Academic Year: 2023-24 **Semester: V**

Class / Branch: TEIT

Subject: DevOps Lab

Name of Instructor: Prof. Sujata Oak

Experiment No. 4

Aim: To install and configure Jenkins to test and deploy an application with Maven.

Theory:

Jenkins is an open-source automation tool written in Java with plugins built for Continuous Integration purpose. Jenkins is used to build and test your software projects continuously making it easier for developers to integrate changes to the project, and making it easier for users to obtain a fresh build. It also allows you to continuously deliver your software by integrating with a large number of testing and deployment technologies.

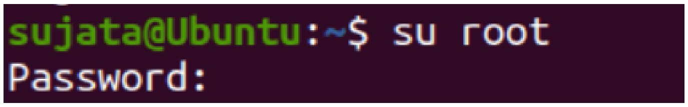
“Continuous Integration is a software development practice where members of a team integrate their work frequently, usually each person integrates at least daily - leading to multiple integrations per day. Each integration is verified by an automated build (including test) to detect integration errors as quickly as possible.” In simple way, Continuous integration (CI) is the practice of frequently building and testing each change done to your code automatically.

Jenkins is a self-contained, open-source automation server which can be used to automate all sortsof tasks related to building, testing, and delivering or deploying software.

To install Jenkins following software packages are required
1) GIT (git-scm.com)
2) Notepad++ (https://notepad-plus-plus.org/downloads/)
3) Latest Java development kit (JDK)
4) Jenkins (https://www.jenkins.io/)
5) Apache Maven (Optional)

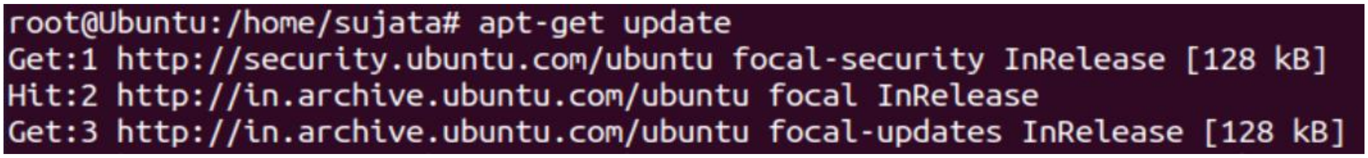
Installation Steps for Jenkins on Ubuntu 20.04

Step 1-: Update ubuntu repository

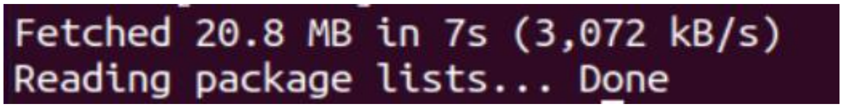


```
sujata@Ubuntu:~$ su root
Password:
```

#apt-get update



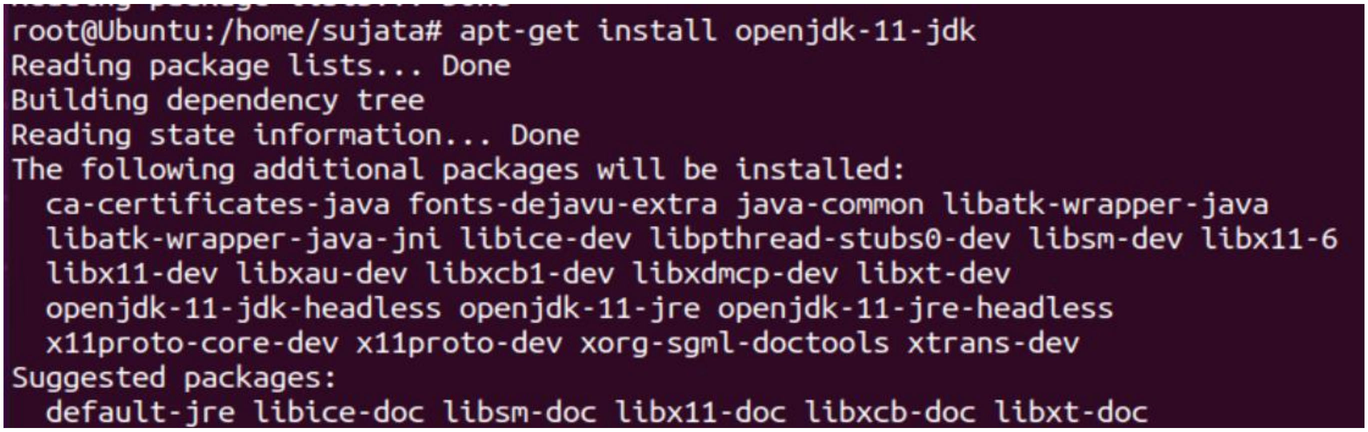
```
root@Ubuntu:/home/sujata# apt-get update
Get:1 http://security.ubuntu.com/ubuntu focal-security InRelease [128 kB]
Hit:2 http://in.archive.ubuntu.com/ubuntu focal InRelease
Get:3 http://in.archive.ubuntu.com/ubuntu focal-updates InRelease [128 kB]
```



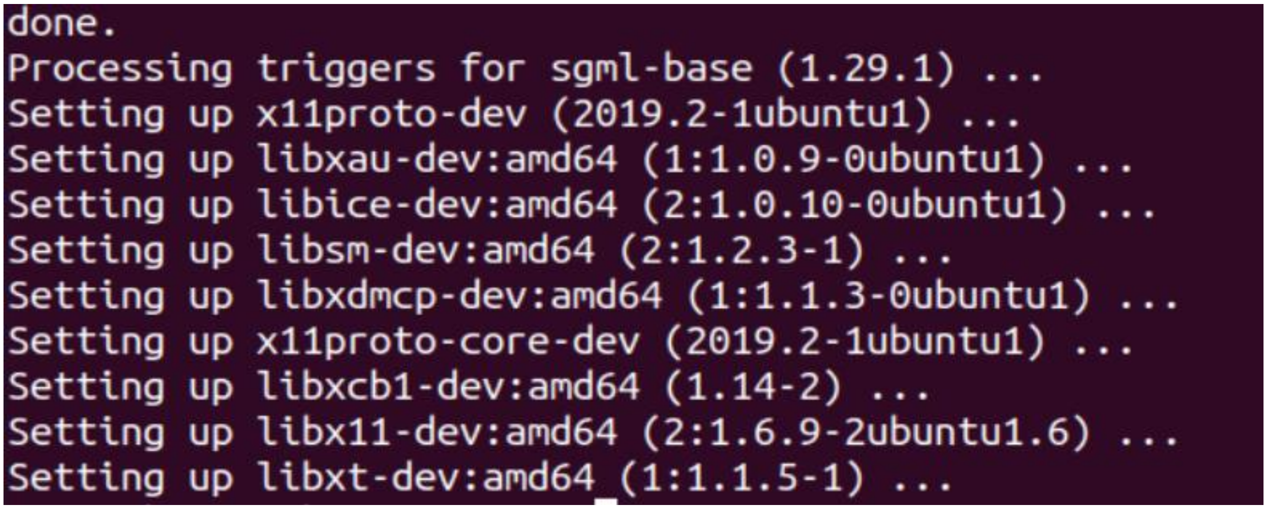
```
Fetched 20.8 MB in 7s (3,072 kB/s)
Reading package lists... Done
```

Step 2-: Install Java development kit

#apt-get install openjdk-11-jdk



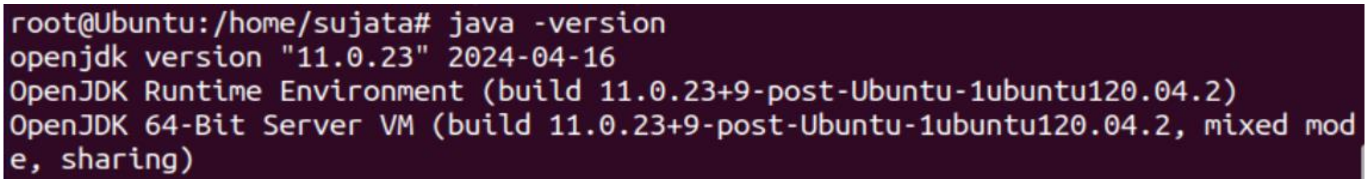
```
root@Ubuntu:/home/sujata# apt-get install openjdk-11-jdk
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  ca-certificates-java fonts-dejavu-extra java-common libatk-wrapper-java
  libatk-wrapper-java-jni libice-dev libpthread-stubs0-dev libsm-dev libx11-6
  libx11-dev libxau-dev libxcb1-dev libxdmcp-dev libxt-dev
  openjdk-11-jdk-headless openjdk-11-jre openjdk-11-jre-headless
  x11proto-core-dev x11proto-dev xorg-sgml-doctools xtrans-dev
Suggested packages:
  default-jre libice-doc libsm-doc libx11-doc libxcb-doc libxt-doc
```



```
done.
Processing triggers for sgml-base (1.29.1) ...
Setting up x11proto-dev (2019.2-1ubuntu1) ...
Setting up libxau-dev:amd64 (1:1.0.9-0ubuntu1) ...
Setting up libice-dev:amd64 (2:1.0.10-0ubuntu1) ...
Setting up libsm-dev:amd64 (2:1.2.3-1) ...
Setting up libxdmcp-dev:amd64 (1:1.1.3-0ubuntu1) ...
Setting up x11proto-core-dev (2019.2-1ubuntu1) ...
Setting up libxcb1-dev:amd64 (1.14-2) ...
Setting up libx11-dev:amd64 (2:1.6.9-2ubuntu1.6) ...
Setting up libxt-dev:amd64 (1:1.1.5-1) ...
```

Step 3-: To test if Java has been installed successfully, run this command:

#java -version

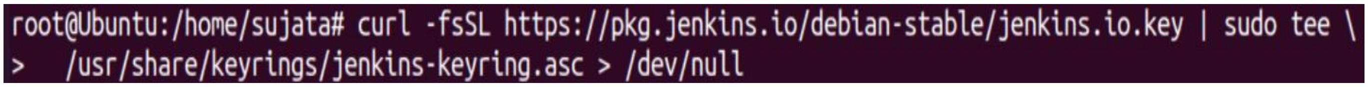


```
root@Ubuntu:/home/sujata# java -version
openjdk version "11.0.23" 2024-04-16
OpenJDK Runtime Environment (build 11.0.23+9-post-Ubuntu-1ubuntu120.04.2)
OpenJDK 64-Bit Server VM (build 11.0.23+9-post-Ubuntu-1ubuntu120.04.2, mixed mod
e, sharing)
```

Step 4-: Install Jenkins

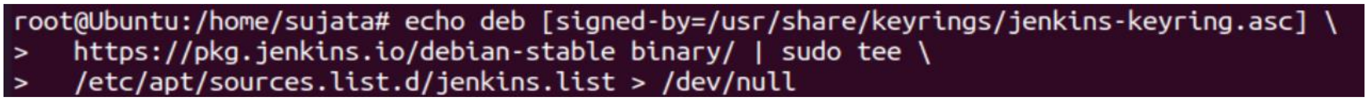
Now, we will install Jenkins itself. Issue the following four commands in sequence to initiate the installation from the Jenkins repository:

```
curl -fsSL https://pkg.jenkins.io/debian-stable/jenkins.io.key | sudo tee \
  /usr/share/keyrings/jenkins-keyring.asc > /dev/null
```



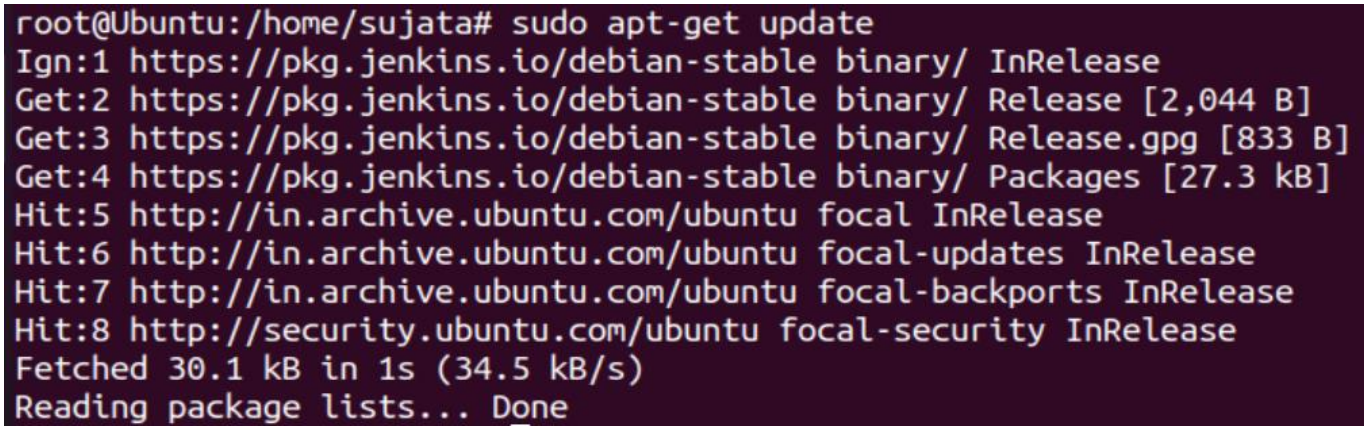
```
root@Ubuntu:/home/sujata# curl -fsSL https://pkg.jenkins.io/debian-stable/jenkins.io.key | sudo tee \
>   /usr/share/keyrings/jenkins-keyring.asc > /dev/null
```

```
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
```



