DEPARTMENT OF
INFORMATION TECHNOLOGY

DEVOPS LAB

LABORATORY MANUAL

SIES GRADUATE SCHOOL OF TECHNOLOGY
PLOT 1-C, D & E, SECTOR V, NERUL, NAVI MUMBAI-400 706

VISION OF THE INSTITUTE

To be a center of excellence in Engineering Education committed towards Socio-Economic Advancement of the country.

MISSION OF THE INSTITUTE

1. To impart advanced knowledge in Engineering and Technology.
2. To transform young minds towards professional competence by inculcating values and developing skills.
3. To promote research and ensure continuous value addition among students and employees.
4. To strengthen association with industry, research organizations and alumni to enhance knowledge on current technologies.
5. To promote next generation technocracy and nurture entrepreneurial culture for social-economic growth.

VISION OF THE DEPARTMENT

To develop IT professionals for accomplishment of industrial & societal needs through quality education.

MISSION OF THE DEPARTMENT

1. To impart advanced knowledge and develop skills in Information Technology and allied fields.
2. To enhance professional competence by inculcating values and ethics.
3. To upgrade technical skills and also encourage research culture.
4. To extend industry and alumni association for knowledge enhancement.
5. To nurture entrepreneurial talent and contribute towards socio-economic growth.

COURSE OUTCOMES

At the end of the course, the student should be able to:

1. To learn the fundamentals of DevOps engineering and be fully proficient with DevOps terminologies, concepts, benefits, and deployment options to meet your business requirements
2. To obtain complete knowledge of the "version control system" to effectively track changes augmented with Git and GitHub
3. To demonstrate the importance of Jenkins to Build and deploy Software Applications on server environment
4. Demonstrate the importance of Selenium and Jenkins to test Software Applications
5. To understand concept of containerization and Analyze the Containerization of OS images and deployment of applications over Docker
6. To Synthesize software configuration and provisioning using Puppet /Ansible.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
To learn the fundamentals of DevOps engineering and be fully proficient with DevOps terminologies, concepts, benefits, and deployment options to meet your business requirements	2	3	3	2	3	2	2	3	3	3	2	2	3	2
To obtain complete knowledge of the "version control system" to effectively track changes augmented with Git and GitHub	2	3	3	2	3	2	2	3	3	3	2	2	2	2
To demonstrate the importance of Jenkins to Build and deploy Software Applications on server environment	2	3	3	2	3	2	2	3	3	3	2	2	3	2
Demonstrate the importance of Selenium and Jenkins to test Software Applications	2	3	3	2	3	2	2	3	3	3	2	2	3	2

To understand concept of containerization and Analyze the Containerization of OS images and deployment of applications over Docker	2	3	3	2	3	2	2	3	3	3	2	2	2	2
To Synthesize software configuration and provisioning using Puppet /Ansible.	2	3	3	2	3	2	2	3	3	3	2	2	2	2

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CODE OF CONDUCT FOR THE LABORATORIES

- All the students must observe the Dress Code while in the laboratory.
- Sandals or open-toed shoes are NOT allowed.
- Food, drinks and smoking are NOT allowed.
- All bags must be left at the indicated place.
- The lab timetable must be strictly followed.
- Be PUNCTUAL for your laboratory sessions.
- Program must be executed within the given time.
- Noise must be kept to minimum.
- Workspace must be kept clean and tidy all the time.
- Handle the systems and interfacing kits with care.
- All students are liable for any damage to the accessories due to negligence.
- All interfacing kits connecting cables must be RETURNED to the lab supervisor.
- Students are strictly PROHIBITED from taking out any items from the laboratory.
- Students are NOT allowed to work in the laboratory without the Lab supervisor.
- USB Ports have been disabled. If you want to use USB drive consult lab supervisor.
- Report immediately to the Lab Supervisor of any malfunction of the accessories..

Before leaving the lab

- Place the chairs properly.
- Turn off the system properly.
- Turn off the monitor.

Please check the laboratory notice board regularly for updates.

End semester lab examination, conducted as per the UOM regulations, carries 25 marks of Oral and Pracical.

At the end of each laboratory session you must obtain the signature of the teacher along with the marks for the session out of 05 on the lab notebook and 05 for journal.

Lab Reports

- Note that, although students are encouraged to collaborate during lab, each must individually prepare a report and submit.
- They must be organized, neat and legible.
- Your report should be complete, thorough and understandable.
- You should include a well-drawn and labeled engineering schematic for each circuit investigated.
- Your reports should follow the prescribed format, to give your report structure and to make sure that you address all important points.
- Graphics requiring- drawn straight lines should be done with a straight edge. Well drawn free-hand sketches are permissible for schematics.
- Space must be provided in the flow of your discussion for any tables or figures. Do not collect figures and drawings in a single appendix at the end of the report.
- Reports should be submitted within one week after completing a scheduled lab session.

Presentation

- Experimental facts should always be given in the past tense.
- Discussions or remarks about the presentation of data should mainly be in the present tense.
- Discussion of results can be in both the present and past tenses, shifting back and forth from experimental facts to the presentation.
- Any specific conclusions or deductions should be expressed in the past tense.

LIST OF EXPERIMENTS

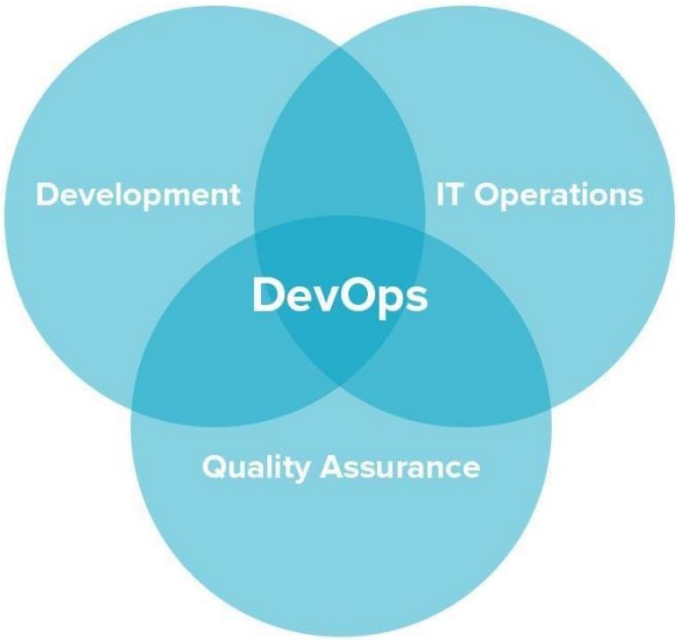
1. To understand DevOps: Principles, Practices, and DevOps, Engineer Role and Responsibilities.
2. To understand Version Control System / Source Code Management, install git and create a GitHub account. b) To Perform various GIT operations on local and Remote repositories using GIT CheatSheet.
3. a) To understand Continuous Integration, install and configure Jenkins with Maven/Ant/Gradle to setup a build Job. b) To Build the pipeline of jobs using Maven / Gradle / Ant in Jenkins, create a pipeline script to Test and deploy an application over the tomcat server
4. To understand Jenkins Master-Slave Architecture and scale your Jenkins standalone implementation by implementing slave nodes.
5. To Setup and Run Selenium Tests in Jenkins Using Maven.
6. To understand Docker Architecture and Container Life Cycle, install Docker and execute docker commands to manage images and interact with containers.
7. To learn Dockerfile instructions, build an image for a sample web application using Dockerfile.
8. To install and Configure Pull based Software Configuration Management and provisioning tools using Puppet.
9. To learn Software Configuration Management and provisioning using Puppet Blocks(Manifest, Modules, Classes, Function)
10. To provision a LAMP/MEAN Stack using Puppet Manifest.

EXPERIMENT-1

Aim: To understand DevOps: Principles, practices, DevOps, Engineer role and responsibilities.

Theory:

1. Definition for DevOps: DevOps stands for development and operations. It's a practice that aims at merging development, quality assurance, and operations (deployment and integration) into a single, continuous set of processes. This methodology is a natural extension of Agile and continuous delivery approaches. By adopting DevOps companies gain three core advantages that cover technical, business, and cultural aspects of development:
    - Higher speed and quality of product releases
    - Faster responsiveness to customer needs
    - Better working environment

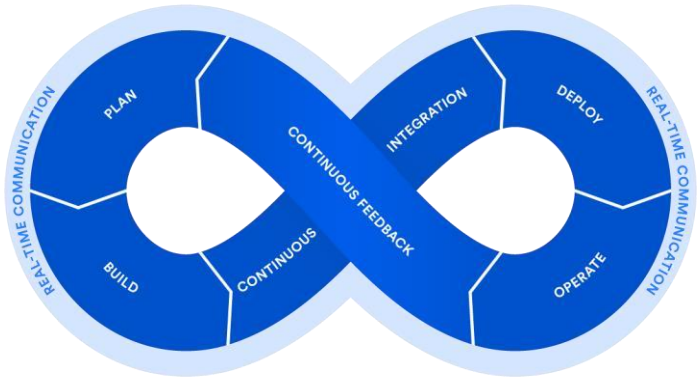


2. Principles: In 2010 Damon Edwards and John Willis came up with the CAMS model to showcase the key values of DevOps. CAMS is an acronym that stands for Culture, Automation, Measurement, and Sharing.
    - Culture: DevOps is initially the culture and mindset forging strong collaborative bonds between software development and infrastructure operations teams. This culture is built upon the following pillars.

- Constant collaboration and communication: These have been the building blocks of DevOps since its dawn. Your team should work cohesively with the understanding of the needs and expectations of all members.

- Gradual changes: The implementation of gradual rollouts allows delivery teams to release a product to users while having an opportunity to make updates and roll back if something goes wrong.
- Shared end-to-end responsibility: When every member of a team moves towards one goal and is equally responsible for a project from beginning to end, they work cohesively and look for ways of facilitating other members' tasks
- Early problem-solving: DevOps requires that tasks be performed as early in the project lifecycle as possible. So, in case of any issues, they will be addressed more quickly.
- Automation of processes: Automating as many development, testing, configuration, and deployment procedures as possible is the golden rule of DevOps. It allows specialists to get rid of time-consuming repetitive work and focus on other important activities that can't be automated by their nature.
- Measurement of KPIs (Key Performance Indicators): Decision-making should be powered by factual information in the first place. To get optimal performance, it is necessary to keep track of the progress of activities composing the DevOps flow. Measuring various metrics of a system allows for understanding what works well and what can be improved.
- Sharing: Sharing is caring: This phrase explains the DevOps philosophy better than anything else as it highlights the importance of collaboration. It is crucial to share feedback, best practices, and knowledge among teams since this promotes transparency, creates collective intelligence and eliminates constraints. You don't want to put the whole development process on pause just because the only person who knows how to handle certain tasks went on a vacation or quitted.

3. Practices: DevOps requires a delivery cycle that comprises planning, development, testing, deployment, release, and monitoring with active cooperation between different members of a team.



To break down the process even more, let's have a look at the core practices that constitute the DevOps:

- Agile planning**:** In contrast to traditional approaches of project management, agile planning organizes work in short iterations to increase the number of releases. This means that the team has only high-level objectives outlined, while making detailed planning for two iterations in advance. This allows for flexibility and pivots once the ideas are tested on an early product increment.

- Continuous development**:** The concept of continuous "everything" embraces continuous or iterative software development, meaning that all the development work is divided into small portions for better and faster production. Engineers commit code in small chunks multiple times a day for it to be easily tested.

- Continuous automated testing**:** A quality assurance team sets committed code testing using automation tools like Selenium, Ranorex, UFT, etc. If bugs and vulnerabilities are revealed, they are sent back to the engineering team. This stage also entails version control to detect integration problems in advance. A Version Control System (VCS) allows developers to record changes in the files and share them with other members of the team, regardless of their location.

- Continuous integration and continuous delivery (CI/CD)**:** The code that passes automated tests is integrated in a single, shared repository on a server. Frequent code submissions prevent a so-called "integration hell" when the differences between individual code branches and the mainline code become so drastic over time that integration takes more than actual coding. Continuous delivery, detailed in our dedicated article, is an approach that merges development, testing, and deployment operations into a streamlined process as it heavily relies on automation. This stage enables the automatic delivery of code updates into a production environment.

- Continuous deployment**:** At this stage, the code is deployed to run in production on a public server. Code must be deployed in a way that doesn't affect already functioning features and can be available for a large number of users. Frequent deployment allows for a "fail fast" approach, meaning that the new features are tested and verified early. There are various automated tools that help engineers deploy a product increment. The most popular are Chef, Puppet, Azure Resource Manager, and Google Cloud Deployment Manager.

- Continuous monitoring**:** The final stage of the DevOps lifecycle is oriented to the assessment of the whole cycle. The goal of monitoring is detecting the problematic areas of a process and analysing the feedback from the team and users to report existing inaccuracies and improve the product's functioning.

- Microservices**:** The microservice architectural approach entails building one application as a set of independent services that communicate with each other, but are configured individually. Building an application this way, you can isolate any arising problems ensuring that a failure in one service doesn't break the rest of the application functions. With the high rate of

deployment, microservices allow for keeping the whole system stable, while fixing the problems in isolation.

4. Engineer's Roles and Responsibilities:

The main function of a DevOps engineer is to introduce the continuous delivery and continuous integration workflow, which requires the understanding of the mentioned tools and the knowledge of several programming languages. Depending on the organization, job descriptions differ. Smaller businesses look for engineers with broader skillsets and responsibilities. For example, the job description may require product building along with the developers. Larger companies may look for an engineer for a specific stage of the DevOps lifecycle that will work with a certain automation tool.

The basic and widely-accepted responsibilities of a DevOps engineer are: • Writing

specifications and documentation for the server-side features

- Continuous deployment and continuous integration (CI/CD) management
- Performance assessment and monitoring
- Infrastructure management
- Cloud deployment and management
- Assistance with DevOps culture adoption

Conclusion: Hence we have understood the formal definition of DevOps, its practices, principles and the roles of a DevOps Engineer.

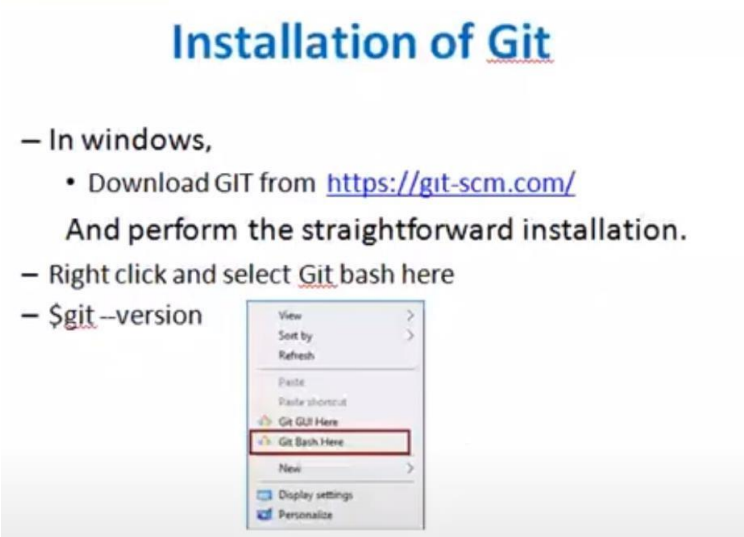
EXPERIMENT-2

Aim: a) To understand Version Control System / Source Code Management, install git and create a GitHub account.

Theory:

Version Control System/Source code management:

A version control system is a software that tracks changes to a file or set of files over time so that you can recall specific versions later. It also allows you to work together with other programmers. The version control system is a collection of software tools that help a team to manage changes in a source code. It uses a special kind of database to keep track of every modification to the code. Developers can compare earlier versions of the code with an older version to fix the mistakes.



GitHub is a global company that provides hosting for software development version control using Git. It is a Subsidiary of Microsoft, which acquired the company in 2018 for $7.5 billion. It offers all of the distributed version control and source code management (SCM) functionality of Git as well as adding its own features. It provides access control and several collaboration features such as bug tracking, feature requests, task management, and wikis for every project.

GitHub offers plans for free, professional, and enterprise accounts. Free GitHub accounts are commonly

Used to host open source projects. As of January 2019, GitHub offers unlimited private repositories to all Plans, including free accounts. As of May 2019, GitHub reports having over 37 million users and more than 100 million repositories (including at least 28 million public repositories), making it the largest host of source code in the world.

Conclusion:

Hence, we have studied about Version Control System / Source Code Management, installed git and have created a GitHub account.

Aim: b) To perform various GIT operations on local and Remote repositories using GIT Cheat-Sheet.

Theory: GitHub is a global company that provides hosting for software development version control using Git. It is a subsidiary of Microsoft, which acquired the company in 2018 for $7.5 billion. It offers all of the distributed version control and source code management (SCM) functionality of Git as well as adding its own features. It provides access control and several collaboration features such as bug tracking, feature requests, task management, and wikis for every project.

GitHub offers plans for free, professional, and enterprise accounts. Free GitHub accounts are commonly used to host open source projects. As of January 2019, GitHub offers unlimited private repositories to all plans, including free accounts. As of May 2019, GitHub reports having over 37 million users and more than 100 million repositories (including at least 28 million public repositories), making it the largest host of source code in the world.

Making a new Git folder:

Setting up local repository:

Setting up new folder for git project:

```
ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops
$ cat >> testfile
this is riya


ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops
$ cat testfile
this is riya

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops
$ git init
Initialized empty Git repository in C:/riya/SEM 5/DevOps/git/devops/.git/

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (master)
$
```

Adding files to git and committing:

```
ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (master)
$ cat file2
this is line 1

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (master)
$ git status
On branch master

No commits yet

Untracked files:
  (use "git add <file>..." to include in what will be committed)
        file2
        testfile

nothing added to commit but untracked files present (use "git add" to track)

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (master)
$ git add .
warning: LF will be replaced by CRLF in file2.
The file will have its original line endings in your working directory
warning: LF will be replaced by CRLF in testfile.
The file will have its original line endings in your working directory

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (master)
$ git status
On branch master

No commits yet

Changes to be committed:
  (use "git rm --cached <file>..." to unstage)
        new file:   file2
        new file:   testfile


ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (master)
$ git commit -m "first commit"
[master (root-commit) 9543445] first commit
 2 files changed, 2 insertions(+)
 create mode 100644 file2
 create mode 100644 testfile

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (master)
$
```

Committing changes and Detecting changed files:

```
ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (master)
$ cat > testfile
this is line2

[2]+  Stopped                 cat > testfile

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (master)
$ git commit -m "second commit" testfile
warning: LF will be replaced by CRLF in testfile.
The file will have its original line endings in your working directory
warning: LF will be replaced by CRLF in testfile.
The file will have its original line endings in your working directory
[master d3462eb] second commit
 1 file changed, 1 insertion(+), 1 deletion(-)

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (master)
$ git log
commit d3462ebb7ed66277196b3d4a0f024e2de7ee0ebd (HEAD -> master)
Author: riya <riya@riya.com>
Date:   Mon Aug 9 20:17:45 2021 +0530

    second commit

commit 95434454f61ec6f0d5126607a1f0a9d441b8c2e7
Author: riya <riya@riya.com>
Date:   Mon Aug 9 20:12:59 2021 +0530

    first commit

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (master)
$
```

Adding remote repository:

```
ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (master)
$ git remote add origin https://github.com/riyasingh1803/devops.git

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (master)
$ git branch -M main

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (ma
in)
$ git remote show origin
* remote origin
  Fetch URL: https://github.com/riyasingh1803/devops.git
  Push  URL: https://github.com/riyasingh1803/devops.git
  HEAD branch: (unknown)

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (ma
in)
$ git push -u origin main
Enumerating objects: 7, done.
Counting objects: 100% (7/7), done.
Delta compression using up to 4 threads
Compressing objects: 100% (4/4), done.
Writing objects: 100% (7/7), 500 bytes | 250.00 KiB/s, done.
Total 7 (delta 0), reused 0 (delta 0), pack-reused 0
To https://github.com/riyasingh1803/devops.git
 * [new branch]      main -> main
Branch 'main' set up to track remote branch 'main' from 'origin'.

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (ma
in)
$
```

2 lines (2 sloc) | 30 Bytes Raw Blame

```
1  this is line2
2  riya singh here
```

Pulling changes from remote repository:

```
ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (ma
in)
$ git pull https://github.com/riyasingh1803/devops.git
remote: Enumerating objects: 5, done.
remote: Counting objects: 100% (5/5), done.
remote: Compressing objects: 100% (2/2), done.
remote: Total 3 (delta 0), reused 0 (delta 0), pack-reused 0
Unpacking objects: 100% (3/3), 676 bytes | 6.00 KiB/s, done.
From https://github.com/riyasingh1803/devops
 * branch            HEAD       -> FETCH_HEAD
Updating d3462eb..c43fcb6
Fast-forward
 testfile | 1 +
 1 file changed, 1 insertion(+)
```

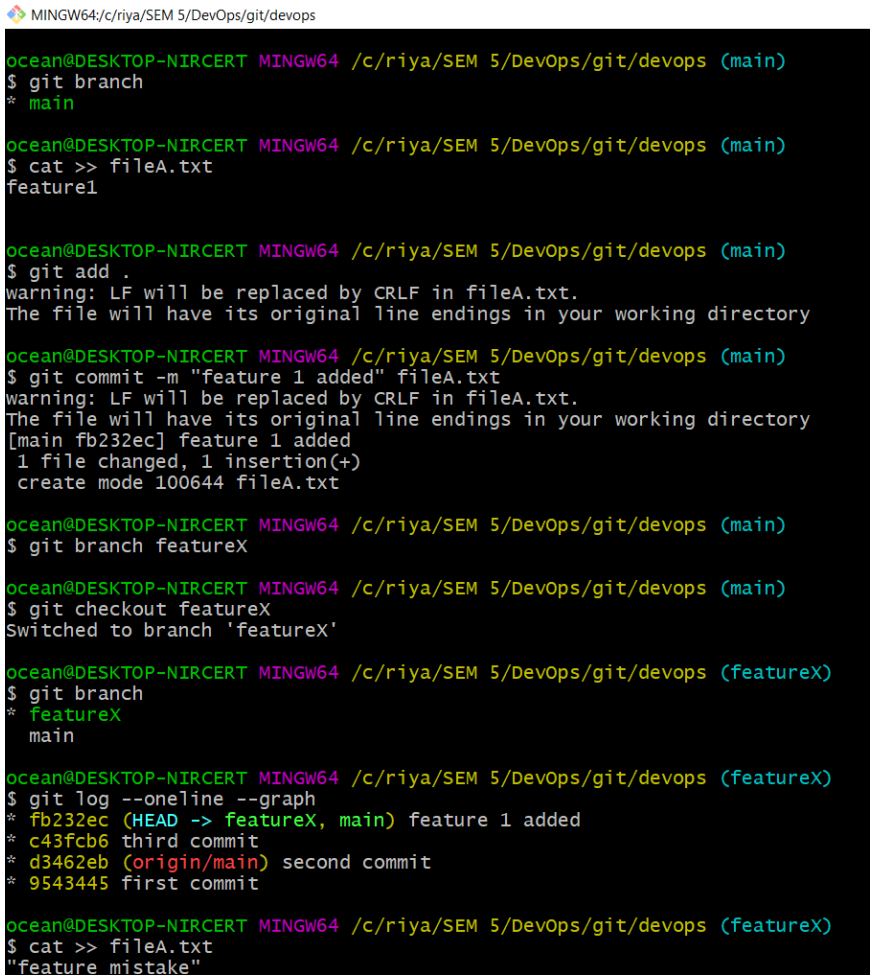
Reading Log of commits:

```
ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (ma
in)
$ git log
commit c43fcb697cd4505da776b3d337a364c81cb0bc5f (HEAD -> main)
Author: riyasingh1803 <83019966+riyasingh1803@users.noreply.githu
b.com>
Date:   Mon Aug 9 20:23:36 2021 +0530

    third commit

commit d3462ebb7ed66277196b3d4a0f024e2de7ee0ebd (origin/main)
Author: riya <riya@riya.com>
Date:   Mon Aug 9 20:17:45 2021 +0530

    second commit

commit 95434454f61ec6f0d5126607a1f0a9d441b8c2e7
Author: riya <riya@riya.com>
Date:   Mon Aug 9 20:12:59 2021 +0530

    first commit

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (ma
in)
$
```

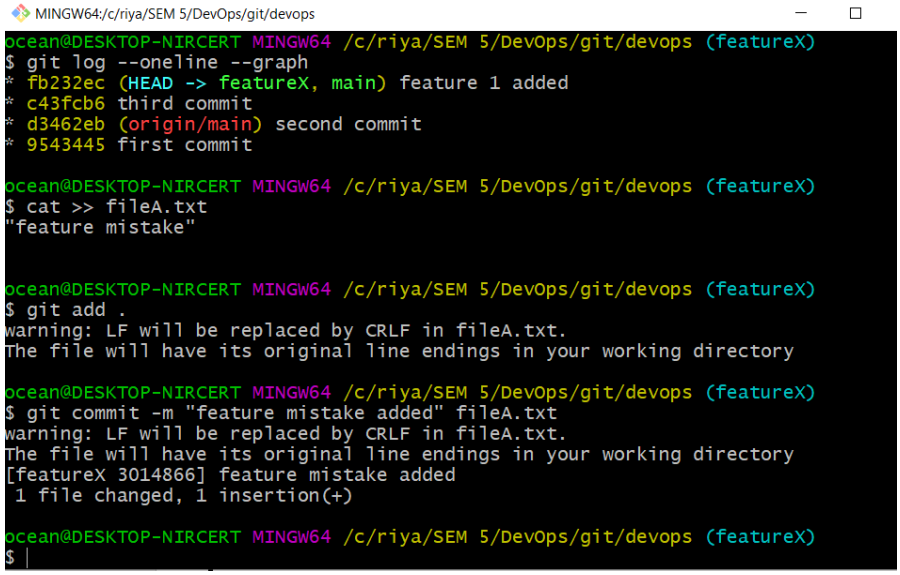
Trying fetch:

```
ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (ma
in)
$ git fetch https://github.com/riyasingh1803/devops.git
remote: Enumerating objects: 5, done.
remote: Counting objects: 100% (5/5), done.
remote: Compressing objects: 100% (2/2), done.
remote: Total 3 (delta 0), reused 0 (delta 0), pack-reused 0
Unpacking objects: 100% (3/3), 664 bytes | 5.00 KiB/s, done.
From https://github.com/riyasingh1803/devops
 * branch            HEAD       -> FETCH_HEAD

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (ma
in)
$ git log
commit c43fcb697cd4505da776b3d337a364c81cb0bc5f (HEAD -> main)
Author: riyasingh1803 <83019966+riyasingh1803@users.noreply.github.com>
Date:   Mon Aug 9 20:23:36 2021 +0530

    third commit

commit d3462ebb7ed66277196b3d4a0f024e2de7ee0ebd (origin/main)
Author: riya <riya@riya.com>
Date:   Mon Aug 9 20:17:45 2021 +0530

    second commit

commit 95434454f61ec6f0d5126607a1f0a9d441b8c2e7
Author: riya <riya@riya.com>
Date:   Mon Aug 9 20:12:59 2021 +0530

    first commit

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (main)
$
```

Git branch create and checkout a branch:



Git commit on feature branch:



Checkout old commit:

```
ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devop
s (featureX)
$ cat fileA.txt
feature1
"feature mistake"

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devop
s (featureX)
$ git checkout main
Switched to branch 'main'
Your branch is ahead of 'origin/main' by 2 commits.
  (use "git push" to publish your local commits)

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (main)
$ cat file fileA.txt
cat: file: No such file or directory
feature1

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (main)
$ cat fileA.txt
feature1

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (main)
$
```

Merge with merge commit:

MINGW64:/c/riya/SEM 5/DevOps/git/devops

```
ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (main)
$ git checkout -b 'featureZ'
Switched to a new branch 'featureZ'

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (featureZ)
$ cat fileA.txt
feature1
"feature mistake"

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (featureZ)
$ cat >> fileA.txt
this is feature Z


ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (featureZ)
$ git commit -m "add feature Z" fileA.txt
warning: LF will be replaced by CRLF in fileA.txt.
The file will have its original line endings in your working directory
warning: LF will be replaced by CRLF in fileA.txt.
The file will have its original line endings in your working directory
[featureZ fda96f1] add feature Z
 1 file changed, 1 insertion(+)

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (featureZ)
$ git checkout main
Switched to branch 'main'
Your branch is ahead of 'origin/main' by 3 commits.
  (use "git push" to publish your local commits)

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (main)
$ git merge --no-ff featureZ
hint: Waiting for your editor to close the file...       0 [sig] bash 1817! si
gpacket::process: Suppressing signal 18 to win32 process (pid 4892)
 718535 [sig] bash 1817! sigpacket::process: Suppressing signal 18 to win32 pr
ocess (pid 4892)
128178939 [sig] bash 1817! sigpacket::process: Suppressing signal 18 to win32
process (pid 4892)
128892627 [sig] bash 1817! sigpacket::process: Suppressing signal 18 to win32
process (pid 4892)
129415297 [sig] bash 1817! sigpacket::process: Suppressing signal 18 to win32
process (pid 4892)
129798942 [sig] bash 1817! sigpacket::process: Suppressing signal 18 to win32
process (pid 4892)
130068800 [sig] bash 1817! sigpacket::process: Suppressing signal 18 to win32
process (pid 4892)
130231930 [sig] bash 1817! sigpacket::process: Suppressing signal 18 to win32
process (pid 4892)
131382524 [sig] bash 1817! sigpacket::process: Suppressing signal 18 to win32
process (pid 4892)
Merge made by the 'recursive' strategy.
 fileA.txt | 1 +
 1 file changed, 1 insertion(+)

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (main)
$ cat fileA.txt
feature1
"feature mistake"
this is feature Z
```

```
ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (main)
$ git log --oneline --graph
*   e7f2452 (HEAD -> main) Merge branch 'featureZ'
|\
| * fda96f1 (featureZ) add feature Z
|/
* 3014866 (featureX) feature mistake added
* fb232ec feature 1 added
* c43fcb6 third commit
* d3462eb (origin/main) second commit
* 9543445 first commit

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (main)
$
```

Merge with merge conflict:

MINGW64:/c/riya/SEM 5/DevOps/git/devops

```
ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (main)
$ cat >> myfile
feature1


ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (main)
$ git add .
warning: LF will be replaced by CRLF in myfile.
The file will have its original line endings in your working directory

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (main)
$ git commit -m "add feature1" myfile
warning: LF will be replaced by CRLF in myfile.
The file will have its original line endings in your working directory
[main 47df593] add feature1
 1 file changed, 1 insertion(+)
 create mode 100644 myfile

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (main)
$ git checkout -b feature2
Switched to a new branch 'feature2'

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (feature2)
$ cat >> myfile
feature2


ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (feature2)
$ git add .
warning: LF will be replaced by CRLF in myfile.
The file will have its original line endings in your working directory

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (feature2)
$ git commit -m "add feature2" myfile
warning: LF will be replaced by CRLF in myfile.
The file will have its original line endings in your working directory
[feature2 e071959] add feature2
 1 file changed, 1 insertion(+)

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (feature2)
$ git checkout main
Switched to branch 'main'
Your branch is ahead of 'origin/main' by 6 commits.
  (use "git push" to publish your local commits)

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (main)
$ cat myfile
```

```
ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (main)
$ cat myfile
feature1

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (main)
$ cat >> myfile
feature3


ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (main)
$ git add .
warning: LF will be replaced by CRLF in myfile.
The file will have its original line endings in your working directory

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (main)
$ git commit -m "add feature3" myfile
warning: LF will be replaced by CRLF in myfile.
The file will have its original line endings in your working directory
[main 18ed667] add feature3
 1 file changed, 1 insertion(+)

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (main)
$ cat myfile
feature1
feature3

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (main)
$ git merge feature2
Auto-merging myfile
CONFLICT (content): Merge conflict in myfile
Automatic merge failed; fix conflicts and then commit the result.

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (main|MERGING)
$ cat myfile
feature1
<<<<<<< HEAD
feature3
=======
feature2
>>>>>>> feature2
```

*myfile - Notepad

ile Edit Format View Help

```
eature1
<<<<<< HEAD
eature3
======
eature2
>>>>>> feature2
```

Solving merge conflict:

```
ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (main|MERGING)
$ git add .

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (main|MERGING)
$ git merge feature2
fatal: You have not concluded your merge (MERGE_HEAD exists).
Please, commit your changes before you merge.

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (main|MERGING)
$ git commit -m "resolved conflict"
[main 0f166a9] resolved conflict

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (main)
$ git merge feature2
Already up to date.

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (main)
$ cat myfile
feature1

feature3

feature2

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (main)
$ git log --oneline --graph
*   0f166a9 (HEAD -> main) resolved conflict
|\
| * e071959 (feature2) add feature2
* | 18ed667 add feature3
|/
* 47df593 add feature1
*   e7f2452 Merge branch 'featureZ'
|\
| * fda96f1 (featureZ) add feature Z
|/
* 3014866 (featureX) feature mistake added
* fb232ec feature 1 added
* c43fcb6 third commit
* d3462eb (origin/main) second commit
* 9543445 first commit
```

Conclusion:

Hence, we have performed various GIT operations on local and remote repositories using GIT CheatSheet successfully.

