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# Jenkins From Scratch

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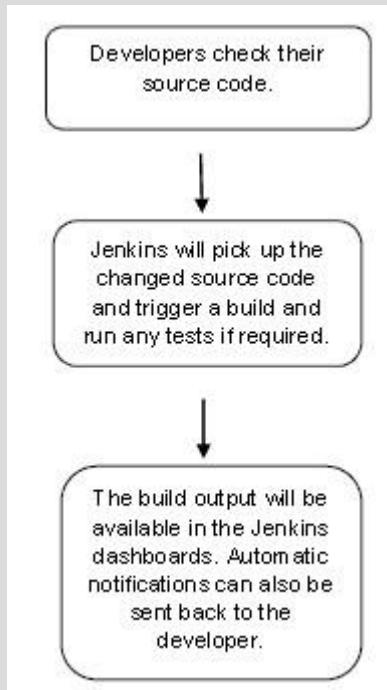
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# Jenkins

Jenkins is a powerful application that allows continuous integration and continuous delivery of projects, regardless of the platform you are working on. It is a free source that can handle any kind of build or continuous integration. You can integrate Jenkins with a number of testing and deployment technologies. In this tutorial, we would explain how you can use Jenkins to build and test your software projects continuously.

## Why Jenkins?

Jenkins is a software that allows **continuous integration**. Jenkins will be installed on a server where the central build will take place. The following flowchart demonstrates a very simple workflow of how Jenkins works.



Along with Jenkins, sometimes, one might also see the association of **Hudson**. Hudson is a very popular open-source Java-based continuous integration tool developed by Sun Microsystems which was later acquired by Oracle. After the acquisition of Sun by Oracle, a fork was created from the Hudson source code, which brought about the introduction of Jenkins.

## What is Continuous Integration?

Continuous Integration is a development practice that requires developers to integrate code into a shared repository at regular intervals. This concept was meant to remove the problem of finding later occurrence of issues in the build lifecycle. Continuous integration requires the developers to have frequent builds. The common practice is that whenever a code commit occurs, a build should be triggered.

## System Requirements

<b>JDK</b>	<b>JDK 1.5 or above</b>
<b>Memory</b>	2 GB RAM (recommended)

<b>Disk Space</b>	No minimum requirement. Note that since all builds will be stored on the Jenkins machines, it has to be ensured that sufficient disk space is available for build storage.
<b>Operating System Version</b>	Jenkins can be installed on Windows, Ubuntu/Debian, Red Hat/Fedora/CentOS, Mac OS X, openSUSE, FreeBSD, OpenBSD, Gentoo or Docker or AWS
<b>Java Container</b>	The WAR file can be run in any container that supports Servlet 2.4/JSP 2.0 or later. (An example is Tomcat 5).

## Jenkins - Installation

### Download Jenkins

The official website for Jenkins is [Jenkins](#). If you click the given link, you can get the home page of the Jenkins official website as shown below.



By default, the latest release and the Long-Term support release will be available for download. The past releases are also available for download. Click the Long-Term Support Release tab in the download section.



Click the link “Older but stable version” to download the Jenkins war file.

## Starting Jenkins

Open the command prompt. From the command prompt, browse to the directory where the jenkins.war file is present. Run the following command

```
D:\>Java -jar Jenkins.war
```

After the command is run, various tasks will run, one of which is the extraction of the war file which is done by an embedded webserver called winstome.

```
D:\>Java -jar Jenkins.war
```

Running from: D:\jenkins.war

```
Webroot: $user.home/.jenkins  
Sep 29, 2015 4:10:46 PM winstone.Logger logInternal  
INFO: Beginning extraction from war file
```

Once the processing is complete without major errors, the following line will come in the output of the command prompt.

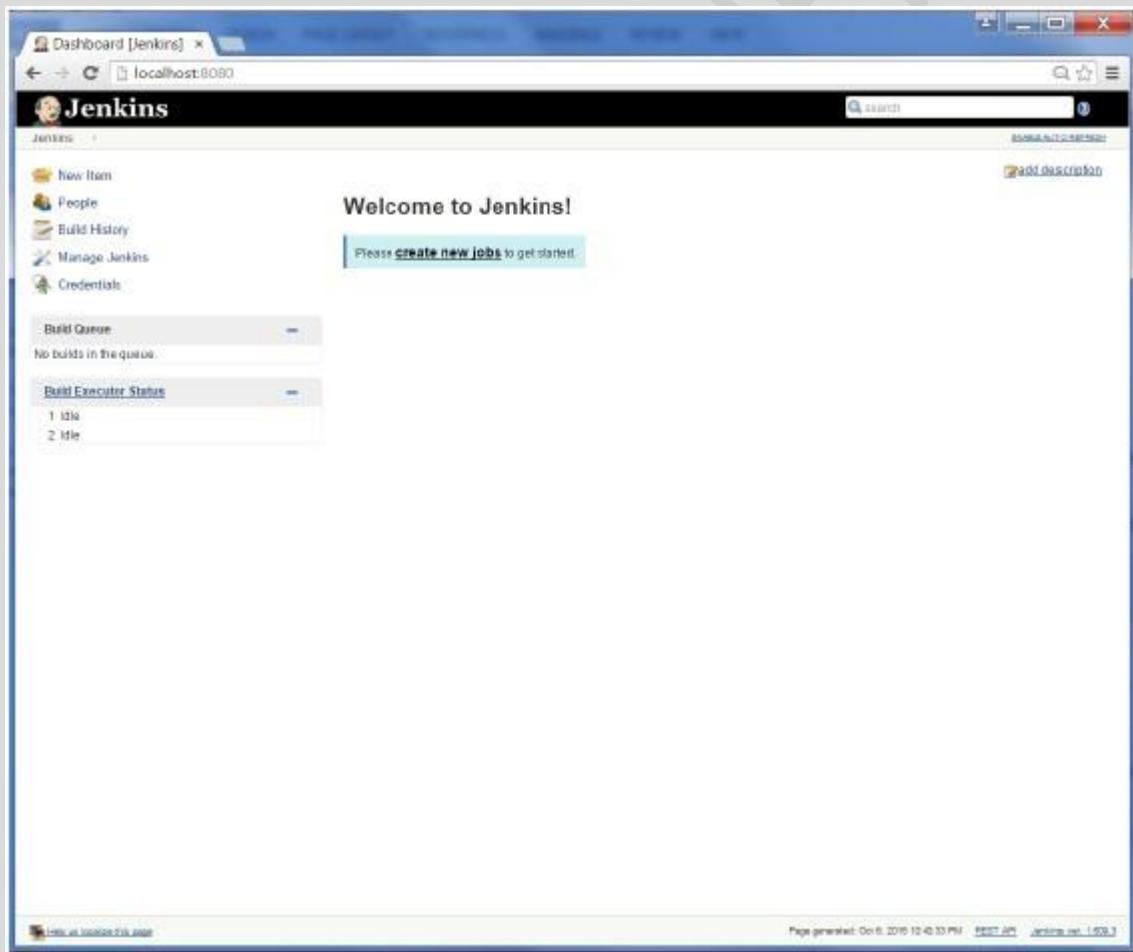
INFO: Jenkins is fully up and running

## Accessing Jenkins

Once Jenkins is up and running, one can access Jenkins from the link –

**http://localhost:8080**

This link will bring up the Jenkins dashboard.



# Jenkins – Tomcat Setup

The following prerequisites must be met for Jenkins Tomcat setup.

## Step 1: Verifying Java Installation

To verify Java installation, open the console and execute the following java command.

OS	Task	Command
<b>Windows</b>	Open command console	\>java -version
<b>Linux</b>	Open command terminal	\$java -version

If Java has been installed properly on your system, then you should get one of the following outputs, depending on the platform you are working on.

OS	Output
<b>Windows</b>	Java version "1.7.0_60"  Java (TM) SE Run Time Environment (build 1.7.0_60-b19)  Java Hotspot (TM) 64-bit Server VM (build 24.60-b09, mixed mode)
<b>Linux</b>	java version "1.7.0_25"  Open JDK Runtime Environment (rhel-2.3.10.4.el6_4-x86_64)  Open JDK 64-Bit Server VM (build 23.7-b01, mixed mode)

We assume the readers of this tutorial have Java 1.7.0\_60 installed on their system before proceeding for this tutorial.

In case you do not have Java JDK, you can download it from the link [Oracle](#)

## Step 2: Verifying Java Installation

Set the JAVA\_HOME environment variable to point to the base directory location where Java is installed on your machine. For example,

OS	Output
<b>Windows</b>	Set Environmental variable JAVA_HOME to C:\ProgramFiles\java\jdk1.7.0_60
<b>Linux</b>	export JAVA_HOME=/usr/local/java-current

Append the full path of the Java compiler location to the System Path.

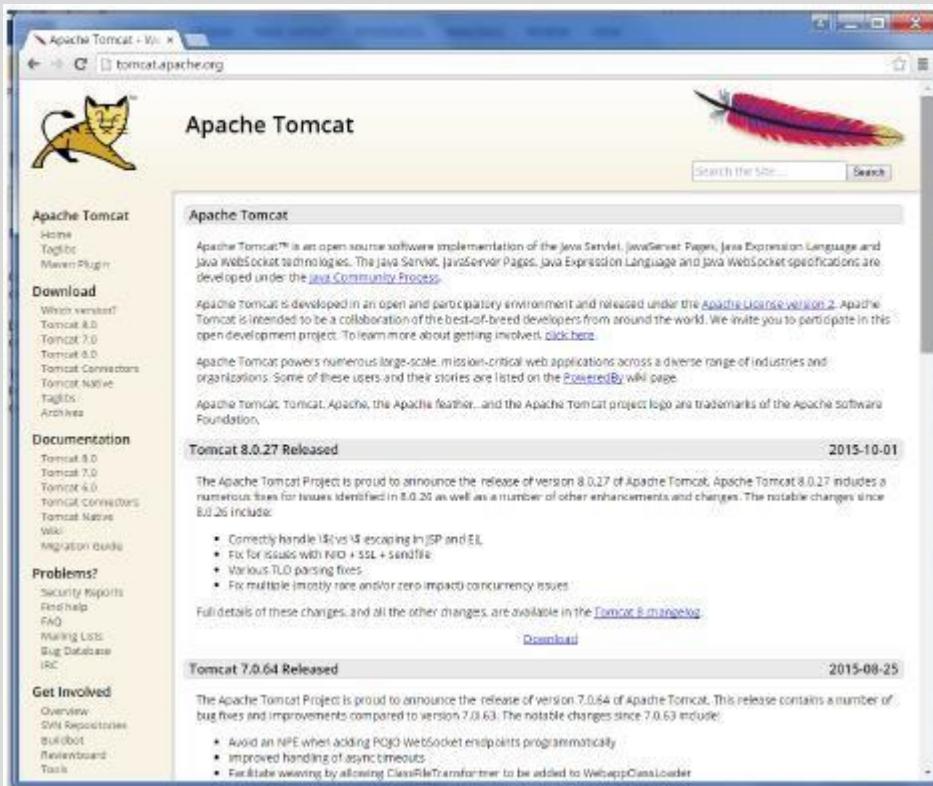
OS	Output

<b>Windows</b>	Append the String; C:\Program Files\Java\jdk1.7.0_60\bin to the end of the system variable PATH.
<b>Linux</b>	export PATH=\$PATH:\$JAVA_HOME/bin/

Verify the command java-version from command prompt as explained above.

## Step 3: Download Tomcat

The official website for tomcat is [Tomcat](http://tomcat.apache.org). If you click the given link, you can get the home page of the tomcat official website as shown below.



Browse to the link <https://tomcat.apache.org/download-70.cgi> to get the download for tomcat.

Go to the 'Binary Distributions' section. Download the 32-bit Windows zip file.

Then unzip the contents of the downloaded zip file.

## Step 4: Jenkins and Tomcat Setup

Copy the Jenkins.war file which was downloaded from the previous section and copy it to the webapps folder in the tomcat folder.

Now open the command prompt. From the command prompt, browse to the directory where the tomcat7 folder is location. Browse to the bin directory in this folder and run the start.bat file

```
E:\Apps\tomcat7\bin>startup.bat
```

Once the processing is complete without major errors, the following line will come in the output of the command prompt.

```
INFO: Server startup in 1302 ms
```

Open the browser and go to the link – **http://localhost:8080/jenkins**. Jenkins will be up and running on tomcat.

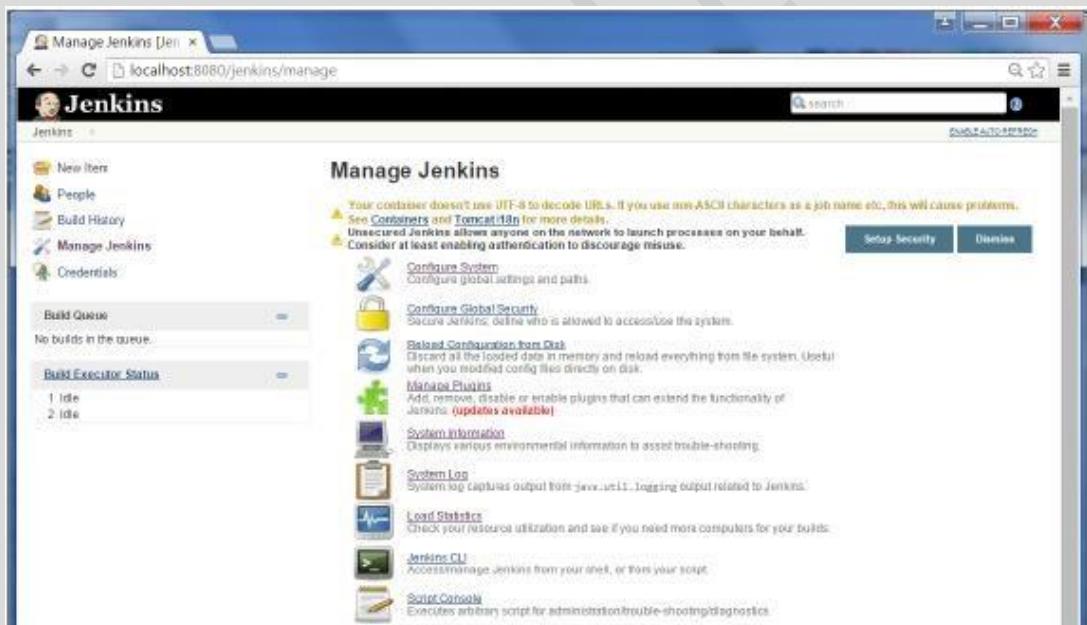


## Jenkins - Git Setup

For this exercise, you have to ensure that Internet connectivity is present from the machine on which Jenkins is installed. In your Jenkins Dashboard (Home screen), click the Manage Jenkins option on the left-hand side.



In the next screen, click the 'Manage Plugins' option.



In the next screen, click the Available tab. This tab will give a list of plugins which are available for downloading. In the 'Filter' tab type 'Git plugin'

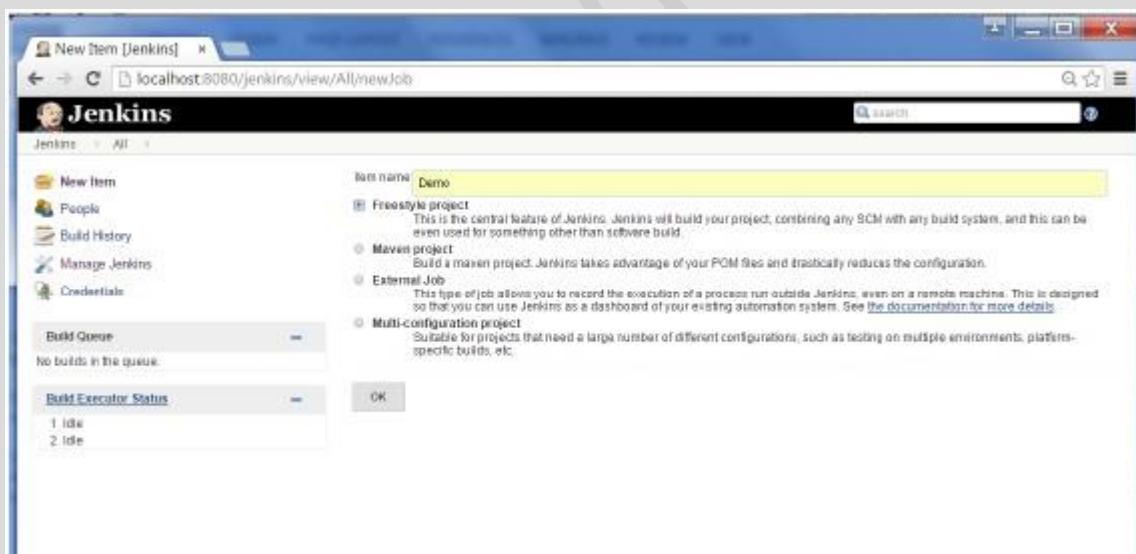
The list will then be filtered. Check the Git Plugin option and click on the button 'Install without restart'

The installation will then begin and the screen will be refreshed to show the status of the download.

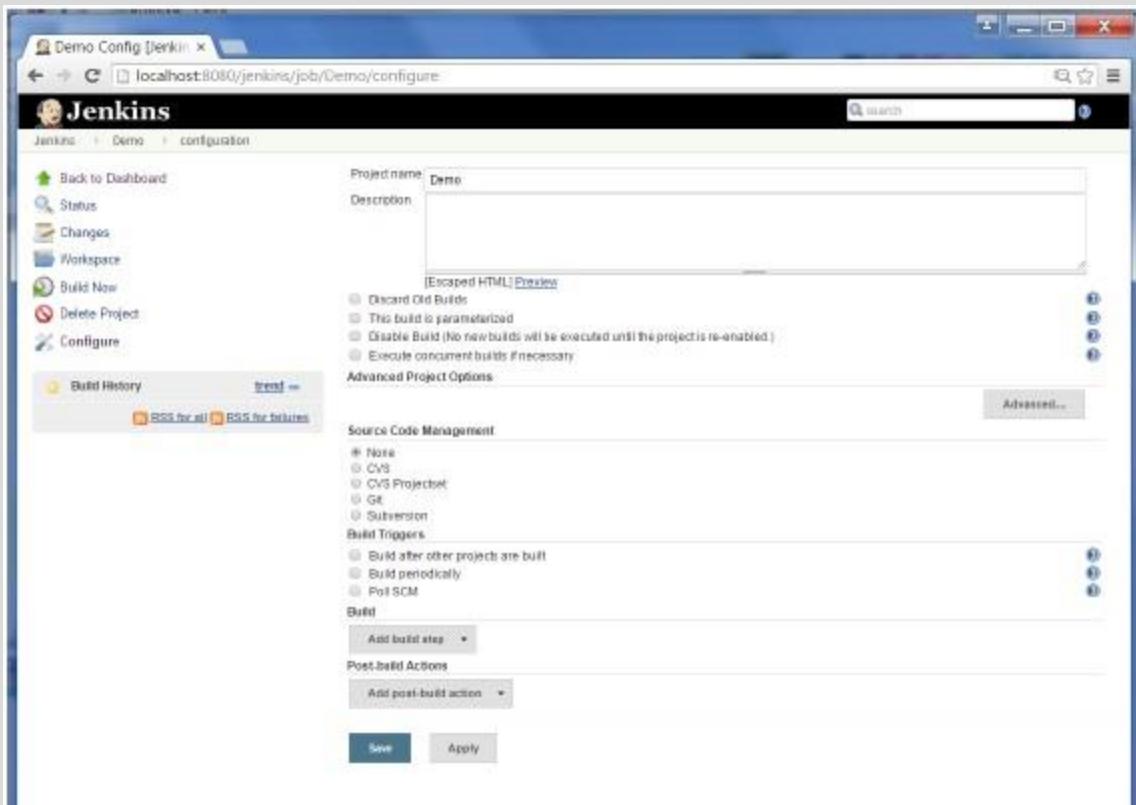


Once all installations are complete, restart Jenkins by issue the following command in the browser. **<http://localhost:8080/jenkins/restart>**

After Jenkins is restarted, Git will be available as an option whilst configuring jobs. To verify, click on New Item in the menu options for Jenkins. Then enter a name for a job, in the following case, the name entered is 'Demo'. Select 'Freestyle project' as the item type. Click the Ok button.



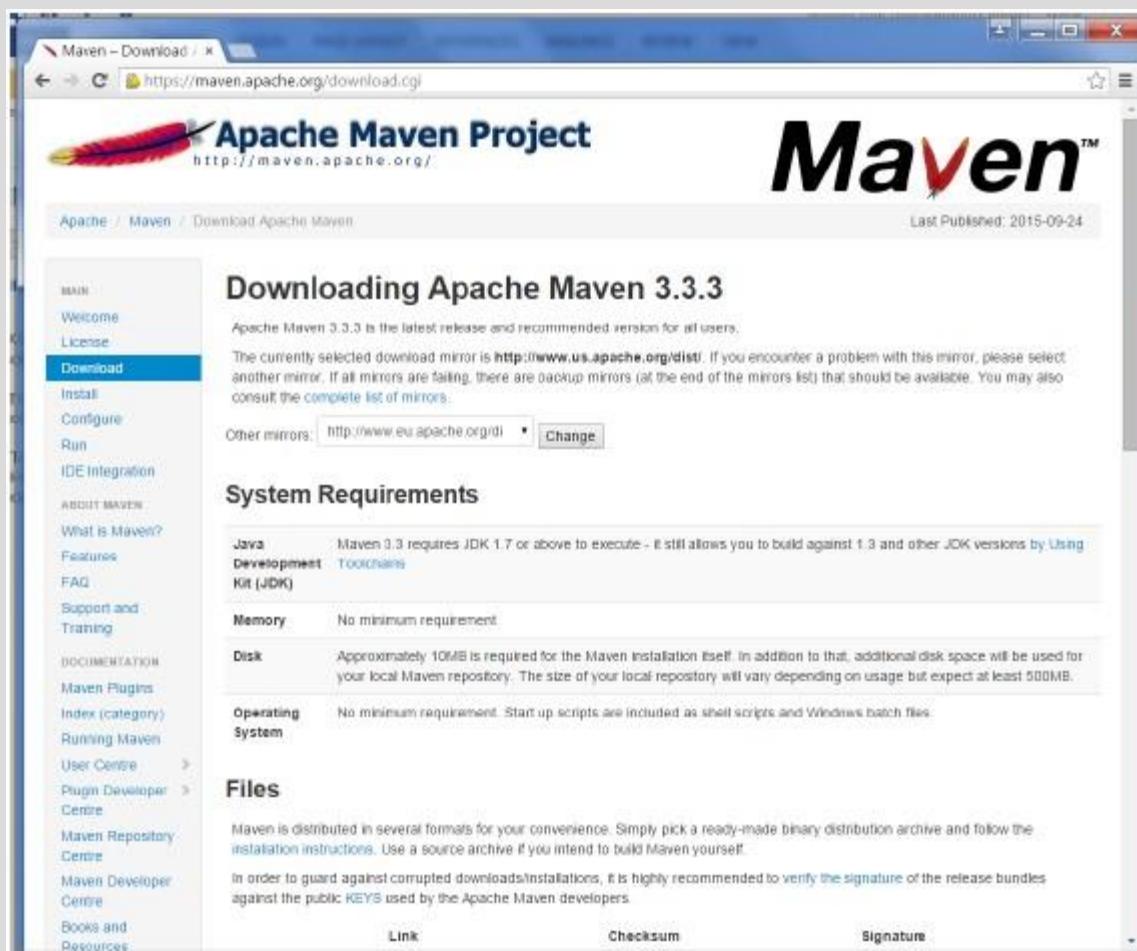
In the next screen, if you browse to the Source code Management section, you will now see 'Git' as an option.



## Jenkins – Maven Setup

### Step 1: Downloading and Setting Up Maven

The official website for maven is [Apache Maven](#). If you click the given link, you can get the home page of the maven official website as shown below.



While browsing to the site, go to the Files section and download the link to the Binary.zip file.

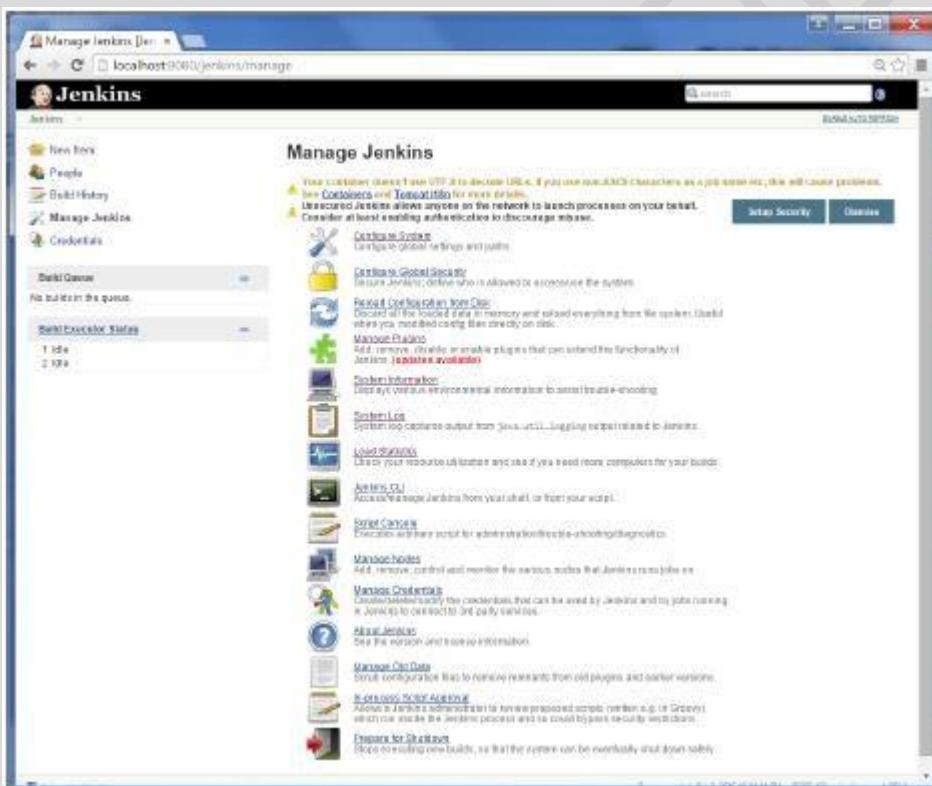
Once the file is downloaded, extract the files to the relevant application folder. For this purpose, the maven files will be placed in E:\Apps\apache-maven-3.3.3.

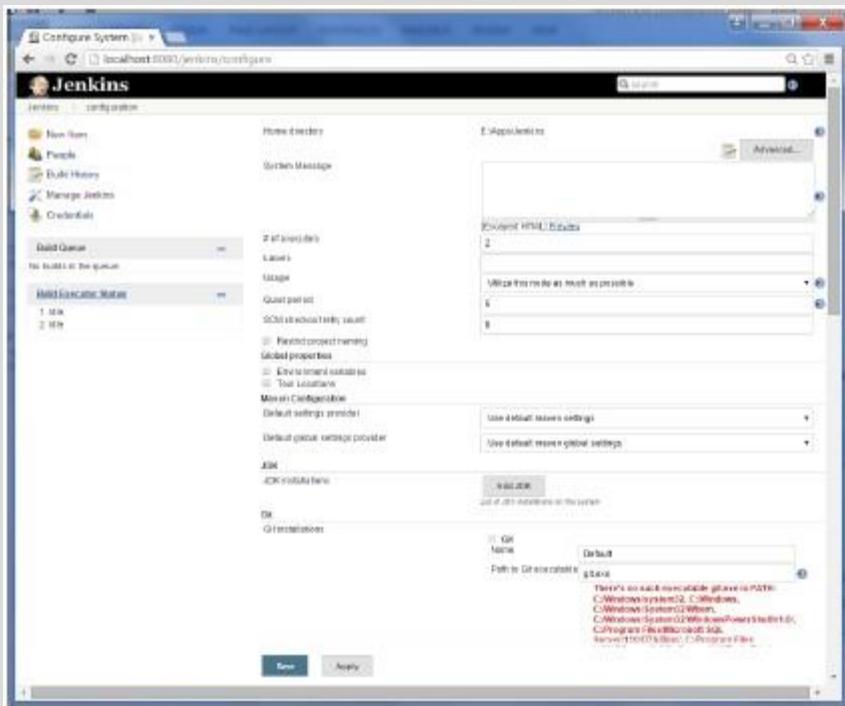
## Step 2: Setting up Jenkins and Maven

In the Jenkins dashboard (Home screen), click Manage Jenkins from the left-hand side menu.

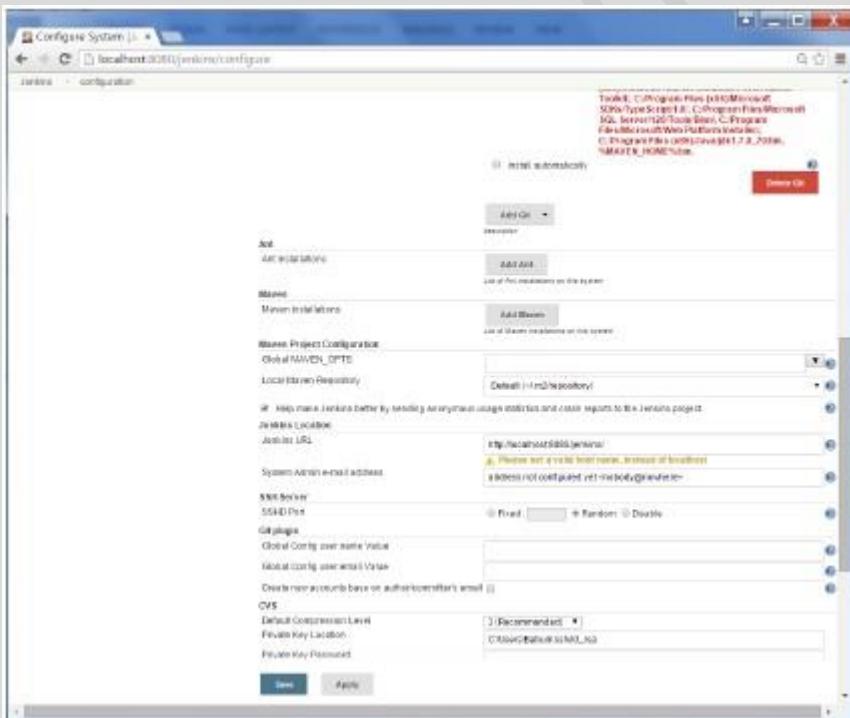


Then, click on 'Configure System' from the right hand side.