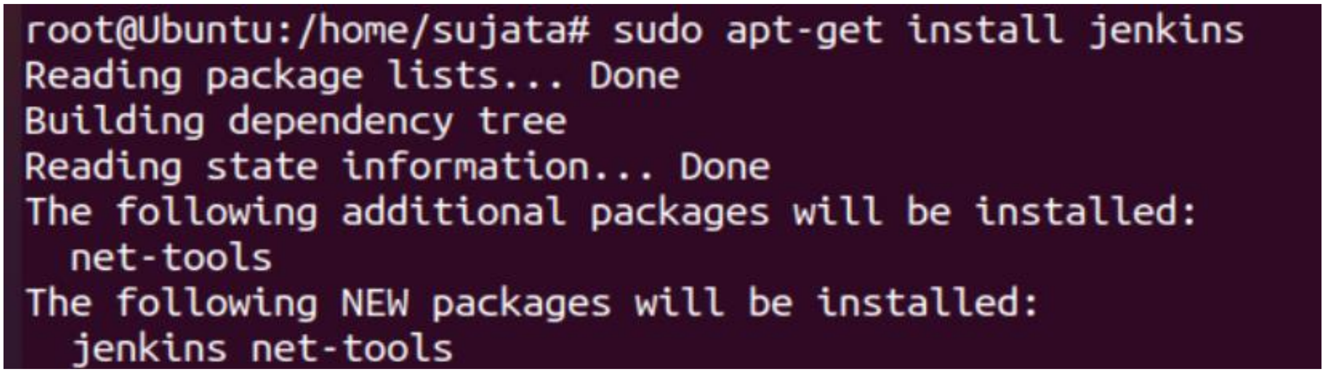
```
root@Ubuntu:/home/sujata# echo deb [signed-by=/usr/share/keyrings/jenkins-keyring.asc] \
>   https://pkg.jenkins.io/debian-stable binary/ | sudo tee \
>   /etc/apt/sources.list.d/jenkins.list > /dev/null
```

sudo apt-get update



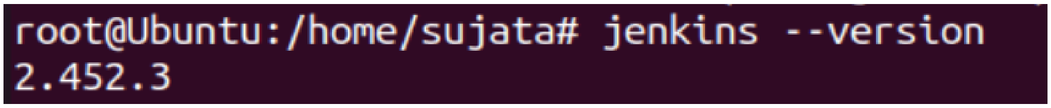
```
root@Ubuntu:/home/sujata# sudo apt-get update
Ign:1 https://pkg.jenkins.io/debian-stable binary/ InRelease
Get:2 https://pkg.jenkins.io/debian-stable binary/ Release [2,044 B]
Get:3 https://pkg.jenkins.io/debian-stable binary/ Release.gpg [833 B]
Get:4 https://pkg.jenkins.io/debian-stable binary/ Packages [27.3 kB]
Hit:5 http://in.archive.ubuntu.com/ubuntu focal InRelease
Hit:6 http://in.archive.ubuntu.com/ubuntu focal-updates InRelease
Hit:7 http://in.archive.ubuntu.com/ubuntu focal-backports InRelease
Hit:8 http://security.ubuntu.com/ubuntu focal-security InRelease
Fetched 30.1 kB in 1s (34.5 kB/s)
Reading package lists... Done
```

sudo apt-get install jenkins



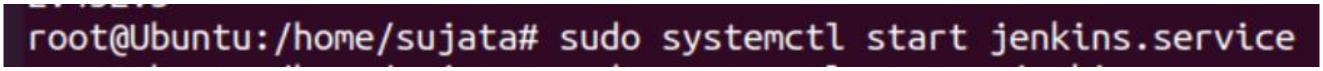
```
root@Ubuntu:/home/sujata# sudo apt-get install jenkins
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  net-tools
The following NEW packages will be installed:
  jenkins net-tools
```

Step 5-: To check Jenkins installed or not:
# jenkins --version



```
root@Ubuntu:/home/sujata# jenkins --version
2.452.3
```

Step 6-: Once that’s done, start the Jenkins service with the following command:
# sudo systemctl start jenkins.service

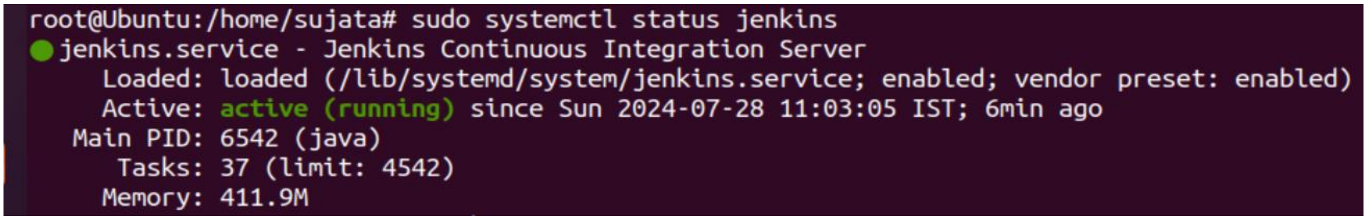


```
root@Ubuntu:/home/sujata# sudo systemctl start jenkins.service
```

To confirm its status, use:

#sudo systemctl status jenkins

If its WORKING it will show as active (running)

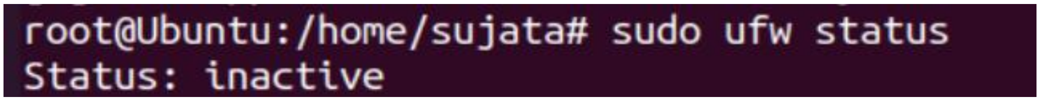


```
root@Ubuntu:/home/sujata# sudo systemctl status jenkins
● jenkins.service - Jenkins Continuous Integration Server
     Loaded: loaded (/lib/systemd/system/jenkins.service; enabled; vendor preset: enabled)
     Active: active (running) since Sun 2024-07-28 11:03:05 IST; 6min ago
   Main PID: 6542 (java)
      Tasks: 37 (limit: 4542)
     Memory: 411.9M
```

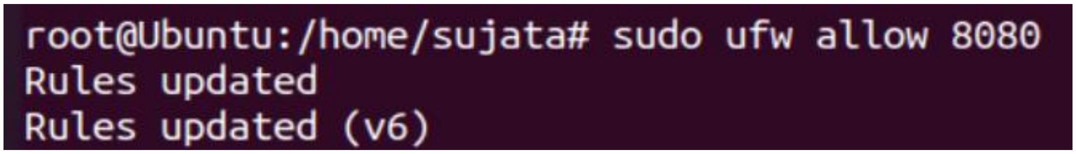
Press ctrl+z to exit

Step 7:- Adjust Firewall and Configuring Jenkins

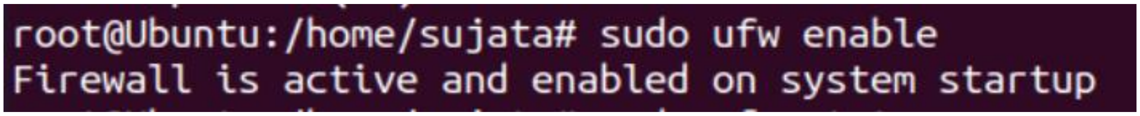
With Jenkins installed, we can proceed with adjusting the firewall settings. By default, Jenkins will run on port **8080**.
In order to ensure that this port is accessible, we will need to configure the built-in **Ubuntu firewall** (ufw). To open the 8080 port and enable the firewall, use the following commands:



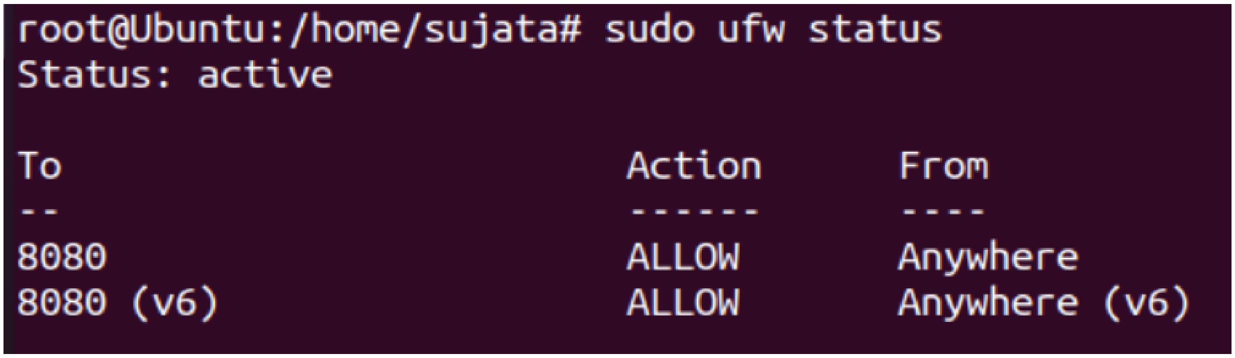
```
root@Ubuntu:/home/sujata# sudo ufw status
Status: inactive
```



```
root@Ubuntu:/home/sujata# sudo ufw allow 8080
Rules updated
Rules updated (v6)
```



```
root@Ubuntu:/home/sujata# sudo ufw enable
Firewall is active and enabled on system startup
```

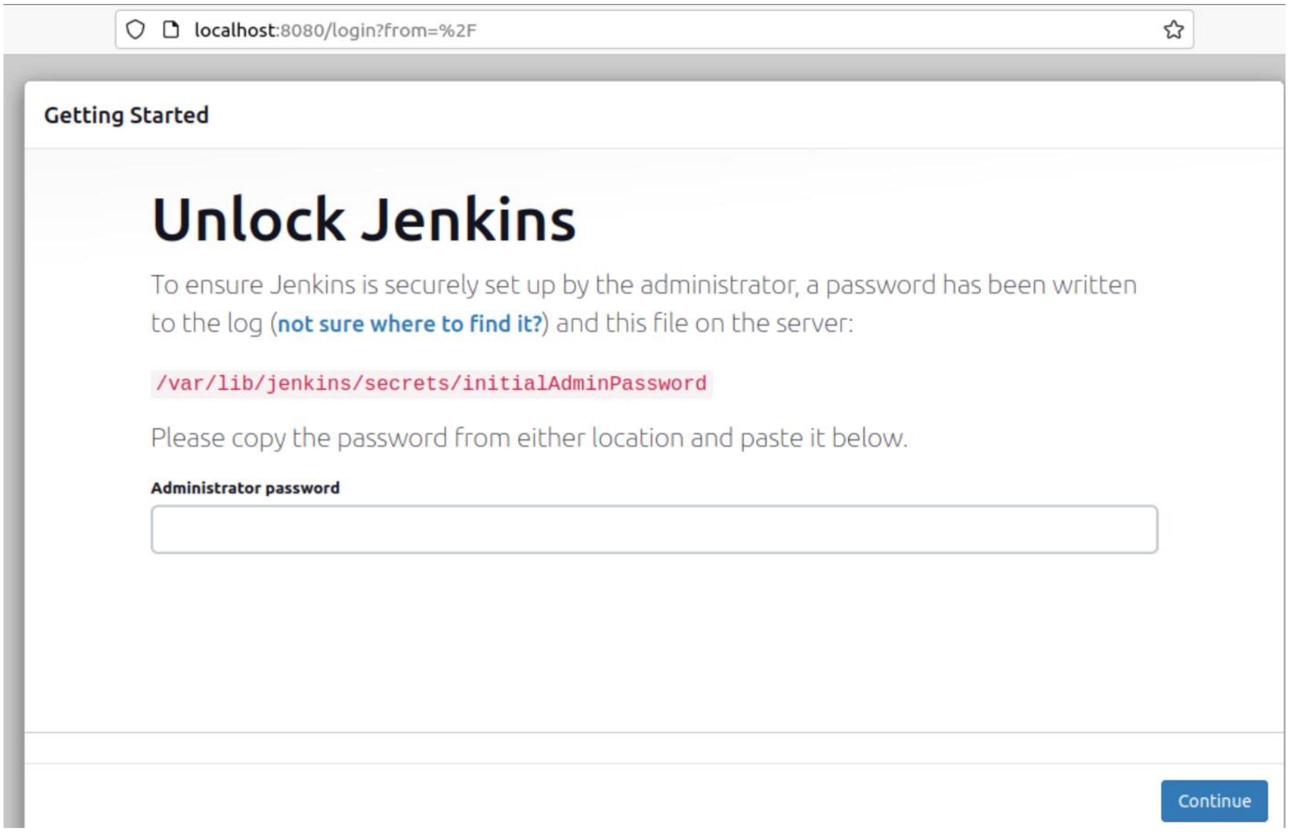


```
root@Ubuntu:/home/sujata# sudo ufw status
Status: active

To                         Action      From
--                         ------      ----
8080                       ALLOW       Anywhere
8080 (v6)                  ALLOW       Anywhere (v6)
```

Step 8-: With the firewall configured, it's time to set up Jenkins itself.

