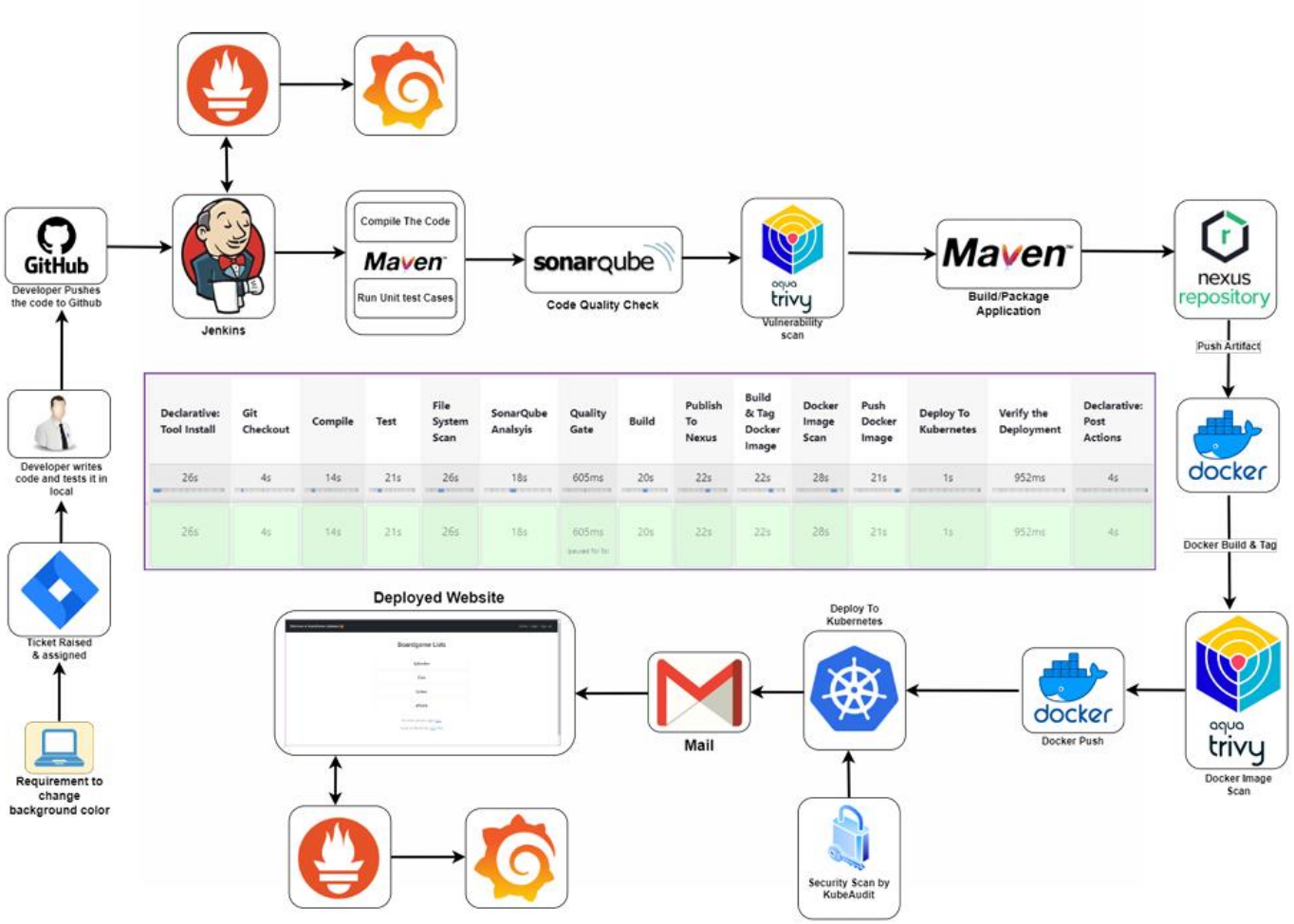
CI/CD
DEVOPS PIPELINE PROJECT
Deployment of Java Application on Kubernetes

Introduction

In the rapidly evolving landscape of software development, the adoption of DevOps practices has become imperative for organizations striving for agility, efficiency, and quality in their software delivery processes. The project at hand focuses on the implementation of a robust DevOps Continuous Integration/Continuous Deployment (CI/CD) pipeline, orchestrated by Jenkins, to streamline the development, testing, and deployment phases of a software product.

Architecture



Purpose and Objectives

The primary purpose of this project is to automate the software delivery lifecycle, from code compilation to deployment, thereby accelerating time-to-market, enhancing product quality, and reducing manual errors. The key objectives include:

- Establishing a seamless CI/CD pipeline using Jenkins to automate various stages of the software delivery process.
- Integrating essential DevOps tools such as Maven, SonarQube, Trivy, Nexus Repository, Docker, Kubernetes, Prometheus, and Grafana to ensure comprehensive automation and monitoring.
- Improving code quality through static code analysis and vulnerability scanning.
- Ensuring reliable and consistent deployments on a Kubernetes cluster with proper load balancing.
- Facilitating timely notifications and alerts via email integration for efficient communication and incident management.
- Implementing robust monitoring and alerting mechanisms to track system health and performance.

Tools Used

1.**Jenkins**: Automation orchestration for CI/CD pipeline.
2. **Maven**: Build automation and dependency management.
3. **SonarQube**: Static code analysis for quality assurance.
4**. Trivy**: Vulnerability scanning for Docker images.
5. **Nexus Repository**: Artifact management and version control.
6. **Docker**: Containerization for consistency and portability.
7. **Kubernetes**: Container orchestration for deployment.
8. **Gmail Integration**: Email notifications for pipeline status.
9. **Prometheus and Grafana**: Monitoring and visualization of system metrics.
10.**AWS** : Creating virtual machines .

SEGMENT 1 :
1.Setting up Virtual Machines on AWS

To establish the infrastructure required for the DevOps tools setup, virtual machines were provisioned on the Amazon Web Services (AWS) platform. Each virtual machine served a specific purpose in the CI/CD pipeline. Here's an overview of the virtual machines created for different tools:

1. **Kubernetes Master Node:** This virtual machine served as the master node in the Kubernetes cluster. It was responsible for managing the cluster's state, scheduling applications, and coordinating communication between cluster nodes.

2. **Kubernetes Worker Node 1 and Node 2**: These virtual machines acted as worker nodes in the Kubernetes cluster, hosting and running containerized applications. They executed tasks assigned by the master node and provided resources for application deployment and scaling.

3. **SonarQube Server**: A dedicated virtual machine hosted the SonarQube server, which performed static code analysis to ensure code quality and identify potential issues such as bugs, code smells, and security vulnerabilities.