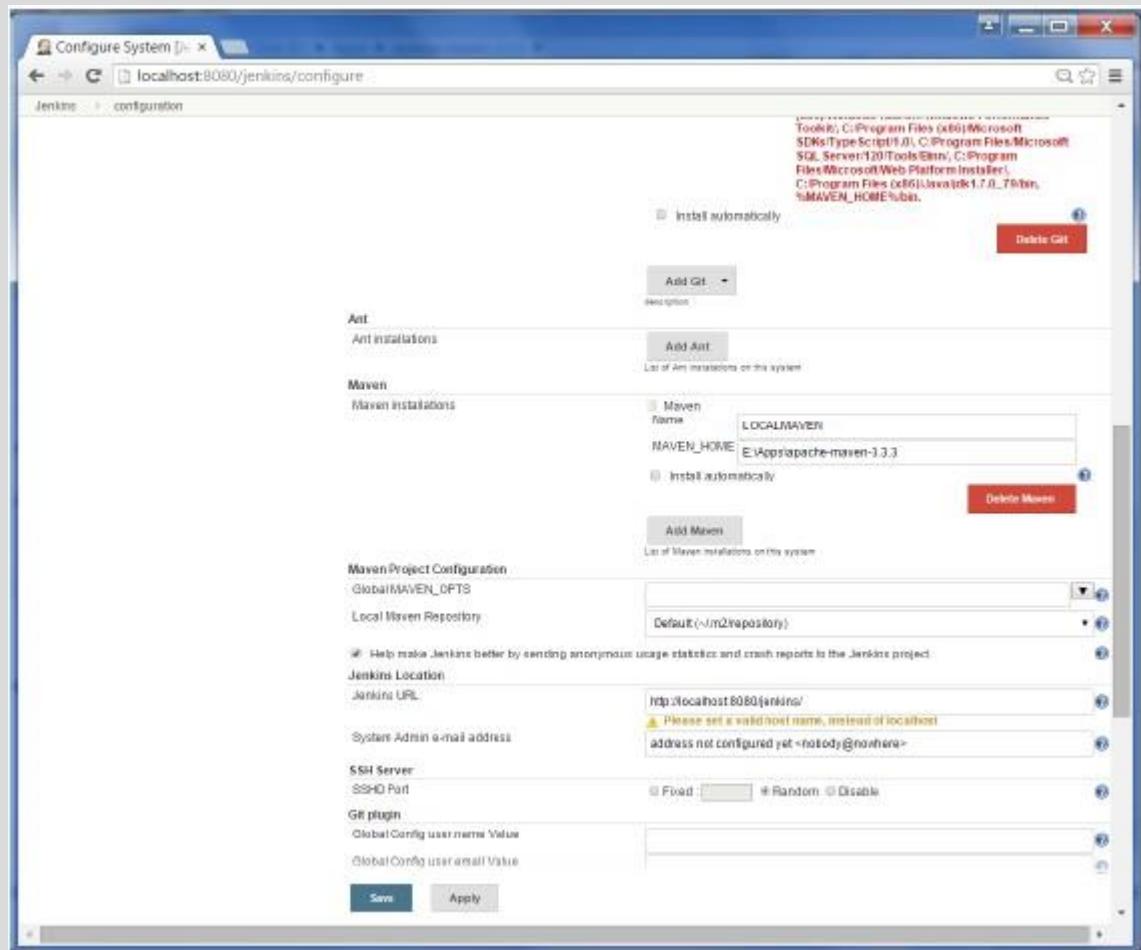
In the Configure system screen, scroll down till you see the Maven section and then click on the 'Add Maven' button.



Uncheck the 'Install automatically' option.

Add any name for the setting and the location of the MAVEN\_HOME.

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



You can now create a job with the 'Maven project' option. In the Jenkins dashboard, click the New Item option.

Dashboard [Jenkins] X localhost:8080/jenkins/ Jenkins

New Item People Build History Manage Jenkins Credentials

All S W Name Last Success Last Failure Last Duration

Icon: Demo N/A N/A N/A

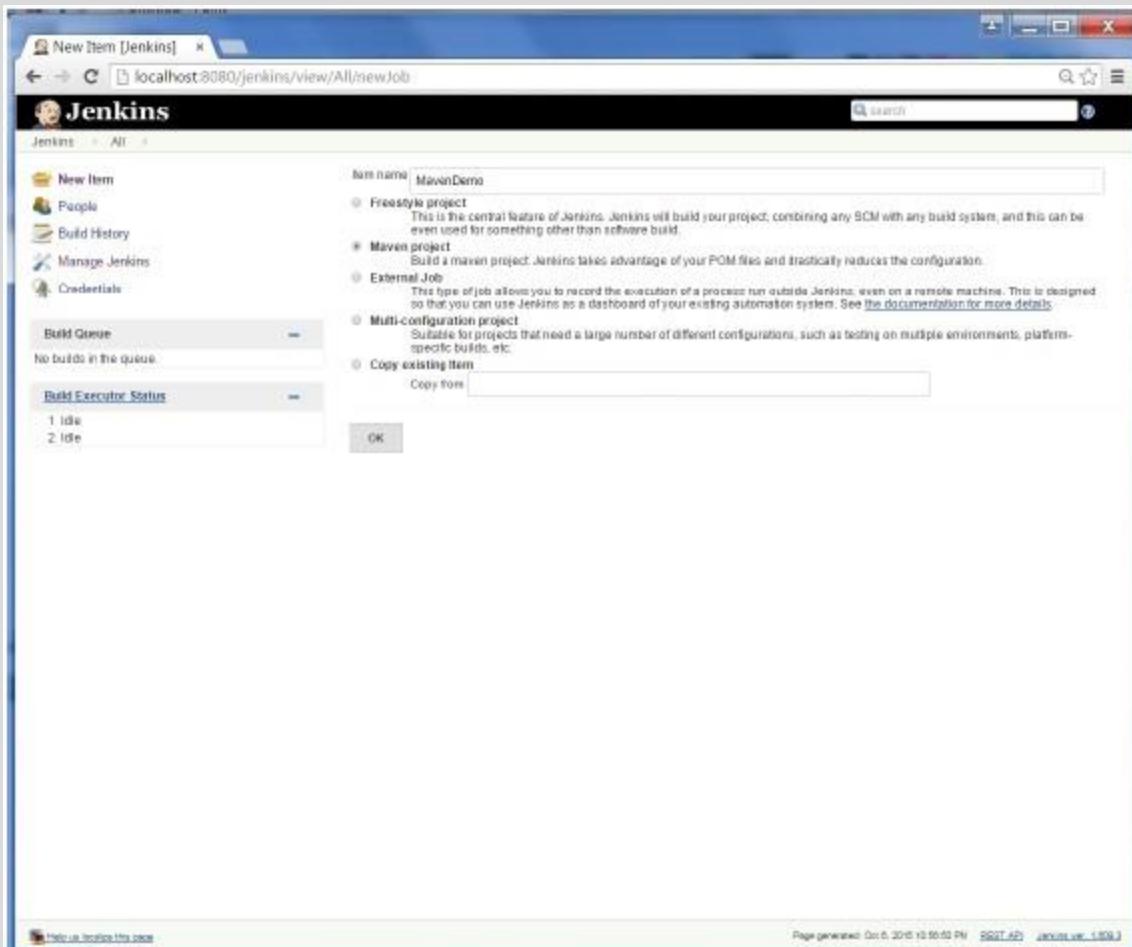
Legend RSS for all RSS for failures RSS for last failed build

Build Queue No builds in the queue.

Build Executor Status 1 Idle 2 Idle

Help | Log in | My page Page generated: Oct 6, 2015 12:55:57 PM REST API Jenkins ver. 1.60.3

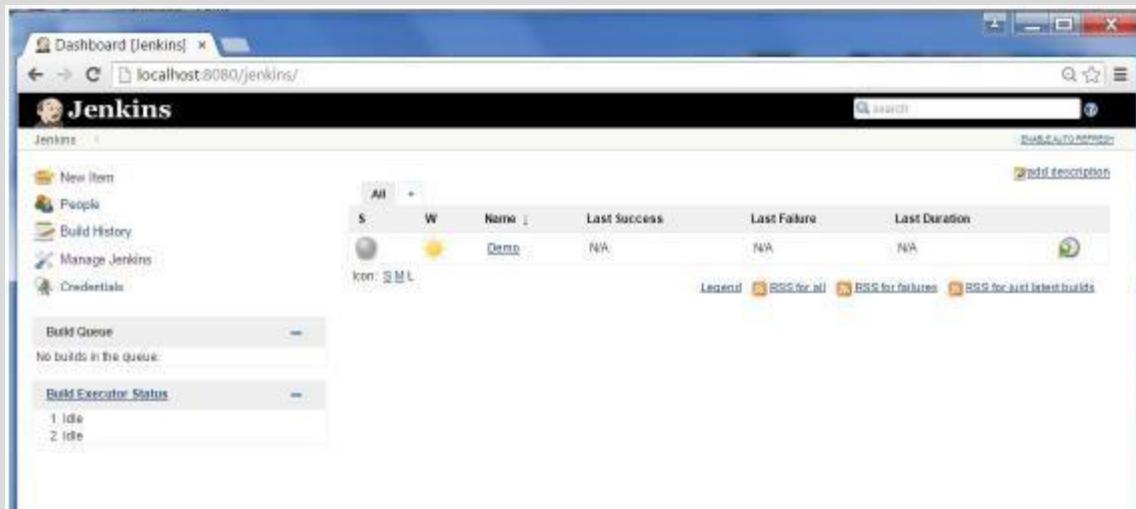
The screenshot shows the Jenkins dashboard at the URL `localhost:8080/jenkins/`. The main content area displays a single job entry for "Demo". The job's status is listed as "N/A" for both "Last Success" and "Last Failure". A legend at the bottom right indicates that yellow icons represent RSS feeds for all, failures, and the last failed build. Below the job entry, there are two dropdown menus: "Build Queue" which shows "No builds in the queue.", and "Build Executor Status" which shows "1 Idle" and "2 Idle". On the left side, there is a sidebar with links for "New Item", "People", "Build History", "Manage Jenkins", and "Credentials". At the bottom of the page, there are links for "Help", "Log in", and "My page", along with a note about the page being generated on October 6, 2015, at 12:55:57 PM, and the Jenkins version being 1.60.3.



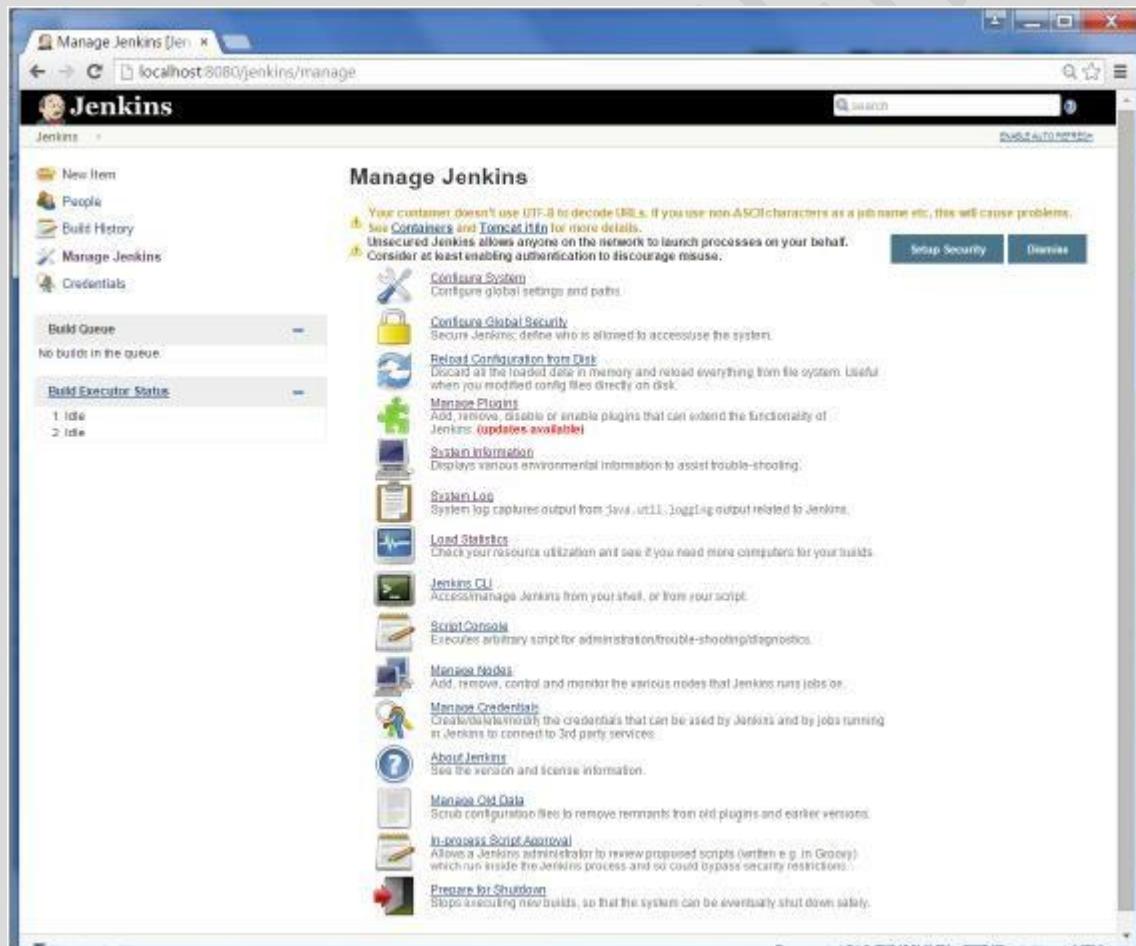
## Jenkins - Configuration

You probably would have seen a couple of times in the previous exercises wherein we had to configure options within Jenkins. The following shows the various configuration options in Jenkins.

So one can get the various configuration options for Jenkins by clicking the 'Manage Jenkins' option from the left hand menu side.



You will then be presented with the following screen –



Click on Configure system. Discussed below are some of the Jenkins configuration settings which can be carried out.

## Jenkins Home Directory

Jenkins needs some disk space to perform builds and keep archives. One can check this location from the configuration screen of Jenkins. By default, this is set to `~/jenkins`, and this location will initially be stored within your user profile location. In a proper environment, you need to change this location to an adequate location to store all relevant builds and archives. One can do this in the following ways

- ⊕ Set "JENKINS\_HOME" environment variable to the new home directory before launching the servlet container.
- ⊕ Set "JENKINS\_HOME" system property to the servlet container.
- ⊕ Set JNDI environment entry "JENKINS\_HOME" to the new directory.

The following example will use the first option of setting the "JENKINS\_HOME" environment variable.

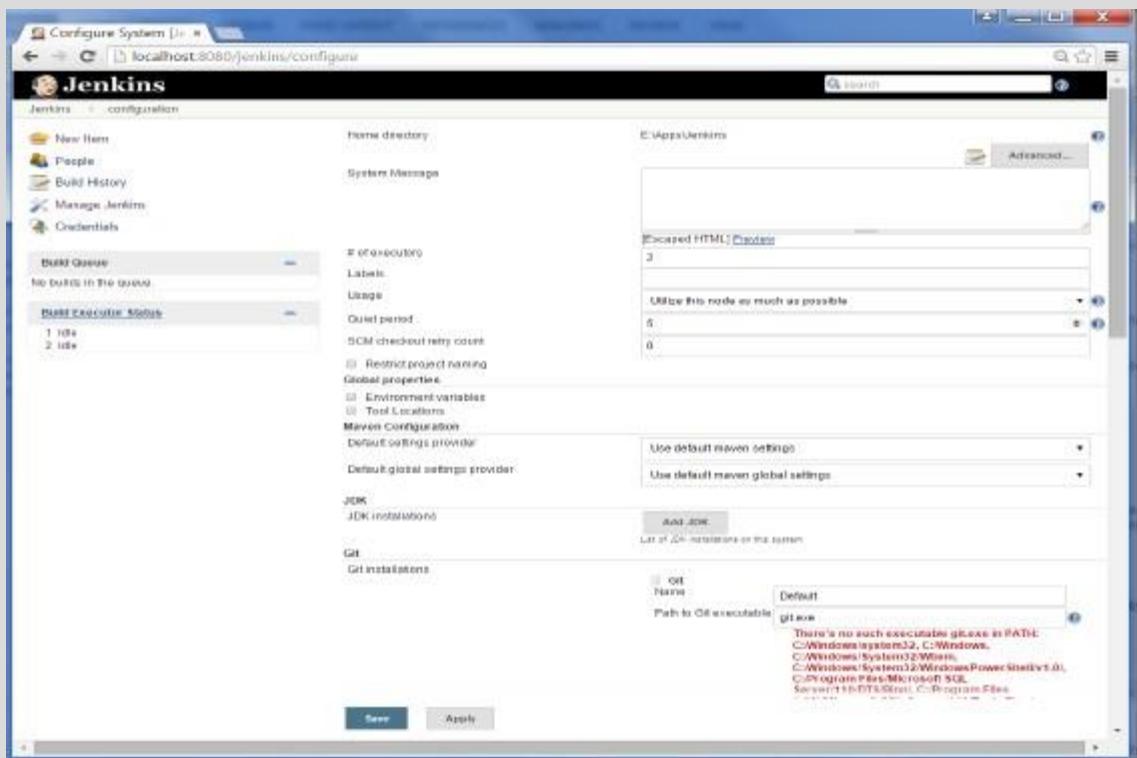
First create a new folder `E:\Apps\Jenkins`. Copy all the contents from the existing `~/jenkins` to this new directory.

Set the `JENKINS_HOME` environment variable to point to the base directory location where Java is installed on your machine. For example,

OS	Output
Windows	Set Environmental variable <code>JENKINS_HOME</code> to you're the location you desire. As an example you can set it to <code>E:\Apps\Jenkins</code>
Linux	<code>export JENKINS_HOME =/usr/local/Jenkins</code> or the location you desire.

In the Jenkins dashboard, click Manage Jenkins from the left-hand side menu. Then click on 'Configure System' from the right-hand side.

In the Home directory, you will now see the new directory which has been configured.



## # of executors

This refers to the total number of concurrent job executions that can take place on the Jenkins machine. This can be changed based on requirements. Sometimes the recommendation is to keep this number the same as the number of CPU on the machines for better performance.

## Environment Variables

This is used to add custom environment variables which will apply to all the jobs. These are key-value pairs and can be accessed and used in Builds wherever required.

## Jenkins URL

By default, the Jenkins URL points to localhost. If you have a domain name setup for your machine, set this to the domain name else overwrite localhost with IP of machine. This will help in setting up slaves and while sending out links using the email as you can directly access the Jenkins URL using the environment variable JENKINS\_URL which can be accessed as \${JENKINS\_URL}.

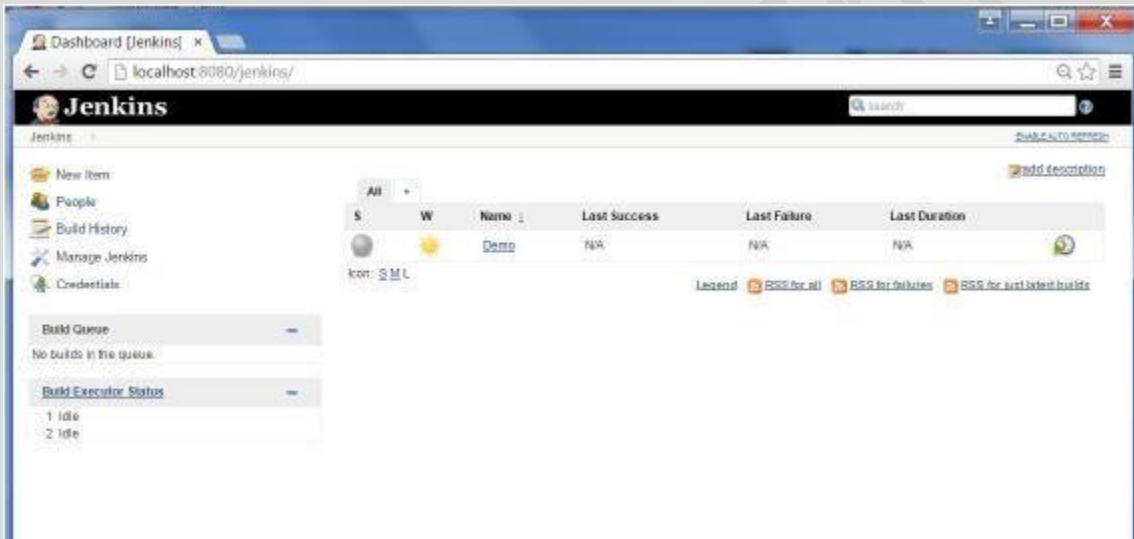
## Email Notification

In the email Notification area, you can configure the SMTP settings for sending out emails. This is required for Jenkins to connect to the SMTP mail server and send out emails to the recipient list.

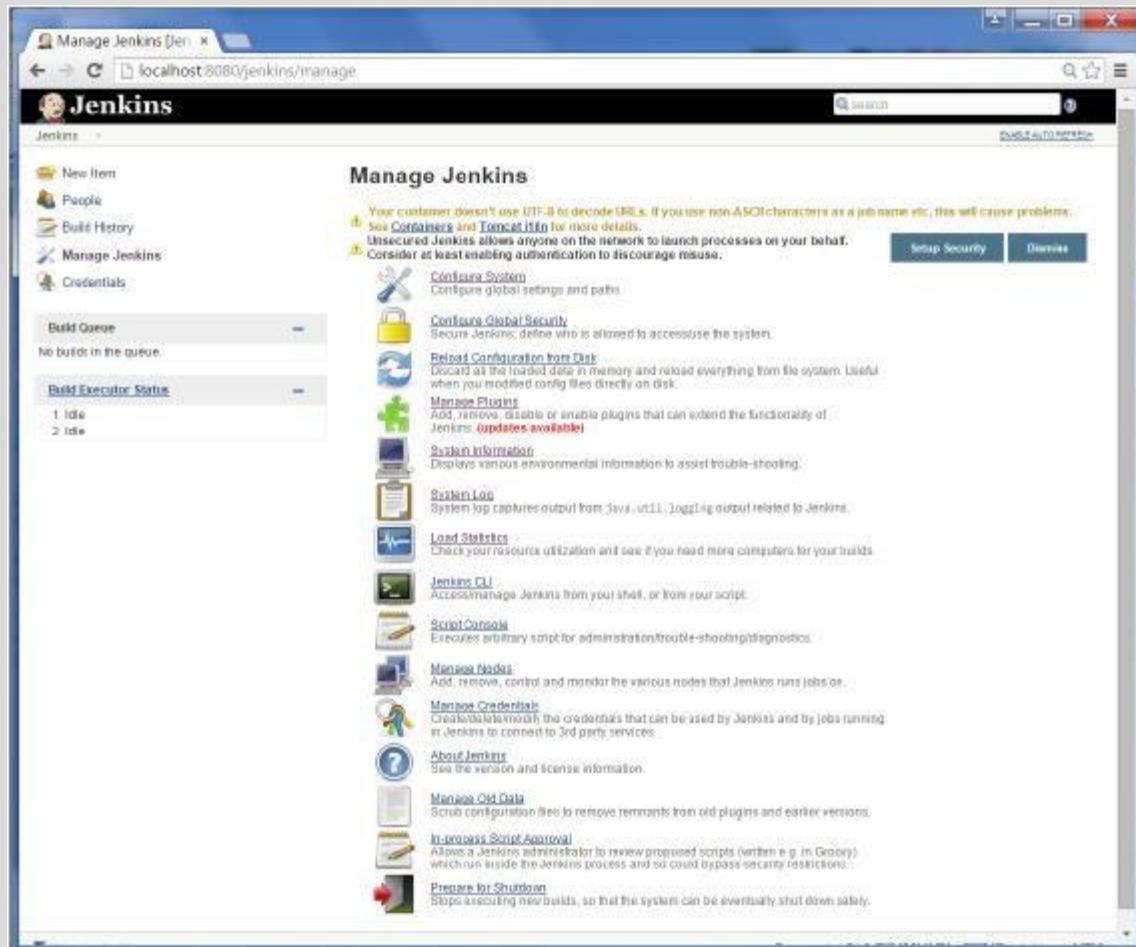
## Jenkins - Management

To manage Jenkins, click on the 'Manage Jenkins' option from the left-hand menu side.

So one can get the various configuration options for Jenkins by clicking the 'Manage Jenkins' option from the left hand menu side.



You will then be presented with the following screen –



Some of the management options are as follows –

## Configure System

This is where one can manage paths to the various tools to use in builds, such as the JDKs, the versions of Ant and Maven, as well as security options, email servers, and other system-wide configuration details. When plugins are installed, Jenkins will add the required configuration fields dynamically after the plugins are installed.

## Reload Configuration from Disk

Jenkins stores all its system and build job configuration details as XML files which is stored in the Jenkins home directory. Here also all of the build history is stored. If you are migrating build jobs from one Jenkins instance to another, or archiving old build jobs, you will need to add or remove the corresponding build job directories to Jenkins's builds directory. You don't need to take Jenkins offline to do this—you can simply use

the "Reload Configuration from Disk" option to reload the Jenkins system and build job configurations directly.

## Manage Plugin

Here one can install a wide variety of third-party plugins right from different Source code management tools such as Git, Mercurial or ClearCase, to code quality and code coverage metrics reporting. Plugins can be installed, updated and removed through the Manage Plugins screen.

The screenshot shows the Jenkins Manage Plugins interface. The title bar says "Update Center Jenkins" and the address bar shows "localhost:8080/jenkins/pluginManager/". The main area has a header "Jenkins" with a user icon and "Plugin Manager". Below it is a breadcrumb "Jenkins > Plugin Manager". On the left is a sidebar with "Back to Dashboard" and "Manage Jenkins". The main content area has tabs: "Updates" (selected), "Available", "Installed", and "Advanced". The "Updates" tab displays a table of available plugins:

Install	Name	Version	Installed
<a href="#">CVS Plugin</a>	This bundled plugin integrates Jenkins with CVS version control system.	2.12	2.11
<a href="#">JavaDoc Plugin</a>	This plugin adds JavaDoc support to Jenkins.	1.3	1.1
<a href="#">JUnit Plugin</a>	Allows JUnit-test results to be published.	1.9	1.2-beta-4
<a href="#">Matrix Authorization Strategy Plugin</a>	Offers matrix-based security authentication strategies (global and per-project).	1.2	1.1
<a href="#">Matrix Project Plugin</a>	Multi-configuration (matrix) project type.	1.6	1.4.1
<a href="#">Maven Integration plugin</a>	Jenkins plugin for building Maven 2.0 jobs via a special project type.	2.12.1	2.7.1
<a href="#">OWASP MathttP Formatter Plugin</a>	Uses policy definitions to alter/limit HTML markup in user-submitted text.	1.3	1.1
<a href="#">PAM Authentication plugin</a>	Adds Unix Pluggable Authentication Module (PAM) support to Jenkins.	1.2	1.1
<a href="#">Script Security Plugin</a>	Allows Jenkins administrators to control what in-process scripts can be run by less-privileged users.	1.15	1.13
<a href="#">SSH Slaves plugin</a>	This plugin allows you to manage slaves running on other machines over SSH.	1.10	1.9
<a href="#">Subversion Plugin</a>	This plugin adds the Subversion support (via SVNKit) to Jenkins.	2.5.3	1.54
<a href="#">Translation Assistance plugin</a>	This plugin adds an additional dialog box in every page, which enables people to contribute localizations for the messages they are seeing in the current page.	1.12	1.10
<a href="#">Windows Slaves Plugin</a>	Allows you to connect to Windows machines and start slave agents on them.	1.1	1.0

At the bottom of the table are three buttons: "Download now and install after restart", "Update information obtained: 1 hr 36 min ago", and "Check now". Below the table is a note: "Select All None This page lists updates to the plugins you currently use." At the very bottom are links for "Help us localize this page", "Page generated: Oct 6, 2015 11:08:25 PM", "SCM API", and "Jenkins Ver. 1.603.2".

## System Information

This screen displays a list of all the current Java system properties and system environment variables. Here one can check exactly what version of Java Jenkins is running in, what user it is running under, and so forth.

The following screenshot shows some of the name-value information available in this section.

The screenshot shows a Jenkins interface with a sidebar on the left containing links like 'New item', 'People', 'Build History', 'Manage Jenkins', and 'Credentials'. The main content area is titled 'System Properties' and displays a table of system configuration parameters. The table has two columns: 'Name' and 'Value'. Some key entries include:

Name	Value
ant.home	C:\ant\ant-1.7.0\bin
catalina.base	E:\Appstromcat7
catalina.home	E:\Appstromcat7
catalina.useNaming	true
common.loader	\$catalina.base\$ \$catalina.base\$ lib\$ jar\$ catalina.home\$ lib\$ catalina.home\$ jar\$ lib\$ jar
file.encoding	CP1252
file.encoding.pkg	sun.io
file.separator	\
java.awt.graphicsenv	sun.awt.Win32GraphicsEnvironment
java.awt.printerjob	sun.awt.windows.WPrinterJob
java.class.path	E:\Appstromcat7\bin\bootstrap.jar;E:\Appstromcat7\bin\lombok-jul.jar
java.class.version	51.0
java.endorsed.dirs	E:\Appstromcat7\endorsed
java.ext.dirs	C:\Program Files (x86)\Java\jdk1.7.0_79\jre\lib\ext
java.home	C:\Program Files (x86)\Java\jdk1.7.0_79\jre
java.io.tmpdir	E:\Appstromcat7\temp
java.library.path	C:\Program Files (x86)\Java\jdk1.7.0_79\bin;C:\Windows\Sun\Java\bin;C:\Windows\System32;C:\Windows;C:\Windows\system32;C:\Windows;C:\Windows\System32\Windows;C:\Windows\System32\WindowsPowerShell\v1.0\;C:\Program Files\Microsoft\SQL Server\110\Tools\Binn\;C:\Program Files\Microsoft\SQL Server\110\Tools\Binn\Management\;C:\Program Files (x86)\Microsoft Visual Studio 10.0\Tools\Binn\Microsoft\VisualStudio\10.0\PrivateAssemblies\;C:\Program Files (x86)\Microsoft SQL Server\110\DTSP\Binn\;C:\Program Files (x86)\Windows Kits\8.1\Windows Performance Toolkit\;C:\Program Files (x86)\Microsoft SDKs\TypeScript\1.0\;C:\Program Files\Microsoft SQL Server\120\Tools\Binn\;C:\Program Files\Microsoft\Web Platform Installer\;C:\Program Files (x86)\Java\jdk1.7.0_79\bin;%MAVEN_HOME%\bin
java.naming.factory.initial	org.apache.naming.java.javaURLContextFactory
java.naming.factory.url.plugins	org.apache.naming
java.runtime.name	Java(TM) SE Runtime Environment
java.runtime.version	1.7.0_79-b15
java.specification.name	Java Platform API Specification
java.specification.vendor	Oracle Corporation
java.specification.version	1.7
java.util.logging.config.file	E:\Appstromcat7\conf\logging.properties
java.util.logging.manager	org.apache.juli.ClassLoaderLogManager
java.vendor	Oracle Corporation
java.vendor.url	http://java.oracle.com/
java.vendor.url_bug	http://bugreport.sun.com/bugreport/
java.version	1.7.0_79
java.vm.info	mixed mode, sharing

## System Log

The System Log screen is a convenient way to view the Jenkins log files in real time. Again, the main use of this screen is for troubleshooting.

## Load Statistics

This page displays graphical data on how busy the Jenkins instance is in terms of the number of concurrent builds and the length of the build queue which gives an idea of how long your builds need to wait before being executed. These statistics can give a good idea of whether extra capacity or extra build nodes is required from an infrastructure perspective.

## Script Console

This screen lets you run Groovy scripts on the server. It is useful for advanced troubleshooting since it requires a strong knowledge of the internal Jenkins architecture.

## Manage nodes

Jenkins is capable of handling parallel and distributed builds. In this screen, you can configure how many builds you want. Jenkins runs simultaneously, and, if you are using distributed builds, set up build nodes. A build node is another machine that Jenkins can use to execute its builds.

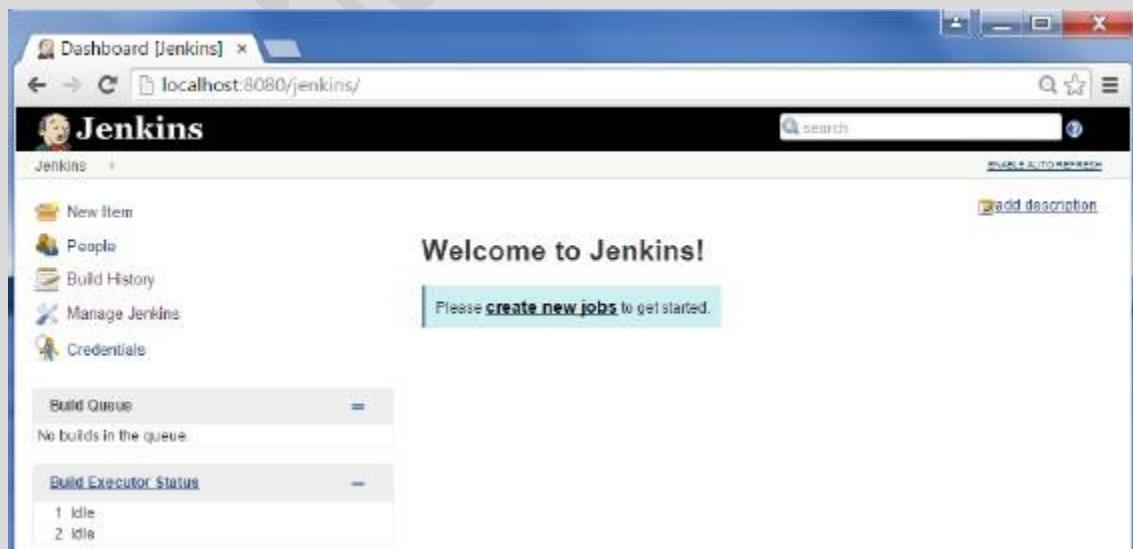
## Prepare for Shutdown

If there is a need to shut down Jenkins, or the server Jenkins is running on, it is best not to do so when a build is being executed. To shut down Jenkins cleanly, you can use the Prepare for Shutdown link, which prevents any new builds from being started. Eventually, when all of the current builds have finished, one will be able to shut down Jenkins cleanly.