Once installation is done, you can test the application on http://localhost:8080 in browser **OR** **http://127.0.0.1:8080**

Type in the IP of your VPS along with the port number. The Jenkins setup wizard will be shown below:



Unlock Jenkins

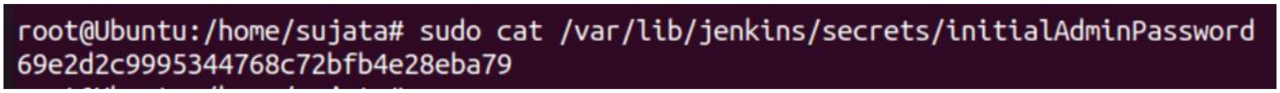
To ensure Jenkins is securely set up by the administrator, a password has been written to the log (not sure where to find it?) and this file on the server:

`/var/lib/jenkins/secrets/initialAdminPassword`

Please copy the password from either location and paste it below.

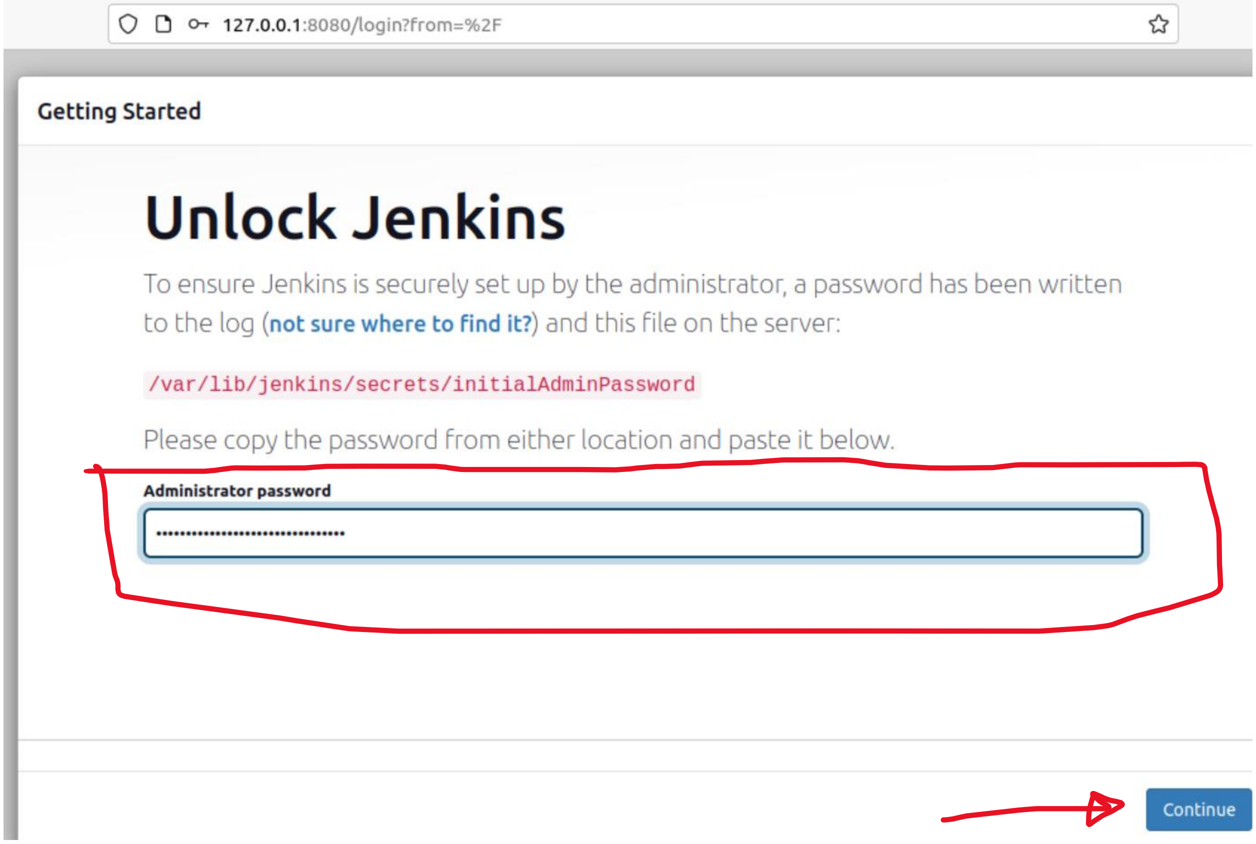
Administrator password

An administrator password will be needed to proceed with the configuration. It can be easily found inside the **/var/lib/jenkins/secrets/initialAdminPassword** file. To check the initial password, use the [cat command]() as indicated below:



```
root@Ubuntu:/home/sujata# sudo cat /var/lib/jenkins/secrets/initialAdminPassword
69e2d2c9995344768c72bfb4e28eba79
```

Copy the password, go back to the setup wizard, paste it and click **Continue**.



127.0.0.1:8080/login?from=%2F

Getting Started

Unlock Jenkins

To ensure Jenkins is securely set up by the administrator, a password has been written to the log (not sure where to find it?) and this file on the server:

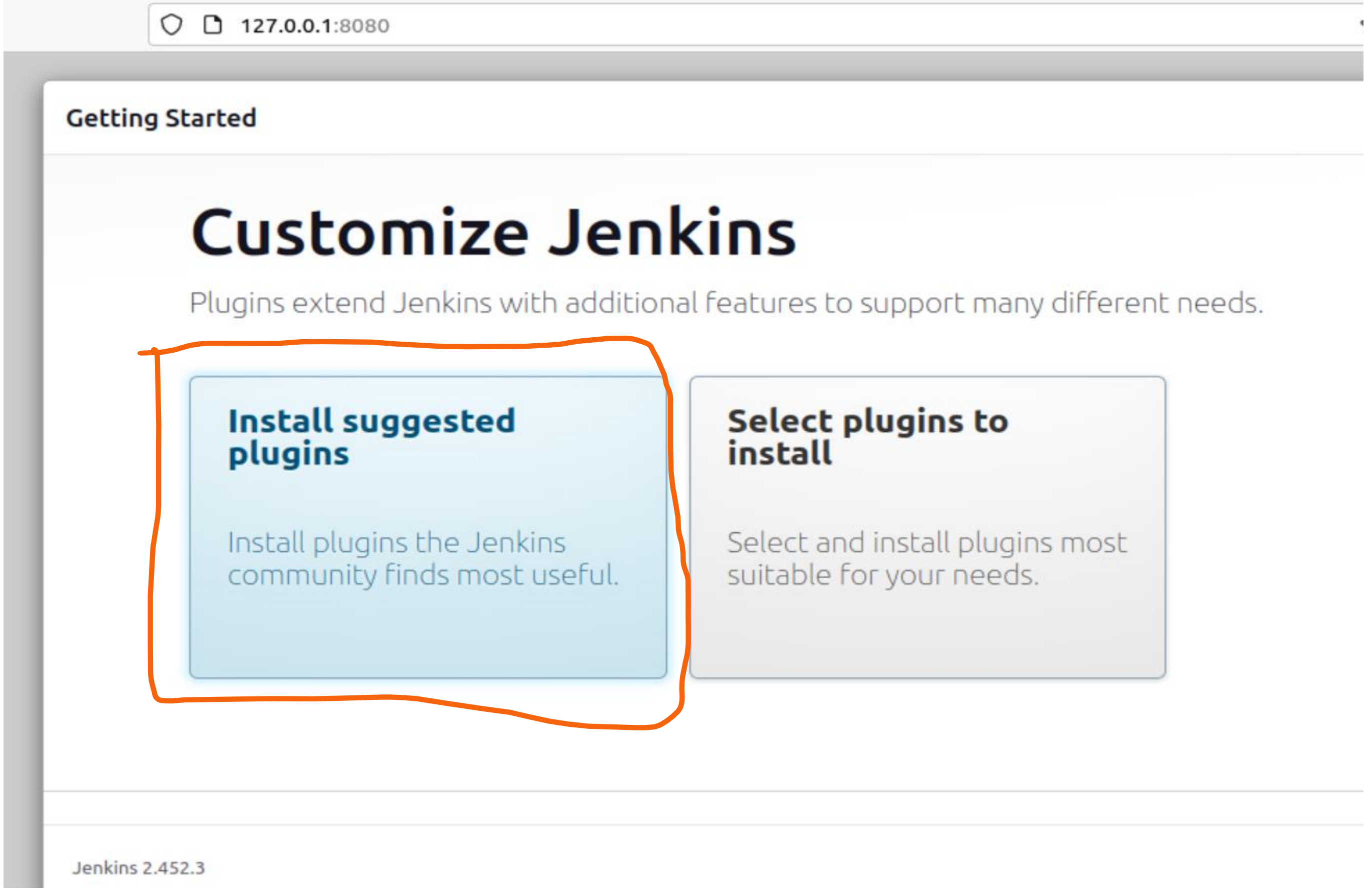
`/var/lib/jenkins/secrets/initialAdminPassword`

Please copy the password from either location and paste it below.

Administrator password

••••••••••••••••••••••••••••••••

Step 9-: Customize Jenkins window will appear. We recommend simply selecting the **Install suggested plugins** option for this step.



127.0.0.1:8080

Getting Started

Customize Jenkins

Plugins extend Jenkins with additional features to support many different needs.

Install suggested plugins

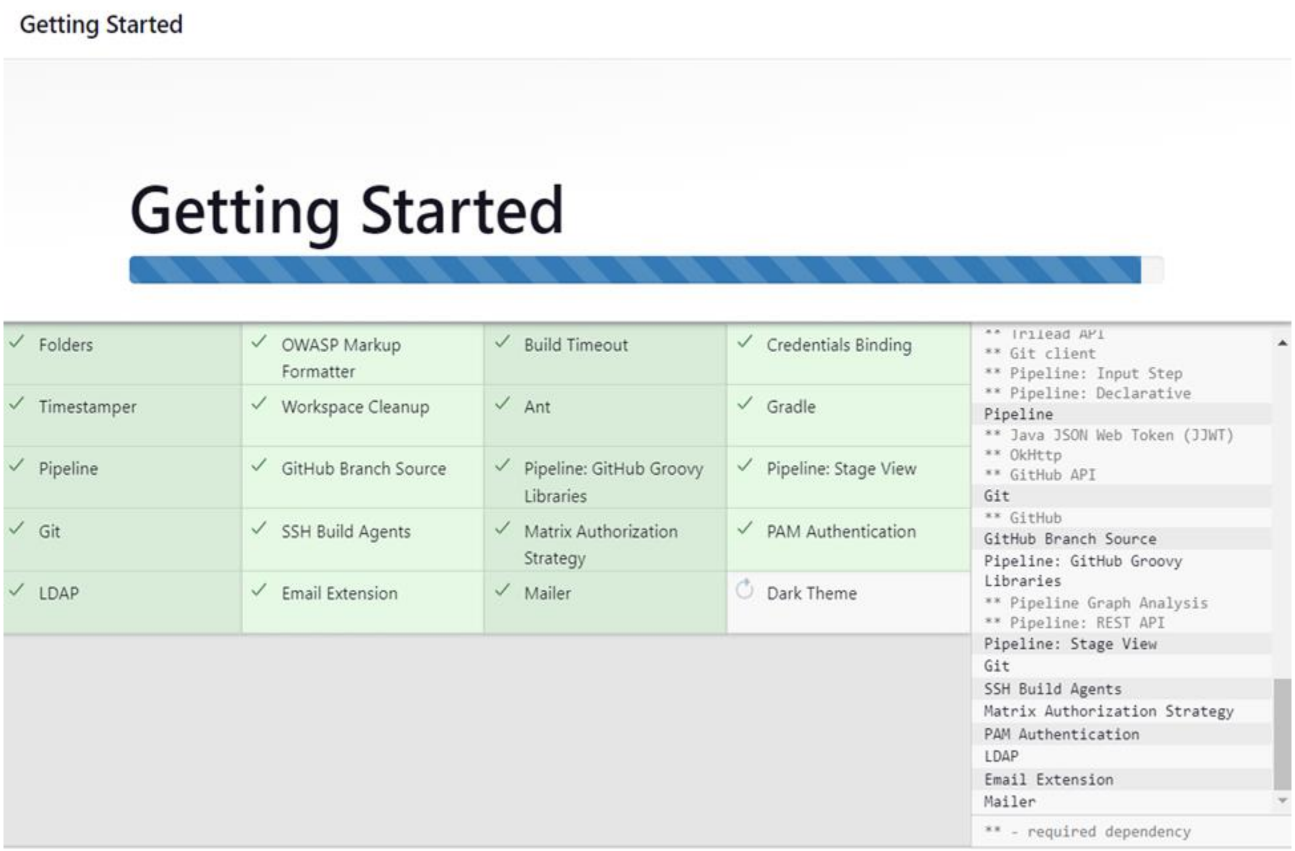
Install plugins the Jenkins community finds most useful.

Select plugins to install

Select and install plugins most suitable for your needs.

Jenkins 2.452.3

Step 10-: Give it a couple of minutes for the installation process to complete. Once it’s done, specify your username, password, full name, and email address, and click on **Save and Continue** to create an admin user.

