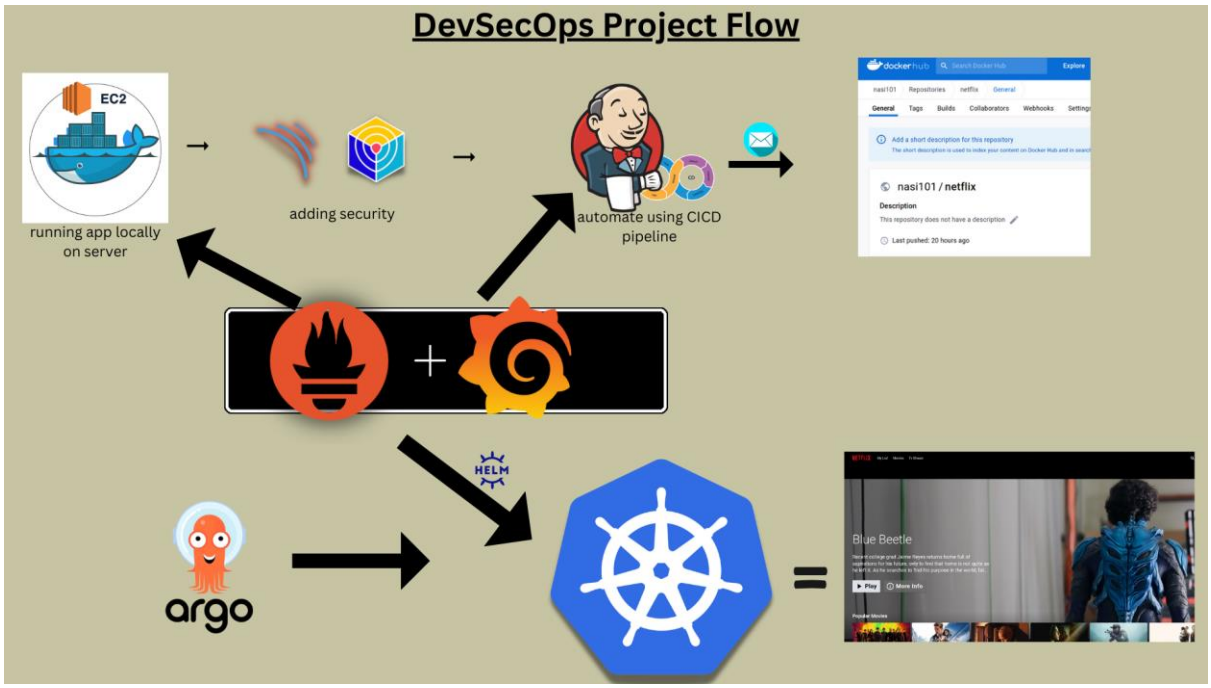
DevSecOps Project: Deploy Netflix Clone on Cloud using Jenkins

Introduction:

Embarking on an exciting DevSecOps journey, we're diving into the deployment of a Netflix Clone on the cloud using Jenkins. This project encapsulates the fusion of development, security, and operations practices, ensuring a streamlined and secure pipeline for delivering software.

Project Architecture:



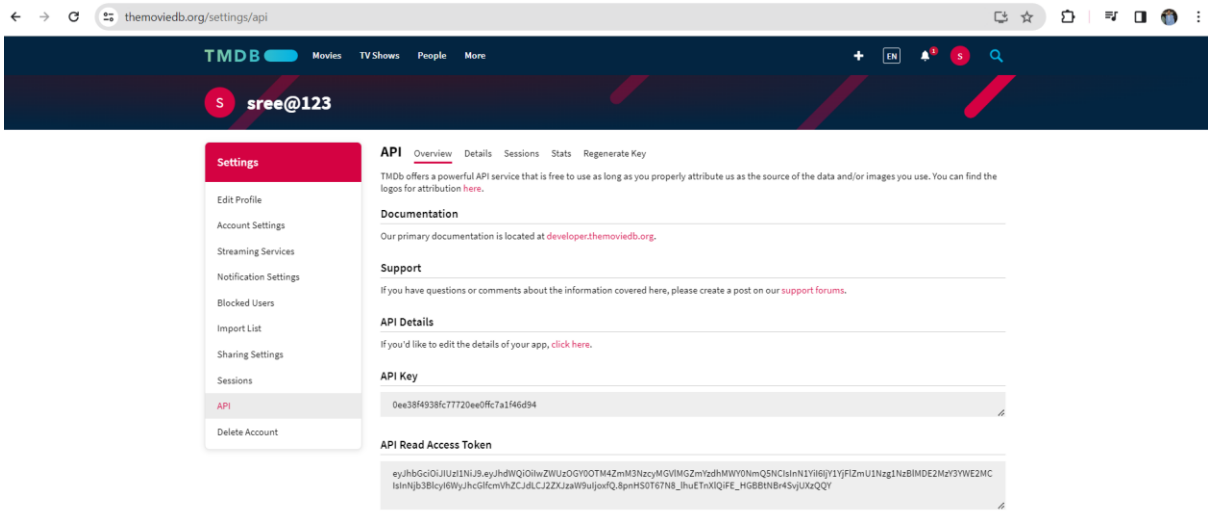
Phase 1: Initial Setup and Deployment

1. Launch EC2 (Ubuntu 22.04):
    - Provision an EC2 instance on AWS with Ubuntu 22.04.
    - Connect to the instance using SSH.
2. Clone the Code:
    - Update all the packages and then clone the code.
    - Clone your application's code repository onto the EC2 instance:
    - git clone https://github.com/uniquesreedhar/DevSecOps-NetflixProject.git
3. Install Docker and Run the App Using a Container:

    Set up Docker on the EC2 instance:
    - sudo apt-get update
    - sudo apt-get install docker.io -y
    - sudo usermod -aG docker $USER # Replace with your system's username, e.g., 'ubuntu'

- newgrp docker
- sudo chmod 777 /var/run/docker.sock

4. Build and run your application using Docker containers:
    - docker build -t netflix .
    - docker run -d --name netflix -p 8081:80 netflix:latest
      #to delete
    - docker stop <containerid>
    - docker rmi -f Netflix
      It will show an error cause you need API key
5. : Get the API Key:
    - Open a web browser and navigate to TMDB (The Movie Database) website.
    - Click on "Login" and create an account.
    - Once logged in, go to your profile and select "Settings."
    - Click on "API" from the left-side panel.
    - Create a new API key by clicking "Create" and accepting the terms and conditions.
    - Provide the required basic details and click "Submit."
    - You will receive your TMDB API key.
    - Now recreate the Docker image with your api key:
    - docker build --build-arg TMDB_V3_API_KEY=<your-api-key> -t netflix .



Phase 2: Security

1. Install SonarQube and Trivy:
   Install SonarQube and Trivy on the EC2 instance to scan for vulnerabilities.
2. Sonarqube:
    - docker run -d --name sonar -p 9000:9000 sonarqube:lts-community
      To access:
    - publicIP:9000 (by default username & password is admin)
3. To install Trivy:
    - sudo apt-get install wget apt-transport-https gnupg lsb-release

- wget -qO - https://aquasecurity.github.io/trivy-repo/deb/public.key | sudo apt-key add –
- echo deb https://aquasecurity.github.io/trivy-repo/deb $(lsb_release -sc) main | sudo tee -a /etc/apt/sources.list.d/trivy.list
- sudo apt-get update
- sudo apt-get install trivy

