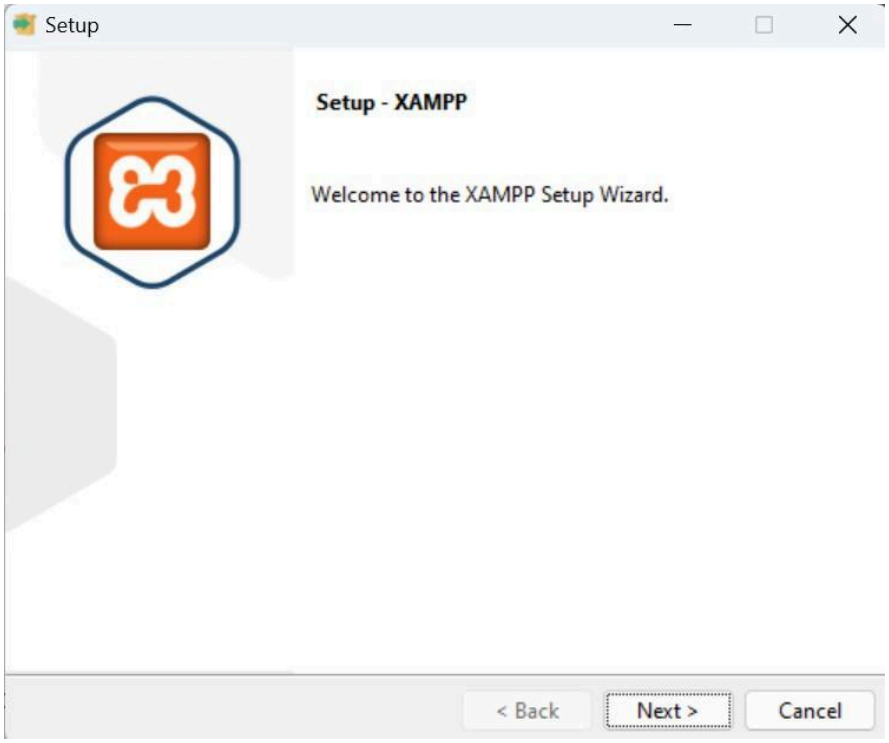
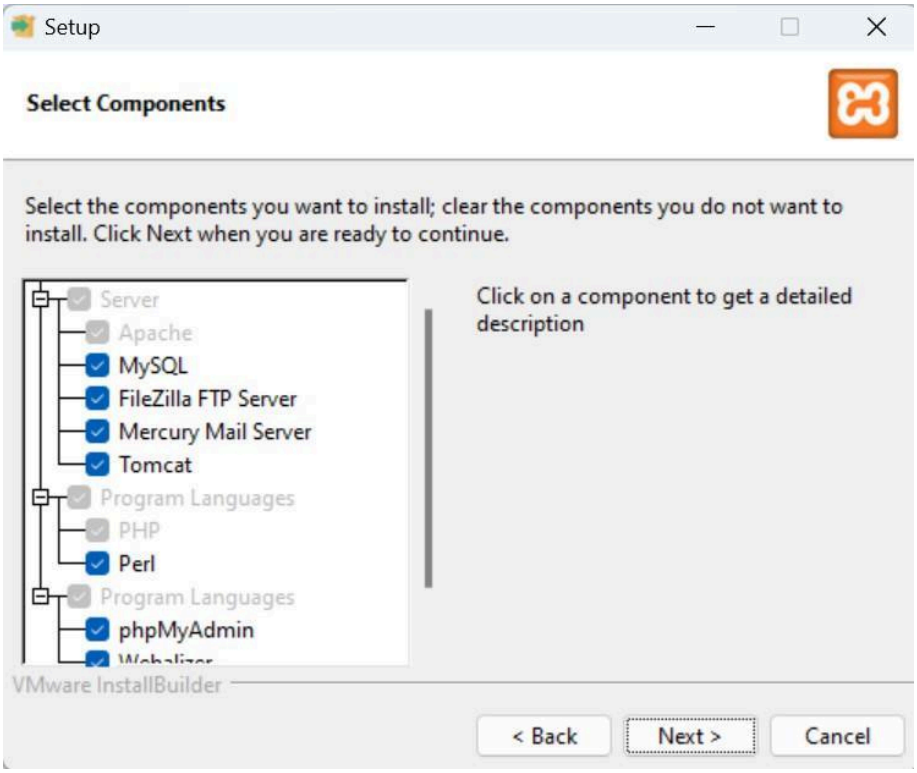
Aim: To understand the benefits of Cloud Infrastructure and Setup AWS Cloud9 IDE, Launch AWS Cloud9 IDE and Perform Collaboration Demonstration.





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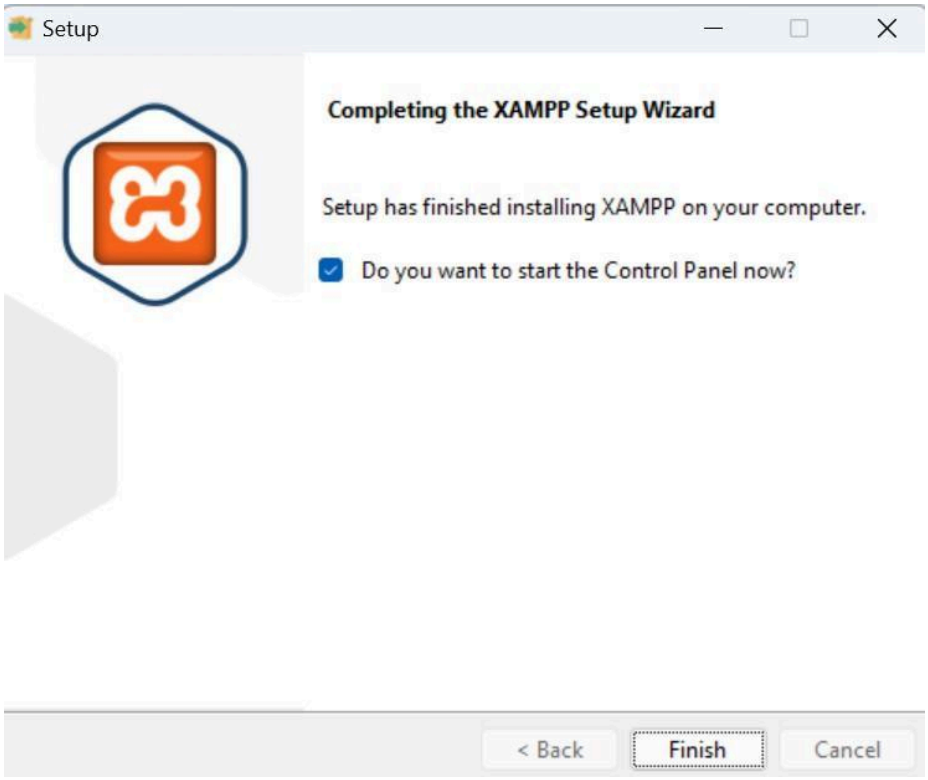

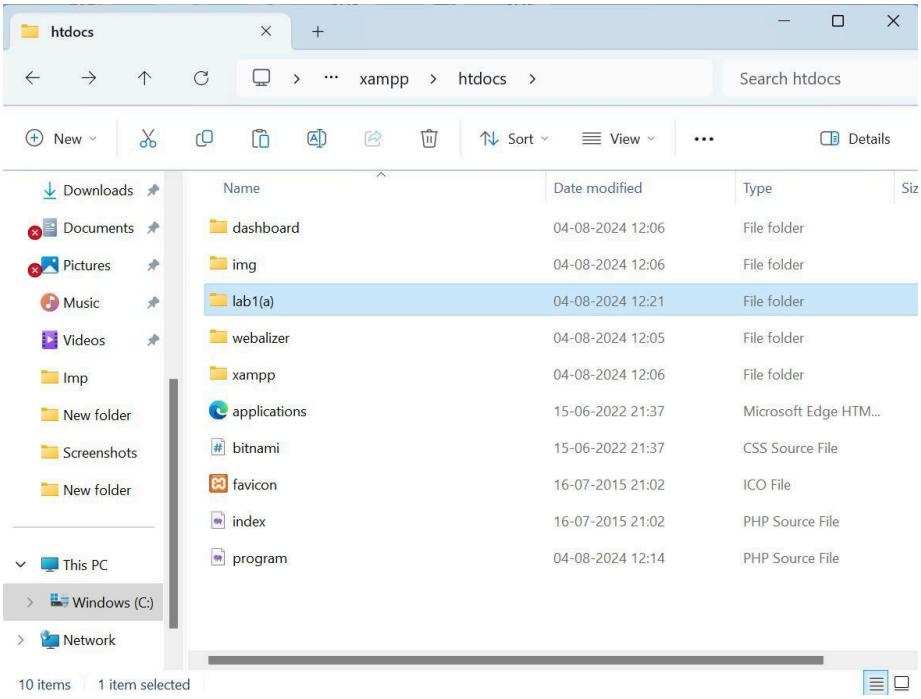

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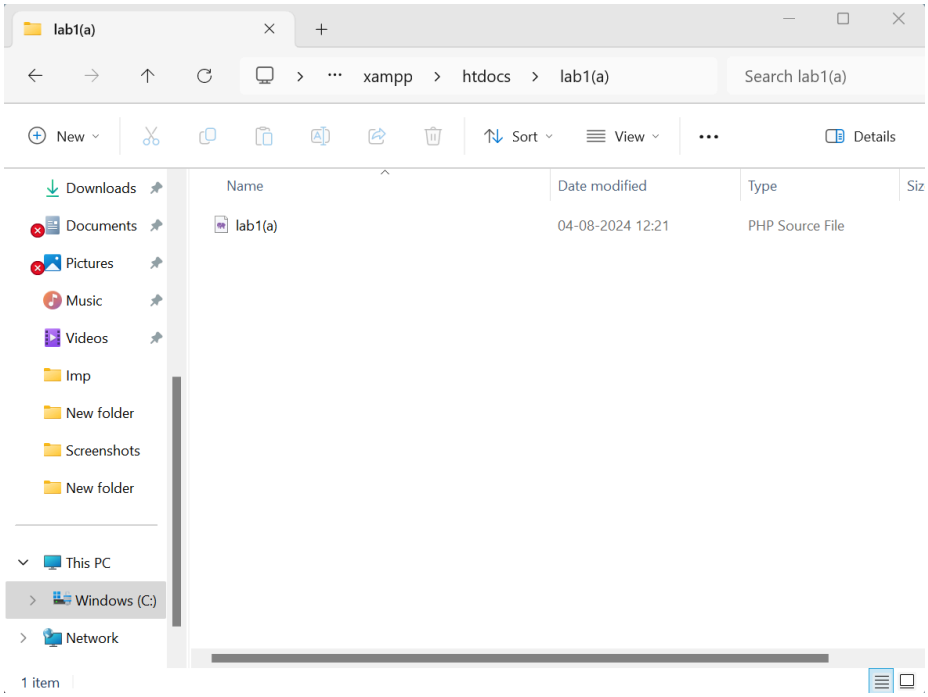
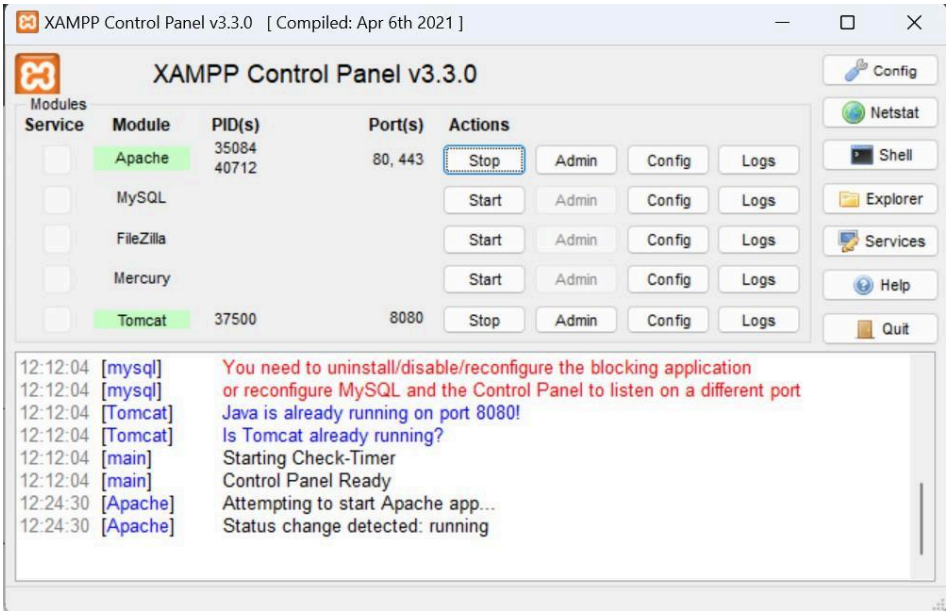
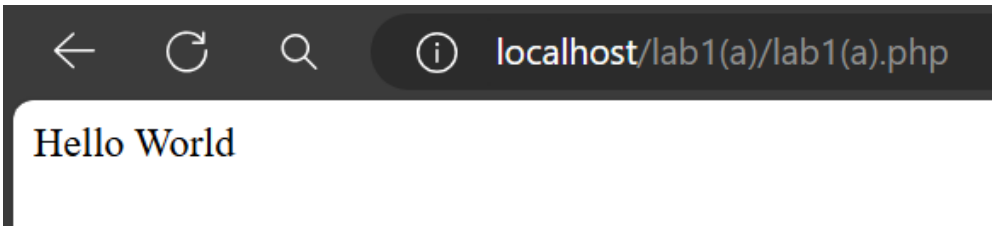
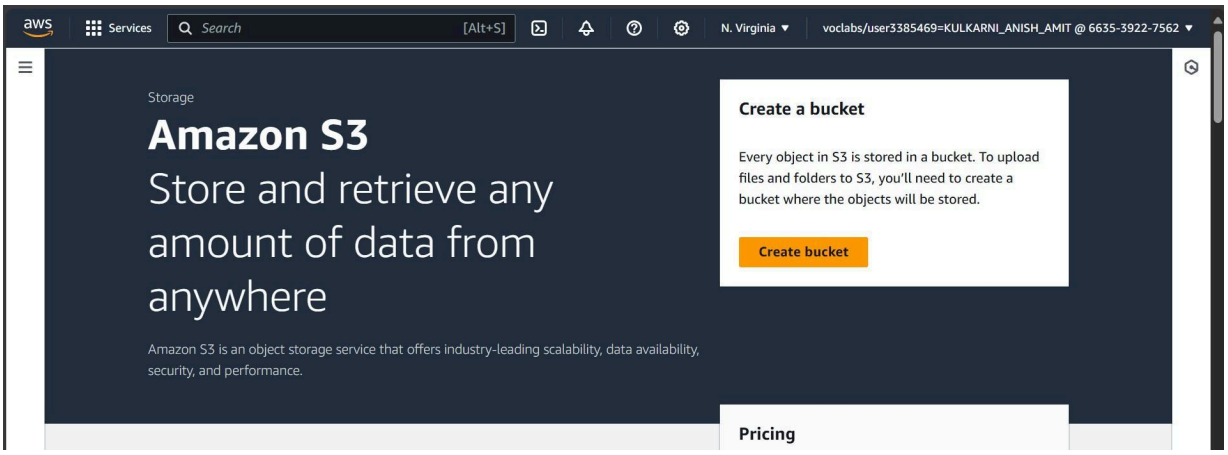
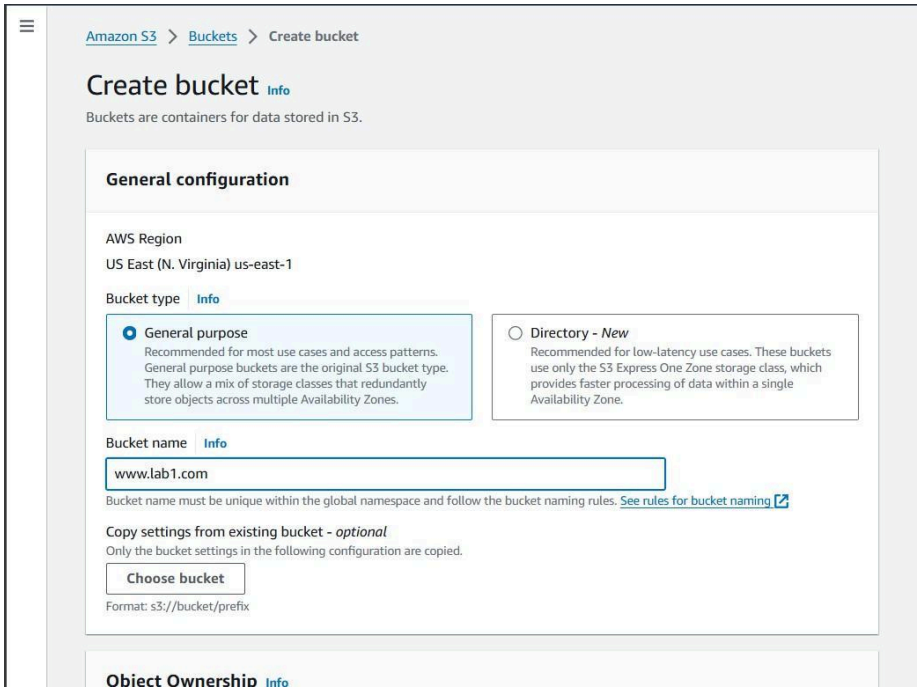


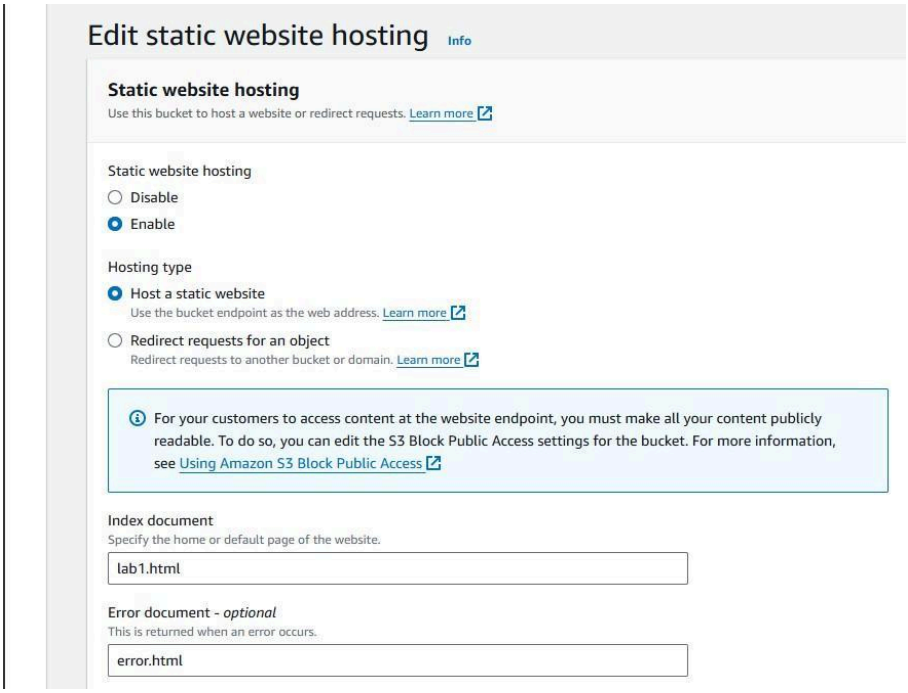



localhost/lab1(a)/
Index of /lab1(a)
Name
Last modified
Size
Description
Parent Directory
-
lab1(a).php
2024-08-04 12:21
31
Apache/2.4.58 (Win64) OpenSSL/3.1.3 PHP/8.0.30 Server at localhost Port 80


localhost/lab1(a)/lab1(a).php
Hello World


aws
Services
Search
[Alt+S]
N. Virginia
voclabs/user3385469=KULKARNI_ANISH_AMIT @ 6635-3922-7562
Storage
Amazon S3
Store and retrieve any amount of data from anywhere
Amazon S3 is an object storage service that offers industry-leading scalability, data availability, security, and performance.
Create a bucket
Every object in S3 is stored in a bucket. To upload files and folders to S3, you'll need to create a bucket where the objects will be stored.
Create bucket
Pricing


Amazon S3 > Buckets > Create bucket
Create bucket Info
Buckets are containers for data stored in S3.
General configuration
AWS Region
US East (N. Virginia) us-east-1
Bucket type Info
General purpose
Recommended for most use cases and access patterns. General purpose buckets are the original S3 bucket type. They allow a mix of storage classes that redundantly store objects across multiple Availability Zones.
Directory - New
Recommended for low-latency use cases. These buckets use only the S3 Express One Zone storage class, which provides faster processing of data within a single Availability Zone.
Bucket name Info
www.lab1.com
Bucket name must be unique within the global namespace and follow the bucket naming rules. See rules for bucket naming
Copy settings from existing bucket - optional
Only the bucket settings in the following configuration are copied.
Choose bucket
Format: s3://bucket/prefix
Object Ownership Info


Edit static website hosting Info
Static website hosting
Use this bucket to host a website or redirect requests. Learn more
Static website hosting
Disable
Enable
Hosting type
Host a static website
Use the bucket endpoint as the web address. Learn more
Redirect requests for an object
Redirect requests to another bucket or domain. Learn more
For your customers to access content at the website endpoint, you must make all your content publicly readable. To do so, you can edit the S3 Block Public Access settings for the bucket. For more information, see Using Amazon S3 Block Public Access
Index document
Specify the home or default page of the website.
lab1.html
Error document - optional
This is returned when an error occurs.
error.html

Static website hosting

Use this bucket to host a website or redirect requests. Learn more

Static website hosting
Enabled

Hosting type
Bucket hosting

Bucket website endpoint
When you configure your bucket as a static website, the website is available at the AWS Region-specific website endpoint of the bucket. Learn more
http://www.lab1a.com.s3-website-us-east-1.amazonaws.com

Upload Info

Add the files and folders you want to upload to S3. To upload a file larger than 160GB, use the AWS CLI, AWS SDK or Amazon S3 REST API. Learn more

Drag and drop files and folders you want to upload here, or choose **Add files** or **Add folder**.

Files and folders (2 Total, 2.7 KB) Remove Add files Add folder

All files and folders in this table will be uploaded.

Find by name 1

Name	Folder	Type
error.html	-	text/html
lab1.html	-	text/html

Upload succeeded
View details below.

Upload: status

Close

The information below will no longer be available after you navigate away from this page.

Summary

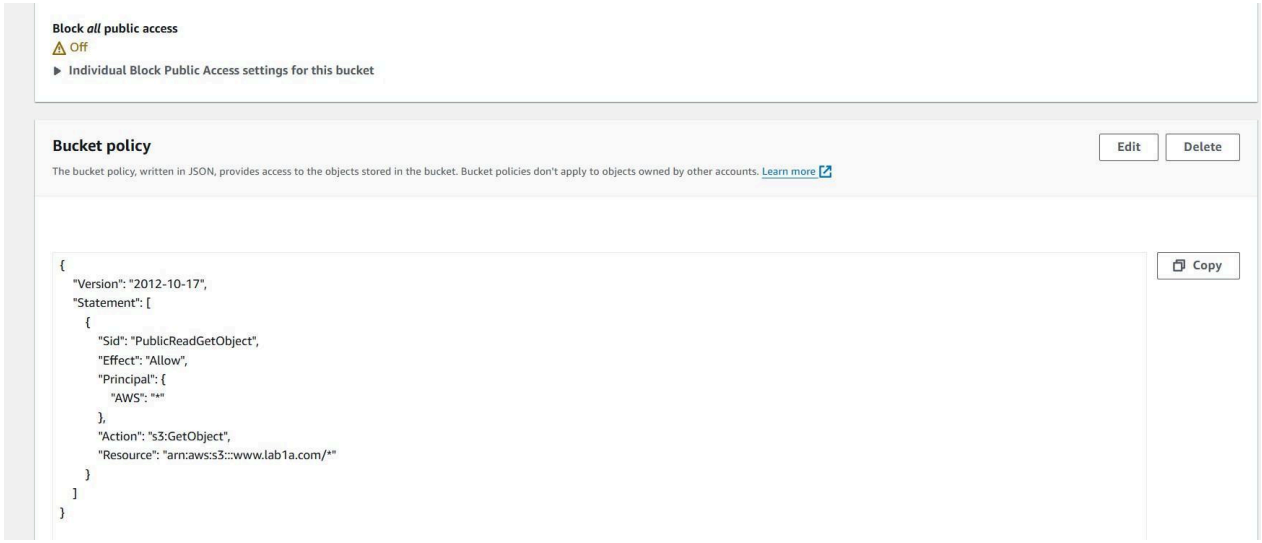
Destination	Succeeded	Failed
s3://www.lab1a.com	2 files, 2.7 KB (100.00%)	0 files, 0 B (0%)

Files and folders | Configuration

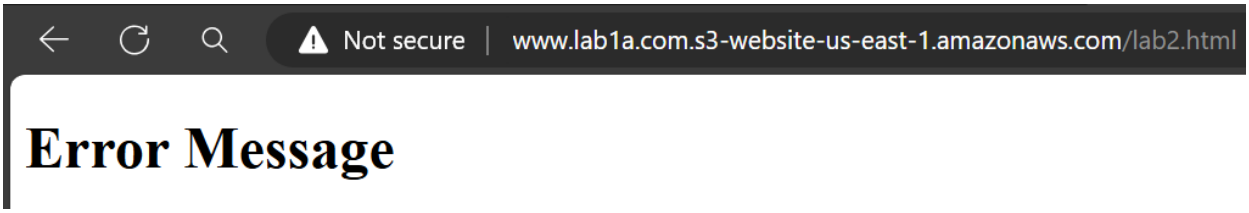
Files and folders (2 Total, 2.7 KB)

Find by name 1

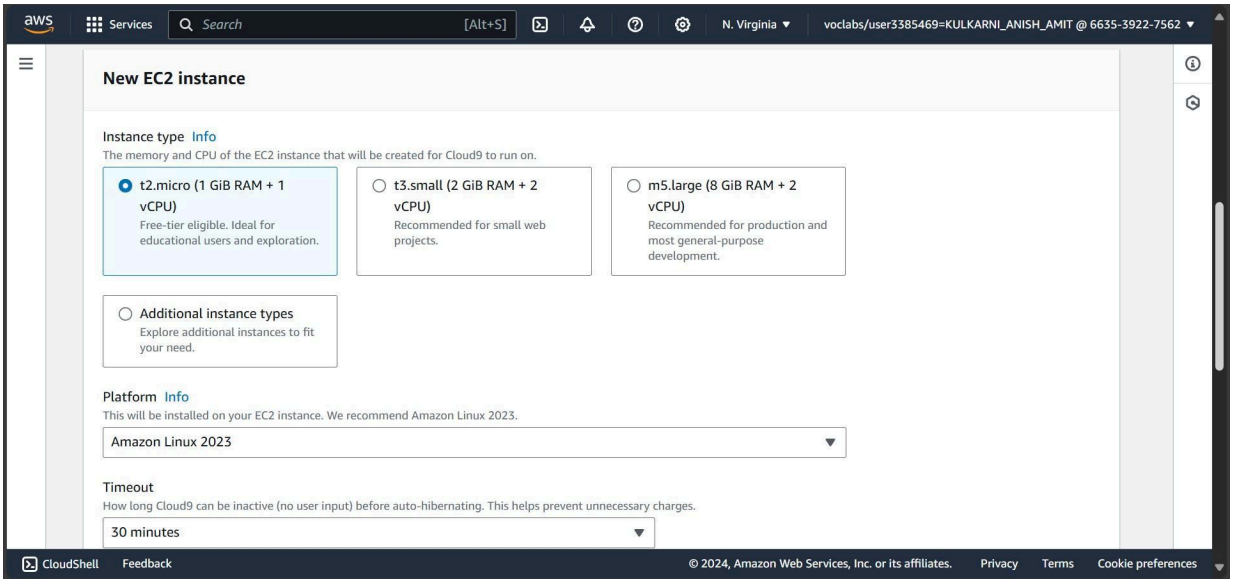
Name	Folder	Type	Size	Status	Error
error.html	-	text/html	150.0 B	Succeeded	-
lab1.html	-	text/html	2.6 KB	Succeeded	-

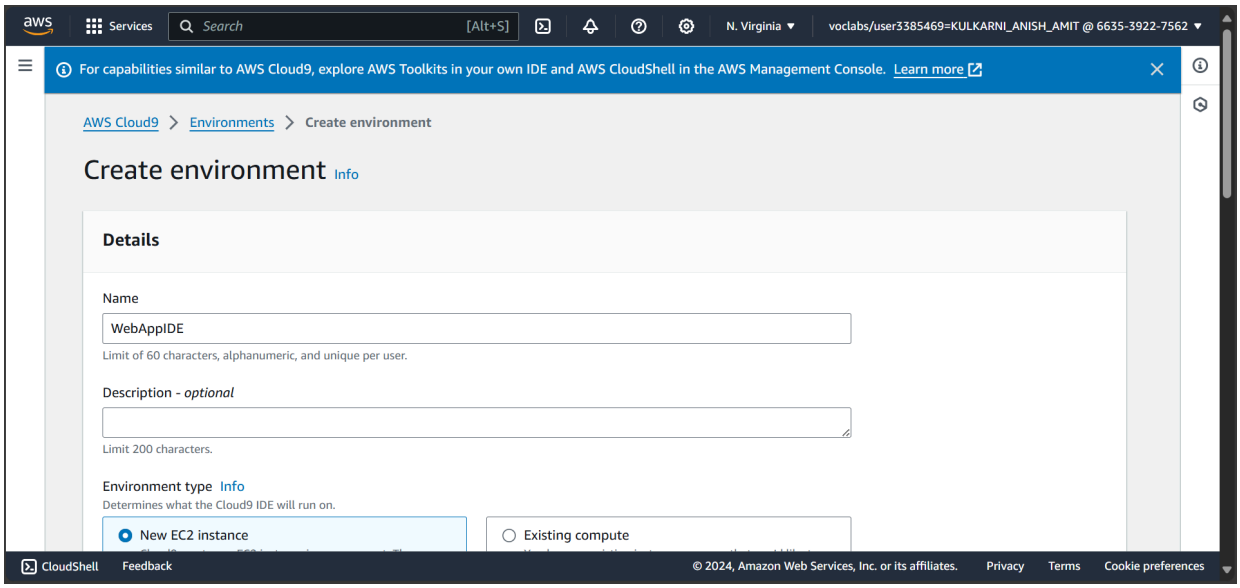

Block all public access
Off
Individual Block Public Access settings for this bucket
Bucket policy
Edit
Delete
The bucket policy, written in JSON, provides access to the objects stored in the bucket. Bucket policies don't apply to objects owned by other accounts. Learn more
Copy
{
"Version": "2012-10-17",
"Statement": [
{
"Sid": "PublicReadGetObject",
"Effect": "Allow",
"Principal": {
"AWS": "*"
},
"Action": "s3:GetObject",
"Resource": "arn:aws:s3:::www.lab1a.com/*"
}
]
}


Not secure
www.lab1a.com.s3-website-us-east-1.amazonaws.com
Hello World!
This is a lab1(a) website


Not secure
www.lab1a.com.s3-website-us-east-1.amazonaws.com/lab2.html
Error Message

Aim:To understand the benefits of Cloud Infrastructure and Setup AWS Cloud9 IDE, Launch AWS Cloud9 IDE and Perform Collaboration Demonstration.





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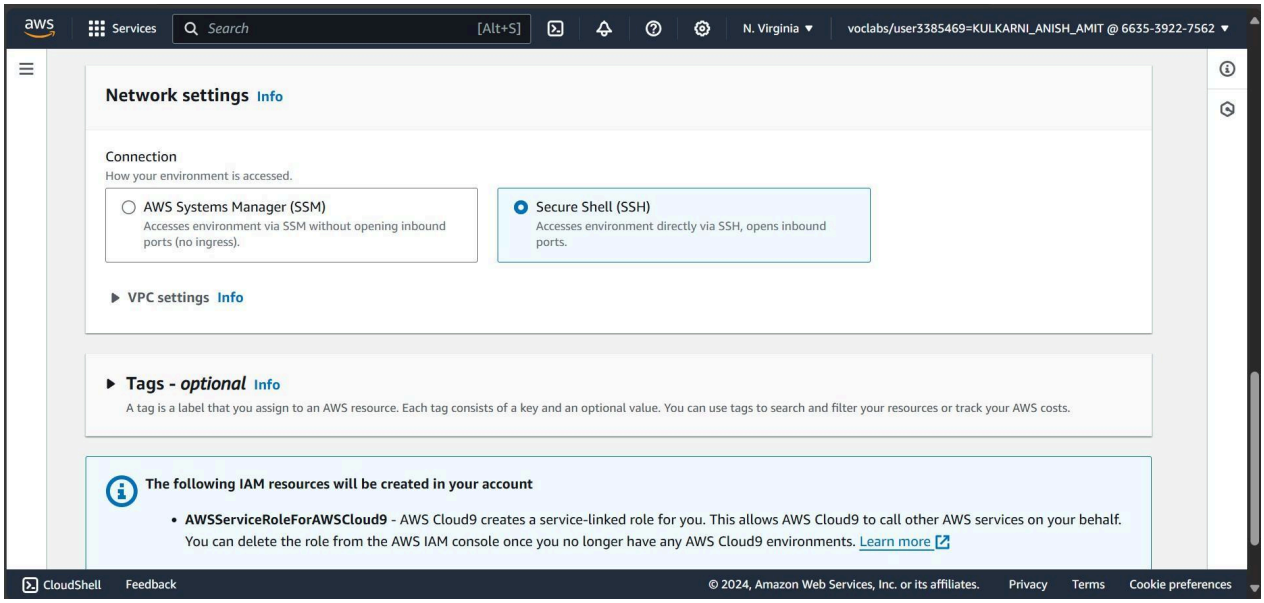

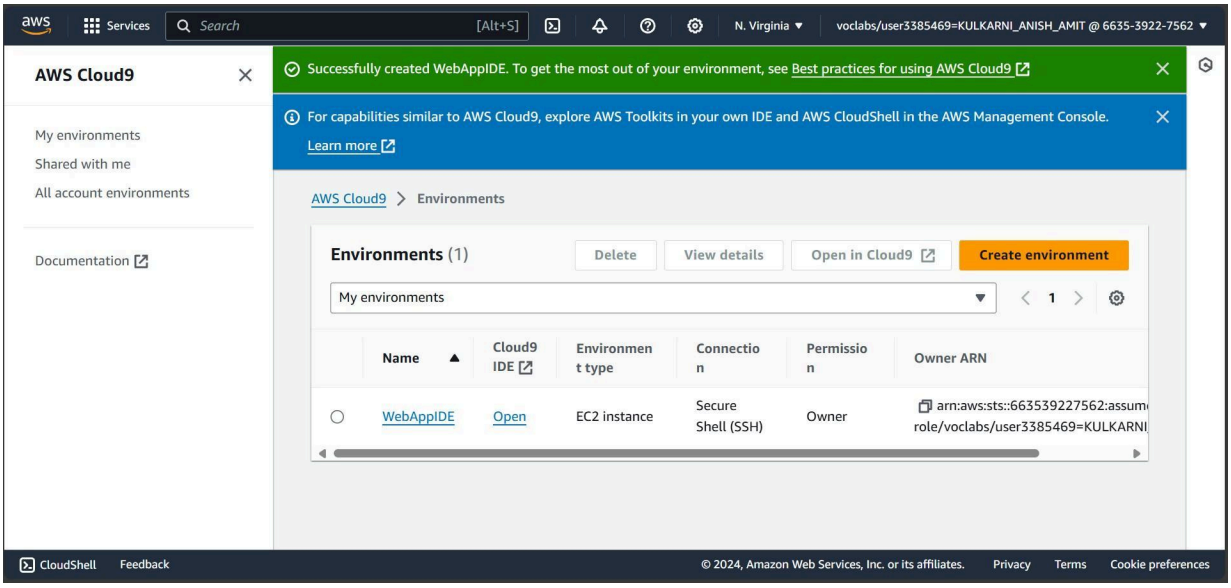

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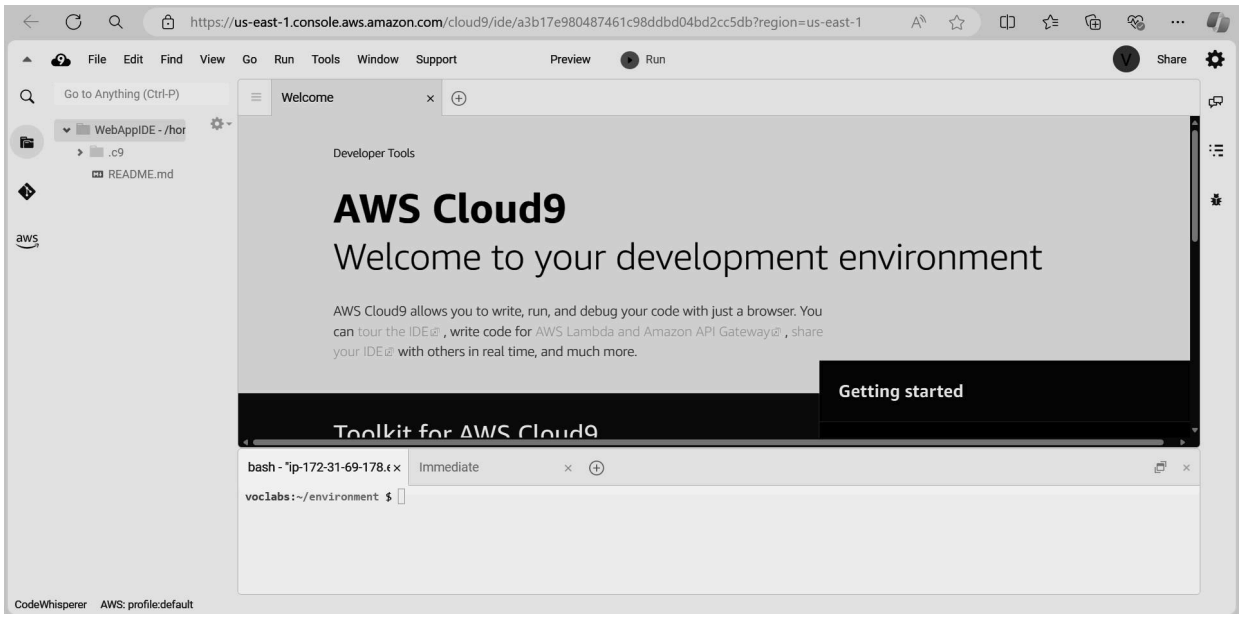
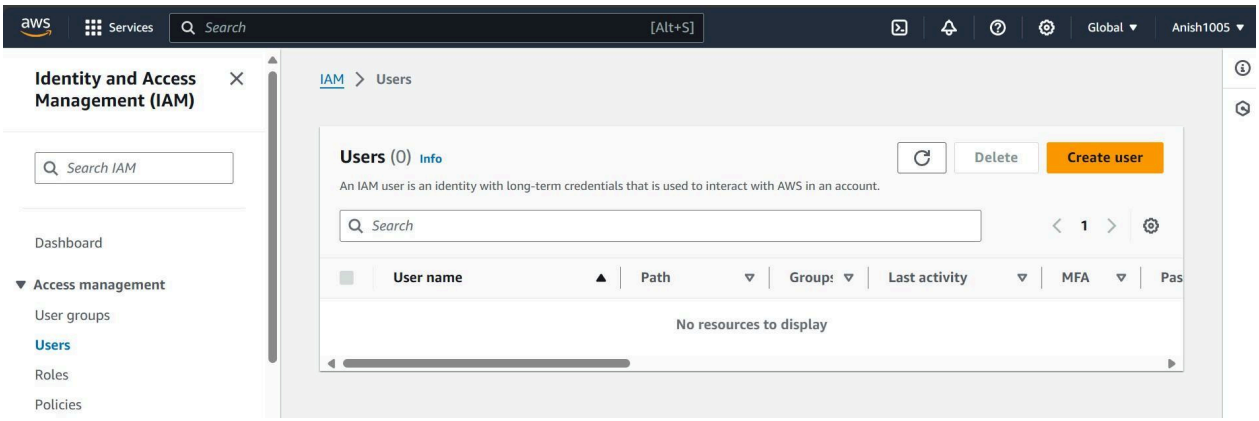
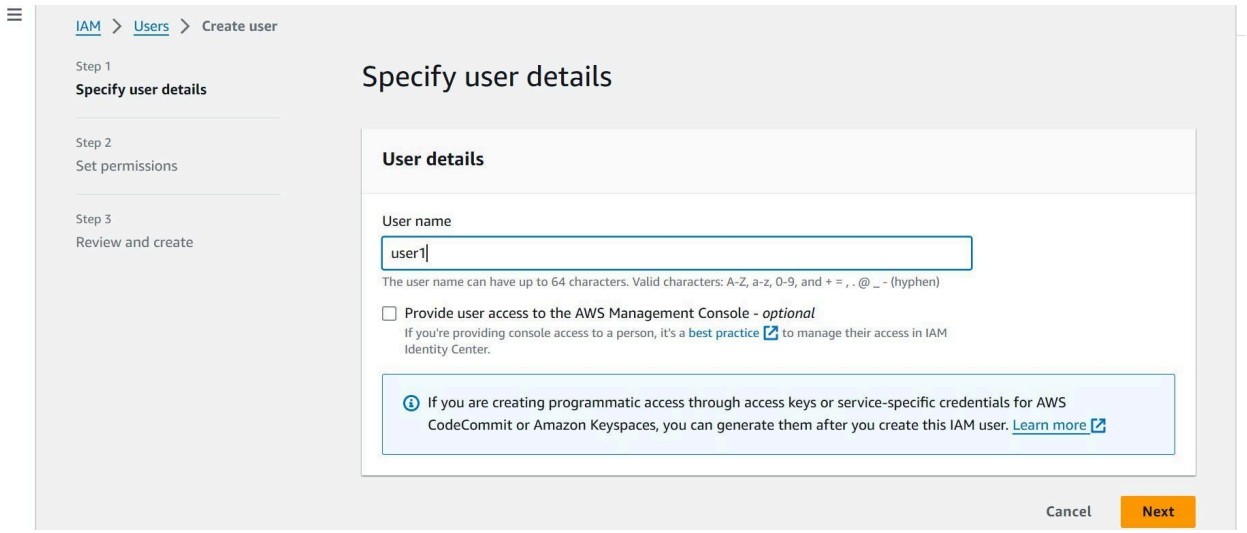
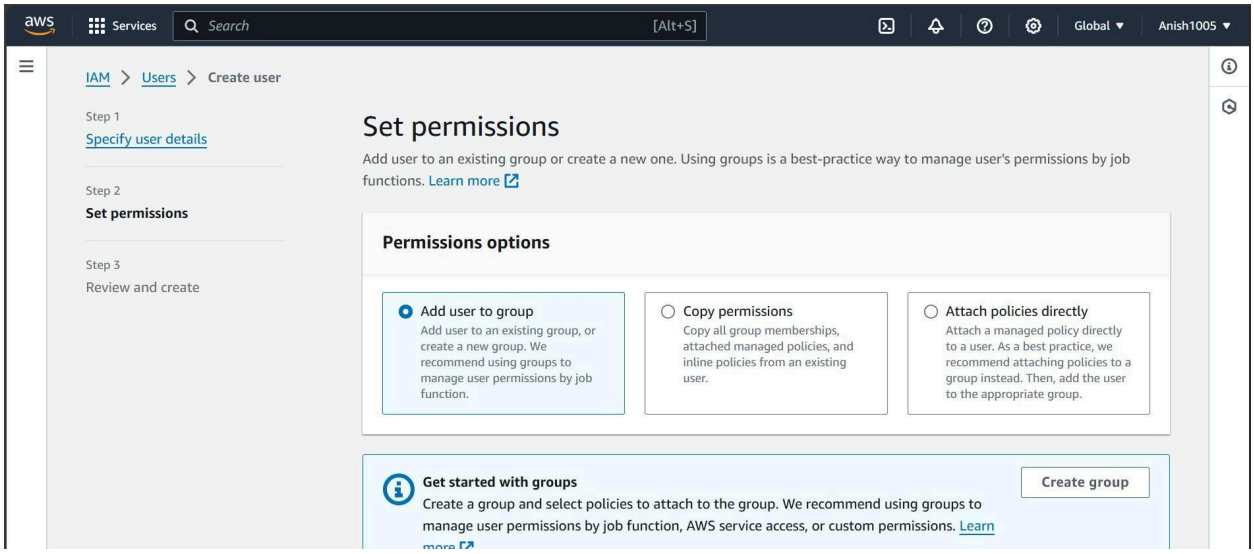
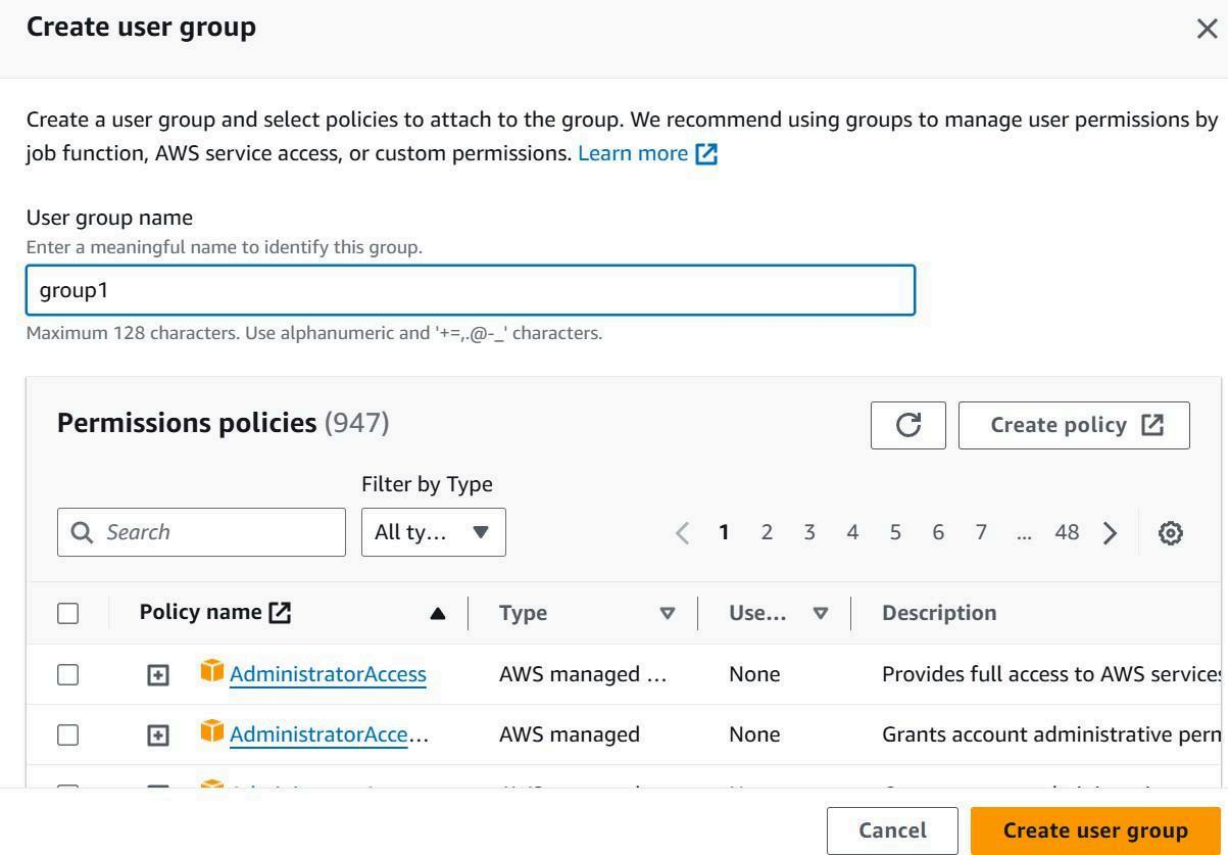