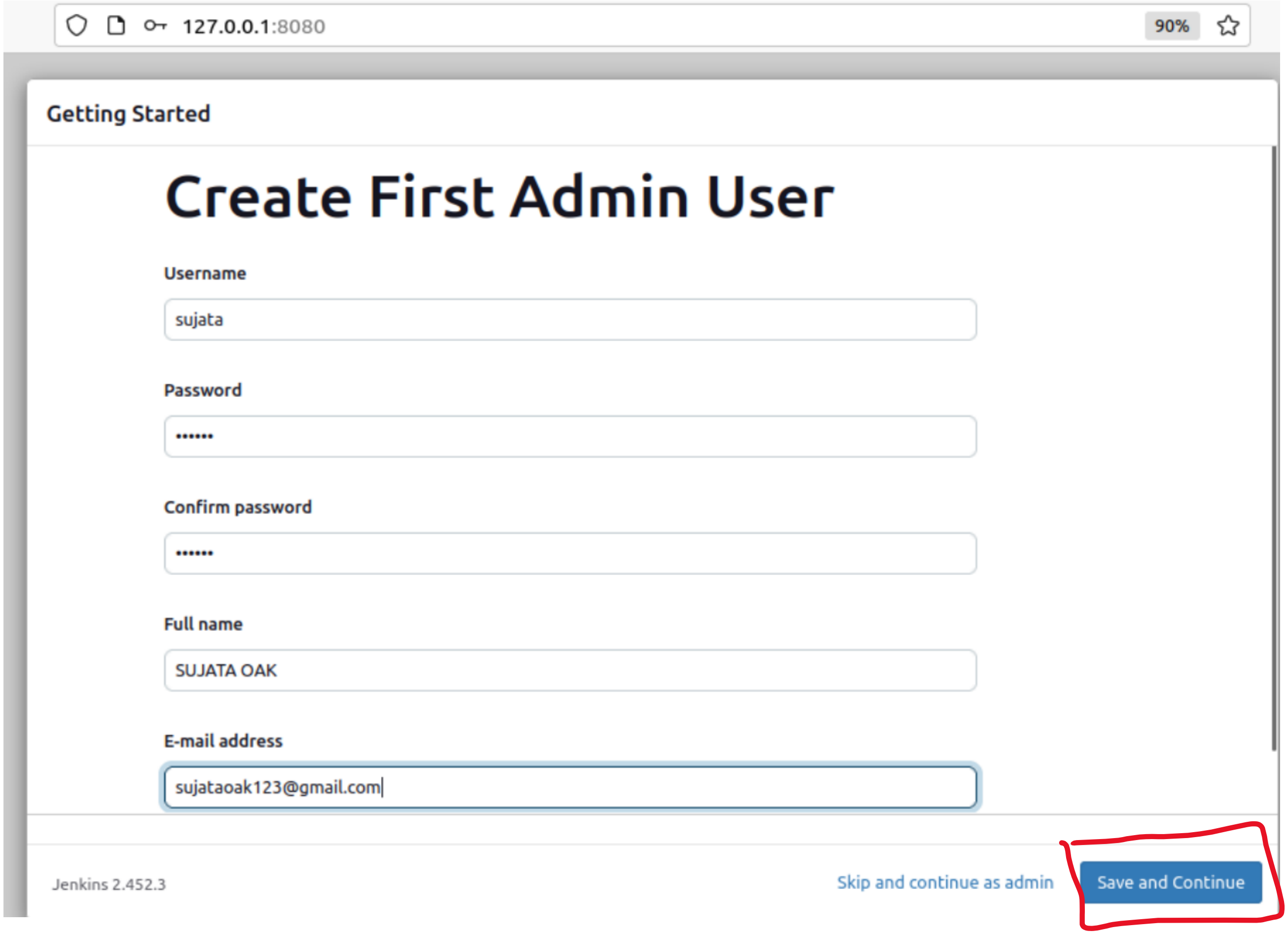


Getting Started

Getting Started

✓ Folders	✓ OWASP Markup Formatter	✓ Build Timeout	✓ Credentials Binding
✓ Timestamper	✓ Workspace Cleanup	✓ Ant	✓ Gradle
✓ Pipeline	✓ GitHub Branch Source	✓ Pipeline: GitHub Groovy Libraries	✓ Pipeline: Stage View
✓ Git	✓ SSH Build Agents	✓ Matrix Authorization Strategy	✓ PAM Authentication
✓ LDAP	✓ Email Extension	✓ Mailer	Dark Theme

```
** Trilead API
** Git client
** Pipeline: Input Step
** Pipeline: Declarative
Pipeline
** Java JSON Web Token (JJWT)
** OkHttp
** GitHub API
Git
** GitHub
GitHub Branch Source
Pipeline: GitHub Groovy
Libraries
** Pipeline Graph Analysis
** Pipeline: REST API
Pipeline: Stage View
Git
SSH Build Agents
Matrix Authorization Strategy
PAM Authentication
LDAP
Email Extension
Mailer
** - required dependency
```



Getting Started

Create First Admin User

Username: sujata

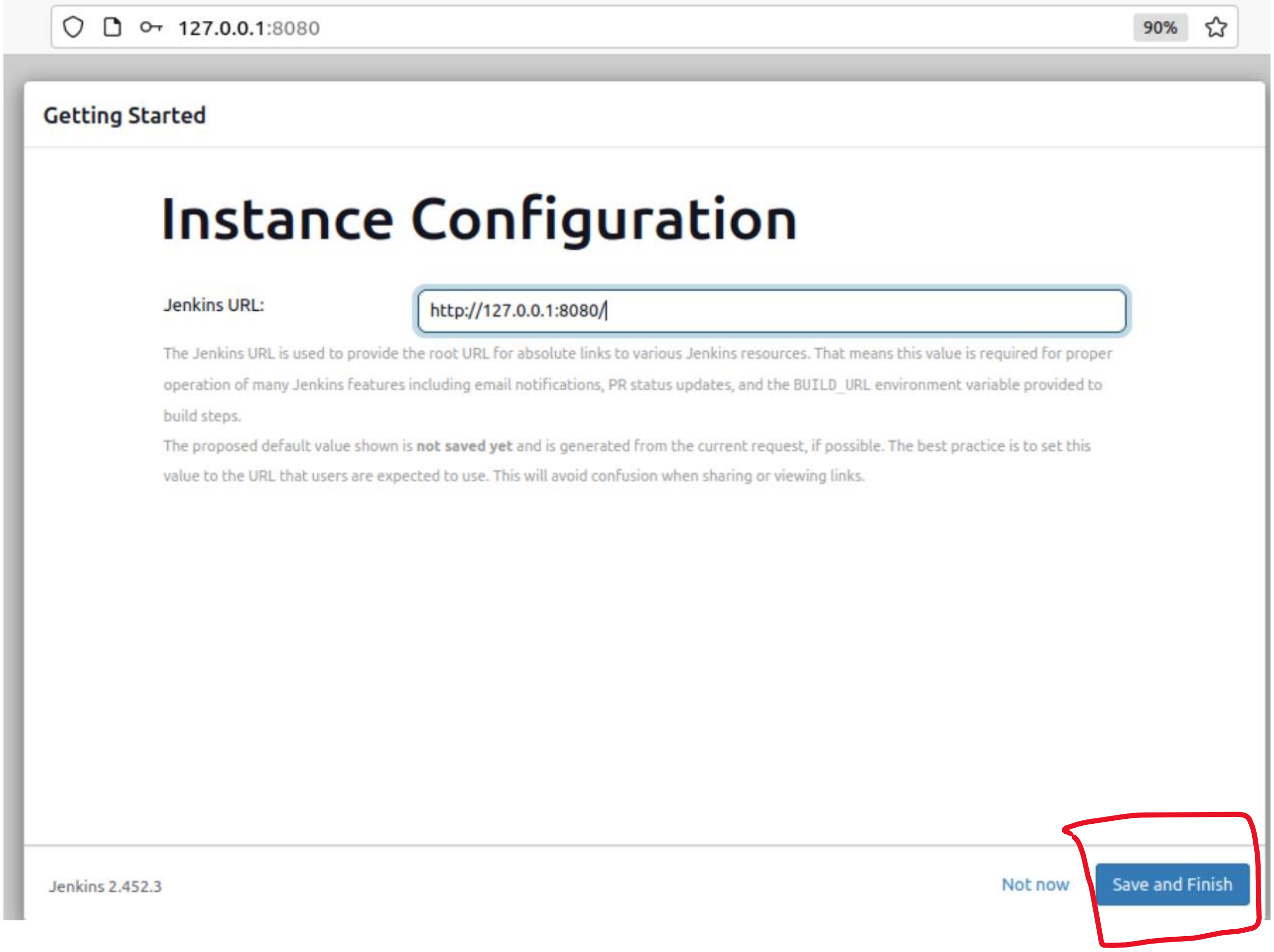
Password: ••••••

Confirm password: ••••••

Full name: SUJATA OAK

E-mail address: sujataoak123@gmail.com

Then specify the preferred **Jenkins URL** and finish the configuration process.

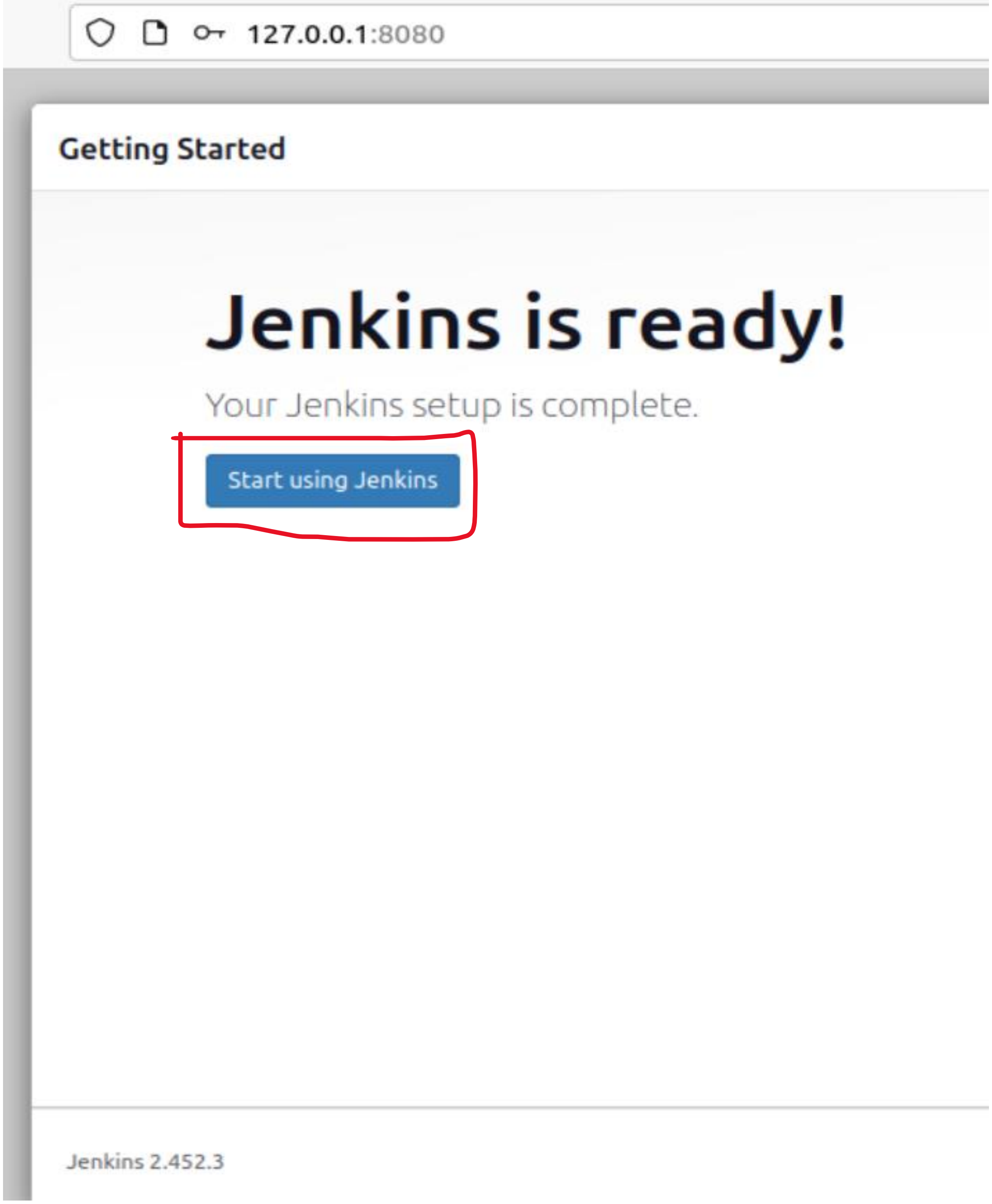


Instance Configuration

Jenkins URL: http://127.0.0.1:8080/

The Jenkins URL is used to provide the root URL for absolute links to various Jenkins resources. That means this value is required for proper operation of many Jenkins features including email notifications, PR status updates, and the BUILD_URL environment variable provided to build steps.

The proposed default value shown is **not saved yet** and is generated from the current request, if possible. The best practice is to set this value to the URL that users are expected to use. This will avoid confusion when sharing or viewing links.



