Comprehensive CI/CD Pipeline with Monitoring: Git, Jenkins, Docker, Kubernetes, Prometheus, and Grafana

Project Overview

This project demonstrates the implementation of a comprehensive CI/CD pipeline using Git, Terraform, Ansible, Docker, and Kubernetes to automate software deployment, scaling, and operations across a Kubernetes cluster. Additionally, the pipeline includes monitoring of Jenkins jobs with Prometheus and Grafana for enhanced observability.

Challenges Addressed

- Increasing Demand: The company required a platform to handle increased demand for their product, which utilized Docker containers.
- Monolithic Architecture: Previously, they used a monolithic architecture with manual deployments.
- Version Control: Implementing a Git workflow for version control and controlled releases.

Solution Implemented

- CI/CD Pipeline: A Jenkins pipeline automates the entire deployment lifecycle.
- Git Integration: Version control is implemented with Git, triggering builds on commits to the master branch.
- Dockerization: Dockerfiles containerize the application code for deployment.
- Kubernetes Deployment: Containerized code gets deployed on a Kubernetes cluster with two replicas.
- NodePort Service: A NodePort service exposes the application on port 30008.
- Infrastructure Provisioning: Terraform manages infrastructure creation on AWS.
- Configuration Management: Ansible deploys necessary software and configurations on servers.
- Monitoring Integration: Prometheus and Grafana are used for monitoring Jenkins jobs. Prometheus collects metrics from Jenkins, and Grafana provides dashboards for visualizing these metrics.

Monitoring Integration

- Prometheus and Grafana: Monitoring of Jenkins jobs is integrated using Prometheus and Grafana.
    - Prometheus Setup: Prometheus is configured to scrape Jenkins metrics and store them.
    - Grafana Dashboard: Grafana is set up to visualize Jenkins metrics, including job performance, build duration, and failure rates.

Key Technologies

- CI/CD Tool: Jenkins

- Version Control: Git
- Infrastructure Provisioning: Terraform
- Configuration Management: Ansible
- Containerization: Docker
- Container Orchestration: Kubernetes
- Monitoring: Prometheus, Grafana

Skills Demonstrated

- CI/CD Pipeline Design and Implementation
- Git Integration for Version Control
- Dockerfile Creation and Containerization
- Kubernetes Deployment and Management
- Infrastructure Provisioning with Terraform
- Configuration Management with Ansible
- Monitoring with Prometheus and Grafana

Project Outcomes

- Automated Deployment: Streamlined the deployment process for faster releases.
- Scalability: Enabled easy scaling to handle increased demand.
- Improved Efficiency: Reduced manual intervention and improved operational efficiency.
- Enhanced Observability: Provided real-time monitoring and insights into Jenkins job performance and system health.

Documentation

This PDF file outlines the complete deployment process with screenshots.

By showcasing this project, I aim to demonstrate my ability to design, implement, and manage complex DevOps CI/CD pipelines for efficient and scalable application deployments.

Contact Information

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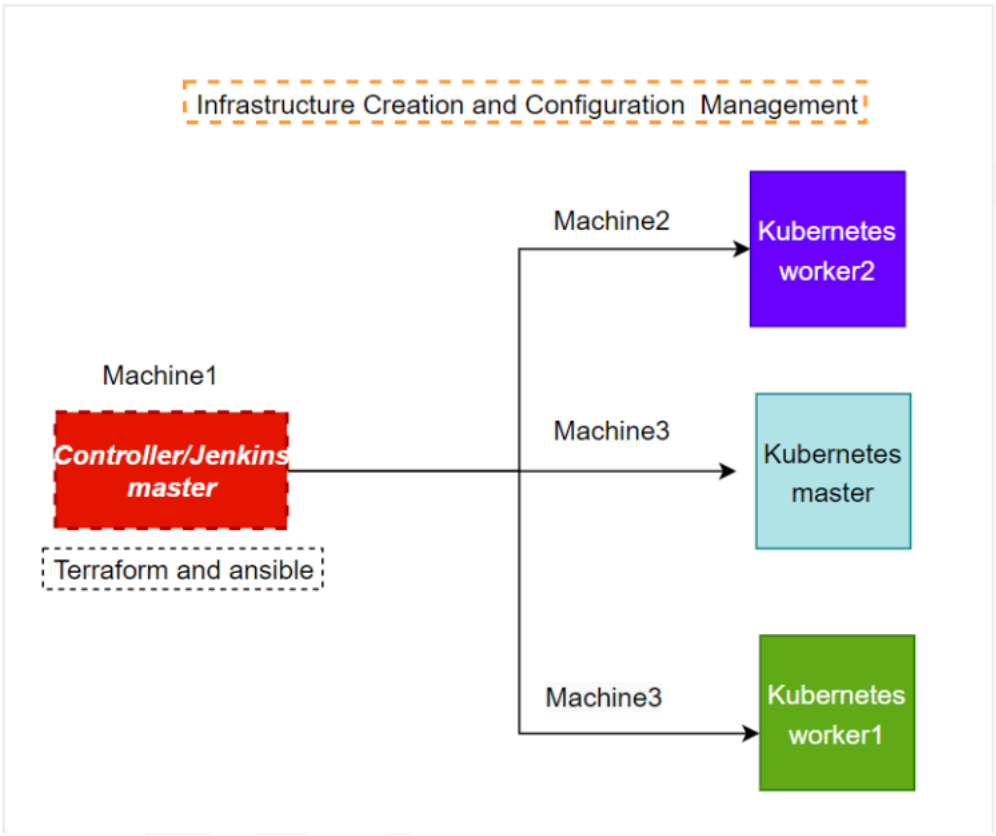
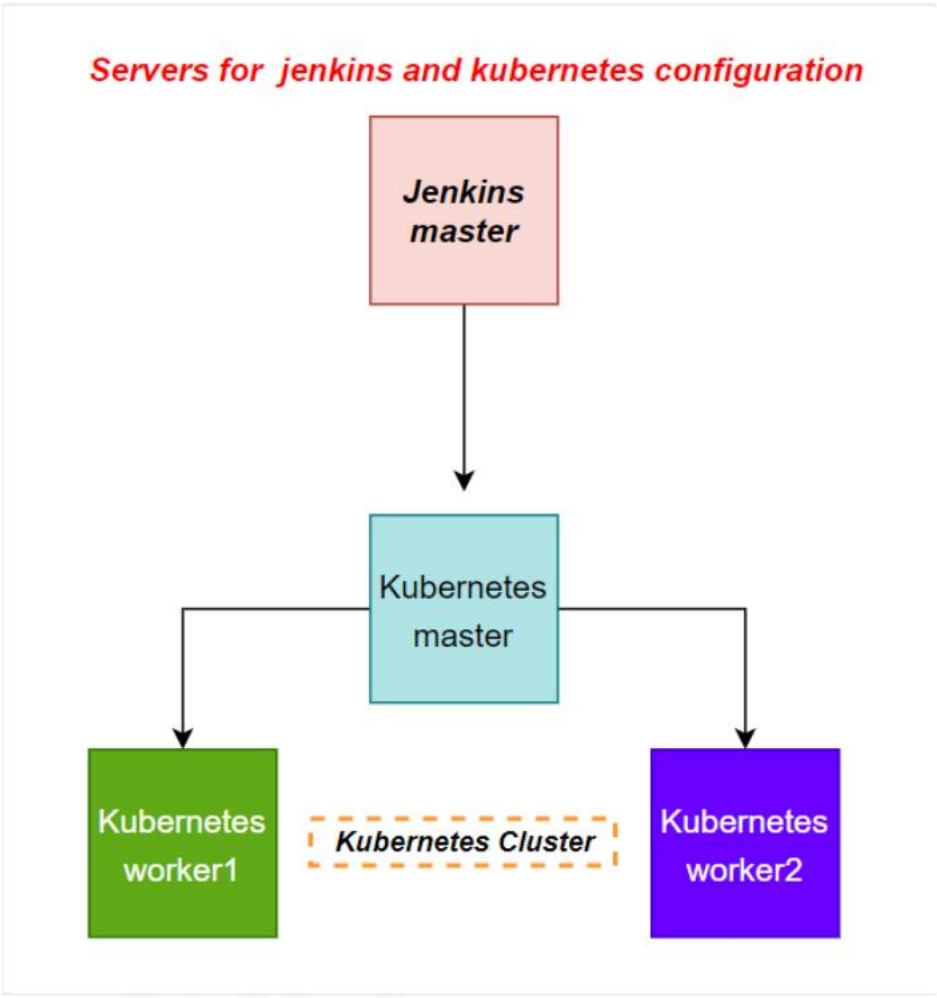

Infrastructure Creation and Configuration Management
Machine2
Kubernetes worker2
Machine1
Controller/Jenkins master
Machine3
Kubernetes master
Terraform and ansible
Machine3
Kubernetes worker1


Servers for jenkins and kubernetes configuration
Jenkins master
Kubernetes master
Kubernetes worker1
Kubernetes Cluster
Kubernetes worker2

Terraform installation

- Created a EC2 instance manually in aws console
- Navigated into the EC2 instance and installed terraform through a shellscript

```
ubuntu@worker1:~$ vi terraforminstall.sh
ubuntu@worker1:~$ bash terraforminstall.sh
```

i-00b8547948a9cfa59 (Worker1)

PublicIPs: 3.141.13.91 PrivateIPs: 172.31.26.221

```
sudo apt-get update && sudo apt-get install -y gnupg software-properties-common
wget -O- https://apt.releases.hashicorp.com/gpg | \
gpg --dearmor | \
sudo tee /usr/share/keyrings/hashicorp-archive-keyring.gpg
gpg --no-default-keyring \
--keyring /usr/share/keyrings/hashicorp-archive-keyring.gpg \
--fingerprint
echo "deb [signed-by=/usr/share/keyrings/hashicorp-archive-keyring.gpg] \
https://apt.releases.hashicorp.com $(lsb_release -cs) main" | \
sudo tee /etc/apt/sources.list.d/hashicorp.list
sudo apt update
sudo apt-get install terraform -y
~
~
~
~
~
~
~
~
"terraforminstall.sh" 12L, 548B
```

Architecture creation

After installation of terraform created a directory named infracreation

- Navigated inside the directory and created a main.tf file with a hcl script to create three EC2 instances

```
ubuntu@worker1:~$ mkdir infracreation
ubuntu@worker1:~$ cd infracreation
ubuntu@worker1:~/infracreation$ vi main.tf
```

```
provider "aws"{
    secret_key= ""
    access_key= ""
    region= "eu-east-2"
}

resource "aws_instance" "k8master"{
    ami= "ami-05fb0b8c1424f266b"
    instance_type= "t2.medium"
    key_name= "venkatohio"
    provider= "aws.worker2"
    tags= {
        Name= "worker2"
    }
}
resource "aws_instance" "k8slave"{
    ami= "ami-05fb0b8c1424f266b"
    instance_type= "t2.medium"
    key_name= "venkatohio"
    provider= "aws.worker3"
    tags= {
        Name= "worker3"
    }
}
resource "aws_instance" "k8slave"{
    ami= "ami-05fb0b8c1424f266b"
    instance_type= "t2.medium"
    key_name= "venkatohio"
    provider= "aws.worker4"
    tags= {
        Name= "worker4"
    }
}
```

- Then initialized terraform

```
ubuntu@worker1:~/infracreation$ terraform init

Initializing the backend...

Initializing provider plugins...
- Finding latest version of hashicorp/aws...
- Installing hashicorp/aws v5.31.0...
- Installed hashicorp/aws v5.31.0 (signed by HashiCorp)

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.
ubuntu@worker1:~/infracreation$
```

- Performed terraform plan

```
ubuntu@worker1:~/infracreation$ 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:

  # aws_instance.this2 will be created
  + resource "aws_instance" "this2" {
      + ami                                  = "ami-05fb0b8c1424f266b"
      + arn                                  = (known after apply)
      + associate_public_ip_address          = (known after apply)
      + availability_zone                    = (known after apply)
      + cpu_core_count                       = (known after apply)
      + cpu_threads_per_core                 = (known after apply)
      + disable_api_stop                     = (known after apply)
      + disable_api_termination              = (known after apply)
      + ebs_optimized                        = (known after apply)
      + get_password_data                    = false
      + host_id                              = (known after apply)
```

- And then applied the changes by terraform apply command

```
aws_instance.this3: Creating...
aws_instance.this4: Creating...
aws_instance.this2: Creating...
aws_instance.this3: Still creating... [10s elapsed]
aws_instance.this4: Still creating... [10s elapsed]
aws_instance.this2: Still creating... [10s elapsed]
aws_instance.this3: Still creating... [20s elapsed]
aws_instance.this4: Still creating... [20s elapsed]
aws_instance.this2: Still creating... [20s elapsed]
aws_instance.this3: Still creating... [30s elapsed]
aws_instance.this4: Still creating... [30s elapsed]
aws_instance.this2: Still creating... [30s elapsed]
aws_instance.this3: Creation complete after 31s [id=i-07edd73dde8245ebf]
aws_instance.this4: Creation complete after 31s [id=i-03b429699eedc391e]
aws_instance.this2: Still creating... [40s elapsed]
aws_instance.this2: Still creating... [50s elapsed]
aws_instance.this2: Creation complete after 52s [id=i-0b31db3012c176c15]

Apply complete! Resources: 3 added, 0 changed, 0 destroyed.
ubuntu@worker1:~/infracreation$
```

Ansible configuration

- Then installed ansible in the server through a ansibleinstall.sh shell script file

```
  GNU nano 6.2                                          ansibleinstall.sh
sudo apt update
sudo apt install software-properties-common
sudo apt-add-repository ppa: ansible/ansible
sudo apt install ansible




                                                    [ Read 4 lines ]
^G Help        ^O Write Out   ^W Where Is    ^K Cut         ^T Execute     ^C Location    M-U Und
^X Exit        ^R Read File   ^\ Replace     ^U Paste       ^J Justify     ^/ Go To Line  M-E Red
```

Ansible is successfully installed

```
ubuntu@worker1:~$ ansible --version
ansible 2.10.8
  config file = None
  configured module search path = ['/home/ubuntu/.ansible/plugins/modules', '/usr/share/ansible/plugins/modules']
  ansible python module location = /usr/lib/python3/dist-packages/ansible
  executable location = /usr/bin/ansible
  python version = 3.10.12 (main, Nov 20 2023, 15:14:05) [GCC 11.4.0]
ubuntu@worker1:~$
```

- Ssh key is generated

```
ubuntu@worker1:~$ ssh-keygen
Generating public/private rsa key pair.
Enter file in which to save the key (/home/ubuntu/.ssh/id_rsa):
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/ubuntu/.ssh/id_rsa
Your public key has been saved in /home/ubuntu/.ssh/id_rsa.pub
The key fingerprint is:
SHA256:rSszP1TSJq9shqpp9O+E2D2pfoOyS920KCG421+fwCE ubuntu@worker1
The key's randomart image is:
+---[RSA 3072]----+
|                 |
|                 |
|         .       |
|.       o.+      |
|o . E o S*.      |
| o.= O +...      |
|..+.=.@+..       |
| +ooo+B+*o       |
|..*B==oO=.       |
+----[SHA256]-----+
```

