Mitesh Soni, Alan Mark Berg

Jenkins 2.x Continuous Integration Cookbook

Third Edition

Over 90 recipes to produce great results using pro-level practices, techniques, and solutions

Packt>

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Mitesh Soni
Alan Mark Berg</span>

BIRMINGHAM - MUMBAI

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Third Edition

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About the Authors

Mitesh Soni is an avid learner with 10 years of experience in the IT industry. He is an SCJP, SCWCD, VCP, IBM Urbancode, and IBM Bluemix certified professional and Certified Scrum Master. He loves DevOps and cloud computing and he also has an interest in programming in Java. He finds design patterns fascinating. He believes a picture is worth a thousand words.

He occasionally contributes to `etutorialsworld.com`. He loves to play with kids, fiddle with his camera, and take photographs at Indroda Park. He is addicted to taking pictures without knowing many technical details. He lives in the capital of Mahatma Gandhi's home state.

Mitesh has also authored the following books with Packt:

- *Jenkins Essentials, Second Edition*
- *DevOps Bootcamp*
- *Implementing DevOps with Microsoft Azure*
- *DevOps for Web Development*
- *Jenkins Essentials*
- *Learning Chef*

"I've missed more than 9,000 shots in my career. I've lost almost 300 games. 26 times, I've been trusted to take the game-winning shot and missed. I've failed over and over and over again in my life. And that is why I succeed."

— Michael Jordan.

Alan Mark Berg, BSc, MSc, PGCE, has been the lead developer at Central Computer Services at the University of Amsterdam since 1998. He is currently working in an Innovation Work Group that accelerates the creation of new and exciting services. In his famously scarce spare time, he writes. Alan has a bachelor's degree, two master's degrees, a teaching qualification, and quality assurance certifications. He has also coauthored two Packt Publishing books about Sakai (`http://sakaiproject.org`), a highly successful open source learning management platform used by millions of students around the world. He has won a couple of awards, including the Sakai Fellowship and Teaching With Sakai Innovation Award (TWSIA).

Alan enjoys working with talent; this forces him to improve his own competencies. This motivation is why Alan enjoys working in energetic, open source communities of interest. At the time of writing, he is on the board of directors of the Apereo Foundation and is the community offi cer for its Learning Analytics Initiative (`https://confluence.sakaiproject.org/display/LAI/Learning+Analytics+Initiative`).

In previous incarnations, Alan was a QA director, a technical writer, an Internet/Linux course writer, a product line development officer, and a teacher. He likes to get his hands dirty with building, gluing systems, exploring data, and turning it into actionable information. He remains agile by ruining various development and acceptance environments and generally rampaging through the green fields of technological opportunity

About the Reviewers

Juan Vicente Herrera Ruiz de Alejo has a degree in computer science. He is the leader of the Madrid DevOps meetup. He is the teacher of DevOps master's program at Alcala de Henares University in Madrid and has been working in IT companies for the past 12 years.

He also works as a volunteer at an NGO dedicated to fighting breast cancer.

He is currently working for Logtrust.com and has worked for companies such as Colt telecom, Everis, and BBVA.

I would like to thank my wife, Emma, and my entire family for all their support.

Javier Delgado is an automation fanatic, continuous tasks (inspection, testing, and delivery) evangelist, and perpetual new-knowledge addict.

He works as a continuous delivery expert at ING Bank NV.

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Customer Feedback

I would like to dedicate this book to all those empty bus stands, benches, cycles, cameras, roads, and trees who have witnessed my anger, emotions, love, and hostility. Without them, people would have come across real me (Pun Intended).
I apologize in advance if I have missed any name. I have tried to recollect every name with whom I have shared good memories. I don't have a good 'memory' and that is blessing as well as curse at times.

On a serious note, I would like to dedicate this book to Shreyansh (Shreyu-My sister (Jigisha)'s baby boy) showed me the power of innocence and smile, Vinay Kher for teaching me how to improve always and keeping my text messages in his mobile, my parents who are always there silently and pray for me, Simba (Priyanka Agashe) for supporting and encouraging me all the time and forced me to believe in myself, Indian Army, and all brave soldiers in uniform for protecting us.
Ashita A, Sourabh Mishra and Gowri, thanks for showing me mirror whenever it was required. I value your presence in my life. It was fun to learn about life from you. I might have forgotten everything you taught me the next day. Sorry for being childish but I can't change it.
I am grateful to Rinka, Bhagyashri, Avanti, Aishwarya P, Vijay, Priya, Harshal, Tejas, Sharvil P, Apoorva S, Nandan, Bhavna, Vishakha S, Pradnya B, Viral I, Chaitali, Sudeep, Amit R, Manisha Y, Vaishnavi, Parinda, Arpita, Jinesh, Vihan, Saurabh S, and Raghav H, who have always helped me, made me smile, and made my life easier in last few years or so.
I want to say thanks... and share my gratitude for everything I've been blessed with. I would like to thank Jigisha-Nitesh, Dada-Dadi, Priyanka-Hemant, Anupama-Mihir, Nalini and family, Kim and Yaashi, Kirti, Bindiya, Jai Jamba, Nitesh, Munal, Ashish B, Mayur Mothliya, Rohini, Aakanksha, Yohan Wadia, Rohan C, Chintan Solanki, Vijay Patel, Nikul, Paresh, Raju, Yogendra, Ajay, Ruchi, Navrang O, Dharmesh R, my village friends, Prakash, Mitul, Kanak, Bapu, Ravi, Vimal, Chitrang, Krimali, Saputara Group, Subhash, Ranjit, Rangusinh, Setan, Jayesh and his family, Ramesh and his family, Vijay Prajapati, Munni Bhabhi and her family and teachers.
Divya, Deepti, and Sneha… this wouldn't have possible without you guys. Thank you for inspiring me and keeping me on my toes.

Table of Contents

Preface

Jenkins is a Java-based automation server that supports the discovery of defects early in the software cycle and the deployment of application packages in an automated manner. Thanks to a rapidly growing number of plugins, Jenkins communicates with many types of systems, building and triggering a wide variety of tests and integrations with various release management services.

CI involves making small changes to software and then building and applying quality assurance processes. Defects not only occur in the code, but also appear in naming conventions, documentation, how the software is designed, build scripts, the process of deploying the software to servers, and so on. CI forces the defects to emerge early, rather than waiting for the software to be fully produced. If defects are caught in the later stages of the software development life cycle, the process will be more expensive. The cost of repair radically increases as soon as the bugs escape into production. Estimates suggest it is 100 to 1,000 times cheaper to capture defects early. Effective use of a CI server, such as Jenkins, could be the difference between enjoying a holiday and working unplanned hours to heroically save the day. And as you can imagine, in my day job as a senior developer with aspirations for quality assurance, I like long boring days, at least for mission-critical production environments.

Continuous Delivery (CD) involves the deployment of applications in web servers or application servers located on-premise or in cloud environments. Jenkins supports integration with many cloud service providers and also supports integration with Platform as a Service offerings too. With shell script and command execution support, many deployment and configuration scenarios can be achieved too.

Jenkins can automate the building of software regularly and trigger tests, pulling in the results and failing based on defined criteria. Failing early via build failure lowers the costs, increases confidence in the software produced, and has the potential to morph subjective processes into an aggressive metrics-based process that the development team feels is unbiased.

Jenkins is not just an automation server, it is also a vibrant and highly active community. Enlightened self-interest dictates participation.

What this book covers

Chapter 1, *Getting Started with Jenkins*, covers how to install Jenkins 2.x on Windows, CentOs, Microsoft Azure, and AWS. There are important recipes that show how to install or upload plugins, how to configure Proxy, how to configure `JENKINS_HOME` and tools in Manage Jenkins. This chapter will also cover how to create freestyle jobs for Ant and Maven projects

Chapter 2, *Management and Monitoring of Jenkins*, helps us understand master/agent architecture, how to manage Jenkins Build jobs using Eclipse, backing up and restoring Jenkins, command-line options in Jenkins using Jenkins CLI, managing disk usage, shutting down Jenkins safely, monitoring Jenkins, and configuring email notifications.

Chapter 3, *Managing Security*, covers how to improve security with Jenkins configuration, configure Matrix-based Security and handle a Project-based Matrix Authorization Strategy. It will also cover Jenkins and its integration with OpenLDAP and Active Directory. Later in the chapter, we will cover Jenkins and OWASP Zed Attack Proxy Integration, finding 500 errors and XSS attacks in Jenkins through fuzzing, exploring the OWASP Dependency-Check plugin, and working with the Audit Trail plugin.

Chapter 4, *Improve Code Quality*, explores the use of source code metrics. To save money and improve quality, you need to remove defects in the software life cycle as early as possible. This chapter covers details on how to integrate Jenkins with SonarQube, how to update center in SonarQube, quality gates, quality profiles and rules, verifying HTML, CSS, and JavaScript validity using SonarQube, verifying Java code using SonarQube, and configuring SonarQube as a Windows service.

Chapter 5, *Building Applications in Jenkins*, details approaches to configuring Ant, Maven, and Android projects for execution, how to configure environment variables, running Groovy scripts through Maven, running Ant through Groovy in Maven, and remotely triggering jobs through the Jenkins API.

Chapter 6, *Continuous Delivery*, discusses Continuous Delivery, how to archive artifacts, copying artifact from other build jobs, integrating Jenkins with Artifactory, deploying a WAR file from Jenkins to Tomcat, AWS Beanstalk, Azure App Services, and how to promote builds.

Chapter 7, *Continuous Testing*, details Continuous Testing, how to publish unit testing reports from Jenkins, creating Selenium test cases using Eclipse, integrating Jenkins and Selenium for functional testing, Jenkins and Cucumber Test reports, creating load tests in Apache JMeter, executing load tests from Jenkins, reporting JMeter performance metrics, and testing with FitNesse.

Chapter 8, *Orchestration*, explores orchestration of a pipeline, understanding upstream and downstream jobs, configuring upstream and downstream jobs, configuring a build pipeline, creating a pipeline job, using a sample pipeline for execution, configuring a pipeline job for end-to-end automation, and getting started with the Blue Ocean dashboard.

Chapter 9 , *Jenkins UI Customization*, details skinning Jenkins with the simple themes plugin, skinning and provisioning Jenkins using a WAR overlay, generating a home page, creating HTML reports, efficient use of views, saving screen space with the Dashboard View plugin, making noise with HTML5 browsers, and an extreme view for reception areas.

What you need for this book

This book is for beginners. It assumes that you are familiar with at least the Java programming language. Knowledge of core Java and JEE is essential in order to use this book to gain better insight. A strong understanding of program logic will provide you with the background to be productive with Jenkins while using plugins to write commands for the shell.

As the application development life cycle covers lot of tools in general, it is essential to have some knowledge of repositories such as SVN and Git, IDE tools such as Eclipse, and build tools such as Ant and Maven.

Knowledge of code analysis tools will make the job easier in terms of configuration and integration; however, it is not vital to perform the exercises given in this book. Most of the configuration steps are clearly mentioned. SonarQuve 6.3 version is used for code analysis.

You will be walked through the steps required to install Jenkins on a Windows and Linux-based host. In order to be immediately successful, you will need administrative access to a host that runs a modern version of Windows and Linux; Windows 10 is what will be used for demonstration purposes. If you are a more experienced reader, then a recent release of almost any distribution will work just as well (but you may be required to do a little bit of extra work that is not outlined in the book).

You can use a free trial of Microsoft Azure to work on some recipes.

Additionally, you will need access to the internet to download plugins that you do not already have, as well as an installation of Jenkins. Any normal hardware configuration is good enough, such as 4 GB RAM and 500 GB hard disk.

Who this book is for

Jenkins Continous Integration Cookbook is for beginners and advanced users both. This book targets developers and system administrators who are involved in the application development life cycle and are looking to automate it. Developers, technical leads, testers, and operational professionals are the target readers to jumpstart Jenkins. Readers should be aware of the issues faced by development and operations team as they are stakeholders in the application life cycle management process. The reasons to jumpstart Jenkins are to understand the importance of the contributions Continuous Integration (CI), Continuous Testing, and Continuous Delivery (CD) make to effective application life cycle management.

Conventions

In this book, you will find a number of styles of text that distinguish between different kinds of information. Here are some examples of these styles, and an explanation of their meaning.

Code words in text, database table names, folder names, filenames, file extensions, pathnames, dummy URLs, user input, and Twitter handles are shown as follows: "We can include other contexts through the use of the `include` directive."

A block of code is set as follows:

```
 @charset "utf-8";
#test {
background-image: url(/userContent/camera.png);
}
#main-table{
background-image: url(/userContent/camera.png)
!important;
```

When we wish to draw your attention to a particular part of a code block, the relevant lines or items are set in bold:

```
 <project xmlns="http://maven.apache.org/POM/4.0.0"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://maven.apache.org/POM/4.0.0
http://maven.apache.org/maven-v4_0_0.xsd">
<modelVersion>4.0.0</modelVersion>
<groupId>nl.uva.berg</groupId>
```

Any command-line input or output is written as follows:

```
 ----Project and session
Project: class org.apache.Maven.model.Model
Session: class org.apache.Maven.execution.MavenSession
longname: SuperGood
```

New terms and **important words** are shown in bold. Words that you see on the screen, in menus or dialog boxes for example, appear in the text like this: "Clicking the Next button moves you to the next screen."

Warnings or important notes appear in a box like this.

Tips and tricks appear like this.

Reader feedback

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6. Choose from the drop-down menu where you purchased this book from.
7. Click on Code Download.

Once the file is downloaded, please make sure that you unzip or extract the folder using the latest version of:

- WinRAR / 7-Zip for Windows
- Zipeg / iZip / UnRarX for Mac
- 7-Zip / PeaZip for Linux

The code bundle for the book is also hosted on GitHub at https://github.com/PacktPublishing/Jenkins-Continuous-Integration-Cookbook-Third-Edition. We also have other code bundles from our rich catalog of books and videos available at https://github.com/PacktPublishing/. Check them out!

Downloading the color images of this book

We also provide you with a PDF file that has color images of the screenshots/diagrams used in this book. The color images will help you better understand the changes in the output. You can download this file from https://www.packtpub.com/sites/default/files/downloads/JenkinsContinuousIntegrationCook

Errata

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If you have a problem with any aspect of this book, you can contact us at `questions@packtpub.com`, and we will do our best to address the problem.

Getting Started with Jenkins

In this chapter, we will discuss how to install and configure Jenkins, and what new features or UI improvements are available from Jenkins 2 and later. We will cover the following recipes:

- Installing Jenkins 2 on Windows
- Installing Jenkins 2 on CentOS
- Installing Jenkins 2 on Azure
- Installing Jenkins as a service in Windows
- Installing plugins in Jenkins
- Uploading plugins in Jenkins
- Configuring proxy in Jenkins
- Configuring global settings in Jenkins
- Configuring JENKINS_HOME
- Understanding JENKINS_HOME directory
- Using different ports for Jenkins
- Configuring JAVA_HOME in Jenkins
- Configuring Git in Jenkins
- Configuring ANT_HOME in Jenkins
- Configuring MAVEN_HOME in Jenkins
- Configuring GRADLE_HOME in Jenkins
- Creating a Freestyle job for an Ant project
- Creating a Maven job for a Maven project

Introduction

Jenkins is an open source automation server that is widely used by many organizations to implement popular DevOps practices, such as Continuous Integration and Continuous Delivery. Jenkins is feature-rich and is vastly extendable through plugins. Further, Jenkins and its plugins improve rapidly. There is a new minor version of Jenkins released weekly, mostly with improvements, occasionally with bugs. The community manages core stability via the use of a long-term support release of Jenkins, which is mature and less feature-rich when compared to the latest version. For a stable system in a complex environment, you need to monitor, clean up storage, back up, keep control of your Jenkins scripts, and consistently clean and polish. This chapter has recipes for the most common tasks. Proper maintenance lowers the risk of failures, such as:

- **New plugins causing exceptions**: There are a lot of good plugins being written with rapid version changes. In this situation, it is easy for you to accidentally add new versions of plugins with new defects. There have been a number of occasions during upgrades when suddenly the plugin does not work. To combat the risk of plugin exceptions, consider using a test Jenkins instance before releasing to a critical system.
- **Storage overflowing with artifacts**: If you keep a build history that includes artifacts such as WAR files, large sets of JAR files, or other types of binaries and source code, then your storage space will be consumed at a surprising rate. Storage costs have decreased tremendously, but storage usage equates to longer backup times and more communication from slave to master. To minimize the risk of disk overflowing, you will need to consider your backup and restore policy and the associated build retention policy expressed in the advanced options of jobs.
- **Script spaghetti**: As jobs are written by various development teams, the location and style of the included scripts vary. This makes it difficult for you to keep track. Consider using well-defined locations for your scripts and a scripts repository managed through a plugin.
- **Resource depletion**: As memory is consumed, or the number of intense jobs increases, then Jenkins slows down. Proper monitoring and quick reactions reduce impact.
- **A general lack of consistency between jobs due to organic growth**: Jenkins is easy to install and use. The ability to seamlessly turn on plugins is addictive. The pace of adoption of Jenkins within an organization can be breathtaking. Without a consistent policy, your teams will introduce lots of plugins and also lots of ways of performing the same work. Conventions improve consistency and readability of jobs and thus decrease maintenance.

The Jenkins community is working hard on your behalf. If you see an issue, please report it back.

Signing up to the community:

To add community bug reports or modify wiki pages, you will need to create an account at: https://wiki.jenkins-ci.org/display/JENKINS/Issue+Tracking.

Installing Jenkins 2 on Windows

Let's install Jenkins 2 on a Windows operating system. It can be a physical machine, virtual machine available on Cloud.

Getting ready

To carry out this recipe, you need to download Jenkins.

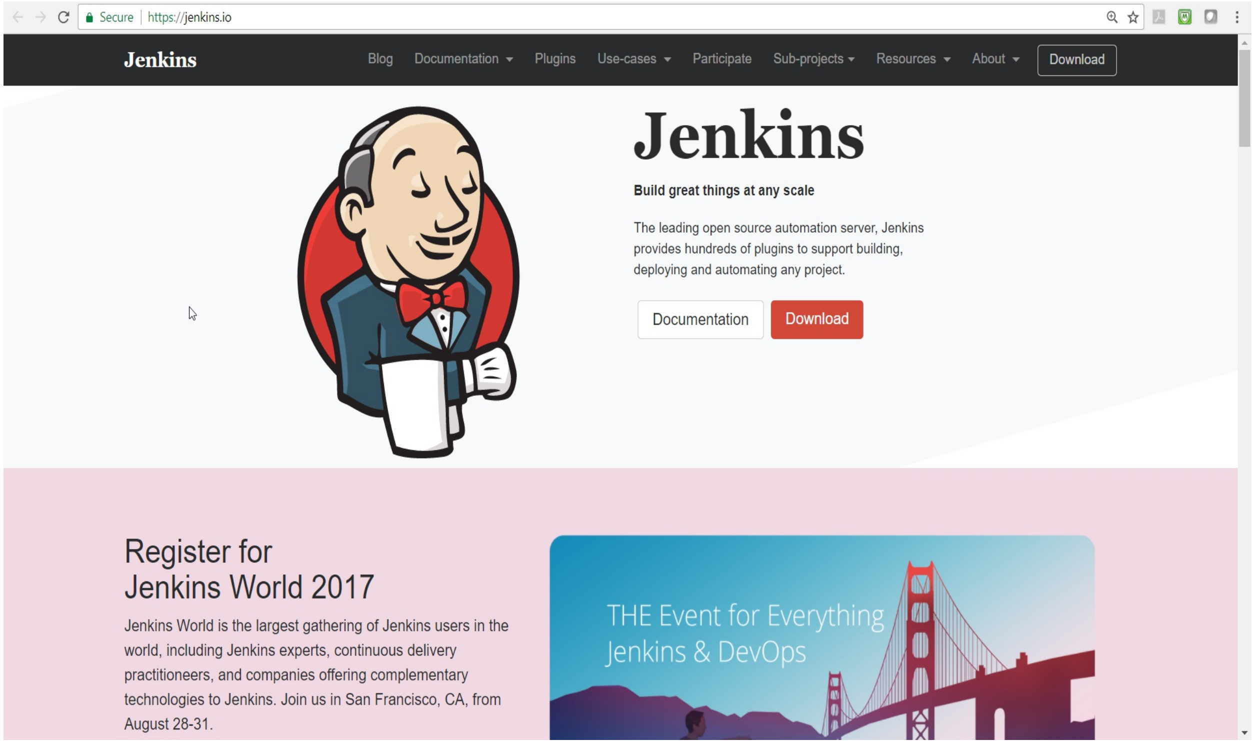
For a business unit, it is advisable to have the following requirements:

- Java 8
- 4 GB + RAM
- 500 GB+ free disk space

How to do it...

Let's install Jenkins now by following these steps:

1. Go to https://jenkins.io.
2. Click on Download, as shown in the following screenshot:



Jenkins

Build great things at any scale

The leading open source automation server, Jenkins provides hundreds of plugins to support building, deploying and automating any project.

Register for Jenkins World 2017

Jenkins World is the largest gathering of Jenkins users in the world, including Jenkins experts, continuous delivery practitioneers, and companies offering complementary technologies to Jenkins. Join us in San Francisco, CA, from August 28-31.

2. Download the latest Windows package from Jenkins, available at: http://mirrors.jenkins.io/windows/latest.
3. Click on the package and follow the step-by-step instructions to install it.

Installing Jenkins 2 on CentOS

Let's look at the steps required to install Jenkins on CentOS.

Getting ready

For a business unit, it is advisable to have the following requirements:

- Java 8
- 4 GB+ RAM
- 500 GB+ free disk space

Jenkins requires Java. To install Java, execute:

```
sudo yum install java
```

How to do it...

1. Jenkins' stable and recent versions are available in a YUM repository.
2. Add the Jenkins repository to the `yum repos`:

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

3. For the stable version, execute:

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

4. Import the following `key`:

```
sudo rpm --import https://jenkins-ci.org/redhat/jenkins-ci.org.key
```

5. Install Jenkins by executing the following command:

```
sudo yum install jenkins
```

There's more...

- To start the Jenkins service, execute:

  ```
  sudo service jenkins start
  ```

- To stop the Jenkins service, execute:

  ```
  sudo service jenkins stop
  ```

- To restart the Jenkins service, execute:

  ```
  sudo service jenkins restart
  ```

Installing Jenkins 2 on Azure

Microsoft Azure is one of the most popular cloud service providers in recent times. Let's try to install Jenkins on Azure.

Getting ready

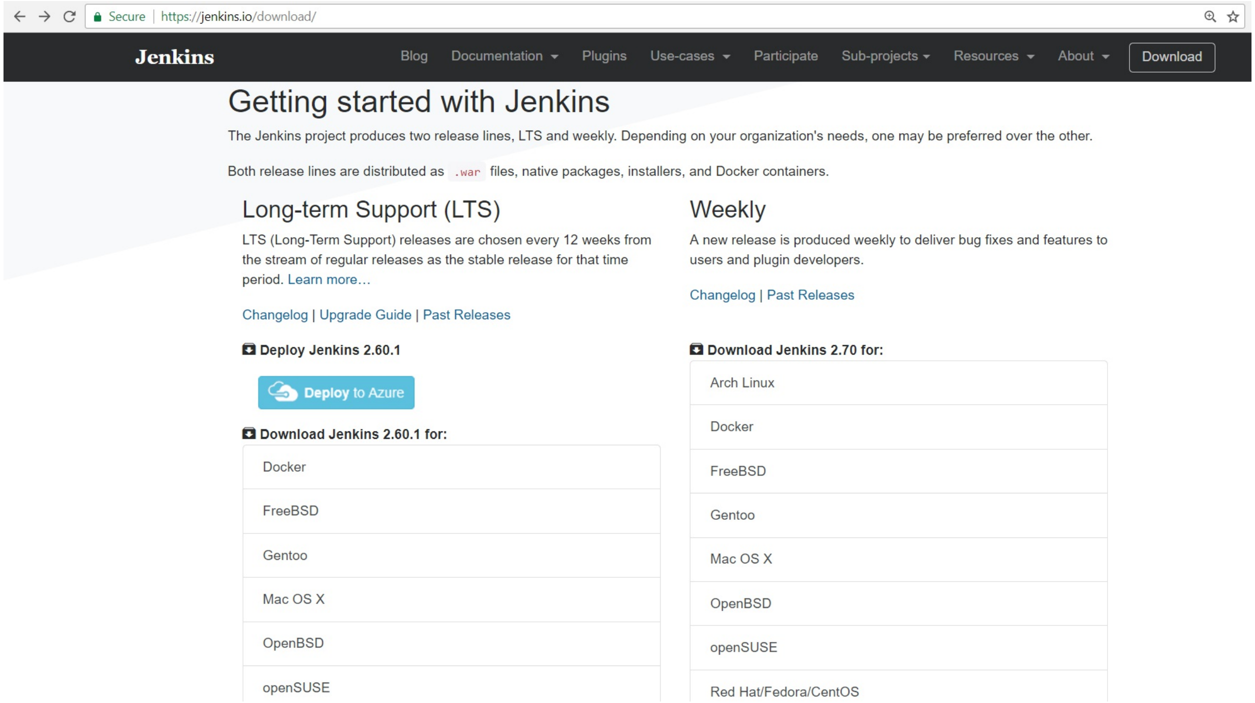
You need to have a Microsoft Azure subscription for Jenkins installation on Azure. A free trial for one month is also available:

1. Go to https://jenkins.io.</span>
2. Click on Download.

How to do it...

Let's see how to install Jenkins on Azure:

1. Click on the Deploy to Azure link on the Jenkins download page:



Getting started with Jenkins

The Jenkins project produces two release lines, LTS and weekly. Depending on your organization's needs, one may be preferred over the other.

Both release lines are distributed as `.war` files, native packages, installers, and Docker containers.

Long-term Support (LTS)

LTS (Long-Term Support) releases are chosen every 12 weeks from the stream of regular releases as the stable release for that time period. Learn more…

Changelog | Upgrade Guide | Past Releases

Deploy Jenkins 2.60.1

Download Jenkins 2.60.1 for:

- Docker
- FreeBSD
- Gentoo
- Mac OS X
- OpenBSD
- openSUSE

Weekly

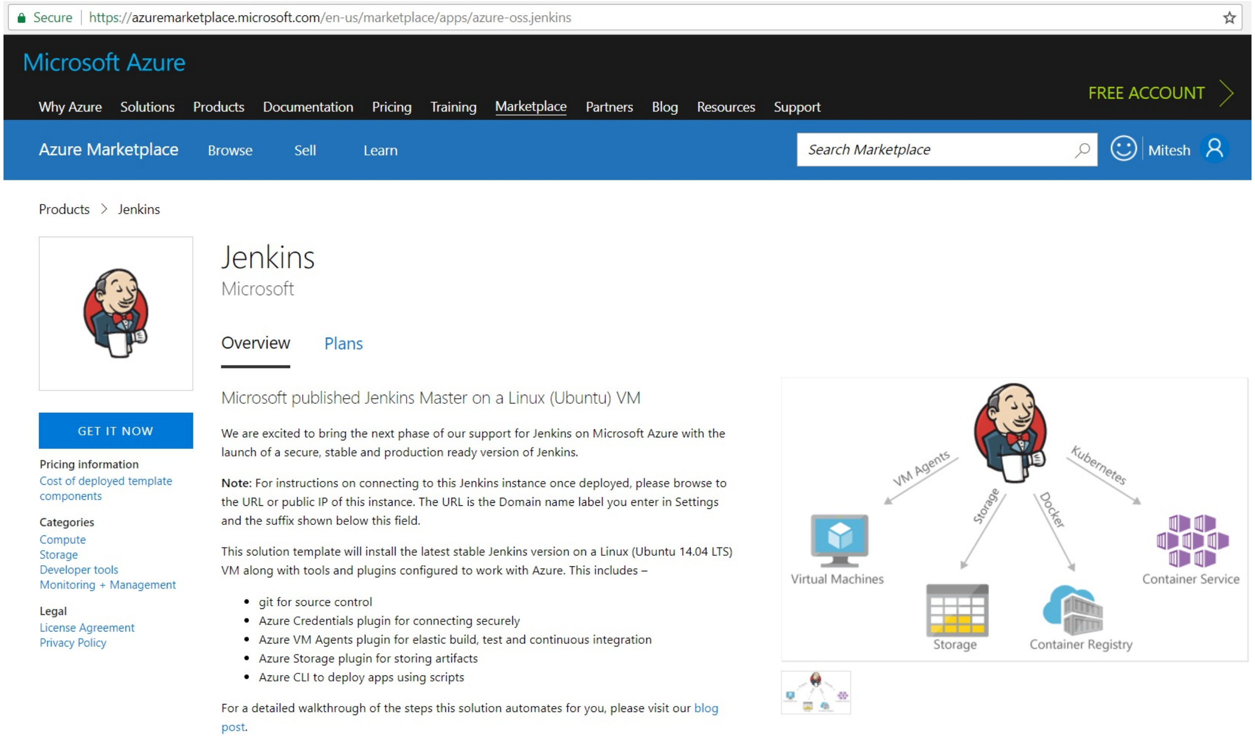
A new release is produced weekly to deliver bug fixes and features to users and plugin developers.

Changelog | Past Releases

Download Jenkins 2.70 for:

- Arch Linux
- Docker
- FreeBSD
- Gentoo
- Mac OS X
- OpenBSD
- openSUSE
- Red Hat/Fedora/CentOS

2. It will redirect you to Azure Marketplace.
3. Verify the Pricing plans and categories involved in it on the same page.
4. Click on GET IT NOW. These steps are demonstrated in the following screenshot:


Secure | https://azuremarketplace.microsoft.com/en-us/marketplace/apps/azure-oss.jenkins
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Plans
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Microsoft published Jenkins Master on a Linux (Ubuntu) VM

We are excited to bring the next phase of our support for Jenkins on Microsoft Azure with the launch of a secure, stable and production ready version of Jenkins.

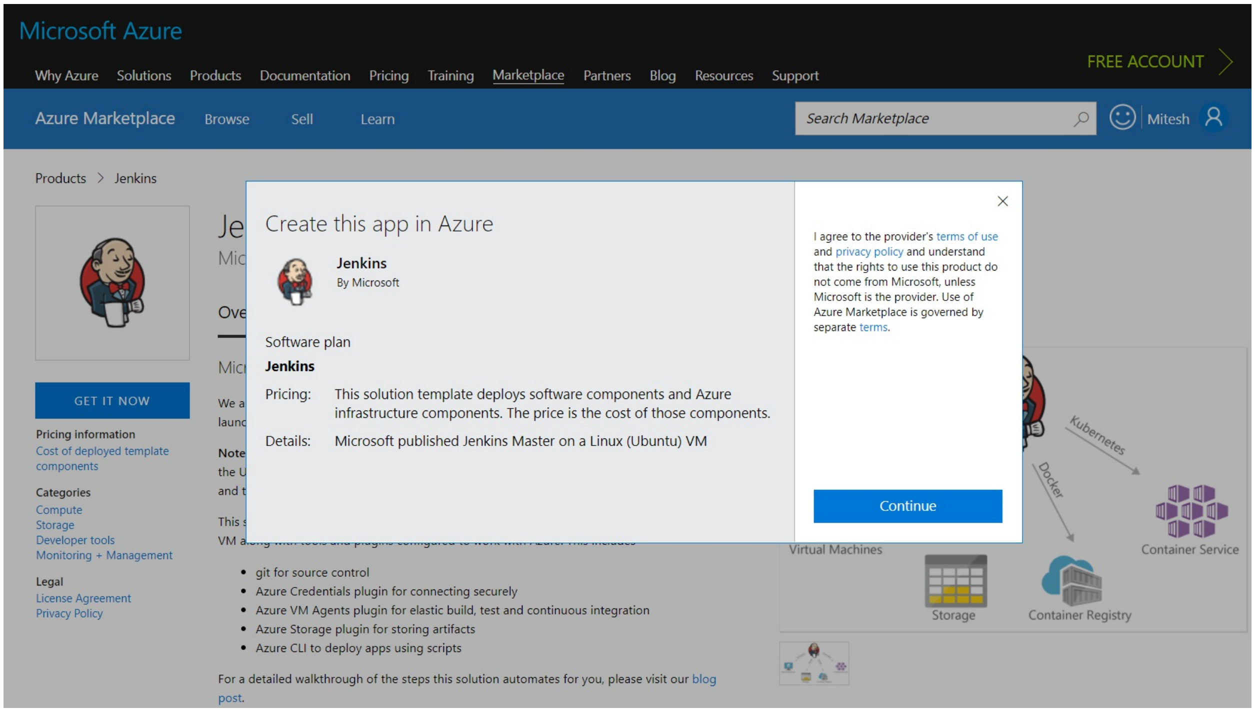
Note: For instructions on connecting to this Jenkins instance once deployed, please browse to the URL or public IP of this instance. The URL is the Domain name label you enter in Settings and the suffix shown below this field.

This solution template will install the latest stable Jenkins version on a Linux (Ubuntu 14.04 LTS) VM along with tools and plugins configured to work with Azure. This includes –

- git for source control
- Azure Credentials plugin for connecting securely
- Azure VM Agents plugin for elastic build, test and continuous integration
- Azure Storage plugin for storing artifacts
- Azure CLI to deploy apps using scripts

For a detailed walkthrough of the steps this solution automates for you, please visit our blog post.

5. In the Create this app in Azure tab, click on Continue:



Create this app in Azure

Jenkins
By Microsoft

Software plan
Jenkins

Pricing: This solution template deploys software components and Azure infrastructure components. The price is the cost of those components.

Details: Microsoft published Jenkins Master on a Linux (Ubuntu) VM

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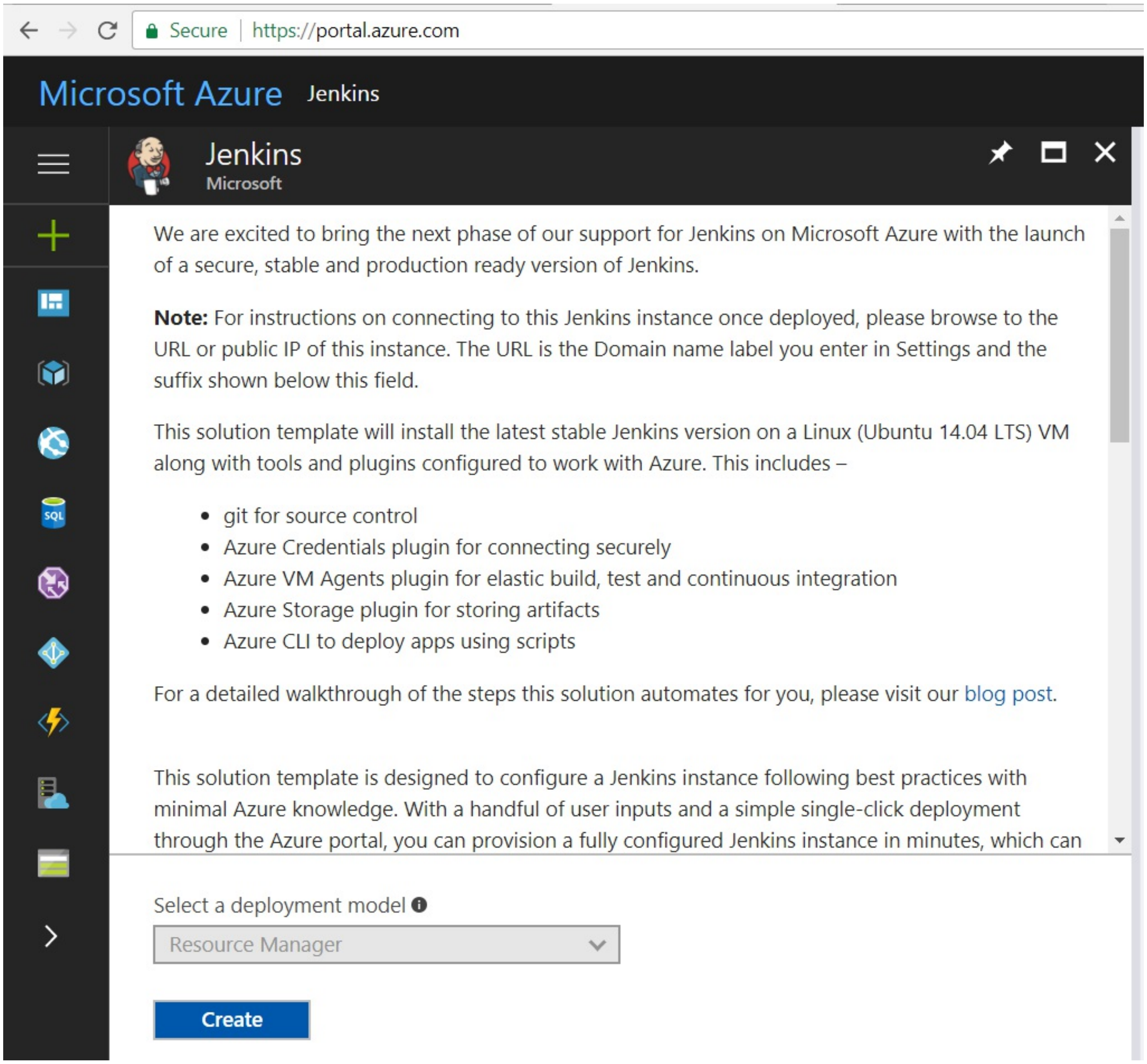
Continue

- git for source control
- Azure Credentials plugin for connecting securely
- Azure VM Agents plugin for elastic build, test and continuous integration
- Azure Storage plugin for storing artifacts
- Azure CLI to deploy apps using scripts

For a detailed walkthrough of the steps this solution automates for you, please visit our blog post.

6. If you already have the Azure subscription, then login with the username and password.
7. Deployment model is already selected.
8. Click on Create:



We are excited to bring the next phase of our support for Jenkins on Microsoft Azure with the launch of a secure, stable and production ready version of Jenkins.

Note: For instructions on connecting to this Jenkins instance once deployed, please browse to the URL or public IP of this instance. The URL is the Domain name label you enter in Settings and the suffix shown below this field.

This solution template will install the latest stable Jenkins version on a Linux (Ubuntu 14.04 LTS) VM along with tools and plugins configured to work with Azure. This includes –

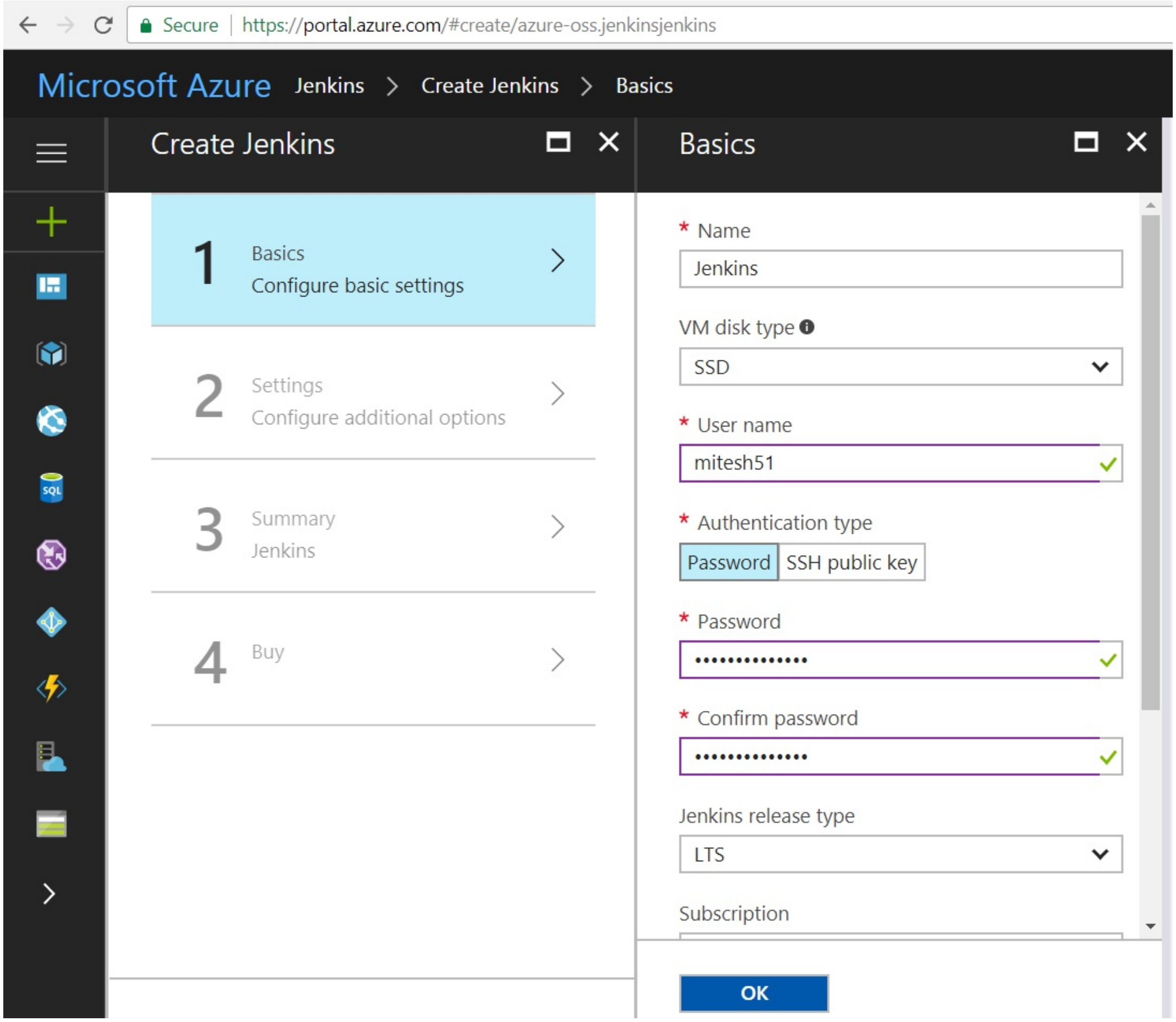
- git for source control
- Azure Credentials plugin for connecting securely
- Azure VM Agents plugin for elastic build, test and continuous integration
- Azure Storage plugin for storing artifacts
- Azure CLI to deploy apps using scripts

For a detailed walkthrough of the steps this solution automates for you, please visit our blog post.

This solution template is designed to configure a Jenkins instance following best practices with minimal Azure knowledge. With a handful of user inputs and a simple single-click deployment through the Azure portal, you can provision a fully configured Jenkins instance in minutes, which can

Select a deployment model: Resource Manager

9. Provide Password, Jenkins release type, and Subscription details, as demonstrated in this next screenshot:



Secure | https://portal.azure.com/#create/azure-oss.jenkinsjenkins
Microsoft Azure
Jenkins > Create Jenkins > Basics
Create Jenkins
1 Basics
Configure basic settings
2 Settings
Configure additional options
3 Summary
Jenkins
4 Buy
Basics
OK

* Name: Jenkins

VM disk type: SSD

* User name: mitesh51

* Authentication type: Password | SSH public key

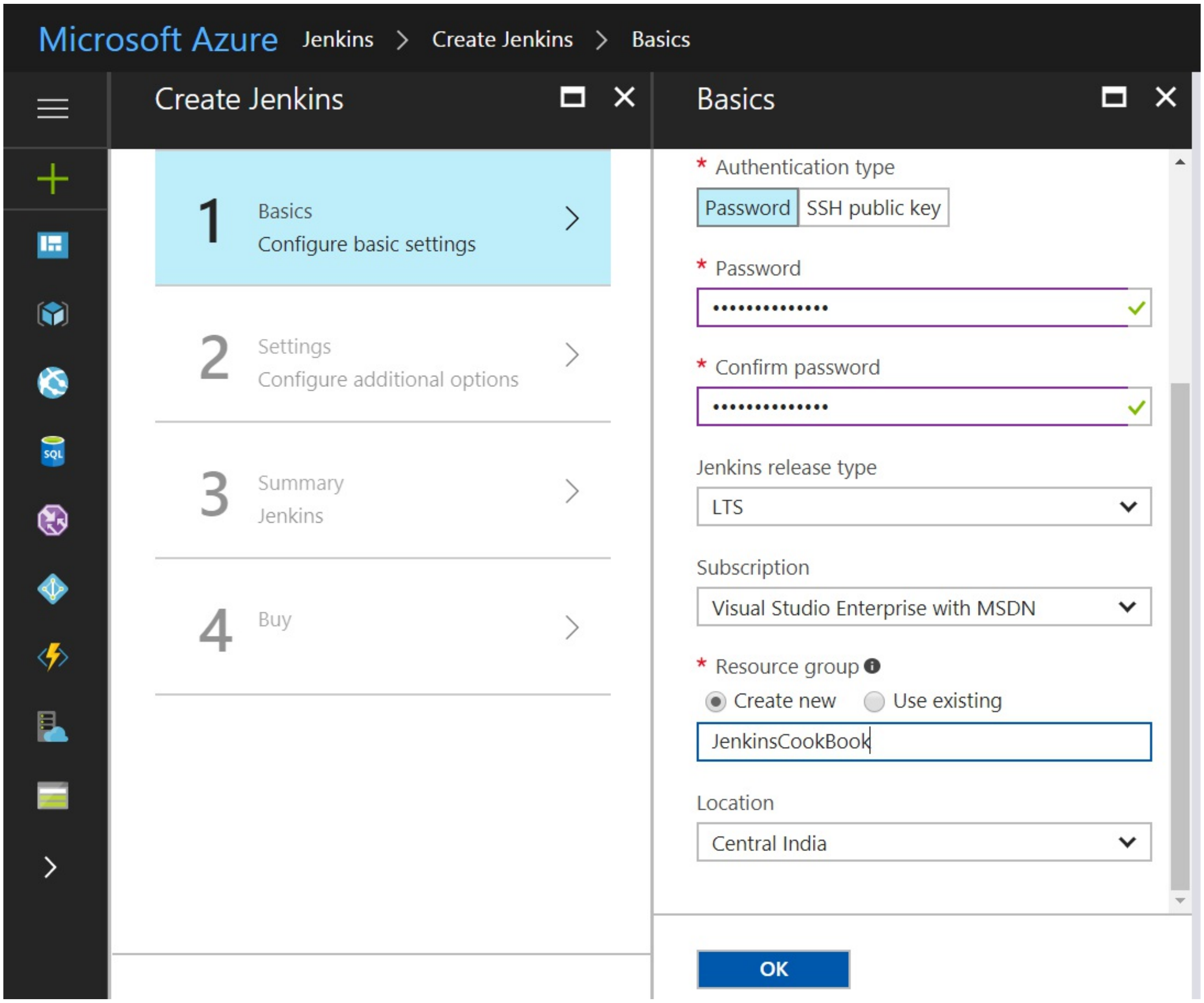
* Password: ••••••••••••••

* Confirm password: ••••••••••••••

Jenkins release type: LTS

Subscription

10. Select Create new and provide Resource group name.
11. Select the Location as per your preference.
12. Click on OK:



Microsoft Azure Jenkins > Create Jenkins > Basics
Create Jenkins
1 Basics Configure basic settings
2 Settings Configure additional options
3 Summary Jenkins
4 Buy
Basics
OK

* Authentication type: Password | SSH public key

* Password: ••••••••••••••• ✓

* Confirm password: ••••••••••••••• ✓

Jenkins release type: LTS

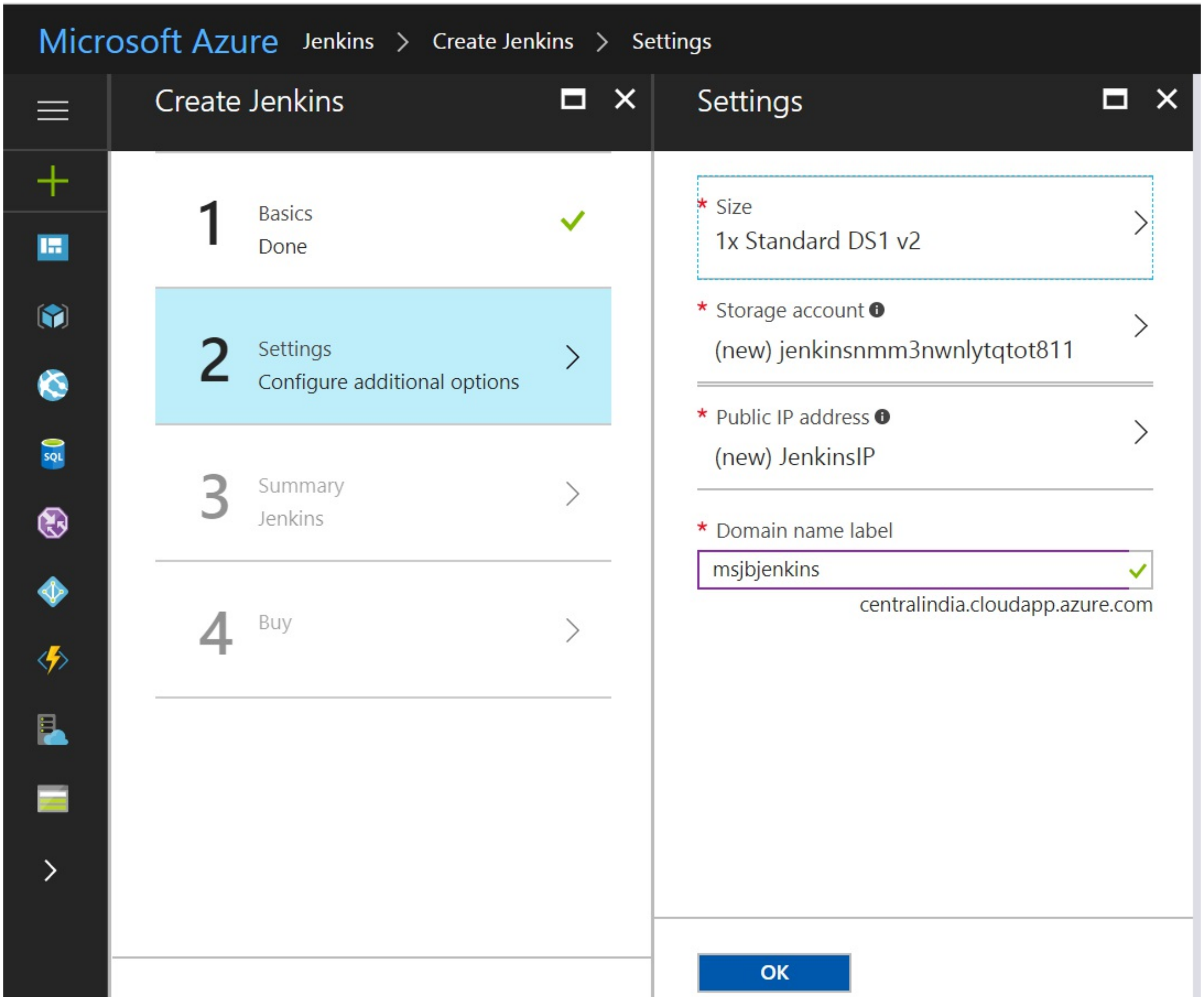
Subscription: Visual Studio Enterprise with MSDN

* Resource group: ● Create new ○ Use existing

JenkinsCookBook

Location: Central India

13. Select the Size based on the requirement.
14. Provide a unique Domain name label.
15. Click OK:



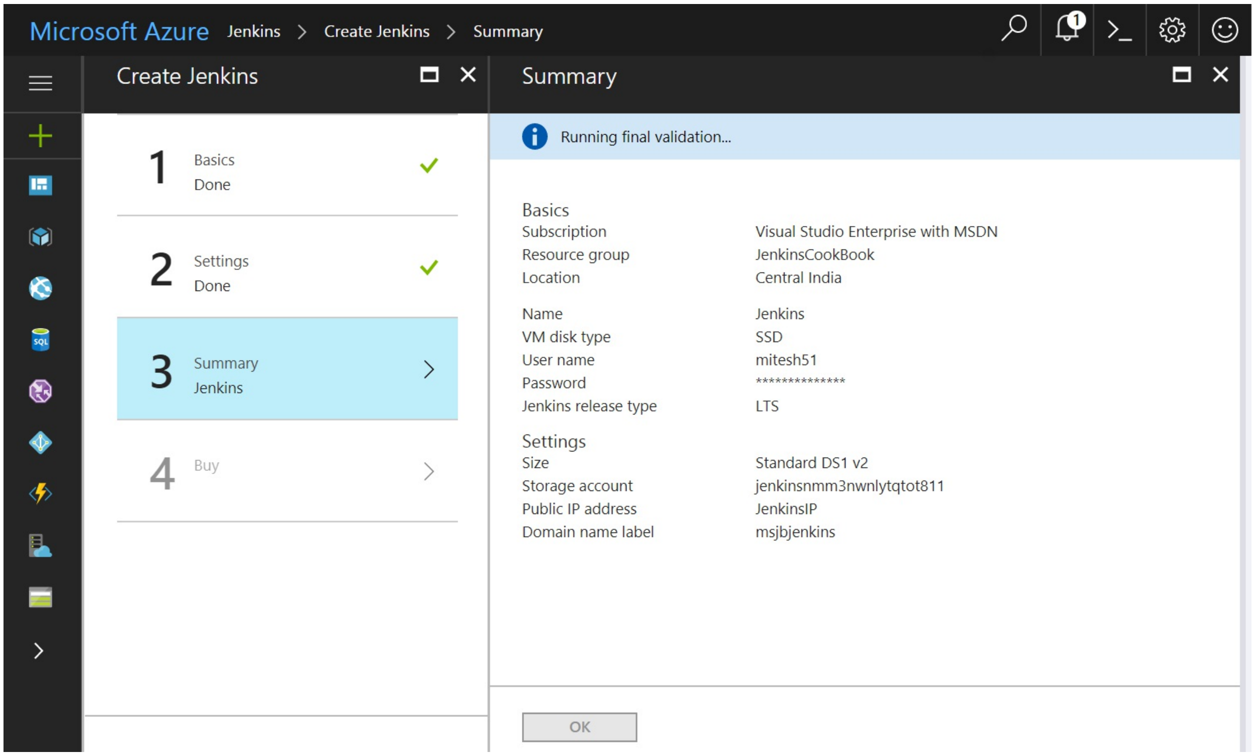
* Size
1x Standard DS1 v2

* Storage account
(new) jenkinsnmm3nwnlytqtot811

* Public IP address
(new) JenkinsIP

* Domain name label
msjbjenkins ✓
centralindia.cloudapp.azure.com

16. Review the selection.
17. Automated validation will be executed based on your selection.
18. Click on OK:



Running final validation...

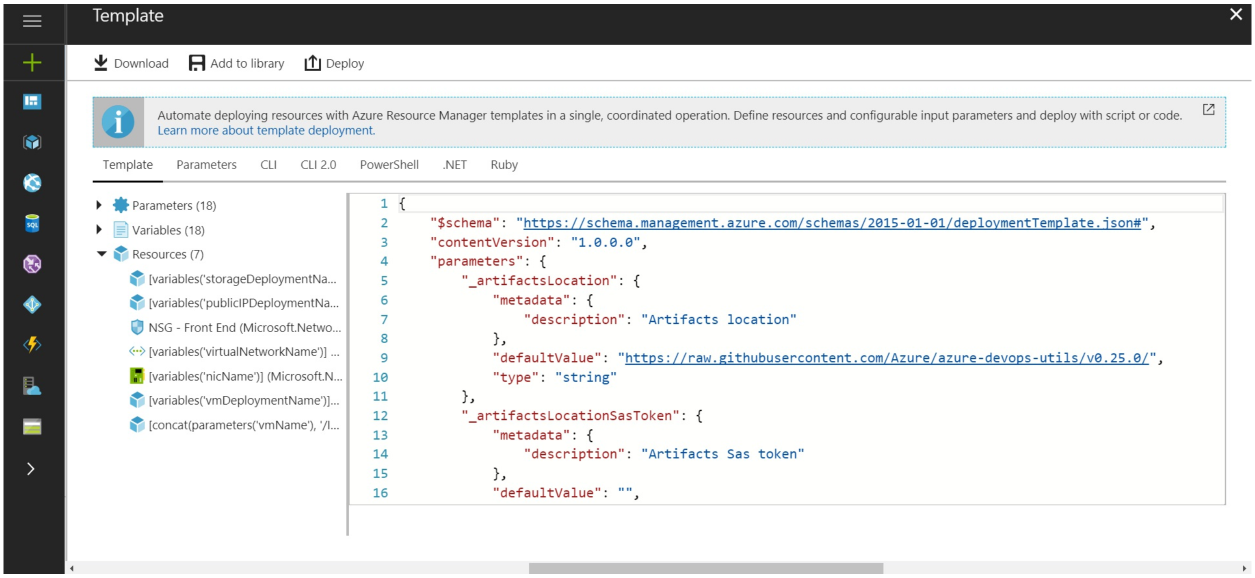
Basics

Subscription	Visual Studio Enterprise with MSDN
Resource group	JenkinsCookBook
Location	Central India
Name	Jenkins
VM disk type	SSD
User name	mitesh51
Password	**************
Jenkins release type	LTS

Settings

Size	Standard DS1 v2
Storage account	jenkinsnmm3nwnlytqtot811
Public IP address	JenkinsIP
Domain name label	msjbjenkins

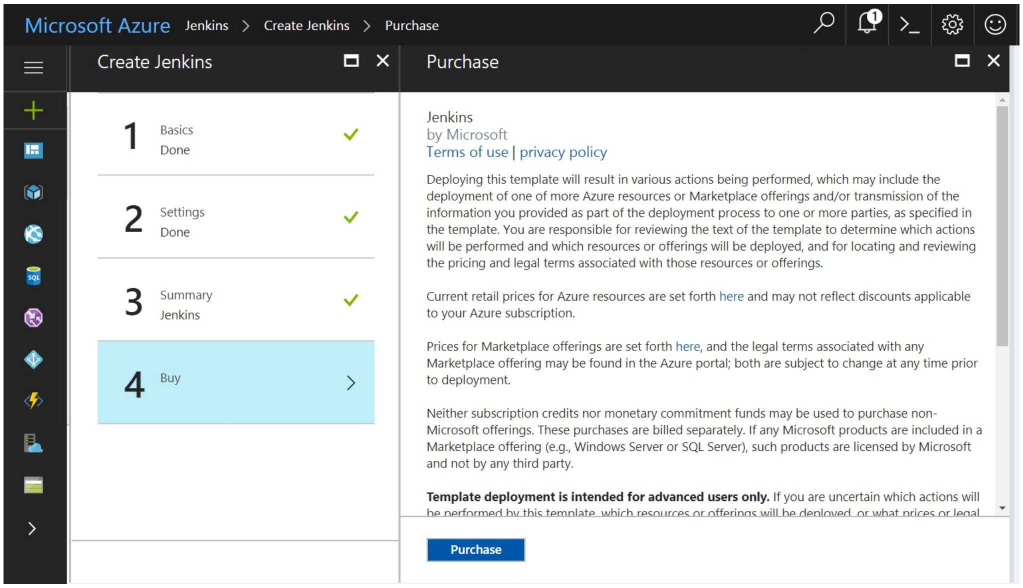
19. Review the Template link available before clicking on the Purchase button:


Template
Download
Add to library
Deploy
Template
Parameters
CLI
CLI 2.0
PowerShell
.NET
Ruby
Parameters (18)
Variables (18)
Resources (7)
[variables('storageDeploymentNa...
[variables('publicIPDeploymentNa...
NSG - Front End (Microsoft.Netwo...
[variables('virtualNetworkName')] ...
[variables('nicName')] (Microsoft.N...
[variables('vmDeploymentName')]...
[concat(parameters('vmName'), '/l...