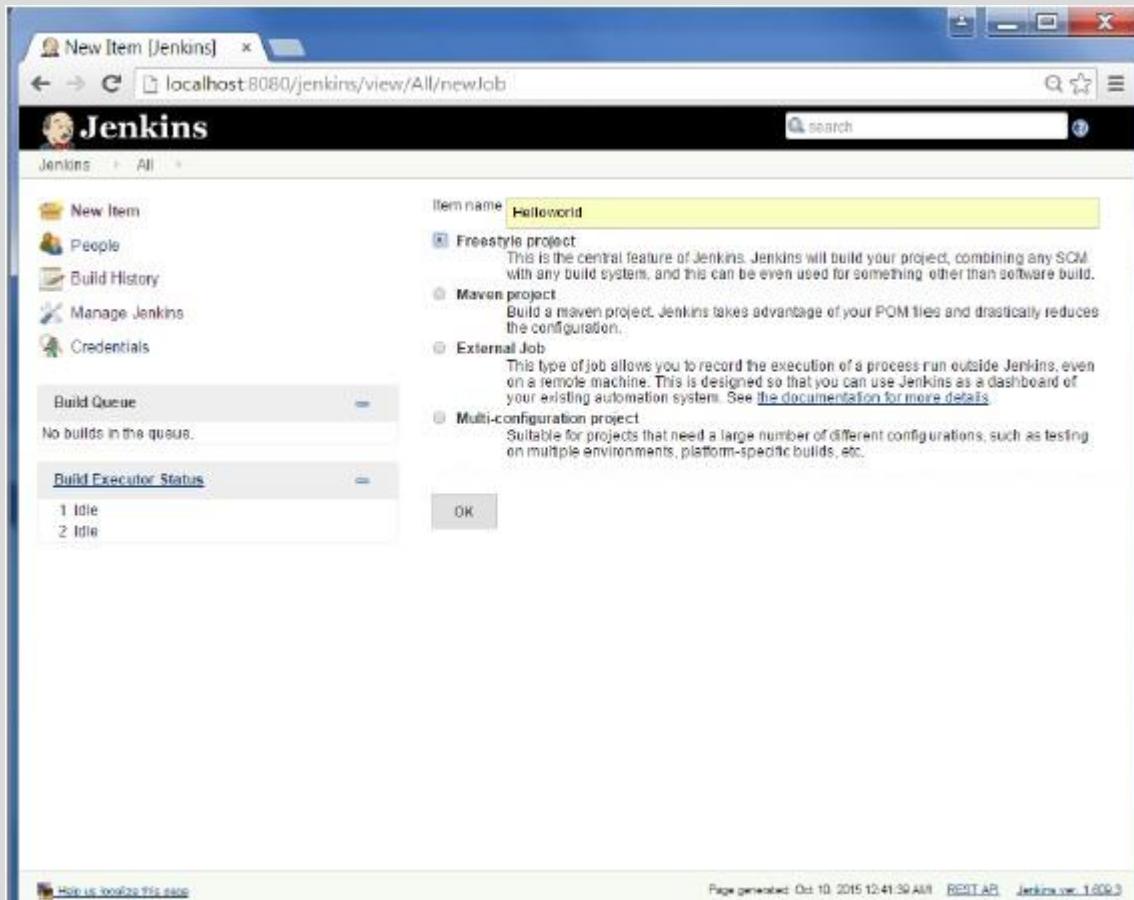
# Jenkins - Setup Build Jobs

For this exercise, we will create a job in Jenkins which picks up a simple HelloWorld application, builds and runs the java program.

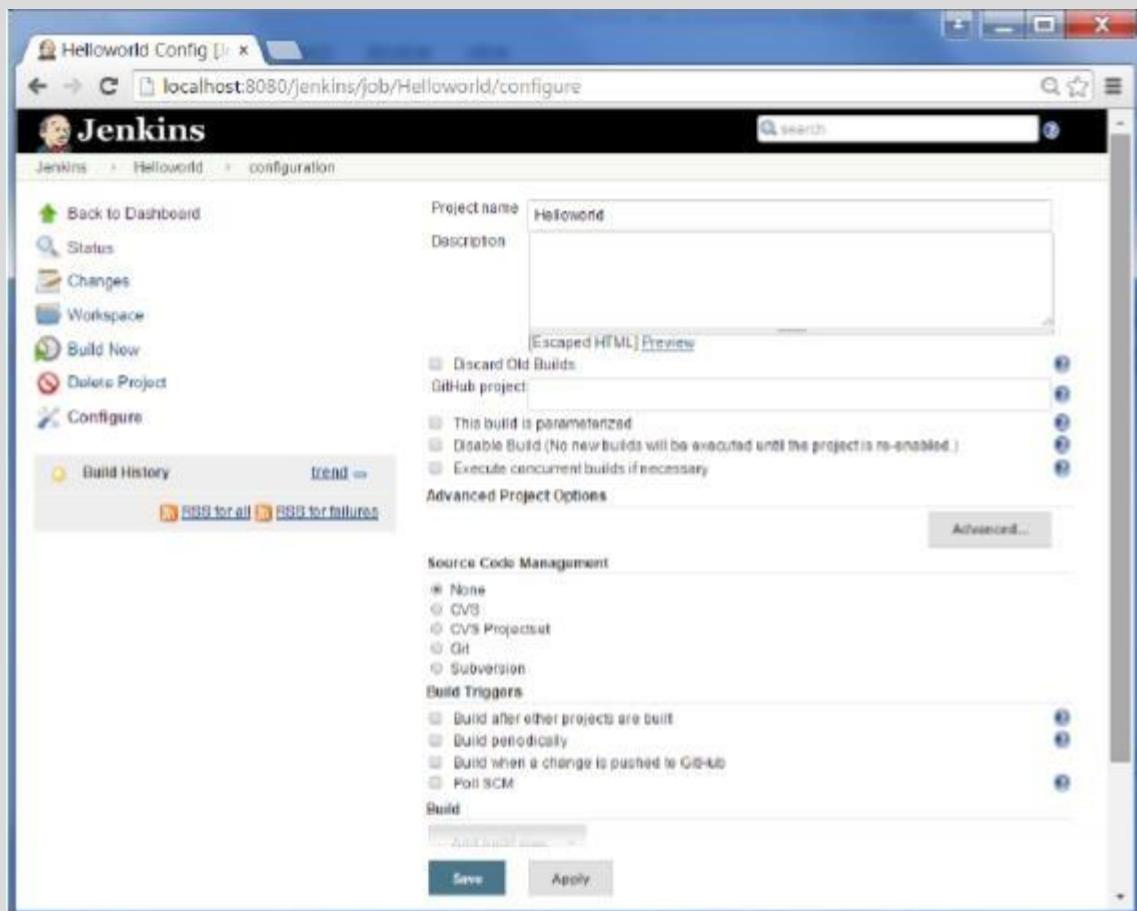
**Step 1** – Go to the Jenkins dashboard and Click on New Item



**Step 2** – In the next screen, enter the Item name, in this case we have named it Helloworld. Choose the ‘Freestyle project option’

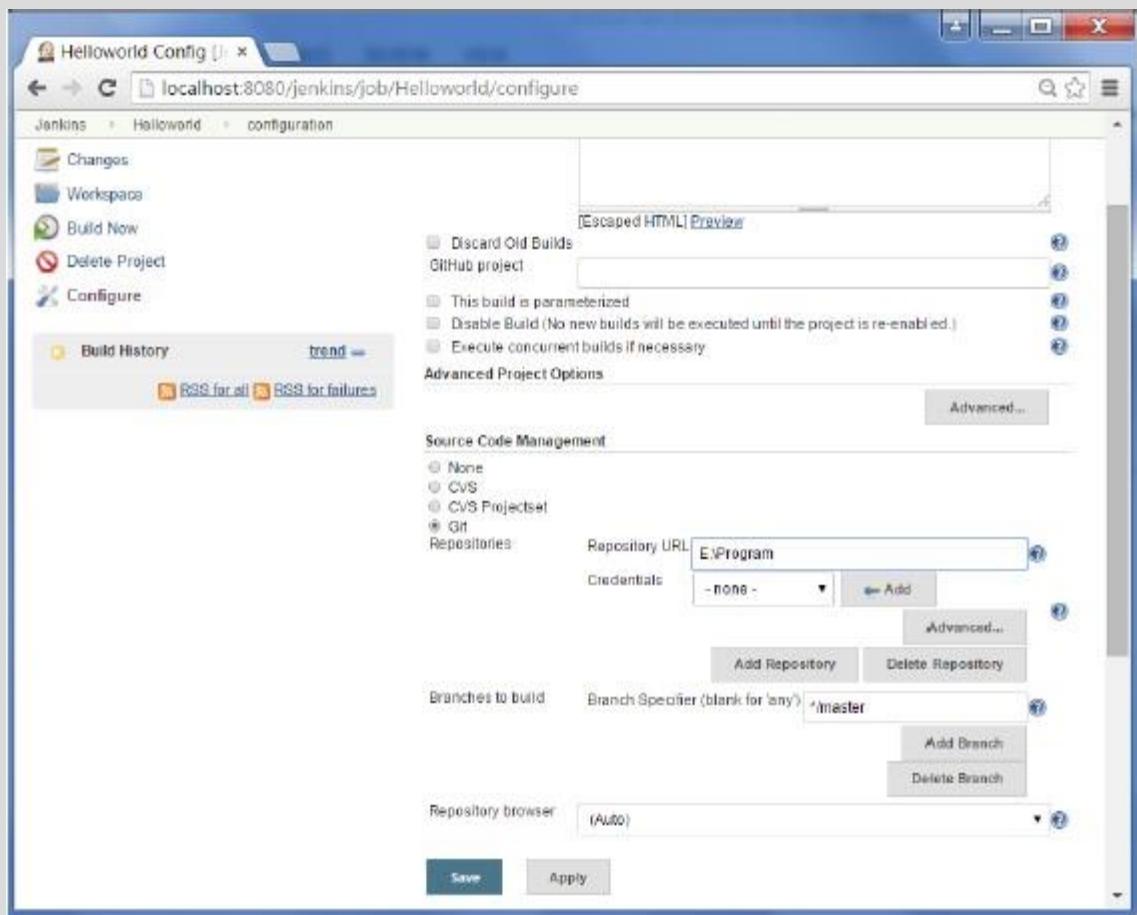


**Step 3** – The following screen will come up in which you can specify the details of the job.

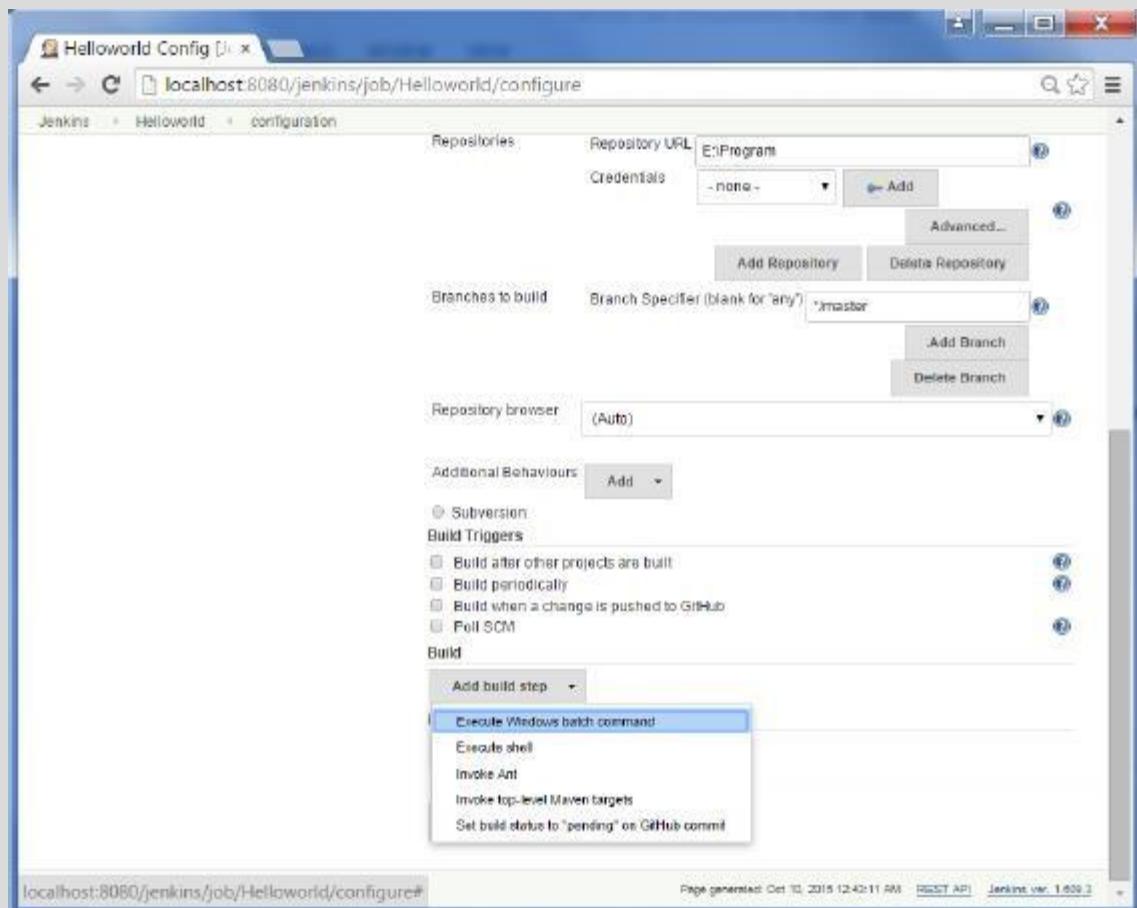


**Step 4** – We need to specify the location of files which need to be built. In this example, we will assume that a local git repository(E:\Program) has been setup which contains a 'HelloWorld.java' file. Hence scroll down and click on the Git option and enter the URL of the local git repository.

**Note** – If your repository is hosted on GitHub, you can also enter the URL of that repository here. In addition to this, you would need to click on the 'Add' button for the credentials to add a user name and password to the GitHub repository so that the code can be picked up from the remote repository.

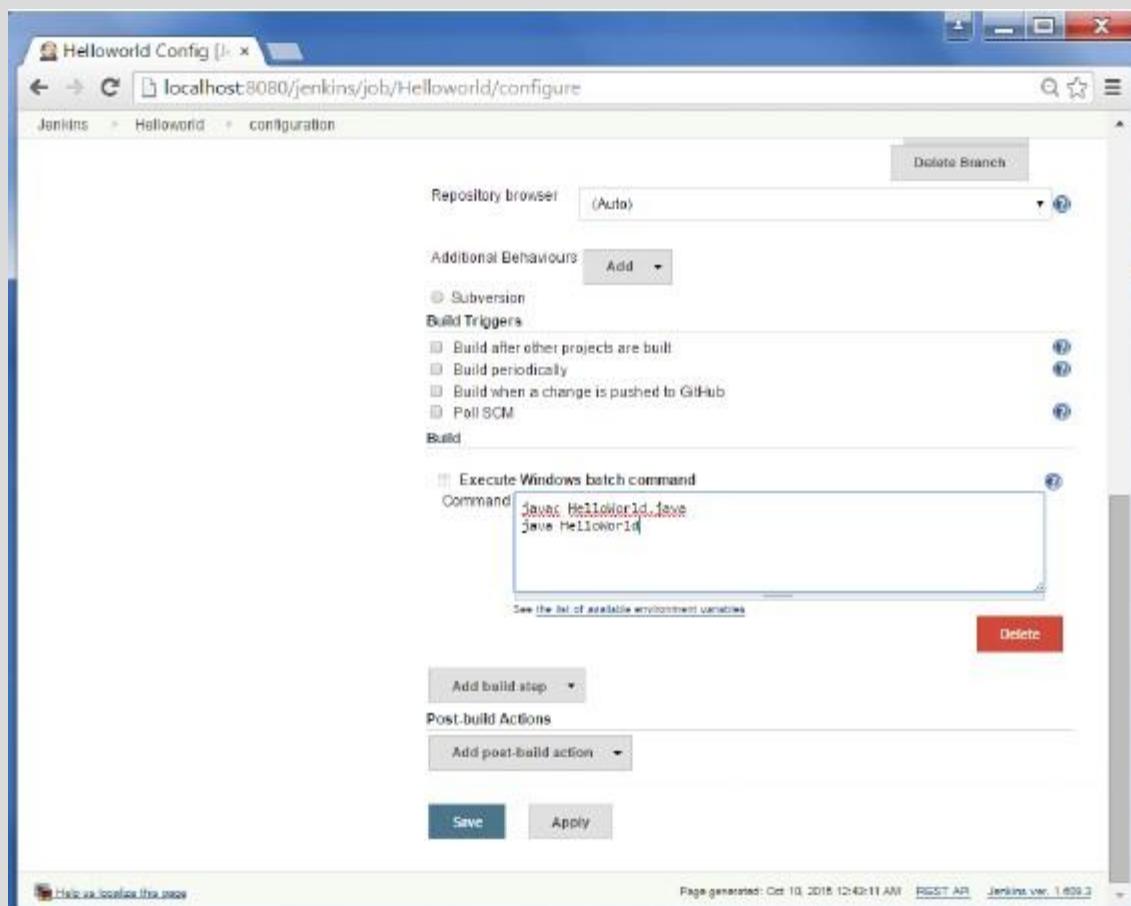


**Step 5** – Now go to the Build section and click on Add build step → Execute Windows batch command



**Step 6** – In the command window, enter the following commands and then click on the Save button.

```
Javac HelloWorld.java  
Java HelloWorld
```



**Step 7** – Once saved, you can click on the Build Now option to see if you have successfully defined the job.



**Step 8** – Once the build is scheduled, it will run. The following Build history section shows that a build is in progress.



**Step 9** – Once the build is completed, a status of the build will show if the build was successful or not. In our case, the following build has been executed successfully. Click on the #1 in the Build history to bring up the details of the build.



**Step 10** – Click on the Console Output link to see the details of the build

The screenshot displays two Jenkins job pages side-by-side.

**Top Window (Build #1):**

- Job Information:** Helloworld #1 (jenkins), Started 4 min 40 sec ago, Took 4.7 sec.
- Build Status:** AM (blue circle)
- Log Summary:** No changes, Started by anonymous user, Revision: 42f9a82ffadd86fb5c3a9d9ae40e731a907f5c8f

**Bottom Window (Build #12 Console):**

- Job Information:** Helloworld #12 (jenkins), Jenkins, Helloworld, #12
- Section:** Console Output
- Output Log:**

```

Started by user anonymous
Building in workspace E:\Jenkins\Jobs\Helloworld\workspace
> C:\Program Files\Git\bin\git.exe rev-parse --is-inside-work-tree # timeout=10
Fetching changes from the remote Git repository
> C:\Program Files\Git\bin\git.exe config remote.origin.url E:\Program #
timeout=10
Fetching upstream changes from E:\Program
> C:\Program Files\Git\bin\git.exe --version # timeout=10
> C:\Program Files\Git\bin\git.exe -c core.askpass=true fetch --tags --progress
E:\Program +refs/heads/*{refs/remotes/origin/*
> C:\Program Files\Git\bin\git.exe rev-parse
"refs/remotes/origin/master^{commit}" # timeout=10
> C:\Program Files\Git\bin\git.exe rev-parse
"refs/remotes/origin/master^{commit}" # timeout=10
Checking out Revision 42f9a82ffadd86fb5c3a9d9ae40e731a907f5c8f
(refs/remotes/origin/master)
> C:\Program Files\Git\bin\git.exe config core.sparsecheckout # timeout=10
> C:\Program Files\Git\bin\git.exe checkout -f
42f9a82ffadd86fb5c3a9d9ae40e731a907f5c8f
> C:\Program Files\Git\bin\git.exe rev-list
42f9a82ffadd86fb5c3a9d9ae40e731a907f5c8f # timeout=10
[workspace] $ cmd /c call E:\Appsv\tomcat7\temp\nudson192847866077504681.bat

E:\Jenkins\jobs\Helloworld\workspace>javac HelloWorld.java

E:\Jenkins\jobs\Helloworld\workspace>java HelloWorld
Hello World

E:\Jenkins\jobs\Helloworld\workspace>exit 0
Finished: SUCCESS

```

Apart from the steps shown above there are just so many ways to create a build job, the options available are many, which what makes Jenkins such a fantastic continuous deployment tool.

# Jenkins - Unit Testing

Jenkins provides an out of box functionality for Junit, and provides a host of plugins for unit testing for other technologies, an example being MSTest for .Net Unit tests. If you go to the link <https://wiki.jenkins-ci.org/display/JENKINS/xUnit+Plugin> it will give the list of Unit Testing plugins available.

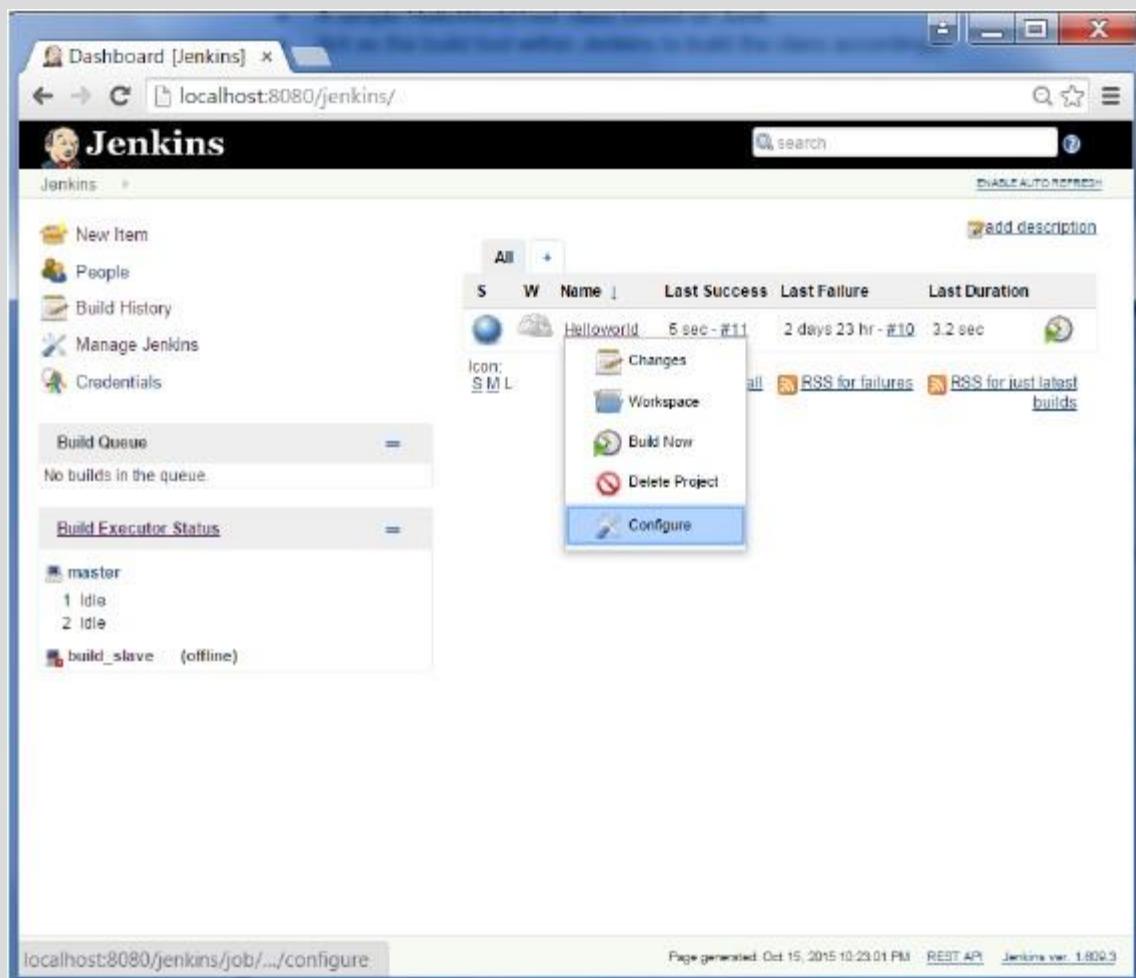
The screenshot shows the Jenkins xUnit Plugin page. On the left, there's a sidebar with links like Home, Mailing lists, Source code, Bugtracker, Security Advisories, Events, Donation, Commercial Support, Wiki Site Map, and Documents. The main content area has a title 'xUnit Plugin' with a small icon. Below it, a message says 'Added by Gregory Boissinot last edited by Gregory Boissinot on Oct 08, 2015 (view change)'. The central part is titled 'Plugin Information' and contains a table with details about the plugin's ID (xunit), latest release (1.98), required core dependencies (junit version 1.6), source code (GitHub), issue tracking (Open Issues, Pull Requests), and maintainers (Gregory Boissinot). To the right of the table is a chart titled 'xunit - installations' showing the number of installations over time from October 2014 to September 2015. The chart shows a steady increase from approximately 12,000 to 15,000 installations. Below the chart, a note says 'This plugin makes it possible to publish the test results of an execution of a testing tool in Jenkins.' At the bottom, there's a button labeled 'CppUnit output'.

## Example of a Junit Test in Jenkins

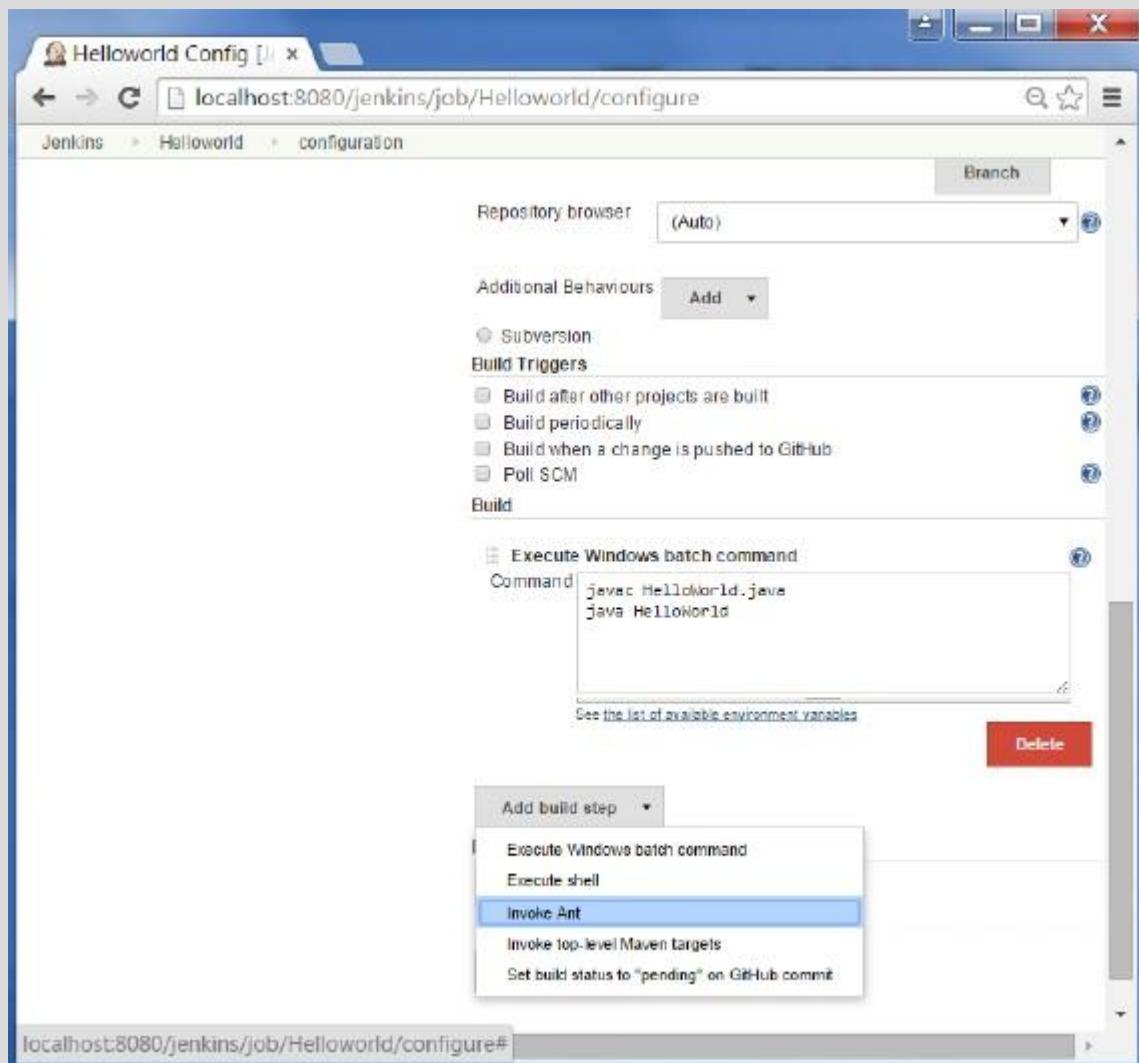
The following example will consider

- A simple HelloWorldTest class based on Junit.
- Ant as the build tool within Jenkins to build the class accordingly.

