Aim: To understand Continuous Integration, install and configure Jenkins with Maven.

Objective: The objective of understanding Continuous Integration (CI) involves grasping the principles and benefits of automating the process of integrating code changes from multiple developers into a shared repository

Theory:

Continuous integration is a DevOps software development practice where developers regularly merge their code changes into a central repository, after which automated builds and tests are run. Continuous integration most often refers to the build or integration stage of the software release process and entails both an automation component (e.g. a CI or build service) and a cultural component (e.g. learning to integrate frequently). The key goals of continuous integration are to find and address bugs quicker, improve software quality, and reduce the time it takes to validate and release new software updates.

Why is Continuous Integration Needed?

In the past, developers on a team might work in isolation for an extended period of time and only merge their changes to the master branch once their work was completed. This made merging code changes difficult and time-consuming, and also resulted in bugs accumulating for a long time without correction. These factors made it harder to deliver updates to customers quickly.

Benefits of Continuous Integration:

1. **Improve Developer Productivity:** Continuous integration helps your team be more productive by freeing developers from manual tasks and encouraging behaviors that help reduce the number of errors and bugs released to customers.

2. **Find and Address Bugs Quicker:** With more frequent testing, your team can discover and address bugs earlier before they grow into larger problems later.

3. **Deliver Updates Faster:** Continuous integration helps your team deliver updates to their customers faster and more frequently.

How does Continuous Integration Work?

With continuous integration, developers frequently commit to a shared repository using a version control system such as Git. Prior to each commit, developers may choose to run local unit tests on their code as an extra verification layer before integrating. A continuous integration service automatically builds and runs unit tests on the new code changes to immediately surface any

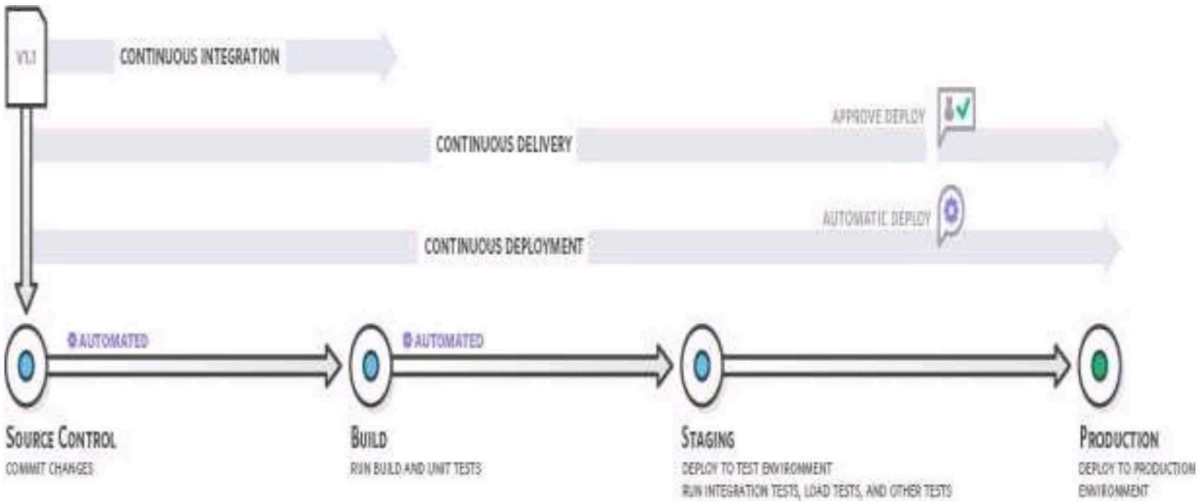

Fig. 4.1 Working of Continuous Integration

Continuous integration refers to the build and unit testing stages of the software release process. Every revision that is committed triggers an automated build and test.

With continuous delivery, code changes are automatically built, tested, and prepared for a release to production. Continuous delivery expands upon continuous integration by deploying all code changes to a testing environment and/or a production environment after the build stage.