Automate deploying resources with Azure Resource Manager templates in a single, coordinated operation. Define resources and configurable input parameters and deploy with script or code. Learn more about template deployment.

```
{
    "$schema": "https://schema.management.azure.com/schemas/2015-01-01/deploymentTemplate.json#",
    "contentVersion": "1.0.0.0",
    "parameters": {
        "_artifactsLocation": {
            "metadata": {
                "description": "Artifacts location"
            },
            "defaultValue": "https://raw.githubusercontent.com/Azure/azure-devops-utils/v0.25.0/",
            "type": "string"
        },
        "_artifactsLocationSasToken": {
            "metadata": {
                "description": "Artifacts Sas token"
            },
            "defaultValue": "",
```

20. Once ready, click on Purchase:



Create Jenkins

1 Basics
Done ✓

2 Settings
Done ✓

3 Summary
Jenkins ✓

4 Buy >

Purchase

Jenkins
by Microsoft
Terms of use | privacy policy

Deploying this template will result in various actions being performed, which may include the deployment of one of more Azure resources or Marketplace offerings and/or transmission of the information you provided as part of the deployment process to one or more parties, as specified in the template. You are responsible for reviewing the text of the template to determine which actions will be performed and which resources or offerings will be deployed, and for locating and reviewing the pricing and legal terms associated with those resources or offerings.

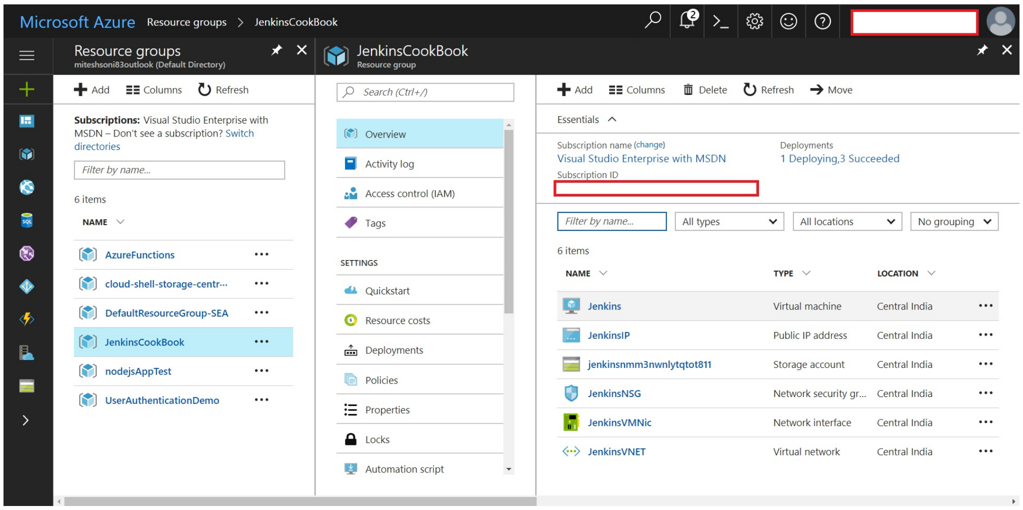
Current retail prices for Azure resources are set forth here and may not reflect discounts applicable to your Azure subscription.

Prices for Marketplace offerings are set forth here, and the legal terms associated with any Marketplace offering may be found in the Azure portal; both are subject to change at any time prior to deployment.

Neither subscription credits nor monetary commitment funds may be used to purchase non-Microsoft offerings. These purchases are billed separately. If any Microsoft products are included in a Marketplace offering (e.g., Windows Server or SQL Server), such products are licensed by Microsoft and not by any third party.

Template deployment is intended for advanced users only. If you are uncertain which actions will be performed by this template, which resources or offerings will be deployed, or what prices or legal

21. In the Azure portal, click on the Resource groups you have created. Review the resources that are being created one by one. Review the deployments in the Overview section.



[redacted]

Resource groups
miteshsoni83outlook (Default Directory)

Subscriptions: Visual Studio Enterprise with MSDN – Don't see a subscription? Switch directories

Filter by name...

6 items

NAME
AzureFunctions
cloud-shell-storage-centr...
DefaultResourceGroup-SEA
JenkinsCookBook
nodejsAppTest
UserAuthenticationDemo

JenkinsCookBook
Resource group

Subscription name (change)
Visual Studio Enterprise with MSDN

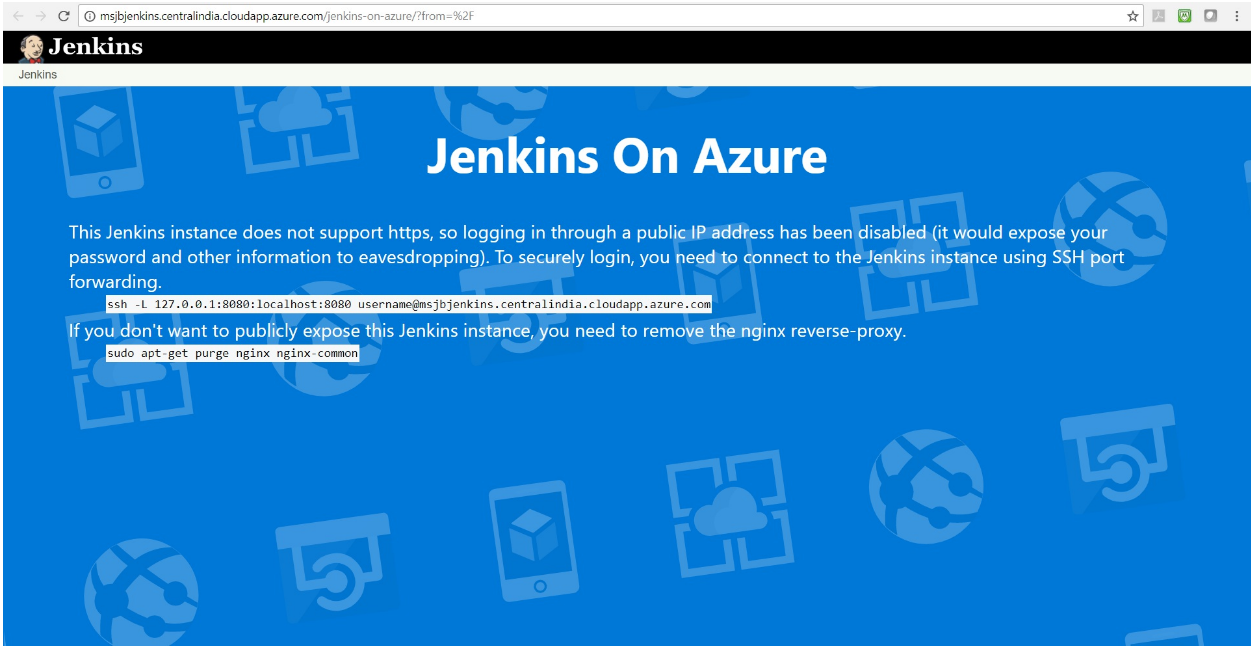
Subscription ID
[redacted]

Deployments
1 Deploying,3 Succeeded

6 items

NAME	TYPE	LOCATION
Jenkins	Virtual machine	Central India
JenkinsIP	Public IP address	Central India
jenkinsnmm3nwnlytqtot811	Storage account	Central India
JenkinsNSG	Network security gr...	Central India
JenkinsVMNic	Network interface	Central India
JenkinsVNET	Virtual network	Central India

22. Click on the JenkinsIP and visit the domain name associated with it:


msjbjenkins.centralindia.cloudapp.azure.com/jenkins-on-azure/?from=%2F
Jenkins
Jenkins

Jenkins On Azure

This Jenkins instance does not support https, so logging in through a public IP address has been disabled (it would expose your password and other information to eavesdropping). To securely login, you need to connect to the Jenkins instance using SSH port forwarding.

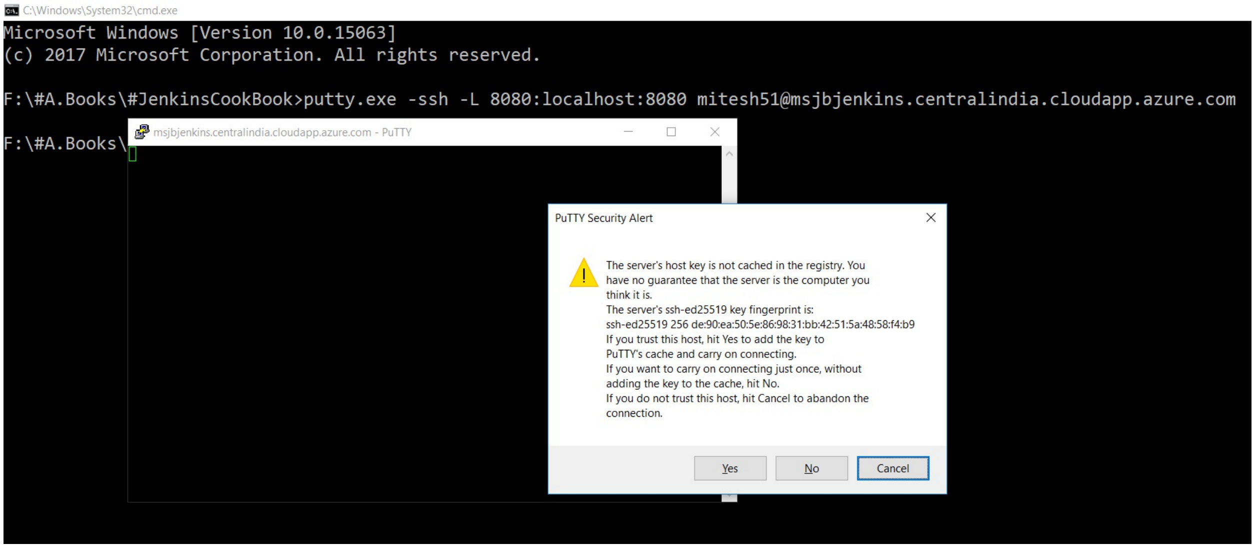
```
ssh -L 127.0.0.1:8080:localhost:8080 username@msjbjenkins.centralindia.cloudapp.azure.com
```

If you don't want to publicly expose this Jenkins instance, you need to remove the nginx reverse-proxy.

```
sudo apt-get purge nginx nginx-common
```

23. Download PuTTY or any other `ssh` client so we can connect to the URL mentioned in the Jenkins page.
24. Go to the location where `putty.exe` is available.
25. Execute the command given on the Jenkins page in command prompt.

26. Select Yes in PuTTY Security Alert:

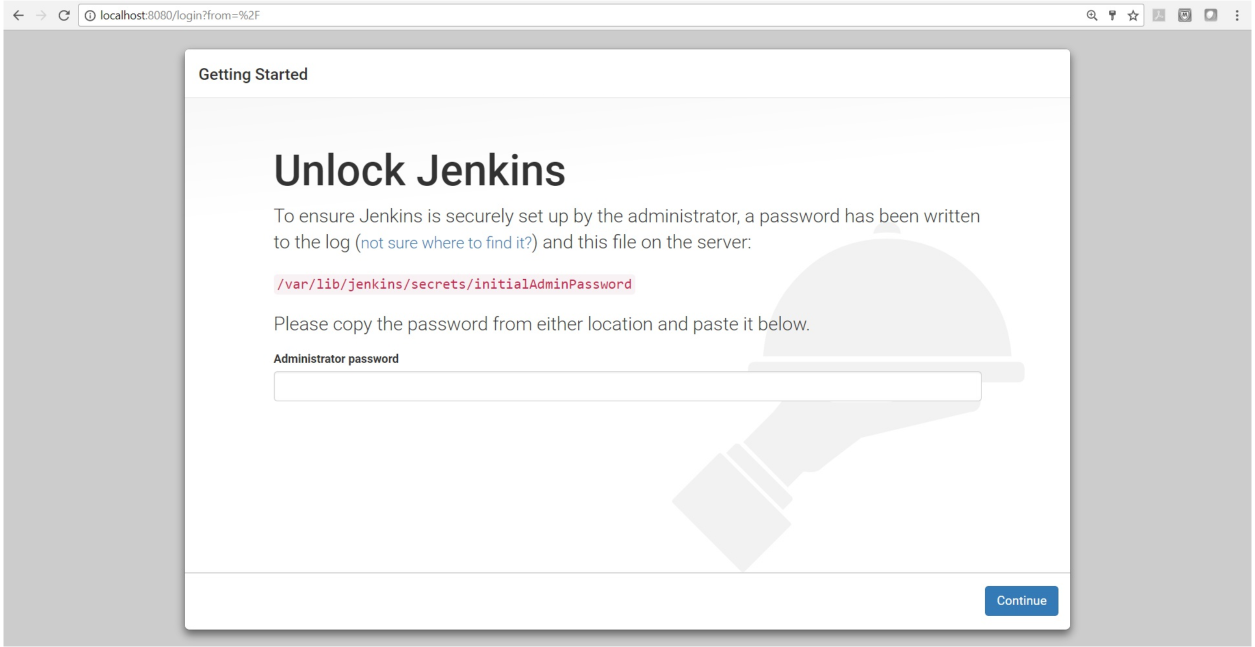

C:\Windows\System32\cmd.exe
msjbjenkins.centralindia.cloudapp.azure.com - PuTTY

```
Microsoft Windows [Version 10.0.15063]
(c) 2017 Microsoft Corporation. All rights reserved.

F:\#A.Books\#JenkinsCookBook>putty.exe -ssh -L 8080:localhost:8080 mitesh51@msjbjenkins.centralindia.cloudapp.azure.com

F:\#A.Books\
```

PuTTY Security Alert

The server's host key is not cached in the registry. You have no guarantee that the server is the computer you think it is.
The server's ssh-ed25519 key fingerprint is:
ssh-ed25519 256 de:90:ea:50:5e:86:98:31:bb:42:51:5a:48:58:f4:b9
If you trust this host, hit Yes to add the key to PuTTY's cache and carry on connecting.
If you want to carry on connecting just once, without adding the key to the cache, hit No.
If you do not trust this host, hit Cancel to abandon the connection.

27. Open the browser and navigate to the URL, http://localhost:8080.
28. It will ask for the Administrator password:



Unlock Jenkins

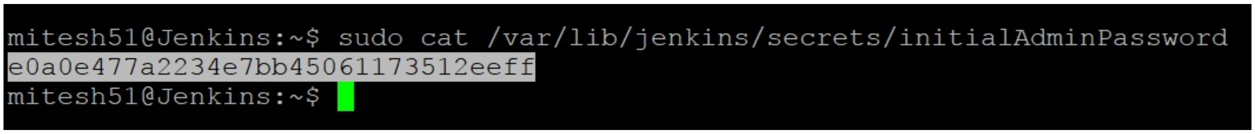
To ensure Jenkins is securely set up by the administrator, a password has been written to the log (not sure where to find it?) and this file on the server:

`/var/lib/jenkins/secrets/initialAdminPassword`

Please copy the password from either location and paste it below.

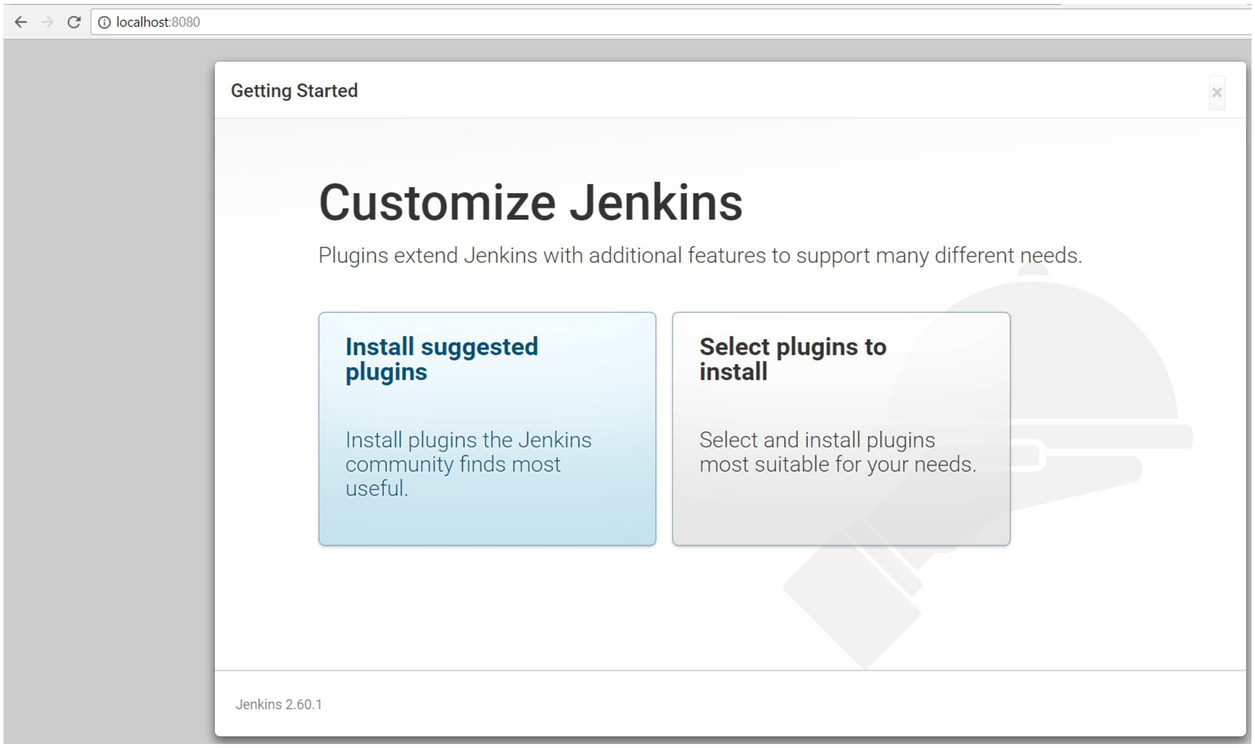
Administrator password

29. In the PuTTY window, execute the `cat` command to get details of the file mentioned for the Administrator password.
30. Replace that password in the Administrator password box and click on Continue:



```
mitesh51@Jenkins:~$ sudo cat /var/lib/jenkins/secrets/initialAdminPassword
e0a0e477a2234e7bb45061173512eeff
mitesh51@Jenkins:~$
```

31. Click on Install suggested plugins:



Customize Jenkins

Plugins extend Jenkins with additional features to support many different needs.

Install suggested plugins

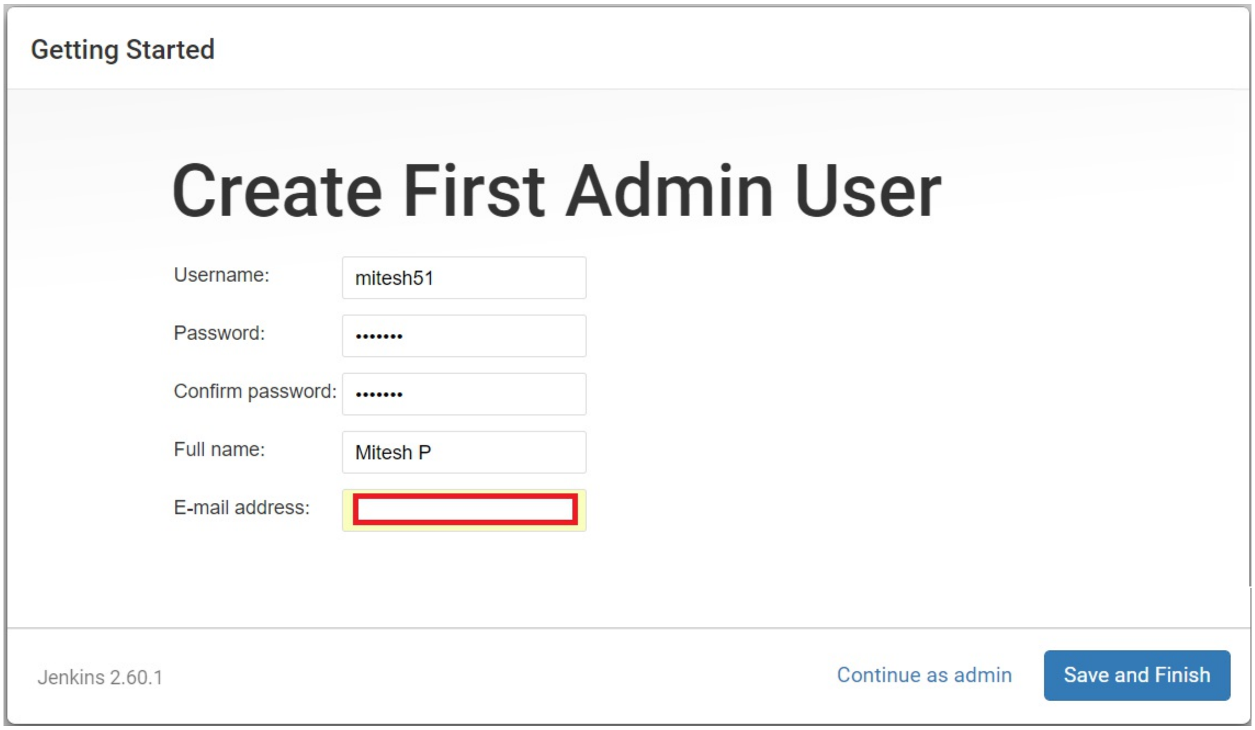
Install plugins the Jenkins community finds most useful.

Select plugins to install

Select and install plugins most suitable for your needs.

Jenkins 2.60.1

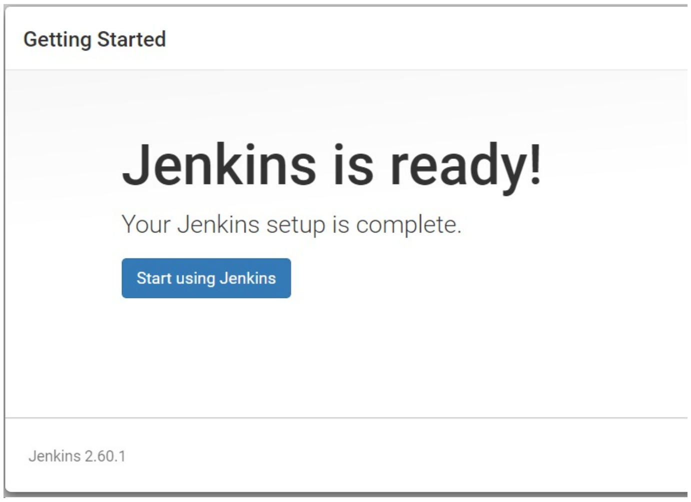
32. Once all plugins are installed successfully, Create First Admin User. Click Save and Finish, as demonstrated in this next screenshot:



Create First Admin User

Username:	mitesh51
Password:	•••••••
Confirm password:	•••••••
Full name:	Mitesh P
E-mail address:	

33. Now, the Jenkins setup is completed. Click on Start using Jenkins:



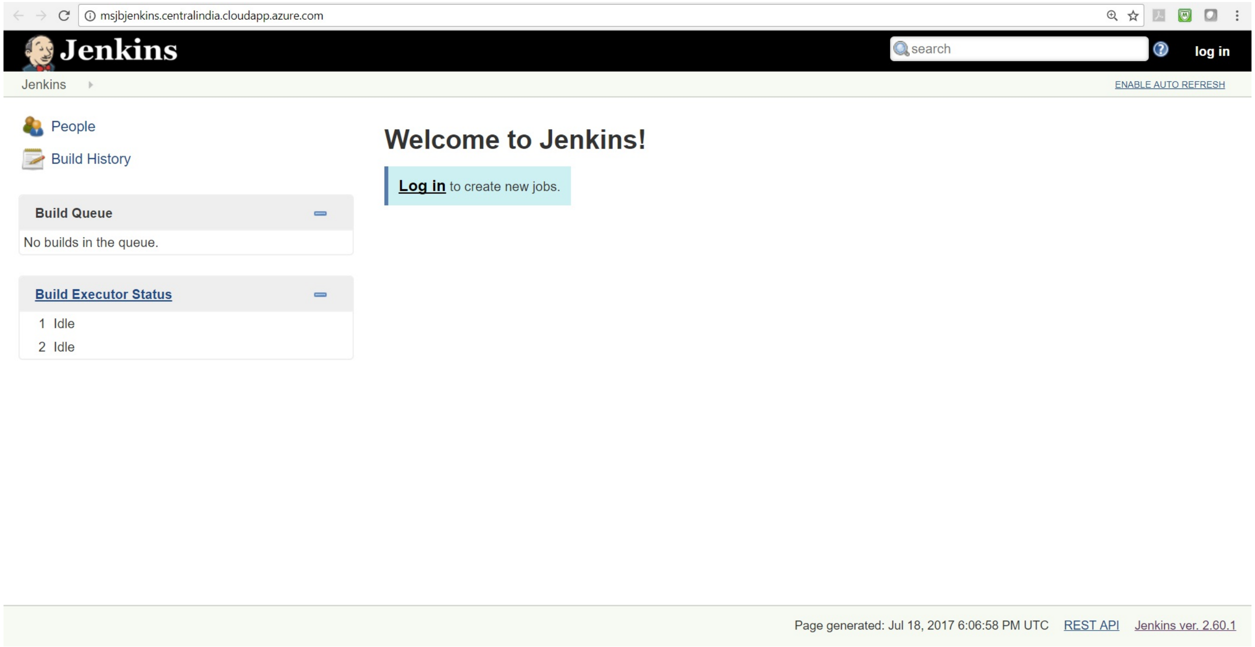
Getting Started

Jenkins is ready!

Your Jenkins setup is complete.

Jenkins 2.60.1

34. Finally, we are at the dashboard screen:



Build Queue

No builds in the queue.

Build Executor Status

1 Idle

2 Idle

Welcome to Jenkins!

Log in to create new jobs.

Page generated: Jul 18, 2017 6:06:58 PM UTC REST API Jenkins ver. 2.60.1

How it works...

Behind the scene, the template creates all the resources that are required to host Jenkins, including virtual network, network security group, virtual machine, and so on, based on the best practices; and then Jenkins is installed and configured in a secured environment in Microsoft Azure.

Installing Jenkins as a Service in Windows

Installing Jenkins as a Windows service allows you to start Jenkins as soon as the machine starts, and regardless of who is interactively using Jenkins.

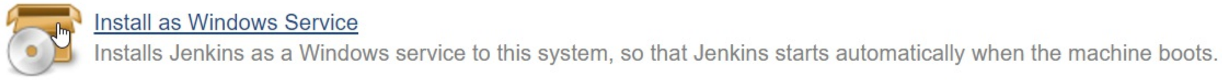
Getting ready

Install and configure Jenkins on Windows.

How to do it...

Follow these steps to install Jenkins as a service in Windows:

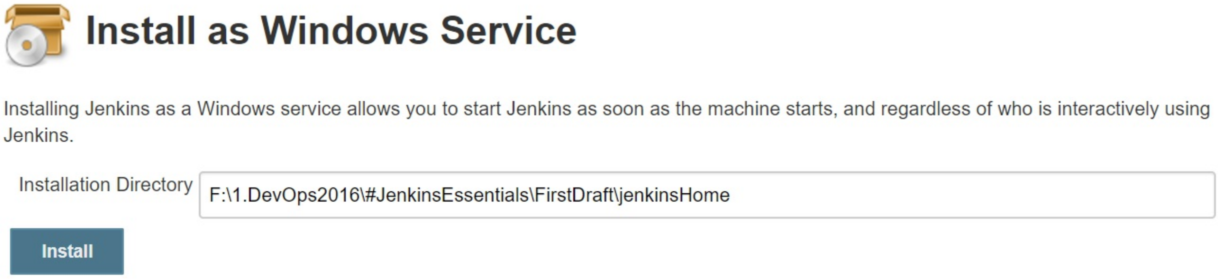
1. Go to the Jenkins dashboard.
2. Click on Manage Jenkins.
3. Click on Install as Windows Service, as shown in the following diagram:



Install as Windows Service

Installs Jenkins as a Windows service to this system, so that Jenkins starts automatically when the machine boots.

4. Keep Installation Directory as the default and click on Install:

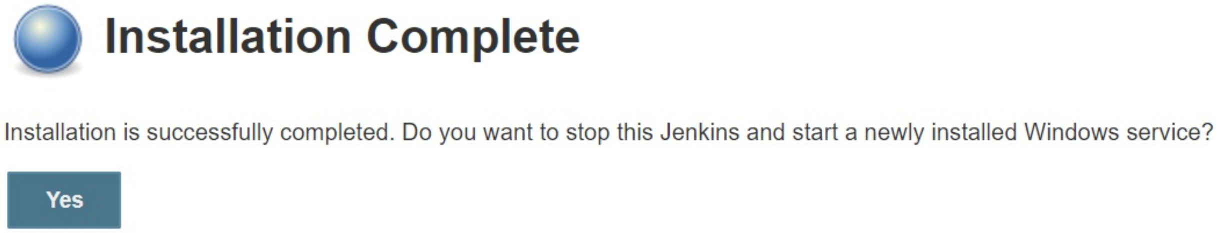


Install as Windows Service

Installing Jenkins as a Windows service allows you to start Jenkins as soon as the machine starts, and regardless of who is interactively using Jenkins.

Installation Directory F:\1.DevOps2016\#JenkinsEssentials\FirstDraft\jenkinsHome

5. Once Windows as a Service installation is successfully completed, click on Yes:



Installation Complete

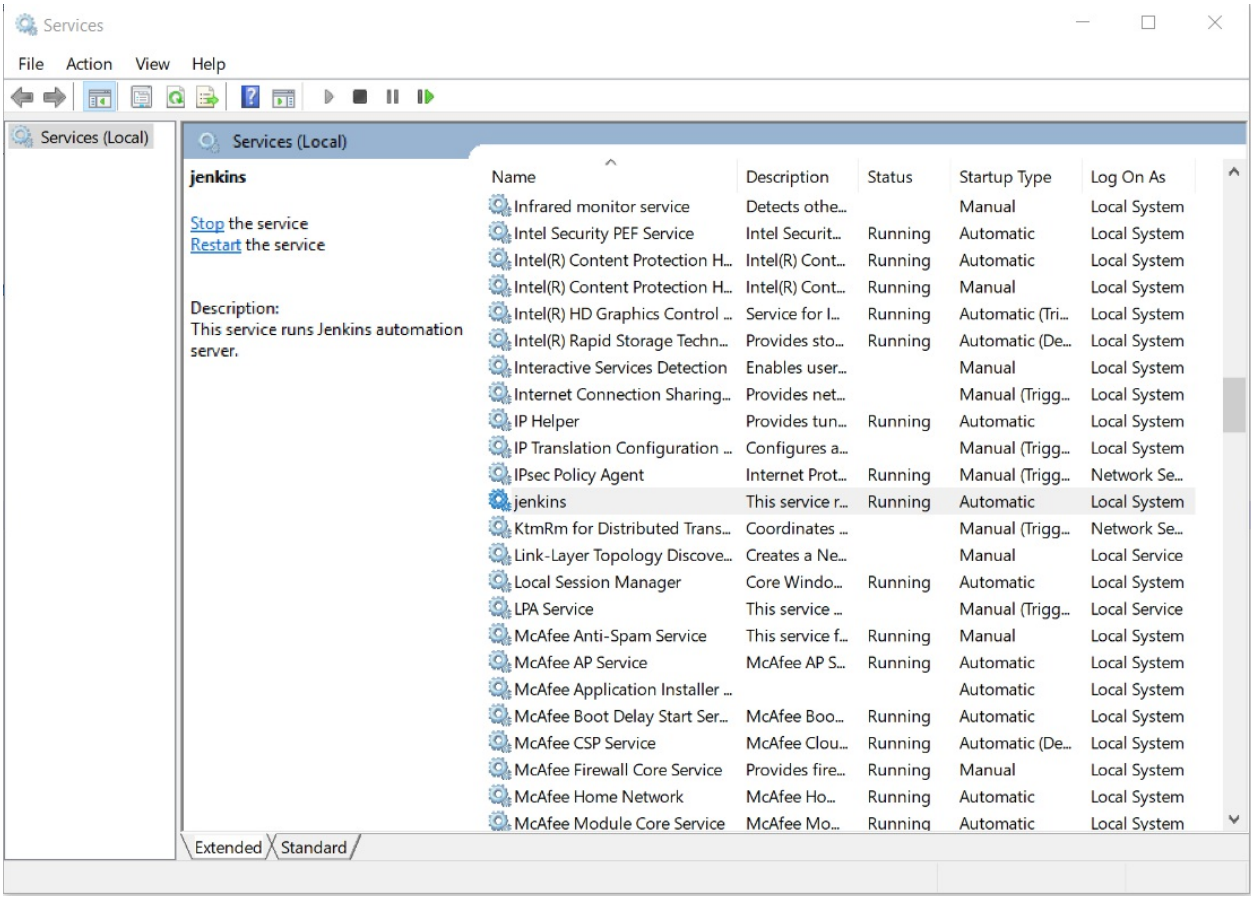
Installation is successfully completed. Do you want to stop this Jenkins and start a newly installed Windows service?

6. Now Jenkins will be available as a service in the Windows system.

How it works...

Go to Control Panel and search for Services.

Click on Services (Local) to view:



jenkins

Stop the service
Restart the service

Description:
This service runs Jenkins automation server.

Name	Description	Status	Startup Type	Log On As
Infrared monitor service	Detects othe...		Manual	Local System
Intel Security PEF Service	Intel Securit...	Running	Automatic	Local System
Intel(R) Content Protection H...	Intel(R) Cont...	Running	Automatic	Local System
Intel(R) Content Protection H...	Intel(R) Cont...	Running	Manual	Local System
Intel(R) HD Graphics Control ...	Service for I...	Running	Automatic (Tri...	Local System
Intel(R) Rapid Storage Techn...	Provides sto...	Running	Automatic (De...	Local System
Interactive Services Detection	Enables user...		Manual	Local System
Internet Connection Sharing...	Provides net...		Manual (Trigg...	Local System
IP Helper	Provides tun...	Running	Automatic	Local System
IP Translation Configuration ...	Configures a...		Manual (Trigg...	Local System
IPsec Policy Agent	Internet Prot...	Running	Manual (Trigg...	Network Se...
jenkins	This service r...	Running	Automatic	Local System
KtmRm for Distributed Trans...	Coordinates ...		Manual (Trigg...	Network Se...
Link-Layer Topology Discove...	Creates a Ne...		Manual	Local Service
Local Session Manager	Core Windo...	Running	Automatic	Local System
LPA Service	This service ...		Manual (Trigg...	Local Service
McAfee Anti-Spam Service	This service f...	Running	Manual	Local System
McAfee AP Service	McAfee AP S...	Running	Automatic	Local System
McAfee Application Installer ...			Automatic	Local System
McAfee Boot Delay Start Ser...	McAfee Boo...	Running	Automatic	Local System
McAfee CSP Service	McAfee Clou...	Running	Automatic (De...	Local System
McAfee Firewall Core Service	Provides fire...	Running	Manual	Local System
McAfee Home Network	McAfee Ho...	Running	Automatic	Local System
McAfee Module Core Service	McAfee Mo...	Running	Automatic	Local System

Once the Jenkins service is available, you can right-click on it and start, stop, or restart services based on your requirements.

Installing plugins in Jenkins

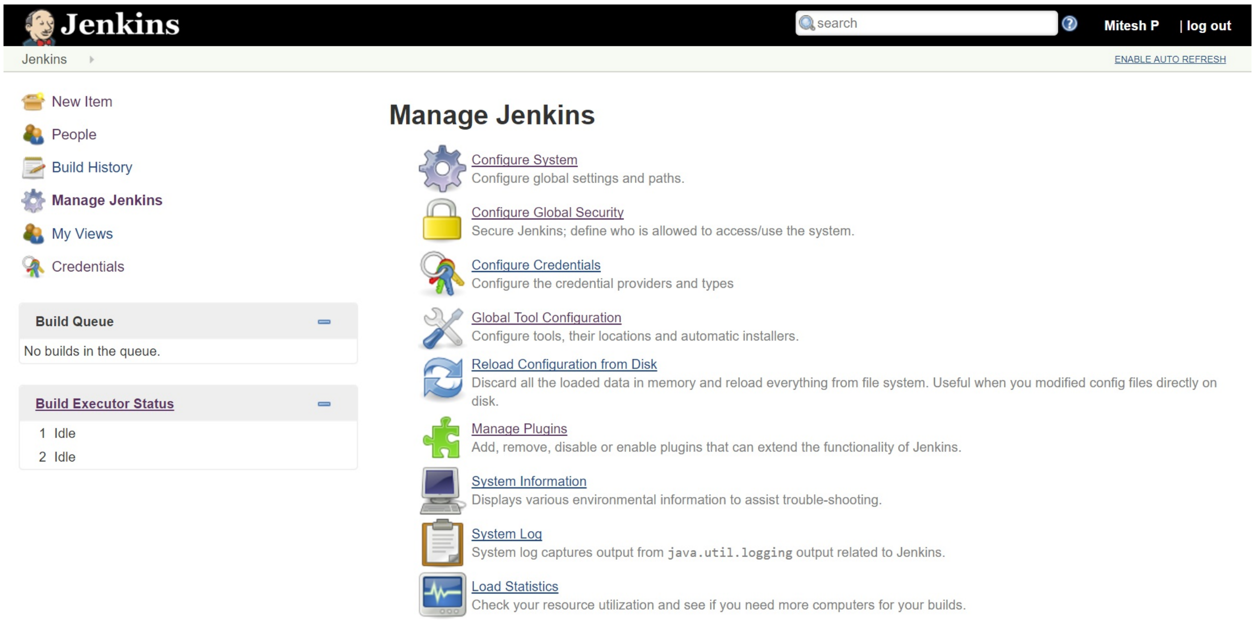
Jenkins is an open source automation server that is widely used and extensible due to more than 400+ plugins. Plugins make Jenkins' integration with other tools very easy. You can create your own plugins also.

Getting ready

There are various categories of plugins available, such as Source Code Management, Slave launchers and controllers, Build triggers, Build tools, Build notifies, Build reports, Other Post-build Actions, External site/tool integrations, UI plugins, Authentication and user management, Android development, iOS development, .NET development, Ruby development, Library plugins, and so on.

How to do it...

1. Go to the Jenkins dashboard. Click on Manage Jenkins and then Manage Plugins:



No builds in the queue.

1 Idle

2 Idle

Manage Jenkins

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.

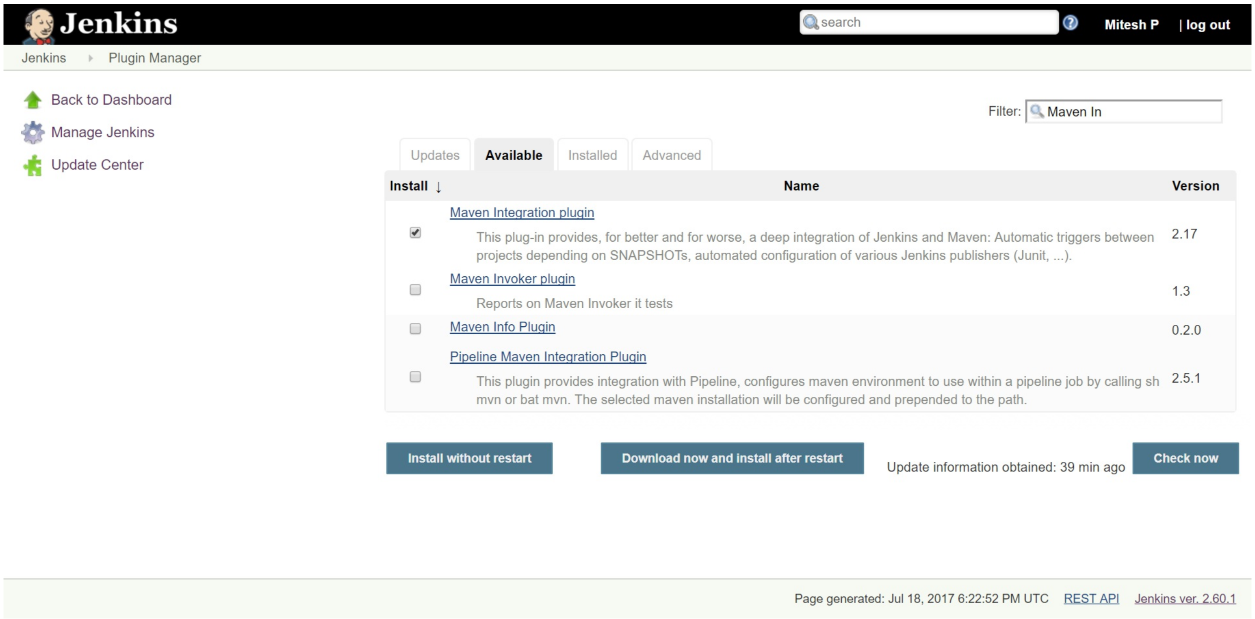
Manage Plugins
Add, remove, disable or enable plugins that can extend the functionality of Jenkins.

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.

2. Go to Available tab and select any plugin to install. Click on Install without restart:



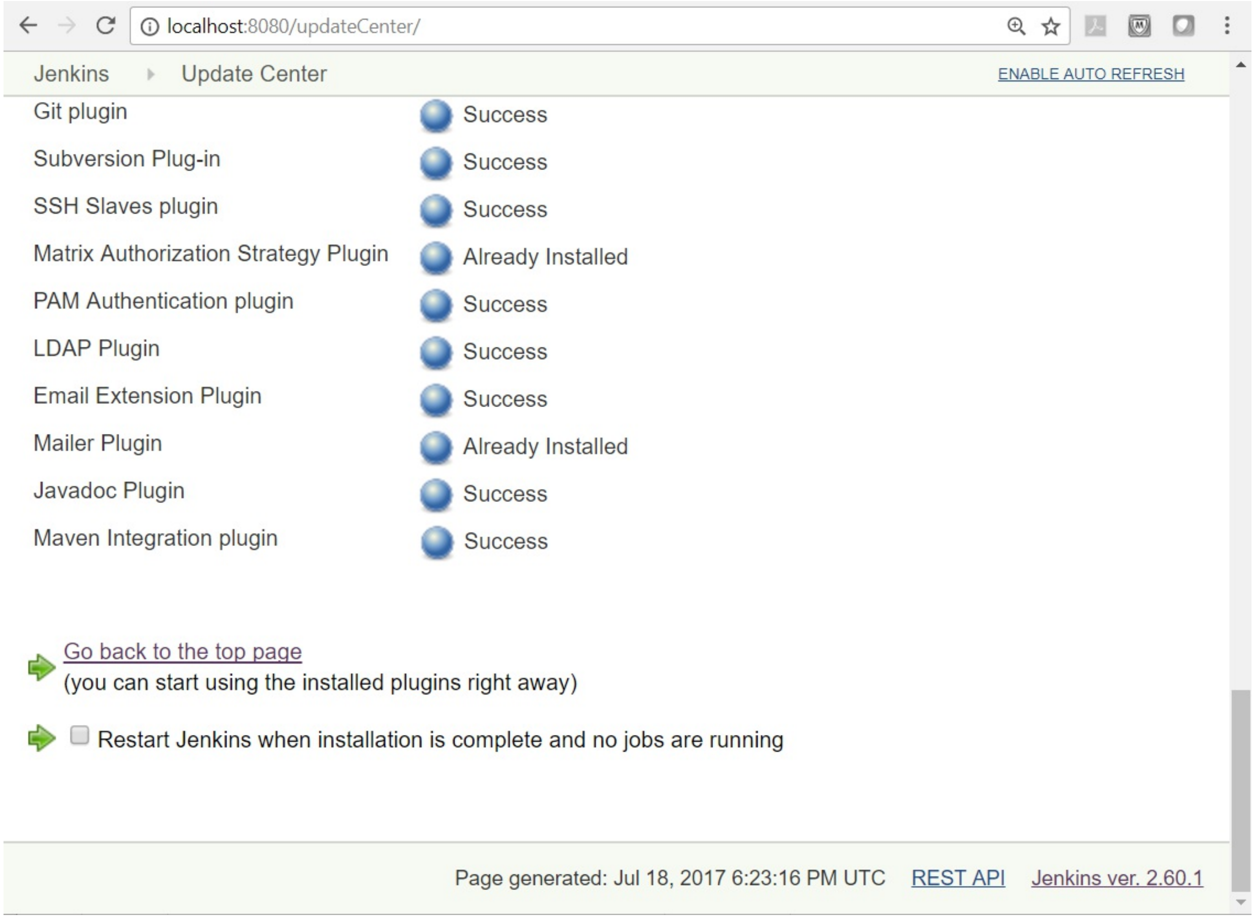
Filter: Maven In

Install ↓	Name	Version
☑	Maven Integration plugin This plug-in provides, for better and for worse, a deep integration of Jenkins and Maven: Automatic triggers between projects depending on SNAPSHOTs, automated configuration of various Jenkins publishers (Junit, ...).	2.17
☐	Maven Invoker plugin Reports on Maven Invoker it tests	1.3
☐	Maven Info Plugin	0.2.0
☐	Pipeline Maven Integration Plugin This plugin provides integration with Pipeline, configures maven environment to use within a pipeline job by calling sh mvn or bat mvn. The selected maven installation will be configured and prepended to the path.	2.5.1

Update information obtained: 39 min ago

Page generated: Jul 18, 2017 6:22:52 PM UTC REST API Jenkins ver. 2.60.1

3. Verify the successful plugin installation, as demonstrated in this next screenshot:



Git plugin	Success
Subversion Plug-in	Success
SSH Slaves plugin	Success
Matrix Authorization Strategy Plugin	Already Installed
PAM Authentication plugin	Success
LDAP Plugin	Success
Email Extension Plugin	Success
Mailer Plugin	Already Installed
Javadoc Plugin	Success
Maven Integration plugin	Success

Go back to the top page
(you can start using the installed plugins right away)

☐ Restart Jenkins when installation is complete and no jobs are running

Page generated: Jul 18, 2017 6:23:16 PM UTC REST API Jenkins ver. 2.60.1

If installation is pending with restart, then restart Jenkins.

How it works...

Once the plugin is installed, a specific block is added in a build job or in the relevant section in Manage Jenkins.

You only need to provide some parameters and credentials for integration of external tools or services with Jenkins.

There's more...

Jenkins defines interfaces or abstract classes that model a facet of a build system. Interfaces or abstract classes define agreement on what needs to be implemented; and Jenkins uses plugins to extend those implementations.

See also

- Visit the Plugin tutorial, https://wiki.jenkins.io/display/JENKINS/Plugin+tutorial for more details.

Uploading plugins in Jenkins

There will be instances where you have all the plugins downloaded from https://updates.jenkins-ci.org/download/plugins/, or you may create your own plugin and you want to utilize that in Jenkins. This recipe will explain how to upload these plugins in Jenkins.

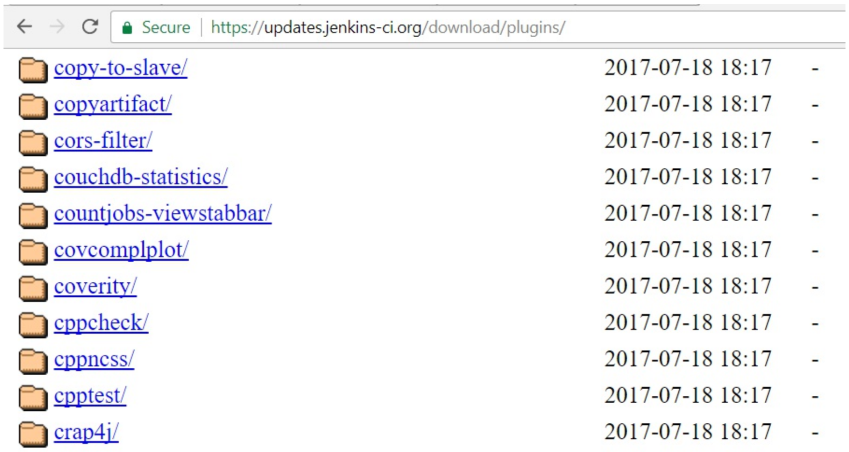
Getting ready

Download the required plugin https://updates.jenkins-ci.org/download/plugins/ or create a plugin using the Plugin tutorial, https://wiki.jenkins.io/display/JENKINS/Plugin+tutorial.

How to do it...

For this recipe, we will download a plugin and upload it from the Jenkins dashboard:

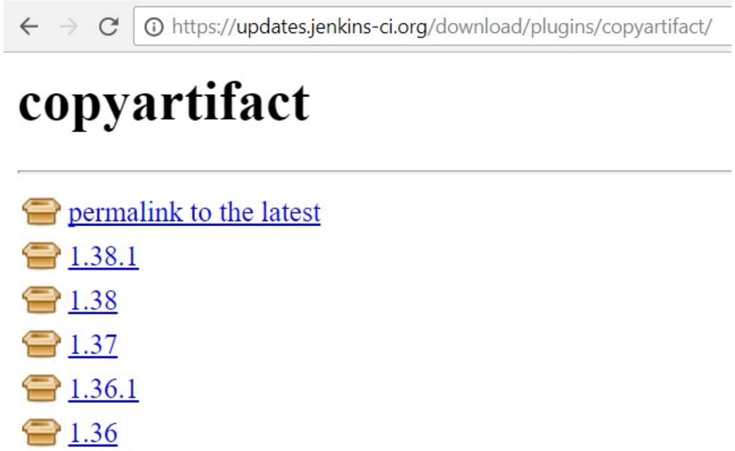
1. Download the copyartifact/ plugin (`.hpi`) file:



Secure | https://updates.jenkins-ci.org/download/plugins/

copy-to-slave/	2017-07-18 18:17	-
copyartifact/	2017-07-18 18:17	-
cors-filter/	2017-07-18 18:17	-
couchdb-statistics/	2017-07-18 18:17	-
countjobs-viewstabbar/	2017-07-18 18:17	-
covcomplplot/	2017-07-18 18:17	-
coverity/	2017-07-18 18:17	-
cppcheck/	2017-07-18 18:17	-
cppncss/	2017-07-18 18:17	-
cpptest/	2017-07-18 18:17	-
crap4j/	2017-07-18 18:17	-

2. Download the latest version to your system:

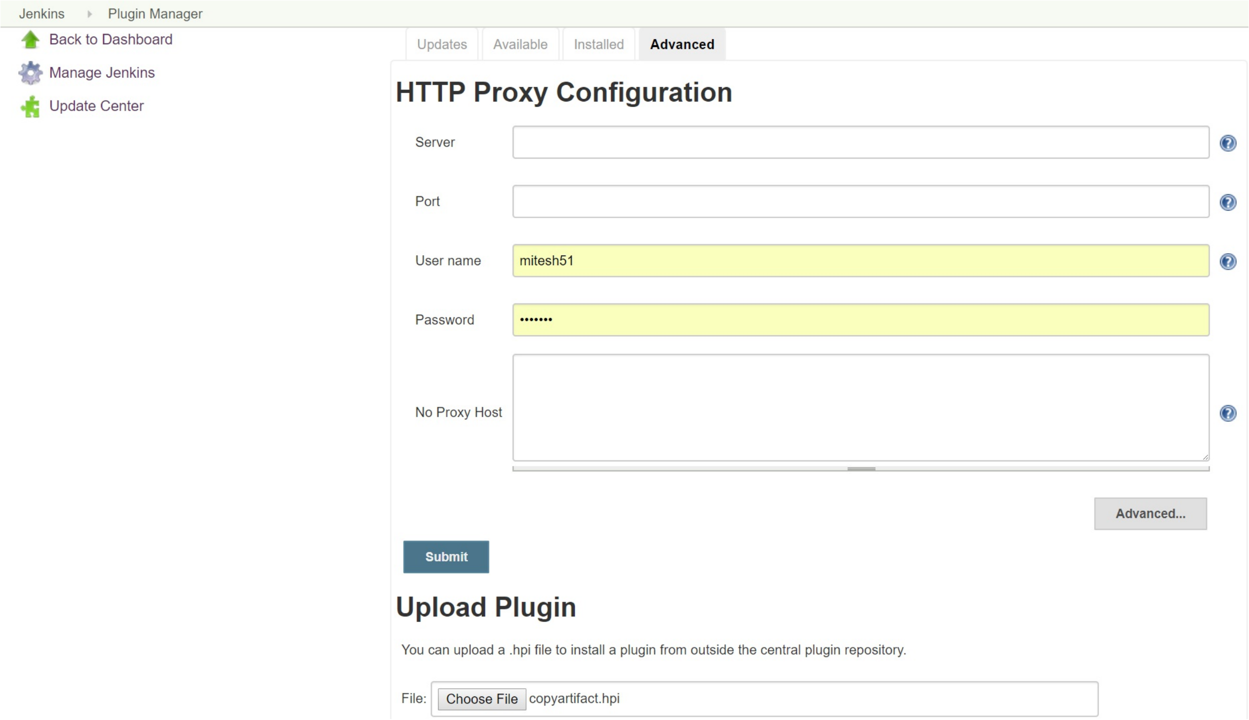


https://updates.jenkins-ci.org/download/plugins/copyartifact/

copyartifact

- permalink to the latest
- 1.38.1
- 1.38
- 1.37
- 1.36.1
- 1.36

3. Go to the Jenkins dashboard.
4. Click on Manage Jenkins.
5. Click on Manage plugins.
6. Go to the Advanced tab. Click on Choose File in the Upload Plugin section:



HTTP Proxy Configuration

Server:

Port:

User name: mitesh51

Password: •••••••

No Proxy Host:

Upload Plugin

You can upload a .hpi file to install a plugin from outside the central plugin repository.

File: Choose File copyartifact.hpi

7. Click on Upload.

How it works...

Once a plugin is uploaded successfully, we can utilize extensibility provided by the plugin that is uploaded into Jenkins.

Configuring proxy in Jenkins

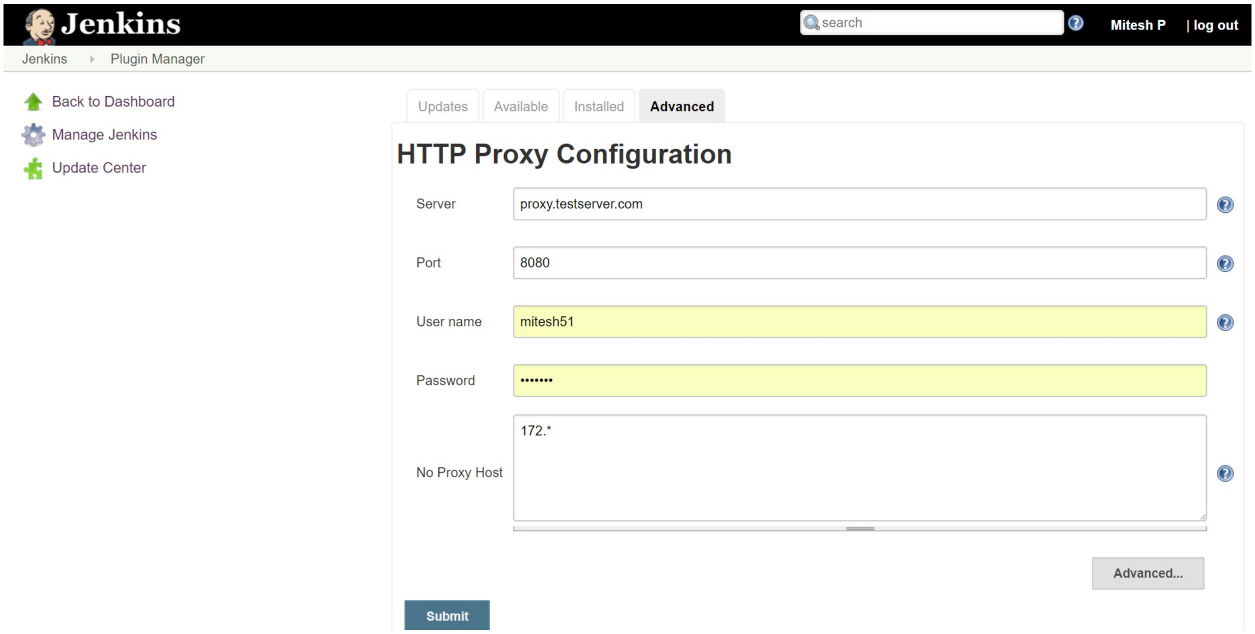
Jenkins is often installed in organizations behind the proxy server. In such scenarios, it is important to configure a proxy in the Jenkins dashboard so plugin updates can be installed successfully.