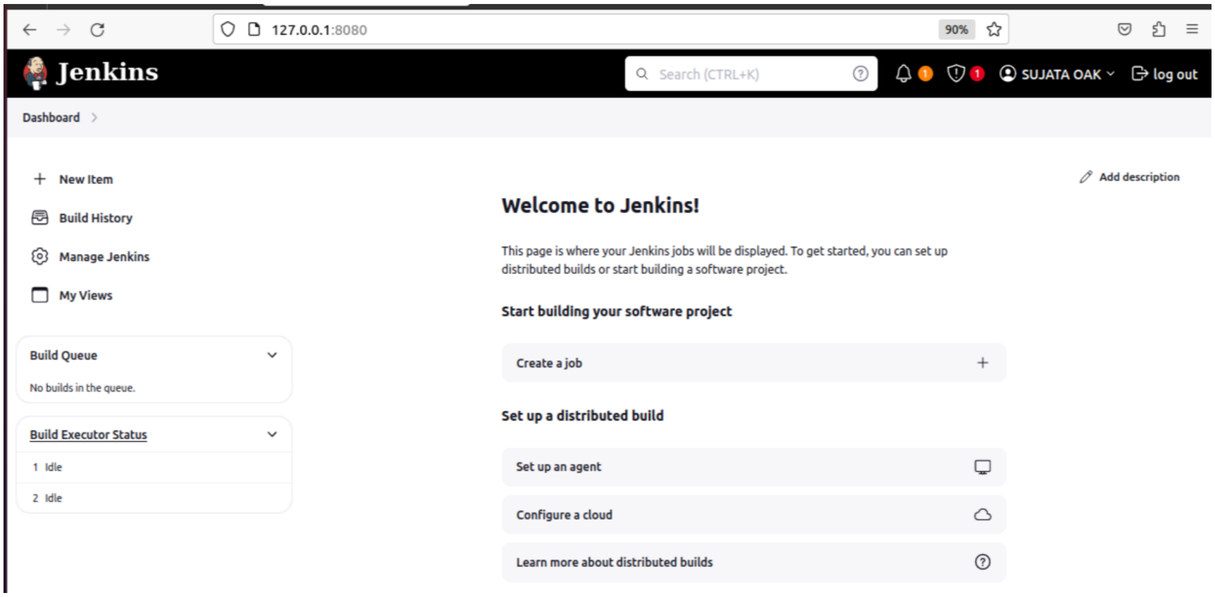
Getting Started

Jenkins is ready!

Your Jenkins setup is complete.

Jenkins 2.452.3

Step 11-: After configuration, the Jenkins dashboard will appear, meaning the Jenkins server installation and initial setup were successful.


127.0.0.1:8080

Jenkins

Dashboard

Welcome to Jenkins!

This page is where your Jenkins jobs will be displayed. To get started, you can set up distributed builds or start building a software project.

Start building your software project

Create a job

Set up a distributed build

Set up an agent

Configure a cloud

Learn more about distributed builds

Build Queue

No builds in the queue.

Build Executor Status

1 Idle

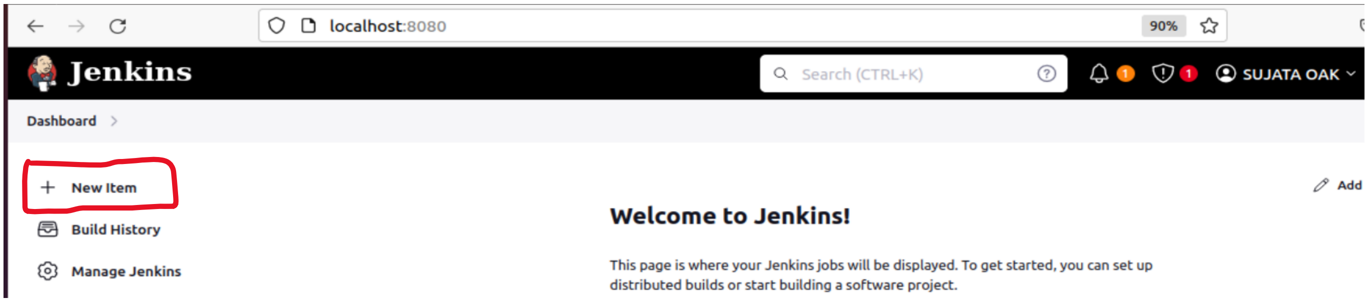
2 Idle

Task to be performed as a part of this experiment:

Jenkins Programming in Java using Version Control Git

Create and run a job in Jenkins for simple **HelloWorld** in Java

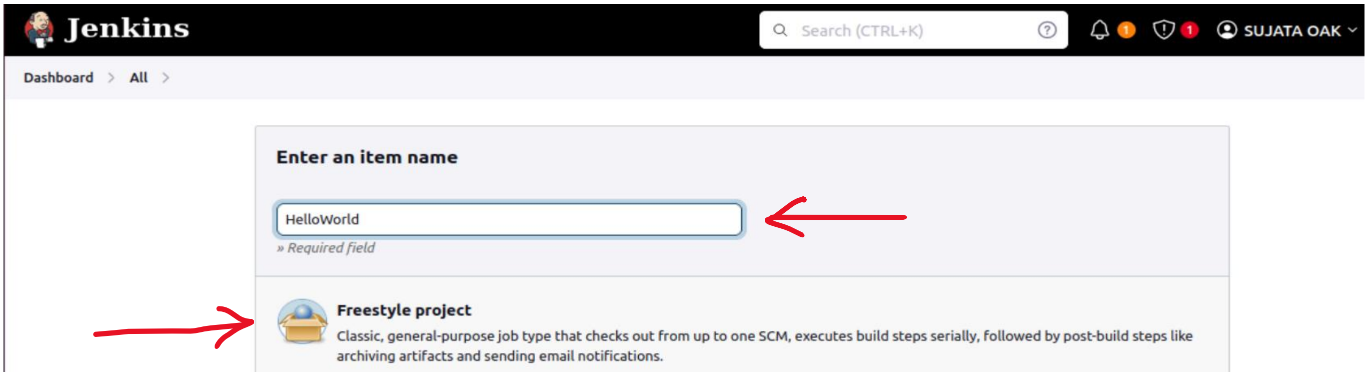
Step 1: Go to the Jenkins dashboard and click on the New Item.



Welcome to Jenkins!

This page is where your Jenkins jobs will be displayed. To get started, you can set up distributed builds or start building a software project.

Step 2: In the next page, enter the item name, and select the 'Freestyle project' option. And click OK. Here, my item name is HelloWorld.



Enter an item name

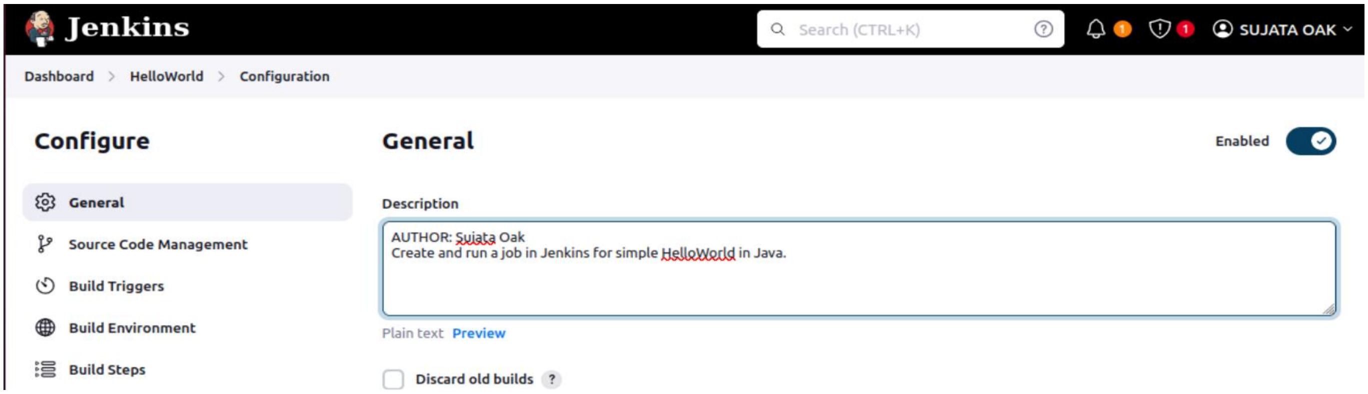
HelloWorld

» Required field

Freestyle project

Classic, general-purpose job type that checks out from up to one SCM, executes build steps serially, followed by post-build steps like archiving artifacts and sending email notifications.

Step 3: When you enter the OK, you will get a configuration page. Enter the details of the project in the Description section.



Jenkins

Search (CTRL+K)

SUJATA OAK

Dashboard > HelloWorld > Configuration

Configure

General

Source Code Management

Build Triggers

Build Environment

Build Steps

General

Enabled

Description

AUTHOR: Sujata Oak
Create and run a job in Jenkins for simple HelloWorld in Java.

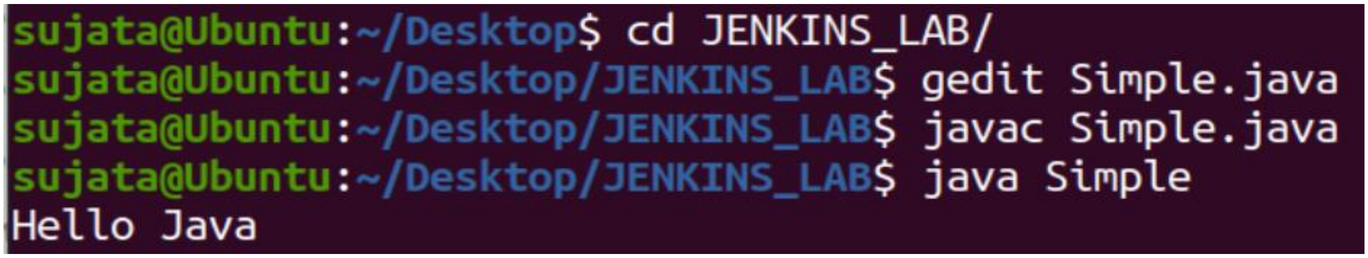
Plain text Preview

□ Discard old builds ?

Step 4: On the Source Code Management section, select the **Git** option, and specify the Repository URL.

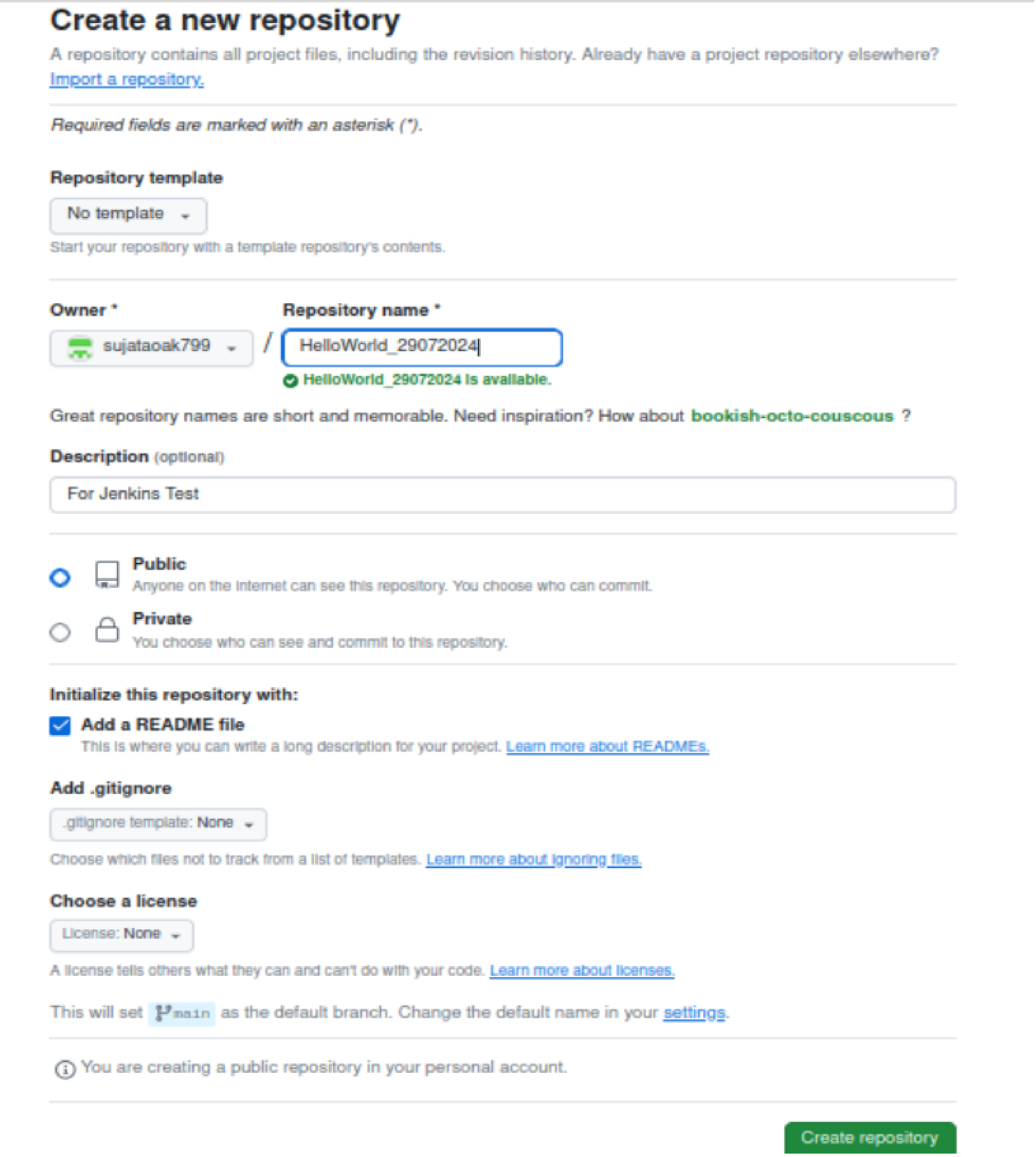
To do that you should have proper github setup on your system. To do the github setup:

- First, you have to create a project in java. Here, I created a simple **HelloWorld** program and saved it to one folder i.e. **Desktop/JENKINS_LAB.** Compile the HelloWorld.java file.



```
sujata@Ubuntu:~/Desktop$ cd JENKINS_LAB/
sujata@Ubuntu:~/Desktop/JENKINS_LAB$ gedit Simple.java
sujata@Ubuntu:~/Desktop/JENKINS_LAB$ javac Simple.java
sujata@Ubuntu:~/Desktop/JENKINS_LAB$ java Simple
Hello Java
```

- Now create a project in your GitHub account and give the Repository name. Here my repository name is HelloWorld_29072024.