- Ssh private key is copied

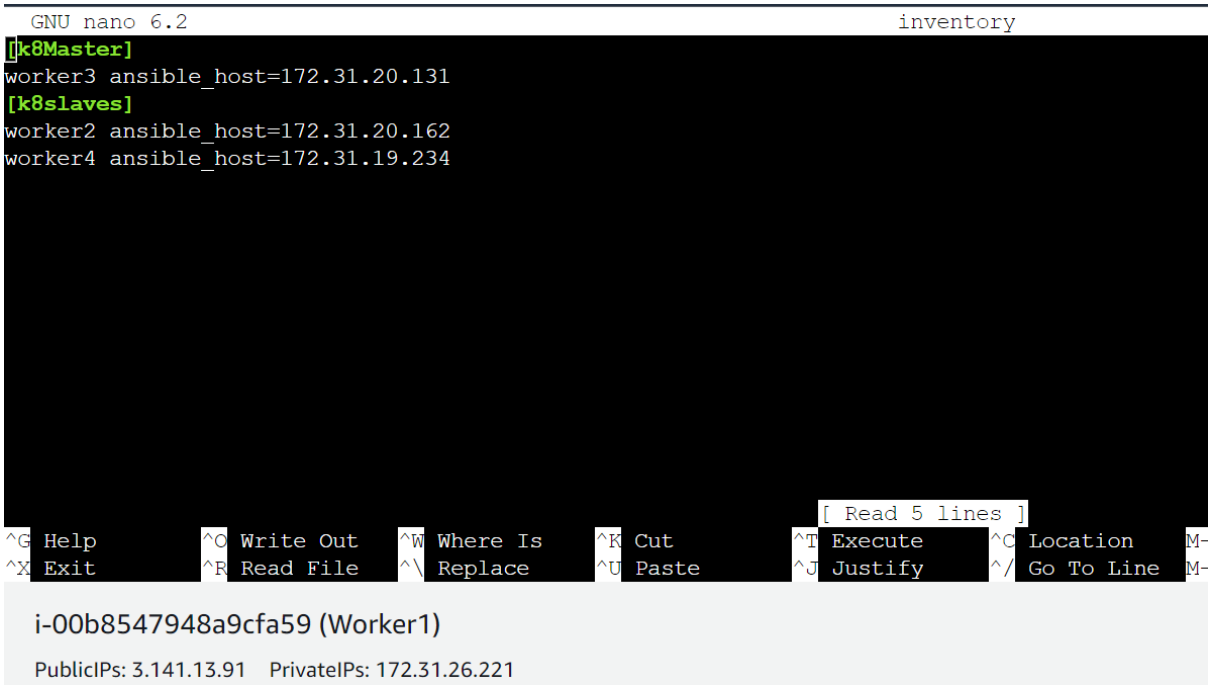
```
ubuntu@worker1:~$ sudo cat /home/ubuntu/.ssh/id_rsa.pub
ssh-rsa AAAAB3NzaC1yc2EAAAADAQABAAABgQCxVi0IcrTODX1Kaqs427G+1Zh5PnV/EICAQDk+aJKqEswZDR4NCQiFPYhPdTNjAsUCs7qR4berZwxAAdS7tvZ2o3oiiki20uud0imjN
hULp0okVKWcATOUm661Vw/3IWinmb70vKOzc5e+H12Htw3HMbF7Cvc1+xx/QYFE8IXUJ9yIQ5C03BYARqi++aB5r63DP4VGj5Qb67nHEzA9IM9zjIaFILIE/7wV1wbyEX6vPCP7Ruitp+
L/6IewxGP0HgClT+ew09rTCcB4jaB9FpZvGewqPI2O0VJ3q7n0pwgHXv8nTWdNnqZDTQ8r0ulDTQdQDnxkNA+xl0Oq5kX90QBpS2dzeb0uQ0ho9KOh+GSnNeIzV6kWxID+eF7t+Kv5QyZ
HUmsmGJ0sXRpVsILsMqd00DN53Lcr27Lu0Y6J7cqQgQl/mXseklNNUTpmfS3AO8lIKtRe0DwRhB1jbx5qiL2L0qRe+RZkfkLoXsG27GalzvTs58Let6IDjIh4fsCdUHM= ubuntu@work
er1
ubuntu@worker1:~$
```

- Navigated to the server worker2 and opened authorized keys file and pasted ssh key generated in worker 1 to establish connection between the two

Similarly same steps performed in worker 3 and worker4

Navigated back to the main server ie., worker1 and created a file named inventory and added private IPs of the worker 2 3 & 4 servers

- Choosen worker3 as a kubernates master and jenkins slave node
- Remaining two servers as kubernates slaves



- With that ansible cluster setup is completed. Ensured connection between all servers by perfoming ansible ping

```
ubuntu@worker1:~$ sudo nano inventory
ubuntu@worker1:~$ ansible -i inventory all -m ping
The authenticity of host '172.31.20.131 (172.31.20.131)' can't be established.
ED25519 key fingerprint is SHA256:xlB5RiGAGABPN0R0DbVSz2KIO59if0V27dyio4nbkU0.
This key is not known by any other names
The authenticity of host '172.31.19.234 (172.31.19.234)' can't be established.
ED25519 key fingerprint is SHA256:Zkel/1vl4HezAbYz0UxAClDr8T0CtPQfBwmuDVsGypA.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? worker2 | SUCCESS => {
    "ansible_facts": {
        "discovered_interpreter_python": "/usr/bin/python3"
    },
    "changed": false,
    "ping": "pong"
}
yes
worker3 | SUCCESS => {
    "ansible_facts": {
        "discovered_interpreter_python": "/usr/bin/python3"
    },
    "changed": false,
    "ping": "pong"
}
yes
worker4 | SUCCESS => {
    "ansible_facts": {
        "discovered_interpreter_python": "/usr/bin/python3"
    },
    "changed": false,
    "ping": "pong"
}
ubuntu@worker1:~$
```

Configuration deployments

- After that a shell script named localhost.sh is created to install java and jenkins in localhost(worker1)

```
  GNU nano 6.2                                                  localhost.sh
sudo apt update
sudo apt install openjdk-11-jdk -y
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 -y
```

- Similarly another shellscript worker3.sh is created to install java docker and kubernates in worker3

```
  GNU nano 6.2                                          worker3.sh
sudo apt update
sudo apt install openjdk-11-jdk -y
sudo apt update
sudo apt install docker.io -y
sudo apt update -y

sudo apt install curl apt-transport-https -y
curl -fsSL  https://packages.cloud.google.com/apt/doc/apt-key.gpg|sudo gpg --dearmor -o /etc/apt/trusted.gpg.d/k8s.gpg
echo "deb https://apt.kubernetes.io/ kubernetes-xenial main" | sudo tee /etc/apt/sources.list.d/kubernetes.list

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

sudo swapoff -a
sudo sed -i '/ swap / s/^(.*)$/#\1/g' /etc/fstab
sudo tee /etc/modules-load.d/k8s.conf <<EOF
                                [ Read 46 lines ]
^G Help       ^O Write Out  ^W Where Is   ^K Cut        ^T Execute    ^C Location   M-U Undo      M-A Set Mark   M-] To Bracket
^X Exit       ^R Read File  ^\ Replace    ^U Paste      ^J Justify    ^/ Go To Line M-E Redo      M-6 Copy       ^Q Where Was
```

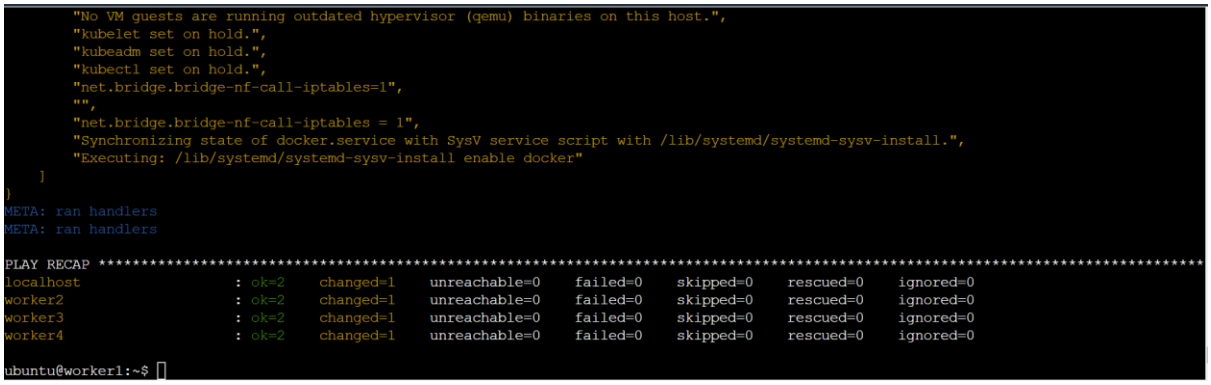
- Finally last shellscript is created to install docker and kubernates on worker2 and worker4

```
  GNU nano 6.2                                          slaves.sh *
sudo apt update
sudo apt install docker.io -y
sudo apt update -y

sudo apt install curl apt-transport-https -y
curl -fsSL  https://packages.cloud.google.com/apt/doc/apt-key.gpg|sudo gpg --dearmor -o /etc/apt/trusted.gpg.d/k8s.gpg
echo "deb https://apt.kubernetes.io/ kubernetes-xenial main" | sudo tee /etc/apt/sources.list.d/kubernetes.list

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

sudo swapoff -a
sudo sed -i '/ swap / s/^(.*)$/#\1/g' /etc/fstab

sudo tee /etc/modules-load.d/k8s.conf <<EOF
overlay
```

- An ansible playbook is created to ececute these shellscripts in their respective servers/hosts

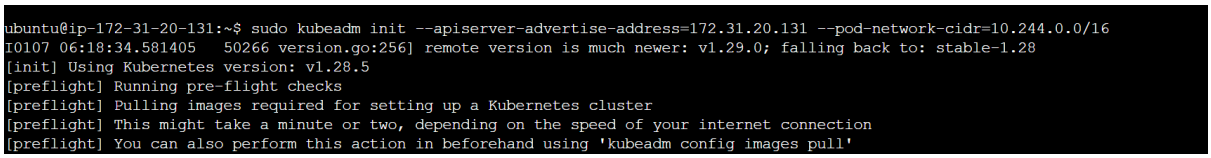
```
---
- hosts: localhost
  name: installing jenkins and java
  become: yes
  tasks:
    - name: executing localhost.sh
      script: localhost.sh
- hosts: k8Master
  name: installing java docker and kubernates
  become: yes
  tasks:
    - name: executing worker3.sh
      script: worker3.sh
- hosts: k8slaves
  name: installing docker and kubernates
  become: yes
  tasks:
    - name: executing slaves.sh
      script: slaves.sh
~
"playbook.yml" 19L, 427B
```

- The playbook is executed successfully resulting the installations in the target host servers

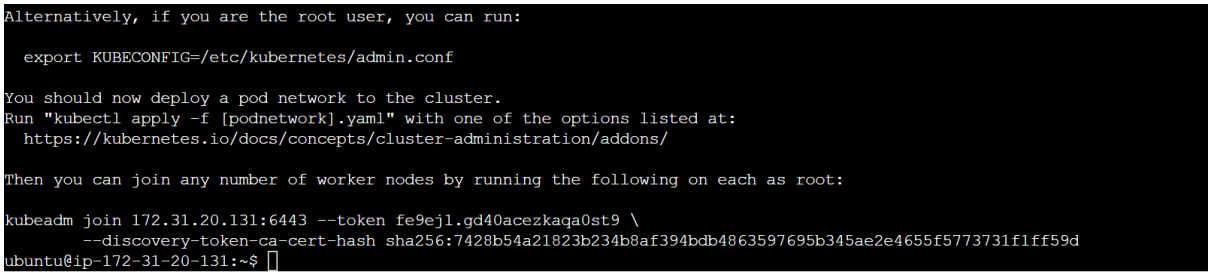


Kubernates cluster configuration

Navigated to the kubernates master and initialised kubeadm



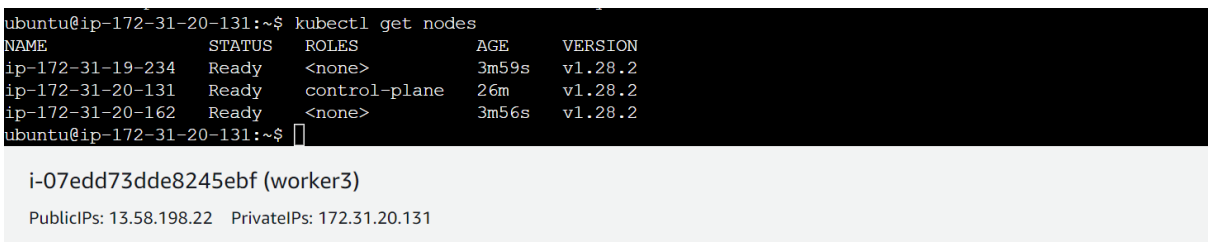
Generated kubeadm token is copied



kubeadm join 172.31.20.131:6443 --token fe9ej1.gd40acezkaqa0st9 \

--discovery-token-ca-cert-hash sha256:7428b54a21823b234b8af394bdb4863597695b345ae2e4655f5773731f1ff59d

- Kubeadm token is ran in the kubernates slaves joining them to the cluster
- Kubernates cluster is successfully configured

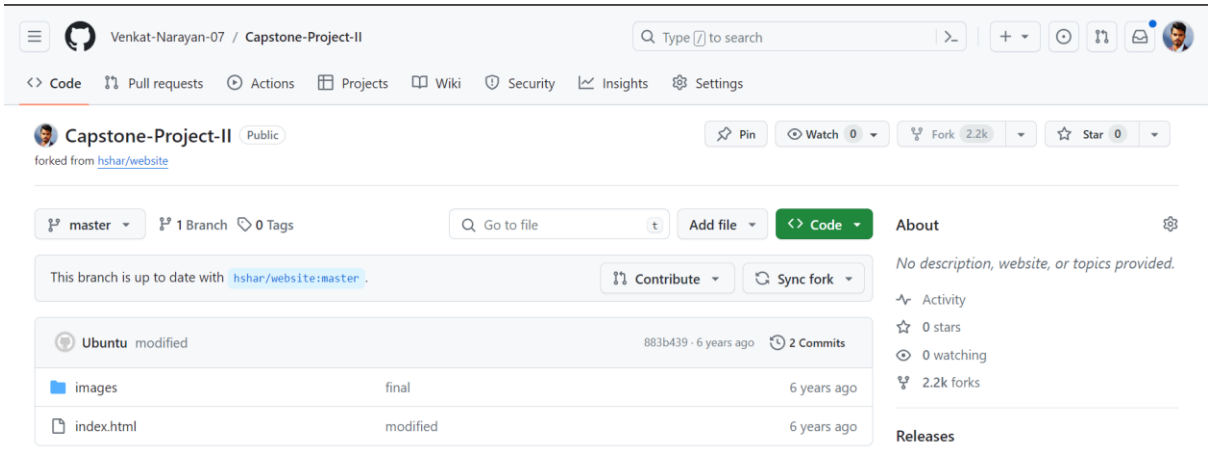


i-07edd73dde8245ebf (worker3)

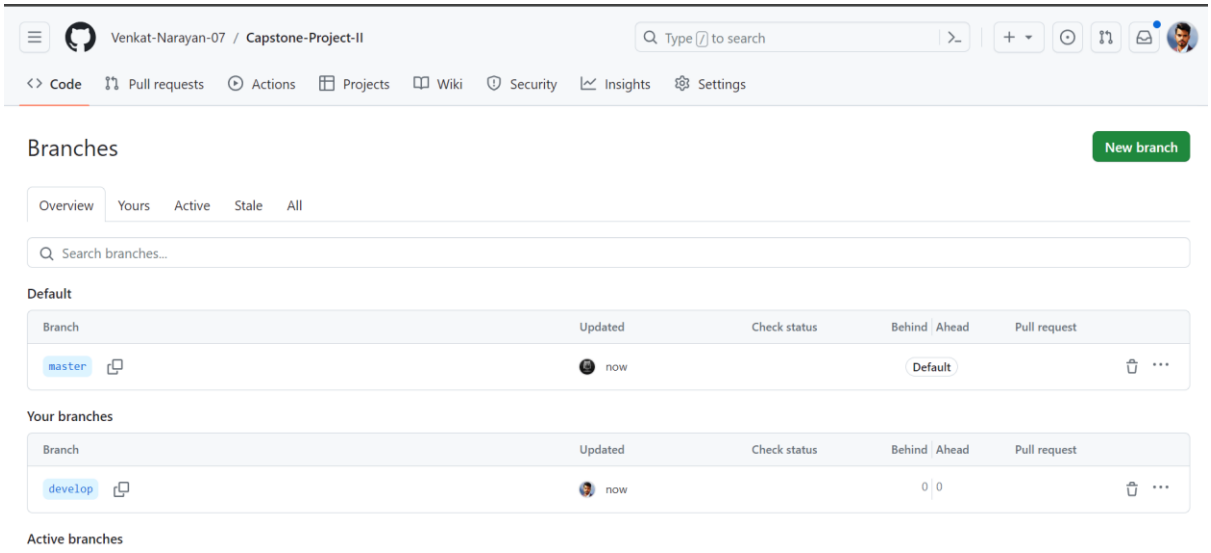
PublicIPs: 13.58.198.22 PrivateIPs: 172.31.20.131