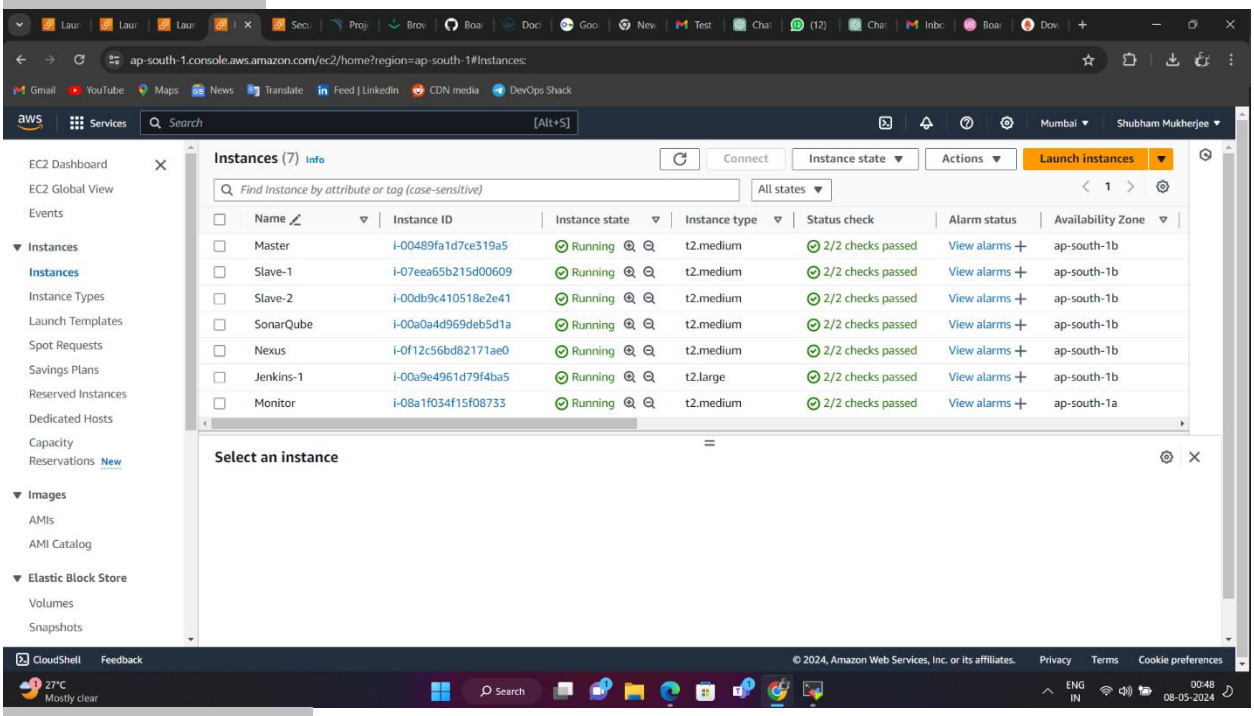
4**. Nexus Repository Manager**: Another virtual machine hosted the Nexus Repository Manager, serving as a centralized repository for storing and managing build artifacts, Docker images, and other dependencies used in the CI/CD pipeline.

5. **Jenkins Server**: A virtual machine was allocated for the Jenkins server, which served as the central hub for orchestrating the CI/CD pipeline. Jenkins coordinated the execution of pipeline stages, triggered builds, and integrated with other DevOps tools for seamless automation.

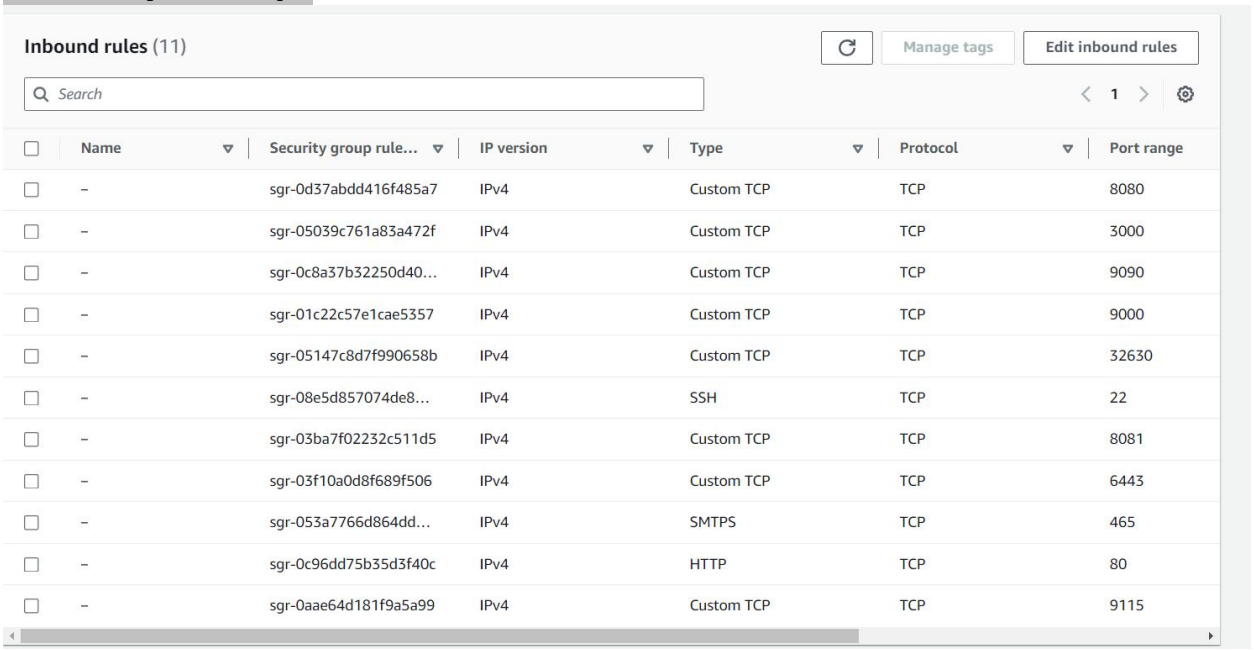
6. **Monitoring Server (Prometheus and Grafana):** A single virtual machine hosted both Prometheus and Grafana for monitoring and visualization of system metrics. Prometheus collected metrics from various components of the CI/CD pipeline, while Grafana provided interactive dashboards for real-time monitoring and analysis.

Each virtual machine was configured with the necessary resources, including CPU, memory, and storage, to support the respective tool's functionalities and accommodate the workload demands of the CI/CD pipeline. Additionally, security measures such as access controls, network configurations, and encryption were implemented to safeguard the virtualized infrastructure and data integrity.

EC2 Instances :



Security Group:



2. Setup K8-Cluster using Kubeadm

This guide outlines the steps needed to set up a Kubernetes cluster using kubeadm.

Pre-requisites

- Ubuntu OS (Xenial or later)
- sudo privileges
- Internet access
- t2.medium instance type or higher

AWS Setup

- Make sure your all instance are in same **Security group**.
- Expose port **6443** in the **Security group**, so that worker nodes can join the cluster.

Execute on Both "Master" & "Worker Node"

Run the following commands on both the master and worker nodes to prepare them for kubeadm.