Continuous Integration Tools:

- Jenkins.
- CircleCI.
- TeamCity.
- Travis CI.
- Buddy.
- GitLab.
- Bamboo.
- Buildbot.

What is Jenkins and Why we use it?

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

With Jenkins, organizations can accelerate the software development process through automation. Jenkins integrates development life-cycle processes of all kinds, including build, document, test, package, stage, deploy, static analysis, and much more.

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Jenkins achieves Continuous Integration with the help of plugins. Plugins allow the integration of Various DevOps stages. If you want to integrate a particular tool, you need to install the plugins for that tool. For example Git, Maven 2 project, Amazon EC2, HTML publisher etc.

Advantages of Jenkins include:

1. It is an open-source tool with great community support.
2. It is easy to install.
3. It has 1000+ plugins to ease your work. If a plugin does not exist, you can code it and share it with the community.
4. It is free of cost.
5. It is built with Java and hence, it is portable to all the major platforms.

What is Maven?

Maven is a powerful project management and comprehension tool that provides complete build life cycle framework to assist developers. It is based on the concept of a POM (Project Object Model) that includes project information and configuration information for Maven such as construction directory, source directory, test source directory, dependency, Goals, plugins etc.

Maven is build automation tool used basically for Java projects, though it can also be used to build and manage projects written in C#, Scala, Ruby, and other languages. Maven addresses two aspects of building software: 1st it describes how software is build and 2nd it describes its dependencies.

Maven when integrated with Jenkins through plugins aids to automate the complete build.

Steps to install and configure Jenkins with Maven :

Step 1: Download Jenkins war file
War is required to install Jenkins
The official website for Jenkins is https://jenkins.io/
Click on download button
Click on Generic Java Package (.war) to download the Jenkins war file.

Step 2: Now go to the location where the file is downloaded.
Open the command prompt and go to the directory where the Jenkins.war file is located. And then run the following command:

```
java –jar jenkins.war
```

Step 3: Accessing Jenkins--Open your browser and type the following url on your browser: http://localhost:8080

This url will bring up the Jenkins dashboard.

Step 4: Now go to the path C:\Users\.jenkins\secrets as per your System. Here you will find your Admin Password to continue the process of installation (Copy that password and paste it in Administrator field).

Step 5: After entering the password you will be redirected to the page select suggested plugins option. Click on Install Suggested Plugins.

Step 6: After Jenkins finishes installing the plugins, enter the required information on the Create First Admin User page.

Step 7: On the Instance Configuration page, confirm the port number you want Jenkins to use and click Save and Finish. (Default port number is 8080)

Step 8: After that go the port 8080 (Make sure that your (.war) file is running on cmd)

Step 9: You should know your user name and password that you have created previously. Click on sign in.

Step 10: Download Maven
The official website for Apache Maven is https://maven.apache.org/download.cgi.
Go to the files section and download the Maven by the given link for Binary zip archive file.
Once the file is downloaded, extract the file into your system.