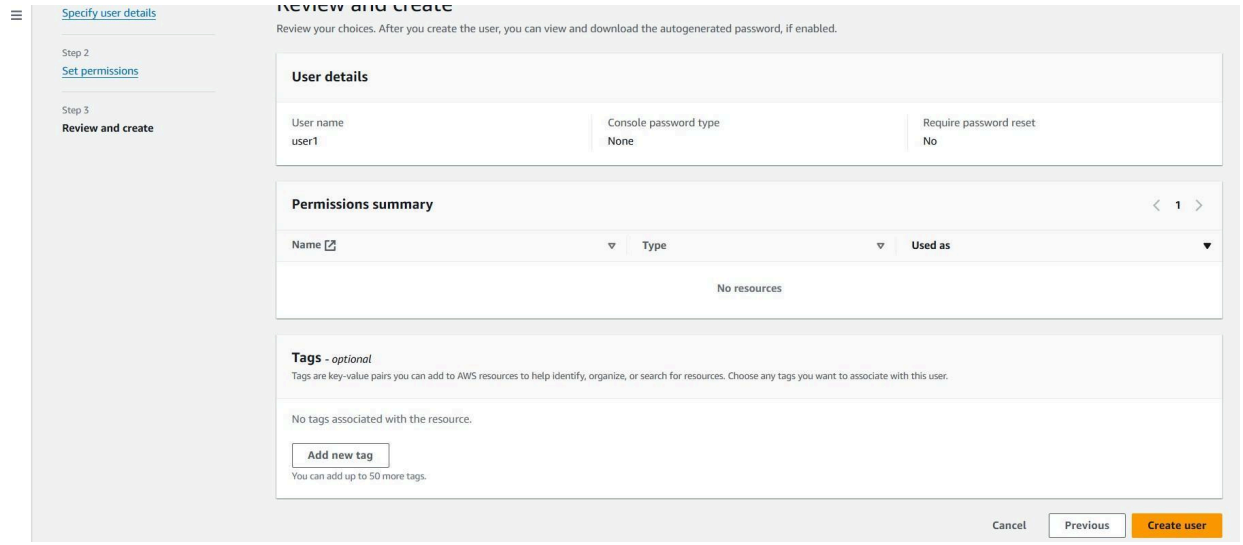


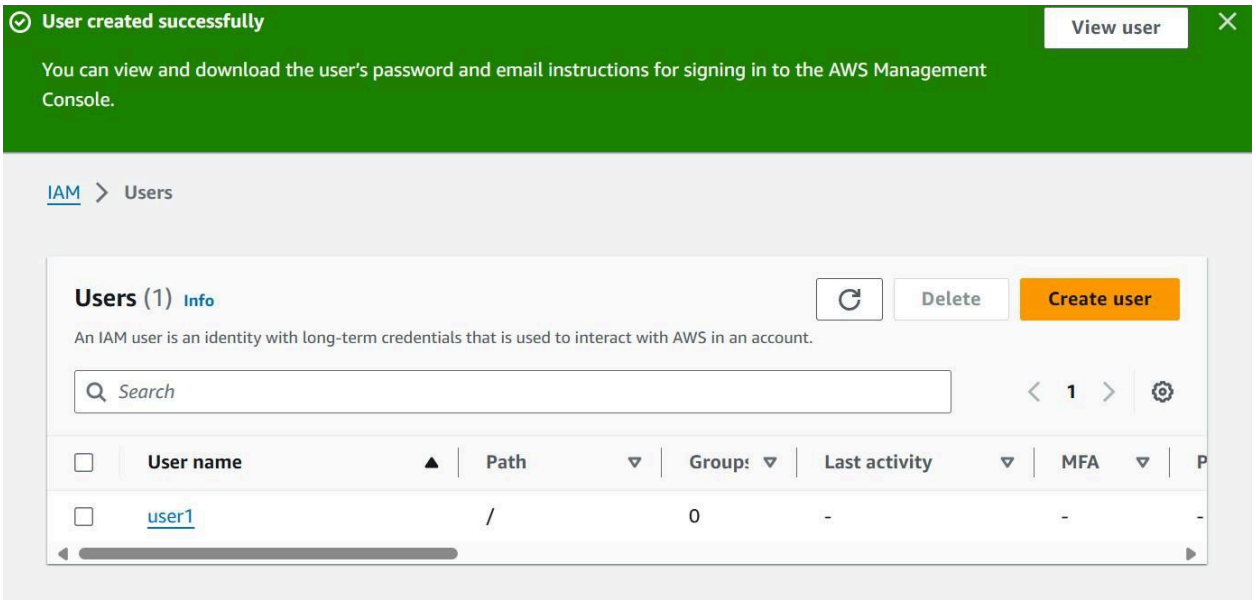


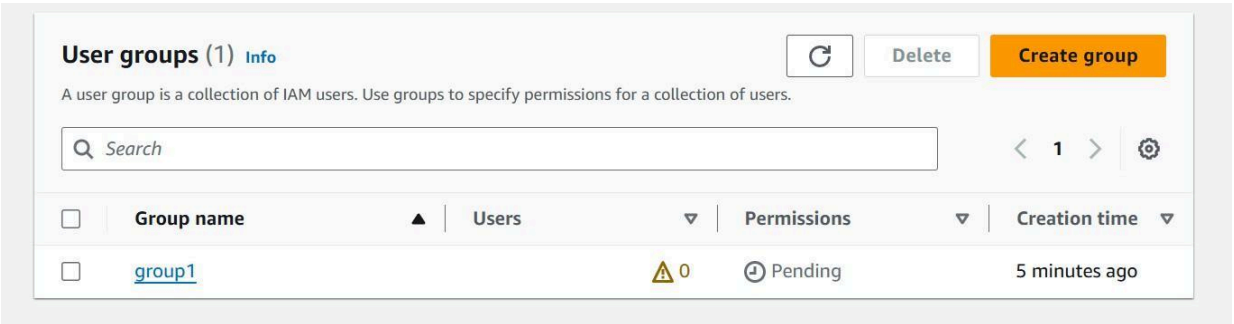
Aditya Ahuja 02 D15C



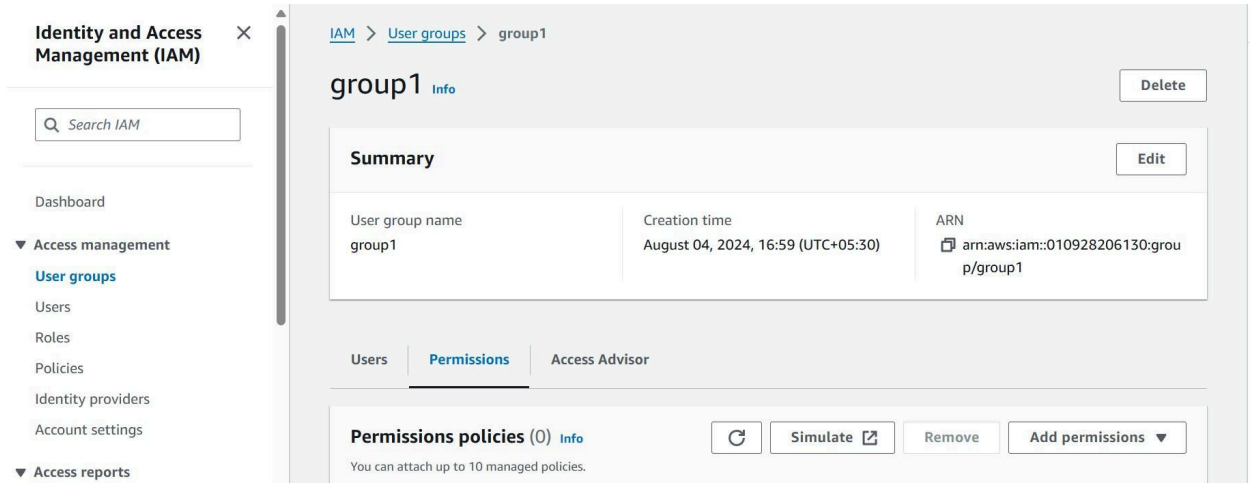


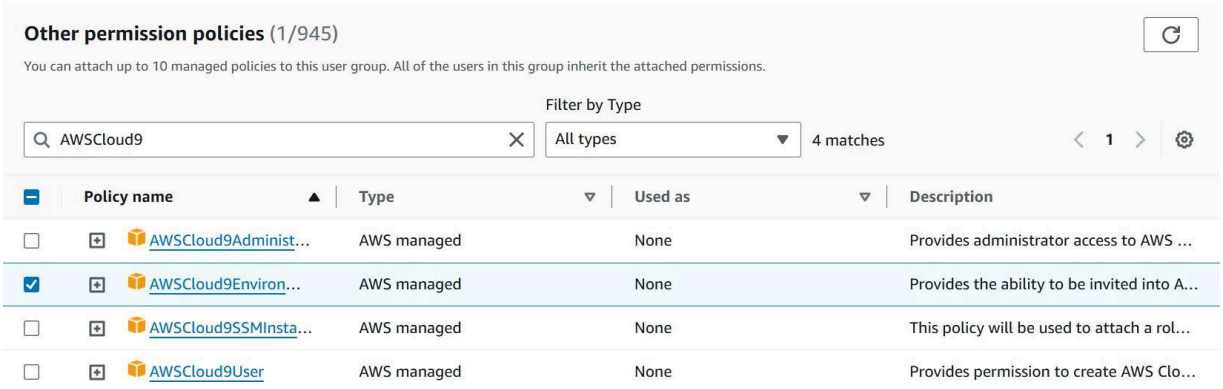

Specify user details
Step 2
Set permissions
Step 3
Review and create
Review your choices. After you create the user, you can view and download the autogenerated password, if enabled.
User details
User name
user1
Console password type
None
Require password reset
No
Permissions summary
Name
Type
Used as
No resources
Tags - optional
Tags are key-value pairs you can add to AWS resources to help identify, organize, or search for resources. Choose any tags you want to associate with this user.
No tags associated with the resource.
Add new tag
You can add up to 50 more tags.
Cancel
Previous
Create user


User created successfully
View user
You can view and download the user's password and email instructions for signing in to the AWS Management Console.
IAM > Users
Users (1) Info
Delete
Create user
An IAM user is an identity with long-term credentials that is used to interact with AWS in an account.
Search
1
User name
Path
Groups
Last activity
MFA
user1
/
0
-
-


User groups (1) Info
Delete
Create group
A user group is a collection of IAM users. Use groups to specify permissions for a collection of users.
Search
1
Group name
Users
Permissions
Creation time
group1
0
Pending
5 minutes ago

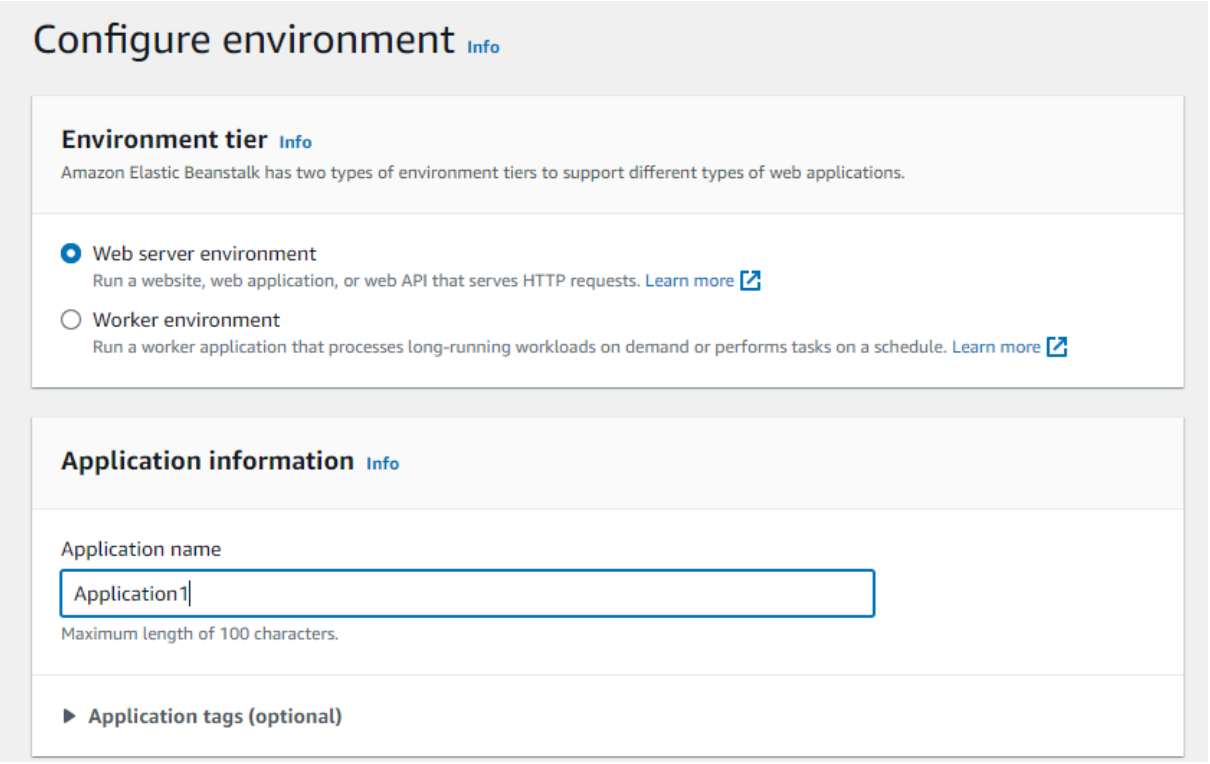
Aditya Ahuja 02 D15C

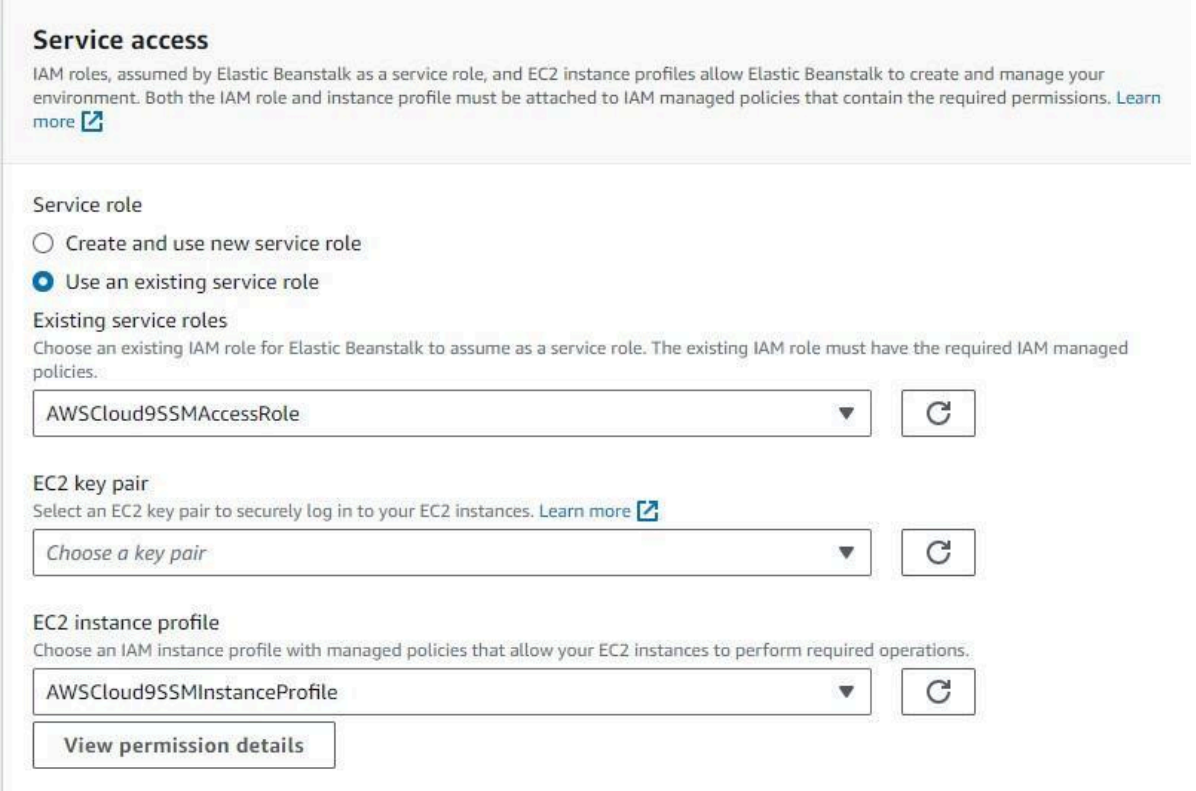




Exp 2

Aim: To Build Your Application using AWS CodeBuild and Deploy on S3 / SEBS using AWS CodePipeline, deploy Sample Application on EC2 instance using AWS CodeDeploy.





Set up networking, database, and tags - *optional* Info

Virtual Private Cloud (VPC)

VPC
Launch your environment in a custom VPC instead of the default VPC. You can create a VPC and subnets in the VPC management console.
Learn more

vpc-0da5a3d9b481e2d7b | (172.31.0.0/16)

Create custom VPC

Review Info

Step 1: Configure environment

Edit

Environment information

Environment tier Web server environment	Application name Application1
Environment name Application1-env	Application code Sample application
Platform arn:aws:elasticbeanstalk:us-east-1::platform/PHP 8.3 running on 64bit Amazon Linux 2023/4.3.1	

Step 2: Configure service access

Edit

Service access Info

Configure the service role and EC2 instance profile that Elastic Beanstalk uses to manage your environment. Choose an EC2 key pair to securely log in to your EC2 instances.

Service role arn:aws:iam::011528263337:role/service-role/AWSCloud9SSMAccessRole	EC2 instance profile AWSCloud9SSMInstanceProfile

Ignore health check	Instance replacement	
false	false	

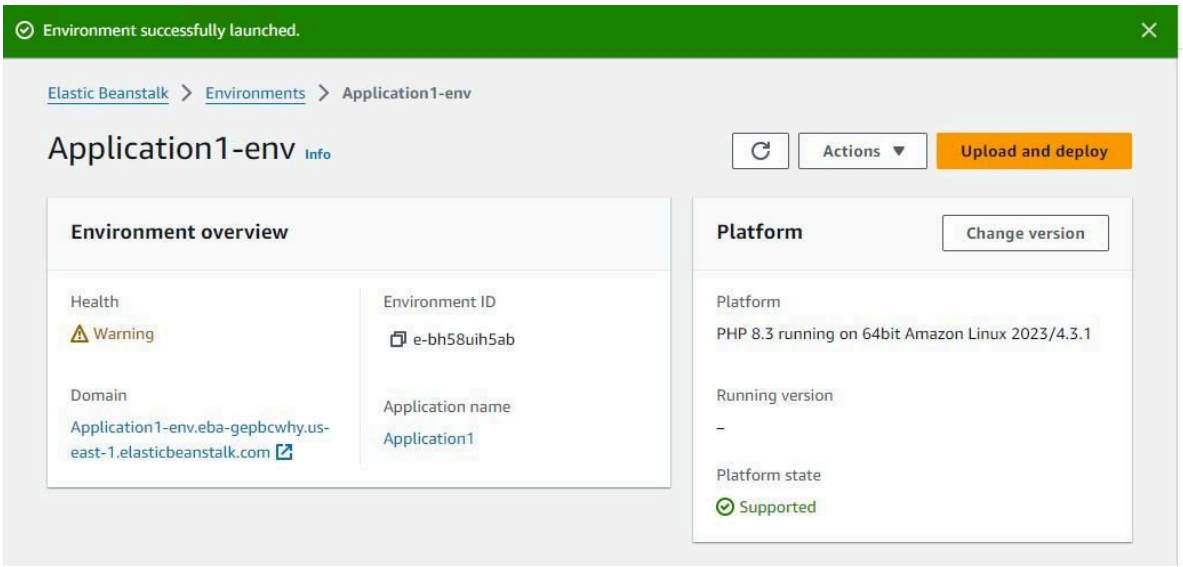
Platform software

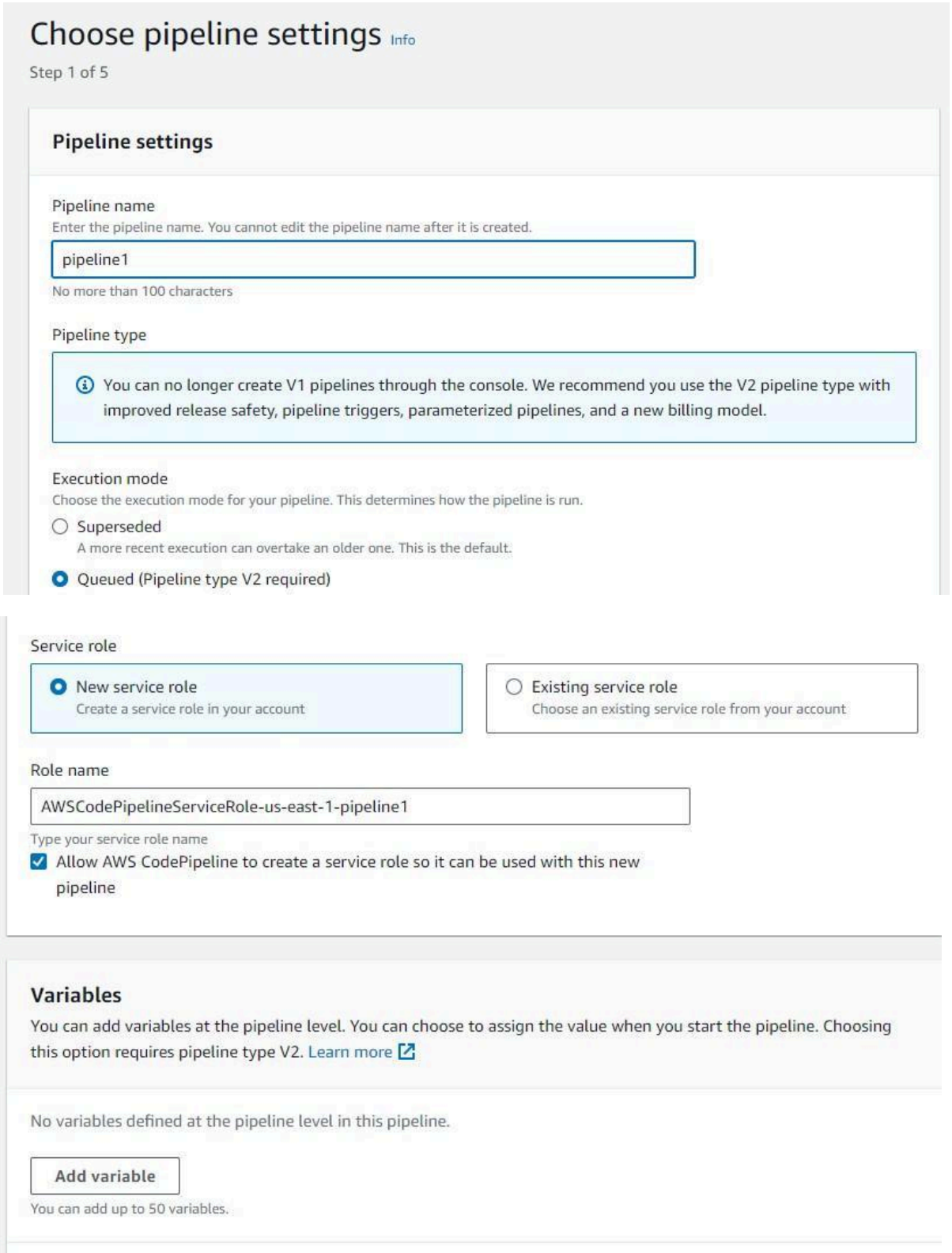
Lifecycle	Log streaming	Allow URL fopen
false	Deactivated	On
Display errors	Document root	Max execution time
Off	–	60
Memory limit	Zlib output compression	Proxy server
256M	Off	nginx
Logs retention	Rotate logs	Update level
7	Deactivated	minor

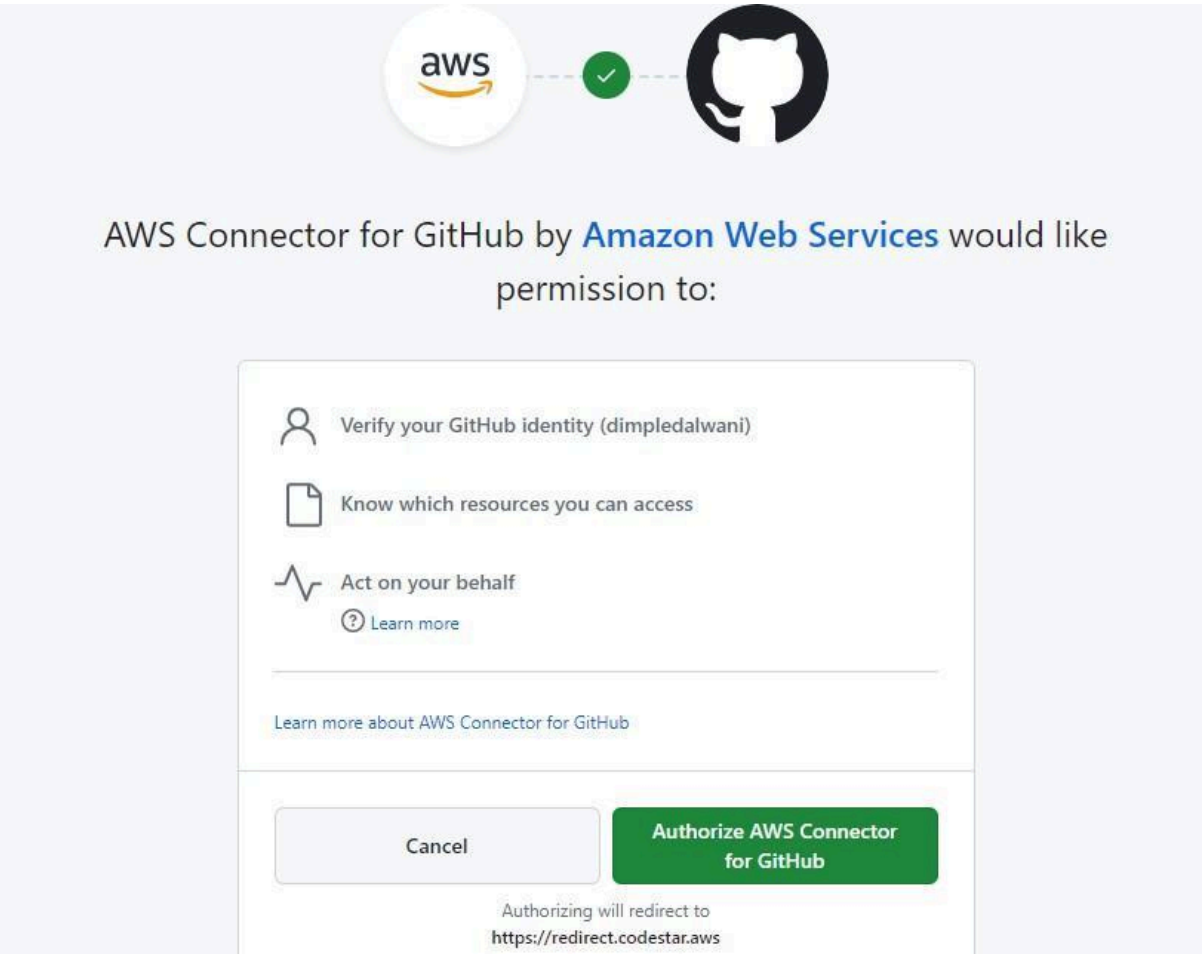
X-Ray enabled

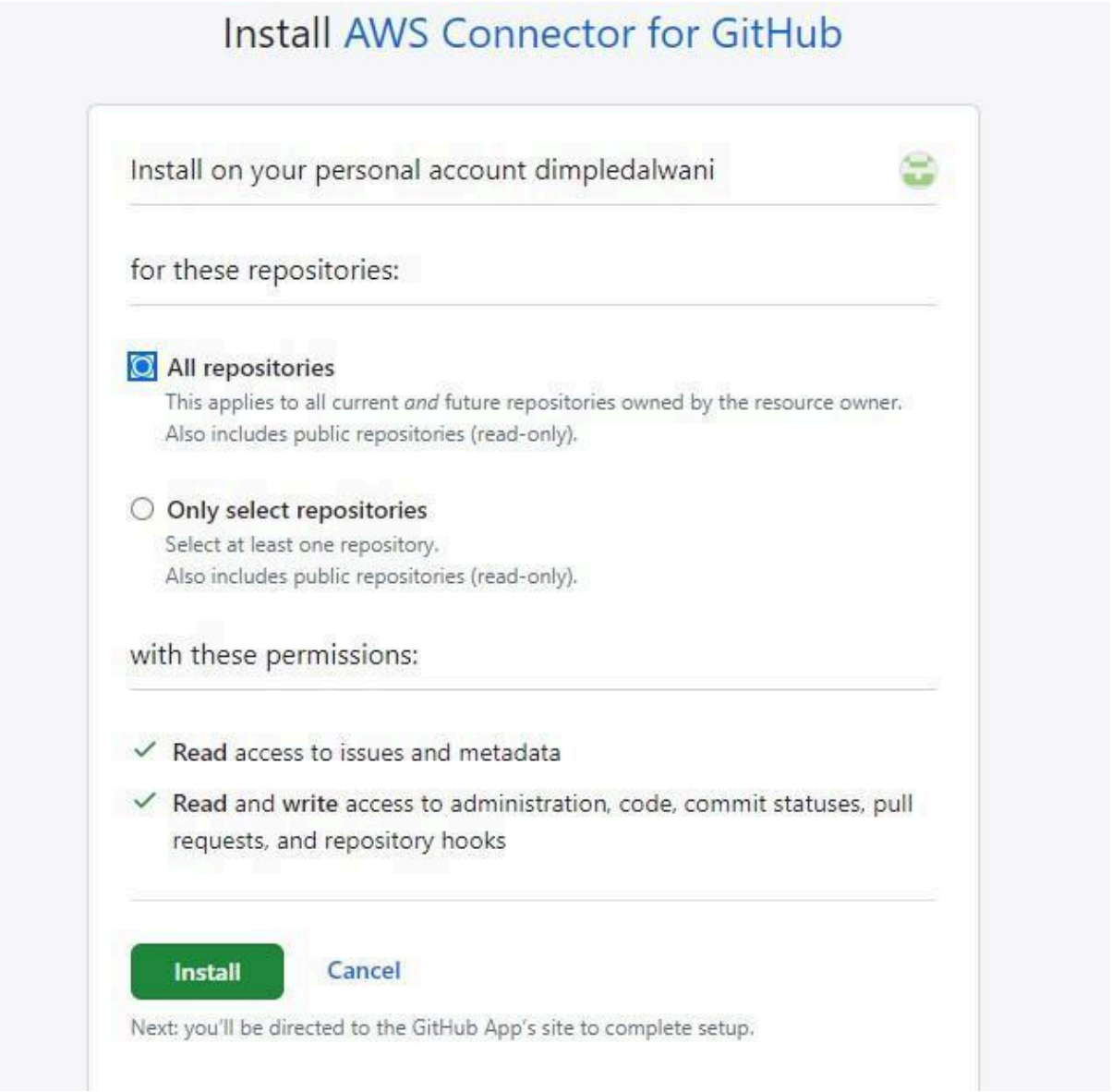
Deactivated

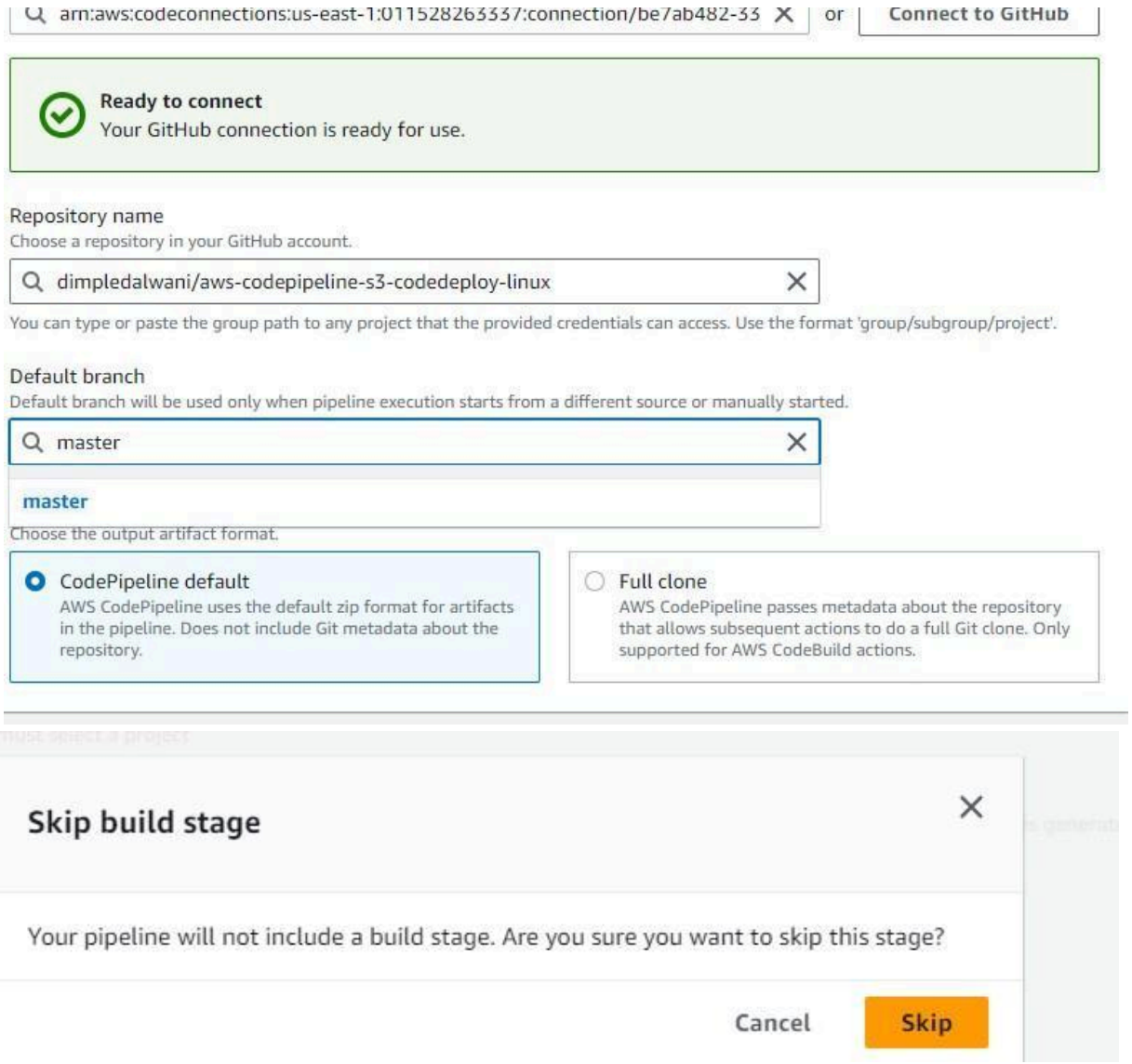
Environment properties




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.
pipeline1
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)
Service role
New service role
Create a service role in your account
Existing service role
Choose an existing service role from your account
Role name
AWSCodePipelineServiceRole-us-east-1-pipeline1
Type your service role name
Allow AWS CodePipeline to create a service role so it can be used with this new pipeline
Variables
You can add variables at the pipeline level. You can choose to assign the value when you start the pipeline. Choosing this option requires pipeline type V2. Learn more
No variables defined at the pipeline level in this pipeline.
Add variable
You can add up to 50 variables.


aws
AWS Connector for GitHub by Amazon Web Services would like permission to:
Verify your GitHub identity (dimpledalwani)
Know which resources you can access
Act on your behalf
Learn more
Learn more about AWS Connector for GitHub
Cancel
Authorize AWS Connector for GitHub
Authorizing will redirect to
https://redirect.codestar.aws


Install AWS Connector for GitHub
Install on your personal account dimpledalwani
for these repositories:
All repositories
This applies to all current and future repositories owned by the resource owner.
Also includes public repositories (read-only).
Only select repositories
Select at least one repository.
Also includes public repositories (read-only).
with these permissions:
Read access to issues and metadata
Read and write access to administration, code, commit statuses, pull requests, and repository hooks
Install
Cancel
Next: you'll be directed to the GitHub App's site to complete setup.


arn:aws:codeconnections:us-east-1:011528263337:connection/be7ab482-33
or
Connect to GitHub
Ready to connect
Your GitHub connection is ready for use.
Repository name
Choose a repository in your GitHub account.
dimpledalwani/aws-codepipeline-s3-codedeploy-linux
You can type or paste the group path to any project that the provided credentials can access. Use the format 'group/subgroup/project'.
Default branch
Default branch will be used only when pipeline execution starts from a different source or manually started.
master
master
Choose the output artifact format.
CodePipeline default
AWS CodePipeline uses the default zip format for artifacts in the pipeline. Does not include Git metadata about the repository.
Full clone
AWS CodePipeline passes metadata about the repository that allows subsequent actions to do a full Git clone. Only supported for AWS CodeBuild actions.

Skip build stage
Your pipeline will not include a build stage. Are you sure you want to skip this stage?
Cancel
Skip

Deploy

Deploy provider
Choose how you deploy to instances. Choose the provider, and then provide the configuration details for that provider.

AWS Elastic Beanstalk

Region

US East (N. Virginia)

Input artifacts
Choose an input artifact for this action. Learn more

SourceArtifact

No more than 100 characters

Application name
Choose an application that you have already created in the AWS Elastic Beanstalk console. Or create an application in the AWS Elastic Beanstalk console and then return to this task.

Application1

Environment name
Choose an environment that you have already created in the AWS Elastic Beanstalk console. Or create an environment in the AWS Elastic Beanstalk console and then return to this task.

Application1-env

Success
Congratulations! The pipeline pipeline1 has been created.

Create a notification rule for this pipeline

Developer Tools > CodePipeline > Pipelines > pipeline1

pipeline1

Notify | Edit | Stop execution | Clone pipeline | Release change

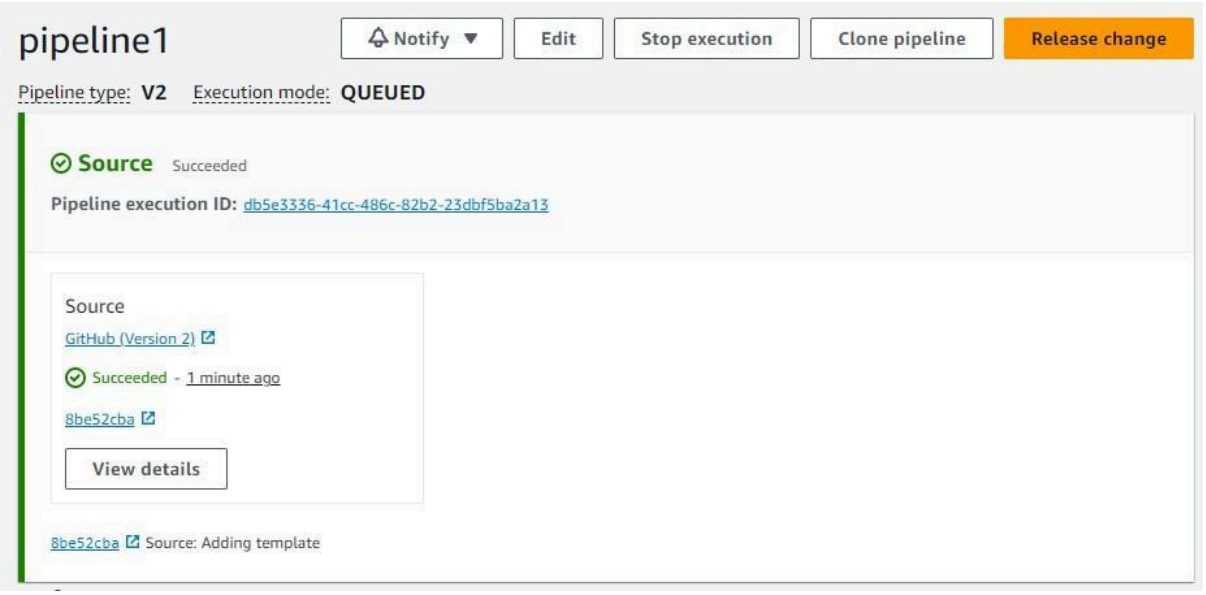
Pipeline type: V2 Execution mode: QUEUED

Source Succeeded

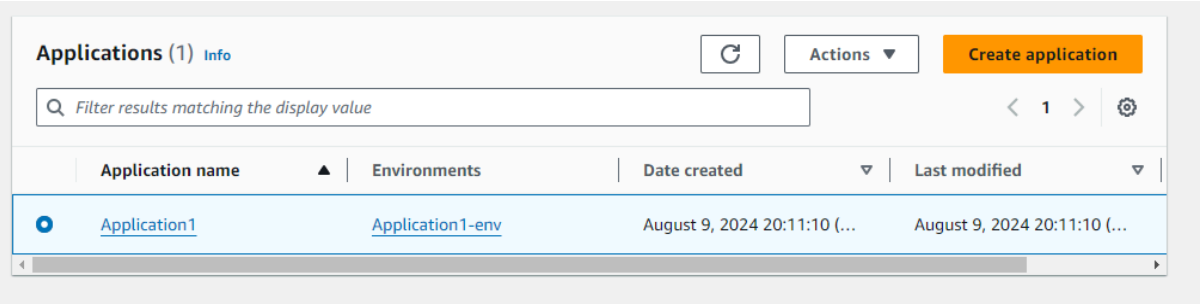
Pipeline execution ID: db5e3336-41cc-486c-82b2-23dbf5ba2a13

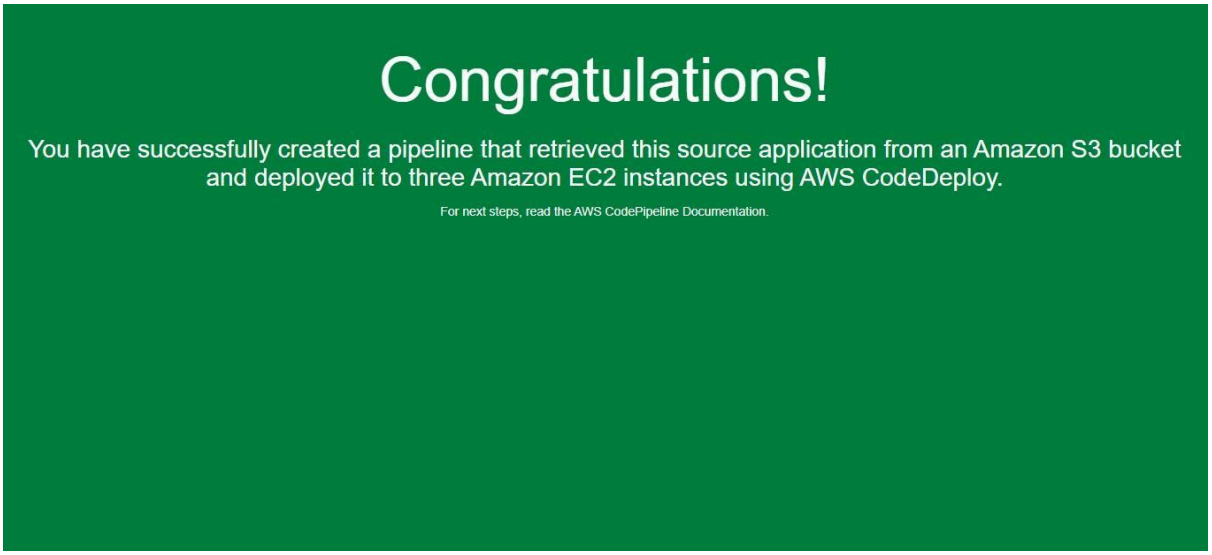
Source
GitHub (Version 2)
Succeeded - Just now
8be52cba
View details


Deploy
In progress
Pipeline execution ID: db5e3336-41cc-486c-82b2-23dbf5ba2a13
Deploy
AWS Elastic Beanstalk
In progress - Just now
View details
8be52cba Source: Adding template


pipeline1
Notify
Edit
Stop execution
Clone pipeline
Release change
Pipeline type: V2
Execution mode: QUEUED
Source
Succeeded
Pipeline execution ID: db5e3336-41cc-486c-82b2-23dbf5ba2a13
Source
GitHub (Version 2)
Succeeded - 1 minute ago
8be52cba
View details
8be52cba Source: Adding template


Deploy
Succeeded
Start rollback
Pipeline execution ID: db5e3336-41cc-486c-82b2-23dbf5ba2a13
Deploy
AWS Elastic Beanstalk
Succeeded - Just now
View details
8be52cba Source: Adding template


Applications (1) Info
Actions
Create application
Filter results matching the display value
1
Application name
Environments
Date created
Last modified
Application1
Application1-env
August 9, 2024 20:11:10 (...
August 9, 2024 20:11:10 (...

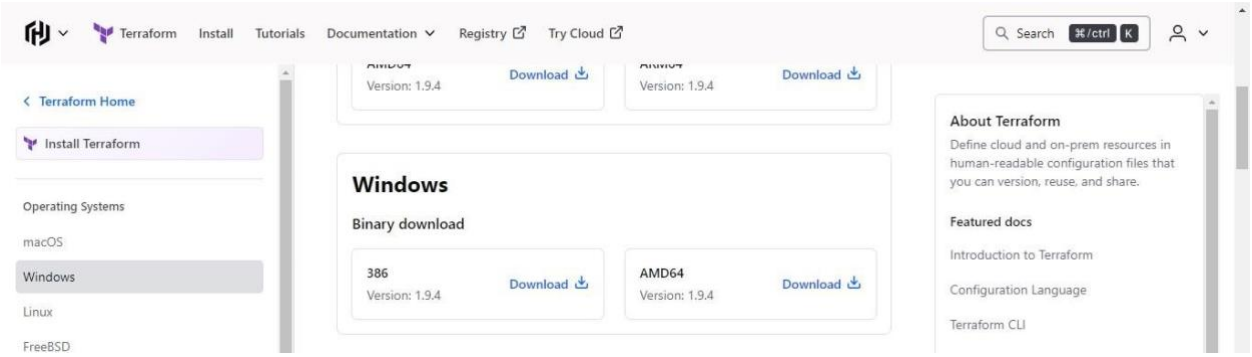

Congratulations!
You have successfully created a pipeline that retrieved this source application from an Amazon S3 bucket and deployed it to three Amazon EC2 instances using AWS CodeDeploy.
For next steps, read the AWS CodePipeline Documentation.

