



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

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 errors.

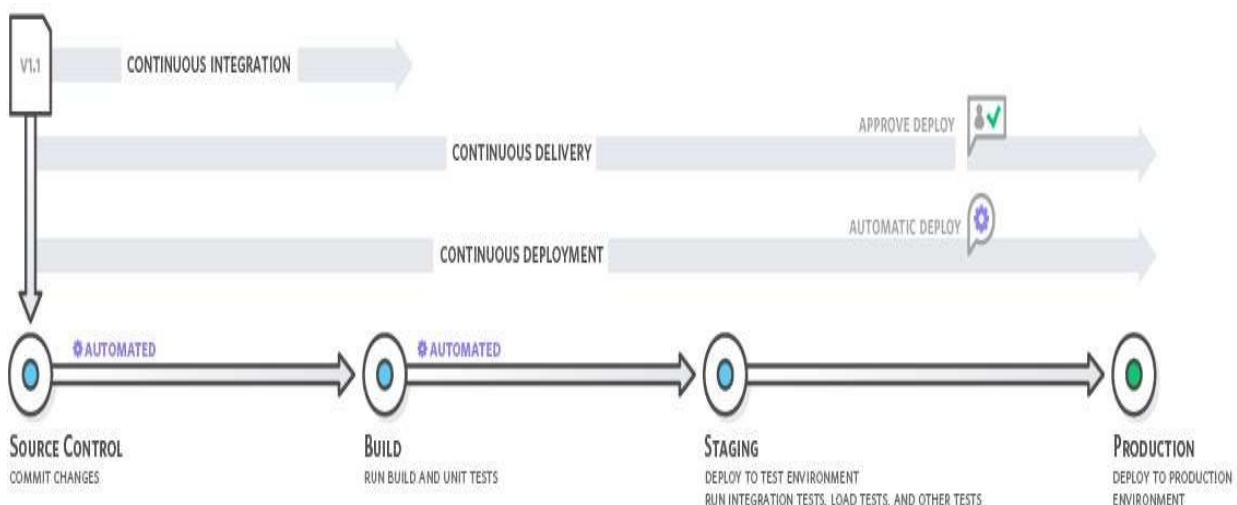


Fig. 4.1 Working of Continuous Integration



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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.

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.



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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



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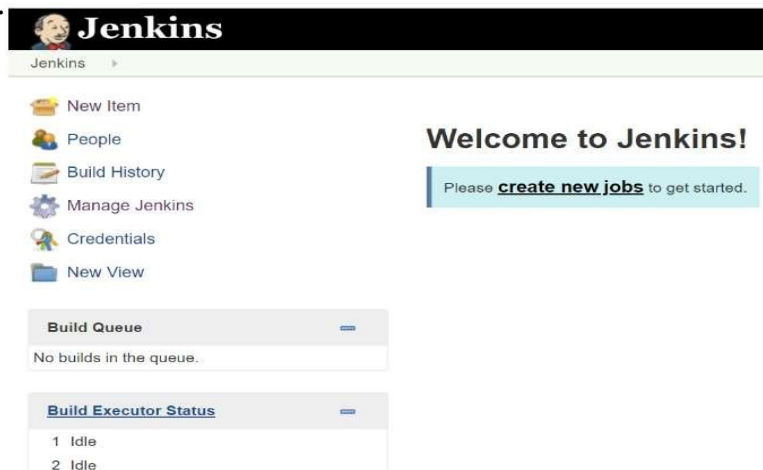
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First of all, you have to set the JAVA_HOME and MAVEN_HOME environment variable in your system.