Step 11: Setting Up Java and Maven in Jenkins

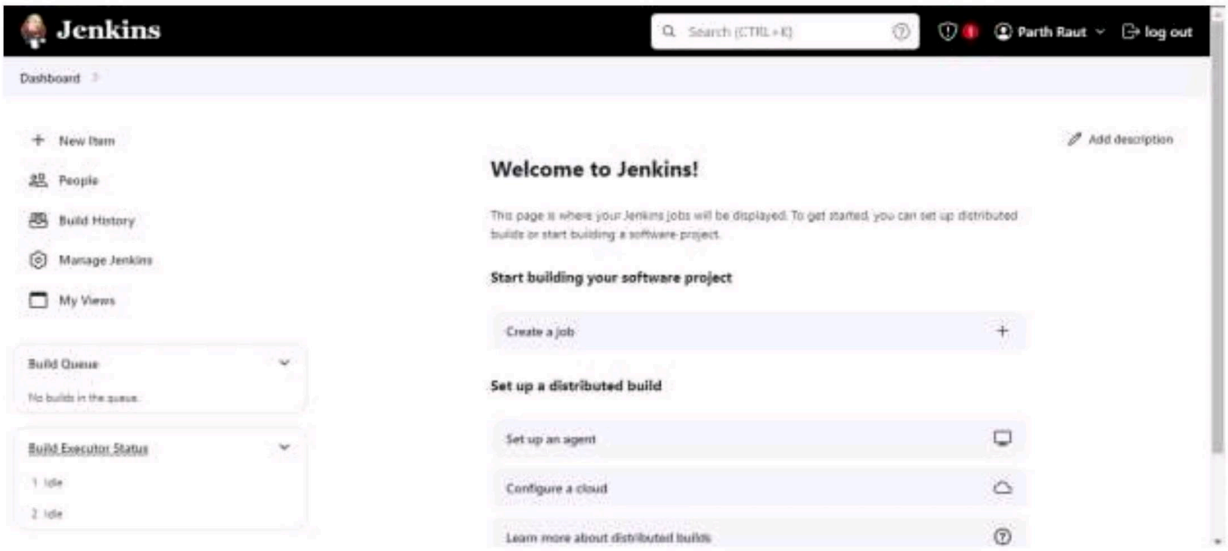
First of all, you have to set the JAVA_HOME and MAVEN_HOME environment variable in your system.

To set the JAVA_HOME and MAVEN_HOME path:

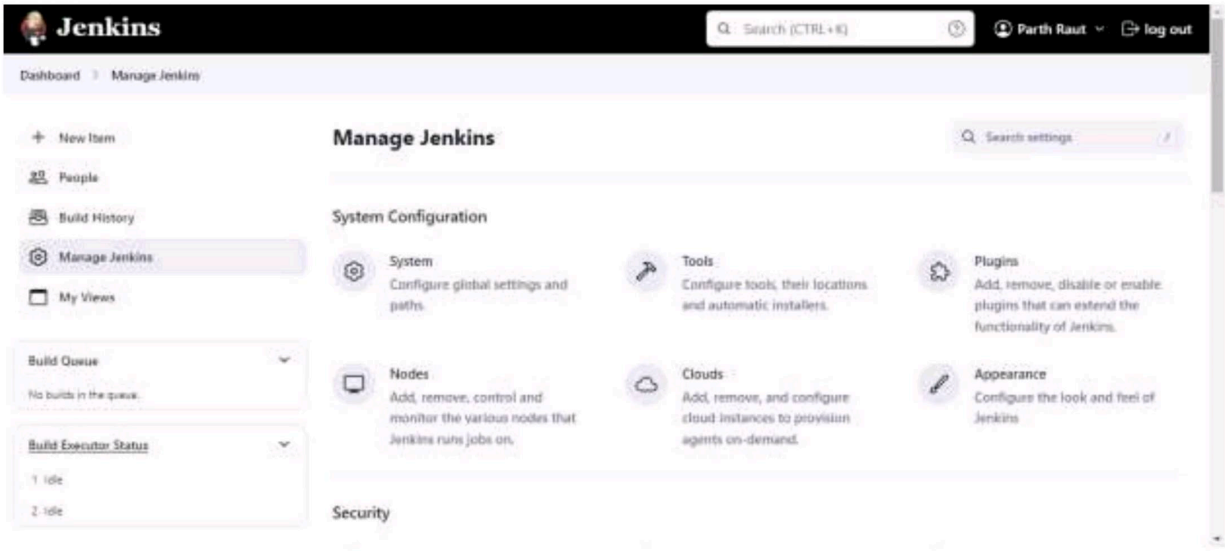
i. Make sure JDK is installed, and JAVA_HOME environment variable is configured. You can verify that the JAVA_HOME environment variable is properly configured or not by using the following command: C:\java -version
ii. Add a MAVEN_HOME system variables, and point it to the Maven folder.
Press Windows key, type adva and clicks on the View advanced system settings
iii. In System Properties dialog, select Advanced tab and clicks on the Environment Variables... button.
iv. In "Environment variables" dialog, System variables, Clicks on the New... button and add a MAVEN_HOME variable and point it to c:\opt\apache-maven-3.6.0

v. Add %MAVEN_HOME%\bin To PATH : In system variables, find PATH, clicks on the Edit... button. In "Edit environment variable" dialog, clicks on the New button and add this %MAVEN_HOME%\bin
vi. Verification: Done, start a new command prompt, type mvn –version

Step 12: Now, in the Jenkins dashboard (Home screen) click on manage Jenkins from the left-hand side menu.