Name: Aditya Ahuja D15C Roll No: 02

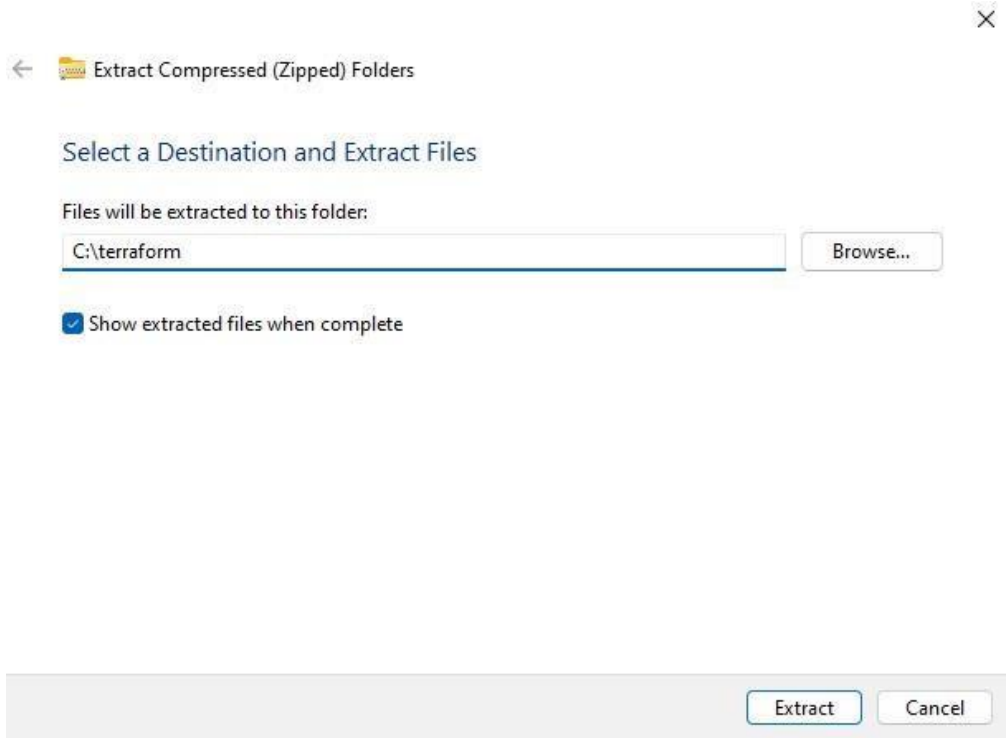
Experiment No. 5

Installation of Terraform

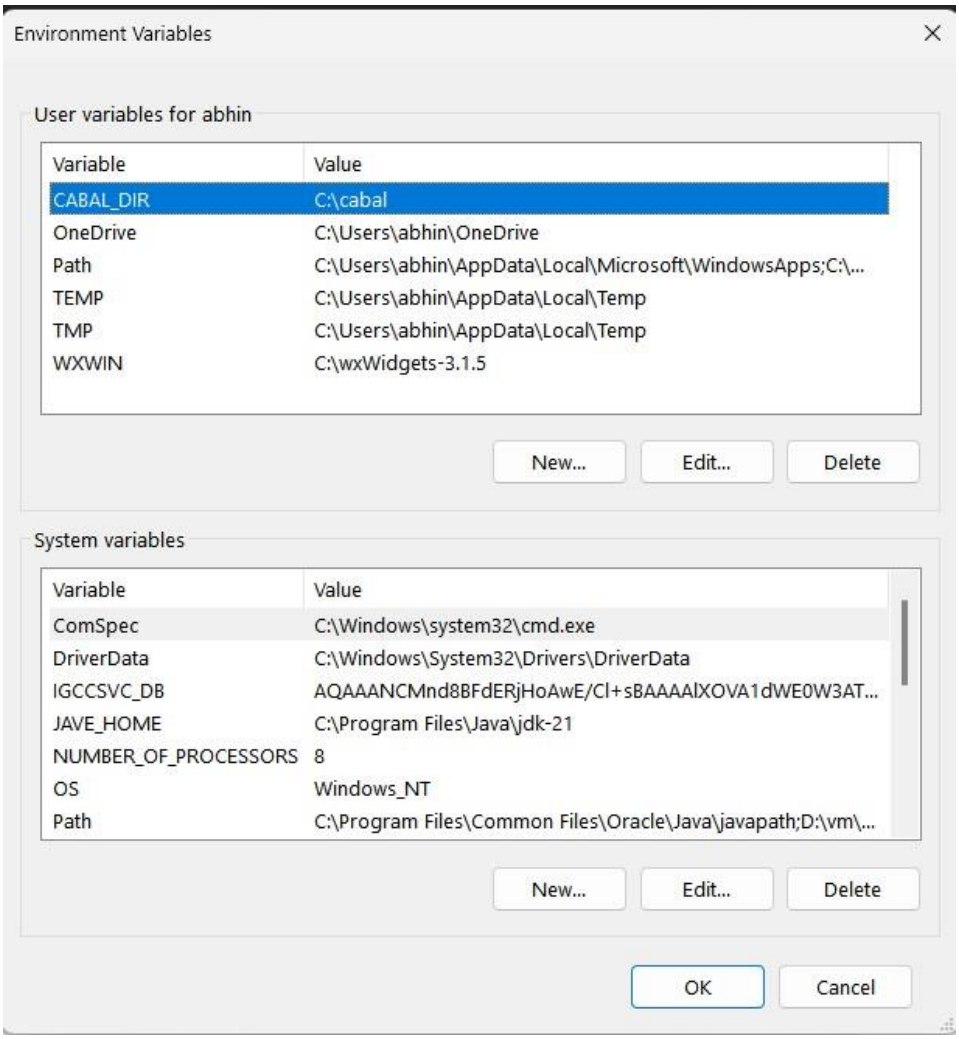
Step 1:To install Terraform, visit the official Terraform website mentioned below, go to the Downloads section, select Windows, and download the 64-bit version for your system. website:https://www.terraform.io/downloads.html



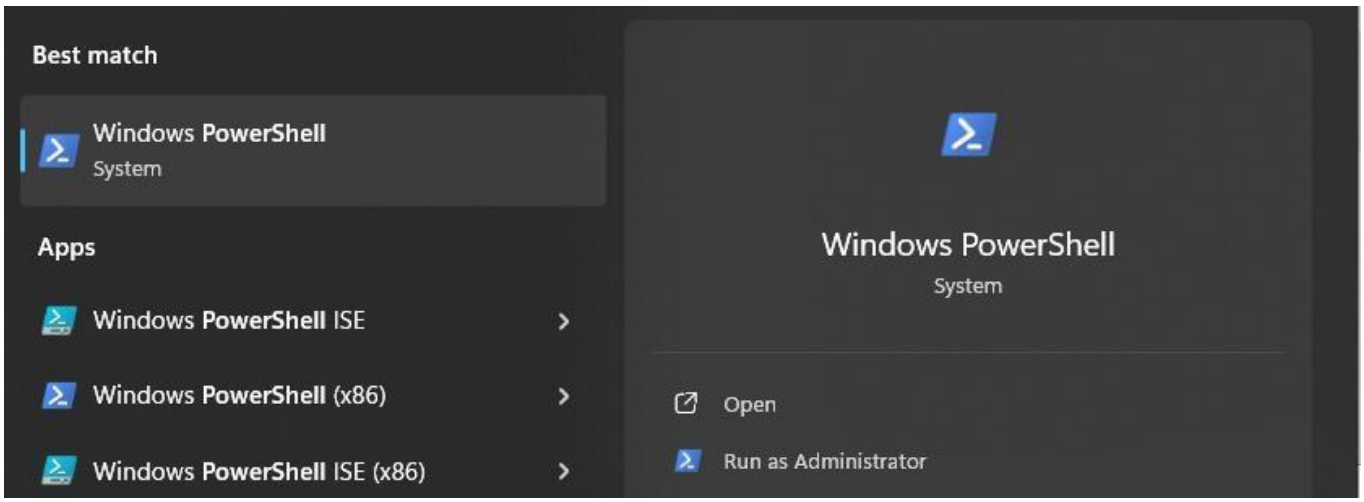
Step 2: Extract the downloaded `Terraform.exe` file to the `C:\Terraform` directory on your system.



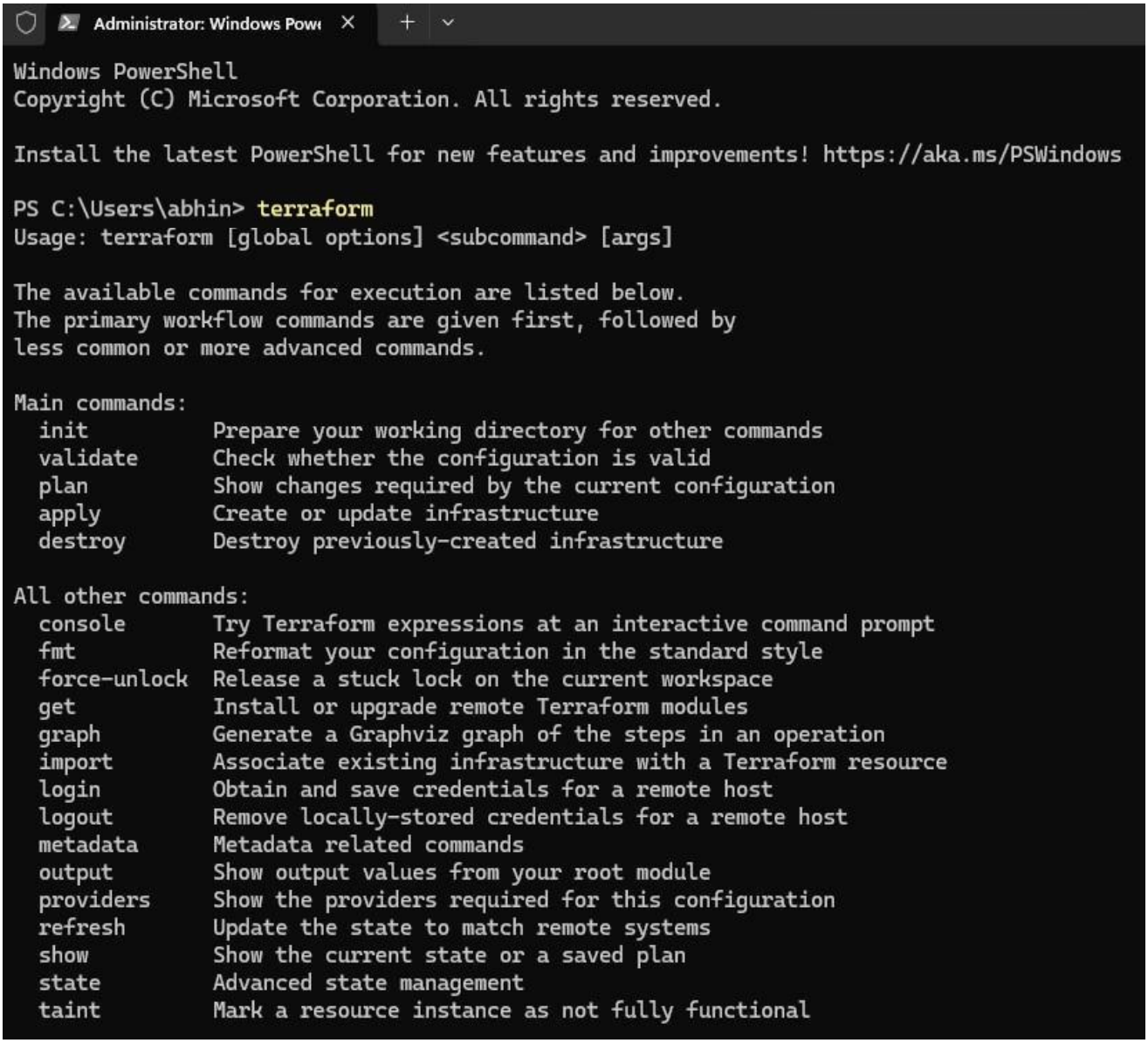
Step 3: Set the System path for Terraform in Environment Variables



Step 4: Run the windows powershell as administrator.



Step 5: Run "`terraform`" to verify its functionality. If you encounter any errors, double-check or update the Terraform path in your environment variables.



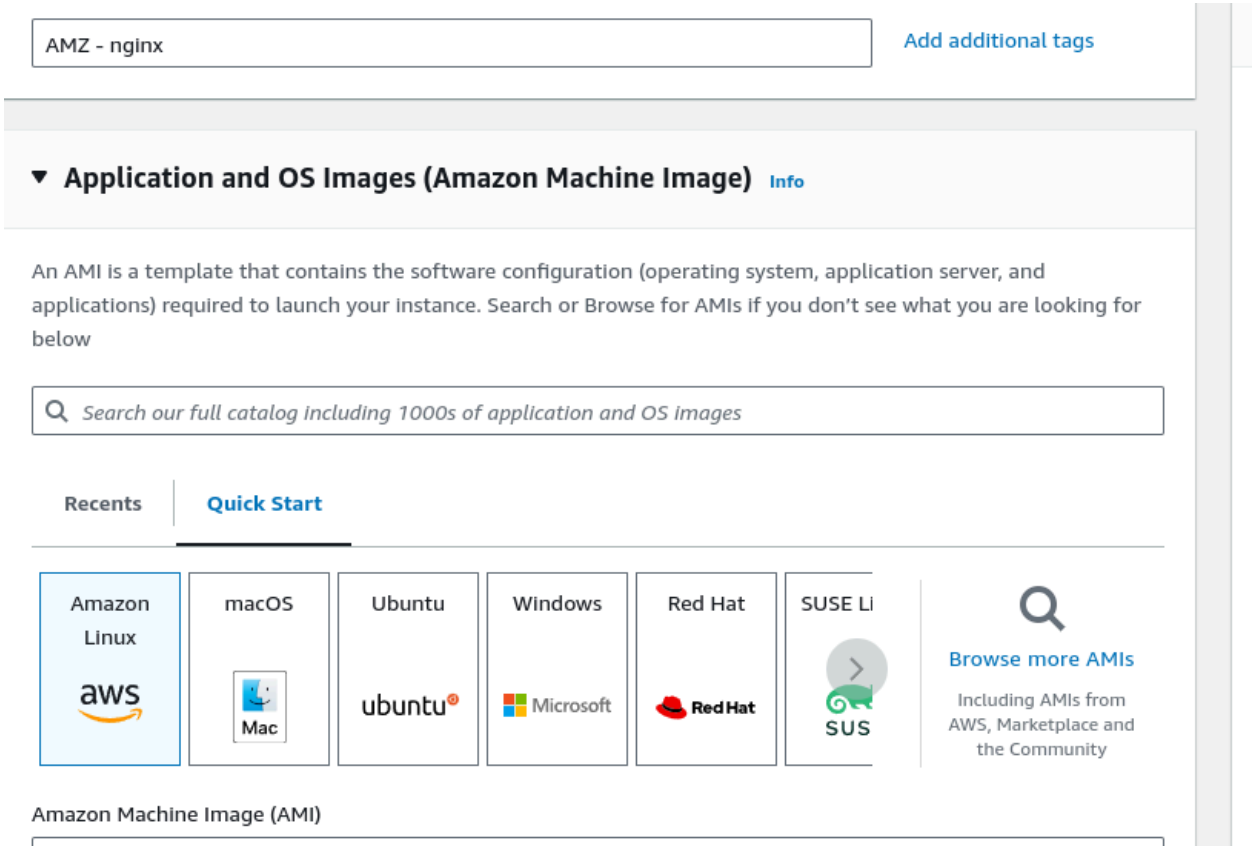
Name: Aditya Ahuja Div:D15C Roll No:02

EXPERIMENT No.4

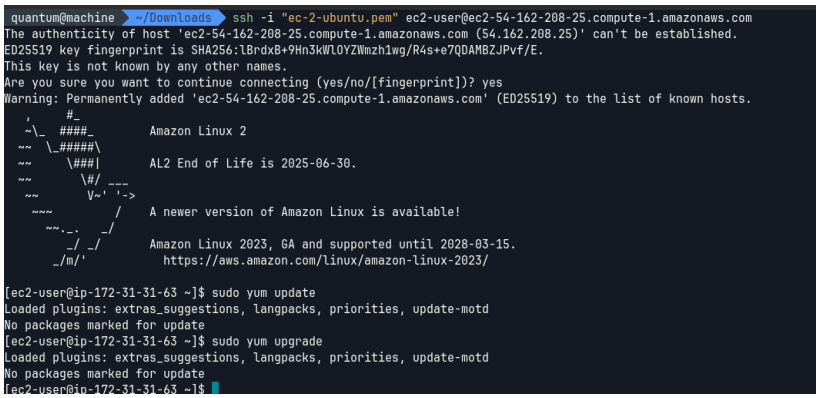
Aim: To install Kubectl and execute Kubectl commands to manage the Kubernetes cluster and deploy Your First Kubernetes Application.

Steps:

1. Select Amazon linux as OS image or use any but change the setting acc to it:



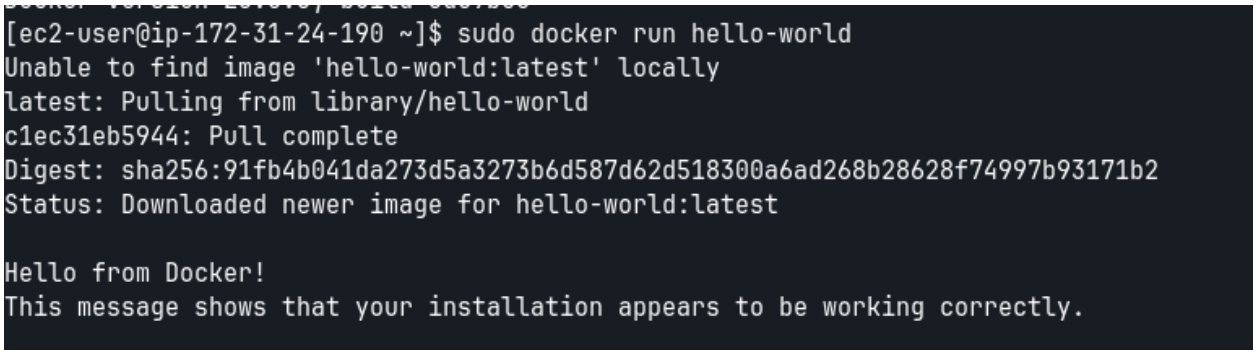
2. Make ssh connection in terminal or in browser:



3. **Install Docker**

Use below commands and enable and test docker;

sudo dnf update
sudo dnf install docker
sudo systemctl enable docker
sudo systemctl start docker



4. Install Kubernetes

Install CNI plugins :

```
CNI_PLUGINS_VERSION="v1.3.0"
ARCH="amd64"
DEST="/opt/cni/bin"
sudo mkdir -p "$DEST"
curl -L
"https://github.com/containernetworking/plugins/releases/download/${CNI_PLUGINS_
VERSION}/cni-plugins-linux-${ARCH}-${CNI_PLUGINS_VERSION}.tgz" | sudo tar -C
"$DEST" -xz
```

Define the directory to download command files:

```
DOWNLOAD_DIR="/usr/local/bin"
sudo mkdir -p "$DOWNLOAD_DIR"
```

Optionally install crictl (required for interaction with the Container Runtime Interface (CRI), optional for kubeadm):

```
CRICTL_VERSION="v1.31.0"
ARCH="amd64"
curl -L
"https://github.com/kubernetes-sigs/cri-tools/releases/download/${CRICTL_VERSION}/
crictl-${CRICTL_VERSION}-linux-${ARCH}.tar.gz" | sudo tar -C $DOWNLOAD_DIR -xz
```

Install kubeadm, kubelet and add a kubelet systemd service:

```
RELEASE="$(curl -sSL https://dl.k8s.io/release/stable.txt)"
ARCH="amd64"
cd $DOWNLOAD_DIR
sudo curl -L --remote-name-all
https://dl.k8s.io/release/${RELEASE}/bin/linux/${ARCH}/{kubeadm,kubelet}
sudo chmod +x {kubeadm,kubelet}
```

```
RELEASE_VERSION="v0.16.2"
curl -sSL
"https://raw.githubusercontent.com/kubernetes/release/${RELEASE_VERSION}/cmd/krel/templates/latest/kubelet/kubelet.service" | sed "s:/usr/bin:${DOWNLOAD_DIR}:g" | sudo tee /usr/lib/systemd/system/kubelet.service
sudo mkdir -p /usr/lib/systemd/system/kubelet.service.d
curl -sSL
"https://raw.githubusercontent.com/kubernetes/release/${RELEASE_VERSION}/cmd/krel/templates/latest/kubeadm/10-kubeadm.conf" | sed "s:/usr/bin:${DOWNLOAD_DIR}:g" | sudo tee /usr/lib/systemd/system/kubelet.service.d/10-kubeadm.conf
```

Now we need to install kubectl

Set up repository:

```
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.key
EOF

sudo yum install -y kubectl
```

```
ec2-user@ip-172-31-24-190 ~ $ kubectl version
Client Version: v1.31.1
Kustomize Version: v5.4.2
```

We have installed successfully installed kubernetes

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

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

```
[root@ip-172-31-24-190 bin]# sudo swapoff -a
echo "net.bridge.bridge-nf-call-iptables=1" | sudo tee -a /etc/sysctl.conf
sudo sysctl -p
net.bridge.bridge-nf-call-iptables=1
net.bridge.bridge-nf-call-iptables = 1
```

Disable SELINUX

Type **sudo nano /etc/selinux/config** and set the value of **SELINUX=disabled** instead of **SELINUX=permissive**
Save the file by pressing ctrl+o then press enter then press ctrl+x

```
# This file controls the state of SELinux on the system.
# SELINUX= can take one of these three values:
#     enforcing - SELinux security policy is enforced.
#     permissive - SELinux prints warnings instead of enforcing.
#     disabled - No SELinux policy is loaded.
# See also:
# https://docs.fedoraproject.org/en-US/quick-docs/getting-started-with-selinux/#getting-started-with-selinux-selinux-states-and-modes
#
# NOTE: In earlier Fedora kernel builds, SELINUX=disabled would also
# fully disable SELinux during boot. If you need a system with SELinux
# fully disabled instead of SELinux running with no policy loaded, you
# need to pass selinux=0 to the kernel command line. You can use grubby
# to persistently set the bootloader to boot with selinux=0:
#
#    grubby --update-kernel ALL --args selinux=0
#
# To revert back to SELinux enabled:
#
#    grubby --update-kernel ALL --remove-args selinux
#
SELINUX=disabled
# SELINUXTYPE= can take one of these three values:
#     targeted - Targeted processes are protected,
#     minimum - Modification of targeted policy. Only selected processes are protected.
#     mls - Multi Level Security protection.
SELINUXTYPE=targeted
```

Then reboot the system using **sudo reboot**
After rebooting we need to make ssh connection with machine after it gets disconnected

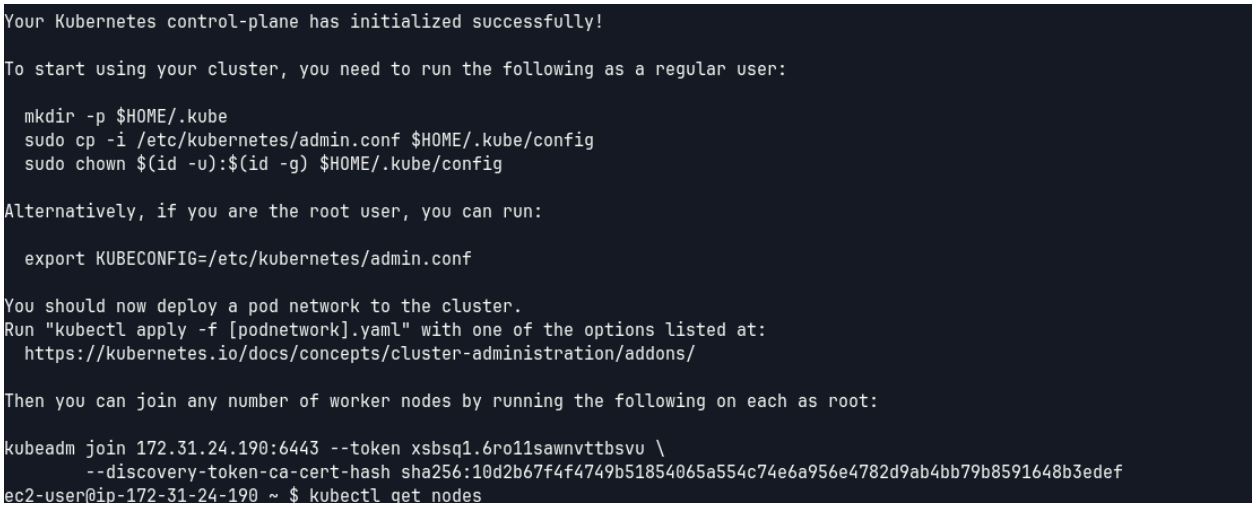
Now if we type command **sestatus,** then it show disabled

```
ec2-user@ip-172-31-24-190 ~ $ sestatus
SELinux status:                 disabled
```

5. Initialize the Kubecluster

Install packages socat and iproute-tc and conntrack to avoid prelight errors
sudo dnf install socat iproute-tc conntrack-tools -y

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

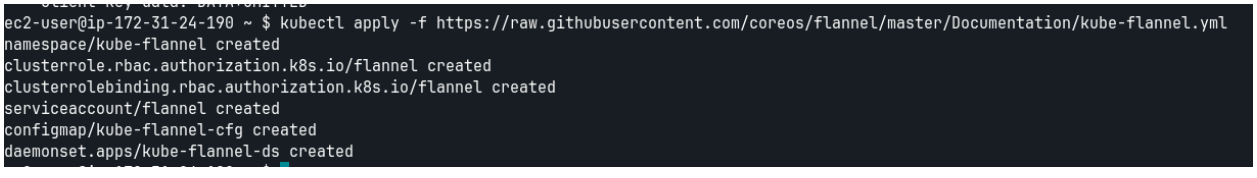


Copy the mkdir and chown commands from the top and execute them

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

sudo systemctl restart kubelet

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



Now type **kubectl get nodes**

```
The connection to the server 172.31.24.190:6443 was refused - did you specify the right host or port?
ec2-user@ip-172-31-24-190 ~ $ kubectl get nodes
The connection to the server 172.31.24.190:6443 was refused - did you specify the right host or port?
ec2-user@ip-172-31-24-190 ~ $ kubectl get nodes
^[[AError from server (Forbidden): nodes is forbidden: User "kubernetes-admin" cannot list resource "nodes" in
ec2-user@ip-172-31-24-190 ~ $ kubectl get nodes
NAME                           STATUS   ROLES           AGE   VERSION
ip-172-31-24-190.ec2.internal   Ready    control-plane   34m   v1.31.0
ec2-user@ip-172-31-24-190 ~ $ kubectl get nodes
NAME                           STATUS   ROLES           AGE   VERSION
ip-172-31-24-190.ec2.internal   Ready    control-plane   34m   v1.31.0
ec2-user@ip-172-31-24-190 ~ $
```

Now that the cluster is up and running, we can deploy our nginx server on this cluster. Apply this deployment file using this command to create a deployment

```
ec2-user@ip-172-31-24-190 ~ $ kubectl apply -f https://k8s.io/examples/application/deployment.yaml
deployment.apps/nginx-deployment created
```

Use ‘kubectl get pods’ to verify if the deployment was properly created and the pod is working correctly.

```
ec2-user@ip-172-31-24-190 ~ $ kubectl get pods
NAME                                READY   STATUS    RESTARTS   AGE
nginx-deployment-d556bf558-mwd8p    0/1     Pending   0          7s
nginx-deployment-d556bf558-zc25s    0/1     Pending   0          7s
```

As we can see our pods are in pending state
On checking logs to we came to know the pods are in tainted state (using command **kubectl describe pod nginx-deployment-d556bf558-mwd8p**)

```
Events:
  Type     Reason            Age   From               Message
  ----     ------            ----  ----               -------
  Warning  FailedScheduling  56s   default-scheduler  0/1 nodes are available: 1 node(s) had untolerated taint {node-role.kubernetes.io/control-plane: }. preemption: 0/1 nodes are available:
```

To make pods untainted
Type kubectl get nodes to see name of node

```
ec2-user@ip-172-31-24-190 ~ $ kubectl get nodes
NAME                           STATUS   ROLES           AGE   VERSION
ip-172-31-24-190.ec2.internal   Ready    control-plane   43m   v1.31.0
ec2-user@ip-172-31-24-190 ~ $
```

Copy the name of the node (ip-172-31-24-190.ec2.internal)

Then type command **kubectl taint nodes <NODE_NAME> - -all**

In my case **kubectl taint nodes ip-172-31-24-190.ec2.internal node-role.kubernetes.io/control-plane-**

```
ec2-user@ip-172-31-24-190 ~ $ kubectl taint nodes ip-172-31-24-190.ec2.internal node-role.kubernetes.io/control-plane-
node/ip-172-31-24-190.ec2.internal untainted
```

After executing above command, check again status of pods if still pending then restart kubelet wait for 1-2 minutes and check again

```
ec2-user@ip-172-31-24-190 ~ $ kubectl get pods
NAME                                READY   STATUS    RESTARTS      AGE
nginx-deployment-d556bf558-mwd8p    1/1     Running   2 (73s ago)   12m
nginx-deployment-d556bf558-zc25s    1/1     Running   2 (73s ago)   12m
```

As we can see our pods are running

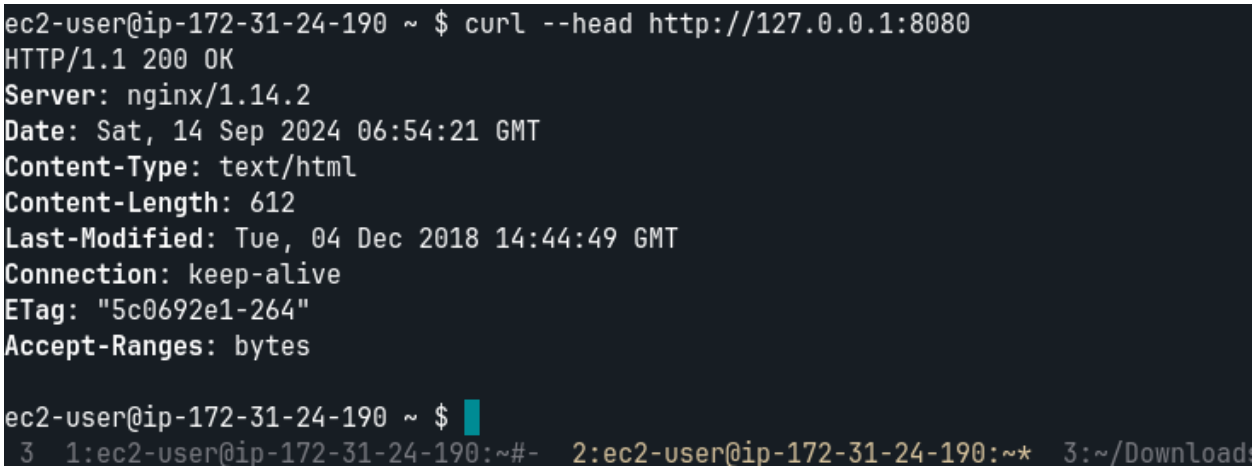
Lastly, port forward the deployment to your localhost so that you can view it.

kubectl port-forward <POD_NAME> 8080:80
In my case : **kubectl port-forward nginx-deployment-d556bf558-mwd8p 8080:80**

Note: if you are getting connection refused error then restart kubelet

```
ec2-user@ip-172-31-24-190 ~ $  kubectl port-forward  nginx-deployment-d556bf558-mwd8p 8080:80
Forwarding from 127.0.0.1:8080 -> 80
Forwarding from [::1]:8080 -> 80
```

As port forwarding is active so we cannot type other commands.
Open new terminal window and make ssh connection to same machine OR we can open instance of same machine in new browser tab
And type command **curl --head http://127.0.0.1:8080**



Response status 200 (OK) indicates that our nginx server is running successfully on kubernetes

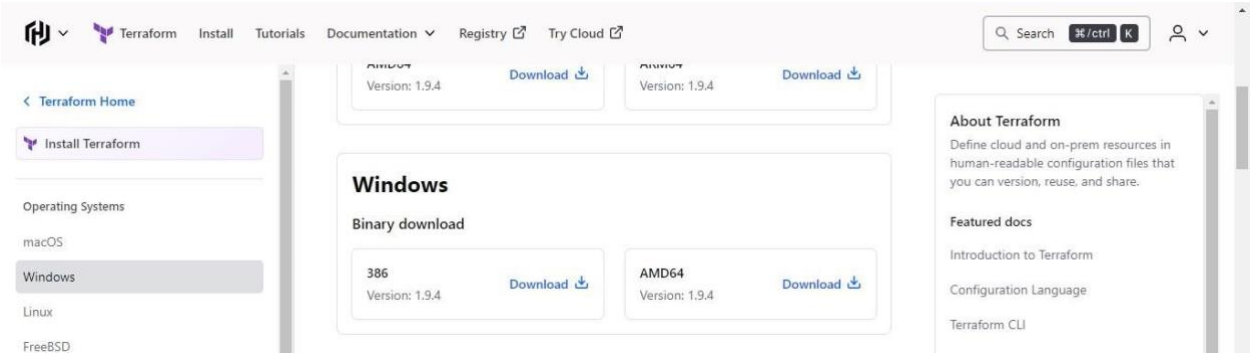
Conclusion: We started with the installation and configuration of Docker and Kubernetes. Initially, the Kubernetes API server encountered some problems, but these were fixed by restarting the kubelet service. The pods we created were not running because the nodes had taints, so we had to remove those taints. After addressing all the issues, the NGINX server pods were successfully deployed and made accessible through port forwarding. The NGINX server can now be accessed from different terminals or by running the port-forward command in the background using an '&' at the end of the command.

Name: Aditya Ahuja D15C Roll No: 02

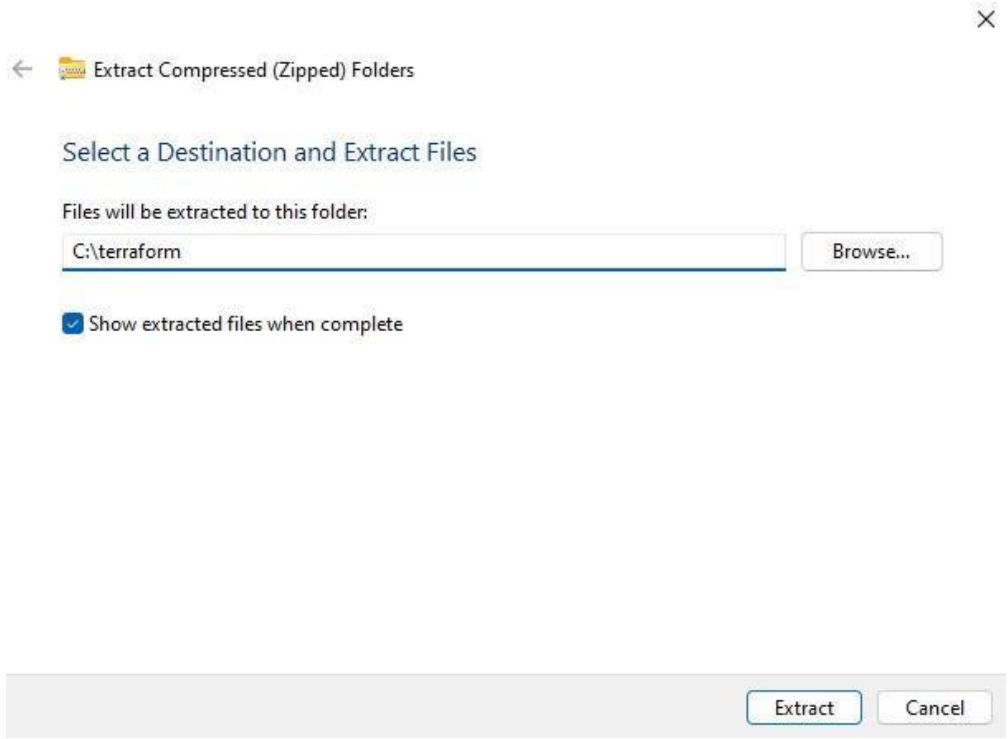
Experiment No. 5

Installation of Terraform

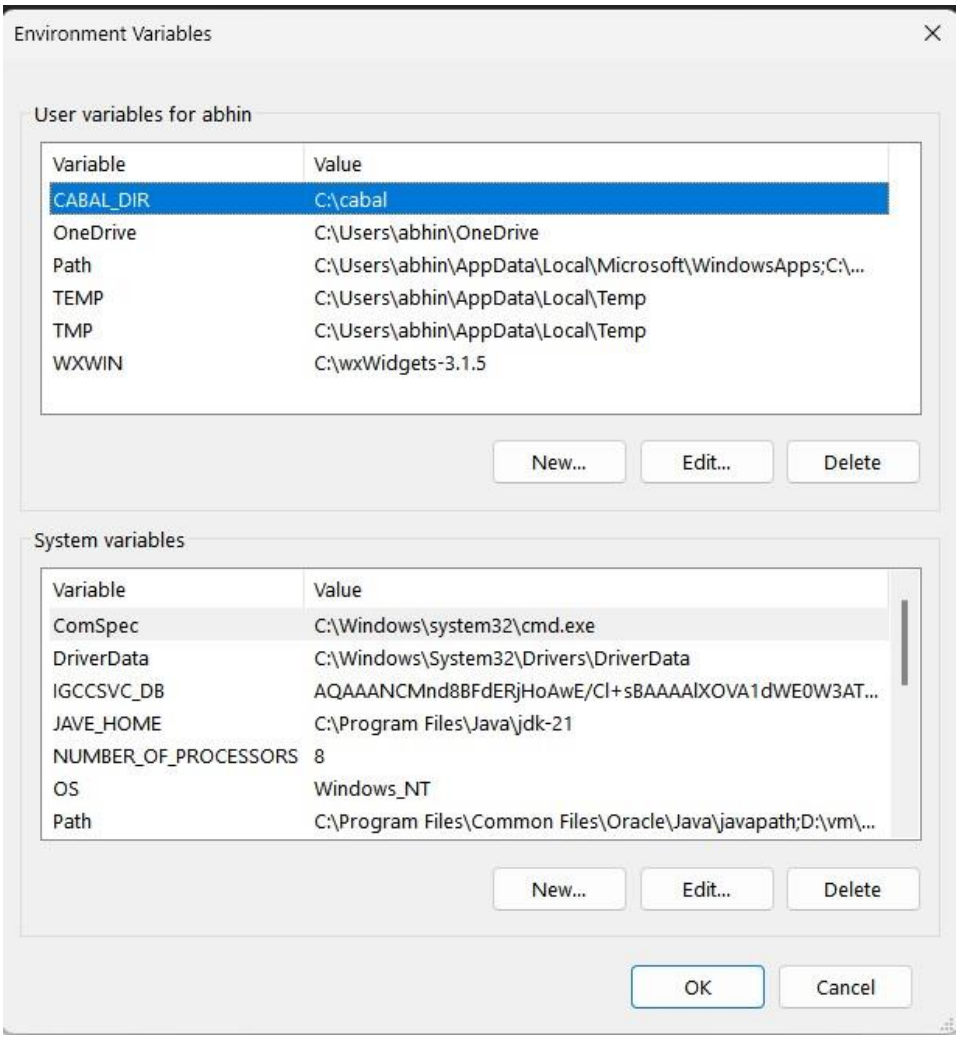
Step 1:To install Terraform, visit the official Terraform website mentioned below, go to the Downloads section, select Windows, and download the 64-bit version for your system. website:https://www.terraform.io/downloads.html



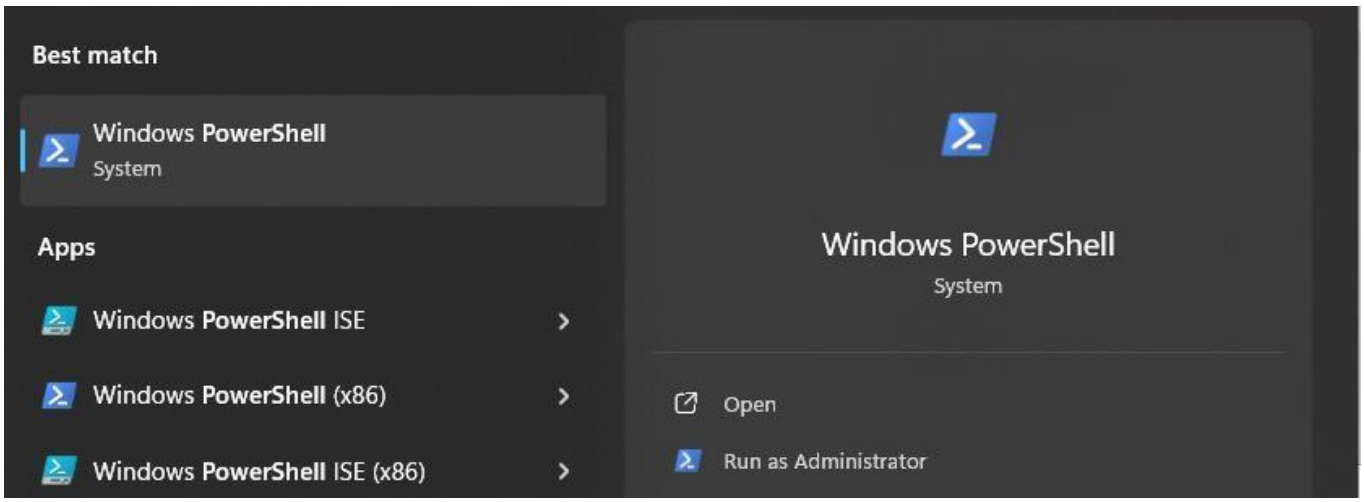
Step 2: Extract the downloaded `Terraform.exe` file to the `C:\Terraform` directory on your system.



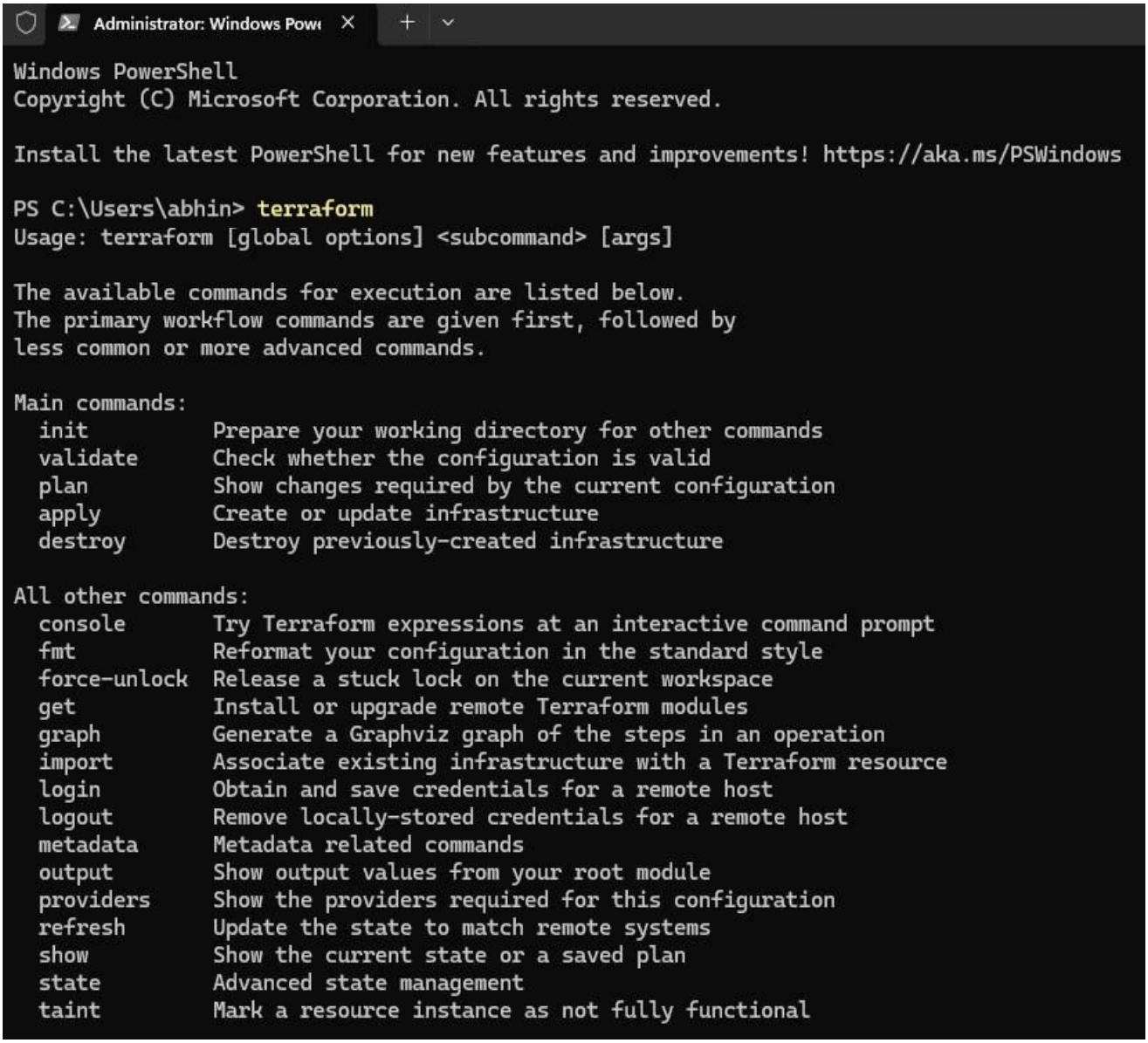
Step 3: Set the System path for Terraform in Environment Variables



Step 4: Run the windows powershell as administrator.



Step 5: Run "`terraform`" to verify its functionality. If you encounter any errors, double-check or update the Terraform path in your environment variables.



Name:Aditya Ahuja D15C **Roll No: 02**

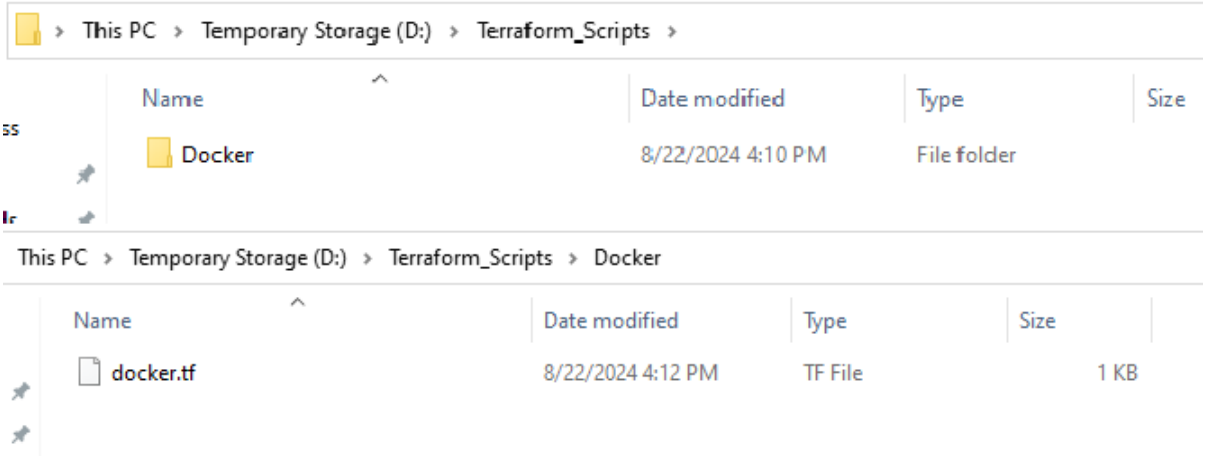
Experiment No. 6

1. Creating a docker image using terraform

```
C:\Users\abhinav>docker --version
Docker version 26.1.3, build b72abbb

C:\Users\abhinav>docker

Usage:  docker [OPTIONS] COMMAND

A self-sufficient runtime for containers

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

Management Commands:
  builder     Manage builds
  buildx*     Docker Buildx
  compose*    Docker Compose
  container   Manage containers
  context     Manage contexts
```

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

3. Create a new folder named ‘Docker’ in the ‘TerraformScripts’ folder. Then create a new docker.tf file using a text editor and write the following contents into it to create a Ubuntu Linux container.



docker.tf - Notepad

File Edit Format View Help

```
terraform {
        required_providers {
                docker = {
                source = "kreuzwerker/docker"
                version = "2.21.0"
                }
        }
}
provider "docker" {
host = "npipe:////.//pipe//docker_engine"
}

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

# Create a container
resource "docker_container" "foo" {
        image = docker_image.ubuntu.image_id
        name = "foo"
}
```

4. Execute Terraform Init command to initialize the resources

```
D:\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.

D:\Terraform_Scripts\Docker>
```

5. Execute Terraform plan to see the available resources

```
D:\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          = (known after apply)
      + container_logs   = (known after apply)
      + entrypoint       = (known after apply)
      + env              = (known after apply)
      + exit_code        = (known after apply)
      + gateway          = (known after apply)
      + hostname         = (known after apply)
      + id               = (known after apply)
      + image            = (known after apply)
      + init             = (known after apply)
      + ip_address       = (known after apply)
      + 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
      + 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.
```

6. Execute Terraform apply to apply the configuration, which will automatically create and run the Ubuntu Linux container based on our configuration. Using command : “terraform apply”

```
D:\Terraform_Scripts\Docker>terraform apply

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          = (known after apply)
      + container_logs   = (known after apply)
      + entrypoint       = (known after apply)
      + env              = (known after apply)
      + exit_code        = (known after apply)
      + gateway          = (known after apply)
      + hostname         = (known after apply)
      + id               = (known after apply)
      + image            = (known after apply)
      + init             = (known after apply)
      + ip_address       = (known after apply)
      + 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
      + 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... [19s elapsed] docker_image.ubuntu: Still creating... (20s elapsed) docker_image.
ubuntu: Still creating... [30s elapsed]
docker_image.ubuntu: Creation complete after 30s [id=sha256:263966596d42ad38ae9914716692777ba9ff8779a62ad93a74fe82e3e1f
ubuntu:latest] docker_container.foo: Creating...
```

7. Check Docker images, Before and After Executing Apply step

```
D:\Terraform_Scripts\Docker>docker images
REPOSITORY                                  TAG                                 IMAGE ID       CREATED       SIZE
mcr.microsoft.com/dotnet/framework/aspnet   4.8-windowsservercore-ltsc2022      0b1ef1176a57   6 weeks ago   5.43GB
mcr.microsoft.com/dotnet/framework/sdk      4.8-windowsservercore-ltsc2022      c3f8c2735565   6 weeks ago   9.04GB
mcr.microsoft.com/dotnet/framework/runtime  4.8-windowsservercore-ltsc2022      e69ea8a5ec1b   6 weeks ago   5.1GB
mcr.microsoft.com/windows/servercore        ltsc2022                            e60f47e635b7   7 weeks ago   4.84GB
mcr.microsoft.com/windows/nanoserver        ltsc2022                            f0ca29645006   7 weeks ago   292MB

D:\Terraform_Scripts\Docker>
```

```
D:\Terraform_Scripts\Docker>docker images
REPOSITORY                                  TAG                                 IMAGE ID       CREATED          SIZE
mcr.microsoft.com/dotnet/framework/aspnet   4.8-windowsservercore-ltsc2022      0b1ef1176a57   6 weeks ago      5.43GB
mcr.microsoft.com/dotnet/framework/sdk      4.8-windowsservercore-ltsc2022      c3f8c2735565   6 weeks ago      9.04GB
mcr.microsoft.com/dotnet/framework/runtime  4.8-windowsservercore-ltsc2022      e69ea8a5ec1b   6 weeks ago      5.1GB
mcr.microsoft.com/windows/servercore        ltsc2022                            e60f47e635b7   7 weeks ago      4.84GB
mcr.microsoft.com/windows/nanoserver        ltsc2022                            f0ca29645006   7 weeks ago      292MB
ubuntu                                      Latest                              2dc39ba859dc   2 minutes ago    77.8MB
```

```
D:\Terraform_Scripts\Docker>docker images
docker_image.ubuntu: Refreshing state... [idrsha256:2dc29b50dcd2d30101475692777ba087762d92de0221fubuntu:latest)
Terrafore used the selected providers to generate the following execution plan. Resource actions are indicated with the following sy
mbols:
    destroy
Terraform will perform the following actions:

  #  docker_image.ubuntu will be destroyed
       resource "docker_image" "ubuntu" {
           - id           = "sha256:2dc39b859dc2ade8ae30147b5692777ba9ff9779a62ad93a78de82e3elfubuntu:latest" -> null
           - image_id     = "sha256:2dc39b859dc2ade8ae30147b5692777ba9ff9779a62ad93a78de82e3elf" -> null
           - Latest       = "sha256:2dc39b859dc2ade8ae30147b5692777ba9ff9779a62ad93a78de82e3elf" -> null
           - name         = "ubuntu:latest" -> null
           - repo digest  = "ubuntu@sha256:204a3d7bb4d7723452be3923b06cd7043704030041c83c#7856c1" -> null
       }

Plan: to add, to change, 1 to destroy.

Do you really want to destroy all resources?
  Terraform will destroy all your managed infrastructure, as shown above.
  There is so unde. Only 'yes' will be accepted to confirm.

  Enter a value: yes

docker image.ubuntu: Destroying... [id-sha256:2de99b59cd42ade83814765692777ba5ff8779a62ad93ad62e3e1fubuntu:latest]
docker image.ubuntu: Destruction complete after is

Destroy complete! Resources: 1 destroyed.
```

Name: Aditya Ahuja Div:D15C Roll No.02

Adv DevOps Practical 7

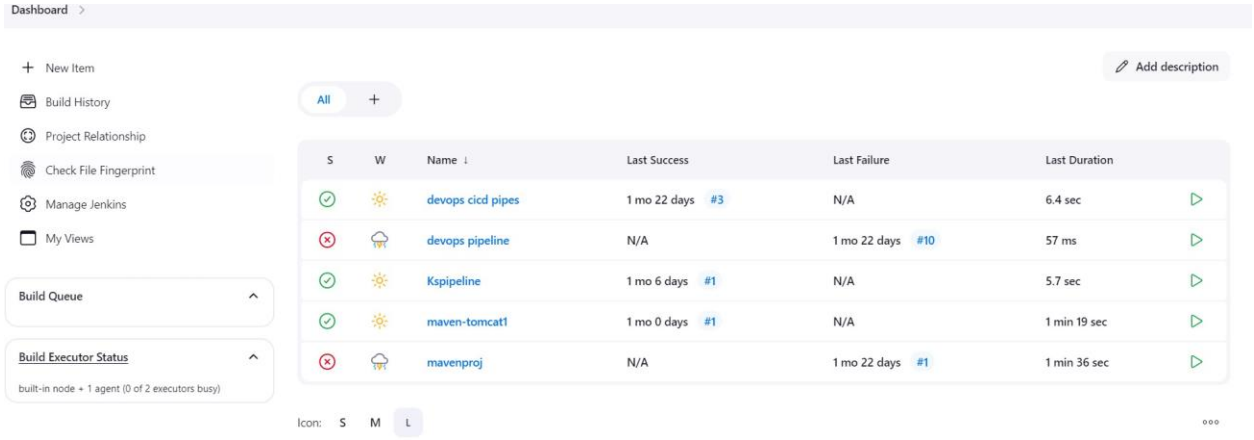
Aim: To understand Static Analysis SAST process and learn to integrate Jenkins SAST to SonarQube/GitLab.