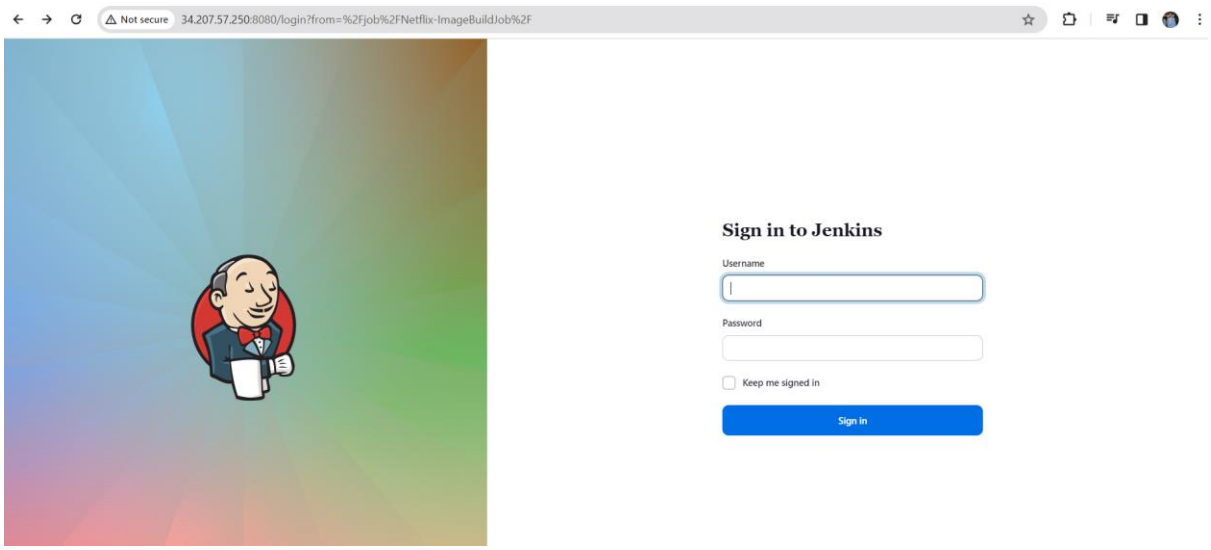
to scan image using trivy

- trivy image <imageid>

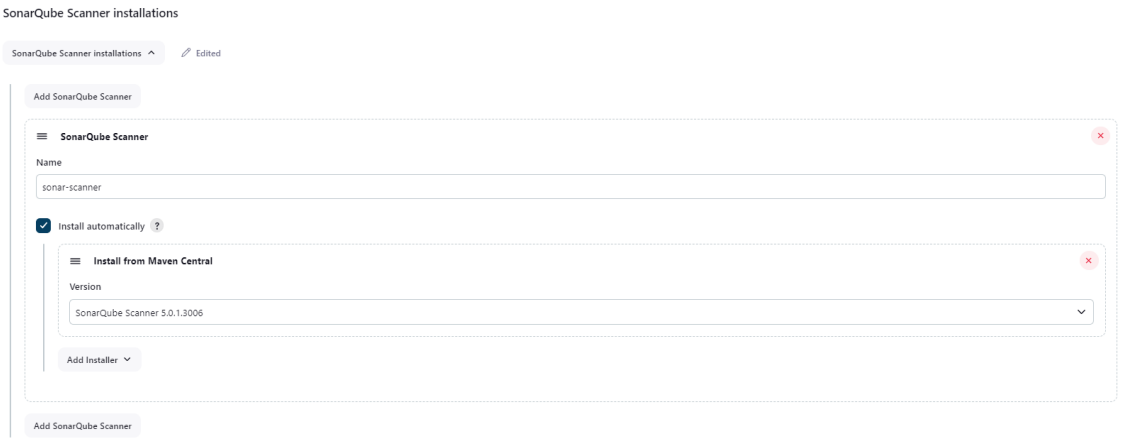
4. Integrate SonarQube and Configure:
    - Integrate SonarQube with your CI/CD pipeline.
    - Configure SonarQube to analyze code for quality and security issues.

Phase 3: CI/CD Setup

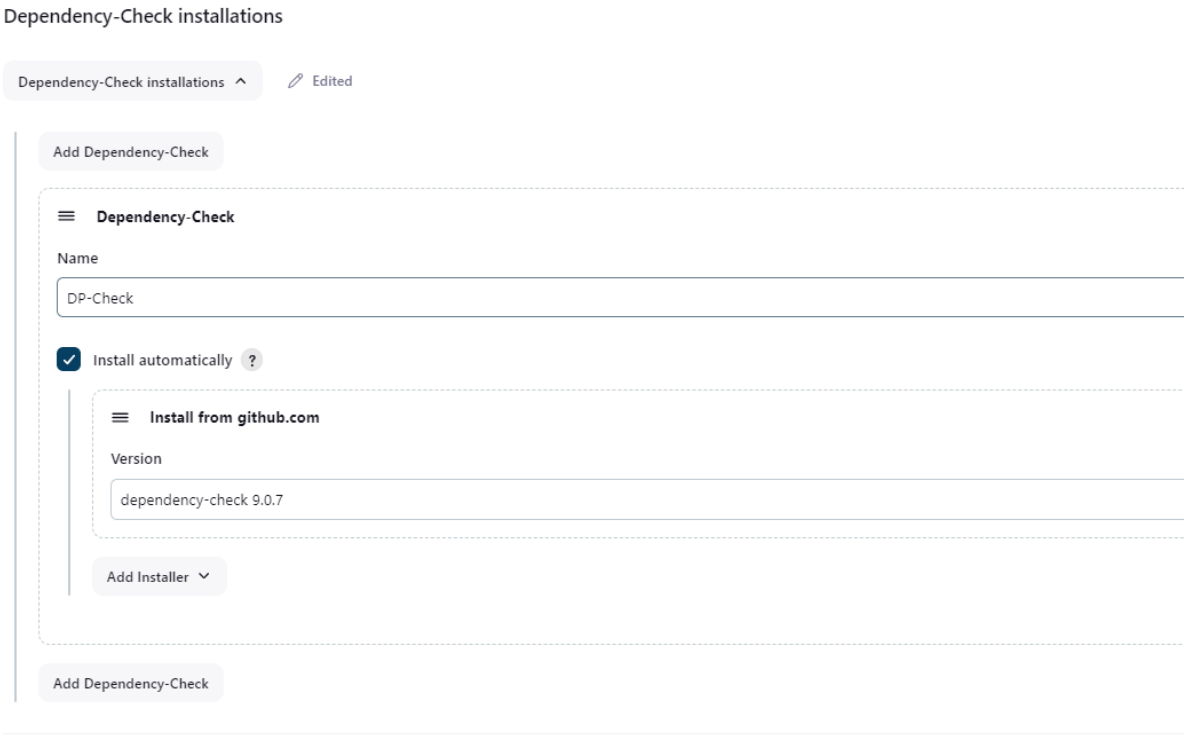
1. Install Jenkins for Automation:
   Install Jenkins on the EC2 instance to automate deployment: Install Java
    - sudo apt update
    - sudo apt install fontconfig openjdk-17-jre
    - java -version
    - openjdk version "17.0.8" 2023-07-18
    - OpenJDK Runtime Environment (build 17.0.8+7-Debian-1deb12u1)
    - OpenJDK 64-Bit Server VM (build 17.0.8+7-Debian-1deb12u1, mixed mode, sharing)
      #jenkins
    - sudo wget -O /usr/share/keyrings/jenkins-keyring.asc \
      https://pkg.jenkins.io/debian-stable/jenkins.io-2023.key
    - 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
    - sudo apt-get update
      sudo apt-get install Jenkins
      sudo systemctl start Jenkins
      sudo systemctl enable Jenkins
      Access Jenkins in a web browser using the public IP of your EC2 instance.
      publicIp:8080



2. Install Necessary Plugins in Jenkins:
    - Goto Manage Jenkins →Plugins → Available Plugins →
      Install below plugins
        1. Eclipse Temurin Installer (Install without restart)
        2. SonarQube Scanner (Install without restart)
        3. NodeJs Plugin (Install Without restart)
        4. Email Extension Plugin
3. Configure Java and Nodejs in Global Tool Configuration
   Goto Manage Jenkins → Tools → Install JDK(17) and NodeJs(16)→ Click on Apply and Save
4. SonarQube
    - Create the token
    - Goto Jenkins Dashboard → Manage Jenkins → Credentials → Add Secret Text. It should look like this
    - After adding sonar token
      Click on Apply and Save
    - The Configure System option is used in Jenkins to configure different server
    - Global Tool Configuration is used to configure different tools that we install using Plugins



5. We will install a sonar scanner in the tools.
   Create a Jenkins webhook:
    1. Configure CI/CD Pipeline in Jenkins:
        - Create a CI/CD pipeline in Jenkins to automate your application deployment.
6. install Dependency-Check Plugin:
    - Go to "Dashboard" in your Jenkins web interface.
    - Navigate to "Manage Jenkins" → "Manage Plugins."
    - Click on the "Available" tab and search for "OWASP Dependency-Check."
    - Check the checkbox for "OWASP Dependency-Check" and click on the "Install without restart" button.
7. Configure Dependency-Check Tool:
    - After installing the Dependency-Check plugin, you need to configure the tool.
    - Go to "Dashboard" → "Manage Jenkins" → "Global Tool Configuration."
    - Find the section for "OWASP Dependency-Check."
    - Add the tool's name, e.g., "DP-Check."
    - Save your settings.

