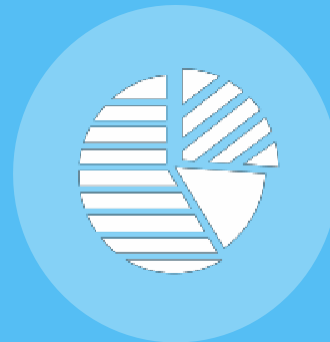
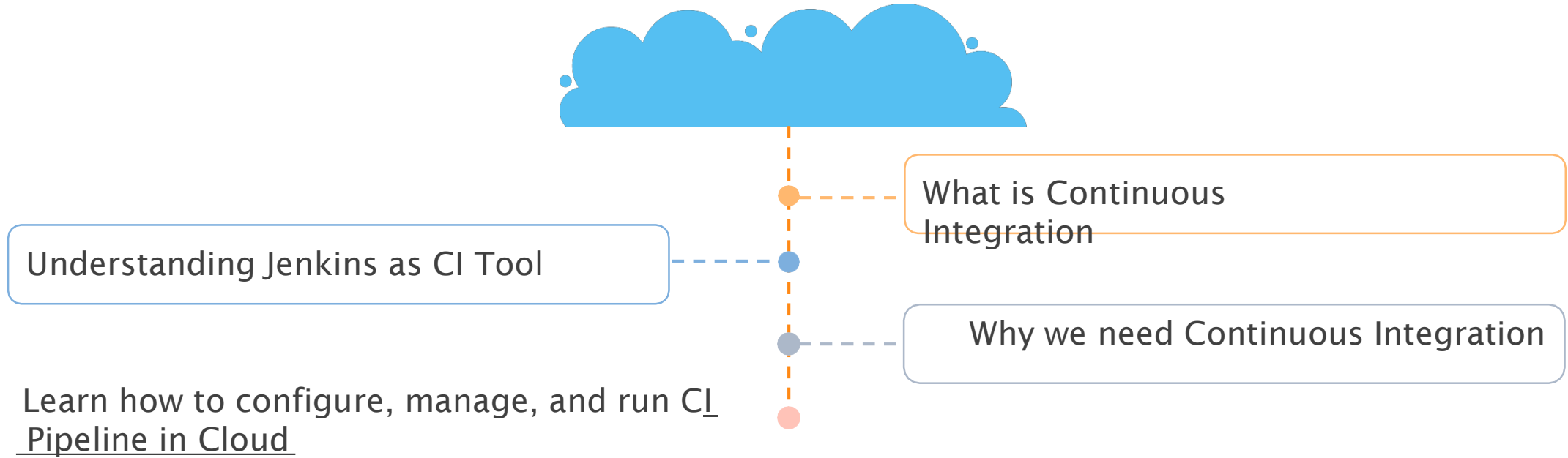