POSTLAB:

REBASING:

MINGW64:/c/riya/SEM 5/DevOps/git/devops

```
ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (main)
$ touch newfile

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (main)
$ git add .

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (main)
$ git commit -m "add newfile" newfile
[main a57021e] add newfile
 1 file changed, 0 insertions(+), 0 deletions(-)
 create mode 100644 newfile

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (main)
$ git checkout -b feature1
Switched to a new branch 'feature1'

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (feature1)
$ cat >> newfile
feature 1 added


ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (feature1)
$ git commit -m "add feature 1" newfile
warning: LF will be replaced by CRLF in newfile.
The file will have its original line endings in your working directory
warning: LF will be replaced by CRLF in newfile.
The file will have its original line endings in your working directory
[feature1 7686c43] add feature 1
 1 file changed, 1 insertion(+)

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (feature1)
$ git checkout main
Switched to branch 'main'
Your branch is ahead of 'origin/main' by 10 commits.
  (use "git push" to publish your local commits)

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (main)
$ touch newfile2

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (main)
$ git add .

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (main)
$ git commit -m "add newfile2" newfile2
[main ef1bedf] add newfile2
 1 file changed, 0 insertions(+), 0 deletions(-)
 create mode 100644 newfile2
```

MINGW64:/c/riya/SEM 5/DevOps/git/devops

```
ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (main)
$ git checkout feature1
Switched to branch 'feature1'

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (feature1)
$ git rebase main
Successfully rebased and updated refs/heads/feature1.

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (feature1)
$ git log --oneline --graph --all
* da25acd (HEAD -> feature1) add feature 1
* ef1bedf (main) add newfile2
* a57021e add newfile
*   0f166a9 resolved conflict
|\
| * e071959 (feature2) add feature2
* | 18ed667 add feature3
|/
* 47df593 add feature1
*   e7f2452 Merge branch 'featureZ'
|\
| * fda96f1 (featureZ) add feature Z
|/
* 3014866 (featureX) feature mistake added
* fb232ec feature 1 added
* c43fcb6 third commit
* d3462eb (origin/main) second commit
* 9543445 first commit

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (feature1)
$ git checkout main
Switched to branch 'main'
Your branch is ahead of 'origin/main' by 11 commits.
  (use "git push" to publish your local commits)

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (main)
$ cat >> newfile
feature2


ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (main)
$ git add .
warning: LF will be replaced by CRLF in newfile.
The file will have its original line endings in your working directory

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (main)
$ git commit -m "add feature2" newfile
warning: LF will be replaced by CRLF in newfile.
The file will have its original line endings in your working directory
```

```
[main 14c4feb] add feature2
 1 file changed, 1 insertion(+)

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (main)
$ git checkout feature1
Switched to branch 'feature1'

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (feature1)
$ git rebase main
error: could not apply da25acd... add feature 1
Resolve all conflicts manually, mark them as resolved with
"git add/rm <conflicted_files>", then run "git rebase --continue".
You can instead skip this commit: run "git rebase --skip".
To abort and get back to the state before "git rebase", run "git rebase --abort".
Could not apply da25acd... add feature 1
Auto-merging newfile
CONFLICT (content): Merge conflict in newfile

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (feature1|REBASE 1/1)
$ git status
interactive rebase in progress; onto 14c4feb
Last command done (1 command done):
   pick da25acd add feature 1
No commands remaining.
You are currently rebasing branch 'feature1' on '14c4feb'.
  (fix conflicts and then run "git rebase --continue")
  (use "git rebase --skip" to skip this patch)
  (use "git rebase --abort" to check out the original branch)

Unmerged paths:
  (use "git restore --staged <file>..." to unstage)
  (use "git add <file>..." to mark resolution)
        both modified:   newfile

no changes added to commit (use "git add" and/or "git commit -a")

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (feature1|REBASE 1/1)
$ cat newfile
<<<<<<< HEAD
feature2
=======
feature 1 added
>>>>>>> da25acd (add feature 1)
```

Solving merge conflict and rebasing:

```
ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (feature1|REBASE 1/1)
$ git add .

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (feature1|REBASE 1/1)
$ git rebase --continue
[detached HEAD 0857830] add feature 1
 1 file changed, 3 insertions(+)
Successfully rebased and updated refs/heads/feature1.

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (feature1)
$ git log --oneline --graph --all
* 0857830 (HEAD -> feature1) add feature 1
* 14c4feb (main) add feature2
* ef1bedf add newfile2
* a57021e add newfile
*   0f166a9 resolved conflict
|\
| * e071959 (feature2) add feature2
* | 18ed667 add feature3
|/
* 47df593 add feature1
*   e7f2452 Merge branch 'featureZ'
|\
| * fda96f1 (featureZ) add feature Z
|/
* 3014866 (featureX) feature mistake added
* fb232ec feature 1 added
* c43fcb6 third commit
* d3462eb (origin/main) second commit
* 9543445 first commit

ocean@DESKTOP-NIRCERT MINGW64 /c/riya/SEM 5/DevOps/git/devops (feature1)
$ git rebase --continue
fatal: No rebase in progress?
```

EXPERIMENT-3

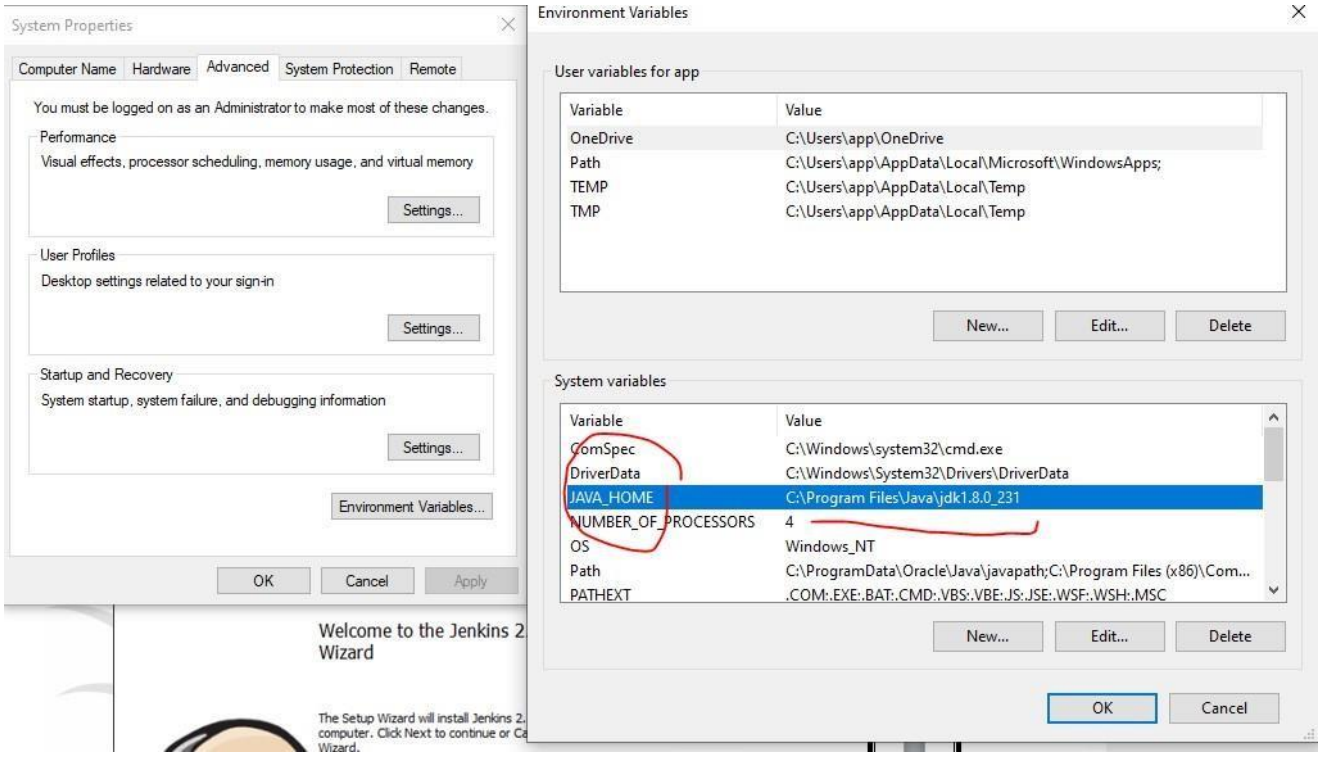
Aim: a) Installation of Jenkins with Maven/Ant/Gradle, GitHub and Python Plugins to setup a build Job.

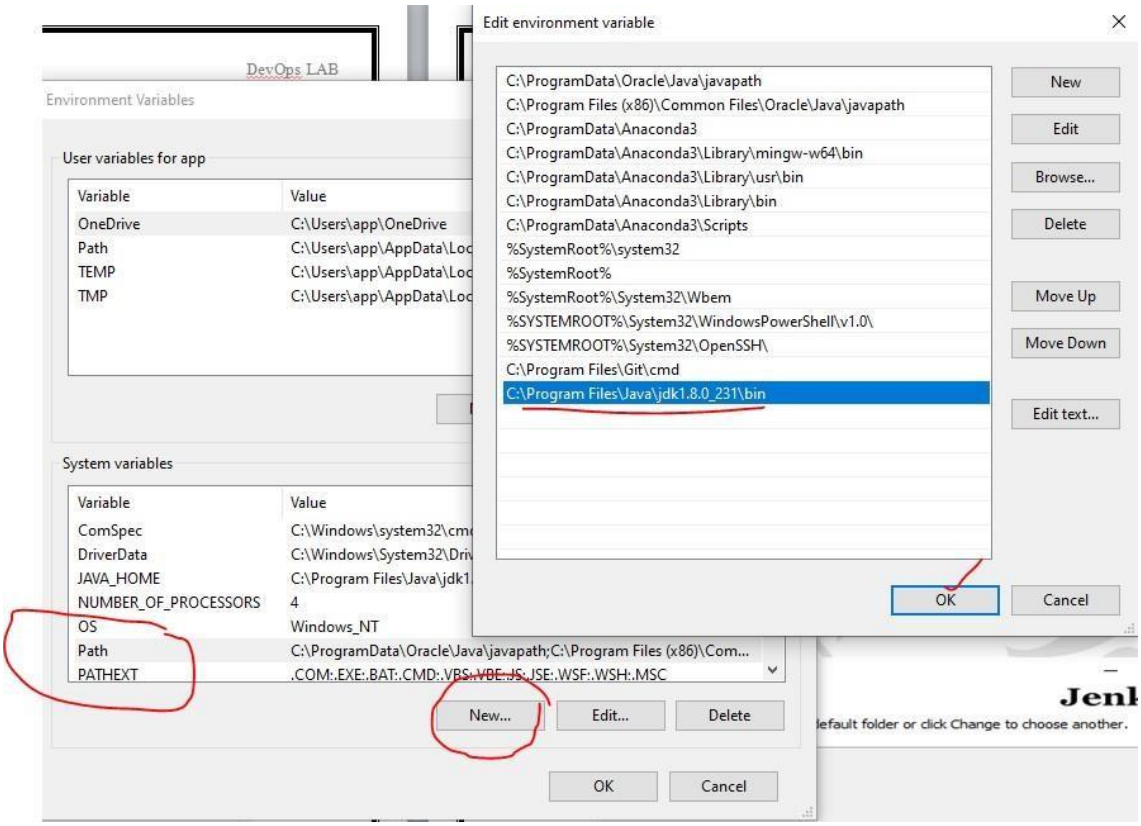
Theory: Jenkins is a free and open-source automation server. It helps automate the parts of software development related to building, testing, and deploying, facilitating continuous integration and continuous delivery. It is a server-based system that runs in servlet containers such as Apache Tomca

Installation process of Jenkins

Install Java: Jdk 1.8 or Java 11.

Set environment variable : path and JAVA_HOME





Step 1) Got to https://www.jenkins.io/download/ and select the platform. In our case Windows

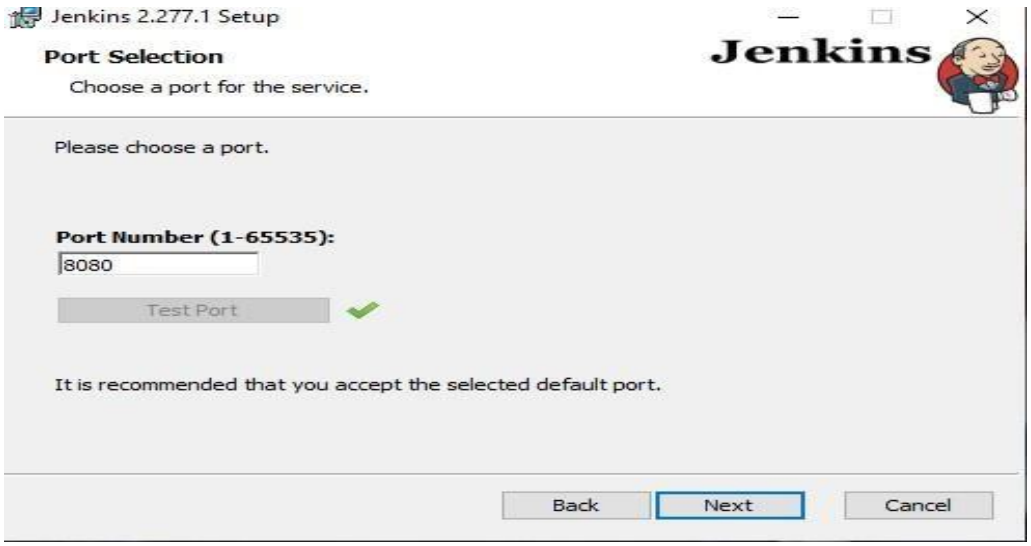
Step 2) Go to download location from local computer and unzip the downloaded package. Doubleclick on unzipped jenkins.msi. You can also Jenkin using a WAR (Web application ARchive) but that is not recommended.

Step 3) In the Jenkin Setup screen, click Next.

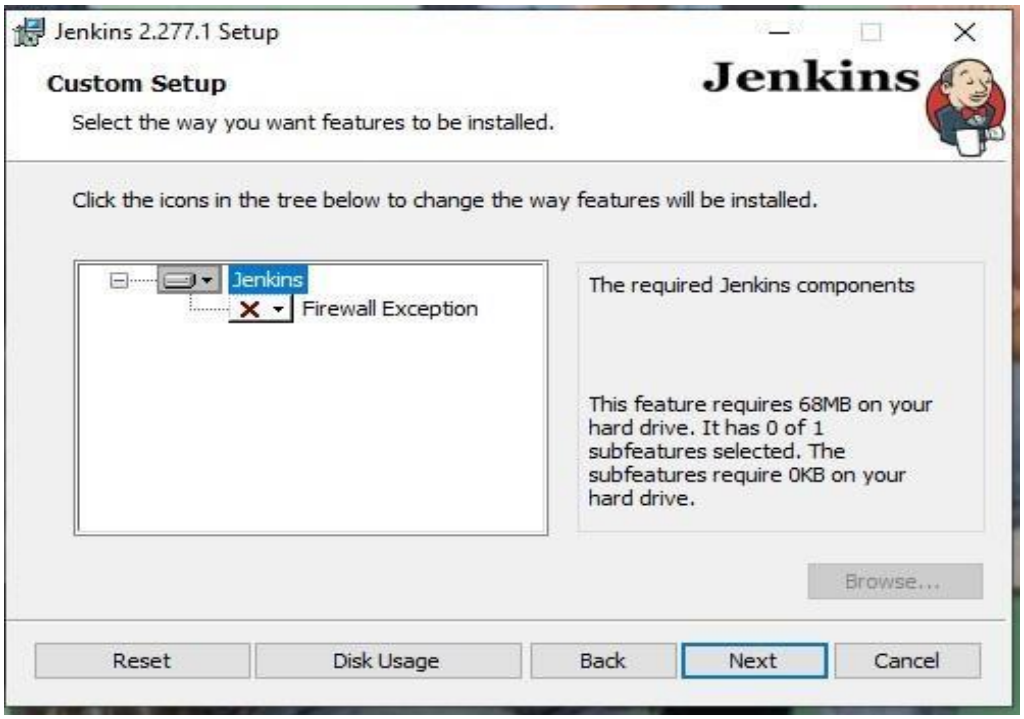
Step 4) Choose the location where you want to have the Jenkins instance installed (default location is C:\Program Files (x86)\Jenkins), then click on Next button.

Here, Select Logon type as ‘ Run service as LocalSystem(Windows equivalent root)

Step 5)Click on the Install button.


Jenkins 2.277.1 Setup
Port Selection
Choose a port for the service.
Jenkins
Please choose a port.
Port Number (1-65535):
8080
Test Port
It is recommended that you accept the selected default port.
Back
Next
Cancel


Jenkins 2.277.1 Setup
Jenkins 2.277.1 Setup
Select Java home directory (JDK or JRE)
Jenkins
Please select the path of a Java Development Kit or Java Runtime Environment.
Only Java 1.8 and 11 are supported by Jenkins.
C:\Program Files\Java\jdk-11.0.1\
Change...
Back
Next
Cancel



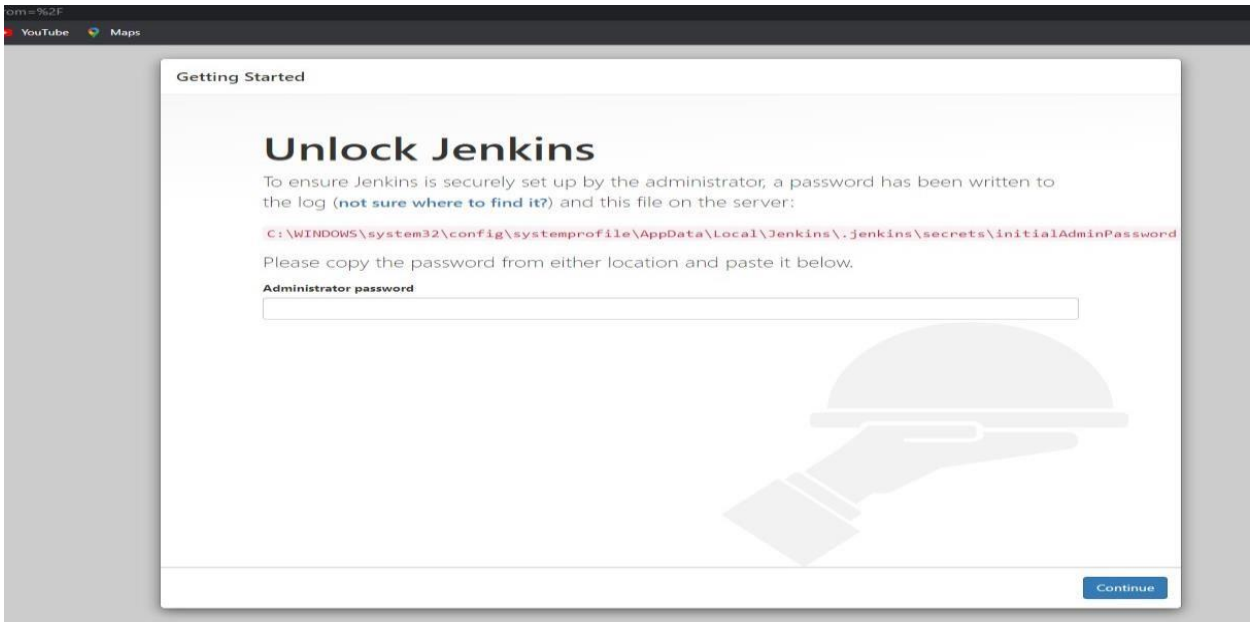
Step 6) Once install is complete, click Finish.

Step 7) During the installation process an info panel may pop-up to inform the user that for a complete setup, the system should be rebooted at the end of the current installation. Click on OK button when the Info panel is popping-up:

How to Unblock Jenkins?

After completing the Jenkins installation phase, you should proceed further and start its configuration. Next steps will guide you how you can unblock Jenkins application:

Step 1) After completing the Jenkins installation process, a browser tab will pop-up asking for the initial Administrator password. To access Jenkins, you need to go to browse the following path in your web browser. http://localhost:8080

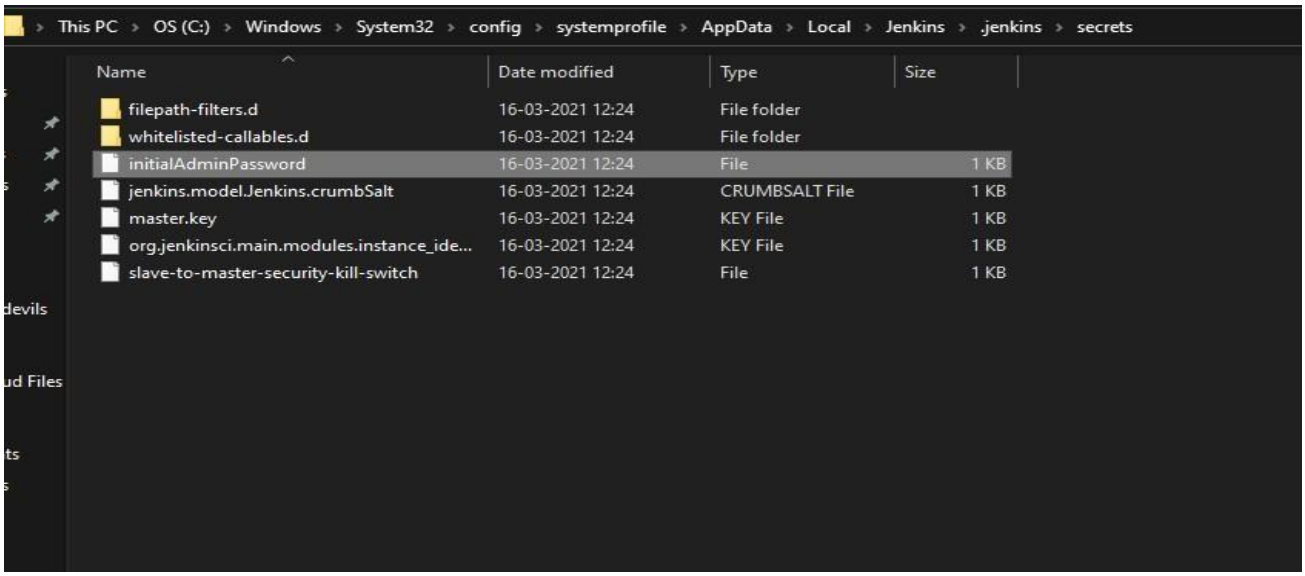


If you can access the above URL, then it confirms that Jenkins is successfully installed in your system.

Step 2) The initial Administrator password should be found under the Jenkins installation path (set at Step 4 in Jenkins Installation).

For default installation location to C:\Program Files (x86)\Jenkins, a file called initialAdminPassword can be found under C:\Program Files (x86)\Jenkins\secrets.

However, If a custom path for Jenkins installation was selected, then you should check that location for initialAdminPassword file.



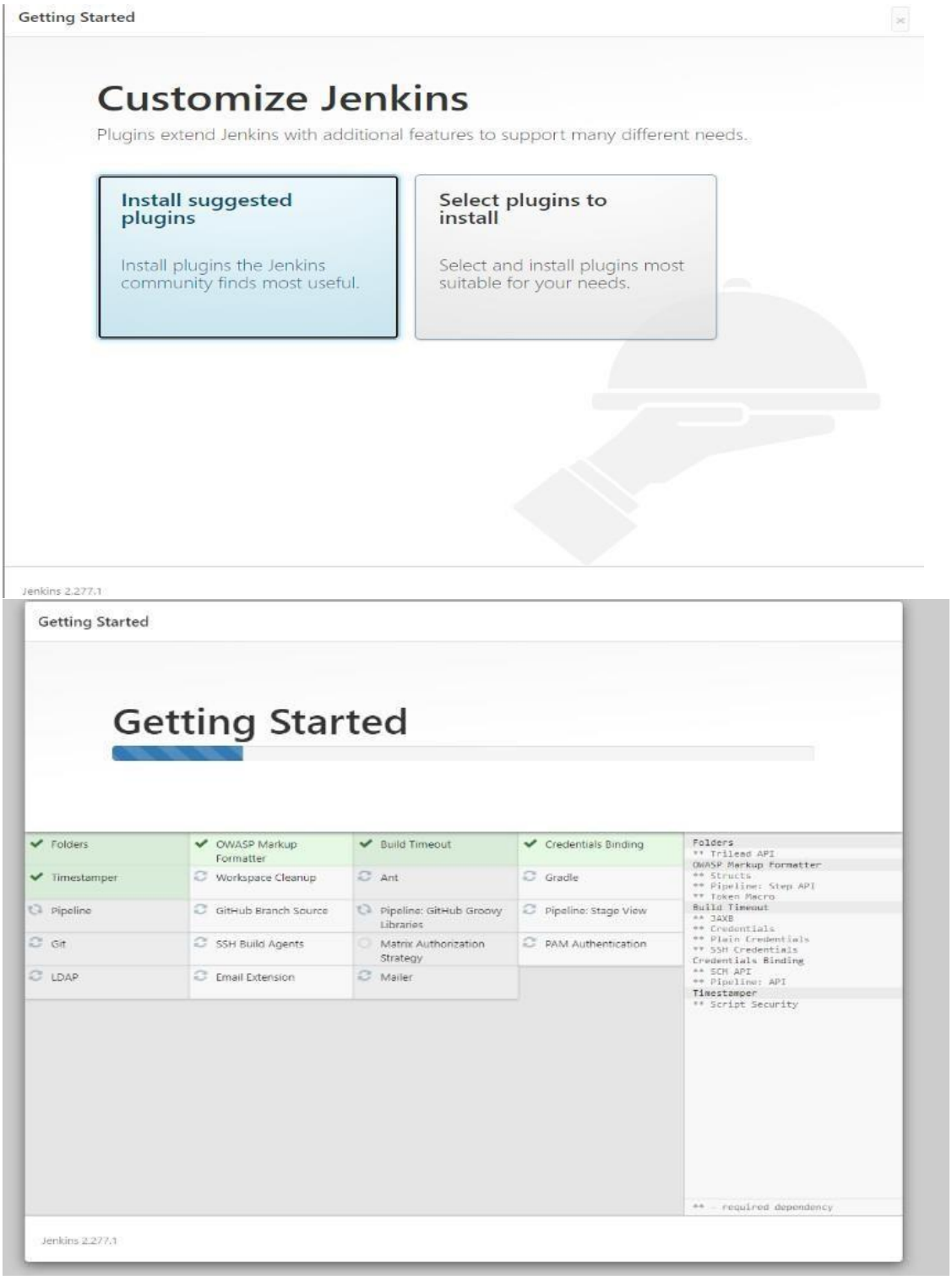
Step 3) Open the highlighted file and copy the content of the initialAdminPassword file.

Step 4) Paste the password it into browser's pop-up tab (http://localhost:8080/login?form=%2F) and click on Continue button.

Customize Jenkins

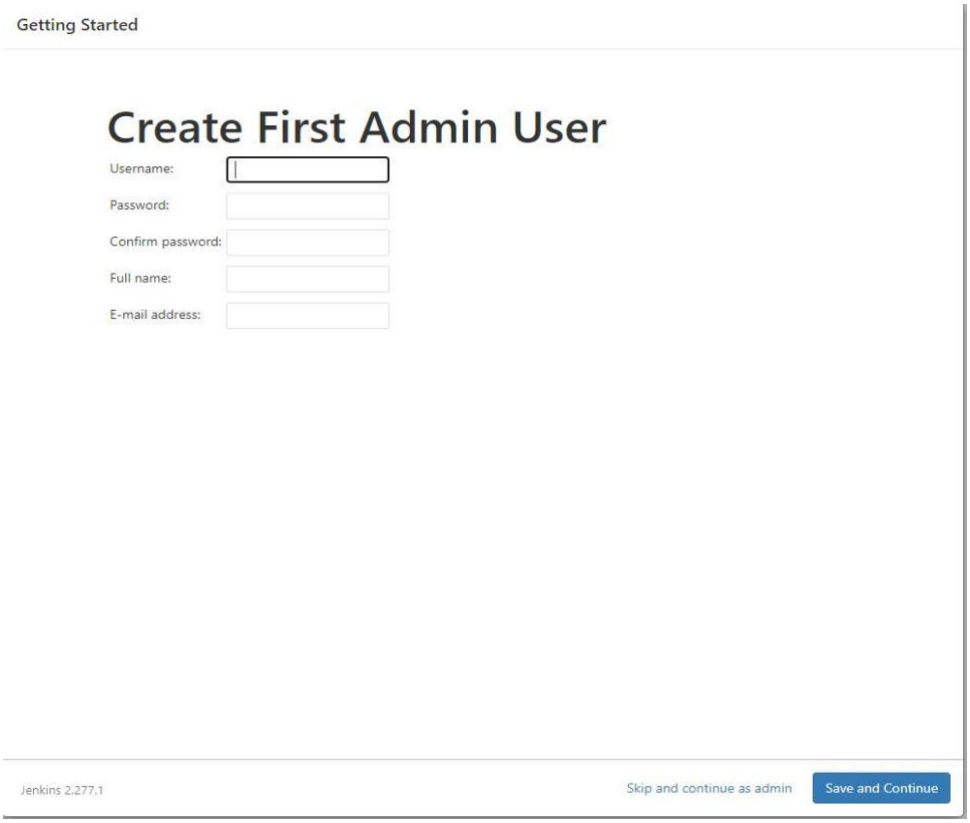
You can also customize your Jenkins environment by below-given steps:

Step 1) Click on the "Install suggested plugins button" so Jenkins will retrieve and install the essential plugins

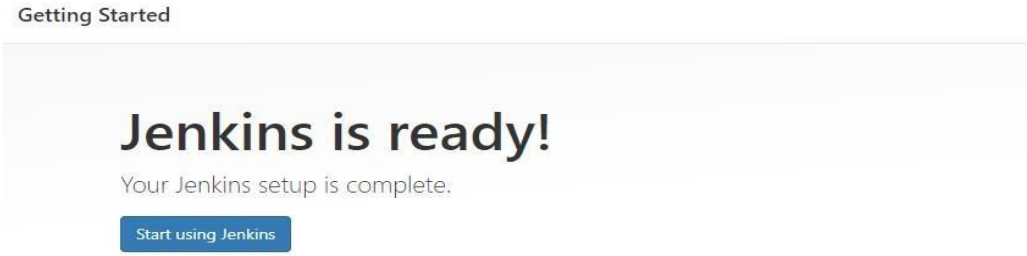


Jenkins will start to download and install all the necessary plugins needed to create new Jenkins Jobs.

Note: You can choose the Option "Select Plugins to Install" and select the plugins you want to install Step 2) After all suggested plugins were installed, the "Create First Admin User" panel will show up. Fill all the fields with desired account details and hit the "Save and Finish" button.

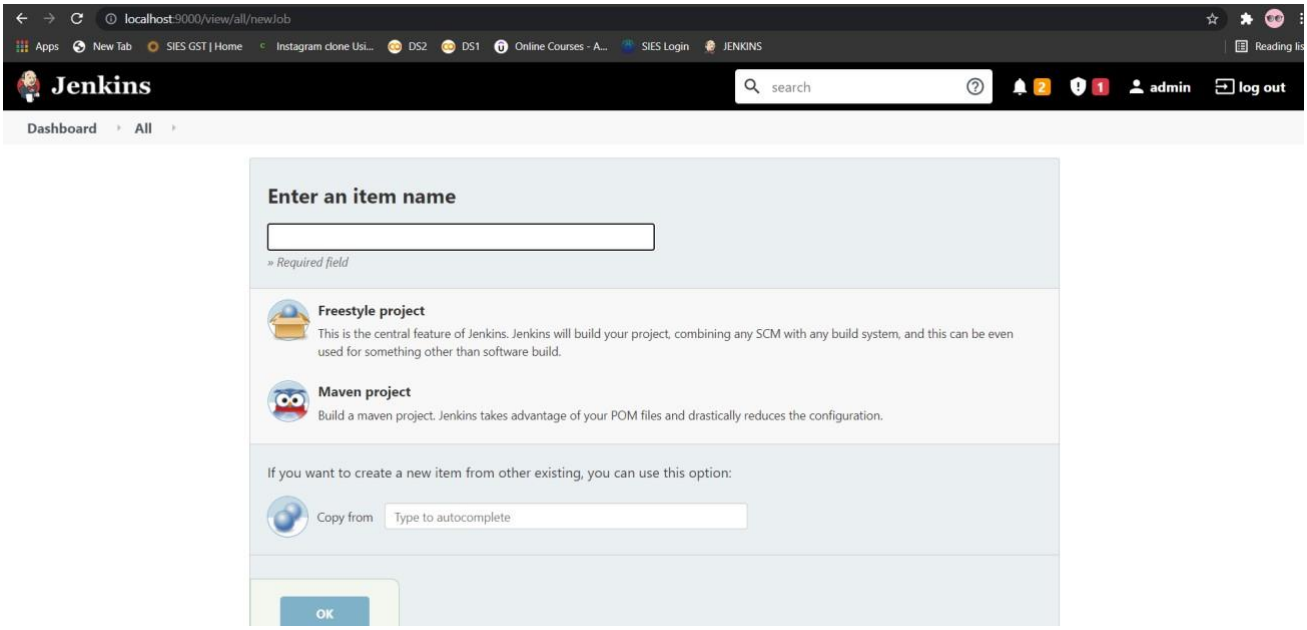


Step 3) Once you have filled the above data, finally it will ask for URL information where you can configure the default instance path for Jenkins. Leave it as it is to avoid any confusion later. However, if another application is already using 8080 port, you can use another port for Jenkins and finally save the settings, and you are done with installation of Jenkins. Hit the "Save and Continue" button:

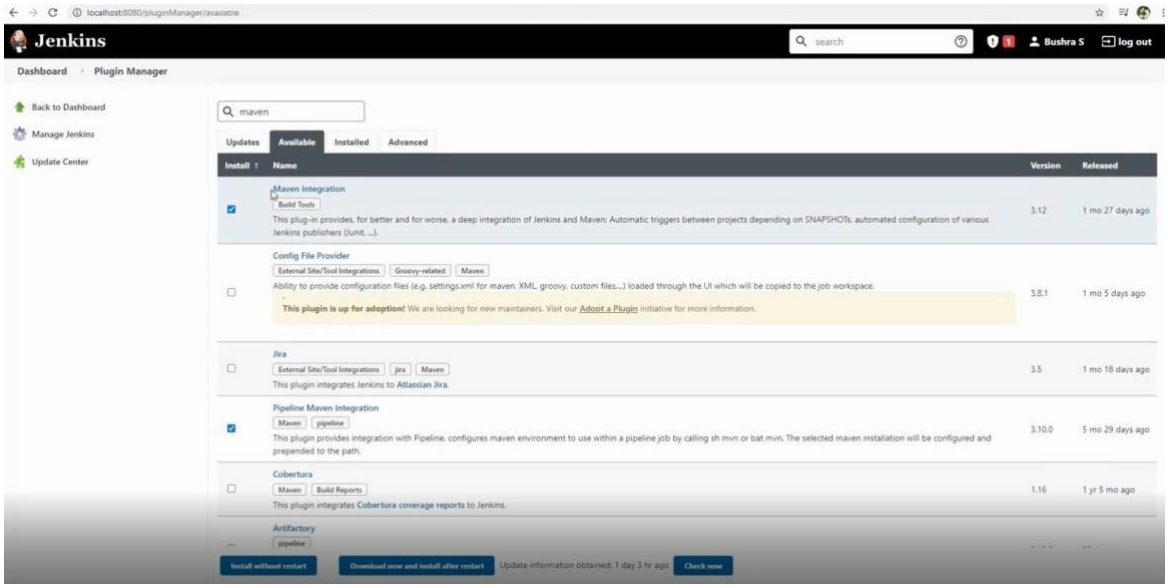


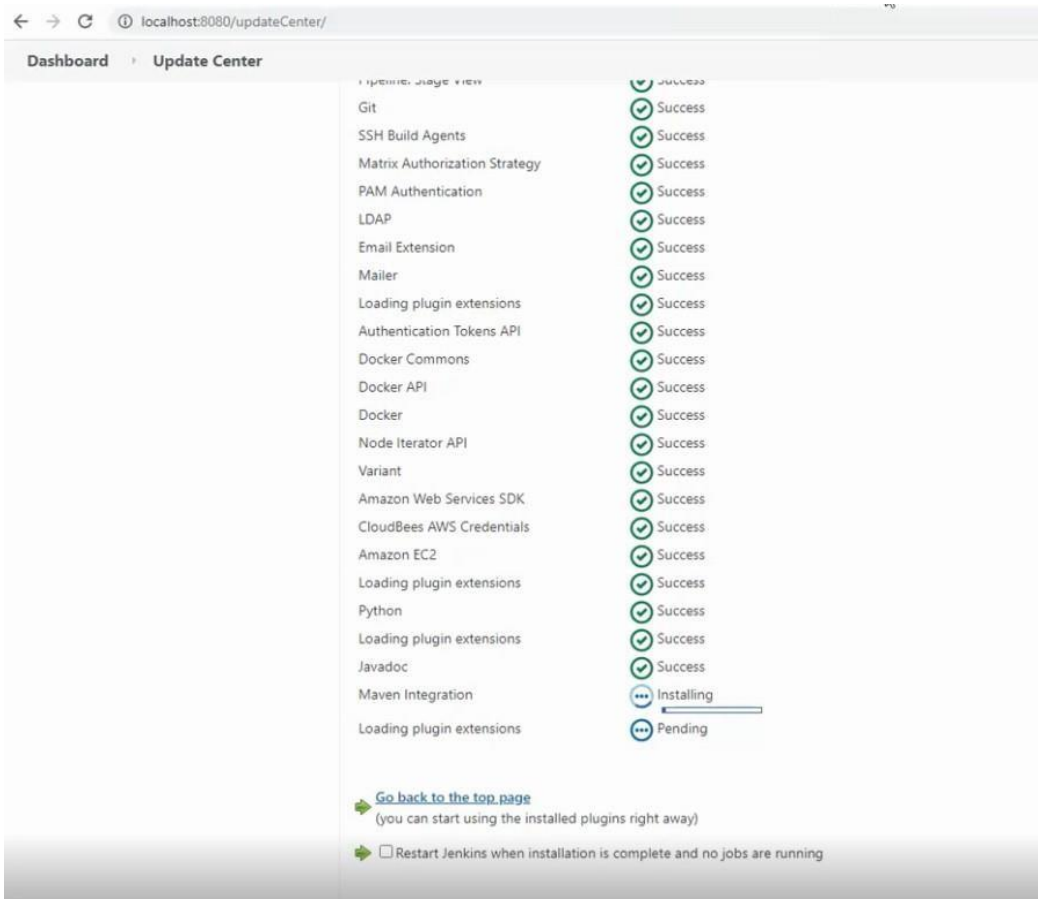
We have successfully installed a new Jenkins Server. Hit the "Start using Jenkins" button.