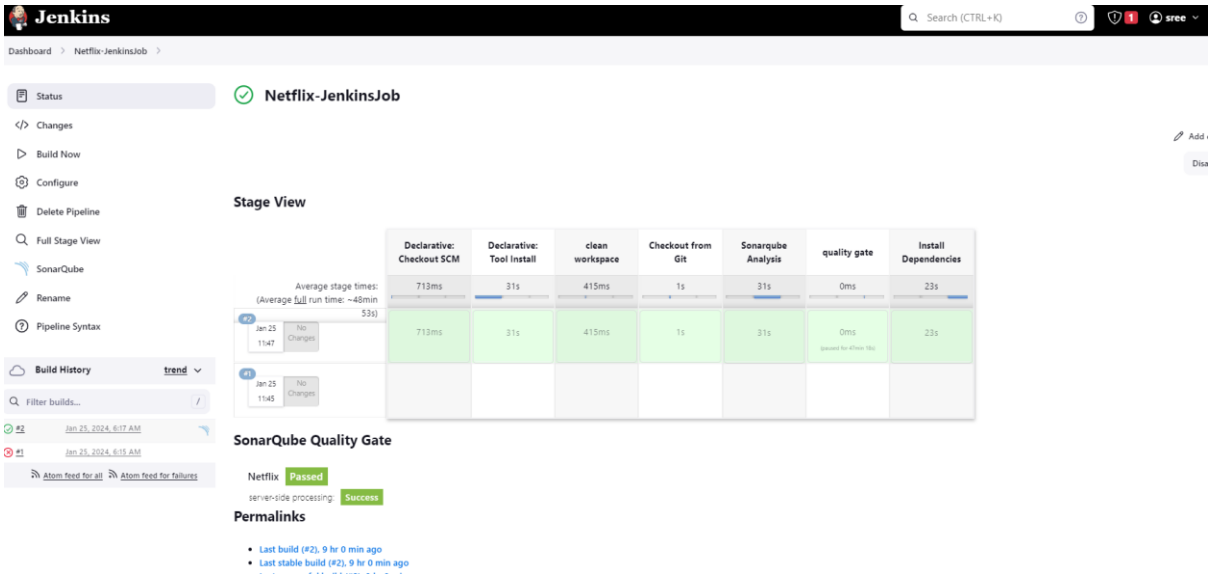


8. Install Docker Tools and Docker Plugins:
    - Go to "Dashboard" in your Jenkins web interface.
    - Navigate to "Manage Jenkins" → "Manage Plugins."
    - Click on the "Available" tab and search for "Docker."
    - Check the following Docker-related plugins:
        1. Docker
        2. Docker Commons
        3. Docker Pipeline
        4. Docker API
        5. docker-build-step
    - Click on the "Install without restart" button to install these plugins.
9. Add DockerHub Credentials:

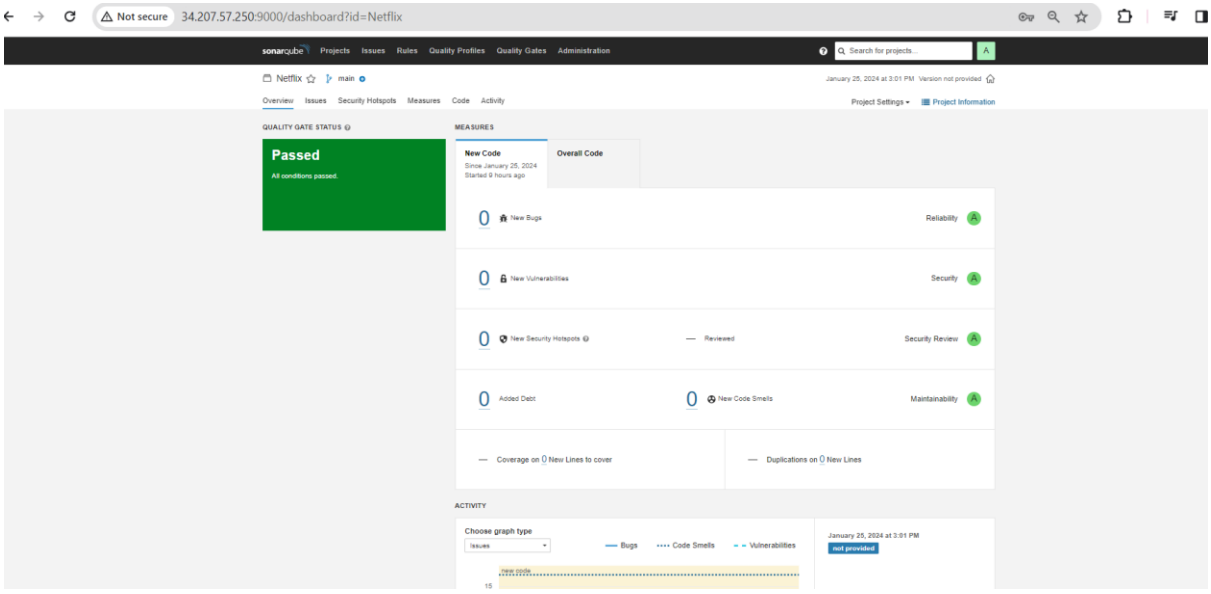
To securely handle DockerHub credentials in your Jenkins pipeline, follow these steps:

- Go to "Dashboard" → "Manage Jenkins" → "Manage Credentials."
- Click on "System" and then "Global credentials (unrestricted)."
- Click on "Add Credentials" on the left side.
- Choose "Secret text" as the kind of credentials.
- Enter your DockerHub credentials (Username and Password) and give the credentials an ID (e.g., "docker").
- Click "OK" to save your DockerHub credentials.

Now, you have installed the Dependency-Check plugin, configured the tool, and added Docker-related plugins along with your DockerHub credentials in Jenkins. You can now proceed with configuring your Jenkins pipeline to include these tools and credentials in your CI/CD process.



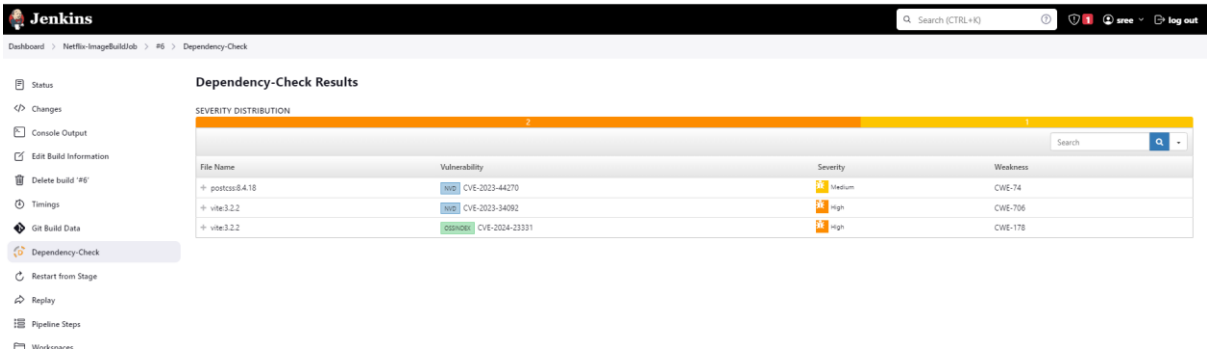
And SonarQube dashboard will look like:



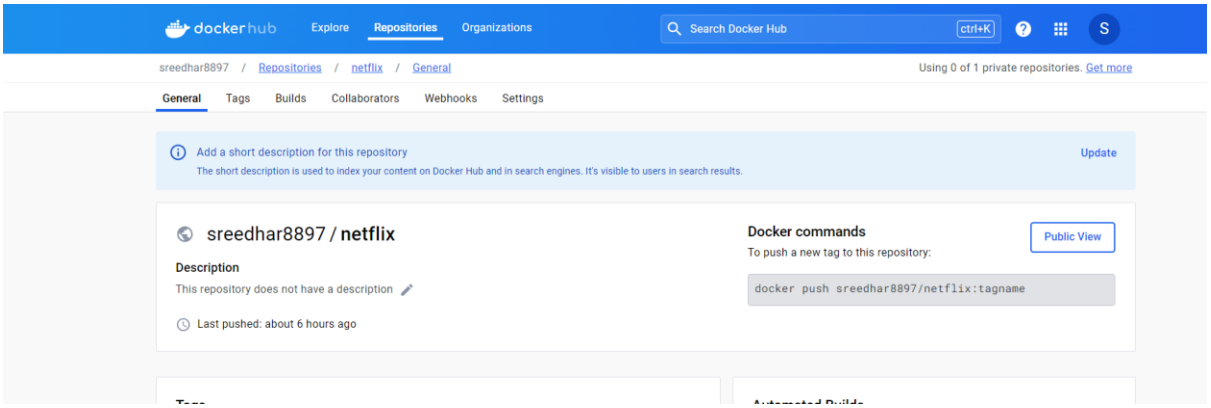
10. Then Simply add the Docker image building and pushing it to the dockerhub steps too in the JenkinsFile.