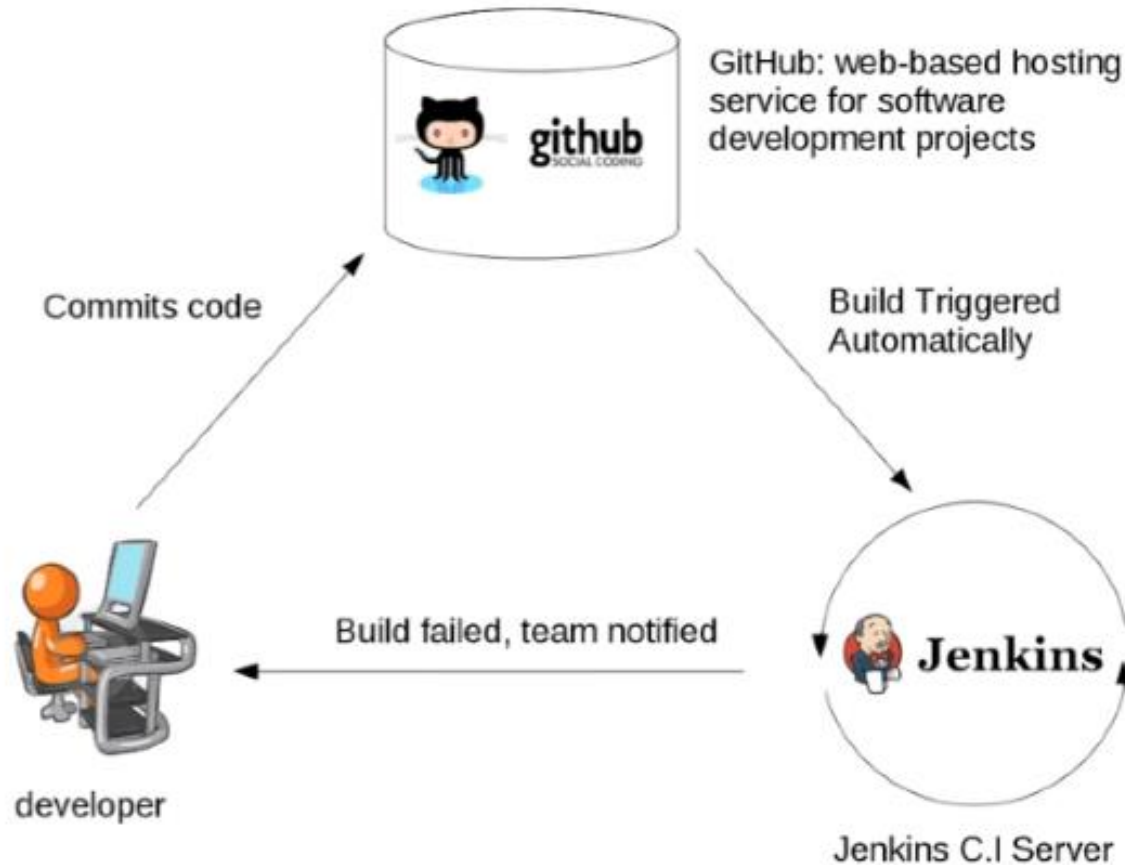
# DevOps

## Continuous Integration



# What's in It for Me

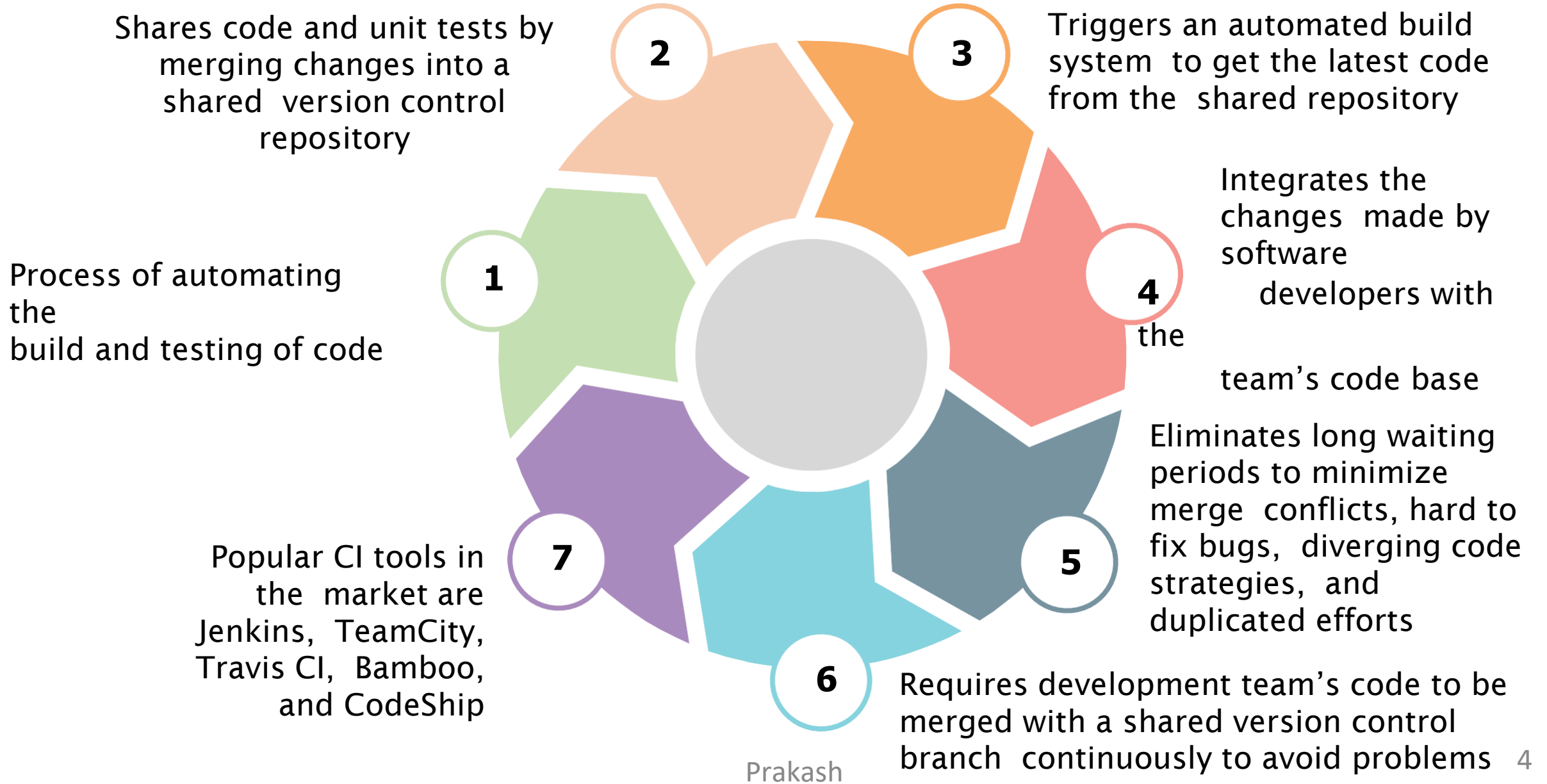




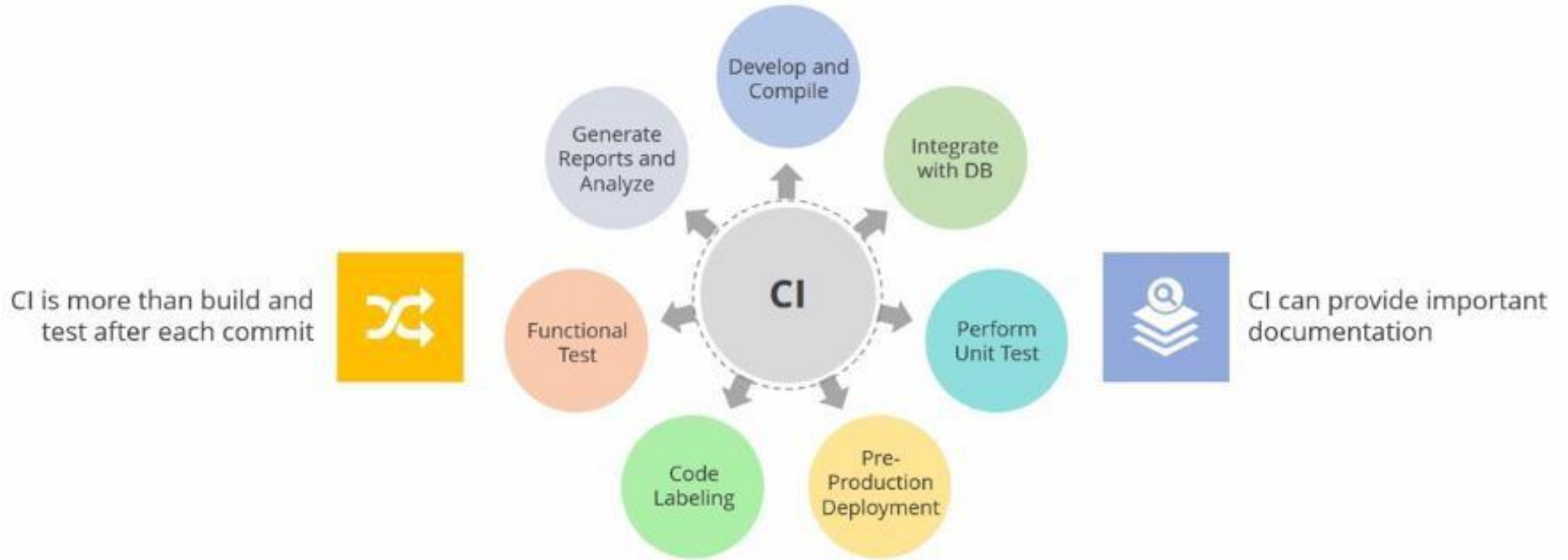
## What is Continuous Integration?

- Developers commit code to a shared repository on a regular basis.
- Version control system is being monitored. When a commit is detected, a build will be triggered automatically.
- If the build is not green, developers will be notified immediately.

# Continuous Integration

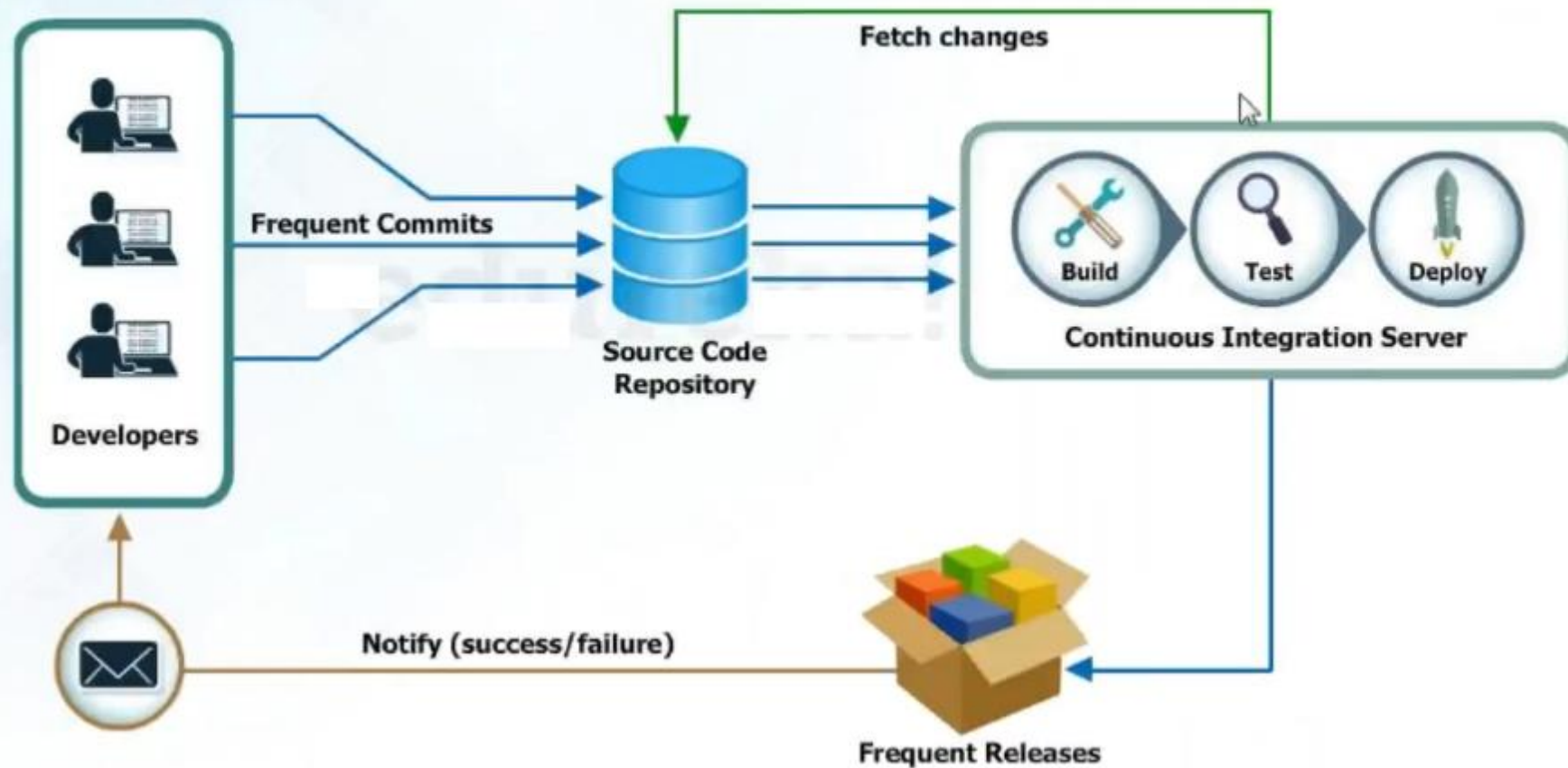


# Continuous Integration (Contd.)



## Continuous Integration (Contd.)

Continuous Integration (CI) is a development practice that requires developers to integrate code into a shared repository several times a day. Each check-in is then verified by an automated build, allowing teams to deploy code quickly to production.



# Why do we need Continuous Integration?

- Detect problems or bugs, as early as possible, in the development life cycle.
- Since the entire code base is integrated, built and tested constantly , the potential bugs and errors are caught earlier in the life cycle which results in better quality software.

# Jenkins

## Using Jenkins as Continuous Integration Tool



Continuous Integration is the most important part of DevOps that is used to integrate various DevOps stages. Jenkins is the most famous Continuous Integration tool,

## What is Jenkins?

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

# The History of Jenkins

**Hudson**



**Jenkins**

- Hudson was started in 2004 at Sun by Kohsuke Kawaguchi as a hobby project.
- First release in 2005.
- Kohsuke worked on Hudson full time in early 2008.
- Became the leading Continuous Integration solution with a market share of over 70% in 2010.
- Renamed to Jenkins in 2011.

# Jenkins

---

Java  
based

Jenkins is written in Java. It was forked from Hudson when Oracle bought Sun Microsystems

Open source  
automation  
server

It provides hundreds of plugins to support build creation, deployment, and automation of any software project

Software  
developmen  
t

It helps automate non-human part of software development process with CI and continuous deployment (CD)

Cross-  
platform  
tool

It is a cross-platform tool, and it offers configuration both through GUI interface and console commands