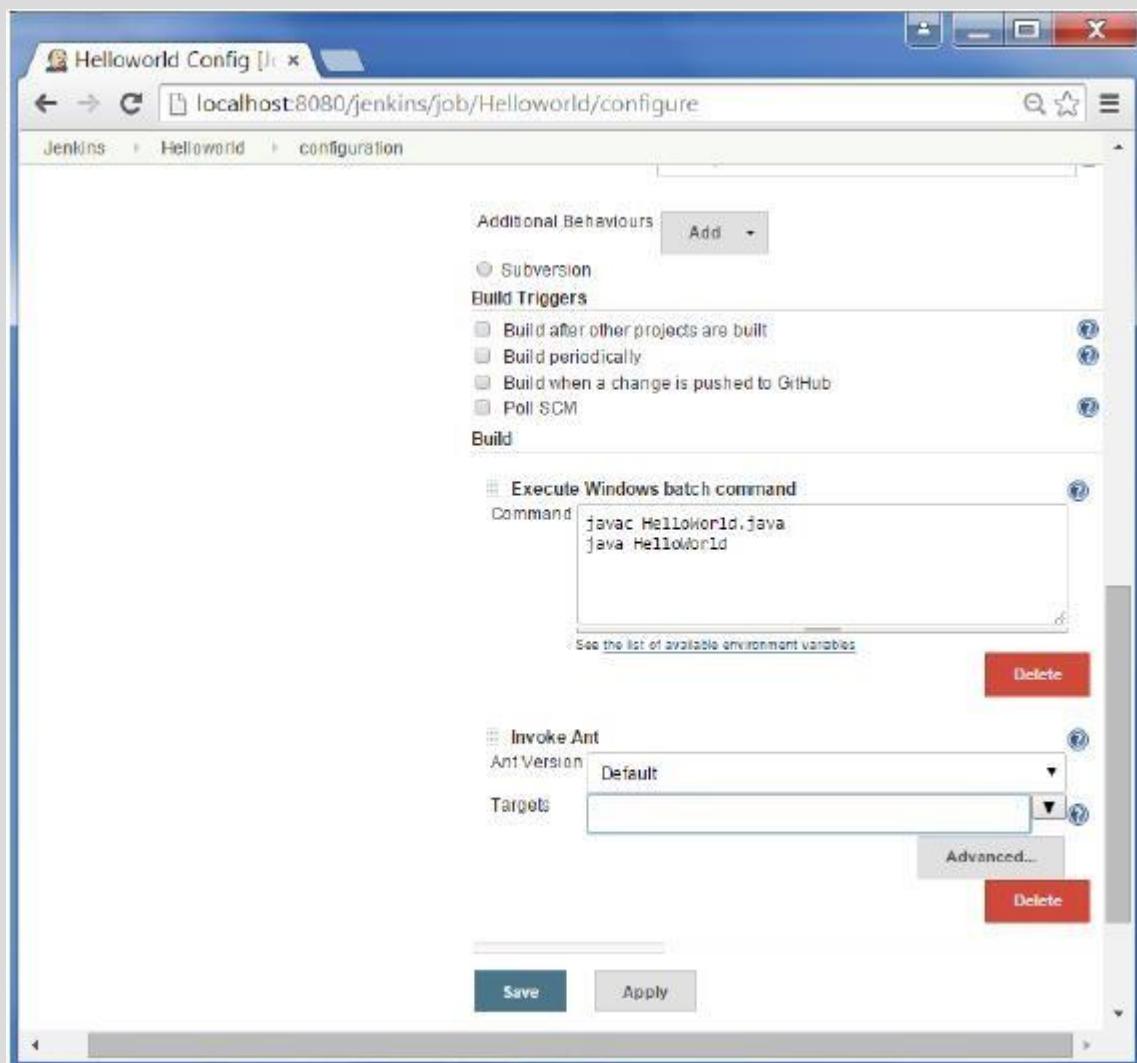
**Step 1** – Go to the Jenkins dashboard and Click on the existing HelloWorld project and choose the Configure option



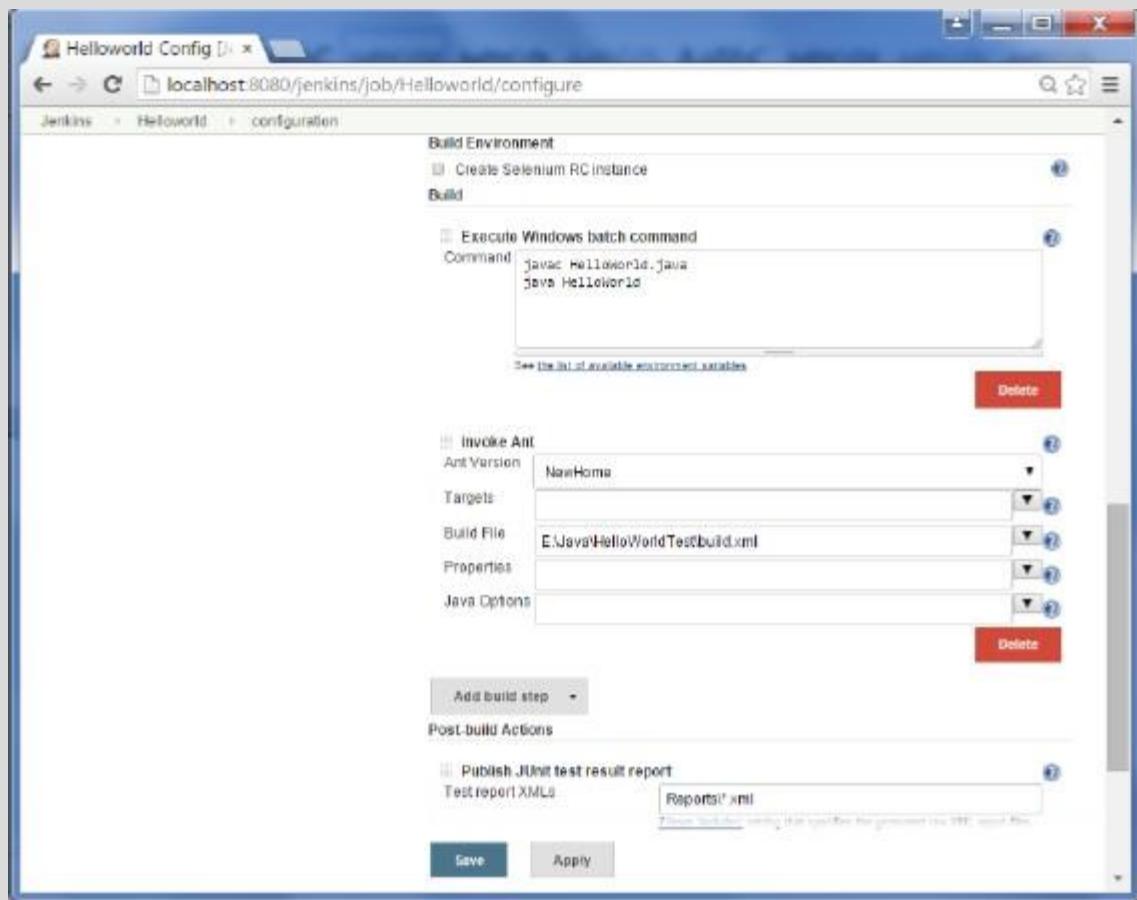
**Step 2** – Browse to the section to Add a Build step and choose the option to Invoke Ant.



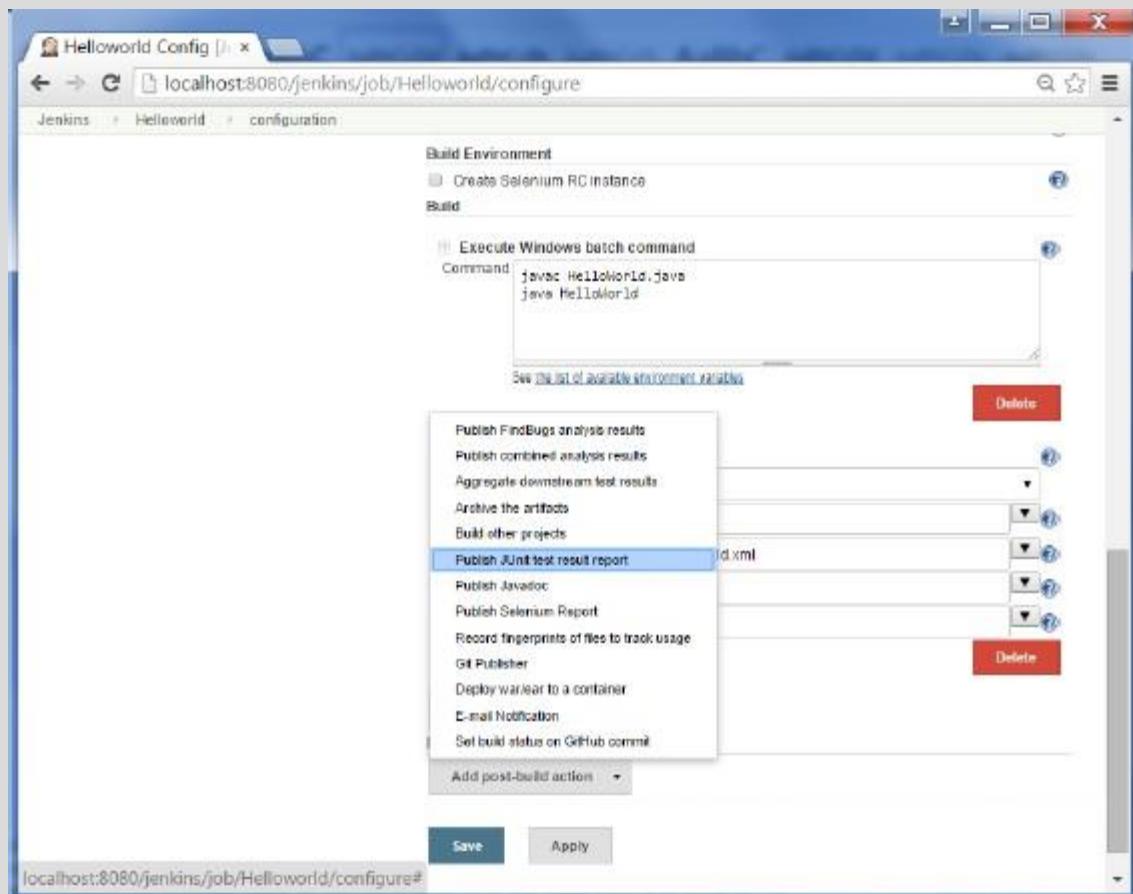
**Step 3** – Click on the Advanced button.



**Step 4** – In the build file section, enter the location of the build.xml file.

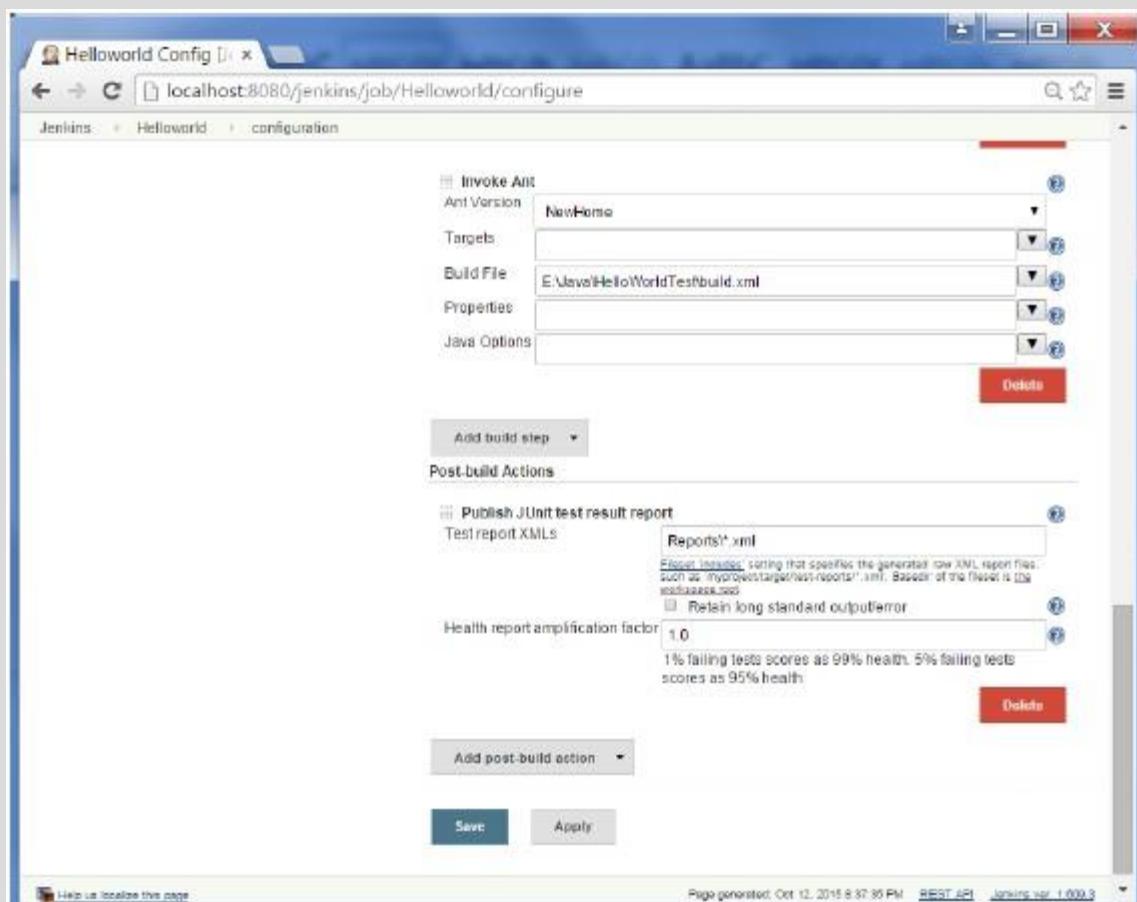


**Step 5** – Next click the option to Add post-build option and choose the option of “Publish Junit test result report”



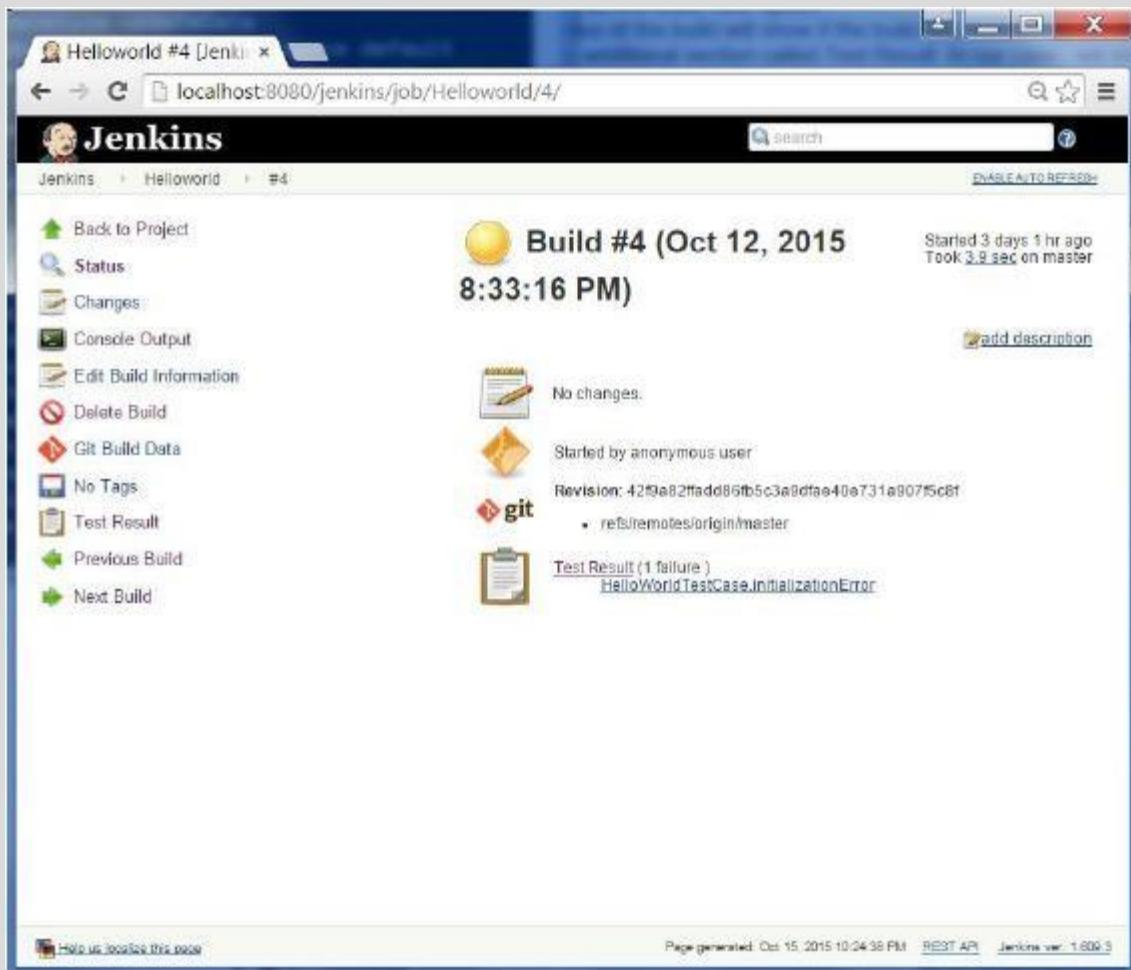
**Step 6** – In the Test reports XML's, enter the location as shown below. Ensure that Reports is a folder which is created in the HelloWorld project workspace. The “\*.xml” basically tells Jenkins to pick up the result xml files which are produced by the running of the Junit test cases. These xml files which then be converted into reports which can be viewed later.

Once done, click the Save option at the end.



### Step 7 – Once saved, you can click on the Build Now option.

Once the build is completed, a status of the build will show if the build was successful or not. In the Build output information, you will now notice an additional section called Test Result. In our case, we entered a negative Test case so that the result would fail just as an example.



The screenshot shows the Jenkins interface for a build named "Helloworld #4". The main title is "Build #4 (Oct 12, 2015) 8:33:16 PM". The build status is yellow, indicating a warning. The build was started 3 days 1 hour ago and took 3.9 sec on master. The left sidebar contains links for Back to Project, Status, Changes, Console Output, Edit Build Information, Delete Build, Git Build Data, No Tags, Test Result, Previous Build, and Next Build. The right panel displays the following information:

- No changes.
- Started by anonymous user
- Revision: 429e82ffadd86fb5c3a8dfe40e731a8075c81
  - refs/remotes/origin/master
- Test Result (1 failure)  
[HelloWorldTestCase.initializationError](#)

At the bottom, there are links for Help me locate this page, REST API, and Jenkins ver. 1.602.5.

One can go to the Console output to see further information. But what's more interesting is that if you click on Test Result, you will now see a drill down of the Test results.

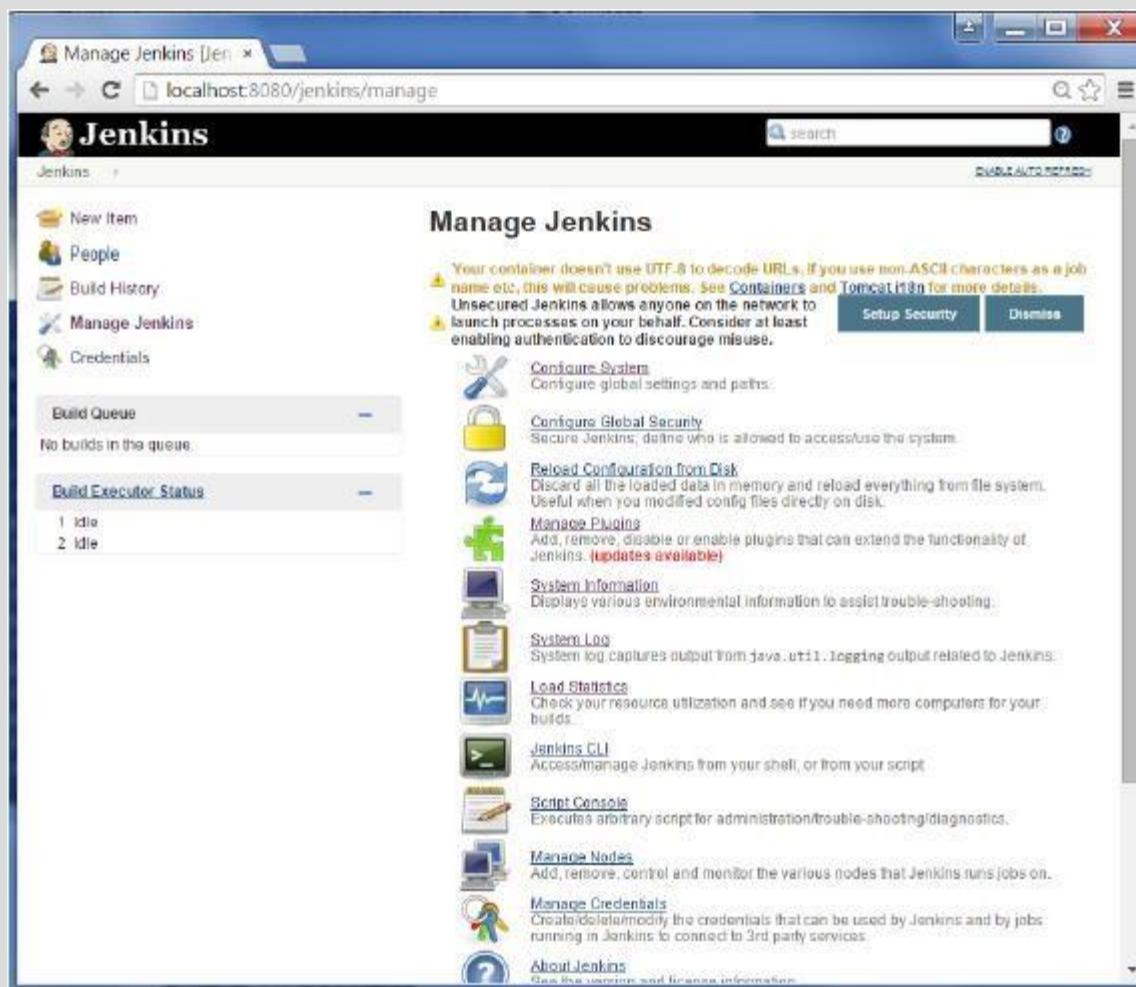
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The screenshot shows the Jenkins Test Result page for the build 'Helloworld #4 Test'. The left sidebar contains links for Back to Project, Status, Changes, Console Output, Edit Build Information, History, Git Build Data, No Tags, Test Result (selected), and Previous Build. The main content area is titled 'Test Result' and shows '1 failures'. A red bar indicates the failure count. Below it, a table lists 'All Failed Tests' with one entry: 'HelloWorldTestCase initializationError' (Duration: 10 ms). Another table shows 'All Tests' with a single row for 'root' (Duration: 10 ms, Fail: 1, Skip: 1, Pass: 0, Total: 1). At the bottom, there are links for 'Help us localize this page', 'Page generated: Oct 12, 2013 5:49:49 PM', 'REST API', and 'Jenkins Ver: 1.509.5'.

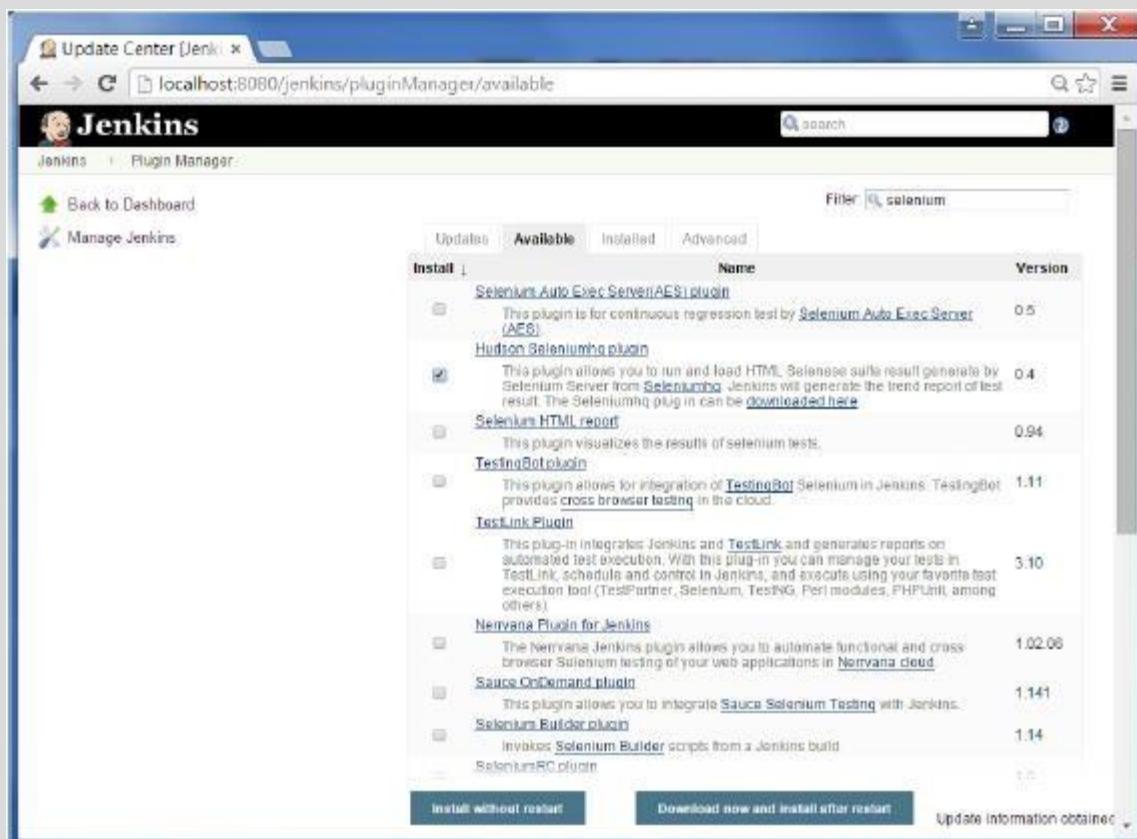
## Jenkins - Automated Testing

One of the basic principles of Continuous Integration is that a build should be verifiable. You have to be able to objectively determine whether a particular build is ready to proceed to the next stage of the build process, and the most convenient way to do this is to use automated tests. Without proper automated testing, you find yourself having to retain many build artifacts and test them by hand, which is hardly in the spirit of Continuous Integration. The following example shows how to use Selenium to run automated web tests.

**Step 1** – Go to Manage Plugins.



**Step 2** – Find the Hudson Selenium Plugin and choose to install. Restart the Jenkins instance.



**Step 3 – Go to Configure system.**

Your container doesn't use UTF-8 to decode URLs. If you use non-ASCII characters as a job name etc., this will cause problems. See [Containers and Tomcat HTTP](#) for more details.

Unsecured Jenkins allows anyone on the network to launch processes on your behalf. Consider at least enabling authentication to discourage misuse.

**Configure System** Configure global settings and paths.

**Configure Global Security** Secure Jenkins, define who is allowed to access the system.

**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** Check your resource utilization and see if you need more computers for your builds.

**Jenkins CLI** Access Jenkins from your shell, or from your script.

**Script Console** Executes arbitrary script for administration/trouble-shooting/diagnostics.

**Manage Nodes** Add, remove, control and monitor the various nodes that Jenkins runs jobs on.

**Step 4** – Configure the selenium server jar and click on the Save button.

Selenium Remote Control

htmlUnit Runner: E:\App\selenium-server-standalone-2.48.2.jar

Shell

Shell executable:

E-mail Notification

SMTP server:

Default user e-mail suffix:

Test configuration by sending test e-mail

**Save** **Apply**

**Note** – The selenium jar file can be downloaded from the location [SeleniumHQ](http://SeleniumHQ)

Click on the download for the Selenium standalone server.

The screenshot shows a web browser window with the URL [www.seleniumhq.org/download/](http://www.seleniumhq.org/download/). The page is titled "Downloads" and features the SeleniumHQ logo. It includes a search bar and navigation links for Projects, Download, Documentation, Support, and About. On the left, there's a sidebar with links for Selenium Downloads, Latest Releases, Previous Releases, Source Code, and Maven Information. The main content area has sections for "Selenium Standalone Server" (with a download link for version 2.48.2), "The Internet Explorer Driver Server" (with a download link for version 2.48.0), and "Selenium Client & WebDriver Language Bindings". A "Donate" button and payment method icons (PayPal, Credit Card, VISA, MasterCard) are also present. A "BrowserStack" logo is visible at the bottom left.

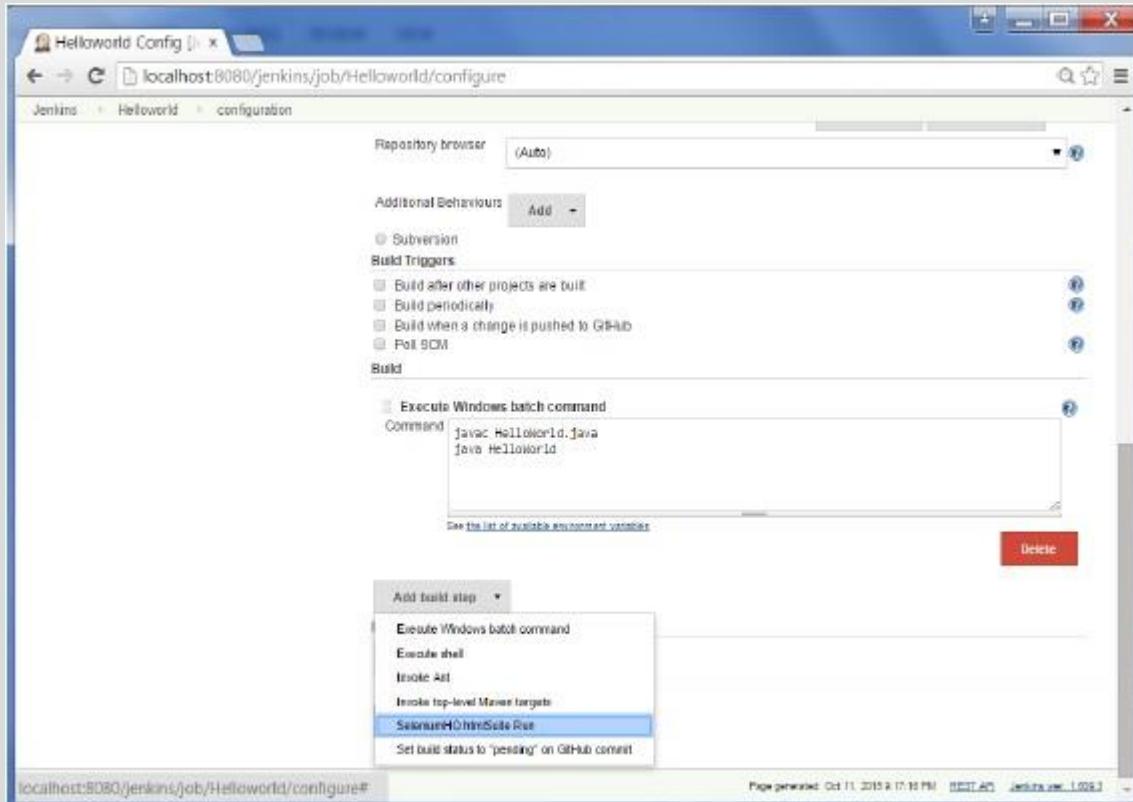
**Step 5** – Go back to your dashboard and click on the Configure option for the HelloWorld project.

The screenshot shows the Jenkins dashboard at [localhost:8080/jenkins/](http://localhost:8080/jenkins/). The left sidebar has links for New Item, People, Build History, Manage Jenkins, and Credentials. The main area shows a table for the 'HelloWorld' job, which has just succeeded. A context menu is open over the 'HelloWorld' row, with options: Changes, Workspace, Build Now, Delete Project, and Configure. The 'Configure' button is highlighted with a blue border. The status bar at the bottom shows the URL [localhost:8080/jenkins/job/HelloWorld/configure](http://localhost:8080/jenkins/job/HelloWorld/configure).

**Step 6 – Click on Add build step and choose the optin of “SeleniumHQ htmlSuite Run”**

The screenshot shows the 'HelloWorld' configuration page at [localhost:8080/jenkins/job/HelloWorld/configure](http://localhost:8080/jenkins/job/HelloWorld/configure). Under the 'Build' section, there is an 'Execute Windows batch command' step with the command `javac HelloWorld.java` and `java HelloWorld`. Below it, there is a 'SeleniumHQ htmlSuite Run' step with the following parameters: browser set to 'firefox', startURL set to '<https://www.google.ae>', suiteFile set to 'E:\Apps\NewSample.html', resultFile set to 'E:\Jenkins\jobs\HelloWorld\workspace\Reports\Results.html', and other set to an empty value. At the bottom, there are 'Add build step' and 'Post-build Actions' dropdown menus, and 'Save' and 'Apply' buttons.