    After all build steps get successful the Jenkins Job will run and looks like:

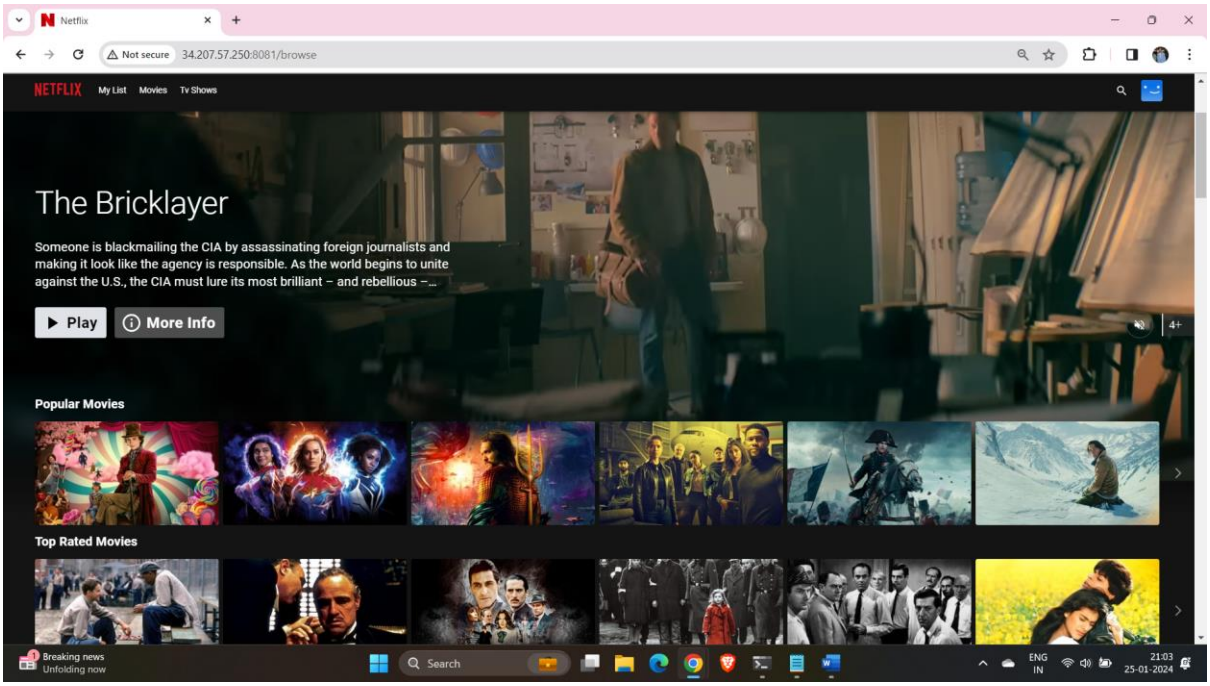
And the dependency checker as:



The image will be moved to your dockerhub



And when u access the <instance ip>:8081 on browser the following page will be displayed



Phase 4: Monitoring

1. Install Prometheus and Grafana:

   Set up Prometheus and Grafana to monitor your application.

   Installing Prometheus:

   - First, create a dedicated Linux user for Prometheus and download Prometheus:
     sudo useradd --system --no-create-home --shell /bin/false Prometheus
     wget https://github.com/prometheus/prometheus/releases/download/v2.47.1/prometheus-2.47.1.linux-amd64.tar.gz
   - Extract Prometheus files, move them, and create directories:
     tar -xvf prometheus-2.47.1.linux-amd64.tar.gz
     cd prometheus-2.47.1.linux-amd64/
     sudo mkdir -p /data /etc/Prometheus
     sudo mv prometheus promtool /usr/local/bin/
     sudo mv consoles/ console_libraries/ /etc/prometheus/
     sudo mv prometheus.yml /etc/prometheus/prometheus.yml

   Set ownership for directories:

   - sudo chown -R prometheus:prometheus /etc/prometheus/ /data/

   Create a systemd unit configuration file for Prometheus:

   - sudo nano /etc/systemd/system/prometheus.service

   Add the following content to the prometheus.service file:

```
[Unit]
Description=Prometheus
Wants=network-online.target
After=network-online.target

StartLimitIntervalSec=500
StartLimitBurst=5

[Service]
User=prometheus
Group=prometheus
Type=simple
Restart=on-failure
RestartSec=5s
ExecStart=/usr/local/bin/prometheus \
  --config.file=/etc/prometheus/prometheus.yml \
  --storage.tsdb.path=/data \
  --web.console.templates=/etc/prometheus/consoles \
  --web.console.libraries=/etc/prometheus/console_libraries \
  --web.listen-address=0.0.0.0:9090 \
  --web.enable-lifecycle

[Install]
WantedBy=multi-user.target
```

- Enable and start Prometheus:
  sudo systemctl enable Prometheus
  sudo systemctl start prometheus
- Verify Prometheus's status:
  sudo systemctl status Prometheus
- You can access Prometheus in a web browser using your server's IP and port 9090:
  http://<your-server-ip>:9090

2. Installing Node Exporter:

- Create a system user for Node Exporter and download Node Exporter:
  sudo useradd --system --no-create-home --shell /bin/false node_exporter
  wget
  https://github.com/prometheus/node_exporter/releases/download/v1.6.1/node_exporter-1.6.1.linux-amd64.tar.gz
- Extract Node Exporter files, move the binary, and clean up:
  tar -xvf node_exporter-1.6.1.linux-amd64.tar.gz
  sudo mv node_exporter-1.6.1.linux-amd64/node_exporter /usr/local/bin/
  rm -rf node_exporter*
- Create a systemd unit configuration file for Node Exporter:
  sudo nano /etc/systemd/system/node_exporter.service
- Add the following content to the node_exporter.service file:

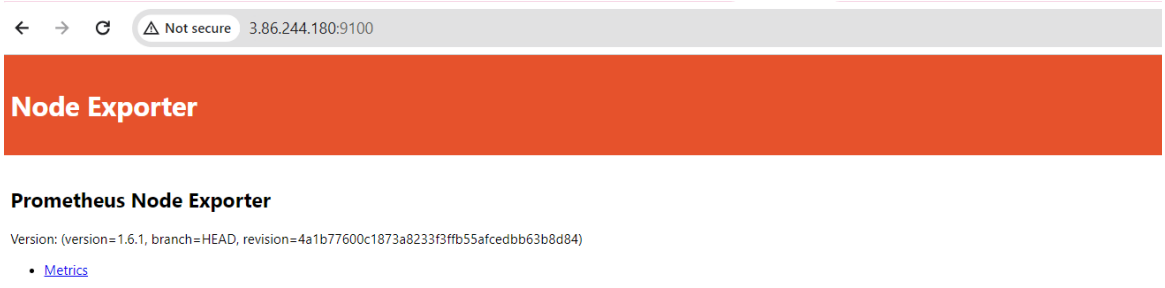
```
[Unit]
Description=Node Exporter
Wants=network-online.target
After=network-online.target

StartLimitIntervalSec=500
StartLimitBurst=5

[Service]
User=node_exporter
Group=node_exporter
Type=simple
Restart=on-failure
RestartSec=5s
ExecStart=/usr/local/bin/node_exporter --collector.logind

[Install]
WantedBy=multi-user.target
```

- Enable and start Node Exporter:
  sudo systemctl enable node_exporter
  sudo systemctl start node_exporter
- Verify the Node Exporter's status:
  sudo systemctl status node_exporter
- You can access Node Exporter metrics in Prometheus.