Integrating Jenkins with SonarQube:

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

Steps to integrate Jenkins with SonarQube

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



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

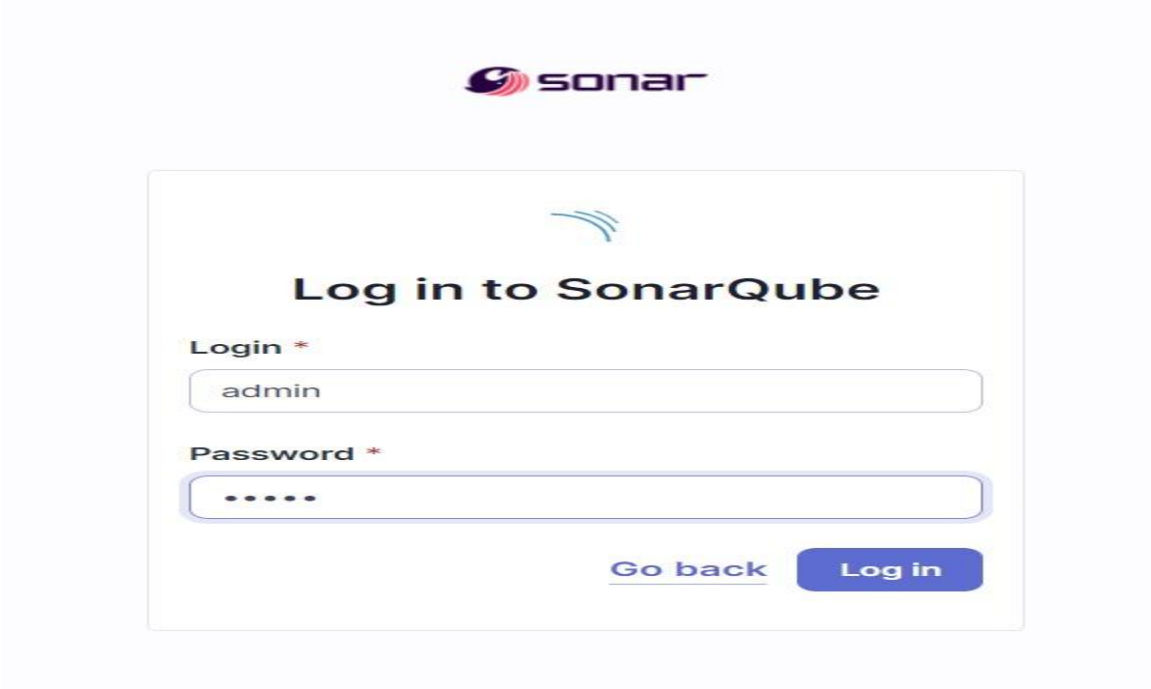
docker run -d --name sonarqube -e SONAR_ES_BOOTSTRAP_CHECKS_DISABLE=true -p 9000:9000 sonarqube:latest

Name: Aditya Ahuja Div:D15C Roll No.02

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

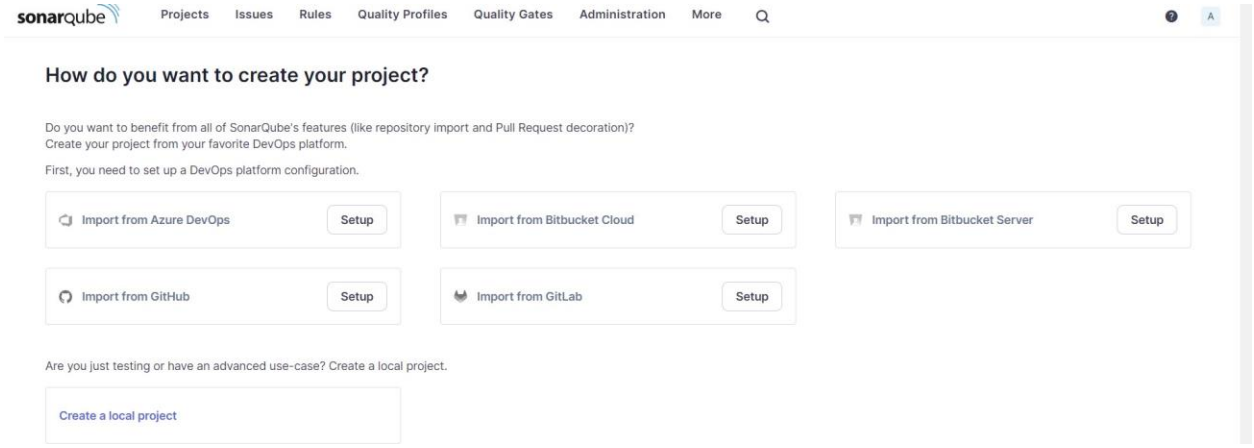
```
PS C:\Users\91773\Desktop\College Resources\Exp7 adv devops> docker run -d --name sonarqube -e SONAR_ES_BOOTSTRAP_CHECKS
_DISABLE=true -p 9000:9000 sonarqube:latest
Unable to find image 'sonarqube:latest' locally
latest: Pulling from library/sonarqube
7478e0ac0f23: Pull complete
90a925ab929a: Pull 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
77e678cded2ef5f989912d3d9e6991dd548eac03faa1eed68dd906614be53acc
PS C:\Users\91773\Desktop\College Resources\Exp7 adv devops>
```

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

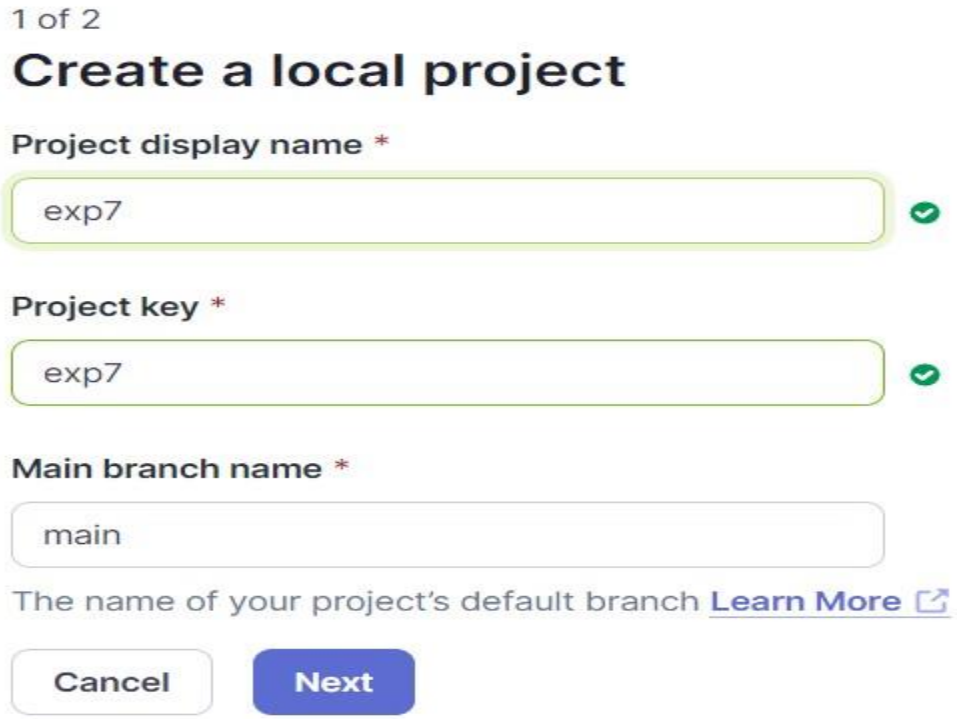


4. Login to SonarQube using username admin and password admin.

Name: Aditya Ahuja Div:D15C Roll No.02



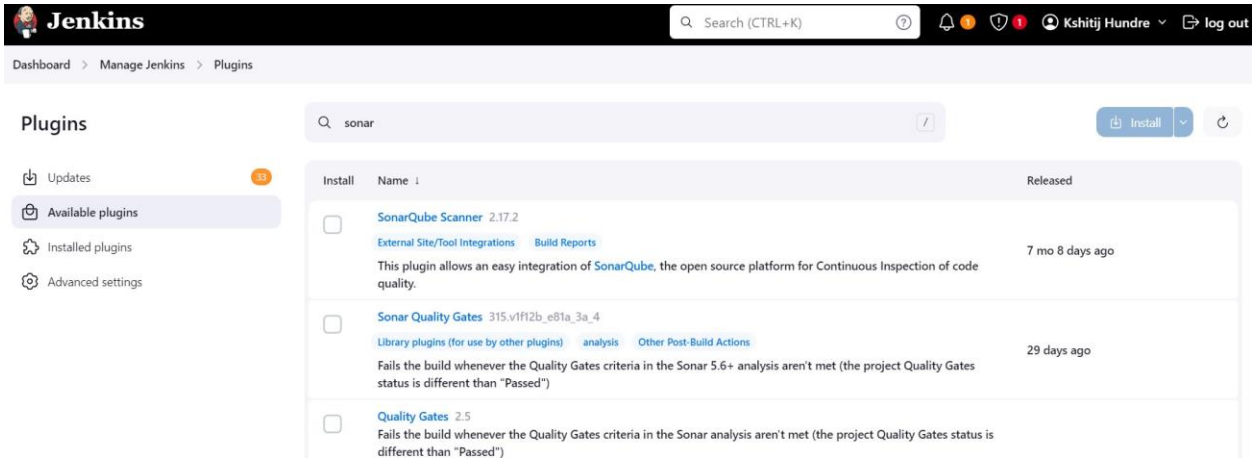
5. Create a manual project in SonarQube with the name sonarqube



Setup the project and come back to Jenkins Dashboard.

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

Name: Aditya Ahuja Div:D15C Roll No.02



6. Under Jenkins 'Manage Jenkins' then go to 'system', scroll and look for **SonarQube Servers** and enter the details.

Enter the Server Authentication token if needed.

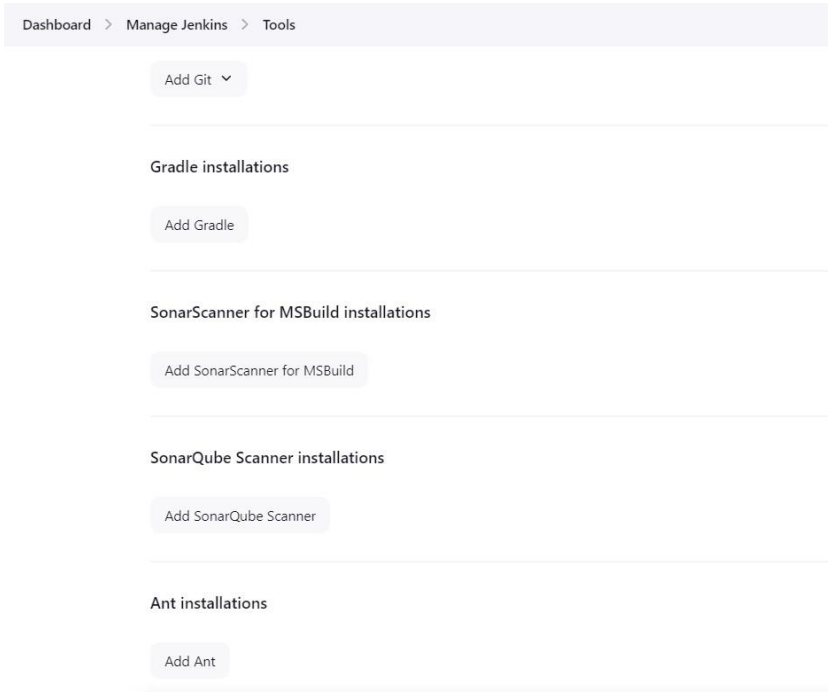
In SonarQube installations: Under **Name** add <project name of sonarqube> for me **sahilexp7**

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

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

Name: Aditya Ahuja Div:D15C Roll No.02

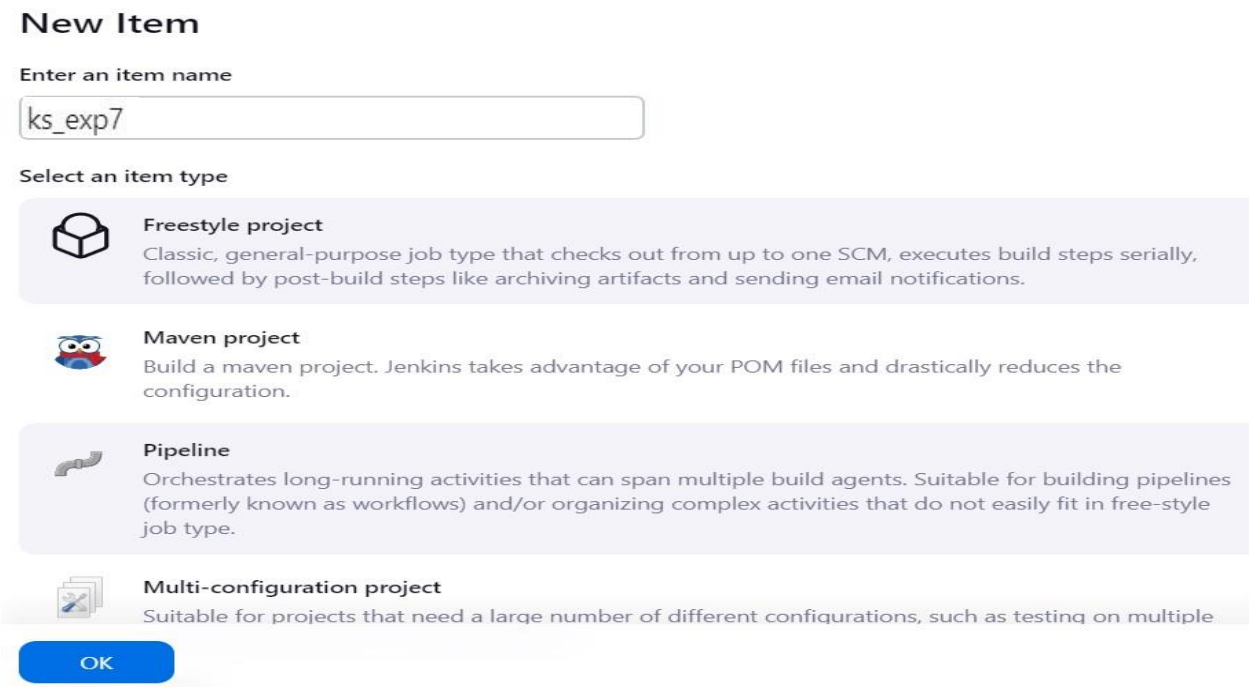
Dashboard > Manage Jenkins > Tools



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

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

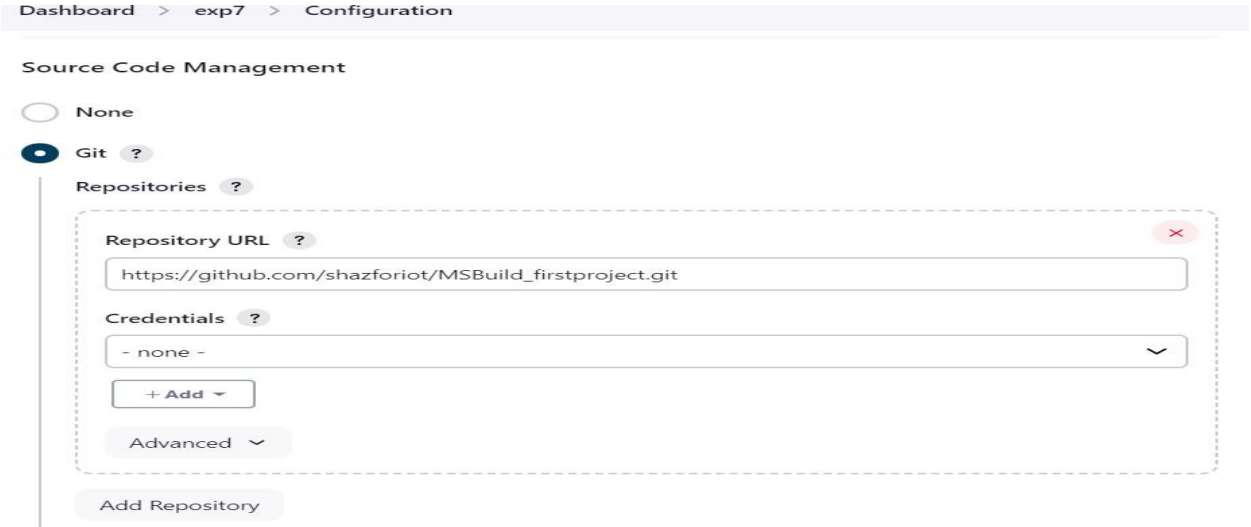
Name: Aditya Ahuja Div:D15C Roll No.02



9. Choose this GitHub repository in Source Code Management.

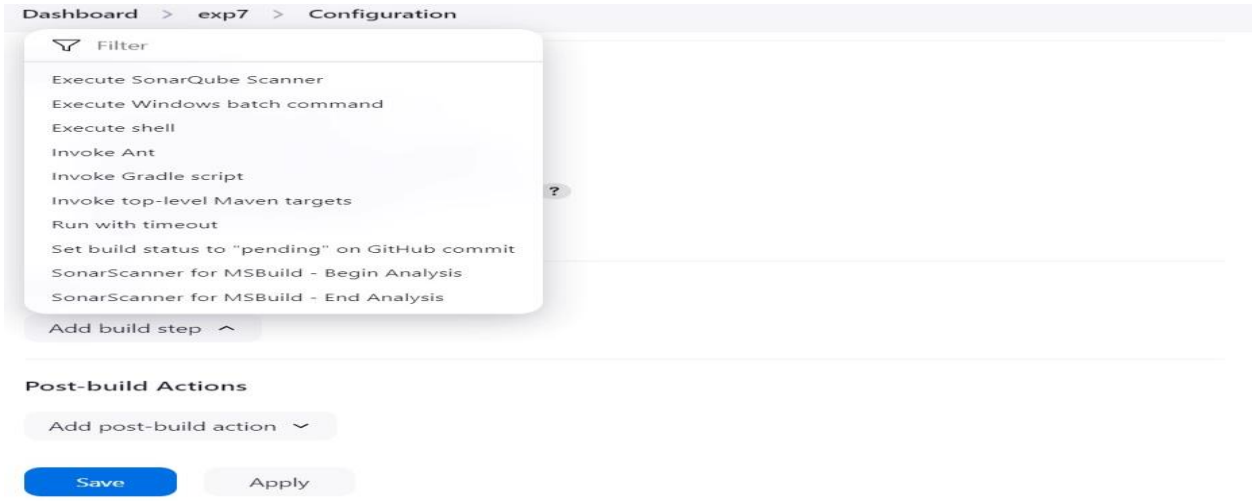
https://github.com/shazforiot/MSBuild_firstproject.git

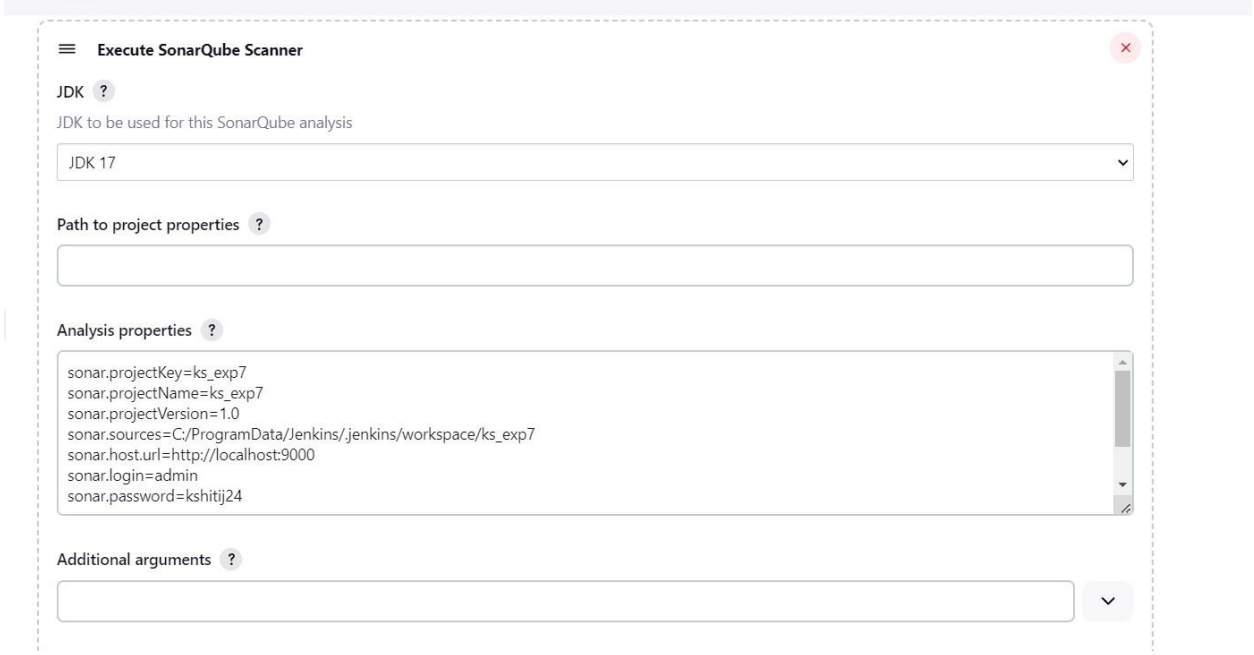
It is a sample hello-world project with no vulnerabilities and issues, just to test the integration.



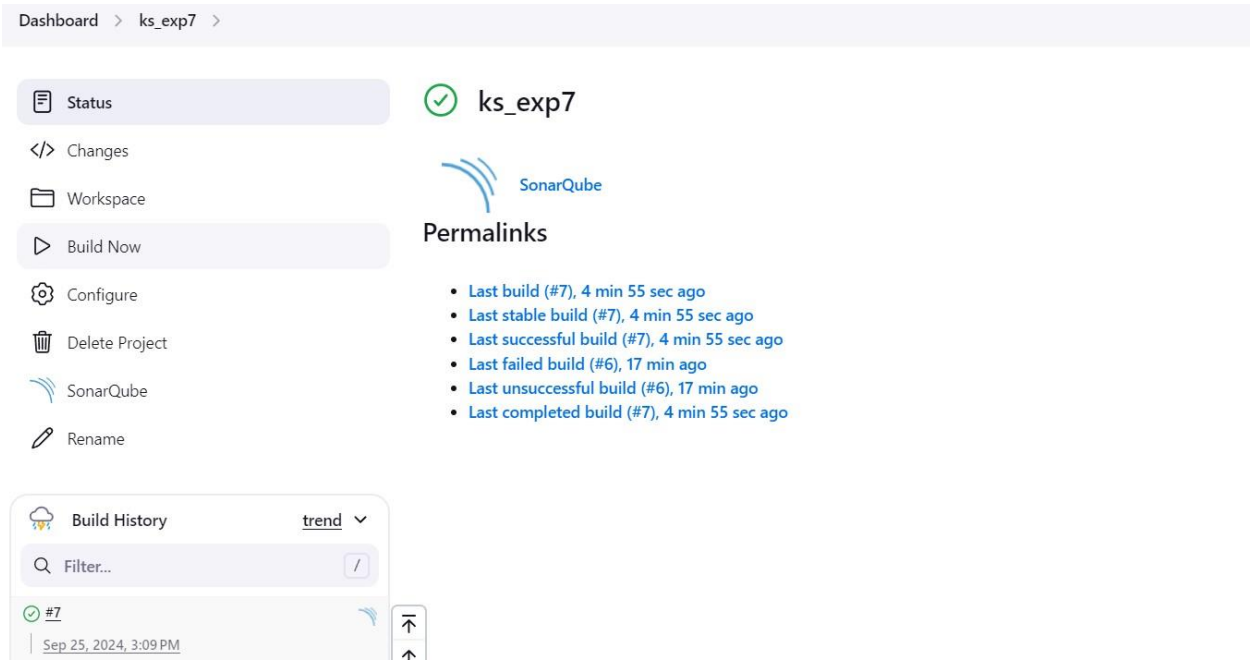
10. Under **Select project → Configuration → Build steps → Execute SonarQube Scanner**, enter these Analysis properties. Mention the SonarQube Project Key, Login, Password, Source path and Host URL.

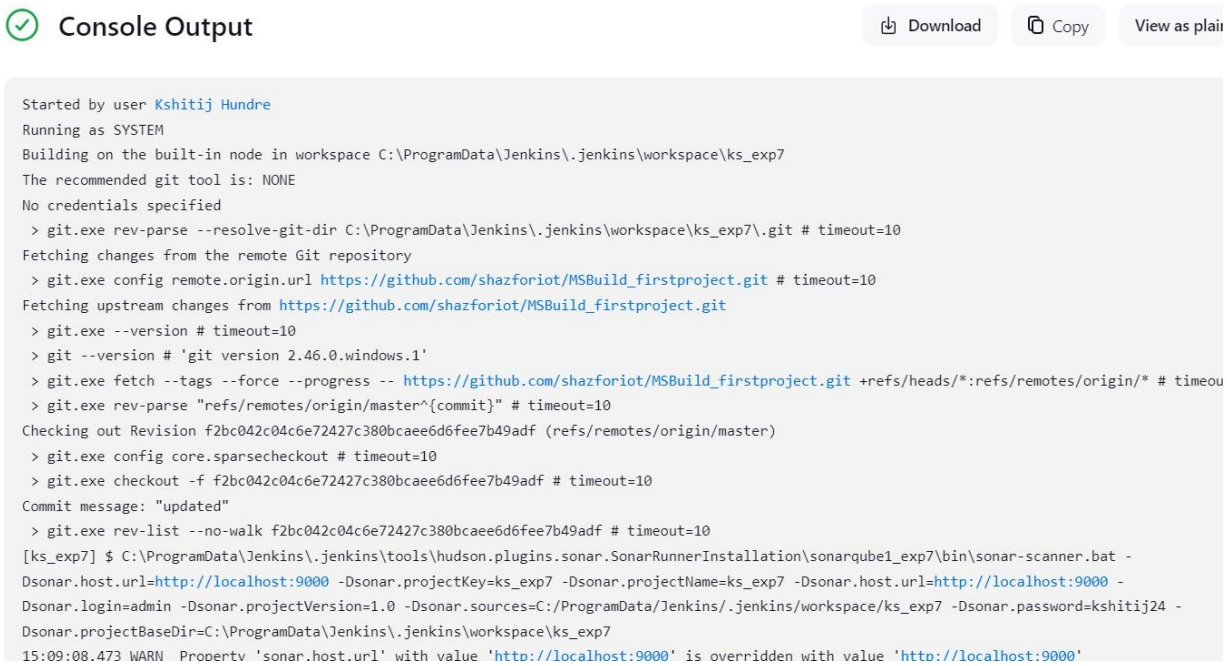
Name: Aditya Ahuja Div:D15C Roll No.02





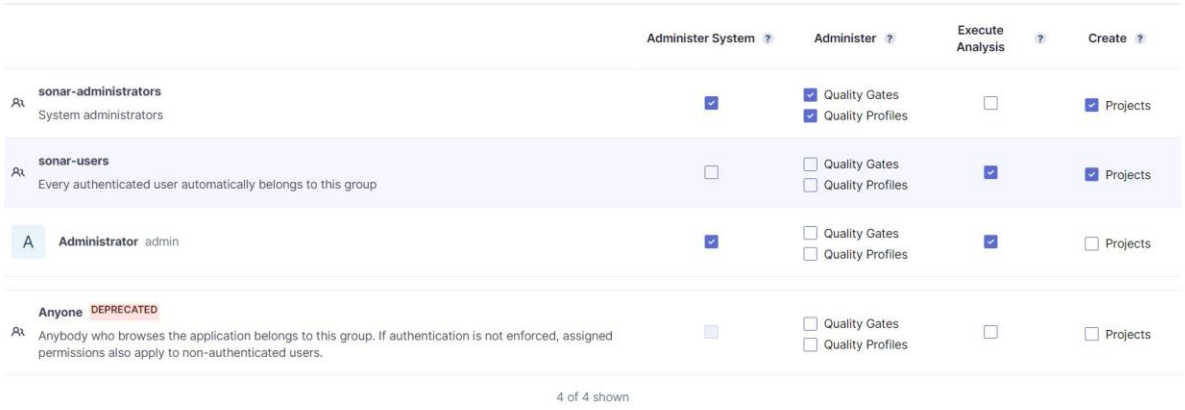
Name: Aditya Ahuja Div:D15C Roll No.02



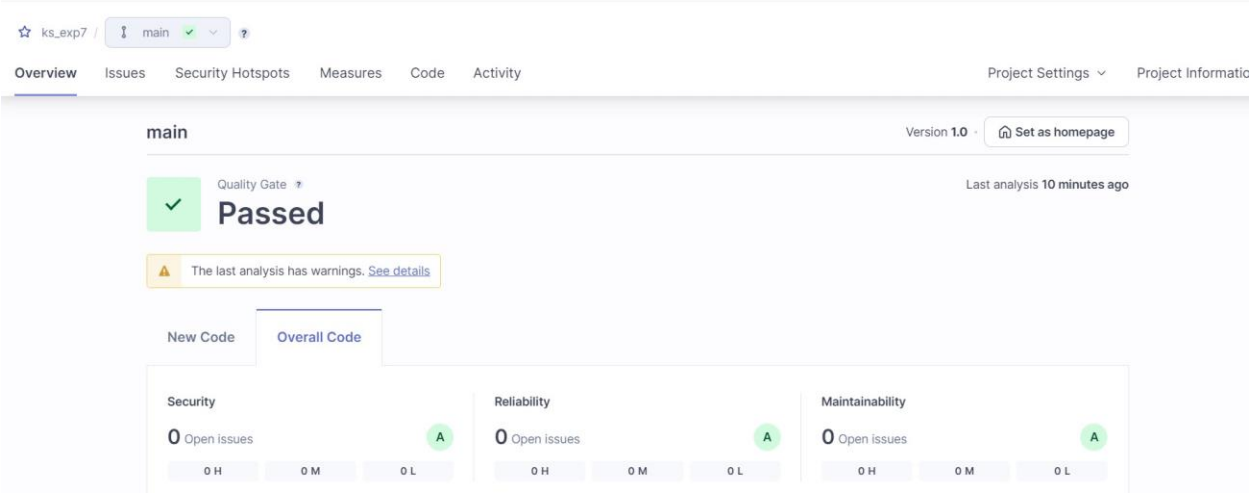


11. Go to http://localhost:9000/<user_name>/permissions and allow Execute Permissions to the Admin user.

Name: Aditya Ahuja Div:D15C Roll No.02



13. Once the build is complete, check project on SonarQube



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

Conclusion:

In this project, we integrated Jenkins with SonarQube for automated static application security testing (SAST). We set up SonarQube using Docker, configured Jenkins with the necessary plugins and authentication, and linked it to a GitHub repository. The SonarQube scanner was added as a build step, enabling continuous code analysis for vulnerabilities, code smells, and quality issues, ensuring automated reporting and continuous code quality improvement.

Expt No. 08 Advanced DevOps Lab

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

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, optimising 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

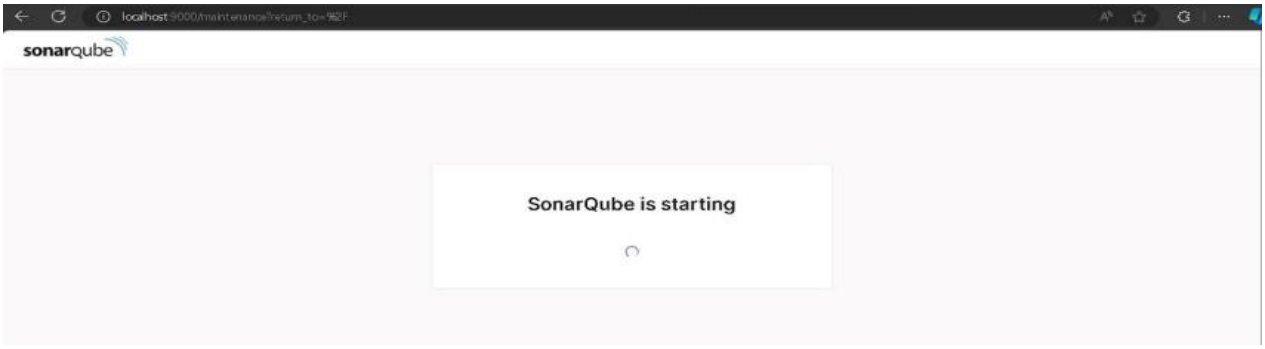
Steps to create a Jenkins CI/CD Pipeline and use SonarQube to perform SAST

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 -

```
PS C:\Users\91773\Desktop\College Resources\Advdevops Exp8> docker run -d --name sonarqube2 -e SONAR_ES_BOOTSTRAP_CHECKS
_DISABLE=true -p 9000:9000 sonarqube:latest
71fc67f0b15baa5be5bdcdd66966938e18682683d020beadcbc909dd027cfe7a
PS C:\Users\91773\Desktop\College Resources\Advdevops Exp8>
```

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

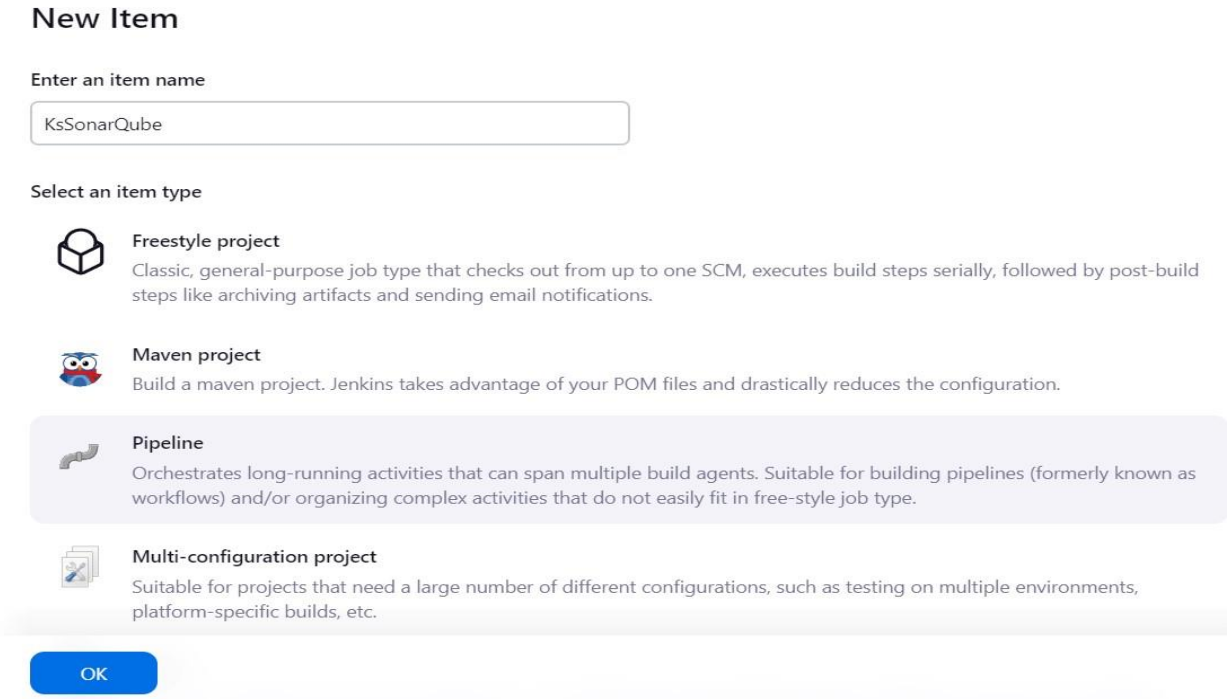


4. Login to SonarQube using username *admin* and password *admin*.

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

Setup the project and come back to Jenkins Dashboard.

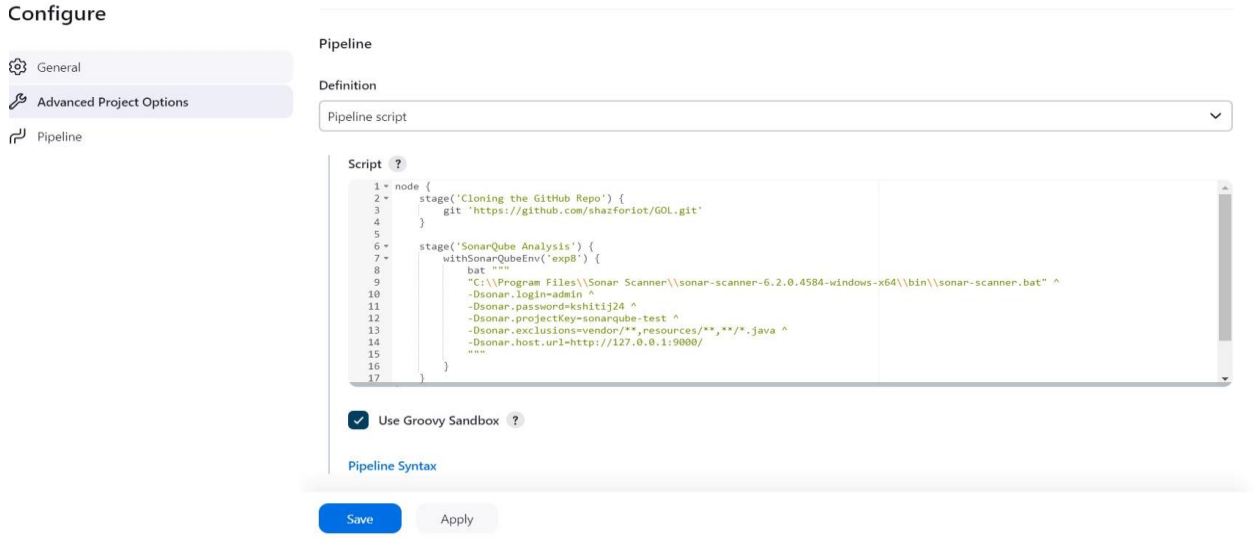
6. Create a New Item in Jenkins, choose **Pipeline**.



7. Under Pipeline Script, enter the following -

```
node {
```

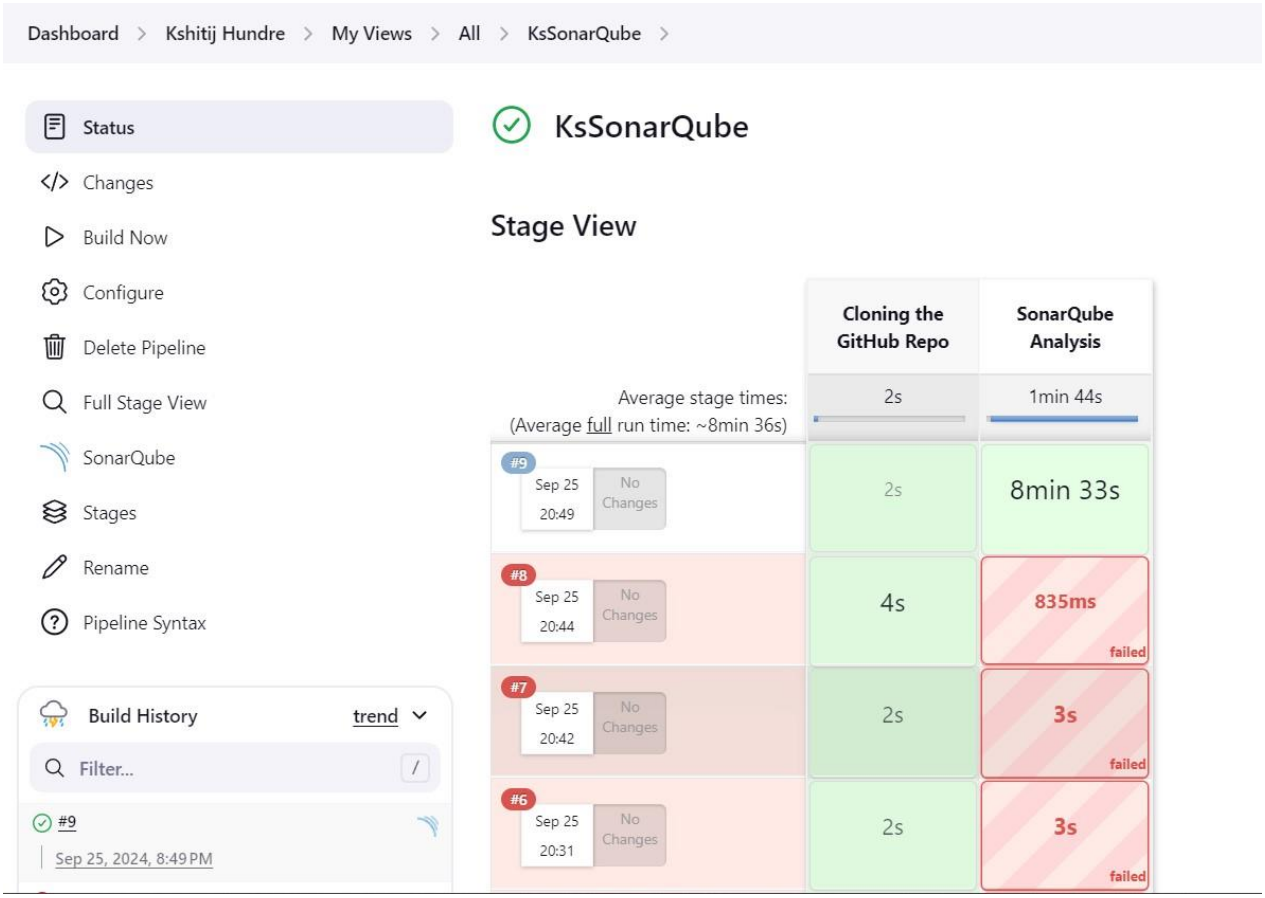
```
        stage('Cloning the GitHub Repo') {
          git 'https://github.com/shazforiot/GOL.git'
        } stage('SonarQube
        analysis') {
          withSonarQubeEnv('sonarqube') {
            sh "<PATH_TO_SONARQUBE_FOLDER>//bin//sonar-scanner \
            -D sonar.login=<SonarQube_USERNAME> \
            -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/"
          }
        }
      }
```

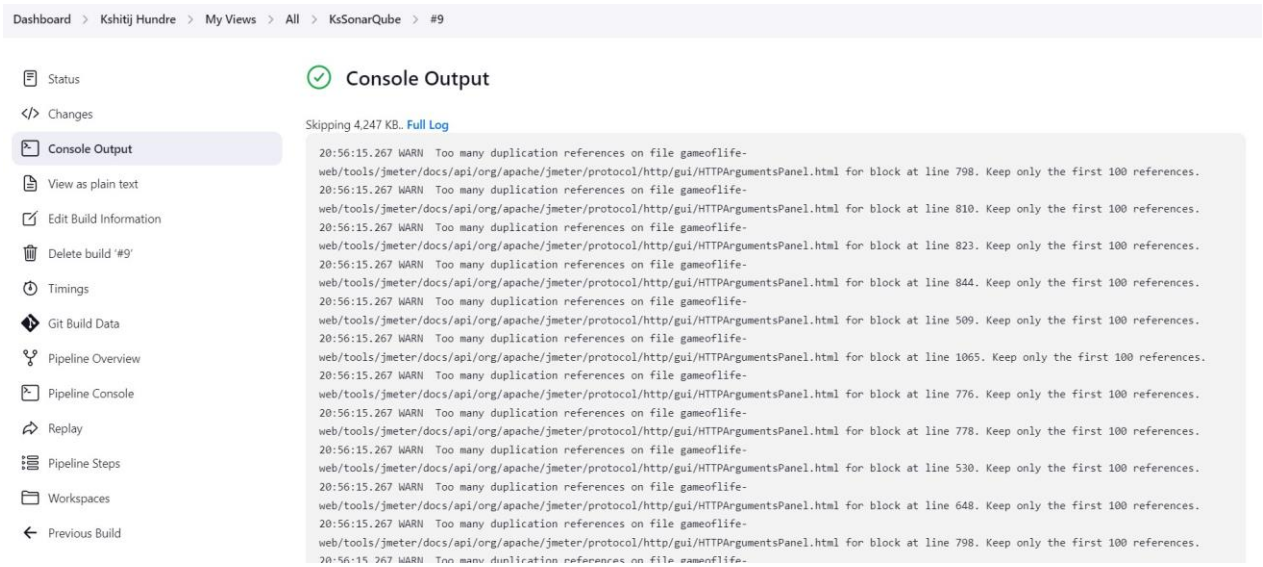


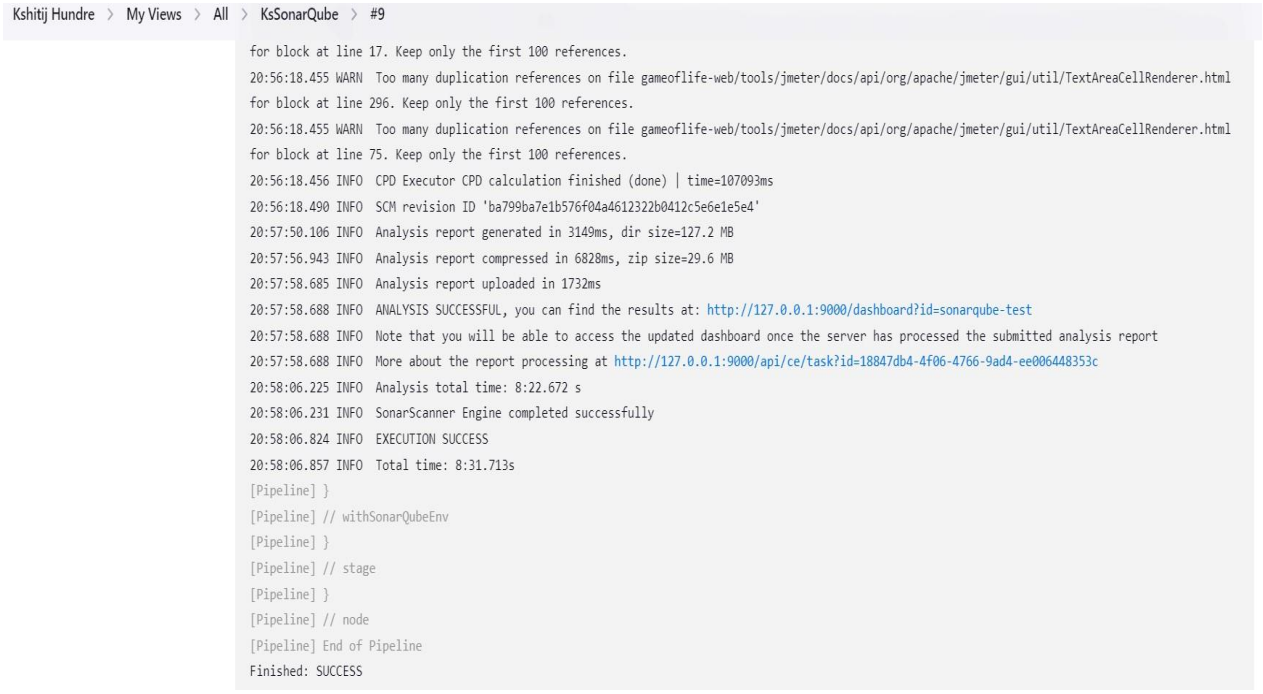
It is a java sample project which has a lot of repetitions and issues that will be detected by SonarQube.