Getting ready

Get all the details related to the server name, port number, and credentials that are allowed to access the proxy server.

How to do it...

1. Go to the Jenkins dashboard.
2. Click on Manage Jenkins.
3. Click on Manage plugins.
4. Go to the Advanced tab.
5. Provide Server, Port, User name, Password, and No Proxy Host:



HTTP Proxy Configuration

Server: proxy.testserver.com

Port: 8080

User name: mitesh51

Password: •••••••

No Proxy Host: 172.*

6. Click on Submit.

Configuring global settings in Jenkins

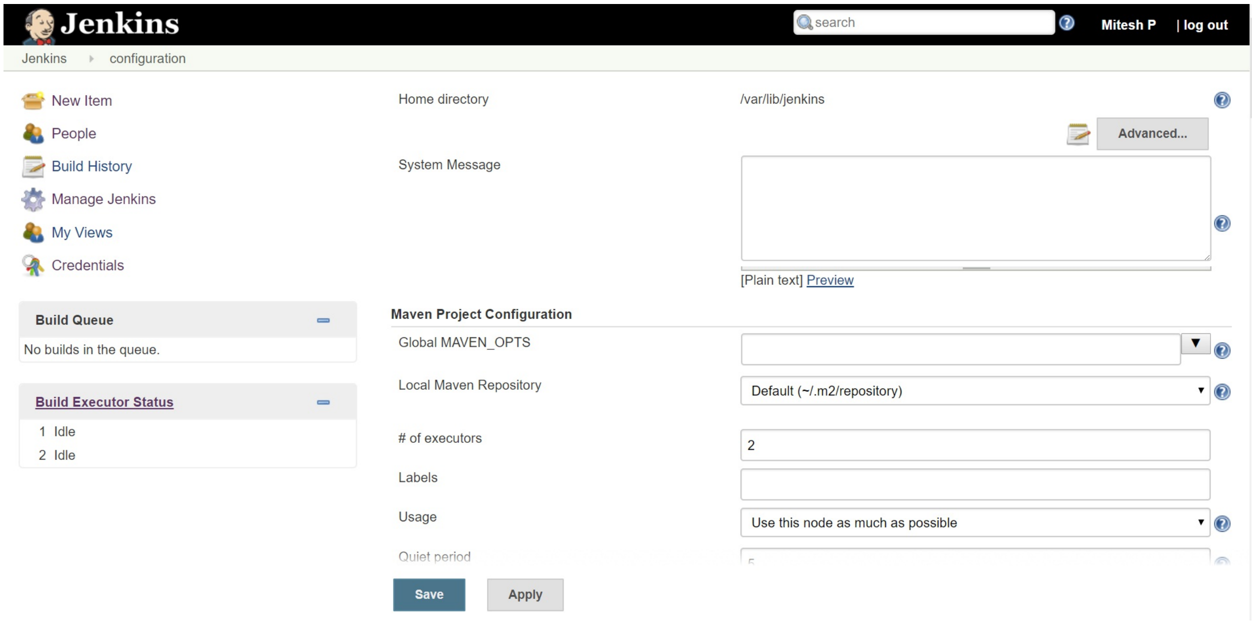
Configure system is the place where initial settings can be done, and it is useful. You can configure SMTP server details, SonarQube server details, environment variables, and so on.

Getting ready

To configure global settings and paths, we need to go to Configure System in the Jenkins dashboard.

How to do it...

1. Go to the Jenkins dashboard.
2. Click on Manage Jenkins.
3. Click on Configure System.
4. Verify the Home directory available:



Build Queue

No builds in the queue.

Build Executor Status

1 Idle
2 Idle

Home directory /var/lib/jenkins

System Message

Maven Project Configuration

Global MAVEN_OPTS

Local Maven Repository: Default (~/.m2/repository)

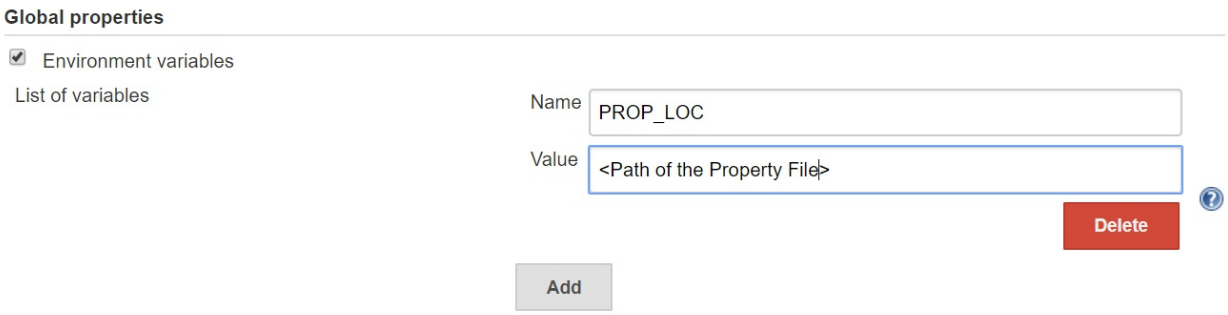
# of executors: 2

Labels

Usage: Use this node as much as possible

Quiet period: 5

5. In the Configure System page, we can define Environment variables too so that it can be used during the execution of build jobs.
6. For example, we can configure the `ANDROID SDK` path in Environment variables in order to set Continuous Integration for Android Apps.



Global properties

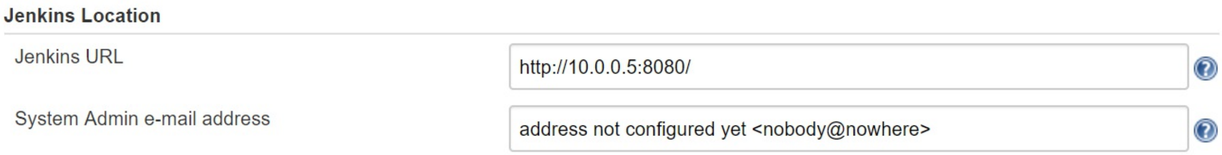
☑ Environment variables

List of variables

Name: PROP_LOC

Value: <Path of the Property File>

7. Another important configuration available on the same page is Jenkins Location. You can specify the HTTP address of the Jenkins installation, as Jenkins cannot reliably detect such a Jenkins URL from within itself:



Jenkins Location

Jenkins URL: http://10.0.0.5:8080/

System Admin e-mail address: address not configured yet <nobody@nowhere>

There's more...

There are some important configurations that you need to do here in the Configure System section, such as SCM Polling, E-mail Notification, Extended E-mail Notification, Git plugin, Disk usage, Quality Gates - SonarQube, Build Pipeline Plugin, Copyartifact: Upstream build that triggered this job, Audit Trail, SonarQube servers, and so on.

Configuring JENKINS_HOME

The `.jenkins` is the main directory that contains all the details for Jenkins installation files, configurations, plugins, build job configuration, and so on.

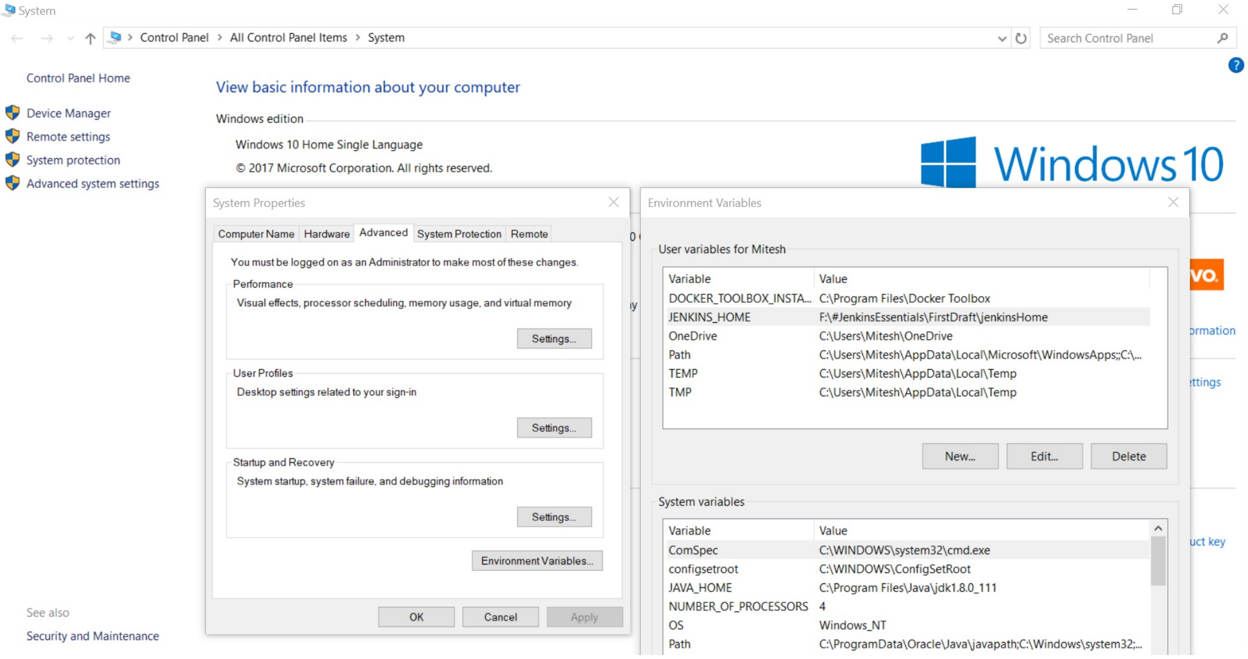
Getting ready

It is important to keep the `.jenkins` directory at a location where a good amount of free space is available. By default, Jenkins creates `.jenkins` (or `JENKINS_HOME`) at a specific location considering the operating systems.

For example, in Windows it is available at `C:\Users\<USER_NAME>\.jenkins`.

How to do it...

1. In Windows, to change to `JENKINS_HOME`, go to the Control Panel | All Control Panel Items | System.
2. Click on Advanced System Settings.
3. Click on Environment Variables.
4. Create a new variable JENKINS_HOME and give the path:



View basic information about your computer

Windows edition

Windows 10 Home Single Language

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You must be logged on as an Administrator to make most of these changes.

Performance

Visual effects, processor scheduling, memory usage, and virtual memory

User Profiles

Desktop settings related to your sign-in

Startup and Recovery

System startup, system failure, and debugging information

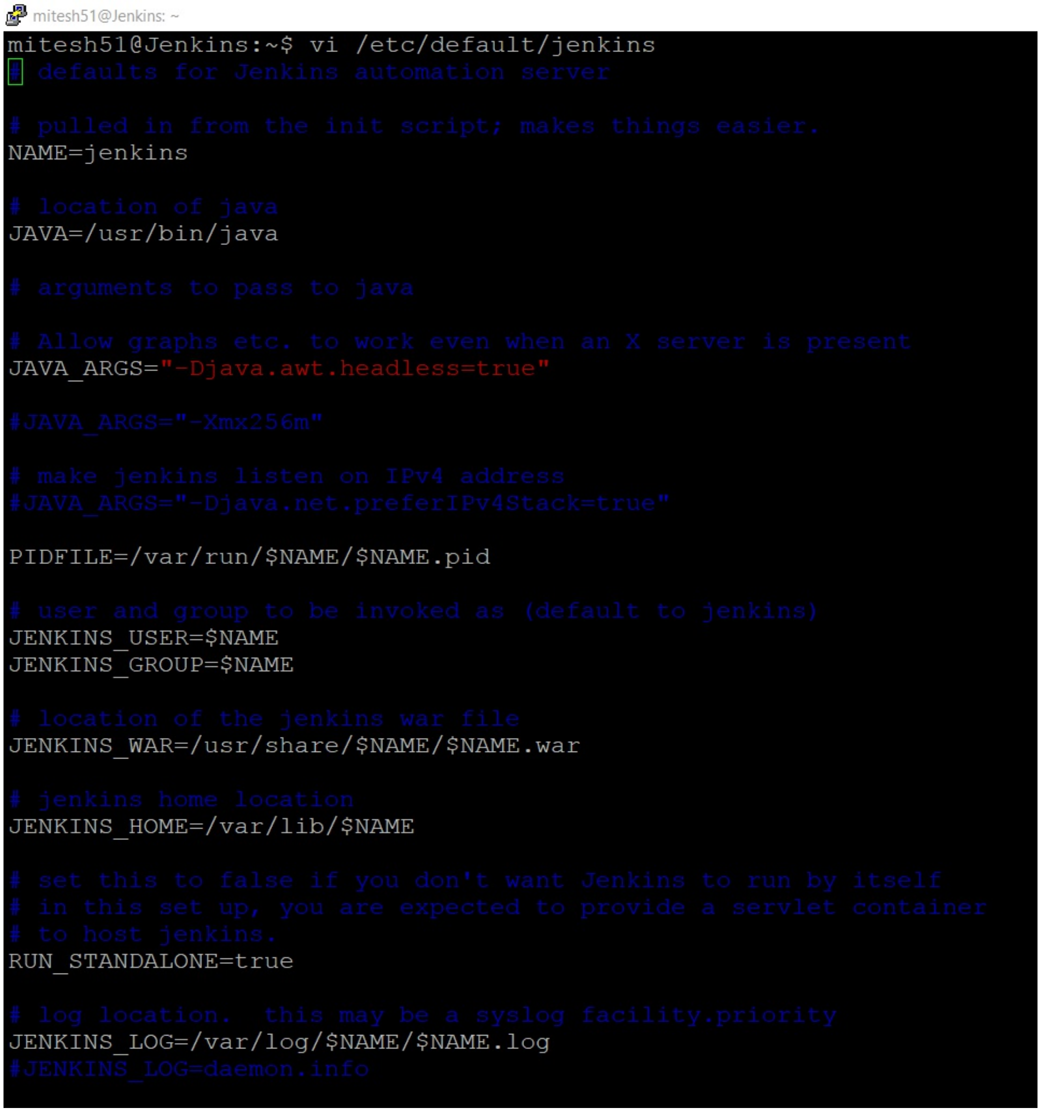
User variables for Mitesh

Variable	Value
DOCKER_TOOLBOX_INSTA...	C:\Program Files\Docker Toolbox
JENKINS_HOME	F:\#JenkinsEssentials\FirstDraft\jenkinsHome
OneDrive	C:\Users\Mitesh\OneDrive
Path	C:\Users\Mitesh\AppData\Local\Microsoft\WindowsApps;;C:\...
TEMP	C:\Users\Mitesh\AppData\Local\Temp
TMP	C:\Users\Mitesh\AppData\Local\Temp

System variables

Variable	Value
ComSpec	C:\WINDOWS\system32\cmd.exe
configsetroot	C:\WINDOWS\ConfigSetRoot
JAVA_HOME	C:\Program Files\Java\jdk1.8.0_111
NUMBER_OF_PROCESSORS	4
OS	Windows_NT
Path	C:\ProgramData\Oracle\Java\javapath;C:\Windows\system32;...

5. In Ubuntu, go to `/etc/default/Jenkins`.
6. Change the `JENKINS_HOME` location:



```
mitesh51@Jenkins:~$ vi /etc/default/jenkins
  defaults for Jenkins automation server

# pulled in from the init script; makes things easier.
NAME=jenkins

# location of java
JAVA=/usr/bin/java

# arguments to pass to java

# Allow graphs etc. to work even when an X server is present
JAVA_ARGS="-Djava.awt.headless=true"

#JAVA_ARGS="-Xmx256m"

# make jenkins listen on IPv4 address
#JAVA_ARGS="-Djava.net.preferIPv4Stack=true"

PIDFILE=/var/run/$NAME/$NAME.pid

# user and group to be invoked as (default to jenkins)
JENKINS_USER=$NAME
JENKINS_GROUP=$NAME

# location of the jenkins war file
JENKINS_WAR=/usr/share/$NAME/$NAME.war

# jenkins home location
JENKINS_HOME=/var/lib/$NAME

# set this to false if you don't want Jenkins to run by itself
# in this set up, you are expected to provide a servlet container
# to host jenkins.
RUN_STANDALONE=true

# log location.  this may be a syslog facility.priority
JENKINS_LOG=/var/log/$NAME/$NAME.log
#JENKINS_LOG=daemon.info
```

7. Once changes are done, save the changes.

How it works...

Once `JENKINS_HOME` is changed, you need to restart Jenkins. The next time Jenkins starts, it will take `JENKINS_HOME` as the location that you have configured.

There's more...

The following table describes the default location of `JENKINS_HOME` in different operating systems:

Operating system	`$JENKINS_HOME` location
Windows	C:\Program Files (x86)\jenkins or `C:\Users\<USER>\.jenkins`
Mac OSX	Macintosh HD/Users/Shared/Jenkins
Ubuntu/Debian	/var/lib/jenkins
Red Hat/CentOS/Fedora	/var/lib/jenkins
OpenSUSE	/var/lib/jenkins
FreeBSD	/usr/local/etc/jenkins
OpenBSD	/usr/local/etc/jenkins

Understanding JENKINS_HOME directory

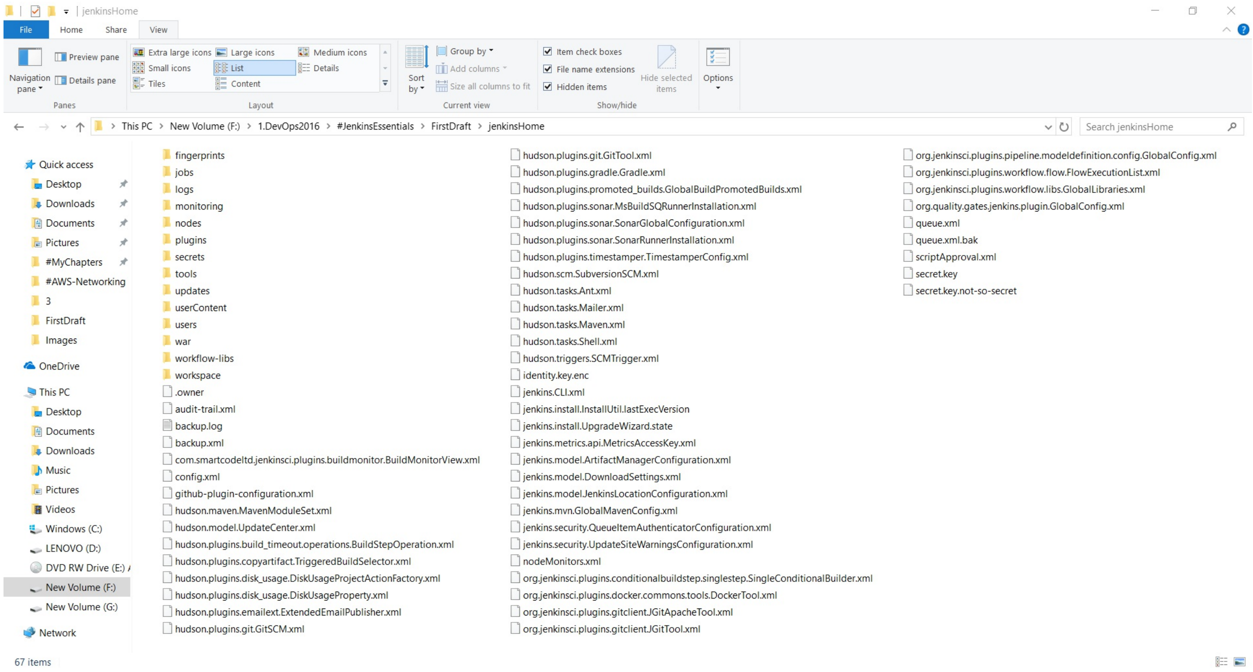
In this recipe, we will discuss the directories available in the `JENKINS_HOME` directory.

Getting ready

Locate the JENKINS_HOME directory from the Environment Variables, or go to the default locations where JENKINS_HOME is available in different operating systems.

How to do it...

1. You have many files and directories in the `JENKINS_HOME` directory. We will give brief information on some important files and directories:



This PC > New Volume (F:) > 1.DevOps2016 > #JenkinsEssentials > FirstDraft > jenkinsHome

```
fingerprints
jobs
logs
monitoring
nodes
plugins
secrets
tools
updates
userContent
users
war
workflow-libs
workspace
.owner
audit-trail.xml
backup.log
backup.xml
com.smartcodeltd.jenkinsci.plugins.buildmonitor.BuildMonitorView.xml
config.xml
github-plugin-configuration.xml
hudson.maven.MavenModuleSet.xml
hudson.model.UpdateCenter.xml
hudson.plugins.build_timeout.operations.BuildStepOperation.xml
hudson.plugins.copyartifact.TriggeredBuildSelector.xml
hudson.plugins.disk_usage.DiskUsageProjectActionFactory.xml
hudson.plugins.disk_usage.DiskUsageProperty.xml
hudson.plugins.emailext.ExtendedEmailPublisher.xml
hudson.plugins.git.GitSCM.xml
hudson.plugins.git.GitTool.xml
hudson.plugins.gradle.Gradle.xml
hudson.plugins.promoted_builds.GlobalBuildPromotedBuilds.xml
hudson.plugins.sonar.MsBuildSQRunnerInstallation.xml
hudson.plugins.sonar.SonarGlobalConfiguration.xml
hudson.plugins.sonar.SonarRunnerInstallation.xml
hudson.plugins.timestamper.TimestamperConfig.xml
hudson.scm.SubversionSCM.xml
hudson.tasks.Ant.xml
hudson.tasks.Mailer.xml
hudson.tasks.Maven.xml
hudson.tasks.Shell.xml
hudson.triggers.SCMTrigger.xml
identity.key.enc
jenkins.CLI.xml
jenkins.install.InstallUtil.lastExecVersion
jenkins.install.UpgradeWizard.state
jenkins.metrics.api.MetricsAccessKey.xml
jenkins.model.ArtifactManagerConfiguration.xml
jenkins.model.DownloadSettings.xml
jenkins.model.JenkinsLocationConfiguration.xml
jenkins.mvn.GlobalMavenConfig.xml
jenkins.security.QueueItemAuthenticatorConfiguration.xml
jenkins.security.UpdateSiteWarningsConfiguration.xml
nodeMonitors.xml
org.jenkinsci.plugins.conditionalbuildstep.singlestep.SingleConditionalBuilder.xml
org.jenkinsci.plugins.docker.commons.tools.DockerTool.xml
org.jenkinsci.plugins.gitclient.JGitApacheTool.xml
org.jenkinsci.plugins.gitclient.JGitTool.xml
org.jenkinsci.plugins.pipeline.modeldefinition.config.GlobalConfig.xml
org.jenkinsci.plugins.workflow.flow.FlowExecutionList.xml
org.jenkinsci.plugins.workflow.libs.GlobalLibraries.xml
org.quality.gates.jenkins.plugin.GlobalConfig.xml
queue.xml
queue.xml.bak
scriptApproval.xml
secret.key
secret.key.not-so-secret
```

2. The following are some important files and directories in the `JENKINS_HOME` directory:

`config.xml`	Jenkins root configuration file
fingerprints	It stores fingerprint records, if any
plugins	It is a root directory for all Jenkins plugins
jobs	It is a root directory for all Jenkins jobs
logs	It stores all log files
secrets	It is a root directory for the secret + key for credential decryption
users	It stores all user-related details in Jenkins
war	It stores all details related to the `JENKINS_WAR` file
workspace	It stores all the files and artifacts related to different build jobs, and it moves content to jobs directory when archiving elements.

See also

In the `JENKINS_HOME` directory, open `config.xml` in any of the text editors and review the options available in the file.

Using different ports for Jenkins

By default, Jenkins runs on port number `8080`.

Getting ready

There are scenarios where Tomcat is running on `8080`, or any other application is running on `8080` port. In such cases, to avoid port conflicts you need to change the Jenkins port.

How to do it...

Let's change a port on which Jenkins runs:

1. If you run Jenkins using the command line, then you can execute a command such as `java -jar -httpPort=9999 jenkins.war` to change the existing port from `8080` to `9999`.
2. Another way to change the port while Jenkins is installed using the Windows package is as follows:
   - Go to the `Program Files/Jenkins` directory where you installed Jenkins
   - Open the `Jenkins.xml` in the editor
   - Find "`--httpPort=8080`" and replace the port `8080` with the new port number

How it works...

First, you installed a virtual image of Ubuntu, changed the password so that it is harder for others to log in, and updated the guest OS for security patches.

Configuring JAVA_HOME in Jenkins

Jenkins is an open source automation server that can be used to configure Continuous Integration for projects written in many programming languages. Let's consider the case of an application that is Java-based.

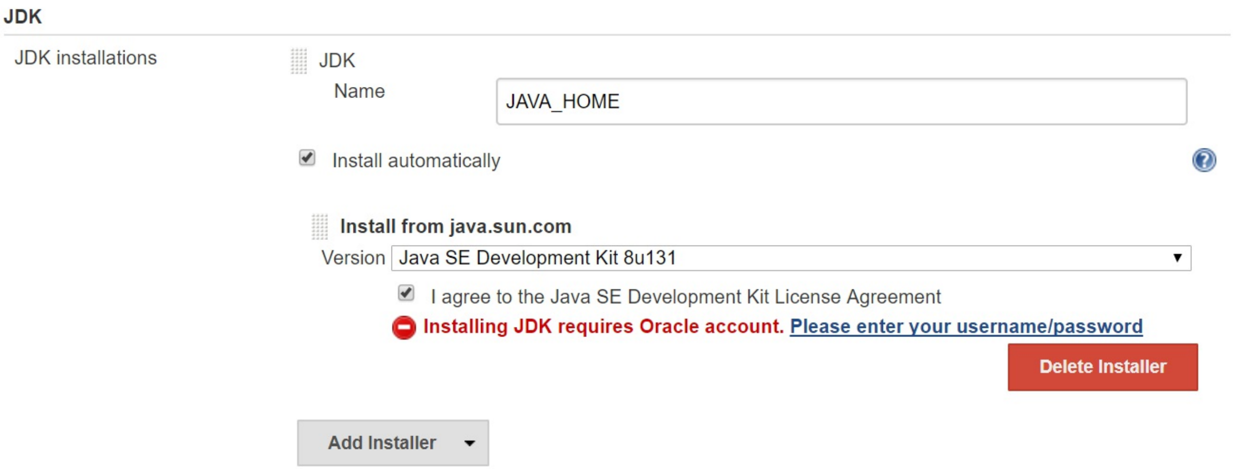
We need to tell Jenkins where Java is installed.

Getting ready

Download the required Java version based on the requirements of an application, or install automatically.

How to do it...

1. Open the Jenkins dashboard.
2. Go to Manage Jenkins.
3. Go to Global Tool Configuration to configure tools, their locations, and automatic installers.
4. Go to the JDK section.
5. Give the Name and tick the Install automatically option; provide details for the Oracle account to download JDK successfully.
6. You can give a logical name such as `JDK 1.7` or `JDK 1.8` to identify the correct version while configuring a build job.
7. You can add multiple JDKs based on the version, so if different applications require different JDKs then the scenario can be managed easily by adding JDK in Jenkins:



JDK

JDK installations

JDK

Name: JAVA_HOME

☑ Install automatically

Install from java.sun.com

Version: Java SE Development Kit 8u131

☑ I agree to the Java SE Development Kit License Agreement

Installing JDK requires Oracle account. Please enter your username/password

How it works...

When you create a build job in Jenkins and configure it, you need to specify the Java version that will be used by the build execution. You can use existing Java available on the system as well if you don't want to install automatically.

In the general section of the build job, we can select a JDK from the list. This list contains all the JDKs that we have configured in the Global Tool Configuration.

Configuring Git in Jenkins

Jenkins can be integrated with many source code repositories, and Git is one of them. Let's consider the case of an application that is Java-based and the source code is stored in Git, Gitlab, and/or GitHub.

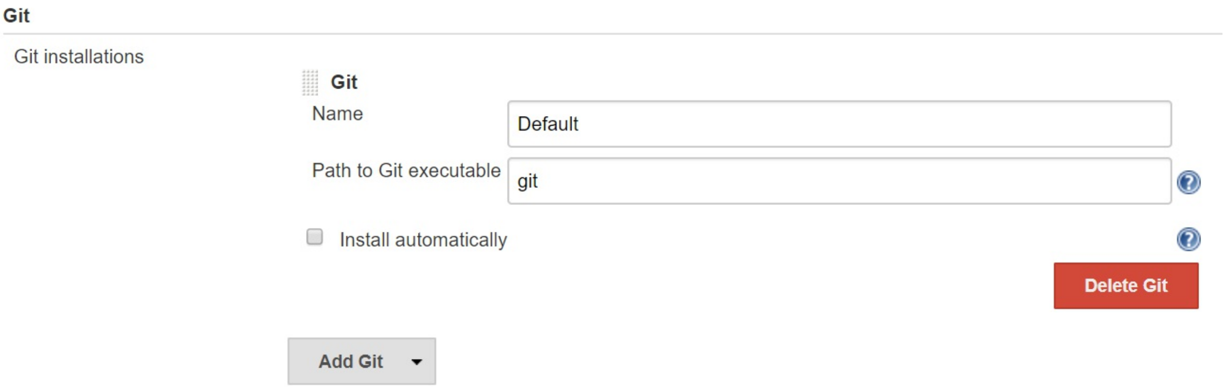
We need to tell Jenkins where Git is installed in the local system.

Getting ready

Download the required Git version based on the operating system, or install automatically.

How to do it...

1. Open the Jenkins dashboard.
2. Go to Manage Jenkins.
3. Go to Global Tool Configuration to configure the tools, their locations, and automatic installers.
4. Go to the Git section.
5. Give the Name and click on Install Automatically, or provide a path to Git.
6. You can add multiple Gits based on the version or for the specific agent. You need to give a meaningful name so it can be identified easily while configuring the build job:



Git

Git installations

Git

Name: Default

Path to Git executable: git

□ Install automatically

How it works...

When you create a build job in Jenkins and configure it, you need to specify the Git version that will be used by the build execution. You can use existing Git installation available on the system as well if you don't want to install automatically.

In the Source Code Management section, select the appropriate Git that is configured in Global Tool Configuration from the list.

Go to the Git executable configuration to change the Git installable.

Configuring ANT_HOME in Jenkins

Jenkins is an open source automation server that can be using to configure Continuous Integration for projects written in many programming languages. Let's consider the case of an application that is Java-based, and which has Ant as a build tool.

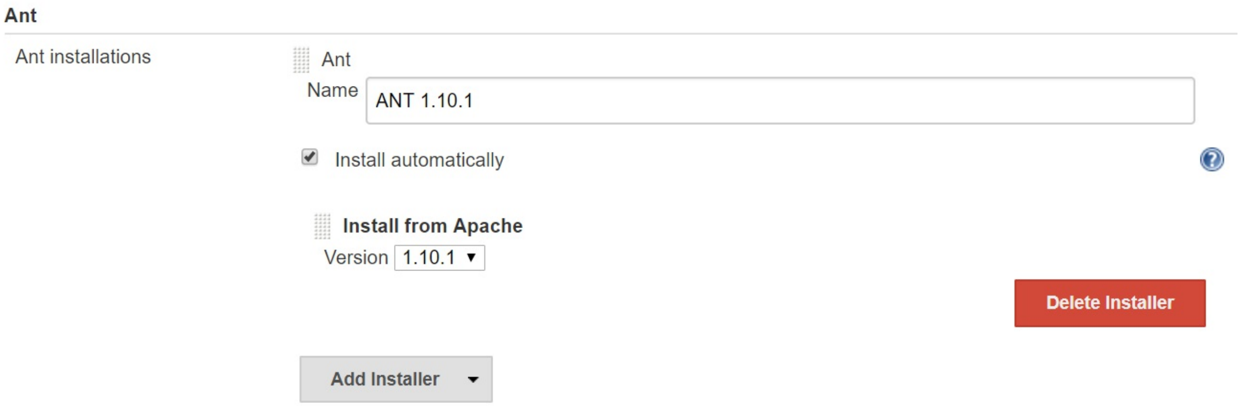
We need to tell Jenkins where the Ant installable directory is available.

Getting ready

Download the required Ant version or install automatically.

How to do it...

1. Open the Jenkins dashboard.
2. Go to Manage Jenkins.
3. Go to Global Tool Configuration to configure the tools, their locations, and automatic installers.
4. Go to the Ant section.
5. Give the Name and click on Install Automatically, or give the path to an existing location where the Ant installation is available.
6. You can give a logical name such as `ANT 1.10.1` or `ANT 1.9.1` to identify the correct version while configuring a build job.
7. You can add multiple Ants based on the version in Jenkins:



Ant

Ant installations

Ant

Name: ANT 1.10.1

☑ Install automatically

Install from Apache

Version: 1.10.1

How it works...

When you create a build job in Jenkins and configure it, you need to specify the Ant version that will be used by the build execution. You can use existing Ant installation available on the system as well if you don't want to install automatically.

Configuring MAVEN_HOME in Jenkins

Jenkins is an open source automation server that can be using to configure Continuous Integration for rojects written in many programming languages. Let's consider the case of an application that is Java-based and, which has Maven as a build tool.

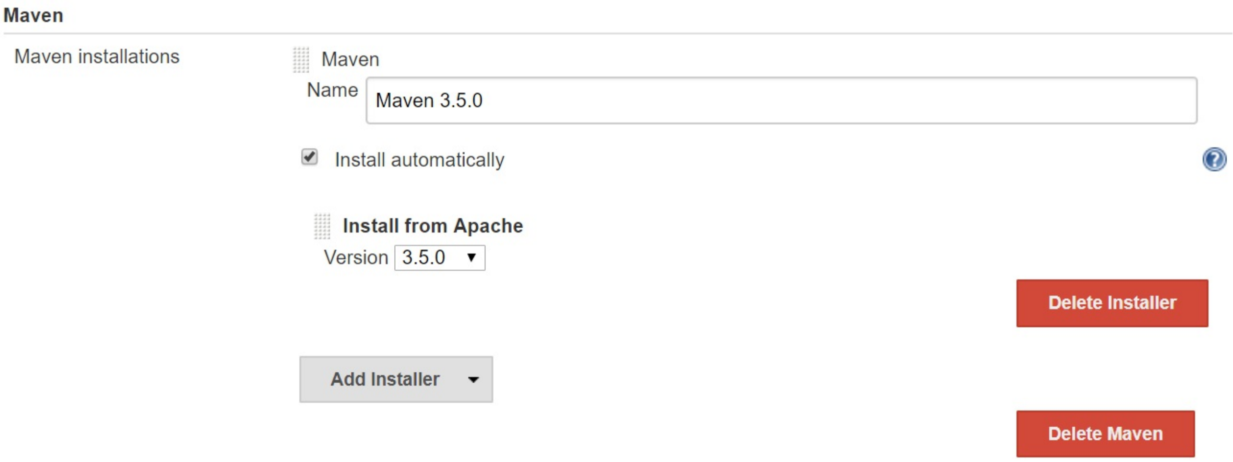
We need to tell Jenkins where the Maven installable directory is available.

Getting ready

Download the required Maven version or install automatically.

How to do it...

1. Open the Jenkins dashboard.
2. Go to Manage Jenkins.
3. Go to Global Tool Configuration to configure the tools, their locations, and automatic installers.
4. Go to the Maven section.
5. Give the Name and click on Install Automatically, or give the path to the existing location where the Maven installation is available.
6. You can give a logical name such as `Maven 3.5.0` or `Maven 3.4.0` to identify the correct version while configuring a build job:



Maven

Maven installations

Maven

Name: Maven 3.5.0

☑ Install automatically

Install from Apache

Version: 3.5.0

7. You can add multiple Mavens based on the version in Jenkins.

How it works...

When you create a build job in Jenkins and configure it, you need to specify the Maven version that will be used by the build execution. You can use existing Maven installation available on the system as well if you don't want to install automatically.

Configuring GRADLE_HOME in Jenkins

Jenkins is an open source automation server that can be using to configure Continuous Integration for projects written in many programming languages. Let's consider the case of an application that is Android-based, and which has Gradle as a build tool.

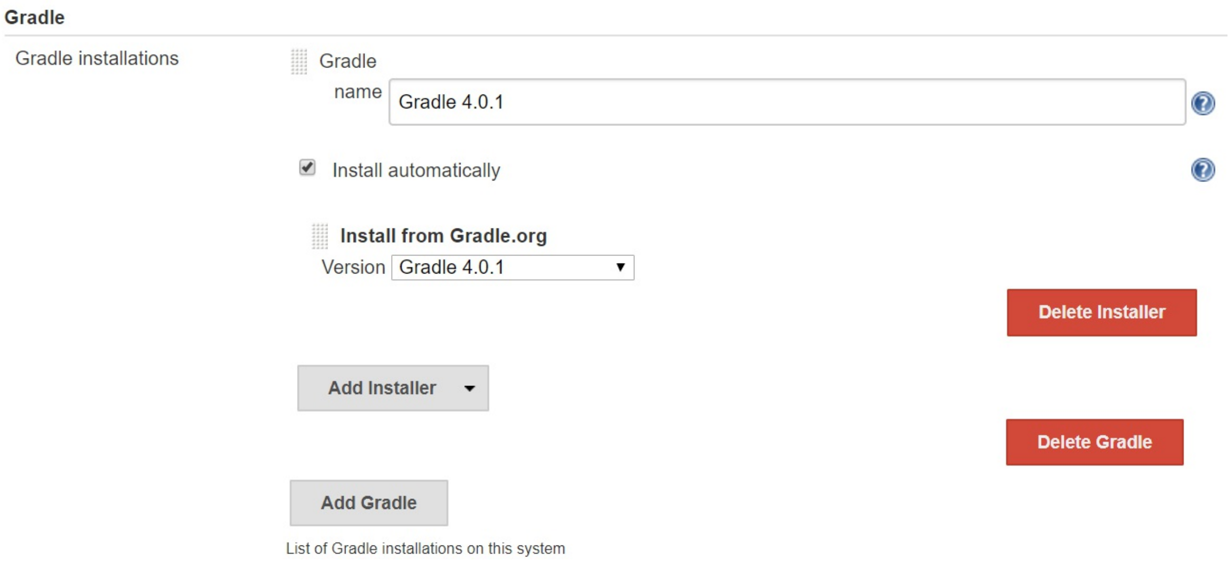
We need to tell Jenkins where the Gradle installable directory is available.

Getting ready

Download the required Gradle version or install automatically.

How to do it...

1. Open the Jenkins dashboard.
2. Go to Manage Jenkins.
3. Go to Global Tool Configuration to configure the tools, their locations, and automatic installers.
4. Go to the Gradle section.
5. Give the Name and click on Install Automatically,
   or give the path to the existing location where the Gradle installation is available.
6. You can give a logical name such as `Gradle 4.0.1` or `Gradle 4.0.0` to identify the correct version while configuring a build job:



Gradle

Gradle installations

Gradle

name: Gradle 4.0.1

☑ Install automatically

Install from Gradle.org

Version: Gradle 4.0.1

List of Gradle installations on this system

7. You can add multiple Gradles based on the version in Jenkins.

How it works...

When you create a build job in Jenkins and configure it, you need to specify the Gradle version that will be used by the build execution. You can use existing Gradle installation available on the system as well if you don't want to install automatically.

Creating a Freestyle job for Ant Project

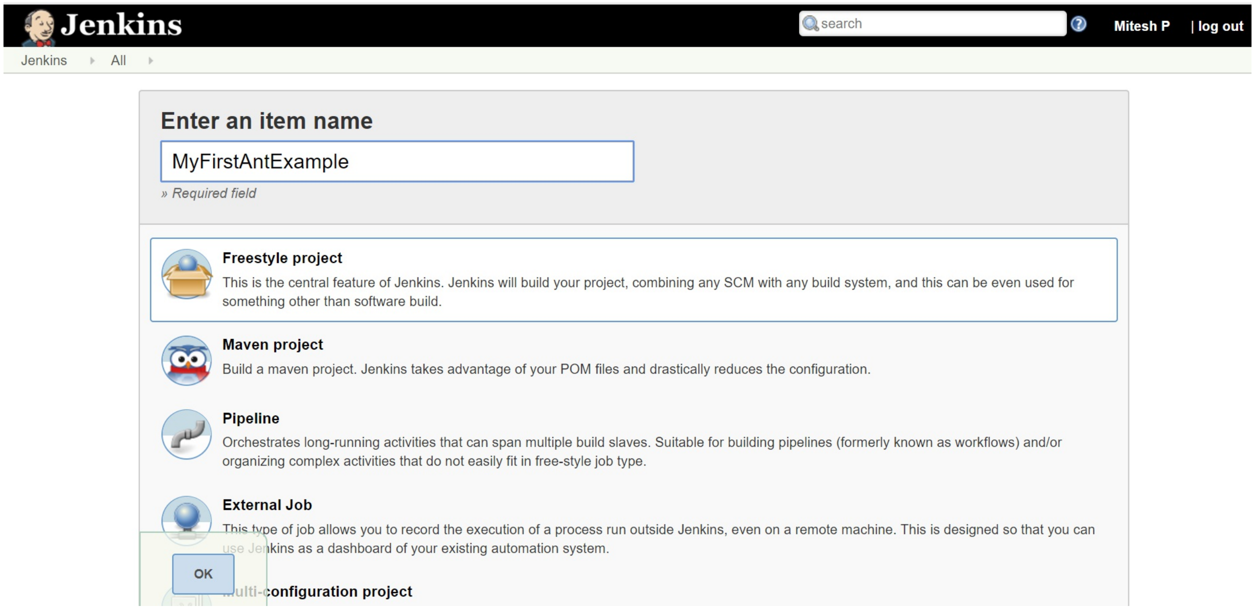
A build job is a basic execution unit in Jenkins. We can perform many actions using build jobs. We can execute commands, send notifications, configure Continuous Integration, and so on.

Getting ready

You will need to configure tools based on the application, such as Ant, Gradle, Java, Git, and so on.

How to do it...

1. Open the Jenkins dashboard.
2. Click on New Item.
3. Enter an item name.
4. Select a template Freestyle project.
5. Click on OK:



Jenkins | search | Mitesh P | log out

Jenkins ▸ All ▸

Enter an item name

MyFirstAntExample

» Required field

Freestyle project
This is the central feature of Jenkins. Jenkins will build your project, combining any SCM with any build system, and this can be even used for something other than software build.

Maven project
Build a maven project. Jenkins takes advantage of your POM files and drastically reduces the configuration.

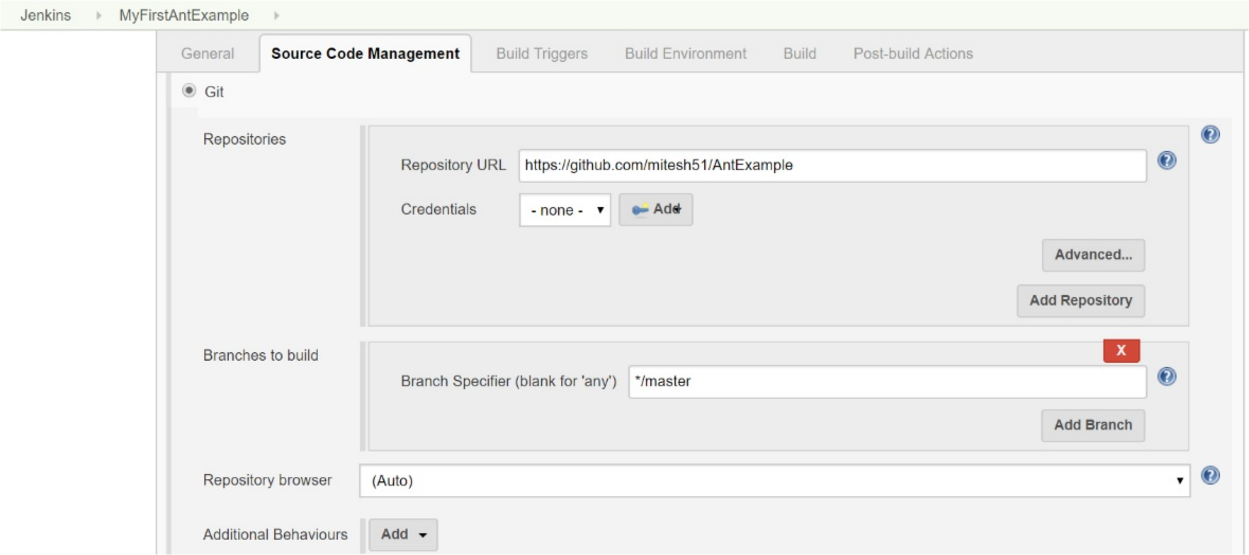
Pipeline
Orchestrates long-running activities that can span multiple build slaves. Suitable for building pipelines (formerly known as workflows) and/or organizing complex activities that do not easily fit in free-style job type.

External Job
This type of job allows you to record the execution of a process run outside Jenkins, even on a remote machine. This is designed so that you can use Jenkins as a dashboard of your existing automation system.

OK

Multi-configuration project

6. Go to the Source Code Management section and select Git.
7. Provide the Repository URL.
8. Provide Credentials, as demonstrated in the next screenshot:



Jenkins ▸ MyFirstAntExample ▸

General | **Source Code Management** | Build Triggers | Build Environment | Build | Post-build Actions

● Git

Repositories

Repository URL: https://github.com/mitesh51/AntExample

Credentials: - none - ▾ | Add

Advanced... | Add Repository

Branches to build

Branch Specifier (blank for 'any'): */master

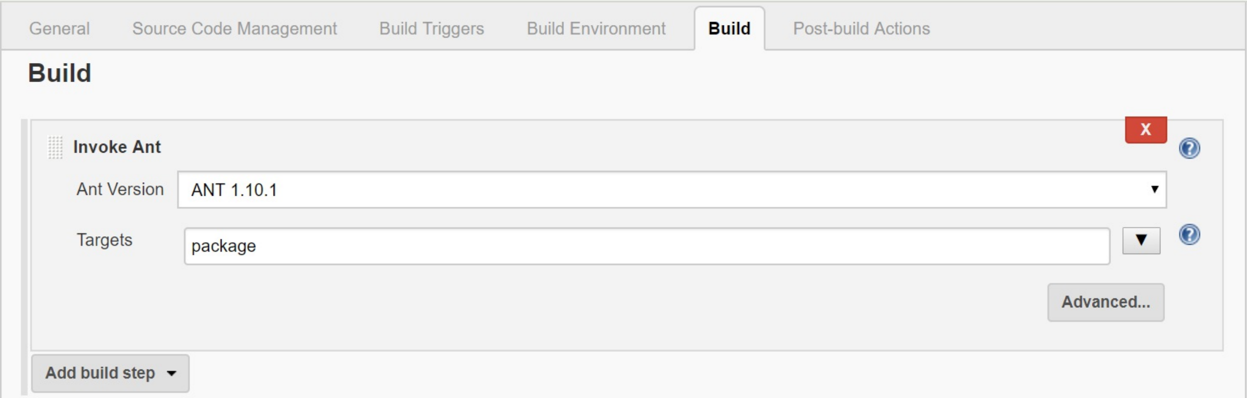
X | Add Branch

Repository browser: (Auto) ▾

Additional Behaviours: Add ▾

9. In the Build section, click on the Add build step and select Invoke Ant.
10. Select the Ant name based on our Global Tool Configuration.
11. Provide Targets. In Ant, we can give a target based on the targets defined in the `build.xml`

file:



Build

Invoke Ant

Ant Version: ANT 1.10.1

Targets: package

12. Click on Save.

How it works...

When you go to the Build Job page and click on Build now, it will execute the build based on the configuration.

Creating a Maven Job for Maven Project

A build job is a basic execution unit in Jenkins. We can perform many actions using build jobs. We can execute commands, send notifications, configure Continuous Integration, and so on.

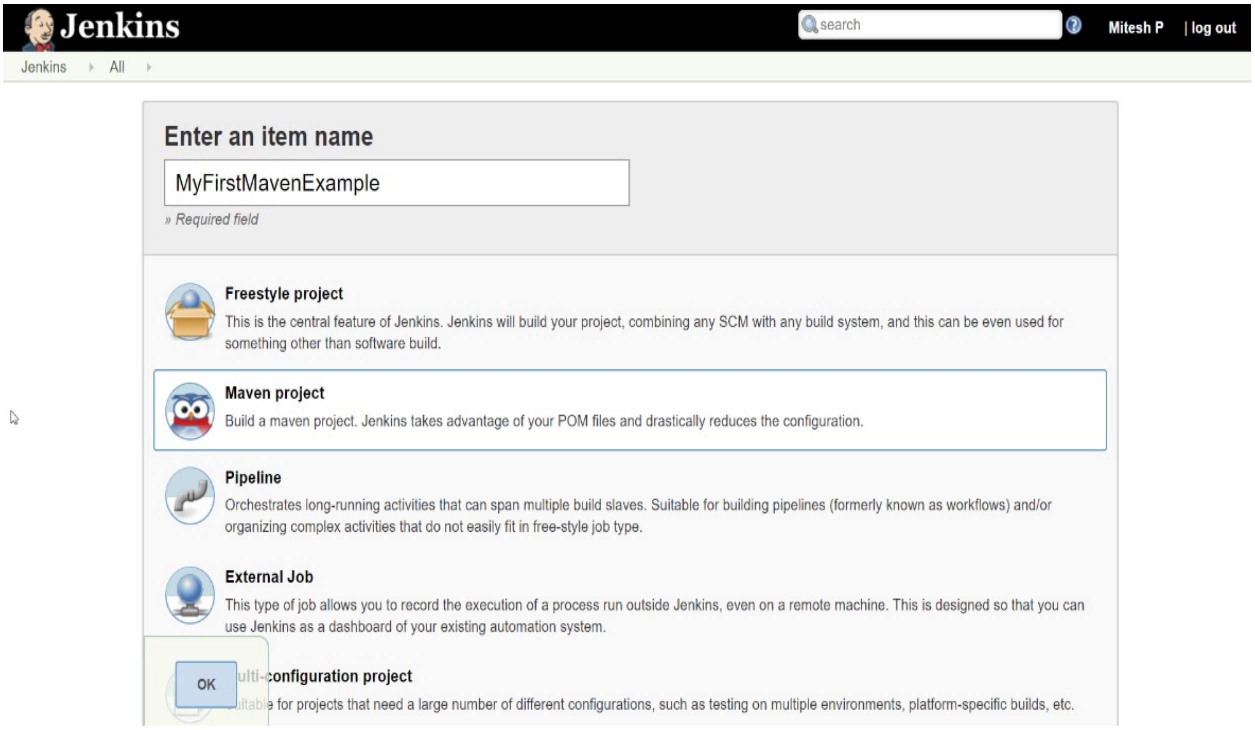
Getting ready

You will need to configure the tools based on the application, such as Maven, Java, Git, and so on.

How to do it...

1. Open the Jenkins dashboard.
2. Click on New Item.
3. Enter an item name.
4. Select a template Maven project.

5. Click on OK:



Enter an item name

MyFirstMavenExample

» Required field

Freestyle project

This is the central feature of Jenkins. Jenkins will build your project, combining any SCM with any build system, and this can be even used for something other than software build.

Maven project

Build a maven project. Jenkins takes advantage of your POM files and drastically reduces the configuration.

Pipeline

Orchestrates long-running activities that can span multiple build slaves. Suitable for building pipelines (formerly known as workflows) and/or organizing complex activities that do not easily fit in free-style job type.

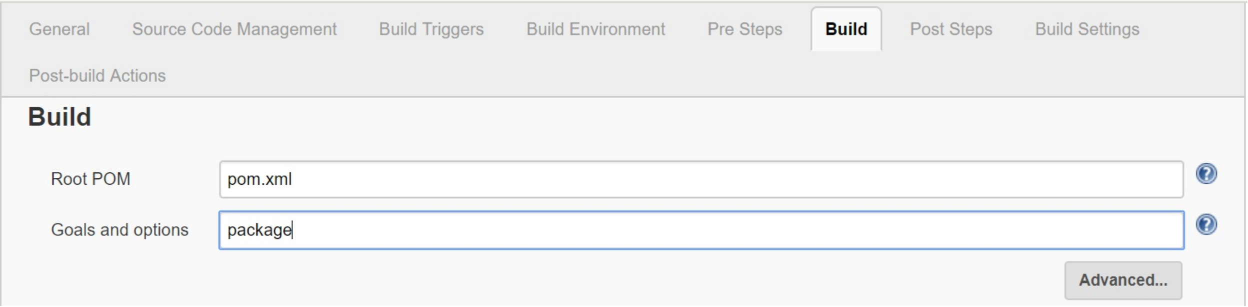
External Job

This type of job allows you to record the execution of a process run outside Jenkins, even on a remote machine. This is designed so that you can use Jenkins as a dashboard of your existing automation system.

ulti-configuration project

itable for projects that need a large number of different configurations, such as testing on multiple environments, platform-specific builds, etc.

6. Go to the Source Code Management section and select Git.
7. Provide the Repository URL.
8. Provide Credentials.
9. In the Build section, the Root POM name will be already available.
10. Maven has its own set of goals and we can execute any one of those goals based on requirements. These steps are demonstrated in this next screenshot:



Build

Root POM: pom.xml

Goals and options: package

11. Click on Save.

How it works...

When you go to the Build Job page and click on Build now, it will execute the build based on the configuration.

Management and Monitoring of Jenkins

In this chapter, we will cover the following recipes:

- Understanding master/agent architecture
- Managing Jenkins Build jobs using Eclipse
- Backing up and restoring Jenkins
- Command line options in Jenkins using Jenkins CLI
- Modifying the Jenkins configuration from the command line
- Managing disk usage
- Shutting down Jenkins safely
- Monitoring Jenkins with JavaMelody
- Monitoring Jenkins job using Build Monitor View
- Configuring mail notifications
- Signaling the need to archive

Understanding master/agent architecture

Jenkins supports the master/agent architecture. In master/agent architecture, we can install Jenkins on master and then utilize other agents for distributing the load.

We shoulddelegate Jenkins jobs to agents for execution. This way, we can support multiple executions using different resources.

There are specific scenarios where master/agent architecture is extremely useful, such as following:

- The Jenkins machine has limited capacity; even with the higher capacity, there will be a time where it can't fulfil all requests. By distributing the load on agent nodes, we can free resources available on the system where Jenkins is installed.
- Different jobs require different kinds of resources, and they are restricted to specific machines only. In such a case, we can only utilize that machine and it is not possible to configure it on a system where Jenkins is installed, so it's often better to utilize that machine as an agent.
- Different operating systems are required or some tools work only in specific OS, so we can utilize those tools by making a system agent on which they are installed.
- To avoid a single point of failure by installing each and every tool on the Jenkins machine.

Murphy as a friend:

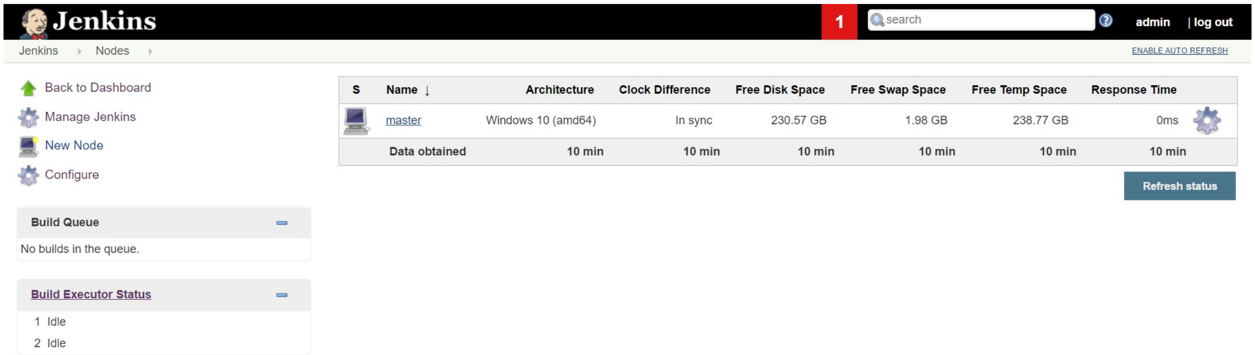
You should assume the worst for all of the recipes in this book: aliens attacking, coffee on the motherboard, cats eating your cable, the cable eating the cat, and so on. Make sure that you are using a test Jenkins instance.

Getting ready

The important thing here is we don't install Jenkins on any agent nodes at all. We only install Jenkins on master and utilize that Jenkins for orchestrating master/agent architecture.

Just to note: on whichever system we install Jenkins, it becomes the master. Just verify that by navigating to Manage Jenkins | Manage Nodes.