3. Configure Prometheus Plugin Integration:
   - Integrate Jenkins with Prometheus to monitor the CI/CD pipeline.
   - Prometheus Configuration:
     To configure Prometheus to scrape metrics from Node Exporter and Jenkins, you need to modify the prometheus.yml file. Here is an example prometheus.yml configuration for your setup:

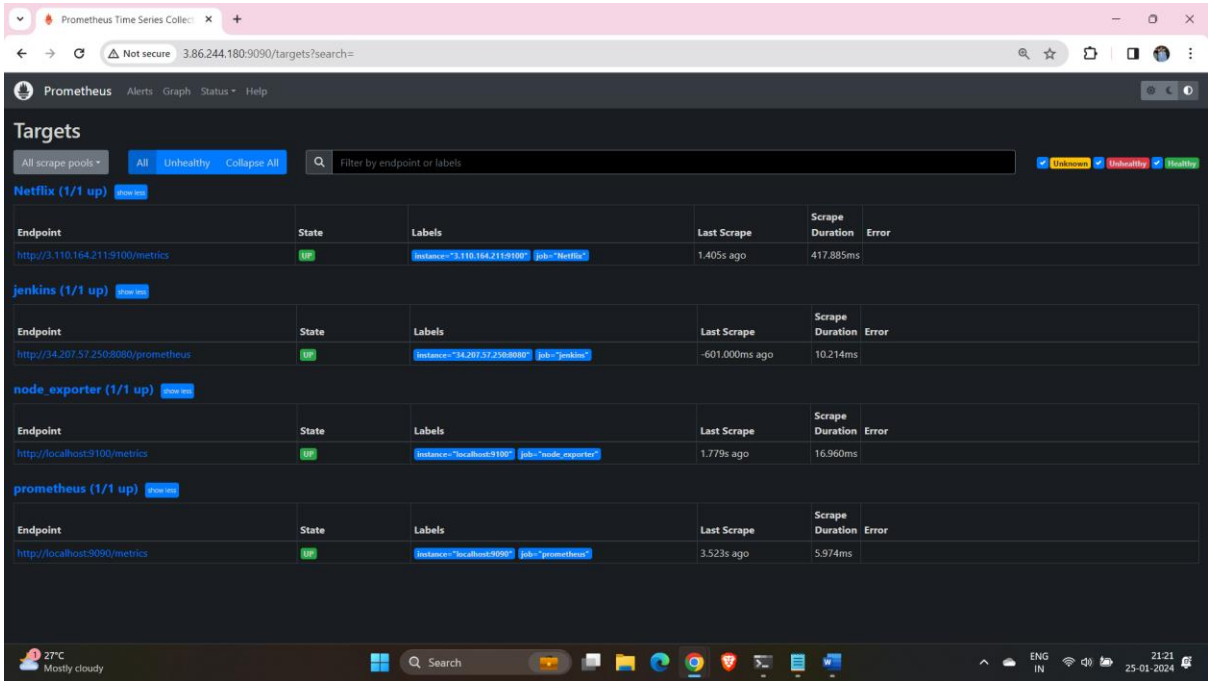
```
global:
  scrape_interval: 15s

scrape_configs:
  - job_name: 'node_exporter'
    static_configs:
      - targets: ['localhost:9100']

  - job_name: 'jenkins'
    metrics_path: '/prometheus'
    static_configs:
      - targets: ['<your-jenkins-ip>:<your-jenkins-port>']
```

- Check the validity of the configuration file:
  promtool check config /etc/prometheus/prometheus.yml
- Reload the Prometheus configuration without restarting:

  curl -X POST http://localhost:9090/-/reload
- You can access Prometheus targets at:
  http://<your-prometheus-ip>:9090/targets



Grafana

Install Grafana on Ubuntu 22.04 and Set it up to Work with Prometheus

Step 1: Install Dependencies:

- First, ensure that all necessary dependencies are installed:
  sudo apt-get update
  sudo apt-get install -y apt-transport-https software-properties-common

Step 2: Add the GPG Key:

- Add the GPG key for Grafana:
  wget -q -O - https://packages.grafana.com/gpg.key | sudo apt-key add -

Step 3: Add Grafana Repository:

- Add the repository for Grafana stable releases:
  echo "deb https://packages.grafana.com/oss/deb stable main" | sudo tee -a /etc/apt/sources.list.d/grafana.list

Step 4: Update and Install Grafana:

- Update the package list and install Grafana:
  sudo apt-get update
  sudo apt-get -y install grafana

Step 5: Enable and Start Grafana Service:

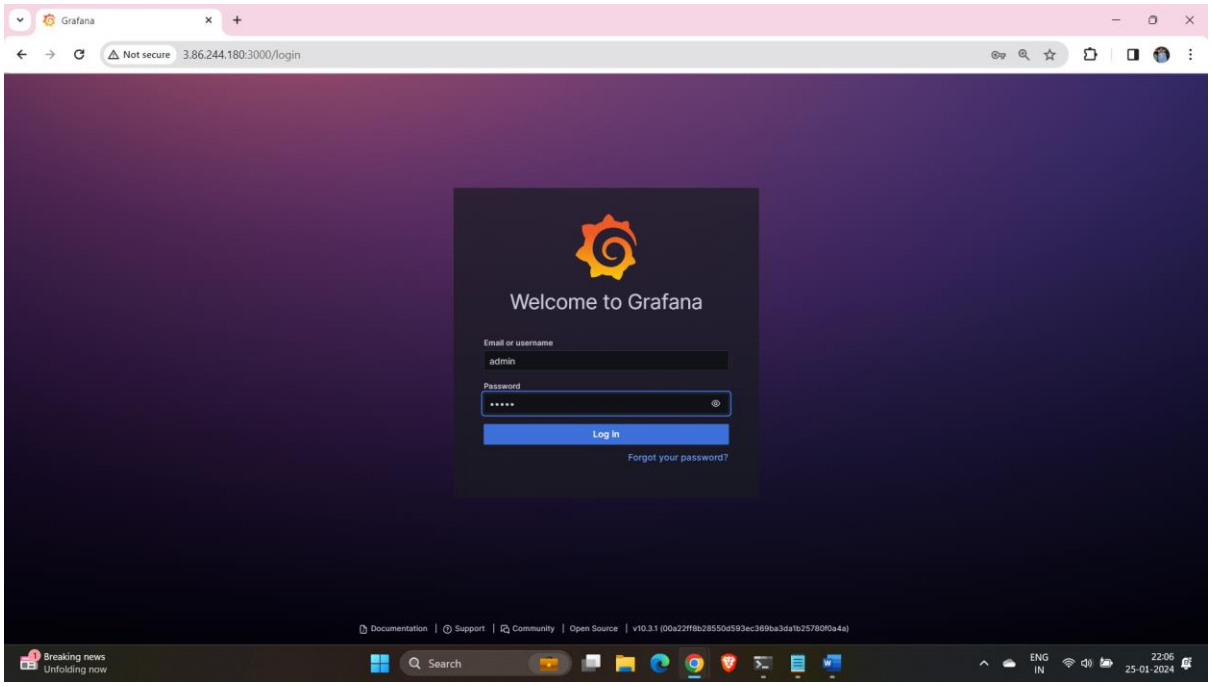
- To automatically start Grafana after a reboot, enable the service:
  sudo systemctl enable grafana-server
- Then, start Grafana:
  sudo systemctl start grafana-server

Step 6: Check Grafana Status:

- Verify the status of the Grafana service to ensure it's running correctly:
  sudo systemctl status grafana-server

Step 7: Access Grafana Web Interface:

- Open a web browser and navigate to Grafana using your server's IP address. The default port for Grafana is 3000. For example:
  http://<your-server-ip>:3000
- You'll be prompted to log in to Grafana. The default username is "admin," and the default password is also "admin."



Step 8: Change the Default Password:

- When you log in for the first time, Grafana will prompt you to change the default password for security reasons. Follow the prompts to set a new password.

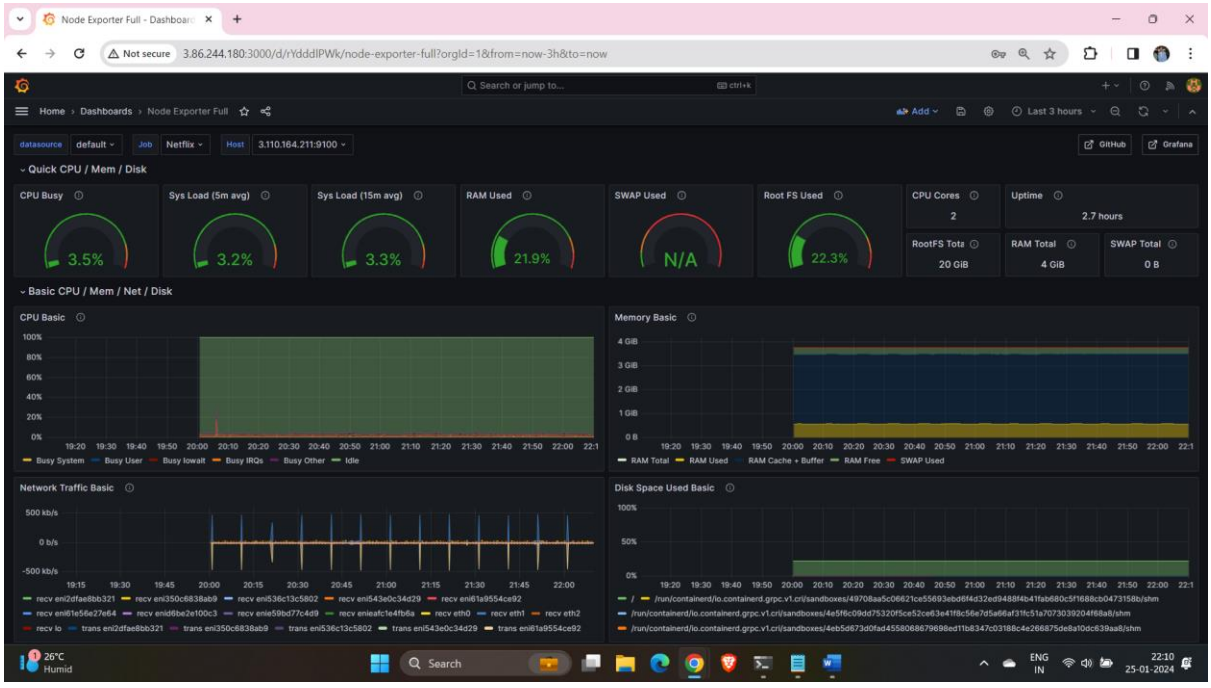
Step 9: Add Prometheus Data Source:

- To visualize metrics, you need to add a data source. Follow these steps:
    1. Click on the gear icon (⚙) in the left sidebar to open the "Configuration" menu.
    2. Select "Data Sources."
    3. Click on the "Add data source" button.
    4. Choose "Prometheus" as the data source type.
    5. In the "HTTP" section:
       Set the "URL" to http://localhost:9090 (assuming Prometheus is running on the same server).
    6. Click the "Save & Test" button to ensure the data source is working.