# Jenkins

---

CI  
server

Distributio  
n

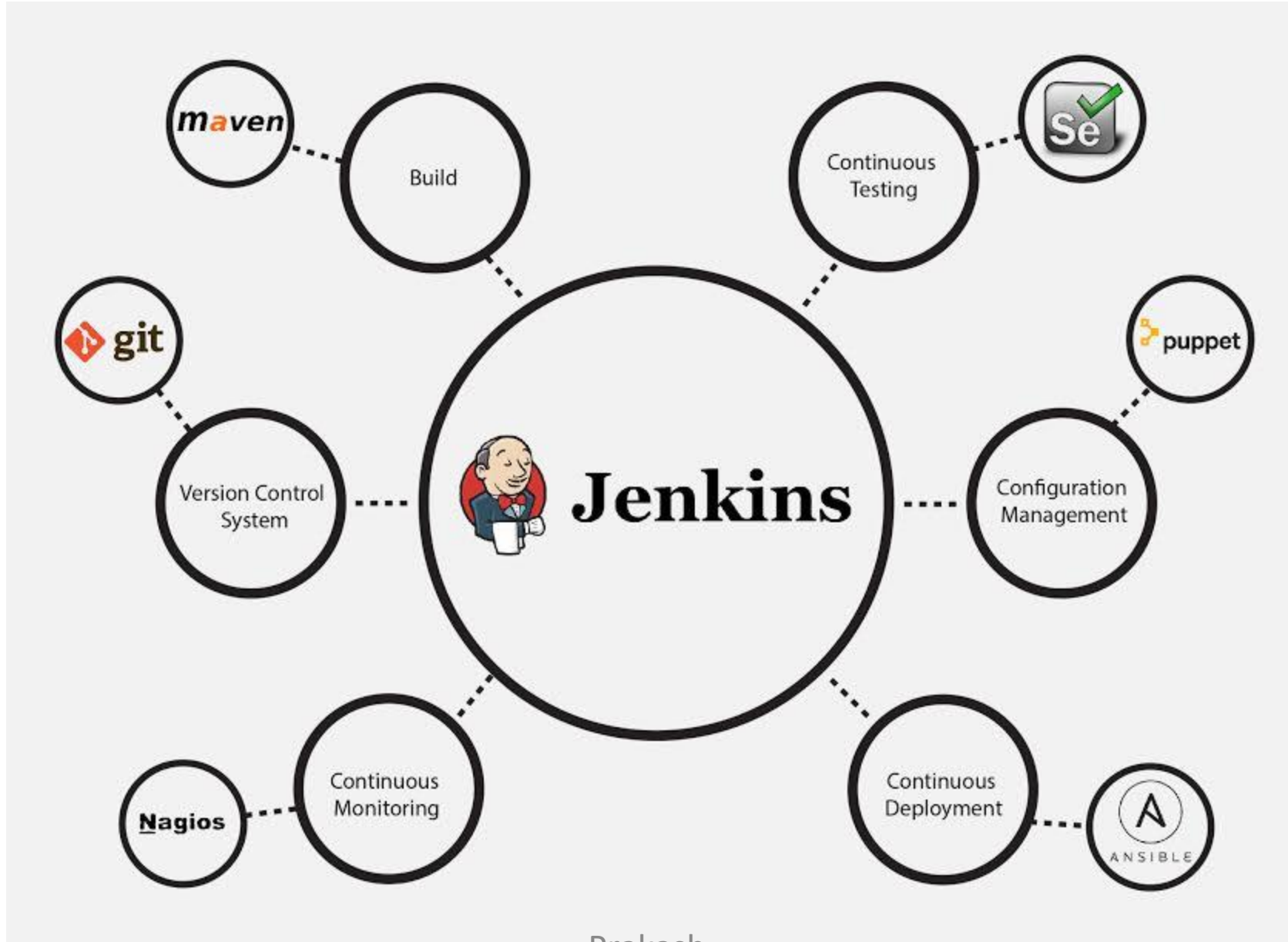
Cross-  
platform

It can be used as a  
CI server or as a  
continuous delivery  
hub for a project

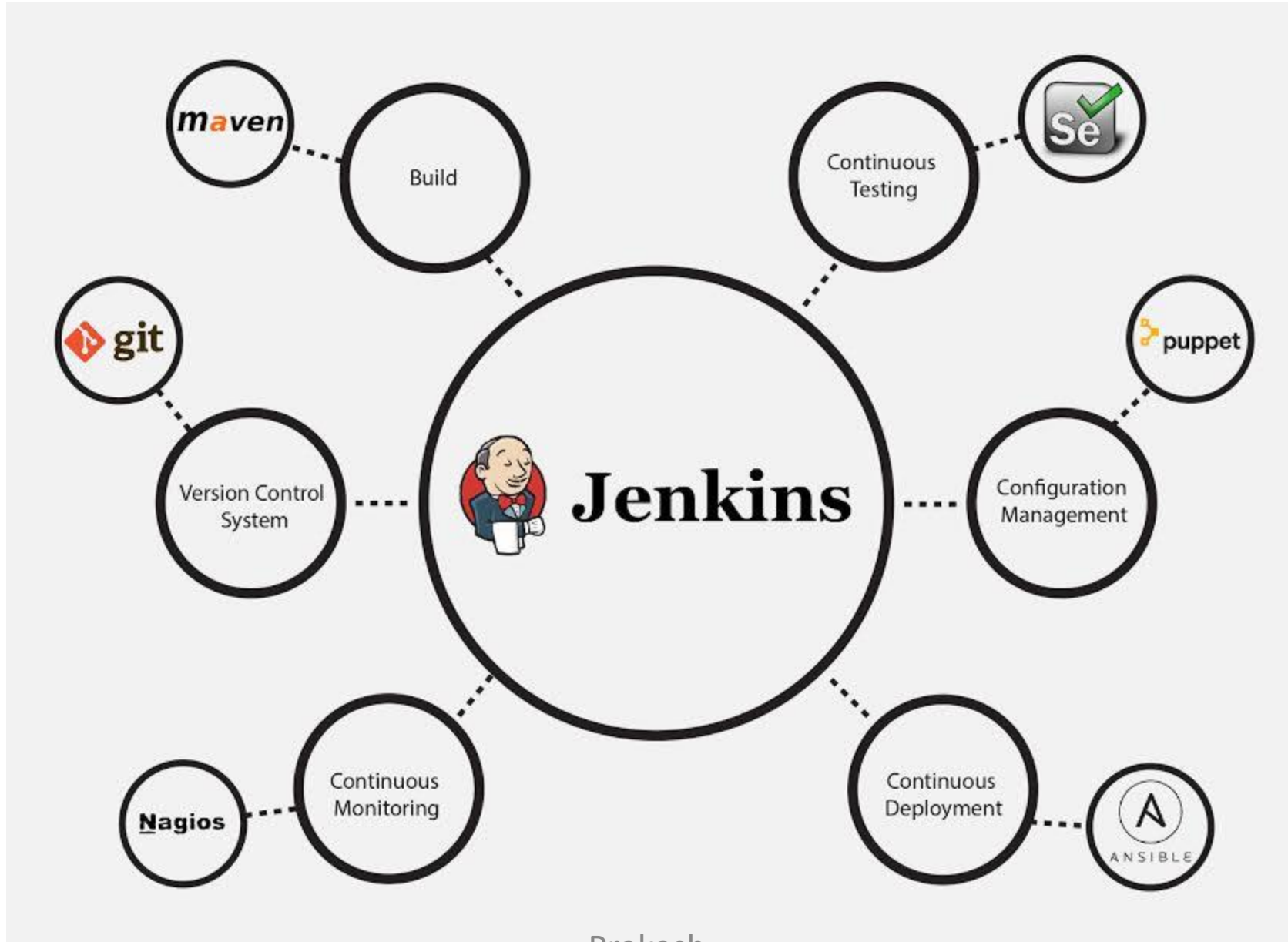
It can easily  
distribute work  
across different  
machines and help  
trigger builds, tests,  
and deployments to  
multiple machines  
and platforms faster

It works on iOS, .Net,  
Android  
Development, Ruby,  
and Java

The image below depicts that Jenkins is integrating various DevOps stages:



The image below depicts that Jenkins is integrating various DevOps stages:



## Advantages of Jenkins include:

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

## Jenkins Key Metrics:

Following are some facts about Jenkins that makes it better than other Continuous Integration tools:

- **Adoption:** Jenkins is widespread, with more than 147,000 active installations and over 1 million users around the world.
- **Plugins:** Jenkins is interconnected with well over 1,000 plugins that allow it to integrate with most of the development, testing and deployment tools.

## Continuous Integration With Jenkins

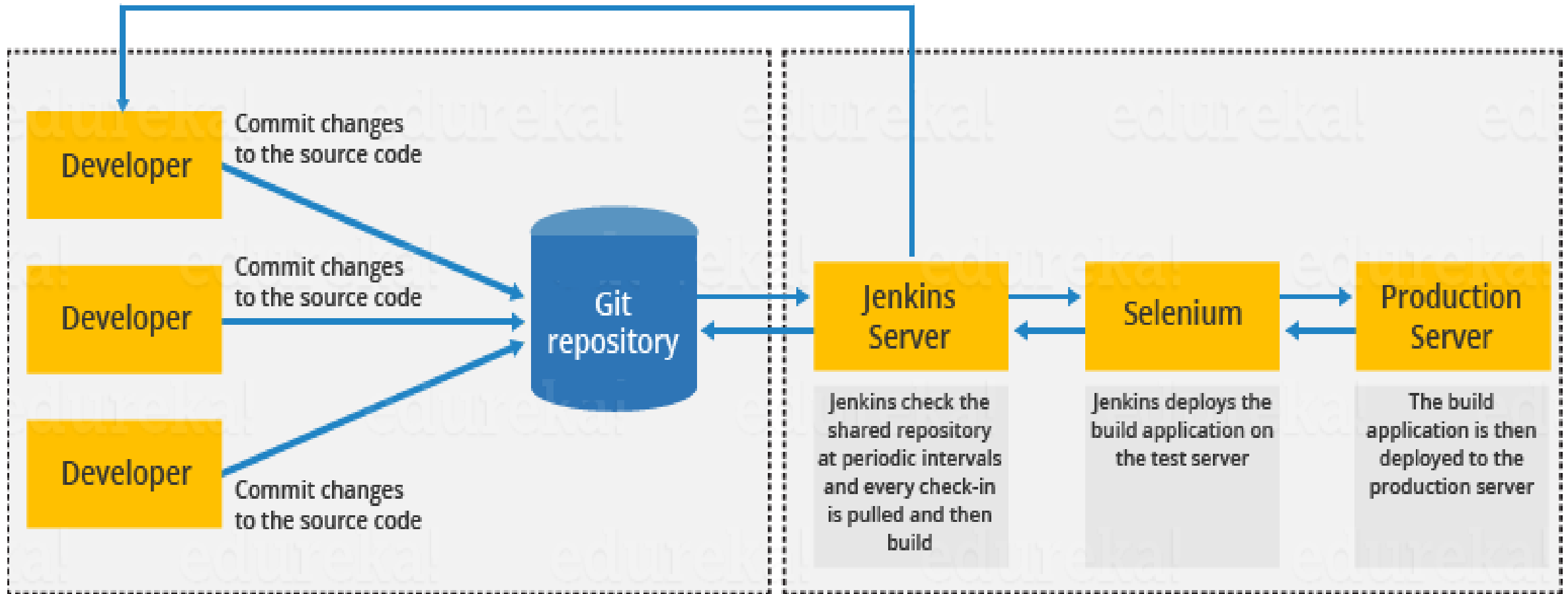
Let us imagine a scenario where the complete source code of the application was built and then deployed on test server for testing. It sounds like a perfect way to develop a software, but, this process has many flaws. I will try to explain them one by one:

- Developers have to wait till the complete software is developed for the test results.
- There is a high possibility that the test results might show multiple bugs. It was tough for developers to locate those bugs because they have to check the entire source code of the application.
- It slows the software delivery process.
- Continuous feedback pertaining to things like coding or architectural issues, build failures, test status and file release uploads was missing due to which the quality of software can go down.
- The whole process was manual which increases the risk of frequent failure.