8. Run The Build.

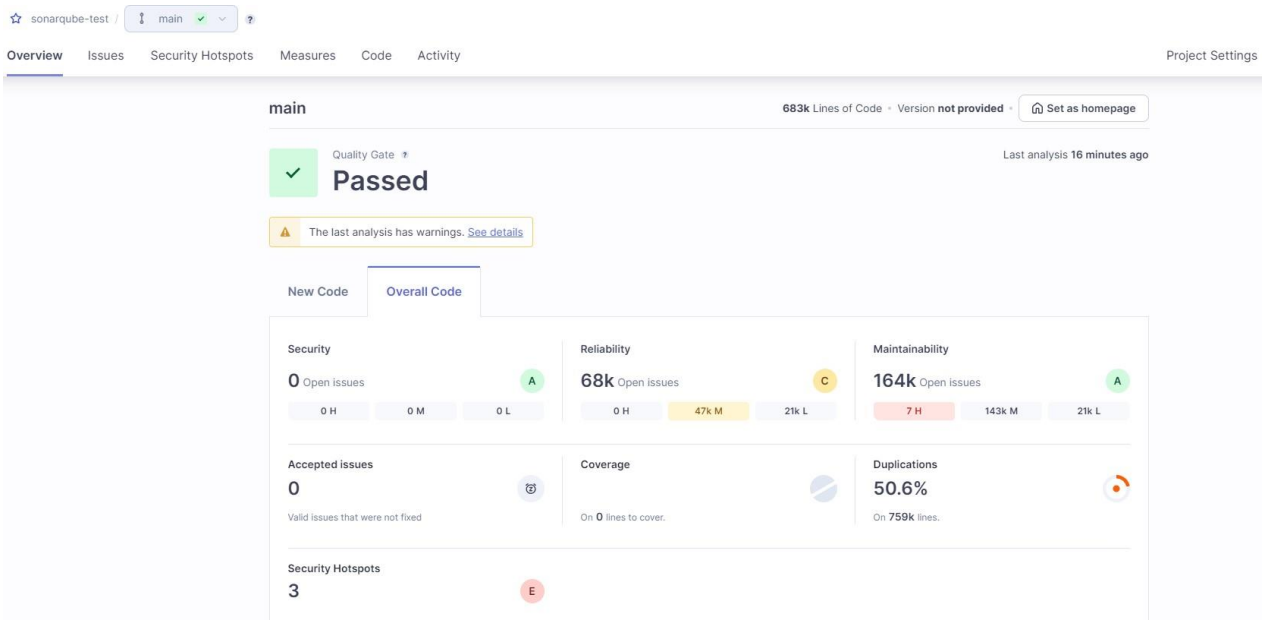
9. Check the console output once the build is complete.


Dashboard > Kshitij Hundre > My Views > All > KsSonarQube >
Status
Changes
Build Now
Configure
Delete Pipeline
Full Stage View
SonarQube
Stages
Rename
Pipeline Syntax
Build History
trend
Filter...
#9
Sep 25, 2024, 8:49 PM
KsSonarQube
Stage View
Cloning the GitHub Repo
SonarQube Analysis
Average stage times:
(Average full run time: ~8min 36s)
2s
1min 44s
#9
Sep 25
20:49
No Changes
2s
8min 33s
#8
Sep 25
20:44
No Changes
4s
835ms
failed
#7
Sep 25
20:42
No Changes
2s
3s
failed
#6
Sep 25
20:31
No Changes
2s
3s
failed


Dashboard > Kshitij Hundre > My Views > All > KsSonarQube > #9
Status
Changes
Console Output
View as plain text
Edit Build Information
Delete build '#9'
Timings
Git Build Data
Pipeline Overview
Pipeline Console
Replay
Pipeline Steps
Workspaces
Previous Build
Console Output
Skipping 4,247 KB.. Full Log
20:56:15.267 WARN Too many duplication references on file gameoflife-web/tools/jmeter/docs/api/org/apache/jmeter/protocol/http/gui/HTTPArgumentsPanel.html for block at line 798. Keep only the first 100 references.
20:56:15.267 WARN Too many duplication references on file gameoflife-web/tools/jmeter/docs/api/org/apache/jmeter/protocol/http/gui/HTTPArgumentsPanel.html for block at line 810. Keep only the first 100 references.
20:56:15.267 WARN Too many duplication references on file gameoflife-web/tools/jmeter/docs/api/org/apache/jmeter/protocol/http/gui/HTTPArgumentsPanel.html for block at line 823. Keep only the first 100 references.
20:56:15.267 WARN Too many duplication references on file gameoflife-web/tools/jmeter/docs/api/org/apache/jmeter/protocol/http/gui/HTTPArgumentsPanel.html for block at line 844. Keep only the first 100 references.
20:56:15.267 WARN Too many duplication references on file gameoflife-web/tools/jmeter/docs/api/org/apache/jmeter/protocol/http/gui/HTTPArgumentsPanel.html for block at line 509. Keep only the first 100 references.
20:56:15.267 WARN Too many duplication references on file gameoflife-web/tools/jmeter/docs/api/org/apache/jmeter/protocol/http/gui/HTTPArgumentsPanel.html for block at line 1065. Keep only the first 100 references.
20:56:15.267 WARN Too many duplication references on file gameoflife-web/tools/jmeter/docs/api/org/apache/jmeter/protocol/http/gui/HTTPArgumentsPanel.html for block at line 776. Keep only the first 100 references.
20:56:15.267 WARN Too many duplication references on file gameoflife-web/tools/jmeter/docs/api/org/apache/jmeter/protocol/http/gui/HTTPArgumentsPanel.html for block at line 778. Keep only the first 100 references.
20:56:15.267 WARN Too many duplication references on file gameoflife-web/tools/jmeter/docs/api/org/apache/jmeter/protocol/http/gui/HTTPArgumentsPanel.html for block at line 530. Keep only the first 100 references.
20:56:15.267 WARN Too many duplication references on file gameoflife-web/tools/jmeter/docs/api/org/apache/jmeter/protocol/http/gui/HTTPArgumentsPanel.html for block at line 648. Keep only the first 100 references.
20:56:15.267 WARN Too many duplication references on file gameoflife-web/tools/jmeter/docs/api/org/apache/jmeter/protocol/http/gui/HTTPArgumentsPanel.html for block at line 798. Keep only the first 100 references.

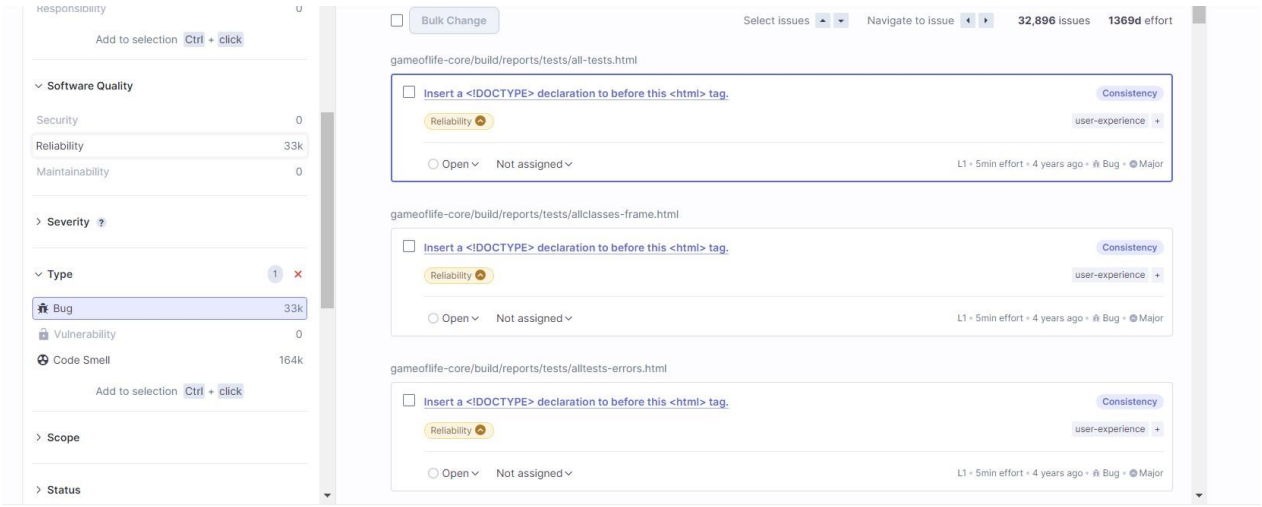


10. After that, check the project in SonarQube.

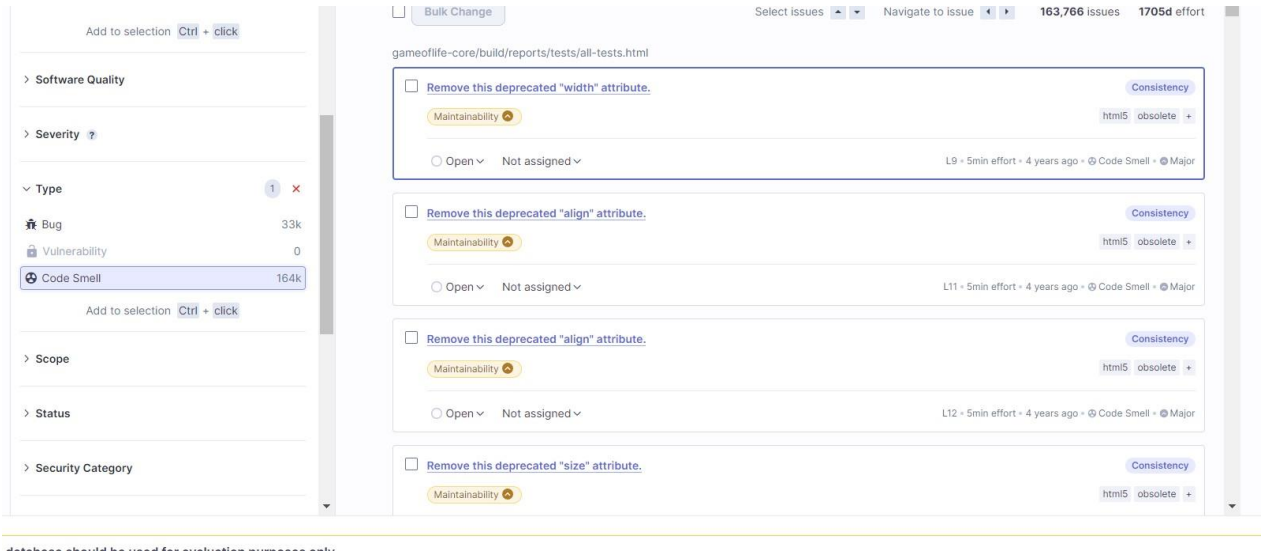


Under different tabs, check all different issues with the code. 11.

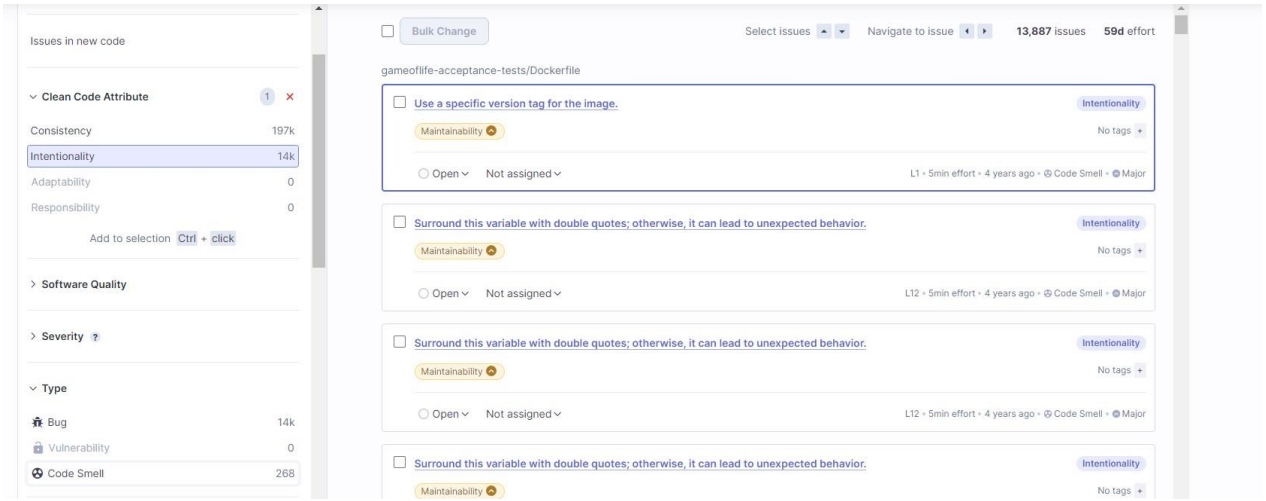
Bugs



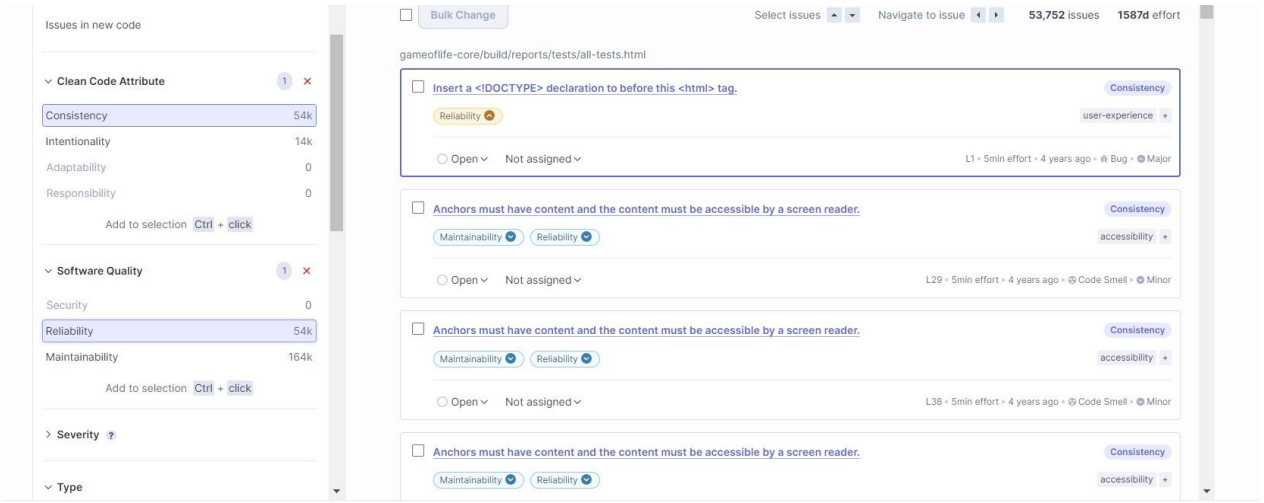
Code Smells



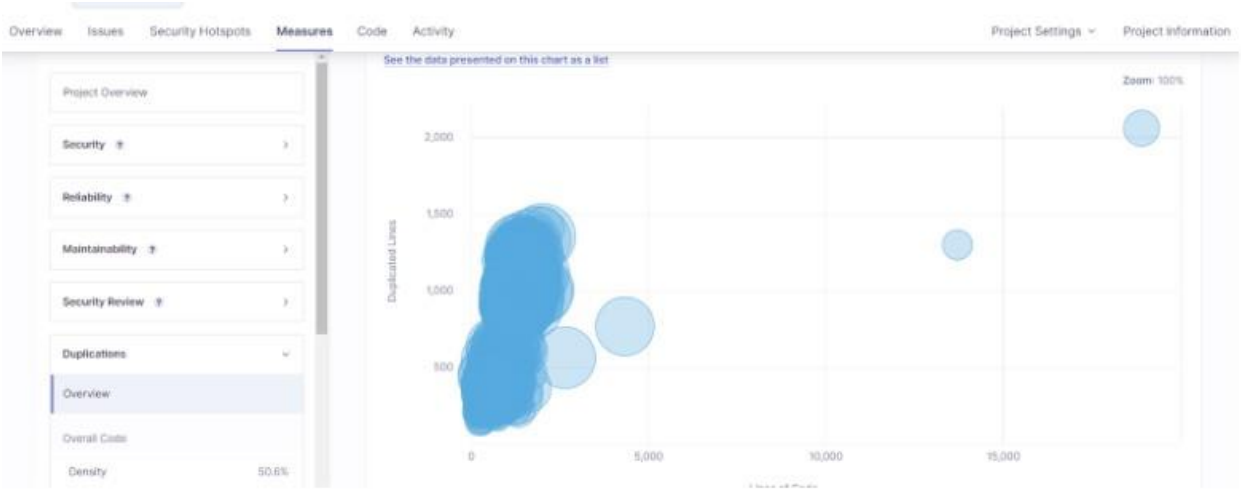
Intentional issues



Reliabilities 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, we integrated Jenkins with SonarQube to enable automated code quality checks within our CI/CD pipeline. We started by deploying SonarQube using Docker, setting up

a project, and configuring it to analyze code quality. Next, we configured Jenkins by installing the SonarQube Scanner plugin, adding SonarQube server details, and setting up the scanner tool. We then developed a Jenkins pipeline to automate the process of cloning a GitHub repository and running SonarQube analysis on the code. This integration helps ensure continuous monitoring of code quality, detecting issues such as bugs, code smells, and security vulnerabilities throughout the development process.

Name: Aditya Ahuja Div: D15C Roll No: 02

Adv DevOps Exp 09

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.

Why We Need Nagios tool?

Here are the important reasons to use Nagios monitoring tool:

- Detects all types of network or server issues
- Helps you to find the root cause of the problem which allows you to get the permanent solution to the problem
- Active monitoring of your entire infrastructure and business processes
- Allows you to monitor and troubleshoot server performance issues
- Helps you to plan for infrastructure upgrades before outdated systems create failures
- You can maintain the security and availability of the service
- Automatically fix problems in a panic situation

Features of Nagios

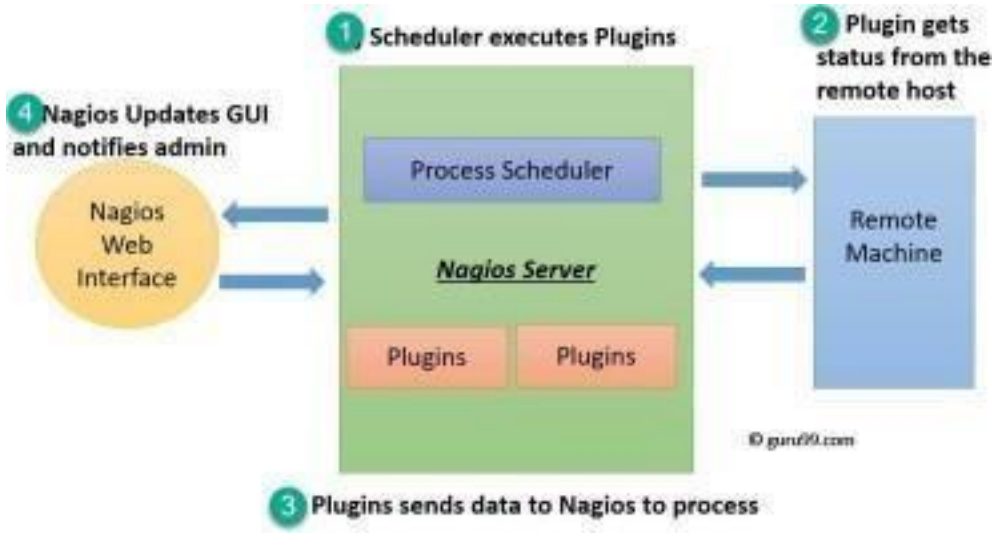
Following are the important features of Nagios monitoring tool:

- Relatively scalable, Manageable, and Secure
- Good log and database system
- Informative and attractive web interfaces
- Automatically send alerts if condition changes
- If the services are running fine, then there is no need to do check that host is an alive
- Helps you to detect network errors or server crashes ● You can troubleshoot the performance issues of the server.
- The issues, if any, can be fixed automatically as they are identified during the monitoring process
- You can monitor the entire business process and IT infrastructure with a single pass

- The product's architecture is easy to write new plugins in the language of your choice
- Nagios allows you to read its configuration from an entire directory which helps you to decide how to define individual files
- Utilizes topology to determine dependencies
- Monitor network services like HTTP, SMTP, HTTP, SNMP, FTP, SSH, POP, etc.
- Helps you to define network host hierarchy using parent hosts
- Ability to define event handlers that runs during service or host events for proactive problem resolution
- Support for implementing redundant monitoring hosts

Nagios Architecture

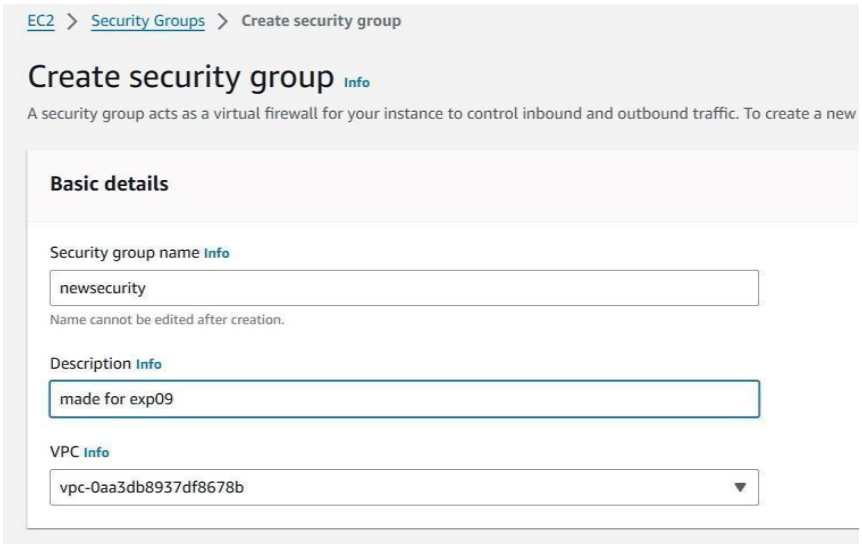
Nagios is a client-server architecture. Usually, on a network, a Nagios server is running on a host, and plugins are running on all the remote hosts which should be monitored.



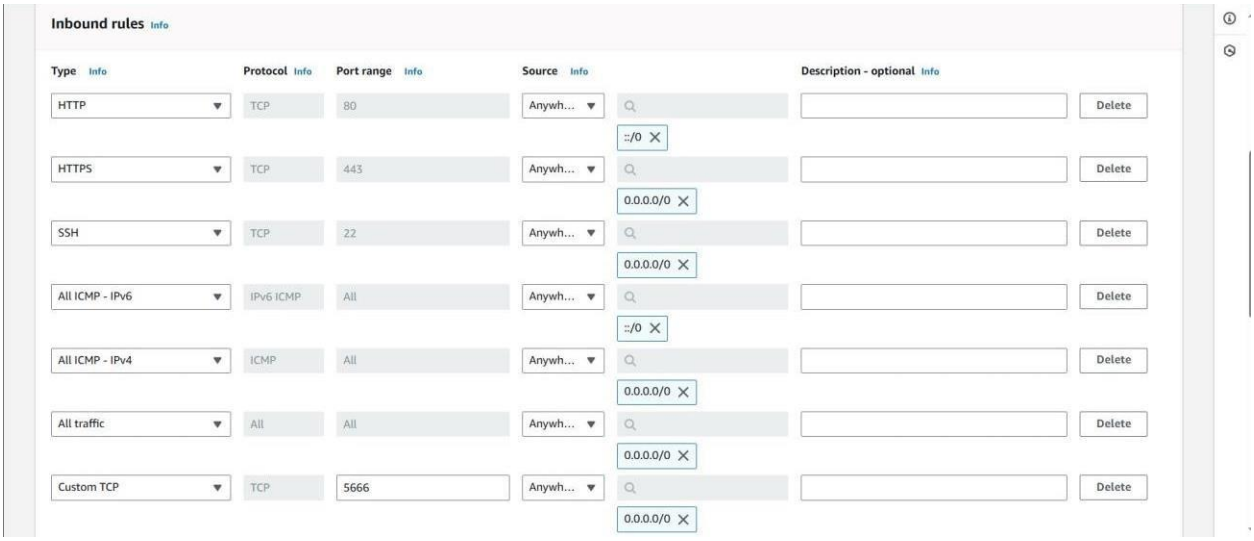
1. The scheduler is a component of the server part of Nagios. It sends a signal to execute the plugins at the remote host.
2. The plugin gets the status from the remote host
3. The plugin sends the data to the process scheduler
4. The process scheduler updates the GUI and notifications are sent to admins.

Name: Aditya Ahuja Div: D15C Roll No: 02

Step 1: Create a security group with the required configurations I have created a new security group with a name ‘newsecurity’



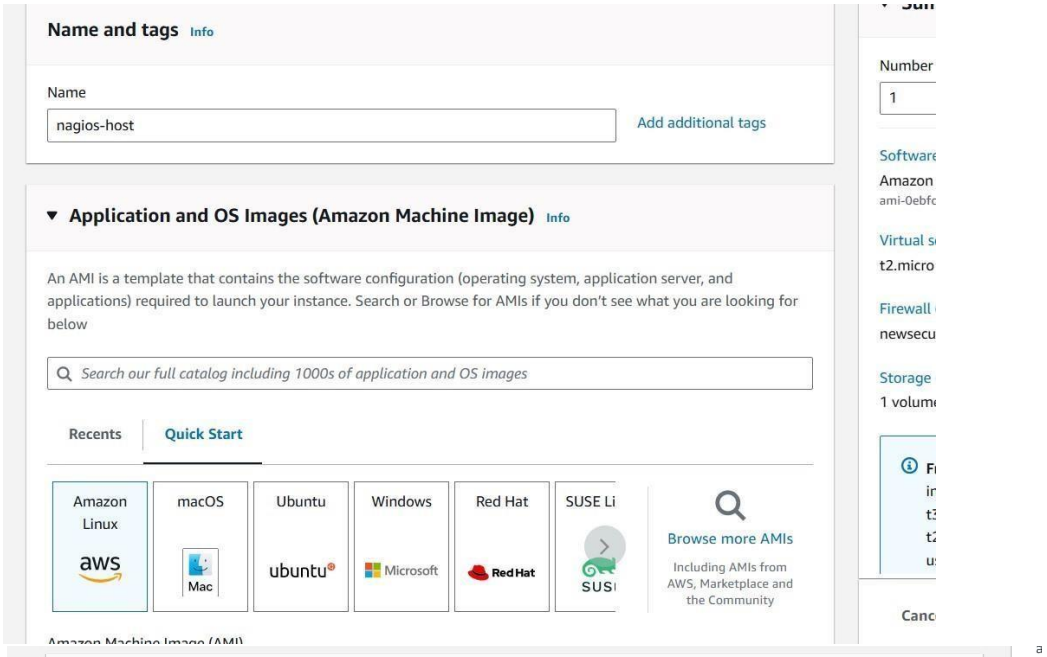
I have modified the INBOUND RULES as follows

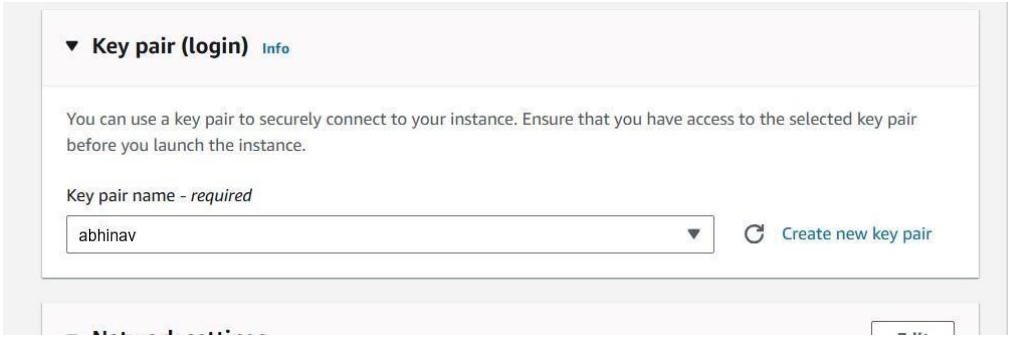


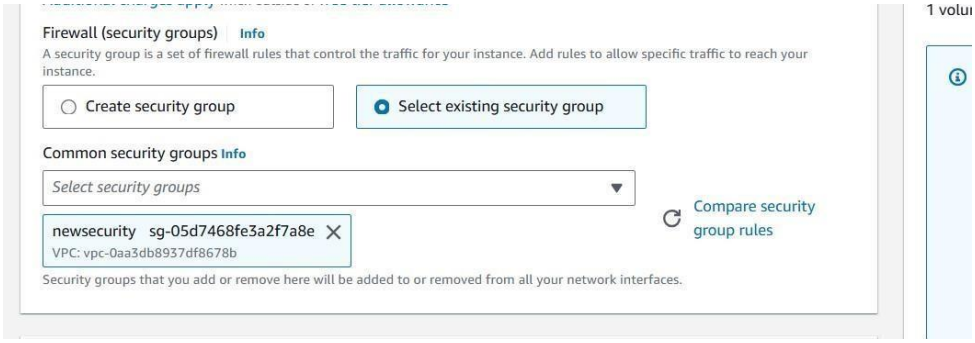
Step 2: Create ec2 instance

Name it as nagios-host. Select instance type as amazon-linux and choose the already created key pair and security group

Name: Aditya Ahuja Div: D15C Roll No: 02

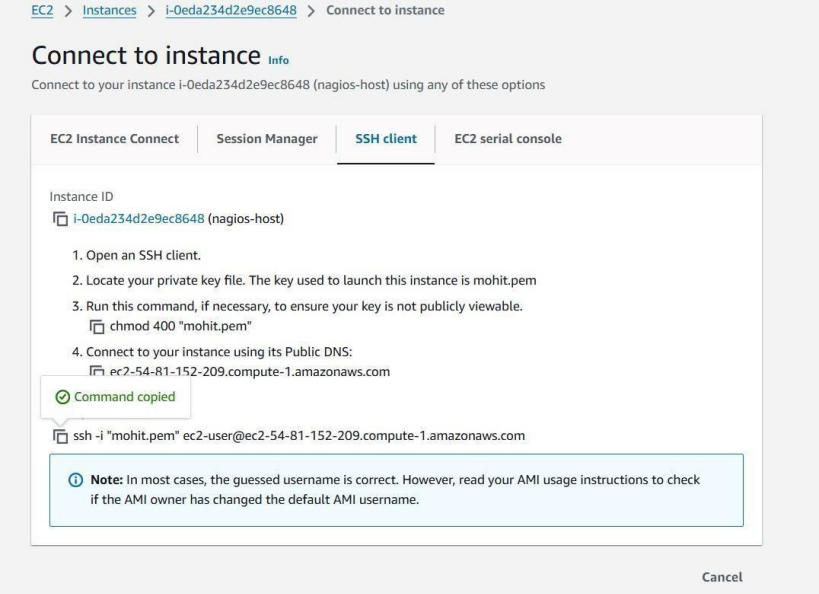




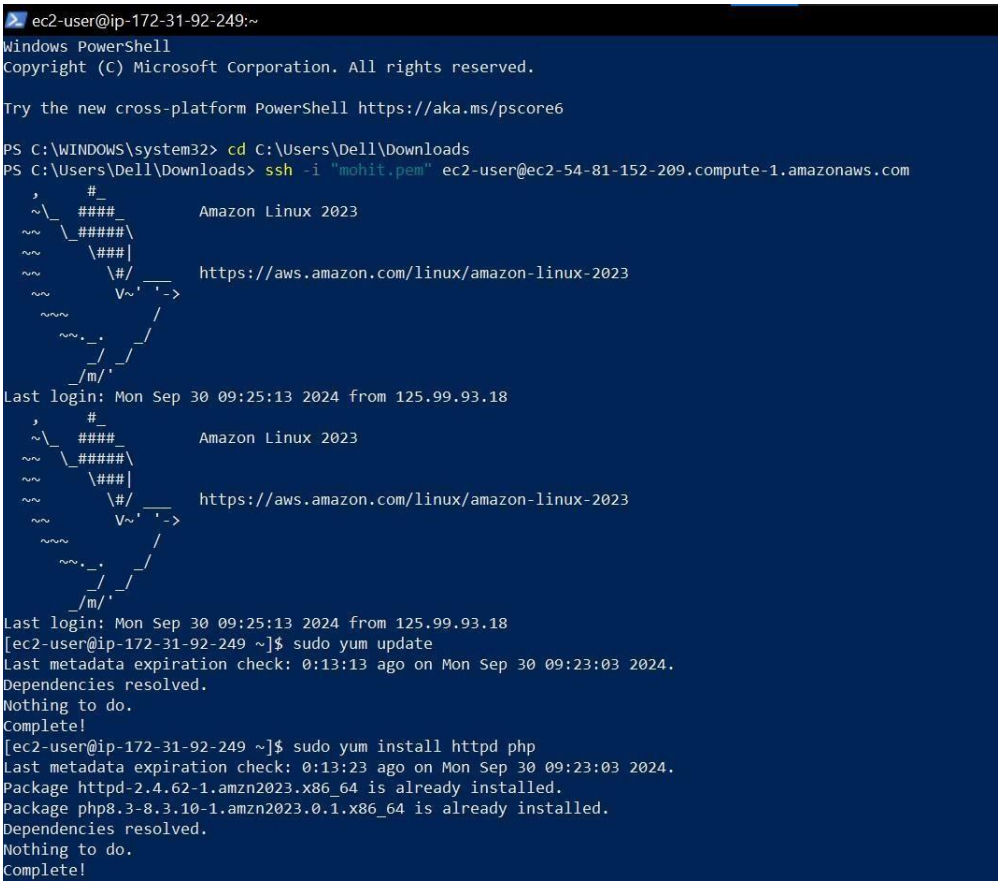


Copy the given ssh command, as we will require it for logging into our nagios-host instance from our windows powershell

Name: Aditya Ahuja Div: D15C Roll No: 02



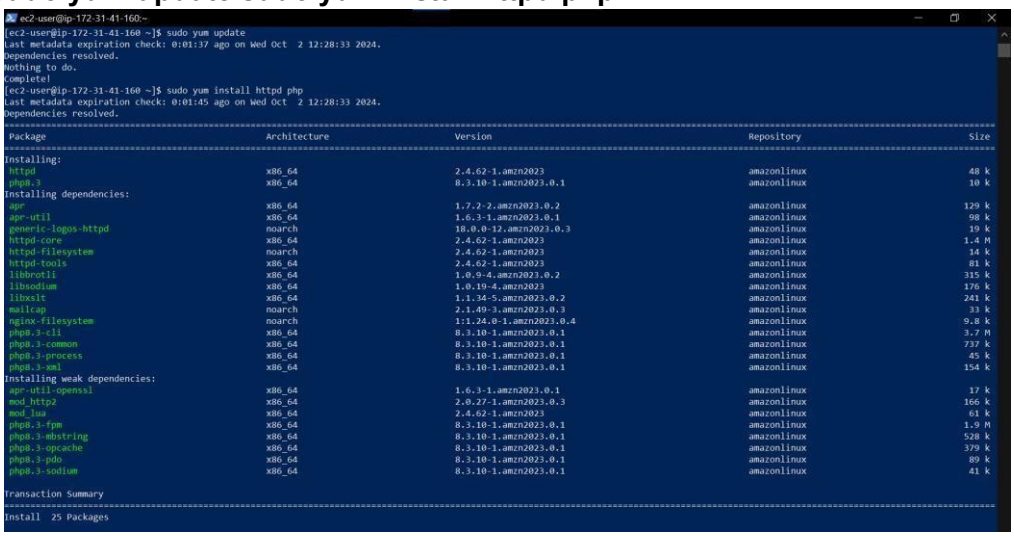
Step 3: Open an administrative powershell and remotely login using the above mentioned ssh command



And then run these commands

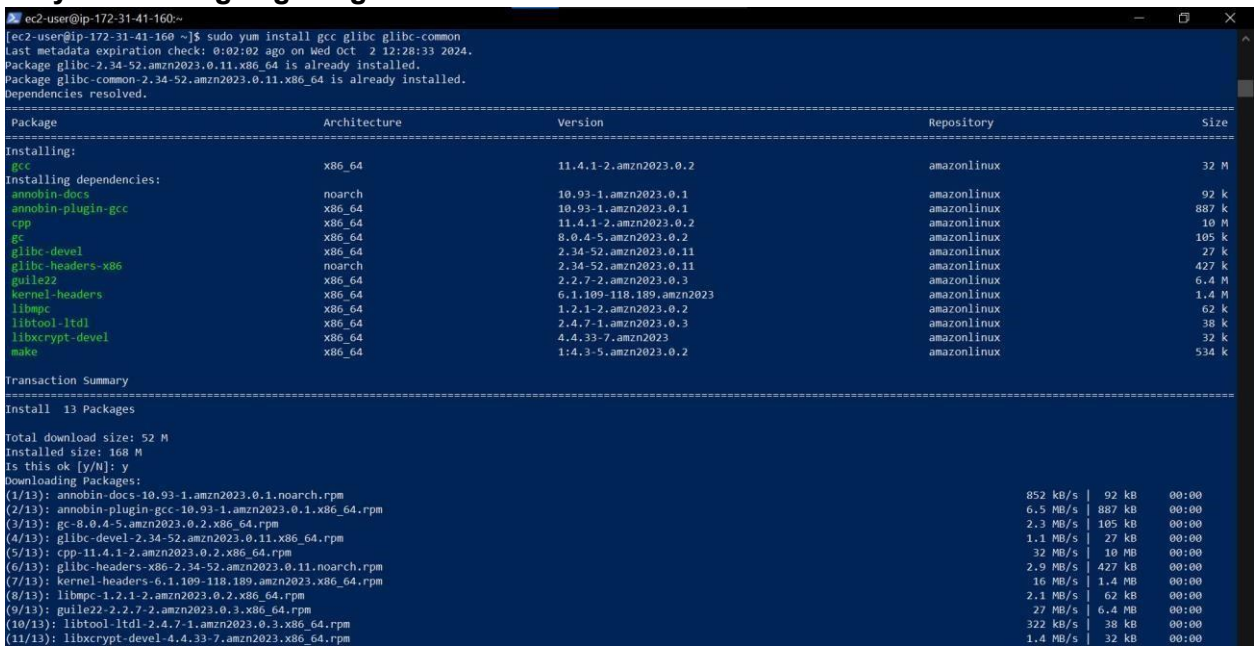
Name: Aditya Ahuja Div: D15C Roll No: 02

sudo yum update sudo yum install httpd php



```
ec2-user@ip-172-31-41-160:~
[ec2-user@ip-172-31-41-160 ~]$ sudo yum update
Last metadata expiration check: 0:01:37 ago on Wed Oct  2 12:28:33 2024.
Dependencies resolved.
Nothing to do.
Complete!
[ec2-user@ip-172-31-41-160 ~]$ sudo yum install httpd php
Last metadata expiration check: 0:01:45 ago on Wed Oct  2 12:28:33 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
================================================================================
Install  25 Packages
```

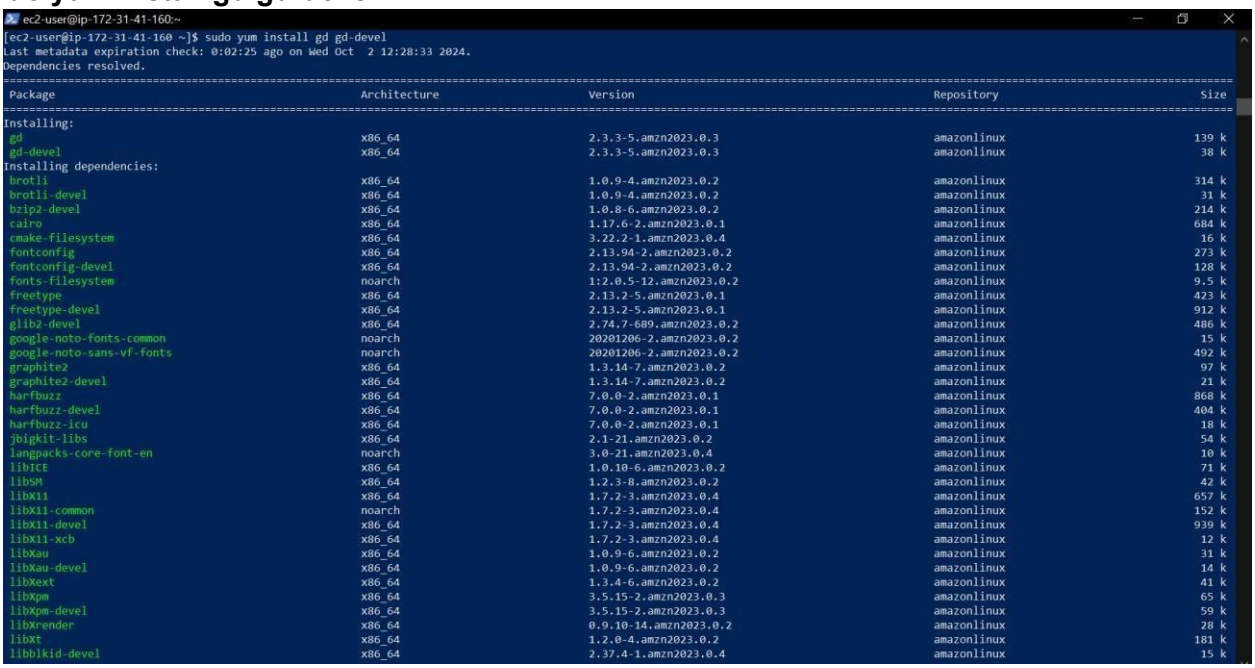
sudo yum install gcc glibc glibc-common



```
ec2-user@ip-172-31-41-160:~
[ec2-user@ip-172-31-41-160 ~]$ sudo yum install gcc glibc glibc-common
Last metadata expiration check: 0:02:02 ago on Wed Oct  2 12:28:33 2024.
Package glibc-2.34-52.amzn2023.0.11.x86_64 is already installed.
Package glibc-common-2.34-52.amzn2023.0.11.x86_64 is already installed.
Dependencies resolved.
================================================================================
 Package                 Architecture  Version                    Repository  Size
================================================================================
Installing:
 gcc                     x86_64        11.4.1-2.amzn2023.0.2      amazonlinux 32 M
Installing dependencies:
 annobin-docs            noarch        10.93-1.amzn2023.0.1       amazonlinux 92 k
 annobin-plugin-gcc      x86_64        10.93-1.amzn2023.0.1       amazonlinux 887 k
 cpp                     x86_64        11.4.1-2.amzn2023.0.2      amazonlinux 10 M
 gc                      x86_64        8.0.4-5.amzn2023.0.2       amazonlinux 105 k
 glibc-devel             x86_64        2.34-52.amzn2023.0.11      amazonlinux 27 k
 glibc-headers-x86       noarch        2.34-52.amzn2023.0.11      amazonlinux 427 k
 guile22                 x86_64        2.2.7-2.amzn2023.0.3       amazonlinux 6.4 M
 kernel-headers          x86_64        6.1.109-118.189.amzn2023   amazonlinux 1.4 M
 libmpc                  x86_64        1.2.1-2.amzn2023.0.2       amazonlinux 62 k
 libtool-ltdl            x86_64        2.4.7-1.amzn2023.0.3       amazonlinux 38 k
 libxcrypt-devel         x86_64        4.4.33-7.amzn2023          amazonlinux 32 k
 make                    x86_64        1:4.3-5.amzn2023.0.2       amazonlinux 534 k

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

Total download size: 52 M
Installed size: 168 M
Is this ok [y/N]: y
Downloading Packages:
(1/13): annobin-docs-10.93-1.amzn2023.0.1.noarch.rpm  852 kB/s |  92 kB  00:00
(2/13): annobin-plugin-gcc-10.93-1.amzn2023.0.1.x86_64.rpm  6.5 MB/s | 887 kB  00:00
(3/13): gc-8.0.4-5.amzn2023.0.2.x86_64.rpm  2.3 MB/s | 105 kB  00:00
(4/13): glibc-devel-2.34-52.amzn2023.0.11.x86_64.rpm  1.1 MB/s |  27 kB  00:00
(5/13): cpp-11.4.1-2.amzn2023.0.2.x86_64.rpm  32 MB/s |  10 MB  00:00
(6/13): glibc-headers-x86-2.34-52.amzn2023.0.11.noarch.rpm  2.9 MB/s | 427 kB  00:00
(7/13): kernel-headers-6.1.109-118.189.amzn2023.x86_64.rpm  16 MB/s | 1.4 MB  00:00
(8/13): libmpc-1.2.1-2.amzn2023.0.2.x86_64.rpm  2.1 MB/s |  62 kB  00:00
(9/13): guile22-2.2.7-2.amzn2023.0.3.x86_64.rpm  27 MB/s | 6.4 MB  00:00
(10/13): libtool-ltdl-2.4.7-1.amzn2023.0.3.x86_64.rpm  322 kB/s |  38 kB  00:00
(11/13): libxcrypt-devel-4.4.33-7.amzn2023.x86_64.rpm  1.4 MB/s |  32 kB  00:00
```