Step 13: Click on "Global Tool Configuration" option.



Step 14: To configure Java, click on "**Add JDK**" button in the JDK section.

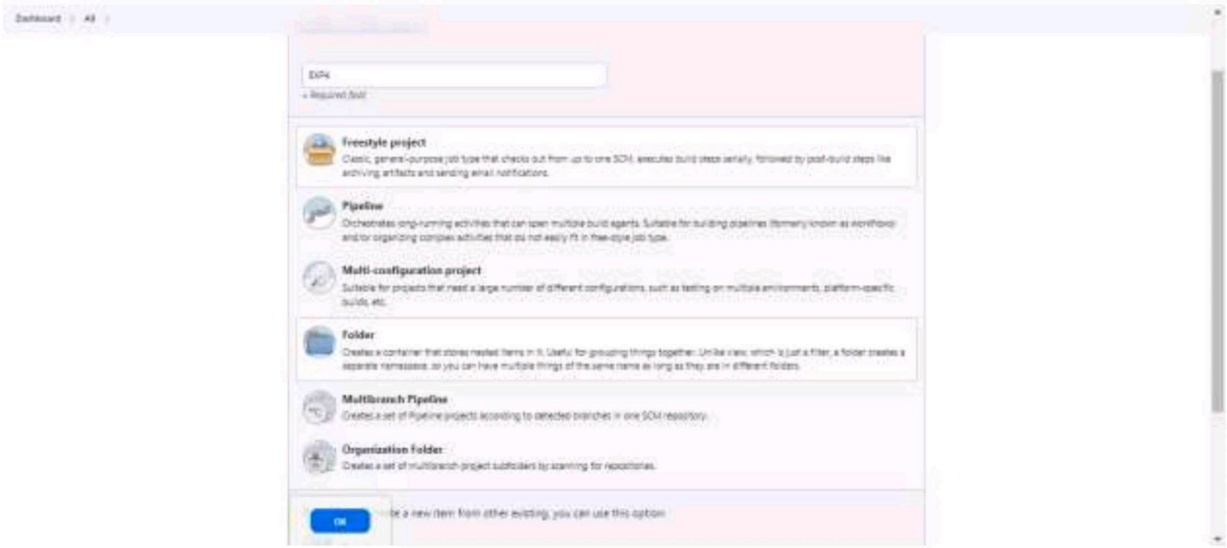
Step 15: Give a **Name** and **JAVA_HOME** path, or check on **install automatically** checkbox.

Step 16: And now, to configure Maven, click on "Add Maven" button in the Maven section, give any **Name** and **MAVEN_HOME** path or check to install automatically checkbox.