Create a new repository

A repository contains all project files, including the revision history. Already have a project repository elsewhere? Import a repository.

Required fields are marked with an asterisk (*).

Repository template

No template ▾

Start your repository with a template repository's contents.

Owner * sujataoak799 ▾ / **Repository name *** HelloWorld_29072024

HelloWorld_29072024 is available.

Great repository names are short and memorable. Need inspiration? How about **bookish-octo-couscous** ?

Description (optional)

For Jenkins Test

● **Public**
Anyone on the internet can see this repository. You choose who can commit.

○ **Private**
You choose who can see and commit to this repository.

Initialize this repository with:

☑ **Add a README file**
This is where you can write a long description for your project. Learn more about READMEs.

Add .gitignore

.gitignore template: None ▾

Choose which files not to track from a list of templates. Learn more about ignoring files.

Choose a license

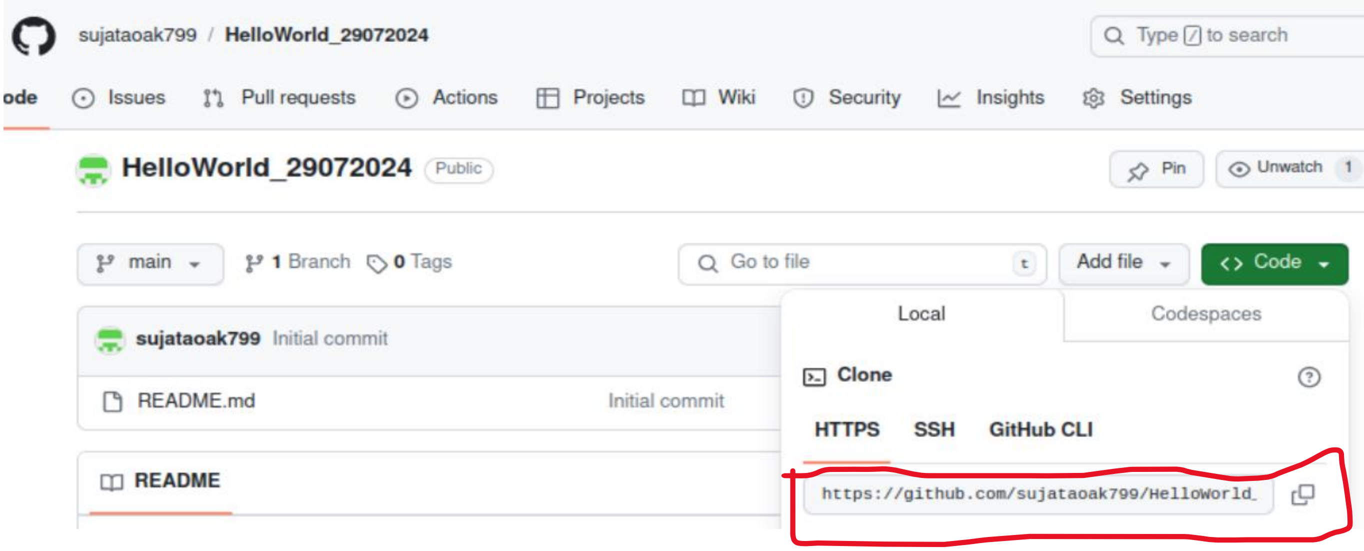
License: None ▾

A license tells others what they can and can't do with your code. Learn more about licenses.

This will set `main` as the default branch. Change the default name in your settings.

ⓘ You are creating a public repository in your personal account.

- Click on **Create repository**.

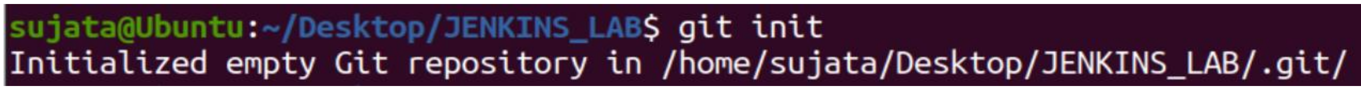


```
https://github.com/sujataoak799/HelloWorld_
```

Your repository is created. Copy the repository URL. My repository URL is: https://github.com/sujataoak799/HelloWorld_29072024.git

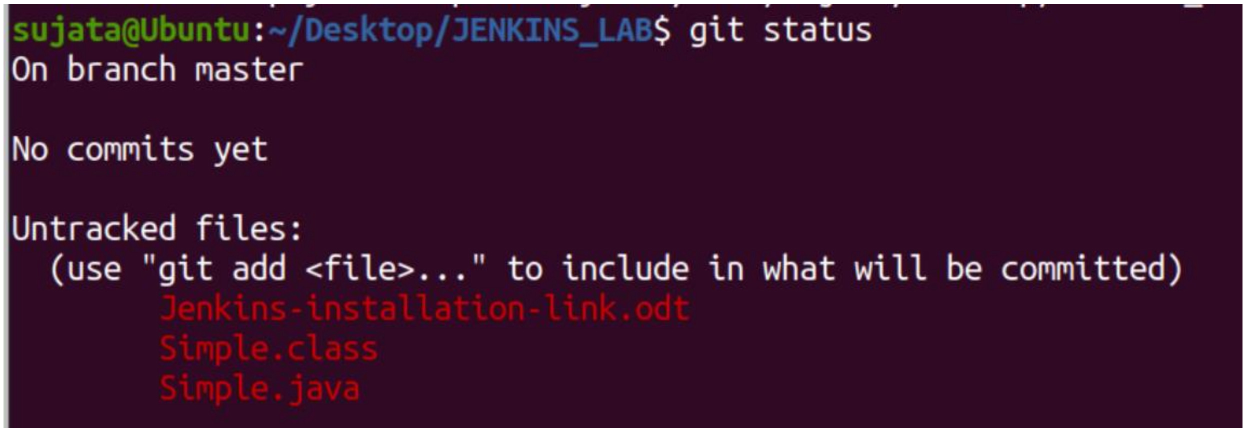
- Open the command prompt in your Ubuntu and go to the path where your java file is created.
- Then run the following command.

git init



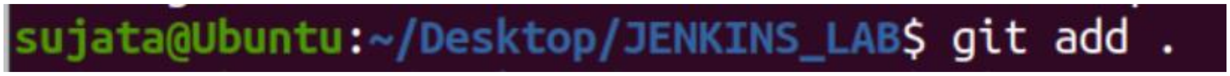
```
sujata@Ubuntu:~/Desktop/JENKINS_LAB$ git init
Initialized empty Git repository in /home/sujata/Desktop/JENKINS_LAB/.git/
```

git status



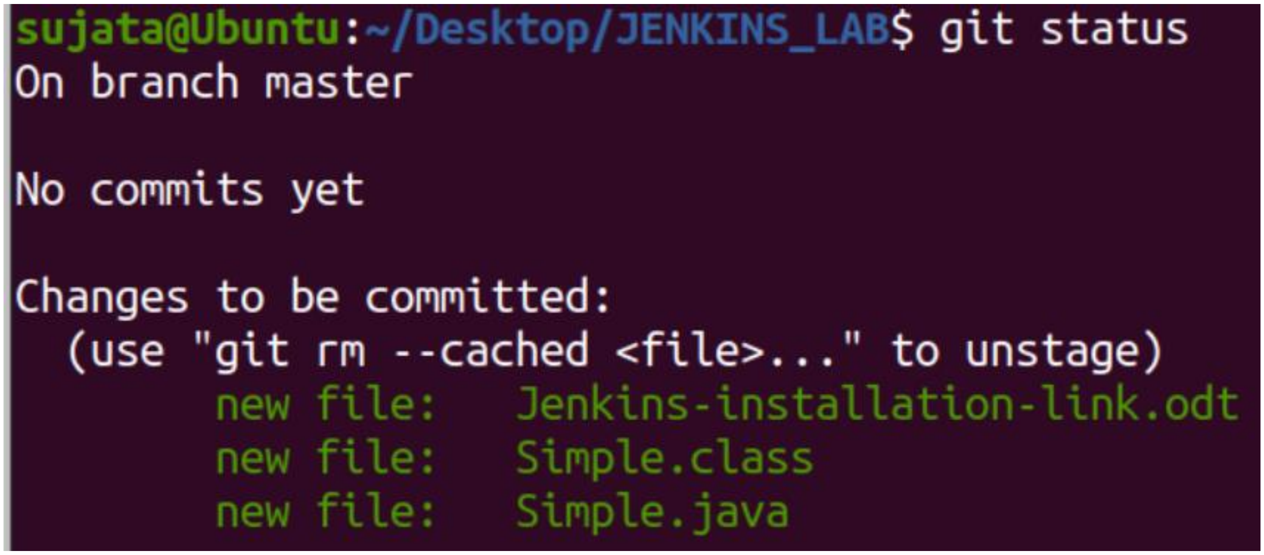
```
sujata@Ubuntu:~/Desktop/JENKINS_LAB$ git status
On branch master

No commits yet

Untracked files:
  (use "git add <file>..." to include in what will be committed)
        Jenkins-installation-link.odt
        Simple.class
        Simple.java
```

git add .



```
sujata@Ubuntu:~/Desktop/JENKINS_LAB$ git add .
```

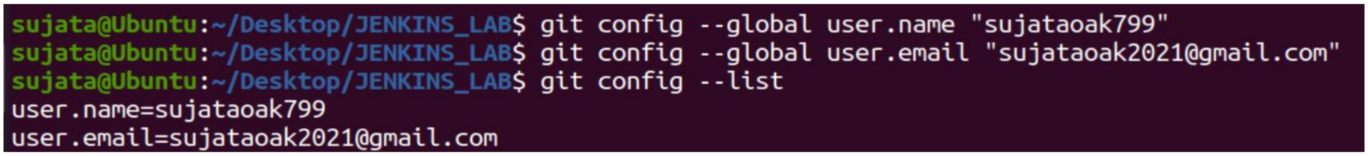
git status



```
sujata@Ubuntu:~/Desktop/JENKINS_LAB$ git status
On branch master

No commits yet

Changes to be committed:
  (use "git rm --cached <file>..." to unstage)
        new file:   Jenkins-installation-link.odt
        new file:   Simple.class
        new file:   Simple.java
```

- Configure your GitHub account in your system.

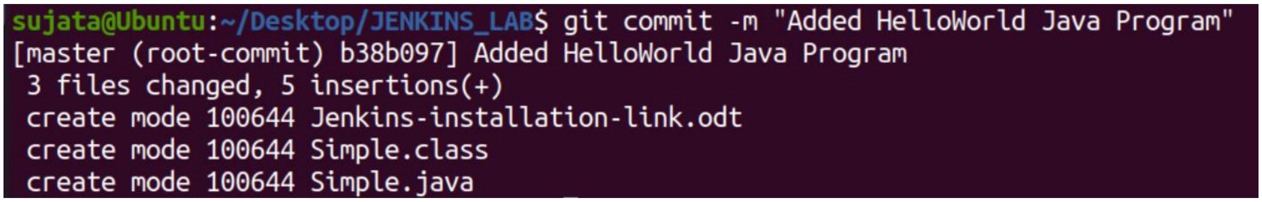
1. git config --global user.email "your@email"
2. git config --global user.name "username"



```
sujata@Ubuntu:~/Desktop/JENKINS_LAB$ git config --global user.name "sujataoak799"
sujata@Ubuntu:~/Desktop/JENKINS_LAB$ git config --global user.email "sujataoak2021@gmail.com"
sujata@Ubuntu:~/Desktop/JENKINS_LAB$ git config --list
user.name=sujataoak799
user.email=sujataoak2021@gmail.com
```

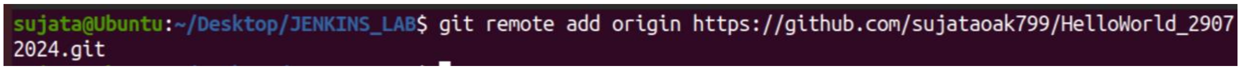
- Commit it and add the repository URL.