It is evident from the above stated problems that not only the software delivery process became slow but the quality of software also went down. This leads to customer dissatisfaction. So to overcome such a chaos there was a dire need for a system to exist where developers can continuously trigger a build and test for every change made in the source code. This is what CI is all about. Jenkins is the most mature CI tool available so let us see how Continuous Integration with Jenkins overcame the above shortcomings.



Build and test results are  
fed back to the developers



**The above diagram is depicting the following functions:**

- First, a developer commits the code to the source code repository. Meanwhile, the Jenkins server checks the repository at regular intervals for changes.
- Soon after a commit occurs, the Jenkins server detects the changes that have occurred in the source code repository. Jenkins will pull those changes and will start preparing a new build.
- If the build fails, then the concerned team will be notified.
- If built is successful, then Jenkins deploys the built in the test server.
- After testing, Jenkins generates a feedback and then notifies the developers about the build and test results.
- It will continue to check the source code repository for changes made in the source code and the whole process keeps on repeating.

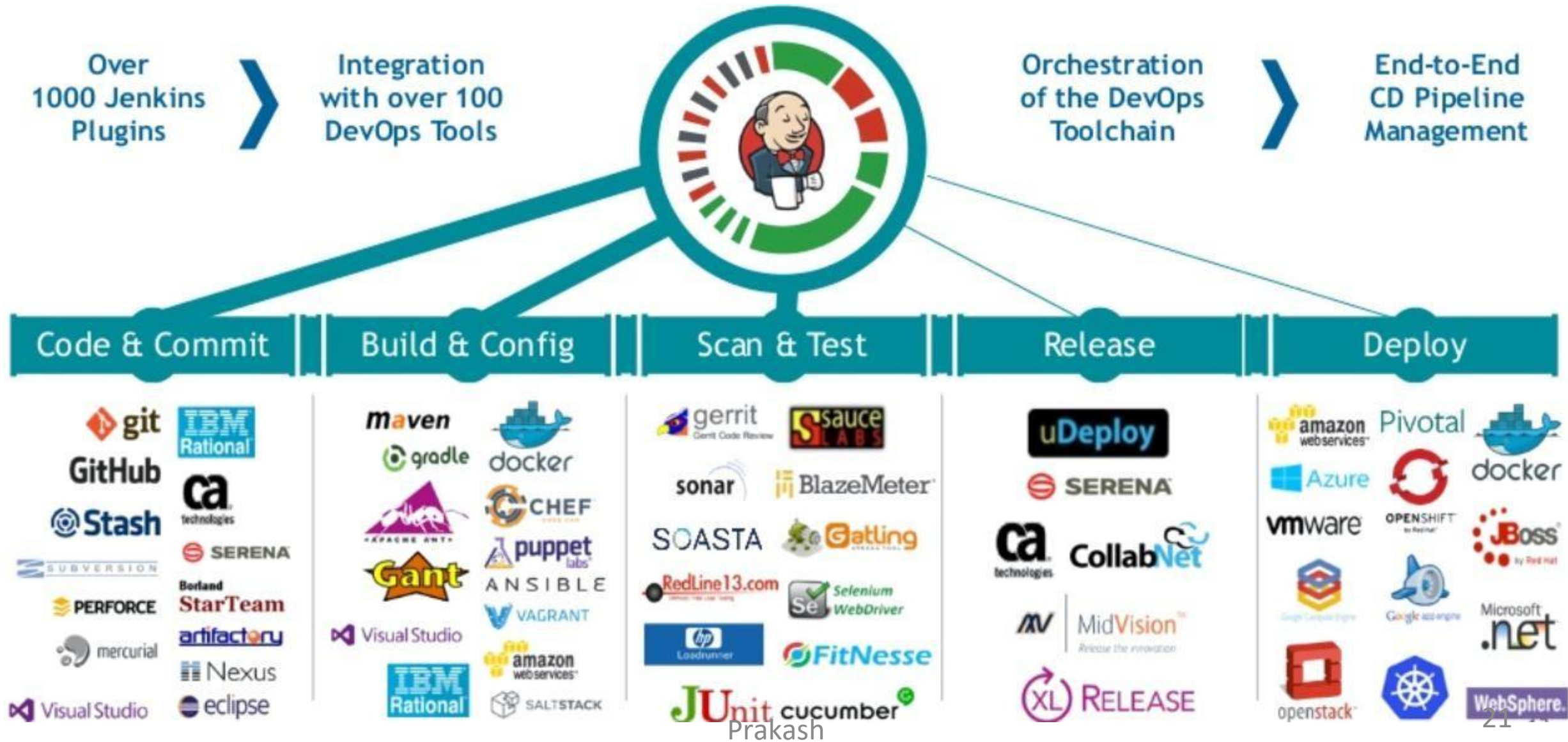
Before Jenkins	After Jenkins
The entire source code was built and then tested. Locating and fixing bugs in the event of build and test failure was difficult and time consuming, which in turn slows the software delivery process.	Every commit made in the source code is built and tested. So, instead of checking the entire source code developers only need to focus on a particular commit. This leads to frequent new software releases.
Developers have to wait for test results	Developers know the test result of every commit made in the source code on the run.
The whole process is manual	You only need to commit changes to the source code and Jenkins will automate the rest of the process for you.

# Continuous Integration Using Jenkins

---

- Builds can be triggered from a commit in version control system or scheduling a cron job or by other builds in the queue
- Support version control systems like CVS, Subversion, Git, Perforce, Clearcase
- Can be integrated with bug tracking databases Jira, Bugzilla, Sonar Quality Gate
- Integrates with testing tools like Nunit, Junit, TestLink, Celenium Capability Axis, qTest, QMetry for Jira, Sonar
- Integrates with build tools like NAnt, EasyAnt, Ansible, Ant, Maven, Gradle, Visual Studio Code Metrics, SaltStack, Python, Ruby, Shell and Windows commands
- Integrates with config tools like Chef, Puppet, Ansible, Vagrant, IBM Rational, SaltStack
- Has plugins for Puppet Enterprise Pipeline, Ansible, OctopusDeploy, Docker Pipeline, Google Deployment Manager, Amazon Web Services, VMWare, Azure, Microsoft .Net, OpenStack

# Continuous Integration Using Jenkins (Contd.)



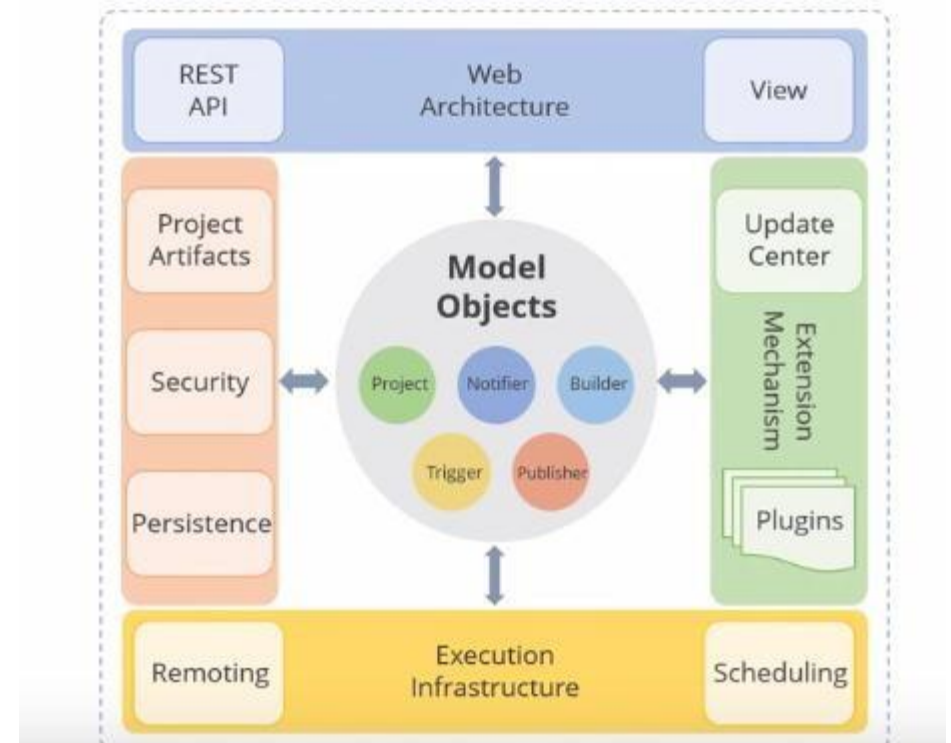
# Jenkins Architecture

---

- Jenkins is a set of Java classes that model the concepts of a build system in a straight-forward fashion
- There are classes like Project, Build, that represents what the name says
- There are interfaces and classes that model code that performs a part of a build, such as SCM for accessing source code control system, Ant for performing an Ant- based build, Mailer for sending out e-mail notifications
- Jenkins classes are bound to URLs by using Stapler. Stapler is a HTTP request handling server.

