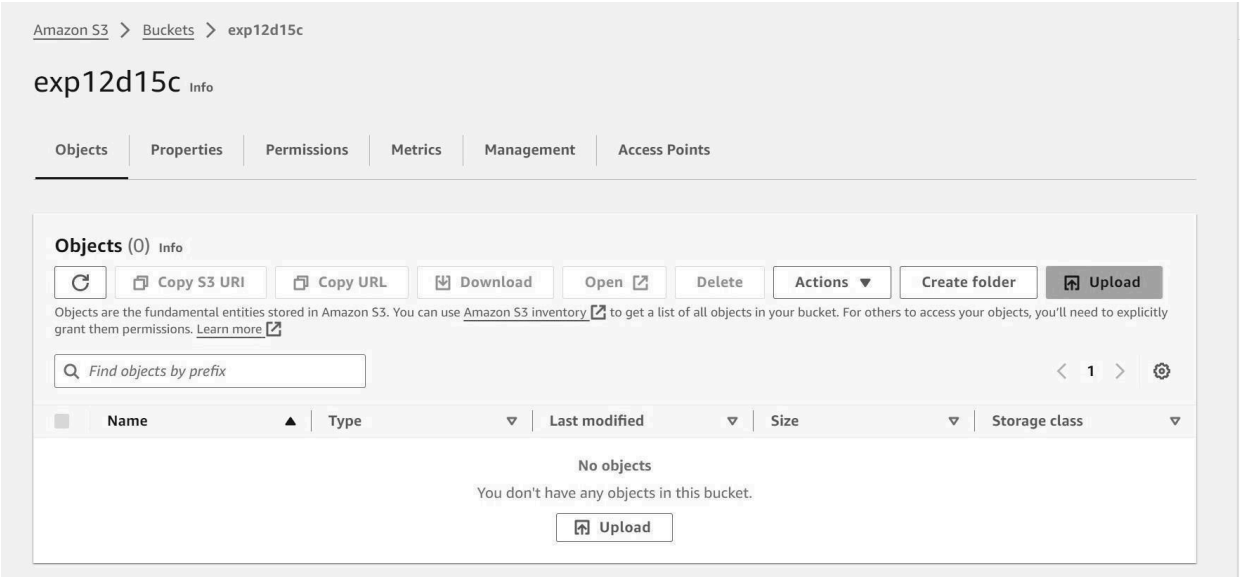
3. Give confirmation that you want to allow full public access and create the bucket



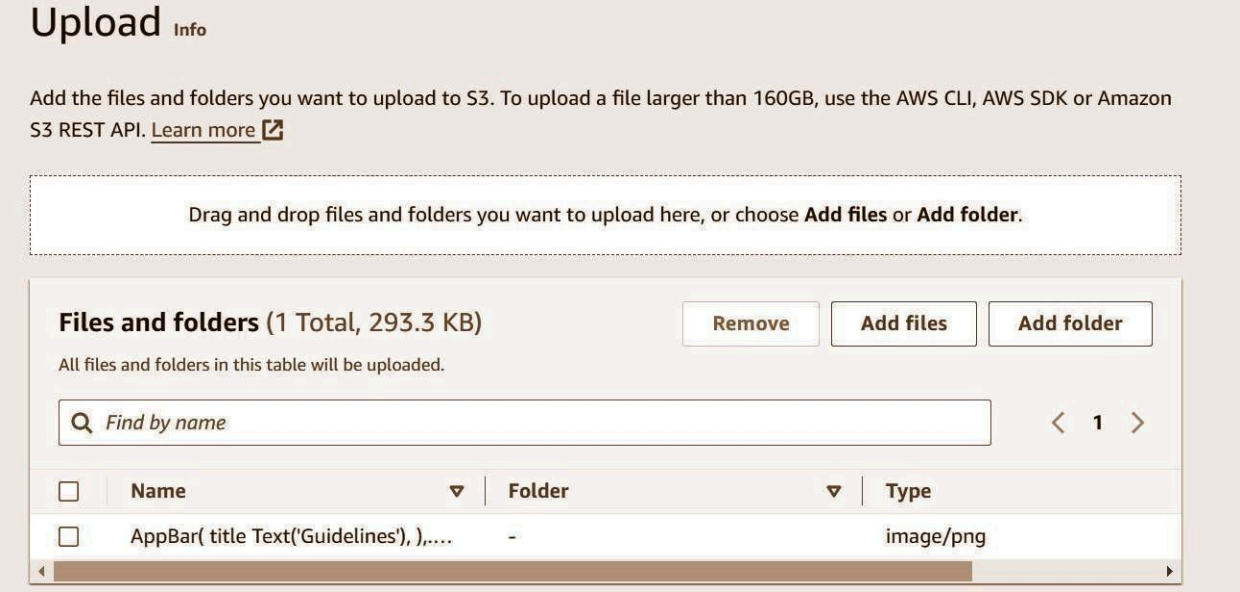
4. You will see the confirmation that the bucket is created successfully