1. Navigate to Manage Jenkins | Manage Nodes and click on New Node:

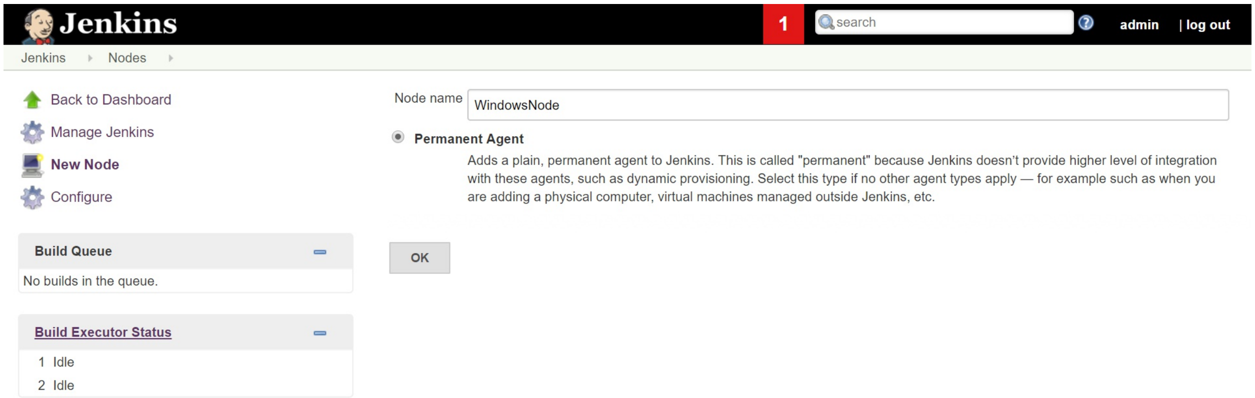


S	Name ↓	Architecture	Clock Difference	Free Disk Space	Free Swap Space	Free Temp Space	Response Time
	master	Windows 10 (amd64)	In sync	230.57 GB	1.98 GB	238.77 GB	0ms
	Data obtained	10 min	10 min	10 min	10 min	10 min	10 min

No builds in the queue.

1 Idle
2 Idle

2. Give the Node name and select Permanent Agent; click OK:



Node name: WindowsNode

● Permanent Agent

Adds a plain, permanent agent to Jenkins. This is called "permanent" because Jenkins doesn't provide higher level of integration with these agents, such as dynamic provisioning. Select this type if no other agent types apply — for example such as when you are adding a physical computer, virtual machines managed outside Jenkins, etc.

No builds in the queue.

1 Idle
2 Idle

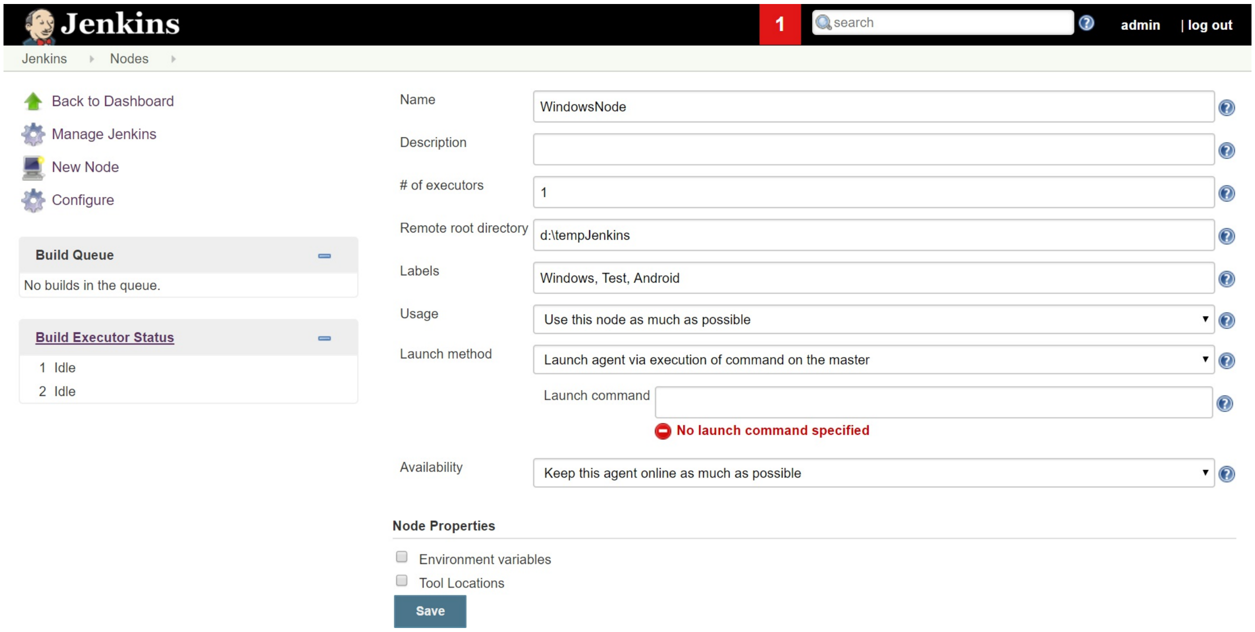
How to do it...

1. Jenkins stable and more recent versions are available in a YUM repository. Following is a table that provides details for configuration of Agents:

# of executors	• Here, we can specify the number of concurrent builds that Jenkins may execute on this agent node. • Agents must have at least one executor, and in case we don't want any execution, then we can configure this setting as 0.
Remote root directory	• An agent node requires us to have a directory dedicated to Jenkins. Specify the path to this directory on the agent. • Use an absolute path only. All job configurations, build logs, and artifacts are stored on the master. • Workspace is available on the agent node.
Labels	• Labels or tags can be utilized to group multiple agent nodes into a logical collection. • The best thing is that we can use this mechanism as a pool of resources to execute build jobs in Jenkins. • For example, we have multiple agents where a test infrastructure is set up. We have two or three projects whose automated testing is done by the QA team. • In such a scenario, we can provide the same `Test` label or tag it to all agent nodes where the test infrastructure is available and then assign the same `Test` label to those projects. • What this does is execute the build jobs on any one of the Test agents with the `Test` label and not without it.
Usage	• This setting controls how Jenkins schedules builds on specific agent nodes. • Use this node as much as possible: This is the default setting where, most of the time, the `Agent` node will be utilized for job execution. • `Only build jobs with label expressions matching this node`: with this setting, Jenkins will execute a build on this agent node when the project is configured to execute on this node with a label expression.
Launch method	• This setting controls how Jenkins starts a specific agent node. • Launch agent via Java Web Start: Allows an agent to be launched using Java Web Start. • Launch agent via execution of command on the master by remotely executing a process on another machine, for example, via SSH or RSH. • Launch slave agents via SSH by sending commands over a secure SSH connection.

	• Let Jenkins control this Windows slave as a Windows service, as it starts a Windows slave with a remote management facility built into Windows.
Availability	• This setting controls when Jenkins starts and stops this agent. • Keep this agent online as much as possible. • Take this agent online and offline at specific times. • Take this agent online when in demand, and offline when idle.
Environment variables	• We can define agent node-specific environment variables here.
Tool locations	• We can define agent node-specific tool locations here.

2. Configure the settings and click on Save:



No builds in the queue.

1 Idle

2 Idle

Name: WindowsNode

Description:

# of executors: 1

Remote root directory: d:\tempJenkins

Labels: Windows, Test, Android

Usage: Use this node as much as possible

Launch method: Launch agent via execution of command on the master

Launch command:

No launch command specified

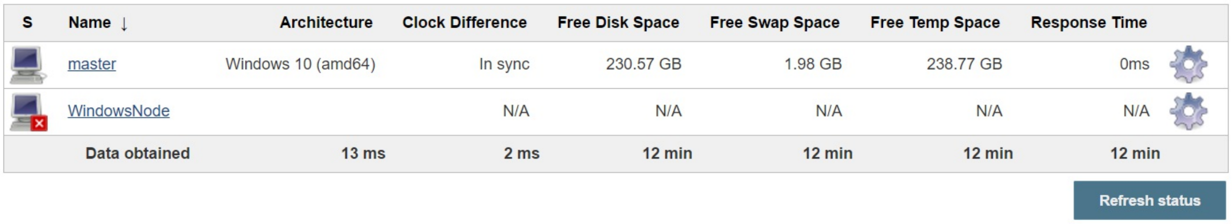
Availability: Keep this agent online as much as possible

Node Properties

□ Environment variables

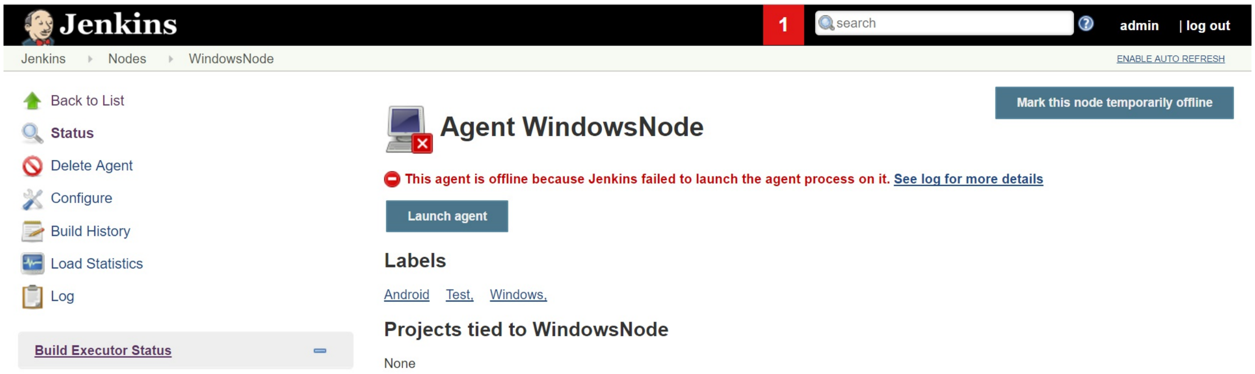
□ Tool Locations

3. We can see the newly created agent in the node list as disconnected. Click on it:



S	Name ↓	Architecture	Clock Difference	Free Disk Space	Free Swap Space	Free Temp Space	Response Time
	master	Windows 10 (amd64)	In sync	230.57 GB	1.98 GB	238.77 GB	0ms
	WindowsNode		N/A	N/A	N/A	N/A	N/A
	Data obtained	13 ms	2 ms	12 min	12 min	12 min	12 min

4. See the details available on the agent page. We are not able to start it:



Agent WindowsNode

This agent is offline because Jenkins failed to launch the agent process on it. See log for more details

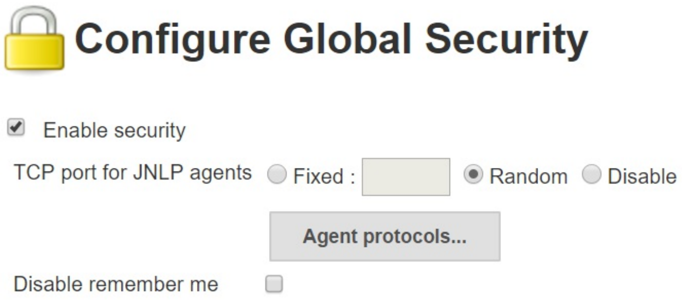
Labels

Android Test, Windows,

Projects tied to WindowsNode

None

5. Go to Manage Jenkins | Configure Global Security | Enable security. In the TCP port for the JNLP agents setting, select Random:
6. Click on Save:



Configure Global Security

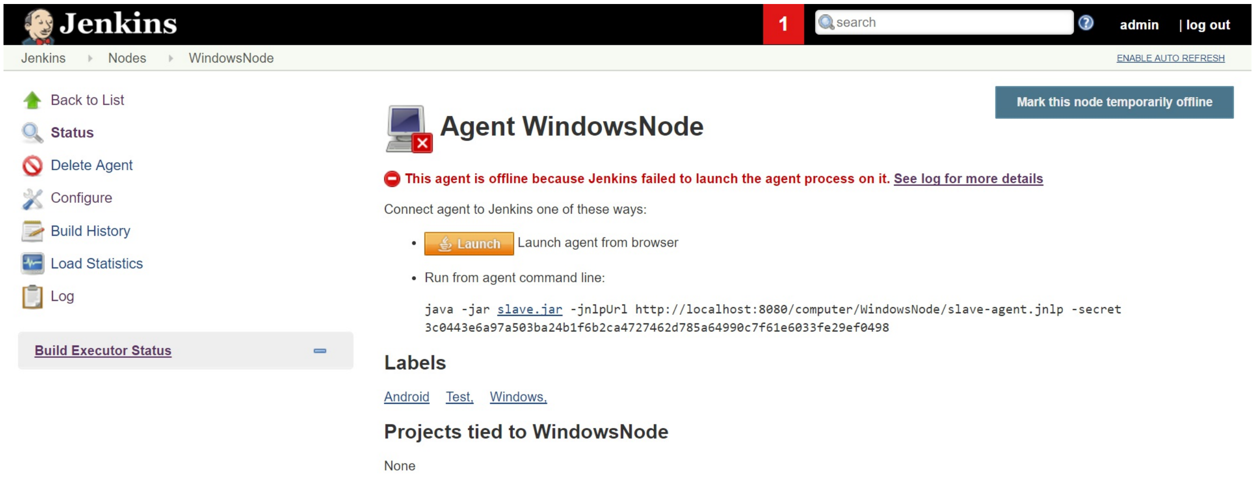
☑ Enable security

TCP port for JNLP agents ○ Fixed : ● Random ○ Disable

Agent protocols...

Disable remember me □

7. Go to the agent node again and execute the given command from the agent node's terminal or command line and then it should be connected:



Agent WindowsNode

This agent is offline because Jenkins failed to launch the agent process on it. See log for more details

Connect agent to Jenkins one of these ways:

- Launch Launch agent from browser
- Run from agent command line:

```
java -jar slave.jar -jnlpUrl http://localhost:8080/computer/WindowsNode/slave-agent.jnlp -secret
3c0443e6a97a503ba24b1f6b2ca4727462d785a64990c7f61e6033fe29ef0498
```

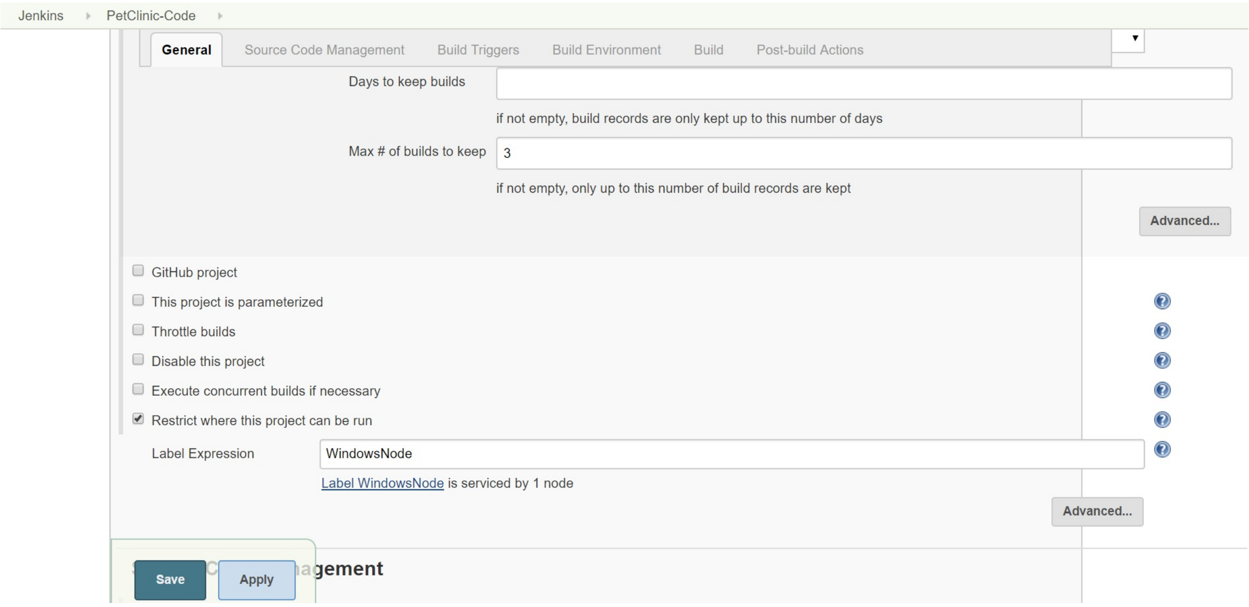
Labels

Android Test, Windows,

Projects tied to WindowsNode

None

8. To configure a job to a specific node, go to the build job and click on Configure.
9. In the General section, select Restrict where this project can be run and provide the label of the agent node that we have created:



Days to keep builds

if not empty, build records are only kept up to this number of days

Max # of builds to keep 3

if not empty, only up to this number of build records are kept

□ GitHub project

□ This project is parameterized

□ Throttle builds

□ Disable this project

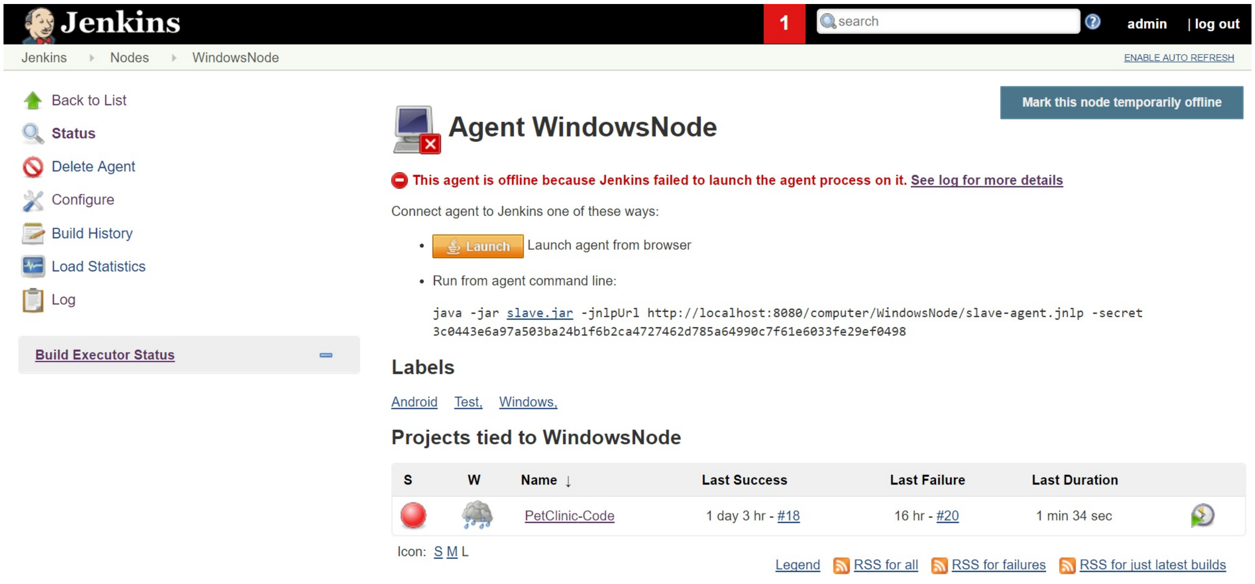
□ Execute concurrent builds if necessary

☑ Restrict where this project can be run

Label Expression WindowsNode

Label WindowsNode is serviced by 1 node

10. Go to Manage Nodes and select the agent node to verify the build job associated with it:



Agent WindowsNode

This agent is offline because Jenkins failed to launch the agent process on it. See log for more details

Connect agent to Jenkins one of these ways:

- Launch Launch agent from browser
- Run from agent command line:

```
java -jar slave.jar -jnlpUrl http://localhost:8080/computer/WindowsNode/slave-agent.jnlp -secret
3c0443e6a97a503ba24b1f6b2ca4727462d785a64990c7f61e6033fe29ef0498
```

Labels

Android Test, Windows,

Projects tied to WindowsNode

S	W	Name ↓	Last Success	Last Failure	Last Duration	
●		PetClinic-Code	1 day 3 hr - #18	16 hr - #20	1 min 34 sec	

Icon: S M L

Legend RSS for all RSS for failures RSS for just latest builds

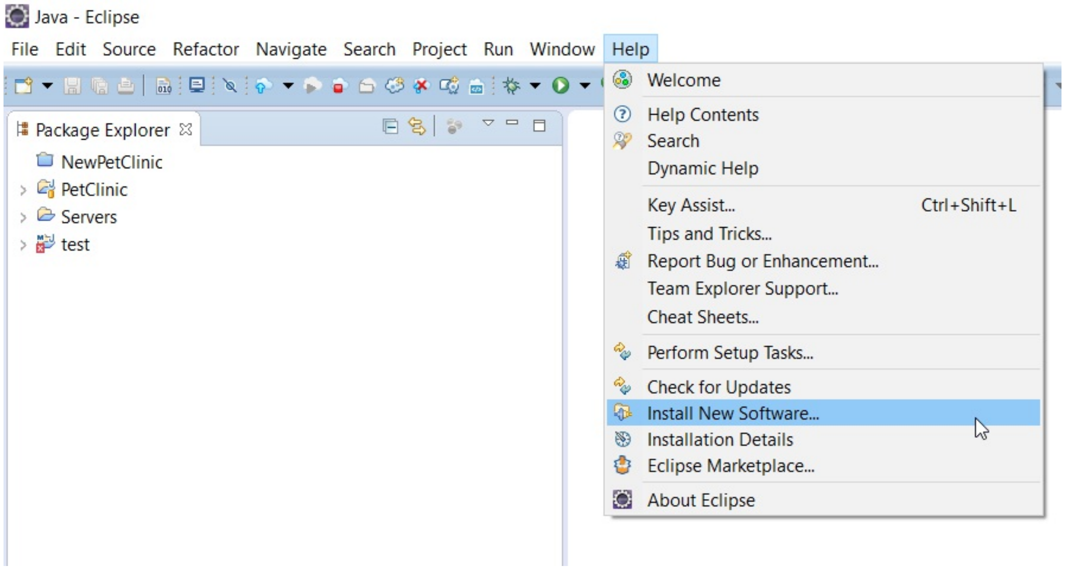
11. This is how we can create a master/agent architecture and distribute the load across agents with only one master available.

Managing Jenkins build jobs using Eclipse

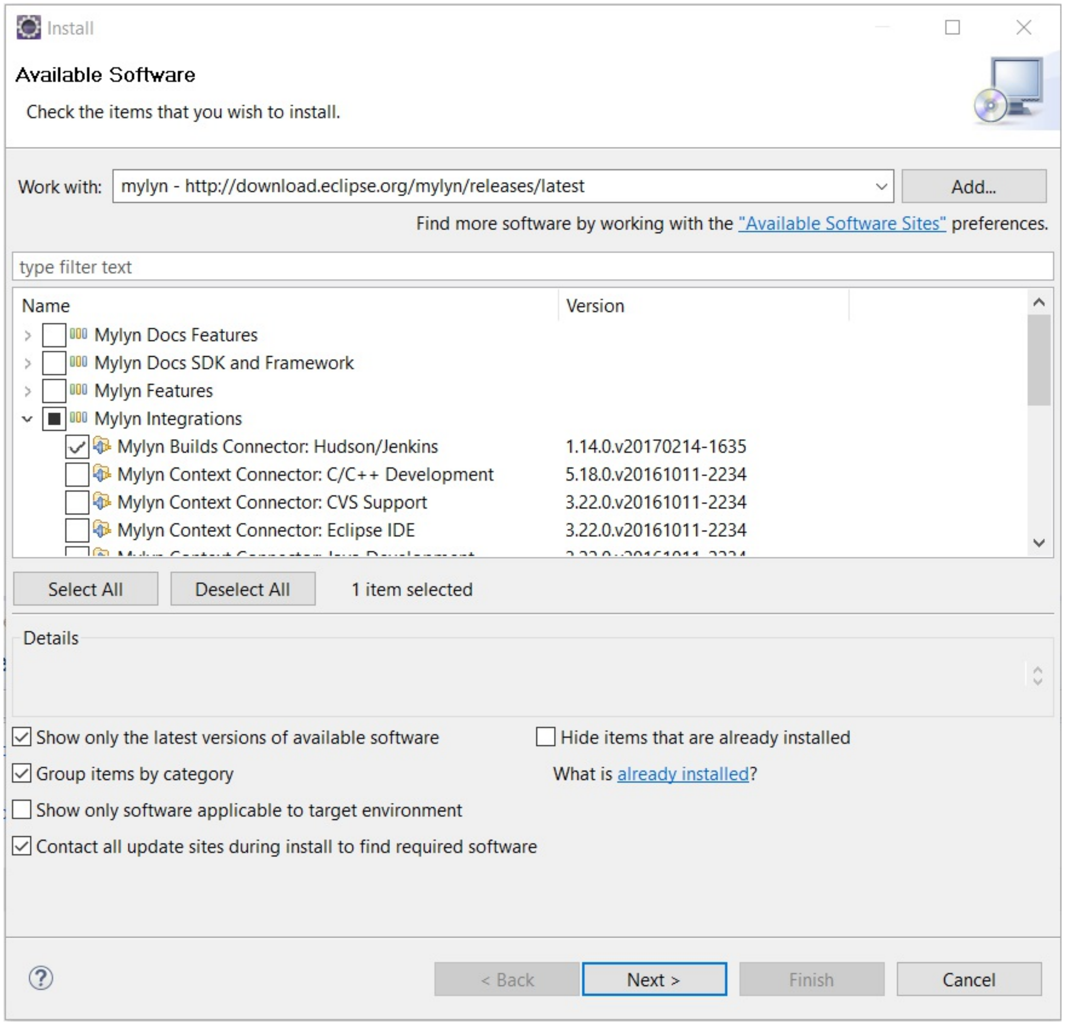
Can we execute a Jenkins job from Eclipse? Yes we can! So, let's see how to do that.

Getting ready

1. Go to Help | Install New Software...:



2. Add a site for Mylyn and click on Next >:



Available Software

Check the items that you wish to install.

Work with: mylyn - http://download.eclipse.org/mylyn/releases/latest

Find more software by working with the "Available Software Sites" preferences.

type filter text

Name	Version
☐ Mylyn Docs Features	
☐ Mylyn Docs SDK and Framework	
☐ Mylyn Features	
■ Mylyn Integrations	
☑ Mylyn Builds Connector: Hudson/Jenkins	1.14.0.v20170214-1635
☐ Mylyn Context Connector: C/C++ Development	5.18.0.v20161011-2234
☐ Mylyn Context Connector: CVS Support	3.22.0.v20161011-2234
☐ Mylyn Context Connector: Eclipse IDE	3.22.0.v20161011-2234
☐ Mylyn Context Connector: Java Development	3.22.0.v20161011-2234

1 item selected

Details

☑ Show only the latest versions of available software

☐ Hide items that are already installed

☑ Group items by category

What is already installed?

☐ Show only software applicable to target environment

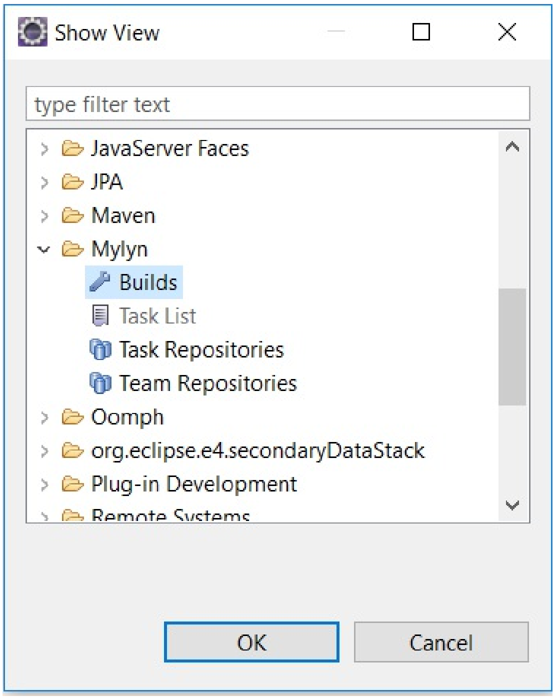
☑ Contact all update sites during install to find required software

3. Review the items to be installed and click on Next >.
4. Accept the terms of the license agreement and then click on Finish. It will start installing the `Mylyn` package.
5. Once it is finished, Restart Eclipse.

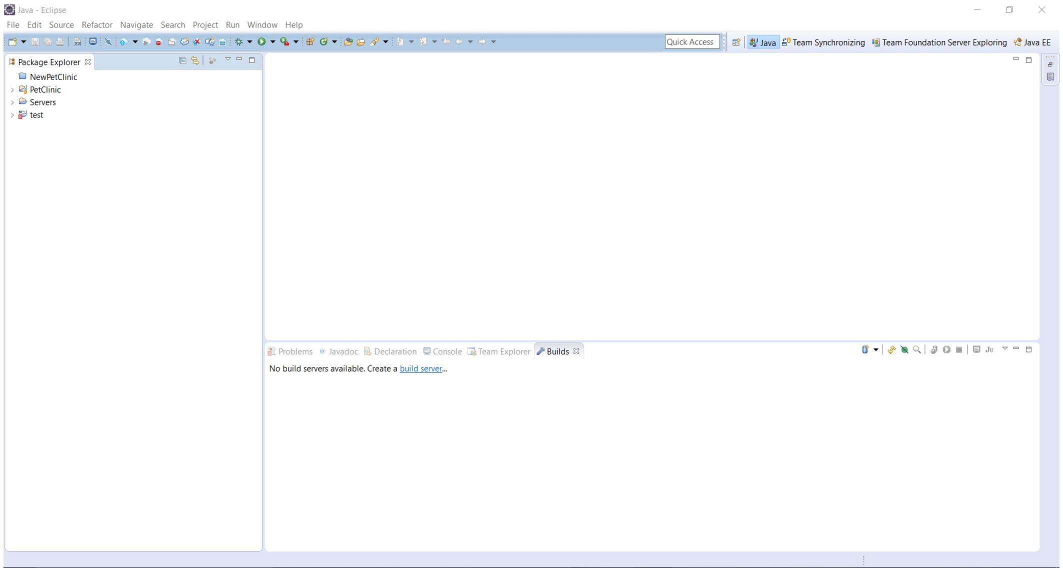
How to do it...

Let's see how to trigger a Jenkins build from Eclipse.

1. In the Windows menu, click on Views.
2. Select Mylyn and click on Builds. Then, click OK:



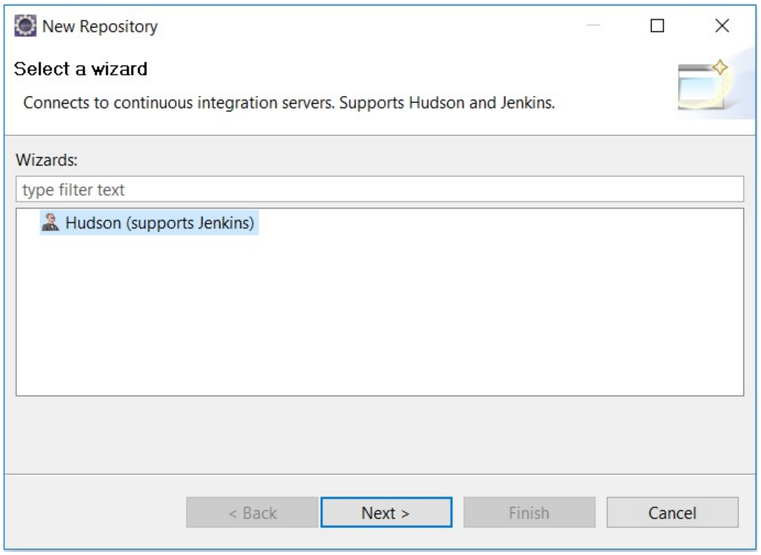
3. In the Builds section, click on the build server link:



No build servers available. Create a build server...

Eclipse in Java View

4. Select Hudson (supports Jenkins) and click on Next >:



New Repository

Select a wizard

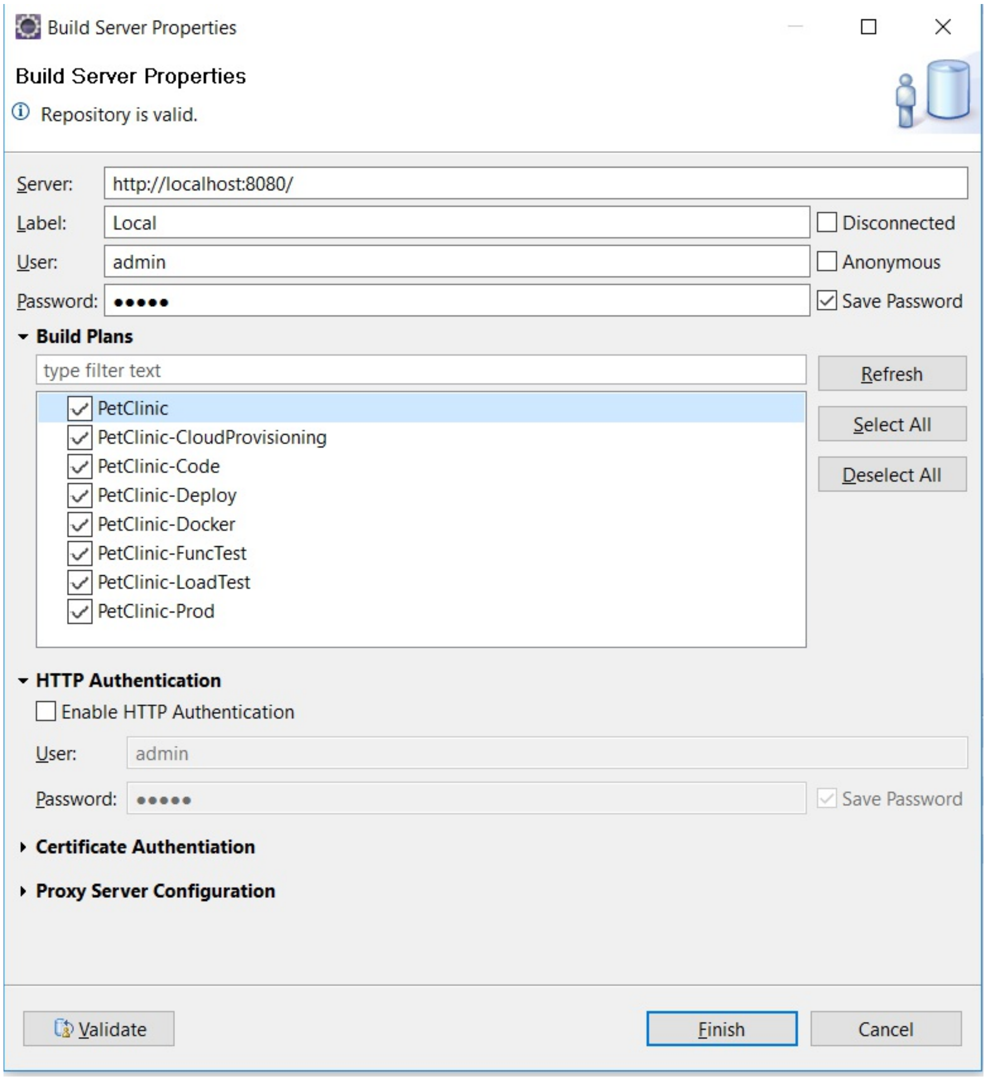
Connects to continuous integration servers. Supports Hudson and Jenkins.

Wizards:

type filter text

Hudson (supports Jenkins)

5. Provide the Server details. Provide the User and Password. Then, click Finish:



Build Server Properties

Build Server Properties

ⓘ Repository is valid.

Server: http://localhost:8080/

Label: Local □ Disconnected

User: admin □ Anonymous

Password: ●●●●● ☑ Save Password

Build Plans

type filter text

☑ PetClinic
☑ PetClinic-CloudProvisioning
☑ PetClinic-Code
☑ PetClinic-Deploy
☑ PetClinic-Docker
☑ PetClinic-FuncTest
☑ PetClinic-LoadTest
☑ PetClinic-Prod

HTTP Authentication

□ Enable HTTP Authentication

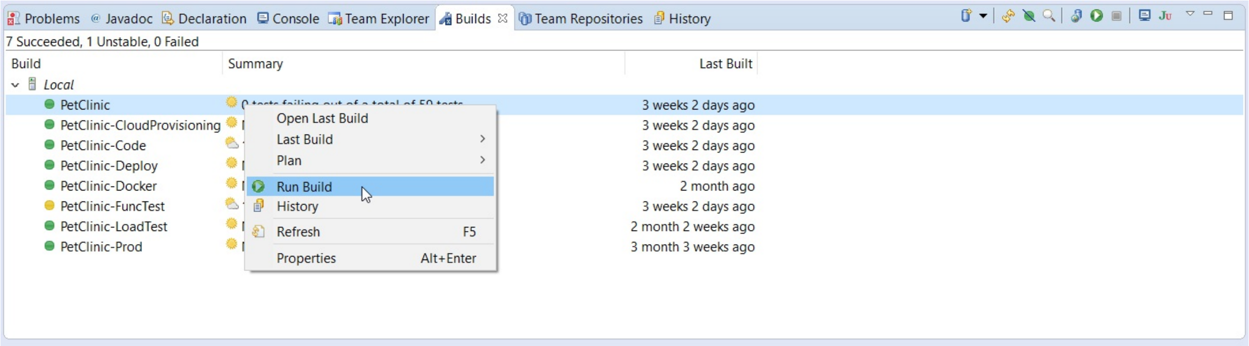
User: admin

Password: ●●●●● ☑ Save Password

Certificate Authentiation

Proxy Server Configuration

6. Find the list of jobs in the Build section, shown as follows. Select any job and click on Run Build to execute it from Eclipse:



7 Succeeded, 1 Unstable, 0 Failed

Build	Summary	Last Built
Local		
PetClinic	0 tests failing out of a total of 50 tests	3 weeks 2 days ago
PetClinic-CloudProvisioning		3 weeks 2 days ago
PetClinic-Code		3 weeks 2 days ago
PetClinic-Deploy		3 weeks 2 days ago
PetClinic-Docker		2 month ago
PetClinic-FuncTest		3 weeks 2 days ago
PetClinic-LoadTest		2 month 2 weeks ago
PetClinic-Prod		3 month 3 weeks ago

7. Try other options as an exercise.

Backing up and restoring Jenkins

A core task for the smooth running of Jenkins is the scheduled backing up of its home directory. This is not necessarily all the artifacts, but is at least its configuration and the history of testing, which plugins will need to make reports.

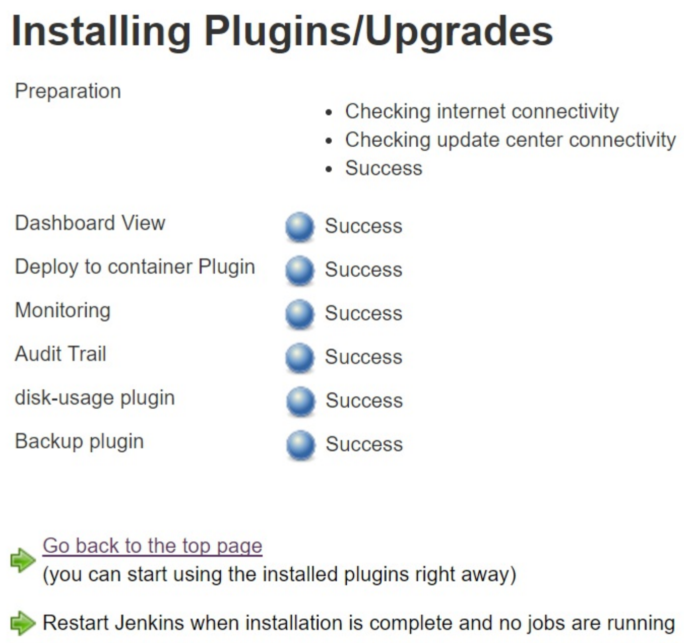
Backups are not interesting unless you can also restore. There is a wide range of stories on this subject. My favorite (and I won't name the well-known company involved) is that, sometime in the early 70's, a company bought a very expensive piece of software and a tape backup facility to back up all the marketing results being harvested through their mainframes. However, not everything was automated. Every night, a tape needed to be moved into a specific slot. A poorly paid worker was allocated the task. For a year, the worker would professionally fulfill the task. One day, a failure occurred and a backup was required. The backup failed to restore. The reason was that the worker also needed to press the record button every night, but this was not mentioned in the tasks assigned to him. There was a failure to regularly test the restore process. The process failed, not the poorly paid person. Hence, through learning lessons from history, this recipe describes both backup and restore.

The rapid evolution of plugins and the validity of recipes:

Plugins improve aggressively and you may need to update them weekly. Although it is unlikely that the core configuration will change, it is quite likely that extra options will be added, increasing the variables that you input in the GUI. Therefore, the screenshots shown in this book may be slightly different from the most modern version, but the recipes should remain intact.

Getting ready

Let's now install the all-important plugins required for the following sections at once:



Installing Plugins/Upgrades

Preparation

- Checking internet connectivity
- Checking update center connectivity
- Success

Dashboard View	● Success
Deploy to container Plugin	● Success
Monitoring	● Success
Audit Trail	● Success
disk-usage plugin	● Success
Backup plugin	● Success

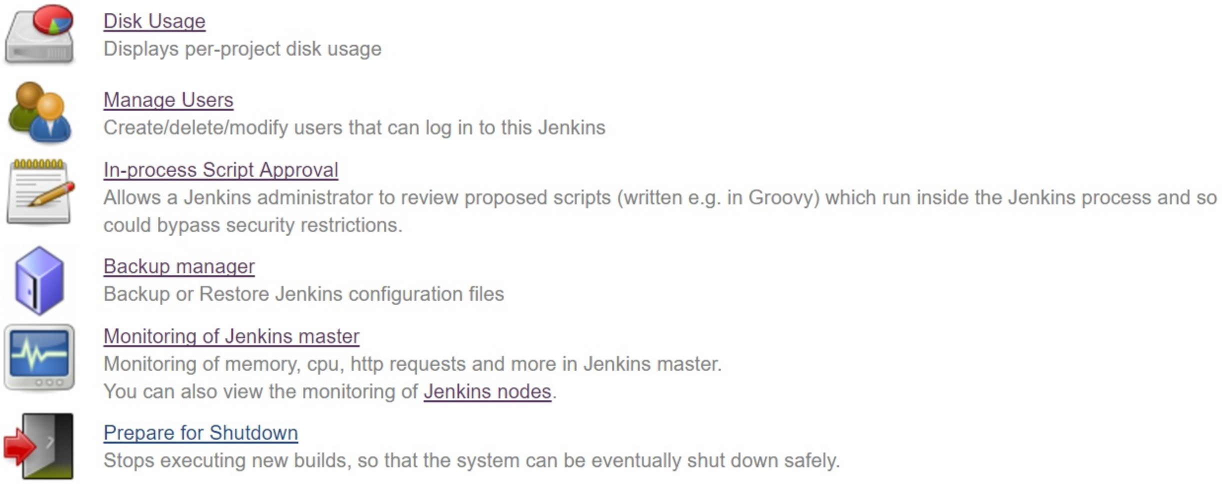
Go back to the top page
(you can start using the installed plugins right away)

Restart Jenkins when installation is complete and no jobs are running

The backup plugin allows us to back up JENKINS_HOME and restore it.

How to do it...

1. Go to Manage Jenkins and click on Backup Manager:



Disk Usage
Displays per-project disk usage

Manage Users
Create/delete/modify users that can log in to this Jenkins

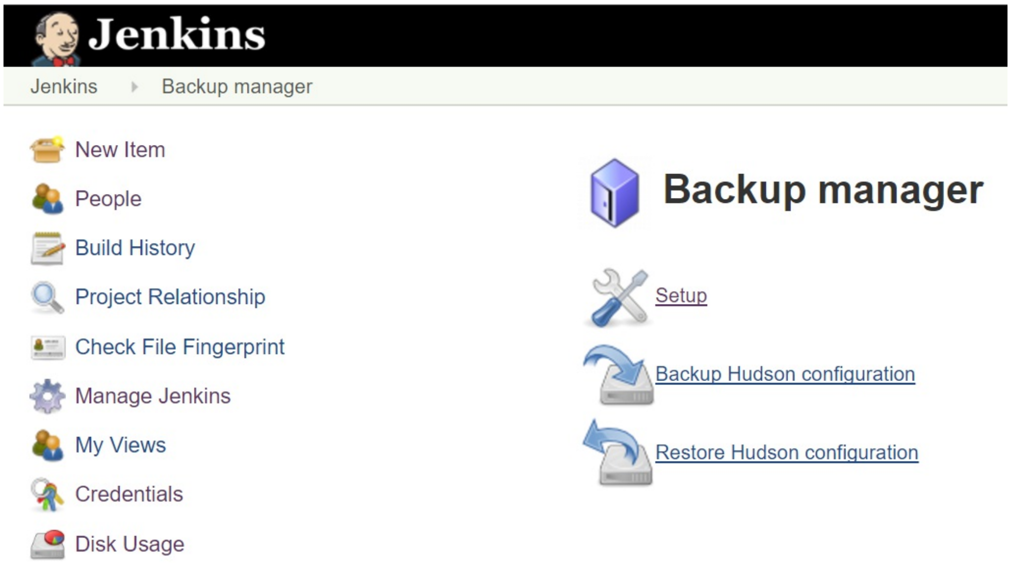
In-process Script Approval
Allows a Jenkins administrator to review proposed scripts (written e.g. in Groovy) which run inside the Jenkins process and so could bypass security restrictions.

Backup manager
Backup or Restore Jenkins configuration files

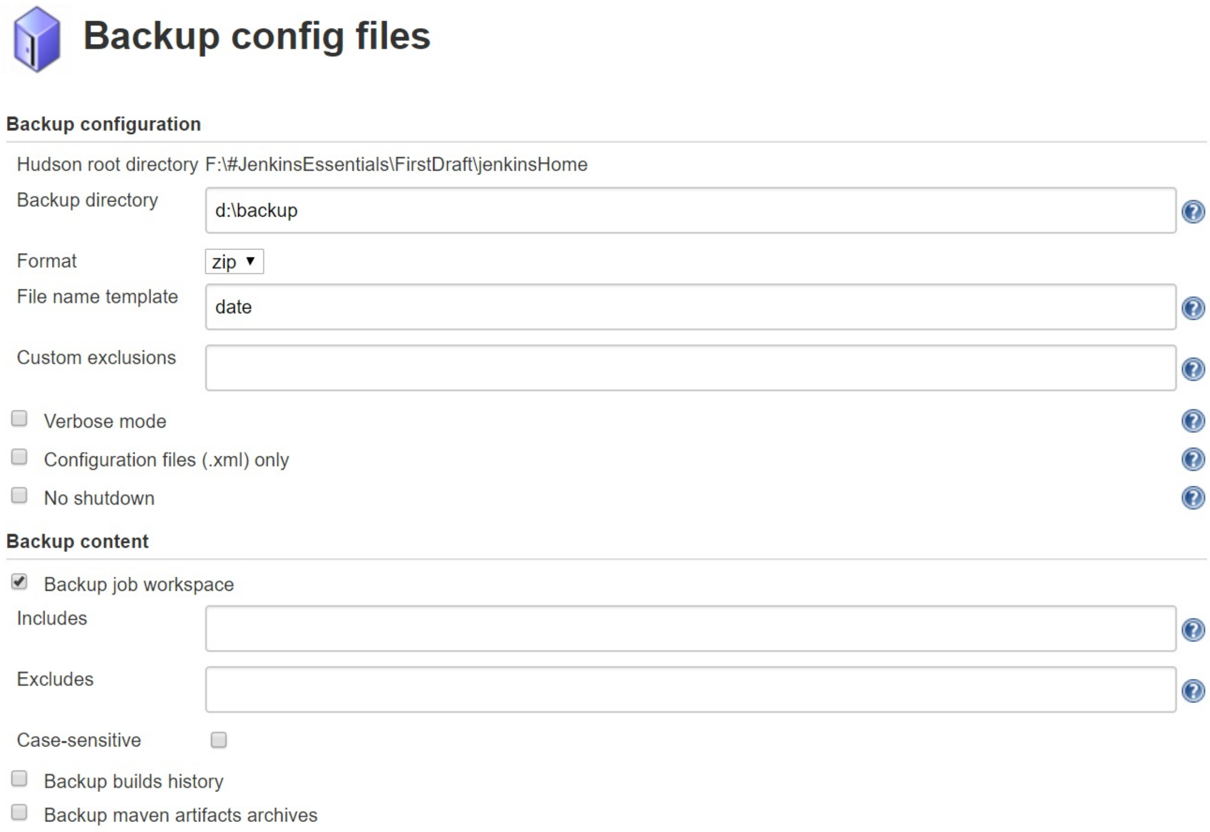
Monitoring of Jenkins master
Monitoring of memory, cpu, http requests and more in Jenkins master.
You can also view the monitoring of Jenkins nodes.

Prepare for Shutdown
Stops executing new builds, so that the system can be eventually shut down safely.

2. Click on Setup:



3. Configure the Backup directory, Format, File name template, and so on:



Backup config files

Backup configuration

Hudson root directory F:\#JenkinsEssentials\FirstDraft\jenkinsHome

Backup directory: d:\backup

Format: zip

File name template: date

Custom exclusions:

□ Verbose mode

□ Configuration files (.xml) only

□ No shutdown

Backup content

☑ Backup job workspace

Includes:

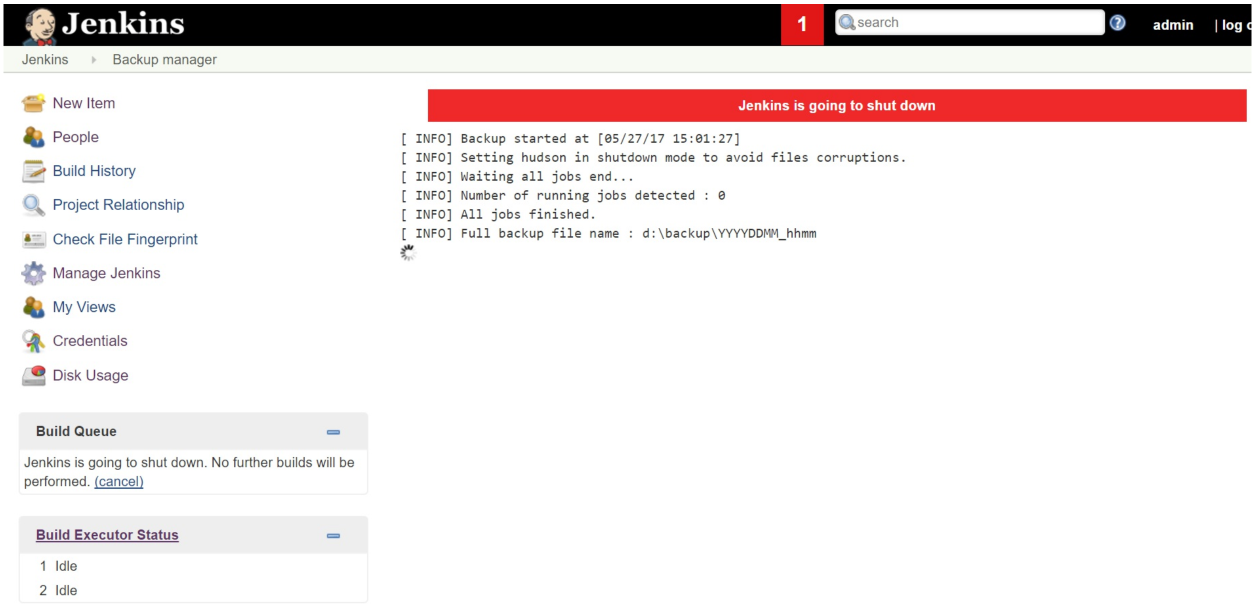
Excludes:

Case-sensitive □

□ Backup builds history

□ Backup maven artifacts archives

4. Click on the Backup Hudson configuration:



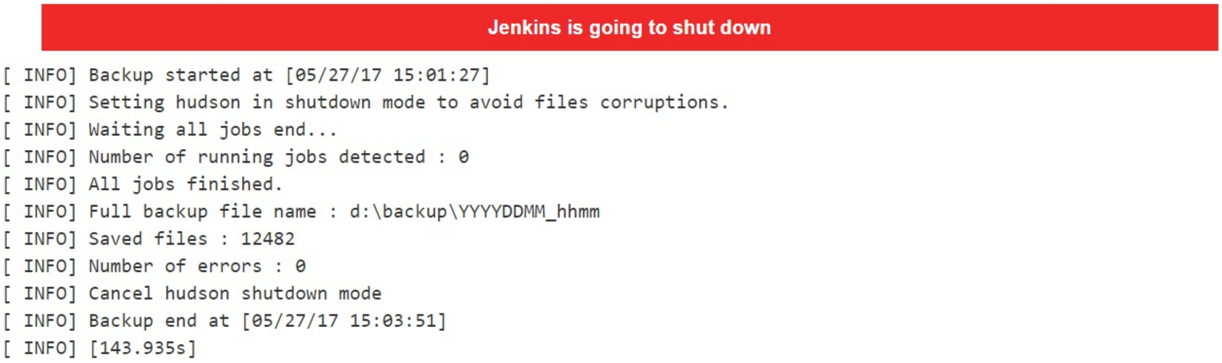
Jenkins is going to shut down

```
[ INFO] Backup started at [05/27/17 15:01:27]
[ INFO] Setting hudson in shutdown mode to avoid files corruptions.
[ INFO] Waiting all jobs end...
[ INFO] Number of running jobs detected : 0
[ INFO] All jobs finished.
[ INFO] Full backup file name : d:\backup\YYYYDDMM_hhmm
```

Jenkins is going to shut down. No further builds will be performed. (cancel)

1 Idle
2 Idle

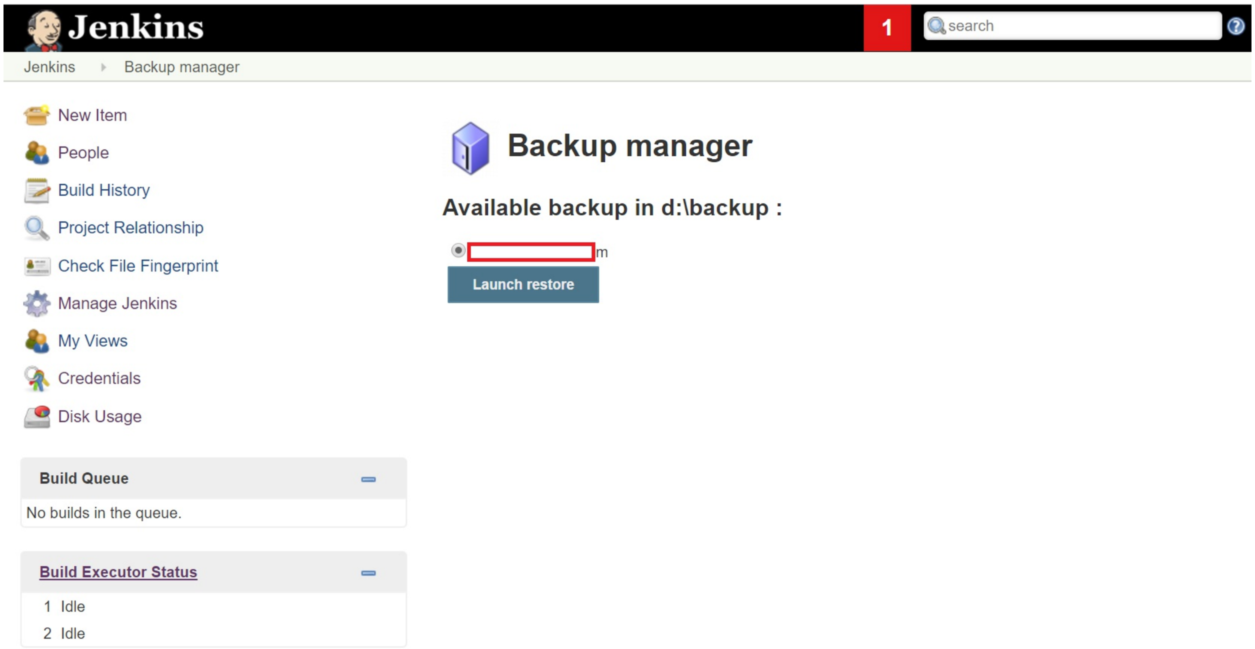
5. Once the backup is completed successfully, verify the logs:



Jenkins is going to shut down

```
[ INFO] Backup started at [05/27/17 15:01:27]
[ INFO] Setting hudson in shutdown mode to avoid files corruptions.
[ INFO] Waiting all jobs end...
[ INFO] Number of running jobs detected : 0
[ INFO] All jobs finished.
[ INFO] Full backup file name : d:\backup\YYYYDDMM_hhmm
[ INFO] Saved files : 12482
[ INFO] Number of errors : 0
[ INFO] Cancel hudson shutdown mode
[ INFO] Backup end at [05/27/17 15:03:51]
[ INFO] [143.935s]
```

6. Go to Backup Manager and click on Restore Hudson configuration:



Backup manager

Available backup in d:\backup :

● [redacted]m

No builds in the queue.

1 Idle

2 Idle

See also

Currently, there is more than one plugin for backups. I have chosen the `thinBackup` plugin (https://wiki.jenkins-ci.org/display/JENKINS/thinBackup), as it allows scheduling.