Github configuration

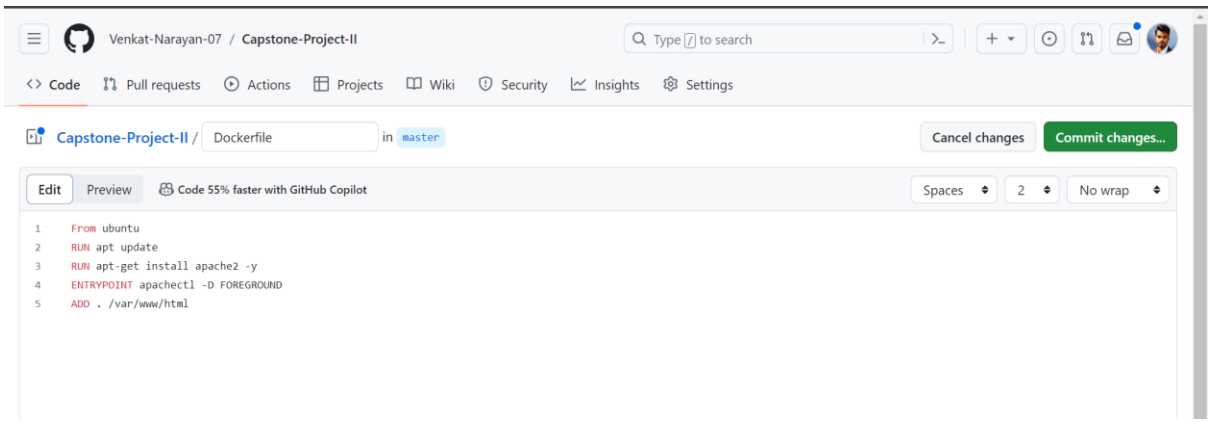
- Then navigated to the git repo provided and forked to my github account



- Created a new branch named develop



- Then created a new file named dockerfile to copy the entire repo and create a custom image out of it



- Similarly created a new file named hshar-deployment.yml to deploy hshar webpage from the image created by dockerfile with 3 replicas and create and attach nodeport service on port 30008

Venkat-Narayan-07 Update hshar-deployment.yml

Code Blame 21 lines (21 loc) · 352 Bytes Code 55% faster with GitHub Copilot

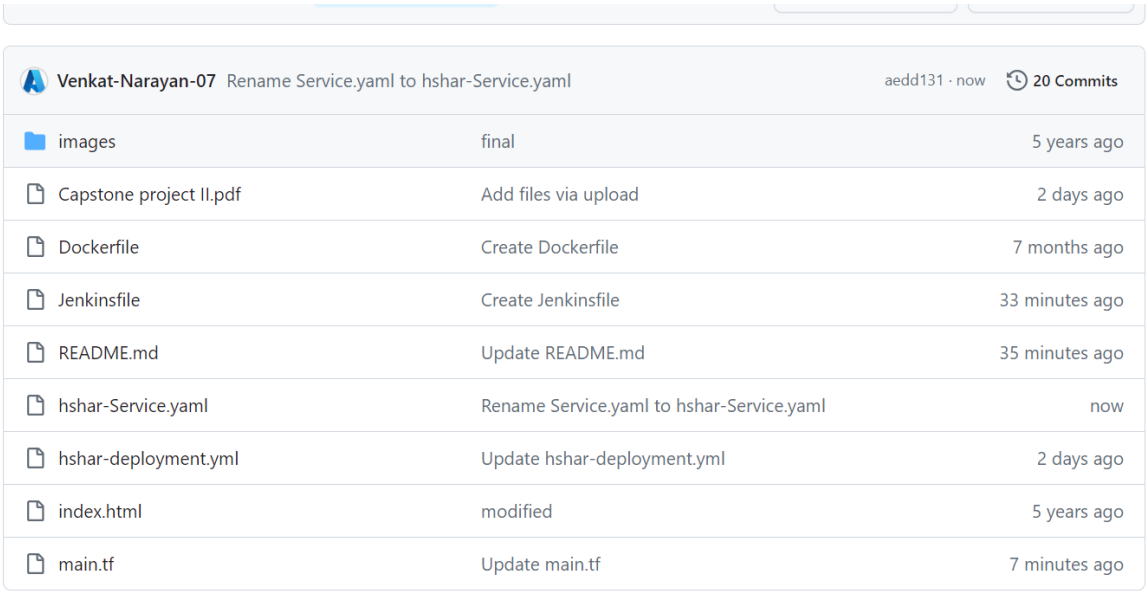
```yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  name: hshar-deployment
  labels:
    web: hshar
spec:
  replicas: 1
  selector:
    matchLabels:
      web: hshar
  template:
    metadata:
      labels:
        web: hshar
    spec:
      containers:
      - name: hshar
        image: venkatnarayan16/hshar
        ports:
          - containerPort: 80
```

Capstone-Project-II / hshar-Service.yaml in master

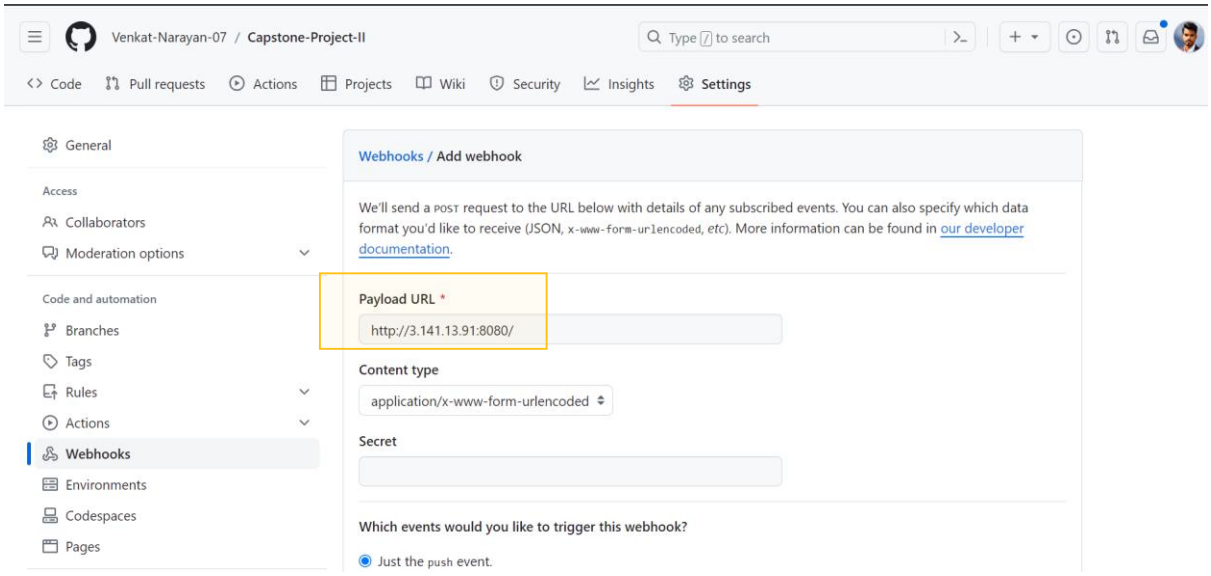
Edit Preview Code 55% faster with GitHub Copilot

```yaml
apiVersion: v1
kind: Service
metadata:
  name: hshar-service
spec:
  type: NodePort
  selector:
    web: hshar
  ports:
    - port: 80
      nodePort: 30008

```

- With that our git repo is ready

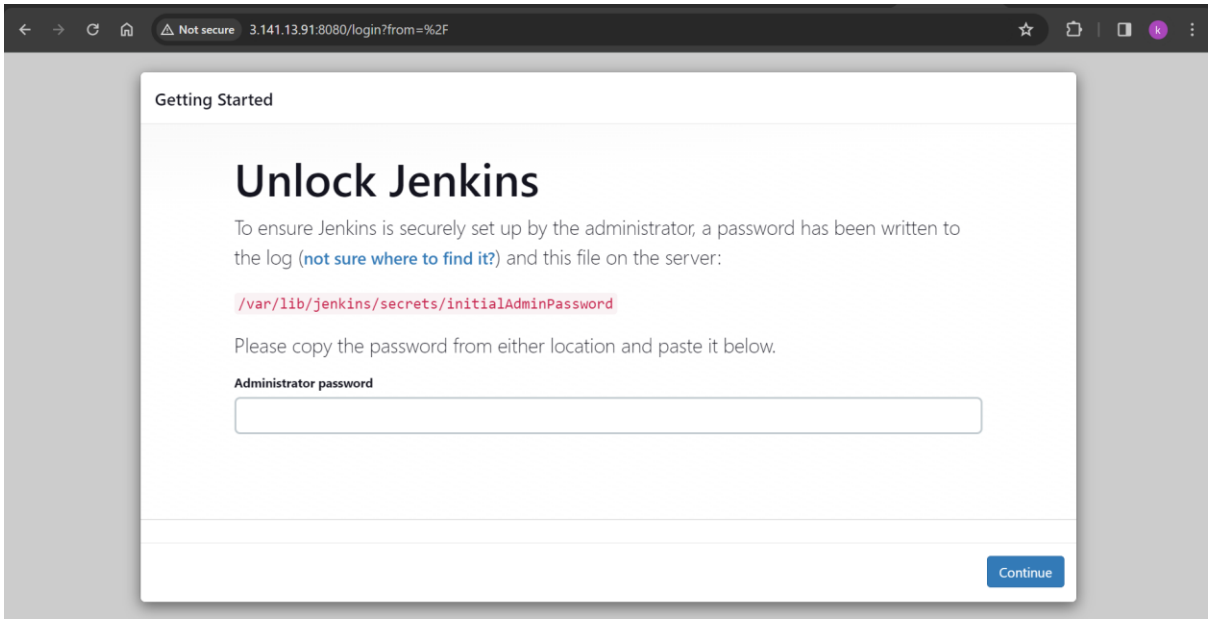


- Finally in the repo settings, a webhook is created to get triggered whenever there is a push to the repo



Jenkins configuration

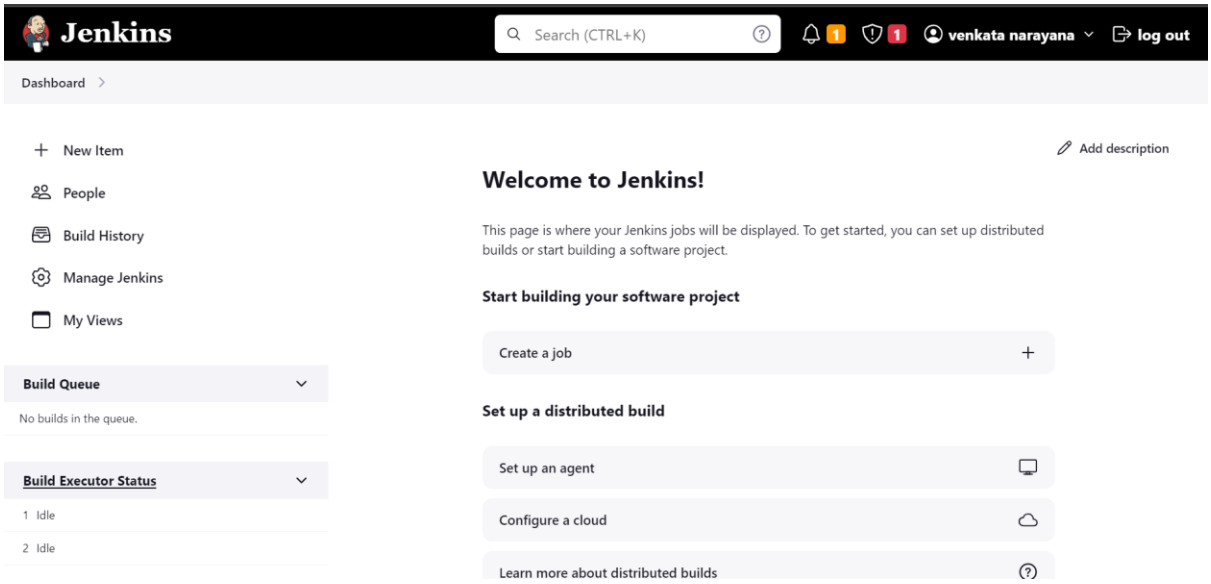
- Afterthat navigated to the jenkins dashboard and signed in



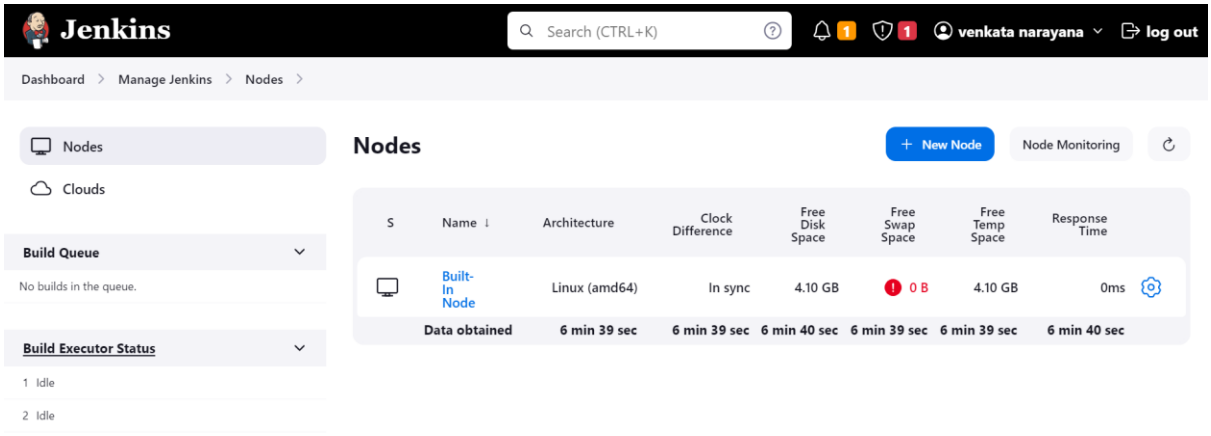

```
ubuntu@worker1:~$ sudo cat /var/lib/jenkins/secrets/initialAdminPassword
1104584b404c4f5998b0fa1460455790
ubuntu@worker1:~$
```

i-00b8547948a9cfa59 (Worker1)

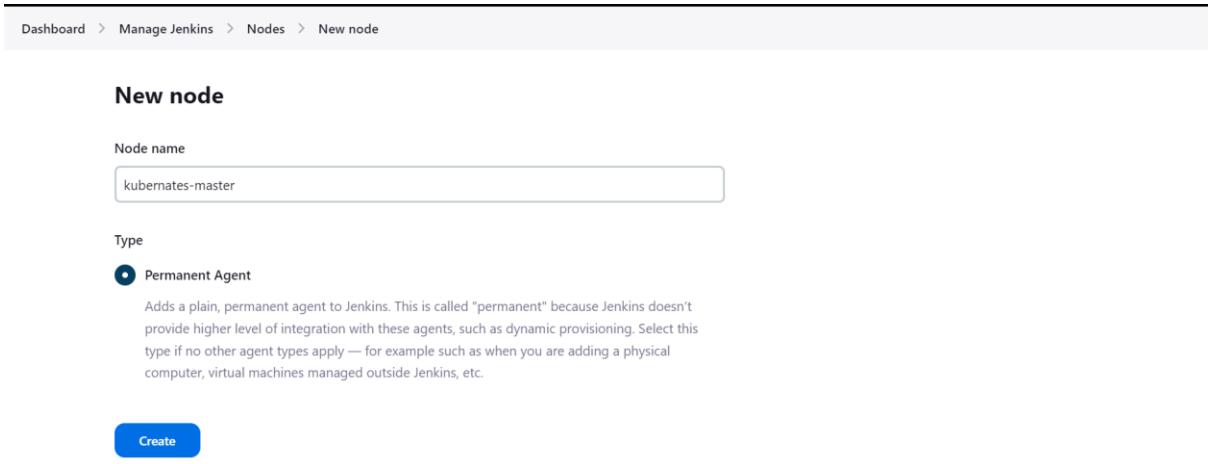
PublicIPs: 3.141.13.91 PrivateIPs: 172.31.26.221