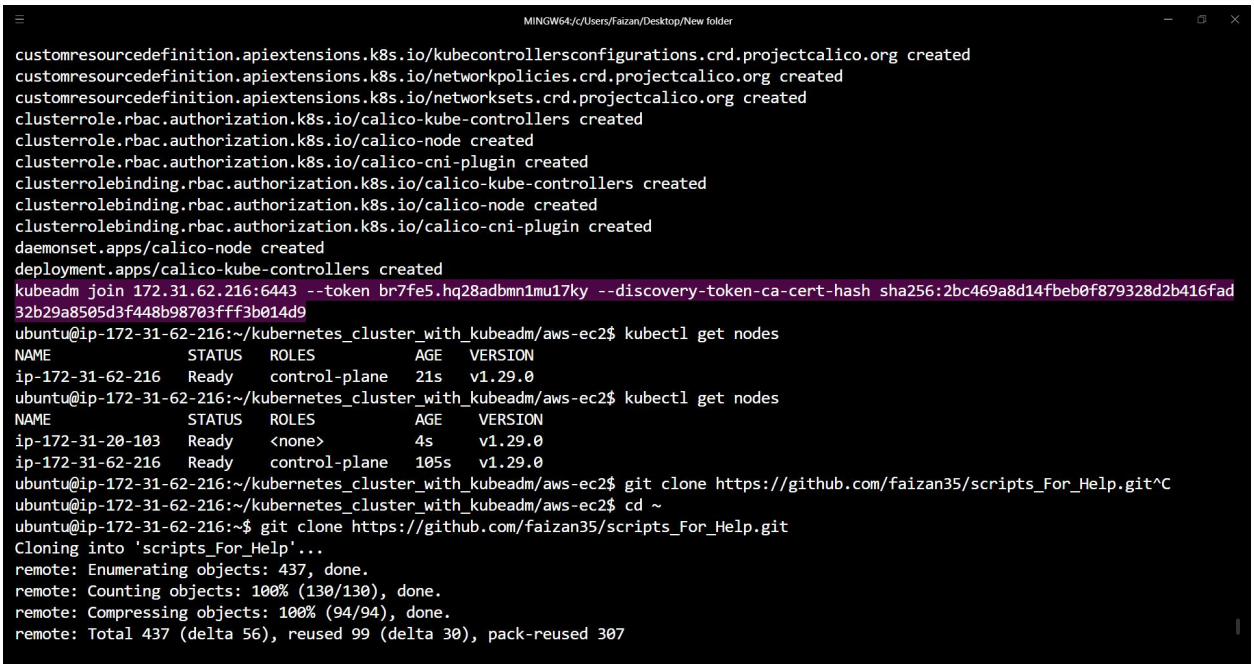
```
# disable swap
sudo swapoff -a

# Create the .conf file to load the modules at bootup
cat <<EOF | sudo tee /etc/modules-load.d/k8s.conf
overlay
br_netfilter
EOF

sudo modprobe overlay
sudo modprobe br_netfilter

# sysctl params required by setup, params persist across reboots
cat <<EOF | sudo tee /etc/sysctl.d/k8s.conf
net.bridge.bridge-nf-call-iptables  = 1
net.bridge.bridge-nf-call-ip6tables = 1
net.ipv4.ip_forward                 = 1
EOF

# Apply sysctl params without reboot
```

```
sudo sysctl --system

## Install CRIO Runtime
sudo apt-get update -y
sudo apt-get install -y software-properties-common curl apt-transport-https ca-certificates gpg

sudo curl -fsSL https://pkgs.k8s.io/addons:/cri-o:/prerelease:/main/deb/Release.key | sudo gpg --dearmor -o /etc/apt/keyrings/cri-o-apt-keyring.gpg
echo "deb [signed-by=/etc/apt/keyrings/cri-o-apt-keyring.gpg] https://pkgs.k8s.io/addons:/cri-o:/prerelease:/main/deb/ /" | sudo tee /etc/apt/sources.list.d/cri-o.list

sudo apt-get update -y
sudo apt-get install -y cri-o

sudo systemctl daemon-reload
sudo systemctl enable crio --now
sudo systemctl start crio.service

echo "CRI runtime installed successfully"

# Add Kubernetes APT repository and install required packages
curl -fsSL https://pkgs.k8s.io/core:/stable:/v1.29/deb/Release.key | sudo gpg --dearmor -o /etc/apt/keyrings/kubernetes-apt-keyring.gpg
echo 'deb [signed-by=/etc/apt/keyrings/kubernetes-apt-keyring.gpg] https://pkgs.k8s.io/core:/stable:/v1.29/deb/ /' | sudo tee /etc/apt/sources.list.d/kubernetes.list

sudo apt-get update -y
sudo apt-get install -y kubelet="1.29.0-*" kubectl="1.29.0-*" kubeadm="1.29.0-*"
sudo apt-get update -y
sudo apt-get install -y jq

sudo systemctl enable --now kubelet
sudo systemctl start kubelet
```

Execute ONLY on "Master Node"

```
sudo kubeadm config images pull

sudo kubeadm init

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


# Network Plugin = calico
kubectl apply -f
https://raw.githubusercontent.com/projectcalico/calico/v3.26.0/manifests/calico.yaml

kubeadm token create --print-join-command
```

- You will get kubeadm token, **Copy it**.