Command-line options in Jenkins using Jenkins CLI

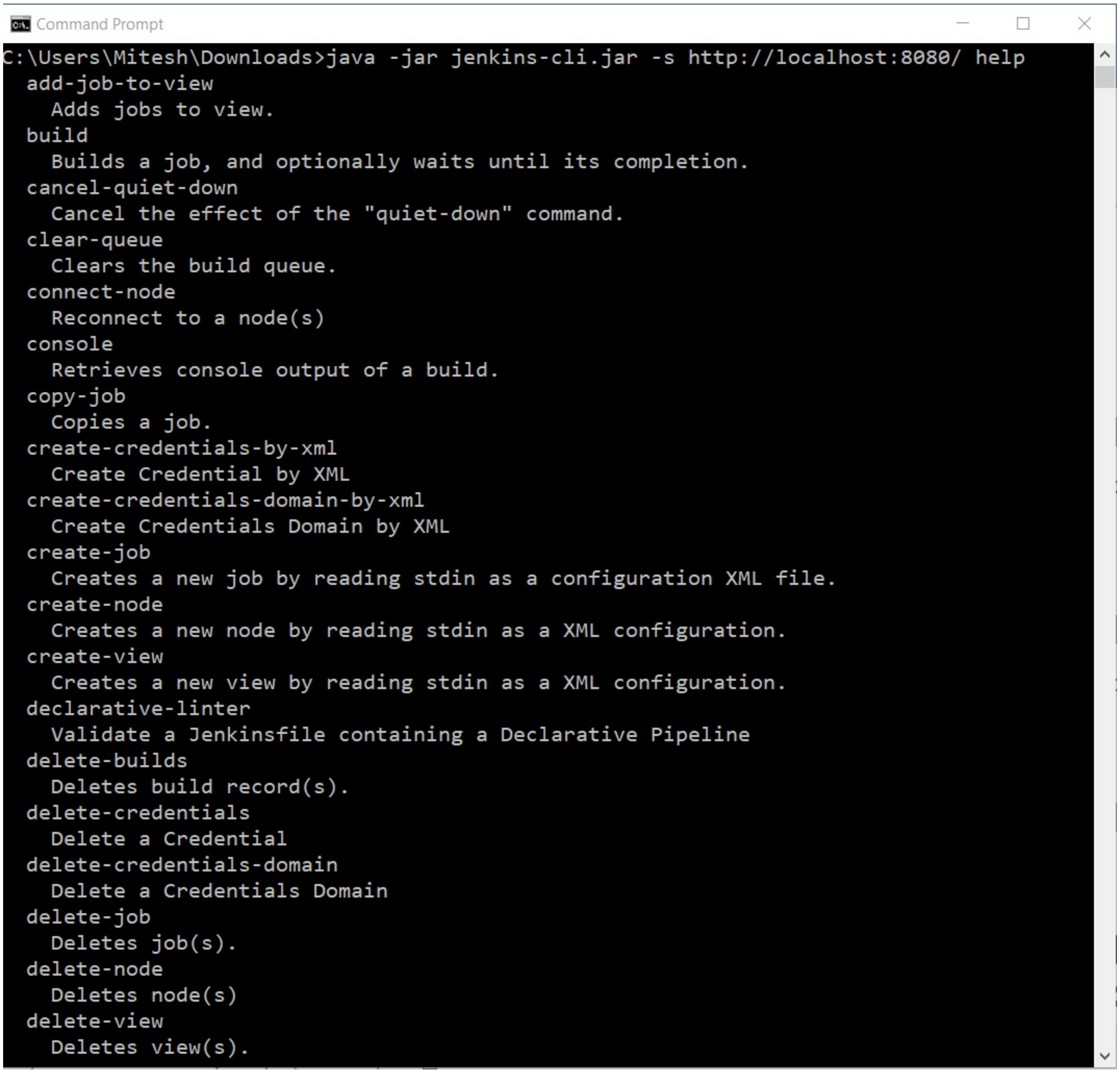
You can access various features in Jenkins through a command-line tool.

Getting ready

Download the `Jenkins-cli.jar` file from the link available on the Jenkins dashboard.

How to do it...

1. Go to the location where `Jenkins-cli.jar` is downloaded and execute the `java -jar jenkins-cli.jar -s http://localhost:8080/ help` command to see the help of CLI commands:

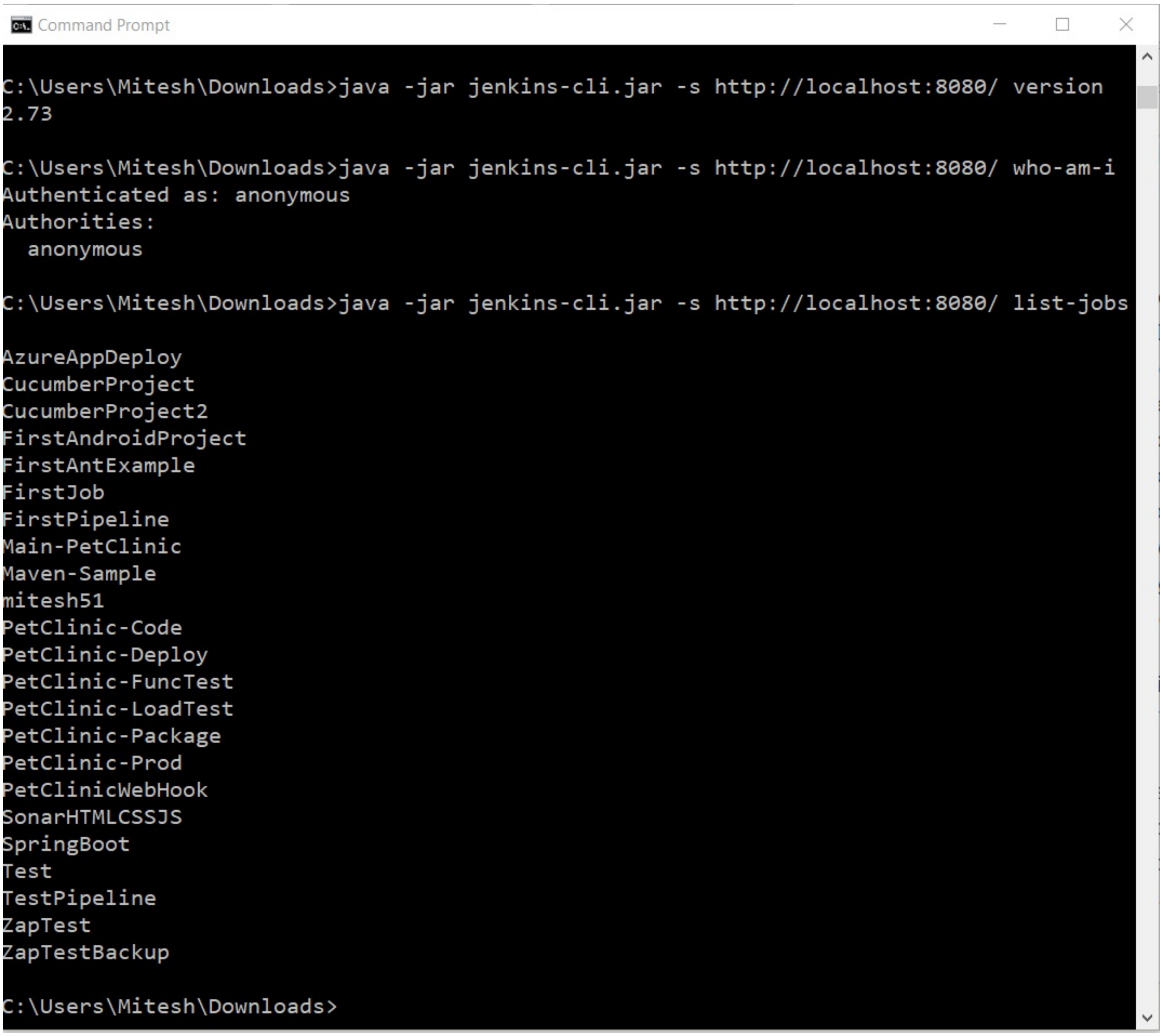


```
C:\Users\Mitesh\Downloads>java -jar jenkins-cli.jar -s http://localhost:8080/ help
  add-job-to-view
    Adds jobs to view.
  build
    Builds a job, and optionally waits until its completion.
  cancel-quiet-down
    Cancel the effect of the "quiet-down" command.
  clear-queue
    Clears the build queue.
  connect-node
    Reconnect to a node(s)
  console
    Retrieves console output of a build.
  copy-job
    Copies a job.
  create-credentials-by-xml
    Create Credential by XML
  create-credentials-domain-by-xml
    Create Credentials Domain by XML
  create-job
    Creates a new job by reading stdin as a configuration XML file.
  create-node
    Creates a new node by reading stdin as a XML configuration.
  create-view
    Creates a new view by reading stdin as a XML configuration.
  declarative-linter
    Validate a Jenkinsfile containing a Declarative Pipeline
  delete-builds
    Deletes build record(s).
  delete-credentials
    Delete a Credential
  delete-credentials-domain
    Delete a Credentials Domain
  delete-job
    Deletes job(s).
  delete-node
    Deletes node(s)
  delete-view
    Deletes view(s).
```

2. Execute the following commands:

```
java -jar jenkins-cli.jar -s http://localhost:8080/ version
java -jar jenkins-cli.jar -s http://localhost:8080/ who-am-i
java -jar jenkins-cli.jar -s http://localhost:8080/ list-jobs
```

3. Verify the output, shown as follows:



```
C:\Users\Mitesh\Downloads>java -jar jenkins-cli.jar -s http://localhost:8080/ version
2.73

C:\Users\Mitesh\Downloads>java -jar jenkins-cli.jar -s http://localhost:8080/ who-am-i
Authenticated as: anonymous
Authorities:
  anonymous

C:\Users\Mitesh\Downloads>java -jar jenkins-cli.jar -s http://localhost:8080/ list-jobs

AzureAppDeploy
CucumberProject
CucumberProject2
FirstAndroidProject
FirstAntExample
FirstJob
FirstPipeline
Main-PetClinic
Maven-Sample
mitesh51
PetClinic-Code
PetClinic-Deploy
PetClinic-FuncTest
PetClinic-LoadTest
PetClinic-Package
PetClinic-Prod
PetClinicWebHook
SonarHTMLCSSJS
SpringBoot
Test
TestPipeline
ZapTest
ZapTestBackup

C:\Users\Mitesh\Downloads>
```

4. Try other commands yourself.

Modifying the Jenkins configuration from the command line

You may well be wondering about the XML files at the top level of the Jenkins workspace. These are configuration files. The `config.xml` file is the main one that deals with the default server values, but there are also specific ones for any plugins that have values set through the GUI.

There is also a `jobs` subdirectory underneath the workspace. Each individual job configuration is contained in a subdirectory with the same name as the job. The job-specific configuration is then stored in `config.xml` within the subdirectory. It's a similar situation for the `users` directory: there is one subdirectory per user, with the personal information stored in `config.xml`.

Under a controlled situation where all the Jenkins servers in your infrastructure have the same plugins and version levels, it is possible for you to test on one test machine and then push the configuration files to all the other machines. You can then restart the Jenkins servers with the **command-line interface** (**CLI**).

This recipe familiarizes you with the main XML configuration structure and then provides hints about the plugin API based on the details of the XML.

Getting ready

You will need a Jenkins server with security enabled and the ability to edit files, either by logging in and working from the command line or through editing with a text editor.

How to do it...

Let's see how to modify the Jenkins configuration.

1. In the top-level directory of Jenkins, look for the `config.xml` file. Edit the line with `numExecutors`, changing the number `2` to `3`:

   ```
   <numExecutors>3</numExecutors>
   ```

2. Restart the server. You will see that the number of executors has increased from the default two to three.
3. Plugins persist their configuration through XML files. To prove this point, look for the `thinBackup.xml` file. You will not find it unless you have installed the `thinBackup` plugin.

How it works...

Jenkins uses **XStream** (http://xstream.codehaus.org/) to persist its configuration into a readable XML format. The XML files in the workspace are configuration files for plugins, tasks, and an assortment of other persisted information. The `config.xml` file is the main configuration file. Security settings and global configuration are set here and reflect changes made through the GUI. Plugins use the same structure and the XML values correspond to member values in the underlying plugin classes. The GUI itself is created from XML via the Jelly framework (http://commons.apache.org/jelly/).

By restarting the server, you are certain that any configuration changes are picked up during the initialization phase.

It is also possible to use Reload configuration from a storage feature from the Manage Jenkins page, and to load an updated configuration without restarting.

Managing disk usage

Jenkins stores multiple jobs and the multiple builds created are stored on the machine. It is important to keep track of disk usage, as, over time, builds from multiple projects will take up a lot of space.

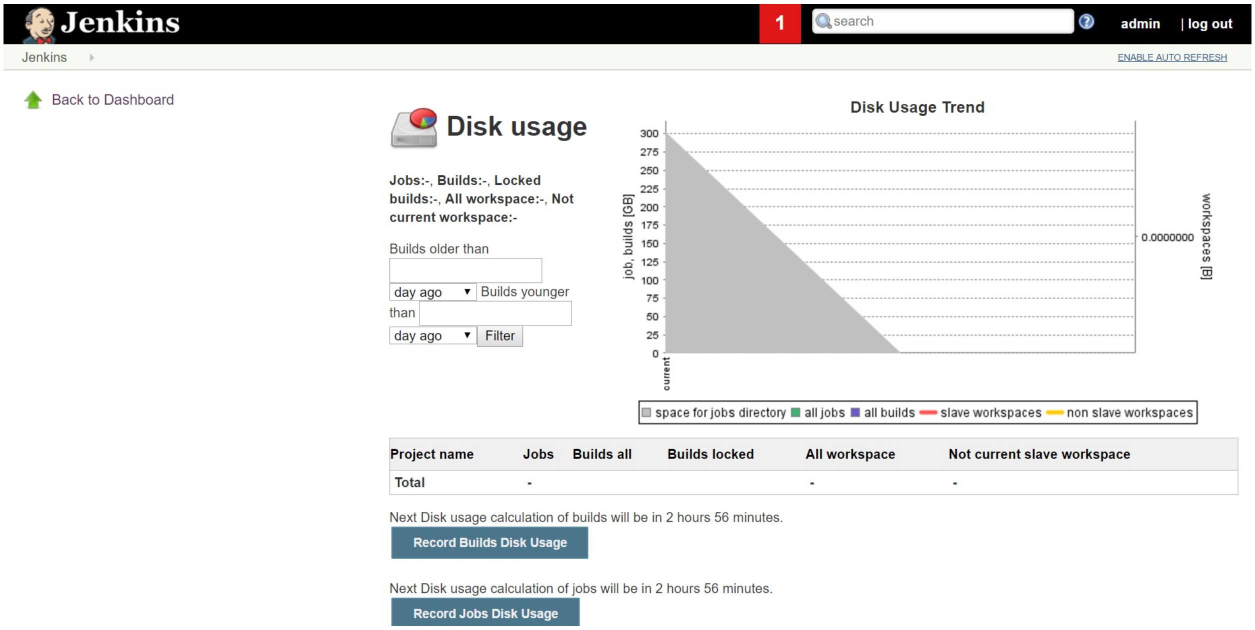
Getting ready

Go to Dashboard| Manage Jenkins|Manage Plugins|Available|Install Disk Usage plugin.

How to do it...

This plugin gives details on disk usage on the system where Jenkins is installed.

1. Go to Dashboard | Manage Jenkins | Disk Usage:



Disk usage

Jobs:-, Builds:-, Locked builds:-, All workspace:-, Not current workspace:-

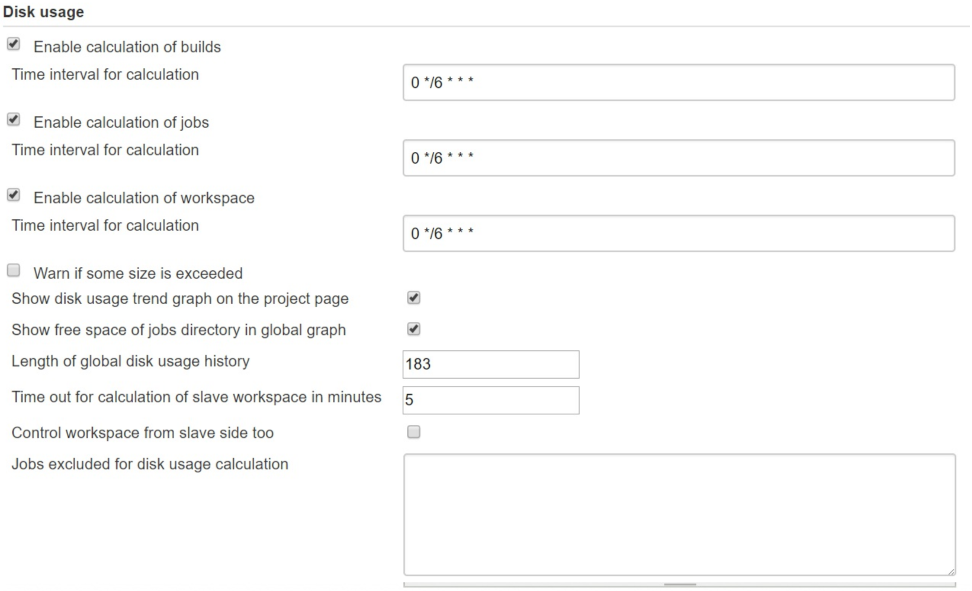
Builds older than [ ] day ago ▾ Builds younger than [ ] day ago ▾

Project name	Jobs	Builds all	Builds locked	All workspace	Not current slave workspace
Total	-			-	-

Next Disk usage calculation of builds will be in 2 hours 56 minutes.

Next Disk usage calculation of jobs will be in 2 hours 56 minutes.

2. Go to Manage Jenkins and click on Configure System. Go to the Disk usage section and click on Show disk usage trend graph on the project page:



Disk usage

☑ Enable calculation of builds

Time interval for calculation: 0 */6 * * *

☑ Enable calculation of jobs

Time interval for calculation: 0 */6 * * *

☑ Enable calculation of workspace

Time interval for calculation: 0 */6 * * *

☐ Warn if some size is exceeded

Show disk usage trend graph on the project page ☑

Show free space of jobs directory in global graph ☑

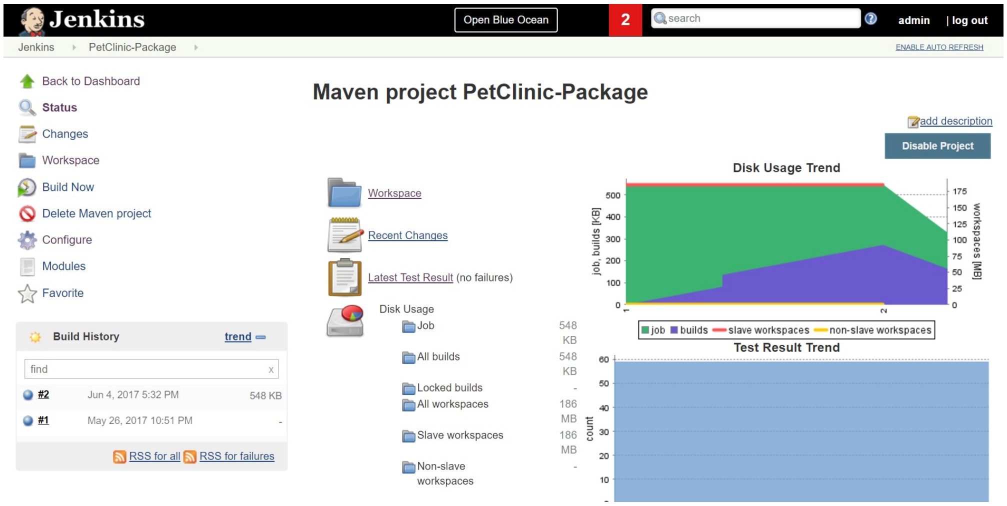
Length of global disk usage history: 183

Time out for calculation of slave workspace in minutes: 5

Control workspace from slave side too ☐

Jobs excluded for disk usage calculation:

3. Go to a specific project and verify whether the Disk Usage Trend chart is available or not:



Maven project PetClinic-Package

#2	Jun 4, 2017 5:32 PM	548 KB
#1	May 26, 2017 10:51 PM	-

Latest Test Result (no failures)

Disk Usage

Job	548 KB
All builds	548 KB
Locked builds	-
All workspaces	186 MB
Slave workspaces	186 MB
Non-slave workspaces	-

4. In the next recipe, we will try to modify the build status using log parsing.

See also

To start the Jenkins service, execute:

```
sudo service jenkins start
```

Shutdown Jenkins safely

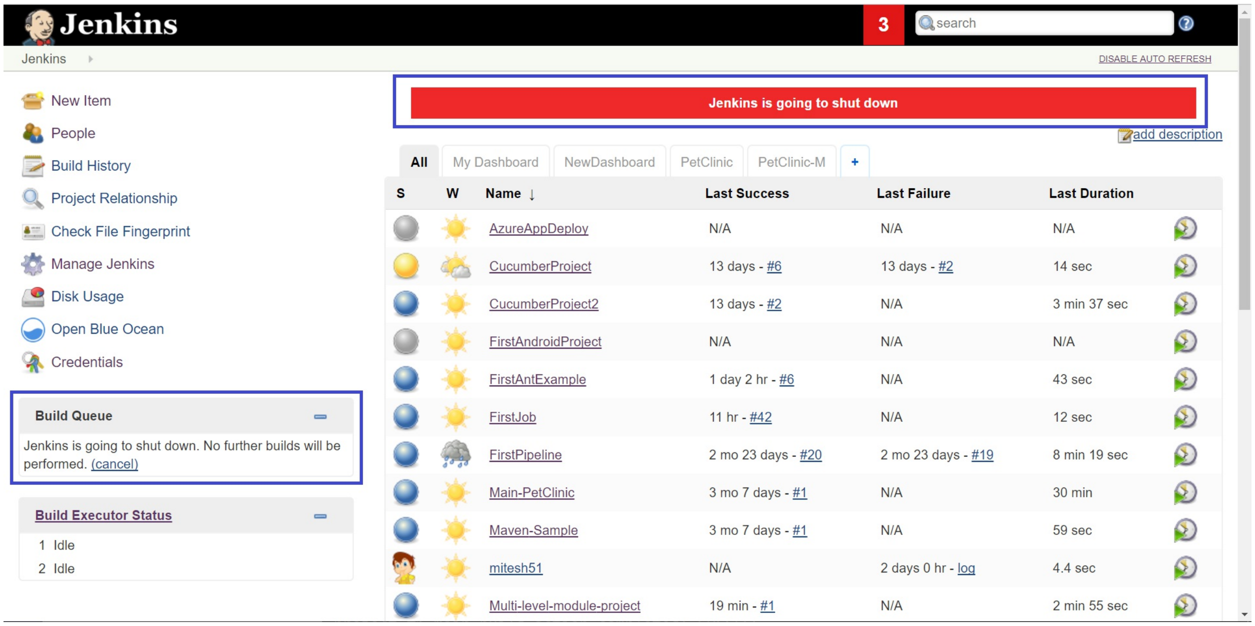
Is it possible to stop executing new builds so that the system can eventually be shut down safely? Let's find out in the following recipe.

Getting ready

You need to have administrative access to Jenkins.

How to do it...

1. Go to the Jenkins dashboard, then Manage Jenkins Prepare for Shutdown:



Jenkins is going to shut down

Build Queue

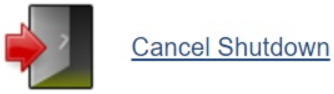
Jenkins is going to shut down. No further builds will be performed. (cancel)

Build Executor Status

1 Idle
2 Idle

S	W	Name ↓	Last Success	Last Failure	Last Duration
		AzureAppDeploy	N/A	N/A	N/A
		CucumberProject	13 days - #6	13 days - #2	14 sec
		CucumberProject2	13 days - #2	N/A	3 min 37 sec
		FirstAndroidProject	N/A	N/A	N/A
		FirstAntExample	1 day 2 hr - #6	N/A	43 sec
		FirstJob	11 hr - #42	N/A	12 sec
		FirstPipeline	2 mo 23 days - #20	2 mo 23 days - #19	8 min 19 sec
		Main-PetClinic	3 mo 7 days - #1	N/A	30 min
		Maven-Sample	3 mo 7 days - #1	N/A	59 sec
		mitesh51	N/A	2 days 0 hr - log	4.4 sec
		Multi-level-module-project	19 min - #1	N/A	2 min 55 sec

2. Go to the Jenkins dashboard again, then Manage Jenkins to Cancel Shutdown:



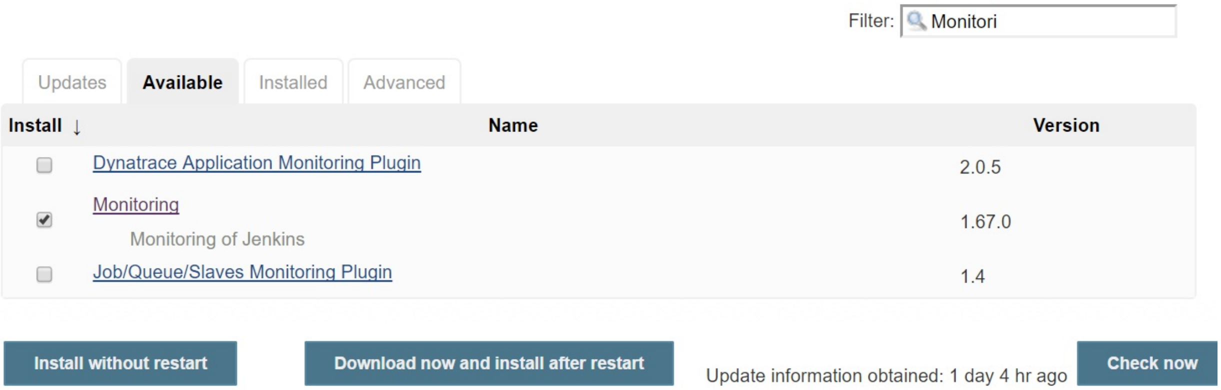
Monitoring Jenkins with JavaMelody

JavaMelody (http://code.google.com/p/javamelody/) is an open source project that provides comprehensive monitoring. The Jenkins plugin monitors both the master instance of Jenkins and also its nodes. The plugin provides a detailed wealth of important information. You can view evolution charts ranging from 1 day or 1 week to months for the main quantities, such as CPU or memory. Evolution charts are very good at pinpointing scheduled jobs that are resource-hungry.

The `Monitoring` plugin provides the monitoring of Jenkins with JavaMelody. It provides charts for CPU, memory, system load average, HTTP response time, and so on. It also provides details of HTTP sessions, errors and logs, actions for garbage collection, heap dumps, invalid session(s), and so on.

Getting ready

Install the Monitoring plugin from the Jenkins dashboard:



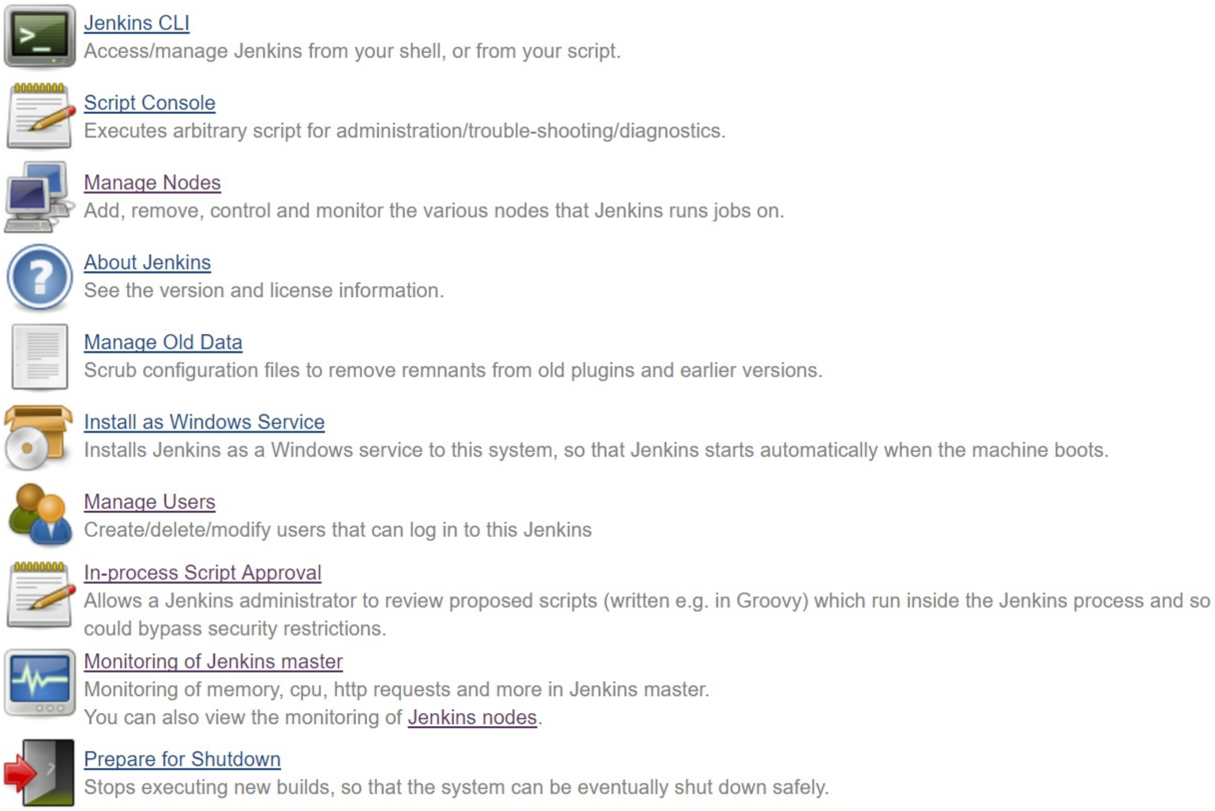
Filter: Monitori

Install ↓	Name	Version
□	Dynatrace Application Monitoring Plugin	2.0.5
☑	Monitoring Monitoring of Jenkins	1.67.0
□	Job/Queue/Slaves Monitoring Plugin	1.4

Update information obtained: 1 day 4 hr ago

How to do it...

1. On the Jenkins dashboard, click on Manage Jenkins. Click on Monitoring of Jenkins master, as shown in the following screenshot:



Jenkins CLI
Access/manage 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.

About Jenkins
See the version and license information.

Manage Old Data
Scrub configuration files to remove remnants from old plugins and earlier versions.

Install as Windows Service
Installs Jenkins as a Windows service to this system, so that Jenkins starts automatically when the machine boots.

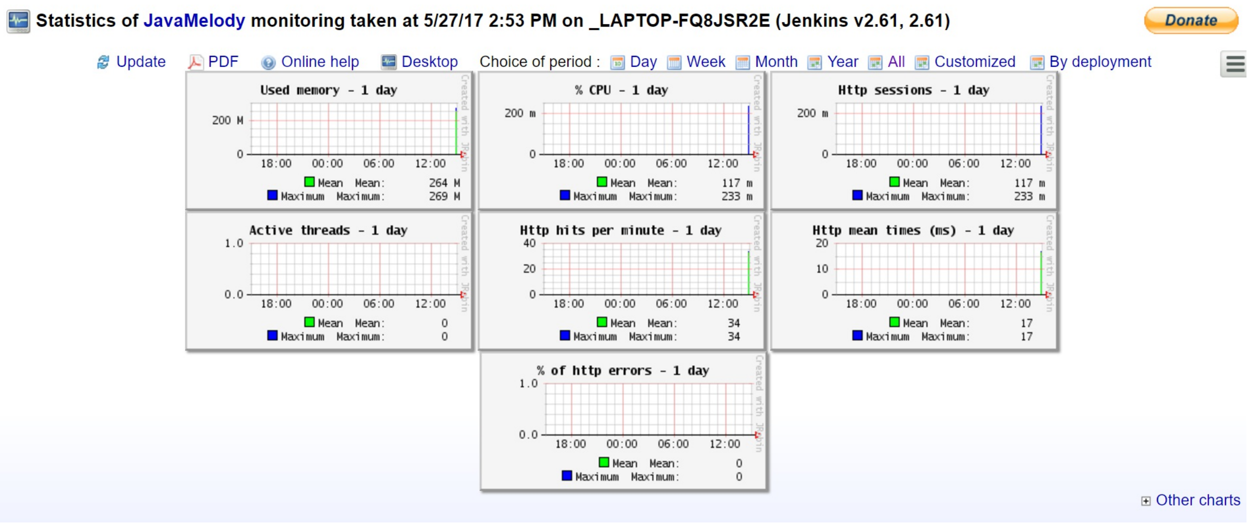
Manage Users
Create/delete/modify users that can log in to this Jenkins

In-process Script Approval
Allows a Jenkins administrator to review proposed scripts (written e.g. in Groovy) which run inside the Jenkins process and so could bypass security restrictions.

Monitoring of Jenkins master
Monitoring of memory, cpu, http requests and more in Jenkins master.
You can also view the monitoring of Jenkins nodes.

Prepare for Shutdown
Stops executing new builds, so that the system can be eventually shut down safely.

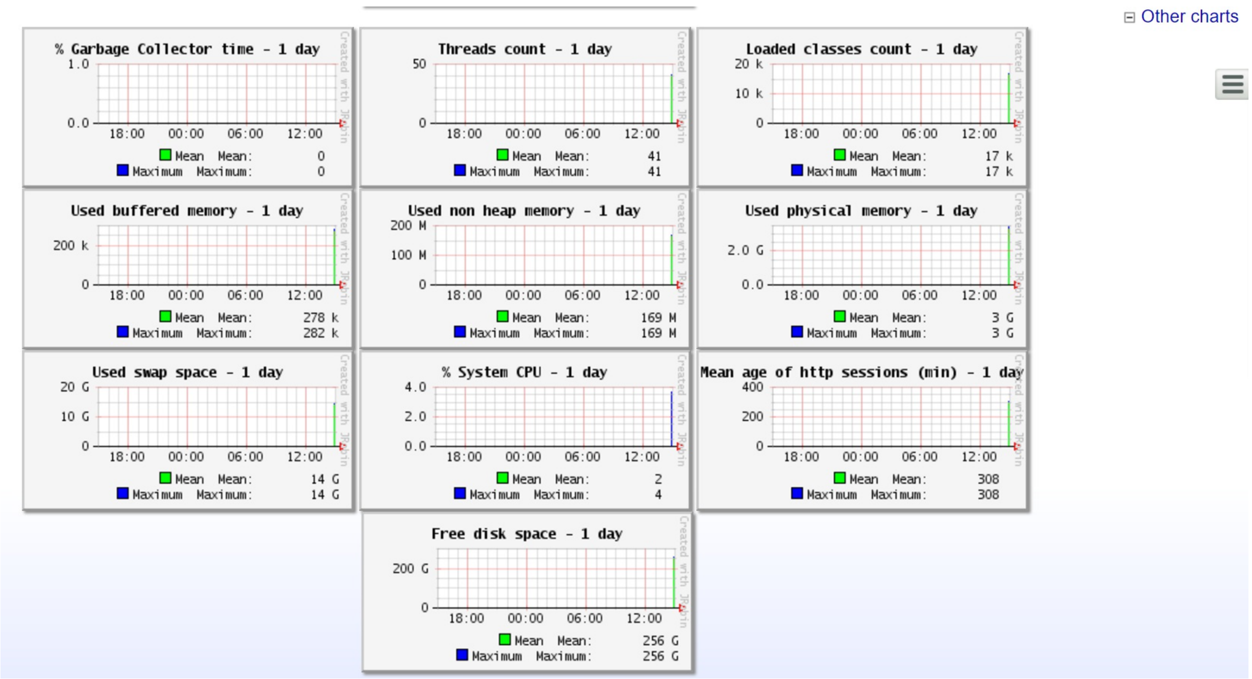
2. It will open the statistics of JavaMelody monitoring, as shown in the following screenshot. Observe all of the statistics:



Statistics of JavaMelody monitoring taken at 5/27/17 2:53 PM on _LAPTOP-FQ8JSR2E (Jenkins v2.61, 2.61)

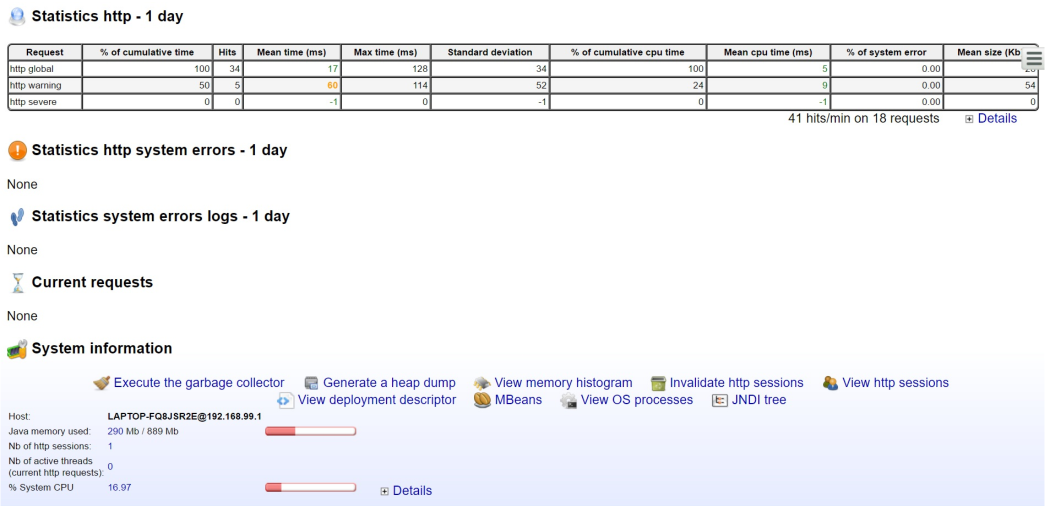
3. Click on Other charts and observe the other details related to Garbage Collector time,

Threads count, and so on:



Java Melody with Garbage Collector and Thread Count

4. Scroll down the page and find Statistics system error logs. To get more information, click on the Details link of any section. The statistics for HTTP are as shown in the following figure:



Statistics http - 1 day

Request	% of cumulative time	Hits	Mean time (ms)	Max time (ms)	Standard deviation	% of cumulative cpu time	Mean cpu time (ms)	% of system error	Mean size (Kb
http global	100	34	17	128	34	100	5	0.00	[illegible]
http warning	50	5	60	114	52	24	9	0.00	54
http severe	0	0	-1	0	-1	0	-1	0.00	0

41 hits/min on 18 requests ⊞ Details

Statistics http system errors - 1 day

None

Statistics system errors logs - 1 day

None

Current requests

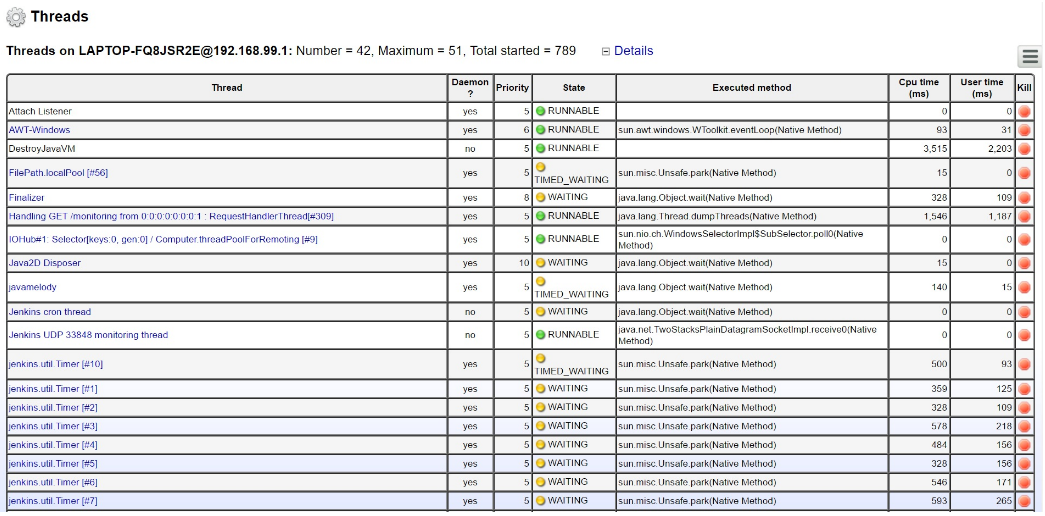
None

System information

Host:	LAPTOP-FQ8JSR2E@192.168.99.1
Java memory used:	290 Mb / 889 Mb
Nb of http sessions:	1
Nb of active threads (current http requests):	0
% System CPU	16.97

⊞ Details

5. Verify that the details are available on the Threads as well:



Threads

Threads on LAPTOP-FQ8JSR2E@192.168.99.1: Number = 42, Maximum = 51, Total started = 789 ⊟ Details

Thread	Daemon ?	Priority	State	Executed method	Cpu time (ms)	User time (ms)	Kill
Attach Listener	yes	5	🟢 RUNNABLE		0	0	🔴
AWT-Windows	yes	6	🟢 RUNNABLE	sun.awt.windows.WToolkit.eventLoop(Native Method)	93	31	🔴
DestroyJavaVM	no	5	🟢 RUNNABLE		3,515	2,203	🔴
FilePath.localPool [#56]	yes	5	🟡 TIMED_WAITING	sun.misc.Unsafe.park(Native Method)	15	0	🔴
Finalizer	yes	8	🟡 WAITING	java.lang.Object.wait(Native Method)	328	109	🔴
Handling GET /monitoring from 0:0:0:0:0:0:0:1 : RequestHandlerThread[#309]	yes	5	🟢 RUNNABLE	java.lang.Thread.dumpThreads(Native Method)	1,546	1,187	🔴
IOHub#1: Selector[keys:0, gen:0] / Computer.threadPoolForRemoting [#9]	yes	5	🟢 RUNNABLE	sun.nio.ch.WindowsSelectorImpl$SubSelector.poll0(Native Method)	0	0	🔴
Java2D Disposer	yes	10	🟡 WAITING	java.lang.Object.wait(Native Method)	15	0	🔴
javamelody	yes	5	🟡 TIMED_WAITING	java.lang.Object.wait(Native Method)	140	15	🔴
Jenkins cron thread	no	5	🟡 WAITING	java.lang.Object.wait(Native Method)	0	0	🔴
Jenkins UDP 33848 monitoring thread	no	5	🟢 RUNNABLE	java.net.TwoStacksPlainDatagramSocketImpl.receive0(Native Method)	0	0	🔴
jenkins.util.Timer [#10]	yes	5	🟡 TIMED_WAITING	sun.misc.Unsafe.park(Native Method)	500	93	🔴
jenkins.util.Timer [#1]	yes	5	🟡 WAITING	sun.misc.Unsafe.park(Native Method)	359	125	🔴
jenkins.util.Timer [#2]	yes	5	🟡 WAITING	sun.misc.Unsafe.park(Native Method)	328	109	🔴
jenkins.util.Timer [#3]	yes	5	🟡 WAITING	sun.misc.Unsafe.park(Native Method)	578	218	🔴
jenkins.util.Timer [#4]	yes	5	🟡 WAITING	sun.misc.Unsafe.park(Native Method)	484	156	🔴
jenkins.util.Timer [#5]	yes	5	🟡 WAITING	sun.misc.Unsafe.park(Native Method)	328	156	🔴
jenkins.util.Timer [#6]	yes	5	🟡 WAITING	sun.misc.Unsafe.park(Native Method)	546	171	🔴
jenkins.util.Timer [#7]	yes	5	🟡 WAITING	sun.misc.Unsafe.park(Native Method)	593	265	🔴

Java Melody - Threads

There's more...

Monitoring is the foundation of comprehensive testing and troubleshooting. This section explores the relationship between these issues and the measurements exposed in the plugin.

Troubleshooting with JavaMelody - memory

Your Jenkins server can at times have memory issues due to greedy builds, leaky plugins, or some hidden complexity in the infrastructure. JavaMelody has a comprehensive range of memory measurements, including a heap dump and a memory histogram.

The Java virtual machine divides memory into various areas and, to clean up, it removes objects that have no references to other objects. Garbage collection can be CPU-intensive when it is busy, and the nearer to consumption of full memory, the busier garbage collection becomes. To an external monitoring agent, this looks like a CPU spike that is often difficult to track down. Just because the garbage collector manages memory, it is also a fallacy to believe that there is no potential for memory leakage in Java. Memory can be held for too long by many common practices such as custom caches or calls to native libraries.

Slow burning memory leaks will show up as gentle slopes on memory-related evolution graphs. If you suspect that you have a memory leak, then you can get the plugin to force a full garbage collection through the Execute the garbage collector link. If it is not a memory leak, the gentle slope will abruptly fall.

Memory issues can also express themselves as large CPU spikes as the garbage collector franticly tries to clean up, but can barely clean enough space. The garbage collector can also pause the application while comprehensively looking for-no-longer referenced objects (`"Stop the world garbage collection"`), thus causing long response times for web browser requests. This can be seen through the mean and max times in Statistics http - 1 day.

Troubleshooting with JavaMelody - painful jobs

You should consider the following points:

- **Offload work**: For a stable infrastructure, offload as much work from the master instance as possible. If you have scheduled tasks, keep the heaviest ones separate in time. Time separation not only evens out load, but also makes finding the problematic build easier through the observation of the evolution charts of JavaMelody. Also consider spatial separation; if a given node or a labeled set of nodes shows problematic issues, then start switching around the machine location of jobs and view their individual performance characteristics through `http://host:port/monitoring/nodes`.
- **Hardware is cheap**: Compared to paying for human hours, buying an extra 8 GB is roughly equivalent to one man hour's effort.

A common gotcha is to add memory to the server, while forgetting to update the init scripts to allow Jenkins to use more memory.

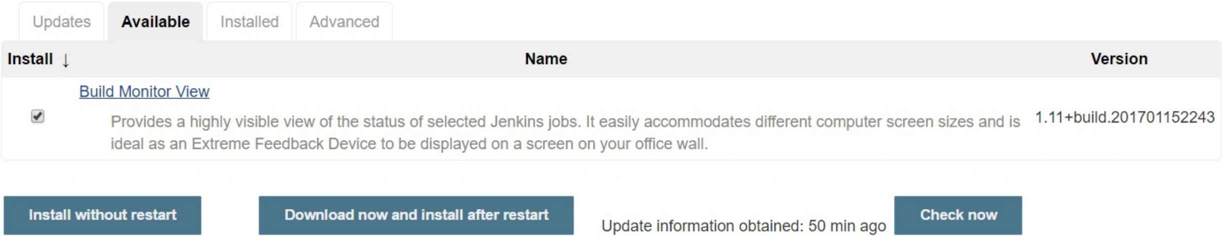
- **Review the build scripts**: Javadoc generation and custom Ant scripts can fork JVMs and reserve memory defined within their own configuration. Programming errors can also be the cause of frustration. Don't forget to review JavaMelody's report on Statistic system error log and Statistic http system errors.
- **Don't forget external factors**: Factors include backups, cron jobs, updating the locate database, and network maintenance. These will show up as periodic patterns in the evolution charts.
- **Strength in numbers**: Use JavaMelody in combination with the disk usage plugin and others to keep a comprehensive overview of the vital statistics. Each plugin is simple to configure, but their usefulness to you will grow more quickly than the maintenance costs of adding extra plugins.

Monitoring a Jenkins Job using a Build Monitor View

The `Build Monitor` plugin provides a visualization of the status and progress of selected Jenkins jobs. It displays an updated view automatically every couple of seconds using AJAX. It can easily accommodate different computer screen sizes too.

Getting ready

Go to Manage Jenkins | Manage Plugins | Available tab. Install the Build Monitor View plugin:



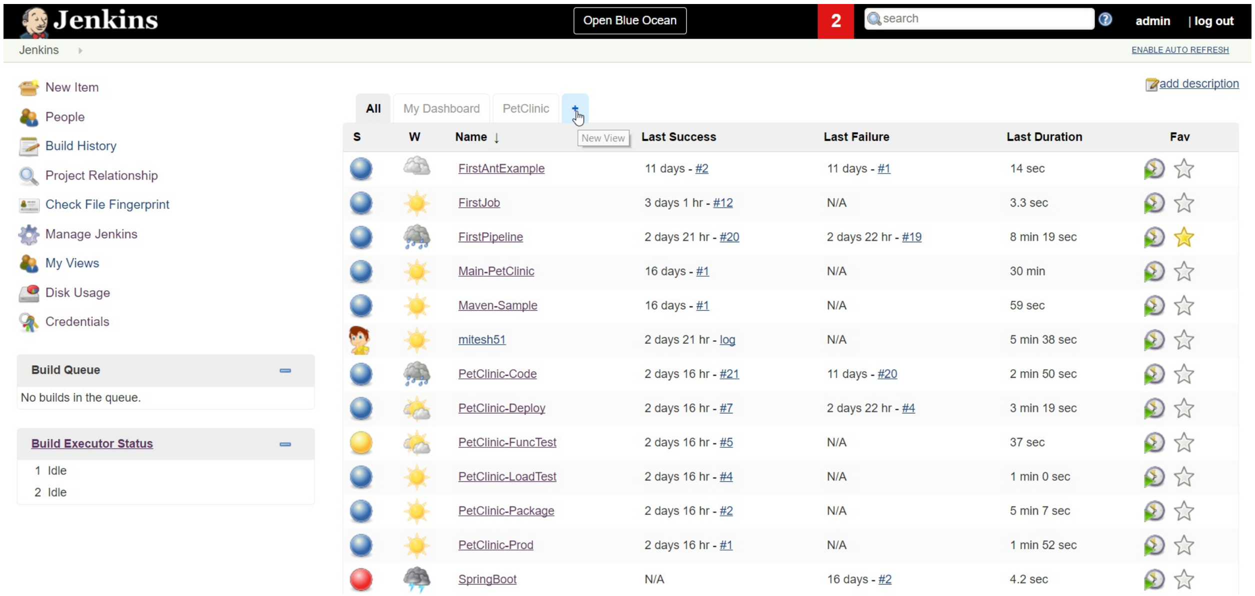
Install ↓	Name	Version
☑	Build Monitor View Provides a highly visible view of the status of selected Jenkins jobs. It easily accommodates different computer screen sizes and is ideal as an Extreme Feedback Device to be displayed on a screen on your office wall.	1.11+build.201701152243

Update information obtained: 50 min ago

Go to the Jenkins dashboard.

How to do it...

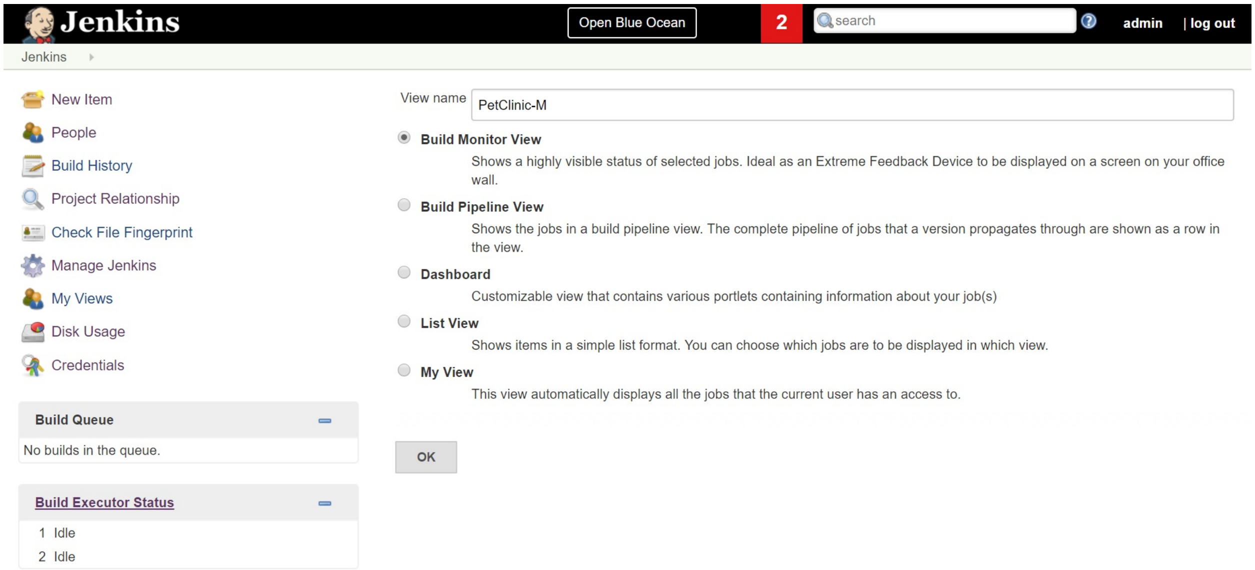
1. Click on New View:



S	W	Name ↓	Last Success	Last Failure	Last Duration	Fav
🔵	☁	FirstAntExample	11 days - #2	11 days - #1	14 sec	☆
🔵	☀	FirstJob	3 days 1 hr - #12	N/A	3.3 sec	☆
🔵	⛈	FirstPipeline	2 days 21 hr - #20	2 days 22 hr - #19	8 min 19 sec	★
🔵	☀	Main-PetClinic	16 days - #1	N/A	30 min	☆
🔵	☀	Maven-Sample	16 days - #1	N/A	59 sec	☆
	☀	mitesh51	2 days 21 hr - log	N/A	5 min 38 sec	☆
🔵	⛈	PetClinic-Code	2 days 16 hr - #21	11 days - #20	2 min 50 sec	☆
🔵	⛅	PetClinic-Deploy	2 days 16 hr - #7	2 days 22 hr - #4	3 min 19 sec	☆
🟡	⛅	PetClinic-FuncTest	2 days 16 hr - #5	N/A	37 sec	☆
🔵	☀	PetClinic-LoadTest	2 days 16 hr - #4	N/A	1 min 0 sec	☆
🔵	☀	PetClinic-Package	2 days 16 hr - #2	N/A	5 min 7 sec	☆
🔵	☀	PetClinic-Prod	2 days 16 hr - #1	N/A	1 min 52 sec	☆
🔴	⛈	SpringBoot	N/A	16 days - #2	4.2 sec	☆

Jenkins Dashboard - Create New View

2. Provide View name and select Build Monitor View. Click OK:



View name: PetClinic-M

● **Build Monitor View**
Shows a highly visible status of selected jobs. Ideal as an Extreme Feedback Device to be displayed on a screen on your office wall.

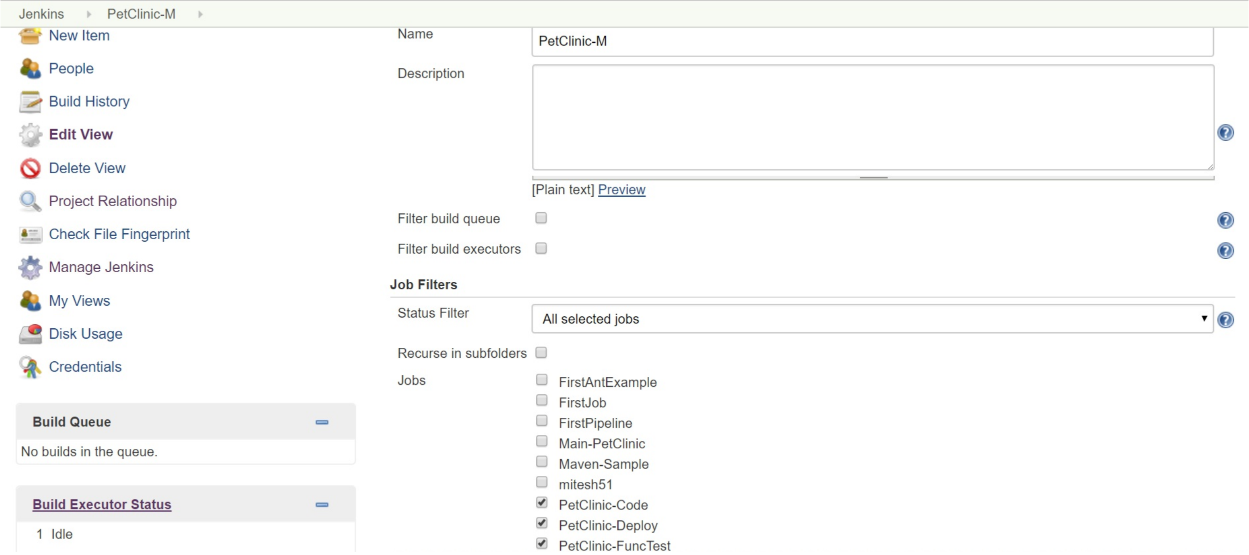
○ **Build Pipeline View**
Shows the jobs in a build pipeline view. The complete pipeline of jobs that a version propagates through are shown as a row in the view.

○ **Dashboard**
Customizable view that contains various portlets containing information about your job(s)

○ **List View**
Shows items in a simple list format. You can choose which jobs are to be displayed in which view.

○ **My View**
This view automatically displays all the jobs that the current user has an access to.

3. Select the jobs to be displayed in the newly created Build Monitor View. Click Save:



No builds in the queue.

1 Idle

Name: PetClinic-M

Description:

[Plain text] Preview

Filter build queue □

Filter build executors □

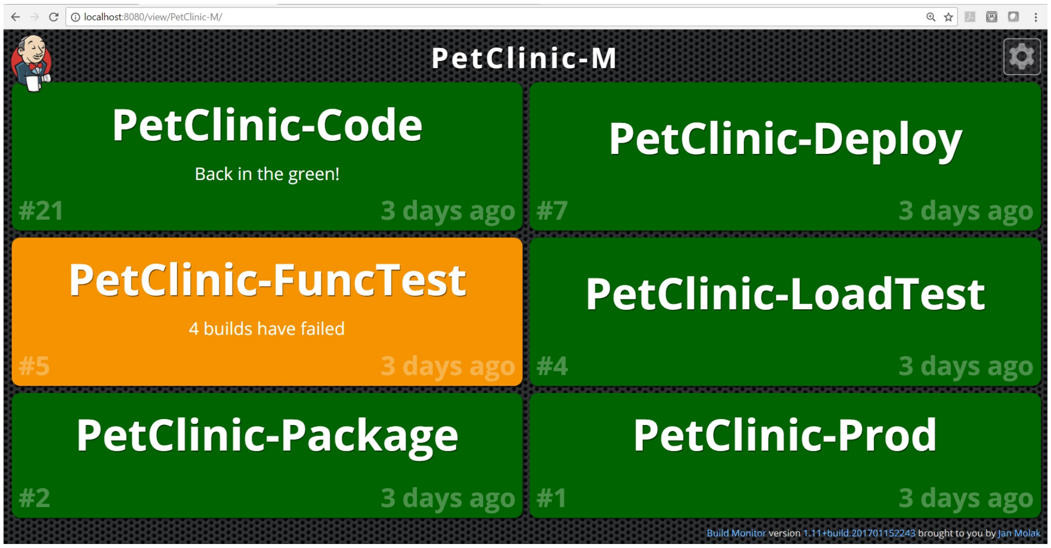
Job Filters

Status Filter: All selected jobs

Recurse in subfolders □

Jobs:
- □ FirstAntExample
- □ FirstJob
- □ FirstPipeline
- □ Main-PetClinic
- □ Maven-Sample
- □ mitesh51
- ☑ PetClinic-Code
- ☑ PetClinic-Deploy
- ☑ PetClinic-FuncTest

4. Verify the status of the Build Monitor View on the Jenkins dashboard:



PetClinic-M

PetClinic-Code Back in the green! #21 3 days ago	PetClinic-Deploy #7 3 days ago
PetClinic-FuncTest 4 builds have failed #5 3 days ago	PetClinic-LoadTest #4 3 days ago
PetClinic-Package #2 3 days ago	PetClinic-Prod #1 3 days ago

Build Monitor version 1.11+build.201701152243 brought to you by Jan Molak

In a single window, we can get the status of multiple jobs.