# Jenkins Architecture in Detail

- Views
  - Jenkins' model objects have multiple "views" that are used to render HTML pages about each object.
  - Jenkins uses Jelly as the view technology.
- Persistence
  - Jenkins uses the file system to store its data. Directories are created inside \$JENKINS\_HOME in a way that models the object model structure.
- Plugins
  - Jenkins' object model is extensible and it supports the notion of "plugins," which can plug into those extensibility points and extend the capabilities of Jenkins.



Step 1. Launch an instance (Amazon Linux) , Login to the instance, install and setup java environment

```
sudo yum install -y git java-1.8.0-openjdk-devel aws-cli
```

```
sudo alternatives --config java
```

In this command change version of java to the latest version.

Step 2. Install Apache Maven

```
sudo wget http://repos.fedorapeople.org/repos/dchen/apache-maven/epel-apache-maven.repo -O /etc/yum.repos.d/epel-apache-maven.repo
```

```
sudo sed -i s/\$releasever/6/g /etc/yum.repos.d/epel-apache-maven.repo
```

```
yum install maven
```

```
mvn --version
```

Step 4. Install Jenkins

```
wget -O /etc/yum.repos.d/jenkins.repo http://pkg.jenkins-ci.org/redhat-stable/jenkins.repo
```

```
rpm --import http://pkg.jenkins-ci.org/redhat-stable/jenkins-ci.org.key
```

```
sudo yum install jenkins
```

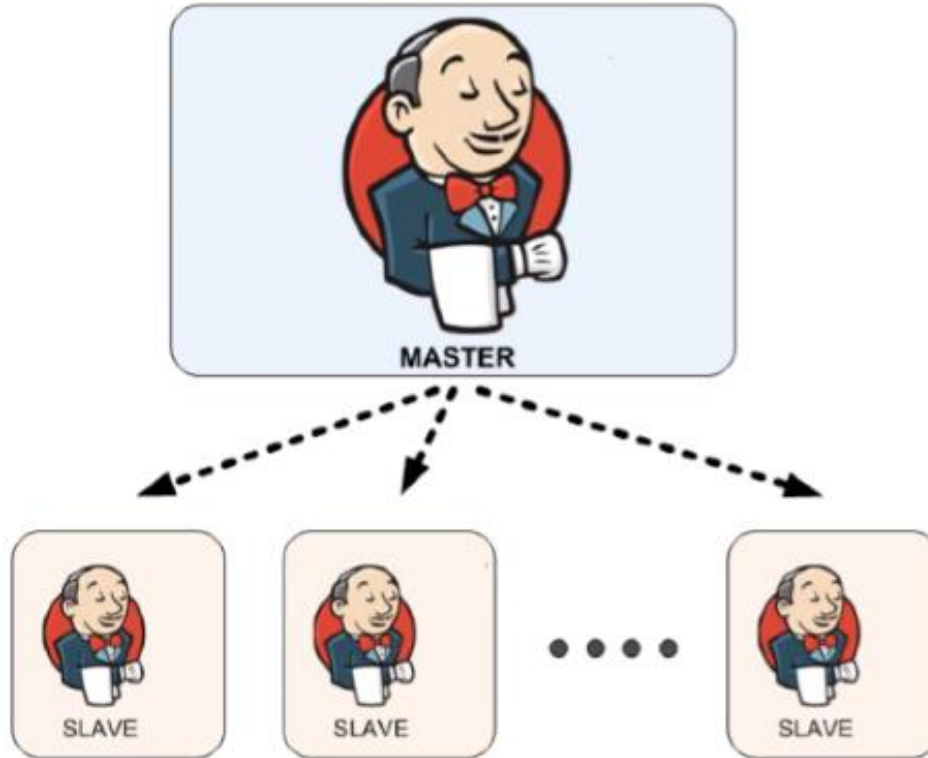
```
sudo service jenkins start
```

```
sudo chkconfig --add jenkins
```

That's it! Now you can go to URL <http://<instance ip>:8080>



# Jenkins' Master and Slave Architecture



## Master:

- Schedule build jobs.
- Dispatch builds to the slaves for the actual job execution.
- Monitor the slaves and record the build results.
- Can also execute build jobs directly.

## Slave:







- Execute build jobs dispatched by the master.

# Plugin

- A Plugin, like plugins on any other system, is a piece of software that extends the core functionality of the core Jenkins server.

Jenkins

[ENABLE AUTO REFRESH](#)

-  [New Item](#)
-  [People](#)
-  [Build History](#)
-  [Manage Jenkins](#)
-  [My Views](#)
-  [Credentials](#)

 [add description](#)

**Build Queue**

No builds in the queue.

**Build Executor Status**

1 Idle

2 Idle

## Welcome to Jenkins!

Please **create new jobs** to get started.

Job listing section

KNOWLEDGE  
CHECK

What are the advantages of Jenkins?

- a . At integration stage, build failures are cached
- b . It achieves continuous integration agile development and test driven development
- c . For each code commit changes, an automatic build report notification is generated
- d . All of the above



KNOWLEDGE  
CHECK

What are the advantages of Jenkins?

- a . At integration stage, build failures are cached
- b . It achieves continuous integration Agile development and test driven development
- c . For each code commit changes, an automatic build report notification is generated
- d . All of the above



The correct answer is **d. All of the above**

Advantages of Jenkins are that at integration stage, build failures are cached. It achieves continuous integration Agile development and test driven development. For each code commit changes, an automatic build report notification is generated.

# Exercise

## 1

### Exercise to set up CI pipeline using Jenkins

To configure and explore Docker networking, perform the following steps:

1. Create a HelloWorld Java program
2. Add it to Git repository
3. Install Jenkins
4. Create a project in Jenkins to trigger build for code changes to HelloWorld in GitHub
5. Run test cases of HelloWorld using Jmeter in Jenkins

# Key Takeaways

---

- Continuous Integration automates the build and testing of code for every commit to version control.
- Tools used for Continuous Integration are Jenkins, TeamCity, Travis CI, Bamboo, and CodeShip.
- Jenkins is a cross-platform tool and offers configuration both through GUI interface and console commands.
- TeamCity is a Java-based build management and continuous integration server.

## QUIZ

1

What is Jenkins?

- a . A Build Server
- b . A Test Server
- c . An Open source automation server for builds, test, and deployment
- d . A Mail Server





## QUIZ

1

What is Jenkins?

- a A Build Server
- b A Test Server
- c An Open source automation server for builds, test, and deployment
- d A Mail Server



The correct answer is

**c. Open source automation server for builds, test, and deployment**

Jenkins has plugins for a build server, test server, and an open source automation server.

## QUIZ

2

What of the following is NOT a plugin of Jenkins?

- a Maven
- .
- b Git
- .
- c Amazon  
EC2
- .
- d Source  
Code
- .



## QUIZ

2

Which of the following is NOT a plugin of Jenkins?

- a Maven
- .
- b Git
- .
- c Amazon  
EC2
- .
- d Source  
Code
- .



The correct answer is **d. Source Code**

Various source code repositories have a plugin for Jenkins; however, source code itself cannot be a plugin.

## QUIZ

3

Which of the following is is NOT true for Continuous Integration with Jenkins?

- a . Producing clean build
- b . Automating unit test execution
- c . Providing continuous feedback
- d . Integrating with source code



## QUIZ 3

Which of the following is NOT true for Continuous Integration with Jenkins?

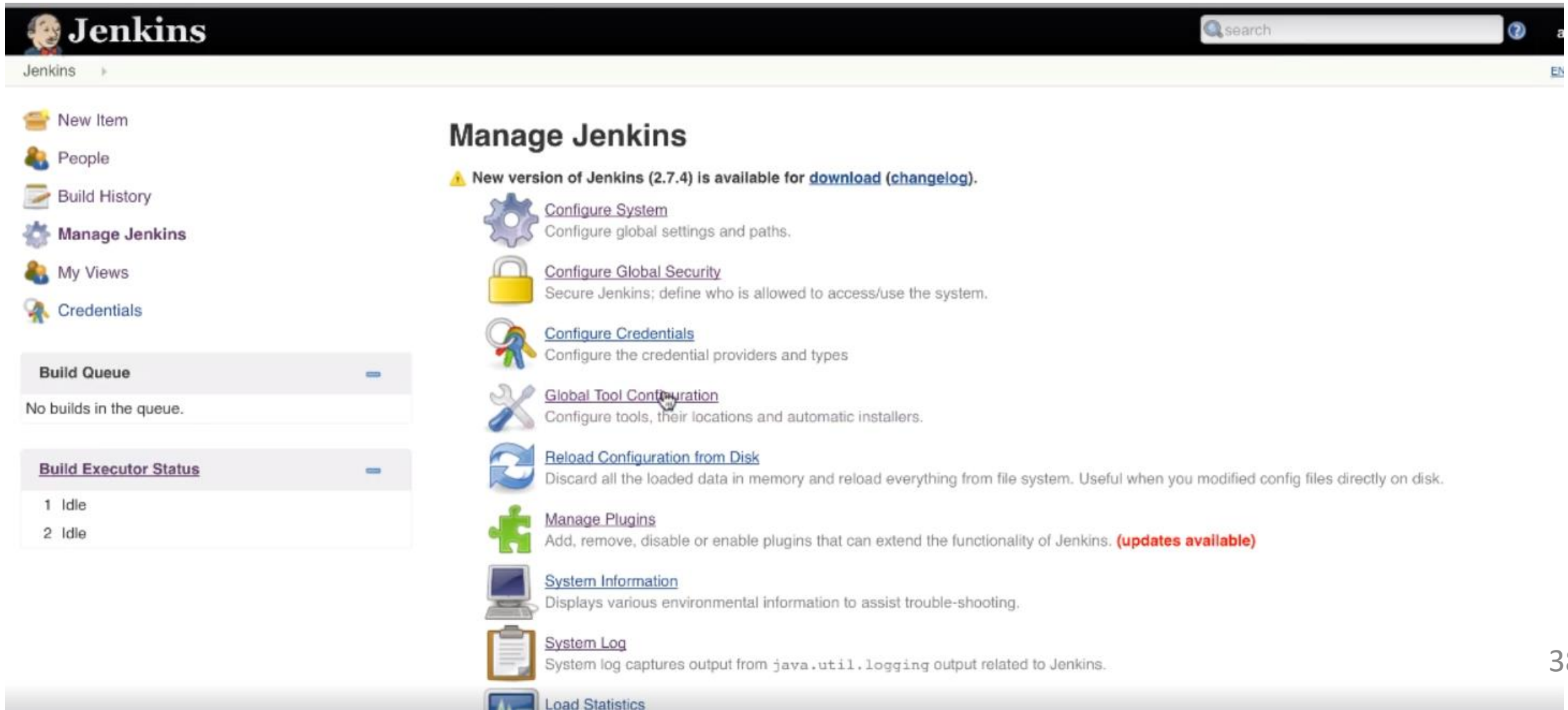
- a . Producing clean build
- b . Automating unit test execution
- c . Providing continuous feedback
- d . Integrating with source code



The correct answer is **c. Providing continuous feedback**.  
Jenkins does not have any tool/plugin for providing continuous feedback.