1. git commit -m "Added HelloWorld Java Program"



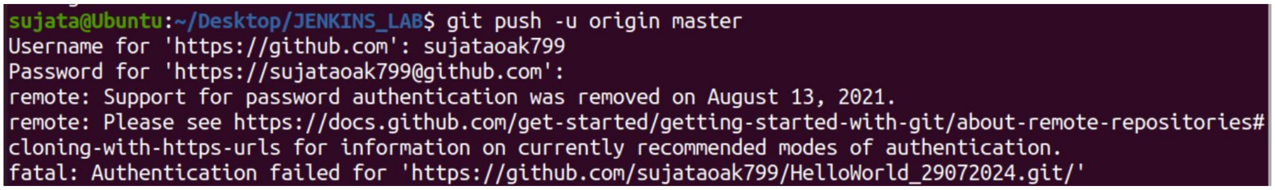
```
sujata@Ubuntu:~/Desktop/JENKINS_LAB$ git commit -m "Added HelloWorld Java Program"
[master (root-commit) b38b097] Added HelloWorld Java Program
 3 files changed, 5 insertions(+)
 create mode 100644 Jenkins-installation-link.odt
 create mode 100644 Simple.class
 create mode 100644 Simple.java
```

2. git remote add origin https://github.com/sujataoak799/HelloWorld_29072024.git

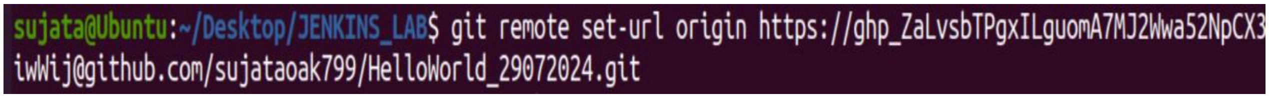


```
sujata@Ubuntu:~/Desktop/JENKINS_LAB$ git remote add origin https://github.com/sujataoak799/HelloWorld_2907
2024.git
```

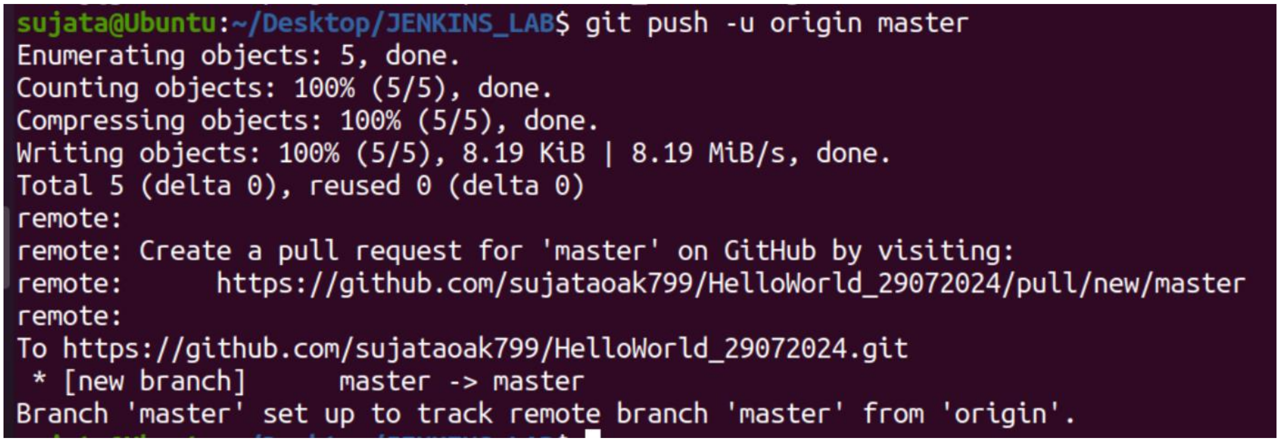
3. git push -u origin master



```
sujata@Ubuntu:~/Desktop/JENKINS_LAB$ git push -u origin master
Username for 'https://github.com': sujataoak799
Password for 'https://sujataoak799@github.com':
remote: Support for password authentication was removed on August 13, 2021.
remote: Please see https://docs.github.com/get-started/getting-started-with-git/about-remote-repositories#
cloning-with-https-urls for information on currently recommended modes of authentication.
fatal: Authentication failed for 'https://github.com/sujataoak799/HelloWorld_29072024.git/'
```

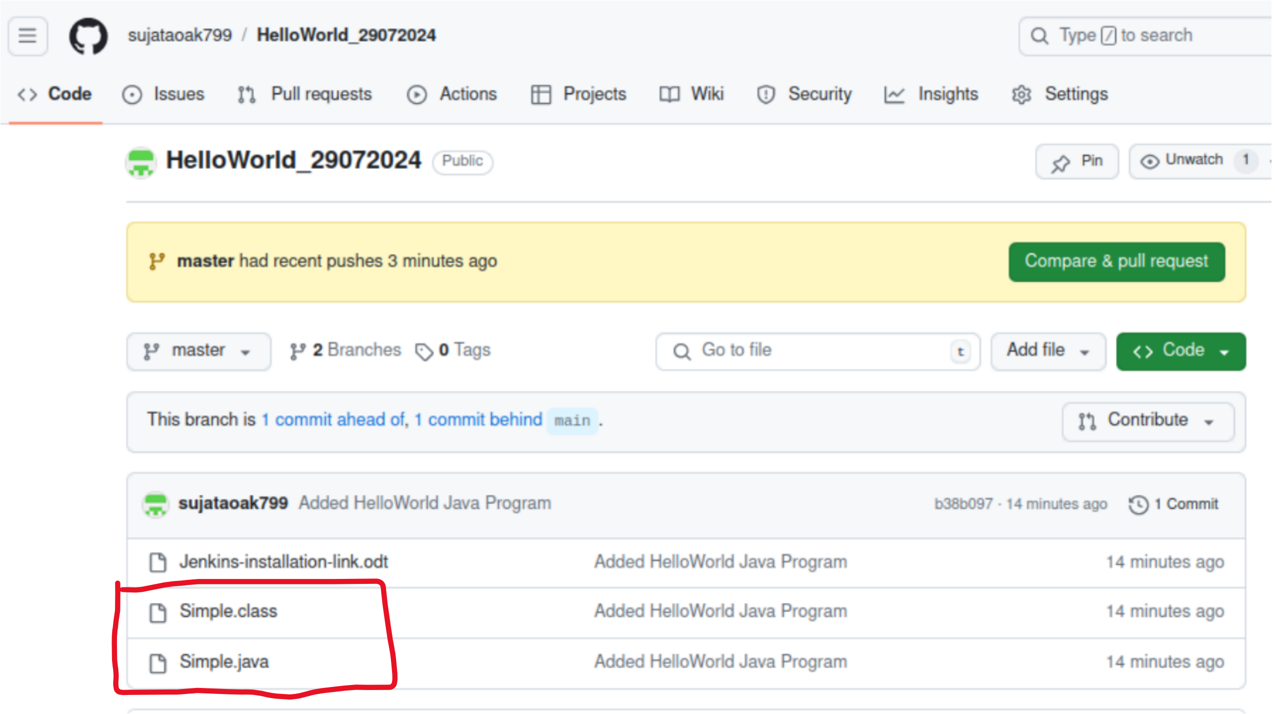


```
sujata@Ubuntu:~/Desktop/JENKINS_LAB$ git remote set-url origin https://ghp_ZaLvsbTPgxILguomA7MJ2Wwa52NpCX3
iwWij@github.com/sujataoak799/HelloWorld_29072024.git
```



```
sujata@Ubuntu:~/Desktop/JENKINS_LAB$ git push -u origin master
Enumerating objects: 5, done.
Counting objects: 100% (5/5), done.
Compressing objects: 100% (5/5), done.
Writing objects: 100% (5/5), 8.19 KiB | 8.19 MiB/s, done.
Total 5 (delta 0), reused 0 (delta 0)
remote:
remote: Create a pull request for 'master' on GitHub by visiting:
remote:      https://github.com/sujataoak799/HelloWorld_29072024/pull/new/master
remote:
To https://github.com/sujataoak799/HelloWorld_29072024.git
 * [new branch]      master -> master
Branch 'master' set up to track remote branch 'master' from 'origin'.
```

- Now, when you refresh your GitHub account, the HelloWorld file will be added in your repository.



HelloWorld_29072024 Public

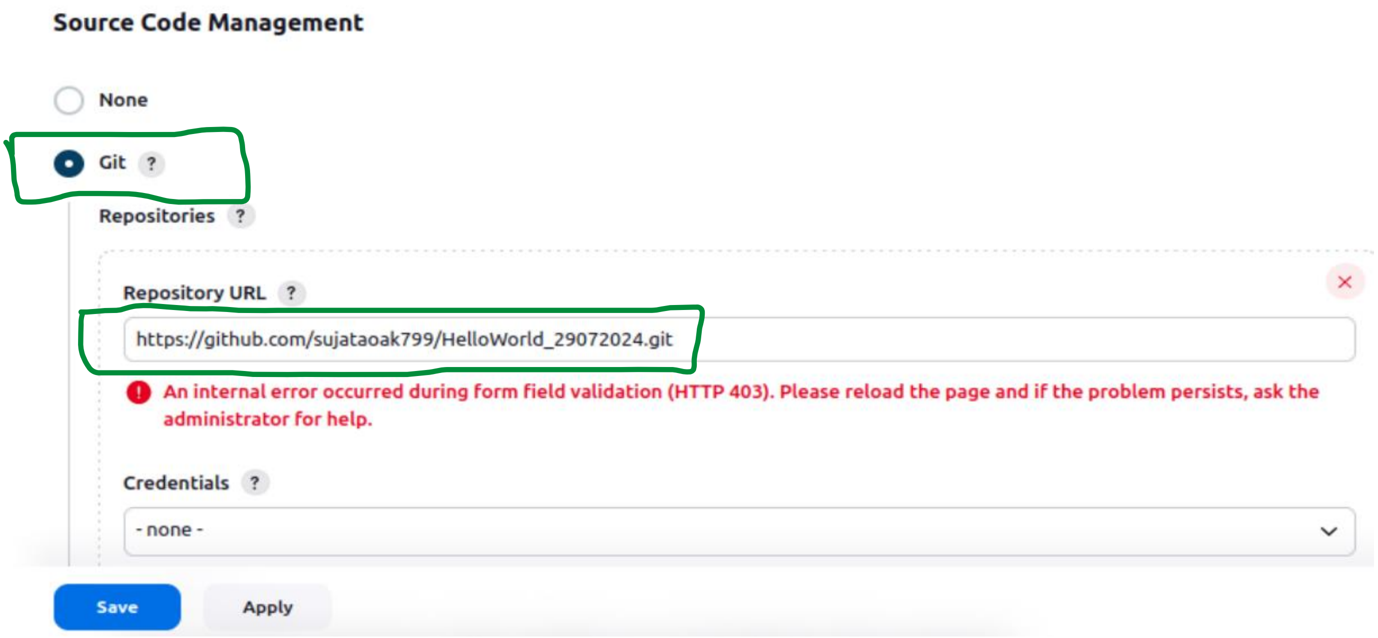
master had recent pushes 3 minutes ago

This branch is 1 commit ahead of, 1 commit behind main .

sujataoak799 Added HelloWorld Java Program b38b097 · 14 minutes ago 1 Commit

Jenkins-installation-link.odt	Added HelloWorld Java Program	14 minutes ago
Simple.class	Added HelloWorld Java Program	14 minutes ago
Simple.java	Added HelloWorld Java Program	14 minutes ago

Step 5: Add the Repository URL in the **Source Code Management** section.



Source Code Management

○ None

● Git ?

Repositories ?