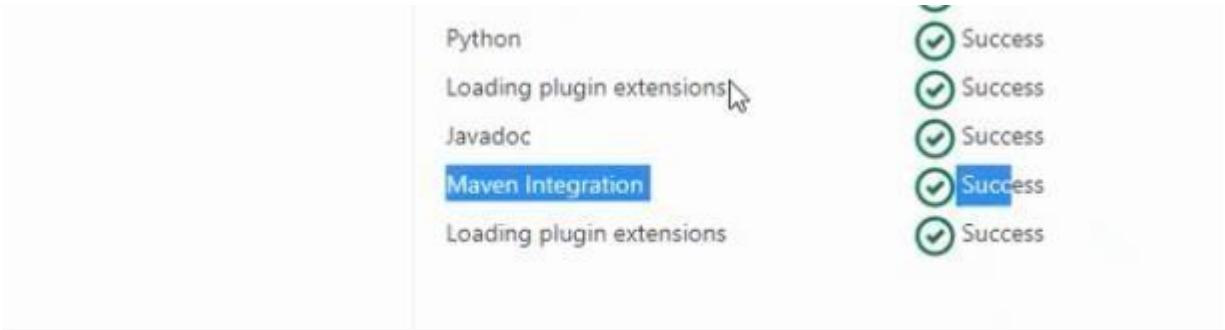
Below you can find the Jenkins instance up and run, ready to create first Jenkins jobs:

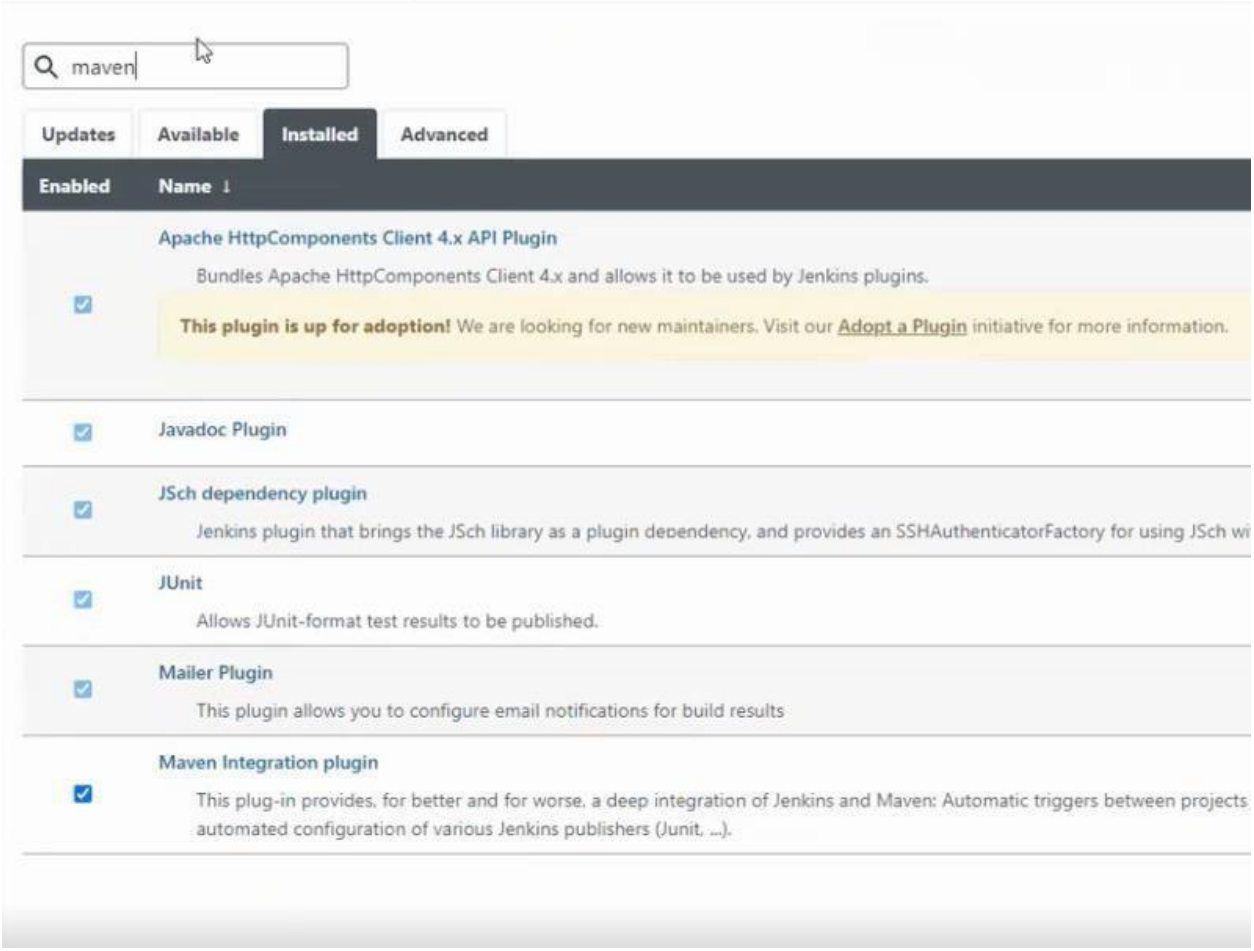


Installation of Maven Integration Plugins:

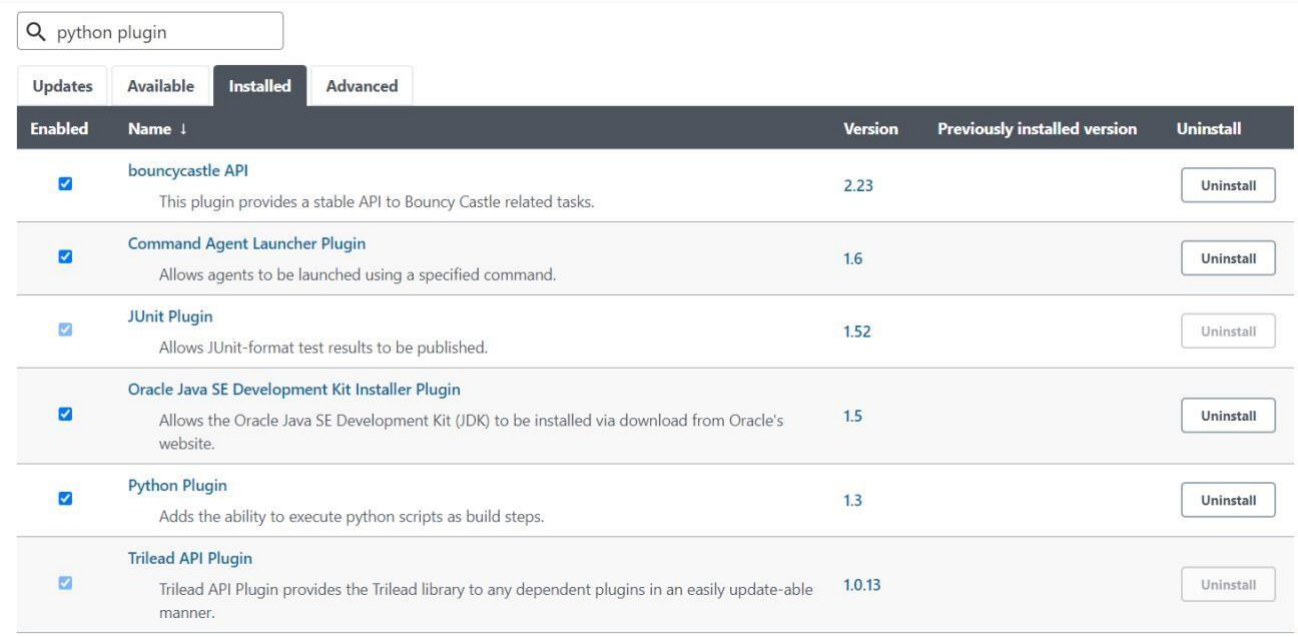




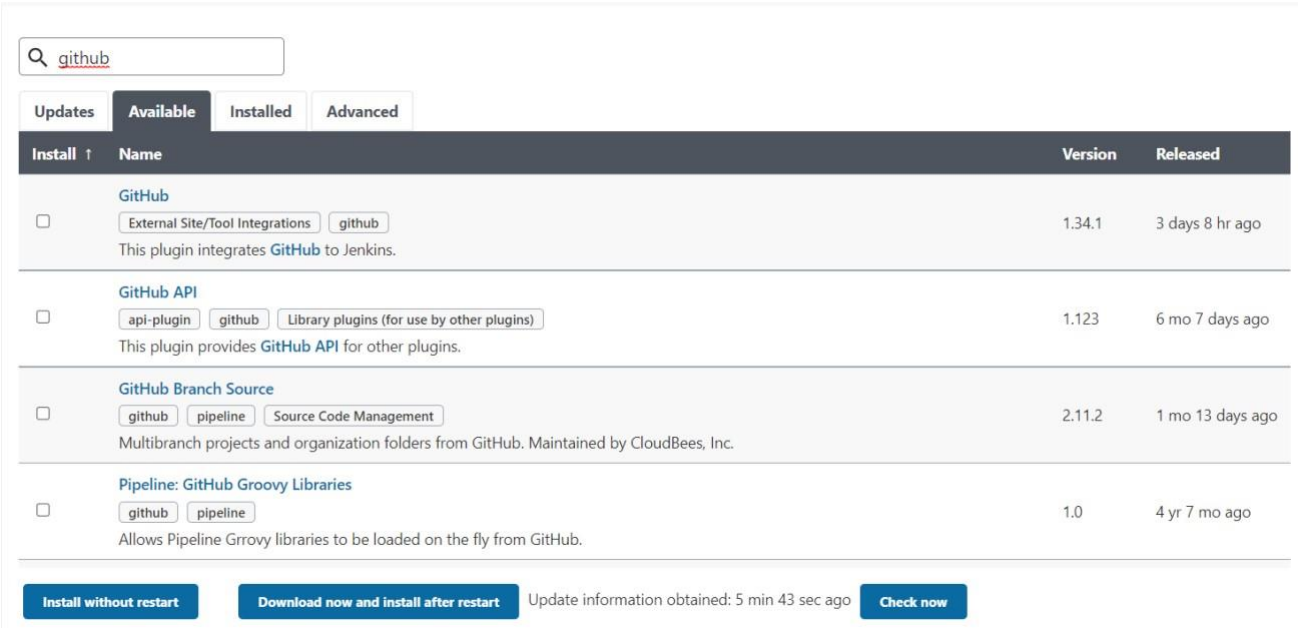

Python
Success
Loading plugin extensions
Success
Javadoc
Success
Maven Integration
Success
Loading plugin extensions
Success

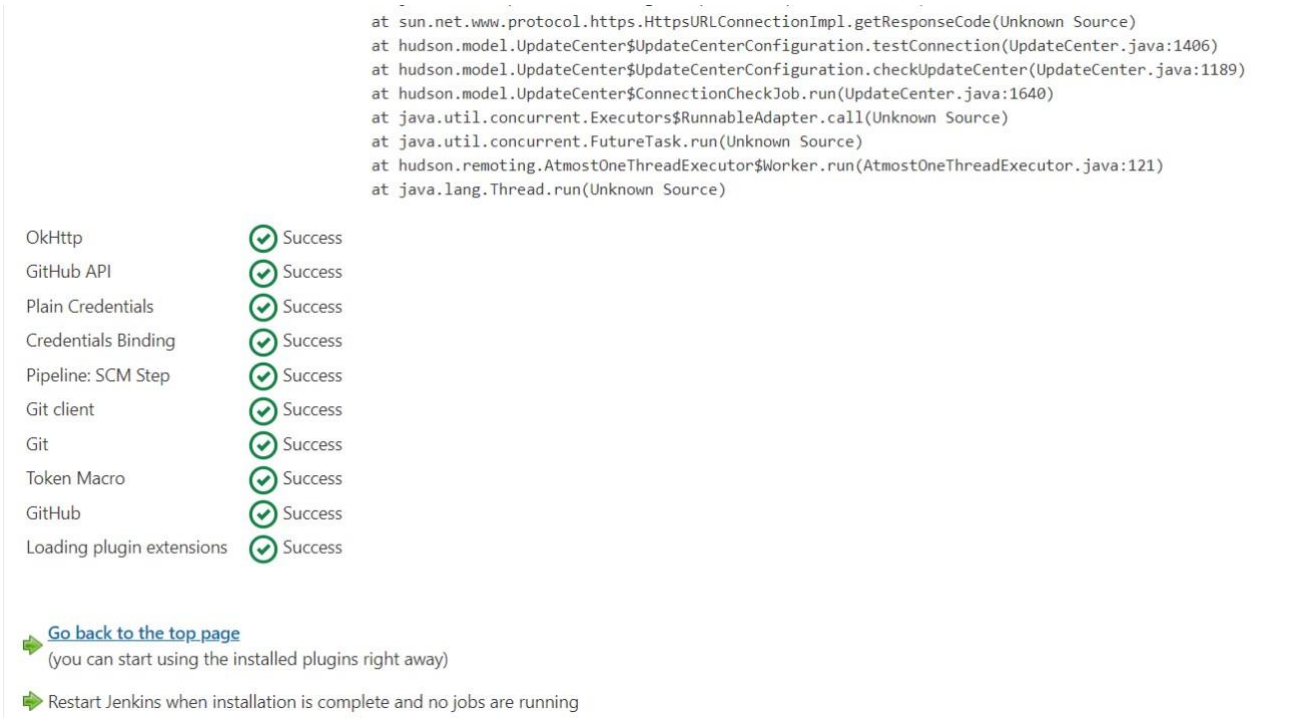

maven
Updates
Available
Installed
Advanced
Enabled
Name ↓
Apache HttpComponents Client 4.x API Plugin
Bundles Apache HttpComponents Client 4.x and allows it to be used by Jenkins plugins.
This plugin is up for adoption! We are looking for new maintainers. Visit our Adopt a Plugin initiative for more information.
Javadoc Plugin
JSch dependency plugin
Jenkins plugin that brings the JSch library as a plugin dependency, and provides an SSHAuthenticatorFactory for using JSch wi
JUnit
Allows JUnit-format test results to be published.
Mailer Plugin
This plugin allows you to configure email notifications for build results
Maven Integration plugin
This plug-in provides, for better and for worse, a deep integration of Jenkins and Maven: Automatic triggers between projects
automated configuration of various Jenkins publishers (Junit, ...).

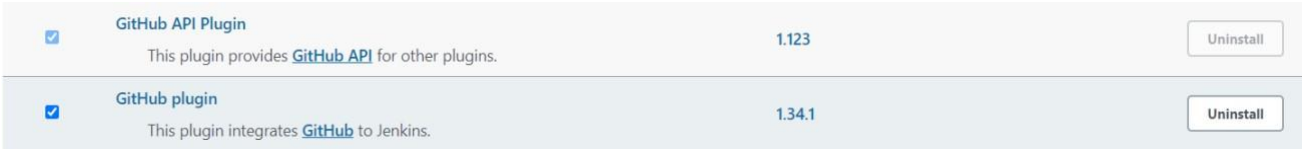
Installation of Python Plugin:



Installation of GitHub Plugin:







Conclusion:

Hence, we have successfully installed Jenkins and configured Jenkins with Maven/Ant/Gradle ,GitHub and Python Plugins to setup a build Job.

Aim: b)

i. To set up and build a Java, Maven /Ant and Python jobs in Jenkins.
ii. To build the pipeline of jobs using Maven / Ant in Jenkins, create a pipeline script to Test and deploy an application over the tomcat server.

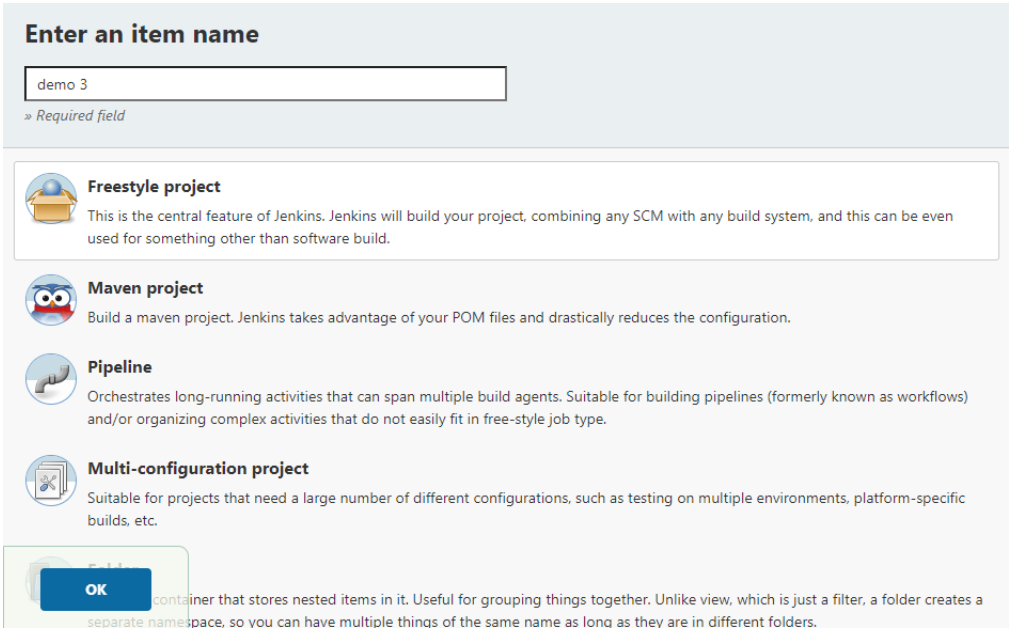
Theory:

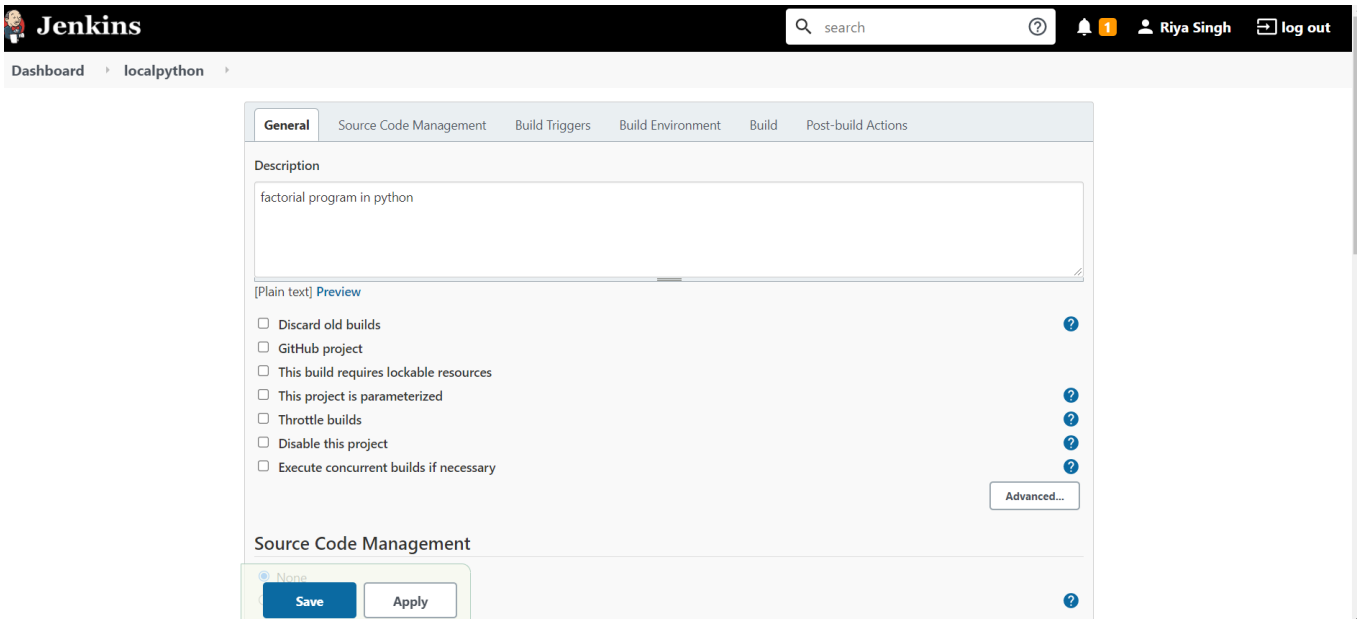
Jenkins is a free and open source automation server. It helps automate the parts of software development related to building, testing, and deploying, facilitating continuous integration and continuous delivery. It is a server-based system that runs in servlet containers such as Apache Tomcat.

A. To set up and build a Java, Maven /Ant and Python jobs in Jenkins.

Steps for Creating and Testing Python job in Jenkins:

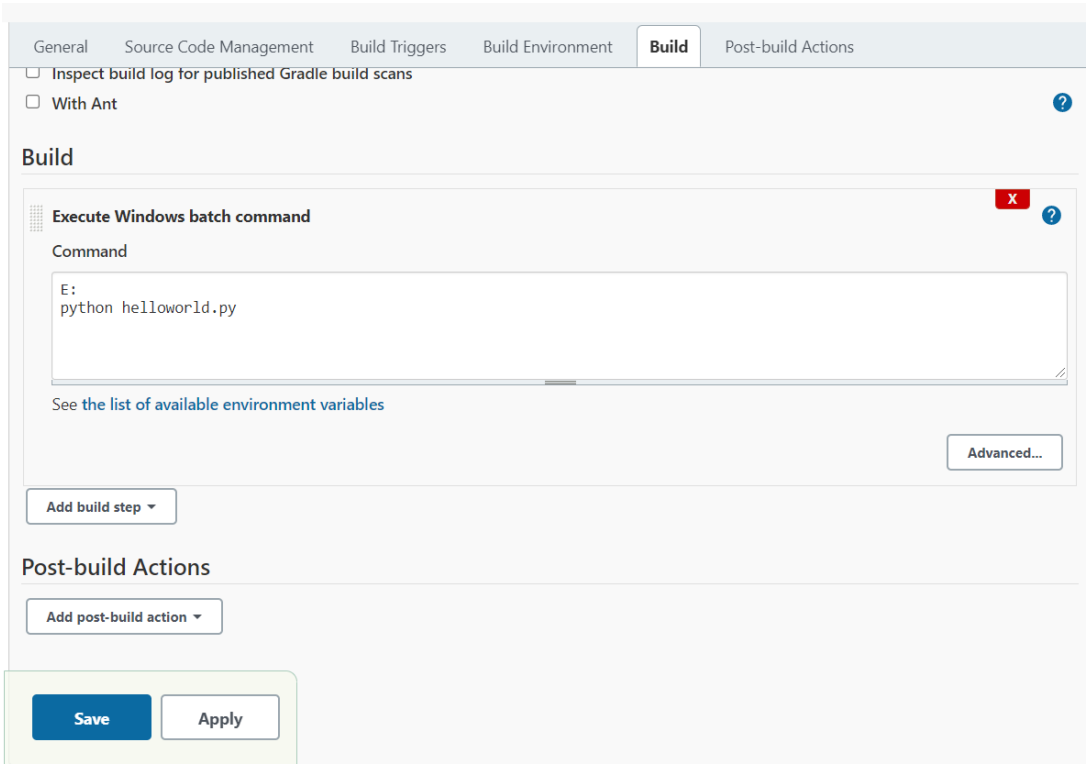
1. Install python and set environment settings on our machine.
2. Install Python plugins in Jenkins i.e. Manage Jenkins-> Manage Plugins -> Available-> Python Plugin -> select the plugin and click on install without restart.
3. Create a new job as freestyle project in Jenkins. New Item - > Freestyle Project. Add some optional description.





4. Configure -> Build section, add build steps-> commands to run the py script. Implicit = >select Execute python script => write some implicit python script here -> save and apply. Go to step 5. Explicit => write the following Build steps, assuming your python script is stored in this location D:\python scripts

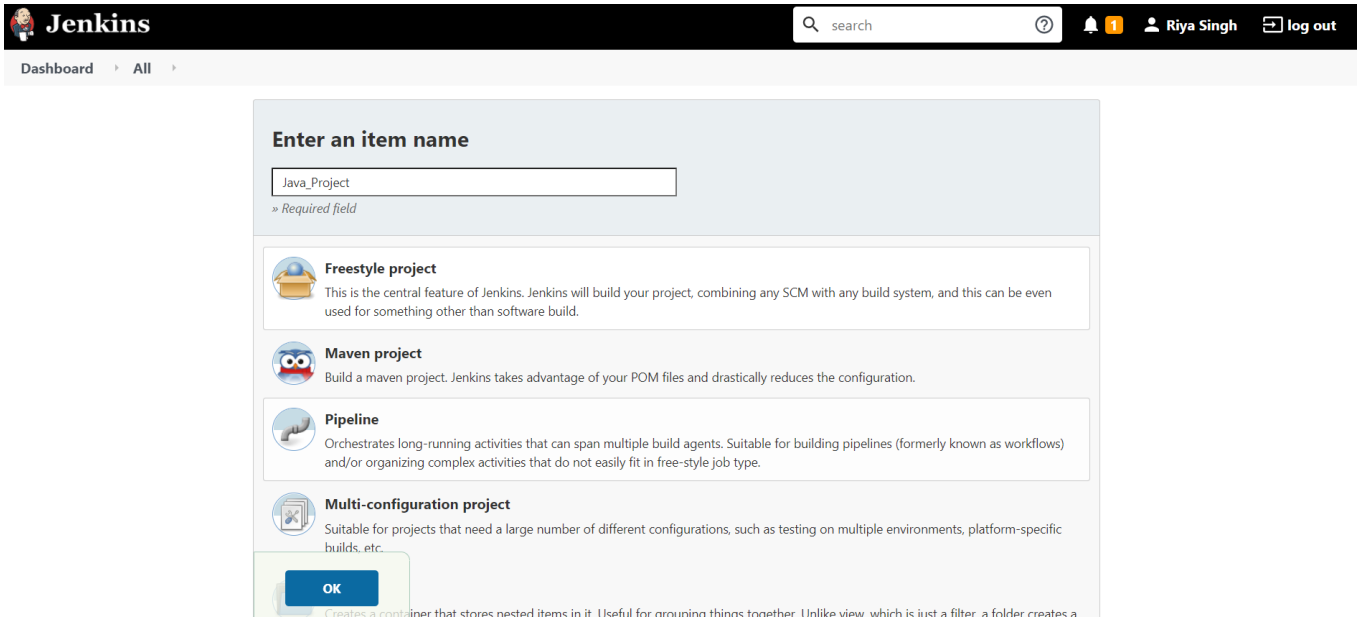
E:
python helloworld.py



5. Build Now - > Console Output.

Steps for Testing Java job in Jenkins:

1. Install Java and set environment settings.
2. Create a new job as freestyle project.



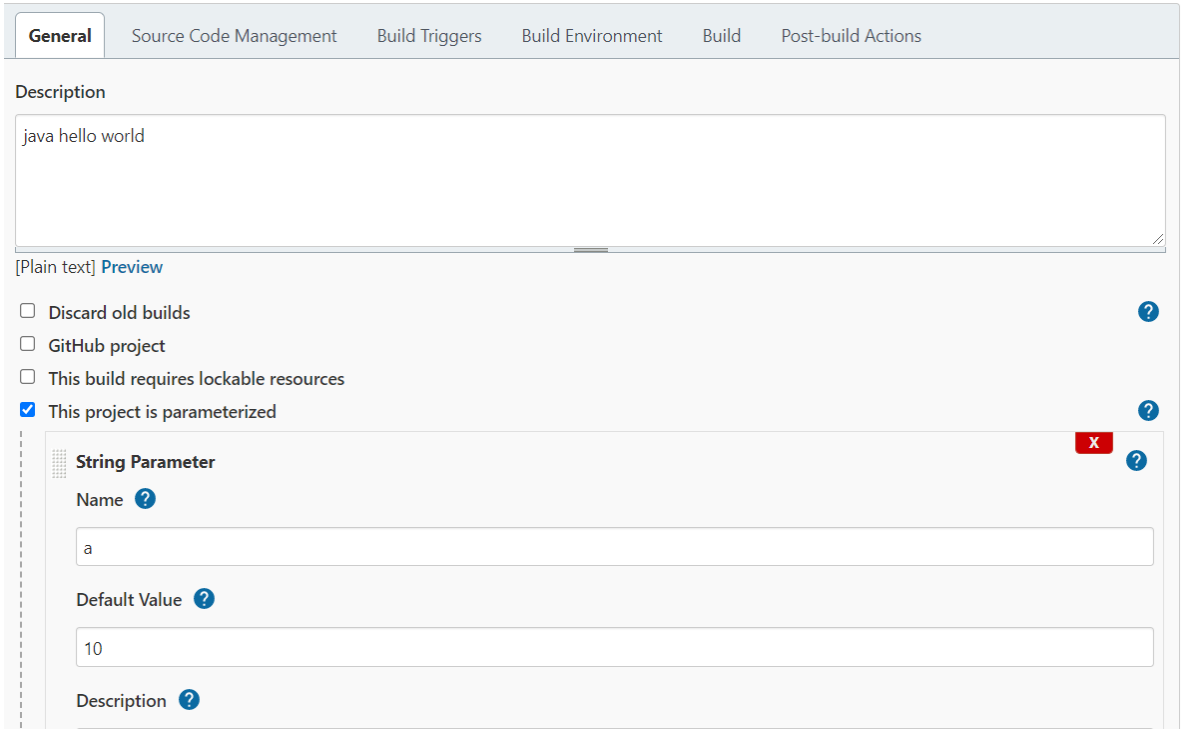
3. Configure ->Build section, commands to run the Java program. Add build steps-> select Windows batch commands. Go to Configure -> Build section, write the following Build steps, assuming your java program is stored in this location D:\ java program

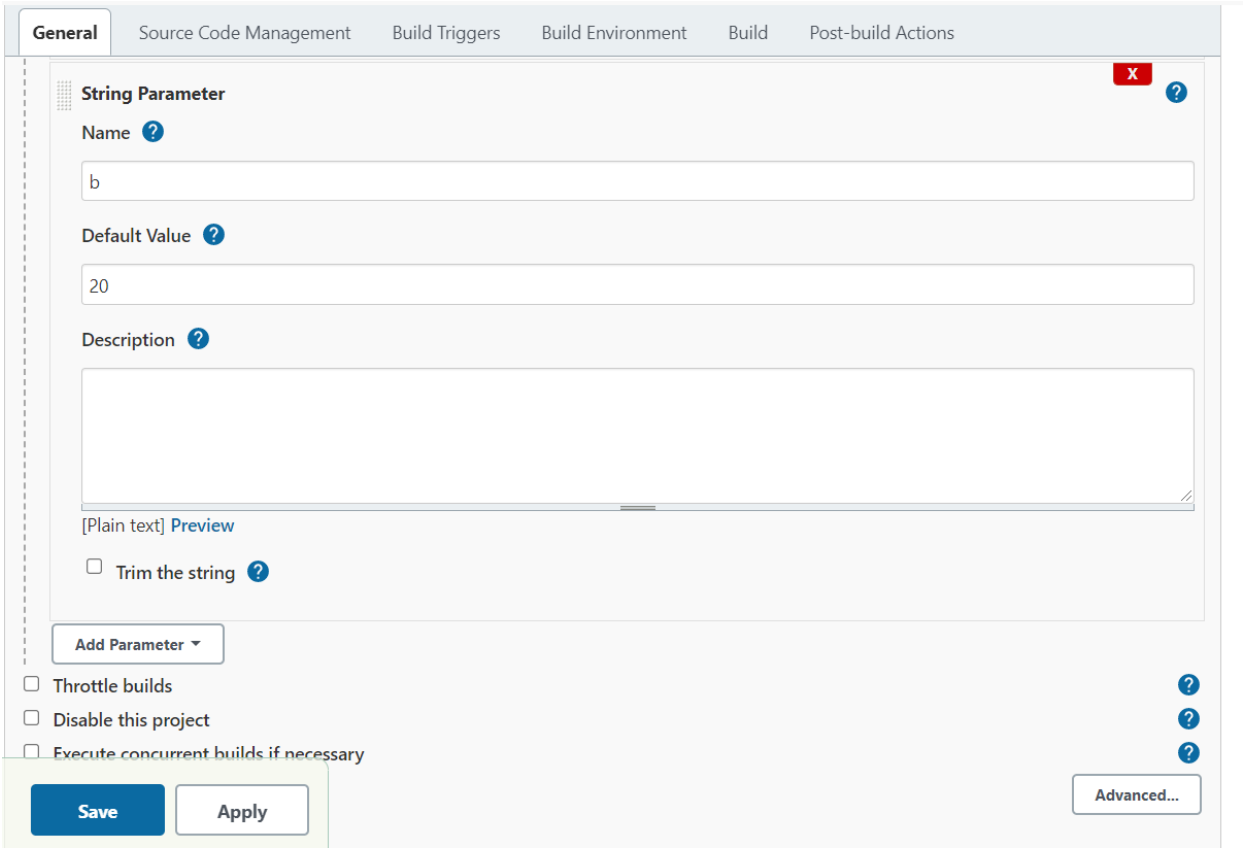
   E:

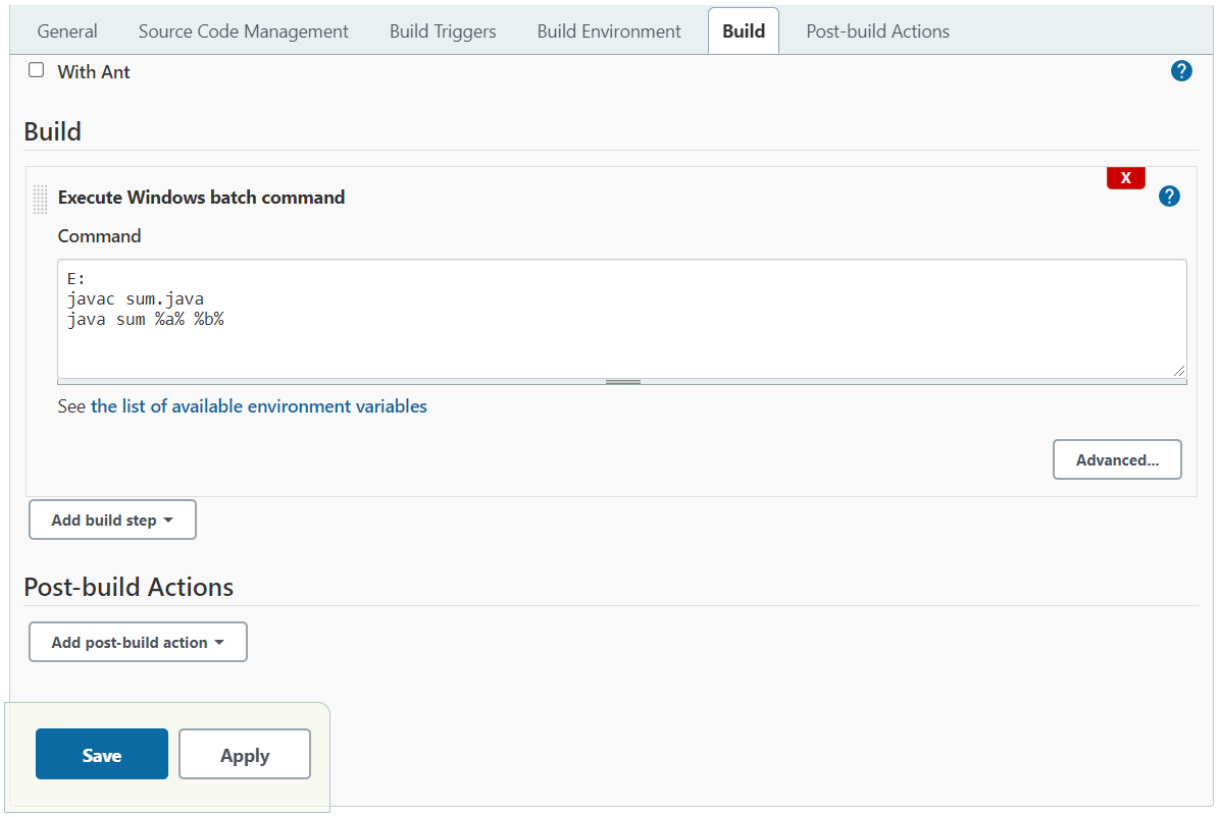
   javac sum.java

   java sum %a% %b%

   -> save and apply


General
Source Code Management
Build Triggers
Build Environment
Build
Post-build Actions
Description
java hello world
[Plain text] Preview
Discard old builds
GitHub project
This build requires lockable resources
This project is parameterized
String Parameter
Name
a
Default Value
10
Description

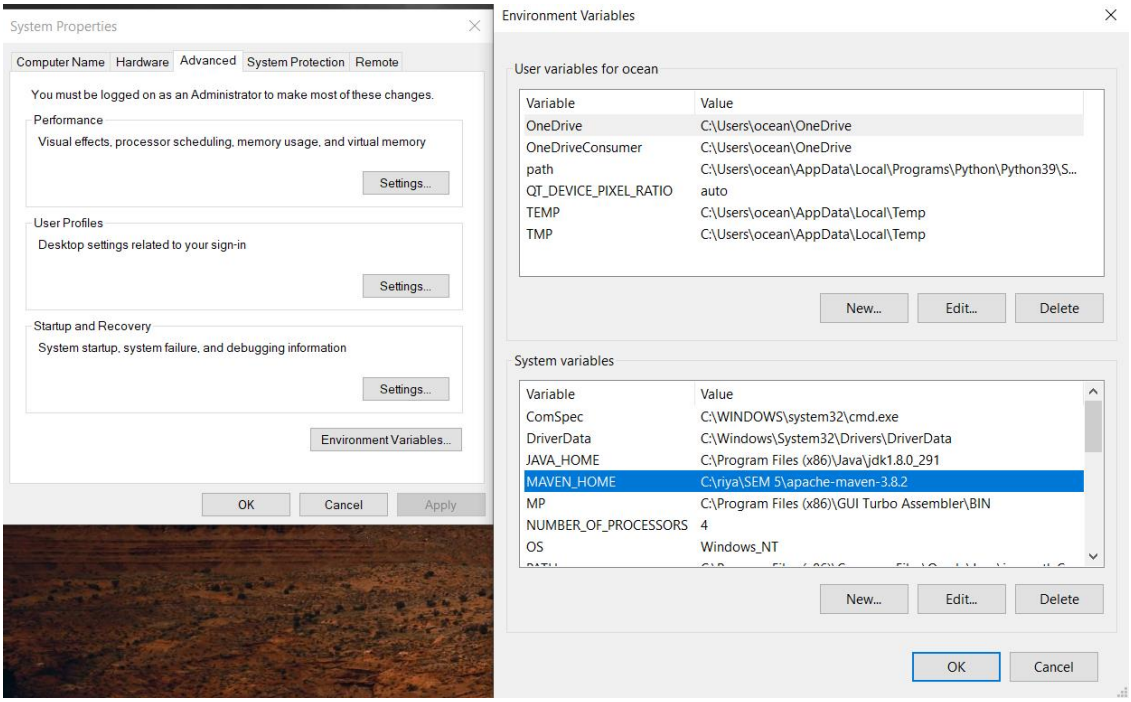

General
Source Code Management
Build Triggers
Build Environment
Build
Post-build Actions
String Parameter
Name
b
Default Value
20
Description
[Plain text] Preview
Trim the string
Add Parameter
Throttle builds
Disable this project
Execute concurrent builds if necessary
Save
Apply
Advanced...