## Configure Jenkins to work Maven, Java and GIT

1. Go to Manage Jenkins then select Global Tool Configuration
2. As you see we need to setup couple of things like JDK, GIT, Maven etc. So Jenkins to know where to locate those tools while build process.



The screenshot shows the Jenkins web interface. At the top is the Jenkins logo and a search bar. Below the logo is a navigation menu with links: New Item, People, Build History, Manage Jenkins (highlighted), My Views, and Credentials. On the left, there are two panels: 'Build Queue' showing 'No builds in the queue.' and 'Build Executor Status' showing two idle executors. The main content area is titled 'Manage Jenkins' and contains a list of configuration options, each with an icon and a description. A notification at the top of this section states: 'New version of Jenkins (2.7.4) is available for [download](#) ([changelog](#)).' The configuration options are: 'Configure System' (gear icon), 'Configure Global Security' (lock icon), 'Configure Credentials' (key icon), 'Global Tool Configuration' (wrench icon, highlighted with a mouse cursor), 'Reload Configuration from Disk' (refresh icon), 'Manage Plugins' (puzzle piece icon), 'System Information' (monitor icon), 'System Log' (clipboard icon), and 'Load Statistics' (bar chart icon).

**Jenkins**

Search

Jenkins

New Item

People

Build History

**Manage Jenkins**

My Views

Credentials

**Build Queue**

No builds in the queue.










**Build Executor Status**

1 Idle

2 Idle

### Manage Jenkins

New version of Jenkins (2.7.4) is available for [download](#) ([changelog](#)).

-  [Configure System](#)  
Configure global settings and paths.
-  [Configure Global Security](#)  
Secure Jenkins; define who is allowed to access/use the system.
-  [Configure Credentials](#)  
Configure the credential providers and types
-  [Global Tool Configuration](#)  
Configure tools, their locations and automatic installers.
-  [Reload Configuration from Disk](#)  
Discard all the loaded data in memory and reload everything from file system. Useful when you modified config files directly on disk.
-  [Manage Plugins](#)  
Add, remove, disable or enable plugins that can extend the functionality of Jenkins. **(updates available)**
-  [System Information](#)  
Displays various environmental information to assist trouble-shooting.
-  [System Log](#)  
System log captures output from `java.util.logging` output related to Jenkins.
-  [Load Statistics](#)

## JDK

### JDK installations



JDK

Name

LocalJDK

JAVA\_HOME

/usr/lib/jvm/java-1.8.0-openjdk-1.8.0.161-0.b14.36.amzn1.x86\_64



Install automatically



Delete JDK

Add JDK

List of JDK installations on this system

## Git

### Git installations



Git

Name

LocalGit

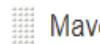
Path to Git executable

git



## Maven

### Maven installations



Maven

Name

LocalMaven

MAVEN\_HOME

/usr/share/apache-maven



Install automatically

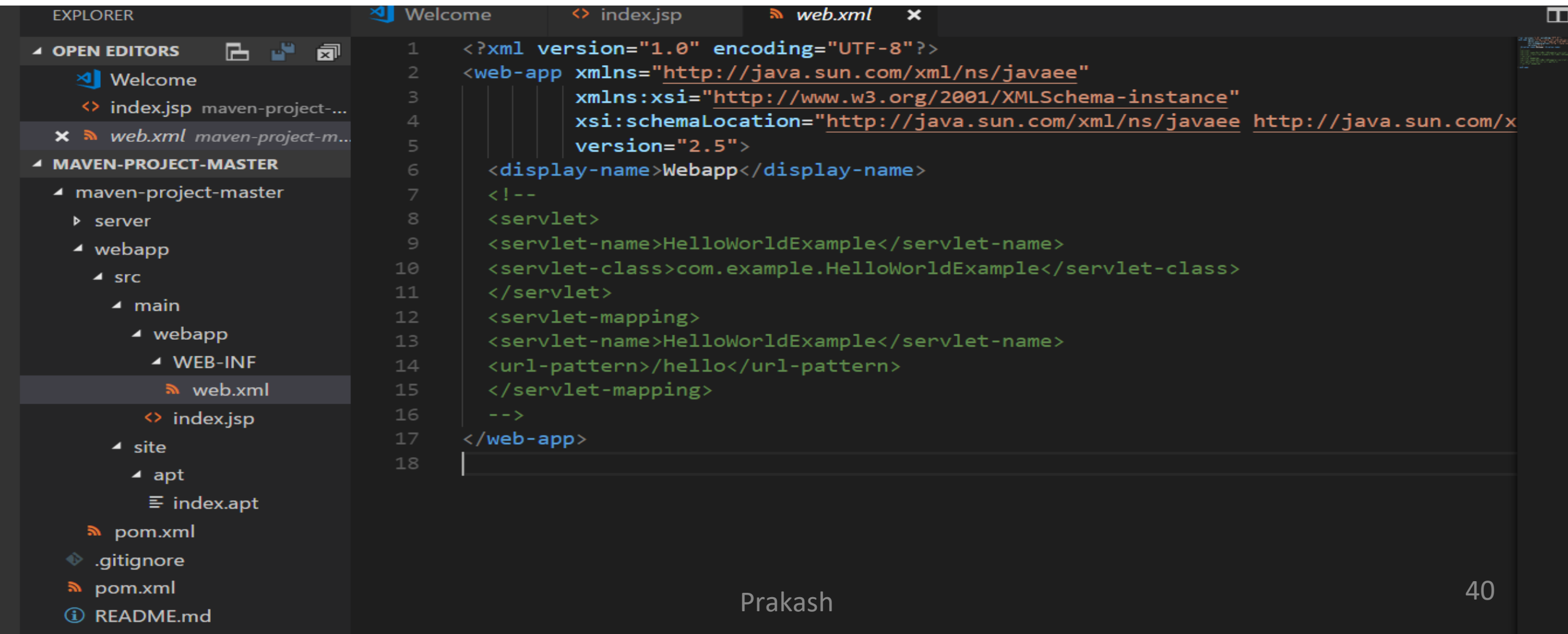
Delete Maven

## First Maven Based Project:

Github repo UTR <https://github.com/prakashk0301/maven-project.git>

Web.xml: it will tell you how to deploy your application

Index.jsp: Html page information ,which we can see after successful deployment.



The screenshot shows an IDE with a dark theme. On the left is the Explorer panel showing a project structure for 'MAVEN-PROJECT-MASTER'. The 'web.xml' file is selected under the 'webapp' directory. The main editor area displays the content of 'web.xml' with line numbers 1 through 18. The code defines a web application with a display name 'Webapp', a single servlet named 'HelloWorldExample' using the class 'com.example.HelloWorldExample', and a mapping for the URL pattern '/hello'.