Name: Aditya Ahuja Div: D15C Roll No: 02

sudo yum install gd gd-devel



```
ec2-user@ip-172-31-41-160:~
[ec2-user@ip-172-31-41-160 ~]$ sudo yum install gd gd-devel
Last metadata expiration check: 0:02:25 ago on Wed Oct  2 12:28:33 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
fontconfig-devel	x86_64	2.13.94-2.amzn2023.0.2	amazonlinux	128 k
fonts-filesystem	noarch	1:2.0.5-12.amzn2023.0.2	amazonlinux	9.5 k
freetype	x86_64	2.13.2-5.amzn2023.0.1	amazonlinux	423 k
freetype-devel	x86_64	2.13.2-5.amzn2023.0.1	amazonlinux	912 k
glib2-devel	x86_64	2.74.7-689.amzn2023.0.2	amazonlinux	486 k
google-noto-fonts-common	noarch	20201206-2.amzn2023.0.2	amazonlinux	15 k
google-noto-sans-vf-fonts	noarch	20201206-2.amzn2023.0.2	amazonlinux	492 k
graphite2	x86_64	1.3.14-7.amzn2023.0.2	amazonlinux	97 k
graphite2-devel	x86_64	1.3.14-7.amzn2023.0.2	amazonlinux	21 k
harfbuzz	x86_64	7.0.0-2.amzn2023.0.1	amazonlinux	868 k
harfbuzz-devel	x86_64	7.0.0-2.amzn2023.0.1	amazonlinux	404 k
harfbuzz-icu	x86_64	7.0.0-2.amzn2023.0.1	amazonlinux	18 k
jbigkit-libs	x86_64	2.1-21.amzn2023.0.2	amazonlinux	54 k
langpacks-core-font-en	noarch	3.0-21.amzn2023.0.4	amazonlinux	10 k
libICE	x86_64	1.0.10-6.amzn2023.0.2	amazonlinux	71 k
libSM	x86_64	1.2.3-8.amzn2023.0.2	amazonlinux	42 k
libX11	x86_64	1.7.2-3.amzn2023.0.4	amazonlinux	657 k
libX11-common	noarch	1.7.2-3.amzn2023.0.4	amazonlinux	152 k
libX11-devel	x86_64	1.7.2-3.amzn2023.0.4	amazonlinux	939 k
libX11-xcb	x86_64	1.7.2-3.amzn2023.0.4	amazonlinux	12 k
libXau	x86_64	1.0.9-6.amzn2023.0.2	amazonlinux	31 k
libXau-devel	x86_64	1.0.9-6.amzn2023.0.2	amazonlinux	14 k
libXext	x86_64	1.3.4-6.amzn2023.0.2	amazonlinux	41 k
libXpm	x86_64	3.5.15-2.amzn2023.0.3	amazonlinux	65 k
libXpm-devel	x86_64	3.5.15-2.amzn2023.0.3	amazonlinux	59 k
libXrender	x86_64	0.9.10-14.amzn2023.0.2	amazonlinux	28 k
libXt	x86_64	1.2.0-4.amzn2023.0.2	amazonlinux	181 k
libblkid-devel	x86_64	2.37.4-1.amzn2023.0.4	amazonlinux	15 k

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**

```
[ec2-user@ip-172-31-41-160 ~]$ sudo adduser -m nagios
[ec2-user@ip-172-31-41-160 ~]$ sudo passwd nagios
Changing password for user nagios.
New password:
Retype new password:
passwd: all authentication tokens updated successfully.
[ec2-user@ip-172-31-41-160 ~]$
```

Create a new user group & create a new directory for Nagios downloads using the following commands **sudo groupadd nagcmd sudo usermod -a -G nagcmd nagios sudo usermod -a -G nagcmd apache mkdir ~/downloads cd ~/downloads**

Use **wget** to download the source zip files.

In this step, we are downloading, the latest version of nagios and the necessary plugins required to carry out the tasks of setting up a nagios server wget

https://sourceforge.net/projects/nagios/files/latest/download

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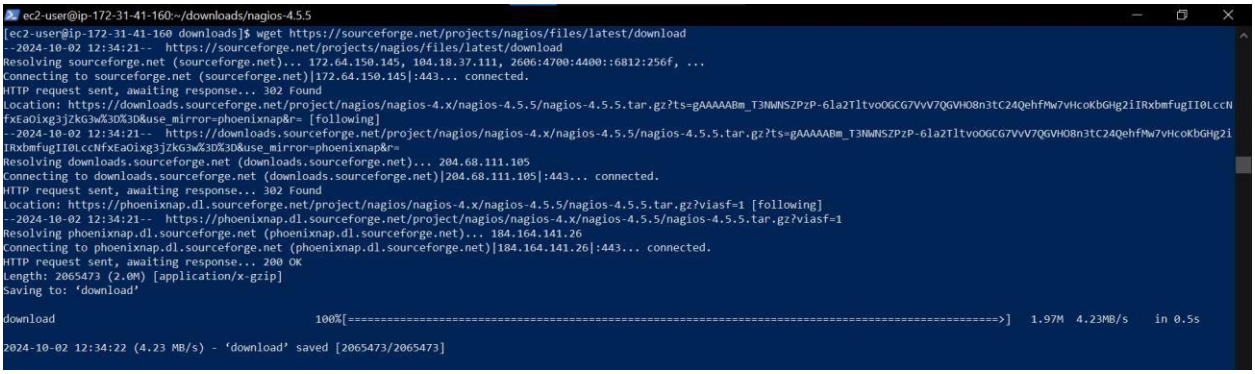
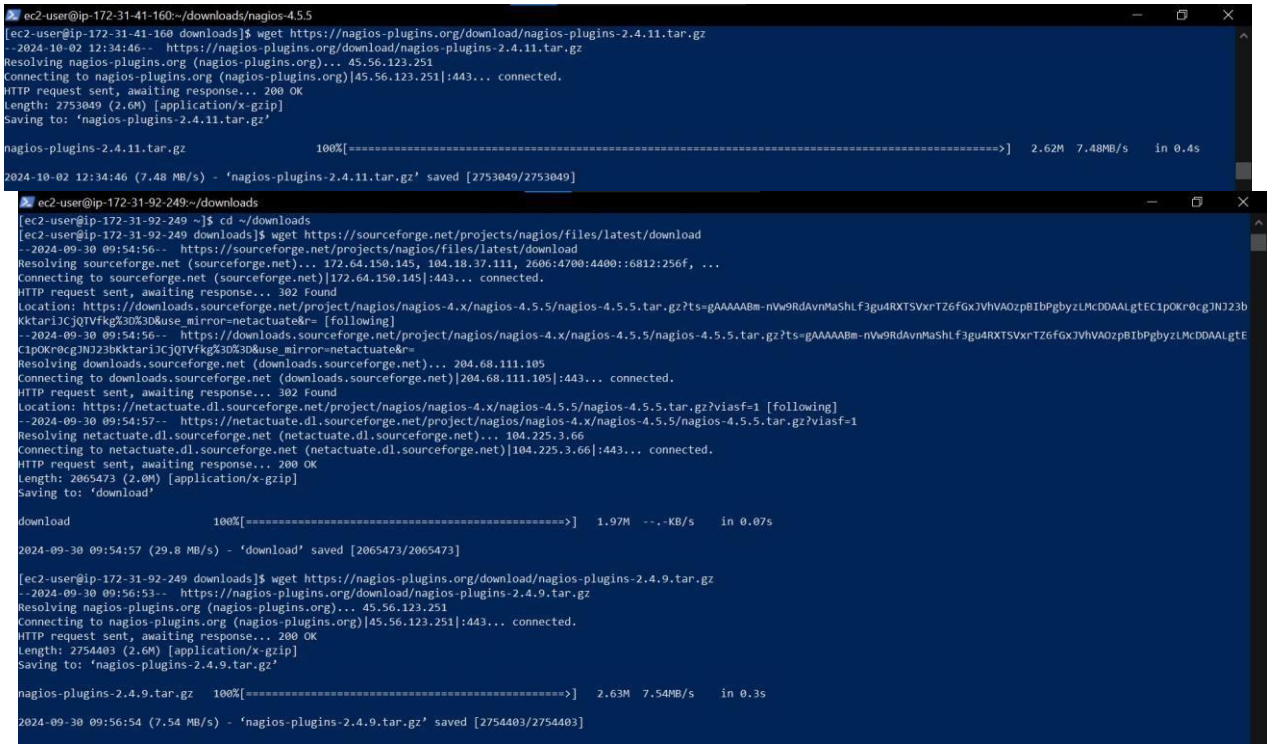
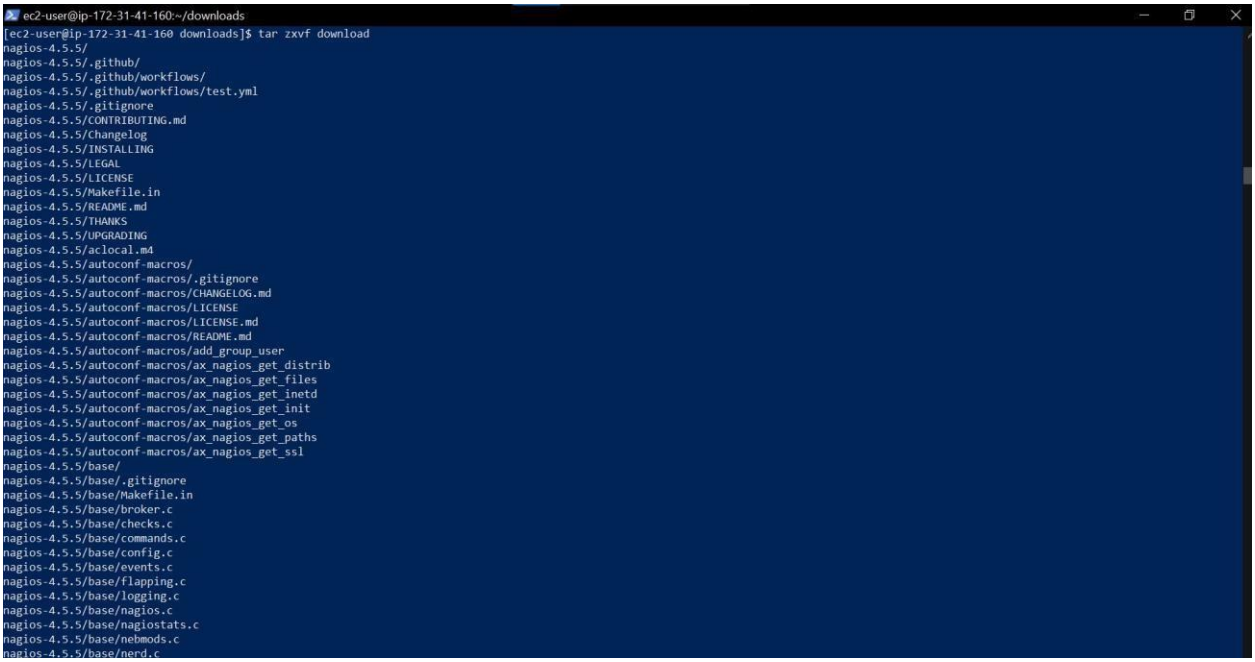


wget https://nagios-plugins.org/download/nagios-plugins-2.4.11.tar.gz



Now, we run the next command in the following manner tar zxvf <nagios4.5.5 version> (for me it has gotten saved as 'download') So i wrote **tar zxvf download**



After which we are supposed to **change our directory** over there

For eg. **cd nagios-4.5.5**… depending on the version that we have downloaded

Next, Run this command (make sure that you are working inside nagios-4.x.x directory)

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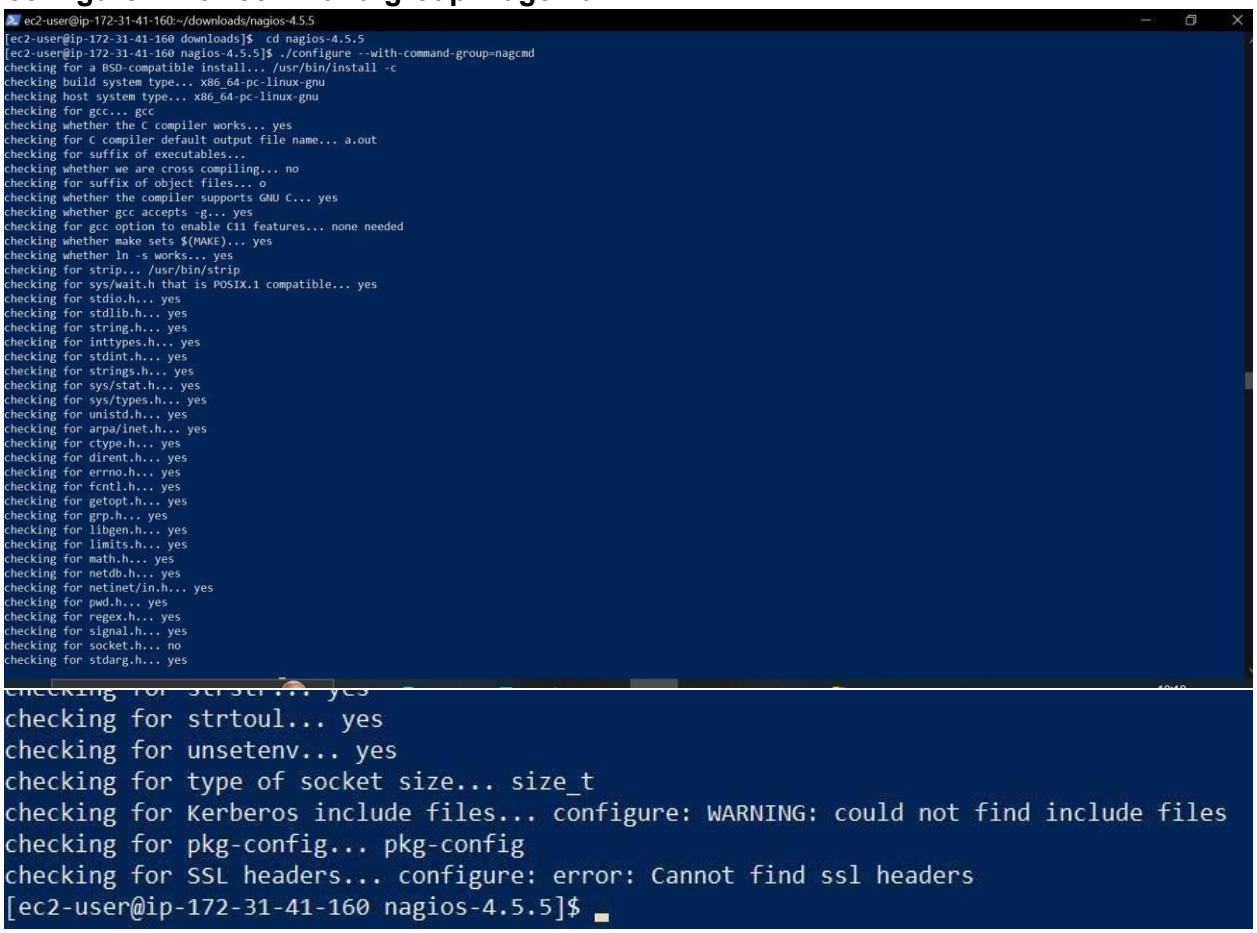
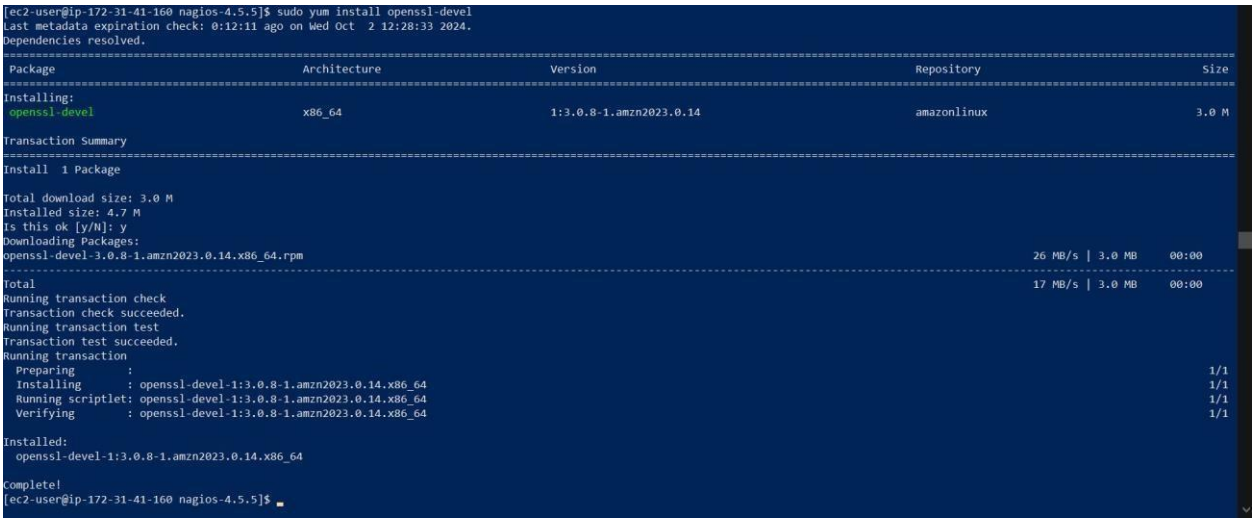
./configure --with-command-group=nagcmd



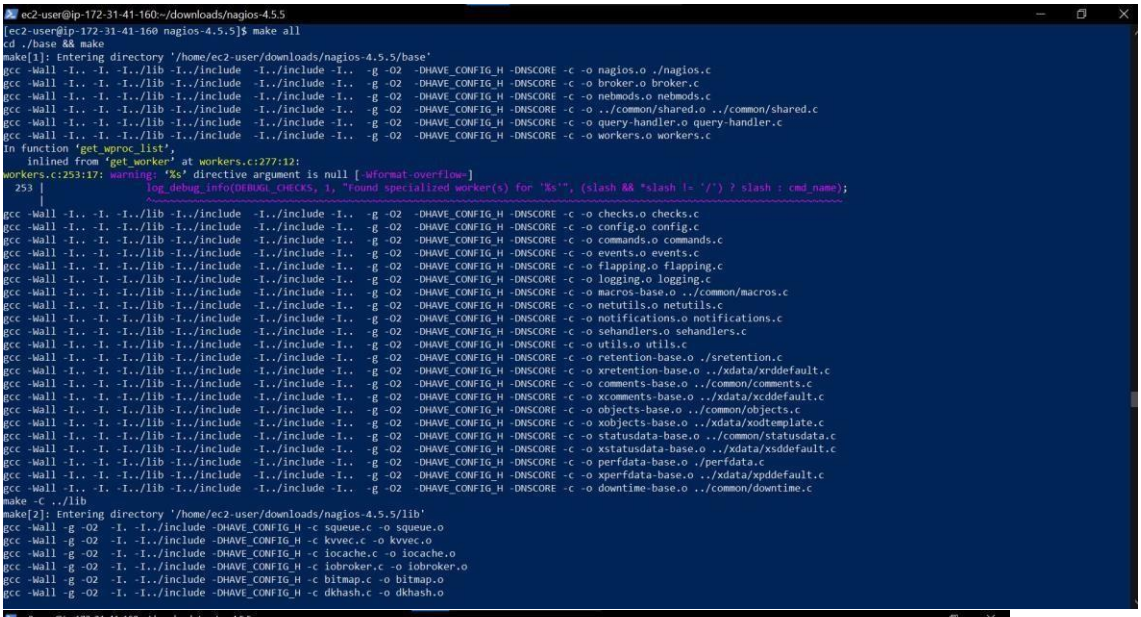
After running this command, we get an **error related to ssl header being absent**

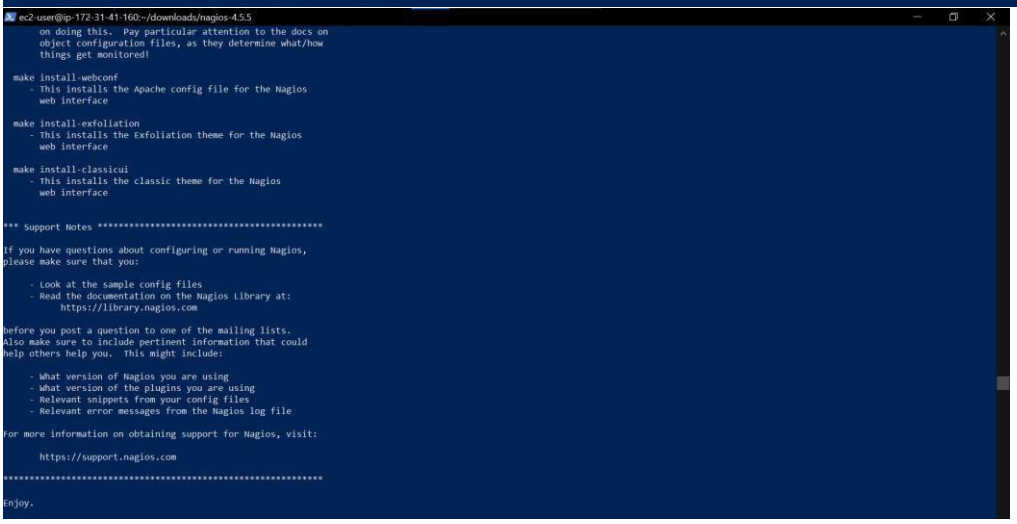
For that purpose, we are to run the following command. **sudo yum install openssl-devel** (for ssl header)



Now, Re-run **./configure --with-command-group=nagcmd**

After this, run **make all** command





Run the following set of commands to ensure that **sudo make install**

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```
ec2-user@ip-172-31-41-160:~/downloads/nagios-4.5.5
[ec2-user@ip-172-31-41-160 nagios-4.5.5]$ sudo make install
cd ./base && make install
make[1]: Entering directory '/home/ec2-user/downloads/nagios-4.5.5/base'
/usr/bin/install -c -m 775 -o nagios -g nagios -d /usr/local/nagios/bin
/usr/bin/install -c -s -m 774 -o nagios -g nagios nagios /usr/local/nagios/bin
/usr/bin/install -c -s -m 774 -o nagios -g nagios nagiostats /usr/local/nagios/bin
make[1]: Leaving directory '/home/ec2-user/downloads/nagios-4.5.5/base'
cd ./cgi && make install
make[1]: Entering directory '/home/ec2-user/downloads/nagios-4.5.5/cgi'
make install-basic
make[2]: Entering directory '/home/ec2-user/downloads/nagios-4.5.5/cgi'
/usr/bin/install -c -m 775 -o nagios -g nagios -d /usr/local/nagios/sbin
for file in *.cgi; do \
       /usr/bin/install -c -s -m 775 -o nagios -g nagios $file /usr/local/nagios/sbin; \
done
make[2]: Leaving directory '/home/ec2-user/downloads/nagios-4.5.5/cgi'
make[1]: Leaving directory '/home/ec2-user/downloads/nagios-4.5.5/cgi'
cd ./html && make install
make[1]: Entering directory '/home/ec2-user/downloads/nagios-4.5.5/html'
/usr/bin/install -c -m 775 -o nagios -g nagios -d /usr/local/nagios/share
/usr/bin/install -c -m 775 -o nagios -g nagios -d /usr/local/nagios/share/media
/usr/bin/install -c -m 775 -o nagios -g nagios -d /usr/local/nagios/share/stylesheets
/usr/bin/install -c -m 775 -o nagios -g nagios -d /usr/local/nagios/share/contexthelp
/usr/bin/install -c -m 775 -o nagios -g nagios -d /usr/local/nagios/share/docs
/usr/bin/install -c -m 775 -o nagios -g nagios -d /usr/local/nagios/share/docs/images
/usr/bin/install -c -m 775 -o nagios -g nagios -d /usr/local/nagios/share/js
/usr/bin/install -c -m 775 -o nagios -g nagios -d /usr/local/nagios/share/images
/usr/bin/install -c -m 775 -o nagios -g nagios -d /usr/local/nagios/share/images/logos
/usr/bin/install -c -m 775 -o nagios -g nagios -d /usr/local/nagios/share/includes
/usr/bin/install -c -m 775 -o nagios -g nagios -d /usr/local/nagios/share/ssi
/usr/bin/install -c -m 664 -o nagios -g nagios ./robots.txt /usr/local/nagios/share
/usr/bin/install -c -m 664 -o nagios -g nagios ./jsonquery.html /usr/local/nagios/share
rm -f /usr/local/nagios/share/index.html
rm -f /usr/local/nagios/share/main.html
rm -f /usr/local/nagios/share/side.html
rm -f /usr/local/nagios/share/map.html
rm -f /usr/local/nagios/share/rss-*
rm -f /usr/local/nagios/share/graph-header.html
rm -f /usr/local/nagios/share/histogram.html
rm -f /usr/local/nagios/share/histogram-form.html
rm -f /usr/local/nagios/share/histogram-graph.html
rm -f /usr/local/nagios/share/histogram-links.html
rm -f /usr/local/nagios/share/infobox.html
rm -f /usr/local/nagios/share/map.php
```

sudo make install-init

```
ec2-user@ip-172-31-41-160:~/downloads/nagios-4.5.5
[ec2-user@ip-172-31-41-160 nagios-4.5.5]$ sudo make install-init
/usr/bin/install -c -m 755 -d -o root -g root /lib/systemd/system
/usr/bin/install -c -m 755 -o root -g root startup/default-service /lib/systemd/system/nagios.service
```

sudo make install-config

```
[ec2-user@ip-172-31-41-160 nagios-4.5.5]$ sudo make install-config
/usr/bin/install -c -m 775 -o nagios -g nagios -d /usr/local/nagios/etc
/usr/bin/install -c -m 775 -o nagios -g nagios -d /usr/local/nagios/etc/objects
/usr/bin/install -c -b -m 664 -o nagios -g nagios sample-config/nagios.cfg /usr/local/nagios/etc/nagios.cfg
/usr/bin/install -c -b -m 664 -o nagios -g nagios sample-config/cgi.cfg /usr/local/nagios/etc/cgi.cfg
/usr/bin/install -c -b -m 660 -o nagios -g nagios sample-config/resource.cfg /usr/local/nagios/etc/resource.cfg
/usr/bin/install -c -b -m 664 -o nagios -g nagios sample-config/template-object/templates.cfg /usr/local/nagios/etc/objects/templates.cfg
/usr/bin/install -c -b -m 664 -o nagios -g nagios sample-config/template-object/commands.cfg /usr/local/nagios/etc/objects/commands.cfg
/usr/bin/install -c -b -m 664 -o nagios -g nagios sample-config/template-object/contacts.cfg /usr/local/nagios/etc/objects/contacts.cfg
/usr/bin/install -c -b -m 664 -o nagios -g nagios sample-config/template-object/timeperiods.cfg /usr/local/nagios/etc/objects/timeperiods.cfg
/usr/bin/install -c -b -m 664 -o nagios -g nagios sample-config/template-object/localhost.cfg /usr/local/nagios/etc/objects/localhost.cfg
/usr/bin/install -c -b -m 664 -o nagios -g nagios sample-config/template-object/windows.cfg /usr/local/nagios/etc/objects/windows.cfg
/usr/bin/install -c -b -m 664 -o nagios -g nagios sample-config/template-object/printer.cfg /usr/local/nagios/etc/objects/printer.cfg
/usr/bin/install -c -b -m 664 -o nagios -g nagios sample-config/template-object/switch.cfg /usr/local/nagios/etc/objects/switch.cfg

*** Config files installed ***

Remember, these are *SAMPLE* config files.  You'll need to read
the documentation for more information on how to actually define
services, hosts, etc. to fit your particular needs.
```

sudo make install-webconf

```
[ec2-user@ip-172-31-41-160 nagios-4.5.5]$ sudo make install-webconf
/usr/bin/install -c -m 644 sample-config/httpd.conf /etc/httpd/conf.d/nagios.conf
if [ 0 -eq 1 ]; then \
        ln -s /etc/httpd/conf.d/nagios.conf /etc/apache2/sites-enabled/nagios.conf; \
fi

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

[ec2-user@ip-172-31-41-160 nagios-4.5.5]$
```

Next, we are supposed to create a nagiosadmin account for nagios login along with password. Specify the password twice. **sudo htpasswd -c /usr/local/nagios/etc/htpasswd.users nagiosadmin**

```
[ec2-user@ip-172-31-41-160 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-172-31-41-160 nagios-4.5.5]$
```

Restart Apache **sudo service httpd restart**

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-172-31-41-160:~/downloads
[ec2-user@ip-172-31-41-160 nagios-4.5.5]$ sudo service httpd restart
Redirecting to /bin/systemctl restart httpd.service
[ec2-user@ip-172-31-41-160 nagios-4.5.5]$ cd ~/downloads
[ec2-user@ip-172-31-41-160 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
```

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Compile and install plugins **cd nagios-plugins-2.4.11**
./configure --with-nagios-user=nagios --with-nagios-group=nagios

Run the following command: **sudo chkconfig --add nagios** On running the above command

```
[ec2-user@ip-172-31-41-160 nagios-plugins-2.4.11]$ sudo chkconfig --add nagios
error reading information on service nagios: No such file or directory
```

If this is the output that one is getting, then it means that the init script is missing… We can check this by running ls /etc/init.d/

```
[ec2-user@ip-172-31-92-249 nagios-plugins-2.4.9]$ ls /etc/init.d/
README  functions
[ec2-user@ip-172-31-92-249 nagios-plugins-2.4.9]$
```

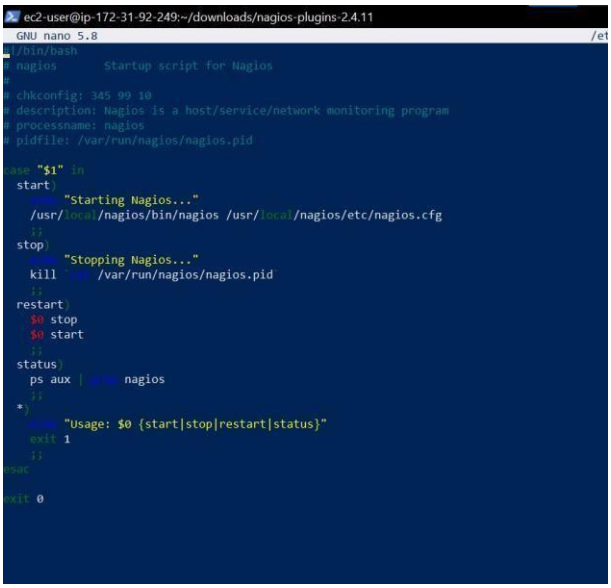
With ls command, we must see a file named nagios, which i was not able to see
If the Init Script is Missing i.e If you don't see the nagios script in /etc/init.d/, you can create it manually. Here's how:

Run the following command: **sudo nano /etc/init.d/nagios**

Within this file, paste the following script

```
#!/bin/bash
# nagios       Startup script for Nagios
#
# chkconfig: 345 99 10
# description: Nagios is a host/service/network monitoring program
# processname: nagios
# pidfile: /var/run/nagios/nagios.pid case
"$1" in start) echo "Starting Nagios..."
    /usr/local/nagios/bin/nagios /usr/local/nagios/etc/nagios.cfg
    ;;
  stop)
    echo "Stopping Nagios..." kill `cat /var/run/nagios/nagios.pid`
    ;;
  restart)
    $0 stop
```

```
    $0 start
    ;;
  status)
    ps aux | grep nagios
    ;;
  *)
    echo "Usage: $0 {start|stop|restart|status}"
    exit 1
    ;;
esac  exit
0
```



Make the Script Executable: After saving the file, run the following command to make it executable: **sudo chmod +x /etc/init.d/nagios**

Run **sudo chkconfig --add nagios** again And then run **sudo chkconfig nagios on**

```
[ec2-user@ip-172-31-41-160 nagios-plugins-2.4.11]$ sudo nano /etc/init.d/nagios
[ec2-user@ip-172-31-41-160 nagios-plugins-2.4.11]$ sudo chmod +x /etc/init.d/nagios
[ec2-user@ip-172-31-41-160 nagios-plugins-2.4.11]$ sudo chkconfig --add nagios
[ec2-user@ip-172-31-41-160 nagios-plugins-2.4.11]$ sudo chkconfig nagios on
Note: Forwarding request to 'systemctl enable nagios.service'.
Synchronizing state of nagios.service with SysV service script with /usr/lib/systemd/systemd-sysv-install.
Executing: /usr/lib/systemd/systemd-sysv-install enable nagios
Created symlink /etc/systemd/system/multi-user.target.wants/nagios.service → /usr/lib/systemd/system/nagios.service.
[ec2-user@ip-172-31-41-160 nagios-plugins-2.4.11]$
```

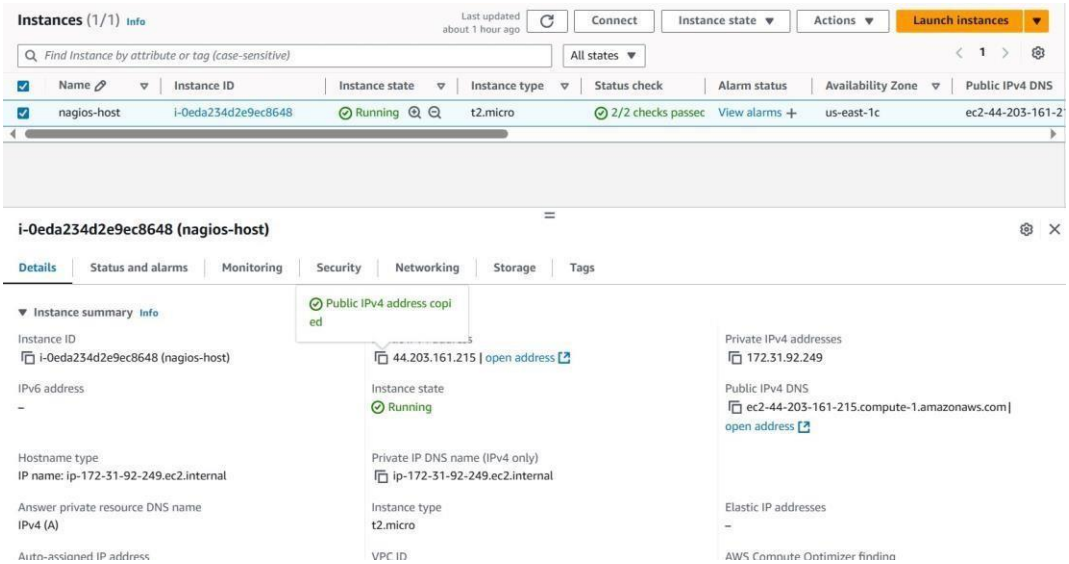
sudo service nagios start

```
[ec2-user@ip-172-31-92-249 nagios-plugins-2.4.11]$ sudo service nagios start
Starting Nagios...

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

Website: https://www.nagios.org
Nagios 4.5.5 starting... (PID=72261)
Local time is Tue Oct 01 20:59:58 UTC 2024
wproc: Successfully registered manager as @wproc with query handler
wproc: Registry request: name=Core Worker 72265;pid=72265
wproc: Registry request: name=Core Worker 72264;pid=72264
wproc: Registry request: name=Core Worker 72263;pid=72263
wproc: Registry request: name=Core Worker 72262;pid=72262
Successfully launched command file worker with pid 72266
wproc: NOTIFY job 4 from worker Core Worker 72262 is a non-check helper but exited with return code 127
wproc:   host=localhost; service=Swap Usage; contact=nagiosadmin
wproc:   early_timeout=0; exited_ok=1; wait_status=32512; error_code=0;
wproc:   stderr line 01: /bin/sh: line 1: /bin/mail: No such file or directory
wproc:   stderr line 02: /usr/bin/printf: write error: Broken pipe
```

Get your public IPv4 address from your instance. We will require it for connecting to our nginx server



Browse for this url: http://<your_public_ip_address>/nagios

The browser may ask you for your nagios credentials which set in the earlier steps

The username is nagiosadmin and enter the password that you set earlier

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Conclusion:

In this experiment, we successfully installed and configured Nagios Core on an Amazon Linux EC2 instance, showcasing its role in continuous monitoring within a DevOps environment. We learned about user management and service configuration, emphasizing Nagios's ability to monitor systems and networks effectively. This experience laid the groundwork for enhancing infrastructure reliability and integrating advanced monitoring strategies in future projects.

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Adv DevOps Exp 10

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

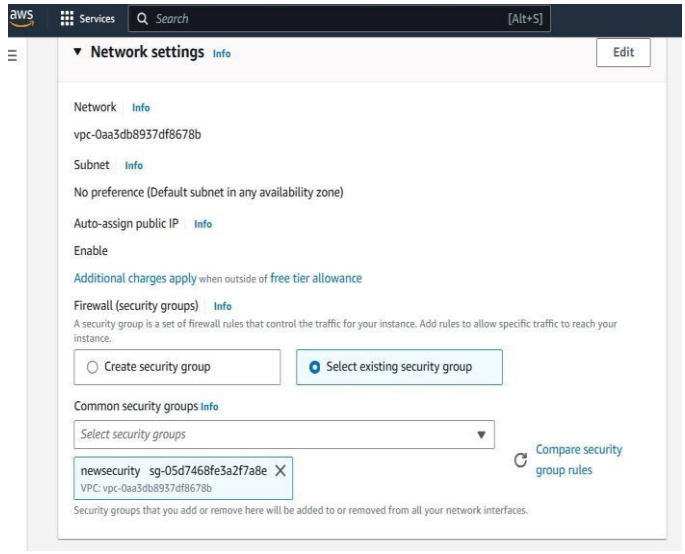
Monitoring Using Nagios:

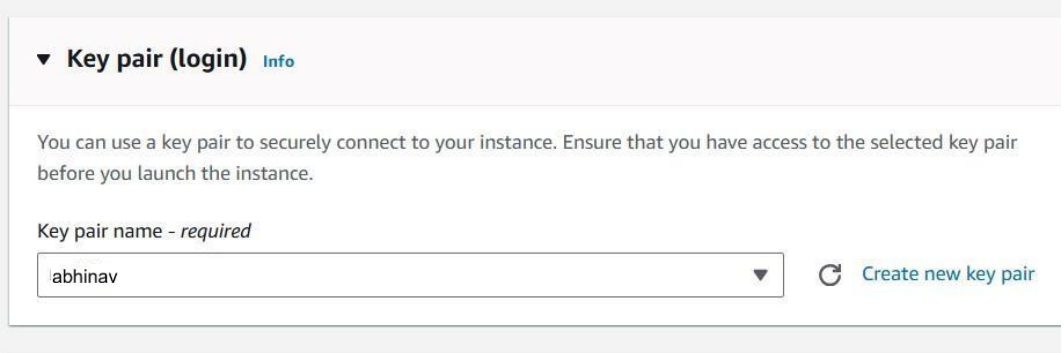
Step 1: To Confirm Nagios is running on the server side Perform the following command on your Amazon Linux Machine (Nagios-host). Run this command **sudo systemctl status**

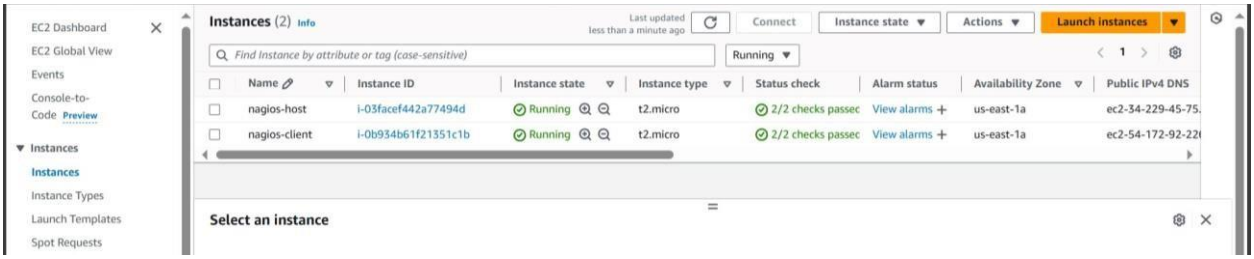
```
ec2-user@ip-172-31-41-160:~/downloads/nagios-plugins-2.4.11
[ec2-user@ip-172-31-41-160 nagios-plugins-2.4.11]$ sudo systemctl status
● ip-172-31-41-160.ec2.internal
    State: running
    Units: 296 loaded (incl. loaded aliases)
     Jobs: 0 queued
   Failed: 0 units
    Since: Wed 2024-10-02 12:28:05 UTC; 33min ago
  systemd: 252.23-2.amzn2023
  CGroup: /
          ├─init.scope
          │ └─1 /usr/lib/systemd/systemd --switched-root --system --deserialize=32
          ├─system.slice
          │ ├─acpid.service
          │ │ ├─1938 /usr/bin/systemd-inhibit --what=handle-suspend-key:handle-hibernate-key --who=noah "--why=acpid instead" --mode=block /usr/sbin/acpid -f
          │ │ └─2059 /usr/sbin/acpid -f
          │ ├─amazon-ssm-agent.service
          │ │ └─2141 /usr/bin/amazon-ssm-agent
          │ ├─atd.service
          │ │ └─2152 /usr/sbin/atd -f
          │ ├─auditd.service
          │ │ └─1768 /sbin/auditd
          │ ├─chronyd.service
          │ │ └─2175 /usr/sbin/chronyd -F 2
          │ ├─dbus-broker.service
          │ │ ├─1946 /usr/bin/dbus-broker-launch --scope system --audit
          │ │ └─1954 dbus-broker --log 4 --controller 9 --machine-id ec2e4d759a3e2f6fe850b14e4cdacabe --max-bytes 536870912 --max-fds 4096 --max-matches 16384 --audit
          │ ├─gssproxy.service
          │ │ └─1959 /usr/sbin/gssproxy -D
          │ ├─httpd.service
          │ │ ├─49553 /usr/sbin/httpd -DFOREGROUND
          │ │ ├─49555 /usr/sbin/httpd -DFOREGROUND
          │ │ ├─49556 /usr/sbin/httpd -DFOREGROUND
          │ │ ├─49557 /usr/sbin/httpd -DFOREGROUND
          │ │ ├─49558 /usr/sbin/httpd -DFOREGROUND
          │ │ └─62800 /usr/sbin/httpd -DFOREGROUND
          │ ├─libstoragemgmt.service
          │ │ └─1940 /usr/bin/lsmd -d
```

Step 2: Before we begin,

To monitor a Linux machine, create an **Ubuntu 20.04 server** EC2 Instance in AWS. Provide it with the **same security group** as the Nagios Host and name it ‘nagios-client’ alongside the host.







Step 3: TO BE DONE IN THE Nagios-host TERMINAL
In the nagios-host terminal, run this command **ps -ef | grep nagios**

```
[ec2-user@ip-172-31-41-160 nagios-plugins-2.4.11]$ ps -ef | grep nagios
ec2-user   63115    2315  0 13:03 pts/0    00:00:00 grep --color=auto nagios
[ec2-user@ip-172-31-41-160 nagios-plugins-2.4.11]$
```

To become a root user, run **'sudo su'** and make two directories using the following commands. If one is running these commands in windows powershell, make sure that he/she copies it line by line as powershell might make an error while interpreting multiple lines **mkdir /usr/local/nagios/etc/objects/monitorhosts mkdir /usr/local/nagios/etc/objects/monitorhosts/linuxhosts**

```
[ec2-user@ip-172-31-92-249 ~]$ sudo su
[root@ip-172-31-92-249 ec2-user]# mkdir /usr/local/nagios/etc/objects/monitorhosts
[root@ip-172-31-92-249 ec2-user]# mkdir /usr/local/nagios/etc/objects/monitorhosts/linuxhosts
[root@ip-172-31-92-249 ec2-user]#
```

Copy the sample localhost.cfg file to linuxhost folder. Use the following mentioned command to achieve it **cp /usr/local/nagios/etc/objects/localhost.cfg /usr/local/nagios/etc/objects/monitorhosts/linuxhosts/linuxserver.cfg**
Open linuxserver.cfg using nano and make the following changes. This is a conf type file in which we will have to modify the configurations in way which will help us specify the hosts and clients to be monitored

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

Changes to be made:

1. Change the hostname to linux-server (EVERYWHERE ON THE FILE)
2. Change address to the public IP address of your LINUX CLIENT.
3. Change hostgroup_name under hostgroup to linux-servers1

```
# 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               linux-server
    alias                   localhost
    address                 54.172.92.226
}



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

```
# Define an optional hostgroup for Linux machines

define hostgroup {

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

IMP: Everywhere else on the file, change the hostname to linux-server instead of localhost.

Open the Nagios Config file and add the following line **nano /usr/local/nagios/etc/nagios.cfg**

Add the following line in the file and save **cfg_dir=/usr/local/nagios/etc/objects/monitorhosts/**

```
# OBJECT CONFIGURATION FILE(S)
# These are the object configuration files in which you define hosts,
# host groups, contacts, contact groups, services, etc.
# You can split your object definitions across several config files
# if you wish (as shown below), or keep them all in a single config file.

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

# Definitions for monitoring the local (Linux) host
cfg_file=/usr/local/nagios/etc/objects/localhost.cfg
cfg_dir=/usr/local/nagios/etc/objects/monitorhosts/
# Definitions for monitoring a Windows machine
#cfg_file=/usr/local/nagios/etc/objects/windows.cfg
```

Verify the configuration files by running the following command

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

```
[root@ip-172-31-41-160 nagios-plugins-2.4.11]# /usr/local/nagios/bin/nagios -v /usr/local/nagios/etc/nagios.cfg

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

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

Running pre-flight check on configuration data...