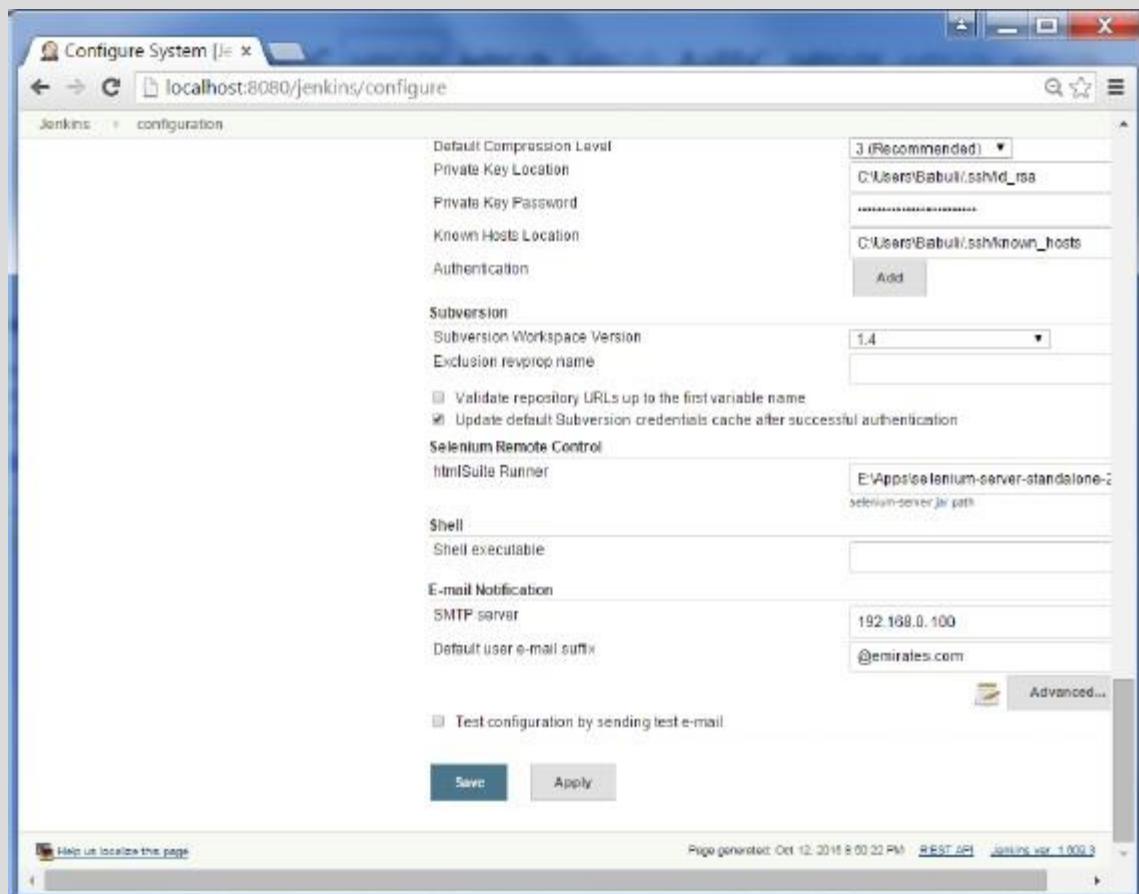
**Step 7** – Add the necessary details for the selenium test. Here the suiteFile is the TestSuite generated by using the Selenium IDE. Click on Save and execute a build. Now the post build will launch the selenium driver, and execute the html test.



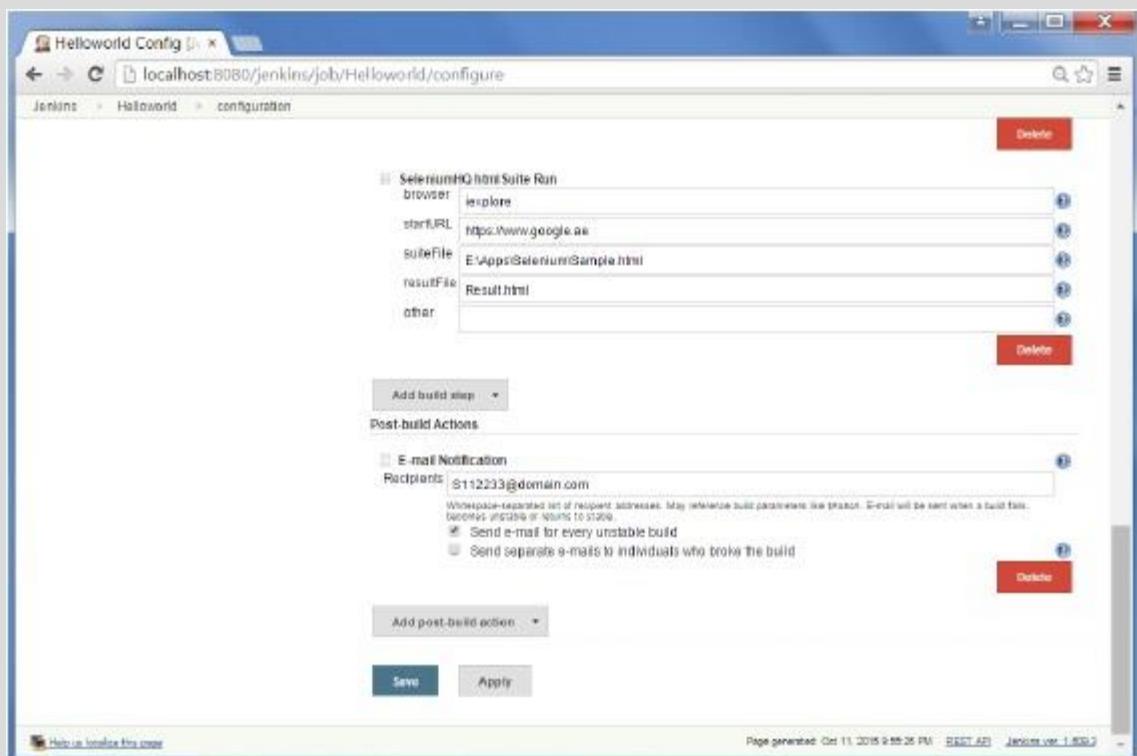
## Jenkins - Notification

Jenkins comes with an out of box facility to add an email notification for a build project.

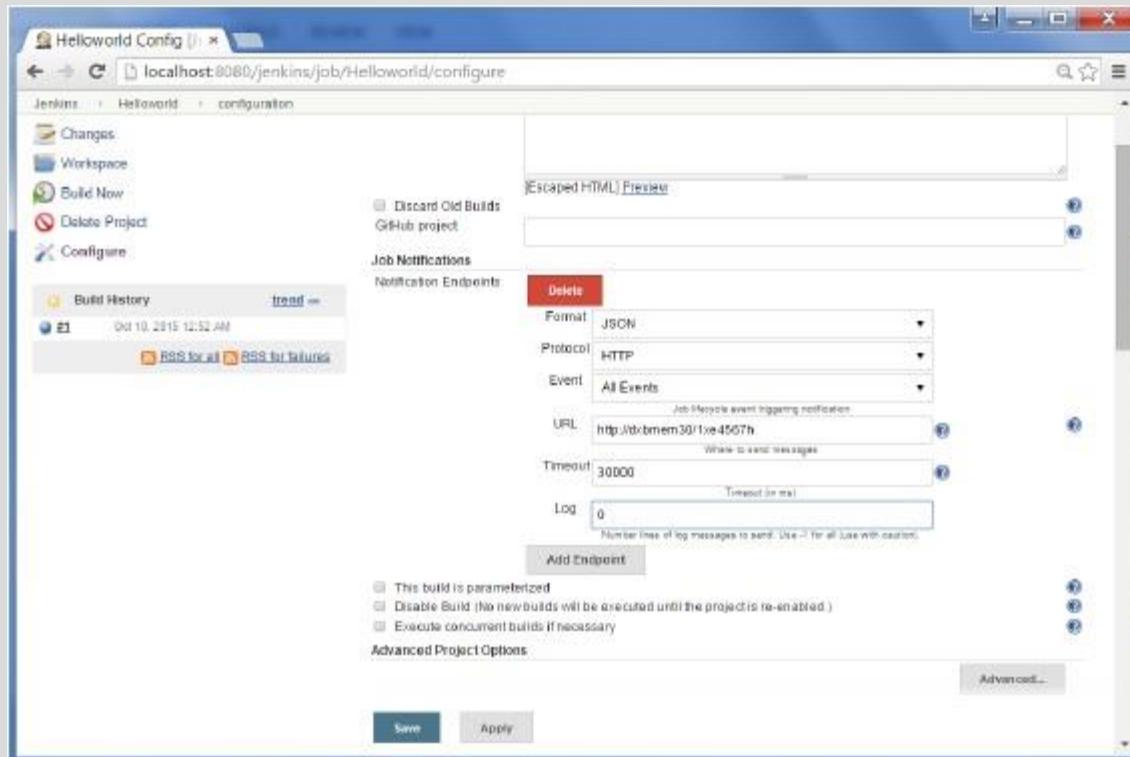
**Step 1** – Configuring an SMTP server. Goto Manage Jenkins → Configure System. Go to the E-mail notification section and enter the required SMTP server and user email-suffix details.



**Step 2** – Configure the recipients in the Jenkins project - When you configure any Jenkins build project, right at the end is the ability to add recipients who would get email notifications for unstable or broken builds. Then click on the Save button.



Apart from the default, there are also notification plugin's available in the market. An example is the notification plugin from Tikal Knowledge which allows sending Job Status notifications in JSON and XML formats. This plugin enables end-points to be configured as shown below.



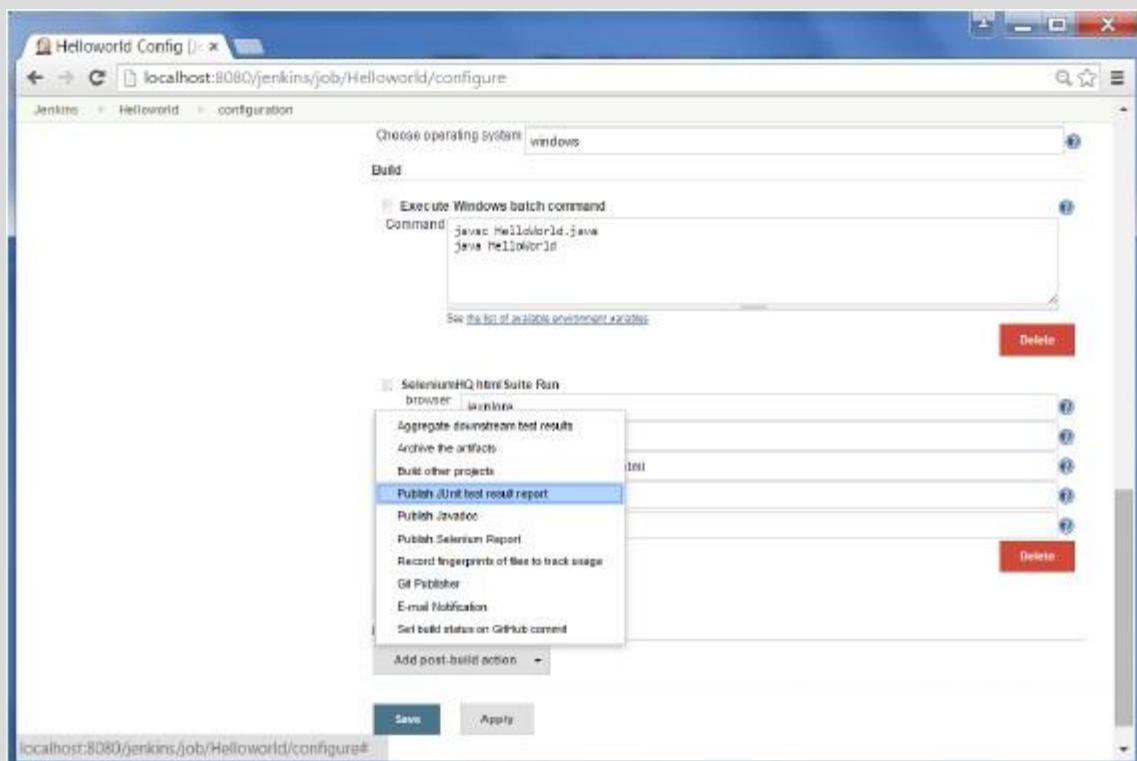
Here are the details of each option –

- **"Format"** – This is the notification payload format which can either be JSON or XML.
- **"Protocol"** – protocol to use for sending notification messages, HTTP, TCP or UDP.
- **"Event"** – The job events that trigger notifications: Job Started, Job Completed, Job Finalized or All Events (the default option).
- **"URL"** – URL to send notifications to. It takes the form of "<http://host>" for HTTP protocol, and "host:port" for TCP and UDP protocols.
- **"Timeout"** – Timeout in milliseconds for sending notification request, 30 seconds by default.

## Jenkins - Reporting

As demonstrated in the earlier section, there are many reporting plugins available with the simplest one being the reports available for jUnit tests.

In the Post-build action for any job, you can define the reports to be created. After the builds are complete, the Test Results option will be available for further drill-down.



## Jenkins - Code Analysis

Jenkins has a host of Code Analysis plugin. The various plugins can be found at <https://wiki.jenkins-ci.org/display/JENKINS/Static+Code+Analysis+Plugins>

The screenshot shows the Jenkins Static Code Analysis Plug-ins page. On the left, there's a sidebar with links like Home, Mailing Lists, Source code, Bugtracker, Security Advisories, Events, Donation, Commercial Support, Wiki Site Map, and Documents. The main content area has a header "Static Code Analysis Plug-ins" with a sub-header "Plugin Information". It shows details for the "analysis-core" plugin, including its ID, latest release (1.74), release date (Sep 07, 2015), required core dependencies (antlr, token-matcher, maven-plugin, matrix-project, dashboard-view), changes since latest release (GitHub, Open Issues, Pull Requests, Maintainer(s)), and usage statistics (a line graph titled "analysis-core - installations" showing a steady increase from ~25,000 in Oct 2014 to ~30,000 in Sep 2015, and a table of installations per month from Oct 2014 to Sep 2015).

This plugin provides utilities for the static code analysis plugins. Jenkins can parse the results file from various Code Analysis tools such as CheckStyle, FindBugs, PMD etc. For each corresponding code analysis tool, a plugin in Jenkins needs to be installed.

Additionally the add-on plugin [Static Analysis Collector](#) is available that combines the individual results of these plugins into a single trend graph and view.

The plugins can provide information such as

- The total number of warnings in a job
- A showing of the new and fixed warnings of a build
- Trend Reports showing the number of warnings per build
- Overview of the found warnings per module, package, category, or type
- Detailed reports of the found warnings optionally filtered by severity (or new and fixed)

## Jenkins - Distributed Builds

Sometimes many build machines are required if there are instances wherein there are a larger and heavier project which get built on a regular basis. And running all of these

builds on a central machine may not be the best option. In such a scenario, one can configure other Jenkins machines to be slave machines to take the load off the master Jenkins server.

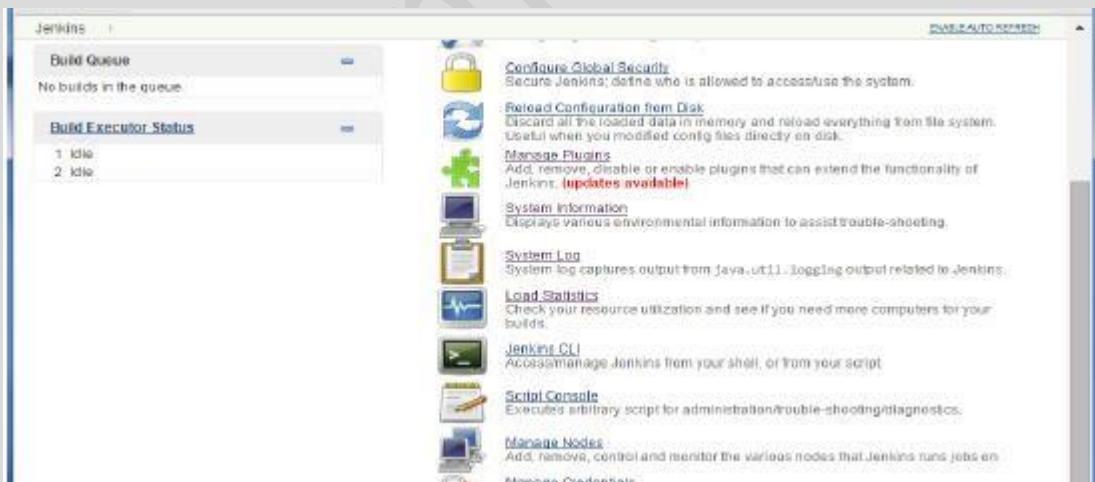
Sometimes you might also need several different environments to test your builds. In this case using a slave to represent each of your required environments is almost a must.

A slave is a computer that is set up to offload build projects from the master and once setup this distribution of tasks is fairly automatic. The exact delegation behavior depends on the configuration of each project; some projects may choose to "stick" to a particular machine for a build, while others may choose to roam freely between slaves.

Since each slave runs a separate program called a "slave agent" there is no need to install the full Jenkins (package or compiled binaries) on a slave. There are various ways to start slave agents, but in the end the slave agent and Jenkins master needs to establish a bi-directional communication link (for example a TCP/IP socket.) in order to operate.

To set up slaves/nodes in Jenkins follow the steps given below.

**Step 1** – Go to the Manage Jenkins section and scroll down to the section of Manage Nodes.



**Step 2** – Click on New Node

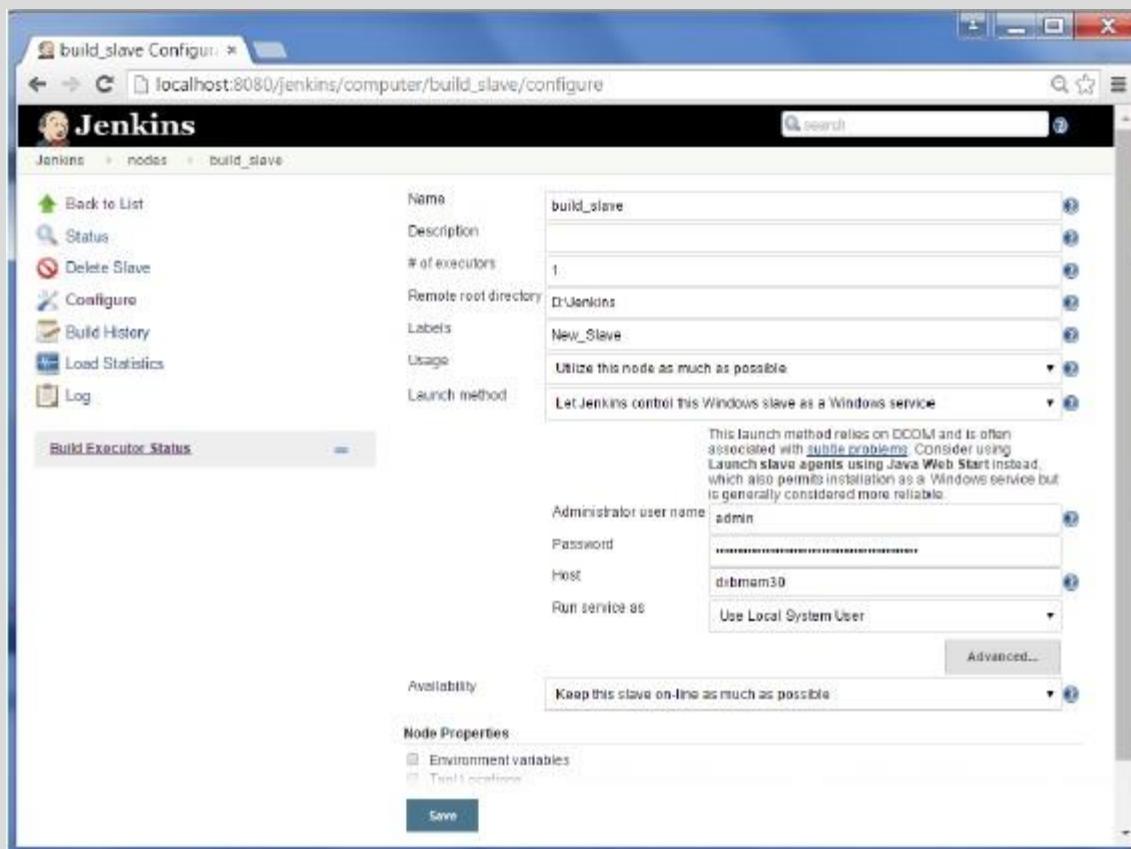
The screenshot shows the Jenkins 'Nodes' page. On the left, there's a sidebar with links: 'Back to Dashboard', 'Manage Jenkins', 'New Node', and 'Configure'. The main area has a table titled 'Nodes' with one row. The table columns are: S, Name, Architecture, Clock Difference, Free Disk Space, Free Swap Space, and Free. The row contains: master, Windows 7 (x86), In sync, 229.80 GB, 12.13 GB, and Data obtained. Below the table is a 'Refresh status' button. On the far right, there's a 'SEARCH' bar and a 'DRAFT AUTO APPROVAL' link.

**Step 3** – Give a name for the node, choose the Dumb slave option and click on Ok.

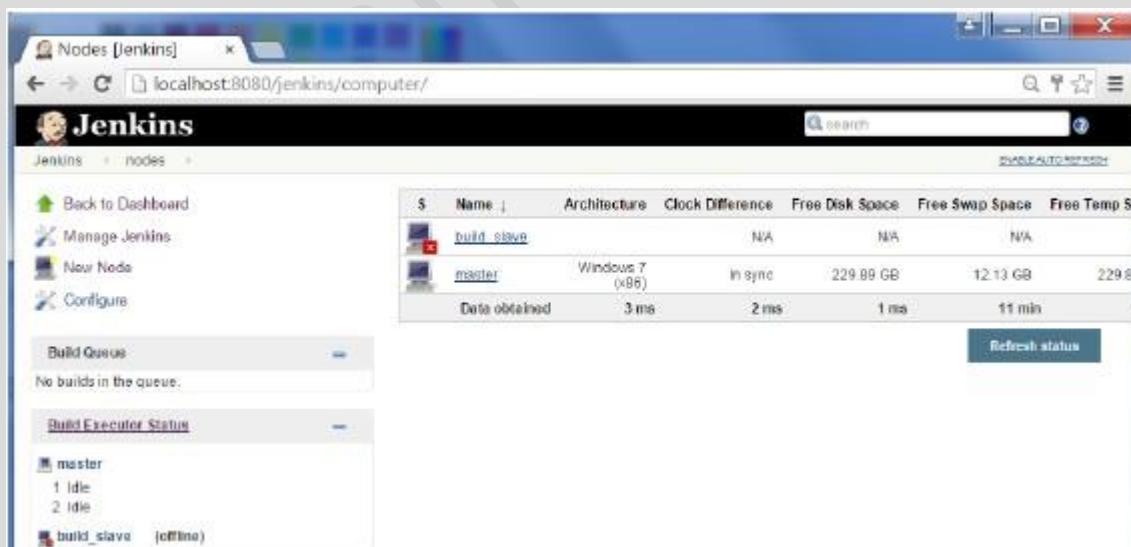
The screenshot shows the 'New Node' configuration page. The 'Node name' field is filled with 'build\_slave'. The 'Dumb Slave' radio button is selected. A tooltip explains: 'Adds a plain, dumb slave to Jenkins. This is called "dumb" because Jenkins doesn't provide higher level of integration with these slaves, such as dynamic provisioning. Select this type if no other slave types apply — for example such as when you are adding a physical computer, virtual machines managed outside Jenkins, etc.' At the bottom right is an 'OK' button.

**Step 4** – Enter the details of the node slave machine. In the below example, we are considering the slave machine to be a windows machine, hence the option of "Let Jenkins control this Windows slave as a Windows service" was chosen as the launch method. We also need to add the necessary details of the slave node such as the node name and the login credentials for the node machine. Click the Save button. The Labels for which the name is entered as "New\_Slave" is what can be used to configure jobs to use this slave machine.

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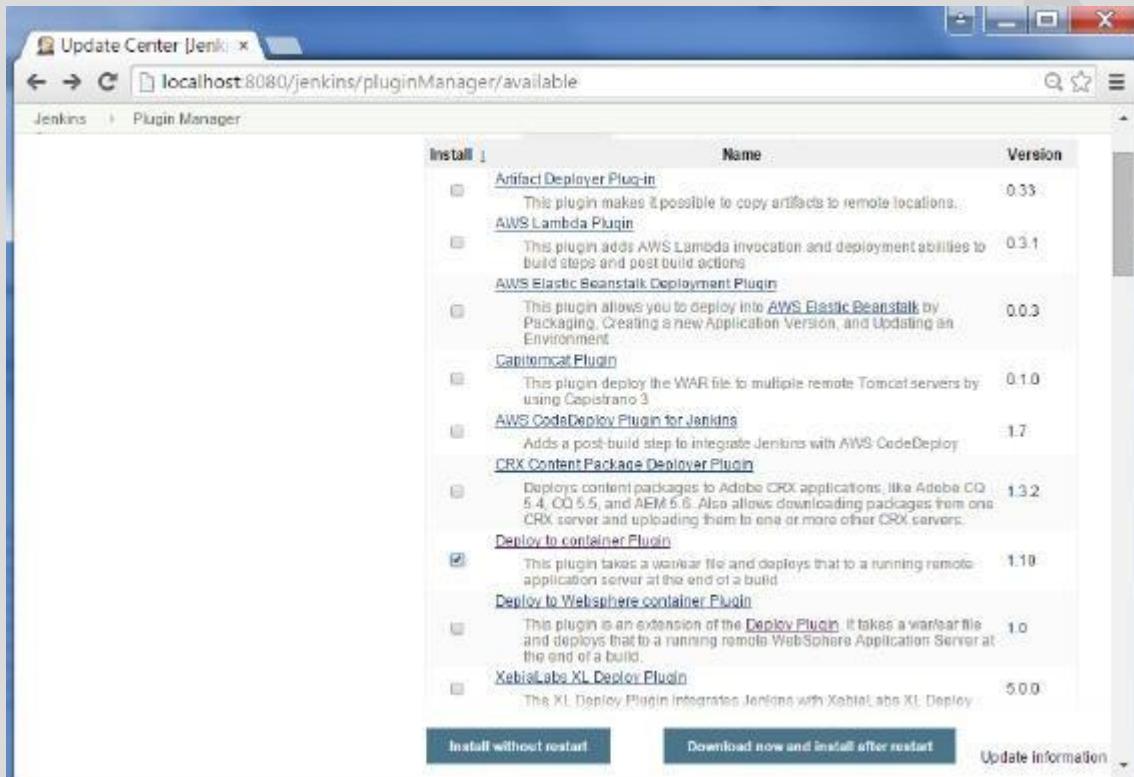
Once the above steps are completed, the new node machine will initially be in an offline state, but will come online if all the settings in the previous screen were entered correctly. One can at any time make the node slave machine as offline if required.



# Jenkins - Automated Deployment

There are many plugins available which can be used to transfer the build files after a successful build to the respective application/web server. One example is the "Deploy to container Plugin". To use this follow the steps given below.

**Step 1** – Go to Manage Jenkins → Manage Plugins. Go to the Available section and find the plugin "Deploy to container Plugin" and install the plugin. Restart the Jenkins server.



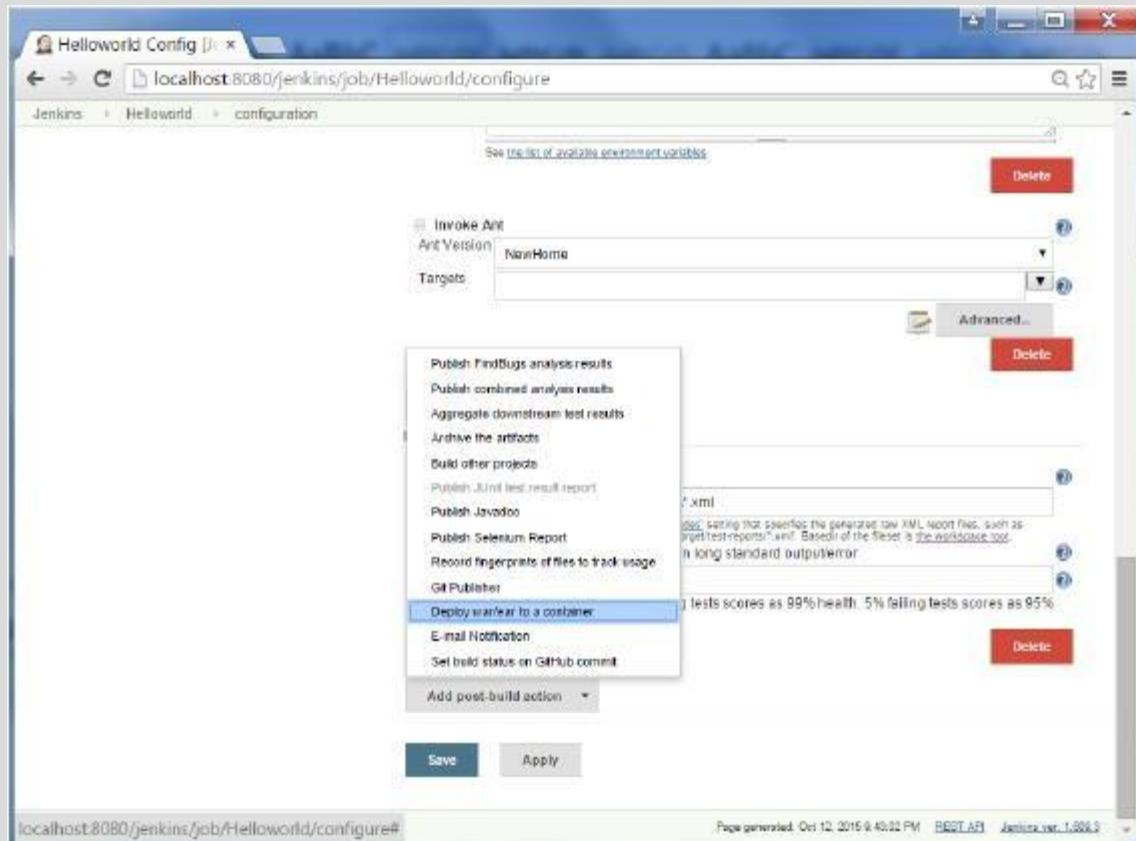
This plugin takes a war/ear file and deploys that to a running remote application server at the end of a build.

Tomcat 4.x/5.x/6.x/7.x

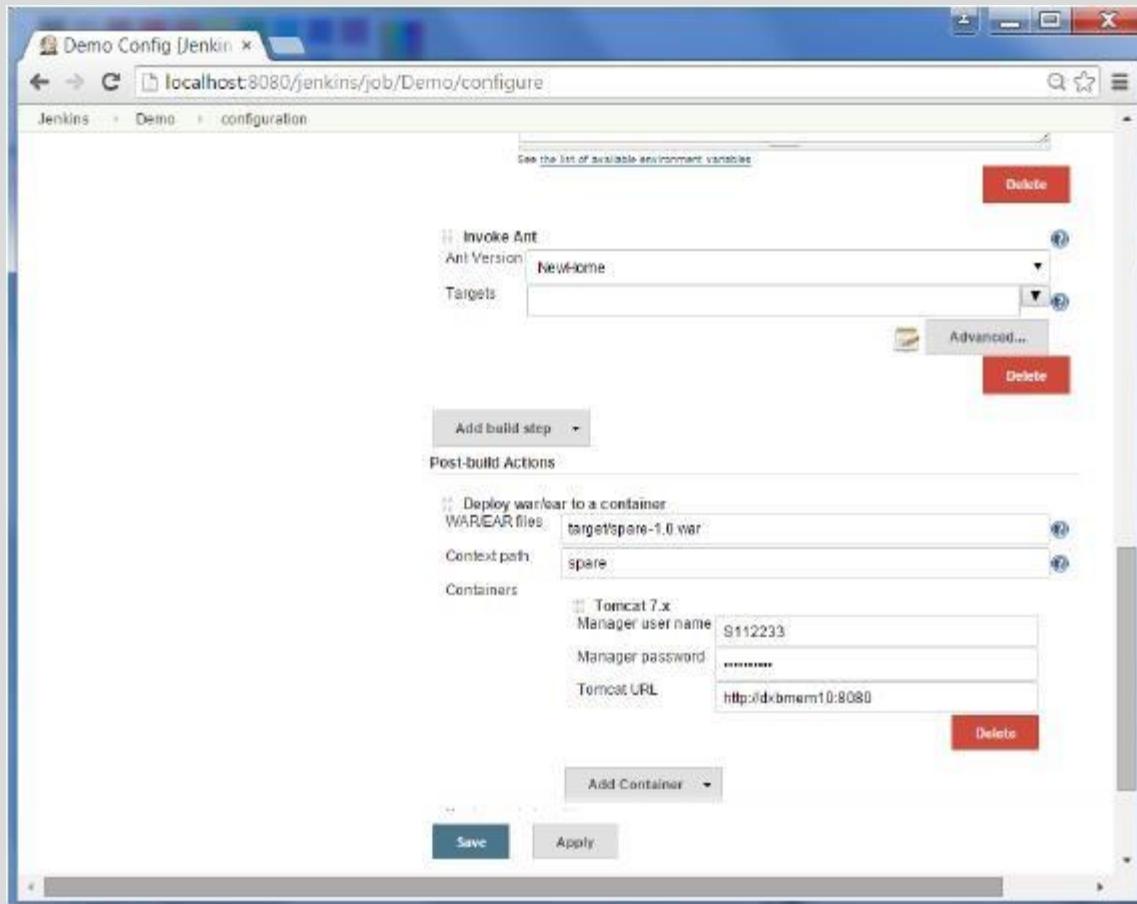
JBoss 3.x/4.x

Glassfish 2.x/3.x

**Step 2** – Go to your Build project and click the Configure option. Choose the option "Deploy war/ear to a container"



**Step 3** – In the Deploy war/ear to a container section, enter the required details of the server on which the files need to be deployed and click on the Save button. These steps will now ensure that the necessary files get deployed to the necessary container after a successful build.