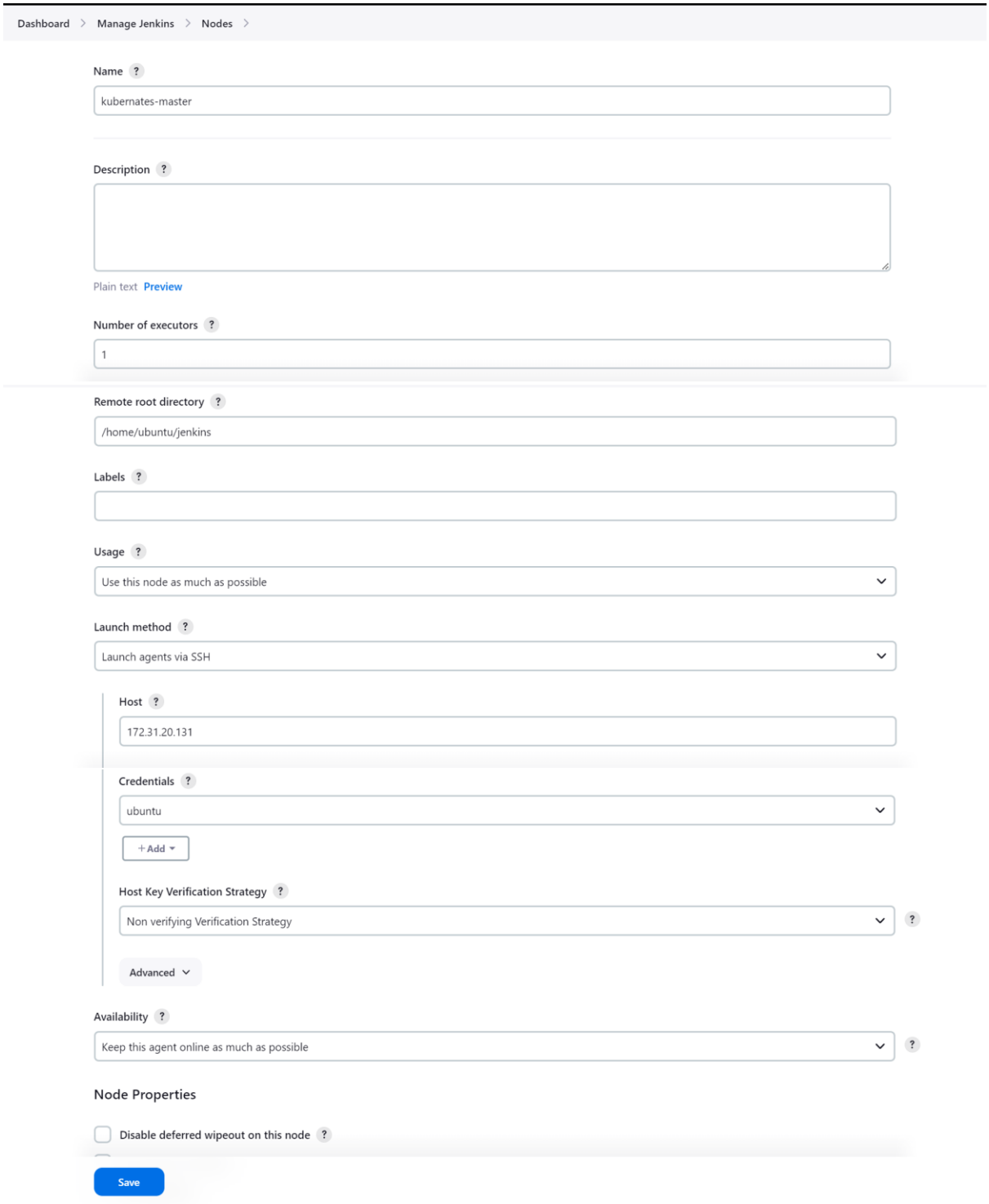


- In the jenkins dashboard navigated to manage jenkins and nodes and added a new node

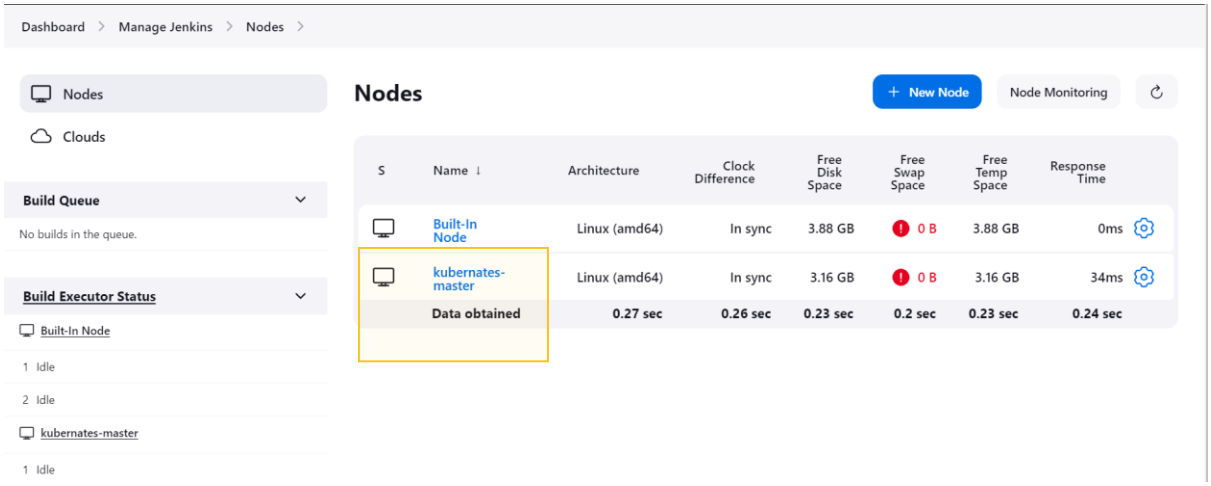


- Named the node as kubernates master and provided private IP of the worker3 server

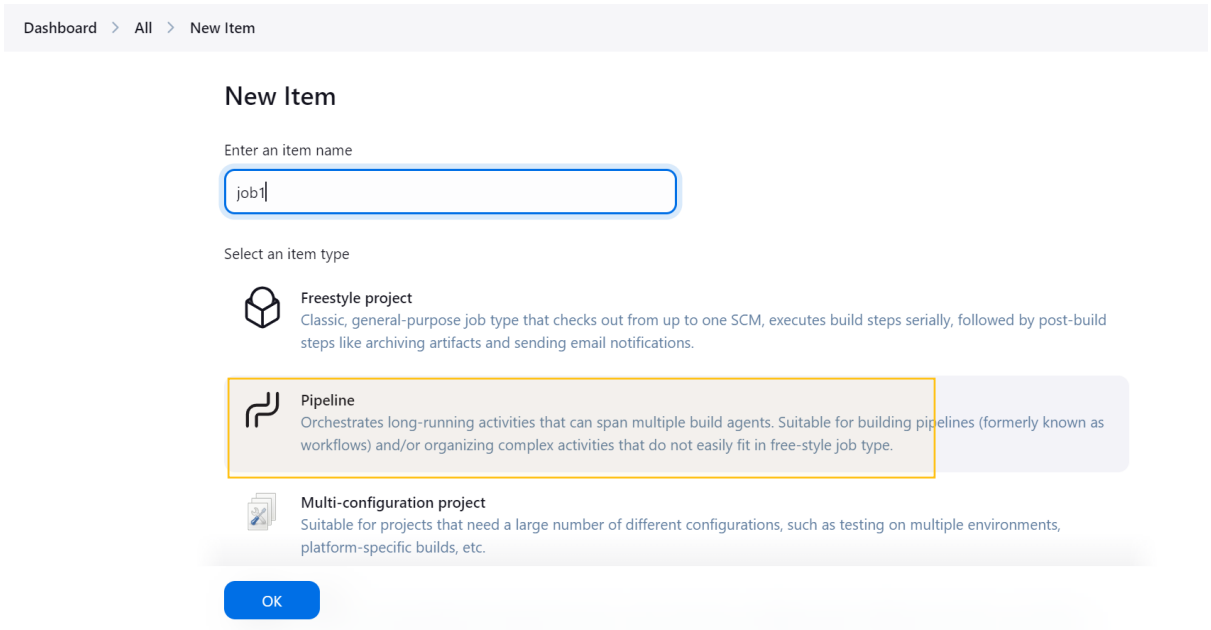



Dashboard > Manage Jenkins > Nodes >
Name ?
kubernates-master
Description ?
Plain text Preview
Number of executors ?
1
Remote root directory ?
/home/ubuntu/jenkins
Labels ?
Usage ?
Use this node as much as possible
Launch method ?
Launch agents via SSH
Host ?
172.31.20.131
Credentials ?
ubuntu
+ Add
Host Key Verification Strategy ?
Non verifying Verification Strategy
Advanced
Availability ?
Keep this agent online as much as possible
Node Properties
Disable deferred wipeout on this node ?
Save

- Worker3 is successfully added as a jenkins node



- Then created a job1



- Job1 is configured to the worker3 and git repo and the master branch is specified in source code management.
- Enabled webhook to trigger build whenever there is a push to master branch

Dashboard > job1 > Configuration

Configure

- General
- Advanced Project Options
- Pipeline

General

Enabled

Description

End-to-end Jenkins CI/CD pipeline using Docker and Kubernates

Plain text Preview

- [ ] Discard old builds
- [ ] Do not allow concurrent builds
- [ ] Do not allow the pipeline to resume if the controller restarts
- [ ] GitHub project
- [ ] Pipeline speed/durability override

Configure

- General
- Advanced Project Options
- Pipeline

Build Triggers

- [ ] Build after other projects are built
- [ ] Build periodically
- [x] GitHub hook trigger for GITScm polling
- [ ] Poll SCM
- [ ] Quiet period
- [ ] Trigger builds remotely (e.g., from scripts)

Advanced Project Options

Advanced

Pipeline

Configure

- General
- Advanced Project Options
- Pipeline

Pipeline script from SCM

SCM

Git

Repositories

Repository URL

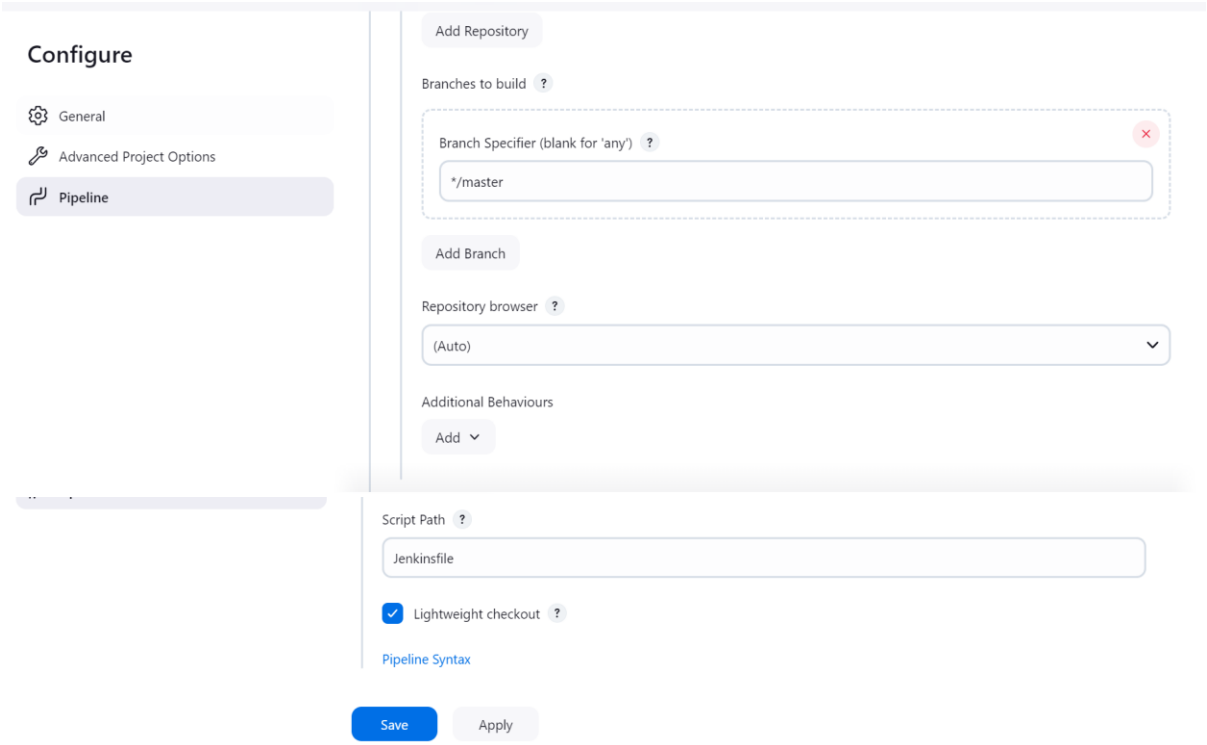
https://github.com/Venkat-Narayan-07/Capstone-Project-II.git