Execute on ALL of your Worker Node's

1. Perform pre-flight checks

sudo kubeadm reset pre-flight checks

2. Paste the join command you got from the master node and append --v=5 at the end.

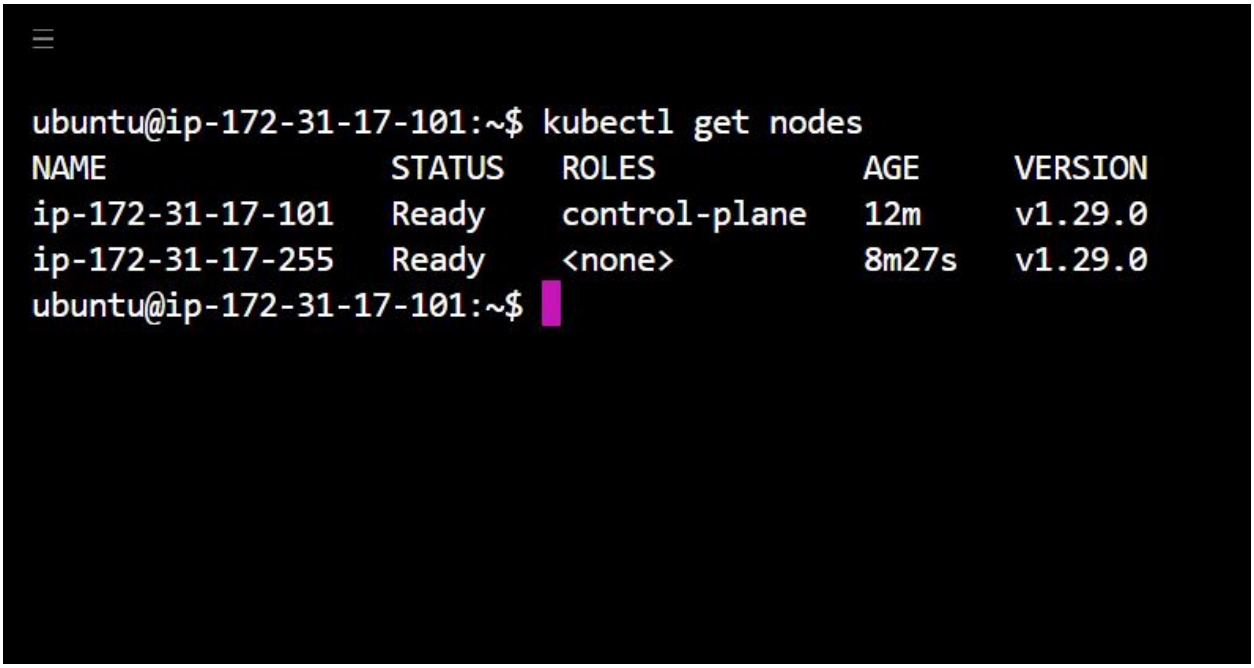
sudo your-token --v=5

Use sudo before the token.

Verify Cluster Connection

On Master Node:

kubectl get nodes



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3. Installing Jenkins on Ubuntu

Execute these commands on Jenkins Server

```
#!/bin/bash
# Install OpenJDK 17 JRE Headless
sudo apt install openjdk-17-jre-headless -y
# Download Jenkins GPG key
sudo wget -O /usr/share/keyrings/jenkins-keyring.asc \
https://pkg.jenkins.io/debian-stable/jenkins.io-2023.key
# Add Jenkins repository to package manager sources
echo deb [signed-by=/usr/share/keyrings/jenkins-keyring.asc] \
https://pkg.jenkins.io/debian-stable binary/ | sudo tee \
/etc/apt/sources.list.d/jenkins.list > /dev/null
# Update package manager repositories
sudo apt-get update
# Install Jenkins
sudo apt-get install jenkins -y
```

Save this script in a file, for example, install_jenkins.sh, and make it executable using:

```
chmod +x install_jenkins.sh
```

Then, you can run the script using:

```
./install_jenkins.sh
```

This script will automate the installation process of OpenJDK 17 JRE Headless and Jenkins.

KUBECTL

```
curl -o kubectl https://amazon-eks.s3.us-west-2.amazonaws.com/1.19.6/2021-01-05/bin/linux/amd64/kubectl
chmod +x ./kubectl
sudo mv ./kubectl /usr/local/bin
kubectl version --short –client
```

4. Install docker for future use

Execute these commands on Jenkins, SonarQube and Nexus Servers

```
#!/bin/bash
# Update package manager repositories
sudo apt-get update
# Install necessary dependencies
sudo apt-get install -y ca-certificates curl
# Create directory for Docker GPG key
sudo install -m 0755 -d /etc/apt/keyrings
# Download Docker's GPG key
sudo curl -fsSL https://download.docker.com/linux/ubuntu/gpg -o
/etc/apt/keyrings/docker.asc
# Ensure proper permissions for the key
sudo chmod a+r /etc/apt/keyrings/docker.asc
# Add Docker repository to Apt sources
echo "deb [arch=$(dpkg --print-architecture) signed
by=/etc/apt/keyrings/docker.asc] https://download.docker.com/linux/ubuntu \
$(. /etc/os-release && echo "$VERSION_CODENAME") stable" | \
sudo tee /etc/apt/sources.list.d/docker.list > /dev/null
# Update package manager repositories
sudo apt-get update
sudo apt-get install -y docker-ce docker-ce-cli containerd.io docker-buildx-plugin
docker-compose-plugin
```

Save this script in a file, for example, install_docker.sh, and make it executable using:

```
chmod +x install_docker.sh
```

Then, you can run the script using:

```
./install_docker.sh
```

5. SetUp Nexus

Execute these commands on Nexues VM

```
#!/bin/bash
# Update package manager repositories
sudo apt-get update
# Install necessary dependencies
sudo apt-get install -y ca-certificates curl
# Create directory for Docker GPG key
sudo install -m 0755 -d /etc/apt/keyrings
# Download Docker's GPG key
sudo curl -fsSL https://download.docker.com/linux/ubuntu/gpg -o
/etc/apt/keyrings/docker.asc
# Ensure proper permissions for the key
sudo chmod a+r /etc/apt/keyrings/docker.asc
# Add Docker repository to Apt sources
echo "deb [arch=$(dpkg --print-architecture) signed
by=/etc/apt/keyrings/docker.asc] https://download.docker.com/linux/ubuntu \
$(. /etc/os-release && echo "$VERSION_CODENAME") stable" | \
sudo tee /etc/apt/sources.list.d/docker.list > /dev/null
# Update package manager repositories
sudo apt-get update
sudo apt-get install -y docker-ce docker-ce-cli containerd.io docker-buildx-plugin
docker-compose-plugin
```

Save this script in a file, for example, install_docker.sh, and make it executable using:

```
chmod +x install_docker.sh
```

Then, you can run the script using:

```
./install_docker.sh
```

Create Nexus using docker container

To create a Docker container running Nexus 3 and exposing it on port 8081, you can
use the following command:

```
docker run -d --name nexus -p 8081:8081 sonatype/nexus3:latest
```

This command does the following:

• -d: Detaches the container and runs it in the background.
• --name nexus: Specifies the name of the container as "nexus".
• -p 8081:8081: Maps port 8081 on the host to port 8081 on the container, allowing access to Nexus through port 8081.
• sonatype/nexus3:latest: Specifies the Docker image to use for the container, in this case, the latest version of Nexus 3 from the Sonatype repository.

After running this command, Nexus will be accessible on your host machine at http://IP:8081.

Get Nexus initial password

Your provided commands are correct for accessing the Nexus password stored in the container. Here's a breakdown of the steps:

1. **Get Container ID**: You need to find out the ID of the Nexus container. You can do this by running:

```
docker ps
```

This command lists all running containers along with their IDs, among other information.

2. **Access Container's Bash Shell**: Once you have the container ID, you can execute the docker exec command to access the container's bash shell:

```
docker exec -it <container_ID> /bin/bash
```

Replace <container_ID> with the actual ID of the Nexus container.

3. **Navigate to Nexus Directory**: Inside the container's bash shell, navigate to the directory where Nexus stores its configuration:

```
cd sonatype-work/nexus3
```

4. **View Admin Password**: Finally, you can view the admin password by displaying the contents of the admin.password file:

```
cat admin.password
```

5. **Exit the Container Shell**: Once you have retrieved the password, you can exit the container's bash shell:

```
exit
```

This process allows you to access the Nexus admin password stored within the container. Make sure to keep this password secure, as it grants administrative access to your Nexus instance.