Configuring mail notifications

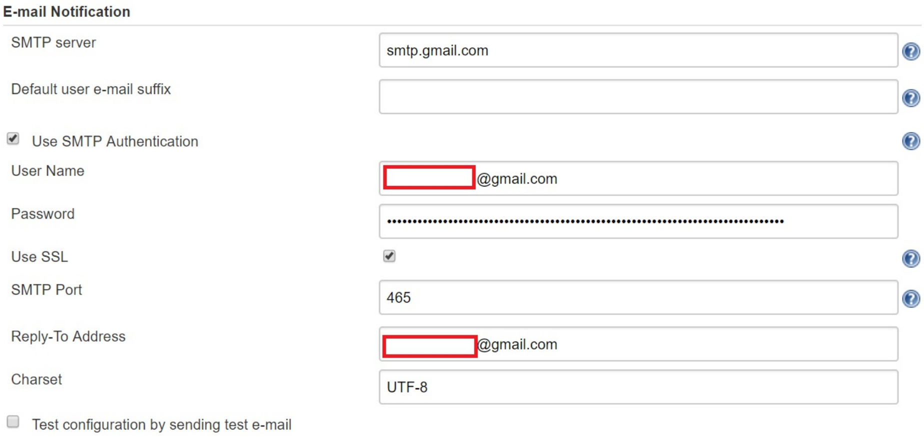
How about sending a mail notification when a build is successful or fails?

Getting ready

It is essential to know when something fails so that we can take corrective measures at the right time. You need to have an email account to configure email notifications in Jenkins and SMTP details.

How to do it...

1. Go to Manage Jenkins and go to the E-mail Notification section. Provide all the necessary details based on the email account:



E-mail Notification

SMTP server: smtp.gmail.com

Default user e-mail suffix:

☑ Use SMTP Authentication

User Name: [redacted]@gmail.com

Password: ••

Use SSL: ☑

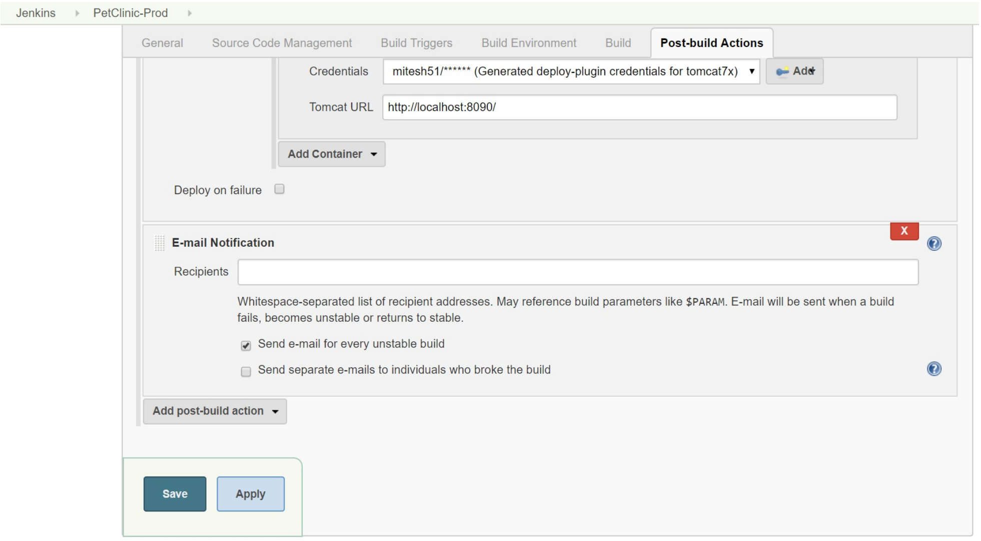
SMTP Port: 465

Reply-To Address: [redacted]@gmail.com

Charset: UTF-8

☐ Test configuration by sending test e-mail

2. In the build job where you want to configure mail notifications, go to Post-build Actions and select E-mail Notification. Provide a recipients list with one of the checkbox selected:



Credentials: mitesh51/****** (Generated deploy-plugin credentials for tomcat7x)

Tomcat URL: http://localhost:8090/

Deploy on failure ☐

E-mail Notification

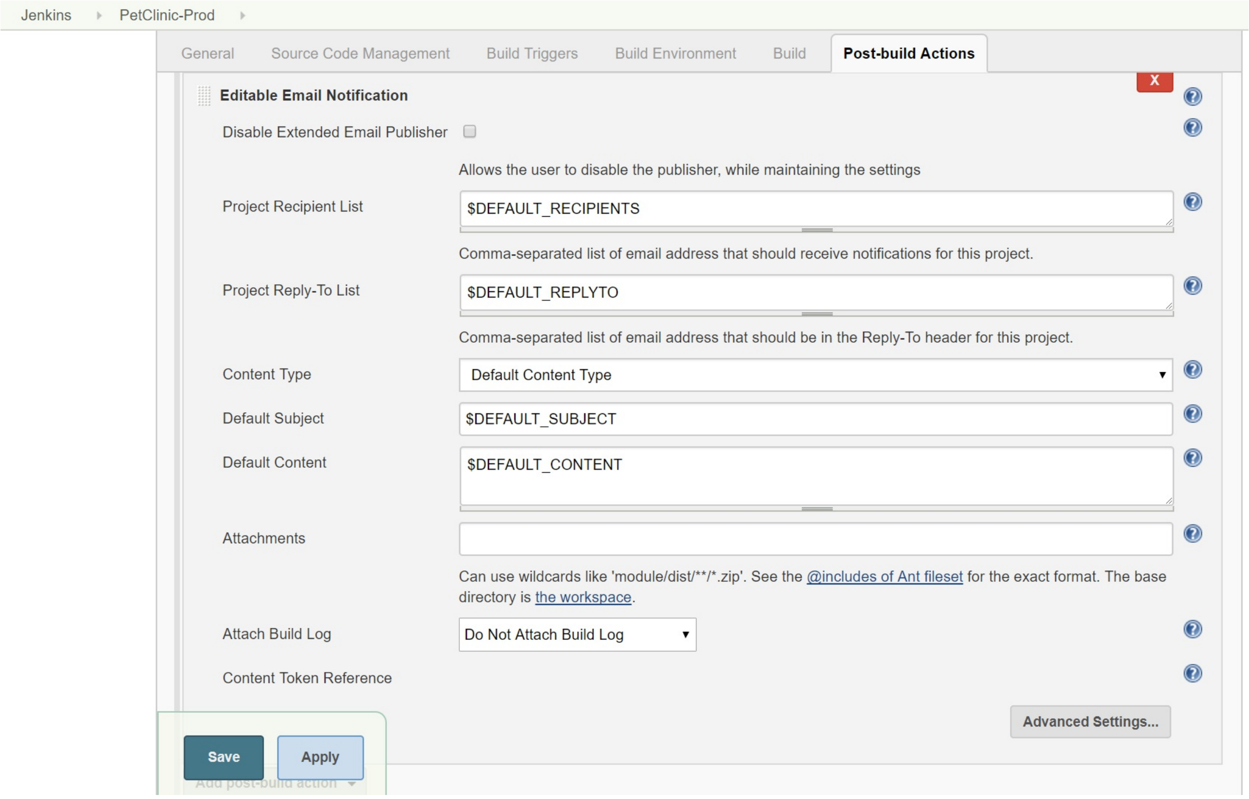
Recipients:

Whitespace-separated list of recipient addresses. May reference build parameters like `$PARAM`. E-mail will be sent when a build fails, becomes unstable or returns to stable.

☑ Send e-mail for every unstable build

☐ Send separate e-mails to individuals who broke the build

3. Go to Post-build Actions of the Jenkins build job and select Editable Email notification to send more customized emails to recipients:



Editable Email Notification

Disable Extended Email Publisher □

Allows the user to disable the publisher, while maintaining the settings

Project Recipient List: $DEFAULT_RECIPIENTS

Comma-separated list of email address that should receive notifications for this project.

Project Reply-To List: $DEFAULT_REPLYTO

Comma-separated list of email address that should be in the Reply-To header for this project.

Content Type: Default Content Type

Default Subject: $DEFAULT_SUBJECT

Default Content: $DEFAULT_CONTENT

Attachments:

Can use wildcards like 'module/dist/**/*.zip'. See the @includes of Ant fileset for the exact format. The base directory is the workspace.

Attach Build Log: Do Not Attach Build Log

Content Token Reference

4. This is how email notifications can be configured.

Signaling the need to archive

Each development team is unique. Teams have their own way of doing business. In many organizations, there are one-off tasks that need to be done periodically. For example, at the end of each year, making a full backup of the entire filesystem.

This recipe details a script that checks for the last successful run of any job; if the year is different to the current year, then a warning is set at the beginning of the job's description. Thus, it is hinting to you that it's time to perform an action, such as archiving and then deleting. You can of course programmatically do the archiving. However, for high-value actions, it is worth forcing interceding, letting the Groovy scripts focus your attention.

Getting ready

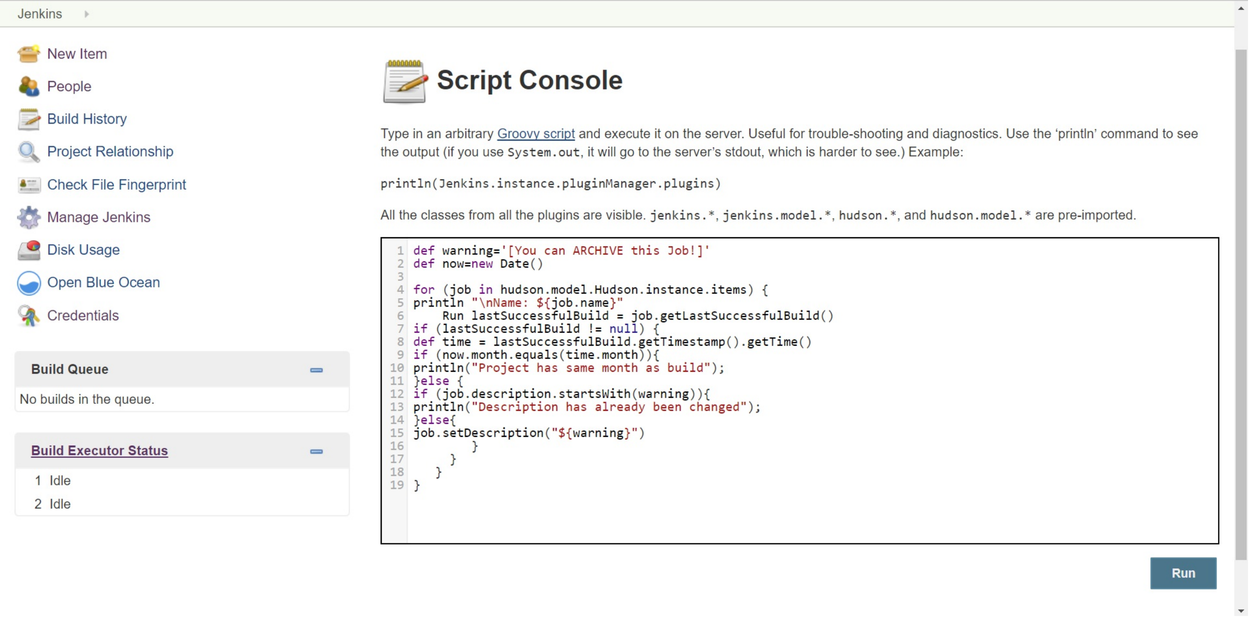
Log in to Jenkins with an administrative account.

How to do it...

1. Within the Manage Jenkins page, click on the Script Console link and run the following script:

   ```
   def warning='[You can ARCHIVE this Job]'
   def now=new Date()

   for (job in hudson.model.Hudson.instance.items) {
   println "\nName: ${job.name}"
       Run lastSuccessfulBuild = job.getLastSuccessfulBuild()
   if (lastSuccessfulBuild != null) {
   def time = lastSuccessfulBuild.getTimestamp().getTime()
   if (now.month.equals(time.month)){
   println("Project has same month as build");
   }else {
   if (job.description.startsWith(warning)){
   println("Description has already been changed");
   }else{
   job.setDescription("${warning}")
           }
        }
      }
   }
   ```

2. Provide the script in Script Console and click on Run:



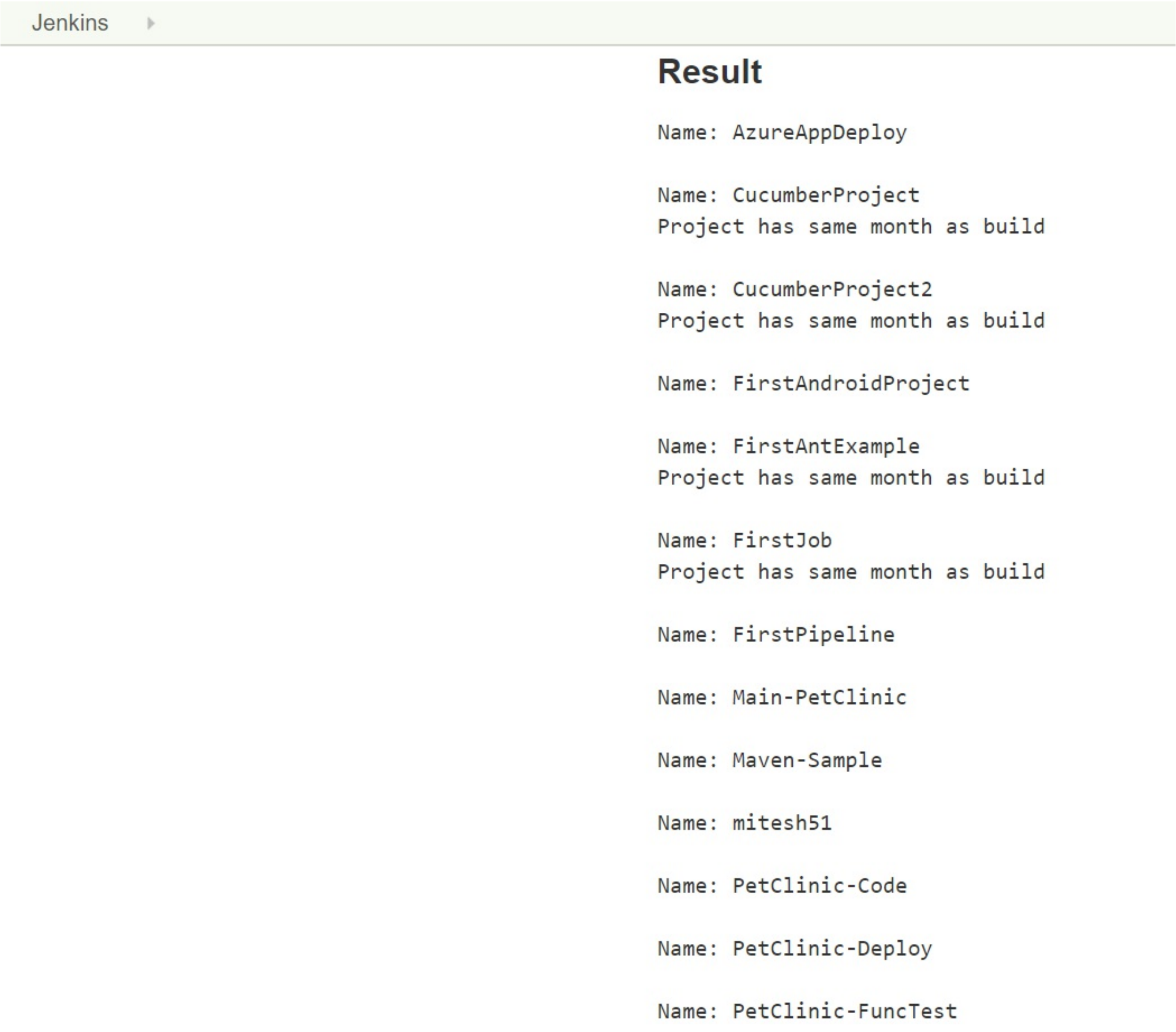
Type in an arbitrary Groovy script and execute it on the server. Useful for trouble-shooting and diagnostics. Use the 'println' command to see the output (if you use `System.out`, it will go to the server's stdout, which is harder to see.) Example:

```
println(Jenkins.instance.pluginManager.plugins)
```

All the classes from all the plugins are visible. `jenkins.*`, `jenkins.model.*`, `hudson.*`, and `hudson.model.*` are pre-imported.

```
def warning='[You can ARCHIVE this Job!]'
def now=new Date()

for (job in hudson.model.Hudson.instance.items) {
println "\nName: ${job.name}"
    Run lastSuccessfulBuild = job.getLastSuccessfulBuild()
if (lastSuccessfulBuild != null) {
def time = lastSuccessfulBuild.getTimestamp().getTime()
if (now.month.equals(time.month)){
println("Project has same month as build");
}else {
if (job.description.startsWith(warning)){
println("Description has already been changed");
}else{
job.setDescription("${warning}")
        }
     }
   }
}
```

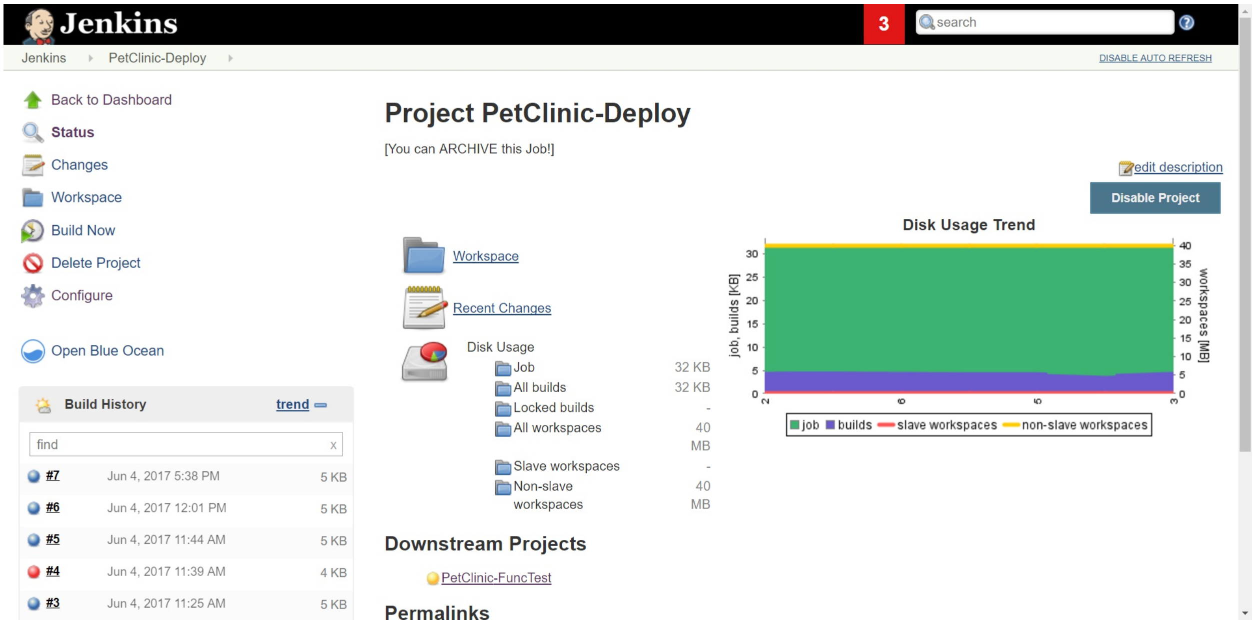
3. Successful execution of the script will give output based on the build jobs available in your Jenkins. The following is the sample output:



Result

```
Name: AzureAppDeploy

Name: CucumberProject
Project has same month as build

Name: CucumberProject2
Project has same month as build

Name: FirstAndroidProject

Name: FirstAntExample
Project has same month as build

Name: FirstJob
Project has same month as build

Name: FirstPipeline

Name: Main-PetClinic

Name: Maven-Sample

Name: mitesh51

Name: PetClinic-Code

Name: PetClinic-Deploy

Name: PetClinic-FuncTest
```

4. Any project that had its last successful build in another month than this will have the description You can archive this job added to its description, as shown in the following screenshot:



Project PetClinic-Deploy

[You can ARCHIVE this Job!]

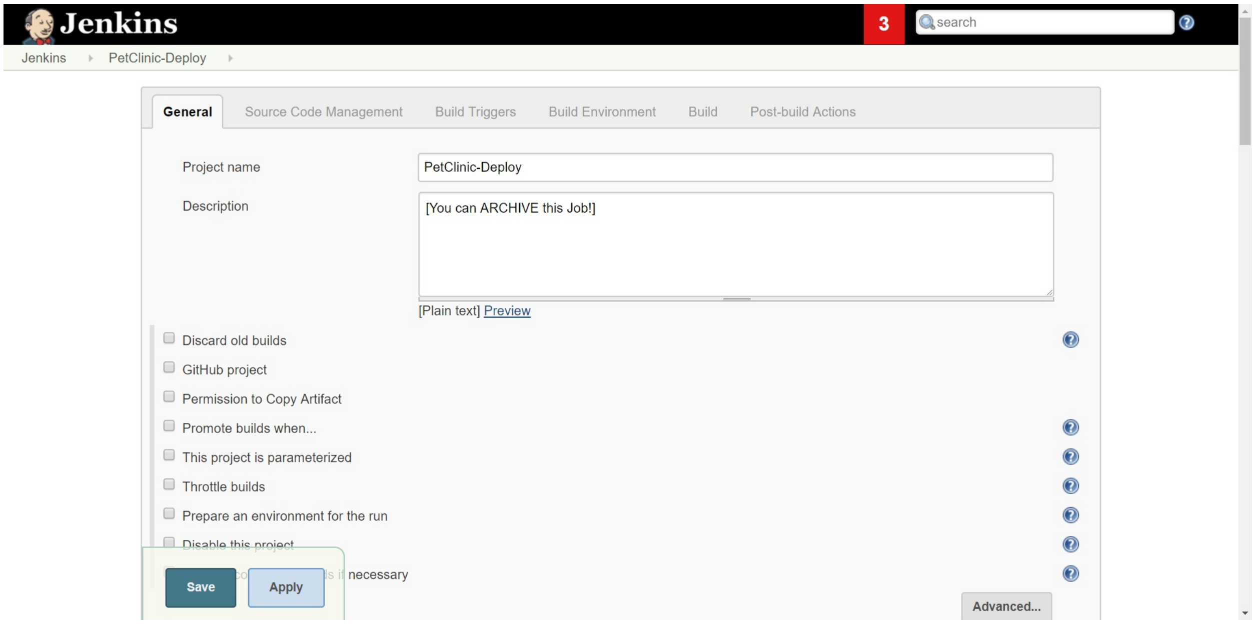
Disk Usage

Job	32 KB
All builds	32 KB
Locked builds	-
All workspaces	40 MB
Slave workspaces	-
Non-slave workspaces	40 MB

Build History trend

#7	Jun 4, 2017 5:38 PM	5 KB
#6	Jun 4, 2017 12:01 PM	5 KB
#5	Jun 4, 2017 11:44 AM	5 KB
#4	Jun 4, 2017 11:39 AM	4 KB
#3	Jun 4, 2017 11:25 AM	5 KB

5. Click on Configure to check the description as well:



Project name: PetClinic-Deploy

Description: [You can ARCHIVE this Job!]

[Plain text] Preview

☐ Discard old builds

☐ GitHub project

☐ Permission to Copy Artifact

☐ Promote builds when...

☐ This project is parameterized

☐ Throttle builds

☐ Prepare an environment for the run

☐ Disable this project

necessary

How it works...

Let's see how the script will be executed:

- A warning string is defined and the current date is now stored. Each job in Jenkins is programmatically iterated via the `for` statement.
- Jenkins has a class to store build run information. The runtime information is retrieved via `job.getLastSuccessfulBuild()` and is stored in the `lastSuccessfulBuild` instance. If no successful build has occurred, then `lastSuccessfulBuild` is set to null; otherwise, it has the runtime information.
- The time of the last successful build is retrieved and then stored in the `time` instance via `lastSuccessfulBuild.getTimestamp().getTime()`.

The current year is compared with the year of the last successful build and, if they are different and the warning string has not already been added to the front of the job description, then the description is updated.

Javadoc:

You will find the job API mentioned at http://javadoc.jenkins-ci.org/hudson/model/Job.html and the run information at http://javadoc.jenkins-ci.org/hudson/model/Run.html.

There's more...

Before writing your own code, you should review what already exists. With 1,000 plugins and expanding, Jenkins has a large, freely available, and openly licensed example code base. Although in this case, the standard API was used, it is well worth reviewing the plugin code base. In this example, you will find part of the code reused from the `lastsuccessversioncolumn` plugin. (http://tinyurl.com/pack-jenkins-1).

If you find any defects while reviewing the plugin code base, please contribute to the community via patches and bug reports.

Managing Security

In this chapter, we will cover the following recipes:

- Improving security with Jenkins configuration
- Configuring Authorization - Matrix-based security
- Configuring a Project-based Matrix Authorization Strategy
- Jenkins and OpenLDAP integration
- Jenkins and Active Directory integration
- Jenkins and OWASP Zed attack proxy integration
- Testing for OWASP's top 10 security issues
- Finding 500 errors and XSS attacks in Jenkins through fuzzing
- Avoiding sign-up bots with JCaptcha

Introduction

In this chapter, we'll discuss the security of Jenkins, taking into account that Jenkins can live in a rich variety of infrastructures. We will also look at how to scan for known security issues in the libraries used by Java code that Jenkins compiles.

The only perfectly secure system is a system that does not exist. For real services, you will need to pay attention to the different surfaces open to attack. Jenkins' primary surfaces are its web-based graphical user interface and its trust relationships with its slave nodes and the native OS. Online services need vigorous attention to their security surface. For Jenkins, there are three main reasons why:

- Jenkins has the ability to communicate with a wide range of infrastructures through either its plugins or the master-slave topology
- The rate of code change around the plugins is high and open to the accidental inclusion of security-related defects
- You need to harden the default install

Another positive thing is that Jenkins code is freely available for review and the core community keeps a vigilant eye.

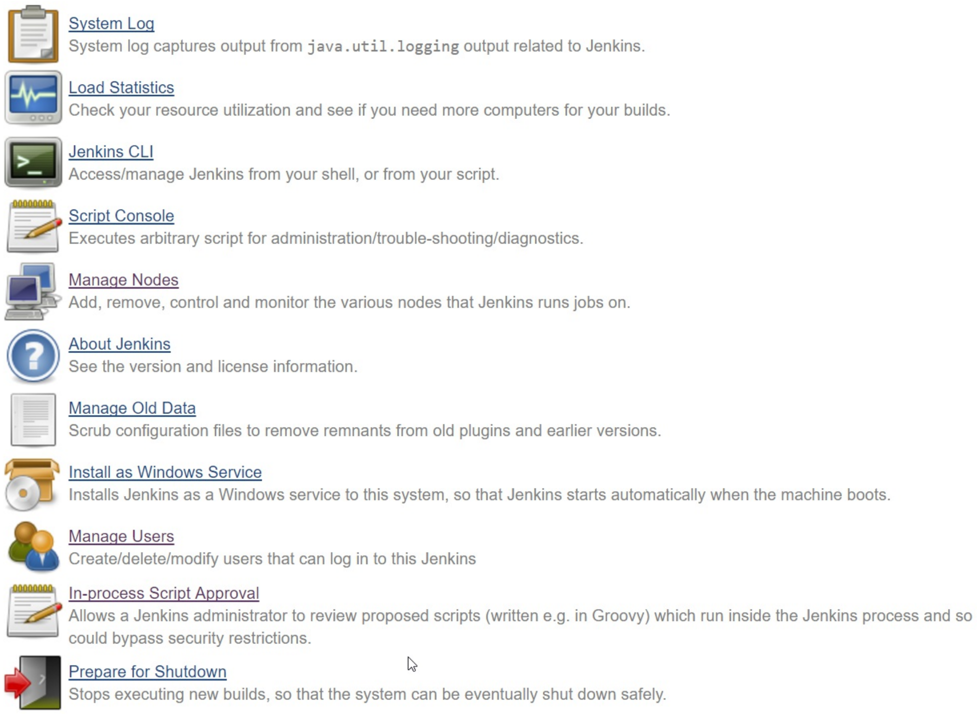
Improving security with Jenkins configuration

In this section, we will cover how to manage multiple users.

Getting ready

Through user management, we can provide access to Jenkins to multiple users and provide them with roles based on project-based access when it is required. The Manage Users will only appear if the selected security realm is Jenkins' own user database.

1. Go to Manage Jenkins and click on Manage Users:



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/manage 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.

About Jenkins
See the version and license information.

Manage Old Data
Scrub configuration files to remove remnants from old plugins and earlier versions.

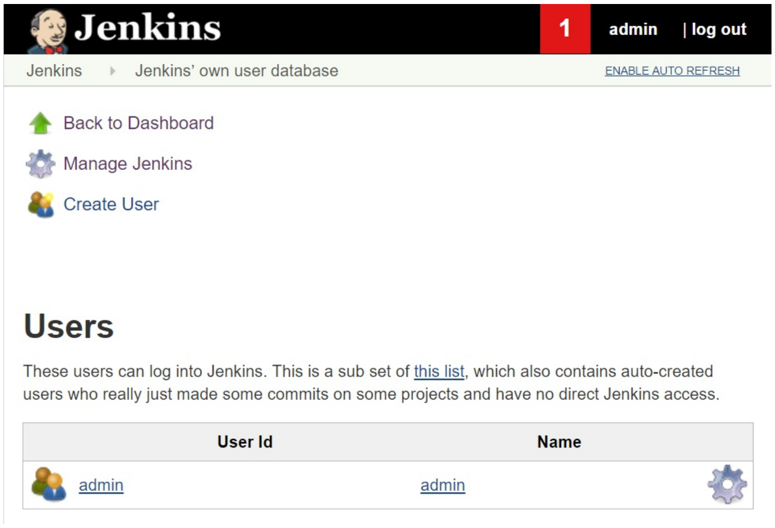
Install as Windows Service
Installs Jenkins as a Windows service to this system, so that Jenkins starts automatically when the machine boots.

Manage Users
Create/delete/modify users that can log in to this Jenkins

In-process Script Approval
Allows a Jenkins administrator to review proposed scripts (written e.g. in Groovy) which run inside the Jenkins process and so could bypass security restrictions.

Prepare for Shutdown
Stops executing new builds, so that the system can be eventually shut down safely.

2. Verify the existing admin user available in Jenkins:

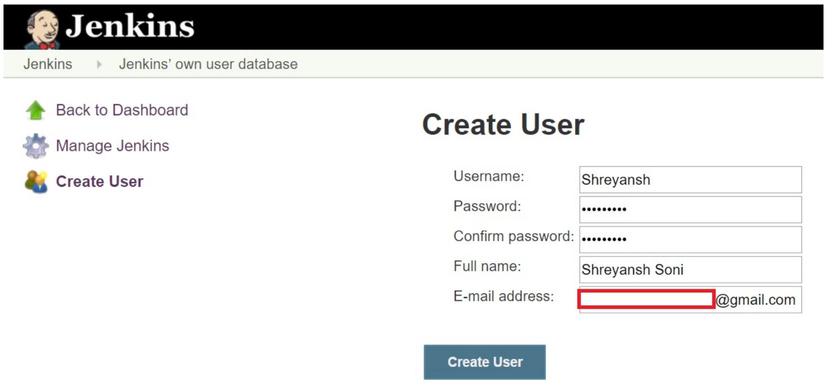


Users

These users can log into Jenkins. This is a sub set of this list, which also contains auto-created users who really just made some commits on some projects and have no direct Jenkins access.

User Id	Name
admin	admin

3. Click on the Create User link and provide details:



Create User

Username: Shreyansh

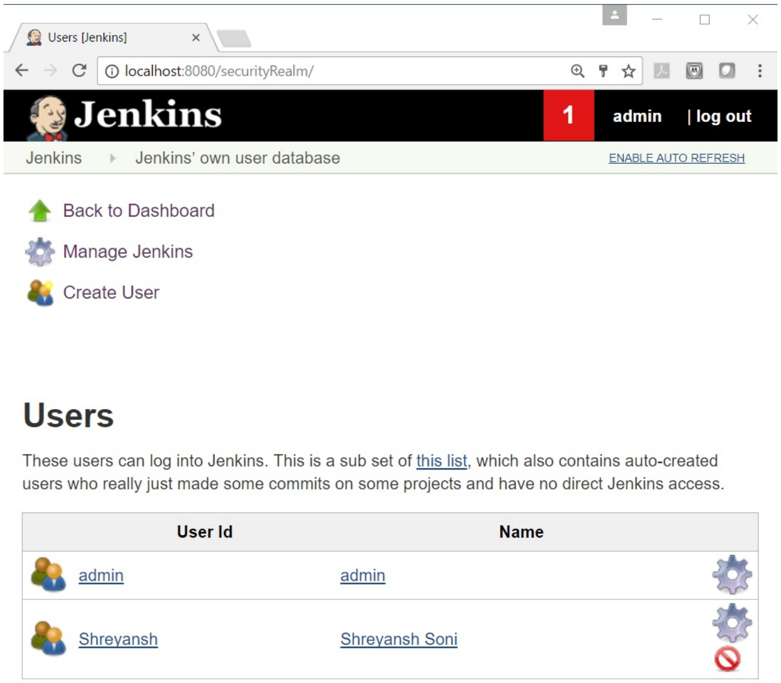
Password: •••••••••

Confirm password: •••••••••

Full name: Shreyansh Soni

E-mail address: [redacted]@gmail.com

4. Verify the list of users in Manage Jenkins| Manage Users:



Users

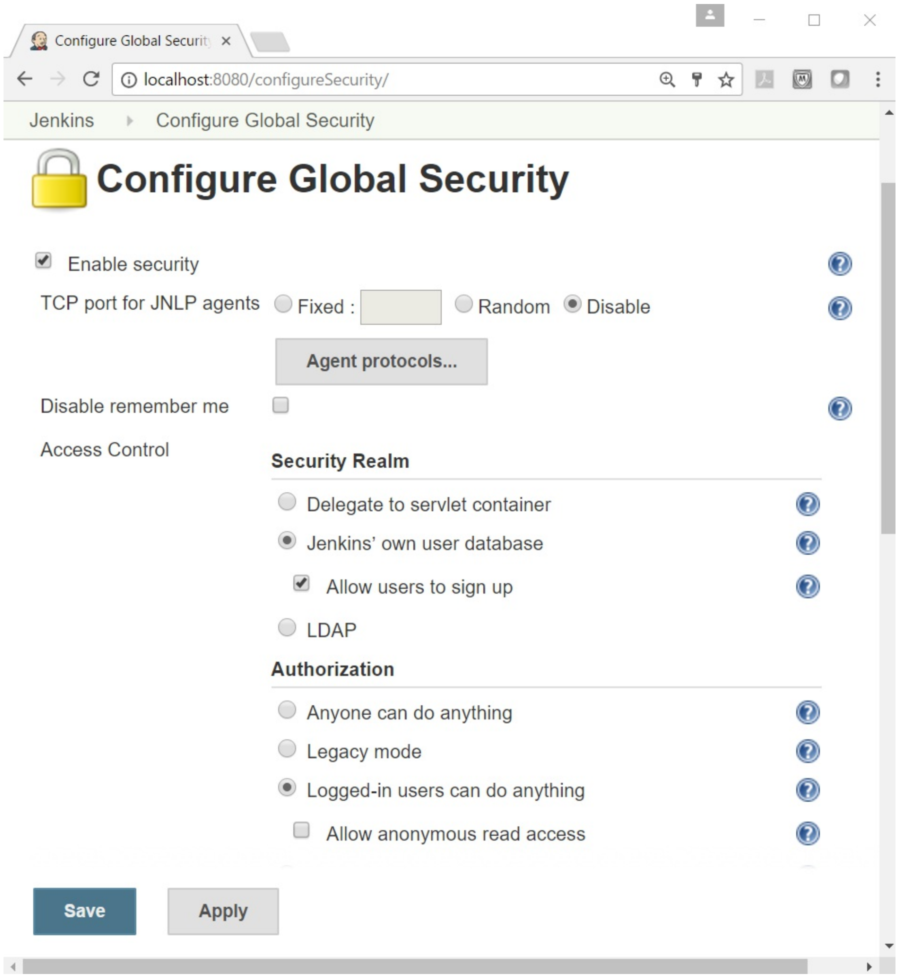
These users can log into Jenkins. This is a sub set of this list, which also contains auto-created users who really just made some commits on some projects and have no direct Jenkins access.

User Id	Name
admin	admin
Shreyansh	Shreyansh Soni

You can change or delete users from Manage Jenkins | Manage Users.

How to do it...

1. To allow sign up and access to only logged in users, go to Manage Jenkins | Configure Global Security.
2. In the Access Control section, click on Jenkins' own user database and select Allow users to sign up:



Configure Global Security

☑ Enable security

TCP port for JNLP agents ○ Fixed : ○ Random ● Disable

Disable remember me □

Access Control

Security Realm

○ Delegate to servlet container

● Jenkins' own user database

☑ Allow users to sign up

○ LDAP

Authorization

○ Anyone can do anything

○ Legacy mode

● Logged-in users can do anything

□ Allow anonymous read access

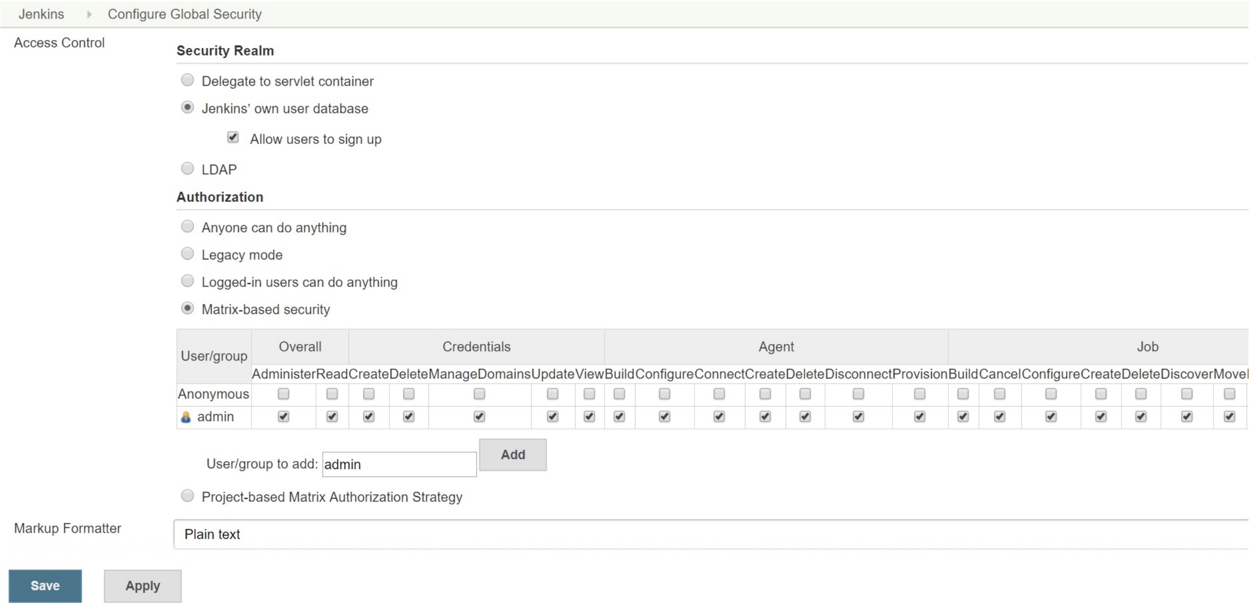
3. So, this is how we can create users and allow users to sign up, as well as to access Jenkins.

Configuring Authorization - Matrix-based security

In the Authorization section, we can configure Matrix-based security so that we can configure who can do what. We can configure predefined roles available in Jenkins.

Getting ready

Select Matrix-based security and add a name in the User/group to add box. Make sure that you give access to admin before saving it; otherwise, the Jenkins account will be locked out:



Access Control

Security Realm

○ Delegate to servlet container
● Jenkins' own user database
☑ Allow users to sign up
○ LDAP

Authorization

○ Anyone can do anything
○ Legacy mode
○ Logged-in users can do anything
● Matrix-based security

User/group	Overall		Credentials					Agent							Job						
	Administer	Read	Create	Delete	ManageDomains	Update	View	Build	Configure	Connect	Create	Delete	Disconnect	Provision	Build	Cancel	Configure	Create	Delete	Discover	Move
Anonymous	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
admin	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑

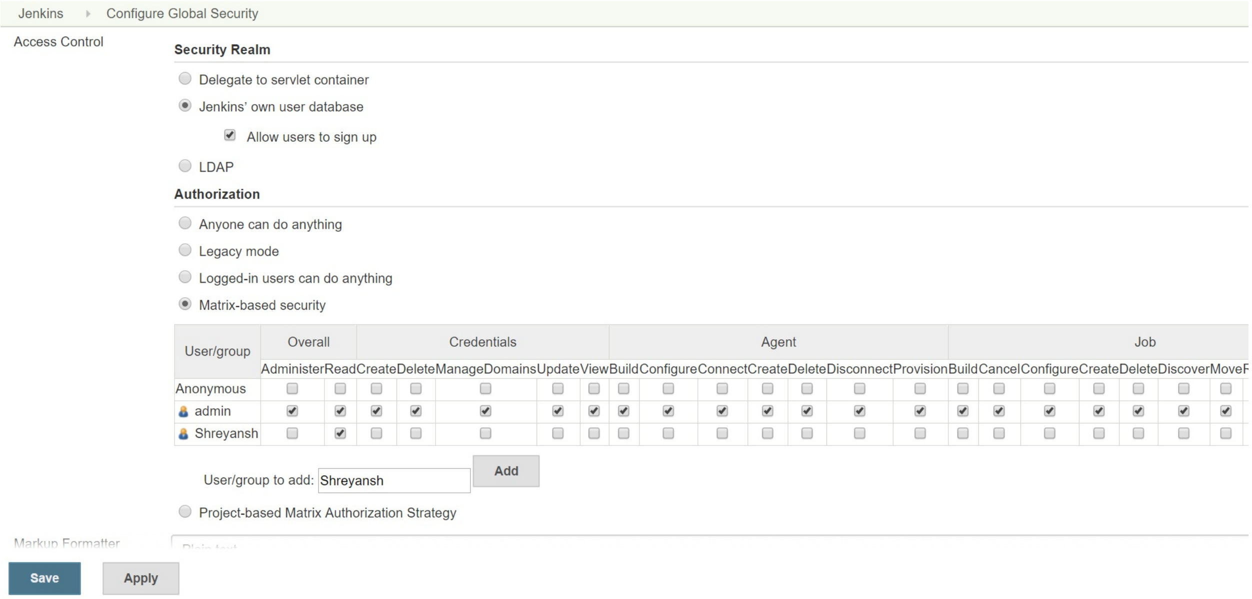
User/group to add: admin

○ Project-based Matrix Authorization Strategy

Markup Formatter: Plain text

How to do it...

1. Give the name of our newly created user, click on Add, and provide all the required rights. We can do the same thing for different users.
2. Click on Save:



Jenkins ▸ Configure Global Security

Access Control

Security Realm

○ Delegate to servlet container

● Jenkins' own user database

☑ Allow users to sign up

○ LDAP

Authorization

○ Anyone can do anything

○ Legacy mode

○ Logged-in users can do anything

● Matrix-based security

User/group	Overall		Credentials					Agent							Job						
	Administer	Read	Create	Delete	ManageDomains	Update	View	Build	Configure	Connect	Create	Delete	Disconnect	Provision	Build	Cancel	Configure	Create	Delete	Discover	Move
Anonymous	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
admin	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Shreyansh	□	☑	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□

User/group to add: Shreyansh

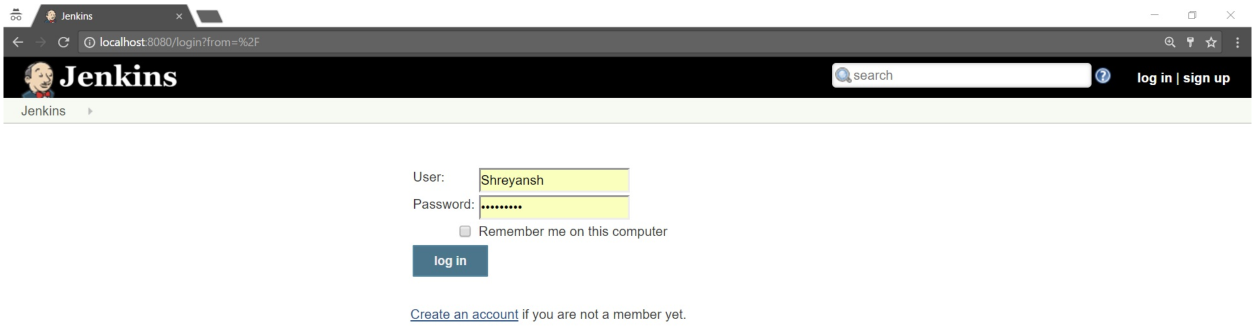
Add

○ Project-based Matrix Authorization Strategy

Markup Formatter

Save Apply

3. To verify the access, open a new incognito window in the browser and log in with the User and Password of the newly created user:



User: Shreyansh

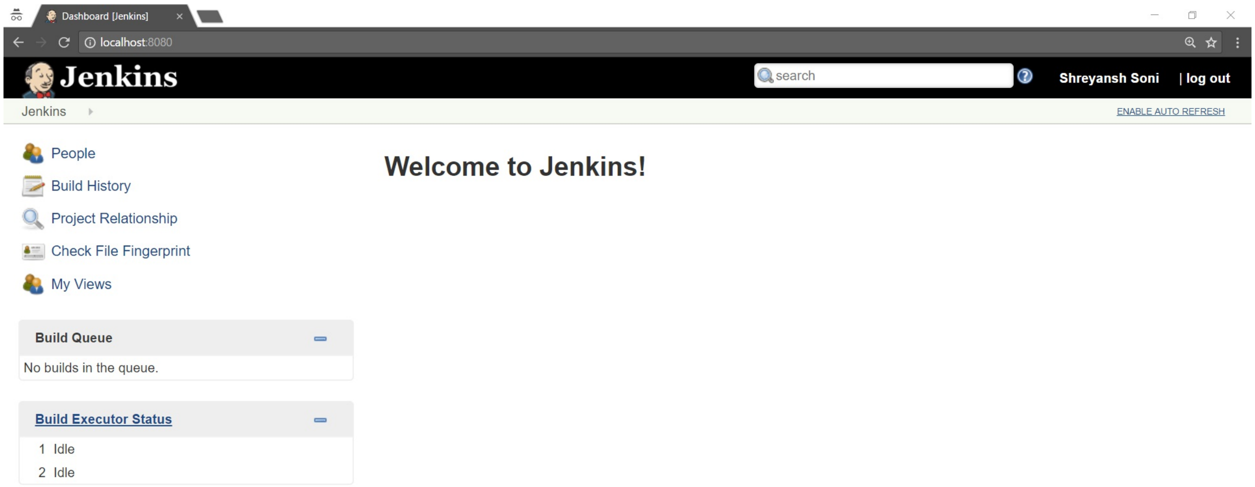
Password: •••••••••

□ Remember me on this computer

log in

Create an account if you are not a member yet.

4. Verify that the limited access is available to the new user. The New Item and Manage Jenkins links are not available:



Welcome to Jenkins!

Build Queue

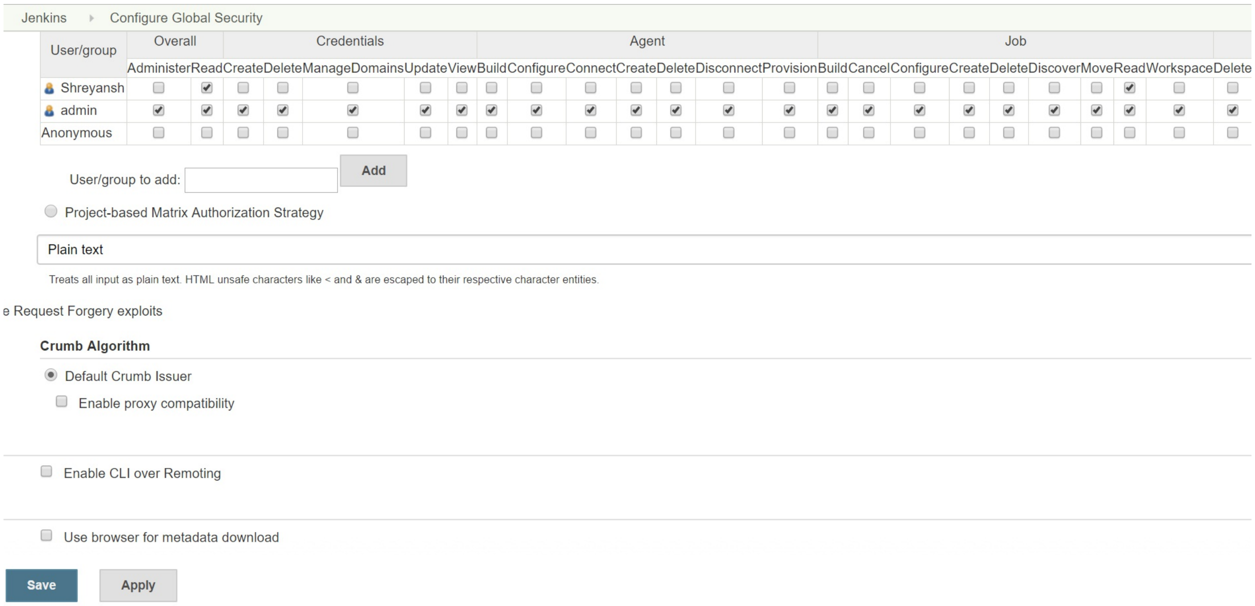
No builds in the queue.

Build Executor Status

1 Idle

2 Idle

5. Now go to Manage Jenkins | Global Security Configuration. Allow Read rights in the Job category for the user Shreyansh.
6. Click on Save:



User/group	Overall		Credentials					Agent							Job									
	Administer	Read	Create	Delete	ManageDomains	Update	View	Build	Configure	Connect	Create	Delete	Disconnect	Provision	Build	Cancel	Configure	Create	Delete	Discover	Move	Read	Workspace	Delete
Shreyansh	□	☑	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	☑	□	□
admin	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Anonymous	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□

User/group to add: Add

○ Project-based Matrix Authorization Strategy

Plain text

Treats all input as plain text. HTML unsafe characters like < and & are escaped to their respective character entities.

e Request Forgery exploits

Crumb Algorithm

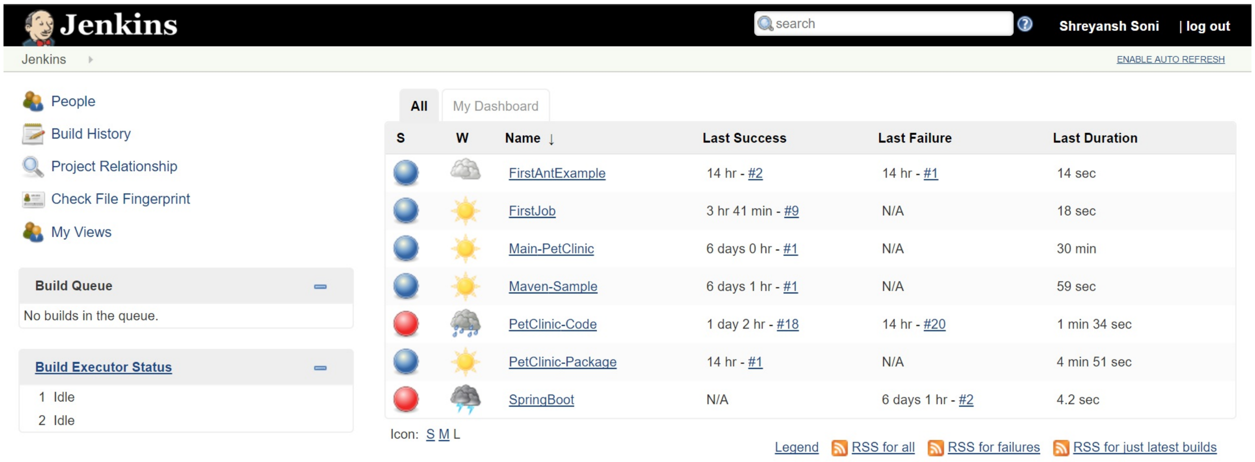
● Default Crumb Issuer

□ Enable proxy compatibility

□ Enable CLI over Remoting

□ Use browser for metadata download

7. Go to the incognito window that we opened before and refresh the page. Now we have read access to the jobs available in Jenkins:



Jenkins search Shreyansh Soni | log out

Jenkins ENABLE AUTO REFRESH

- People
- Build History
- Project Relationship
- Check File Fingerprint
- My Views

Build Queue

No builds in the queue.

Build Executor Status

1 Idle
2 Idle

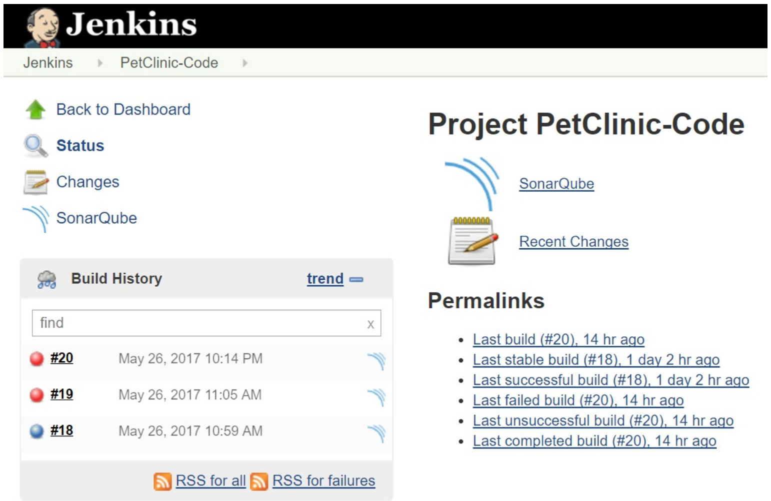
All | My Dashboard

S	W	Name ↓	Last Success	Last Failure	Last Duration
🔵	☁	FirstAntExample	14 hr - #2	14 hr - #1	14 sec
🔵	☀	FirstJob	3 hr 41 min - #9	N/A	18 sec
🔵	☀	Main-PetClinic	6 days 0 hr - #1	N/A	30 min
🔵	☀	Maven-Sample	6 days 1 hr - #1	N/A	59 sec
🔴	⛈	PetClinic-Code	1 day 2 hr - #18	14 hr - #20	1 min 34 sec
🔵	☀	PetClinic-Package	14 hr - #1	N/A	4 min 51 sec
🔴	⛈	SpringBoot	N/A	6 days 1 hr - #2	4.2 sec

Icon: S M L

Legend RSS for all RSS for failures RSS for just latest builds

8. We can see the jobs, but we can't execute them, as rights are not available:



Jenkins

Jenkins PetClinic-Code

- Back to Dashboard
- Status
- Changes
- SonarQube

Build History trend

find

🔴	#20	May 26, 2017 10:14 PM
🔴	#19	May 26, 2017 11:05 AM
🔵	#18	May 26, 2017 10:59 AM

RSS for all RSS for failures

Project PetClinic-Code

SonarQube

Recent Changes

Permalinks

- Last build (#20), 14 hr ago
- Last stable build (#18), 1 day 2 hr ago
- Last successful build (#18), 1 day 2 hr ago
- Last failed build (#20), 14 hr ago
- Last unsuccessful build (#20), 14 hr ago
- Last completed build (#20), 14 hr ago

9. This is how we can manage users and authorization in Jenkins. In the next section, we will learn how to give project-based access.

Configuring a Project-based Matrix Authorization Strategy

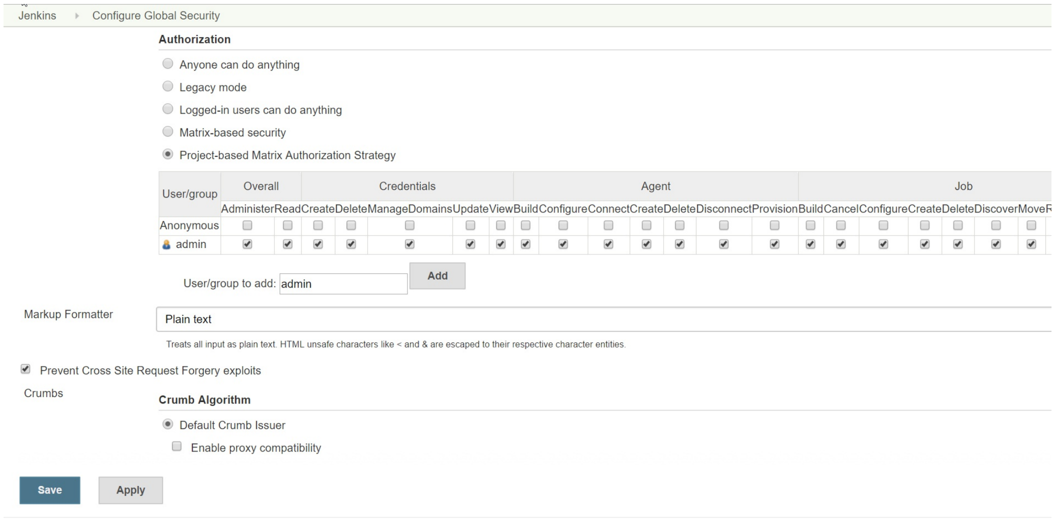
Project-based Matrix Authorization Strategy is an extension of Matrix-based security. It allows an access control list matrix to be defined for each project. This feature is very useful when we want to give access to specific jobs to specific users so that the security of Jenkins is not compromised.