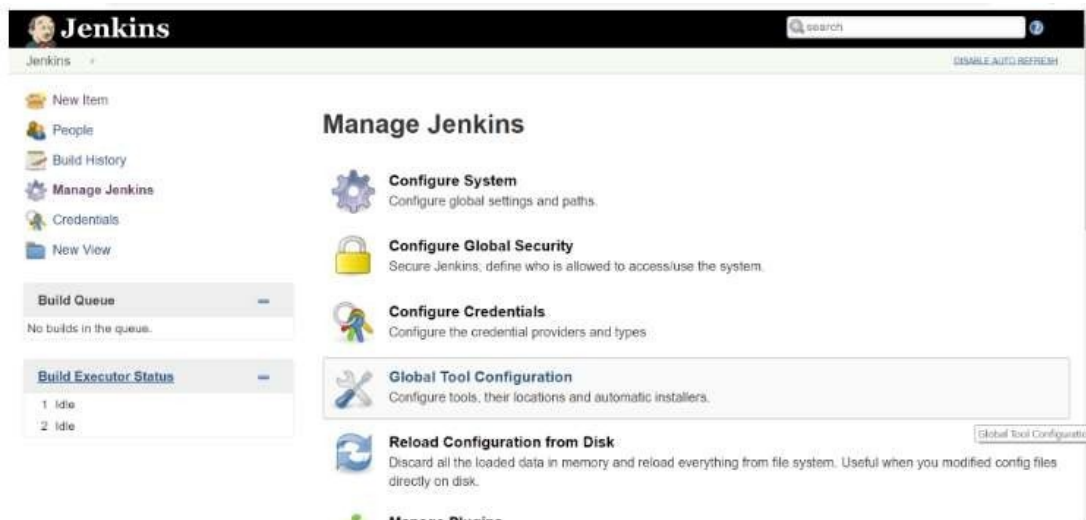
To set the JAVA_HOME and MAVEN_HOME path:

- 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
- 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
- In System Properties dialog, select Advanced tab and clicks on the Environment Variables... button.
- 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
- 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
- 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.