6. SetUp SonarQube

Execute these commands on SonarQube VM

```
#!/bin/bash
# Update package manager repositories
sudo apt-get update
# Install necessary dependencies
sudo apt-get install -y ca-certificates curl
# Create directory for Docker GPG key
sudo install -m 0755 -d /etc/apt/keyrings
# Download Docker's GPG key
sudo curl -fsSL https://download.docker.com/linux/ubuntu/gpg -o
/etc/apt/keyrings/docker.asc
# Ensure proper permissions for the key
sudo chmod a+r /etc/apt/keyrings/docker.asc
# Add Docker repository to Apt sources
echo "deb [arch=$(dpkg --print-architecture) signed
by=/etc/apt/keyrings/docker.asc] https://download.docker.com/linux/ubuntu \
$(. /etc/os-release && echo "$VERSION_CODENAME") stable" | \
sudo tee /etc/apt/sources.list.d/docker.list > /dev/null
# Update package manager repositories
sudo apt-get update
sudo apt-get install -y docker-ce docker-ce-cli containerd.io docker-buildx-plugin
docker-compose-plugin
```

Save this script in a file, for example, install_docker.sh, and make it executable using:

```
chmod +x install_docker.sh
```

Then, you can run the script using:

```
./install_docker.sh
```

Create Sonarqube Docker container

To run SonarQube in a Docker container with the provided command, you can follow
these steps:

1. Open your terminal or command prompt.
2. Run the following command:

```
docker run -d --name sonar -p 9000:9000 sonarqube:lts-community
```

This command will download the sonarqube:lts-community Docker image from Docker
Hub if it's not already available locally. Then, it will create a container named "sonar"
from this image, running it in detached mode (-d flag) and mapping port 9000 on the
host machine to port 9000 in the container (-p 9000:9000 flag).

3. Access SonarQube by opening a web browser and navigating to http://VmIP:9000.

This will start the SonarQube server, and you should be able to access it using the provided URL. If you're running Docker on a remote server or a different port, replace localhost with the appropriate hostname or IP address and adjust the port accordingly.

SEGMENT-2 | Private Git Setup

Steps to create a private Git repository, generate a personal access token, connect to the repository, and push code to it:

1. Create a Private Git Repository:
o Go to your preferred Git hosting platform (e.g., GitHub, GitLab, Bitbucket).
o Log in to your account or sign up if you don't have one.
o Create a new repository and set it as private.
2. Generate a Personal Access Token:
o Navigate to your account settings or profile settings.
o Look for the "Developer settings" or "Personal access tokens" section.
o Generate a new token, providing it with the necessary permissions (e.g., repo access).
3. Clone the Repository Locally:
o Open Git Bash or your terminal.
o Navigate to the directory where you want to clone the repository.
o Use the git clone command followed by the repository's URL. For example:
git clone <repository_URL>
4. Replace <repository_URL> with the URL of your private repository.
5. Add Your Source Code Files:
o Navigate into the cloned repository directory.
o Paste your source code files or create new ones inside this directory.
6. Stage and Commit Changes:
o Use the git add command to stage the changes:

```
git add .
```

o Use the git commit command to commit the staged changes along with a meaningful message:

```
git commit -m "Your commit message here"
```

7. Push Changes to the Repository:
o Use the git push command to push your committed changes to the remote repository:

```
git push
```

o If it's your first time pushing to this repository, you might need to specify the remote and branch:

```
git push -u origin master
```

8. Replace master with the branch name if you're pushing to a different branch.

9. Enter Personal Access Token as Authentication:
o When prompted for credentials during the push, enter your username (usually your email) and use your personal access token as the password.
By following these steps, you'll be able to create a private Git repository, connect to it
using Git Bash, and push your code changes securely using a personal access token
for authentication.

GIT REPOSITORY - https://github.com/Shubham-Stunner/BoardGame.git

SEGMENT-3 | CICD

Install below Plugins in Jenkins

1. **Eclipse Temurin Installer**:
o This plugin enables Jenkins to automatically install and configure the Eclipse Temurin JDK (formerly known as AdoptOpenJDK).
o To install, go to Jenkins dashboard -> Manage Jenkins -> Manage Plugins -> Available tab.
o Search for "Eclipse Temurin Installer" and select it.
o Click on the "Install without restart" button.

2**. Pipeline Maven Integration**:
o This plugin provides Maven support for Jenkins Pipeline.
o It allows you to use Maven commands directly within your Jenkins Pipeline scripts.
o To install, follow the same steps as above, but search for "Pipeline Maven Integration" instead.

3**. Config File Provider**:
o This plugin allows you to define configuration files (e.g., properties, XML, JSON) centrally in Jenkins.
o These configurations can then be referenced and used by your Jenkins jobs.
o Install it using the same procedure as mentioned earlier.

4. **SonarQube Scanner**:
o SonarQube is a code quality and security analysis tool.
o This plugin integrates Jenkins with SonarQube by providing a scanner that analyzes code during builds.
o You can install it from the Jenkins plugin manager as described above.

5**. Kubernetes CLI**:
o This plugin allows Jenkins to interact with Kubernetes clusters using the Kubernetes command-line tool (kubectl).
o It's useful for tasks like deploying applications to Kubernetes from Jenkins jobs.

o Install it through the plugin manager.

6**. Kubernetes**:
o This plugin integrates Jenkins with Kubernetes by allowing Jenkins agents to run as pods within a Kubernetes cluster.
o It provides dynamic scaling and resource optimization capabilities for Jenkins builds.
o Install it from the Jenkins plugin manager.

7**. Docker**:
o This plugin allows Jenkins to interact with Docker, enabling Docker builds and integration with Docker registries.
o You can use it to build Docker images, run Docker containers, and push/pull images from Docker registries.
o Install it from the plugin manager.

8. **Docker Pipeline Step**:
o This plugin extends Jenkins Pipeline with steps to build, publish, and run Docker containers as part of your Pipeline scripts.
o It provides a convenient way to manage Docker containers directly from Jenkins Pipelines.
o Install it through the plugin manager like the others.

After installing these plugins, you may need to configure them according to your specific environment and requirements. This typically involves setting up credentials, configuring paths, and specifying options in Jenkins global configuration or individual job configurations. Each plugin usually comes with its own set of documentation to guide you through the configuration process.