Getting ready

Go to Manage Jenkins | Global Security Configuration.

How to do it...

1. In the Authorization section, select Project-based Matrix Authorization Strategy.
2. Give admin all rights and Save:



Jenkins ▸ Configure Global Security

Authorization

○ Anyone can do anything
○ Legacy mode
○ Logged-in users can do anything
○ Matrix-based security
● Project-based Matrix Authorization Strategy

User/group	Overall		Credentials					Agent							Job							
	Administer	Read	Create	Delete	ManageDomains	Update	View	Build	Configure	Connect	Create	Delete	Disconnect	Provision	Build	Cancel	Configure	Create	Delete	Discover	Move	R
Anonymous	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	
admin	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	

User/group to add: admin

Markup Formatter: Plain text

Treats all input as plain text. HTML unsafe characters like < and & are escaped to their respective character entities.

☑ Prevent Cross Site Request Forgery exploits

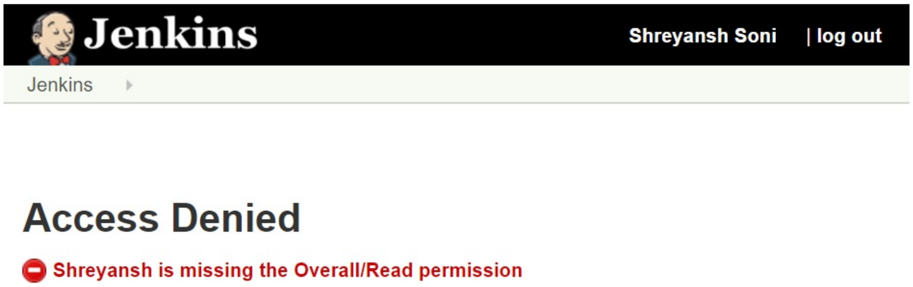
Crumbs

Crumb Algorithm

● Default Crumb Issuer
□ Enable proxy compatibility

3. Go to the incognito window where we logged in using the credentials of Shreyansh.

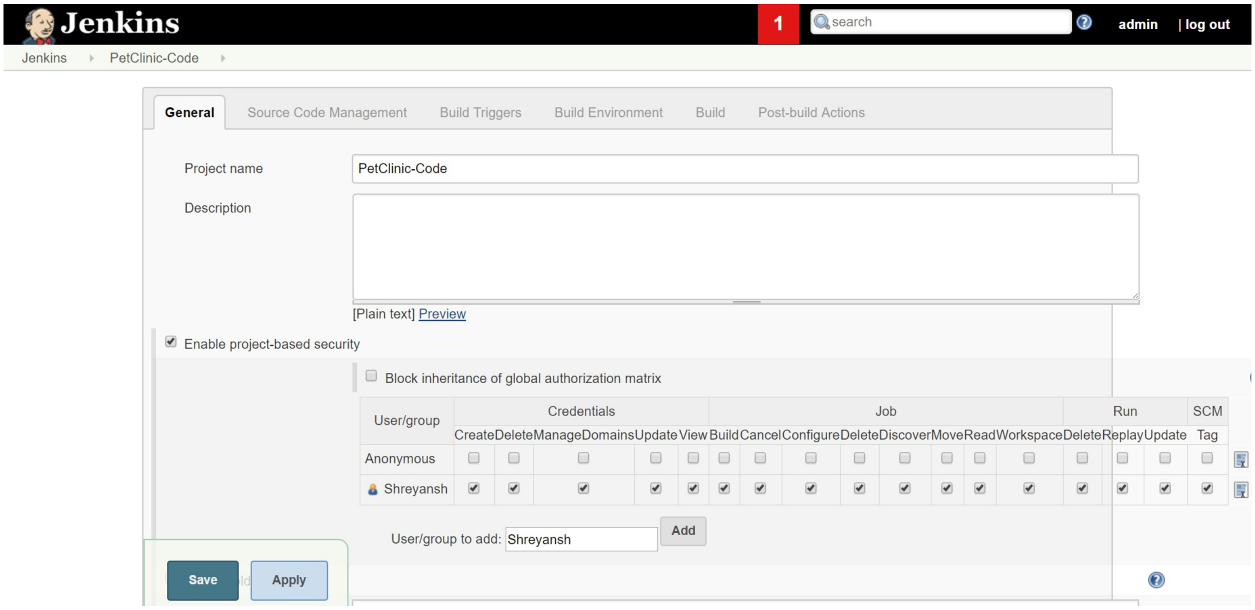
4. Refresh the page and we will get Access Denied. The reason is that we haven't given any rights to Shreyansh in Project-based Matrix Authorization Strategy:



Access Denied

Shreyansh is missing the Overall/Read permission

5. We need to provide overall Read rights so Shreyansh can access the Jenkins dashboard:



Project name: PetClinic-Code

Description:

☑ Enable project-based security

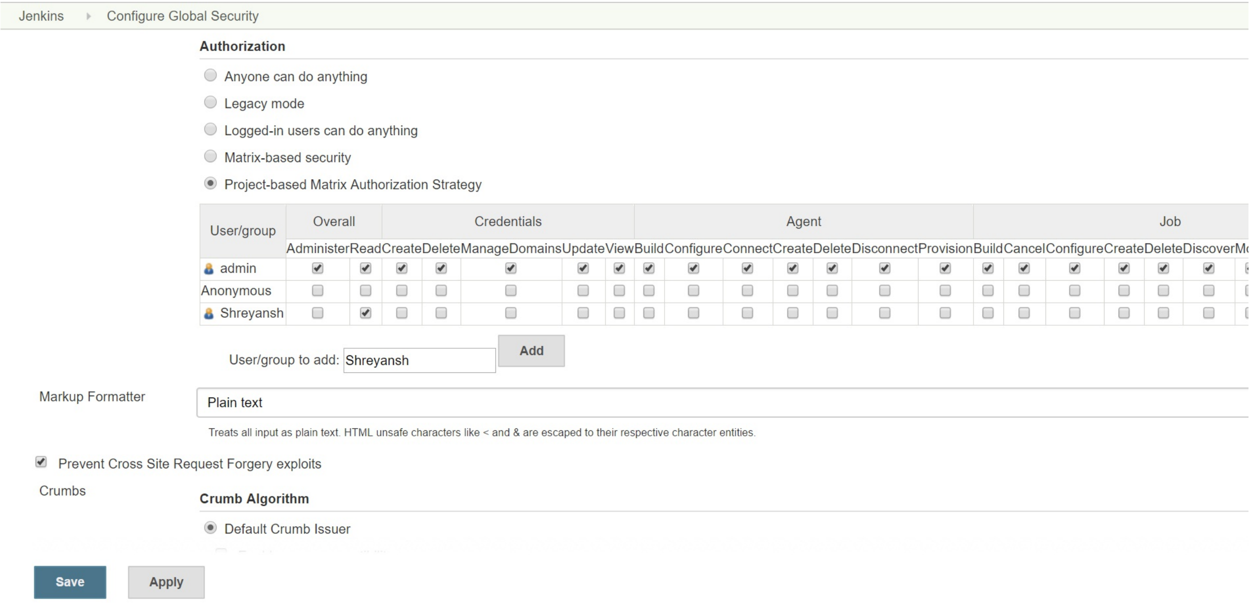
☐ Block inheritance of global authorization matrix

User/group	Credentials					Job								Run			SCM
	Create	Delete	ManageDomains	Update	View	Build	Cancel	Configure	Delete	Discover	Move	Read	Workspace	Delete	Replay	Update	Tag
Anonymous	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Shreyansh	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑

User/group to add: Shreyansh

6. Now, go to the individual build job as an admin and select Enable project-based security in the job configuration page.

7. Add Shreyansh as a user and click on Save:



Jenkins › Configure Global Security

Authorization

○ Anyone can do anything
○ Legacy mode
○ Logged-in users can do anything
○ Matrix-based security
● Project-based Matrix Authorization Strategy

User/group	Overall		Credentials					Agent							Job						
	Administer	Read	Create	Delete	ManageDomains	Update	View	Build	Configure	Connect	Create	Delete	Disconnect	Provision	Build	Cancel	Configure	Create	Delete	Discover	M
admin	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Anonymous	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Shreyansh	□	☑	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□

User/group to add: Shreyansh Add

Markup Formatter: Plain text

Treats all input as plain text. HTML unsafe characters like < and & are escaped to their respective character entities.

☑ Prevent Cross Site Request Forgery exploits

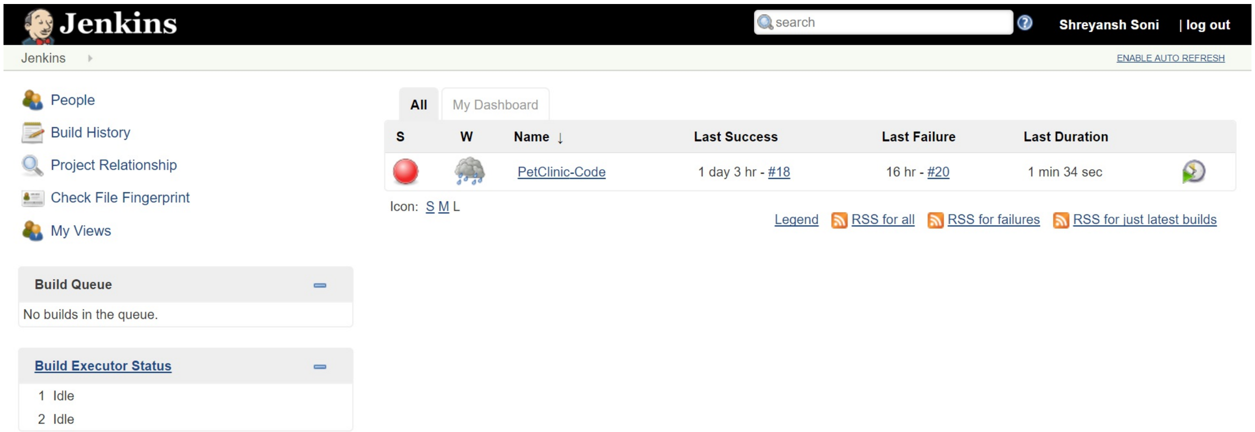
Crumbs

Crumb Algorithm

● Default Crumb Issuer

Save Apply

8. Now, go to the incognito window where Shreyansh is logged in and refresh the page.
9. We can see one job, which we have configured to give access to Shreyansh:



S	W	Name ↓	Last Success	Last Failure	Last Duration
●		PetClinic-Code	1 day 3 hr - #18	16 hr - #20	1 min 34 sec

Icon: S M L

Legend RSS for all RSS for failures RSS for just latest builds

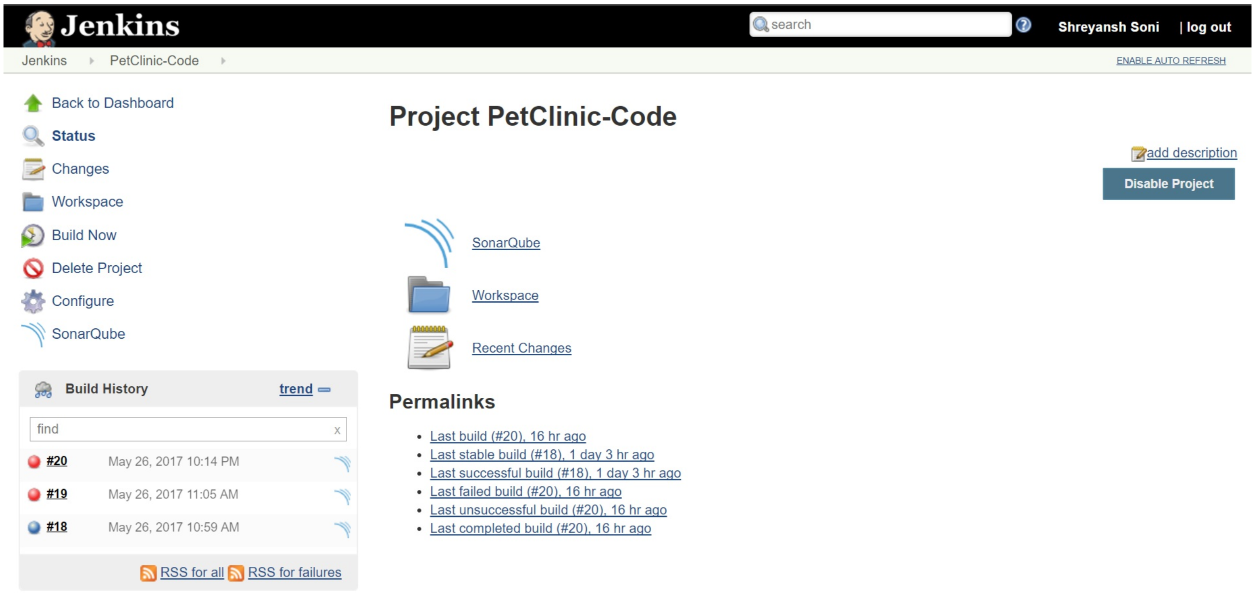
Build Queue

No builds in the queue.

Build Executor Status

1 Idle
2 Idle

10. Click on the build and verify that all the rights are available to the user Shreyansh:



#20	May 26, 2017 10:14 PM
#19	May 26, 2017 11:05 AM
#18	May 26, 2017 10:59 AM

Permalinks

- Last build (#20), 16 hr ago
- Last stable build (#18), 1 day 3 hr ago
- Last successful build (#18), 1 day 3 hr ago
- Last failed build (#20), 16 hr ago
- Last unsuccessful build (#20), 16 hr ago
- Last completed build (#20), 16 hr ago

Now we have finished user management, role-based access, and project-based access in Jenkins as a part of securing Jenkins.

Jenkins and OpenLDAP integration

The **Lightweight Directory Access Protocol** (**LDAP**) provides a highly popular open standards directory service. It is used in many organizations to display user information to the world. LDAP is also used as a central service to hold user passwords for authentication and can contain information necessary for routing mail, POSIX account administration, and various other pieces of information that external systems may require. Jenkins can directly connect to LDAP for authentication or indirectly through the CAS SSO server (http://www.jasig.org/cas), which then uses LDAP as its password container. Jenkins also has an email plugin (https://wiki.jenkins-ci.org/display/JENKINS/LDAP+Email+Plugin) that pulls its routing information out of LDAP.

Because LDAP is a common enterprise service, Jenkins may also encounter LDAP while running integration tests as part of the build application's testing infrastructure.

This recipe shows you how to quickly install an OpenLDAP server named `slapd` and then add organizations, users, and groups via **LDAPData Interchange Format** (**LDIF**), a simple text format for storing LDAP records (http://en.wikipedia.org/wiki/LDAP_Data_Interchange_Format).

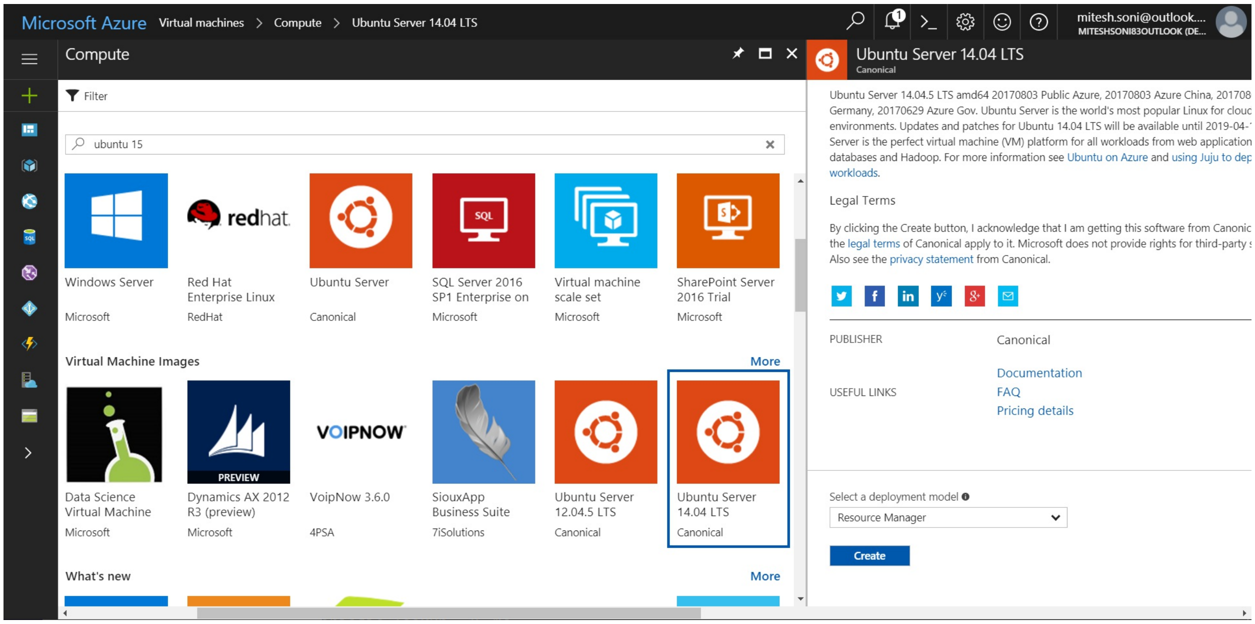
Active Directory is also popular in corporate environments. Jenkins has a plugin for Active Directory (https://wiki.jenkins-ci.org/display/JENKINS/Active+Directory+plugin).

Getting ready

For this recipe, you will install OpenLDAP on Ubuntu 14.04 LTS or newer. You can create a virtual machine using VirtualBox or the VMware Workstation too.

Here, the Ubuntu virtual machine is created in Microsoft Azure. You can set up a free trial account for Microsoft Azure and try this out:

1. On the left sidebar, click on Virtual Machines and click on Add. Select Ubuntu Server 14.04 LTS and click on Create:



Ubuntu Server 14.04.5 LTS amd64 20170803 Public Azure, 20170803 Azure China, 201708 Germany, 20170629 Azure Gov. Ubuntu Server is the world's most popular Linux for clouc environments. Updates and patches for Ubuntu 14.04 LTS will be available until 2019-04- Server is the perfect virtual machine (VM) platform for all workloads from web application databases and Hadoop. For more information see Ubuntu on Azure and using Juju to dep workloads.

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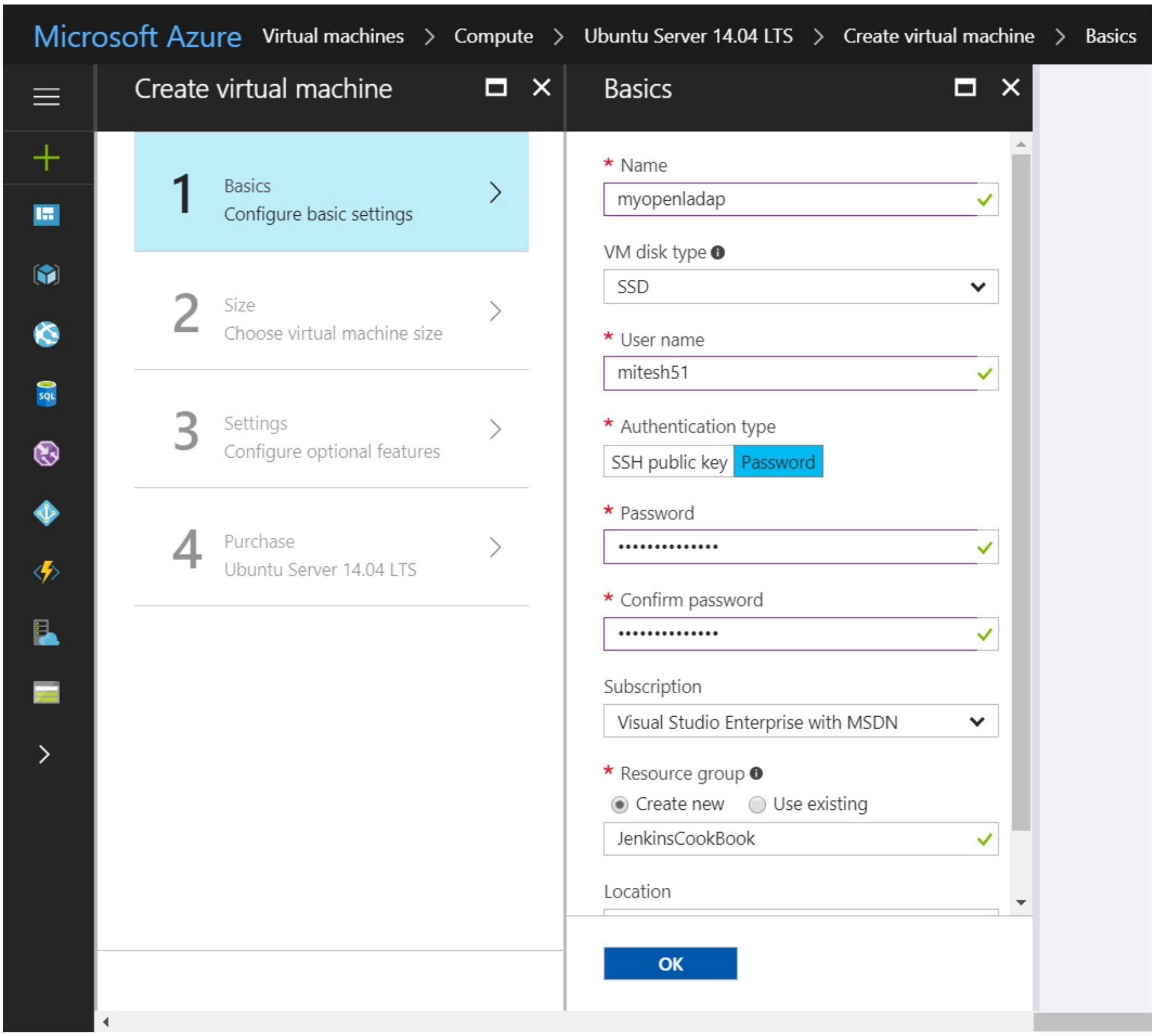
USEFUL LINKS Documentation FAQ Pricing details

Select a deployment model: Resource Manager

2. Provide the virtual machine's Name, User name, Password, Subscription, and Resource group name.
3. Select Location.
4. Click OK:


Microsoft Azure
Virtual machines > Compute > Ubuntu Server 14.04 LTS > Create virtual machine > Basics
Create virtual machine
Basics
OK

1 Basics
Configure basic settings

2 Size
Choose virtual machine size

3 Settings
Configure optional features

4 Purchase
Ubuntu Server 14.04 LTS

* Name
myopenladap ✓

VM disk type
SSD

* User name
mitesh51 ✓

* Authentication type
SSH public key [✓ Password]

* Password
•••••••••••••• ✓

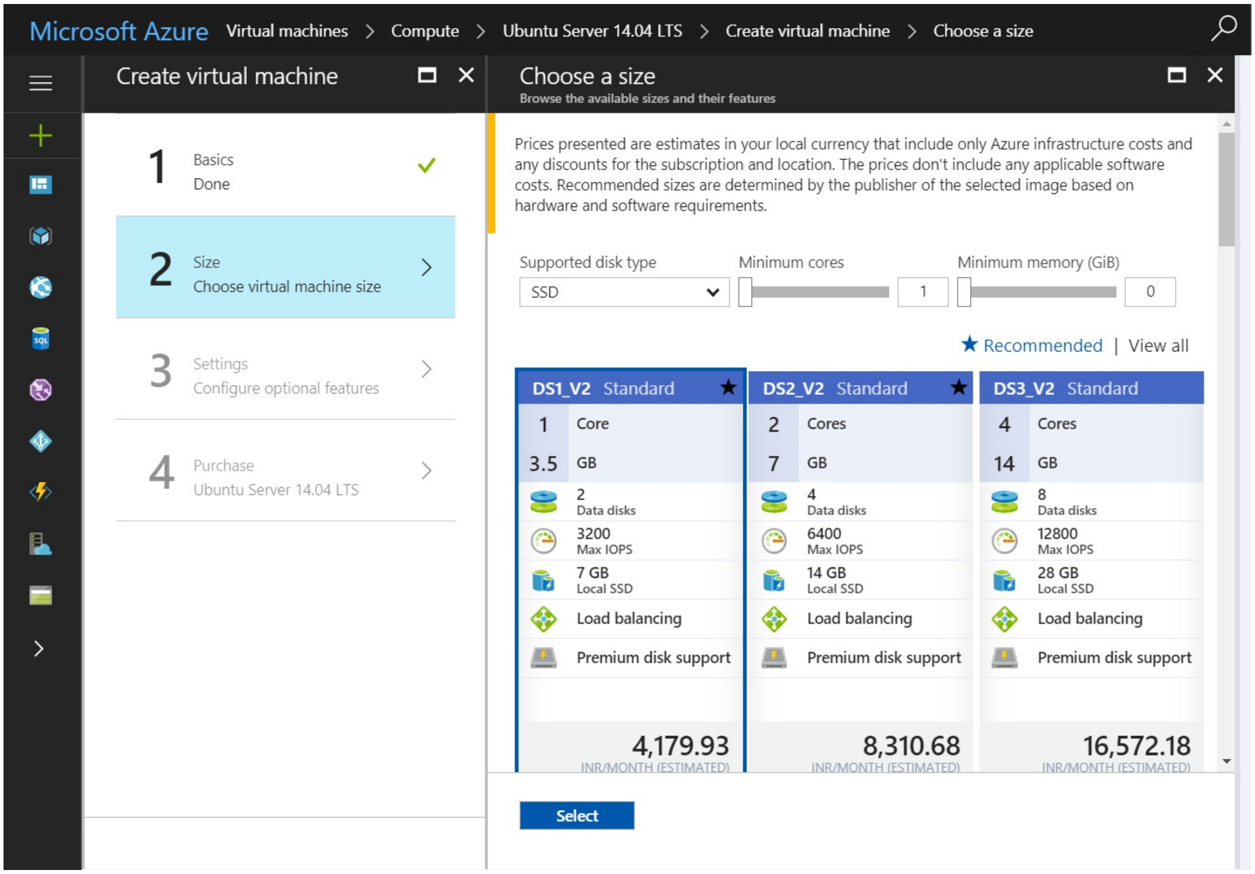
* Confirm password
•••••••••••••• ✓

Subscription
Visual Studio Enterprise with MSDN

* Resource group
● Create new ○ Use existing
JenkinsCookBook ✓

Location

5. Select Choose virtual machine size:



Microsoft Azure
Virtual machines > Compute > Ubuntu Server 14.04 LTS > Create virtual machine > Choose a size
Create virtual machine
1 Basics Done
2 Size Choose virtual machine size
3 Settings Configure optional features
4 Purchase Ubuntu Server 14.04 LTS
Choose a size
Browse the available sizes and their features
★ Recommended | View all
Select

Prices presented are estimates in your local currency that include only Azure infrastructure costs and any discounts for the subscription and location. The prices don't include any applicable software costs. Recommended sizes are determined by the publisher of the selected image based on hardware and software requirements.

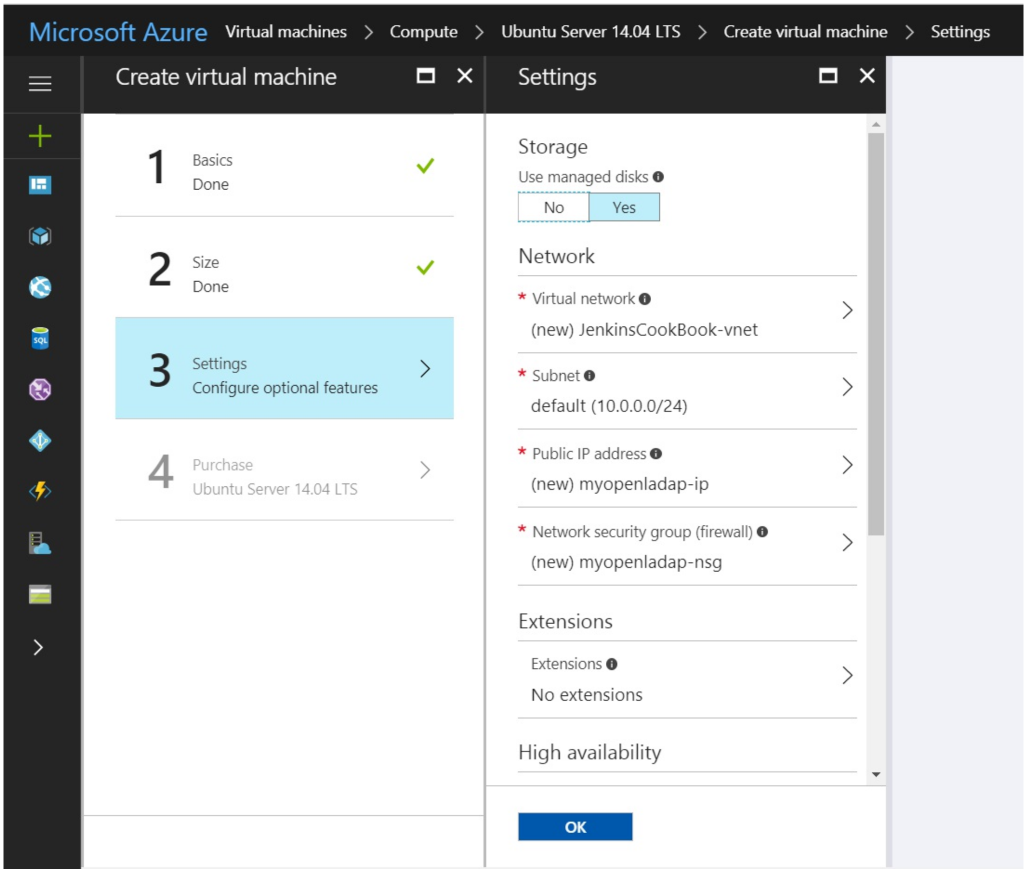
Supported disk type: SSD

Minimum cores: 1

Minimum memory (GiB): 0

DS1_V2 Standard ★	DS2_V2 Standard ★	DS3_V2 Standard
1 Core	2 Cores	4 Cores
3.5 GB	7 GB	14 GB
2 Data disks	4 Data disks	8 Data disks
3200 Max IOPS	6400 Max IOPS	12800 Max IOPS
7 GB Local SSD	14 GB Local SSD	28 GB Local SSD
Load balancing	Load balancing	Load balancing
Premium disk support	Premium disk support	Premium disk support
4,179.93 INR/MONTH (ESTIMATED)	8,310.68 INR/MONTH (ESTIMATED)	16,572.18 INR/MONTH (ESTIMATED)

6. Keep the default settings:



Microsoft Azure
Virtual machines > Compute > Ubuntu Server 14.04 LTS > Create virtual machine > Settings
Create virtual machine
1 Basics Done
2 Size Done
3 Settings Configure optional features
4 Purchase Ubuntu Server 14.04 LTS
Settings
OK

Storage

Use managed disks: No [✓ Yes]

Network

* Virtual network: (new) JenkinsCookBook-vnet

* Subnet: default (10.0.0.0/24)

* Public IP address: (new) myopenladap-ip

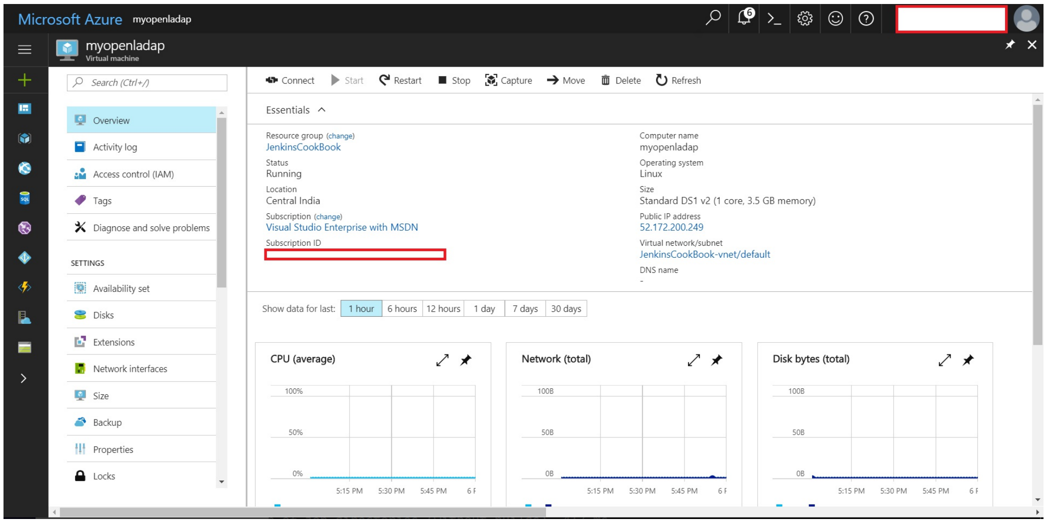
* Network security group (firewall): (new) myopenladap-nsg

Extensions

Extensions: No extensions

High availability

7. Click on Purchase in the next pane. Note the IP Address allocated:



Resource group (change)
JenkinsCookBook

Status
Running

Location
Central India

Subscription (change)
Visual Studio Enterprise with MSDN

Subscription ID
[redacted]

Computer name
myopenladap

Operating system
Linux

Size
Standard DS1 v2 (1 core, 3.5 GB memory)

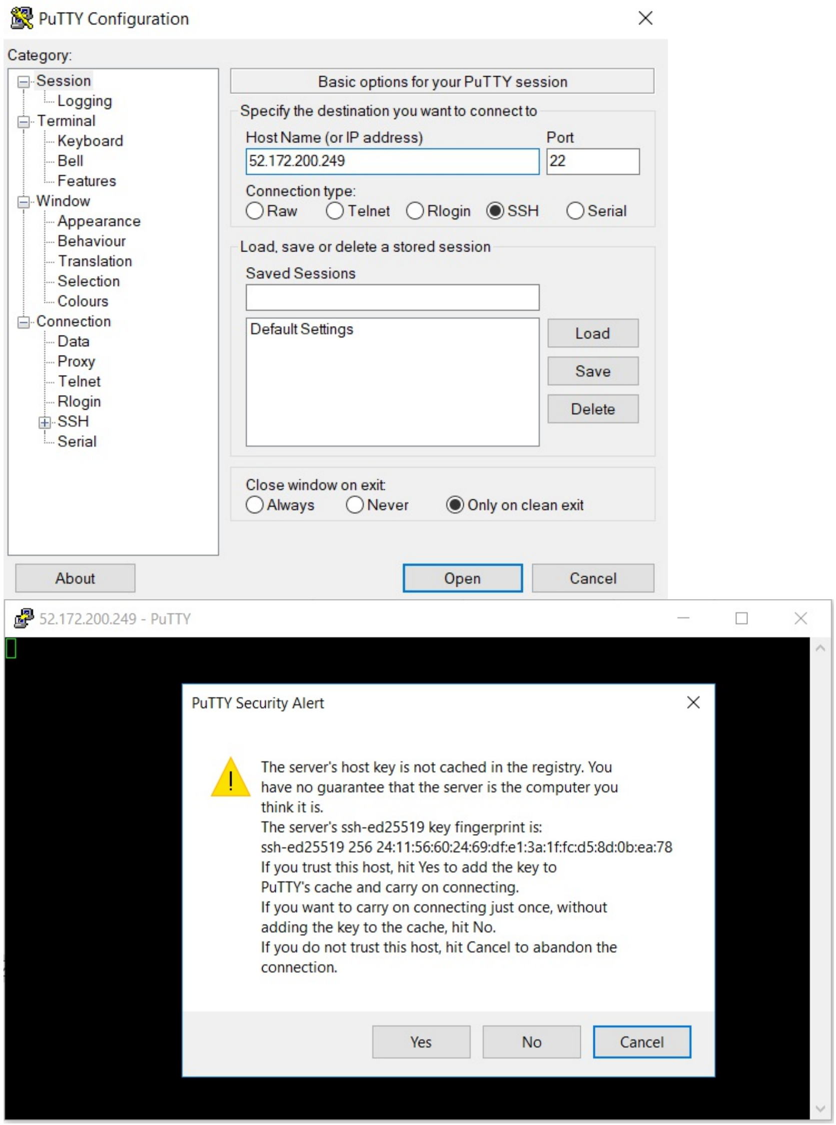
Public IP address
52.172.200.249

Virtual network/subnet
JenkinsCookBook-vnet/default

DNS name
-

Virtual Machine in Microsoft Azure

8. Open PuTTY to remotely access the Ubuntu virtual machine you have created:



Host Name (or IP address): 52.172.200.249

Port: 22

Connection type: ○ Raw ○ Telnet ○ Rlogin ● SSH ○ Serial

Close window on exit: ○ Always ○ Never ● Only on clean exit

The server's host key is not cached in the registry. You have no guarantee that the server is the computer you think it is.
The server's ssh-ed25519 key fingerprint is:
ssh-ed25519 256 24:11:56:60:24:69:df:e1:3a:1f:fc:d5:8d:0b:ea:78
If you trust this host, hit Yes to add the key to PuTTY's cache and carry on connecting.
If you want to carry on connecting just once, without adding the key to the cache, hit No.
If you do not trust this host, hit Cancel to abandon the connection.

9. Log in to the console with the credential provided during the VM creation.

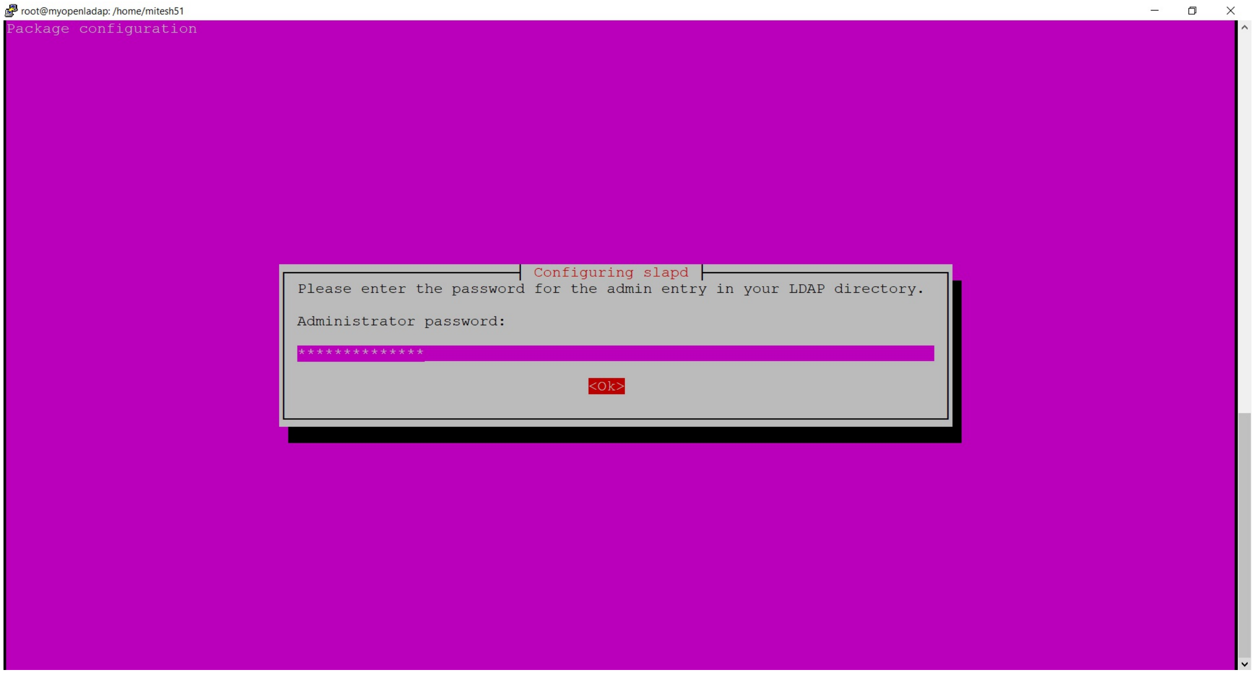
```
login as: mitesh51
mitesh51@52.172.200.249's password:
Welcome to Ubuntu 14.04.5 LTS (GNU/Linux 4.4.0-91-generic x86_64)
* Documentation: https://help.ubuntu.com/
System information as of Sat Aug 12 12:31:29 UTC 2017
System load: 0.24 Memory usage: 2% Processes: 82
Usage of /: 41.0% of 1.94GB Swap usage: 0% Users logged in: 0
Graph this data and manage this system at:
https://landscape.canonical.com/
Get cloud support with Ubuntu Advantage Cloud Guest:
http://www.ubuntu.com/business/services/cloud
0 packages can be updated.
0 updates are security updates.
```

10. Your **Hardware Enablement Stack** (**HWE**) is supported until April 2019.
11. The programs included with the Ubuntu system are free software; the exact distribution terms for each program are described in the individual files in `/usr/share/doc/*/copyright`.

12. Ubuntu comes with *ABSOLUTELY NO WARRANTY*, to the extent permitted by applicable law.
13. The OpenLDAP server is in Ubuntu's default repositories under the package `slapd`. Execute `apt-get install slapdldap-utils` in the PuTTY console, where you are connected to the virtual machine:

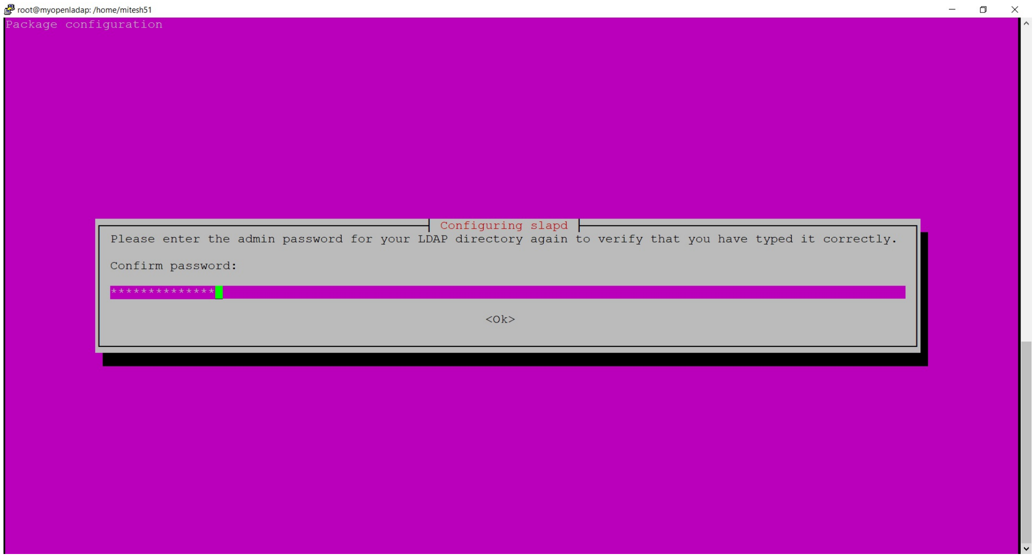
```
root@myopenladap:/home/mitesh51# apt-get installslapdldap-utils
```

14. The installation process needs some configuration. Enter the admin password:



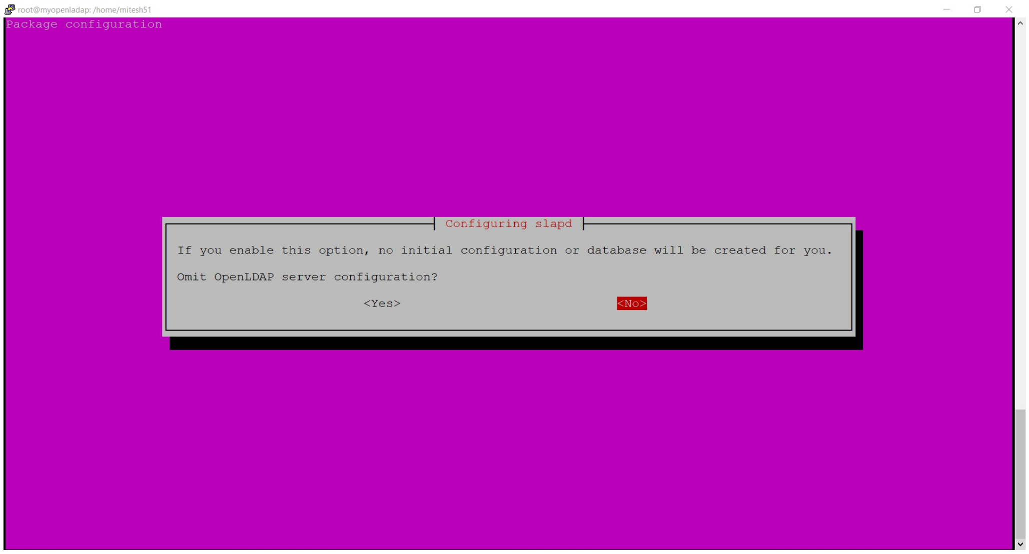
```
root@myopenladap: /home/mitesh51
Package configuration

                    ┤ Configuring slapd ├
 Please enter the password for the admin entry in your LDAP directory.

 Administrator password:

 **************

                              <Ok>
```

15. Confirm the admin password for the admin entry in your LDAP directory:



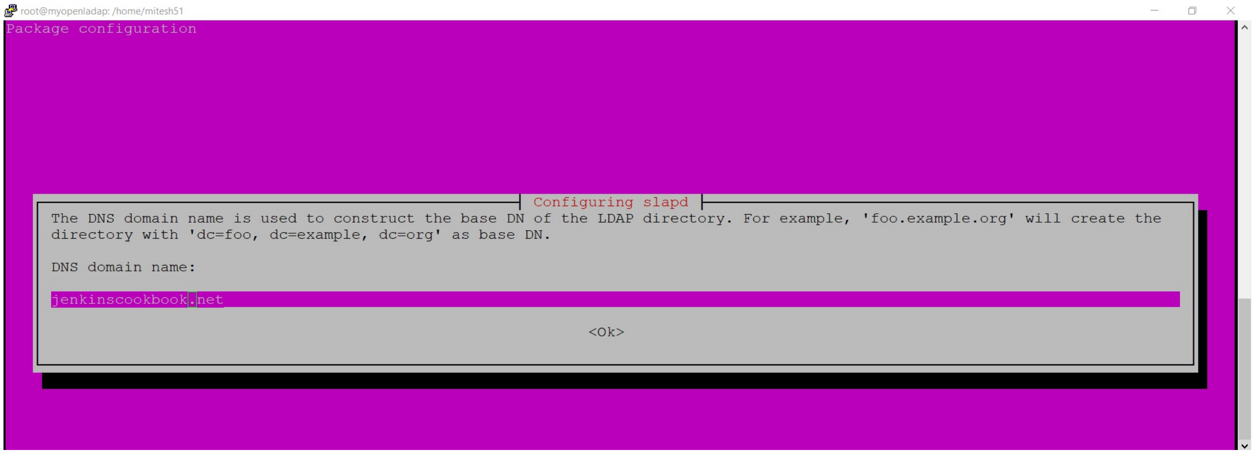
```
root@myopenladap: /home/mitesh51
Package configuration

                    ┤ Configuring slapd ├
 Please enter the admin password for your LDAP directory again to verify that you have typed it correctly.

 Confirm password:

 **************

                              <Ok>
```

16. Select No in Omit OpenLDAP server configuration:



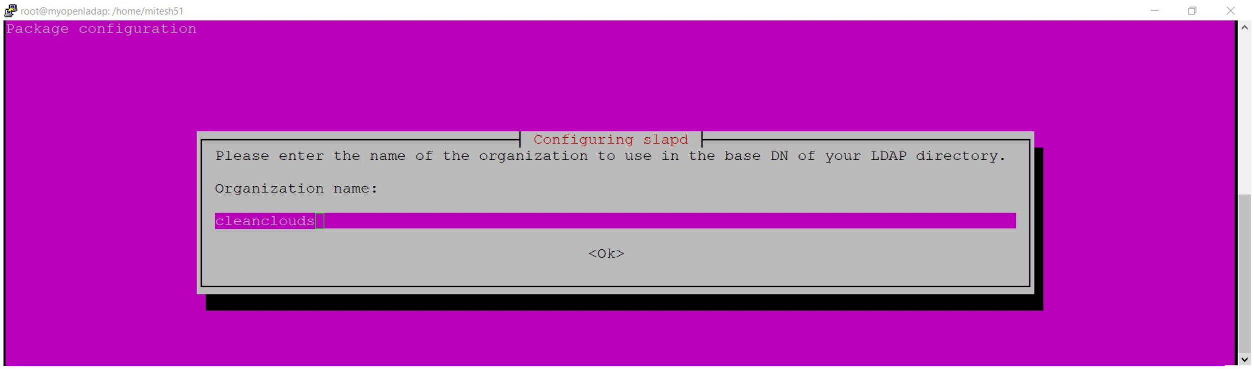
```
root@myopenladap: /home/mitesh51
Package configuration

                     Configuring slapd
 If you enable this option, no initial configuration or database will be created for you.

 Omit OpenLDAP server configuration?

                    <Yes>                              <No>
```

17. Give the DNS domain name that provides the base structure of your directory path.
18. Click OK:



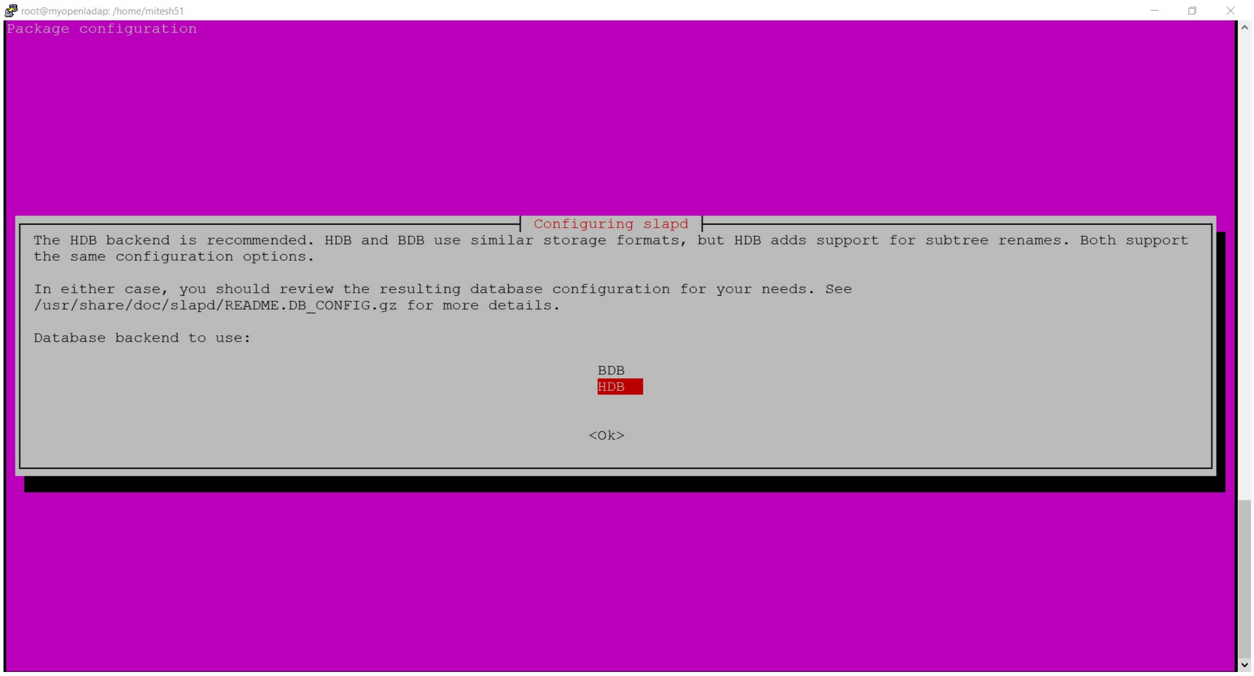
```
root@myopenladap: /home/mitesh51
Package configuration

                                       Configuring slapd
 The DNS domain name is used to construct the base DN of the LDAP directory. For example, 'foo.example.org' will create the
 directory with 'dc=foo, dc=example, dc=org' as base DN.

 DNS domain name:

 jenkinscookbook.net

                                             <Ok>
```

19. Provide the Organization name and click OK:



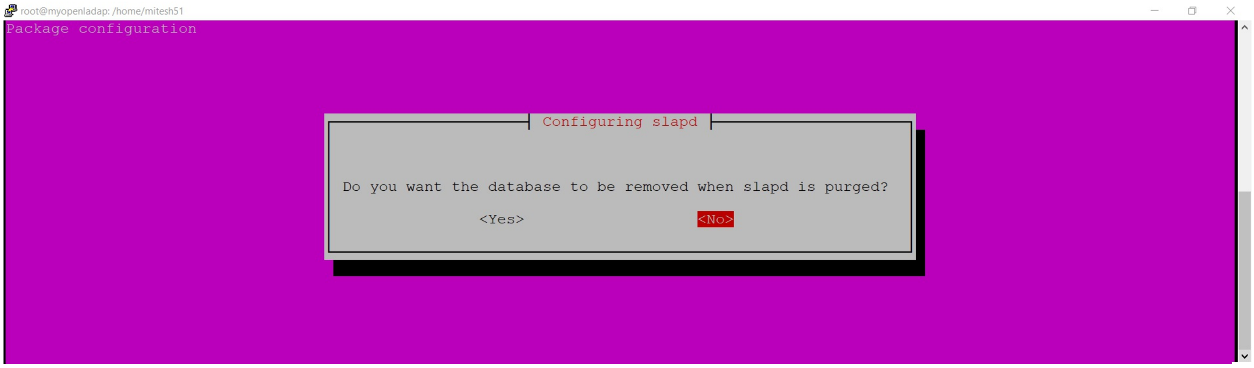
```
root@myopenladap: /home/mitesh51
Package configuration

                               Configuring slapd
 Please enter the name of the organization to use in the base DN of your LDAP directory.

 Organization name:

 cleanclouds

                                     <Ok>
```

20. Select HDB as the database:



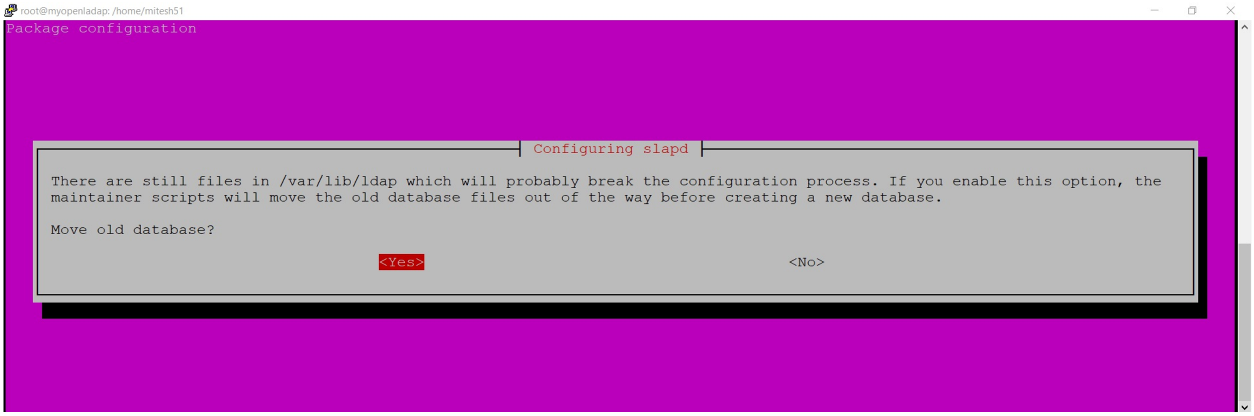
```
Package configuration

                          ┤ Configuring slapd ├
 The HDB backend is recommended. HDB and BDB use similar storage formats, but HDB adds support for subtree renames. Both support
 the same configuration options.

 In either case, you should review the resulting database configuration for your needs. See
 /usr/share/doc/slapd/README.DB_CONFIG.gz for more details.

 Database backend to use:

                                         BDB
                                         HDB

                                        <Ok>
```

21. Select No in remove the database when the `slapd` package is purged:



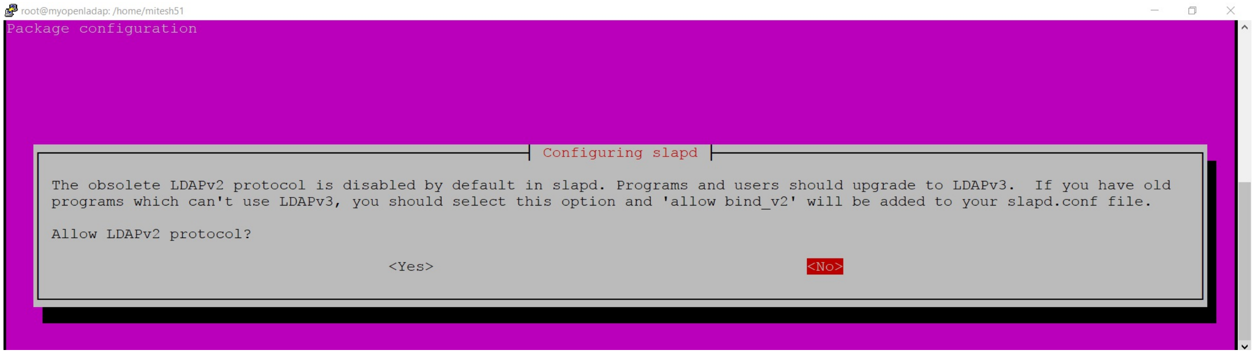
```
Package configuration

                 ┤ Configuring slapd ├

 Do you want the database to be removed when slapd is purged?

                <Yes>                      <No>
```