## Jenkins - Metrics & Trends

There are various plugins which are available in Jenkins to showcase metrics for builds which are carried out over a period of time. These metrics are useful to understand your builds and how frequently they fail/pass over time. As an example, let's look at the 'Build History Metrics plugin'.

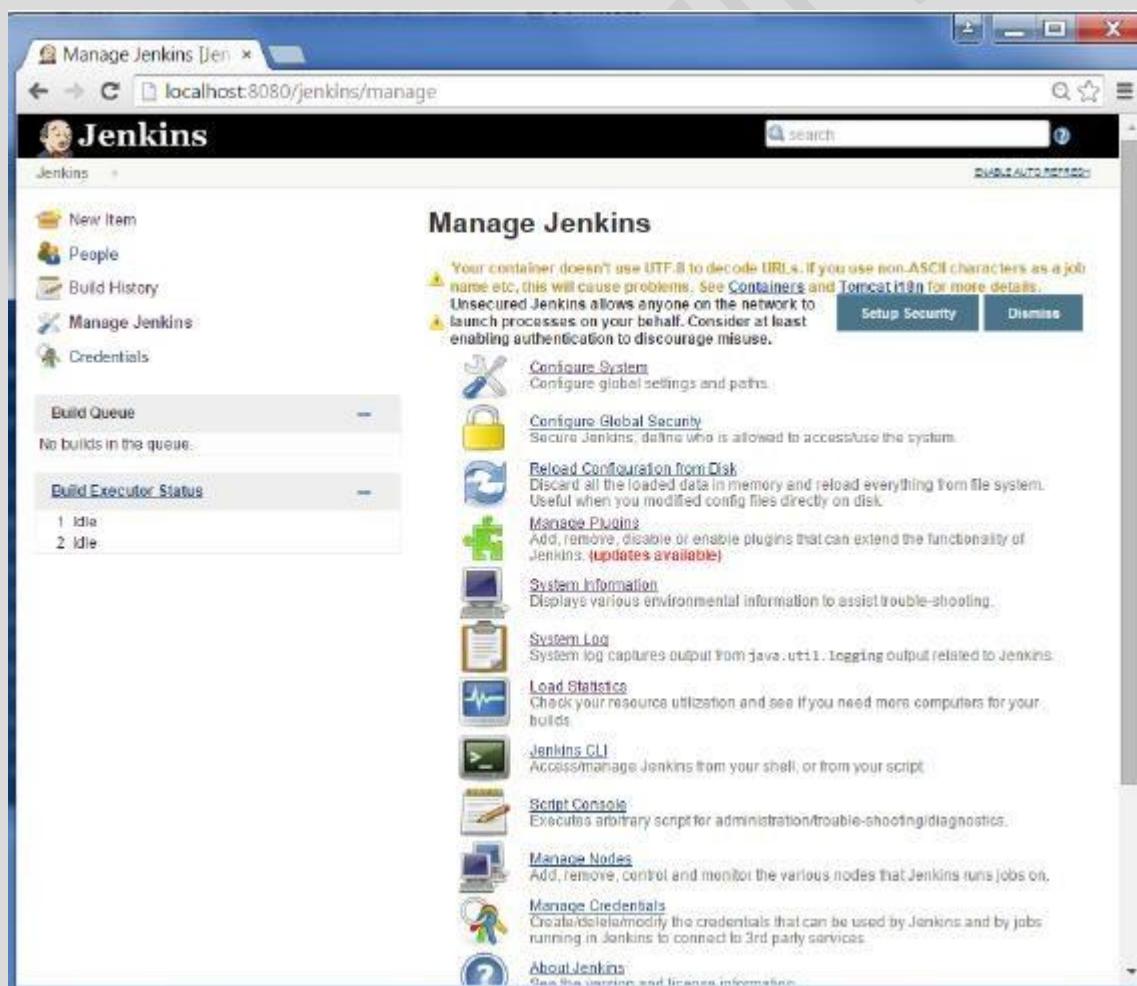
This plugin calculates the following metrics for all of the builds once installed

- Mean Time To Failure (MTTF)
- Mean Time To Recovery (MTTR)
- Standard Deviation of Build Times

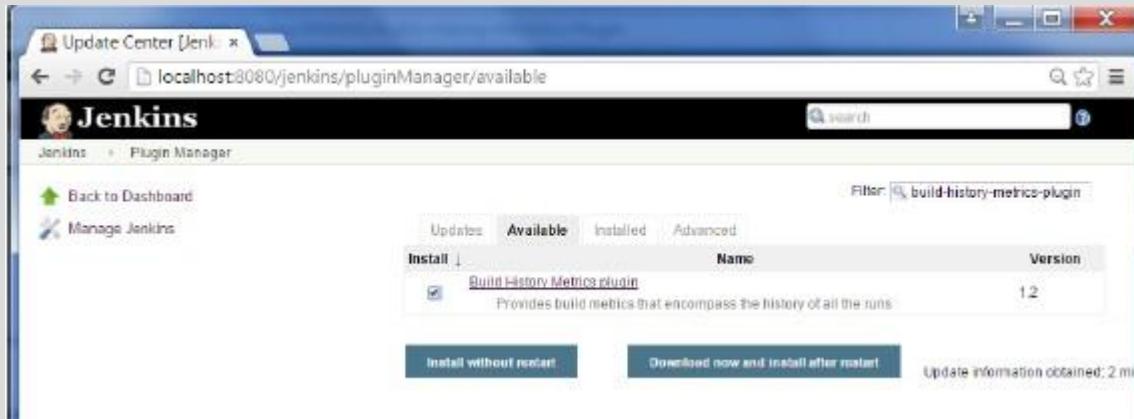
**Step 1** – Go to the Jenkins dashboard and click on Manage Jenkins



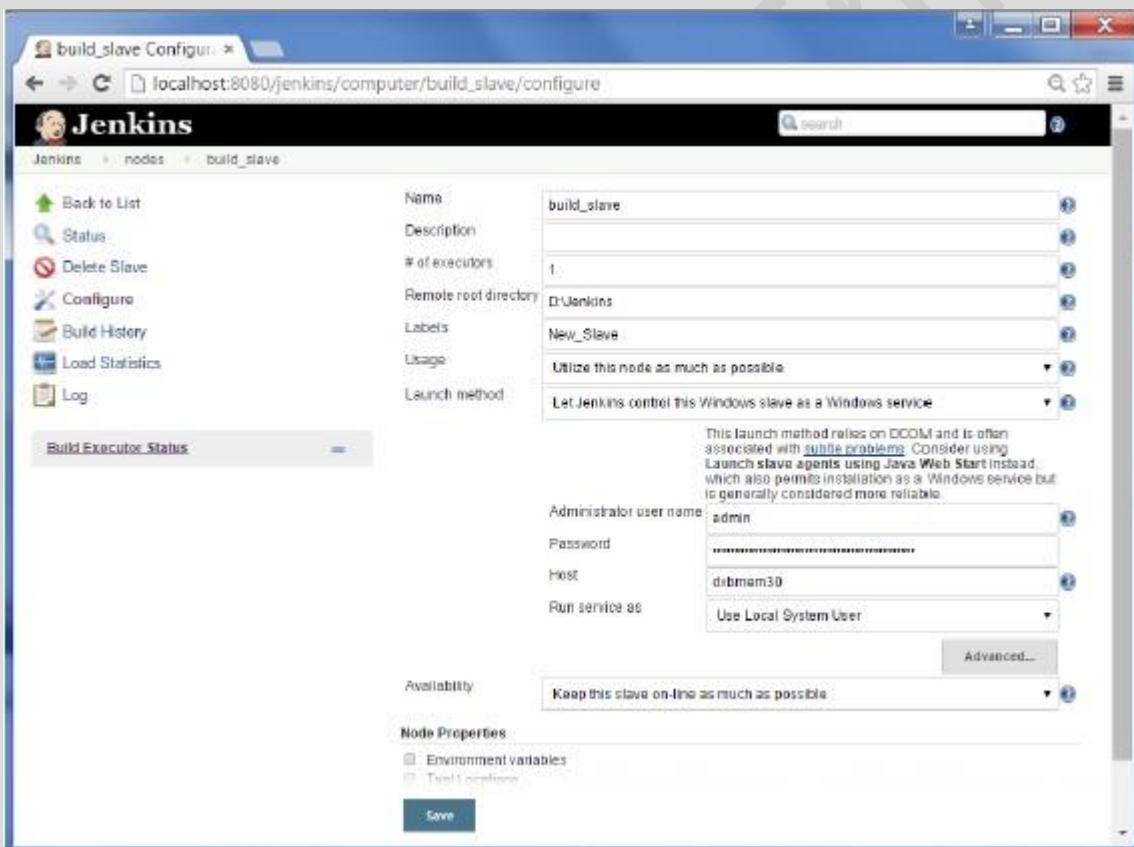
**Step 2** – Go to the Manage Plugins option.



**Step 3** – Go to the Available tab and search for the plugin 'Build History Metrics plugin' and choose to 'install without restart'.



**Step 4** – The following screen shows up to confirm successful installation of the plugin. Restart the Jenkins instance.



When you go to your Job page, you will see a table with the calculated metrics. Metric's are shown for the last 7 days, last 30 days and all time.

The screenshot shows the Jenkins dashboard for the 'Helloworld' project. On the left, there's a sidebar with links like 'Back to Dashboard', 'Status', 'Changes', 'Workspace', 'Build Now', 'Delete Project', and 'Configure'. Below that is the 'Build History' section, which lists builds from #12 down to #1, with dates ranging from Oct 24, 2015 to Oct 11, 2015. There are also 'RSS for all' and 'RSS for failures' links. To the right of the sidebar is the main content area titled 'Project Helloworld'. It features a 'Workspace' icon and a 'Recent Changes' icon. Below these are three tables showing metrics: MTTR, MTTF, and Standard Deviation, with data for Last 7 Days, Last 30 Days, and All Time. At the bottom of the main content area is a 'Permalinks' section with a bulleted list of links to various build logs.

	Last 7 Days	0 ms
MTTR	Last 30 Days	23 hr
	All Time	23 hr
	Last 7 Days	0 ms
MTTF	Last 30 Days	2 days 4 hr
	All Time	2 days 4 hr
	Last 7 Days	0 ms
Standard Deviation	Last 30 Days	52 sec
	All Time	52 sec

	Last 7 Days	0 ms
MTTR	Last 30 Days	23 hr
	All Time	23 hr
	Last 7 Days	0 ms
MTTF	Last 30 Days	2 days 4 hr
	All Time	2 days 4 hr
	Last 7 Days	0 ms
Standard Deviation	Last 30 Days	52 sec
	All Time	52 sec

	Last 7 Days	0 ms
MTTR	Last 30 Days	23 hr
	All Time	23 hr
	Last 7 Days	0 ms
MTTF	Last 30 Days	2 days 4 hr
	All Time	2 days 4 hr
	Last 7 Days	0 ms
Standard Deviation	Last 30 Days	52 sec
	All Time	52 sec

**Permalinks**

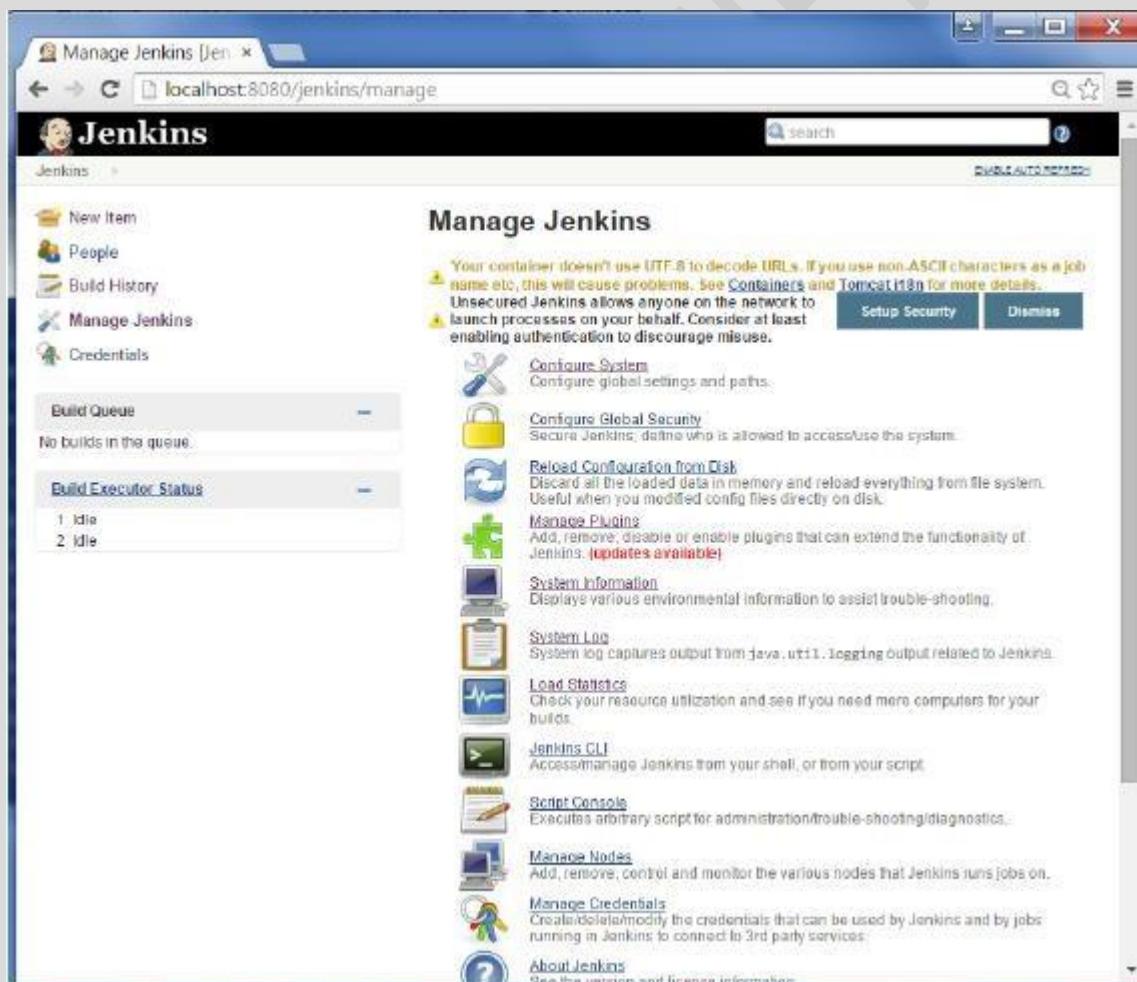
- [Last build \(#12\) 5.5 sec ago](#)
- [Last stable build \(#11\) 8 days 17 hr ago](#)
- [Last successful build \(#11\) 8 days 17 hr ago](#)
- [Last failed build \(#12\) 5.5 sec ago](#)
- [Last unstable build \(#4\) 11 days ago](#)
- [Last unsuccessful build \(#12\) 5.5 sec ago](#)

To see overall trends in Jenkins, there are plugins available to gather information from within the builds and Jenkins and display them in a graphical format. One example of such a plugin is the 'Hudson global-build-stats plugin'. So let's go through the steps for this.

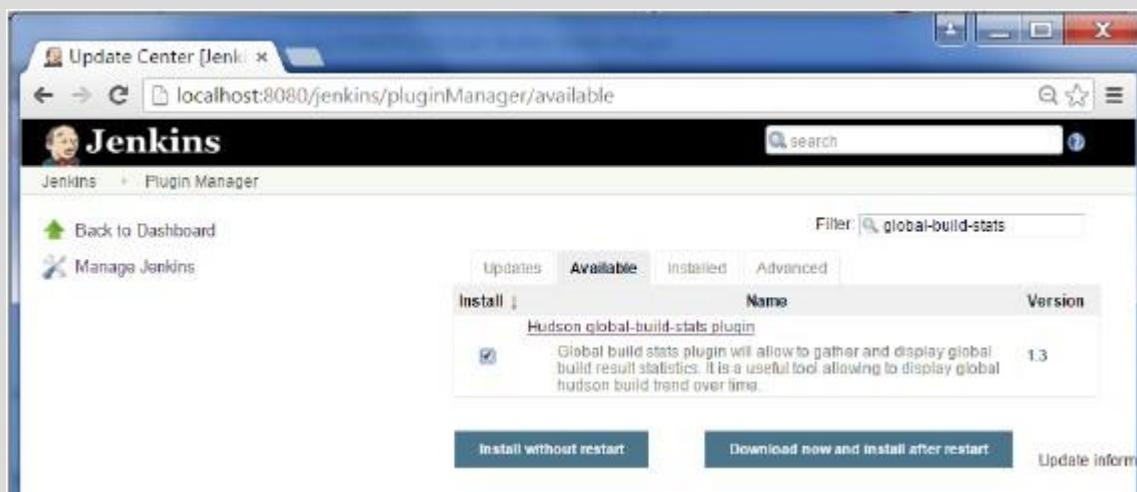
**Step 1** – Go to the Jenkins dashboard and click on Manage Jenkins



## Step 2 – Go to the Manage Plugins option



## Step 3 – Go to the Available tab and search for the plugin 'Hudson global-build-stats plugin' and choose to 'install without restart'.



**Step 4** – The following screen shows up to confirm successful installation of the plugin. Restart the Jenkins instance.



To see the Global statistics, please follow the Step 5 through 8.

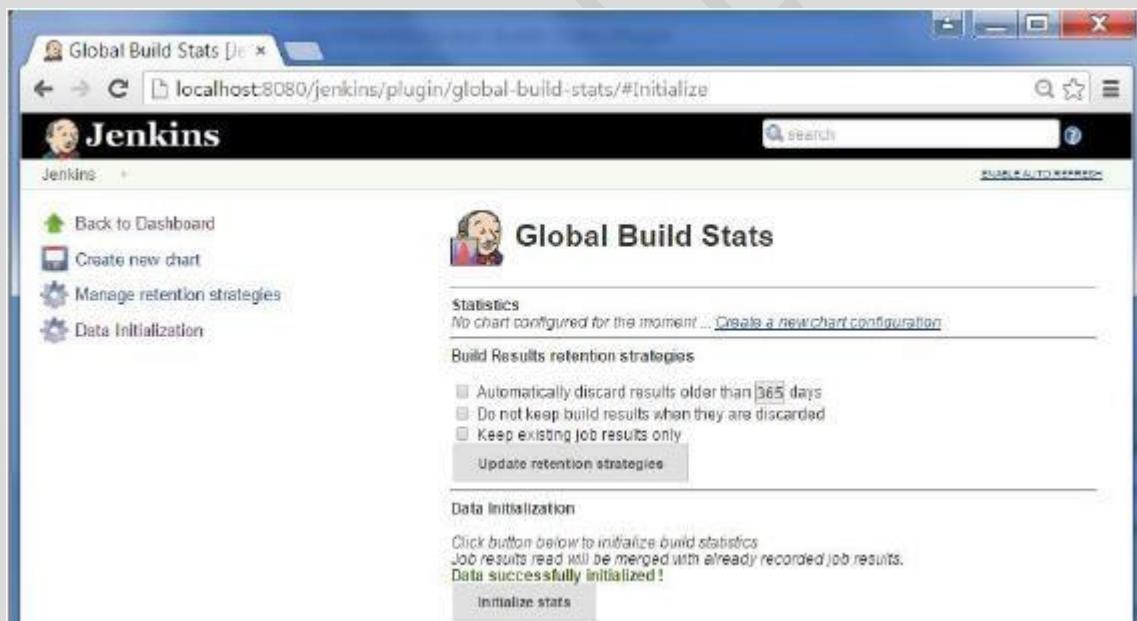
**Step 5** – Go to the Jenkins dashboard and click on Manage Jenkins. In the Manage Jenkins screen, scroll down and now you will now see an option called 'Global Build Stats'. Click on this link.



**Step 6** – Click on the button ‘Initialize stats’. What this does is that it gathers all the existing records for builds which have already been carried out and charts can be created based on these results.



**Step 7** – Once the data has been initialized, it's time to create a new chart. Click on the 'Create new chart' link.

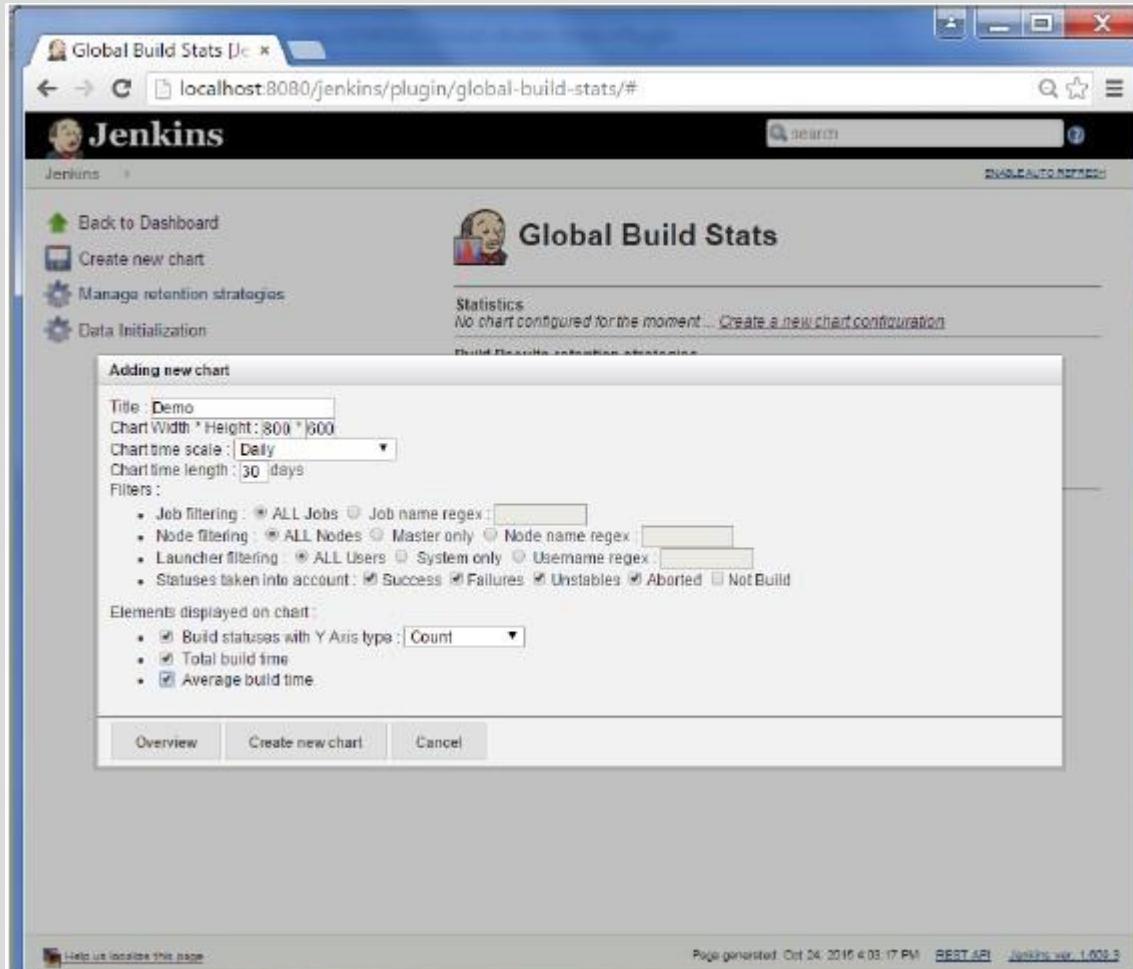


**Step 8** – A pop-up will come to enter relevant information for the new chart details. Enter the following mandatory information

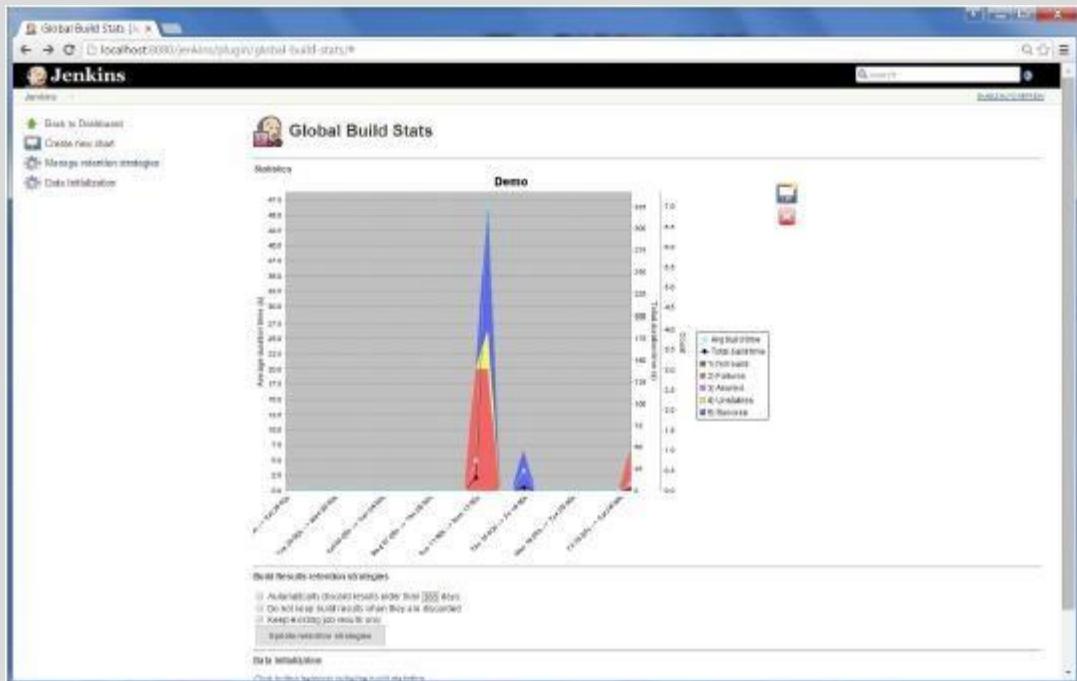
- Title – Any title information, for this example is given as 'Demo'
- Chart Width – 800
- Chart Height – 600
- Chart time scale – Daily

 Chart time length – 30 days

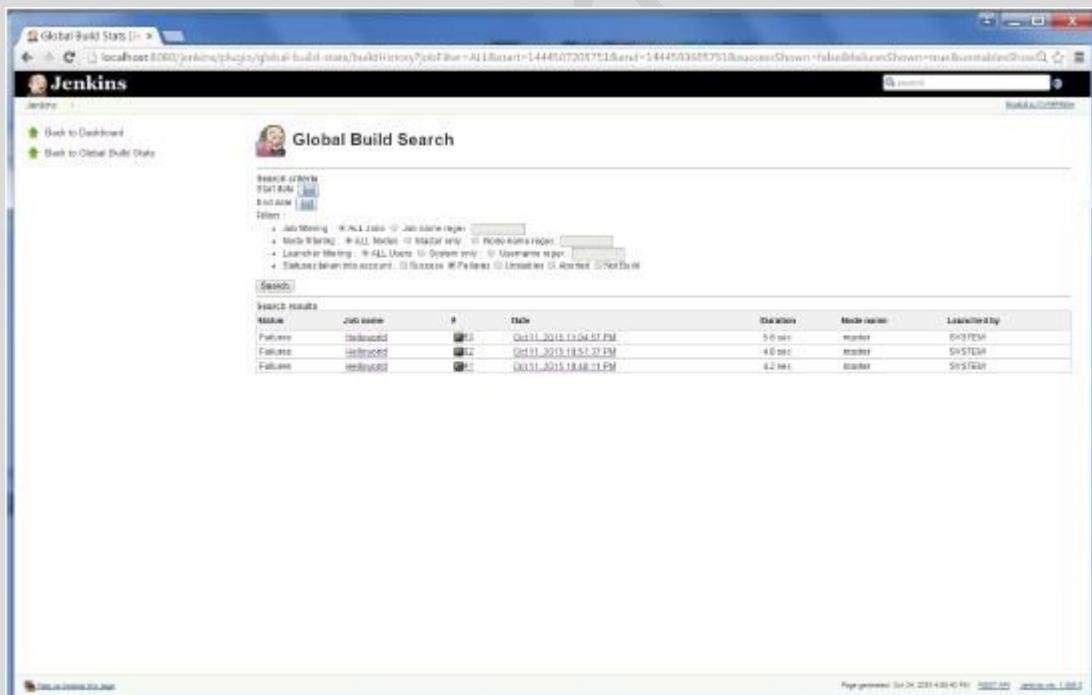
The rest of the information can remain as it is. Once the information is entered, click on Create New chart.



You will now see the chart which displays the trends of the builds over time.



If you click on any section within the chart, it will give you a drill down of the details of the job and their builds.



## Jenkins - Server Maintenance

The following are some of the basic activities you will carry out, some of which are best practices for Jenkins server maintenance

## URL Options

The following commands when appended to the Jenkins instance URL will carry out the relevant actions on the Jenkins instance.

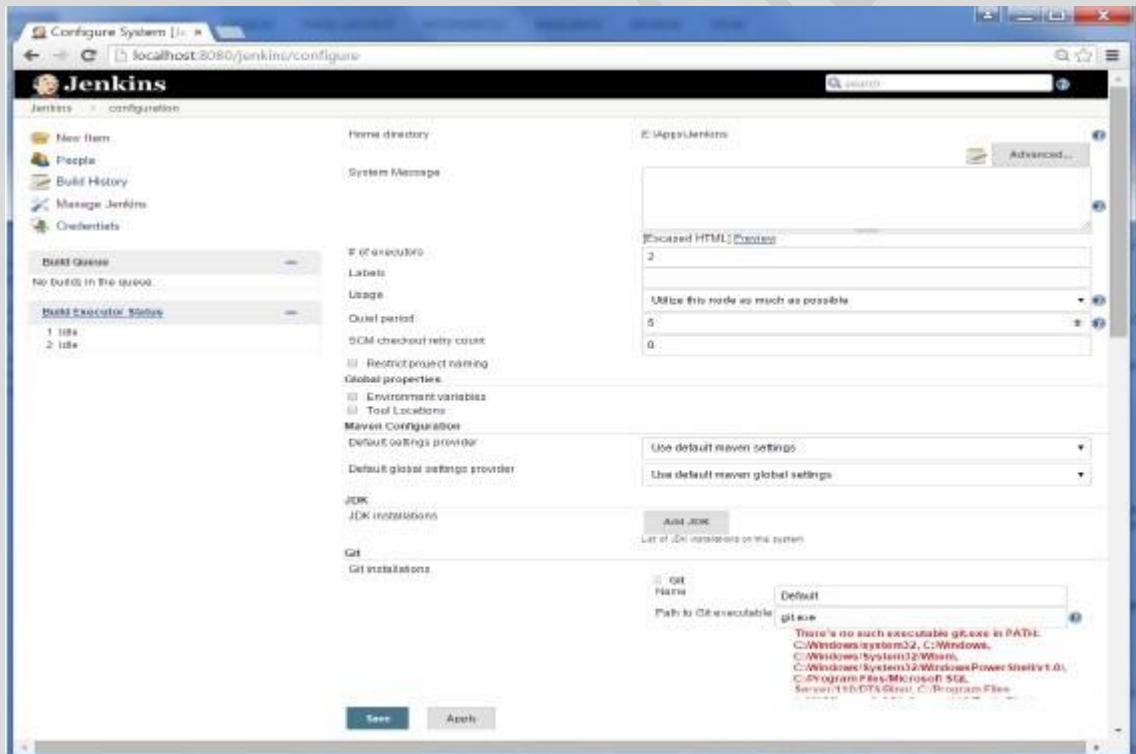
**http://localhost:8080/jenkins/exit** – shutdown jenkins

**http://localhost:8080/jenkins/restart** – restart jenkins

**http://localhost:8080/jenkins/reload** – to reload the configuration

## Backup Jenkins Home

The Jenkins Home directory is nothing but the location on your drive where Jenkins stores all information for the jobs, builds etc. The location of your home directory can be seen when you click on Manage Jenkins → Configure system.