Jenkins Pipeline

Create a new Pipeline job .

```
pipeline {
    agent any

    environment {
        SCANNER_HOME = tool 'sonar-scanner'
    }

    tools {
        jdk 'jdk17'
        maven 'maven3'
    }

    stages {
        stage('Git Checkout') {
            steps {
                git branch: 'main', credentialsId: 'git-cred', url: 'https://github.com/Shubham-
Stunner/BoardGame.git'
            }
        }

        stage('Compile') {
            steps {
                sh "mvn compile"
            }
        }

        stage('Test') {
            steps {
                sh "mvn test"
            }
        }

        stage('Trivy File system scan') {
            steps {
                sh "trivy fs --format table -o trivy-fs-report.html ."
            }
        }

        stage('SonarQube Analysis') {
            steps {
                withSonarQubeEnv('sonar') {
```

```
                sh '''$SCANNER_HOME/bin/sonar-scanner -Dsonar.projectName=BoardGame -
Dsonar.projectKey=BoardGame \
                    -Dsonar.java.binaries=. '''
            }
        }
    }

    stage('Quality Gate') {
        steps {
            script {
                waitForQualityGate abortPipeline: false, credentialsId: 'sonar-token'
            }
        }
    }

    stage('Build') {
        steps {
            sh "mvn package"
        }
    }

    stage('Publish Artifacts to Nexus') {
        steps {
            withMaven(globalMavenSettingsConfig: 'global-settings', jdk: 'jdk17', maven: 'maven3',
mavenSettingsConfig: '', traceability: true) {
                sh "mvn deploy"
            }
        }
    }

    stage('Build and Tag Docker Image') {
        steps {
            script {
                withDockerRegistry(credentialsId: 'docker-cred', toolName: 'docker') {
                    sh "docker build -t stunnershubham/boardgame:latest ."
                }
            }
        }
    }

    stage('Docker Image Scan') {
        steps {
            script {
                withDockerRegistry(credentialsId: 'docker-cred', toolName: 'docker') {
                    sh "trivy image --format table -o trivy-image-report.html
stunnershubham/boardgame:latest"
                }
            }
```

```
        }
    }

    stage('Push Docker Image') {
        steps {
            script {
                withDockerRegistry(credentialsId: 'docker-cred', toolName: 'docker') {
                    sh "docker push stunnershubham/boardgame:latest"
                }
            }
        }
    }

    stage('Deploy to Kubernetes') {
        steps {
            withKubeConfig(caCertificate: '', clusterName: 'kubernetes', contextName: '', credentialsId: 'k8-
cred', namespace: 'webapps', restrictKubeConfigAccess: false, serverUrl: 'https://172.31.8.22:6443') {
                sh "kubectl apply -f deployment-service.yaml"
                sh "kubectl get pods -n webapps"
            }
        }
    }
}

post {
    always {
        script {
            def jobName = env.JOB_NAME
            def buildNumber = env.BUILD_NUMBER
            def pipelineStatus = currentBuild.result ?: 'UNKNOWN'
            def bannerColor = pipelineStatus.toUpperCase() == 'SUCCESS' ? 'green' : 'red'

            def body = """
                <html>
                <body>
                <div style="border: 4px solid ${bannerColor}; padding: 10px;">
                <h2>${jobName} - Build ${buildNumber}</h2>
                <div style="background-color: ${bannerColor}; padding: 10px;">
                <h3 style="color: white;">Pipeline Status: ${pipelineStatus.toUpperCase()}</h3>
                </div>
                <p>Check the <a href="${BUILD_URL}">console output</a>.</p>
                </div>
                </body>
                </html>
            """

            emailext(
                subject: "${jobName} - Build ${buildNumber} - ${pipelineStatus.toUpperCase()}",
```

```
            body: body,
            to: 'shubhammukherji654@gmail.com',
            from: 'jenkins@example.com',
            replyTo: 'jenkins@example.com',
            mimeType: 'text/html',
            attachmentsPattern: 'trivy-image-report.html'
        )
      }
    }
  }
}
```

SEGMENT-4 | Monitoring

Prometheus

Links to download Prometheus, Node_Exporter & black Box exporter
https://prometheus.io/download/

Extract and Run Prometheus
After downloading Promethous extract the .tar file

Now Cd into the extracted file and and run
./prometheus &

By default Prometheus runs on Port 9090 and access it using your instance
<IP address>:9090

Similarly download and run Blackbox exporter.
./ backbox_exporter &

Grafana

Links to download Grafana https://grafana.com/grafana/download

OR

Run This code on Monitoring VM to Install Grafana

```
sudo apt-get install -y adduser libfontconfig1 musl
wget https://dl.grafana.com/enterprise/release/grafana-enterprise_10.4.2_amd64.deb
sudo dpkg -i grafana-enterprise_10.4.2_amd64.deb
```

once Installed run

sudo /bin/systemctl start Grafana-server

by default Grafana runs on port 3000 so access it using instance <IPaddress>:3000

Configure Prometheus

Go inside the Prometheus.yaml file and edit it

```
scrape_configs:
  - job_name: 'blackbox'
    metrics_path: /probe
    params:
      module: [http_2xx]  # Look for a HTTP 200 response.
    static_configs:
      - targets:
        - http://prometheus.io    # Target to probe with http.
        - https://prometheus.io   # Target to probe with https.
        - http://example.com:8080 # Target to probe with http on port 8080.
    relabel_configs:
      - source_labels: [__address__]
        target_label: __param_target
      - source_labels: [__param_target]
        target_label: instance
      - target_label: __address__
        replacement:<IP address>:9115
```

Replace the IP address with your instance IP address.

After this Restart Prometheus using this command
`pgrep Prometheus`

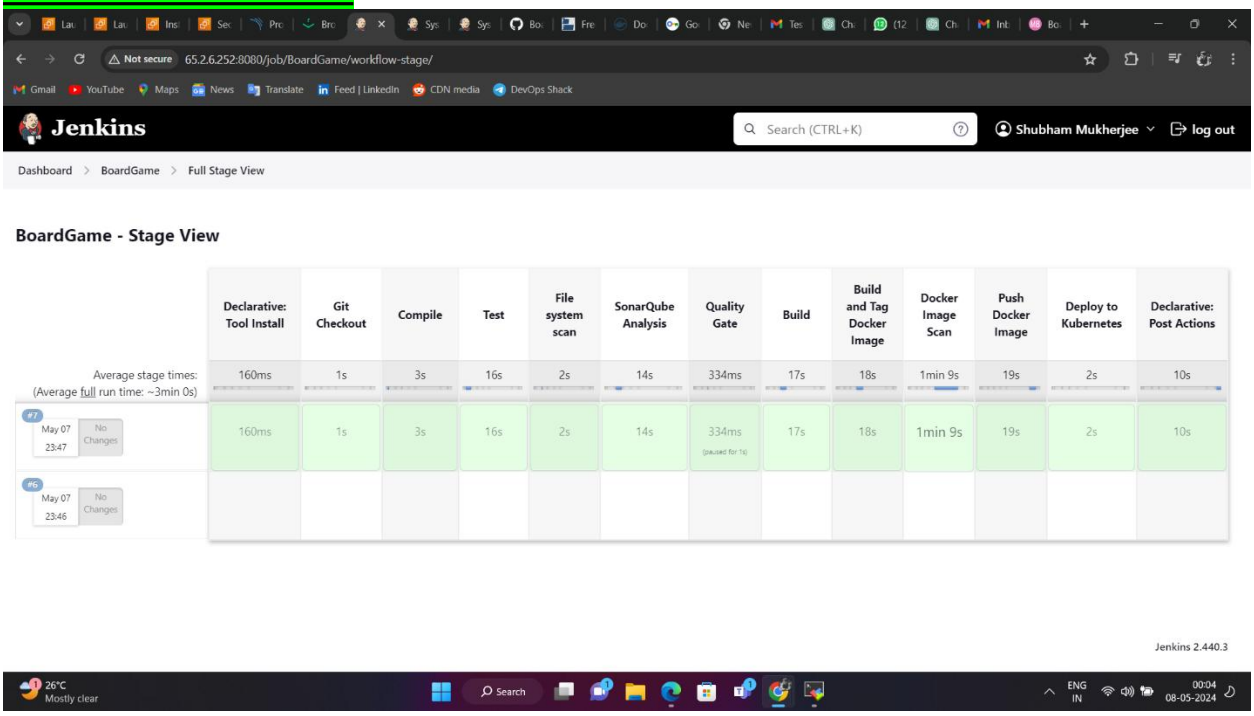
Once you run the above command you will get the Id of Prometheus
then use the id and kill it
`kill <ID>`