Checking objects...
        Checked 16 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
[root@ip-172-31-41-160 nagios-plugins-2.4.11]#
```

You are good to go if there are no errors.

Restart the nagios service **service nagios**

restart

And by running sudo systemctl status nagios, we can again check whether our server is running or not

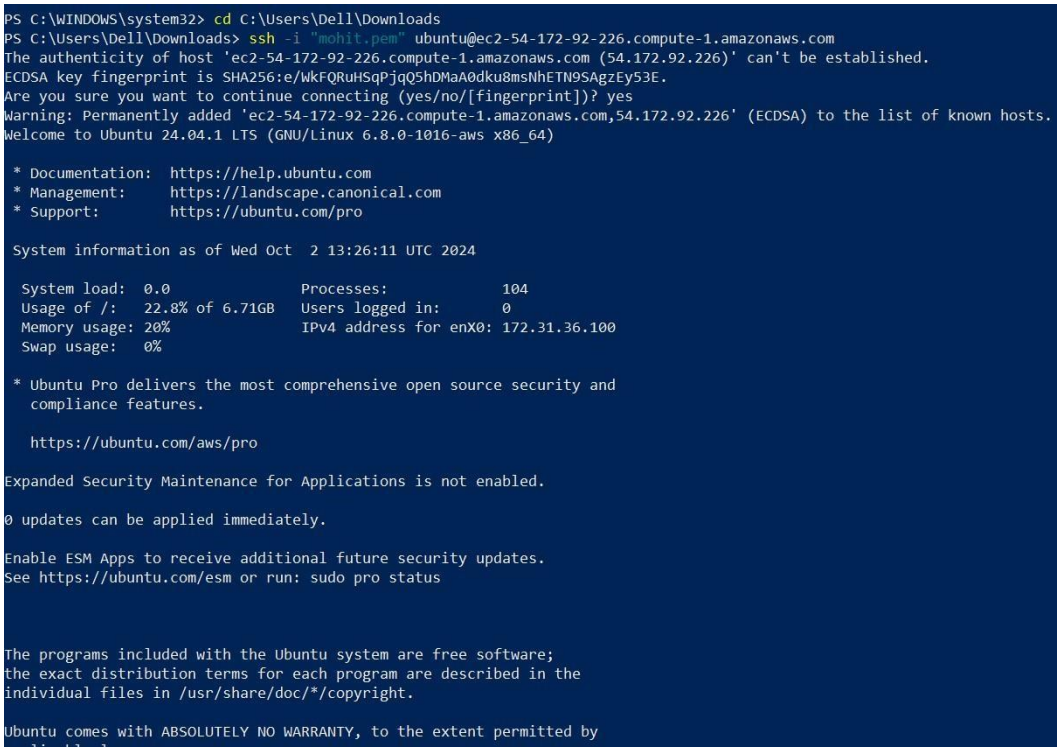
```
root@ip-172-31-41-160:/tmp/nagios-plugins-2.4.11
[root@ip-172-31-41-160 nagios-plugins-2.4.11]# sudo systemctl restart nagios
[root@ip-172-31-41-160 nagios-plugins-2.4.11]# sudo systemctl status nagios
● nagios.service - Nagios Core 4.5.5
     Loaded: loaded (/usr/lib/systemd/system/nagios.service; enabled; preset: disabled)
     Active: active (running) since Wed 2024-10-02 13:20:17 UTC; 7s ago
       Docs: https://www.nagios.org/documentation
    Process: 78776 ExecStartPre=/usr/local/nagios/bin/nagios -v /usr/local/nagios/etc/nagios.cfg (code=exited, status=0/SUCCESS)
    Process: 78777 ExecStart=/usr/local/nagios/bin/nagios -d /usr/local/nagios/etc/nagios.cfg (code=exited, status=0/SUCCESS)
   Main PID: 78778 (nagios)
      Tasks: 6 (limit: 1112)
     Memory: 4.0M
        CPU: 24ms
     CGroup: /system.slice/nagios.service
             ├─78778 /usr/local/nagios/bin/nagios -d /usr/local/nagios/etc/nagios.cfg
             ├─78779 /usr/local/nagios/bin/nagios --worker /usr/local/nagios/var/rw/nagios.qh
             ├─78780 /usr/local/nagios/bin/nagios --worker /usr/local/nagios/var/rw/nagios.qh
             ├─78781 /usr/local/nagios/bin/nagios --worker /usr/local/nagios/var/rw/nagios.qh
             ├─78782 /usr/local/nagios/bin/nagios --worker /usr/local/nagios/var/rw/nagios.qh
             └─78783 /usr/local/nagios/bin/nagios -d /usr/local/nagios/etc/nagios.cfg

Oct 02 13:20:17 ip-172-31-41-160.ec2.internal nagios[78778]: qh: echo service query handler registered
Oct 02 13:20:17 ip-172-31-41-160.ec2.internal nagios[78778]: qh: help for the query handler registered
Oct 02 13:20:17 ip-172-31-41-160.ec2.internal nagios[78778]: wproc: Successfully registered manager as @wproc with query handler
Oct 02 13:20:17 ip-172-31-41-160.ec2.internal nagios[78778]: wproc: Registry request: name=Core Worker 78782;pid=78782
Oct 02 13:20:17 ip-172-31-41-160.ec2.internal nagios[78778]: wproc: Registry request: name=Core Worker 78781;pid=78781
Oct 02 13:20:17 ip-172-31-41-160.ec2.internal nagios[78778]: wproc: Registry request: name=Core Worker 78780;pid=78780
Oct 02 13:20:17 ip-172-31-41-160.ec2.internal nagios[78778]: wproc: Registry request: name=Core Worker 78779;pid=78779
Oct 02 13:20:17 ip-172-31-41-160.ec2.internal nagios[78778]: Successfully launched command file worker with pid 78783
Oct 02 13:20:21 ip-172-31-41-160.ec2.internal nagios[78778]: HOST ALERT: linux-server;UP;SOFT;1;PING OK - Packet loss = 0%, RTA = 0.93 ms
Oct 02 13:20:24 ip-172-31-41-160.ec2.internal nagios[78778]: SERVICE ALERT: localhost;HTTP;WARNING;HARD;4;HTTP WARNING: HTTP/1.1 403 Forbidden - 319 bytes in 0.0
[root@ip-172-31-41-160 nagios-plugins-2.4.11]# sudo systemctl status httpd
● httpd.service - The Apache HTTP Server
     Loaded: loaded (/usr/lib/systemd/system/httpd.service; disabled; preset: disabled)
    Drop-In: /usr/lib/systemd/system/httpd.service.d
             └─php-fpm.conf
     Active: active (running) since Wed 2024-10-02 12:47:56 UTC; 33min ago
       Docs: man:httpd.service(8)
   Main PID: 49553 (httpd)
     Status: "Total requests: 26; Idle/Busy workers 100/0;Requests/sec: 0.0129; Bytes served/sec:  94 B/sec"
      Tasks: 230 (limit: 1112)
     Memory: 21.7M
        CPU: 1.416s
     CGroup: /system.slice/httpd.service
             ├─49553 /usr/sbin/httpd -DFOREGROUND
```

Step 4: TO BE DONE IN THE Nagios-client TERMINAL

Now it is time to switch to the client machine.

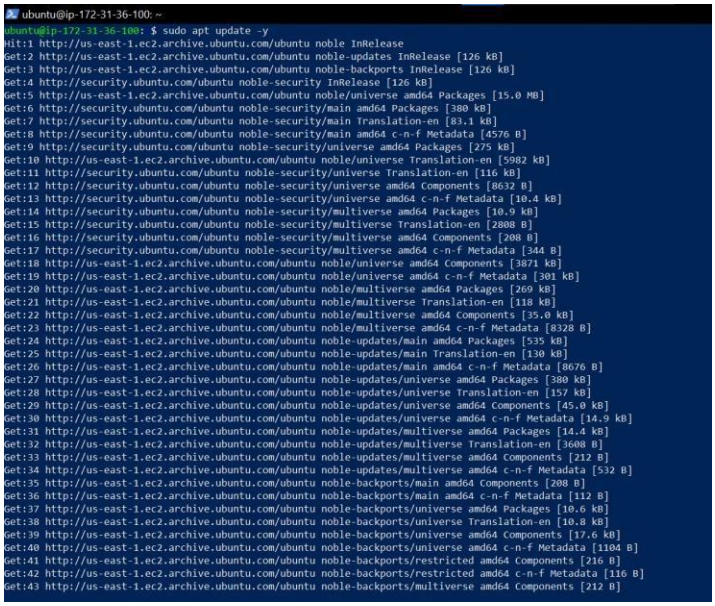
SSH into the machine or simply use the EC2 Instance Connect feature.



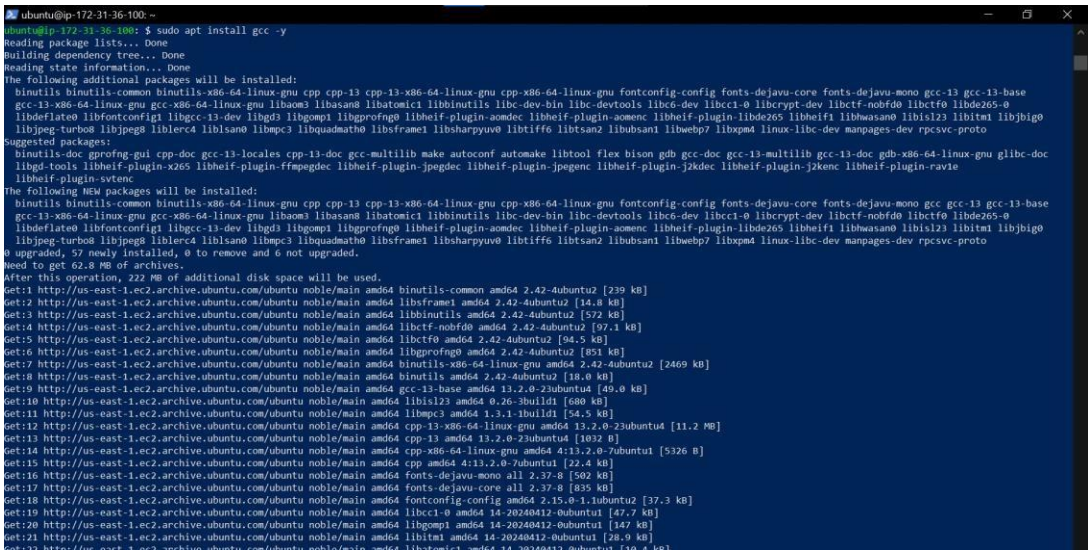
Make a package index update and install gcc, nagios-nrpe-server and the plugins. Run the following commands to achieve the same. **sudo apt update -y sudo apt install gcc -y sudo apt**

install -y nagios-nrpe-server nagios-plugins

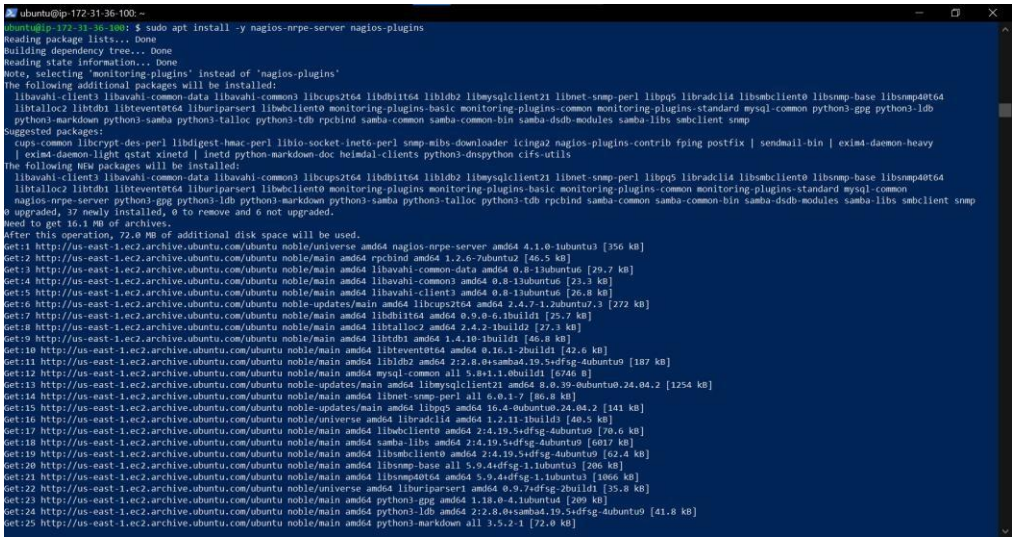
Name:Aditya Ahuja Div: D15C Roll No: 02



```
ubuntu@ip-172-31-36-100: ~
ubuntu@ip-172-31-36-100: $ sudo apt update -y
Hit:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble InRelease
Get:2 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates InRelease [126 kB]
Get:3 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-backports InRelease [126 kB]
Get:4 http://security.ubuntu.com/ubuntu noble-security InRelease [126 kB]
Get:5 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/universe amd64 Packages [15.0 MB]
Get:6 http://security.ubuntu.com/ubuntu noble-security/main amd64 Packages [380 kB]
Get:7 http://security.ubuntu.com/ubuntu noble-security/main Translation-en [83.1 kB]
Get:8 http://security.ubuntu.com/ubuntu noble-security/main amd64 c-n-f Metadata [4576 B]
Get:9 http://security.ubuntu.com/ubuntu noble-security/universe amd64 Packages [275 kB]
Get:10 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/universe Translation-en [5982 kB]
Get:11 http://security.ubuntu.com/ubuntu noble-security/universe Translation-en [116 kB]
Get:12 http://security.ubuntu.com/ubuntu noble-security/universe amd64 Components [8632 B]
Get:13 http://security.ubuntu.com/ubuntu noble-security/universe amd64 c-n-f Metadata [10.4 kB]
Get:14 http://security.ubuntu.com/ubuntu noble-security/multiverse amd64 Packages [10.9 kB]
Get:15 http://security.ubuntu.com/ubuntu noble-security/multiverse Translation-en [2808 B]
Get:16 http://security.ubuntu.com/ubuntu noble-security/multiverse amd64 Components [208 B]
Get:17 http://security.ubuntu.com/ubuntu noble-security/multiverse amd64 c-n-f Metadata [344 B]
Get:18 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/universe amd64 Components [3871 kB]
Get:19 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/universe amd64 c-n-f Metadata [301 kB]
Get:20 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/multiverse amd64 Packages [269 kB]
Get:21 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/multiverse Translation-en [118 kB]
Get:22 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/multiverse amd64 Components [35.0 kB]
Get:23 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/multiverse amd64 c-n-f Metadata [8328 B]
Get:24 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/main amd64 Packages [535 kB]
Get:25 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/main Translation-en [130 kB]
Get:26 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/main amd64 c-n-f Metadata [8676 B]
Get:27 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/universe amd64 Packages [380 kB]
Get:28 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/universe Translation-en [157 kB]
Get:29 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/universe amd64 Components [45.0 kB]
Get:30 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/universe amd64 c-n-f Metadata [14.9 kB]
Get:31 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/multiverse amd64 Packages [14.4 kB]
Get:32 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/multiverse Translation-en [3608 B]
Get:33 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/multiverse amd64 Components [212 B]
Get:34 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/multiverse amd64 c-n-f Metadata [532 B]
Get:35 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-backports/main amd64 Components [208 B]
Get:36 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-backports/main amd64 c-n-f Metadata [112 B]
Get:37 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-backports/universe amd64 Packages [10.6 kB]
Get:38 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-backports/universe Translation-en [10.8 kB]
Get:39 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-backports/universe amd64 Components [17.6 kB]
Get:40 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-backports/universe amd64 c-n-f Metadata [1104 B]
Get:41 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-backports/restricted amd64 Components [216 B]
Get:42 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-backports/restricted amd64 c-n-f Metadata [116 B]
Get:43 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-backports/multiverse amd64 Components [212 B]
```



```
ubuntu@ip-172-31-36-100: ~
ubuntu@ip-172-31-36-100: $ sudo apt install gcc -y
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  binutils binutils-common binutils-x86-64-linux-gnu cpp cpp-13 cpp-13-x86-64-linux-gnu cpp-x86-64-linux-gnu fontconfig-config fonts-dejavu-core fonts-dejavu-mono gcc-13 gcc-13-base
  gcc-13-x86-64-linux-gnu gcc-x86-64-linux-gnu libaom3 libasan8 libatomic1 libbinutils libc-dev-bin libc-devtools libc6-dev libcc1-0 libcrypt-dev libctf-nobfd0 libctf0 libde265-0
  libdeflate0 libfontconfig1 libgcc-13-dev libgd3 libgomp1 libgprofng0 libheif-plugin-aomdec libheif-plugin-aomenc libheif-plugin-libde265 libheif1 libhwasan0 libisl23 libitm1 libjbig0
  libjpeg-turbo8 libjpeg8 liblerc4 liblsan0 libmpc3 libquadmath0 libsframe1 libsharpyuv0 libtiff6 libtsan2 libubsan1 libwebp7 libxpm4 linux-libc-dev manpages-dev rpcsvc-proto
Suggested packages:
  binutils-doc gprofng-gui cpp-doc gcc-13-locales cpp-13-doc gcc-multilib make autoconf automake libtool flex bison gdb gcc-doc gcc-13-multilib gcc-13-doc gdb-x86-64-linux-gnu glibc-doc
  libgd-tools libheif-plugin-x265 libheif-plugin-ffmpegdec libheif-plugin-jpegdec libheif-plugin-jpegenc libheif-plugin-j2kdec libheif-plugin-j2kenc libheif-plugin-rav1e
  libheif-plugin-svtenc
The following NEW packages will be installed:
  binutils binutils-common binutils-x86-64-linux-gnu cpp cpp-13 cpp-13-x86-64-linux-gnu cpp-x86-64-linux-gnu fontconfig-config fonts-dejavu-core fonts-dejavu-mono gcc gcc-13 gcc-13-base
  gcc-13-x86-64-linux-gnu gcc-x86-64-linux-gnu libaom3 libasan8 libatomic1 libbinutils libc-dev-bin libc-devtools libc6-dev libcc1-0 libcrypt-dev libctf-nobfd0 libctf0 libde265-0
  libdeflate0 libfontconfig1 libgcc-13-dev libgd3 libgomp1 libgprofng0 libheif-plugin-aomdec libheif-plugin-aomenc libheif-plugin-libde265 libheif1 libhwasan0 libisl23 libitm1 libjbig0
  libjpeg-turbo8 libjpeg8 liblerc4 liblsan0 libmpc3 libquadmath0 libsframe1 libsharpyuv0 libtiff6 libtsan2 libubsan1 libwebp7 libxpm4 linux-libc-dev manpages-dev rpcsvc-proto
0 upgraded, 57 newly installed, 0 to remove and 6 not upgraded.
Need to get 62.8 MB of archives.
After this operation, 222 MB of additional disk space will be used.
Get:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 binutils-common amd64 2.42-4ubuntu2 [239 kB]
Get:2 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 libsframe1 amd64 2.42-4ubuntu2 [14.8 kB]
Get:3 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 libbinutils amd64 2.42-4ubuntu2 [572 kB]
Get:4 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 libctf-nobfd0 amd64 2.42-4ubuntu2 [97.1 kB]
Get:5 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 libctf0 amd64 2.42-4ubuntu2 [94.5 kB]
Get:6 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 libgprofng0 amd64 2.42-4ubuntu2 [851 kB]
Get:7 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 binutils-x86-64-linux-gnu amd64 2.42-4ubuntu2 [2469 kB]
Get:8 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 binutils amd64 2.42-4ubuntu2 [18.0 kB]
Get:9 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 gcc-13-base amd64 13.2.0-23ubuntu4 [49.0 kB]
Get:10 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 libisl23 amd64 0.26-3build1 [680 kB]
Get:11 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 libmpc3 amd64 1.3.1-1build1 [54.5 kB]
Get:12 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 cpp-13-x86-64-linux-gnu amd64 13.2.0-23ubuntu4 [11.2 MB]
Get:13 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 cpp-13 amd64 13.2.0-23ubuntu4 [1032 B]
Get:14 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 cpp-x86-64-linux-gnu amd64 4:13.2.0-7ubuntu1 [5326 B]
Get:15 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 cpp amd64 4:13.2.0-7ubuntu1 [22.4 kB]
Get:16 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 fonts-dejavu-mono all 2.37-8 [502 kB]
Get:17 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 fonts-dejavu-core all 2.37-8 [835 kB]
Get:18 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 fontconfig-config amd64 2.15.0-1.1ubuntu2 [37.3 kB]
Get:19 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 libcc1-0 amd64 14-20240412-0ubuntu1 [47.7 kB]
Get:20 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 libgomp1 amd64 14-20240412-0ubuntu1 [147 kB]
Get:21 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 libitm1 amd64 14-20240412-0ubuntu1 [28.9 kB]
```

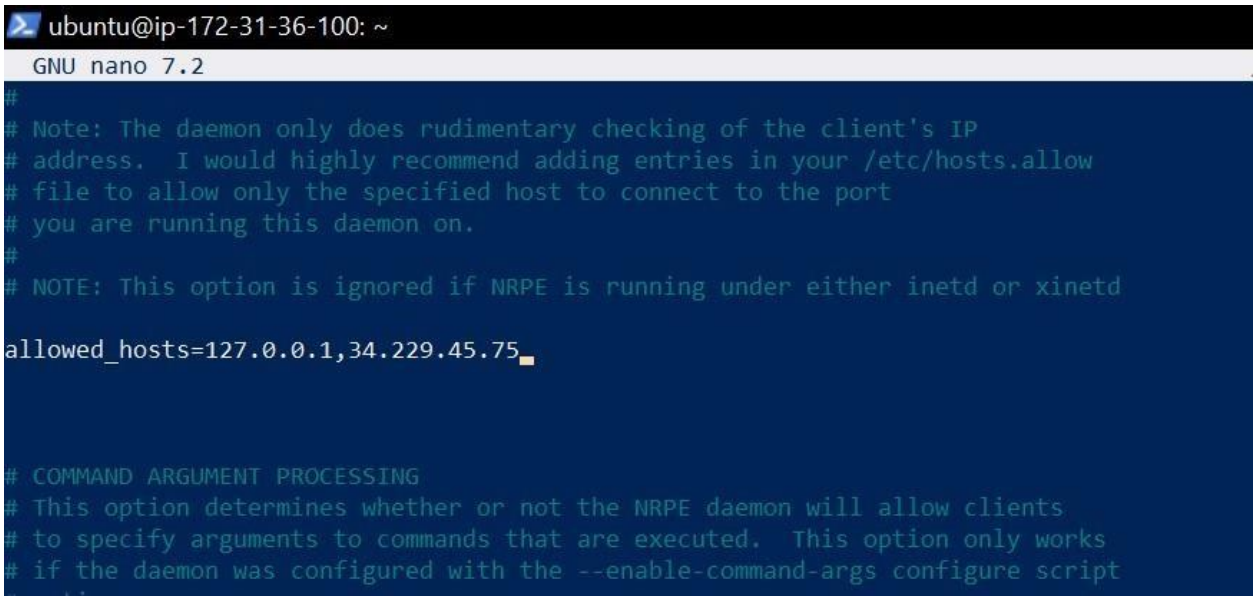