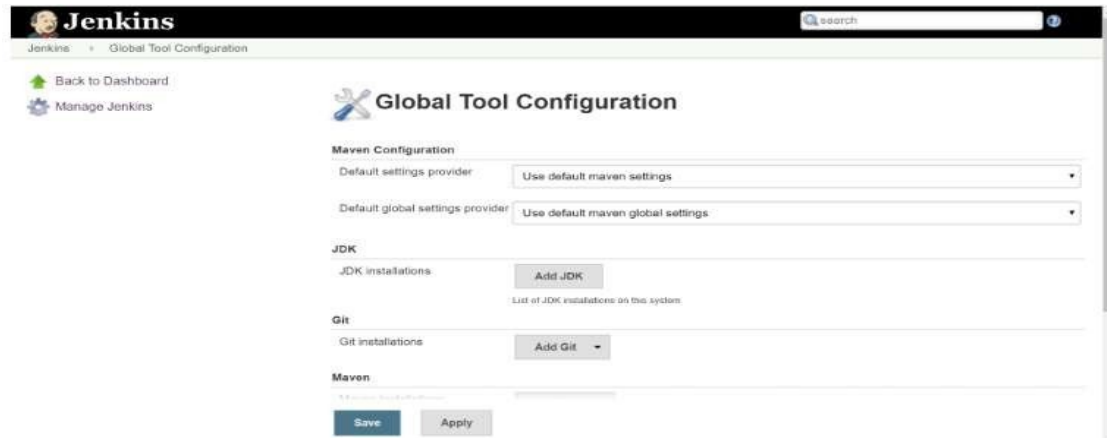




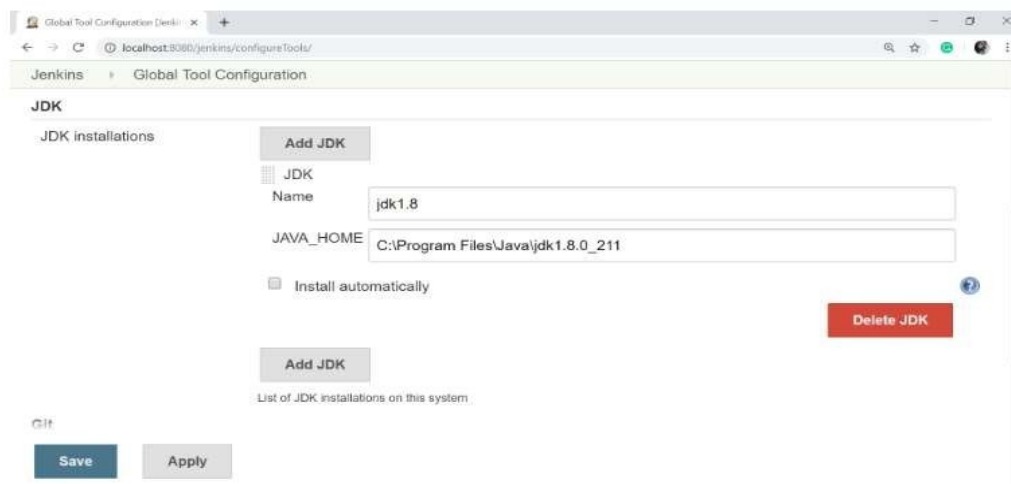
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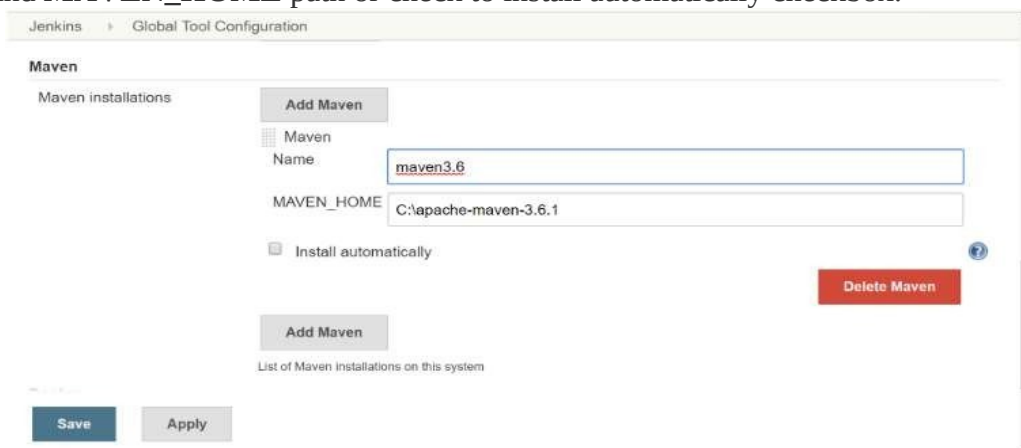
Step 14: To configure Java, click on "Add JDK" button in the JDK section.



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.