Step 10: Import a Dashboard:

- To make it easier to view metrics, you can import a pre-configured dashboard. Follow these steps:
- Click on the "+" (plus) icon in the left sidebar to open the "Create" menu.
- Select "Dashboard."
- Click on the "Import" dashboard option.
- Enter the dashboard code you want to import (e.g., code 1860).
- Click the "Load" button.
- Select the data source you added (Prometheus) from the dropdown.
- Click on the "Import" button.

You should now have a Grafana dashboard set up to visualize metrics from Prometheus.

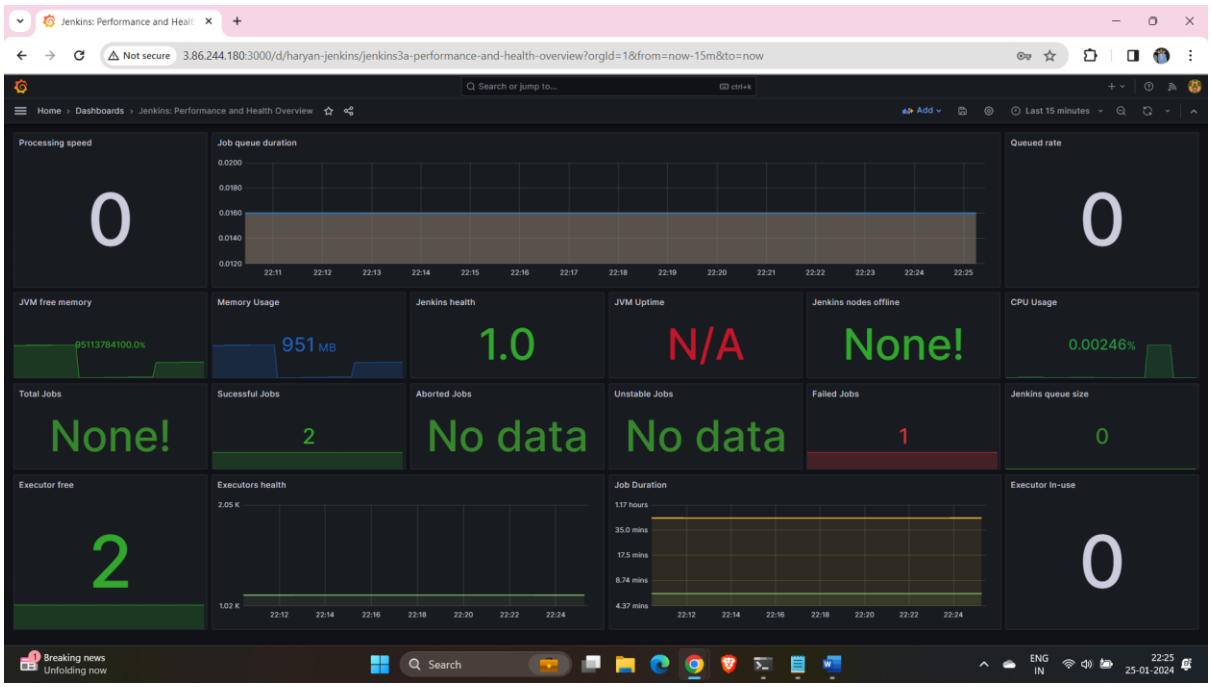


- Grafana is a powerful tool for creating visualizations and dashboards, and you can further customize it to suit your specific monitoring needs.

That's it! You've successfully installed and set up Grafana to work with Prometheus for monitoring and visualization.

Step 11: Configure Prometheus Plugin Integration:

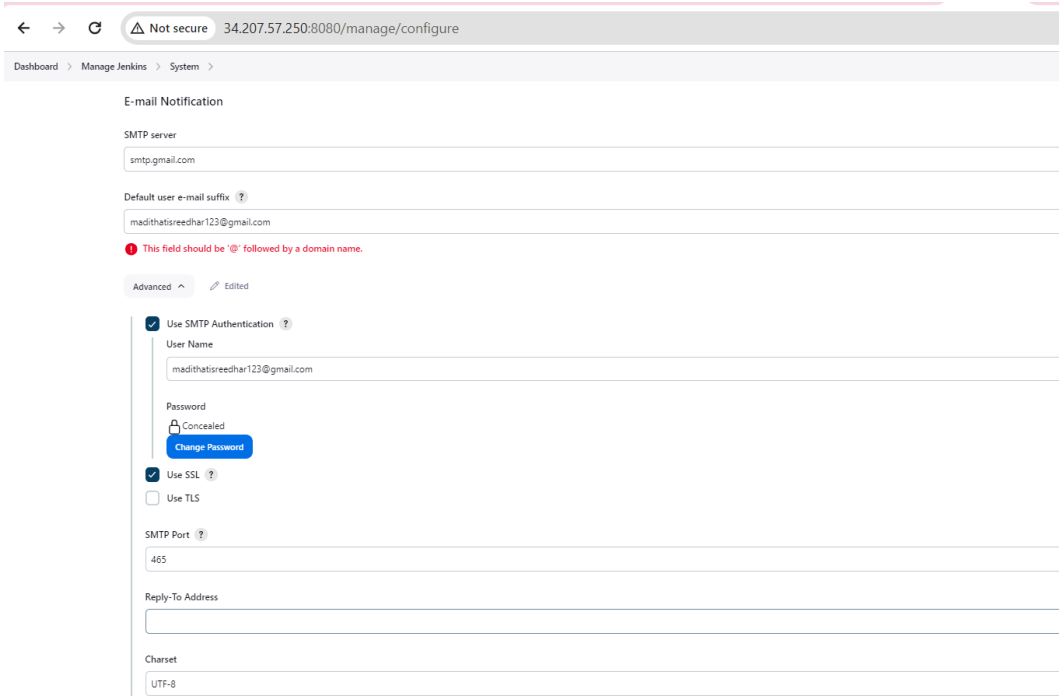
- Integrate Jenkins with Prometheus to monitor the CI/CD pipeline.
- And then create a Grafana Dashboard for the same



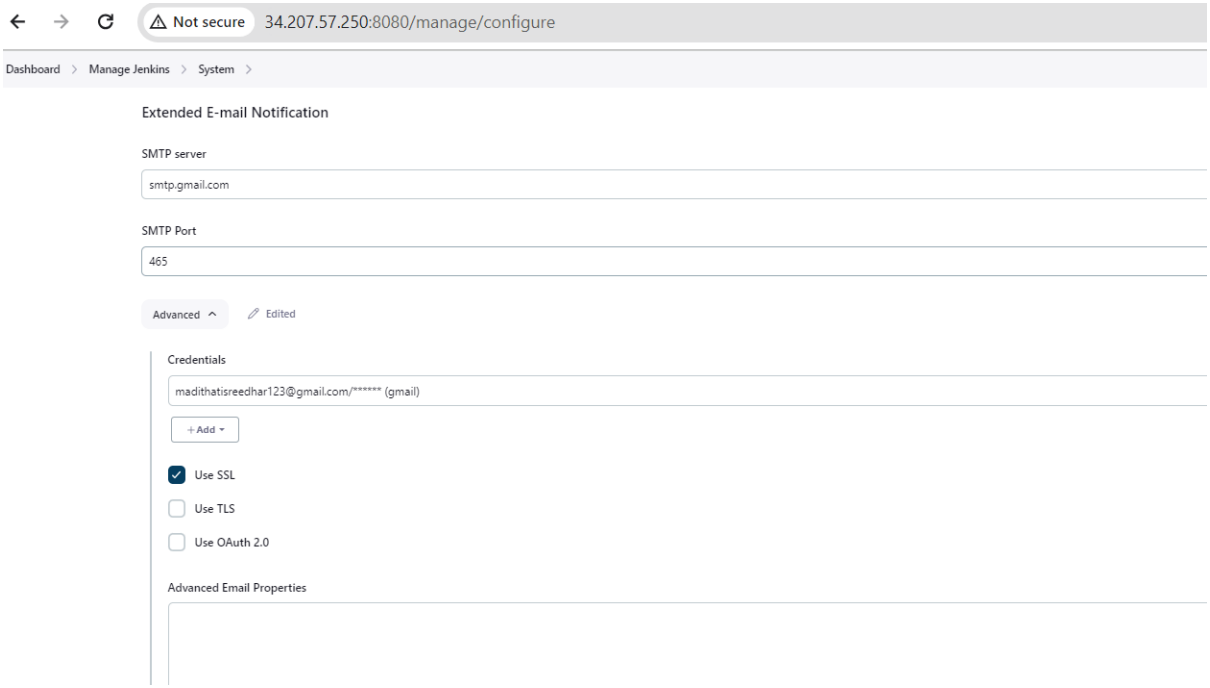
Phase 5: Notification

Implement Notification Services:

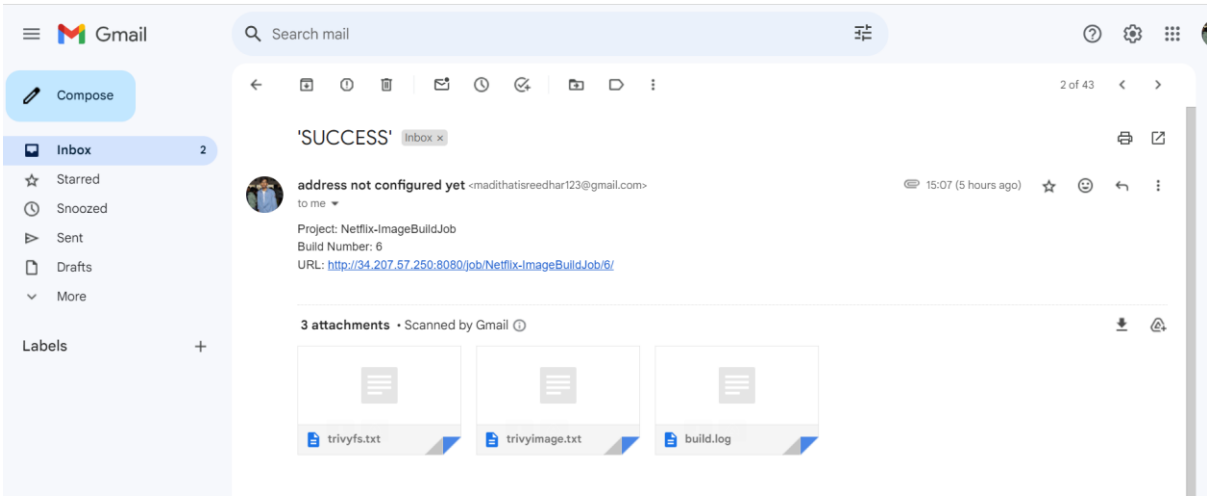
- Set up email notifications in Jenkins or other notification mechanisms.
- Add the Email notification too as a post-build action by configuring it as shown with google app password storing credentials.
- Add this in the email section at Manage Jenkins → System→Email Extension and then test the connection



- And also add this at Extended Email Notification Section



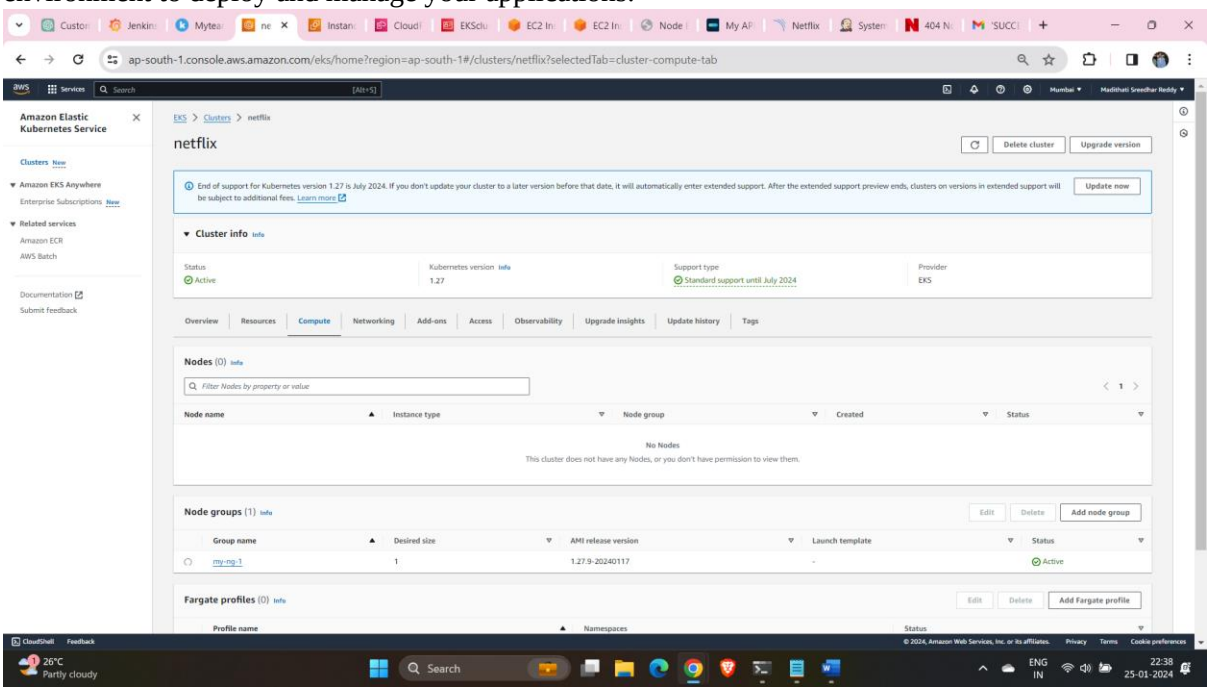
- If any Job Got Success or Failed You will get an email as this:



Phase 6: Kubernetes

Create Kubernetes Cluster with Nodegroups

- In this phase, you'll set up a Kubernetes cluster with node groups. This will provide a scalable environment to deploy and manage your applications.



Monitor Kubernetes with Prometheus

- Prometheus is a powerful monitoring and alerting toolkit, and you'll use it to monitor your Kubernetes cluster. Additionally, you'll install the node exporter using Helm to collect metrics from your cluster nodes.

Install Node Exporter using Helm

- To begin monitoring your Kubernetes cluster, you'll install the Prometheus Node Exporter. This component allows you to collect system-level metrics from your cluster nodes. Here are the steps to install the Node Exporter using Helm:

1. Add the Prometheus Community Helm repository:

- helm repo add prometheus-community https://prometheus-community.github.io/helm-charts

2. Create a Kubernetes namespace for the Node Exporter:
- kubectl create namespace prometheus-node-exporter

3. Install the Node Exporter using Helm:
- helm install prometheus-node-exporter prometheus-community/prometheus-node-exporter --namespace prometheus-node-exporter

Add a Job to Scrape Metrics on nodeip:9001/metrics in prometheus.yml:

- Update your Prometheus configuration (prometheus.yml) to add a new job for scraping metrics from nodeip:9001/metrics. You can do this by adding the following configuration to your prometheus.yml file:

```
- job_name: 'Netflix'

  metrics_path: '/metrics'

  static_configs:

    - targets: ['node1Ip:9100']
```