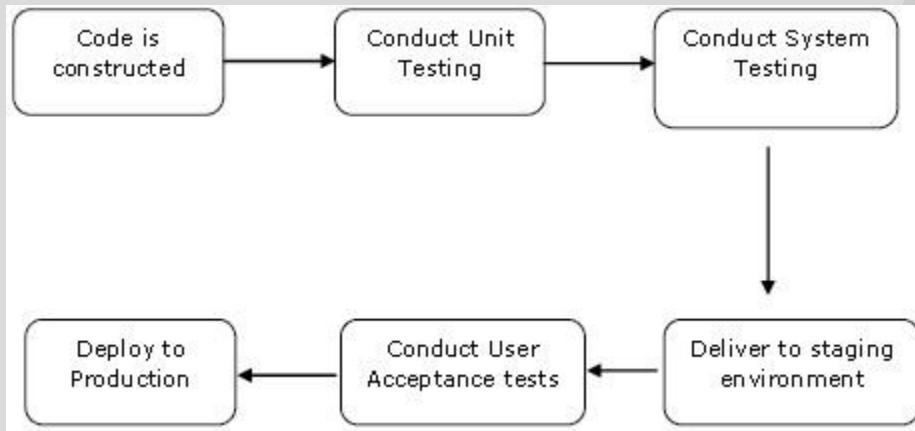


Set up Jenkins on the partition that has the most free disk-space – Since Jenkins would be taking source code for the various jobs defined and doing continuous builds, always ensure that Jenkins is setup on a drive that has enough hard disk space. If you hard disk runs out of space, then all builds on the Jenkins instance will start failing.

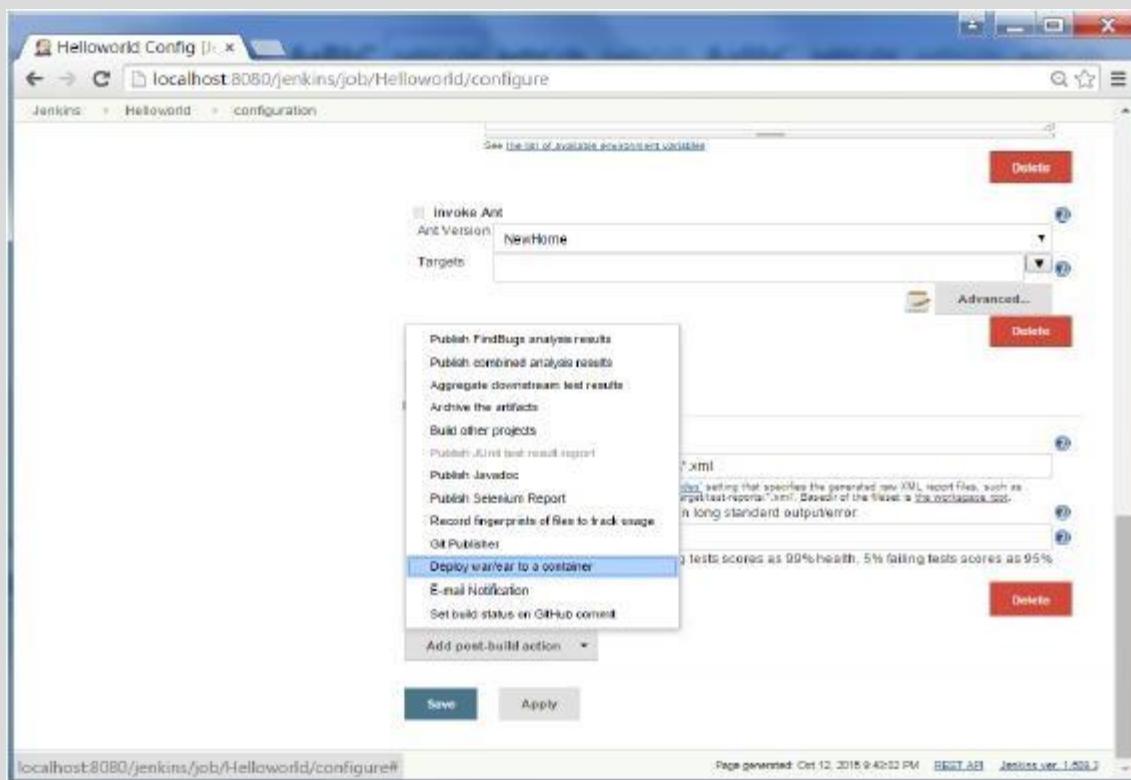
Another best practice is to write cron jobs or maintenance tasks that can carry out clean-up operations to avoid the disk where Jenkins is setup from becoming full.

## Jenkins - Continuous Deployment

Jenkins provides good support for providing continuous deployment and delivery. If you look at the flow of any software development through deployment, it will be as shown below.



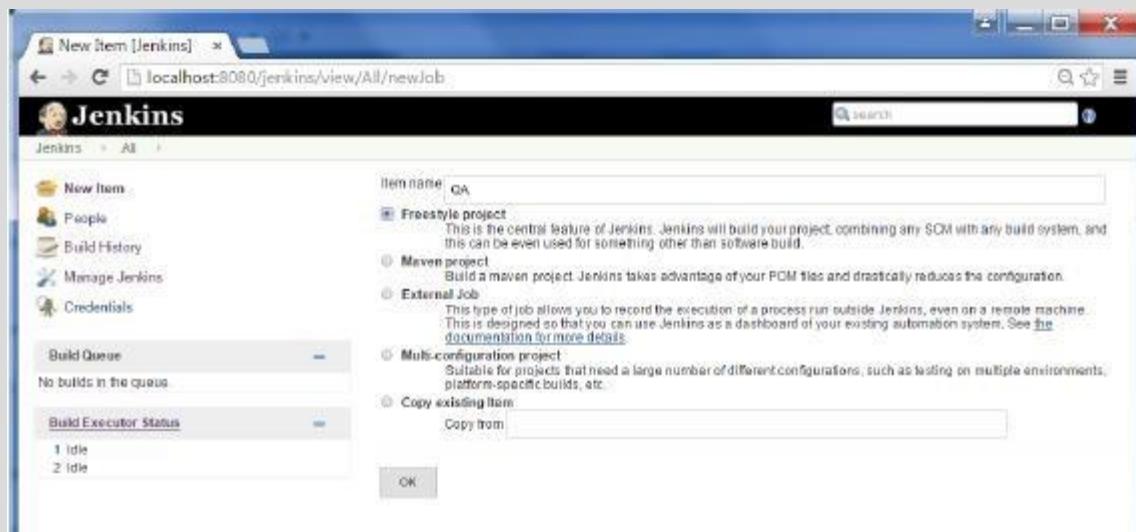
The main part of Continuous deployment is to ensure that the entire process which is shown above is automated. Jenkins achieves all of this via various plugins, one of them being the “Deploy to container Plugin” which was seen in the earlier lessons.



There are plugins available which can actually give you a graphical representation of the Continuous deployment process. But first lets create another project in Jenkins, so that we can see best how this works.

Let's create a simple project which emulates the QA stage, and does a test of the Helloworld application.

**Step 1** – Go to the Jenkins dashboard and click on New Item. Choose a 'Freestyle project' and enter the project name as 'QA'. Click on the Ok button to create the project.



**Step 2** – In this example, we are keeping it simple and just using this project to execute a test program for the Helloworld application.

The screenshot shows the configuration page for the 'QA' job. Under the 'Build' section, there is a step titled 'Execute Windows batch command' with the command 'java HelloWorldTest.java' entered in the text area. There are also sections for 'Build Triggers' (with 'Build after other projects are built' checked), 'Build Environment' (with 'Create Selenium RC Instance'), and 'Post-build Actions' (with 'Add post-build action'). At the bottom are 'Save' and 'Apply' buttons.

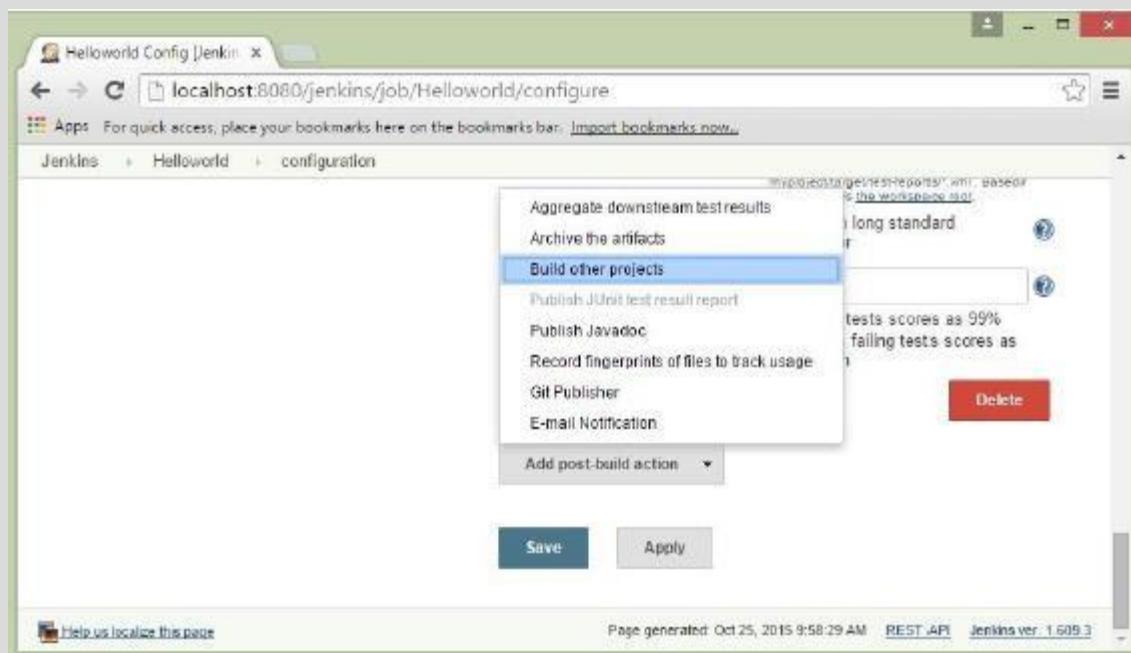
So our project QA is now setup. You can do a build to see if it builds properly.

The screenshot shows the Jenkins interface for a project named "Project QA". On the left, there's a sidebar with links like "Back to Dashboard", "Status", "Changes", "Workspace", "Build Now", "Delete Project", and "Configure". Below that is a "Build History" section with four builds listed, each with a timestamp. To the right of the sidebar are two tables: "MTTR" and "MTTF", both showing data for "Last 7 Days", "Last 30 Days", and "All Time". Below these tables is a "Standard Deviation" table. At the bottom, there are "Permalinks" for the last build and the latest build.

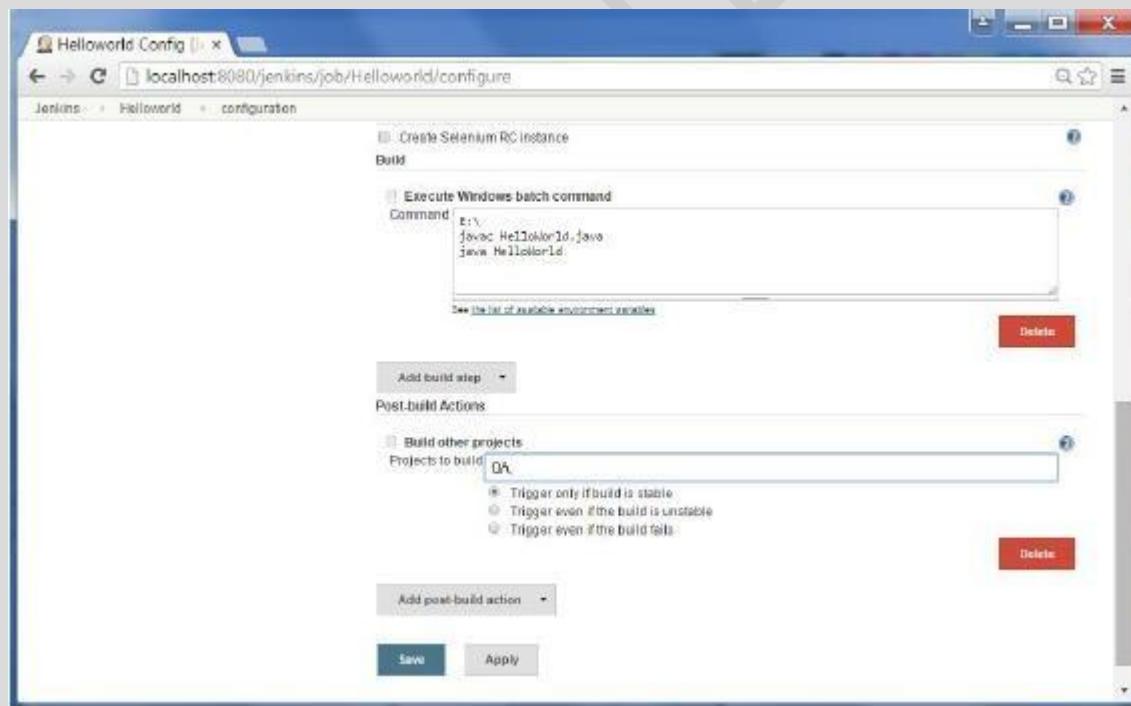
**Step 3** – Now go to your Helloworld project and click on the Configure option

The screenshot shows the Jenkins dashboard. On the left, there's a sidebar with "New Item", "People", "Build History", "Manage Jenkins", and "Credentials". Below that are sections for "Build Queue" (no builds in the queue) and "Build Executor Status" (1 idle). In the main area, there's a list of projects: "Helloworld" (last success: 12 days - #15, last failure: 12 days - #14, last duration: 6.6 sec). A context menu is open over the "Helloworld" project, showing options: "Changes", "Workspace", "Build Now", "Delete Project", and "Configure". The "Configure" button is highlighted in blue.

**Step 4** – In the project configuration, choose the 'Add post-build action' and choose 'Build other projects'



**Step 5** – In the ‘Project to build’ section, enter QA as the project name to build. You can leave the option as default of ‘Trigger only if build is stable’. Click on the Save button.



**Step 6** – Build the Helloworld project. Now if you see the Console output, you will also see that after the Helloworld project is successfully built, the build of the QA project will also happen.

```

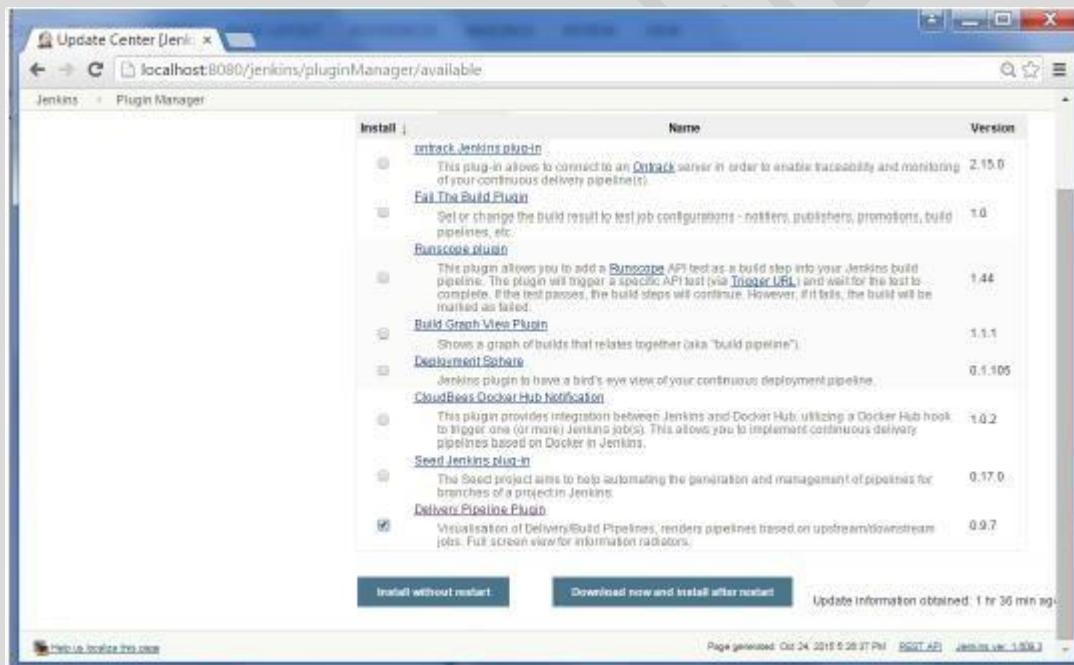
Started by user anonymous
Building in workspace E:\Jenkins\jobs\HelloWorld\workspace
[workspace] $ cmd /c call E:\Apache\tomcat7\temp\hudson397087412396689633.bat
E:\Jenkins\jobs\HelloWorld\workspace>cmd
'cmd' is not recognized as an internal or external command,
operable program or batch file.

E:\Jenkins\jobs\HelloWorld\workspace>javac HelloWorld.java
E:\Jenkins\jobs\HelloWorld\workspace>java HelloWorld
Hello World

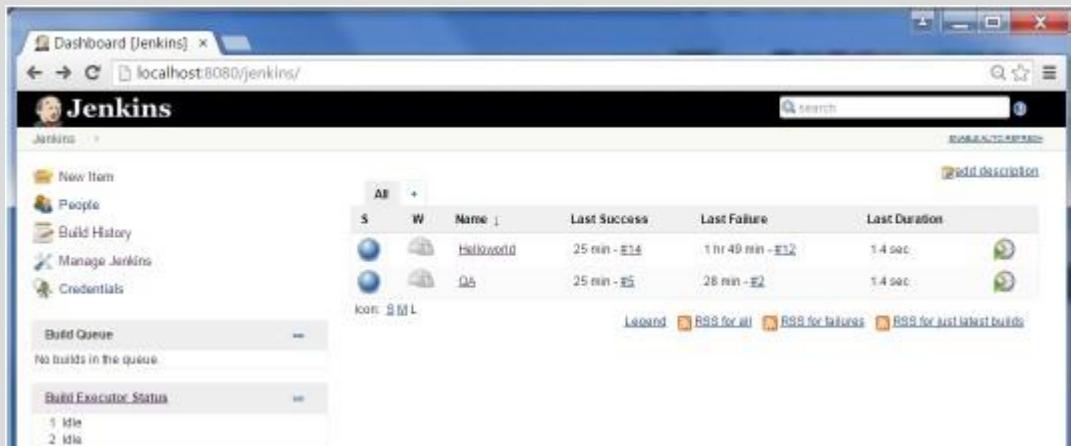
E:\Jenkins\jobs\HelloWorld\workspace>exit 0
warning: you have no plugins providing access control for builds, so falling back to legacy behavior of permitting any downstream builds to be triggered
Triggering a new build of DA
Finished: SUCCESS

```

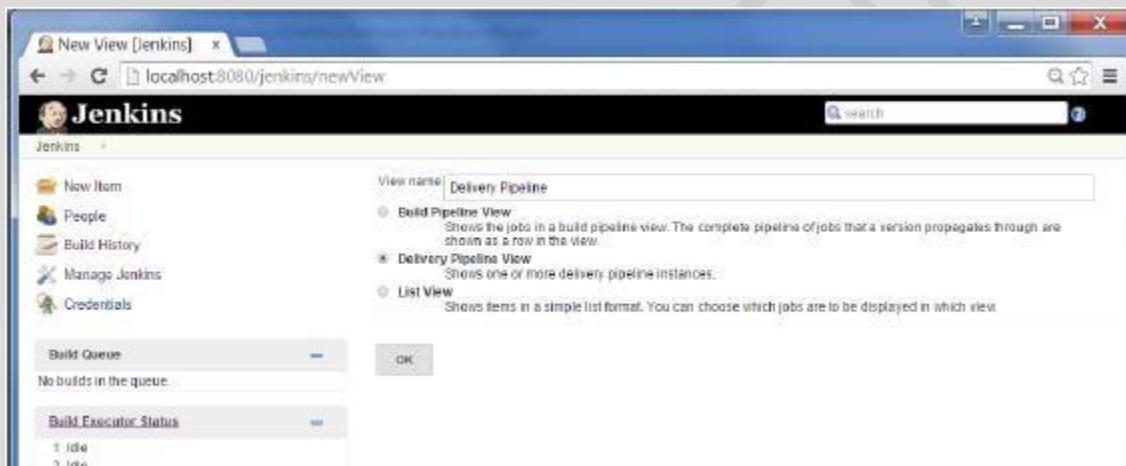
**Step 7** – Let now install the Delivery pipeline plugin. Go to Manage Jenkins → Manage Plugin's. In the available tab, search for ‘Delivery Pipeline Plugin’. Click On Install without Restart. Once done, restart the Jenkins instance.



**Step 8** – To see the Delivery pipeline in action, in the Jenkins Dashboard, click on the + symbol in the Tab next to the ‘All’ Tab.

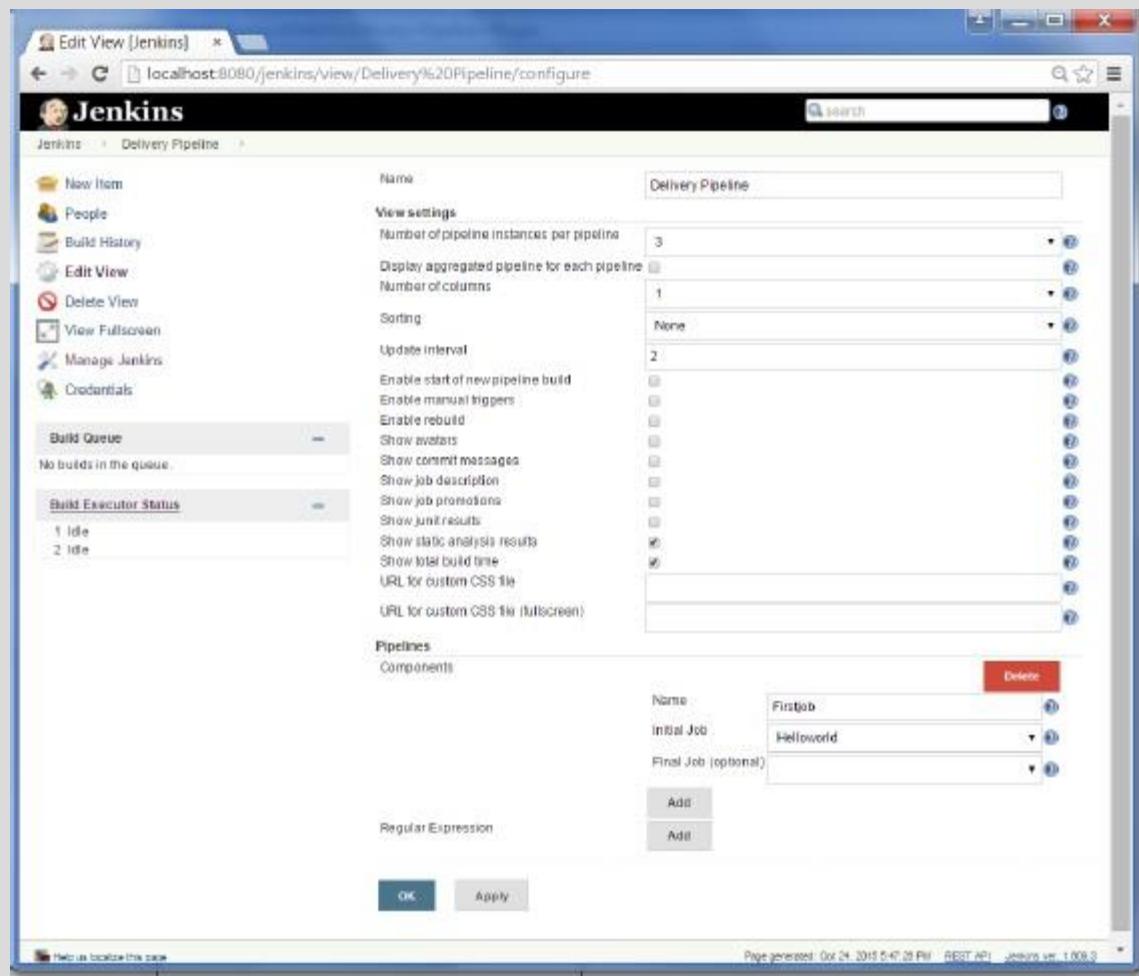


**Step 9** – Enter any name for the View name and choose the option ‘Delivery Pipeline View’.



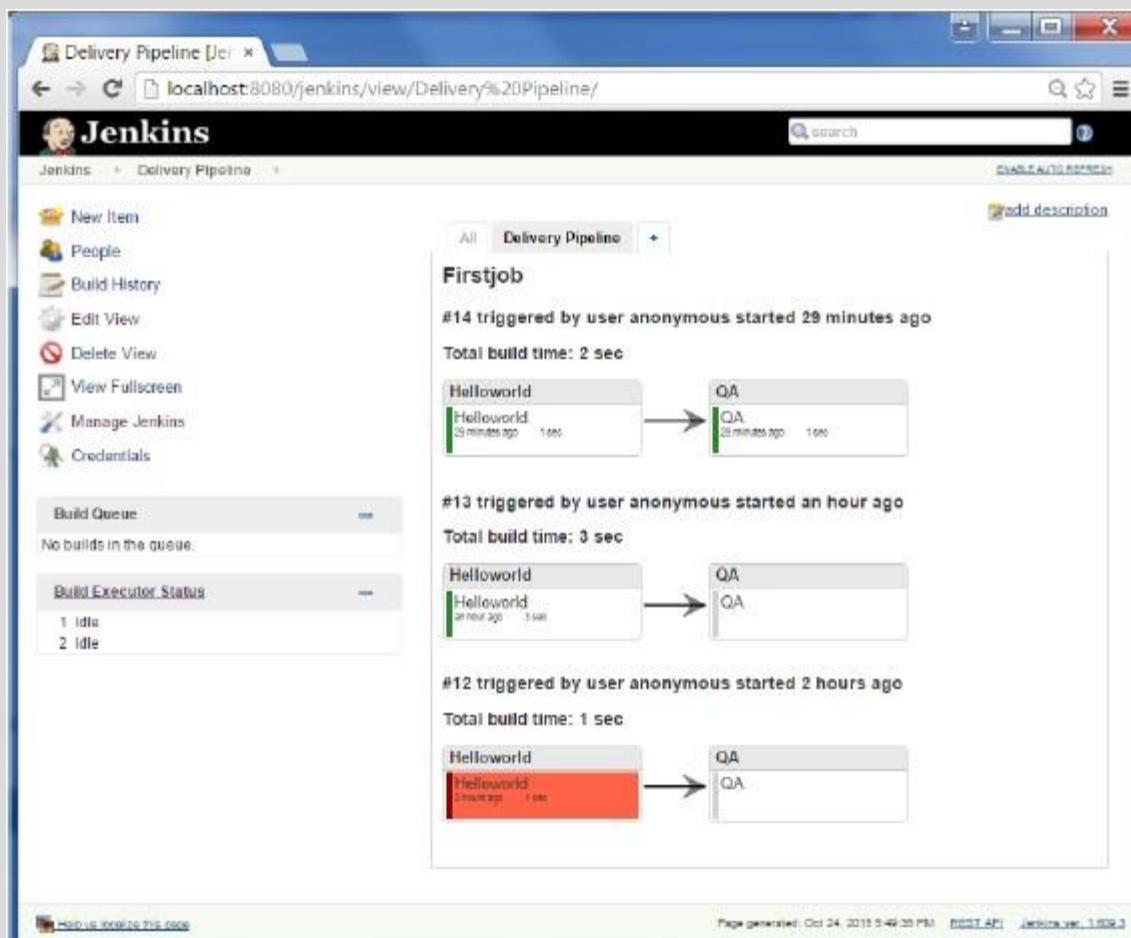
**Step 10** – In the next screen, you can leave the default options. One can change the following settings –

- ✚ Ensure the option ‘Show static analysis results’ is checked.
- ✚ Ensure the option ‘Show total build time’ is checked.
- ✚ For the Initial job – Enter the Hello world project as the first job which should build.
- ✚ Enter any name for the Pipeline ✚ Click the OK button.



You will now see a great view of the entire delivery pipeline and you will be able to see the status of each project in the entire pipeline.

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Another famous plugin is the **build pipeline plugin**. Let's take a look at this.

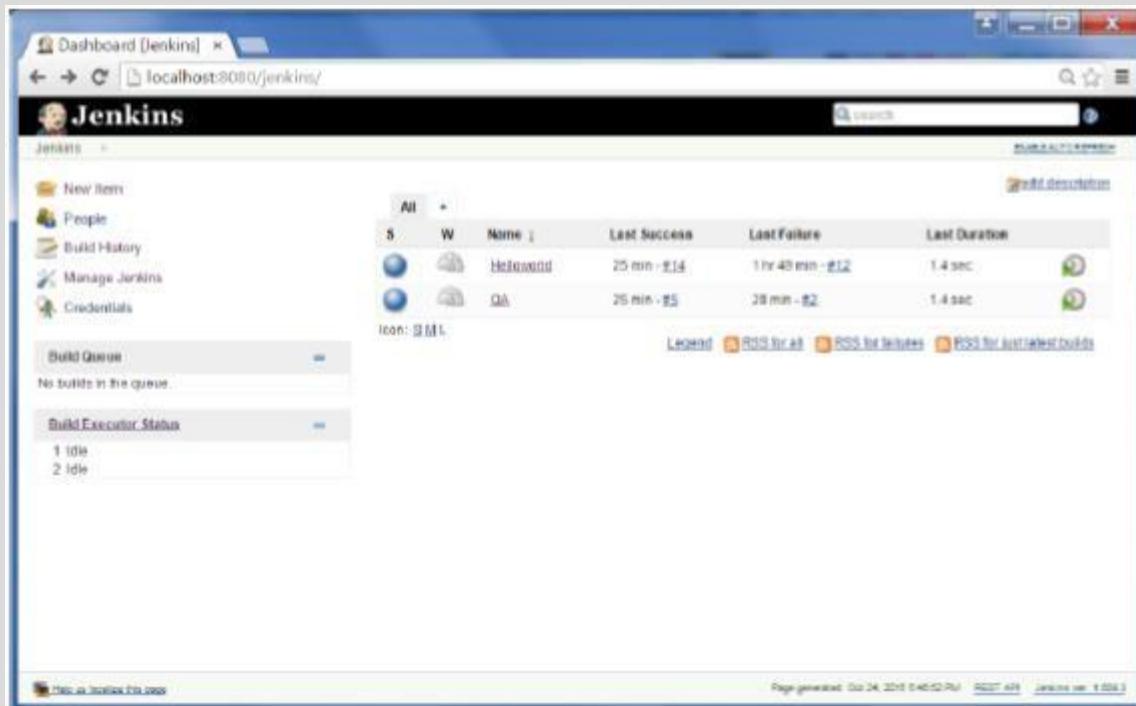
**Step 1** – Go to Manage Jenkins → Manage Plugins. In the available tab, search for ‘Build Pipeline Plugin’. Click On Install without Restart. Once done, restart the Jenkins instance.