Add Prometheus as Data sources inside Grafana

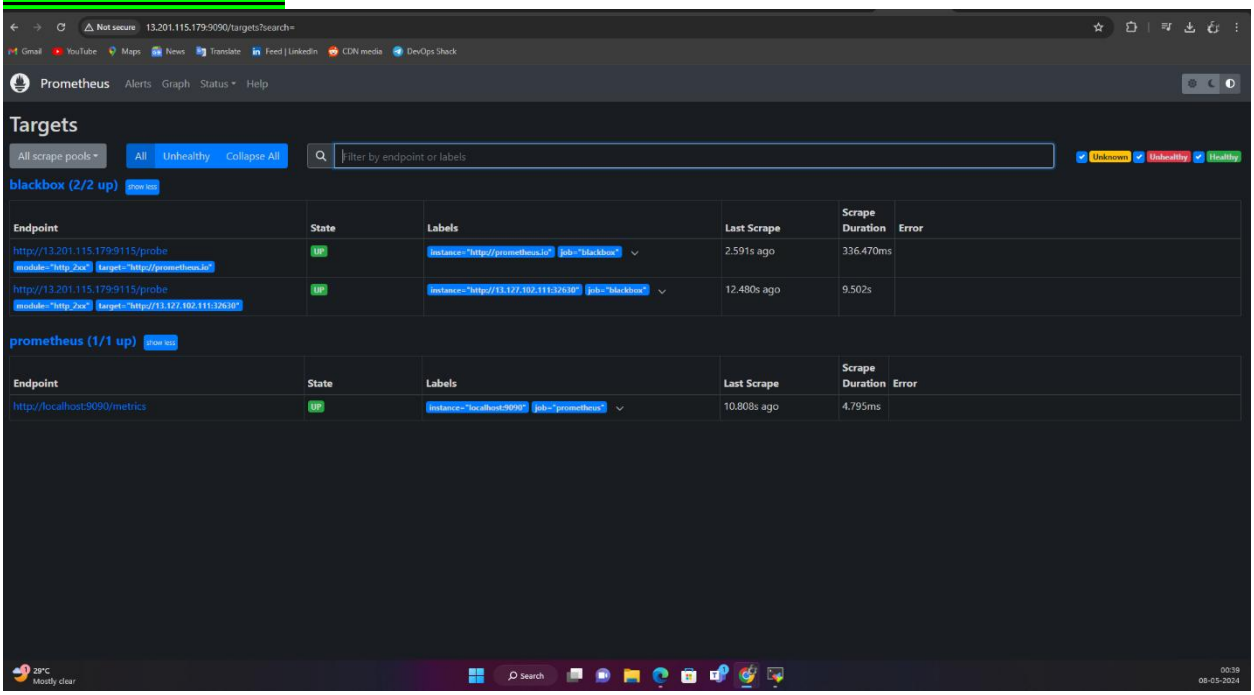
Go to Prometheus server > Data Sources
> Prometheus add IPaddress of Prometheus
> Import Dashboard form web .

Results :