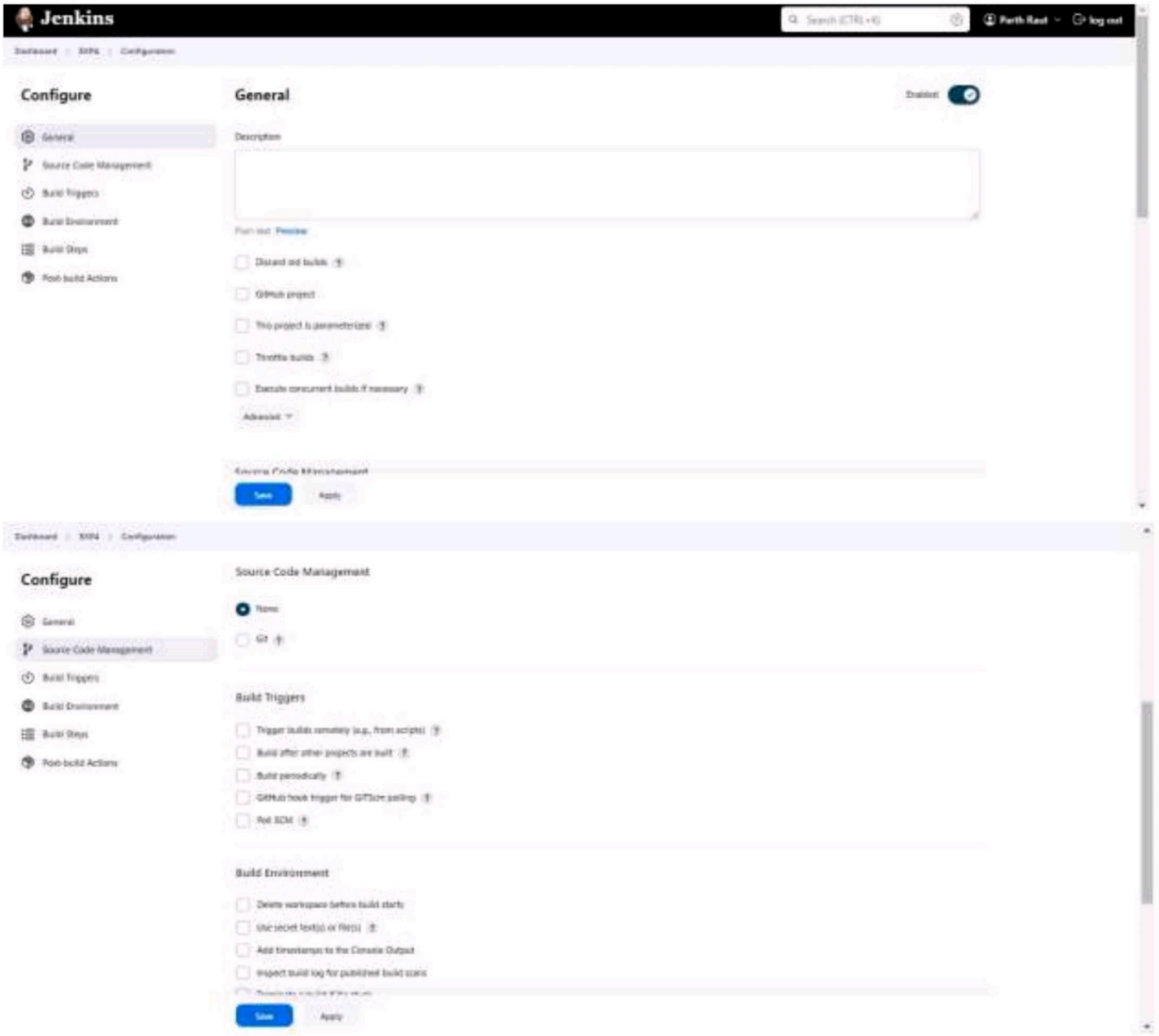
Then, click on the "**Save**" button at the end of the screen.

Now, you can create a job with the Maven project. To do that, click on the **New Item** option or **create a new job** option.

Step 17: Enter the **Item Name** and select the **Maven Project**.
Click OK.