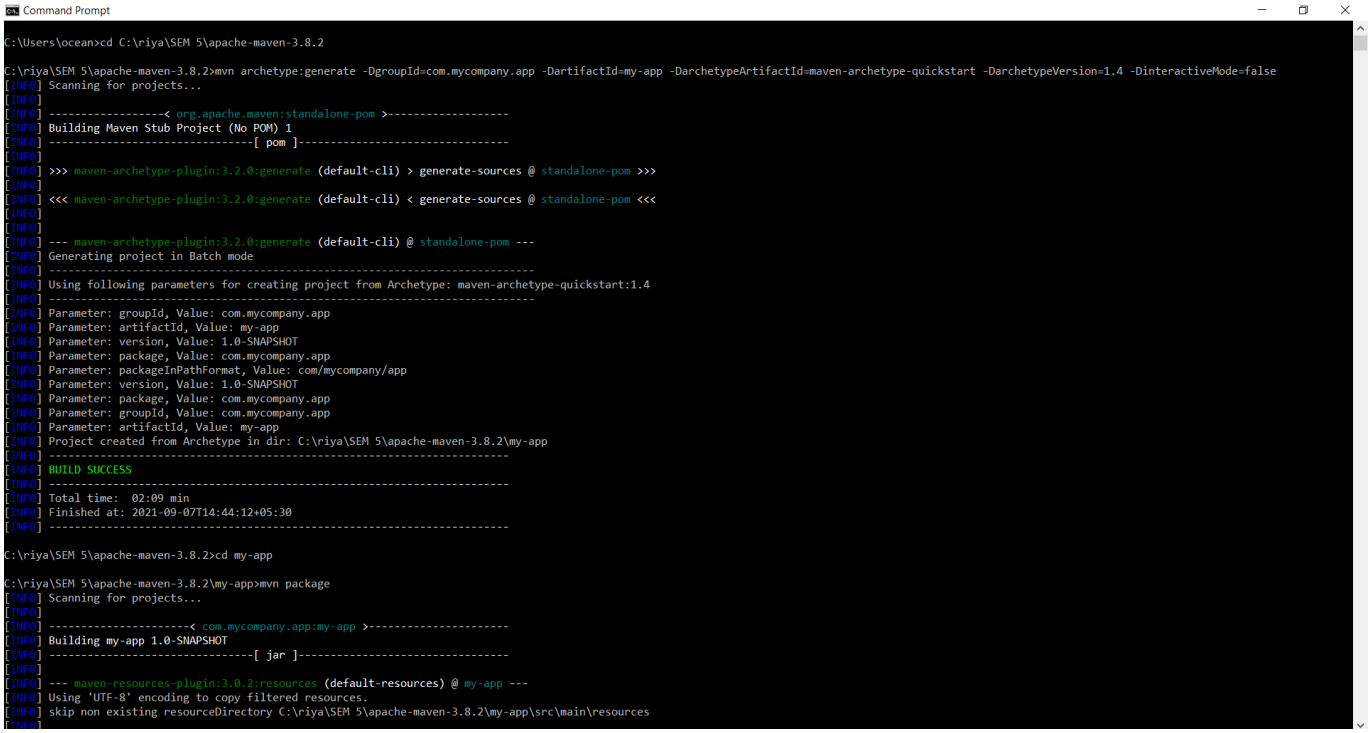
4. Build Now - > Console Output. Verify the output of your java program.

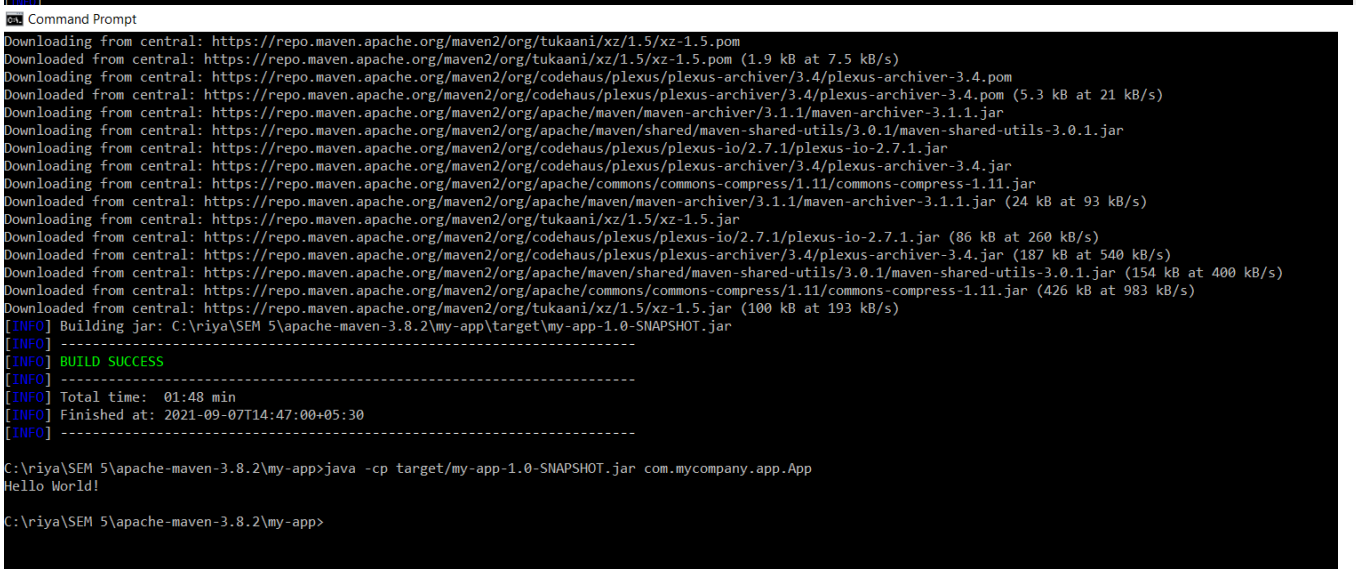
Steps for Building Maven job from the GitHub remote repository into Jenkins:

1. Install Maven and set environment settings. Make sure you've previously set java settings properly.
   Install Maven Integration plugin if not installed earlier and got to Manage Jenkins -> Global tool configurations -> Set Name => Maven <version> and Maven Home => path value of MAVEN_HOME.

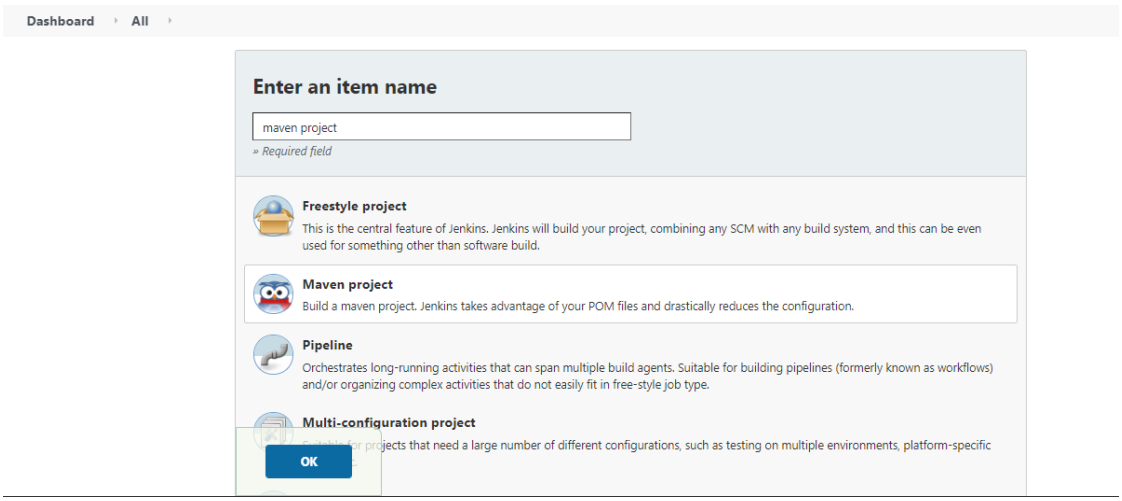


2. Build maven project in your machine using mvn commands to learn how to create and build any maven project as shown here: https://maven.apache.org/guides/getting-started/maven-in-five-minutes.html

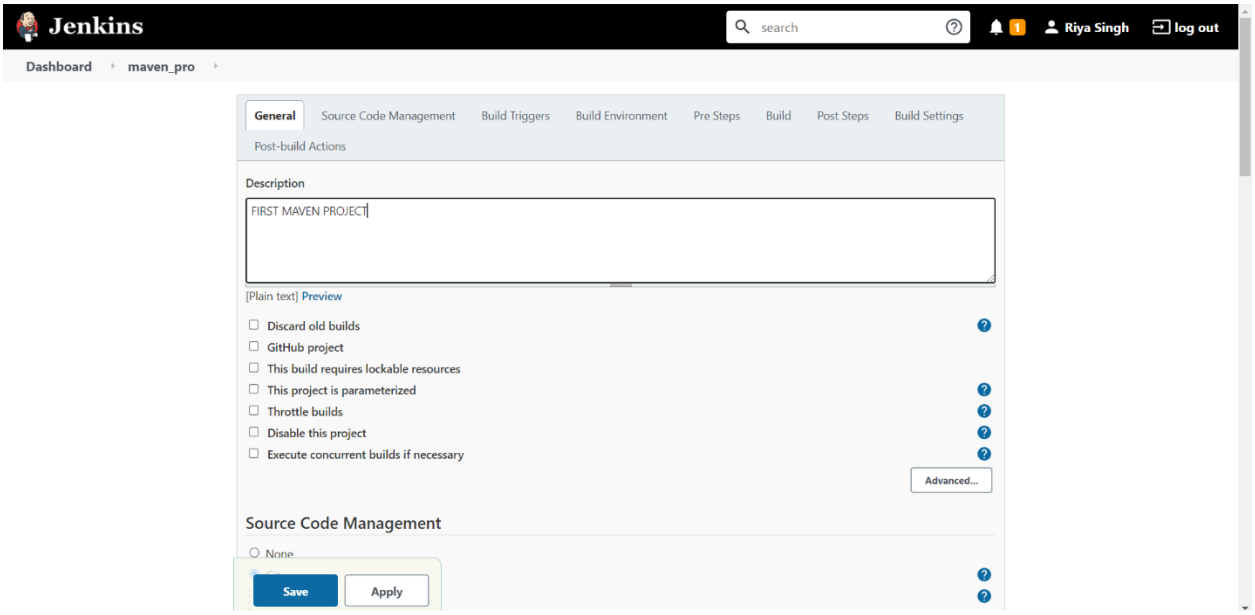


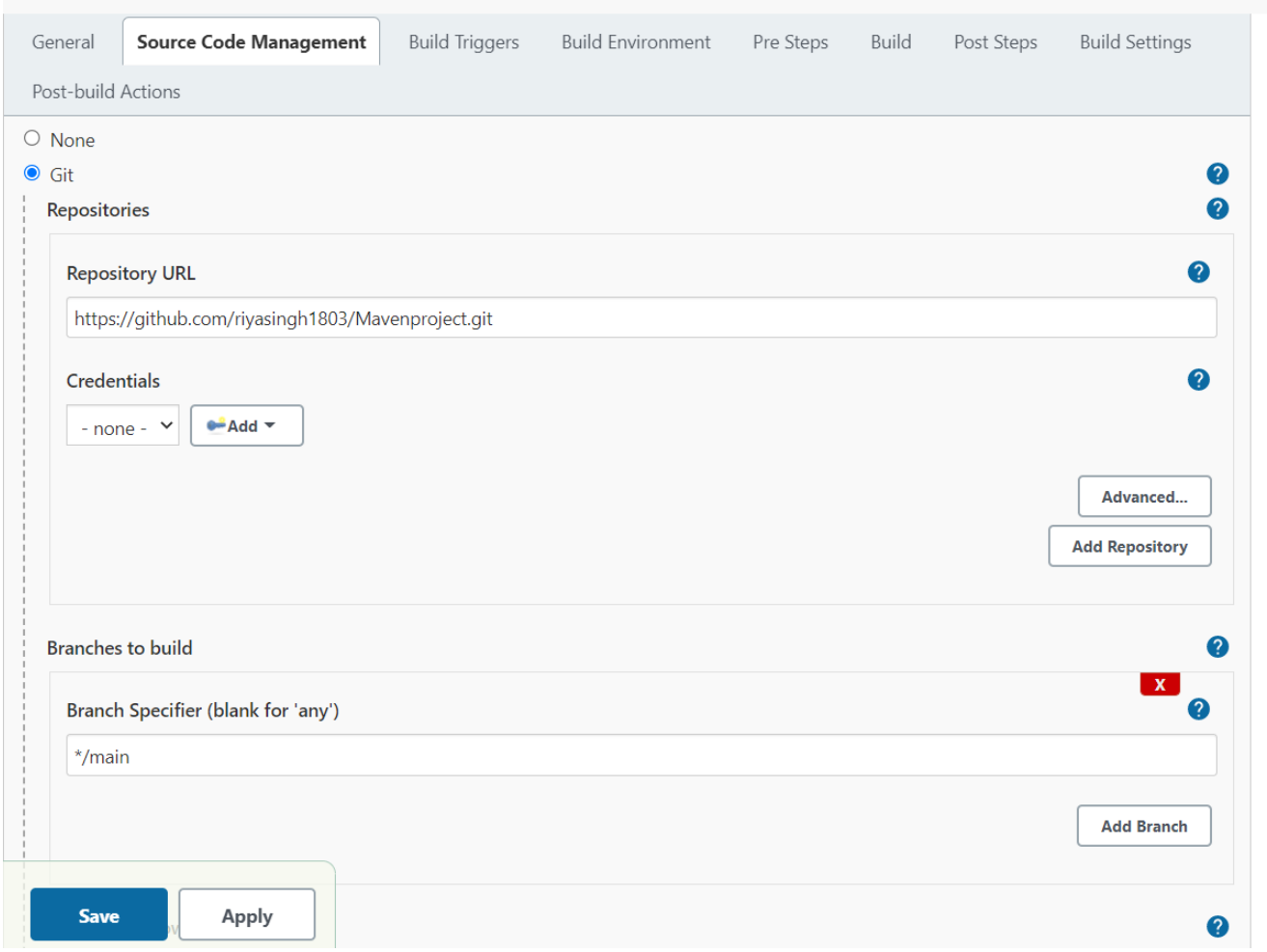


3. Create a maven job as Maven Project.



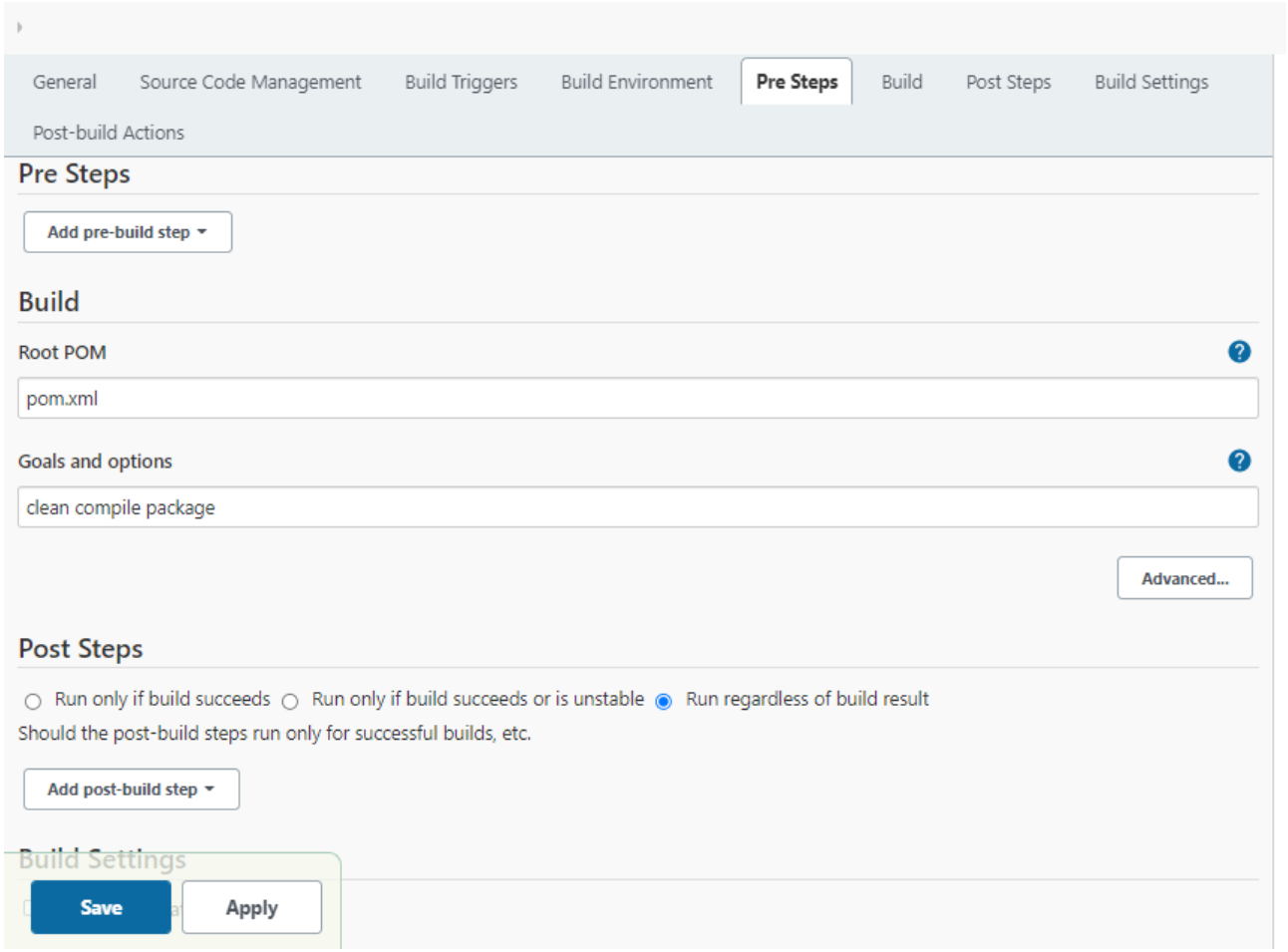
4. In Configure section - >go to Source Code Management -> Git - > paste this repository URL => https://github.com/bushsk/SimpleMavenProject.git (Assuming our maven project is on GitHub repository).



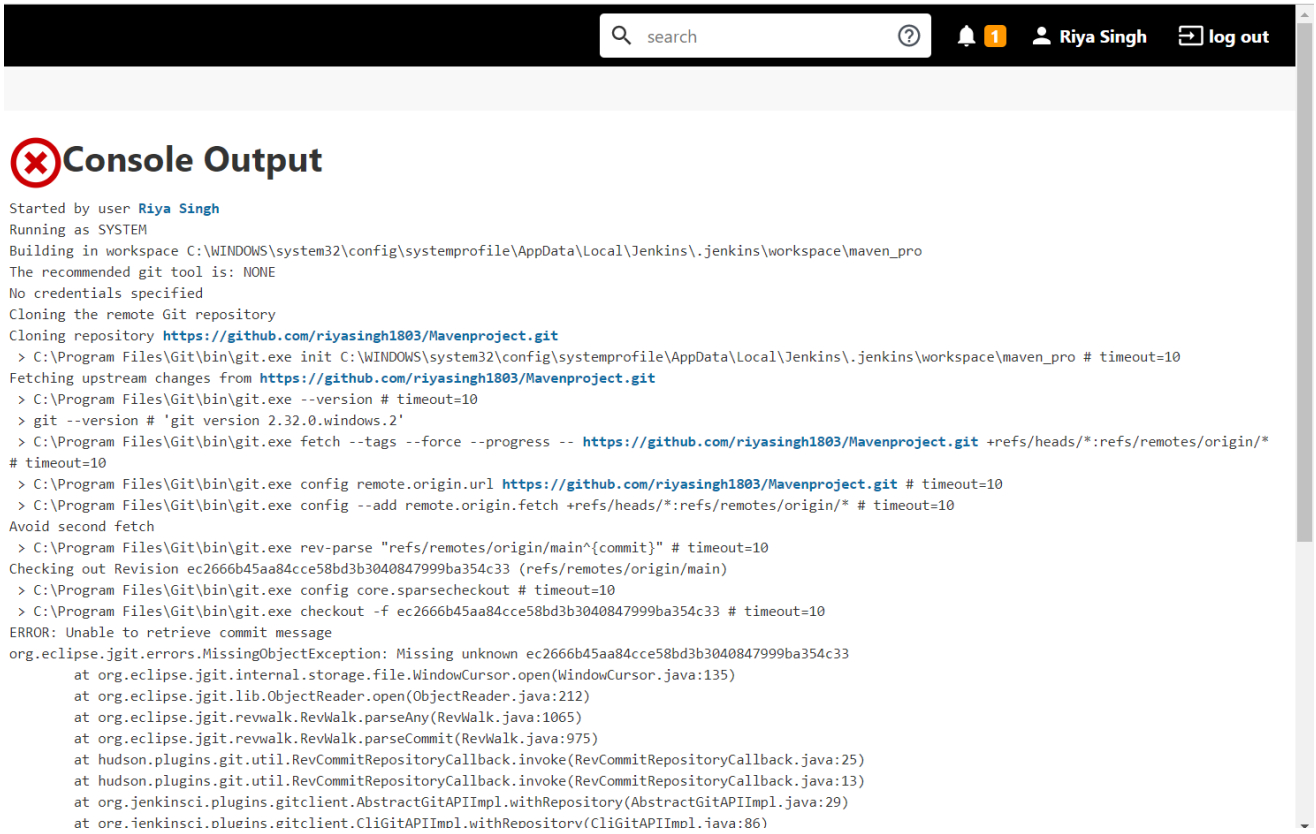


Note: Ensure that the GitHub Plugin is installed at this point. If it has not been installed, then do install it from Manage Jenkins-> Manage Plugins

5. In Build section -> Write the goals and options as => clean compile package. Make sure Root POM is set to pom.xml. -> save and apply.



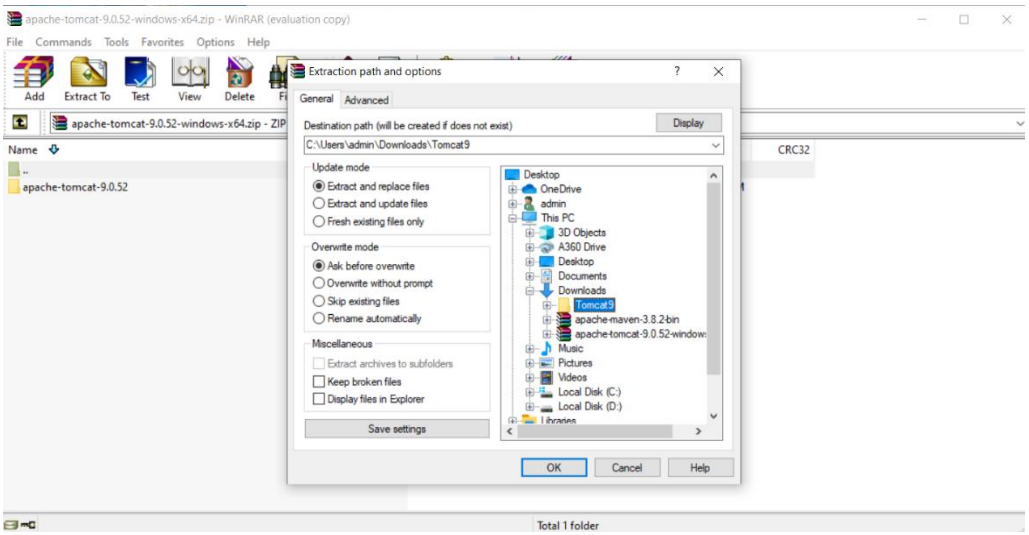
6. Go to build now -> console output and verify whether the .jar file with the given artefact has been created or not inside the given path shown in the console output.



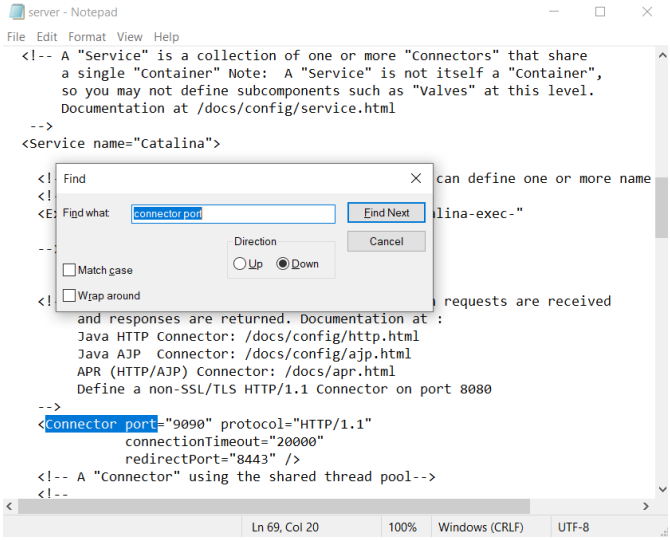
B. To build the pipeline of jobs using Maven / Ant in Jenkins, create a pipeline script to Test and deploy an application over the tomcat server.

<u>Steps for Building Maven job from the GitHub remote repository into Jenkins using Jenkins pipeline: Setup and run apache tomcat server:</u>

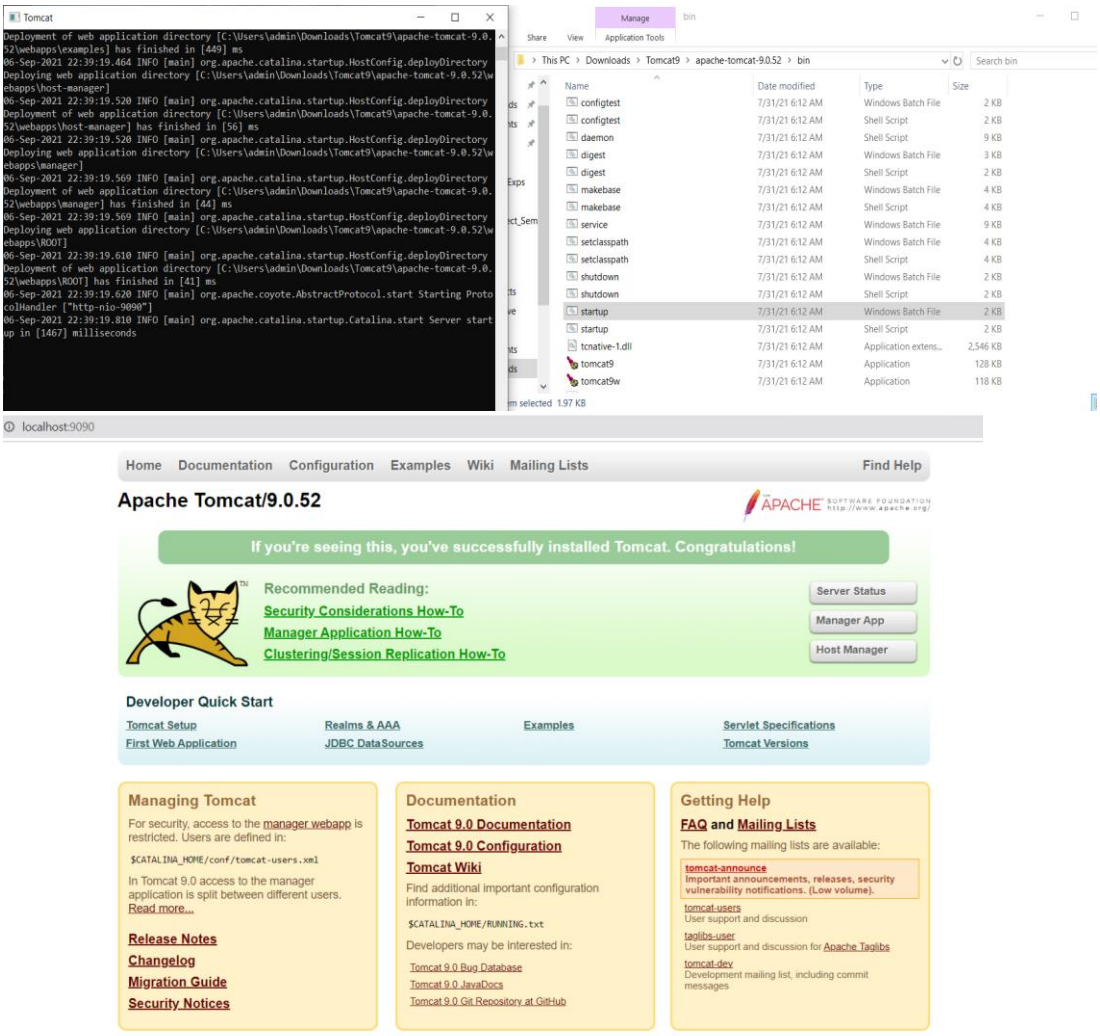
1.
    a. Download apache tomcat server from official apache's tomcat website and Install it by extracting and set it to run on port 9090 or any other port since Jenkins is already running on 8080 port and by default tomcat also runs on 8080.



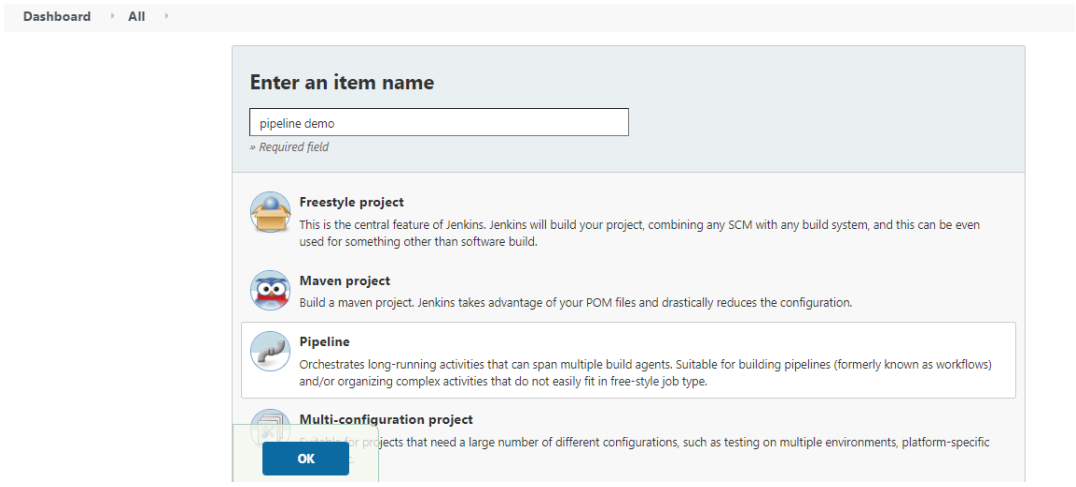
b. To do the above, go to the apache tomcat directory and find server.xml inside config folder. Find this line by Ctrl+f "<Connector port="8080"" and replace it with "<Connector port="9090" and save it.



c. Start the server by running the startup.bat file found inside apache-tomcat-9.0.52\bin folder and go to browser and test if the home page of server is up or not on localhost:9090.



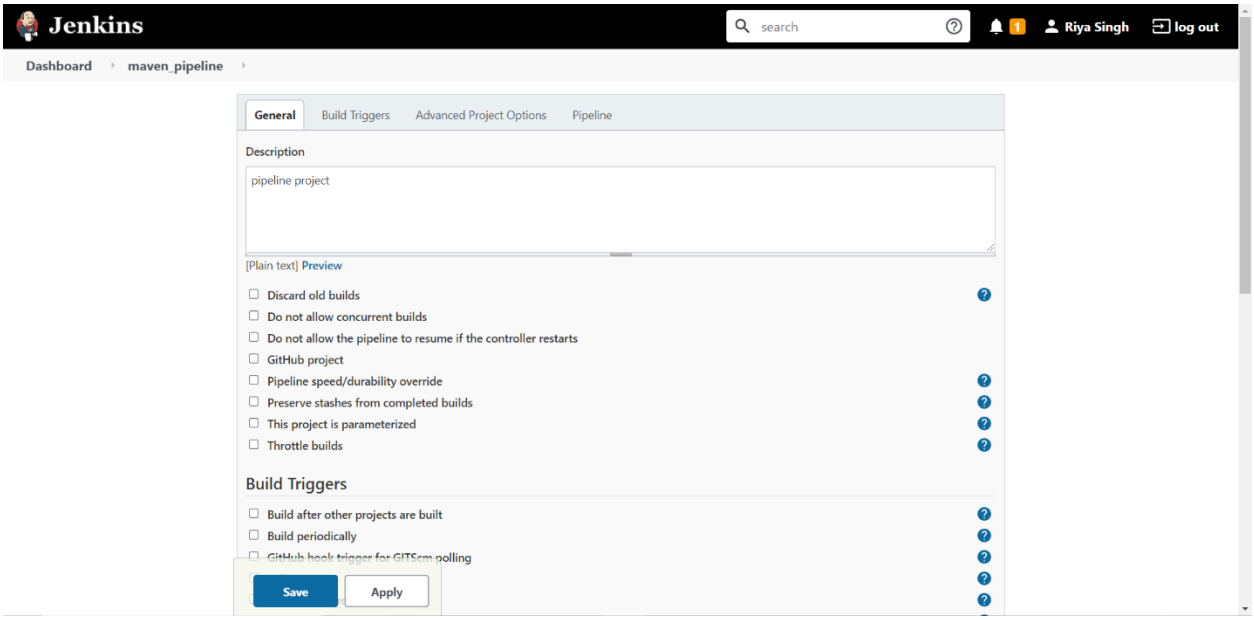
2. Go to Jenkins Dashboard and create a new pipeline project.