Credentials

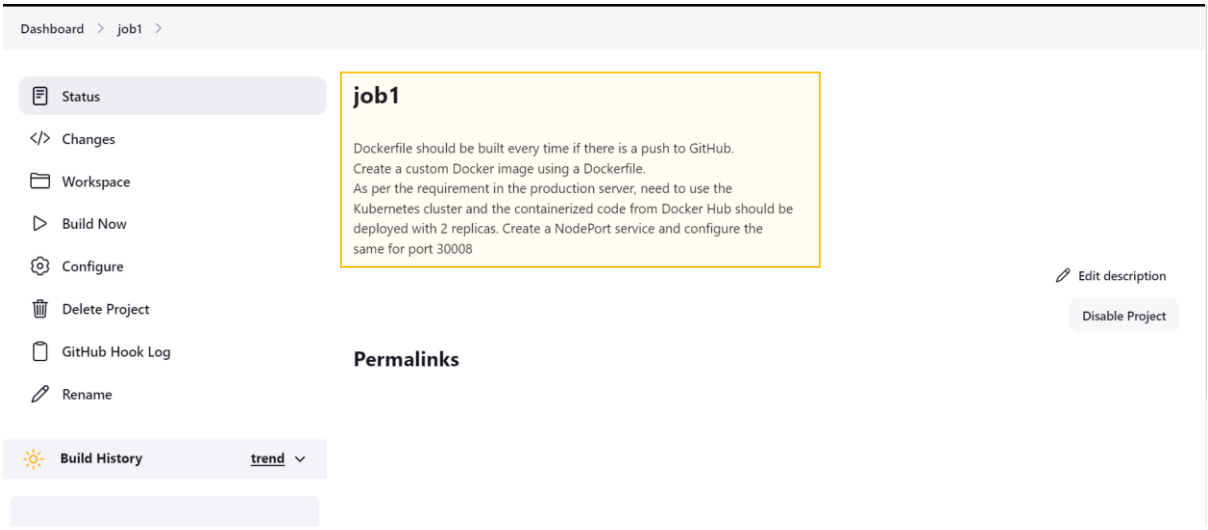
ubuntu

+ Add

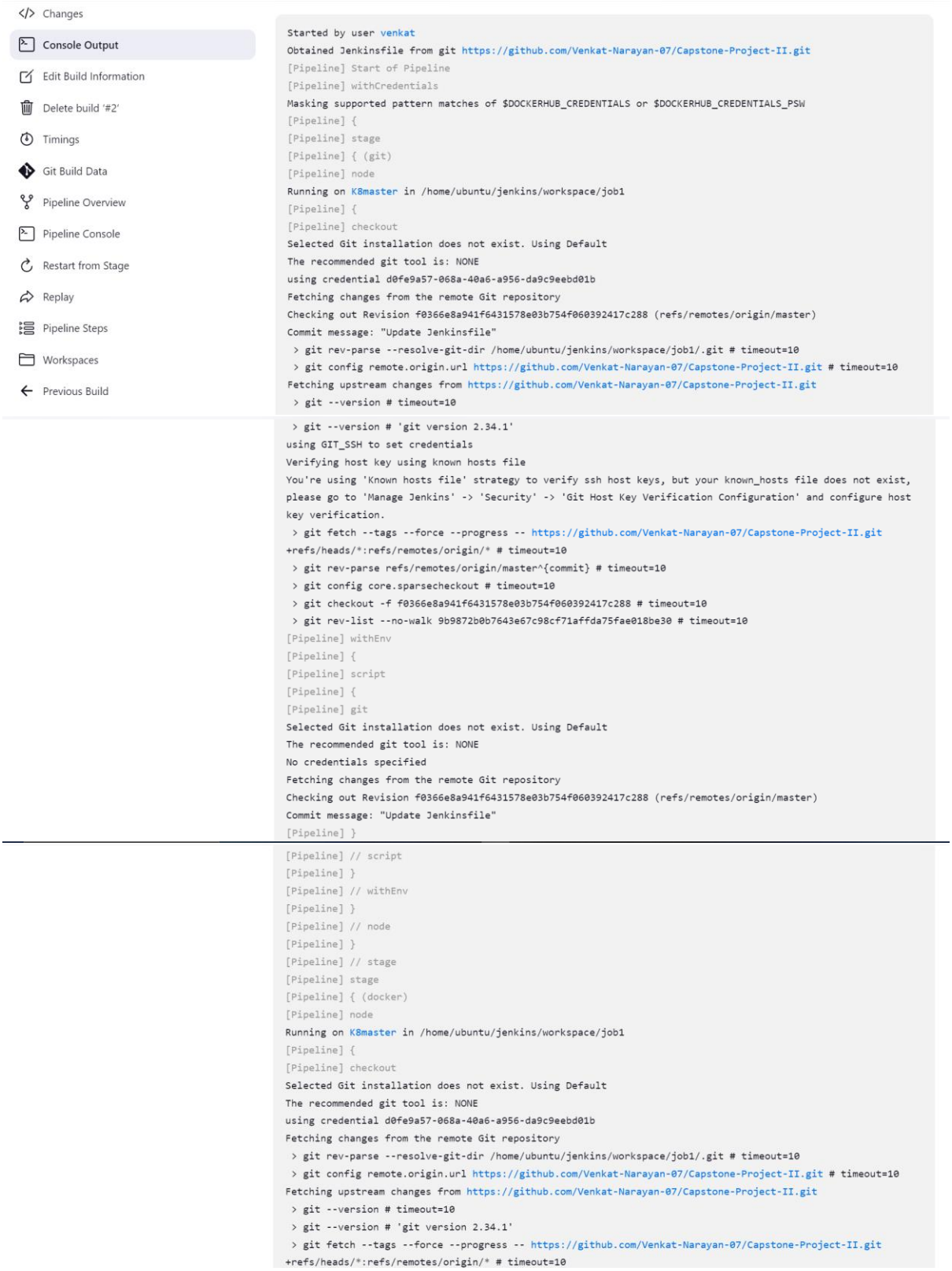
Advanced



- Saved the job1 to the Jenkins dashboard
- Then manually ran build now to test the job.



- Job1 is successfully completed built operation



```
 > git rev-parse refs/remotes/origin/master^{commit} # timeout=10
 > git config core.sparsecheckout # timeout=10
 > git checkout -f f0366e8a941f6431578e03b754f060392417c288 # timeout=10
 > git branch -a -v --no-abbrev # timeout=10
 > git branch -D master # timeout=10
 > git checkout -b master f0366e8a941f6431578e03b754f060392417c288 # timeout=10
 > git rev-parse --resolve-git-dir /home/ubuntu/jenkins/workspace/job1/.git # timeout=10
 > git config remote.origin.url https://github.com/Venkat-Narayan-07/Capstone-Project-II.git # timeout=10
Fetching upstream changes from https://github.com/Venkat-Narayan-07/Capstone-Project-II.git
 > git --version # timeout=10
 > git --version # 'git version 2.34.1'
using GIT_SSH to set credentials
Verifying host key using known hosts file
You're using 'Known hosts file' strategy to verify ssh host keys, but your known_hosts file does not exist,
please go to 'Manage Jenkins' -> 'Security' -> 'Git Host Key Verification Configuration' and configure host
key verification.
 > git fetch --tags --force --progress -- https://github.com/Venkat-Narayan-07/Capstone-Project-II.git
+refs/heads/*:refs/remotes/origin/* # timeout=10
Checking out Revision f0366e8a941f6431578e03b754f060392417c288 (refs/remotes/origin/master)
Commit message: "Update Jenkinsfile"
[Pipeline] withEnv
[Pipeline] {
[Pipeline] script
[Pipeline] {
```

```
[Pipeline] sh
+ sudo docker build /home/ubuntu/jenkins/workspace/prtwebsite/ -t venkatnarayan16/hshar
DEPRECATED: The legacy builder is deprecated and will be removed in a future release.
            Install the buildx component to build images with BuildKit:
            https://docs.docker.com/go/buildx/

Sending build context to Docker daemon  146.9kB

Step 1/5 : From ubuntu
 ---> 35a88802559d
Step 2/5 : RUN apt update
 ---> Using cache
 ---> 402de2009e6d
Step 3/5 : RUN apt-get install apache2 -y
 ---> Using cache
 ---> bcd2c3035568
Step 4/5 : ENTRYPOINT apachectl -D FOREGROUND
 ---> Using cache
 ---> 7be6d0ba8b1c
Step 5/5 : ADD . /var/www/html
 ---> Using cache
 ---> 0acb334df88d
Successfully built 0acb334df88d
Successfully tagged venkatnarayan16/hshar:latest
```

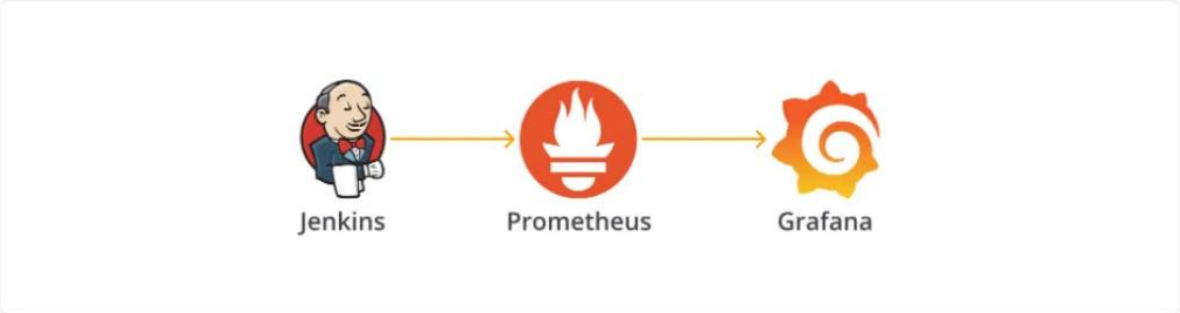
```
Successfully tagged venkatnarayan16/hshar:latest
[Pipeline] sh
 > git rev-parse refs/remotes/origin/master^{commit} # timeout=10
 > git config core.sparsecheckout # timeout=10
 > git checkout -f f0366e8a941f6431578e03b754f060392417c288 # timeout=10
+ sudo echo ****
+ sudo docker login -u venkatnarayan16 --password-stdin
WARNING! Your password will be stored unencrypted in /root/.docker/config.json.
Configure a credential helper to remove this warning. See
https://docs.docker.com/engine/reference/commandline/login/#credentials-store

Login Succeeded
[Pipeline] sh
+ sudo docker push venkatnarayan16/hshar
Using default tag: latest
The push refers to repository [docker.io/venkatnarayan16/hshar]
2f46104f539a: Preparing
2f71b4f6ef9f: Preparing
325d33a349f4: Preparing
a30a5965a4f7: Preparing
325d33a349f4: Layer already exists
2f71b4f6ef9f: Layer already exists
a30a5965a4f7: Layer already exists
2f46104f539a: Layer already exists
```

```
latest: digest: sha256:14bc098d76d4a3b69ec7b5e5877ef5468245f335103d354898a0003874034a05 size: 1162
[Pipeline] }
[Pipeline] // script
[Pipeline] }
[Pipeline] // withEnv
[Pipeline] }
[Pipeline] // node
[Pipeline] }
[Pipeline] // stage
[Pipeline] stage
[Pipeline] { (k8s)
[Pipeline] node
Running on K8master in /home/ubuntu/jenkins/workspace/job1
[Pipeline] {
[Pipeline] checkout
Selected Git installation does not exist. Using Default
The recommended git tool is: NONE
using credential d0fe9a57-068a-40a6-a956-da9c9eebd01b
Fetching changes from the remote Git repository
Checking out Revision f0366e8a941f6431578e03b754f060392417c288 (refs/remotes/origin/master)
Commit message: "Update Jenkinsfile"
[Pipeline] withEnv
[Pipeline] {
[Pipeline] script
[Pipeline] {
[Pipeline] sh
+ kubectl apply -f hshar-deployment.yml
deployment.apps/hshar-deployment unchanged
[Pipeline] sh
 > git rev-parse --resolve-git-dir /home/ubuntu/jenkins/workspace/job1/.git # timeout=10
 > git config remote.origin.url https://github.com/Venkat-Narayan-07/Capstone-Project-II.git # timeout=10
Fetching upstream changes from https://github.com/Venkat-Narayan-07/Capstone-Project-II.git
 > git --version # timeout=10
 > git --version # 'git version 2.34.1'
using GIT_SSH to set credentials
Verifying host key using known hosts file
You're using 'Known hosts file' strategy to verify ssh host keys, but your known_hosts file does not exist,
please go to 'Manage Jenkins' -> 'Security' -> 'Git Host Key Verification Configuration' and configure host
key verification.
 > git fetch --tags --force --progress -- https://github.com/Venkat-Narayan-07/Capstone-Project-II.git
+refs/heads/*:refs/remotes/origin/* # timeout=10
 > git rev-parse refs/remotes/origin/master^{commit} # timeout=10
 > git config core.sparsecheckout # timeout=10
 > git checkout -f f0366e8a941f6431578e03b754f060392417c288 # timeout=10
+ kubectl apply -f hshar-Service.yaml
service/hshar-service unchanged
[Pipeline] }
[Pipeline] // script
[Pipeline] }
[Pipeline] // withEnv
[Pipeline] }
[Pipeline] // node
[Pipeline] }
[Pipeline] // stage
[Pipeline] }
[Pipeline] // withCredentials
[Pipeline] End of Pipeline
Finished: SUCCESS
```

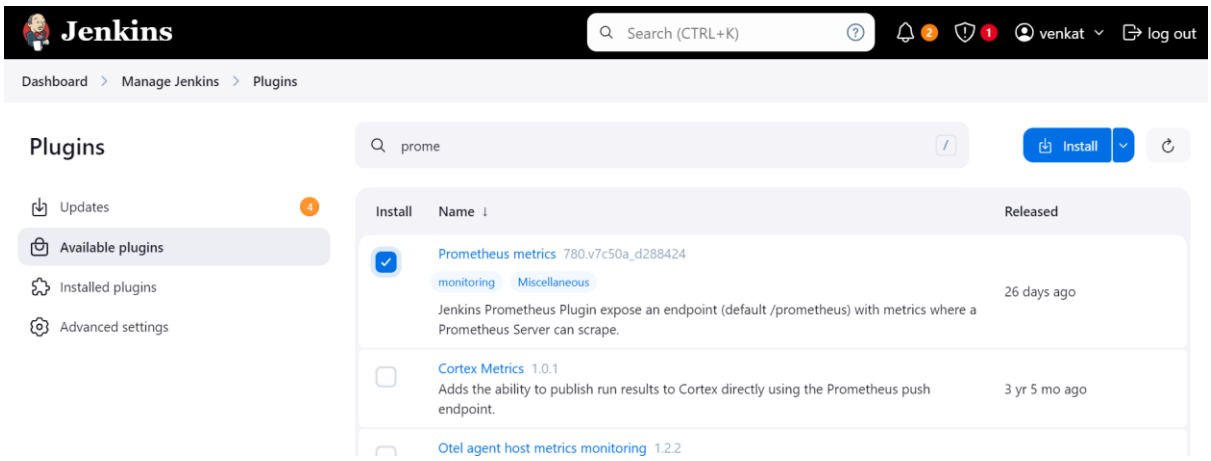
- Whenever there is a push made to the master branch, Jenkins job gets triggered and automatically containerizes the code and deploys replicas of the webpage using docker and Kubernetes respectively.

- Now with the k8s slave machines Ip and on port 30008 we can access the webpage

Monitoring Jenkins job with Prometheus and Grafana

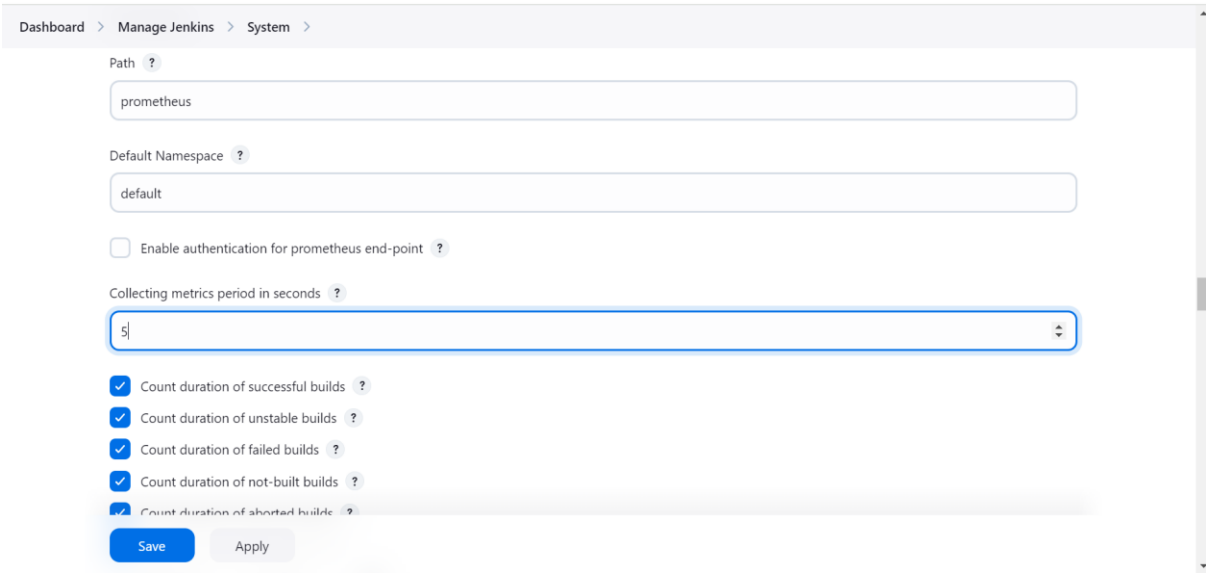


Now download the Prometheus metrics plugin in Jenkins

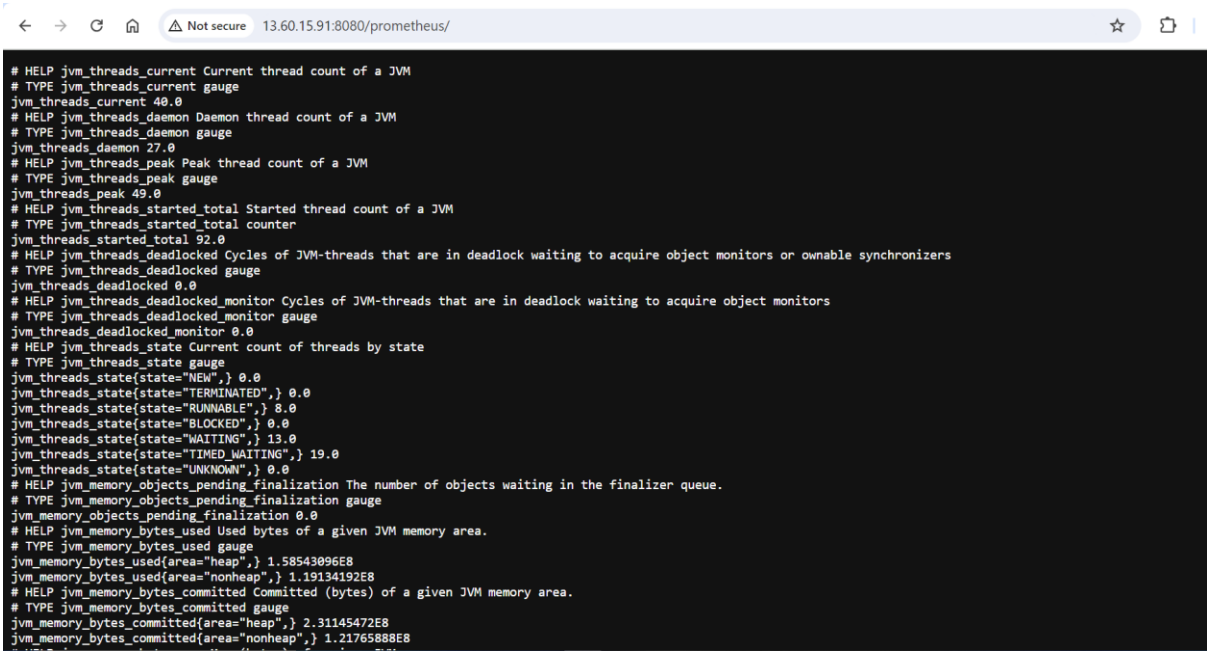


Then go to the **Manage Jenkins -> Configure System** page.