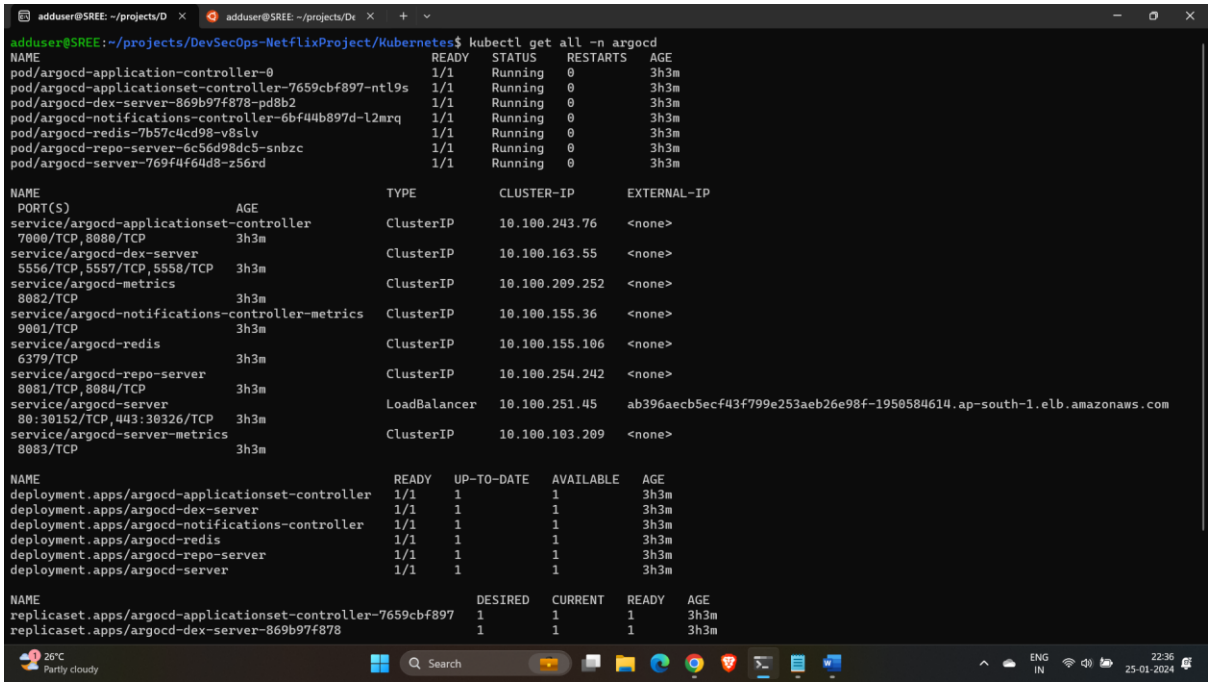
- Replace 'your-job-name' with a descriptive name for your job. The static_configs section specifies the targets to scrape metrics from, and in this case, it's set to nodeip:9001.
- Don't forget to reload or restart Prometheus to apply these changes to your configuration.

To deploy an application with ArgoCD, you can follow these steps, which I'll outline in Markdown format:

Deploy Application with ArgoCD

1.Install ArgoCD:

- You can install ArgoCD on your Kubernetes cluster by following the instructions provided in the EKS Workshop documentation.

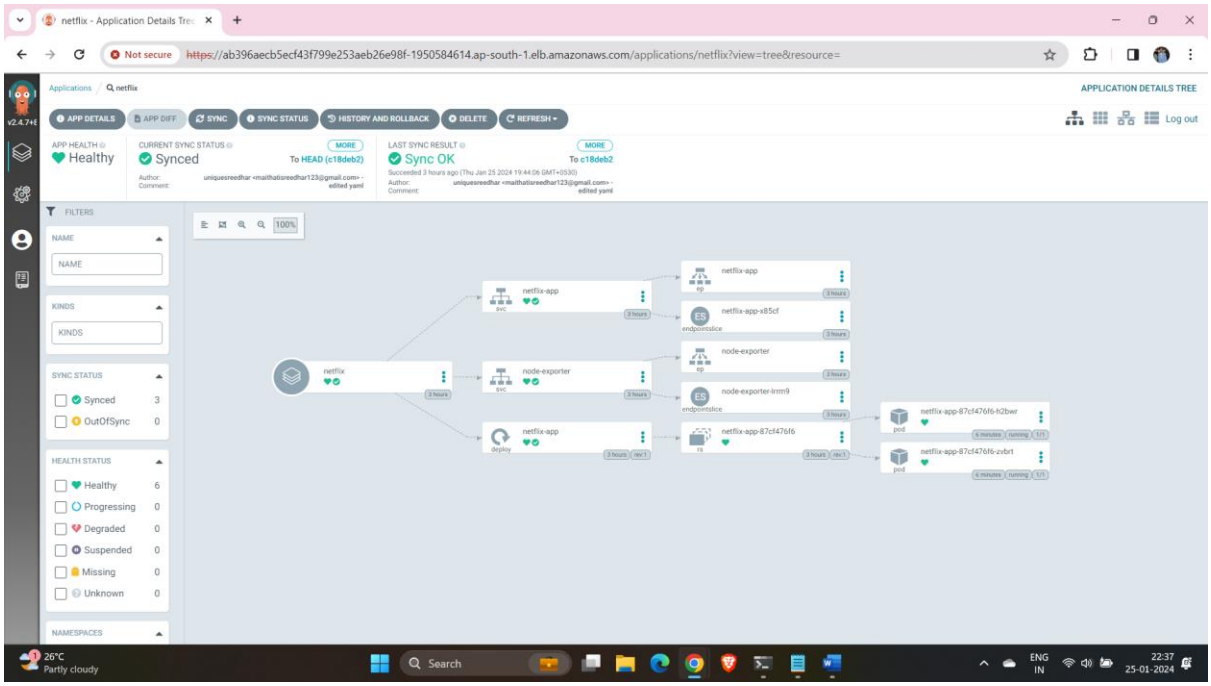


2.Set Your GitHub Repository as a Source:

- After installing ArgoCD, you need to set up your GitHub repository as a source for your application deployment. This typically involves configuring the connection to your repository and defining the source for your ArgoCD application. The specific steps will depend on your setup and requirements.

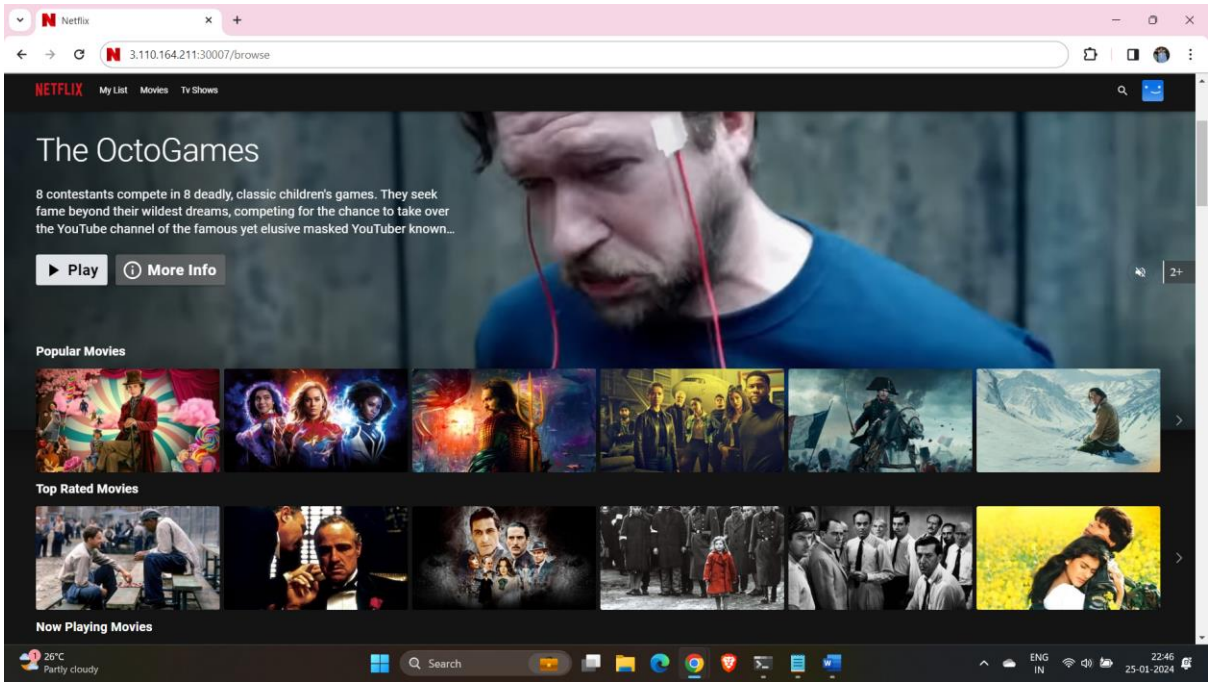
3.Create an ArgoCD Application:

- name: Set the name for your application.
- destination: Define the destination where your application should be deployed.
- project: Specify the project the application belongs to.
- source: Set the source of your application, including the GitHub repository URL, revision, and the path to the application within the repository.
- syncPolicy: Configure the sync policy, including automatic syncing, pruning, and self-healing.



4.Access your Application:

- To Access the app make sure port 30007 is open in your security group and then open a new tab paste your NodeIP:30007, your app should be running.



If you see the page as above:

Congratulations You have Successfully completed the Project

Phase 7: Cleanup

1. Cleanup AWS EC2 Instances:
- Terminate AWS EC2 instances that are no longer needed.
2. Delete the EKS Cluster and Its related resources..

Happy Learning