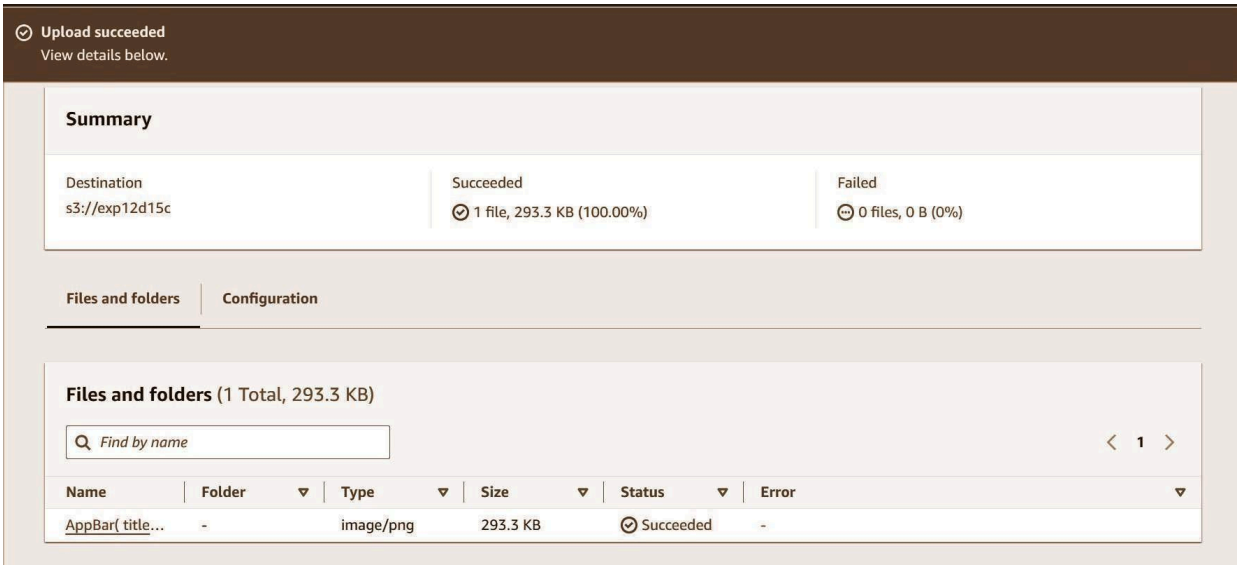
5. Now we need to upload something in the bucket so click on the upload button and add a file



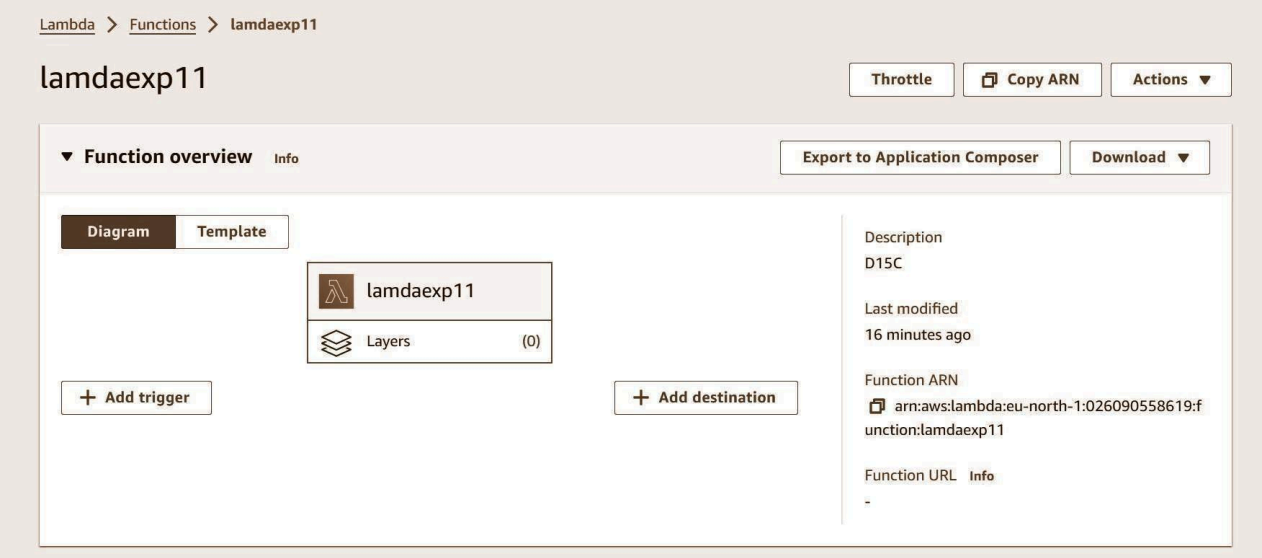
6. I have added a .png extension file; You can upload a .txt file as well