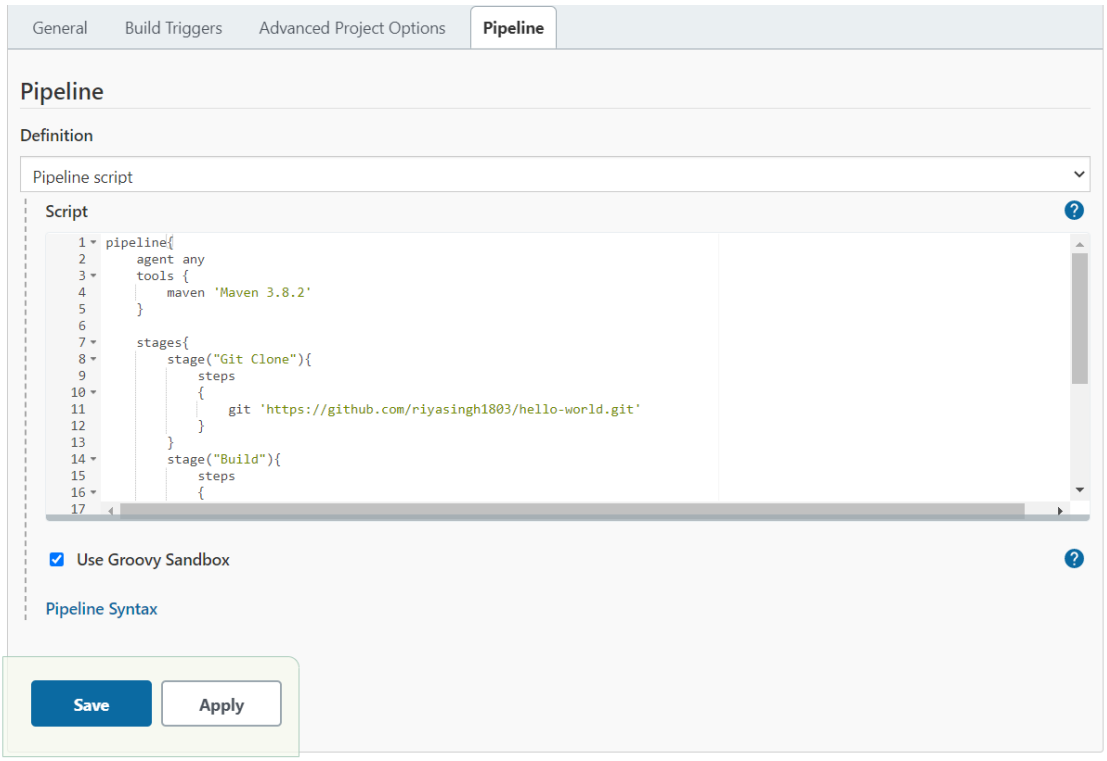


3. Go to Pipeline Section and choose Pipeline Script and write the following script here:

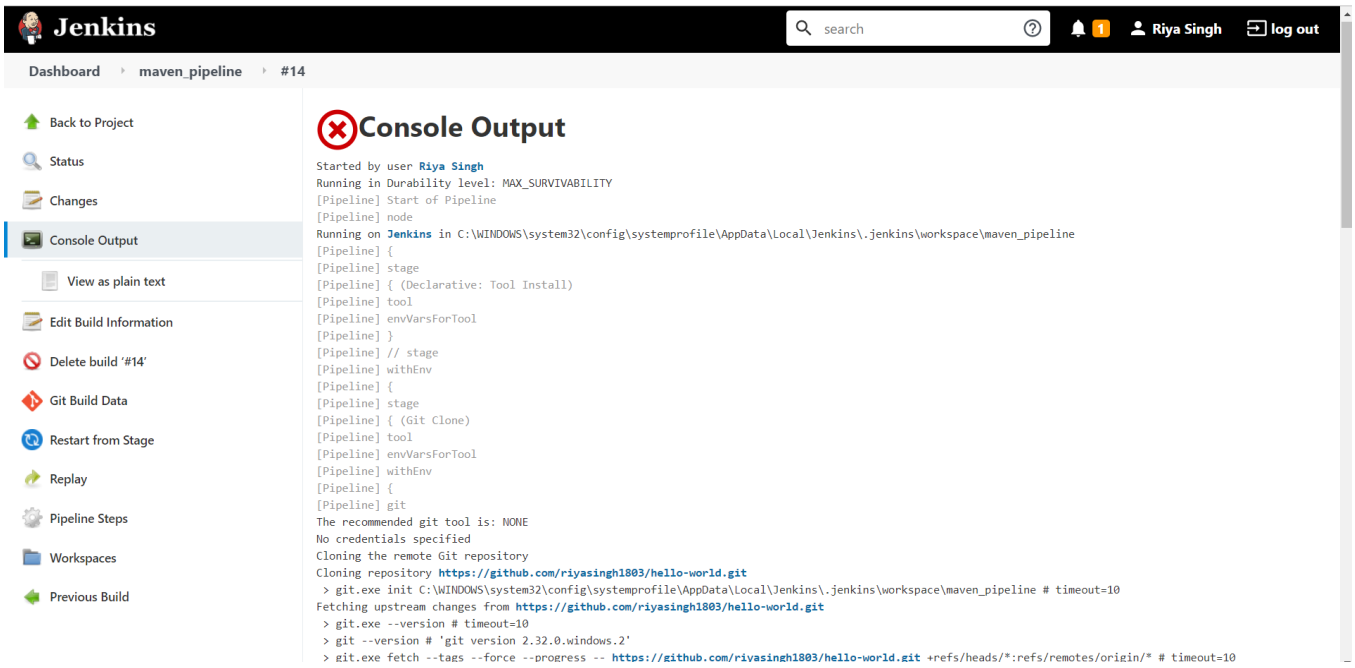
```
pipeline{
    agent any
    tools {
        maven 'Maven 3.8.2'
    }

    stages{
        stage("Git Clone"){
            steps
            {
                git 'https://github.com/riyasingh1803/hello-world.git'
            }
        }
        stage("Build"){
            steps
            {
                bat 'mvn clean install'
            }
        }
        stage("Deploy"){
            steps
            {
                bat 'copy C:\\Windows\\System32\\config\\systemprofile\\AppData\\Local\\Jenkins\\.jenkins\\workspace\\maven_
```

```
pipeline\\webapp\\target\\webapp.war C:\\riya\\SEM 5\\apache-tomcat-9.0.52-windows-x64\\apache-tomcat-9.0.52\\webapps'
        }
    }


  }
}
```





4. Got to Build Now and verify if the pipeline build is successful. Go to http://localhost:9090/webapp/ and verify if the home page of your application is up or not.



Conclusion:

Hence we have successfully built python, java and maven jobs using Jenkins. Also we have created a Jenkins pipeline to deploy test and deploy an application over the tomcat server.

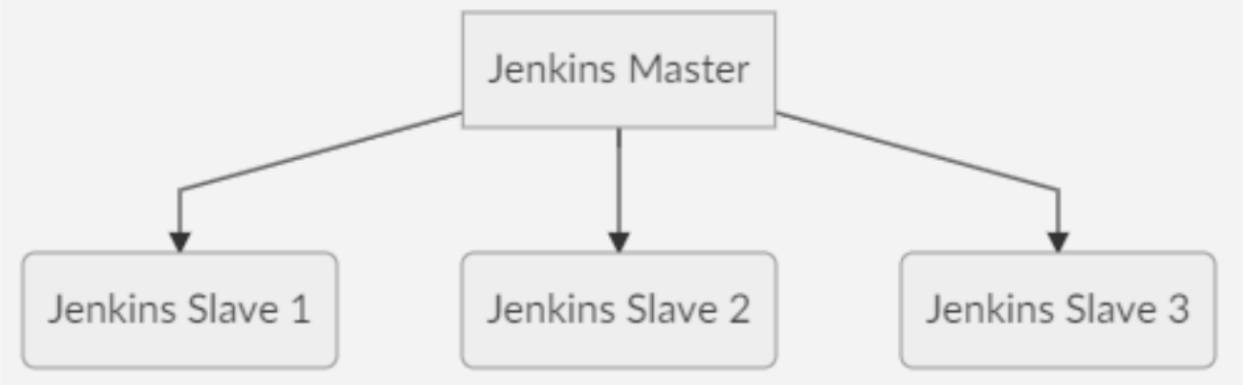
EXPERIMENT-4

AIM: To study Jenkins Master-Slave Architecture to scale your Jenkins standalone implementation by implementing slave nodes.

THEORY**:**

Jenkins is a free and open source automation server. It helps automate the parts of software development related to building, testing, and deploying, facilitating continuous integration and continuous delivery. It is a server-based system that runs in servlet containers such as Apache Tomcat.

Jenkins Master and Slave Architecture



The Jenkins master acts to schedule the jobs and assign slaves and send builds to slaves to execute the jobs. It will also monitor the slave state (offline or online) and getting back the build result responses from slaves and the display build results on the console output. The workload of building jobs is delegated to multiple slaves.

Jenkins Master
Your main Jenkins server is the Master. The Master's job is to handle:

- Scheduling build jobs.
- Dispatching builds to the slaves for the actual execution.
- Monitor the slaves (possibly taking them online and offline as required).
- Recording and presenting the build results.
- A Master instance of Jenkins can also execute build jobs directly.

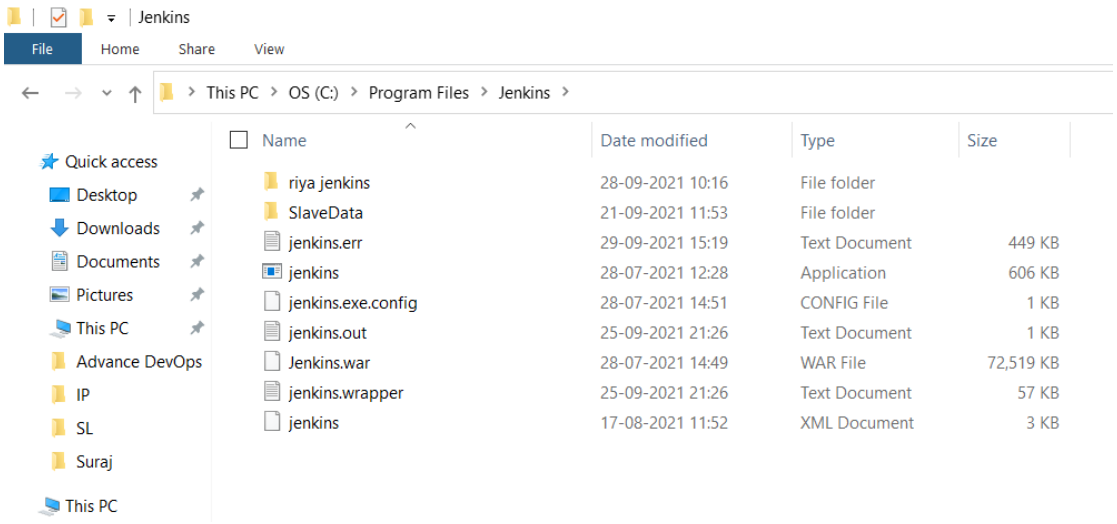
Jenkins Slave

A Slave is a Java executable that runs on a remote machine. Following are the characteristics of Jenkins Slaves:

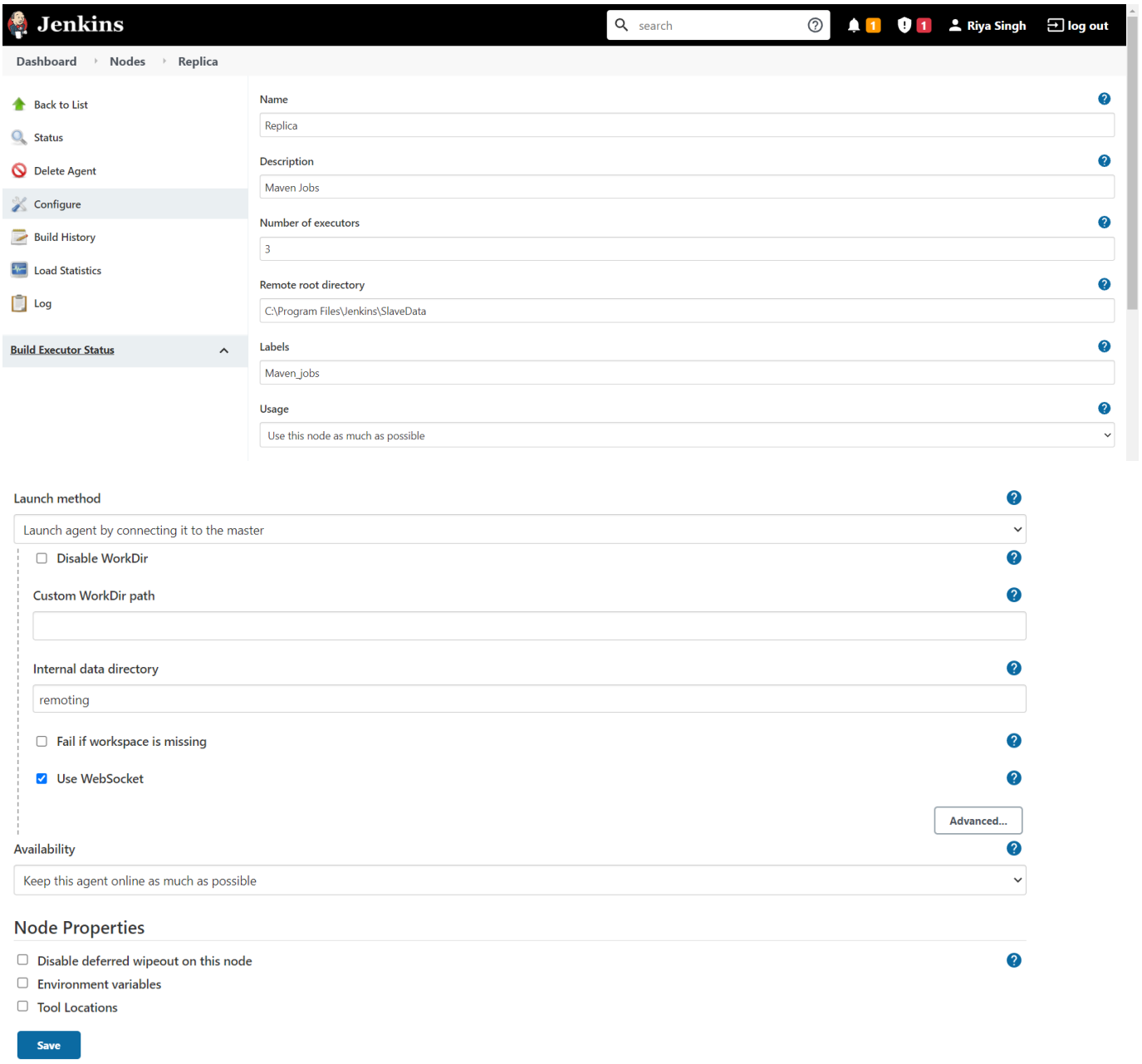
- It hears requests from the Jenkins Master instance.
- Slaves can run on a variety of operating systems.
- The job of a Slave is to do as they are told to, which involves executing build jobs dispatched by the Master.
- You can configure a project to always run on a particular Slave machine or a particular type of Slave machine, or simply let Jenkins pick the next available Slave.

Output:

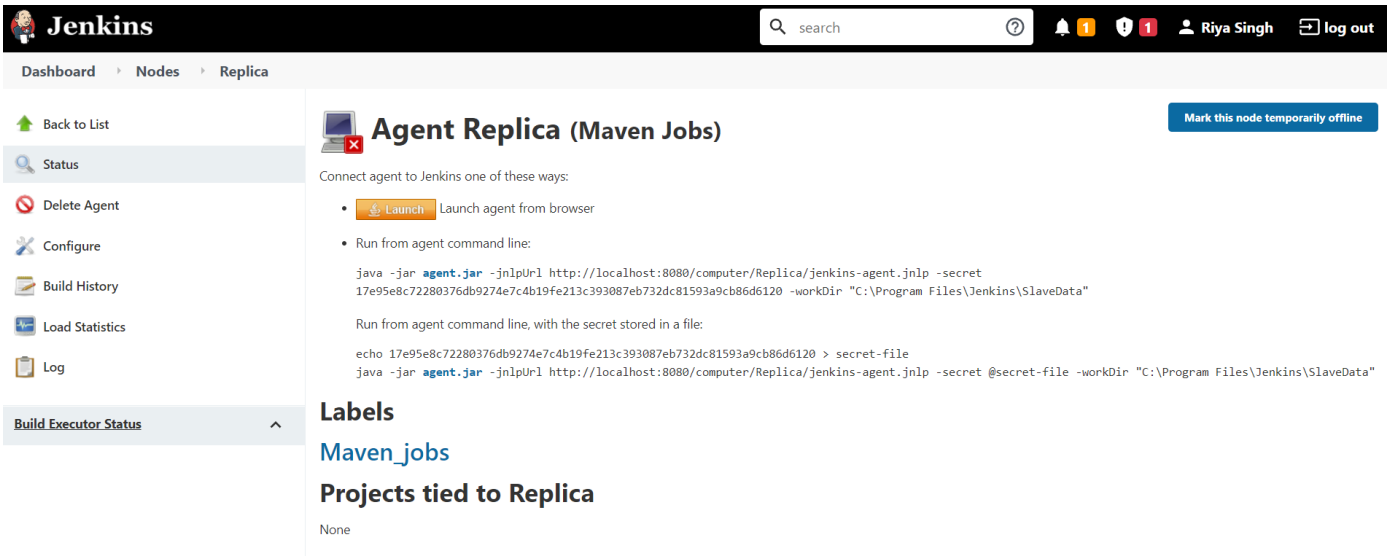
Step 1: Create a workspace by creating a folder anywhere in your system



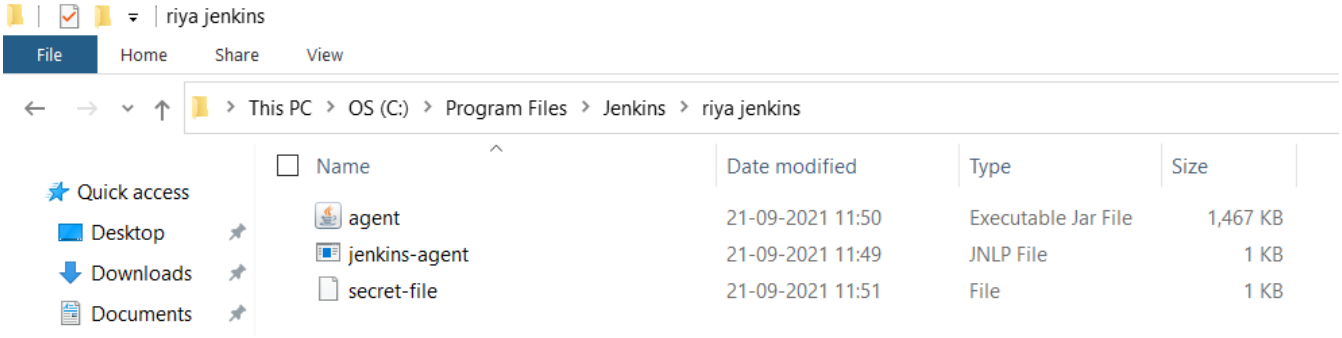
Step 2: Create a new node with the following configuration:



Step 3 : Click on launch to download Jenkins agent.jar and click on agent.jar to download it



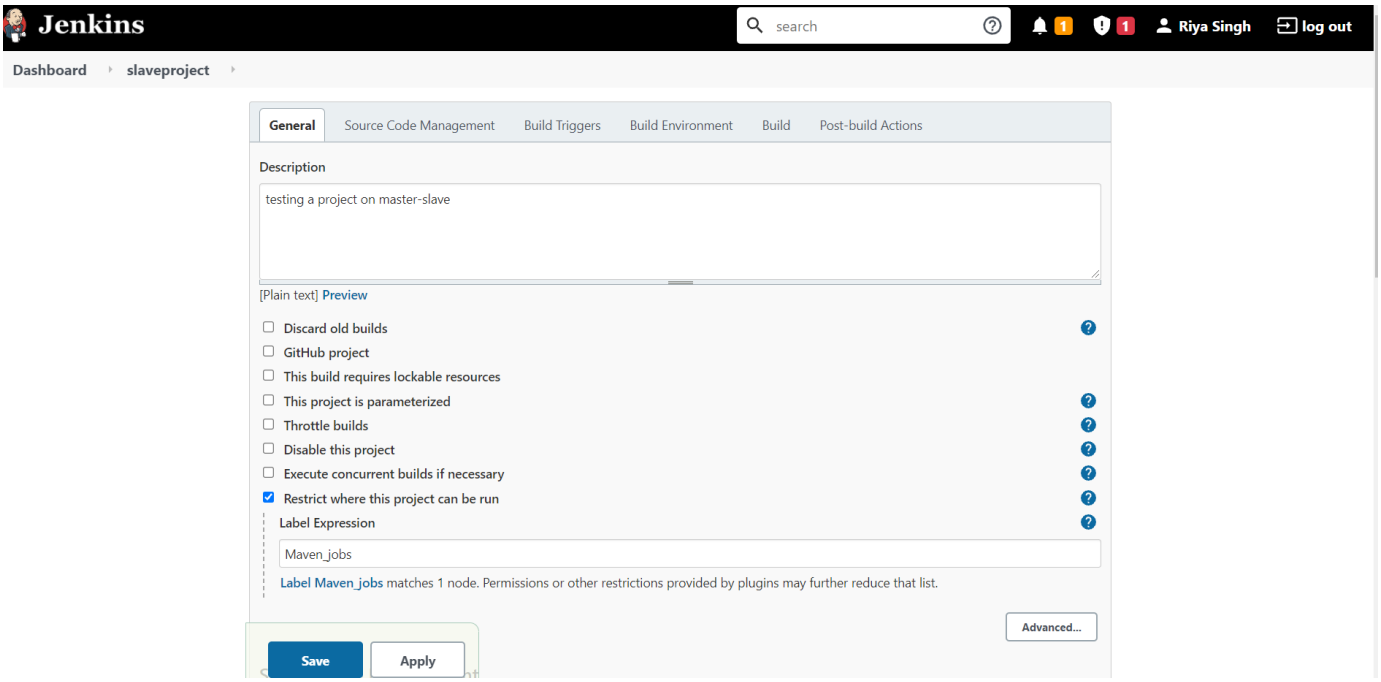
Step 4: Run the following commands being on the same file location where you download above files and observe the status as connected.

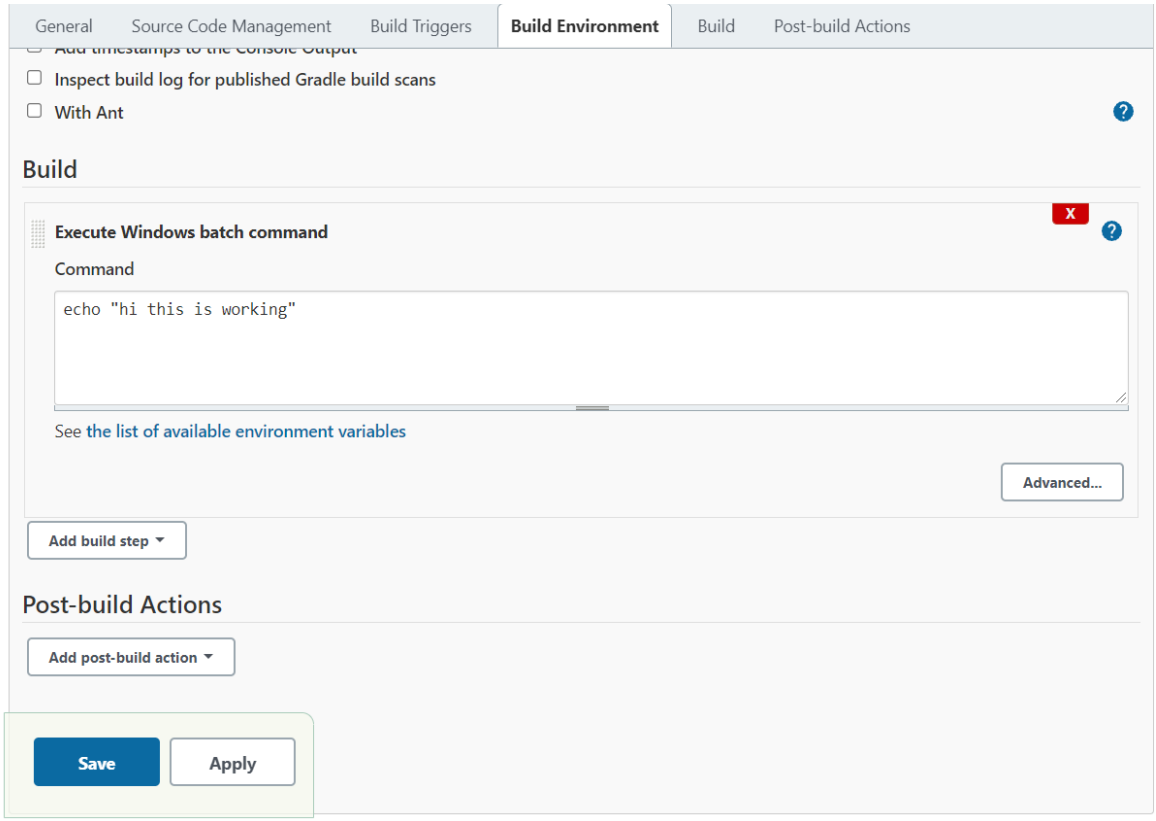


Step 5 : run commands in cmd of your slave node

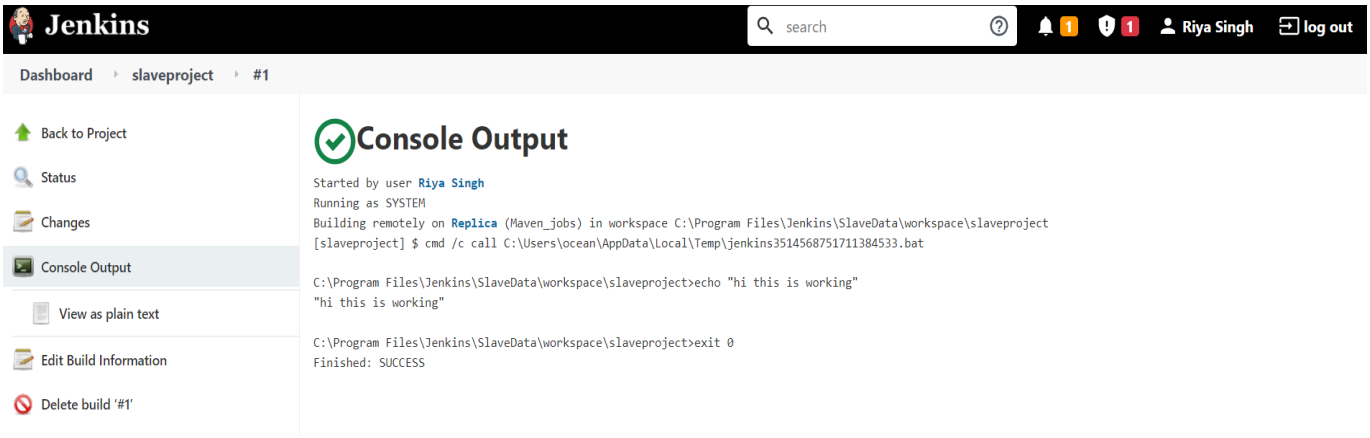
```
C:\Program Files\Jenkins\SlaveData>java -jar agent.jar -jnlpUrl http://localhost:8080/computer/SlaveNode/jenkins-agent.j
nlp -secret @secret-file -workDir "C:\Program Files\Jenkins\SlaveData"
Sep 22, 2021 3:01:54 PM org.jenkinsci.remoting.engine.WorkDirManager initializeWorkDir
INFO: Using C:\Program Files\Jenkins\SlaveData\remoting as a remoting work directory
Sep 22, 2021 3:01:54 PM org.jenkinsci.remoting.engine.WorkDirManager setupLogging
INFO: Both error and output logs will be printed to C:\Program Files\Jenkins\SlaveData\remoting
Sep 22, 2021 3:01:54 PM hudson.remoting.jnlp.Main createEngine
INFO: Setting up agent: SlaveNode
Sep 22, 2021 3:01:54 PM hudson.remoting.jnlp.Main$CuiListener <init>
INFO: Jenkins agent is running in headless mode.
Sep 22, 2021 3:01:54 PM hudson.remoting.Engine startEngine
INFO: Using Remoting version: 4.7
Sep 22, 2021 3:01:54 PM org.jenkinsci.remoting.engine.WorkDirManager initializeWorkDir
INFO: Using C:\Program Files\Jenkins\SlaveData\remoting as a remoting work directory
Sep 22, 2021 3:01:56 PM hudson.remoting.jnlp.Main$CuiListener status
INFO: WebSocket connection open
Sep 22, 2021 3:01:56 PM hudson.remoting.jnlp.Main$CuiListener status
INFO: Connected
```

Step 6: Create a new job / item and select the label expression of your slave node under ‘Restrict where this project can be run’


Jenkins
search
Riya Singh
log out
Dashboard
slaveproject
General
Source Code Management
Build Triggers
Build Environment
Build
Post-build Actions
Description
testing a project on master-slave
[Plain text] Preview
Discard old builds
GitHub project
This build requires lockable resources
This project is parameterized
Throttle builds
Disable this project
Execute concurrent builds if necessary
Restrict where this project can be run
Label Expression
Maven_jobs
Label Maven_jobs matches 1 node. Permissions or other restrictions provided by plugins may further reduce that list.
Advanced...
Save
Apply


General
Source Code Management
Build Triggers
Build Environment
Build
Post-build Actions
Inspect build log for published Gradle build scans
With Ant
Build
Execute Windows batch command
Command
echo "hi this is working"
See the list of available environment variables
Advanced...
Add build step
Post-build Actions
Add post-build action
Save
Apply

Step 7: Build



Conclusion:

Hence Jenkins Master-Slave Architecture to scale Jenkins standalone has been implemented by implementing slave nodes.

EXPERIMENT-5

Aim: a) To setup an Eclipse IDE and Run Selenium Tests Using Maven.

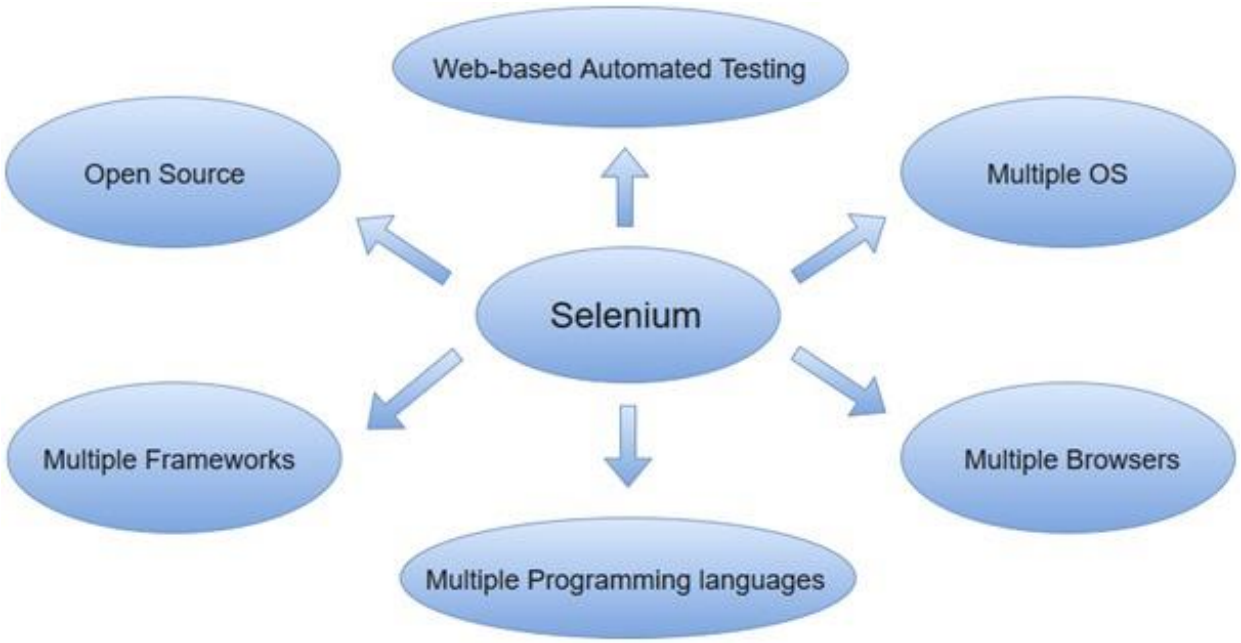
b) To Setup and Run Selenium Tests in Jenkins Using Maven.

Theory:

Jenkins is a free and open source automation server. It helps automate the parts of software development related to building, testing, and deploying, facilitating continuous integration and continuous delivery. It is a server-based system that runs in servlet containers such as Apache Tomcat.

What is Selenium?

Selenium is a free (open-source) automated testing framework used to validate web applications across different browsers and platforms. You can use multiple programming languages like Java, C#, Python etc. to create Selenium Test Scripts. Testing done using the Selenium testing tool is usually referred to as Selenium Testing.



Selenium can be used to automate functional tests and can be integrated with automation test tools such as Maven, Jenkins, & Docker to achieve continuous testing. It can also be integrated with tools such as TestNG, & JUnit for managing test cases and generating reports.

Selenium WebDriver:

Selenium WebDriver is the most important component of Selenium Tool's Suite. The latest release "Selenium 2.0" is integrated with WebDriver API which provides a simpler and more concise programming interface.

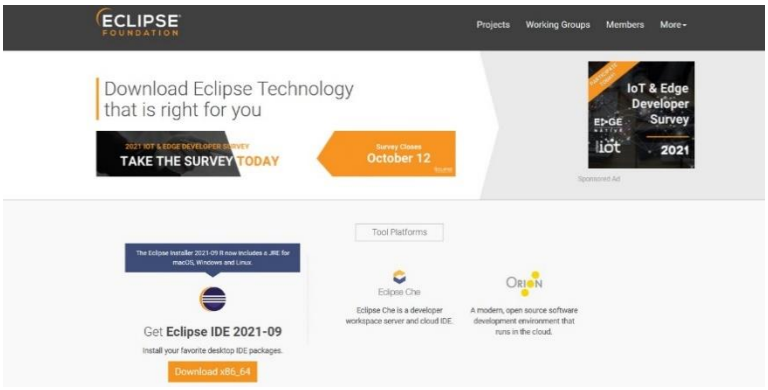
TestNG:

- TestNG is a very important framework when you are actually developing the framework from scratch level.
- TestNG provides you full control over the test cases and the execution of the test cases. Due to this reason, TestNG is also known as a testing framework.
- If you want to run a test case A before that as a pre-request you need to run multiple test cases before you begin a test case A. You can set and map with the help of TestNG so that pre-request test cases run first and then only it will trigger a test case A. In such way, you can control the test cases.
- TestNG framework came after Junit, and TestNG framework adds more powerful functionality and easier to use.
- It is an open source automated TestNG framework. In TestNG, NG stands for "Next Generation.
- TestNG framework eliminates the limitations of the older framework by providing more powerful and flexible test cases with help of easy annotations, grouping, sequencing and parameterizing.
- In TestNG, there is no constraint available such as @beforeclass and @afterclass which is present in Junit.
- TestNG enables you to group the test cases easily which is not possible in JUnit.
- TestNG supports three additional levels such as @Before/After suite, @Before/AfterTest, and Before/AfterGroup.
- TestNG does not extend any class. TestNG framework allows you to define the test cases where each test case is independent of other test cases

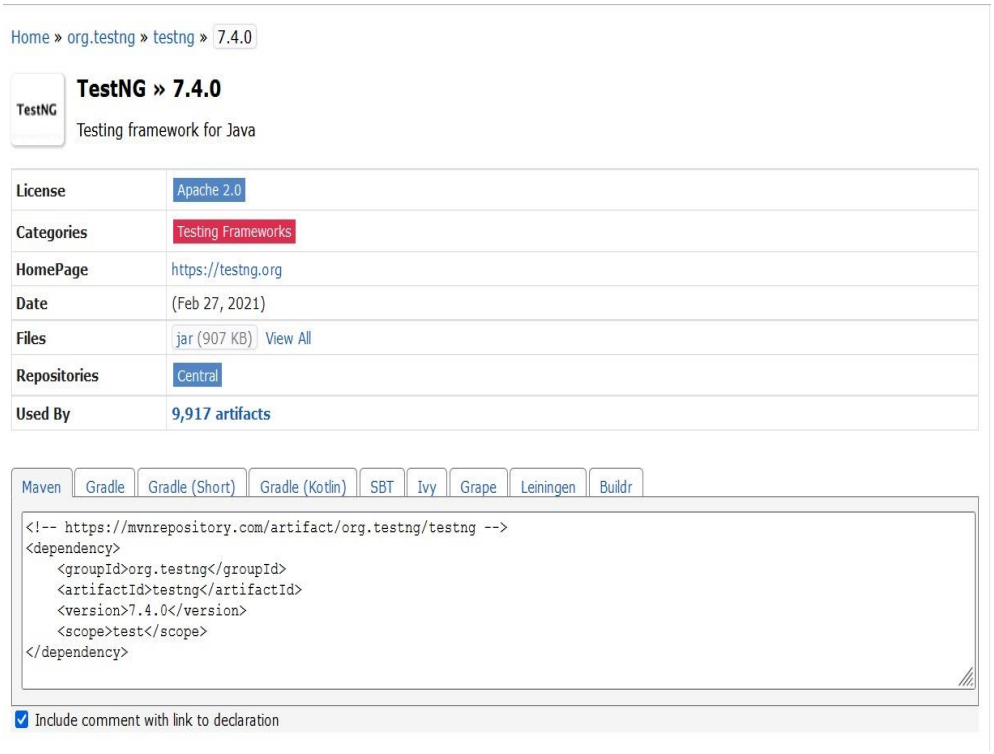
a) To setup an Eclipse IDE and Run Selenium Tests Using Maven.

Steps for writing Selenium test cases in Eclipse using maven:

1. Download and install any latest version of Eclipse IDE from https://www.eclipse.org/downloads/



2. Create your first maven project.
3. Add a new java AppTest class in your \src\test\java. Make sure to that filename should have a keyword „Test".
4. Add the TestNG dependency under dependencies tag in pom.xml <dependencies> visit https://mvnrepository.com/artifact/org.testng/testng/7.4.0 to copy the following dependency tag.



5. Write a sample test case using TestNG to print "Hello world" by annotating @Test and left click on red cross when shown as error to import package import org.testng.annotations.Test and similarly write some valid /suitable test cases.