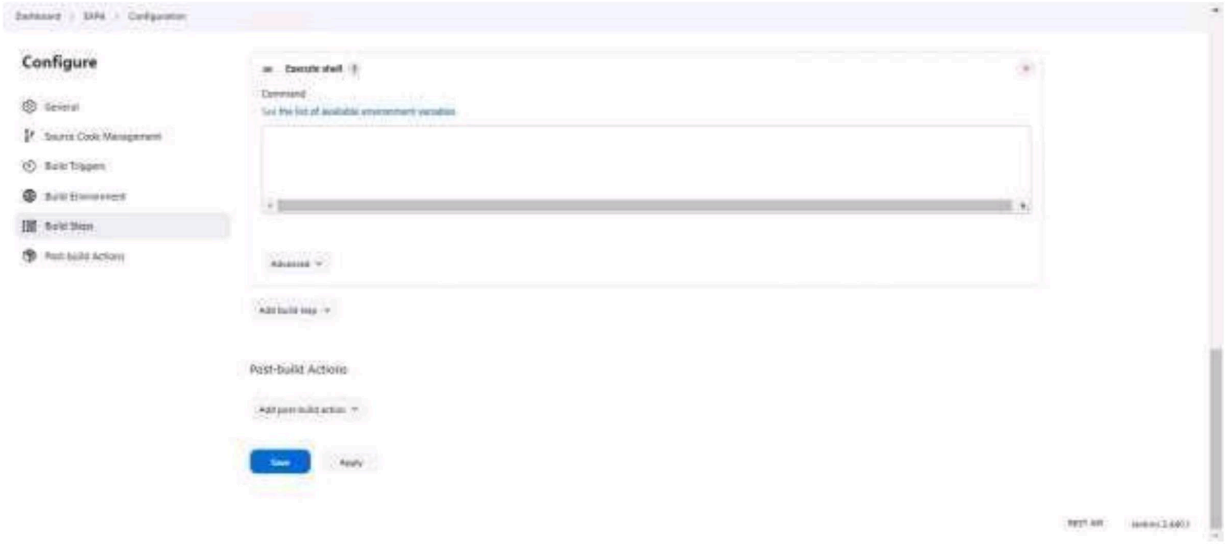


Step 18: Now configure the job. Give the description and in the **Source Code Management** section, select the required option.



Step 19: In the Build Triggers section, there are multiple options, select the required one.

Add the pom.xml file's path in the **Root POM** option. Configure the other fields as per your requirement and then click on the **Save** button.



Conclusion:

1. What are the requirements for using Jenkins?

   1.Jenkins requires Java to run, so you need to install the latest Java Development Kit (JDK) or Java Runtime Environment (JRE) versions based on your system configuration, 32-bit or 64-bit.

   2.Jenkins requires at least 512 MB of RAM and 1 GB of storage on your hard drive.

   3.You can download Jenkins from the official website (<https://jenkins.io/download/>) and select the platform you intend to download Jenkins. For Windows, you can download the .exe file, while for other platforms, you can download the .war file.

   4. use Jenkins for continuous integration and continuous delivery, you need to define a set of instructions in a script, usually written in Groovy. This script includes stages, steps, and triggers to automate the software delivery process.

   5. Jenkins provides a vast number of plugins that can be installed to extend its functionality. For example, the Docker Pipeline plugin is required to run a Jenkins pipeline using Docker.

2. Name the two components that Jenkins is mostly integrated with

Jenkins is mainly integrated with two components: version systems and build tools. Version systems like Git and SVN are examples of the former, while build tools like Apache Maven are examples of the latter. This integration allows Jenkins to efficiently manage code deployment processes by monitoring changes in the source code repository, preparing builds, testing them, and deploying the code in various environments. The continuous automation and feedback loop provided by Jenkins streamline the development and deployment processes, ensuring efficient and error-free software delivery.

3. Name some of the useful plugins in Jenkins.

1.Git Plugin: This plugin integrates Jenkins with Git version control systems, providing features like pulling, fetching, checking out, branching, merging, tagging, and pushing repositories. It also supports distributed version control, security, and flexibility for effective utilization

2.Kubernetes Plugin: This plugin enables Jenkins to run jobs on Kubernetes clusters, allowing for dynamic scaling and resource management

3.GitHub Integration Plugin: This plugin integrates Jenkins with GitHub, providing features like automatic build triggering, pull request integration, and issue tracking

4.Maven Integration Plugin: This plugin integrates Jenkins with Maven, enabling seamless build, testing, and deployment of Maven projects

5.Docker Plugin: This plugin allows Jenkins to build, test, and deploy Docker applications, and also supports containerization and orchestration

6.JUnit Plugin: This plugin integrates Jenkins with JUnit testing framework, providing features like test results visualization, trend tracking, and failure analysis.