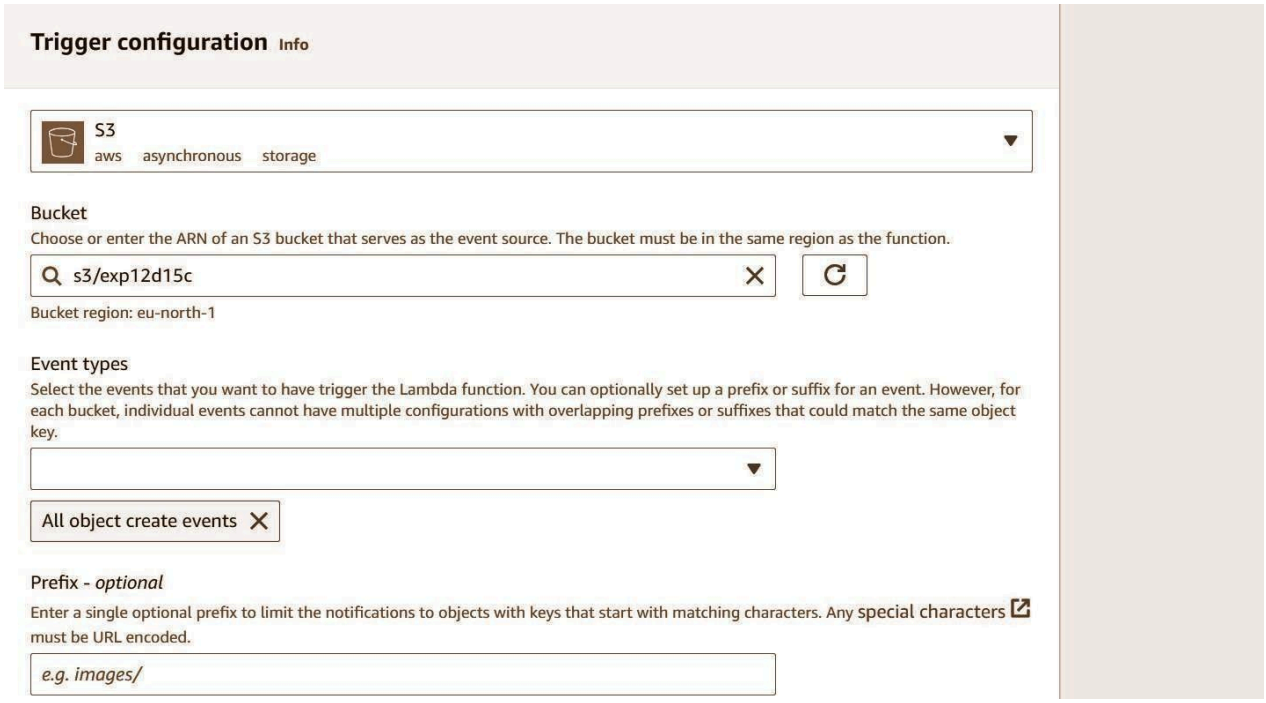
7. Here you can see the confirmation that the upload was a success



8. Now go back to the aws dashboard and search for lamda function service, Open the function we created in experiment 10. We are going to add this bucket as a trigger to this function
9. On the function overview section of the dashboard you can see the “Add trigger” button. Click on that