6. Save and Run as Maven test.

TestHelloWorld.java × seleniumexample/pom.xml

```
1  package seleniumexample;
2
3  import org.openqa.selenium.By;
4  import org.openqa.selenium.JavascriptExecutor;
5  import org.openqa.selenium.WebDriver;
6  import org.openqa.selenium.chrome.ChromeDriver;
7  import org.testng.annotations.Test;
8
9  public class TestHelloWorld {
10     @Test
11     public void testhelloworld()
12     {
13         System.out.println("Hello world! This is Riya Singh");
14     }
15
16 }
17
```

Problems Javadoc Declaration Console ×

```
<terminated> C:\Program Files\Java\jdk-14.0.2\bin\javaw.exe (15-Oct-2021, 10:09:25 pm)
-------------------------------------------------------
Running seleniumexample.TestHelloWorld
Configuring TestNG with: org.apache.maven.surefire.testng.conf.TestNG652Configurator@4563e9ab
Hello world! This is Riya Singh
Tests run: 1, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.926 sec

Results :

Tests run: 1, Failures: 0, Errors: 0, Skipped: 0

[INFO] ------------------------------------------------------------------------
[INFO] BUILD SUCCESS
[INFO] ------------------------------------------------------------------------
[INFO] Total time:  6.564 s
[INFO] Finished at: 2021-10-15T22:09:36+05:30
[INFO] ------------------------------------------------------------------------
```

7. Verify if the build is successful or not in the console output.
8. Now add Selenium dependency under dependencies tag in your pom.xml. Visit https://mvnrepository.com/artifact/org.seleniumhq.selenium/selenium-chrome-driver to copy the following dependency tag.

TestHelloWorld.java seleniumexample/pom.xml ×

```
1  <project xmlns="http://maven.apache.org/POM/4.0.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://maven.apac
2    <modelVersion>4.0.0</modelVersion>
3    <groupId>com.sies.abc</groupId>
4    <artifactId>seleniumexample</artifactId>
5    <version>0.0.1-SNAPSHOT</version>
6
7    <dependencies>
8      <dependency>
9          <groupId>org.testng</groupId>
10         <artifactId>testng</artifactId>
11         <version>7.4.0</version>
12         <scope>test</scope>
13     </dependency>
14     <dependency>
15         <groupId>org.seleniumhq.selenium</groupId>
16         <artifactId>selenium-chrome-driver</artifactId>
17         <version>4.0.0-alpha-6</version>
18     </dependency>
19   </dependencies>
20
21   <properties>
22       <java.version>1.8</java.version>
23       <maven.compiler.source>1.8</maven.compiler.source>
24       <maven.compiler.target>1.8</maven.compiler.target>
25 </properties>
26
27 </project>
```

9. Download a web driver for chrome similar to the version of your chrome browser and extract chrome driver on some suitable location in your drive. **https://sites.google.com/a/chromium.org/chromedriver/downloads**. Ensure that it should be of same version as that of your Chrome browser. To Check chrome version => Go in Help - > About Google chrome.
10. Add following test case using selenium chrome web drivers : Under this test, we will automate the following scenarios and observe the output:

TestHelloWorld.java × seleniumexample/pom.xml

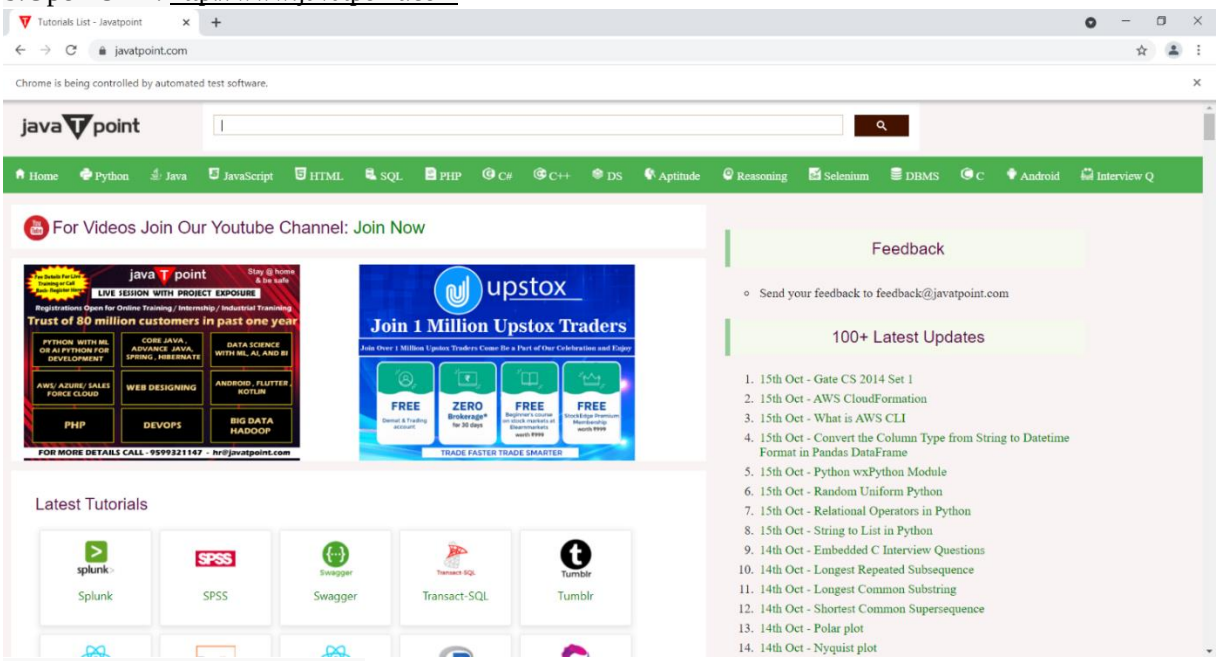
```
1  package seleniumexample;
2
3  import org.openqa.selenium.By;
4  import org.openqa.selenium.JavascriptExecutor;
5  import org.openqa.selenium.WebDriver;
6  import org.openqa.selenium.chrome.ChromeDriver;
7  import org.testng.annotations.Test;
8
9  public class TestHelloWorld {
10
11
12     @Test
13     public void testhelloworld2()
14     {
15         System.setProperty("webdriver.chrome.driver","C:\\Program Files\\Eclipse\\chromedriver.exe" );
16         // Instantiate a ChromeDriver class.
17         WebDriver driver=new ChromeDriver();
18
19         // Launch Website
20         driver.navigate().to("http://www.javatpoint.com/");
21
22         //Maximize the browser
23         driver.manage().window().maximize();
24
25         //Scroll down the webpage by 5000 pixels
26         JavascriptExecutor js = (JavascriptExecutor)driver;
27         js.executeScript("scrollBy(0, 5000)");
28
29         // Click on the search text box and send value
30         driver.findElement(By.id("gsc-i-id1")).sendKeys("core Java");
31         // Click on the search button
32         driver.findElement(By.className("gsc-search-button")).click();
33
34     }
35
36 }
```

Problems Javadoc Declaration Console ×

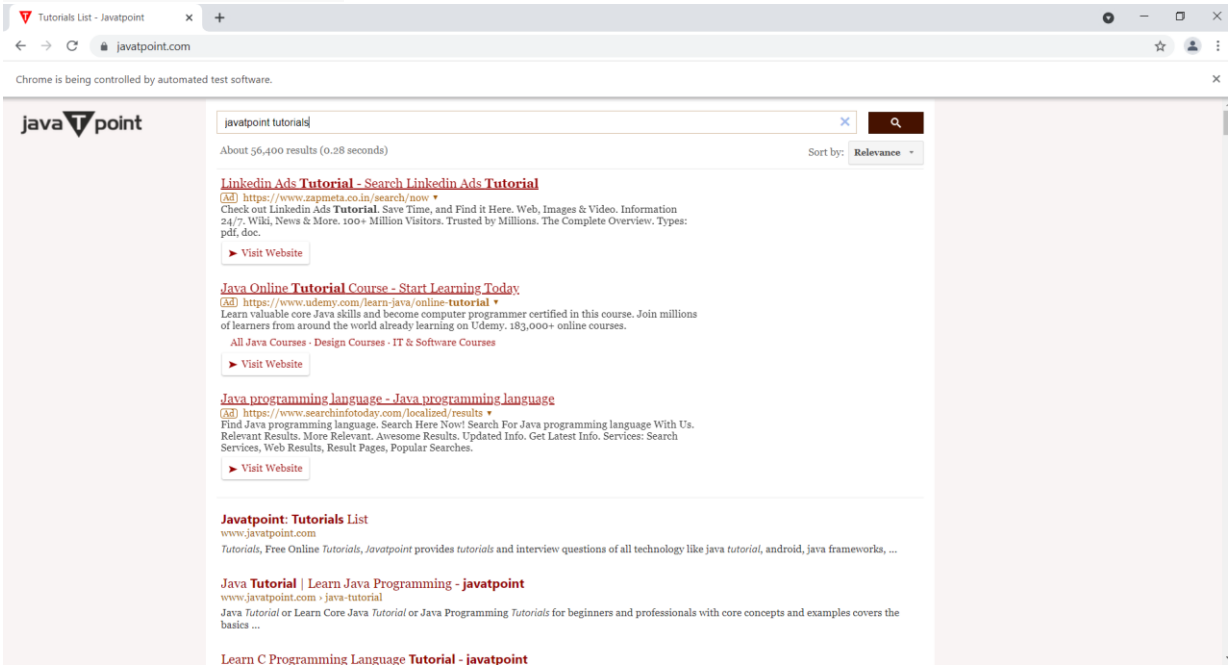
```
<terminated> C:\Program Files\Java\jdk-14.0.2\bin\javaw.exe (15-Oct-2021, 10:51:34 pm)
Configuring TestNG with: org.apache.maven.surefire.testng.conf.TestNG652Configurator@4563e9ab
SLF4J: Failed to load class "org.slf4j.impl.StaticLoggerBinder".
SLF4J: Defaulting to no-operation (NOP) logger implementation
SLF4J: See http://www.slf4j.org/codes.html#StaticLoggerBinder for further details.
Starting ChromeDriver 94.0.4606.41 (333e85df3c9b656b518b5f1add5ff246365b6c24-refs/branch-heads/4606@{#845}) on port 36219
Only local connections are allowed.
Please see https://chromedriver.chromium.org/security-considerations for suggestions on keeping ChromeDriver safe.
ChromeDriver was started successfully.
Oct 15, 2021 10:52:12 PM org.openqa.selenium.remote.ProtocolHandshake createSession
INFO: Detected dialect: W3C
Tests run: 1, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 49.514 sec

Results :

Tests run: 1, Failures: 0, Errors: 0, Skipped: 0

[INFO] ------------------------------------------------------------------------
[INFO] BUILD SUCCESS
[INFO] ------------------------------------------------------------------------
[INFO] Total time:  57.341 s
[INFO] Finished at: 2021-10-15T22:52:35+05:30
[INFO] ------------------------------------------------------------------------
```

a.Invoke Google Chrome browser.

b.Open URL: http://www.javatpoint.com



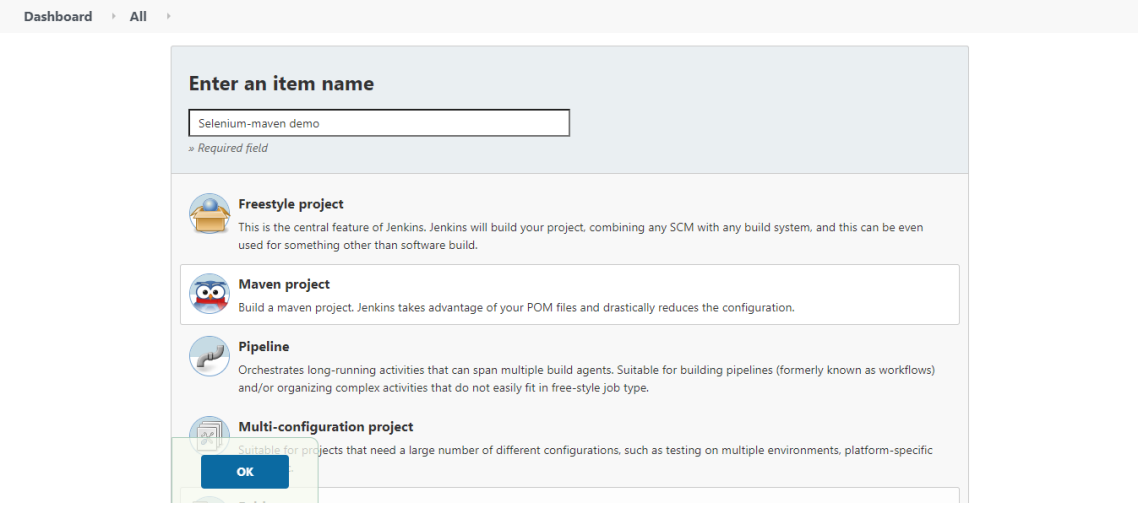
c.Click on the Search text box.
d.Type the value "javatpoint tutorials"
e.Click on the Search button.



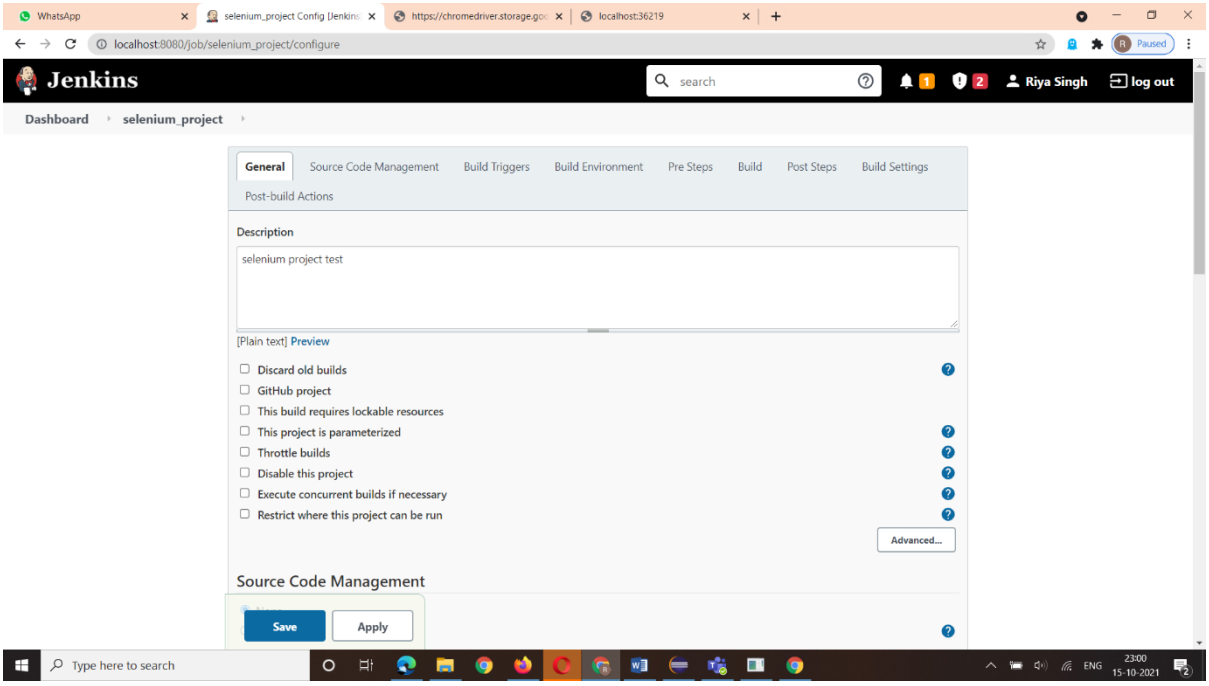
b) To Setup and Run Selenium Tests in Jenkins Using Maven.

Procedure:

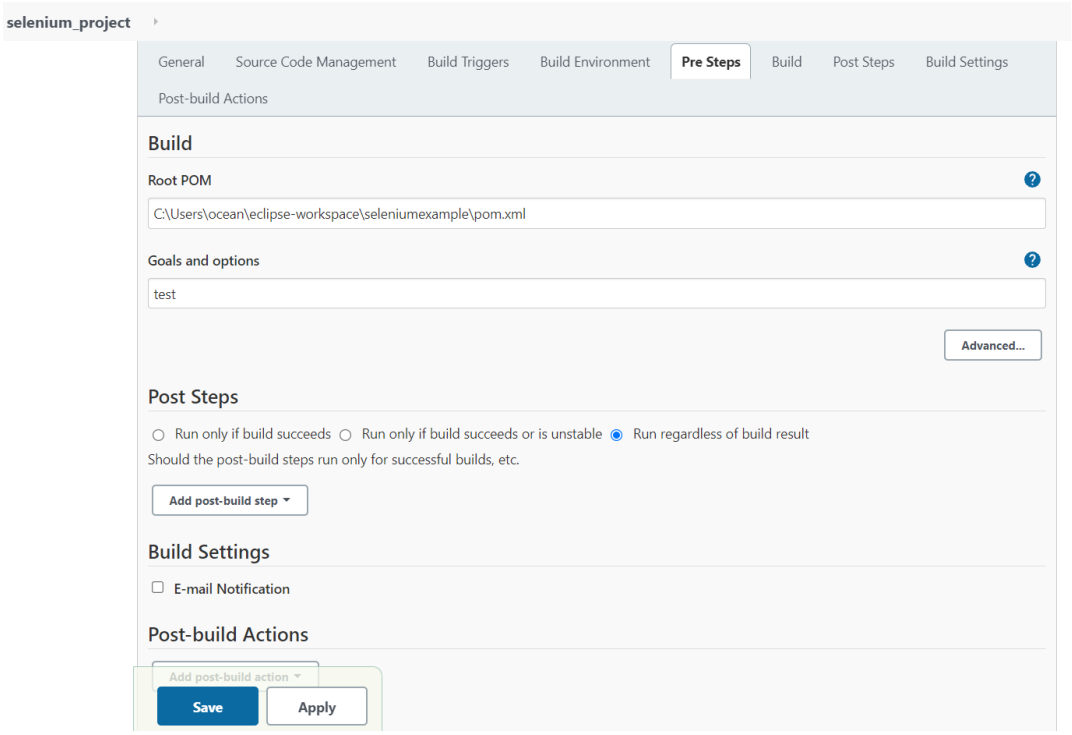
1. Create a maven job as Maven Project.



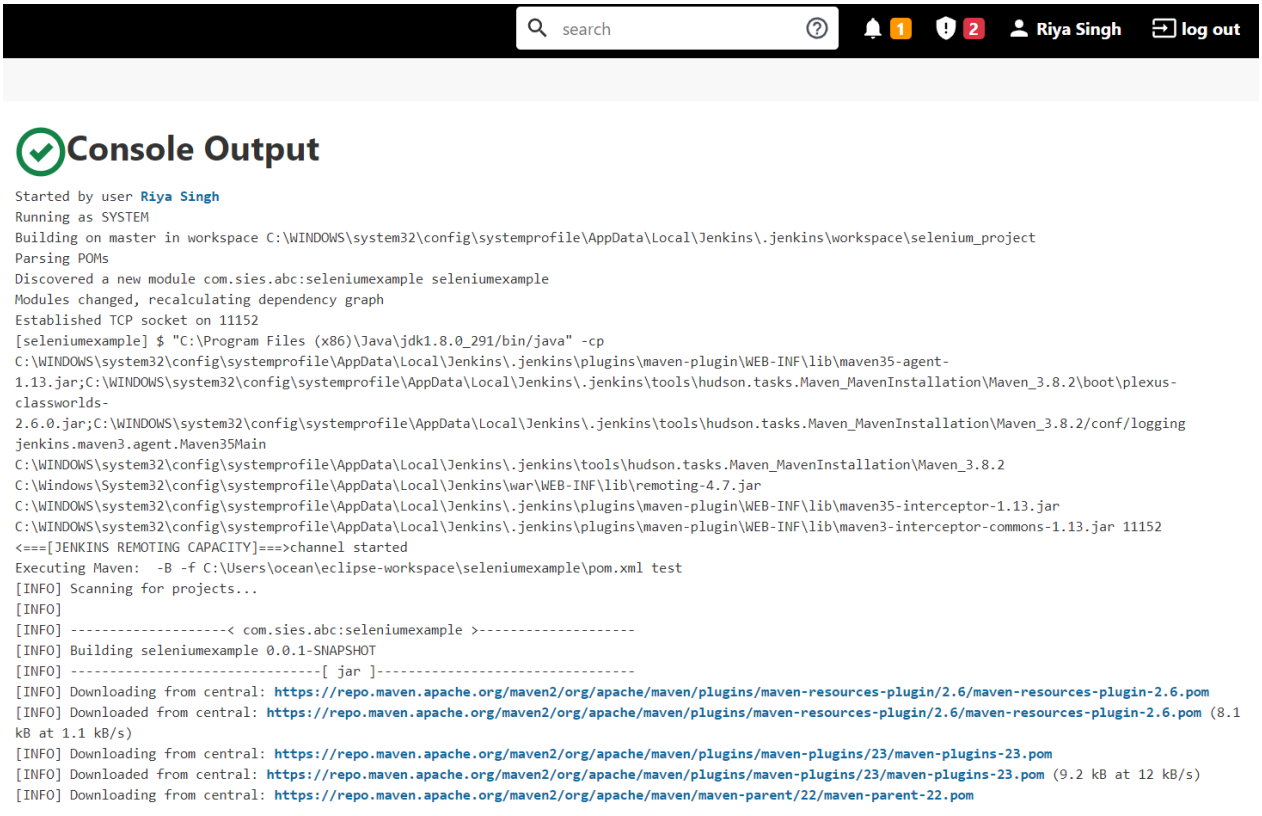
2. In Configure section - >go to Source Code Management -> Git - > paste this repo url => (Assuming our maven project is on Github repository) Note: Ensure that the GitHub Plugin is installed at this point. If it has not been installed, then do install it from Manage Jenkins-> Manage Plugins.



3. Go to Build section -> Write the goals and options as => clean test. Make sure Root POM is set to pom.xml. -> save and apply.



4. Go to build now -> console output and verify whether build as successful.



```
[INFO] Downloading from central: https://repo.maven.apache.org/maven2/org/apache/maven/wagon/wagon-provider-api/1.0-beta-2/wagon-provider-api-1.0-beta-2.jar
[INFO] Downloaded from central: https://repo.maven.apache.org/maven2/org/apache/maven/surefire/surefire-grouper/2.12.4/surefire-grouper-2.12.4.jar (38 kB at
59 kB/s)
[INFO] Downloaded from central: https://repo.maven.apache.org/maven2/org/apache/maven/wagon/wagon-provider-api/1.0-beta-2/wagon-provider-api-1.0-beta-2.jar
(46 kB at 78 kB/s)
[INFO] Downloaded from central: https://repo.maven.apache.org/maven2/org/apache/maven/maven-artifact/2.0/maven-artifact-2.0.jar (79 kB at 65 kB/s)
[INFO] Downloaded from central: https://repo.maven.apache.org/maven2/org/codehaus/plexus/plexus-utils/1.0.4/plexus-utils-1.0.4.jar (164 kB at 100 kB/s)

-------------------------------------------------------
 T E S T S
-------------------------------------------------------
Running seleniumexample.TestHelloWorld
Configuring TestNG with: org.apache.maven.surefire.testng.conf.TestNG652Configurator@f30e0a
Hello world test 1
Tests run: 1, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 3.578 sec

Results :

Tests run: 1, Failures: 0, Errors: 0, Skipped: 0

[JENKINS] Recording test results
[INFO] ------------------------------------------------------------------------
[INFO] BUILD SUCCESS
[INFO] ------------------------------------------------------------------------
[INFO] Total time:  04:28 min
[INFO] Finished at: 2021-09-26T20:44:55+05:30
[INFO] ------------------------------------------------------------------------
Waiting for Jenkins to finish collecting data
[JENKINS] Archiving C:\Users\ocean\eclipse-workspace\seleniumexample\pom.xml to com.sies.abc/seleniumexample/0.0.1-SNAPSHOT/seleniumexample-0.0.1-
SNAPSHOT.pom
channel stopped
Finished: SUCCESS
```

Conclusion:

Hence, we successfully completed the setup of Eclipse IDE and have run Selenium tests using maven on:

a) Eclipse IDE
b) Jenkins

EXPERIMENT-6

Aim: To understand Docker Architecture and Container Life Cycle, install Docker and execute docker commands to manage images and interact with containers.

Theory:

Docker Engine is an open source containerization technology for building and containerizing your applications. Docker Engine acts as a client-server application with:

- A server with a long-running daemon process dockerd.
- APIs which specify interfaces that programs can use to talk to and instruct the Docker daemon.
- A command line interface (CLI) client docker.

The CLI uses Docker APIs to control or interact with the Docker daemon through scripting or direct CLI commands. Many other Docker applications use the underlying API and CLI. The daemon creates and manage Docker objects, such as images, containers, networks, and volumes.

Docker uses a client-server architecture. The Docker client talks to the Docker daemon, which does the heavy lifting of building, running, and distributing your Docker containers. The Docker client and daemon can run on the same system, or you can connect a Docker client to a remote Docker daemon. The Docker client and daemon communicate using a REST API, over UNIX sockets or a network interface. Another Docker client is Docker Compose, that lets you work with applications consisting of a set of containers.

The Docker daemon
The Docker daemon (dockerd) listens for Docker API requests and manages Docker objects such as images, containers, networks, and volumes. A daemon can also communicate with other daemons to manage Docker services.

The Docker client
The Docker client (docker) is the primary way that many Docker users interact with Docker. When you use commands such as docker run, the client sends these commands to dockerd, which carries them out. The docker command uses the Docker API. The Docker client can communicate with more than one daemon.

Docker registries
A Docker registry stores Docker images. Docker Hub is a public registry that anyone can use, and Docker is configured to look for images on Docker Hub by default. You can even run your own private registry.
When you use the docker pull or docker run commands, the required images are pulled from your

configured registry. When you use the docker push command, your image is pushed to your configured registry.

Docker objects

When you use Docker, you are creating and using images, containers, networks, volumes, plugins, and other objects. This section is a brief overview of some of those objects.

Images

An image is a read-only template with instructions for creating a Docker container. Often, an image is based on another image, with some additional customization. For example, you may build an image which is based on the ubuntu image, but installs the Apache web server and your application, as well as the configuration details needed to make your application run.

You might create your own images or you might only use those created by others and published in a registry. To build your own image, you create a Dockerfile with a simple syntax for defining the steps needed to create the image and run it. Each instruction in a Dockerfile creates a layer in the image. When you change the Dockerfile and rebuild the image, only those layers which have changed are rebuilt. This is part of what makes images so lightweight, small, and fast, when compared to other virtualization technologies.

Containers

A container is a runnable instance of an image. You can create, start, stop, move, or delete a container using the Docker API or CLI. You can connect a container to one or more networks, attach storage to it, or even create a new image based on its current state.

By default, a container is relatively well isolated from other containers and its host machine. You can control how isolated a container's network, storage, or other underlying subsystems are from other containers or from the host machine.

A container is defined by its image as well as any configuration options you provide to it when you create or start it. When a container is removed, any changes to its state that are not stored in persistent storage disappear.

There are different stages when we create a Docker container which is known as Docker Container Lifecycle. Some of the states are:

- **Created**: A container that has been created but not started
- **Running**: A container running with all its processes
- **Paused**: A container whose processes have been paused
- **Stopped**: A container whose processes have been stopped
- **Deleted**: A container in a dead state

Installation of Docker:

To get started with Docker Engine on Ubuntu, make sure you meet the prerequisites, and then install Docker.

Prerequisites: OS requirements

To install Docker Engine, you need the 64-bit version of one of these Ubuntu versions:

- Ubuntu Hirsute 21.04
- Ubuntu Focal 20.04 (LTS)
- Ubuntu Bionic 18.04 (LTS)

Installation methods: You can install Docker Engine in different ways, depending on your needs:

1. Most users set up Docker's repositories and install from them
2. Some users download the DEB package and install it manually and manage upgrades completely manually.
3. In testing and development environments, some users choose to use automated convenience scripts to install Docker.

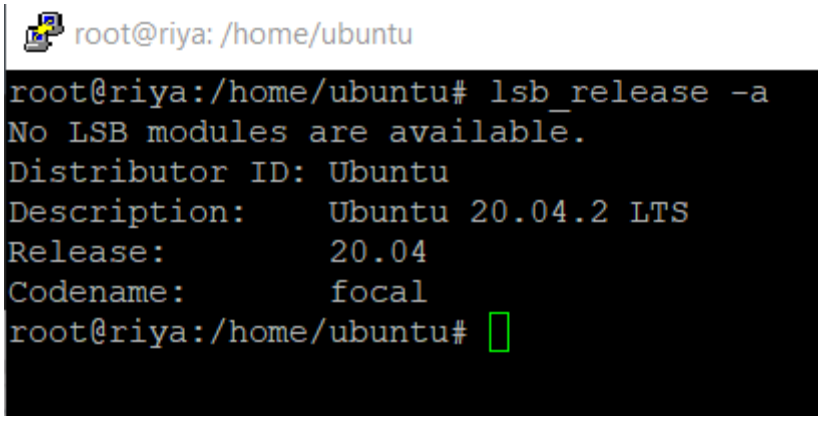
Install using the convenience script: Docker provides a convenience script at get.docker.com to install Docker into development environments quickly and non-interactively. This example downloads the script from get.docker.com and runs it to install the latest stable release of Docker on Linux:

$ curl -fsSL https://get.docker.com -o get-docker.sh

$ sudo sh get-docker.sh

Procedure:

To get OS detail and version
it77@it77-OptiPlex-3050 :~$ lsb_release -a



Uninstall old versions
it77@it77-OptiPlex-3050 :~$ sudo su
t77@it77-OptiPlex-305i0 :~$ sudo apt-get remove docker docker-engine docker.io containerd runc

```
root@riya:/home/ubuntu# sudo apt-get remove docker docker-engine docker.io conta
inerd runc
Reading package lists... Done
Building dependency tree
Reading state information... Done
Package 'docker-engine' is not installed, so not removed
Package 'docker' is not installed, so not removed
Package 'containerd' is not installed, so not removed
Package 'runc' is not installed, so not removed
Package 'docker.io' is not installed, so not removed
0 upgraded, 0 newly installed, 0 to remove and 114 not upgraded.
root@riya:/home/ubuntu#
```

it77@it77-OptiPlex-3050 :~$ sudo apt install curl

```
root@riya:/home/ubuntu# sudo apt install curl
Reading package lists... Done
Building dependency tree
Reading state information... Done
curl is already the newest version (7.68.0-1ubuntu2.7).
0 upgraded, 0 newly installed, 0 to remove and 114 not upgraded.
root@riya:/home/ubuntu#
```

root@it77-OptiPlex-3050:/home/it77# curl -fsSL https://get.docker.com -o get-docker.sh

root@it77-OptiPlex-3050:/home/it77# ls

```
root@riya:/home/ubuntu# curl -fsSL https://get.docker.com -o get-docker.sh
root@riya:/home/ubuntu# ls
get-docker.sh
root@riya:/home/ubuntu#
```

root@it77-OptiPlex-3050:/home/it77# sudo sh get-docker.sh

root@riya: /home/ubuntu

```
root@riya:/home/ubuntu# sudo sh get-docker.sh
# Executing docker install script, commit: 93d2499759296ac1f9c510605fef85052a2c3
2be
Warning: the "docker" command appears to already exist on this system.

If you already have Docker installed, this script can cause trouble, which is
why we're displaying this warning and provide the opportunity to cancel the
installation.

If you installed the current Docker package using this script and are using it
again to update Docker, you can safely ignore this message.

You may press Ctrl+C now to abort this script.
+ sleep 20
+ sh -c apt-get update -qq >/dev/null
+ sh -c DEBIAN_FRONTEND=noninteractive apt-get install -y -qq apt-transport-http
s ca-certificates curl >/dev/null
+ sh -c curl -fsSL "https://download.docker.com/linux/ubuntu/gpg" | gpg --dearmo
r --yes -o /usr/share/keyrings/docker-archive-keyring.gpg
+ sh -c echo "deb [arch=amd64 signed-by=/usr/share/keyrings/docker-archive-keyri
ng.gpg] https://download.docker.com/linux/ubuntu focal stable" > /etc/apt/source
s.list.d/docker.list
+ sh -c apt-get update -qq >/dev/null
+ sh -c DEBIAN_FRONTEND=noninteractive apt-get install -y -qq --no-install-recom
mends  docker-ce-cli docker-scan-plugin docker-ce >/dev/null
+ version_gte 20.10
+ [ -z  ]
+ return 0
+ sh -c DEBIAN_FRONTEND=noninteractive apt-get install -y -qq docker-ce-rootless
-extras >/dev/null
+ sh -c docker version
Client: Docker Engine - Community
 Version:           20.10.9
 API version:       1.41
 Go version:        go1.16.8
 Git commit:        c2ea9bc
 Built:             Mon Oct  4 16:08:29 2021
 OS/Arch:           linux/amd64
 Context:           default
 Experimental:      true

Server: Docker Engine - Community
 Engine:
  Version:          20.10.9
  API version:      1.41 (minimum version 1.12)
  Go version:       go1.16.8
  Git commit:       79ea9d3
  Built:            Mon Oct  4 16:06:37 2021
  OS/Arch:          linux/amd64
  Experimental:     false
```

```
Server: Docker Engine - Community
 Engine:
  Version:          20.10.9
  API version:      1.41 (minimum version 1.12)
  Go version:       go1.16.8
  Git commit:       79ea9d3
  Built:            Mon Oct  4 16:06:37 2021
  OS/Arch:          linux/amd64
  Experimental:     false
 containerd:
  Version:          1.4.11
  GitCommit:        5b46e404f6b9f661a205e28d59c982d3634148f8
 runc:
  Version:          1.0.2
  GitCommit:        v1.0.2-0-g52b36a2
 docker-init:
  Version:          0.19.0
  GitCommit:        de40ad0

================================================================================

To run Docker as a non-privileged user, consider setting up the
Docker daemon in rootless mode for your user:

    dockerd-rootless-setuptool.sh install

Visit https://docs.docker.com/go/rootless/ to learn about rootless mode.


To run the Docker daemon as a fully privileged service, but granting non-root
users access, refer to https://docs.docker.com/go/daemon-access/

WARNING: Access to the remote API on a privileged Docker daemon is equivalent
         to root access on the host. Refer to the 'Docker daemon attack surface'
         documentation for details: https://docs.docker.com/go/attack-surface/

================================================================================

root@riya:/home/ubuntu#
```

Basic Docker Commands:

Check the version of Docker installed

root@it77-OptiPlex-3050:/home/it77# docker –version

```
root@riya:/home/ubuntu# docker --version
Docker version 20.10.9, build c2ea9bc
root@riya:/home/ubuntu#
```

Running existing Docker images: Go to Docker public repository at https://hub.docker.com to get the official images available for testing purpose

Run docker image

root@it77-OptiPlex-3050:/home/it77# docker run docker/whalesay cowsay hello_you

root@it77-OptiPlex-3050:/home/it77# docker run docker/whalesay cowsay hello_me

Check all pulled images

root@it77-OptiPlex-3050:/home/it77# docker images

```
root@riya:/home/ubuntu# docker images
REPOSITORY          TAG       IMAGE ID       CREATED        SIZE
riya                v44       c5fdc106be15   11 days ago    163MB
ubuntu              latest    597ce1600cf4   2 weeks ago    72.8MB
postgres            latest    6ce504119cc8   2 weeks ago    374MB
docker/whalesay     latest    6b362a9f73eb   6 years ago    247MB
```

Pull the sample images

root@it77-OptiPlex-3050:/home/it77# sudo docker pull postgres

```
root@riya:/home/ubuntu# sudo docker pull postgres
Using default tag: latest
latest: Pulling from library/postgres
7d63c13d9b9b: Pull complete
cad0f9d5f5fe: Pull complete
ff74a7a559cb: Pull complete
c43dfd845683: Pull complete
e554331369f5: Pull complete
d25d54a3ac3a: Pull complete
bbc6df00588c: Pull complete
d4deb2e86480: Pull complete
cb59c7cc00aa: Pull complete
80c65de48730: Pull complete
1525521889be: Pull complete
38df9e245e81: Pull complete
380030b85e81: Pull complete
Digest: sha256:eb83331cc518946d8ee1b52e6d9e97d0cdef6195b7bf25323004f2968e91a825
Status: Downloaded newer image for postgres:latest
docker.io/library/postgres:latest
```

Check all running container

root@it77-OptiPlex-3050:/home/it77# docker ps // note the container id

```
root@riya:/home/ubuntu# docker ps
CONTAINER ID   IMAGE     COMMAND   CREATED   STATUS    PORTS     NAMES
```

root@it77-OptiPlex-3050:/home/it77# docker ps -a //previously ran containers

```
root@riya:/home/ubuntu# docker ps -a
CONTAINER ID   IMAGE             COMMAND                  CREATED         STATUS
                    PORTS     NAMES
3a23b46db17c   docker/whalesay   "cowsay hello_me"        3 minutes ago   Exited
 (0) 3 minutes ago            tender_haslett
9d24292f5542   docker/whalesay   "cowsay hello_you"       4 minutes ago   Exited
 (0) 4 minutes ago            pedantic_herschel
409ecf8fa654   riya:v44          "nginx -g 'daemon of…"   11 days ago     Exited
 (0) 11 days ago              intelligent_einstein
c33364f48252   5d259d090daf      "/bin/sh -c 'apt ins…"   11 days ago     Exited
 (1) 11 days ago              friendly_raman
07ebe5b9b801   5d259d090daf      "/bin/sh -c 'apt ins…"   11 days ago     Exited
 (100) 11 days ago            eloquent_lehmann
f97d70b7bfe7   967ecfde73da      "/bin/sh -c 'apt upd…"   11 days ago     Exited
 (100) 11 days ago            unruffled_chatelet
1210b682107a   ubuntu:latest     "bash"                   11 days ago     Exited
 (127) 11 days ago            jovial_euclid
f2e55c0c248f   docker/whalesay   "cowsay hello_you"       11 days ago     Exited
 (0) 11 days ago              jolly_ride
```