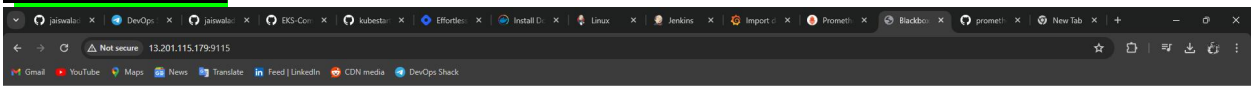
JENKINS PIPELINE



PROMETHEUS



BLACKBOX



Blackbox Exporter

Probe prometheus.io for http_2xx

Debug probe prometheus.io for http_2xx

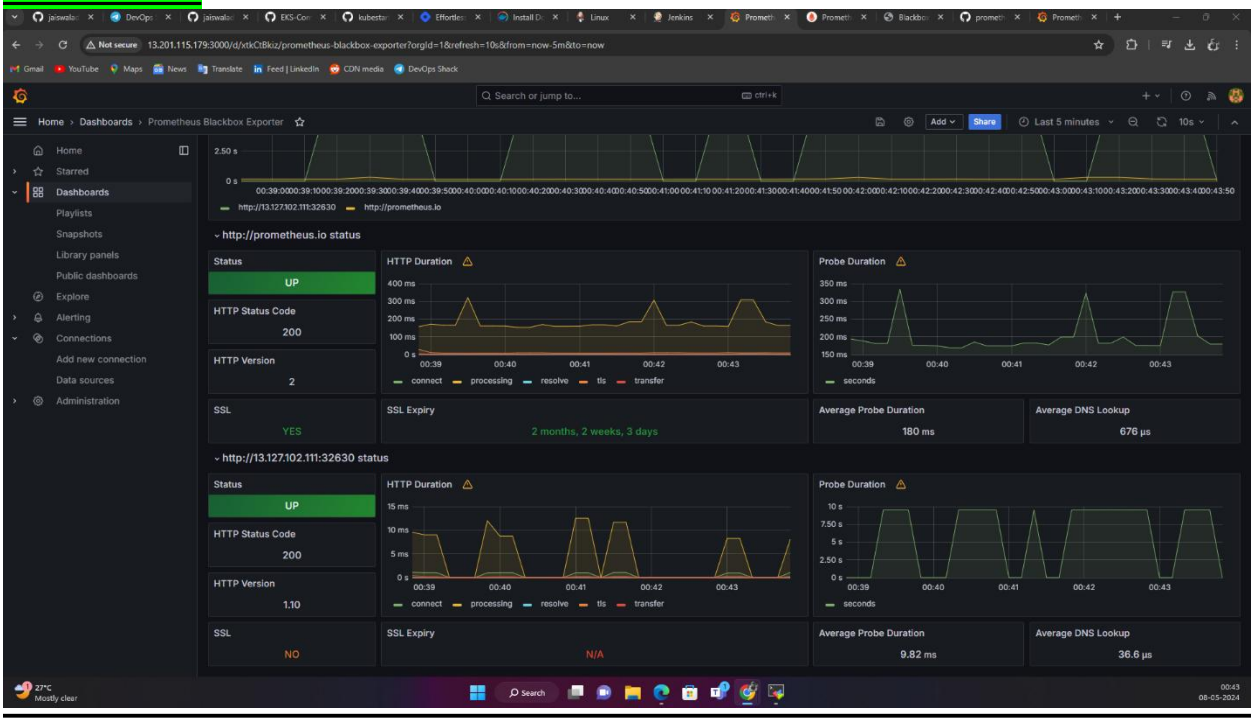
Metrics

Configuration

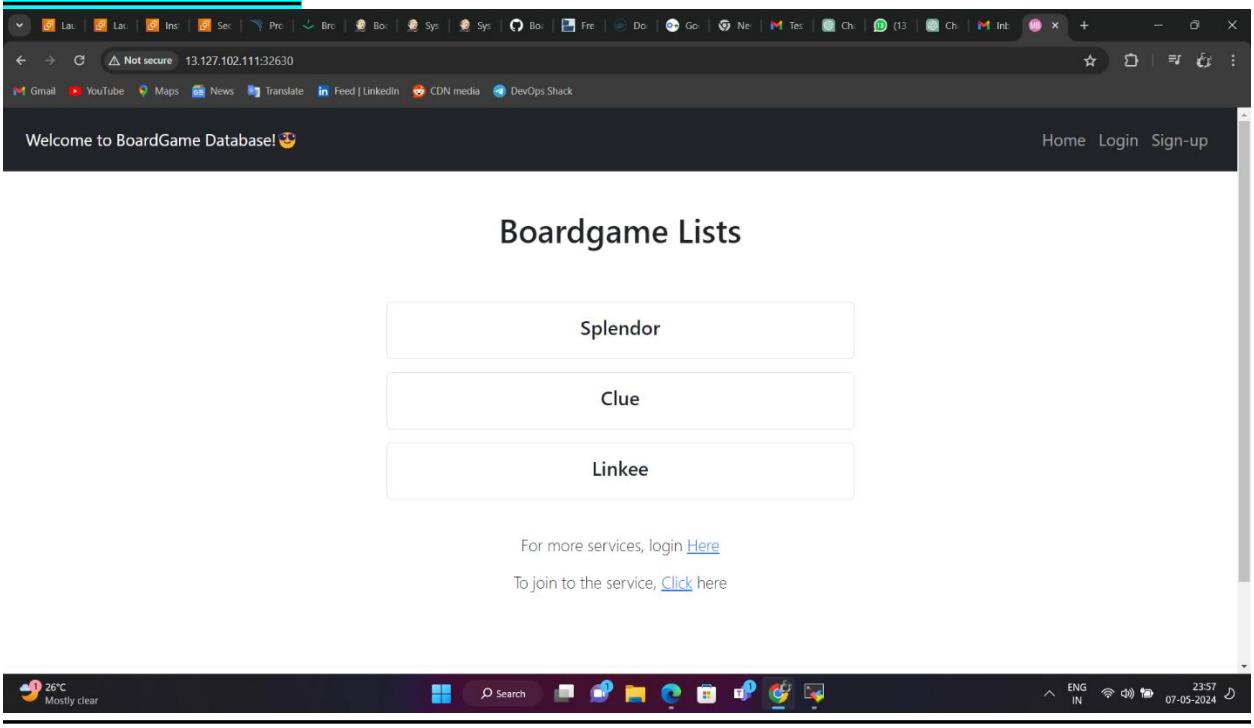
Recent Probes

Module	Target	Result	Debug
http_2xx	http://prometheus.io	Success	Logs
http_2xx	http://13.127.102.111:32630	Success	Logs
http_2xx	http://prometheus.io	Success	Logs
http_2xx	http://13.127.102.111:32630	**Failure**	Logs
http_2xx	http://prometheus.io	Success	Logs
http_2xx	http://13.127.102.111:32630	Success	Logs
http_2xx	http://prometheus.io	Success	Logs
http_2xx	http://13.127.102.111:32630	**Failure**	Logs
http_2xx	http://prometheus.io	Success	Logs
http_2xx	http://13.127.102.111:32630	**Failure**	Logs
http_2xx	http://prometheus.io	Success	Logs
http_2xx	http://13.127.102.111:32630	**Failure**	Logs
http_2xx	http://prometheus.io	Success	Logs
http_2xx	http://13.127.102.111:32630	Success	Logs
http_2xx	http://prometheus.io	Success	Logs
http_2xx	http://13.127.102.111:32630	Success	Logs
http_2xx	http://prometheus.io	Success	Logs
http_2xx	http://13.127.102.111:32630	**Failure**	Logs
http_2xx	http://prometheus.io	Success	Logs
http_2xx	http://13.127.102.111:32630	**Failure**	Logs
http_2xx	http://prometheus.io	Success	Logs
http_2xx	http://13.127.102.111:32630	Success	Logs
http_2xx	http://prometheus.io	Success	Logs
http_2xx	http://13.127.102.111:32630	Success	Logs
http_2xx	http://prometheus.io	Success	Logs

GRAFANA



APPLICATION



Conclusion

In conclusion, the successful implementation of the DevOps CI/CD pipeline project marks a significant milestone in enhancing the efficiency, reliability, and quality of software delivery processes. By automating key aspects of the software development lifecycle, including compilation, testing, deployment, and monitoring, the project has enabled rapid and consistent delivery of software releases, contributing to improved time-to-market and customer satisfaction.

Acknowledgment of Contributions:

I would like to extend my gratitude to DevOps shack for helping me achieving my goals and objectives.

Final Thoughts

Looking ahead, the project's impact extends beyond its immediate benefits, paving the way for continuous improvement and innovation in software development practices. By embracing DevOps principles and leveraging cutting-edge tools and technologies, we have laid a solid foundation for future projects to build upon. The scalability, flexibility, and resilience of the CI/CD pipeline ensure its adaptability to evolving requirements and technological advancements, positioning our organization for long-term success in a competitive market landscape.

References

1. Jenkins Documentation:
https://www.jenkins.io/doc/
2. Maven Documentation:
https://maven.apache.org/guides/index.html
3. SonarQube Documentation:
https://docs.sonarqube.org/latest/
4. Trivy Documentation:
https://github.com/aquasecurity/trivy
5. Nexus Repository Manager Documentation:
https://help.sonatype.com/repomanager3
6. Docker Documentation: https://docs.docker.com/
7. Kubernetes Documentation:
https://kubernetes.io/docs/
8. Prometheus Documentation:
https://prometheus.io/docs/
9. Grafana Documentation:
https://grafana.com/docs/

These resources provided valuable insights, guidance, and support throughout the project lifecycle, enabling us to achieve our goals effectively.