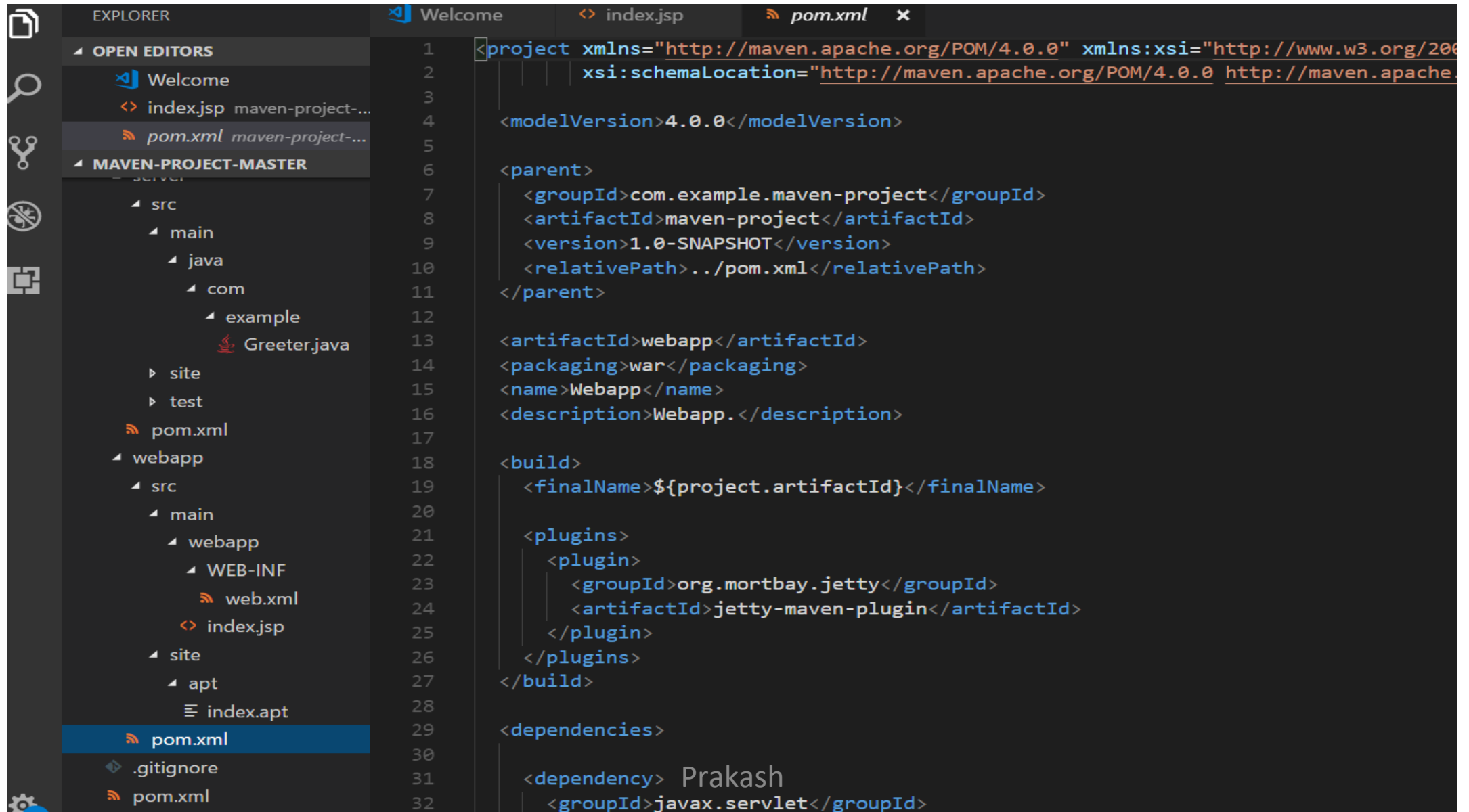
```
1 <?xml version="1.0" encoding="UTF-8"?>
2 <web-app xmlns="http://java.sun.com/xml/ns/javaee"
3         xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
4         xsi:schemaLocation="http://java.sun.com/xml/ns/javaee http://java.sun.com/x
5         version="2.5">
6     <display-name>Webapp</display-name>
7     <!--
8     <servlet>
9         <servlet-name>HelloWorldExample</servlet-name>
10        <servlet-class>com.example.HelloWorldExample</servlet-class>
11    </servlet>
12    <servlet-mapping>
13        <servlet-name>HelloWorldExample</servlet-name>
14        <url-pattern>/hello</url-pattern>
15    </servlet-mapping>
16    -->
17 </web-app>
18
```



# Maven pom.xml file

- Describe the software project being built, including
  - The dependencies on other external modules.
  - The directory structures.
  - The required plugins.
  - The predefined targets for performing certain tasks such as compilation and packaging.

In our project we have total 3 pom.xml file



The screenshot displays an IDE interface with a dark theme. On the left, the 'EXPLORER' sidebar shows a project structure under 'MAVEN-PROJECT-MASTER'. The structure includes a 'src' directory with 'main' (containing 'java' and 'com/example/Greeter.java'), 'site', and 'test'. There is also a 'webapp' directory with 'src' (containing 'main' and 'webapp' which has 'WEB-INF' and 'web.xml'), 'site', and 'apt'. A 'pom.xml' file is listed at the root of the webapp directory. The main editor area shows the content of a selected 'pom.xml' file. The XML content is as follows:

```
1 <?xml version="1.0" encoding="UTF-8" ?>
2 <project xmlns="http://maven.apache.org/POM/4.0.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
3       xsi:schemaLocation="http://maven.apache.org/POM/4.0.0 http://maven.apache.org/maven-v4_0_0.xsd">
4   <modelVersion>4.0.0</modelVersion>
5   <parent>
6     <groupId>com.example.maven-project</groupId>
7     <artifactId>maven-project</artifactId>
8     <version>1.0-SNAPSHOT</version>
9     <relativePath>../pom.xml</relativePath>
10  </parent>
11  <artifactId>webapp</artifactId>
12  <packaging>war</packaging>
13  <name>Webapp</name>
14  <description>Webapp.</description>
15  <build>
16    <finalName>${project.artifactId}</finalName>
17    <plugins>
18      <plugin>
19        <groupId>org.mortbay.jetty</groupId>
20        <artifactId>jetty-maven-plugin</artifactId>
21      </plugin>
22    </plugins>
23  </build>
24  <dependencies>
25    <dependency> Prakash
26      <groupId>javax.servlet</groupId>
```

## Build



### Invoke top-level Maven targets



Maven Version

localMaven



Goals

clean package



Advanced...

Add build step ▾

## Post-build Actions

Add post-build action ▾

Save

Apply

Jenkins has build our project in a workspace under a shared directory on the local box

## Console Output

Started by user `admin`

Building in workspace `/Users/Shared/Jenkins/Home/workspace/maven-project`

```
> git rev-parse --is-inside-work-tree # timeout=10
```

Fetching changes from the remote Git repository

```
git rev-parse --is-inside-work-tree # timeout=10
```

Jenkins figured out the right order to build the job, First one is the root directory of our project

[https://jenkins-ci.org/2011/01/20/](#)

[INFO] -----

[INFO] Reactor Build Order:

[INFO]

[INFO] Maven Project

[INFO] Server

[INFO] Webapp

[INFO]

[INFO] -----

[INFO] Building Maven Project 1.0-SNAPSHOT

## Cleaning the environment before building the job, Basically it is removing any artifact before building

```
Downloaded from central: https://repo.maven.apache.org/maven2/org/apache/maven/plugins/maven-clean-plugin/2.5/maven-clean-plugin-2.5.jar (25 kB at [INFO]
[INFO] --- maven-clean-plugin:2.5:clean (default-clean) @ maven-project ---
Downloading from central: https://repo.maven.apache.org/maven2/org/apache/maven/maven-plugin-api/2.0.6/maven-plugin-api-2.0.6.pom
Progress (1): 1.5 kB
```

```
Downloaded from central: https://repo.maven.apache.org/maven2/org/apache/maven/maven-plugin-api/2.0.6/maven-plugin-api-2.0.6.pom (1.5 kB at 182 kB/s)
```

## Server module: Jenkins is executing the sequence of build command such as compile, test for packaging

```
[INFO]
[INFO] --- maven-clean-plugin:2.5:clean (default-clean) @ webapp ---
[INFO]
[INFO] --- maven-resources-plugin:2.5:resources (default-resources) @ webapp ---
[debug] execute contextualize
[INFO] Using 'utf-8' encoding to copy filtered resources.
[INFO] skip non existing resourceDirectory /var/lib/jenkins/workspace/maven-project/webapp/src/main/resources
[INFO]
[INFO] --- maven-compiler-plugin:2.3.2:compile (default-compile) @ webapp ---
[INFO] No sources to compile
[INFO]
[INFO] --- maven-resources-plugin:2.5:testResources (default-testResources) @ webapp ---
[debug] execute contextualize
[INFO] Using 'utf-8' encoding to copy filtered resources.
[INFO] skip non existing resourceDirectory /var/lib/jenkins/workspace/maven-project/webapp/src/test/resources
[INFO]
[INFO] --- maven-compiler-plugin:2.3.2:testCompile (default-testCompile) @ webapp ---
[INFO] No sources to compile
[INFO]
[INFO] --- maven-surefire-plugin:2.11:test (default-test) @ webapp ---
[INFO] No tests to run.
[INFO] Surefire report directory: /var/lib/jenkins/workspace/maven-project/webapp/target/surefire-reports
Downloading from central: https://repo.maven.apache.org/maven2/org/apache/maven/surefire/surefire-junit3/2.11/surefire-junit3-2.11.jar
Progress (1): 1.7 kB
```

## After server module it prints out the Unit test report

```
-----  
T E S T S  
-----  
  
Results :  
  
Tests run: 0, Failures: 0, Errors: 0, Skipped: 0  
  
[INFO]  
[INFO] --- maven-war-plugin:2.2:war (default-war) @ webapp ---
```