Scroll down to the *Prometheus* section. Prometheus works by retrieving data from the endpoint that we specify. In this case, by default Prometheus will retrieve Jenkins metrics from the **/prometheus** endpoint. restart Jenkins.



Add **/Prometheus** suffix to the Jenkins URL. Here we will see a large number of metrics. Prometheus will retrieve Jenkins metrics data from this endpoint



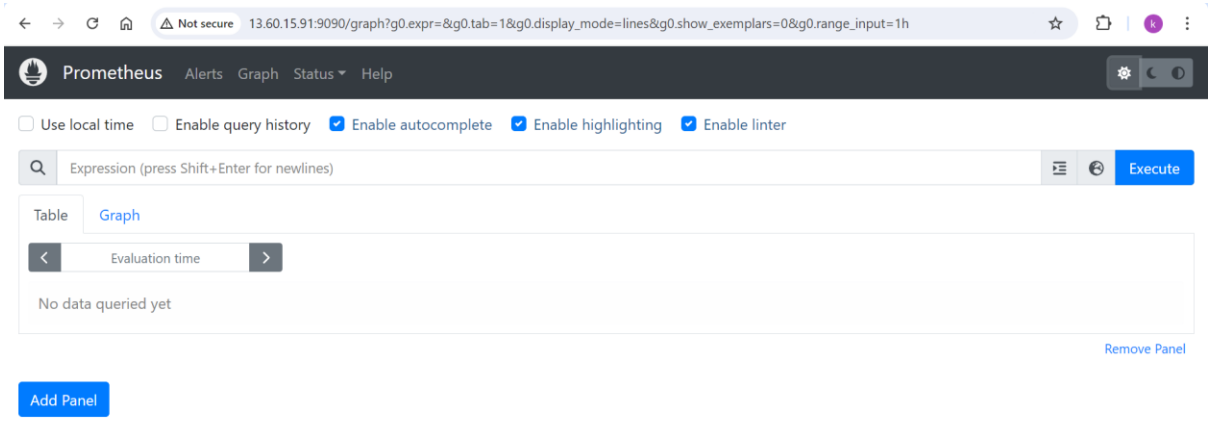
Then goto Jenkins instance and run deploy a prometheus container on port 9090 with prometheus image

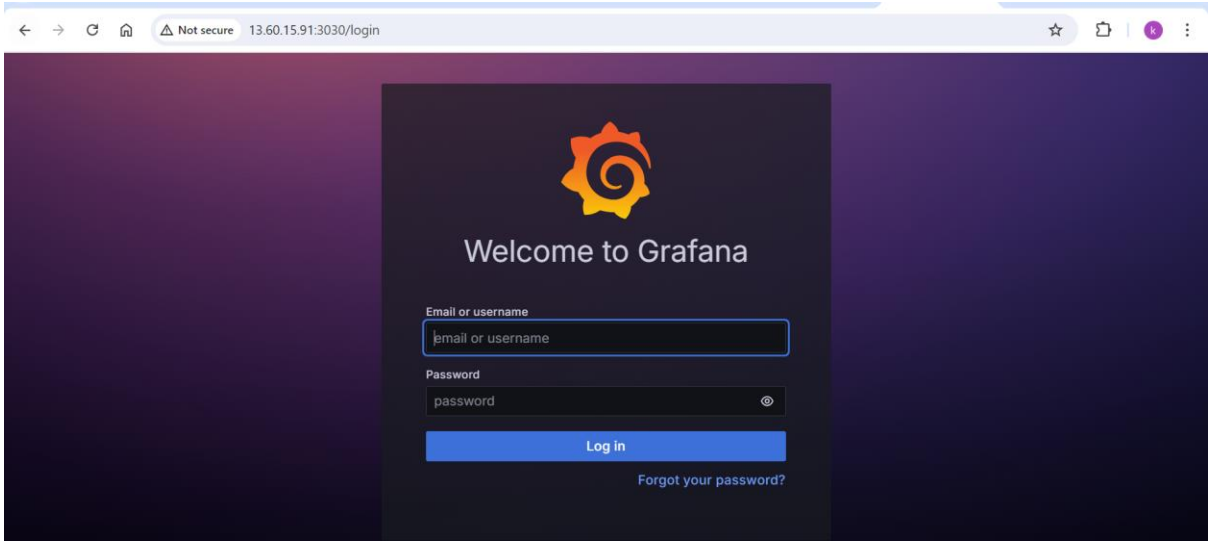
```
ubuntu@ip-10-0-1-226:~$ sudo docker run -d --name prometheus -p 9090:9090 prom/prometheus
Unable to find image 'prom/prometheus:latest' locally
latest: Pulling from prom/prometheus
9fa9226be034: Pull complete
1617e25568b2: Pull complete
92ff7cbea015: Pull complete
3e818186829e: Pull complete
e5110b75bf71: Pull complete
154ef881db4f: Pull complete
eaafa8ad3e2d: Pull complete
fea56ff08967: Pull complete
6e62e059c561: Pull complete
443ffcabdce2: Pull complete
d59855f97034: Pull complete
b32c911ea1d7: Pull complete
Digest: sha256:cafe963e591c872d38f3ea41ff8eb22cee97917b7c97b5c0ccd43a419f11f613
Status: Downloaded newer image for prom/prometheus:latest
2f8e63ab373a977ce6217b708f1e0d5036daca26433d7ebf1d9057f18cfc1fe9
ubuntu@ip-10-0-1-226:~$
```

Similarly, run/deploy Grafana container on port 3030 with grafana image

```
ubuntu@ip-10-0-1-207:~$ sudo docker run -d --name grafana -p 3030:3030 -e "GF_SERVER_HTTP_PORT=3030" grafana/grafana
Unable to find image 'grafana/grafana:latest' locally
latest: Pulling from grafana/grafana
4abcf2066143: Pull complete
b02b4b1ae159: Pull complete
3bb77895c022: Pull complete
06ba99fa00c6: Pull complete
105bf4eba93e: Pull complete
94aeabba6e9f: Pull complete
d5ef5293514d: Pull complete
09419083b5bb: Pull complete
56983880012c: Pull complete
4a1ff49c903a: Pull complete
Digest: sha256:886b56d5534e54f69a8cfcb4b8928da8fc753178a7a3d20c3f9b04b660169805
Status: Downloaded newer image for grafana/grafana:latest
97fe0aed2a4f6b4445bbb2d40e039ab81f367a5e26d0a78f2f37b97c67b5c4dc
ubuntu@ip-10-0-1-207:~$
```

Access prometheus and grafana on respective ports

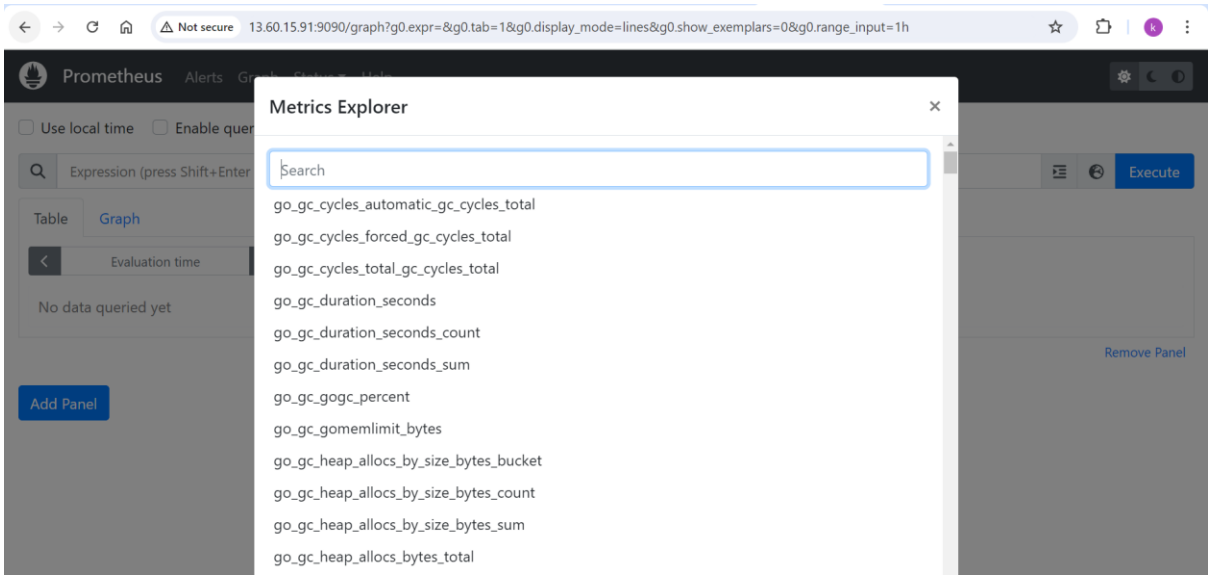




By default, Prometheus only exports its own metrics. To monitor the system outside Prometheus, we must use the Prometheus exporter. Prometheus metrics plugin in Jenkins works by exposing metrics to an endpoint (namely **/prometheus** by default) when the Prometheus server can later retrieve data from that endpoint.

we need to configure the Prometheus server so that it can recognize these endpoints.

We can see that in Metrics Explorer various metics are available but Jenkins metrics are not available.



Exec into the Prometheus container, open the prometheus.yml file.

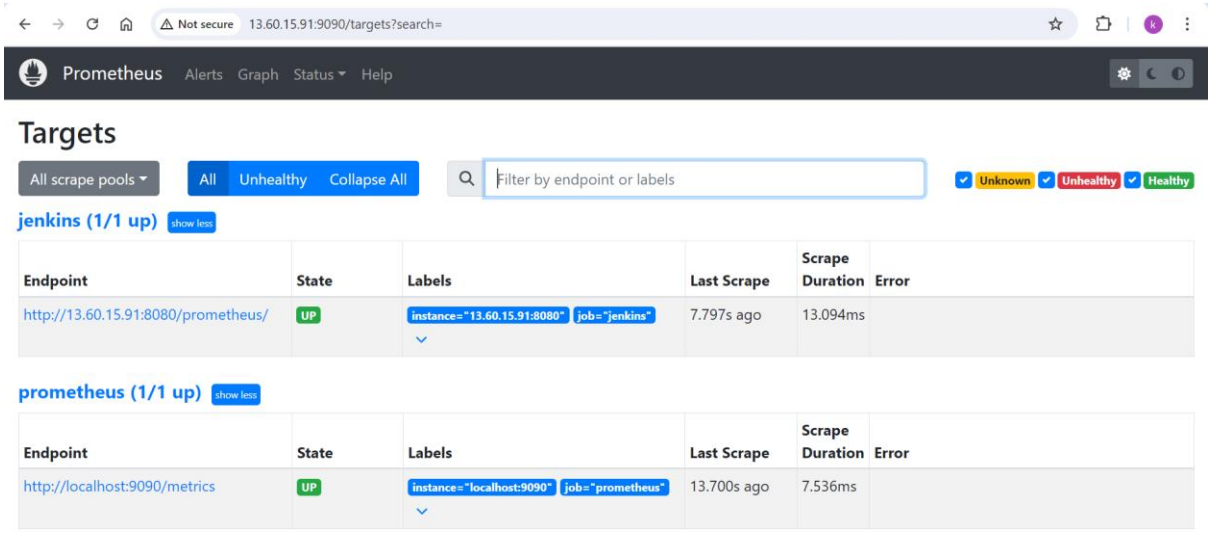
```
ubuntu@ip-10-0-1-226:~$ sudo docker exec -it prometheus sh
/prometheus $ vi /etc/prometheus/prometheus.yml
```

Insert Jenkins Job with Jenkins Url as target. Save and exit then restart promethues container.

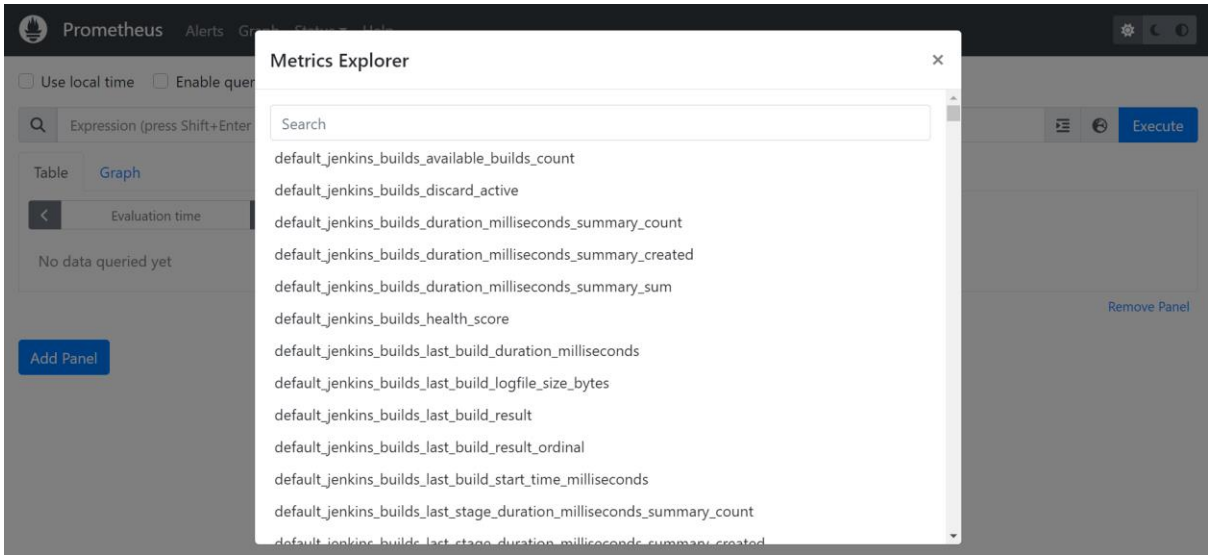
```
# Load rules once and periodically evaluate them according to the global 'evaluation_interval'.
rule_files:
  # - "first_rules.yml"
  # - "second_rules.yml"

# A scrape configuration containing exactly one endpoint to scrape:
# Here it's Prometheus itself.
scrape_configs:
  # The job name is added as a label `job=<job_name>` to any timeseries scraped from this config.
  - job_name: "prometheus"

    # metrics_path defaults to '/metrics'
    # scheme defaults to 'http'.

    static_configs:
      - targets: ["localhost:9090"]
  - job_name: "jenkins"
    metrics_path: /prometheus/
    static_configs:
      - targets: ["13.60.15.91:8080"]
I /etc/prometheus/prometheus.yml [Modified] 33/33 100%
```

```
ubuntu@ip-10-0-1-226:~$ sudo docker container restart prometheus
prometheus
ubuntu@ip-10-0-1-226:~$
```