The screenshot shows the Jenkins Update Center interface. The title bar says "Update Center [Jenkins]". The address bar shows "localhost:8080/jenkins/pluginManager/available". The main content area has a search bar with "Build pipeline" and tabs for "Updates", "Available", "Installed", and "Advanced". The "Available" tab is selected. A table lists five plugins:

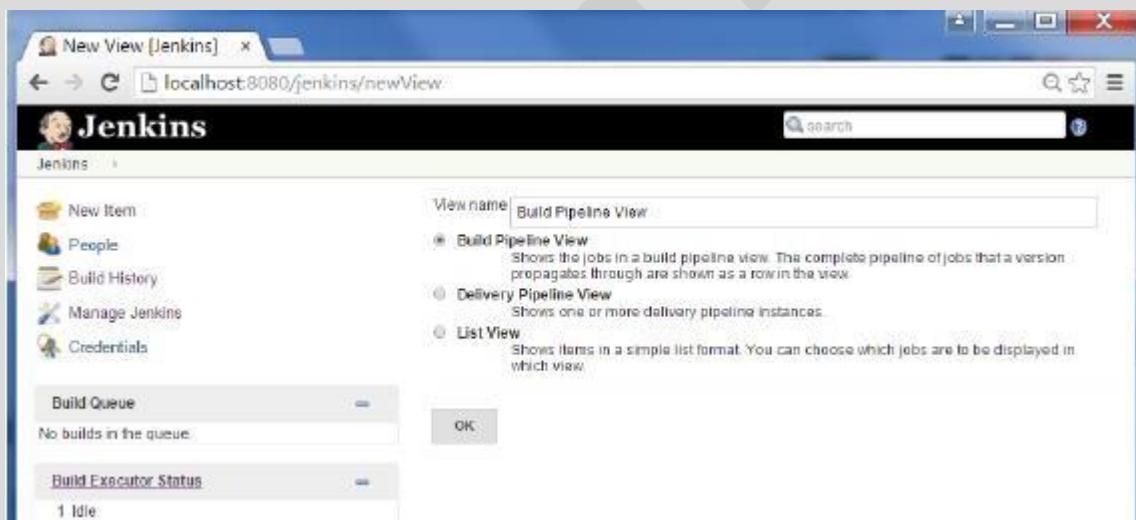
	Name	Version
<input checked="" type="checkbox"/>	<a href="#">Build Pipeline Plugin</a> This plugin provides a _Build Pipeline View_ of upstream and downstream connected jobs that typically form a build pipeline. In addition, it offers the ability to define manual triggers for jobs that require intervention prior to execution, e.g. an approval process outside of Jenkins.	1.4.8
<input type="checkbox"/>	<a href="#">Fail The Build Plugin</a> Set or change the build result to test job configurations - notifiers, publishers, promotions, build pipelines, etc.	1.0
<input type="checkbox"/>	<a href="#">Runscope plugin</a> This plugin allows you to add a Runscope API test as a build step into your Jenkins build pipeline. The plugin will trigger a specific API test (via Trigger URL) and wait for the test to complete. If the test passes, the build steps will continue. However, if it fails, the build will be marked as failed.	1.44
<input type="checkbox"/>	<a href="#">Build Graph View Plugin</a> Shows a graph of builds that relates together (aka "build pipelines")	1.1.1
<input type="checkbox"/>	<a href="#">Delivery Pipeline Plugin</a> Visualisation of Delivery/Build Pipelines, renders pipelines based on upstream/downstream jobs. Full screen viewer for information radiators	0.9.7

At the bottom are buttons for "Install without restart", "Download now and install after restart", and "Update info".

**Step 2** – To see the Build pipeline in action, in the Jenkins Dashboard, click on the + symbol in the Tab next to the 'All' Tab.



**Step 3** – Enter any name for the View name and choose the option ‘Build Pipeline View’.



**Step 4** – Accept the default settings, just in the Selected Initial job, ensure to enter the name of the Helloworld project. Click on the Ok button.

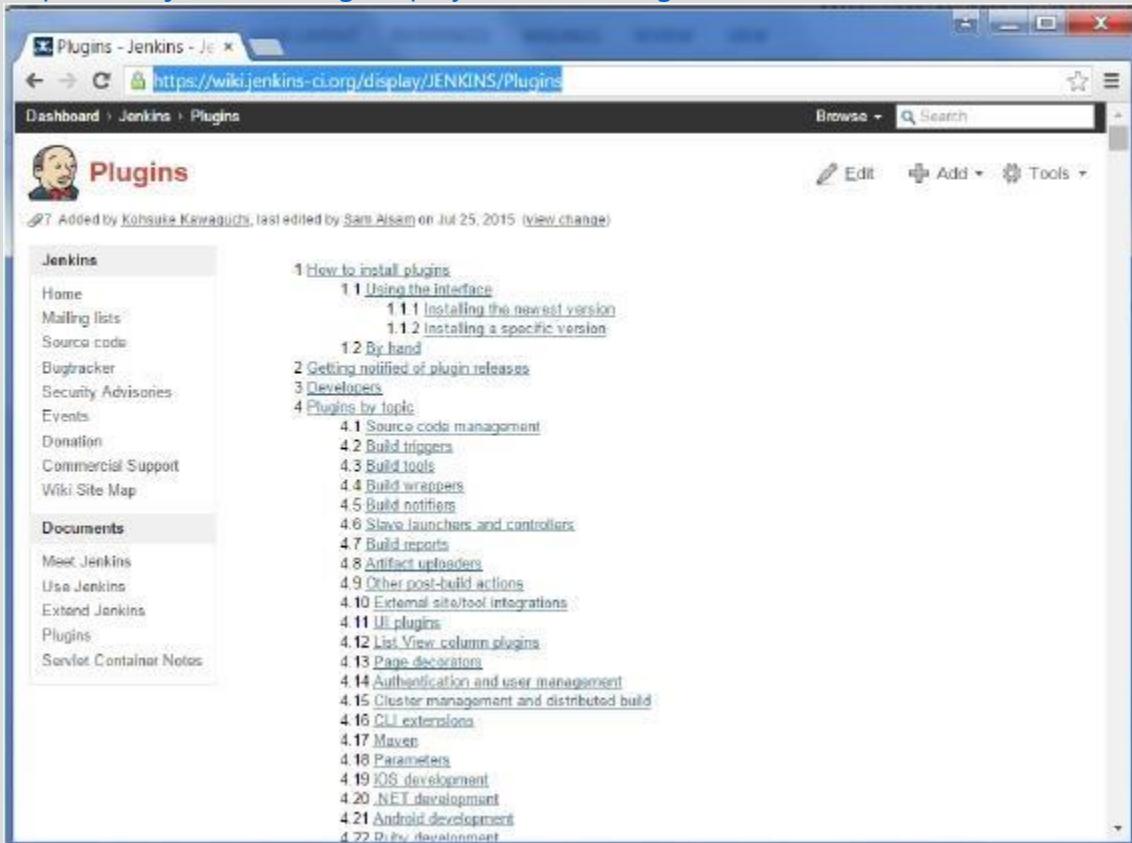
The screenshot shows the Jenkins 'Edit View [Jenkins]' configuration page for 'Build Pipeline View'. The left sidebar includes links for New Item, People, Build History, Edit View, Delete View, Manage Jenkins, and Credentials. The main configuration area has sections for Name, Description, Filter build queue, Filter build executors, Build Pipeline View Title, Layout (set to 'Based on upstream/downstream relations'), and Select Initial Job (set to 'HelloWorld'). Other settings include No Of Displayed Builds (1), Restrict triggers to most recent successful builds (Yes), Always allow manual trigger on pipeline steps (Yes), Show pipeline project headers (Yes), Show pipeline parameters in project headers (Yes), Show pipeline parameters in revision box (Yes), Refresh frequency (in seconds) (3), URL for custom CSS files, and Console Output Link Style (Lightbox). Buttons at the bottom are 'OK' and 'Apply'.

You will now see a great view of the entire delivery pipeline and you will be able to see the status of each project in the entire pipeline.

The screenshot shows the Jenkins 'Build Pipeline View' page. The top navigation bar indicates the view is 'Build Pipeline View'. The main content area is titled 'Build Pipeline' and shows three stages: 'Pipeline #14' (grey), '#14 HelloWord' (green), and '#14 QA' (green). Below the stages, there are buttons for Run, History, Configure, Add Step, Queue, Cancel, and Delete.

# Jenkins - Managing Plugins

To get the list of all plugins available within Jenkins, one can visit the link –  
<https://wiki.jenkins-ci.org/display/JENKINS/Plugins>



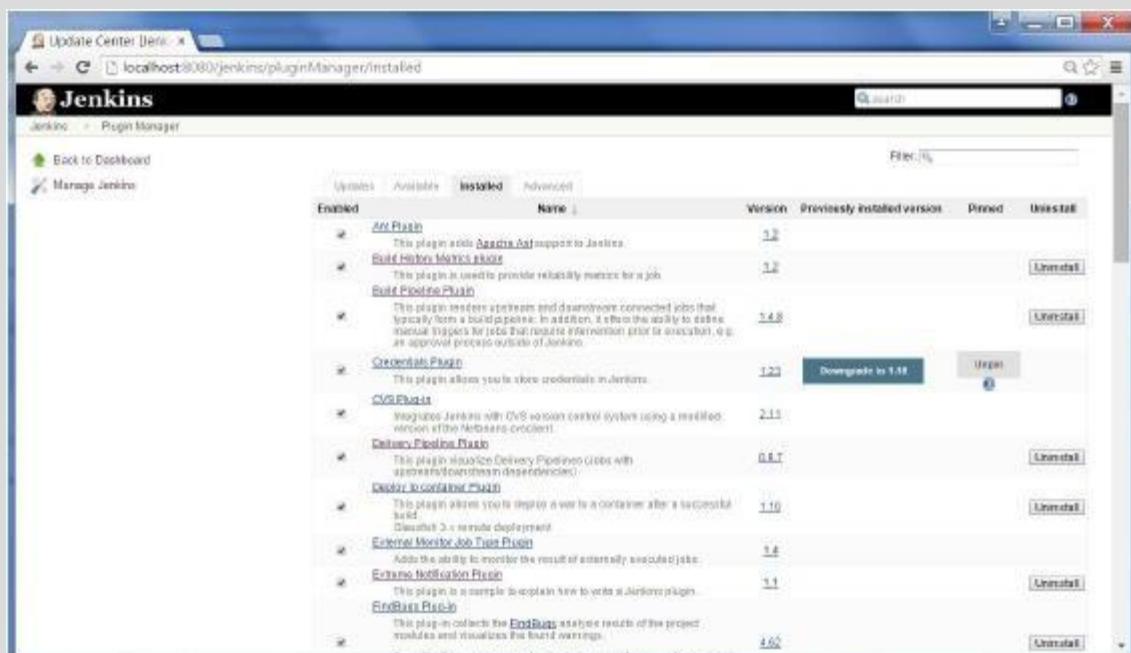
The screenshot shows a Microsoft Internet Explorer window with the title "Plugins - Jenkins - Jenkins". The address bar contains the URL <https://wiki.jenkins-ci.org/display/JENKINS/Plugins>. The page content is titled "Plugins" and includes a sidebar with links to Jenkins documentation like Home, Mailing lists, Source code, Bugtracker, Security Advisories, Events, Donation, Commercial Support, and Wiki Site Map. The main content area lists various plugin categories and their sub-links:

- 1 How to install plugins
  - 1.1 Using the interface
    - 1.1.1 Installing the newest version
    - 1.1.2 Installing a specific version
  - 1.2 By hand
- 2 Getting notified of plugin releases
- 3 Developers
- 4 Plugins by topic
  - 4.1 Source code management
  - 4.2 Build triggers
  - 4.3 Build tools
  - 4.4 Build wrappers
  - 4.5 Build notifiers
  - 4.6 Slave launchers and controllers
  - 4.7 Build reports
  - 4.8 Artifact updaters
  - 4.9 Other post-build actions
  - 4.10 External site/tool integrations
  - 4.11 UI plugins
  - 4.12 List View column plugins
  - 4.13 Page decorators
  - 4.14 Authentication and user management
  - 4.15 Cluster management and distributed build
  - 4.16 CLI extensions
  - 4.17 Mavsp
  - 4.18 Parameters
  - 4.19 iOS development
  - 4.20 .NET development
  - 4.21 Android development
  - 4.22 Derby development

We've already seen many instances for installing plugins, let's look at some other maintenance tasks with regards to plugins

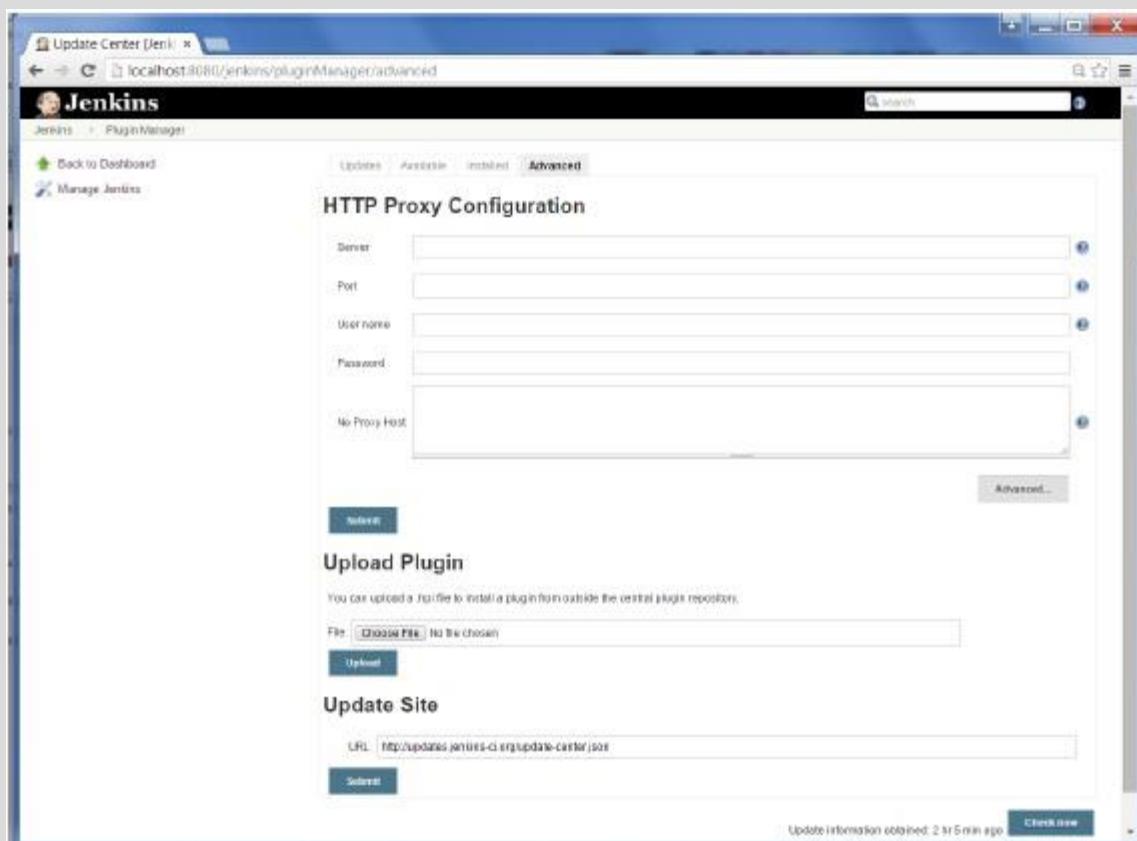
## Uninstalling Plugins

To uninstall a plugin, Go to Manage Jenkins → Manage plugins. Click on the Installed tab. Some of the plugins will have the Uninstall option. You can click these buttons to uninstall the plugins. Ensure to restart your Jenkins instance after the uninstallation.



## Installing another Version of a Plugin

Sometimes it may be required to install an older version of a plugin, in such a case, you can download the plugin from the relevant plugin page on the Jenkins web site. You can then use the **Upload** option to upload the plugin manually.

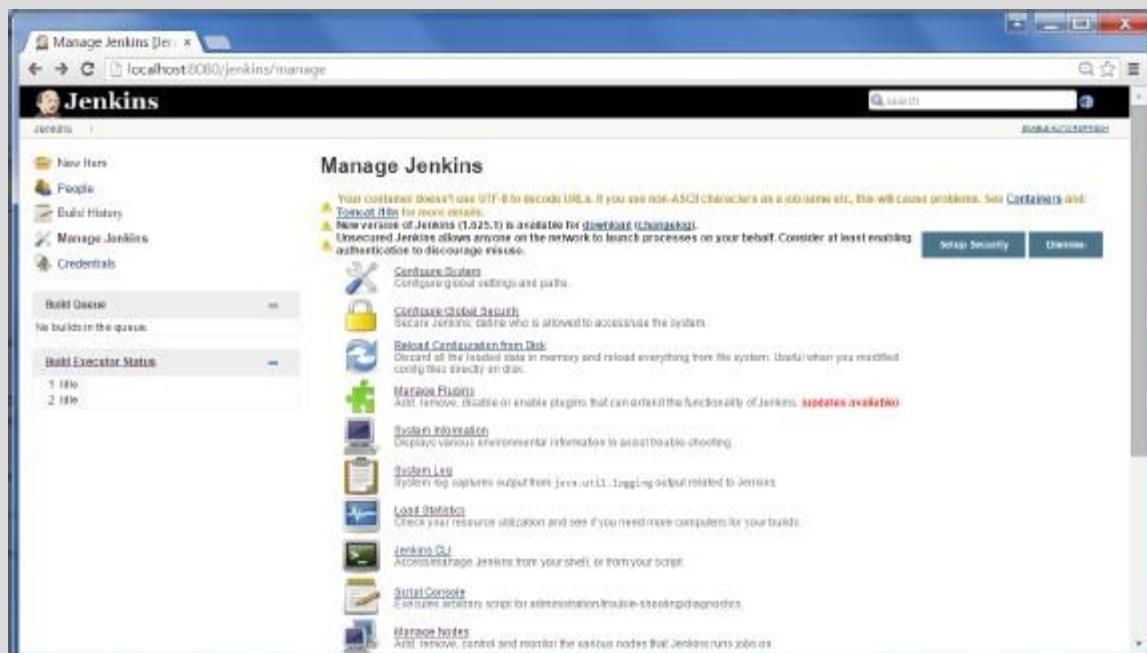


## Jenkins - Security

In Jenkins you have the ability to setup users and their relevant permissions on the Jenkins instance. By default you will not want everyone to be able to define jobs or other administrative tasks in Jenkins. So Jenkins has the ability to have a security configuration in place.

To configure Security in Jenkins, follow the steps given below.

**Step 1** – Click on Manage Jenkins and choose the 'Configure Global Security' option.



**Step 2** – Click on Enable Security option. As an example, let's assume that we want Jenkins to maintain its own database of users, so in the Security Realm, choose the option of 'Jenkins' own user database'.

By default you would want a central administrator to define users in the system, hence ensure the 'Allow users to sign up' option is unselected. You can leave the rest as it is for now and click the Save button.



**Step 3** – You will be prompted to add your first user. As an example, we are setting up an admin users for the system.

The screenshot shows a web browser window titled "Sign up [Jenkins]". The address bar displays "localhost:8080/jenkins/securityRealm/firstUser". The main content area is titled "Sign up". On the left, there is a sidebar with links: "Back to Dashboard", "Manage Jenkins", and "Create User". The right side contains input fields for creating a new user:

Username:	admin
Password:	.....
Confirm password:	.....
Full name:	Administrator
E-mail address:	al@gmail.com

A blue "Sign up" button is located at the bottom of the form.

**Step 4** – It's now time to setup your users in the system. Now when you go to Manage Jenkins, and scroll down, you will see a 'Manage Users' option. Click this option.

The screenshot shows a web browser window titled "Manage Jenkins [jenkins]". The address bar displays "localhost:8080/jenkins/manage". The left sidebar lists several management options: "1 Idle", "2 Idle", "System Information", "System Log", "Load Statistics", "Jenkins CLI", "Script Console", "Manage Nodes", "Manage Credentials", "About Jenkins", "Manage Old Data", "Global Build Status", "Manage Users" (which is highlighted in blue), and "In-process Script Approval". The "Manage Users" option is described as "Creates/deletes/modifies users that can log in to this Jenkins".

**Step 5** – Just like you defined your admin user, start creating other users for the system. As an example, we are just creating another user called 'user'.



**Step 6** – Now it's time to setup your authorizations, basically who has access to what. Go to Manage Jenkins → Configure Global Security.

Now in the Authorization section, click on 'Matrix based security'

**Step 7** – If you don't see the user in the user group list, enter the user name and add it to the list. Then give the appropriate permissions to the user.

Click on the Save button once you have defined the relevant authorizations.

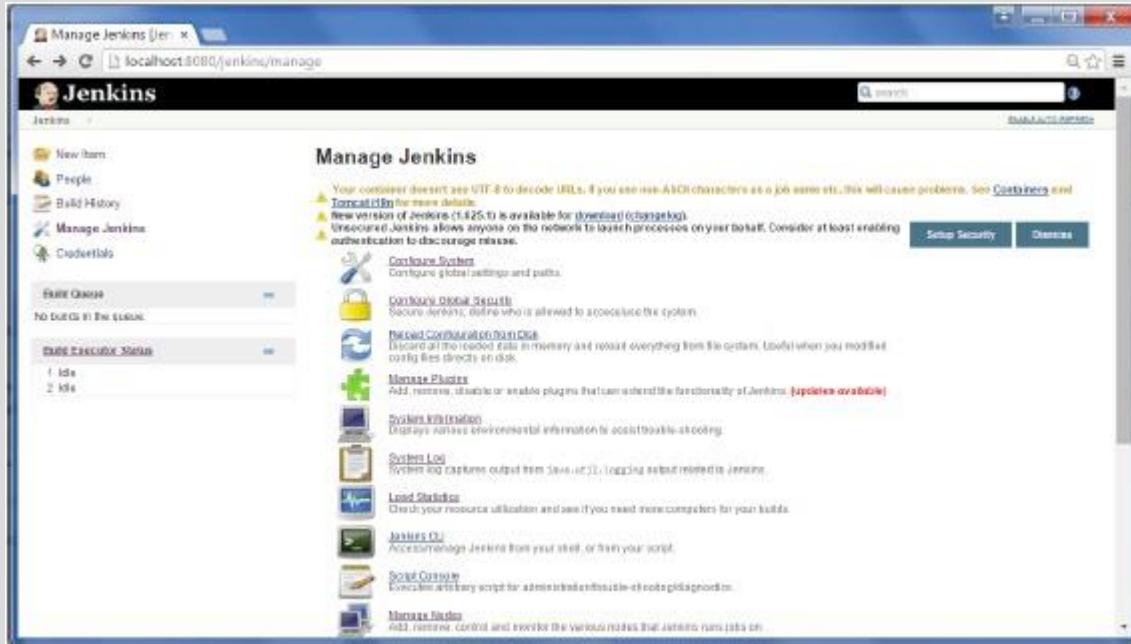
Your Jenkins security is now setup.

**Note** – For Windows AD authentication, one has to add the Active Directory plugin to Jenkins.

# Jenkins - Backup Plugin

Jenkins has a backup plugin which can be used to backup critical configuration settings related to Jenkins. Follow the steps given below to have a backup in place.

**Step 1** – Click on Manage Jenkins and choose the ‘Manage Plugins’ option.



**Step 2** – In the available tab, search for ‘Backup Plugin’. Click On Install without Restart. Once done, restart the Jenkins instance

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The screenshot shows the Jenkins Update Center interface. The URL is `localhost:8080/jenkins/pluginManager/available`. The search bar at the top contains the text 'backup'. The 'Available' tab is selected. A table lists several plugins under the 'Available' tab, with one plugin, 'Backup plugin', highlighted. The 'Backup plugin' row includes a brief description, version (1.6.1), and an 'Install' button.

Install	Name	Version
<a href="#">Backup plugin</a>	Backup plugin allows archiving and restoring your Jenkins (and Hudson) home directory.	1.6.1
<a href="#">Backup and recover job plugin</a>	Backup and restore running jobs.	1.0
<a href="#">Install CloudBees Jenkins Enterprise</a>	This plugin converts an OSS installation to a CloudBees Jenkins Enterprise (CJEE) installation. CJEE has 20+ plugins that address issues in enterprise installations. Plugins include folders, validate merges, templates, role-based access control, backup plugins and others. <a href="#">(complete list)</a> Additionally, you can use the HA component to make Jenkins highly available. <a href="#">Note:</a> As part of the installation process you will require a valid license to use the CloudBees Jenkins Enterprise plugins.	5.0
<a href="#">CloudBees Free Enterprise Plugins</a>	This plugin installs free enterprise plugins from CloudBees. The following plugins are automatically installed: "Folders," easily organize your jobs; "Backup to Cloud," backup your Jenkins into CloudBees cloud; "Wanted Minutes," find out if you are short of slaves and need to add capacity to speed up builds; "CloudBees Status," find out how much of the free CloudBees Jenkins capacity in the cloud is available for your use "Help." You will be asked to register for a free CloudBees account to use these plugins (this plugin was formerly known as the CloudBees Plugin Galore plugin).	1.3
<a href="#">Periodic Backup</a>		1.3
<a href="#">ThinBackup</a>	This plugin simply backs up the global and job specific configurations (not the archive or the workspace).	1.7.4

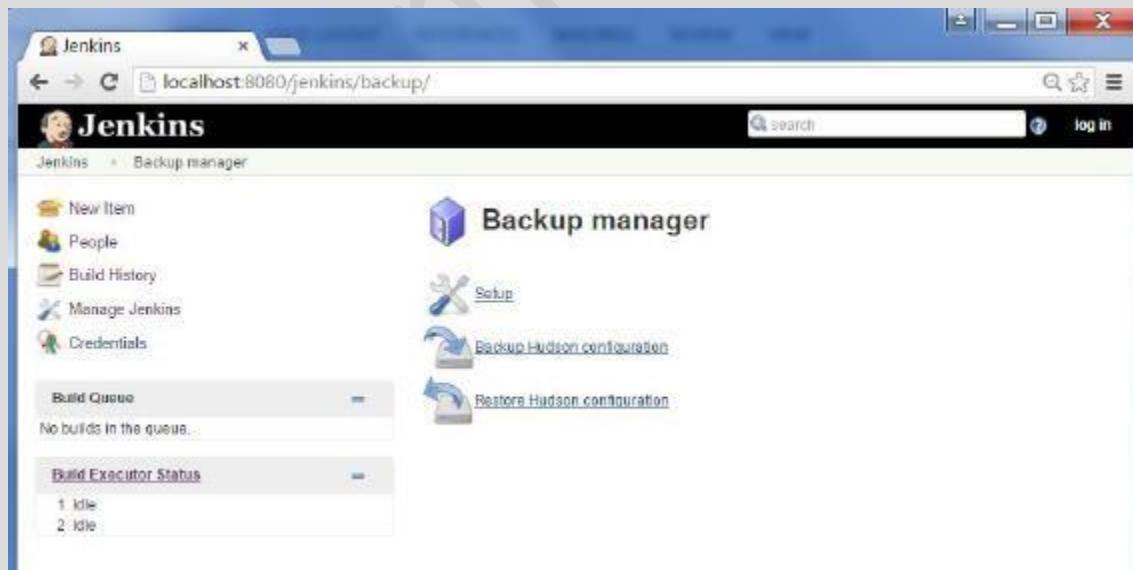
Buttons at the bottom include 'Install without restart', 'Download now and install after restart', and 'Update information of...'.

The screenshot shows the Jenkins Update Center interface. The URL is `localhost:8080/jenkins/updateCenter/`. The title is 'Installing Plugins/Upgrades'. The 'Backup plugin' section shows a success message with a blue circular icon. Below it, there are two green bullet points: 'Go back to the top page' (you can start using the installed plugins right away) and 'Restart Jenkins when installation is complete and no jobs are running'.

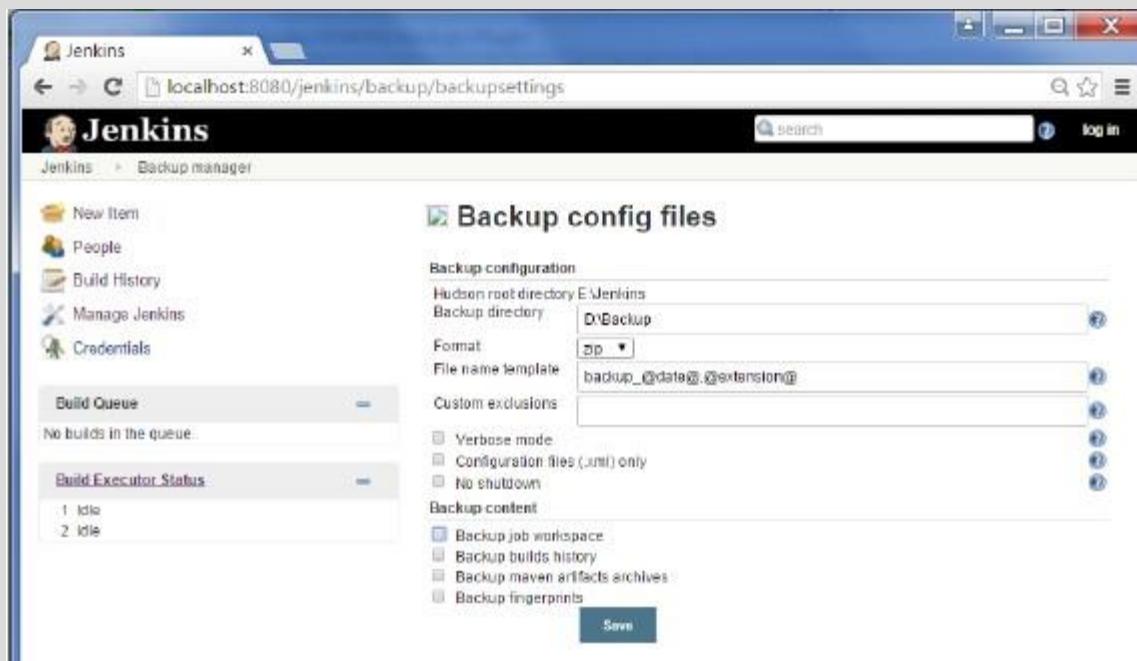
**Step 3** – Now when you go to Manage Jenkins, and scroll down you will see 'Backup Manager' as an option. Click on this option.



#### Step 4 – Click on Setup.



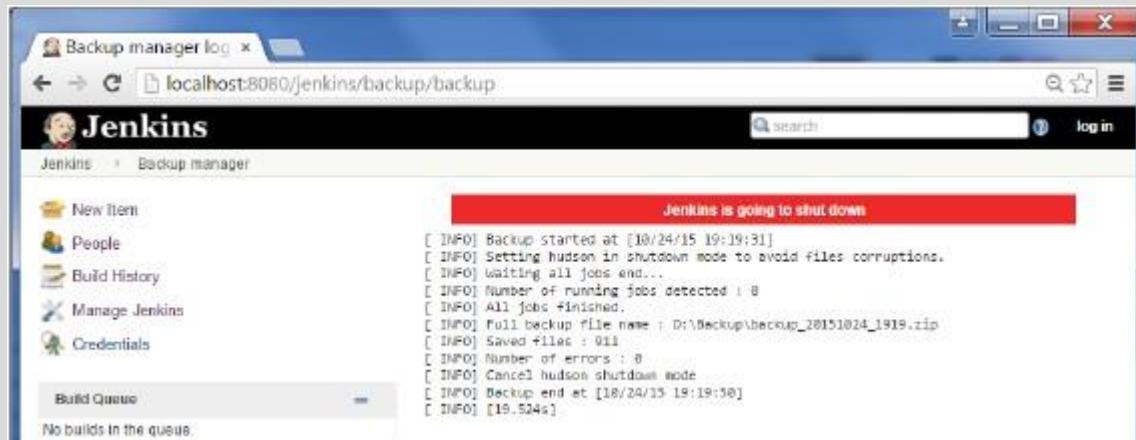
**Step 5** – Here, the main field to define is the directory for your backup. Ensure it's on another drive which is different from the drive where your Jenkins instance is setup. Click on the Save button.



**Step 6** – Click on the ‘Backup Hudson configuration’ from the Backup manager screen to initiate the backup.



The next screen will show the status of the backup



To recover from a backup, go to the Backup Manager screen, click on Restore Hudson configuration.



The list of backups will be shown, click on the appropriate one to click on Launch Restore to begin the restoration of the backup.



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## Resources

<https://www.jenkins.io/> <https://www.jenkins.io/doc/>

<https://www.jenkins.io/doc/book/system-administration/>

<https://www.tutorialandexample.com/jenkins-tutorial/>