Pull the docker image of Ubuntu

root@it77-OptiPlex-3050:/home/it77# docker pull ubuntu:latest

```
root@riya:/home/ubuntu# docker pull ubuntu:latest
latest: Pulling from library/ubuntu
7b1a6ab2e44d: Pull complete
Digest: sha256:626ffe58f6e7566e00254b638eb7e0f3b11d4da9675088f4781a50ae288f3322
Status: Downloaded newer image for ubuntu:latest
docker.io/library/ubuntu:latest
```

root@it77-OptiPlex-3050:/home/it77# docker images

```
root@riya:/home/ubuntu# docker images
REPOSITORY        TAG       IMAGE ID       CREATED         SIZE
ubuntu            latest    ba6acccedd29   16 hours ago    72.8MB
postgres          latest    d191afba1bb1   4 days ago      374MB
riya              v44       c5fdc106be15   11 days ago     163MB
ubuntu            <none>    597ce1600cf4   2 weeks ago     72.8MB
postgres          <none>    6ce504119cc8   2 weeks ago     374MB
```

Run the command in a container: Getting a bash in Ubuntu

root@it77-OptiPlex-3050:/home/it77# docker run -it ubuntu:latest bash

```
root@riya:/home/ubuntu# docker run -it ubuntu:latest bash
root@951c413324c4:/#
```

root@it77-OptiPlex-3050:/home/it77# docker ps

```
ubuntu@riya:~$ docker ps
CONTAINER ID   IMAGE          COMMAND   CREATED          STATUS          PORTS
    NAMES
8be05b4cdfcf   ubuntu:latest   "bash"    11 seconds ago   Up 10 seconds
    admiring_mayer
```

Create an Apache Server and host index.html in the Containers

root@67e9bd16d77b:/# apt update

```
root@riya:/home/ubuntu# apt update
Hit:1 https://download.docker.com/linux/ubuntu focal InRelease
Get:2 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu focal InRelease [265 kB]
Hit:3 http://security.ubuntu.com/ubuntu focal-security InRelease
Hit:4 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu focal-updates InRelease
Hit:5 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu focal-backports InRelease
Fetched 265 kB in 1s (210 kB/s)
Reading package lists... Done
Building dependency tree
Reading state information... Done
119 packages can be upgraded. Run 'apt list --upgradable' to see them.
```

root@67e9bd16d77b:/# apt install apache2

```
root@riya:/home/ubuntu# apt install apache2
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  apache2-bin apache2-data apache2-utils
Suggested packages:
  apache2-doc apache2-suexec-pristine | apache2-suexec-custom www-browser
The following packages will be upgraded:
  apache2 apache2-bin apache2-data apache2-utils
4 upgraded, 0 newly installed, 0 to remove and 115 not upgraded.
Need to get 1519 kB of archives.
After this operation, 0 B of additional disk space will be used.
Do you want to continue? [Y/n] y
Get:1 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu focal-updates/main amd64 a
pache2 amd64 2.4.41-4ubuntu3.7 [95.6 kB]
Get:2 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu focal-updates/main amd64 a
pache2-bin amd64 2.4.41-4ubuntu3.7 [1180 kB]
Get:3 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu focal-updates/main amd64 a
pache2-data all 2.4.41-4ubuntu3.7 [159 kB]
Get:4 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu focal-updates/main amd64 a
pache2-utils amd64 2.4.41-4ubuntu3.7 [84.4 kB]
Fetched 1519 kB in 2s (992 kB/s)
(Reading database ... 64961 files and directories currently installed.)
Preparing to unpack .../apache2_2.4.41-4ubuntu3.7_amd64.deb ...
Unpacking apache2 (2.4.41-4ubuntu3.7) over (2.4.41-4ubuntu3.6) ...
Preparing to unpack .../apache2-bin_2.4.41-4ubuntu3.7_amd64.deb ...
Unpacking apache2-bin (2.4.41-4ubuntu3.7) over (2.4.41-4ubuntu3.6) ...
Preparing to unpack .../apache2-data_2.4.41-4ubuntu3.7_all.deb ...
Unpacking apache2-data (2.4.41-4ubuntu3.7) over (2.4.41-4ubuntu3.6) ...
Preparing to unpack .../apache2-utils_2.4.41-4ubuntu3.7_amd64.deb ...
Unpacking apache2-utils (2.4.41-4ubuntu3.7) over (2.4.41-4ubuntu3.6) ...
Setting up apache2-bin (2.4.41-4ubuntu3.7) ...
Setting up apache2-data (2.4.41-4ubuntu3.7) ...
Setting up apache2-utils (2.4.41-4ubuntu3.7) ...
Setting up apache2 (2.4.41-4ubuntu3.7) ...
Processing triggers for systemd (245.4-4ubuntu3.6) ...
Processing triggers for man-db (2.9.1-1) ...
Processing triggers for ufw (0.36-6) ...
root@riya:/home/ubuntu#
```

root@67e9bd16d77b:/# cd /var/www/html

root@67e9bd16d77b:/var/www/html# mv index.html index.backup

root@67e9bd16d77b:/var/www/html# ls

```
root@riya:/home/ubuntu# cd /var/www/html
root@riya:/var/www/html# mv index.html index.backup
root@riya:/var/www/html# ls
index.backup
root@riya:/var/www/html#
```

root@67e9bd16d77b:/var/www/html# apt install nano

```
root@riya:/var/www/html# apt install nano
Reading package lists... Done
Building dependency tree
Reading state information... Done
nano is already the newest version (4.8-1ubuntu1).
0 upgraded, 0 newly installed, 0 to remove and 115 not upgraded.
root@riya:/var/www/html#
```

root@67e9bd16d77b:/var/www/html# nano index.html

root@riya: /var/www/html

```
 GNU nano 4.8                          index.html


<html>

<title> First page</title>

<body bgcolor="Yellow">

<h1>Riya Singh</h1>

</body>

</html>




                        [ Wrote 13 lines ]
^G Get Help  ^O Write Out ^W Where Is  ^K Cut Text  ^J Justify   ^C Cur Pos
^X Exit      ^R Read File ^\ Replace   ^U Paste Text^T To Spell  ^_ Go To Line
```

root@67e9bd16d77b:/var/www/html# service apache2 restart

```
root@e0f2f6372a7e:/var/www/html# service apache2 restart
 * Restarting Apache httpd web server apache2
AH00558: apache2: Could not reliably determine the server's fully qualified doma
in name, using 172.17.0.2. Set the 'ServerName' directive globally to suppress t
his message
                                                                       [ OK ]
```

root@67e9bd16d77b:/var/www/html# service apache2 status

```
root@e0f2f6372a7e:/var/www/html# service apache2 status
 * apache2 is running
```

Commit an image by opening a new tab in the terminal:

root@it77-OptiPlex-3050:/home/it77# docker commit 67e9bd16d77b bushsk/ubuntu_1:v1

```
ubuntu@riya:~$ docker commit 8be05b4cdfcf riya18/riya:v1
sha256:dc8966a44682e8967535498999412138 4b2ae9fce35b5a0e413c342fd37d7fe7
```

Check the size and image and image id of the committed image

root@it77-OptiPlex-3050:/home/it77# docker images

```
ubuntu@riya:~$ docker images
REPOSITORY        TAG       IMAGE ID       CREATED          SIZE
riya18/riya       v1        dc8966a44682   45 seconds ago   72.8MB
ubuntu            latest    ba6acccedd29   17 hours ago     72.8MB
postgres          latest    d191afba1bb1   4 days ago       374MB
riya              v44       c5fdc106be15   11 days ago      163MB
ubuntu            <none>    597ce1600cf4   2 weeks ago      72.8MB
postgres          <none>    6ce504119cc8   2 weeks ago      374MB
bushsk/ubuntu_1   latest    473a86121ce5   6 months ago     221MB
docker/whalesay   latest    6b362a9f73eb   6 years ago      247MB
ubuntu@riya:~$
```

root@67e9bd16d77b:/var/www/html# exit

Link the port of container with the port of host machine

root@it77-OptiPlex-3050:/home/it77# docker run -itd -p 8888:80 --name **cid1** bushsk/ubuntu_1

```
root@riya:/home# docker run -itd -p 8888:80 --name riya riya18/riya:v1
c8e53de6ca09bcfff7e96ba2ad0aa68d687afcead2f9a346f3970a03d83657eb
```

root@it77-OptiPlex-3050:/home/it77# docker ps

```
ubuntu@riya:~$ docker ps
CONTAINER ID   IMAGE           COMMAND   CREATED          STATUS          PORTS
                  NAMES
c8e53de6ca09   riya18/riya:v1   "bash"    51 seconds ago   Up 50 seconds   0.0.0.0:8888->80/t
cp, :::8888->80/tcp   riya
ubuntu@riya:~$
```

root@it77-OptiPlex-3050:/home/it77# ufw allow 8888

```
root@riya:/home# ufw allow 8888
Rules updated
Rules updated (v6)
```

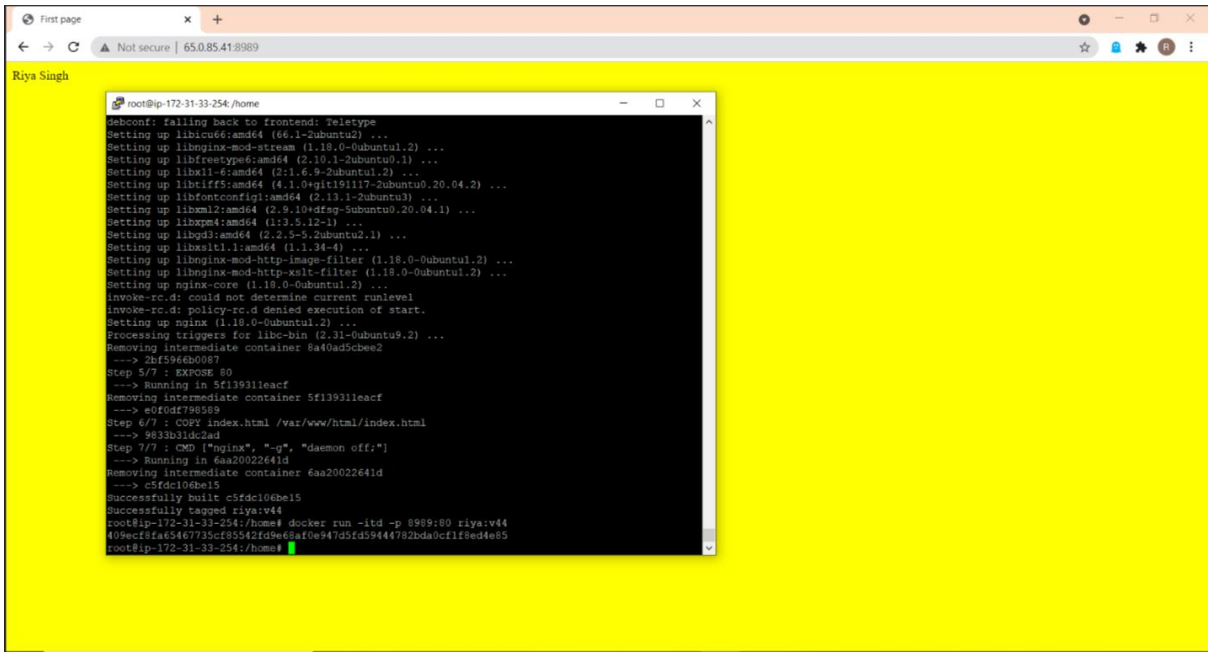
Start Apache in the container

root@it77-OptiPlex-3050:/home/it77# docker exec -it **948fbca4fa7d** service apache2 restart

```
root@ip-172-31-39-206:/home/ubuntu# docker exec -it 6e642bea8ced service apache2
 restart
 * Restarting Apache httpd web server apache2
AH00558: apache2: Could not reliably determine the server's fully qualified doma
in name, using 172.17.0.2. Set the 'ServerName' directive globally to suppress t
his message
                                                                       [ OK ]
```

root@it77-OptiPlex-3050:/home/it77# ifconfig

```
root@ip-172-31-39-206:/home/ubuntu# ifconfig
docker0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 172.17.0.1  netmask 255.255.0.0  broadcast 172.17.255.255
        inet6 fe80::42:bfff:fe03:4b4  prefixlen 64  scopeid 0x20<link>
        ether 02:42:bf:03:04:b4  txqueuelen 0  (Ethernet)
        RX packets 4439  bytes 245376 (245.3 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 5202  bytes 44024023 (44.0 MB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 9001
        inet 172.31.39.206  netmask 255.255.240.0  broadcast 172.31.47.255
        inet6 fe80::876:feff:fedb:9c0c  prefixlen 64  scopeid 0x20<link>
        ether 0a:76:fe:db:9c:0c  txqueuelen 1000  (Ethernet)
        RX packets 181515  bytes 264551104 (264.5 MB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 18220  bytes 1774502 (1.7 MB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 476  bytes 40741 (40.7 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 476  bytes 40741 (40.7 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

veth1e7fc6b: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet6 fe80::5404:1bff:fe35:f3bd  prefixlen 64  scopeid 0x20<link>
        ether 56:04:1b:35:f3:bd  txqueuelen 0  (Ethernet)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 14  bytes 1156 (1.1 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```



Login in hub

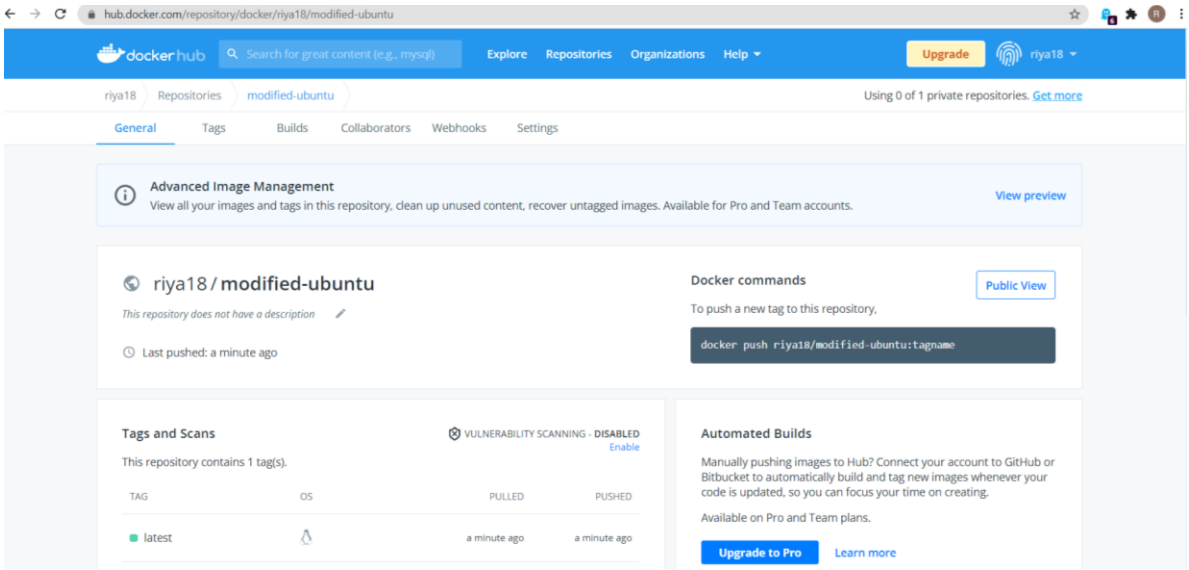
root@it77-OptiPlex-3050:/home/it77# docker login

```
root@riya:/home# docker login
Authenticating with existing credentials...
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
root@riya:/home#
```

Pushing the image on Docker Hub

root@it77-OptiPlex-3050:/home/it77# docker push bushsk/ubuntu_1

```
root@riya:/home# docker ps
CONTAINER ID   IMAGE           COMMAND   CREATED          STATUS          PORTS
                                  NAMES
c8e53de6ca09   riya18/riya:v1   "bash"    30 minutes ago   Up 30 minutes   0.0.0
.0:8888->80/tcp, :::8888->80/tcp   riya
root@riya:/home# docker commit c8e53de6ca09 riya18/modified-ubuntu
sha256:dc3ad06ca40d03c378067d69067c8b2335cb6ee58d59c566f77c20c4995daf61
root@riya:/home# docker images
REPOSITORY               TAG       IMAGE ID       CREATED          SIZE
riya18/modified-ubuntu   latest    dc3ad06ca40d   7 seconds ago    72.8MB
riya18/modified/ubuntu   latest    fe464b5fa813   2 minutes ago    72.8MB
riya18/riya              v1        dc8966a44682   37 minutes ago   72.8MB
ubuntu                   latest    ba6acccedd29   17 hours ago     72.8MB
postgres                 latest    d191afba1bb1   4 days ago       374MB
riya                     v44       c5fdc106be15   11 days ago      163MB
ubuntu                   <none>    597ce1600cf4   2 weeks ago      72.8MB
postgres                 <none>    6ce504119cc8   2 weeks ago      374MB
bushsk/ubuntu_1          latest    473a86121ce5   6 months ago     221MB
docker/whalesay          latest    6b362a9f73eb   6 years ago      247MB
root@riya:/home# docker push riya18/modified-ubuntu
Using default tag: latest
The push refers to repository [docker.io/riya18/modified-ubuntu]
6b355ecd4f5c: Pushed
4e571d608bd6: Pushed
9f54eef41275: Pushed
latest: digest: sha256:f15ef9e38cd9ee5a337829c257742cd6e6e702b061b450a2f7cbd10e5475485b size: 943
```



Stopping and removing containers using container id

root@it77-OptiPlex-3050:/home/it77# docker stop bd9fdf66daaf

```
root@riya:/home# docker stop  c8e53de6ca09
c8e53de6ca09
```

root@it77-OptiPlex-3050:/home/it77# docker kill bd9fdf66daaf -- > not advisable

root@it77-OptiPlex-3050:/home/it77# docker rm bd9fdf66daaf

root@it77-OptiPlex-3050:/home/it77# docker ps -a

Remove multiple containers using container ids:

root@it77-OptiPlex-3050:/home/it77# docker rm bd9 abc

root@it77-OptiPlex-3050:/home/it77# docker rm $(docker ps –aq)

root@it77-OptiPlex-3050:/home/it77# docker ps -a

Deleting the images

root@it77-OptiPlex-3050:/home/it77# docker images

```
root@riya:/home# docker images
REPOSITORY                TAG       IMAGE ID       CREATED          SIZE
riya18/modified-ubuntu    latest    dc3ad06ca40d   7 seconds ago    72.8MB
riya18/modified/ubuntu    latest    fe464b5fa813   2 minutes ago    72.8MB
riya18/riya               v1        dc8966a44682   37 minutes ago   72.8MB
ubuntu                    latest    ba6acccedd29   17 hours ago     72.8MB
postgres                  latest    d191afba1bb1   4 days ago       374MB
riya                      v44       c5fdc106be15   11 days ago      163MB
ubuntu                    <none>    597ce1600cf4   2 weeks ago      72.8MB
postgres                  <none>    6ce504119cc8   2 weeks ago      374MB
bushsk/ubuntu_1           latest    473a86121ce5   6 months ago     221MB
docker/whalesay           latest    6b362a9f73eb   6 years ago      247MB
```

root@it77-OptiPlex-3050:/home/it77# docker rmi 5c6

```
root@riya:/home# docker rmi fe464b5fa813
Untagged: riya18/modified/ubuntu:latest
Deleted: sha256:fe464b5fa8131b4e33a47231baae1343c7c5f0bee6d9e73de974a62a7d72ddf4
```

```
REPOSITORY                TAG       IMAGE ID       CREATED          SIZE
riya18/modified-ubuntu    latest    dc3ad06ca40d   4 minutes ago    72.8MB
riya18/riya               v1        dc8966a44682   42 minutes ago   72.8MB
ubuntu                    latest    ba6acccedd29   17 hours ago     72.8MB
postgres                  latest    d191afba1bb1   4 days ago       374MB
riya                      v44       c5fdc106be15   11 days ago      163MB
ubuntu                    <none>    597ce1600cf4   2 weeks ago      72.8MB
postgres                  <none>    6ce504119cc8   2 weeks ago      374MB
bushsk/ubuntu_1           latest    473a86121ce5   6 months ago     221MB
docker/whalesay           latest    6b362a9f73eb   6 years ago      247MB
```

Conclusion: Hence we have successfully understood the concept of Docker Architecture and Container Life Cycle, installed Docker and executed docker commands to manage images and interact with containers.

EXPERIMENT-7

Aim: To learn Dockerfile instructions, build an image for a sample web application using Dockerfile.

Theory: Docker can build images automatically by reading the instructions from a Dockerfile. A Dockerfile is a text document that contains all the commands a user could call on the command line to assemble an image. Using docker build users can create an automated build that executes several command-line instructions in succession. Docker also gives you the capability to create your own Docker images, and it can be done with the help of Docker Files. A Docker File is a simple text file with instructions on how to build your images.

The **FROM** keyword tells Docker, from which base image you want to base your image from. In our example, we are creating an image from the Ubuntu image.

The next command is the person who is going to maintain this image. Here you specify the **MAINTAINER** keyword and just mention the email ID.

The **RUN** command is used to run instructions against the image. In our case, we first update our Ubuntu system and then install the nginx server on our Ubuntu image.

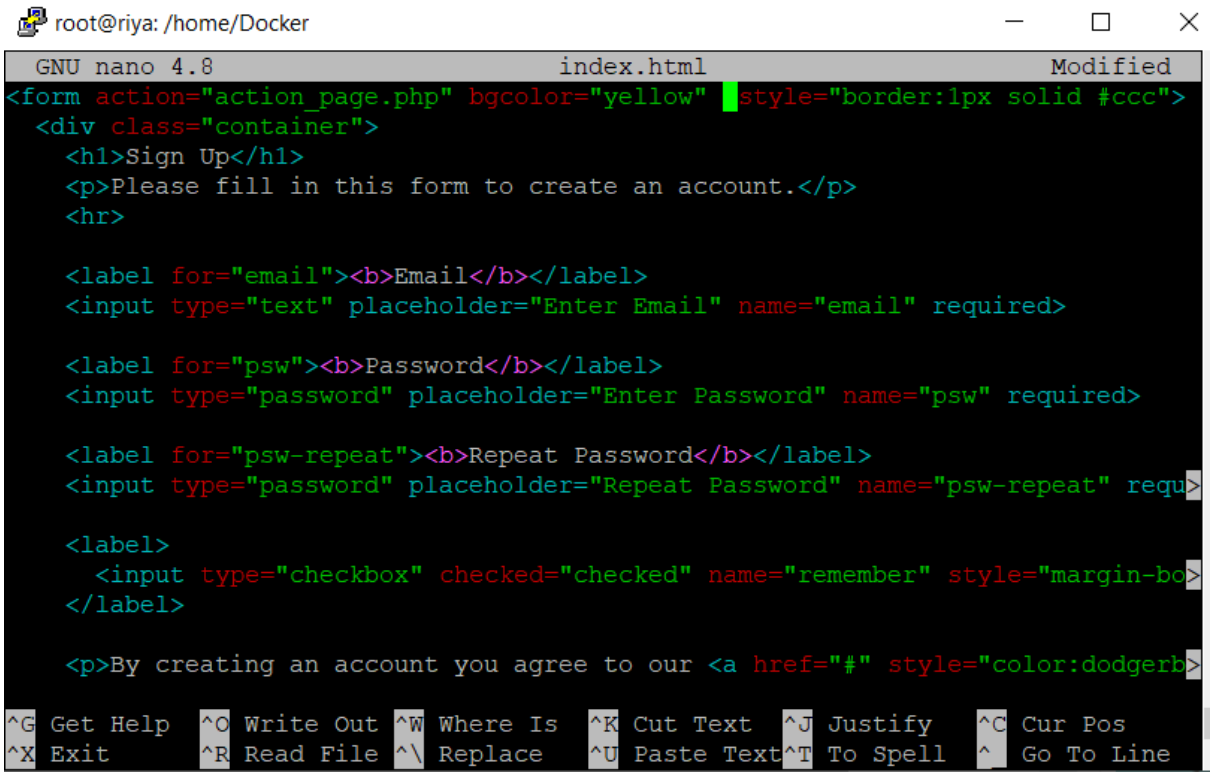
The last **CMD** command is used to display a message to the user.

Procedure:

1. Create a File and redirect your path into it

2. Make an HTML file containing the code of your webpage using nano command.

```
root@riya:/home# mkdir Docker
root@riya:/home# cd Docker
root@riya:/home/Docker# nano index.html
```



3. Create a file with the name, Dockerfile and write the following code using nano command

FROM ubuntu:latest

MAINTAINER "Riya"

RUN apt update -y

EXPOSE 80 # Exposing port 80 of web server

COPY index.html /var/www/html/index.html

CMD ["nginx", "-g", "daemon off;"]

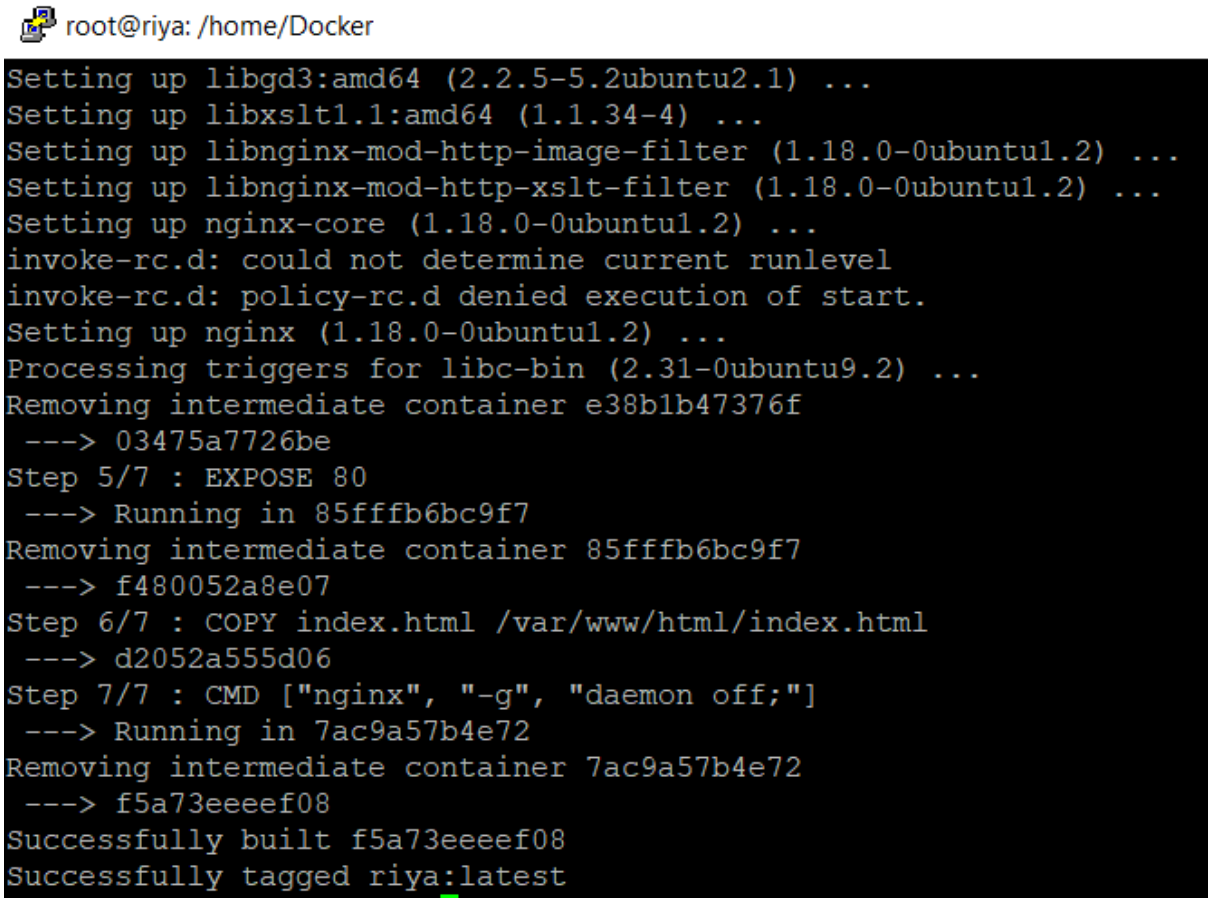
```
root@riya:/home/Docker# nano Dockerfile


Use "fg" to return to nano.

[2]+  Stopped                 nano Dockerfile
root@riya:/home/Docker#
```

root@riya: /home/Docker

```
  GNU nano 4.8                                Dockerfile
FROM ubuntu:latest
MAINTAINER "Riya"
RUN apt update -y
RUN apt install nginx
EXPOSE 80
COPY index.html /var/www/html/index.html
CMD ["nginx", "-g", "daemon off;"]
```

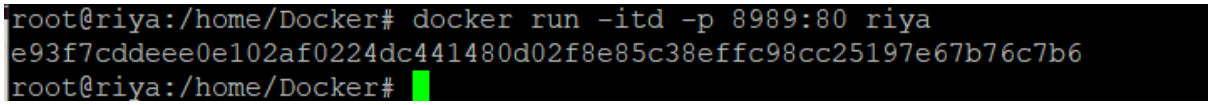
4. Run the following Build command

docker build -t pavani **.**

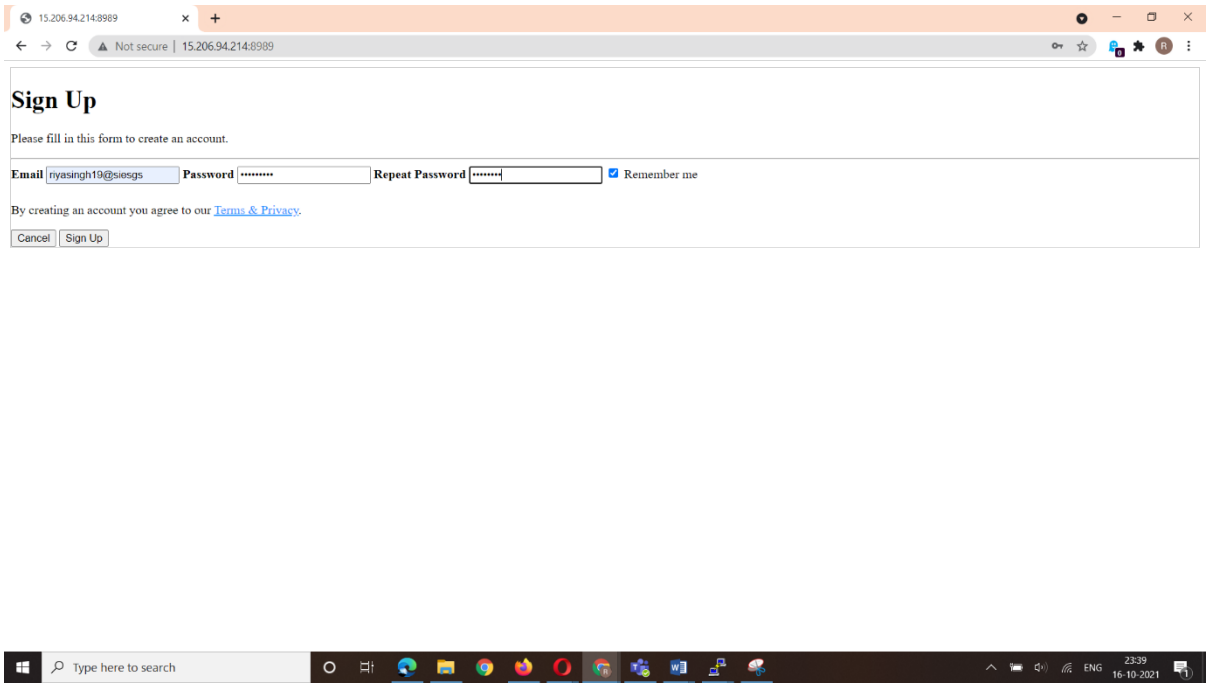


5. Run the following Run commands to activate the webpage on localhost
docker run -itd -p 8989:80 riya

ufw allow 8989



6. Open browser and put IP/localhost with port number as 8989 and run your web application.



Conclusion: Hence, we learnt Dockerfile instructions, built an image for a sample web application using Dockerfile.

EXPERIMENT-8

Aim: To install and configure Pull based Software Configuration Management and provisioning tools using Puppet.

Theory: Puppet is a tool that helps you manage and automate the configuration of servers. When you use Puppet, you define the desired state of the systems in your infrastructure that you want to manage. You do this by writing infrastructure code in Puppet's Domain-Specific Language (DSL)

— Puppet Code — which you can use with a wide array of devices and operating systems. Puppet code is declarative, which means that you describe the desired state of your systems, not the steps needed to get there. Puppet then automates the process of getting these systems into that state and keeping them there. Puppet does this through Puppet primary server and a Puppet agent. The Puppet primary server is the server that stores the code that defines your desired state. The Puppet agent translates your code into commands and then executes it on the systems you specify, in what is called a Puppet run.

You can configure systems with Puppet either in a client-server architecture, using the Puppet agent and Puppet master applications, or in a stand-alone architecture, using the Puppet apply application.

The agent-master architecture When set up as an agent-master architecture, a Puppet master server controls the configuration information, and each managed agent node requests its own configuration catalog from the master.

In this architecture, managed nodes run the Puppet agent application, usually as a background service. One or more servers run the Puppet master application, Puppet Server.

Periodically, each Puppet agent sends facts to the Puppet master, and requests a catalog. The master compiles and returns that node’s catalog, using several sources of information it has access to.

Once it receives a catalog, Puppet agent applies it to the node by checking each resource the catalog describes. If it finds any resources that are not in their desired state, it makes the changes necessary to correct them. Or, in no-op mode, it reports on what changes would have been done.

After applying the catalog, the agent sends a report to the Puppet master. For more information, see:

- Puppet Agent on *nix Systems
- Puppet Agent on Windows Systems
- Puppet Server Communications and security

Puppet agent nodes and Puppet masters communicate by HTTPS with client verification.

The Puppet master provides an HTTP interface, with various endpoints available. When requesting or submitting anything to the master, the agent makes an HTTPS request to one of those endpoints.

Client-verified HTTPS means each master or agent must have an identifying SSL certificate. They each examine their counterpart's certificate to decide whether to allow an exchange of information.

Puppet includes a built-in certificate authority for managing certificates. Agents can automatically request certificates through the master's HTTP API. You can use the puppet cert command to inspect requests and sign new certificates. And agents can then download the signed certificates.

Advantages of Puppet

- Puppet keeps on verifying the configuration at a specified interval (which you can modify as per requirement).

- Puppet defines the configurations for a host with the help of a language which is very easy to learn and is only used for that purpose.
- Mostly Puppet is used by all the industry like Google, red hat etc.
- The larger open-source developer base
- Its works very smooth, even when deployed in a large infrastructure (thousands of hosts to manage)

Installation of Puppet Master:

Setting hostname of Master and Agent:

```
ubuntu@riya2:~$ sudo su
root@riya2:/home/ubuntu# hostnamectl set-hostname puppet-master
root@riya2:/home/ubuntu# hostname
puppet-master
root@riya2:/home/ubuntu# exit
exit
ubuntu@riya2:~$ sudo su
root@puppet-master:/home/ubuntu#
```

```
root@puppet-master:/home/ubuntu# ifconfig
docker0: flags=4099<UP,BROADCAST,MULTICAST>  mtu 1500
        inet 172.17.0.1  netmask 255.255.0.0  broadcast 172.17.255.255
        ether 02:42:7a:a6:a0:4d  txqueuelen 0  (Ethernet)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 9001
        inet 172.31.33.254  netmask 255.255.240.0  broadcast 172.31.47.255
        inet6 fe80::6b:88ff:fede:ddec  prefixlen 64  scopeid 0x20<link>
        ether 02:6b:88:de:dd:ec  txqueuelen 1000  (Ethernet)
        RX packets 15489  bytes 20274966 (20.2 MB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 3805  bytes 407701 (407.7 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 388  bytes 33070 (33.0 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 388  bytes 33070 (33.0 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

```
root@puppet-master:/home/ubuntu# echo $(hostname -I) $(hostname)
172.31.33.254 172.17.0.1 puppet-master
root@puppet-master:/home/ubuntu#
```

```
root@puppet-master:/home/ubuntu# nano /etc/hosts
```

root@puppet-master: /home/ubuntu

```
  GNU nano 4.8                          /etc/hosts
127.0.0.1 localhost

# The following lines are desirable for IPv6 capable hosts
::1 ip6-localhost ip6-loopback
fe00::0 ip6-localnet
ff00::0 ip6-mcastprefix
ff02::1 ip6-allnodes
ff02::2 ip6-allrouters
ff02::3 ip6-allhosts
```

```
  GNU nano 4.8                          /etc/hosts
127.0.0.1 localhost
172.31.33.254 puppet-master

# The following lines are desirable for IPv6 capable hosts
::1 ip6-localhost ip6-loopback
fe00::0 ip6-localnet
ff00::0 ip6-mcastprefix
ff02::1 ip6-allnodes
ff02::2 ip6-allrouters
ff02::3 ip6-allhosts
```