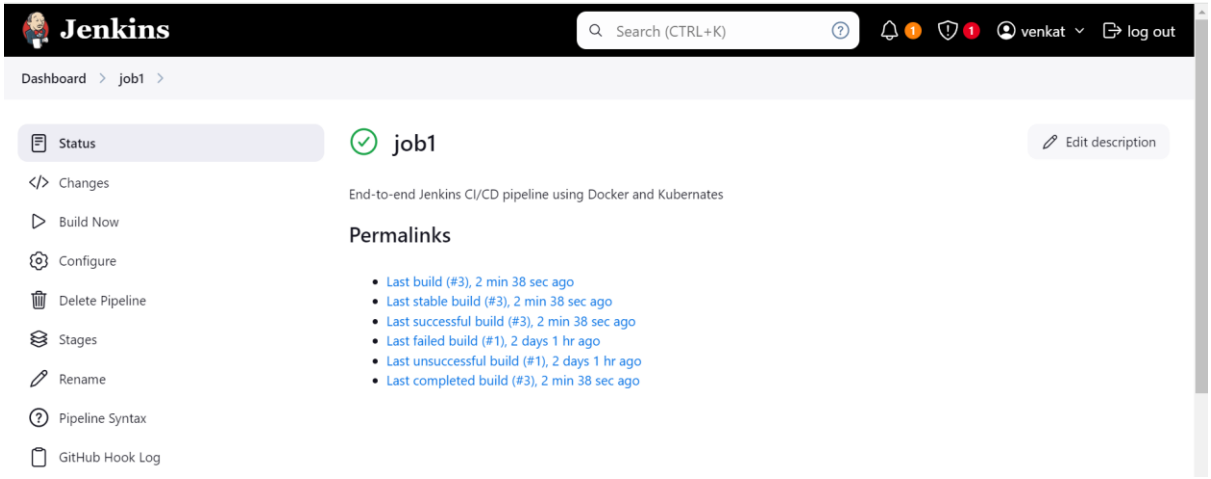
Now verify that the Jenkins endpoint is added in status > targets in Prometheus dashboard.



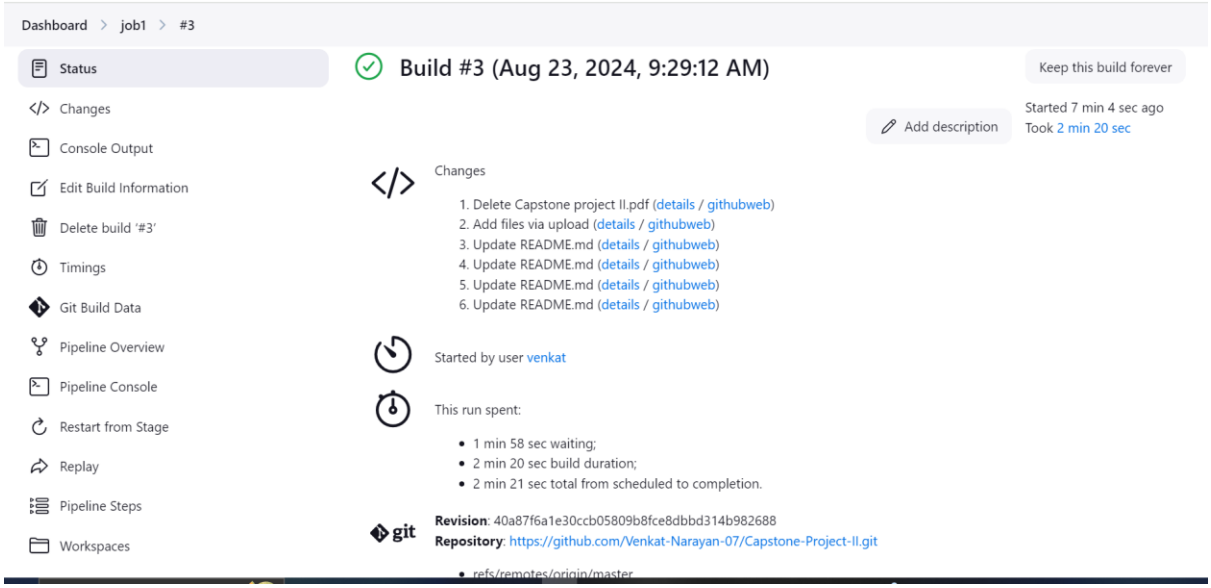
We can see the Jenkins Metrics in Metrics Explorer



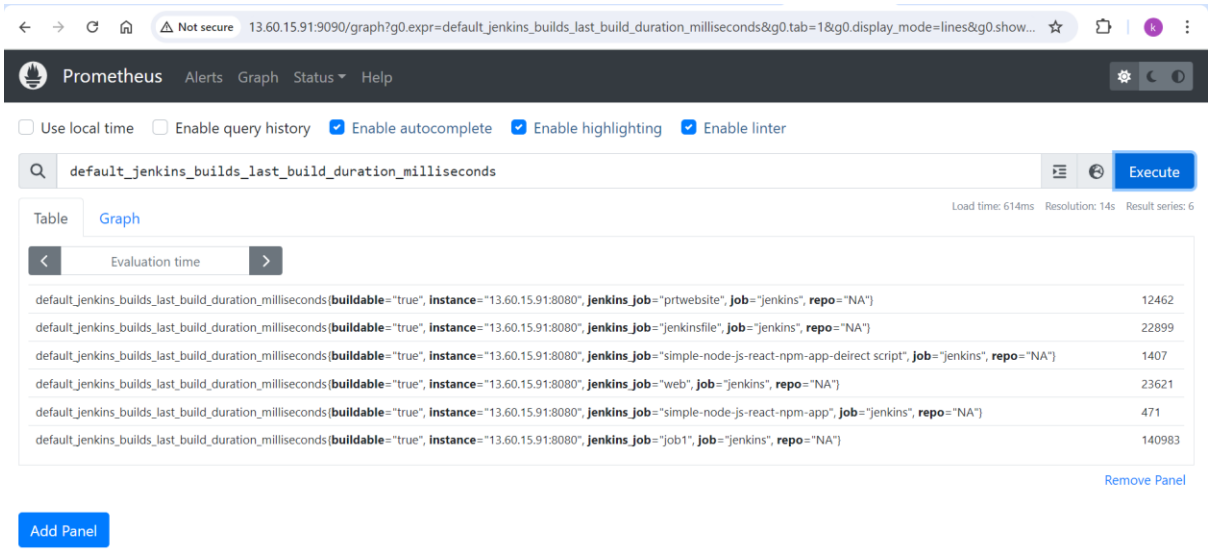
Goto Jenkins portal and trigger Jenkins job to check metrics



We can see that the pipeline took 2 min21sec to complete the job

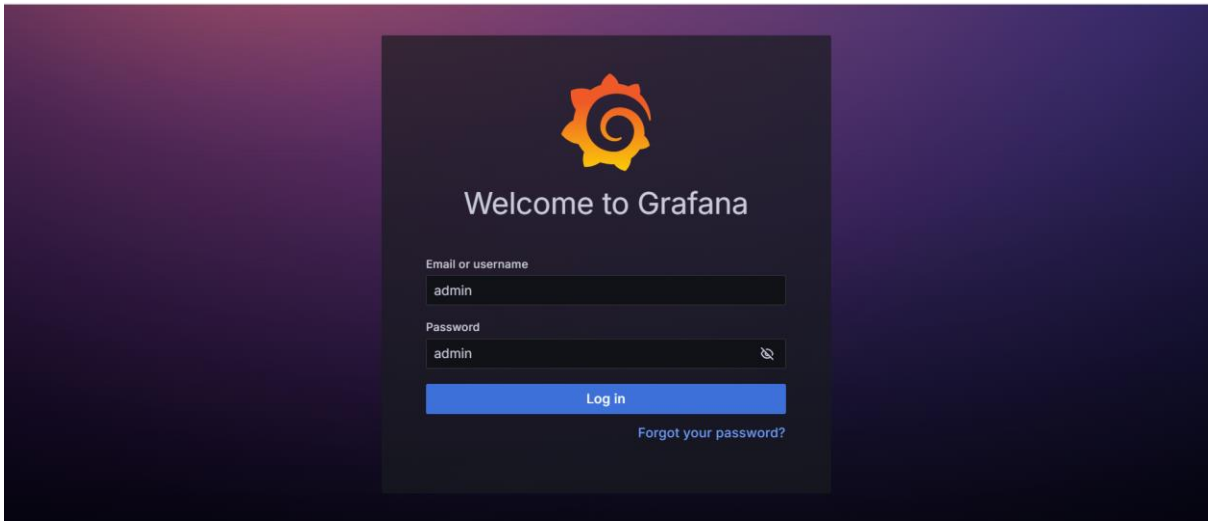


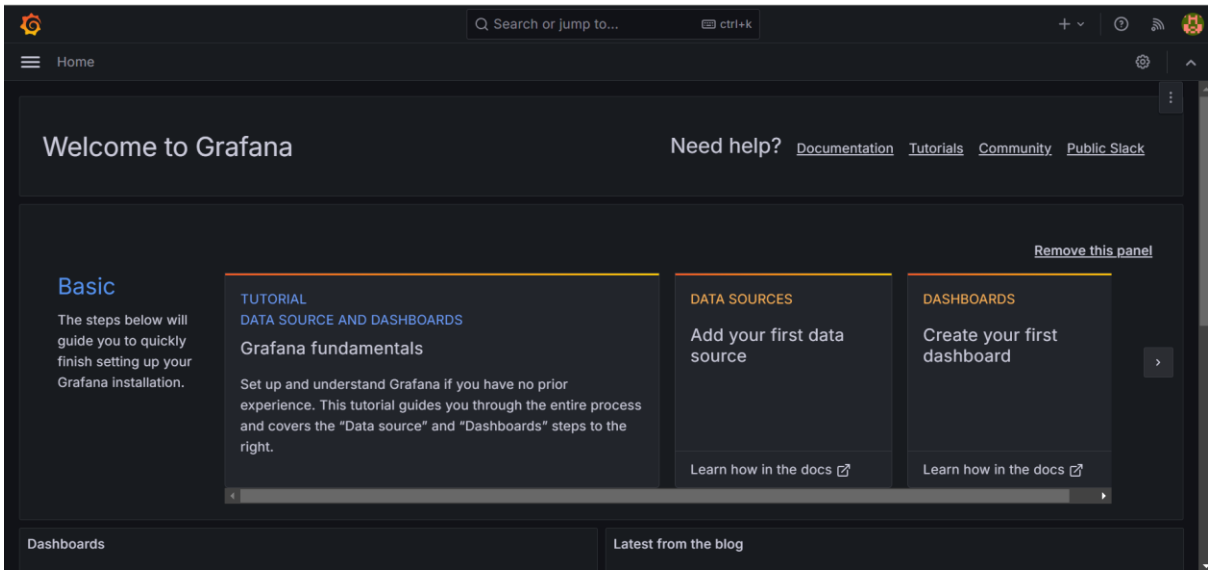
Back to tab Prometheus, by choosing metrics ‘default_jenkins_builds_last_build_duration_milliseconds’ we can see how long the last build duration is in milliseconds.



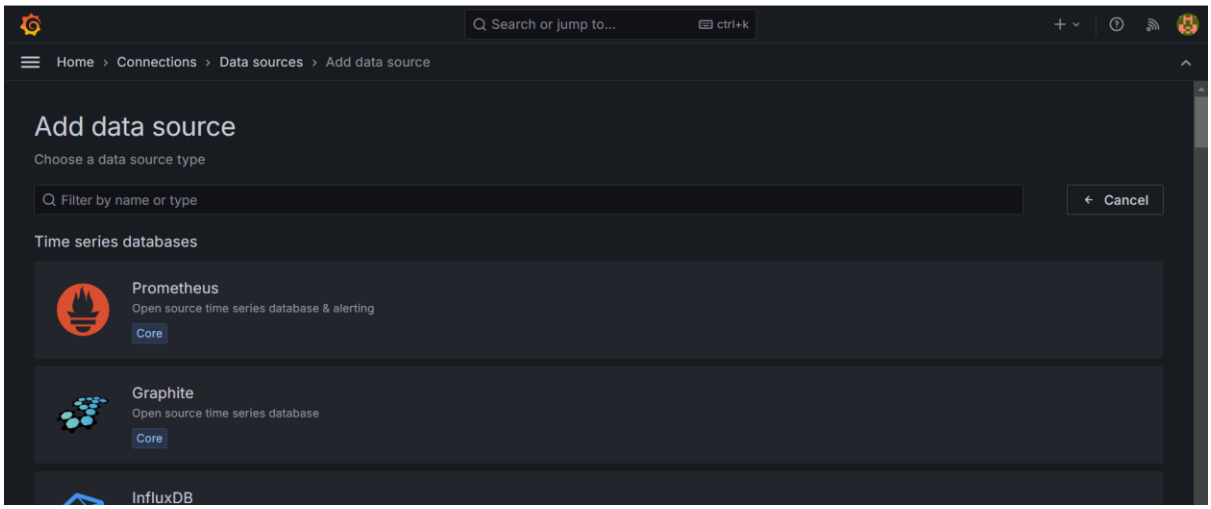
last build duration is 140983 miliseconds = 140.9 seconds = 2.35 minutes. It’s the same with the result from Jenkins.