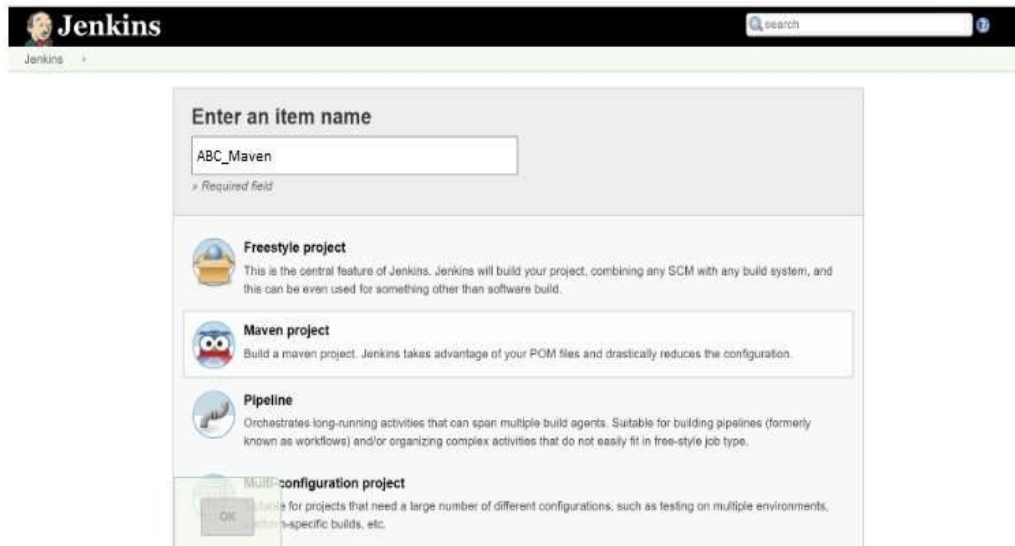
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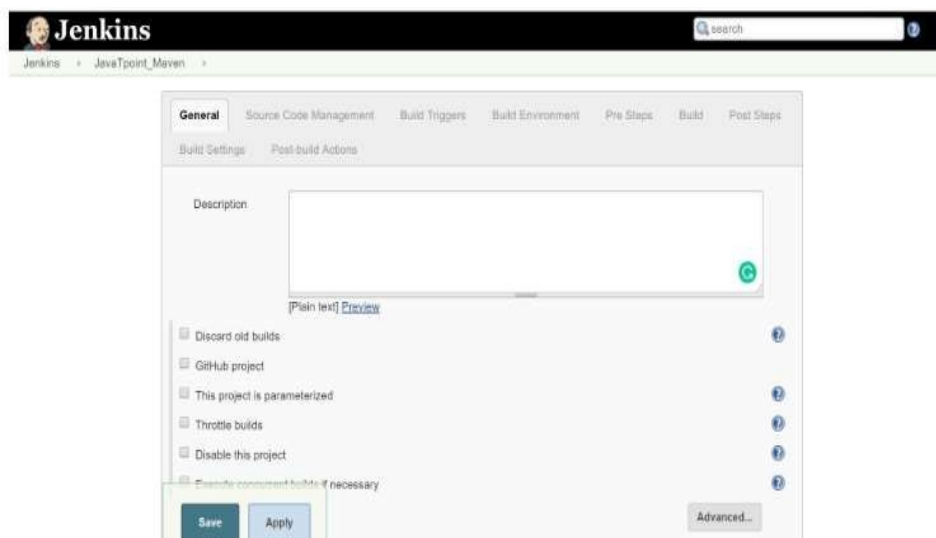
Then, click on the "Save" button at the end of the screen. Now, you can create a job with the Maven project. To do that, click on the **New Item** option or **create a new job** option.



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.





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The screenshot shows the Jenkins configuration page for a build job. The 'Source Code Management' tab is active, showing options for None, CVS, CVS Projectset, Git, and Subversion. The 'Build Triggers' section is expanded, showing various triggers like 'Build whenever a SNAPSHOT dependency is built', 'Build after other projects are built', 'Build periodically', 'GitHub hook trigger for GITScm polling', and 'Poll SCM'. The 'Save' button is highlighted.

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.

The screenshot shows the Jenkins configuration page for a build job, specifically the 'Pre Steps' tab. The 'Build' section is expanded, showing the 'Root POM' field set to 'D:\parent\pom.xml' and the 'Goals and options' field set to 'clean install'. The 'Post Steps' section is also visible, showing options for 'Run only if build succeeds', 'Run only if build succeeds or is unstable', and 'Run regardless of build result'. The 'Save' button is highlighted.

Conclusion:

1. What are the requirements for using Jenkins?

- JDK installed with configured JAVA_HOME environment variable.
- Jenkins war file downloaded and run using Java.
- Web browser to access Jenkins dashboard.
- Maven downloaded and configured with MAVEN_HOME environment variable.



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2. **Name the two components that Jenkins is mostly integrated with.**
 - Version Control Systems (e.g., Git, SVN).
 - Build Tools (e.g., Maven, Gradle).
3. **Name some of the useful plugins in Jenkins.**
 - Git Plugin: Integrates Jenkins with Git repositories for source code management.
 - Maven Plugin: Integrates Jenkins with Maven for building Java projects.
 - Pipeline Plugin: Allows defining continuous delivery pipelines as code.
 - Docker Plugin: Integrates Jenkins with Docker for containerization.
 - JUnit Plugin: Publishes JUnit test results in Jenkins.