Run apt update and upgrade your master

apt-get update && apt-get upgrade -y

root@puppet-master: /home/ubuntu

```
root@puppet-master:/home/ubuntu# apt-get update && apt-get upgrade -y
Get:1 https://download.docker.com/linux/ubuntu focal InRelease [57.7 kB]
Get:2 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu focal InRelease [265 kB
]
Get:3 http://security.ubuntu.com/ubuntu focal-security InRelease [114 kB]
Get:4 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu focal-updates InRelease
 [114 kB]
Get:5 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu focal-backports InRelea
se [101 kB]
Get:6 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu focal-updates/main amd6
4 Packages [1294 kB]
Get:7 http://security.ubuntu.com/ubuntu focal-security/main amd64 Packages [9
45 kB]
Get:8 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu focal-updates/main Tran
slation-en [269 kB]
Get:9 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu focal-updates/main amd6
4 c-n-f Metadata [14.4 kB]
Get:10 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu focal-updates/restrict
ed amd64 Packages [522 kB]
Get:11 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu focal-updates/restrict
ed Translation-en [74.8 kB]
Get:12 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu focal-updates/restrict
ed amd64 c-n-f Metadata [504 B]
Get:13 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu focal-updates/universe
 amd64 Packages [866 kB]
Get:14 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu focal-updates/universe
 Translation-en [186 kB]
Get:15 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu focal-updates/universe
 amd64 c-n-f Metadata [19.3 kB]
Get:16 http://security.ubuntu.com/ubuntu focal-security/main Translation-en [
178 kB]
Get:17 http://security.ubuntu.com/ubuntu focal-security/main amd64 c-n-f Meta
data [8840 B]
```

apt install puppetmaster -y

```
root@puppet-master:/home/ubuntu# apt install puppetmaster -y
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  augeas-lenses facter fonts-lato hiera javascript-common libaugeas0 libboost-filesystem1.71.0 libboost-locale1.71.0 libboost-log1.71.0 libboost-program-options1.71.0 libboost-regex1.71.0
  libboost-thread1.71.0 libcpp-hocon0.1.7 libfacter3.11.0 libjs-jquery libleatherman1.4.2 libruby2.7 libyaml-cpp0.6 puppet puppet-master rake ruby ruby-augeas ruby-deep-merge
  ruby-minitest ruby-net-telnet ruby-power-assert ruby-selinux ruby-shadow ruby-sync ruby-test-unit ruby-xmlrpc ruby2.7 rubygems-integration unzip zip
Suggested packages:
  augeas-doc mcollective-common puppet-common augeas-tools ruby-rrd ruby-hocon ri ruby-dev bundler
The following NEW packages will be installed:
  augeas-lenses facter fonts-lato hiera javascript-common libaugeas0 libboost-filesystem1.71.0 libboost-locale1.71.0 libboost-log1.71.0 libboost-program-options1.71.0 libboost-regex1.71.0
  libboost-thread1.71.0 libcpp-hocon0.1.7 libfacter3.11.0 libjs-jquery libleatherman1.4.2 libruby2.7 libyaml-cpp0.6 puppet puppet-master puppetmaster rake ruby ruby-augeas ruby-deep-merge
  ruby-minitest ruby-net-telnet ruby-power-assert ruby-selinux ruby-shadow ruby-sync ruby-test-unit ruby-xmlrpc ruby2.7 rubygems-integration unzip zip
0 upgraded, 37 newly installed, 0 to remove and 8 not upgraded.
Need to get 12.9 MB of archives.
After this operation, 66.1 MB of additional disk space will be used.
Get:1 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu focal/main amd64 fonts-lato all 2.0-2 [2698 kB]
Get:2 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu focal/universe amd64 augeas-lenses all 1.12.0-1build1 [308 kB]
Get:3 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu focal/main amd64 libboost-filesystem1.71.0 amd64 1.71.0-6ubuntu6 [242 kB]
Get:4 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu focal/main amd64 libboost-thread1.71.0 amd64 1.71.0-6ubuntu6 [249 kB]
Get:5 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu focal/main amd64 libboost-locale1.71.0 amd64 1.71.0-6ubuntu6 [430 kB]
Get:6 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu focal/main amd64 libboost-program-options1.71.0 amd64 1.71.0-6ubuntu6 [342 kB]
Get:7 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu focal/universe amd64 libboost-regex1.71.0 amd64 1.71.0-6ubuntu6 [471 kB]
Get:8 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu focal/universe amd64 libboost-log1.71.0 amd64 1.71.0-6ubuntu6 [612 kB]
Get:9 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu focal/universe amd64 libleatherman1.4.2 amd64 1.4.2+dfsg-2ubuntu3 [377 kB]
Get:10 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu focal/universe amd64 libcpp-hocon0.1.7 amd64 0.1.7-1build1 [366 kB]
```

puppet --version

service puppetmaster status

```
root@puppet-master:/home/ubuntu# puppet --version
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
5.5.10
root@puppet-master:/home/ubuntu# service puppetmaster status
● puppet-master.service - Puppet master
     Loaded: loaded (/lib/systemd/system/puppet-master.service; enabled; vendor preset: enab
     Active: active (running) since Sun 2021-10-24 10:43:07 UTC; 6min ago
       Docs: man:puppet-master(8)
   Main PID: 18013 (puppet)
      Tasks: 2 (limit: 1160)
     Memory: 62.3M
     CGroup: /system.slice/puppet-master.service
             └─18013 /usr/bin/ruby /usr/bin/puppet master

Oct 24 10:43:07 puppet-master puppet-master[17995]: Removing file Puppet::SSL::CertificateRe
Oct 24 10:43:07 puppet-master puppet-master[17995]: Removing file Puppet::SSL::CertificateRe
Oct 24 10:43:07 puppet-master puppet-master[17995]: The WEBrick Puppet master server is depr
Oct 24 10:43:07 puppet-master puppet-master[17995]:     (location: /usr/lib/ruby/vendor_ruby/
Oct 24 10:43:07 puppet-master puppet-master[17995]: Accessing 'bindaddress' as a setting is
Oct 24 10:43:07 puppet-master puppet-master[17995]:     (location: /usr/lib/ruby/vendor_ruby/
Oct 24 10:43:07 puppet-master puppet[17995]: /usr/lib/ruby/vendor_ruby/puppet/util.rb:315: w
Oct 24 10:43:07 puppet-master puppet-master[18013]: Reopening log files
Oct 24 10:43:07 puppet-master puppet-master[18013]: Starting Puppet master version 5.5.10
Oct 24 10:43:07 puppet-master systemd[1]: Started Puppet master.
```

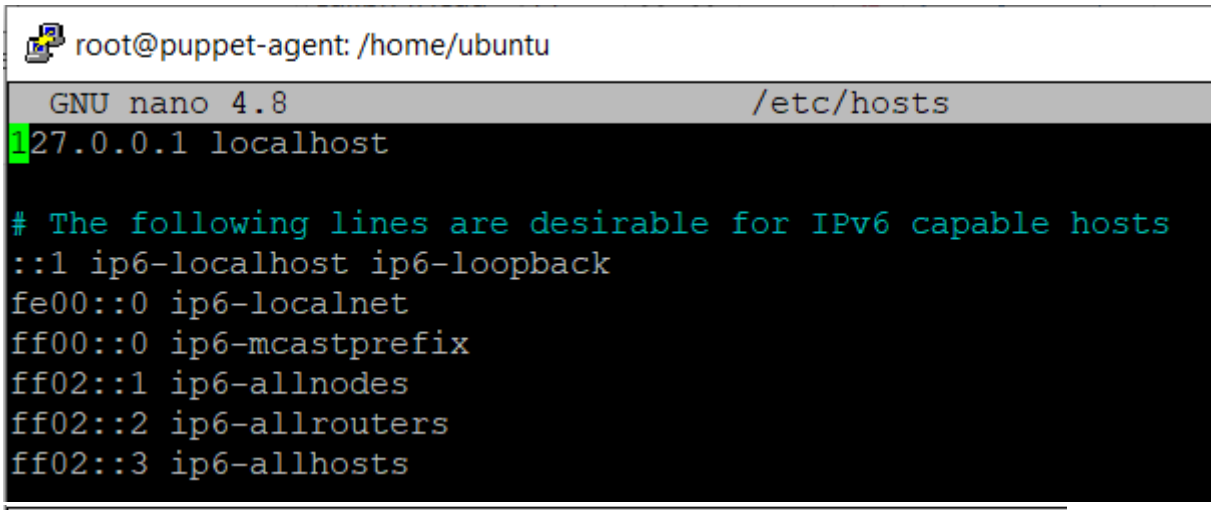
Installation of Puppet Agent:

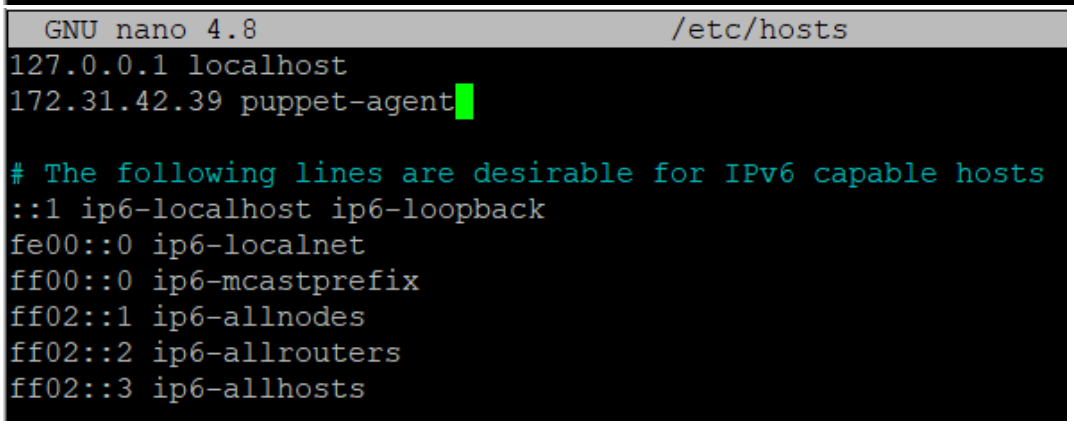
Setting hostname of Agent:

```
ubuntu@riya2:~$ sudo su
root@riya2:/home/ubuntu# hostnamectl set-hostname puppet-agent
root@riya2:/home/ubuntu# hostname
puppet-agent
root@riya2:/home/ubuntu# sudo su
root@puppet-agent:/home/ubuntu#
```

```
root@puppet-agent:/home/ubuntu# echo $(hostname -I) $(hostname)
172.31.42.39 puppet-agent
root@puppet-agent:/home/ubuntu#
```

```
root@puppet-agent:/home/ubuntu# nano /etc/hosts
```



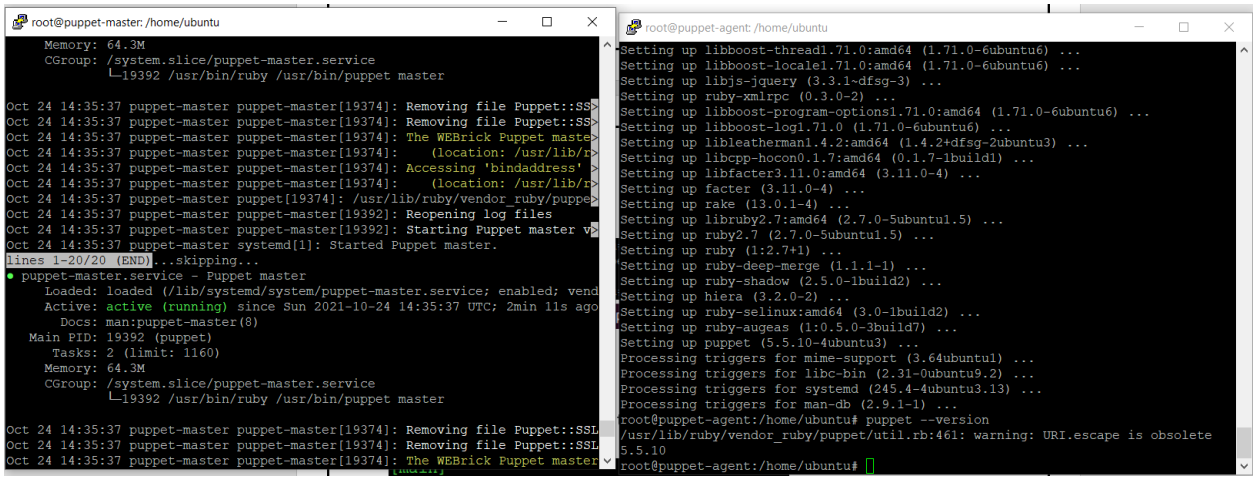


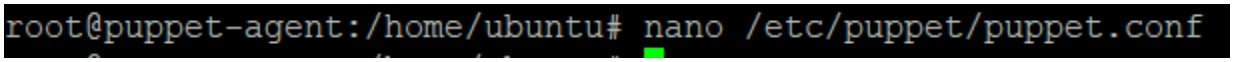
Run apt update and upgrade your agent

```
root@puppet-agent: /home/ubuntu
root@puppet-agent:/home/ubuntu# apt-get update && apt-get upgrade -y
Hit:1 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu focal InRelease
Get:2 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu focal-updates InRelease [1
14 kB]
Get:3 http://security.ubuntu.com/ubuntu focal-security InRelease [114 kB]
Get:4 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu focal-backports InRelease
[101 kB]
Get:5 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu focal-updates/main amd64 P
ackages [1294 kB]
Get:6 http://security.ubuntu.com/ubuntu focal-security/main amd64 Packages [945
kB]
Get:7 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu focal-updates/main Transla
tion-en [269 kB]
Get:8 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu focal-updates/main amd64 c
-n-f Metadata [14.4 kB]
Get:9 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu focal-updates/restricted a
md64 Packages [522 kB]
Get:10 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu focal-updates/restricted
Translation-en [74.8 kB]
Get:11 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu focal-updates/restricted
amd64 c-n-f Metadata [504 B]
Get:12 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu focal-updates/universe am
d64 Packages [866 kB]
Get:13 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu focal-updates/universe Tr
```

Install puppet on agent:

```
root@puppet-agent:/home/ubuntu# apt install puppet
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  augeas-lenses facter fonts-lato hiera javascript-common libaugeas0
  libboost-filesystem1.71.0 libboost-locale1.71.0 libboost-log1.71.0
  libboost-program-options1.71.0 libboost-regex1.71.0 libboost-thread1.71.0
  libcpp-hocon0.1.7 libfacter3.11.0 libjs-jquery libleatherman1.4.2 libruby2.7
  libyaml-cpp0.6 rake ruby ruby-augeas ruby-deep-merge ruby-minitest
  ruby-net-telnet ruby-power-assert ruby-selinux ruby-shadow ruby-sync
  ruby-test-unit ruby-xmlrpc ruby2.7 rubygems-integration unzip zip
Suggested packages:
  augeas-doc mcollective-common puppet-common apache2 | lighttpd | httpd
  augeas-tools ruby-rrd ruby-hocon ri ruby-dev bundler
The following NEW packages will be installed:
  augeas-lenses facter fonts-lato hiera javascript-common libaugeas0
  libboost-filesystem1.71.0 libboost-locale1.71.0 libboost-log1.71.0
  libboost-program-options1.71.0 libboost-regex1.71.0 libboost-thread1.71.0
  libcpp-hocon0.1.7 libfacter3.11.0 libjs-jquery libleatherman1.4.2 libruby2.7
  libyaml-cpp0.6 puppet rake ruby ruby-augeas ruby-deep-merge ruby-minitest
  ruby-net-telnet ruby-power-assert ruby-selinux ruby-shadow ruby-sync
  ruby-test-unit ruby-xmlrpc ruby2.7 rubygems-integration unzip zip
0 upgraded, 35 newly installed, 0 to remove and 8 not upgraded.
Need to get 12.9 MB of archives.
After this operation, 66.0 MB of additional disk space will be used.
```





Configure puppet master entry in puppet agent by adding foll. line into puppet.conf:

```
  GNU nano 4.8                  /etc/puppet/puppet.conf
[main]
ssldir = /var/lib/puppet/ssl
server = puppet-master

[master]
vardir = /var/lib/puppet
cadir  = /var/lib/puppet/ssl/ca
dns_alt_names = puppet




                               [ Wrote 8 lines ]
^G Get Help  ^O Write Out ^W Where Is  ^K Cut Text  ^J Justify   ^C Cur Pos
^X Exit      ^R Read File ^\ Replace   ^U Paste Text^T To Spell  ^_ Go To Line
```

Invoke or start puppet agent

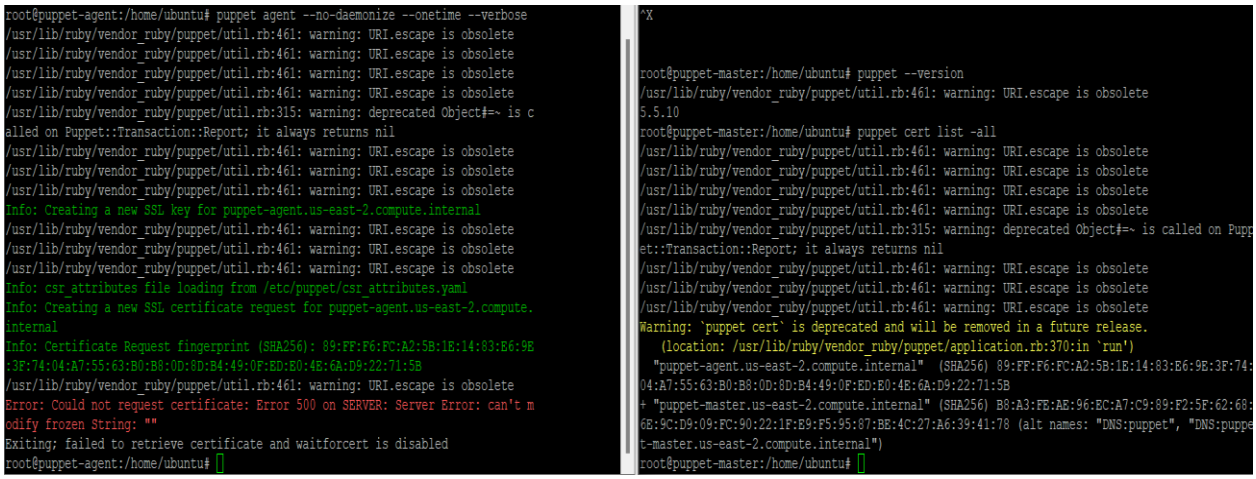
```
root@puppet-agent:/home/ubuntu# service puppet status
● puppet.service - Puppet agent
     Loaded: loaded (/lib/systemd/system/puppet.service; disabled; vendor prese>
     Active: inactive (dead)
       Docs: man:puppet-agent(8)
lines 1-4/4 (END)
```

puppet agent --no-daemonize --onetime --verbose

```
root@puppet-agent:/home/ubuntu# puppet agent --no-daemonize --onetime --verbose
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
/usr/lib/ruby/vendor_ruby/puppet/util.rb:315: warning: deprecated Object#=~ is c
alled on Puppet::Transaction::Report; it always returns nil
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
Info: Creating a new SSL key for puppet-agent.us-east-2.compute.internal
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
Info: csr_attributes file loading from /etc/puppet/csr_attributes.yaml
Info: Creating a new SSL certificate request for puppet-agent.us-east-2.compute.
internal
Info: Certificate Request fingerprint (SHA256): 89:FF:F6:FC:A2:5B:1E:14:83:E6:9E
:3F:74:04:A7:55:63:B0:B8:0D:8D:B4:49:0F:ED:E0:4E:6A:D9:22:71:5B
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
```

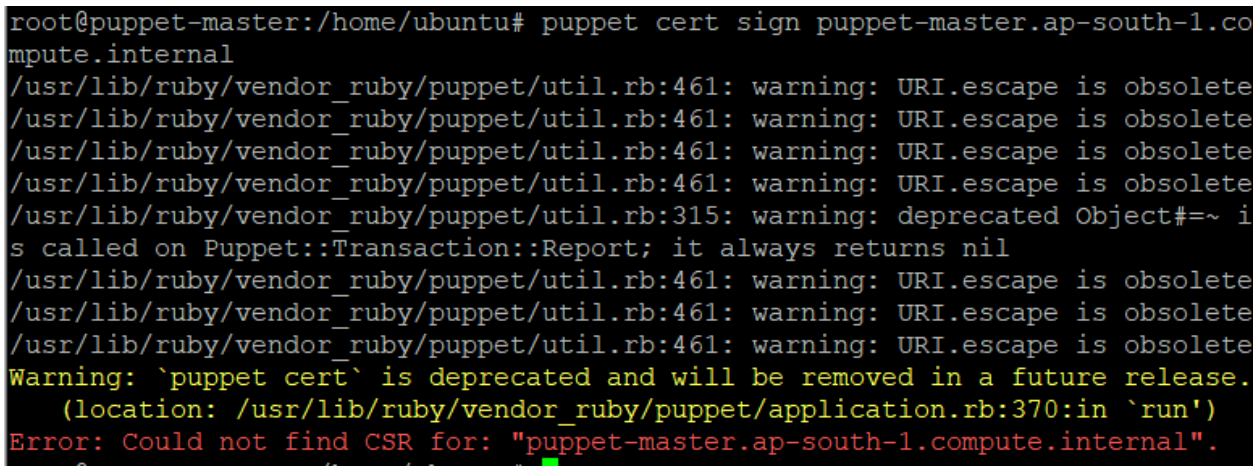
List all certificates on master

```
root@puppet-master:/home/ubuntu# puppet --version
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
5.5.10
root@puppet-master:/home/ubuntu# puppet cert list -all
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
/usr/lib/ruby/vendor_ruby/puppet/util.rb:315: warning: deprecated Object#=~ i
s called on Puppet::Transaction::Report; it always returns nil
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
Warning: `puppet cert` is deprecated and will be removed in a future release.
   (location: /usr/lib/ruby/vendor_ruby/puppet/application.rb:370:in `run')
+ "puppet-master.ap-south-1.compute.internal" (SHA256) 91:80:EC:76:79:82:D9:B
C:C2:9E:4B:96:B4:03:30:C5:86:A1:05:E5:FA:63:62:AE:2F:7B:E6:3C:69:42:EC:98 (al
t names: "DNS:puppet", "DNS:puppet-master.ap-south-1.compute.internal")
root@puppet-master:/home/ubuntu#
```



Sign certificate on puppet master:

puppet cert sign puppet-agent.localdomain



Enable your agent and set server:

```
root@puppet-agent:/home/ubuntu# puppet agent --enable
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
/usr/lib/ruby/vendor_ruby/puppet/util.rb:315: warning: deprecated Object#=~ is calle
d on Puppet::Transaction::Report; it always returns nil
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
root@puppet-agent:/home/ubuntu# puppet agent --server puppet-master
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
/usr/lib/ruby/vendor_ruby/puppet/util.rb:315: warning: deprecated Object#=~ is calle
d on Puppet::Transaction::Report; it always returns nil
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
```

Configure modules on puppet master to install curl on Agent:

```
root@puppet-agent:/home/ubuntu# apt install curl
Reading package lists... Done
Building dependency tree
Reading state information... Done
curl is already the newest version (7.68.0-1ubuntu2.7).
curl set to manually installed.
0 upgraded, 0 newly installed, 0 to remove and 8 not upgraded.
```

```
root@puppet-master:/home/ubuntu# cd /etc/puppet/code
root@puppet-master:/etc/puppet/code# mkdir -p environments/production/manifes
ts
root@puppet-master:/etc/puppet/code# ls
environments
root@puppet-master:/etc/puppet/code# cd environments/production/manifests# pw
d
bash: cd: too many arguments
root@puppet-master:/etc/puppet/code# cd environments/production/manifests
root@puppet-master:/etc/puppet/code/environments/production/manifests# pwd
/etc/puppet/code/environments/production/manifests
root@puppet-master:/etc/puppet/code/environments/production/manifests#
```

```
root@puppet-master:/etc/puppet/code/environments/production/manifests# nano s
ite.pp
```

root@puppet-master: /etc/puppet/code/environme

```
  GNU nano 4.8                                  s
node 'puppet-agent'{
        package {
            'curl':
                name => 'curl',
                ensure => installed,
        }
}
```

```
root@puppet-master:/etc/puppet/code/environments/production/manifests# puppet parser
validate site.pp
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
root@puppet-master:/etc/puppet/code/environments/production/manifests#
```

Conclusion:

Hence, we understood how to install and configure Pull based Software Configuration Management and provisioning tools using Puppet.

EXPERIMENT-9

Aim: To learn Software Configuration Management and provisioning using Puppet Blocks (Manifest, Modules, Classes, Function)

Theory: Puppet is a tool that helps you manage and automate the configuration of servers. Puppet provides the flexibility to integrate Reports with third-party tools using Puppet APIs.

Four types of Puppet building blocks are:

- Resources
- Classes
- Manifest
- Modules

Puppet Resources:
Puppet Resources are the building blocks of Puppet.

Resources are the inbuilt functions that run at the back end to perform the required operations in puppet.

Puppet Classes:
A combination of different resources can be grouped together into a single unit called class.

Puppet Manifest:
Manifest is a directory containing puppet DSL files. Those files have a .pp extension. The .pp extension stands for puppet program. The puppet code consists of definitions or declarations of Puppet Classes.

Puppet Modules:
Modules are a collection of files and directories such as Manifests, Class definitions. They are the re-usable and sharable units in Puppet. For example, the MySQL module to install and configure MySQL or the Jenkins module to manage Jenkins, etc.

There are three kinds of resource types:

1. Puppet core or built-in resource types.
2. Puppet defined resource types.
3. Puppet custom resource types.

Puppet core or built-in resource types:

Core or built-in resource types are the pre-built puppet resource types shipped with puppet software. All of the core or built-in Puppet resource types are written and maintained by Puppet team.

Puppet defined resource types:

Defined resource types are lightweight resource types written in Puppet declarative language using a combination of existing resource types.

Puppet custom resource types:

Custom resource types are completely customized resource types written in Ruby. Let's explore about puppet resource types …

Puppet classes

Puppet classes are the collection of puppet resources bundled together as a single unit. Puppet introduced classes to make the structure re-usable and organized.
First, we need to define a class using class definition syntax; classes must be unique and can be declared only once with the same name:

```
class <class-name> {

<Resource declarations>

}
```

Example:

```
class ntpconfig { file
   {

      "/etc/ntp.conf":

    ensure=> "present", content=> "server 0.centos.pool.ntp.org iburst\n",

   }

}
```

So far we have only defined the class, but we have not used it anywhere. Meaning this code that we have written will never get executed unless we declare this class elsewhere.

Conclusion:

Hence, we understood about Software Configuration Management and provisioning using Puppet Blocks (Manifest, Modules, Classes, Function).

EXPERIMENT-10

Aim: To provision a LAMP/MEAN Stack using Puppet Manifest.

Theory:

Puppet Manifest:

In Puppet, all the programs which are written using Ruby programming language and saved with an extension of .pp are called manifests. In general terms, all Puppet programs which are built with an intension of creating or managing any target host machine is called a manifest.

LAMP Stack:

The widely popular LAMP stack is a set of open source software used for web application development. For a web application to work smoothly, it has to include an operating system, a web server, a database, and a programming language. LAMP, on the other hand, stands for Linux, Apache, MySQL, and PHP, Perl, or Python. It's still relevant as it offers a great alternative to commercial software packages. Further, it works well as a bundle of programs that provide a robust platform to develop and implement web-based applications and servers.

MEAN Stack:

MEAN is a software bundle that stands for MongoDB, ExpressJS, AngularJS, and NodeJS. Together in a stack, these free programs enhance the simplicity of the web development process. Choosing MEAN over LAMP will provide your development team with the benefit of enhanced speed for data retrieval, flexibility in deployment, and a single language that's used from top to bottom.

Creating a puppet module:

Create the foll. dir structures to add a LAMP stack module and create a lamp class inside init.pp:

```
root@puppet-master:/# cd /etc/puppet/code
root@puppet-master:/etc/puppet/code# cd environments/production/manifests
root@puppet-master:/etc/puppet/code/environments/production/manifests# mkdir -p modul
es/lang/manifests
root@puppet-master:/etc/puppet/code/environments/production/manifests# cd modules/lan
g/manifests
root@puppet-master:/etc/puppet/code/environments/production/manifests/modules/lang/ma
nifests# nano init.pp
```

```
 GNU nano 4.8                                  init.pp
class lamp {
  # execute 'apt-get update'
  exec { 'apt-update':                    # exec resource named 'apt-update'
    command => '/usr/bin/apt-get update'  # command this resource will run
  }

  # install apache2 package
  package { 'apache2':
    require => Exec['apt-update'],        # require 'apt-update' before installing
    ensure => installed,
  }

  # ensure apache2 service is running
  service { 'apache2':
    ensure => running,
  }

  # install mysql-server package
  package { 'mysql-server':
    require => Exec['apt-update'],        # require 'apt-update' before installing
    ensure => installed,
  }

  # ensure mysql service is running
  service { 'mysql':
    ensure => running,
  }

  # install php package
  package { 'php':
    require => Exec['apt-update'],        # require 'apt-update' before installing
    ensure => installed,
  }
  # ensure info.php file exists
  file { '/var/www/html/info.php':
    ensure => file,
    content => '',    # phpinfo code
    require => Package['apache2'],        # require 'apache2' package before creating
  }
}
```

Include lamp class inside site.pp:

```
root@puppet-master:/etc/puppet/code/environments/production/manifests/modules/lang/ma
nifests# nano site.pp
```

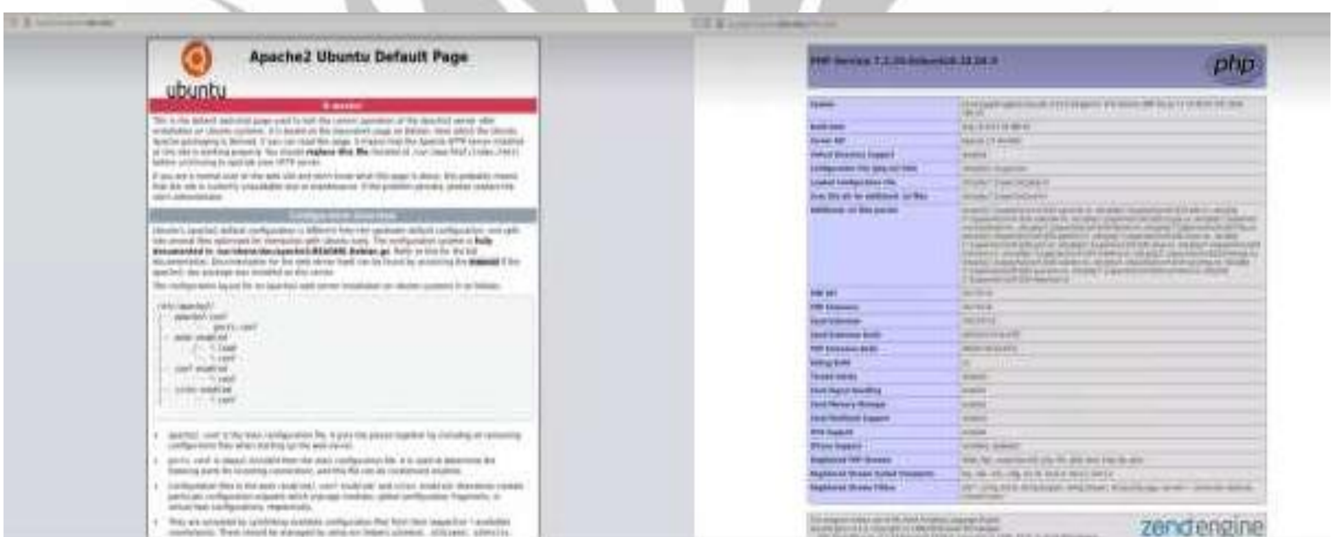
```
node 'puppet-agent'{
   include lamp
        package {
            'curl':
                name => 'curl',
                ensure => installed,
        }
}
```

Before fetching the catalog on agent, verify first whether the following packages are installed or not:

```
root@puppet-master:/# mysql

Command 'mysql' not found, but can be installed with:

apt install mysql-client-core-8.0     # version 8.0.26-0ubuntu0.20.04.3, or
apt install mariadb-client-core-10.3  # version 1:10.3.31-0ubuntu0.20.04.1

root@puppet-master:/# php

Command 'php' not found, but can be installed with:

apt install php7.4-cli

root@puppet-master:/# apache

Command 'apache' not found, did you mean:

  command 'apache2' from deb apache2-bin (2.4.41-4ubuntu3.7)

Try: apt install <deb name>
```

Fetch the catalog:

```
root@puppet-agent:/home/ubuntu# puppet agent -t
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
/usr/lib/ruby/vendor_ruby/puppet/util.rb:315: warning: deprecated Object#=~ is called on Pupp
et::Transaction::Report; it always returns nil
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
/usr/lib/ruby/vendor_ruby/puppet/util.rb:461: warning: URI.escape is obsolete
```



Creating index.html file inside LAMP module:

```
root@puppet-agent:/home/ubuntu# cd /etc/puppet/code/environments/production
root@puppet-agent:/etc/puppet/code/environments/production# cd modules/lamp bash
bash: cd: too many arguments
root@puppet-agent:/etc/puppet/code/environments/production# cd modules
root@puppet-agent:/etc/puppet/code/environments/production/modules# mkdir lamp
root@puppet-agent:/etc/puppet/code/environments/production/modules# cd lamp
root@puppet-agent:/etc/puppet/code/environments/production/modules/lamp# mkdir files
root@puppet-agent:/etc/puppet/code/environments/production/modules/lamp# ls
files
root@puppet-agent:/etc/puppet/code/environments/production/modules/lamp# mkdir manifest
root@puppet-agent:/etc/puppet/code/environments/production/modules/lamp# ls
files  manifest
root@puppet-agent:/etc/puppet/code/environments/production/modules/lamp#
```

```
 GNU nano 4.8                                  index.html
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta http-equiv="X-UA-Compatible" content="IE=edge">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Navbar</title>
</head>
<style>
    *{
        margin: 0;
        padding: 0;
        box-sizing: border-box;
    }

    nav{
        background-color: #2C394B;
    }

    nav ul{
        display: flex;
    }
    nav ul li {
        color: #fff;
        list-style-type: none;
        padding: 15px 25px;
    }

    nav ul li:hover{
        color: #FF4C29;
        background-color: #082032;
    }
</style>
<body>
    <nav>
        <ul>
            <li>Home</li>
            <li>About</li>
            <li>Service</li>
            <li>Contact</li>
        </ul>
    </nav>
</body>
```

Add a file resource to create an index.html inside init.pp:

```
 GNU nano 4.8                                    init.pp
class lamp {
  # execute 'apt-get update'
  exec { 'apt-update':                    # exec resource named 'apt-update'
    command => '/usr/bin/apt-get update'  # command this resource will run
  }

  # install apache2 package
  package { 'apache2':
    require => Exec['apt-update'],        # require 'apt-update' before installing
    ensure => installed,
  }

  # ensure apache2 service is running
  service { 'apache2':
    ensure => running,
  }

  # install mysql-server package
  package { 'mysql-server':
    require => Exec['apt-update'],        # require 'apt-update' before installing
    ensure => installed,
  }

  # ensure mysql service is running
  service { 'mysql':
    ensure => running,
  }
```

```
  # install php package
  package { 'php':
    require => Exec['apt-update'],        # require 'apt-update' before installing
    ensure => installed,
  }
  # ensure info.php file exists
  file { '/var/www/html/info.php':
    ensure => file,
    content => '',    # phpinfo code
    require => Package['apache2'],        # require 'apache2' package before creating
  }

info.php# change index.html
file{ 'var/ww/html/index.html';
        ensure => present,
        source => 'puppet:///modules/lamp/index.html',
        require => File[/var/www/html/index.html],
        }
}
```

Conclusion:

Hence, we provisioned a LAMP/MEAN Stack using Puppet Manifest.