Go to page Grafana in <localhost>:3030. In the login page, give username and password as **admin.**



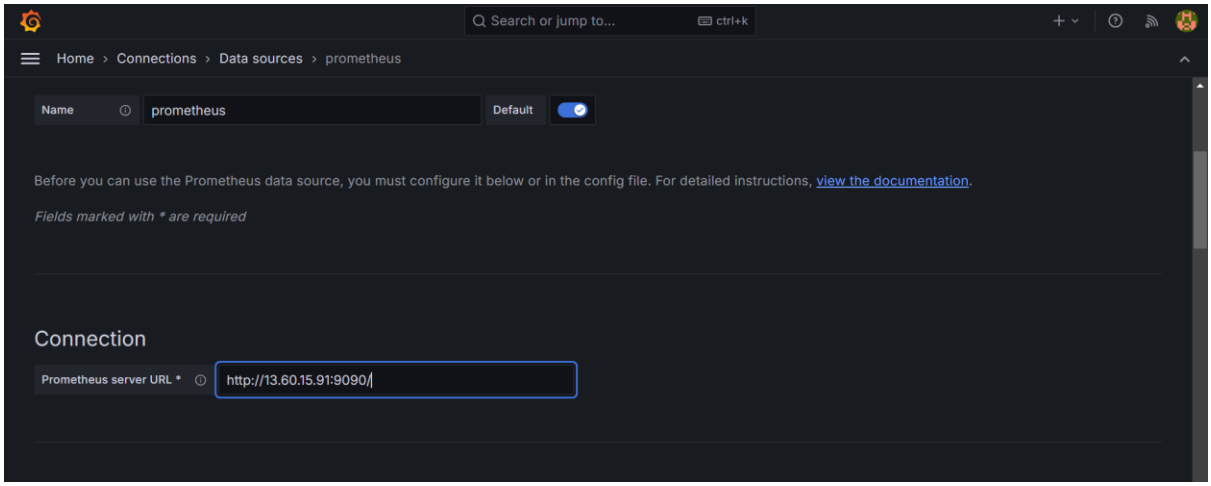


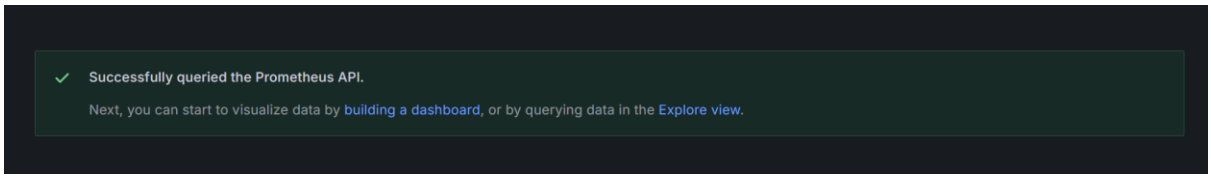
Create a Data Source. From the Home page, click add your first data source. Choose option Prometheus



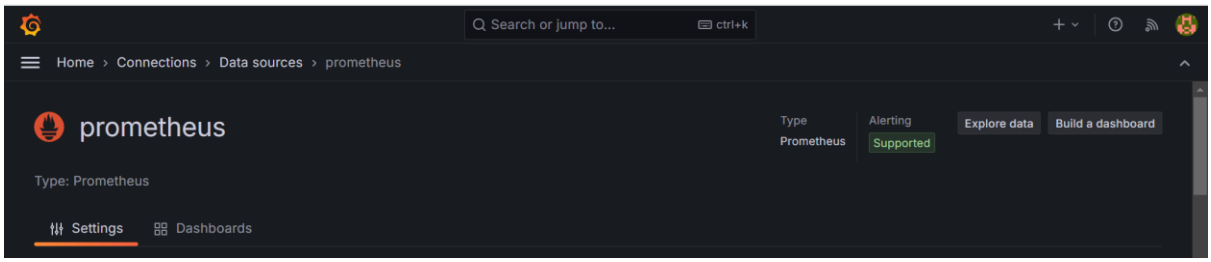
Fill

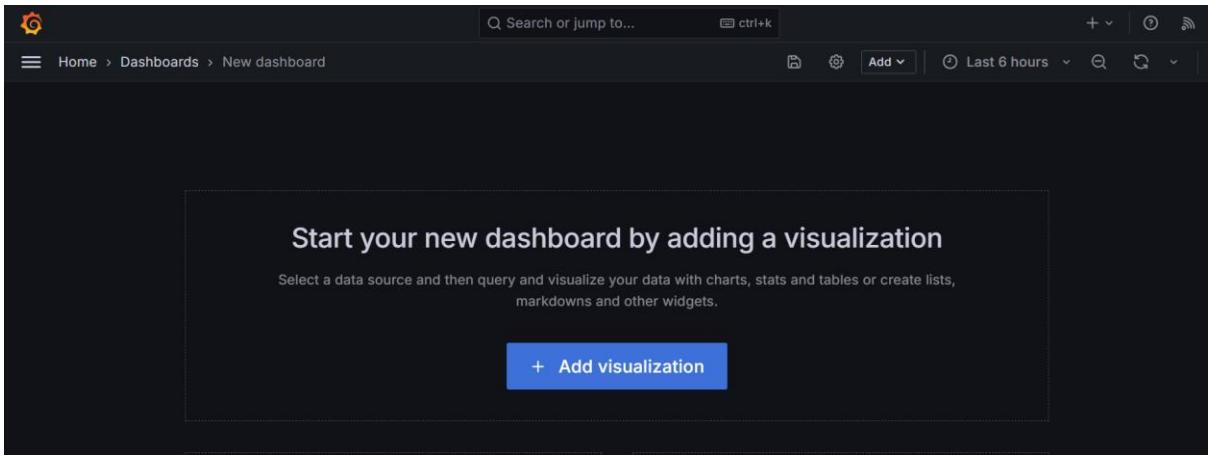
- Name: Jenkins-Prometheus
- URL : <IP_Adress>:9090





create a Grafana dashboard. Scroll up and click **build a dashboard -> Create your first dashboard -> Add visualization**



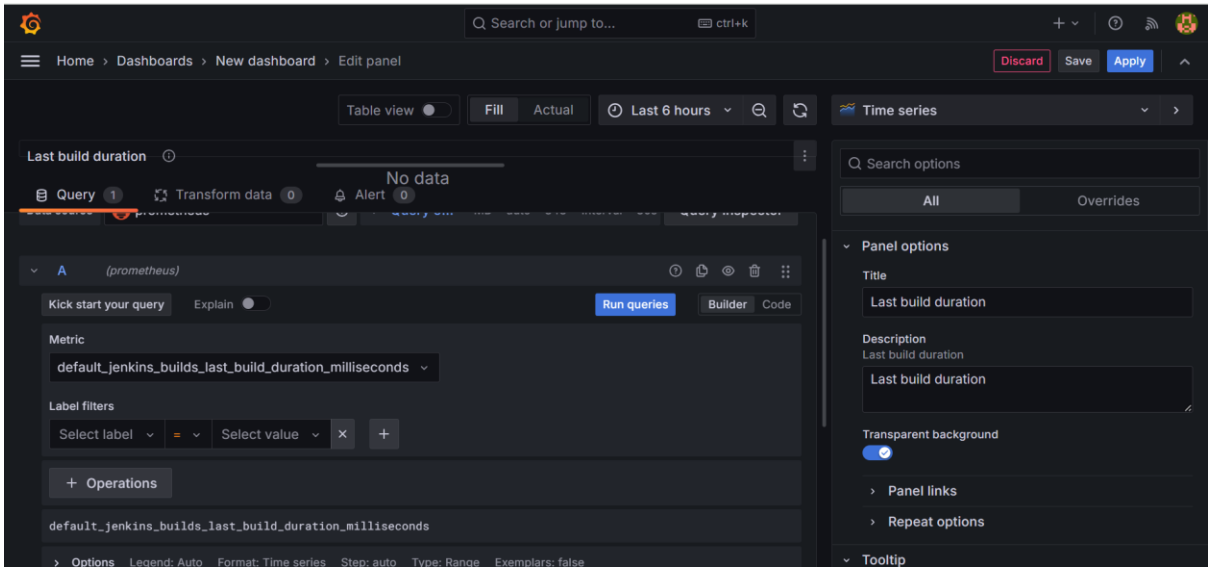


configure

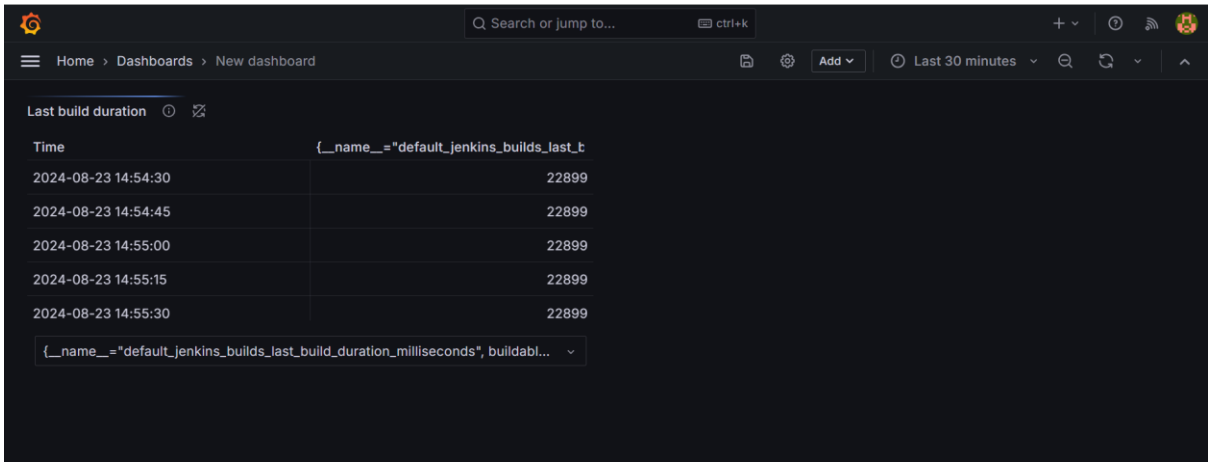
- Title: Last build duration
- Description: Last build duration
- Transparent background: Active
- Graph mode: None

- Metric:default_jenkins_builds_last_build_duration_milliseconds

Click button Run queries. Save the panel by click Save



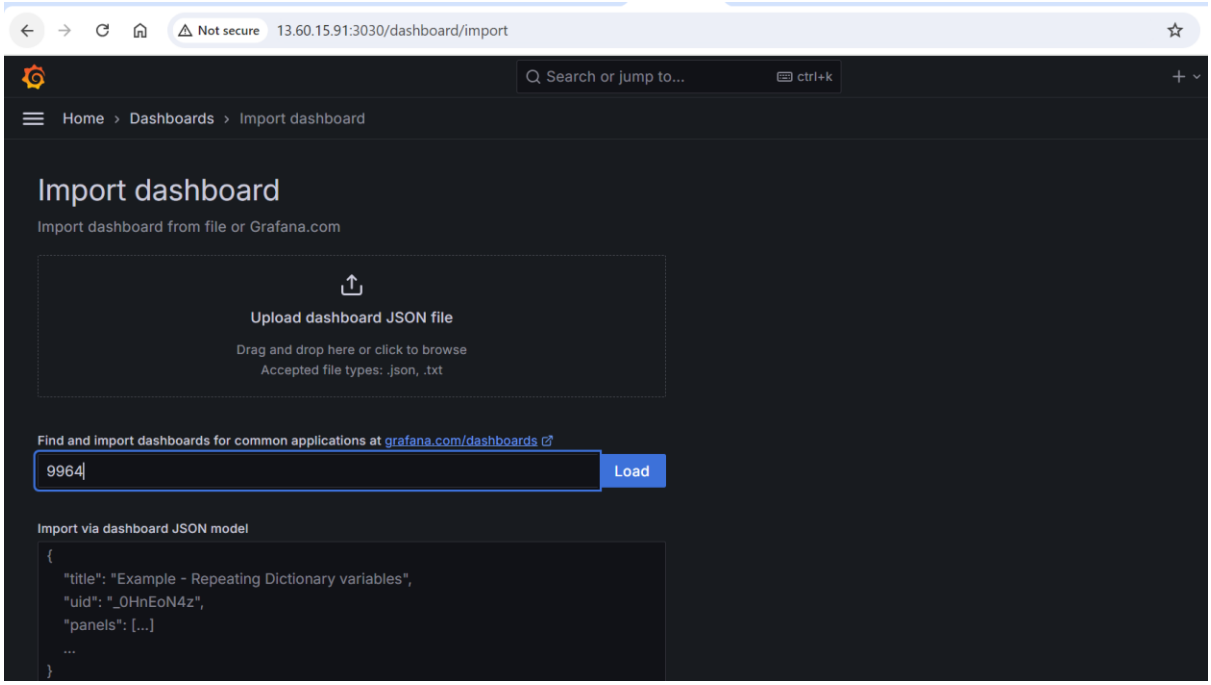
We can see the Jenkins metrics



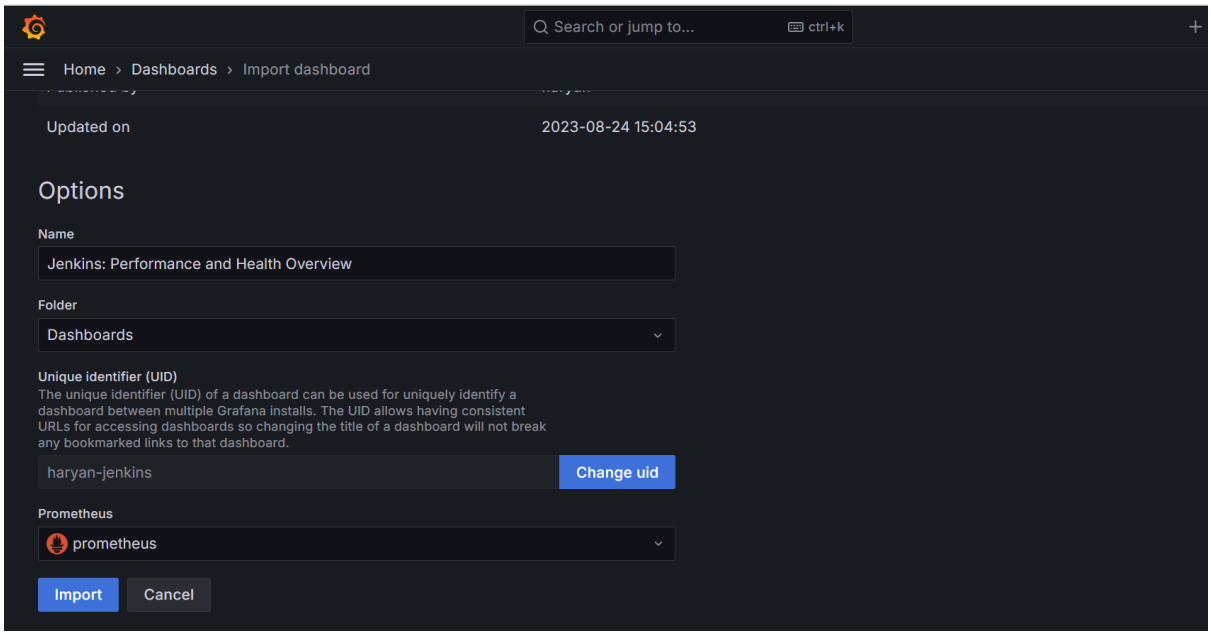
Similarly We can get dashboard too from a template. Search on google Grafana Dashboard/Grafana labs then find Jenkins by Prometheus in Data Source.

Back to dashboard we created before. In the right menu click New -> Import

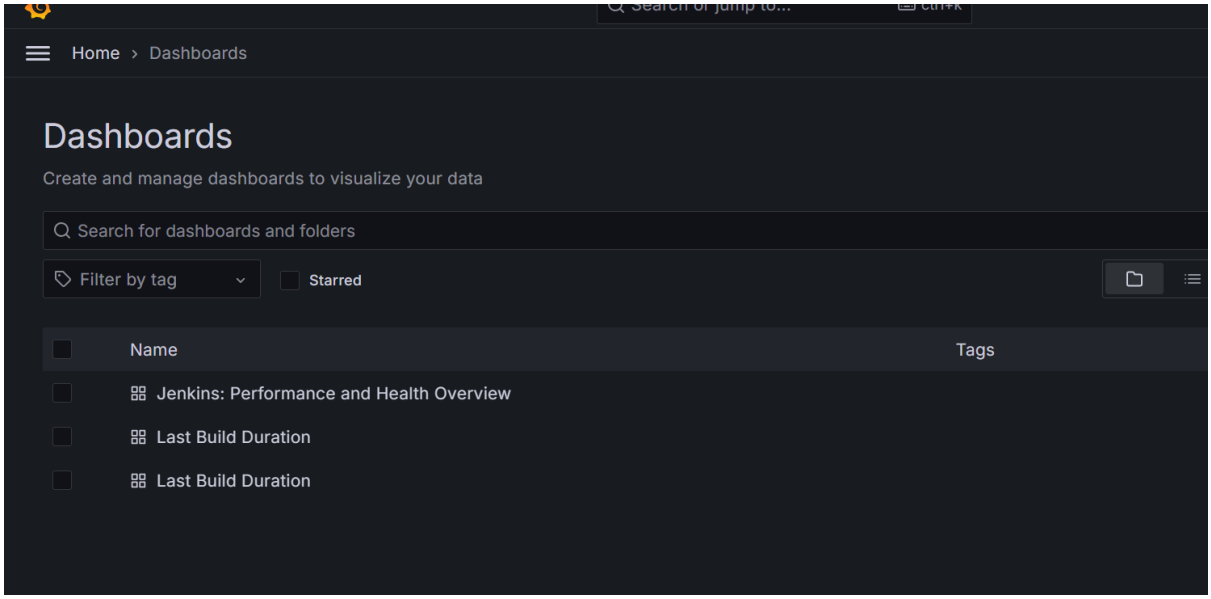
Paste ID from Grafana Dashboard the click Load



In the next page, in data source, choose Prometheus — Jenkins. Click **Import**



Now we will see various metrics in Grafana



Successfully configured monitoring Jenkins with Prometheus and Grafana!