## Lastly it package the Server module and producing the jar file under the server directory

```
[INFO]  
[INFO] --- maven-jar-plugin:2.4:jar (default-jar) @ server ---  
Downloading from central: https://repo.maven.apache.org/maven2/org/apache/maven/maven-archiver/2.5/maven-archiver-2.5.pom  
Progress (1): 2.1/4.5 kB  
Progress (1): 4.5 kB  
  
Downloaded from central: https://repo.maven.apache.org/maven2/org/apache/maven/maven-archiver/2.5/maven-archiver-2.5.pom (4.5 kB)  
Downloading from central: https://repo.maven.apache.org/maven2/org/apache/maven/shared/maven-shared-components/17/maven-shared-components-17.pom  
Progress (1): 2.1/4.5 kB  
Progress (1): 4.5 kB  
  
Downloaded from central: https://repo.maven.apache.org/maven2/org/apache/maven/shared/maven-shared-components/17/maven-shared-components-17.pom (4.5 kB)  
Downloading from central: https://repo.maven.apache.org/maven2/org/apache/maven/maven-archiver/2.5/maven-archiver-2.5.jar  
Progress (1): 2.1/208 kB  
Progress (1): 4.5/208 kB  
Progress (1): 7.7/208 kB  
Progress (1): 10.4/208 kB  
Progress (1): 13.1/208 kB  
Progress (1): 15.8/208 kB  
Progress (1): 18.5/208 kB  
Progress (1): 21.2/208 kB  
Progress (1): 23.9/208 kB  
Progress (1): 26.6/208 kB  
Progress (1): 29.3/208 kB  
Progress (1): 32.0/208 kB  
Progress (1): 34.7/208 kB  
Progress (1): 37.4/208 kB  
Progress (1): 40.1/208 kB  
Progress (1): 42.8/208 kB  
Progress (1): 45.5/208 kB  
Progress (1): 48.2/208 kB  
Progress (1): 50.9/208 kB  
Progress (1): 53.6/208 kB  
Progress (1): 56.3/208 kB  
Progress (1): 59.0/208 kB  
Progress (1): 61.7/208 kB  
Progress (1): 64.4/208 kB  
Progress (1): 67.1/208 kB  
Progress (1): 69.8/208 kB  
Progress (1): 72.5/208 kB  
Progress (1): 75.2/208 kB  
Progress (1): 77.9/208 kB  
Progress (1): 80.6/208 kB  
Progress (1): 83.3/208 kB  
Progress (1): 86.0/208 kB  
Progress (1): 88.7/208 kB  
Progress (1): 91.4/208 kB  
Progress (1): 94.1/208 kB  
Progress (1): 96.8/208 kB  
Progress (1): 99.5/208 kB  
Progress (1): 102.2/208 kB  
Progress (1): 104.9/208 kB  
Progress (1): 107.6/208 kB  
Progress (1): 110.3/208 kB  
Progress (1): 113.0/208 kB  
Progress (1): 115.7/208 kB  
Progress (1): 118.4/208 kB  
Progress (1): 121.1/208 kB  
Progress (1): 123.8/208 kB  
Progress (1): 126.5/208 kB  
Progress (1): 129.2/208 kB  
Progress (1): 131.9/208 kB  
Progress (1): 134.6/208 kB  
Progress (1): 137.3/208 kB  
Progress (1): 140.0/208 kB  
Progress (1): 142.7/208 kB  
Progress (1): 145.4/208 kB  
Progress (1): 148.1/208 kB  
Progress (1): 150.8/208 kB  
Progress (1): 153.5/208 kB  
Progress (1): 156.2/208 kB  
Progress (1): 158.9/208 kB  
Progress (1): 161.6/208 kB  
Progress (1): 164.3/208 kB  
Progress (1): 167.0/208 kB  
Progress (1): 169.7/208 kB  
Progress (1): 172.4/208 kB  
Progress (1): 175.1/208 kB  
Progress (1): 177.8/208 kB  
Progress (1): 180.5/208 kB  
Progress (1): 183.2/208 kB  
Progress (1): 185.9/208 kB  
Progress (1): 188.6/208 kB  
Progress (1): 191.3/208 kB  
Progress (1): 194.0/208 kB  
Progress (1): 196.7/208 kB  
Progress (1): 199.4/208 kB  
Progress (1): 202.1/208 kB  
Progress (1): 204.8/208 kB  
Progress (1): 207.5/208 kB  
Progress (1): 208 kB at 3.6 MB/s  
[INFO] Building jar: /var/lib/jenkins/workspace/maven-project/server/target/server.jar  
[INFO]  
[INFO] -----Prakash-----
```

## Building the webapp module which is pretty similar to the server module

```
[INFO] -----
[INFO] Building Webapp 1.0-SNAPSHOT
[INFO] -----
Downloading from central: https://repo.maven.apache.org/maven2/org/apache/maven/plugins/maven-war-plugin/2.2/maven-war-plugin-2.2.pom
Progress (1): 4.1/6.5 kB
Progress (1): 6.5 kB

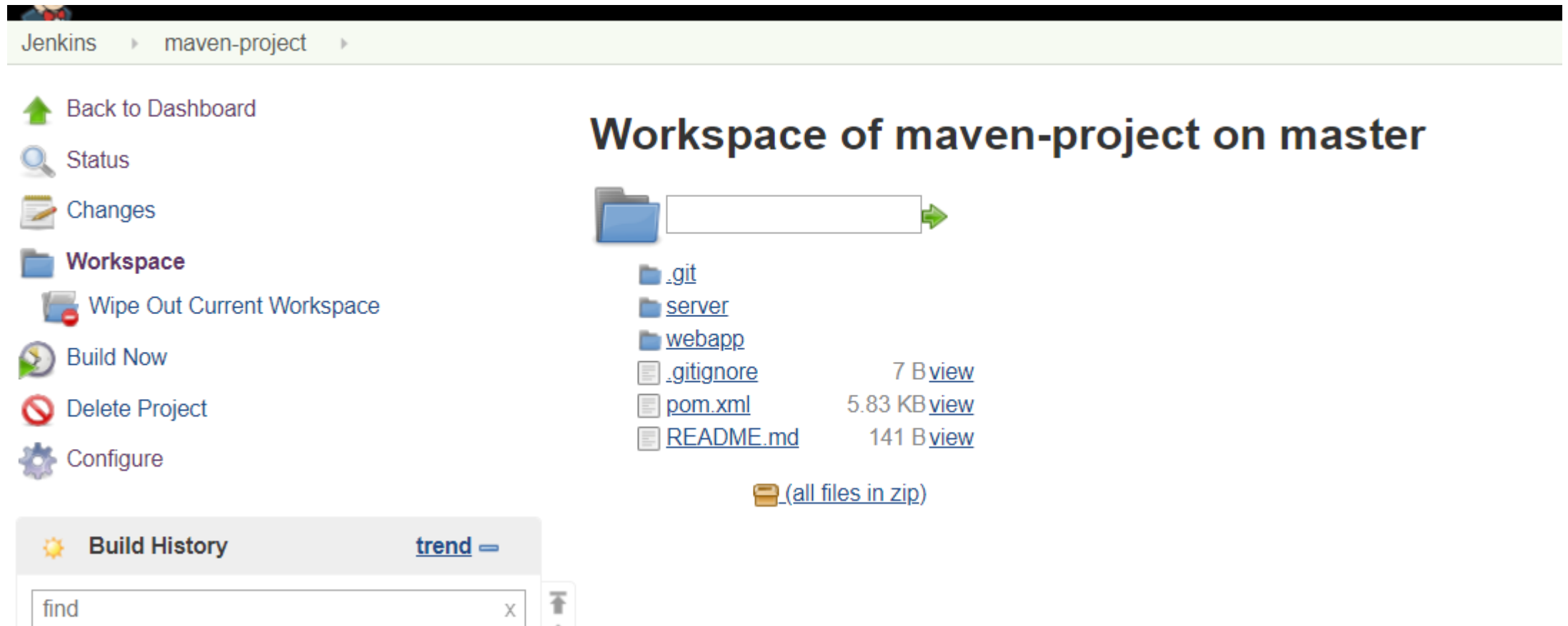
^
[INFO] --- maven-clean-plugin:2.5:clean (default-clean) @ webapp ---
[INFO]
[INFO] --- maven-resources-plugin:2.5:resources (default-resources) @ webapp ---
[debug] execute contextualize
[INFO] Using 'utf-8' encoding to copy filtered resources.
[INFO] skip non existing resourceDirectory /var/lib/jenkins/workspace/maven-project/webapp/src/main/resources
[INFO]
[INFO] --- maven-compiler-plugin:2.3.2:compile (default-compile) @ webapp ---
[INFO] No sources to compile
[INFO]
[INFO] --- maven-resources-plugin:2.5:testResources (default-testResources) @ webapp ---
[debug] execute contextualize
[INFO] Using 'utf-8' encoding to copy filtered resources.
[INFO] skip non existing resourceDirectory /var/lib/jenkins/workspace/maven-project/webapp/src/test/resources
[INFO]
[INFO] --- maven-compiler-plugin:2.3.2:testCompile (default-testCompile) @ webapp ---
[INFO] No sources to compile
[INFO]
[INFO] --- maven-surefire-plugin:2.11:test (default-test) @ webapp ---
[INFO] No tests to run.
[INFO] Surefire report directory: /var/lib/jenkins/workspace/maven-project/webapp/target/surefire-reports
```

**In the end it packages the webapp module and produces the webapp war file which can be further deploy to servlet container like tomcat, apache**

```
Downloaded from central: https://repo.maven.apache.org/maven2/com/thoughtworks/xstream/xstream/1.3.1/xstream-1.3.1.jar (431 kB at 7.3 MB/s)
[INFO] Packaging webapp
[INFO] Assembling webapp [webapp] in [/var/lib/jenkins/workspace/maven-project/webapp/target/webapp]
[INFO] Processing war project
[INFO] Copying webapp resources [/var/lib/jenkins/workspace/maven-project/webapp/src/main/webapp]
[INFO] Webapp assembled in [31 msecs]
[INFO] Building war: /var/lib/jenkins/workspace/maven-project/webapp/target/webapp.war
[INFO] WEB-INF/web.xml already added, skipping
[INFO] -----
[INFO] Reactor Summary:
[INFO]
[INFO] Maven Project ..... SUCCESS [ 1.775 s]
[INFO] Server ..... SUCCESS [ 5.571 s]
[INFO] Webapp ..... SUCCESS [ 0.941 s]
[INFO] -----
[INFO] BUILD SUCCESS
[INFO] -----
[INFO] Total time: 8.578 s
[INFO] Finished at: 2018-02-16T23:46:18Z
[INFO] Final Memory: 21M/51M
[INFO] -----
Finished: SUCCESS
```



**In workspace: It displays the directory structure of this workspace which Jenkins uses to built the project**



The screenshot shows the Jenkins web interface for a project named 'maven-project'. The breadcrumb navigation at the top reads 'Jenkins > maven-project >'. On the left sidebar, there are several action links: 'Back to Dashboard' (with a green arrow icon), 'Status' (with a magnifying glass icon), 'Changes' (with a notepad icon), 'Workspace' (with a folder icon and bold text), 'Wipe Out Current Workspace' (with a trash can icon), 'Build Now' (with a play icon), 'Delete Project' (with a red 'X' icon), and 'Configure' (with a gear icon). Below these is a 'Build History' section with a search bar containing the text 'find' and a 'trend' link. The main content area is titled 'Workspace of maven-project on master'. It features a folder icon, a text input field, and a green arrow icon. Below this, a list of files and directories is shown: '.git', 'server', 'webapp', '.gitignore' (7 B, with a 'view' link), 'pom.xml' (5.83 KB, with a 'view' link), and 'README.md' (141 B, with a 'view' link'). At the bottom of the file list is a download icon and a link '(all files in zip)'.