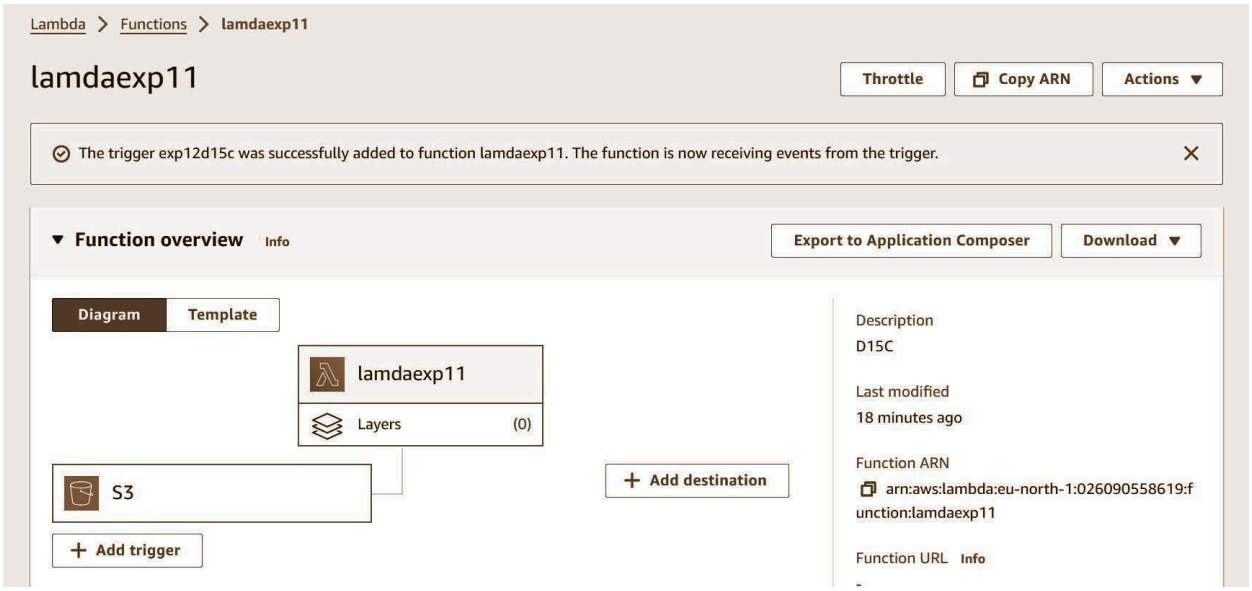


10. It will lead you to the trigger configuration tab; Where you have to select the service and the bucket you created. Add the required configuration information and then

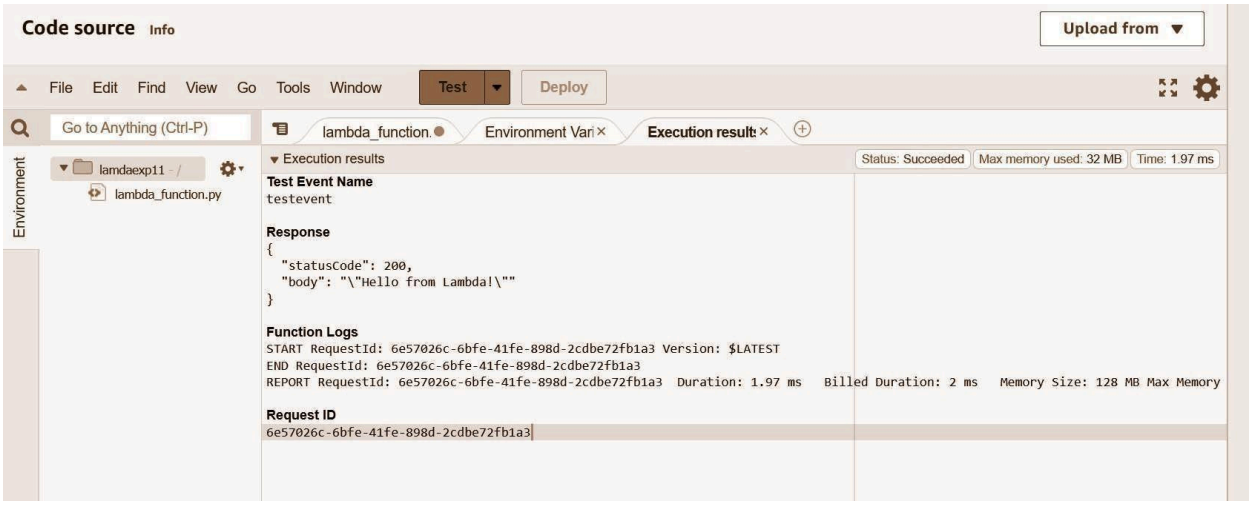


save.

11. Here you can see we have the confirmation message as well the the s3 bucket added to our triggers



12. Test the code by clicking on the Test tab ; Here as you can see our code ran successfully



Conclusion: In conclusion, the experiment successfully demonstrated the integration of an S3 bucket with an AWS Lambda function as a trigger. By creating the S3 bucket and configuring it to invoke the Lambda function upon object uploads, we established a seamless workflow for automated processing.