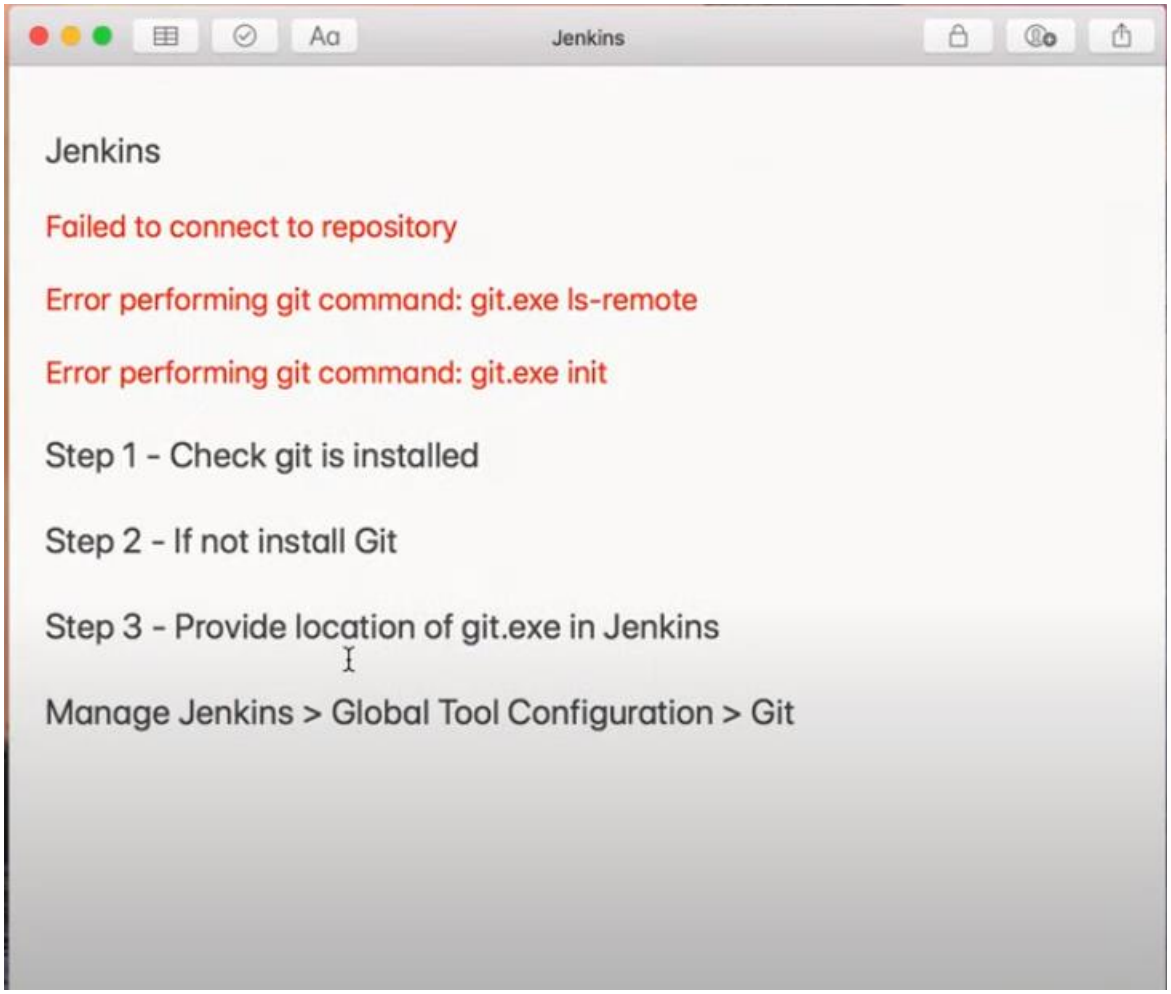
Repository URL ?

https://github.com/sujataoak799/HelloWorld_29072024.git

An internal error occurred during form field validation (HTTP 403). Please reload the page and if the problem persists, ask the administrator for help.

Credentials ?

- none -



Jenkins

Failed to connect to repository

Error performing git command: git.exe ls-remote

Error performing git command: git.exe init

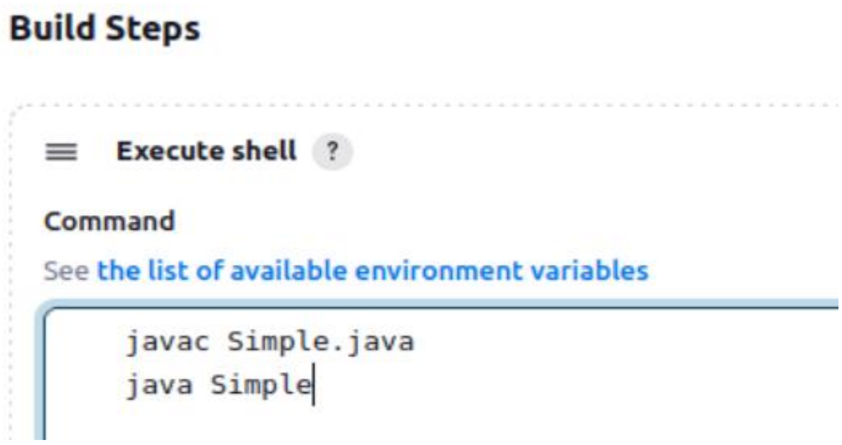
Step 1 - Check git is installed

Step 2 - If not install Git

Step 3 - Provide location of git.exe in Jenkins

Manage Jenkins > Global Tool Configuration > Git

Step 6: Now, it is time to build the code. Click on "**Add build step**" and select the "**Execute Shell**".



Build Steps

Execute shell ?

Command

See the list of available environment variables

```
javac Simple.java
java Simple
```

Step 7: Enter the following command to compile the java code.

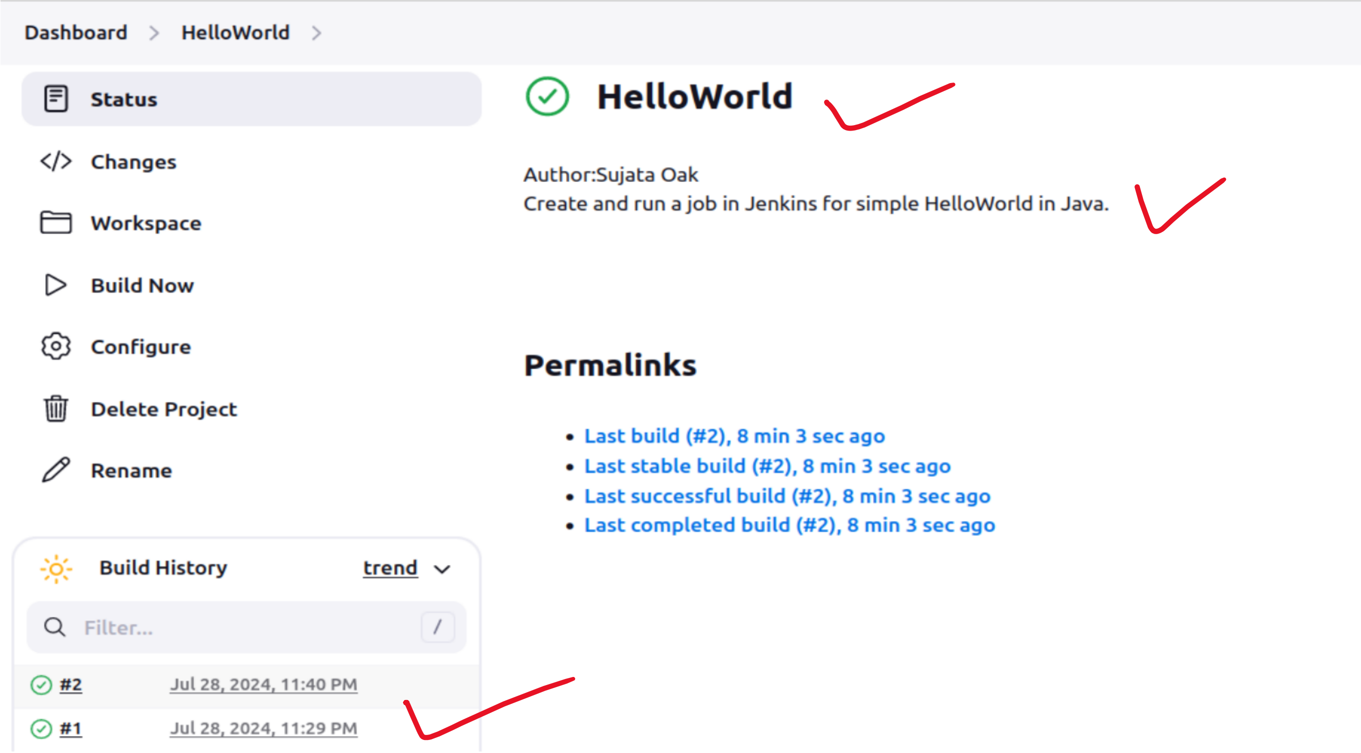
```
javac Simple.java
 java Simple
```

Step 8: Click Apply and then Save button.

Step 9: Once you saved the configuration, then now can click on **Build Now** option.

Step 10: After clicking on **Build Now**, you can see the status of the build on the Build History section.

Once the build is completed, a status of the build will show if the build was successful or not. If the build is failed then it will show in red color. Blue symbol is for success.


Dashboard > HelloWorld >

HelloWorld

Author:Sujata Oak
Create and run a job in Jenkins for simple HelloWorld in Java.

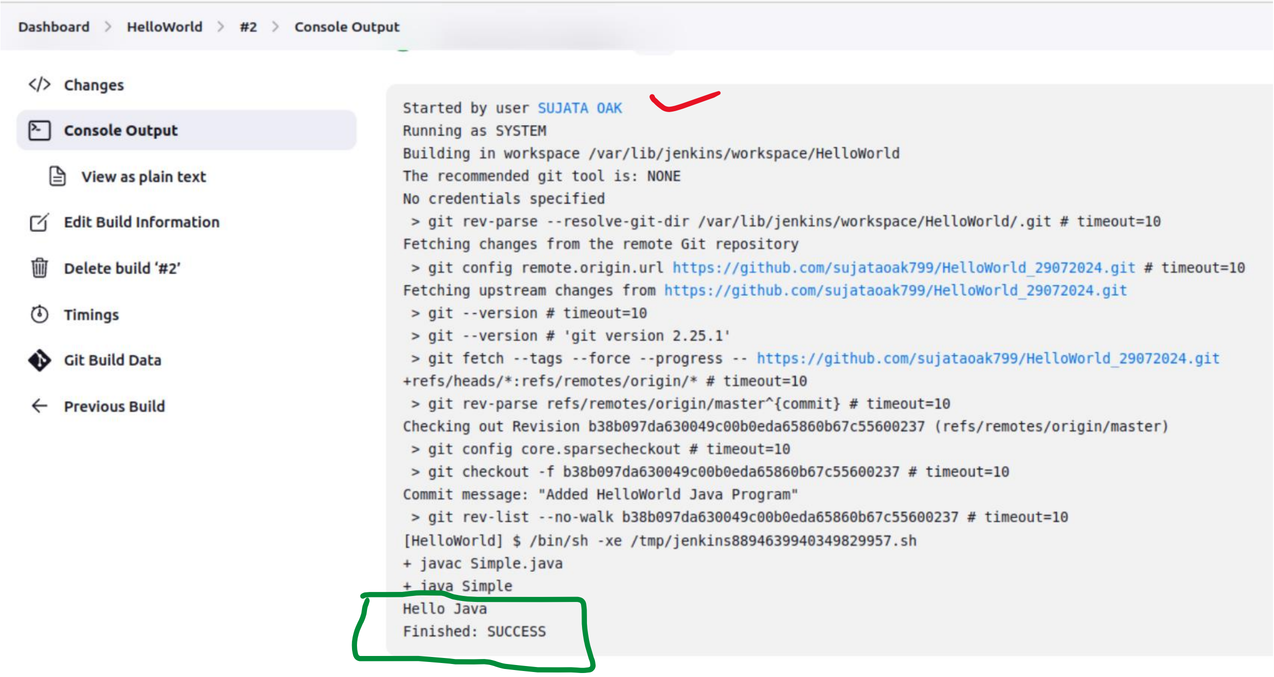
Permalinks

- Last build (#2), 8 min 3 sec ago
- Last stable build (#2), 8 min 3 sec ago
- Last successful build (#2), 8 min 3 sec ago
- Last completed build (#2), 8 min 3 sec ago

✓ #2	Jul 28, 2024, 11:40 PM
✓ #1	Jul 28, 2024, 11:29 PM

Click on the build number **#2** in the **Build History section** to see the details of the build.

Step 11: Click on **Console Output** from the left side of the screen to see the status of the build you run. It should show the success message.



```
Started by user SUJATA OAK
Running as SYSTEM
Building in workspace /var/lib/jenkins/workspace/HelloWorld
The recommended git tool is: NONE
No credentials specified
 > git rev-parse --resolve-git-dir /var/lib/jenkins/workspace/HelloWorld/.git # timeout=10
Fetching changes from the remote Git repository
 > git config remote.origin.url https://github.com/sujataoak799/HelloWorld_29072024.git # timeout=10
Fetching upstream changes from https://github.com/sujataoak799/HelloWorld_29072024.git
 > git --version # timeout=10
 > git --version # 'git version 2.25.1'
 > git fetch --tags --force --progress -- https://github.com/sujataoak799/HelloWorld_29072024.git
+refs/heads/*:refs/remotes/origin/* # timeout=10
 > git rev-parse refs/remotes/origin/master^{commit} # timeout=10
Checking out Revision b38b097da630049c00b0eda65860b67c55600237 (refs/remotes/origin/master)
 > git config core.sparsecheckout # timeout=10
 > git checkout -f b38b097da630049c00b0eda65860b67c55600237 # timeout=10
Commit message: "Added HelloWorld Java Program"
 > git rev-list --no-walk b38b097da630049c00b0eda65860b67c55600237 # timeout=10
[HelloWorld] $ /bin/sh -xe /tmp/jenkins8894639940349829957.sh
+ javac Simple.java
+ java Simple
Hello Java
Finished: SUCCESS
```

Conclusion: In this experiment we understood the installation and implemented the use case of Jenkins in version control system.