```
ubuntu@ip-172-31-36-100: ~
ubuntu@ip-172-31-36-100: $ sudo apt install -y nagios-nrpe-server nagios-plugins
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
Note, selecting 'monitoring-plugins' instead of 'nagios-plugins'
The following additional packages will be installed:
  libavahi-client3 libavahi-common-data libavahi-common3 libcups2t64 libdbi1t64 libldb2 libmysqlclient21 libnet-snmp-perl libpq5 libradcli4 libsmbclient0 libsnmp-base libsnmp40t64
  libtalloc2 libtdb1 libtevent0t64 liburiparser1 libwbclient0 monitoring-plugins-basic monitoring-plugins-common monitoring-plugins-standard mysql-common python3-gpg python3-ldb
  python3-markdown python3-samba python3-talloc python3-tdb rpcbind samba-common samba-common-bin samba-dsdb-modules samba-libs smbclient snmp
Suggested packages:
  cups-common libcrypt-des-perl libdigest-hmac-perl libio-socket-inet6-perl snmp-mibs-downloader icinga2 nagios-plugins-contrib fping postfix | sendmail-bin | exim4-daemon-heavy
  | exim4-daemon-light qstat xinetd | inetd python-markdown-doc heimdal-clients python3-dnspython cifs-utils
The following NEW packages will be installed:
  libavahi-client3 libavahi-common-data libavahi-common3 libcups2t64 libdbi1t64 libldb2 libmysqlclient21 libnet-snmp-perl libpq5 libradcli4 libsmbclient0 libsnmp-base libsnmp40t64
  libtalloc2 libtdb1 libtevent0t64 liburiparser1 libwbclient0 monitoring-plugins monitoring-plugins-basic monitoring-plugins-common monitoring-plugins-standard mysql-common
  nagios-nrpe-server python3-gpg python3-ldb python3-markdown python3-samba python3-talloc python3-tdb rpcbind samba-common samba-common-bin samba-dsdb-modules samba-libs smbclient snmp
0 upgraded, 37 newly installed, 0 to remove and 6 not upgraded.
Need to get 16.1 MB of archives.
After this operation, 72.0 MB of additional disk space will be used.
Get:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/universe amd64 nagios-nrpe-server amd64 4.1.0-1ubuntu3 [356 kB]
Get:2 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 rpcbind amd64 1.2.6-7ubuntu2 [46.5 kB]
Get:3 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 libavahi-common-data amd64 0.8-13ubuntu6 [29.7 kB]
Get:4 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 libavahi-common3 amd64 0.8-13ubuntu6 [23.3 kB]
Get:5 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 libavahi-client3 amd64 0.8-13ubuntu6 [26.8 kB]
Get:6 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/main amd64 libcups2t64 amd64 2.4.7-1.2ubuntu7.3 [272 kB]
Get:7 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 libdbi1t64 amd64 0.9.0-6.1build1 [25.7 kB]
Get:8 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 libtalloc2 amd64 2.4.2-1build2 [27.3 kB]
Get:9 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 libtdb1 amd64 1.4.10-1build1 [46.8 kB]
Get:10 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 libtevent0t64 amd64 0.16.1-2build1 [42.6 kB]
Get:11 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 libldb2 amd64 2:2.8.0+samba4.19.5+dfsg-4ubuntu9 [187 kB]
Get:12 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 mysql-common all 5.8+1.1.0build1 [6746 B]
Get:13 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/main amd64 libmysqlclient21 amd64 8.0.39-0ubuntu0.24.04.2 [1254 kB]
Get:14 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 libnet-snmp-perl all 6.0.1-7 [86.8 kB]
Get:15 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/main amd64 libpq5 amd64 16.4-0ubuntu0.24.04.2 [141 kB]
Get:16 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/universe amd64 libradcli4 amd64 1.2.11-1build3 [40.5 kB]
Get:17 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 libwbclient0 amd64 2:4.19.5+dfsg-4ubuntu9 [70.6 kB]
Get:18 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 samba-libs amd64 2:4.19.5+dfsg-4ubuntu9 [6017 kB]
Get:19 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 libsmbclient0 amd64 2:4.19.5+dfsg-4ubuntu9 [62.4 kB]
Get:20 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 libsnmp-base all 5.9.4+dfsg-1.1ubuntu3 [206 kB]
Get:21 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 libsnmp40t64 amd64 5.9.4+dfsg-1.1ubuntu3 [1066 kB]
Get:22 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/universe amd64 liburiparser1 amd64 0.9.7+dfsg-2build1 [35.8 kB]
Get:23 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 python3-gpg amd64 1.18.0-4.1ubuntu4 [209 kB]
Get:24 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 python3-ldb amd64 2:2.8.0+samba4.19.5+dfsg-4ubuntu9 [41.8 kB]
Get:25 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 python3-markdown all 3.5.2-1 [72.0 kB]
```

Open nrpe.cfg file to make changes. **sudo**

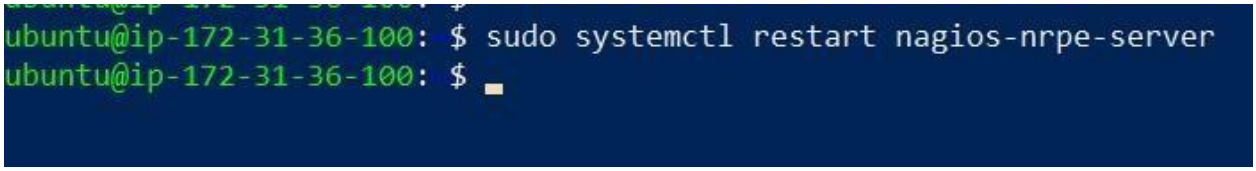
nano /etc/nagios/nrpe.cfg

Under allowed_hosts, add your nagios host IP address like so



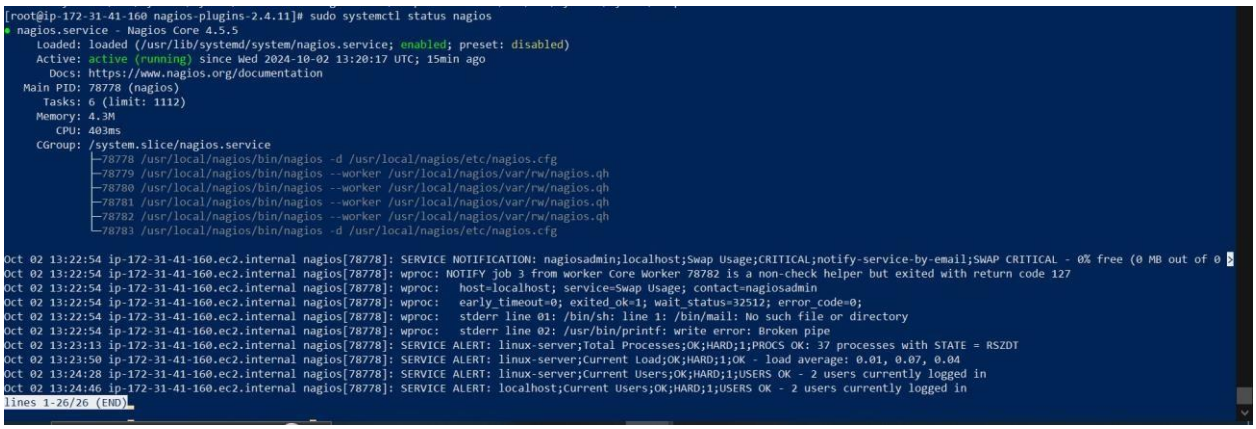
Now restart the NRPE server by this command. **sudo**

systemctl restart nagios-nrpe-server



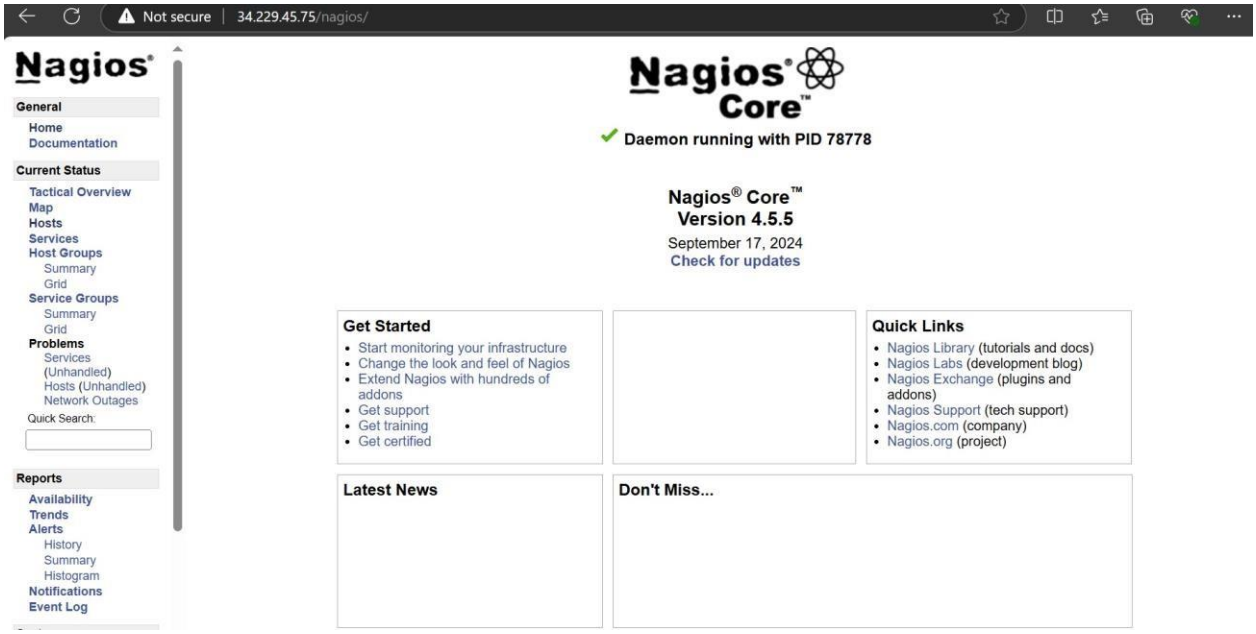
Run the following command in the Nagios-host terminal **sudo**

systemctl status nagios

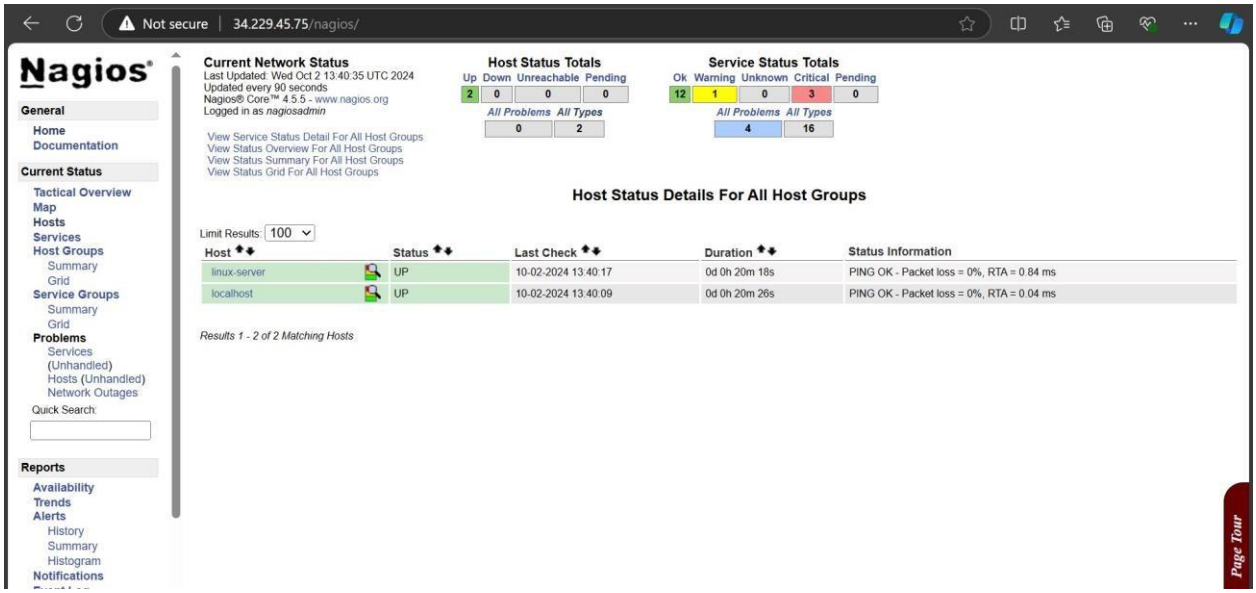


Step 5: Visiting your nagios server using your nagios-host ip address Open up your browser and look for http://<public_ip_address_of_nagios-host>/nagios

Name:Aditya Ahuja Div: D15C Roll No: 02

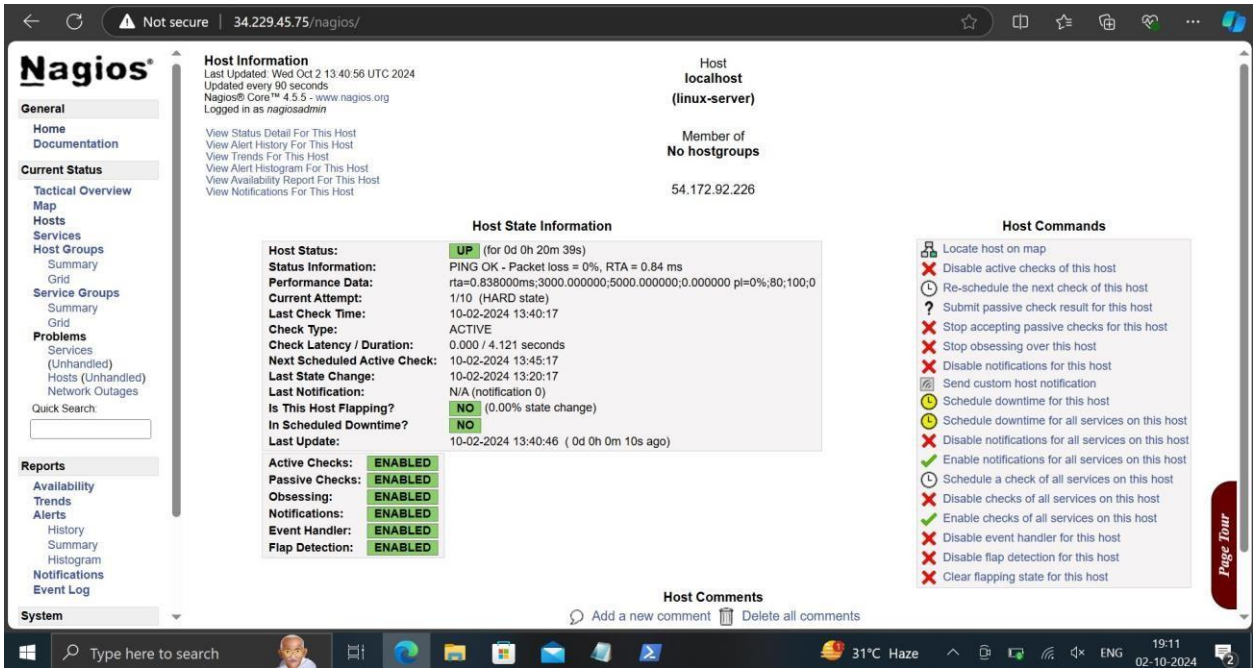


Click on Hosts.

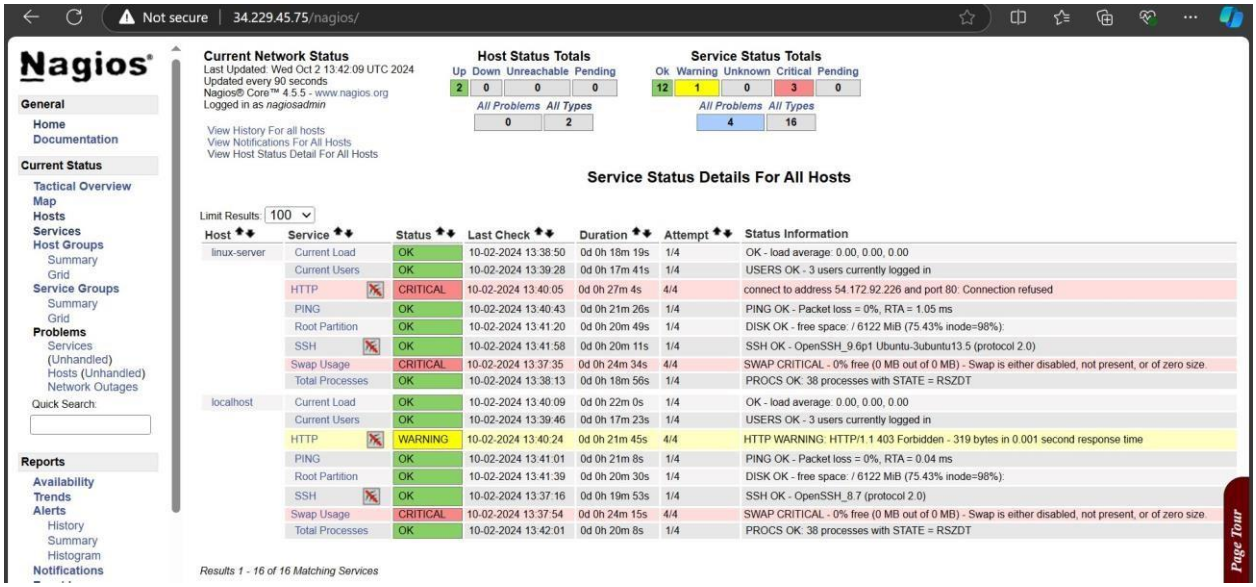


Click on linux-server to view host information

Name:Aditya Ahuja Div: D15C Roll No: 02



We can even navigate to the services section, which explicitly mentions the status, duration, checks, information about the numerous services present on our hosts



Conclusion: In conclusion, the experiment focused on monitoring ports, services, and a Linux server using Nagios. Through the step-by-step process, we successfully configured Nagios to monitor essential network services on the Linux server. By setting up both the Nagios host and client, we were able to track system performance, ensure service availability, and monitor key metrics like CPU and memory usage

Name:Aditya Ahuja Div:D15C Roll no:02

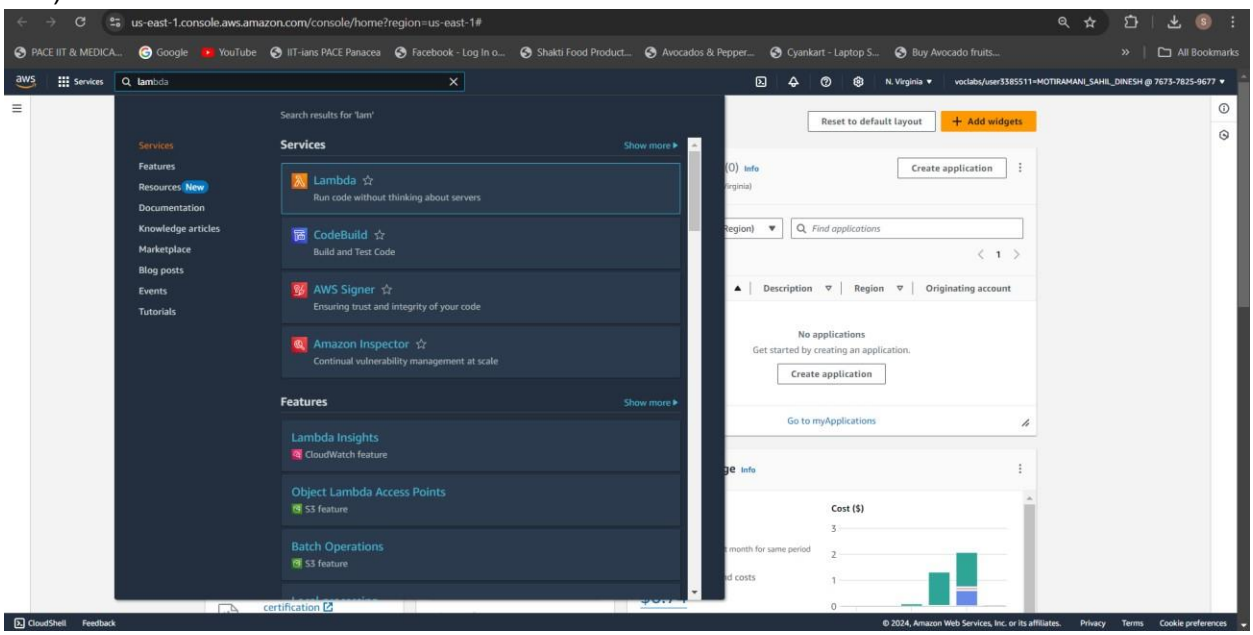
Aim: To understand AWS Lambda, its workflow, various functions and create your first Lambda functions using Python / Java / Nodejs.

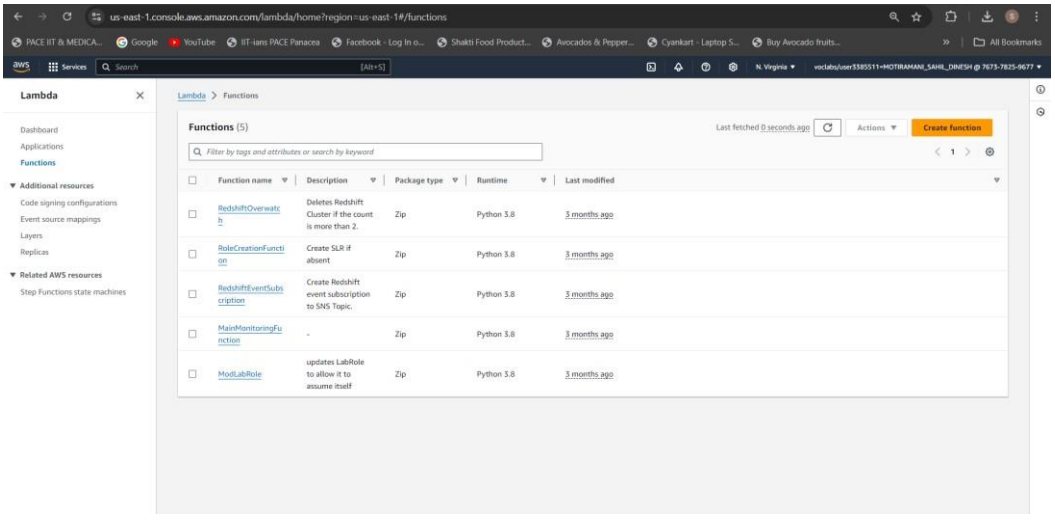
Prerequisites:

1) AWS account (academy recommended)

Step 1: Set up AWS Lambda Function

1) Search for Lambda in the services tab. Click on it once found.





2) Click on create functions.

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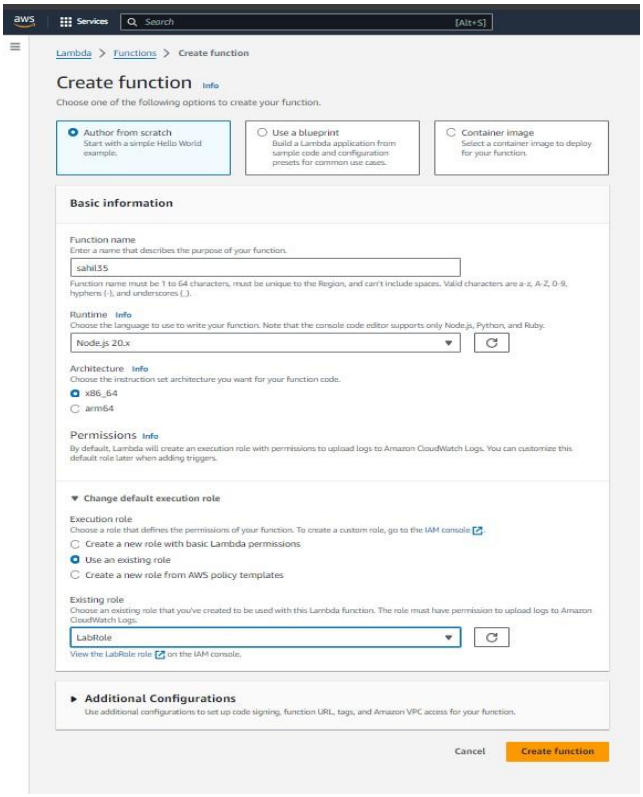
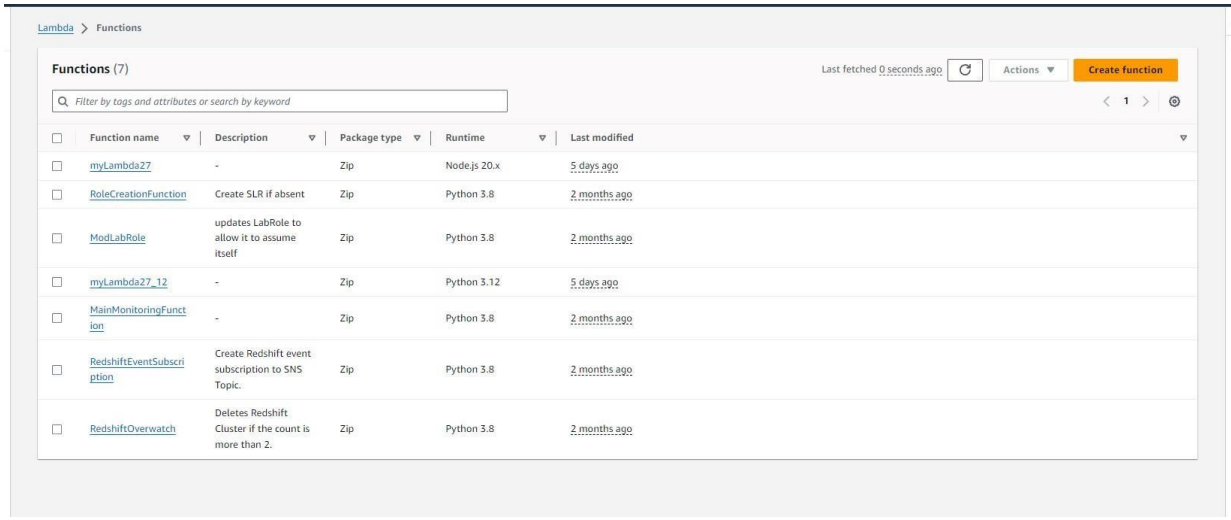
3) Give a name to your Lambda function. Select the runtime as Node.js 20.x (You can also use python). Select the architecture as x86_64. Set the default execution role as LabRole if you are doing this on your academy account. (Use an existing role → LabRole)



4) Once the function is created, click on the name of the function (myLambda27 in my case).



5) This is the dashboard of our lambda function.

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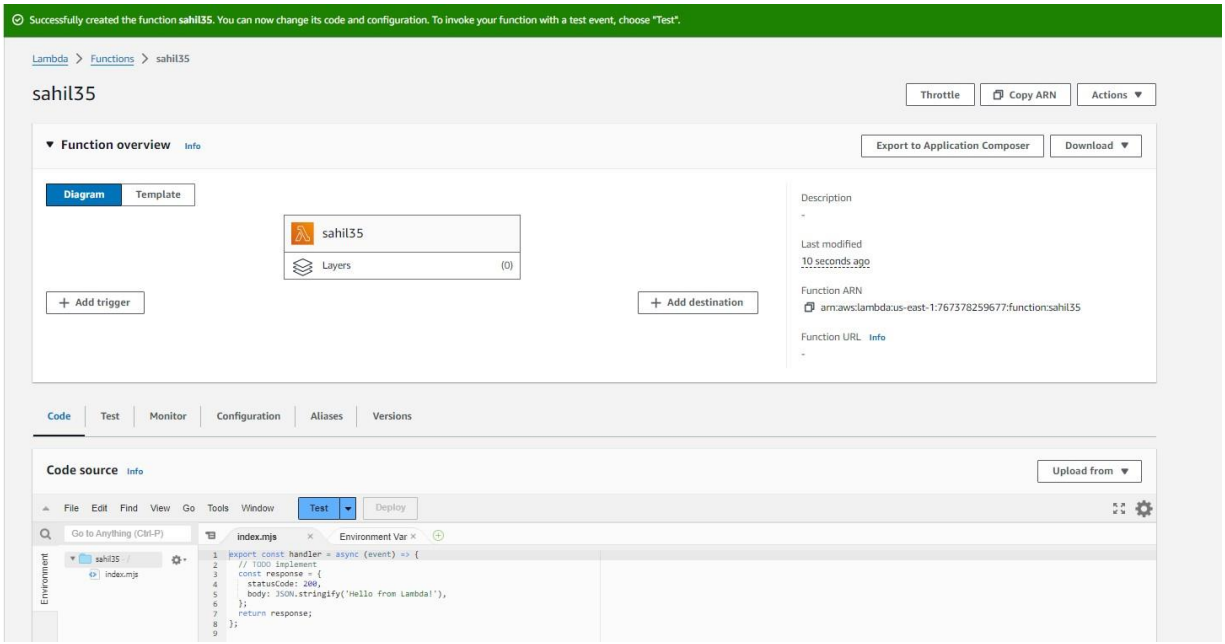
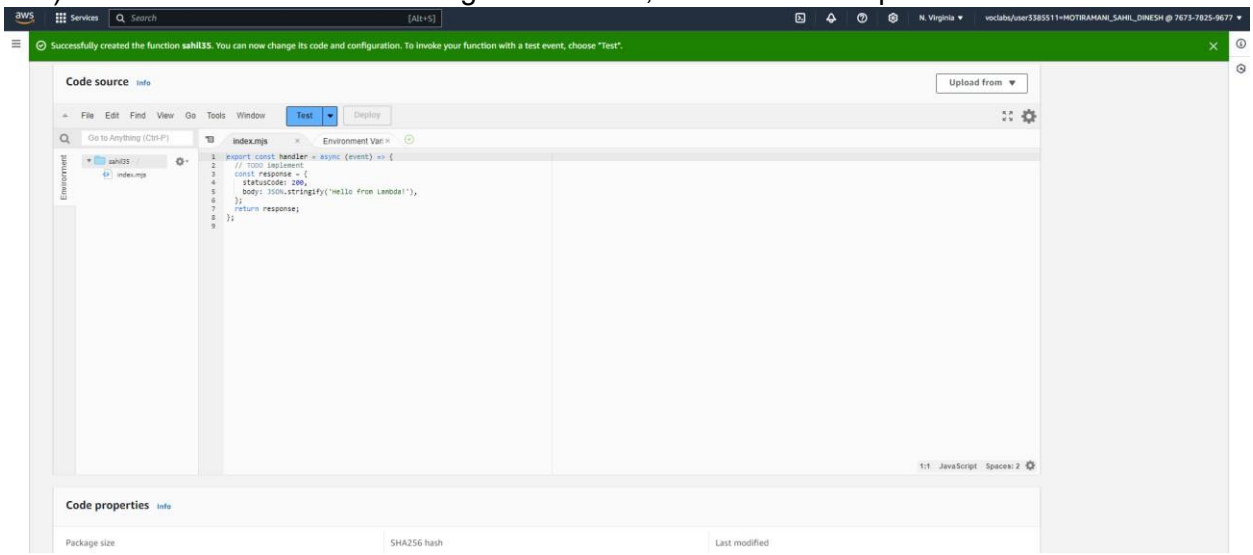


6) This function has the following default code, which is used to print “Hello form Lambda!”.



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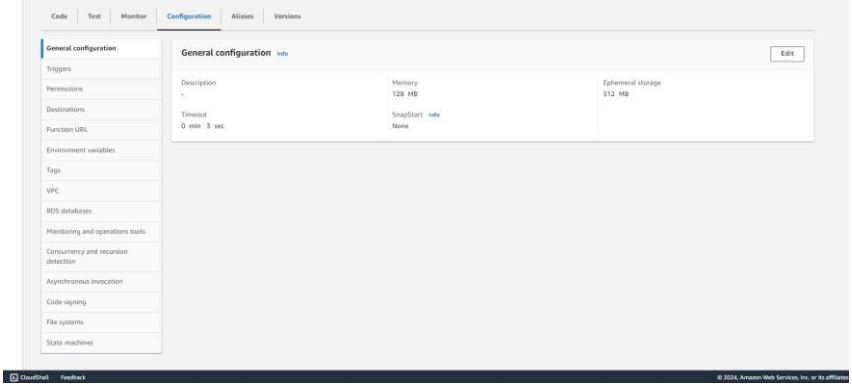
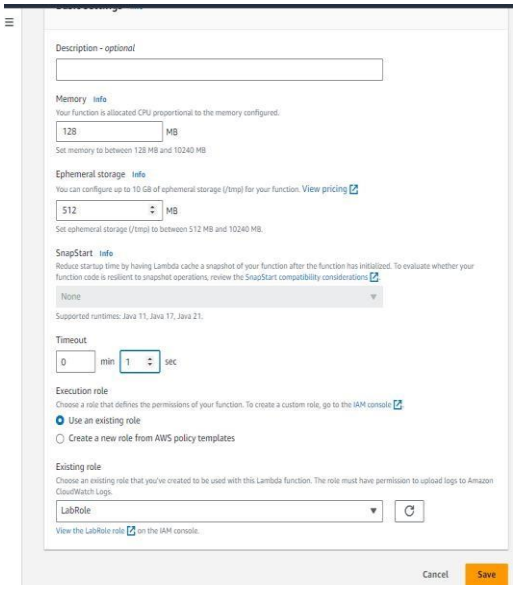
Step 3: Set up configurations and test events

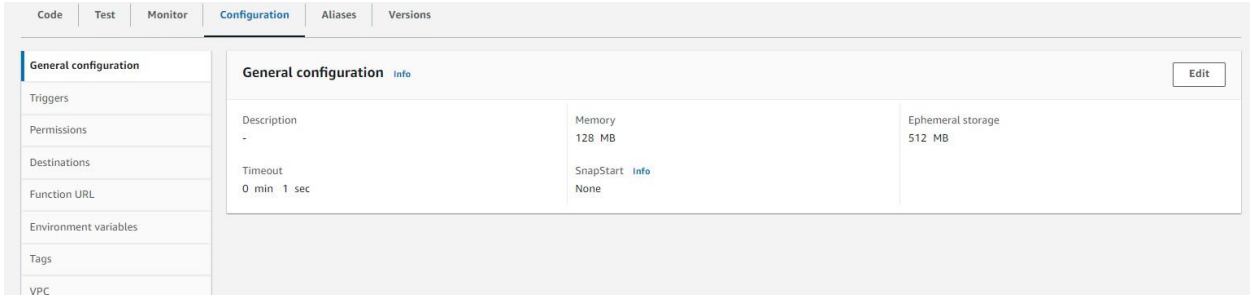
1) Just above the test code, you would find Configuration, click on it. Then click on Edit.



2) Here, change the Timeout to 1 sec. This is the time for which the function can be running before it is forcibly terminated.



3) We can see the executed changes.



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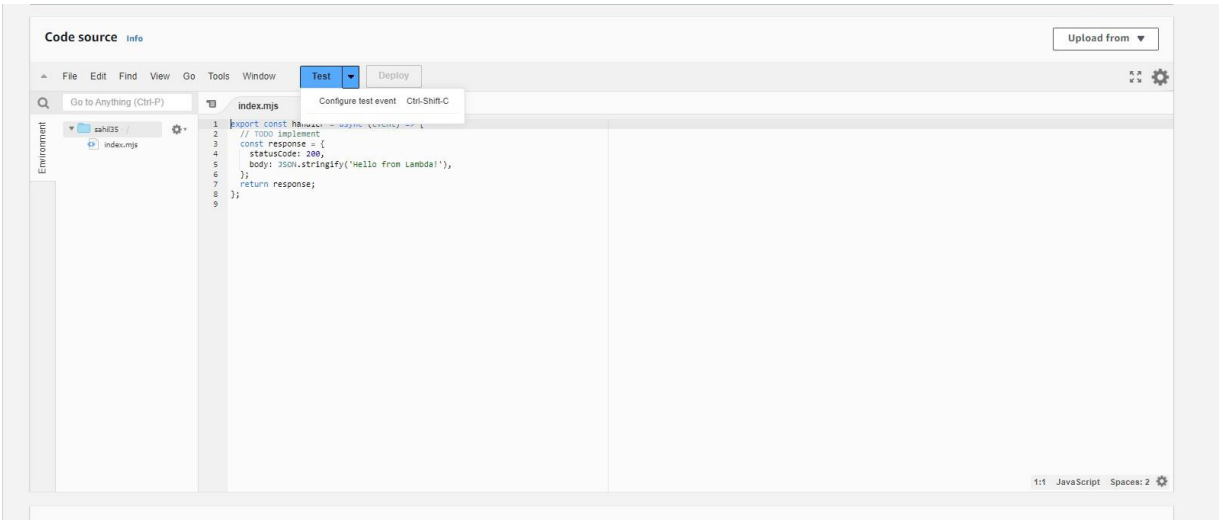
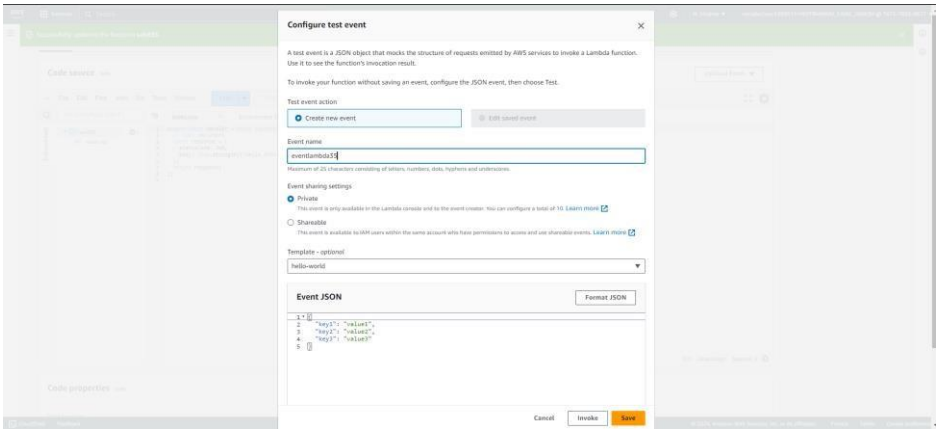
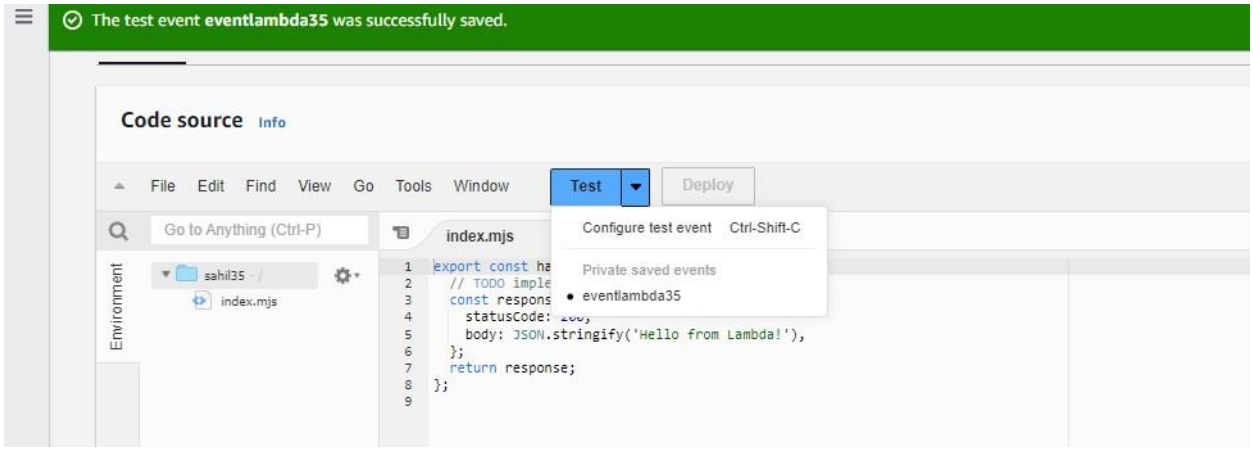
4) Switch back to the code tab. Click on the dropdown arrow near test. Then select configure test event.



5) Here, create a new event, keep the other options default and save the event.



6) Now, again click on the dropdown. This time, select the event you have created. Then, click on TEST.



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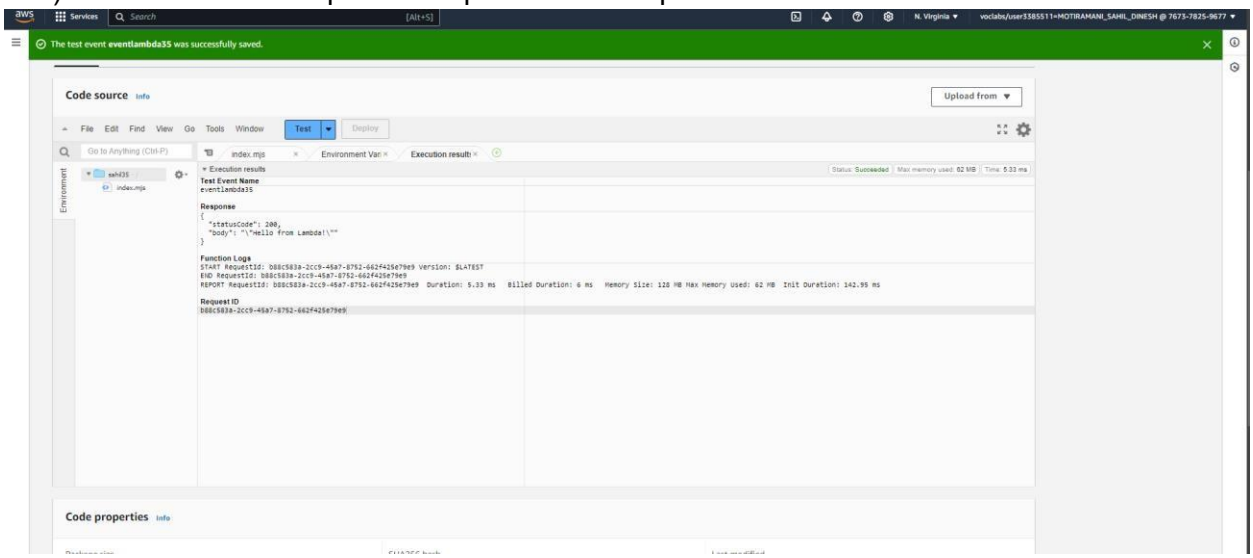
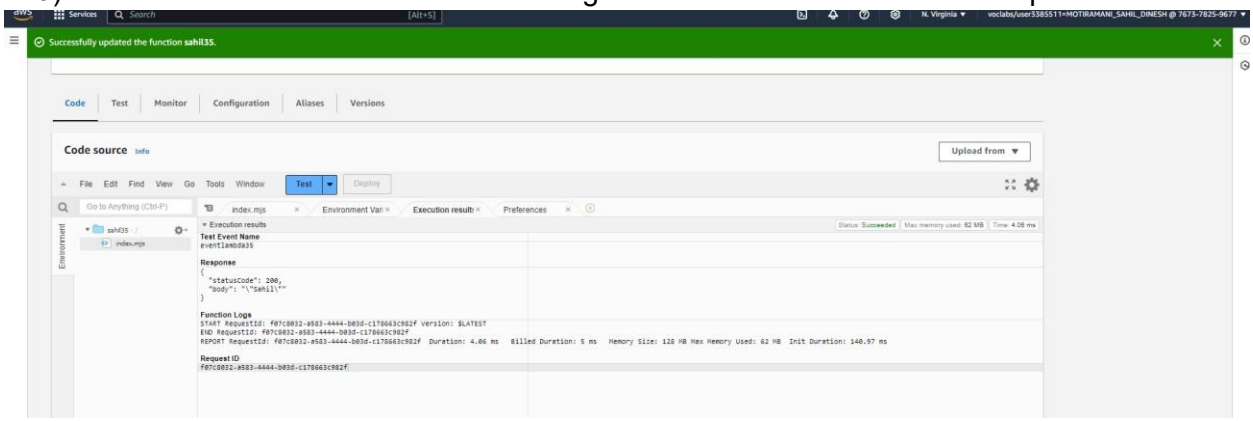
7) We can see the expected output for the sample code.



8) For a test, declare a string and call it in line 6. After making the changes click on deplpoy.

9) Run the test. We can see that the string we declared has come in the output.



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Conclusion:

In this experiment, we effectively investigated the AWS Lambda service by developing and configuring Lambda functions using Python, Java, or Node.js. We discovered how to establish a Lambda function, tweak its settings (like modifying the timeout duration), and evaluate the function with personalized events. Throughout this experience, we noted how Lambda manages executions, including timeout handling and producing expected results according to modifications in the code.

Name:Aditya Ahuja Div:D15C Roll No:02

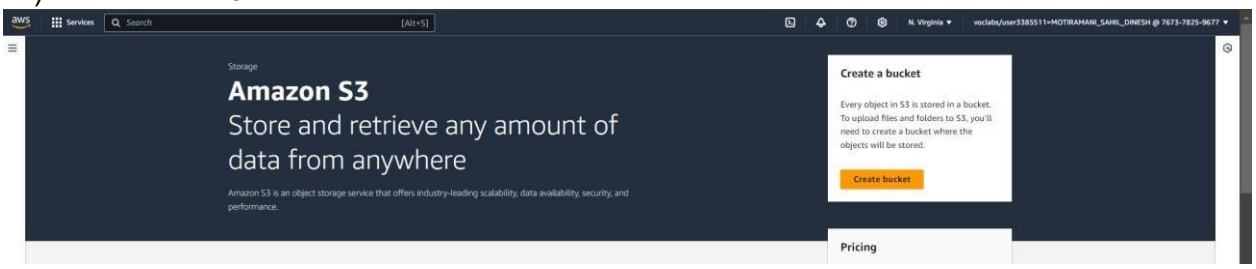
Aim: To create a Lambda function which will log “An Image has been added” once you add an object to a specific bucket in S3.

Prerequisites:

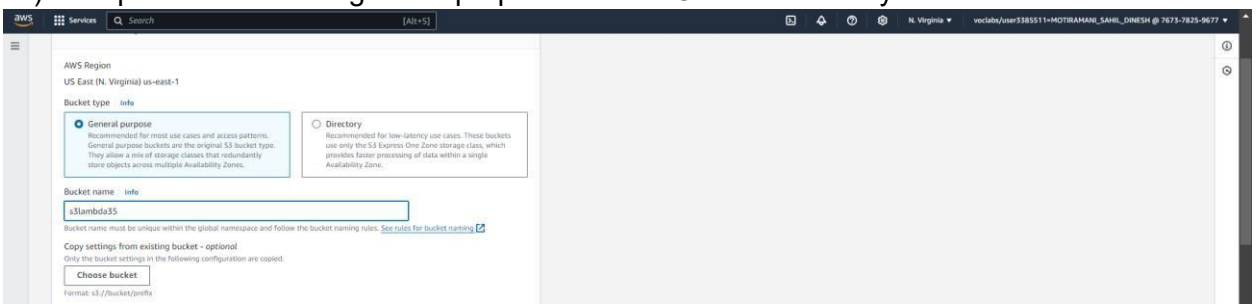
1) AWS account (acacdemy preferable)
2) Lambda function (created in the previous experiment).

Step 1: Create a s3 bucket.

1) Search for S3 bucket in the services search. Then click on create bucket.

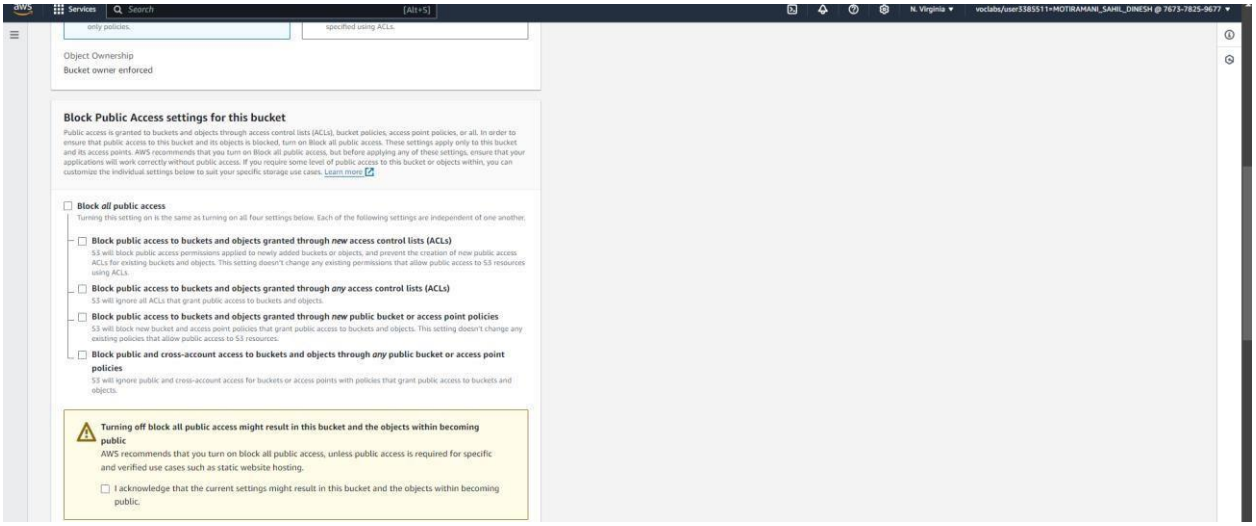


2) Keep the bucket as a general purpose bucket. Give a name to your bucket.

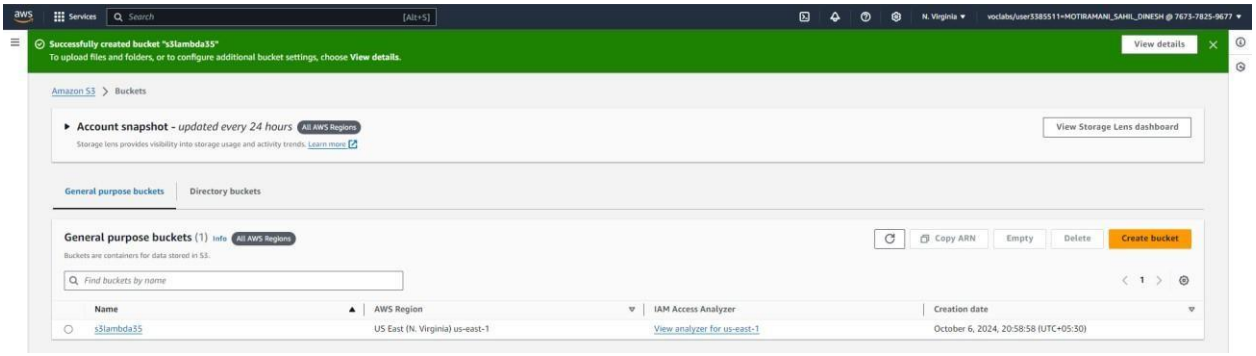


3) Uncheck block all public access.

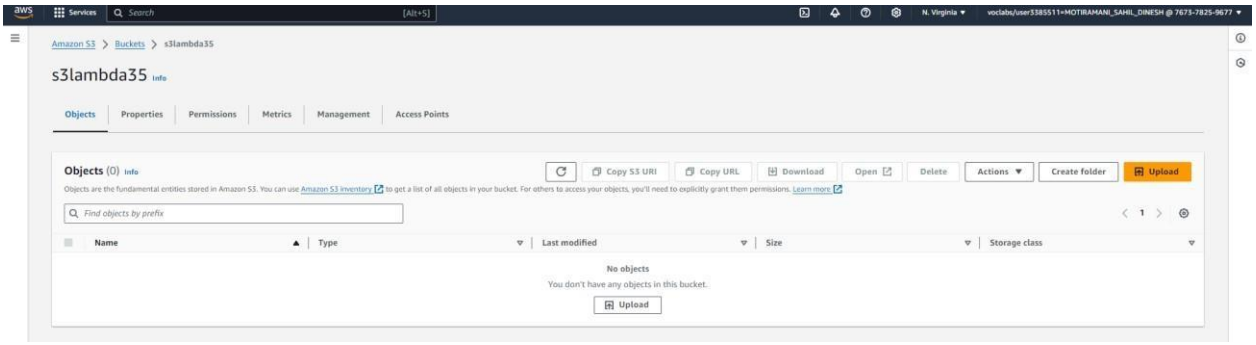
Name:Aditya Ahuja Div:D15C Roll No:02



4) Keeping all other options same, click on create. This would create your bucket. Now click on the name of the bucket.

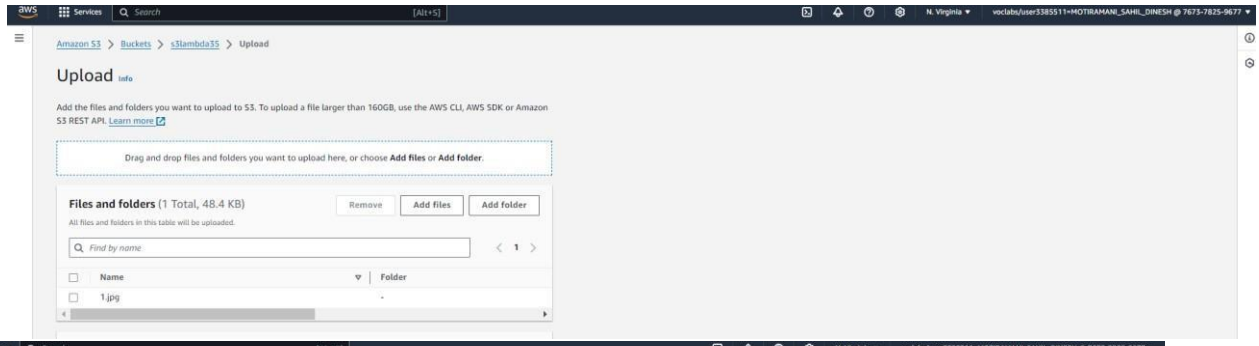


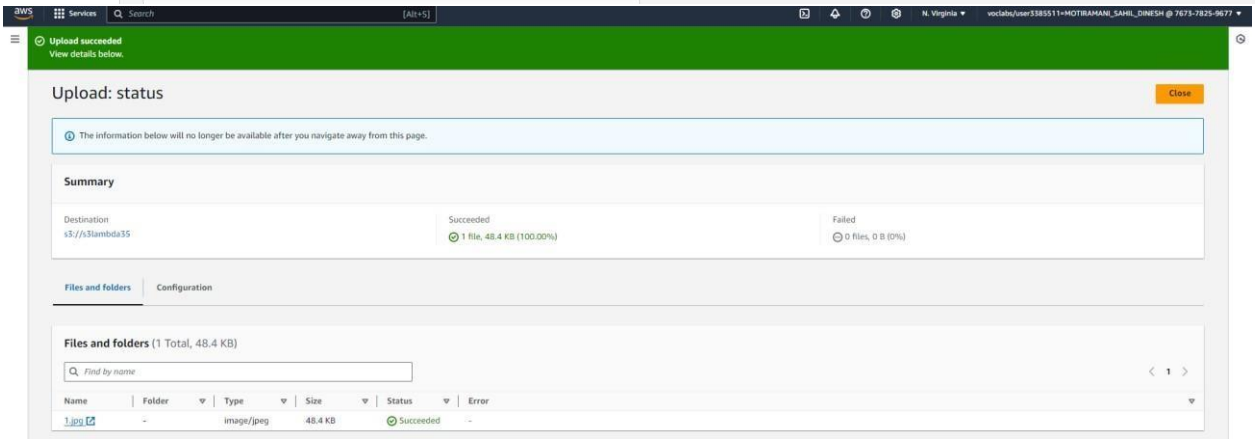
5) Here, click on upload, then add files. Select any image that you want to upload in the bucket and click on upload.



6) The image has been uploaded to the bucket.

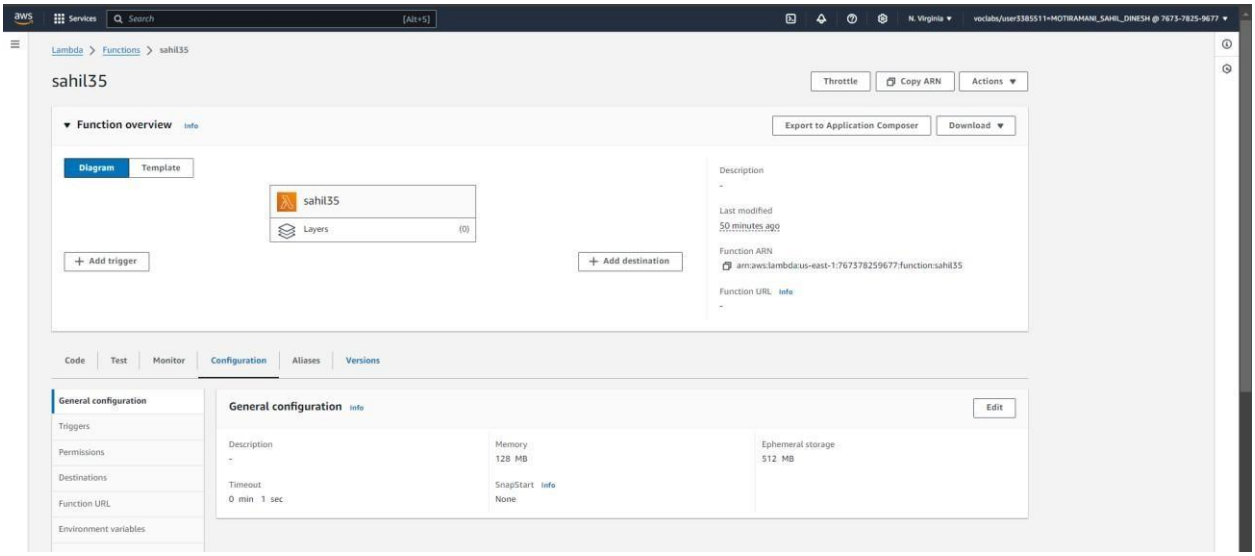
Name:Aditya Ahuja Div:D15C Roll No:02





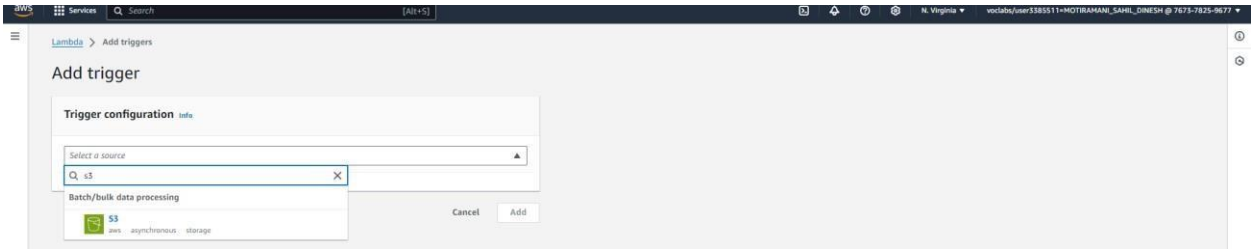
Step 2: Configure Lambda function

1) Go to the lambda function you had created berfor. (Services → Lambda → Click on name of function). Here, click on add trigger.



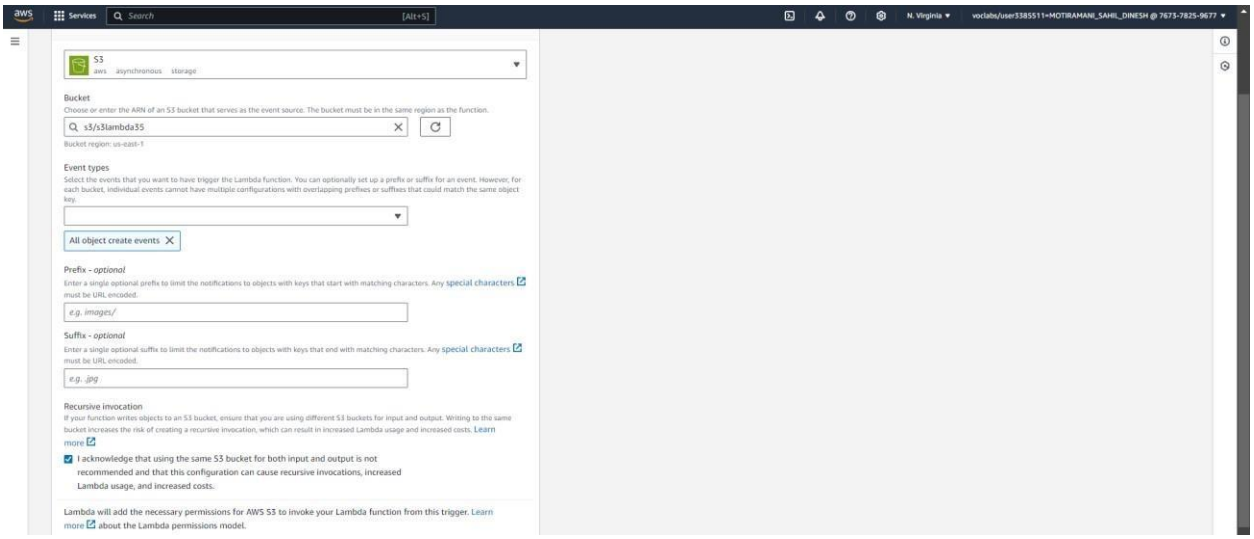
Name:Aditya Ahuja Div:D15C Roll No:02

2) Under trigger configuration, search for S3 and select it.



Name:Aditya Ahuja Div :D15C Roll no:02

Here, select teh S3 bucket you created for this experiment. Acknowledge the condition given by AWS. then click on Add. This will add the S3 bucket trigger to your function.



Scroll down to the code section of the function. Add the following javascript code to the code area by replacingthe existing code.

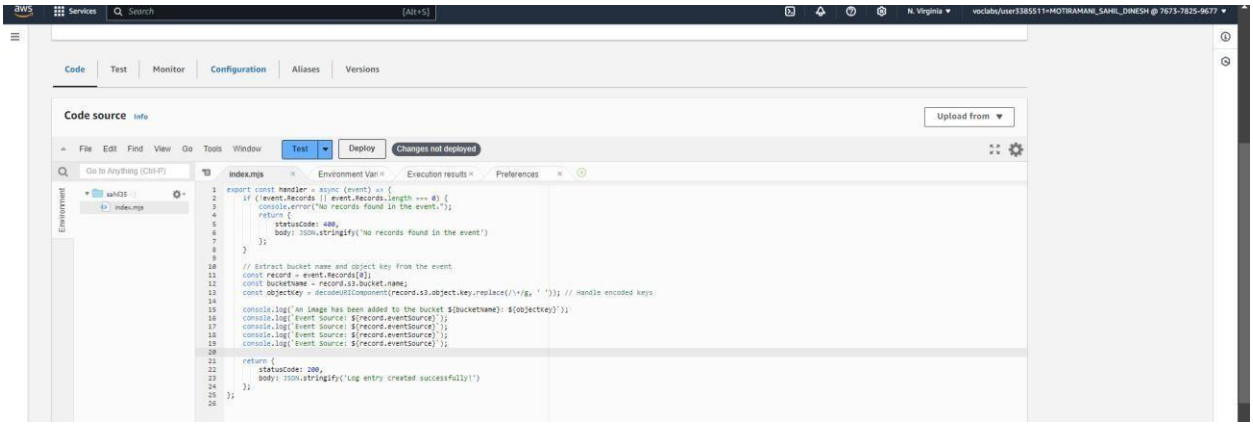
```
export const handler = async (event) => { if
   (!event.Records || event.Records.length === 0) {
   console.error("No records found in the event.");  return
   { statusCode: 400, body: JSON.stringify('No records
         found in the event')
      };
   }

   // Extract bucket name and object key from the event const record = event.Records[0]; const
   bucketName = record.s3.bucket.name; const objectKey =
   decodeURIComponent(record.s3.object.key.replace(/\+/g, ' ')); // Handle
encoded keys

   console.log(`An image has been added to the bucket ${bucketName}: ${objectKey}`);
   console.log(`Event Source: ${record.eventSource}`); console.log(`Event Source:
   ${record.eventSource}`); console.log(`Event Source: ${record.eventSource}`);
   console.log(`Event Source: ${record.eventSource}`); return
```

```
    {
        statusCode: 200, body: JSON.stringify('Log entry
        created successfully!')
    };
};
```

This code checks for records in the event, extracts the bucket name and object key, logs the details, and returns a success message if an image is added to the bucket.



Now, click on the dropdown near test, then click on configure test event.

6) Here, select edit saved event. Select the event taht you had created before. Under Event JSON, paste the following code.

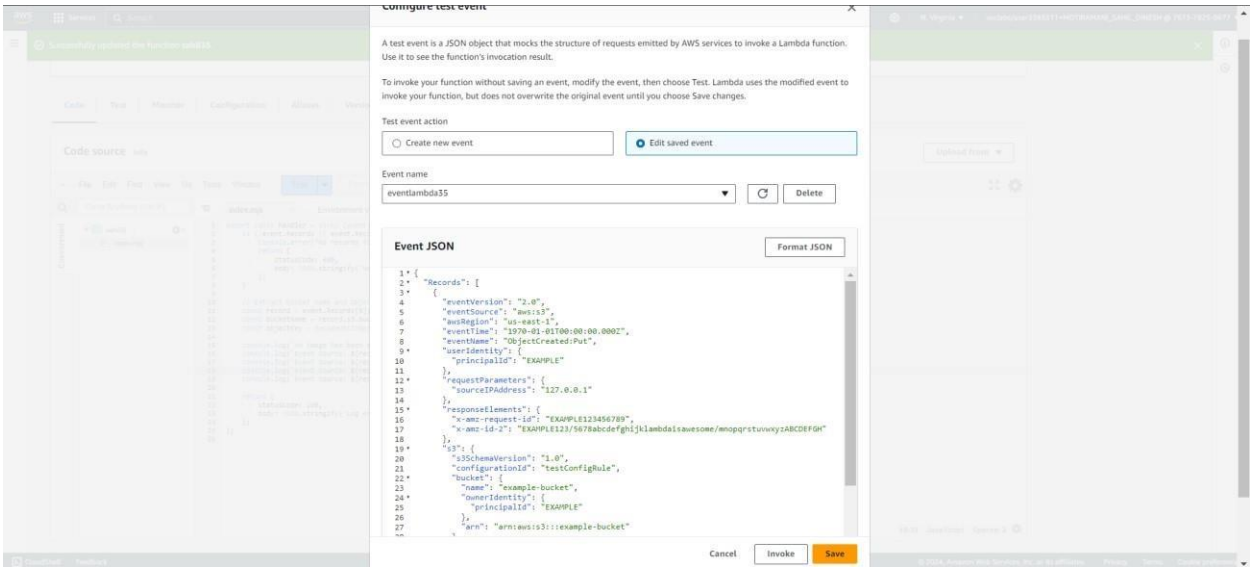
```
{
  "Records": [
    {
      "eventVersion": "2.0",
      "eventSource": "aws:s3",
      "awsRegion": "us-east-1",
      "eventTime": "1970-01-01T00:00:00.000Z",
      "eventName": "ObjectCreated:Put",
      "userIdentity": {
```

```
      "principalId": "EXAMPLE"
    },
    "requestParameters": {
      "sourceIPAddress": "127.0.0.1"
    },
    "responseElements": {
      "x-amz-request-id": "EXAMPLE123456789", "x-amz-id-
      2":
"EXAMPLE123/5678abcdefghijklambdaisawesome/mnopqrstuvwxyzABCDEFGH"
    },
    "s3": {
      "s3SchemaVersion": "1.0",
      "configurationId": "testConfigRule",

"bucket": {
        "name": "example-bucket", "ownerIdentity":
        {
          "principalId": "EXAMPLE"
        },
        "arn": "arn:aws:s3:::example-bucket"
      },
      "object": {
        "key": "test%2Fkey",
        "size": 1024,
        "eTag": "0123456789abcdef0123456789abcdef",  "sequencer":
        "0A1B2C3D4E5F678901"
      }
    }
   }
 ]
```

}

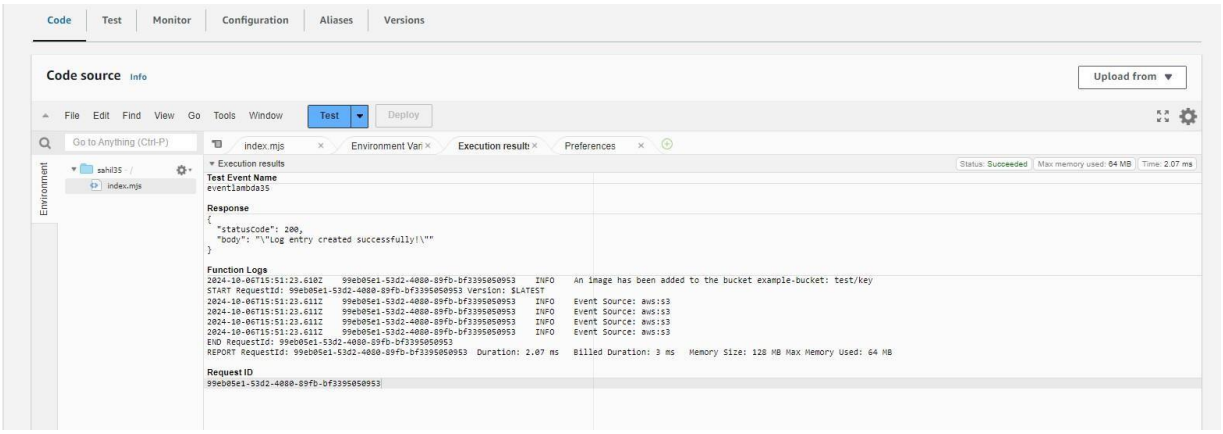
This JSON structure represents an S3 event notification triggered when an object is uploaded to an S3 bucket. It contains details about the event, including the bucket name (example-bucket), the object key (test/key), and metadata like the object's size, the event source (aws:s3), and the event time.



Save the changes. Then deploy the code changes by clicking on deploy.

7) After deploying, click on Test. The console output shows that ‘an image has been added to the bucket’

The JSON response shows that the log entry was created successfully.



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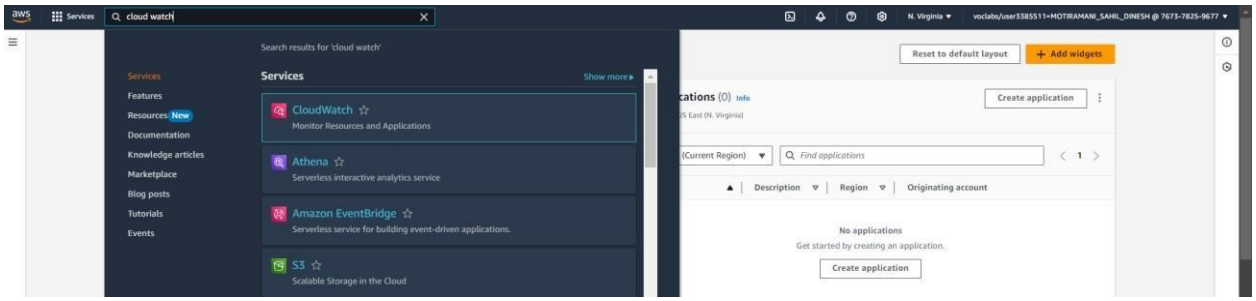
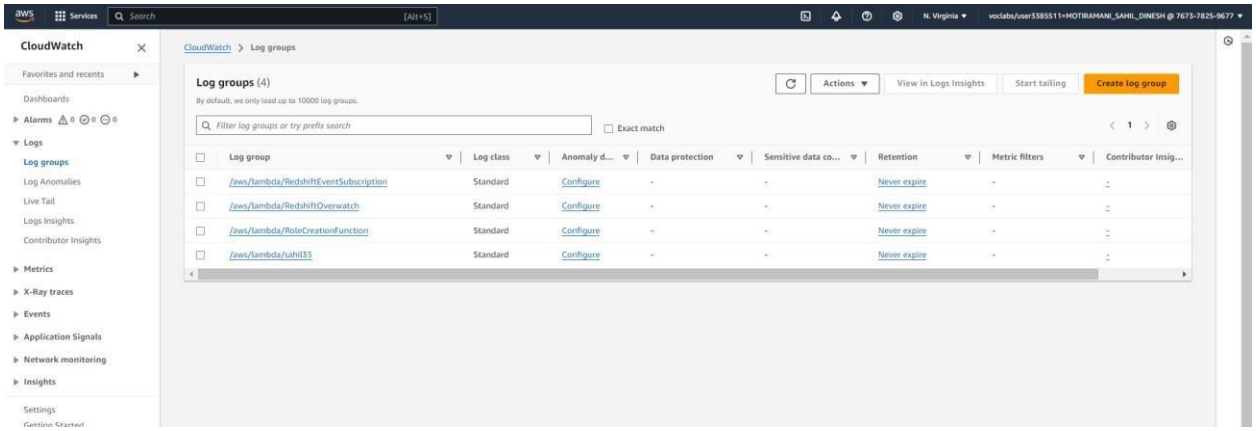
Step 3: Check the logs

1) To check the logs explicitly, search foe CloudWatch on services and open it in a new tab.



2) Here, Click on Logs → Log Groups. Select the log that has the lambda function name you just ran.



3) Here, under Log streams, select the log stream you want to check.

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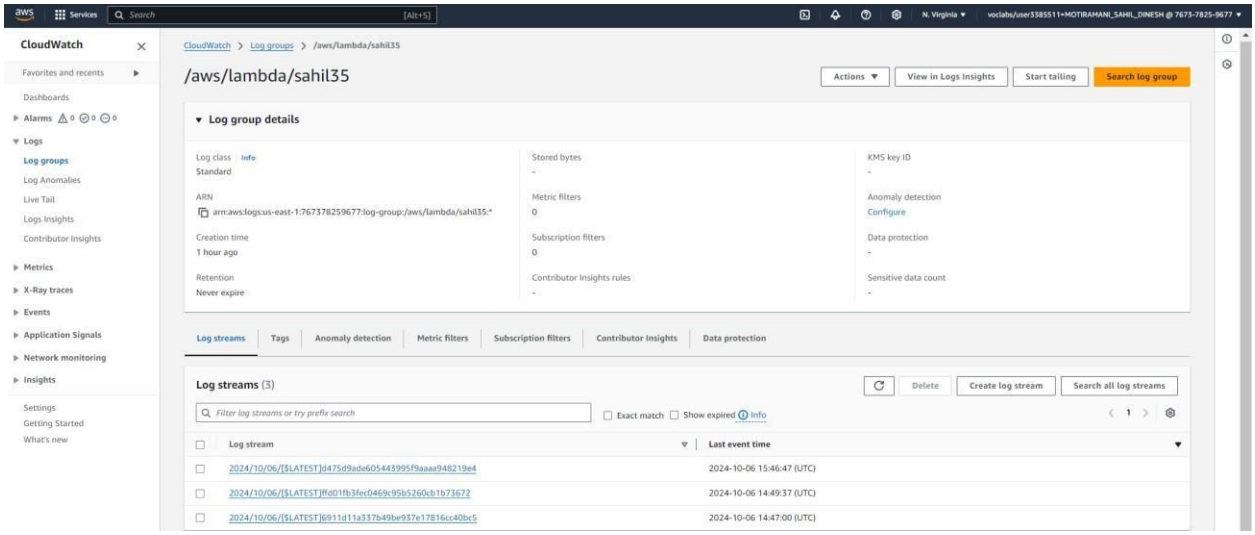
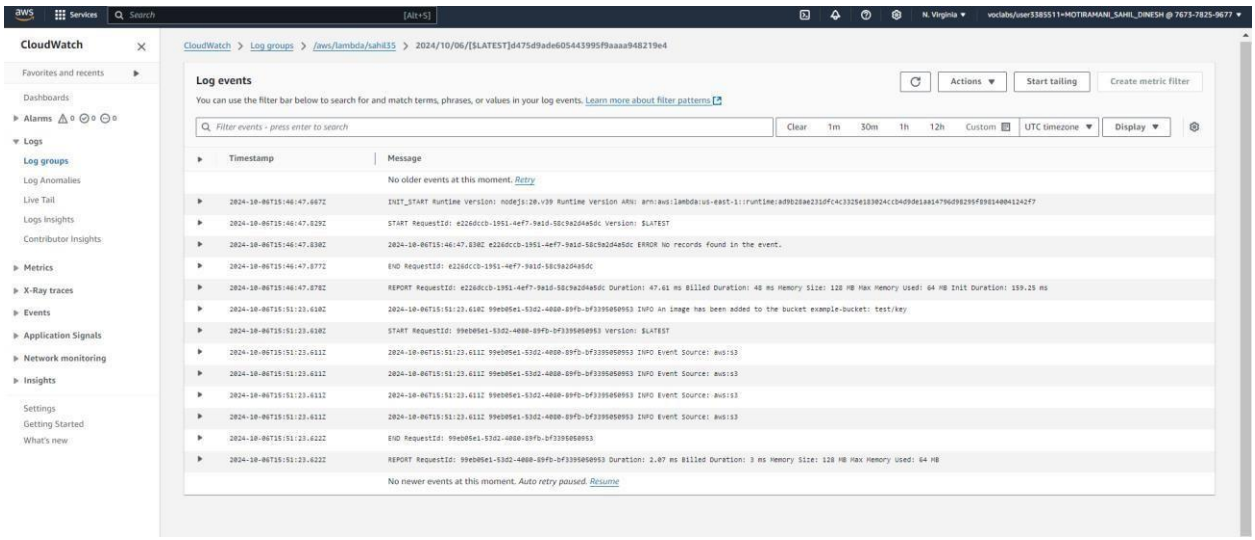


4) Here again, we can see that ‘An image has been added to the bucket’.



Conclusion:

In this experiment, we developed and deployed a Lambda function designed to respond to file uploads in an S3 bucket. The function was triggered automatically whenever a new object was added to the bucket, illustrating how AWS services can efficiently automate workflows. The Lambda function extracted and logged key details from the event, such as the bucket's name and the object's key. We tested this by uploading a sample file, and upon reviewing the logs in CloudWatch, we confirmed that the function executed successfully, capturing the upload event.

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This experiment demonstrated the powerful synergy between AWS Lambda and S3, enabling seamless, event-driven automation.