22. Select Yes in the Move Old Database dialog box:



```
Package configuration

                          ┤ Configuring slapd ├
 There are still files in /var/lib/ldap which will probably break the configuration process. If you enable this option, the
 maintainer scripts will move the old database files out of the way before creating a new database.

 Move old database?

                  <Yes>                                             <No>
```

23. Select No for not allowing LDAPv2 protocol:



```
The obsolete LDAPv2 protocol is disabled by default in slapd. Programs and users should upgrade to LDAPv3.  If you have old
programs which can't use LDAPv3, you should select this option and 'allow bind_v2' will be added to your slapd.conf file.

Allow LDAPv2 protocol?
```

24. After all the configurations, the installation process will be completed.

```
Creating initial configuration... done.
Creating LDAP directory... done.
* Starting OpenLDAPslapd[ OK ]
Setting up ldap-utils (2.4.31-1+nmu2ubuntu8.4) ...
Processing triggers for libc-bin (2.19-0ubuntu6.13) ...
Processing triggers for ufw (0.34~rc-0ubuntu2) ...
Processing triggers for ureadahead (0.100.0-16) ...
root@myopenladap:/home/mitesh51#
root@myopenladap:/home/mitesh51# sudodpkg-reconfigure slapd
* Stopping OpenLDAPslapd[ OK ]
Moving old database directory to /var/backups:
- directory unknown... done.
Creating initial configuration... done.
Creating LDAP directory... done.
* Starting OpenLDAPslapd[ OK ]
Processing triggers for libc-bin (2.19-0ubuntu6.13) ...
root@myopenladap:/home/mitesh51#
```

You will install `PHPldapadmin` to administrate OpenLDAP. Install it with the command `sudo apt-get install phpldapadmin` in the PuTTY console:

```
root@myopenladap:/home/mitesh51# sudo apt-get install phpldapadmin
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following extra packages will be installed:
apache2apache2-bin apache2-data libapache2-mod-php5libapr1libaprutil1
libaprutil1-dbd-sqlite3libaprutil1-ldapphp5-cli php5-common php5-json
php5-ldapphp5-readlinessl-cert
Suggested packages:
apache2-doc apache2-suexec-pristine apache2-suexec-custom apache2-utils
php-pear php5-user-cache openssl-blacklist
The following new packages will be installed:
apache2apache2-bin apache2-data libapache2-mod-php5libapr1libaprutil1
libaprutil1-dbd-sqlite3libaprutil1-ldapphp5-cli php5-common php5-json
php5-ldapphp5-readlinephpldapadminssl-cert
0 upgraded, 15 newly installed, 0 to remove and 0 not upgraded.
Need to get 6,881 kB of archives.
After this operation, 30.9 MB of additional disk space will be used.
Do you want to continue? [Y/n] Y
Get:1 http://azure.archive.ubuntu.com/ubuntu/ trusty/main libapr1amd64 1.5.0-1 [85.1 kB]
Get:2 http://azure.archive.ubuntu.com/ubuntu/ trusty/main libaprutil1amd64 1.5.3-1 [76.4 kB]
Get:3 http://azure.archive.ubuntu.com/ubuntu/ trusty/main php5-jsonamd64 1.3.2-2build1 [34.4
kB]
Get:4 http://azure.archive.ubuntu.com/ubuntu/ trusty-updates/main php5-common amd645.5.9+dfsg-
1ubuntu4.22 [449 kB]
Get:5 http://azure.archive.ubuntu.com/ubuntu/ trusty-updates/main php5-ldapamd645.5.9+dfsg-
1ubuntu4.22 [19.1 kB]
Get:6 http://azure.archive.ubuntu.com/ubuntu/ trusty-updates/main php5-cli amd645.5.9+dfsg-
1ubuntu4.22 [2,154 kB]
Get:7 http://azure.archive.ubuntu.com/ubuntu/ trusty-updates/main php5-
readlineamd645.5.9+dfsg-1ubuntu4.22 [12.1 kB]
Get:8 http://azure.archive.ubuntu.com/ubuntu/ trusty/main libaprutil1-dbd-sqlite3amd64 1.5.3-1
[10.5 kB]
Get:9 http://azure.archive.ubuntu.com/ubuntu/ trusty/main libaprutil1-ldapamd64 1.5.3-1 [8,634
B]
```

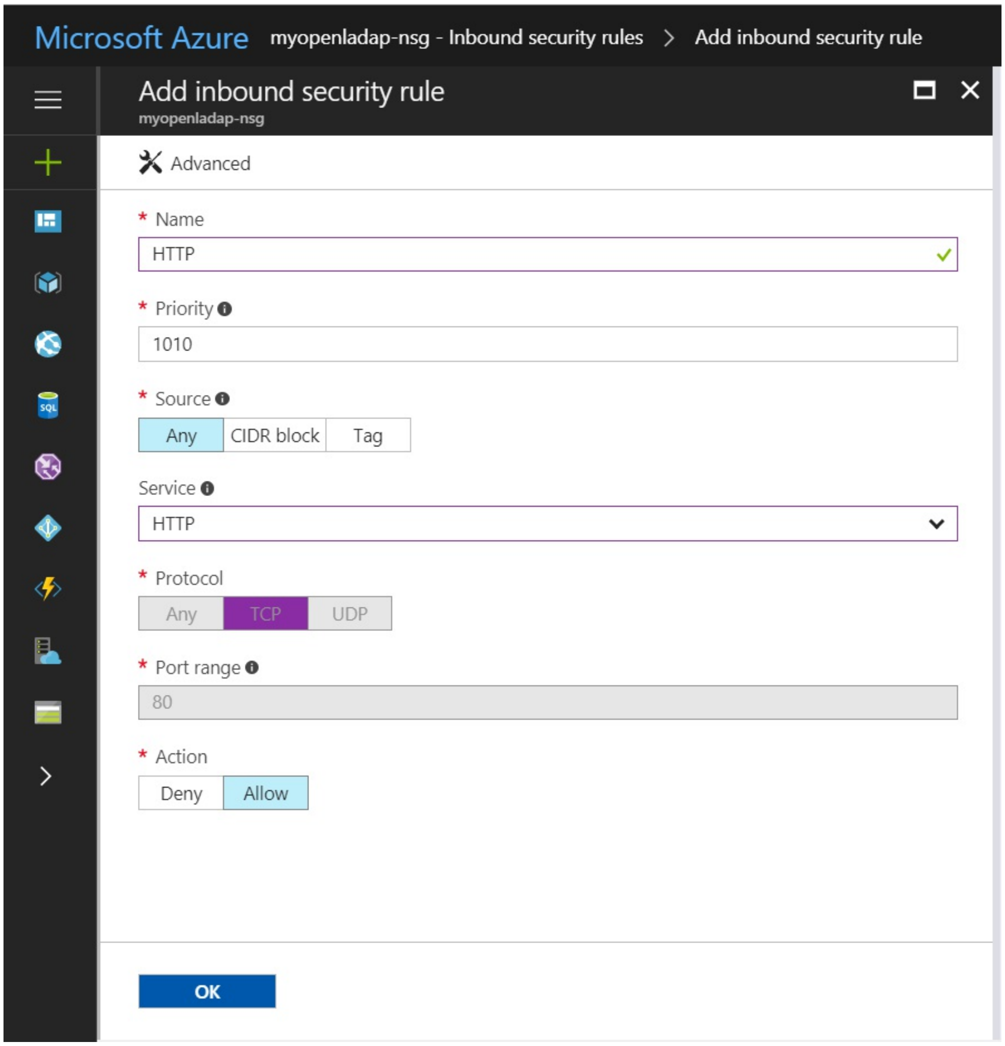
```
Get:10 http://azure.archive.ubuntu.com/ubuntu/ trusty-updates/main apache2-bin amd64 2.4.7-
1ubuntu4.17 [845 kB]
Get:11 http://azure.archive.ubuntu.com/ubuntu/ trusty-updates/main apache2-data all 2.4.7-
1ubuntu4.17 [160 kB]
Get:12 http://azure.archive.ubuntu.com/ubuntu/ trusty-updates/main apache2amd64 2.4.7-
1ubuntu4.17 [87.4 kB]
Get:13 http://azure.archive.ubuntu.com/ubuntu/ trusty-updates/main libapache2-mod-
php5amd645.5.9+dfsg-1ubuntu4.22 [2,194 kB]
Get:14 http://azure.archive.ubuntu.com/ubuntu/ trusty/main ssl-cert all 1.0.33 [16.6 kB]
Get:15 http://azure.archive.ubuntu.com/ubuntu/ trusty-updates/universe phpldapadmin all 1.2.2-
5ubuntu1.1 [730 kB]
Fetched 6,881 kB in 5s (1,305 kB/s)
Preconfiguring packages ...
Selecting previously unselected package libapr1:amd64.
(Reading database ... 29206 files and directories currently installed.)
Preparing to unpack .../libapr1_1.5.0-1_amd64.deb ...
Unpacking libapr1:amd64 (1.5.0-1) ...
...
Processing triggers for man-db (2.6.7.1-1ubuntu1) ...
Processing triggers for ureadahead (0.100.0-16) ...
Processing triggers for ufw (0.34~rc-0ubuntu2) ...
Setting up libapr1:amd64 (1.5.0-1) ...
Setting up libaprutil1:amd64 (1.5.3-1) ...
...
Setting up apache2 (2.4.7-1ubuntu4.17) ...
Enabling module mpm_event.
.
.
Enabling site 000-default.
* Starting web server apache2AH00558: apache2: Could not reliably determine the server's fully
qualified domain name, using 10.0.0.4. Set the 'ServerName' directive globally to suppress
this message
*
Setting up ssl-cert (1.0.33) ...
sent invalidate(group) request, exiting
.
Setting up php5-common (5.5.9+dfsg-1ubuntu4.22) ...


Creating config file /etc/php5/mods-available/pdo.ini with new version
php5_invoke: Enable module pdo for apache2 SAPI
php5_invoke: Enable module pdo for cli SAPI
.
.
Enabling module mpm_prefork.
apache2_switch_mpm Switch to prefork
* Restarting web server apache2AH00558: apache2: Could not reliably determine the server's
fully qualified domain name, using 10.0.0.4. Set the 'ServerName' directive globally to
suppress this message
[ OK ]
apache2_invoke: Enable module php5
* Restarting web server apache2AH00558: apache2: Could not reliably determine the server's
fully qualified domain name, using 10.0.0.4. Set the 'ServerName' directive globally to
suppress this message
[ OK ]
Processing triggers for libc-bin (2.19-0ubuntu6.13) ...
root@myopenladap:/home/mitesh51#
```

Open `/etc/phpldapadmin/config.php` in edit mode and update the following:

- `$servers->setValue('server','host','52.172.200.249')` with the IP address of the virtual machine you have created
- `$servers->setValue('server','base',array('dc=jenkinscookbook,dc=net'));`
- `$servers->setValue('login','bind_id','cn=admin,dc=jenkinscookbook,dc=net');`
- `$config->custom->appearance['hide_template_warning'] = true;`

Go to the Resource group in which you have created the virtual machine. Find the Network Security Group.

Click on Add Inbound security rule and add the HTTP rule:


Microsoft Azure
myopenladap-nsg - Inbound security rules > Add inbound security rule
Add inbound security rule
myopenladap-nsg
Advanced

* Name
HTTP ✓

* Priority
1010

* Source
[✓ Any] CIDR block Tag

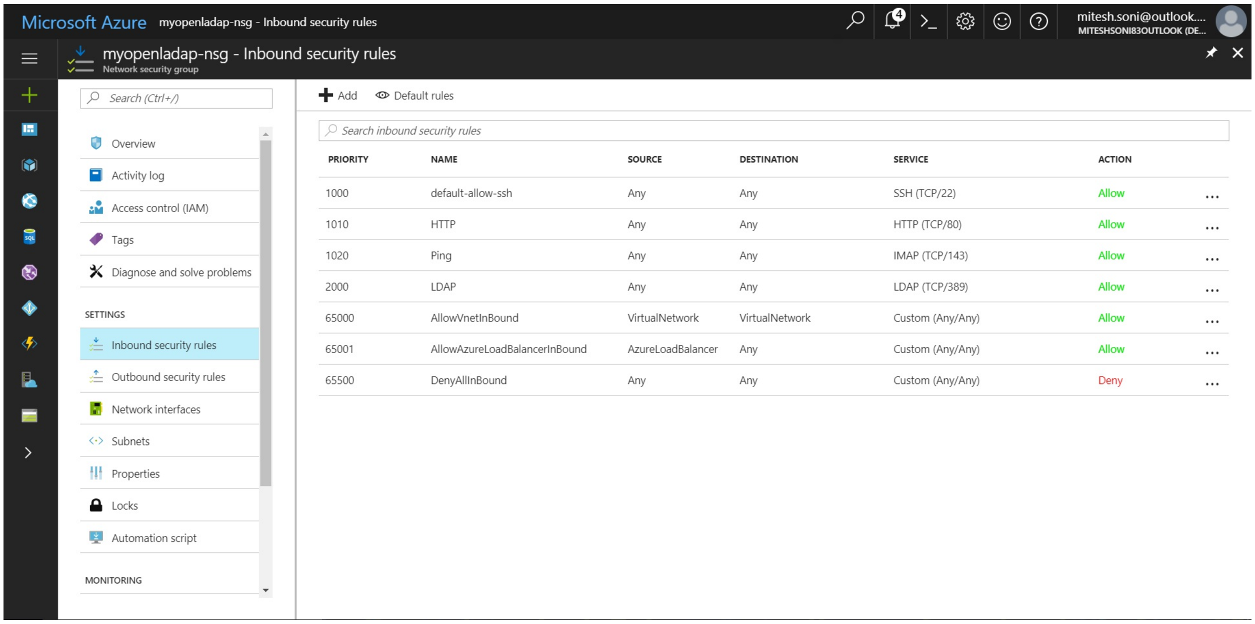
Service
HTTP

* Protocol
Any [✓ TCP] UDP

* Port range
80

* Action
Deny [✓ Allow]

Add the `Ping` command as well so that we can test whether the VM's IP address is accessible or not:

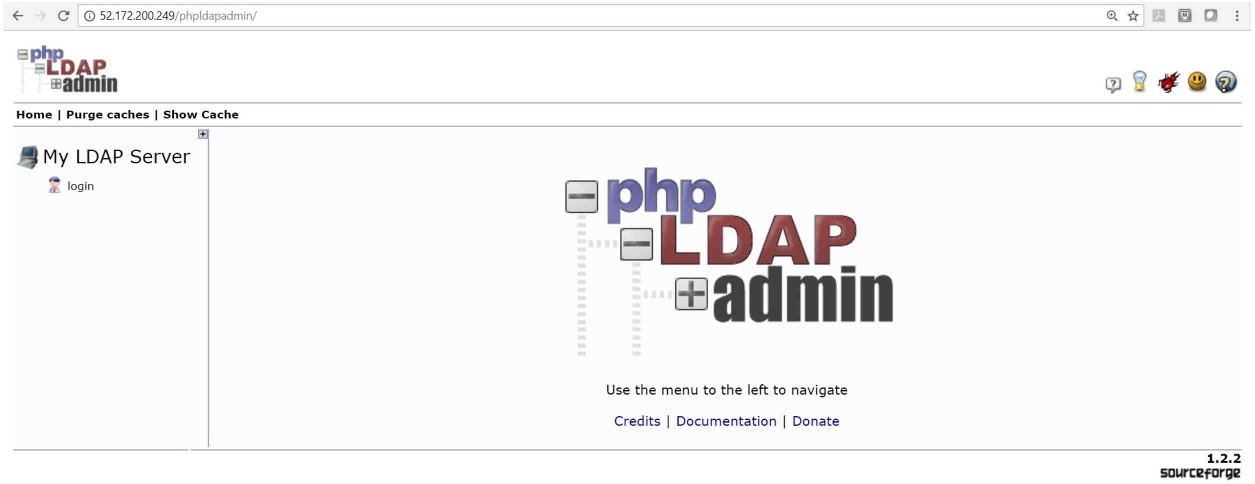


PRIORITY	NAME	SOURCE	DESTINATION	SERVICE	ACTION	
1000	default-allow-ssh	Any	Any	SSH (TCP/22)	Allow	...
1010	HTTP	Any	Any	HTTP (TCP/80)	Allow	...
1020	Ping	Any	Any	IMAP (TCP/143)	Allow	...
2000	LDAP	Any	Any	LDAP (TCP/389)	Allow	...
65000	AllowVnetInBound	VirtualNetwork	VirtualNetwork	Custom (Any/Any)	Allow	...
65001	AllowAzureLoadBalancerInBound	AzureLoadBalancer	Any	Custom (Any/Any)	Allow	...
65500	DenyAllInBound	Any	Any	Custom (Any/Any)	Deny	...

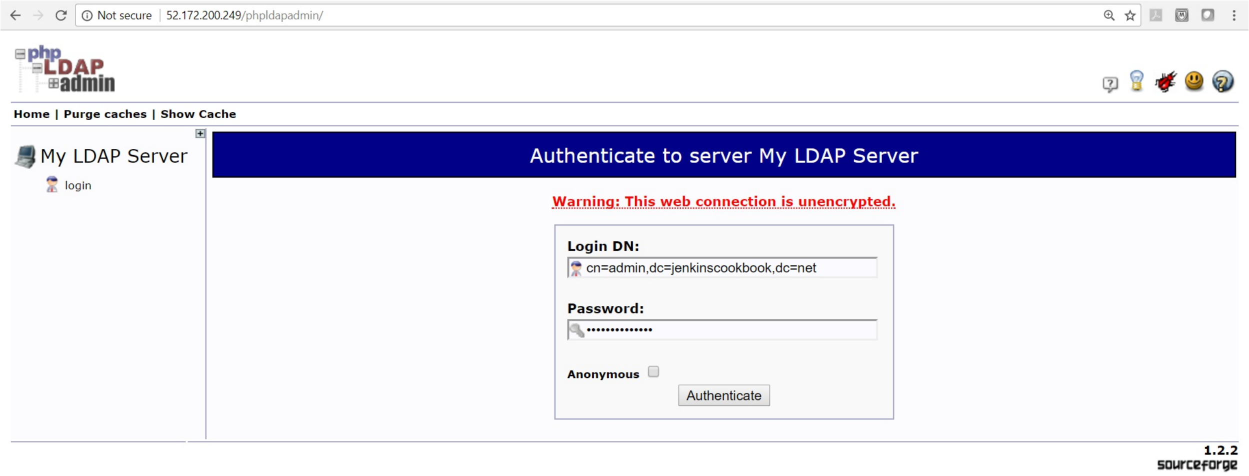
Inbound Security Rules in Network Security Group

Now you are ready to use OpenLDAP using the `phpldapadmin` web interface. Log in with the IP address or DNS/`phpldapadmin`.

Click on Login:


52.172.200.249/phpldapadmin/
phpLDAPadmin
Home | Purge caches | Show Cache
My LDAP Server
login
phpLDAPadmin
Use the menu to the left to navigate
Credits | Documentation | Donate
1.2.2
sourceforge

Log in with the admin username and password provided during the OpenLDAP installation and configuration:


Not secure | 52.172.200.249/phpldapadmin/
Home | Purge caches | Show Cache
My LDAP Server
login
Authenticate
1.2.2
sourceforge

Authenticate to server My LDAP Server

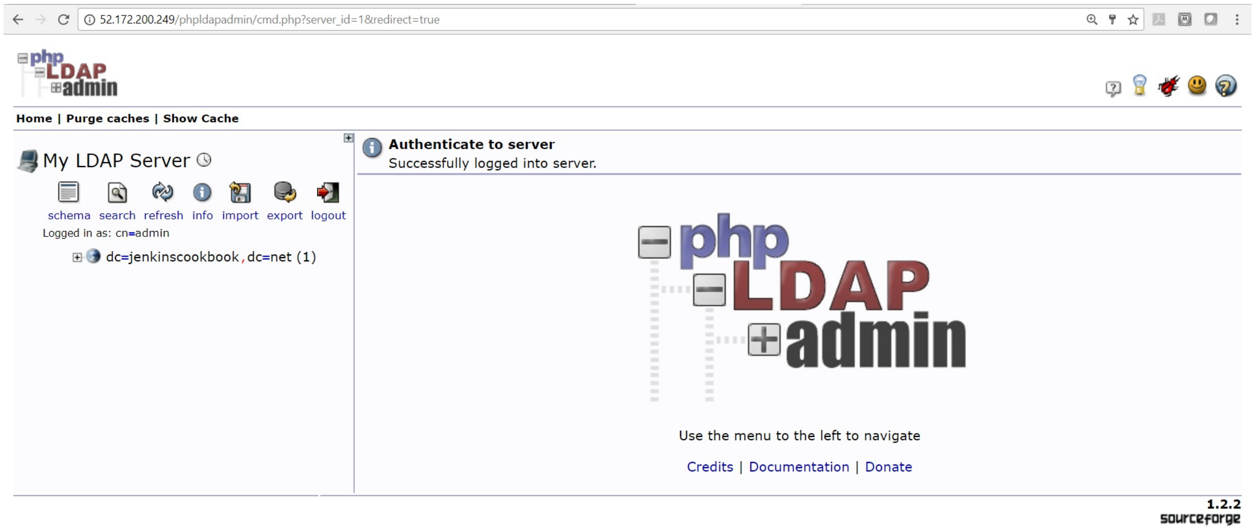
Warning: This web connection is unencrypted.

Login DN: cn=admin,dc=jenkinscookbook,dc=net

Password: ••••••••••••••

Anonymous □

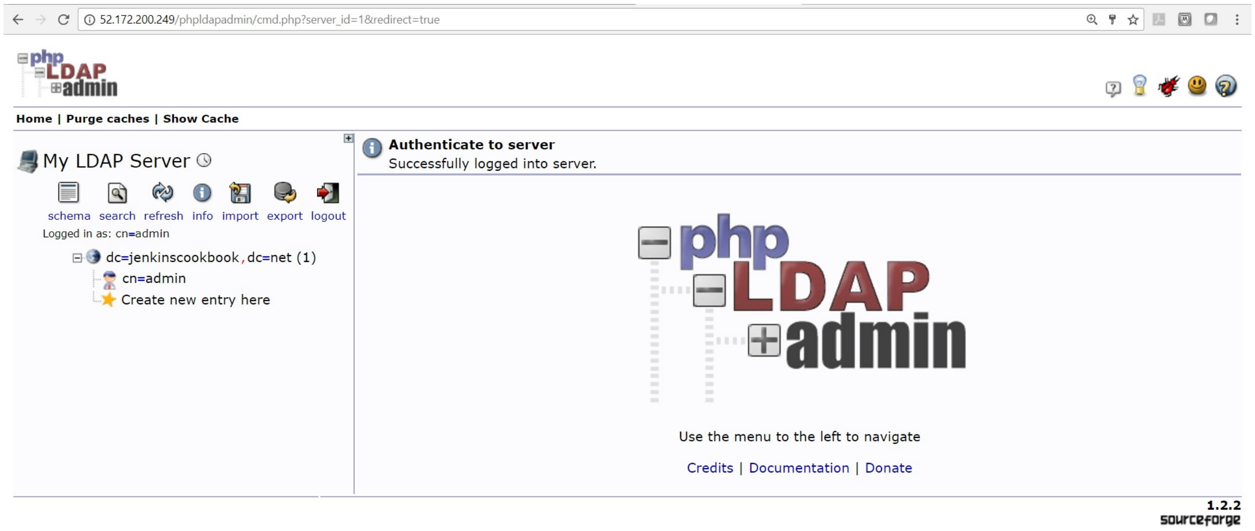
Here you have the `phpldapadmin` web interface:


52.172.200.249/phpldapadmin/cmd.php?server_id=1&redirect=true
Home | Purge caches | Show Cache
My LDAP Server
schema
search
refresh
info
import
export
logout
dc=jenkinscookbook,dc=net (1)
Use the menu to the left to navigate
Credits | Documentation | Donate
1.2.2
sourceforge

Logged in as: cn=admin

Authenticate to server
Successfully logged into server.

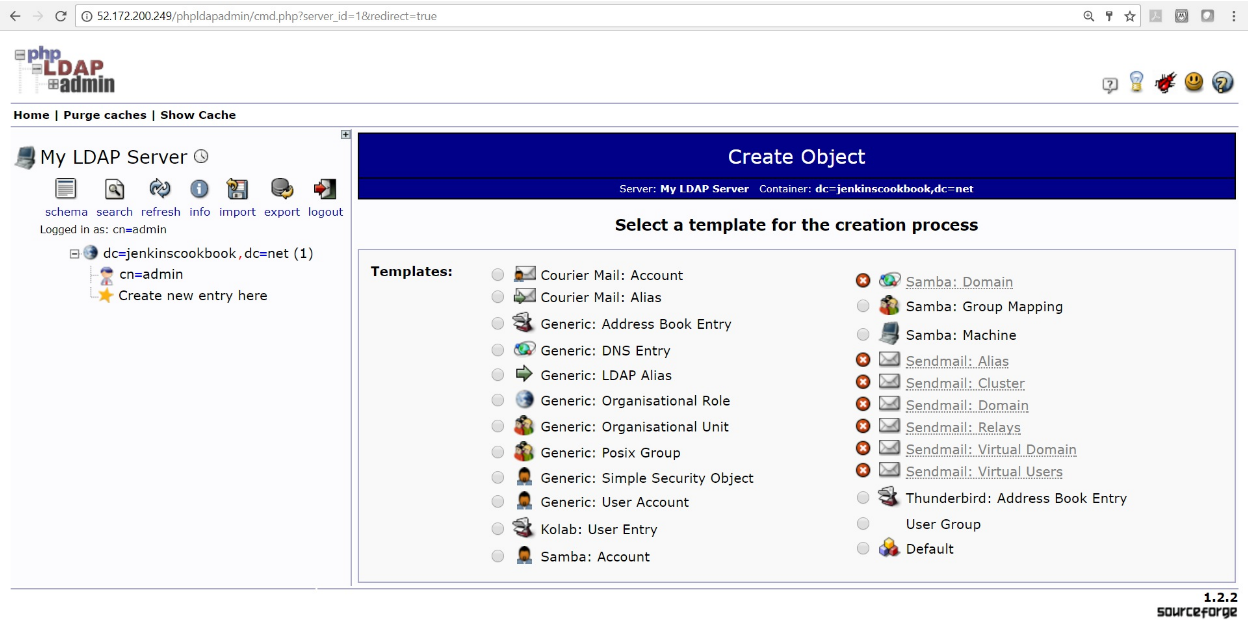
Click on the domain components to see the login you are using:


52.172.200.249/phpldapadmin/cmd.php?server_id=1&redirect=true
Home | Purge caches | Show Cache
My LDAP Server
schema
search
refresh
info
import
export
logout
dc=jenkinscookbook,dc=net (1)
cn=admin
Create new entry here
Use the menu to the left to navigate
Credits | Documentation | Donate
1.2.2
sourceforge

Logged in as: cn=admin

Authenticate to server
Successfully logged into server.

Now you need to add Organizational Units, Groups, and Users. Click on Create new entry here. Select the Generic: Organizational Unit template:



52.172.200.249/phpldapadmin/cmd.php?server_id=1&redirect=true

Home | Purge caches | Show Cache

My LDAP Server

Logged in as: cn=admin

dc=jenkinscookbook,dc=net (1)
cn=admin
Create new entry here

Create Object

Server: **My LDAP Server** Container: **dc=jenkinscookbook,dc=net**

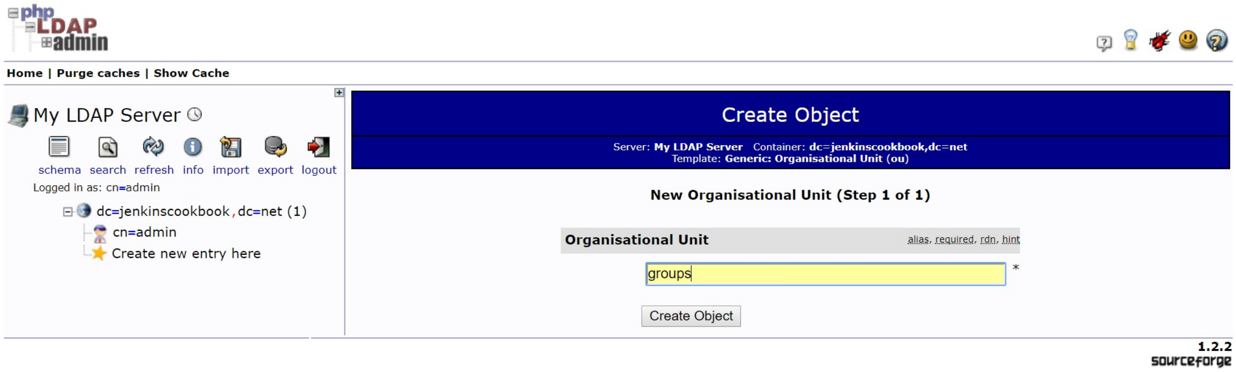
Select a template for the creation process

Templates:

○ Courier Mail: Account
○ Courier Mail: Alias
○ Generic: Address Book Entry
○ Generic: DNS Entry
○ Generic: LDAP Alias
○ Generic: Organisational Role
○ Generic: Organisational Unit
○ Generic: Posix Group
○ Generic: Simple Security Object
○ Generic: User Account
○ Kolab: User Entry
○ Samba: Account
☒ Samba: Domain
○ Samba: Group Mapping
○ Samba: Machine
☒ Sendmail: Alias
☒ Sendmail: Cluster
☒ Sendmail: Domain
☒ Sendmail: Relays
☒ Sendmail: Virtual Domain
☒ Sendmail: Virtual Users
○ Thunderbird: Address Book Entry
○ User Group
○ Default

1.2.2
sourceforge

Type `groups` and click on Create Object:



Home | Purge caches | Show Cache

My LDAP Server

Logged in as: cn=admin

dc=jenkinscookbook,dc=net (1)
cn=admin
Create new entry here

Create Object

Server: **My LDAP Server** Container: **dc=jenkinscookbook,dc=net**
Template: **Generic: Organisational Unit (ou)**

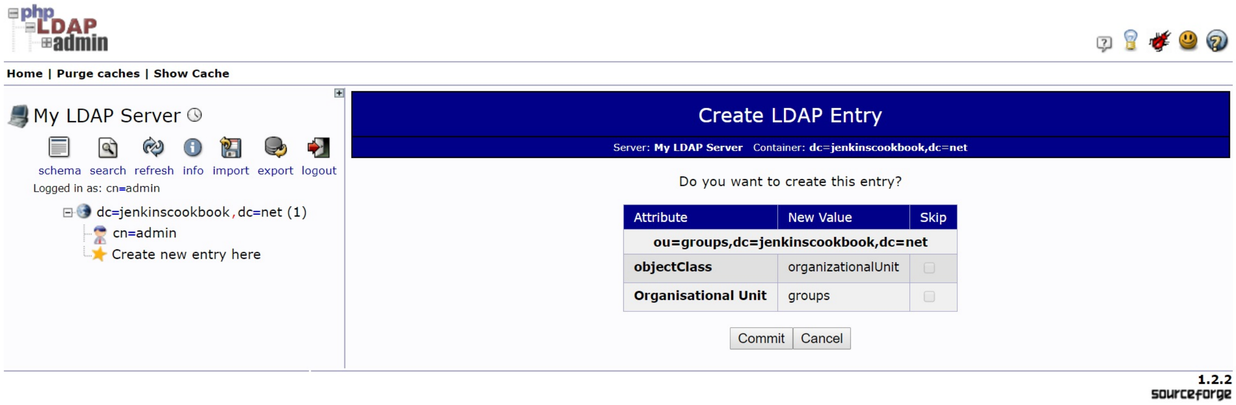
New Organisational Unit (Step 1 of 1)

Organisational Unit alias, required, rdn, hint

groups *

1.2.2
sourceforge

Click on Commit:



Home | Purge caches | Show Cache

My LDAP Server

Logged in as: cn=admin

dc=jenkinscookbook,dc=net (1)
cn=admin
Create new entry here

Create LDAP Entry

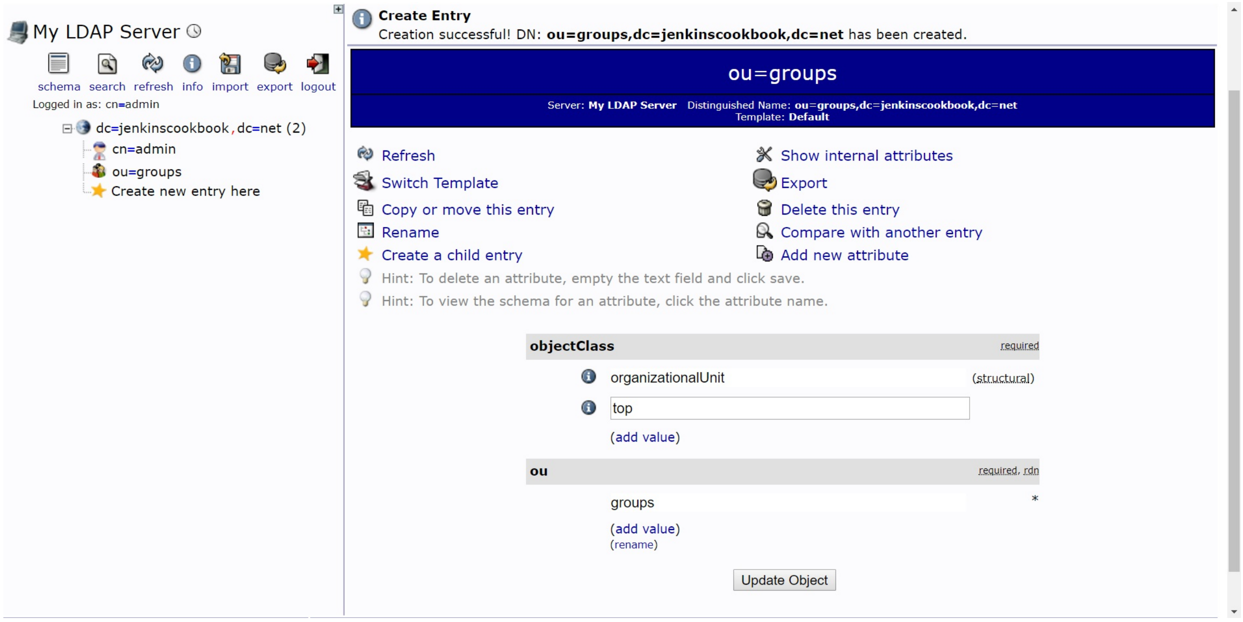
Server: **My LDAP Server** Container: **dc=jenkinscookbook,dc=net**

Do you want to create this entry?

Attribute	New Value	Skip
ou=groups,dc=jenkinscookbook,dc=net		
objectClass	organizationalUnit	□
Organisational Unit	groups	□

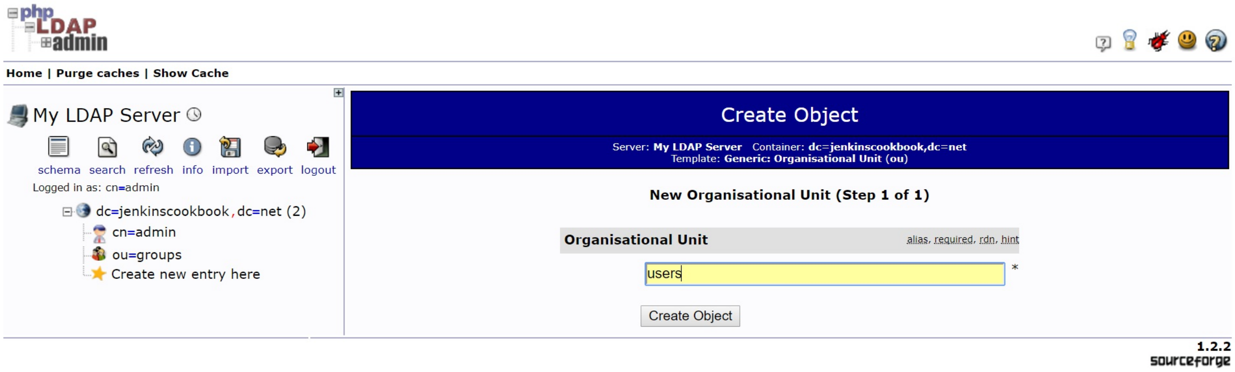
1.2.2
sourceforge

Select the newly created organization unit and verify the content:


Create Entry

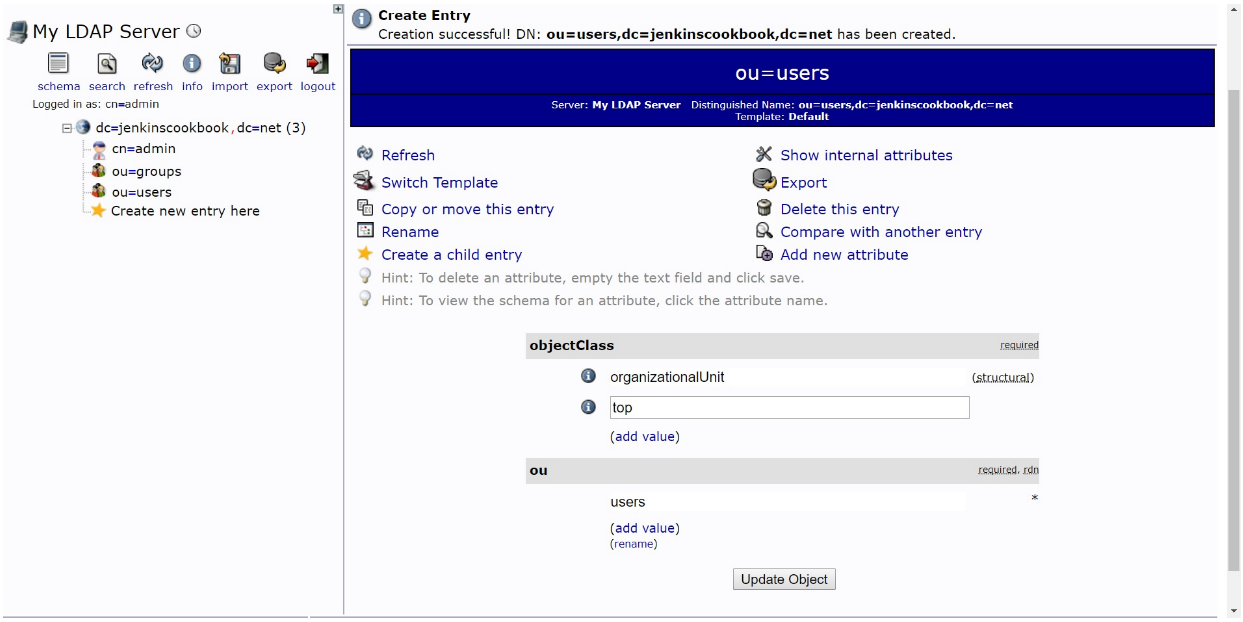
Creation successful! DN: **ou=groups,dc=jenkinscookbook,dc=net** has been created.

Similarly, create users in the Organisational unit:


phpLDAPadmin
Home | Purge caches | Show Cache
My LDAP Server
schema
search
refresh
info
import
export
logout
Logged in as: cn=admin
dc=jenkinscookbook,dc=net (2)
cn=admin
ou=groups
Create new entry here
Create Object
Server: My LDAP Server Container: dc=jenkinscookbook,dc=net
Template: Generic: Organisational Unit (ou)
New Organisational Unit (Step 1 of 1)
Organisational Unit
alias, required, rdn, hint
Create Object
1.2.2
sourceforge

Organisational Unit: users

Commit and verify the object in the `phpldapadmin` web interface:



Create Entry

Creation successful! DN: **ou=users,dc=jenkinscookbook,dc=net** has been created.

ou=users

Server: **My LDAP Server** Distinguished Name: **ou=users,dc=jenkinscookbook,dc=net**
Template: **Default**

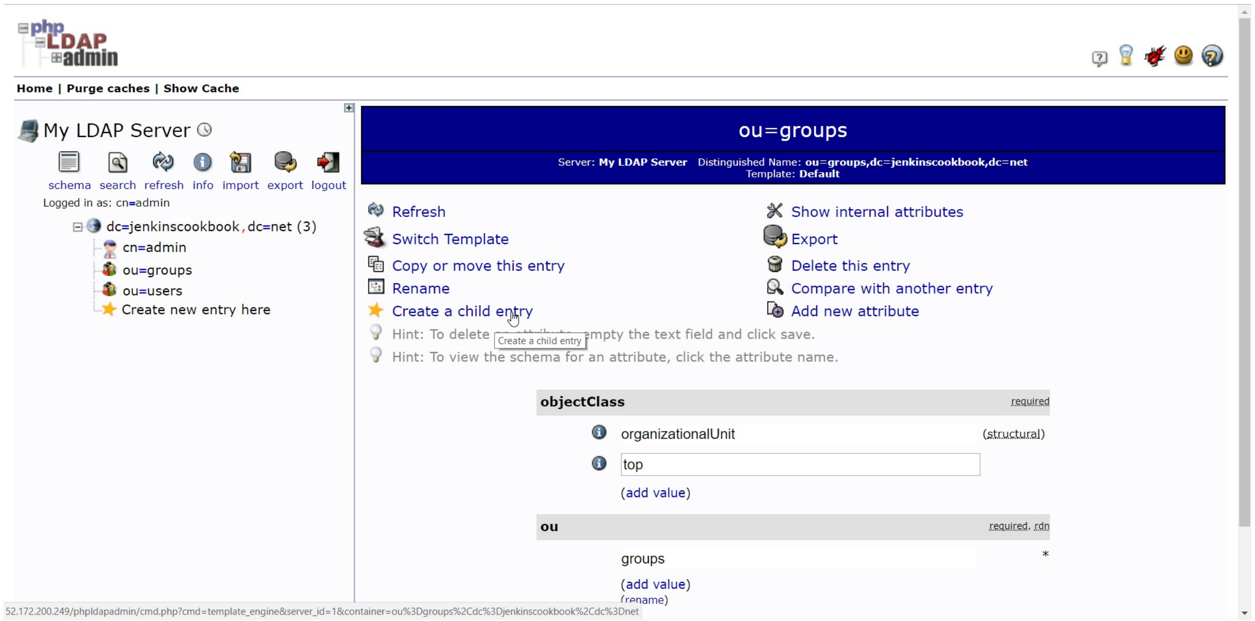
Hint: To delete an attribute, empty the text field and click save.

Hint: To view the schema for an attribute, click the attribute name.

objectClass	required
organizationalUnit	(structural)
top	

ou	required, rdn
users	*

Now, you need to create specific groups within the groups. Select groups and click on Create a child entry:



Logged in as: cn=admin

- dc=jenkinscookbook,dc=net (3)
  - cn=admin
  - ou=groups
  - ou=users
  - Create new entry here

ou=groups

Server: **My LDAP Server** Distinguished Name: **ou=groups,dc=jenkinscookbook,dc=net**
Template: **Default**

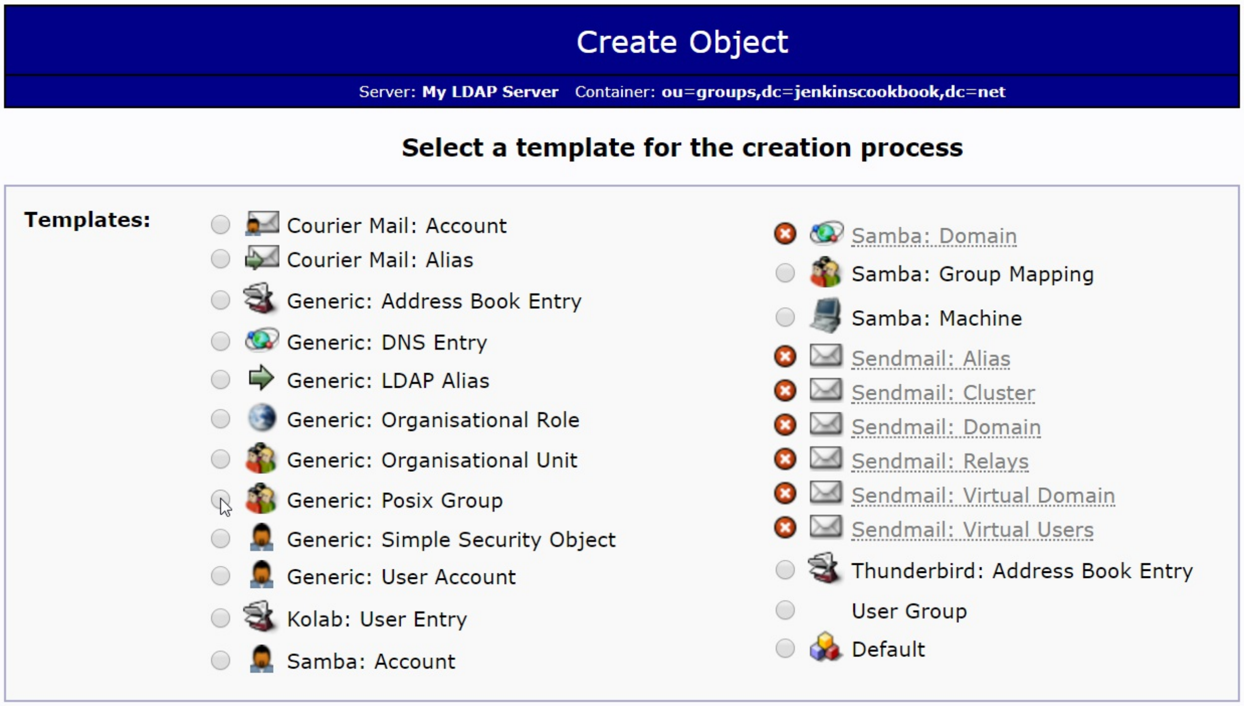
Hint: To delete empty the text field and click save.

Hint: To view the schema for an attribute, click the attribute name.

objectClass	required
organizationalUnit	(structural)
top	
(add value)	
ou	required, rdn
groups	*
(add value) (rename)	

52.172.200.249/phpldapadmin/cmd.php?cmd=template_engine&server_id=1&container=ou%3Dgroups%2Cdc%3Djenkinscookbook%2Cdc%3Dnet

Select Generic: Posix Group:



Create Object

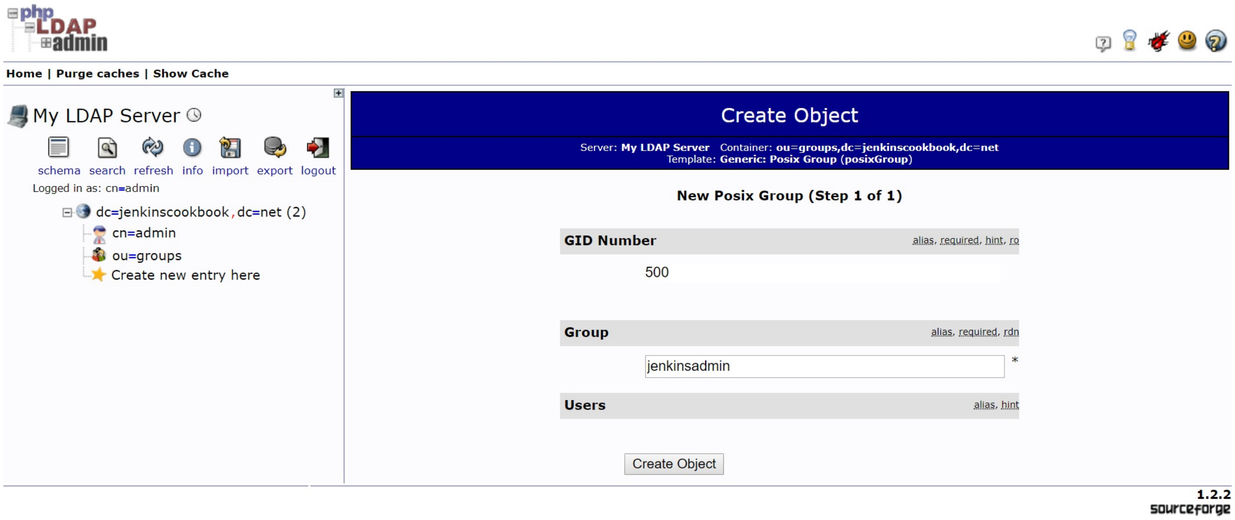
Server: **My LDAP Server** Container: **ou=groups,dc=jenkinscookbook,dc=net**

Select a template for the creation process

Templates:

- ○ Courier Mail: Account
- ○ Courier Mail: Alias
- ○ Generic: Address Book Entry
- ○ Generic: DNS Entry
- ○ Generic: LDAP Alias
- ○ Generic: Organisational Role
- ○ Generic: Organisational Unit
- ○ Generic: Posix Group
- ○ Generic: Simple Security Object
- ○ Generic: User Account
- ○ Kolab: User Entry
- ○ Samba: Account
- ☒ Samba: Domain
- ○ Samba: Group Mapping
- ○ Samba: Machine
- ☒ Sendmail: Alias
- ☒ Sendmail: Cluster
- ☒ Sendmail: Domain
- ☒ Sendmail: Relays
- ☒ Sendmail: Virtual Domain
- ☒ Sendmail: Virtual Users
- ○ Thunderbird: Address Book Entry
- ○ User Group
- ○ Default

Give the Group name and click on Create Object:

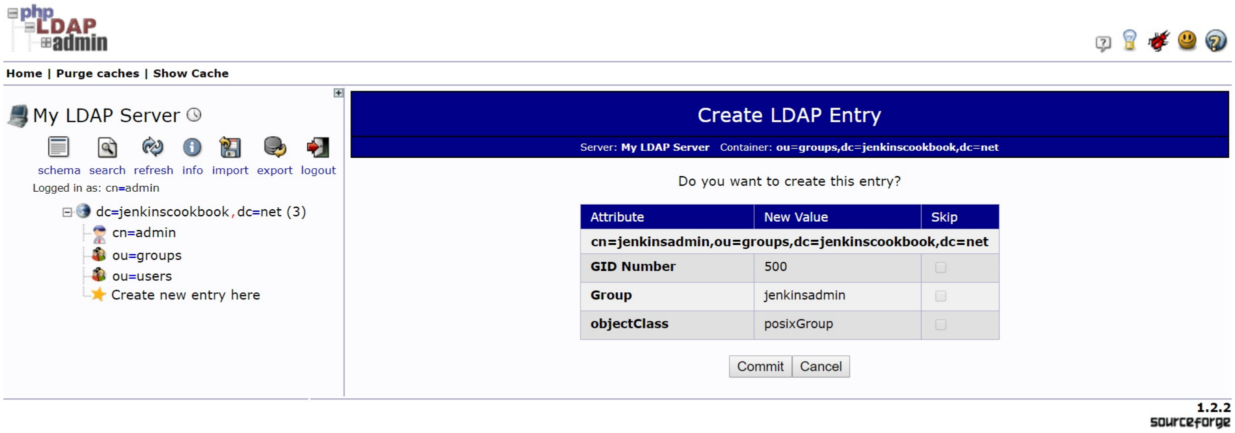

Home | Purge caches | Show Cache
My LDAP Server
schema search refresh info import export logout
Logged in as: cn=admin
dc=jenkinscookbook,dc=net (2)
cn=admin
ou=groups
Create new entry here
Create Object
Server: My LDAP Server Container: ou=groups,dc=jenkinscookbook,dc=net
Template: Generic: Posix Group (posixGroup)
New Posix Group (Step 1 of 1)
Create Object
1.2.2
sourceforge

GID Number: 500

Group: jenkinsadmin

Users:

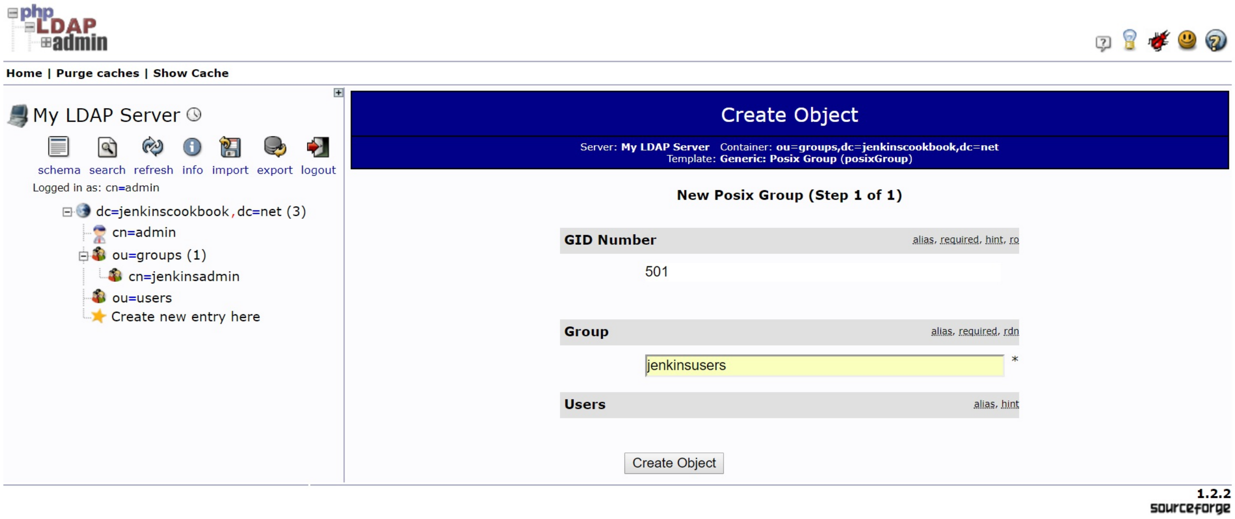
Commit the changes:


Home | Purge caches | Show Cache
My LDAP Server
schema search refresh info import export logout
Logged in as: cn=admin
dc=jenkinscookbook,dc=net (3)
cn=admin
ou=groups
ou=users
Create new entry here
Create LDAP Entry
Server: My LDAP Server Container: ou=groups,dc=jenkinscookbook,dc=net
Commit
Cancel
1.2.2
sourceforge

Do you want to create this entry?

Attribute	New Value	Skip
cn=jenkinsadmin,ou=groups,dc=jenkinscookbook,dc=net		
GID Number	500	□
Group	jenkinsadmin	□
objectClass	posixGroup	□

Similarly, create the `jenkinsusers` group:

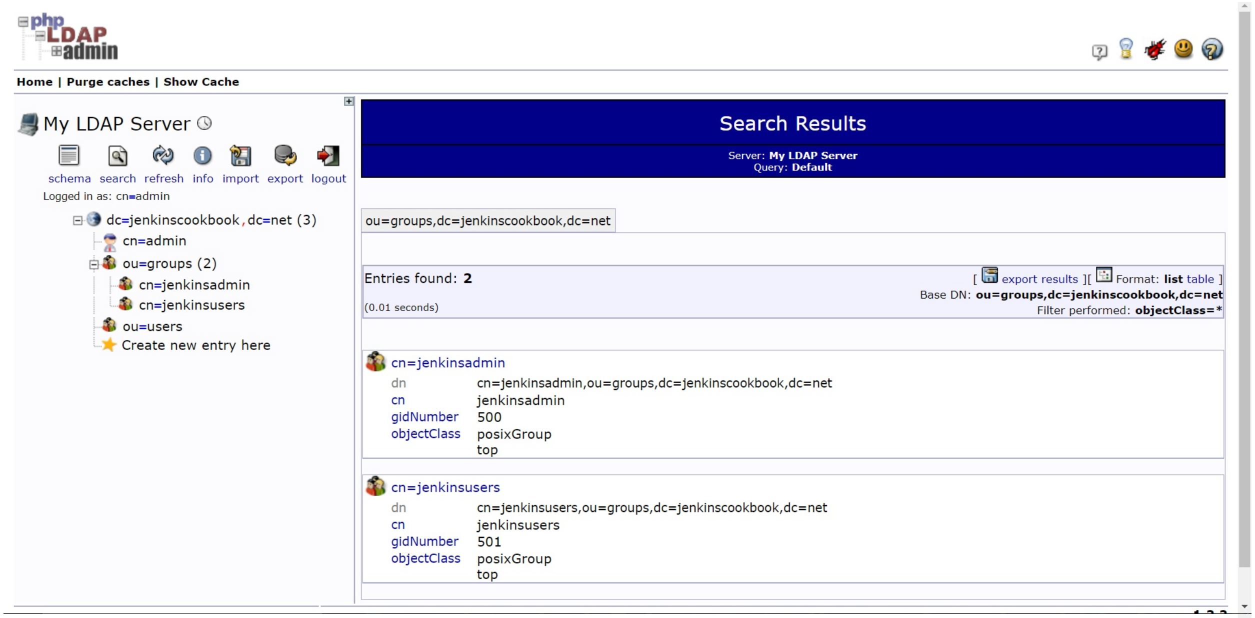

Home | Purge caches | Show Cache
My LDAP Server
schema search refresh info import export logout
Logged in as: cn=admin
dc=jenkinscookbook,dc=net (3)
cn=admin
ou=groups (1)
cn=jenkinsadmin
ou=users
Create new entry here
Create Object
Server: My LDAP Server Container: ou=groups,dc=jenkinscookbook,dc=net
Template: Generic: Posix Group (posixGroup)
New Posix Group (Step 1 of 1)
Create Object
1.2.2
sourceforge

GID Number: 501

Group: jenkinsusers

Users:

Verify both groups in the `phpldapadmin` web interface:



Home | Purge caches | Show Cache

My LDAP Server

schema search refresh info import export logout

Logged in as: cn=admin

- dc=jenkinscookbook,dc=net (3)
  - cn=admin
  - ou=groups (2)
    - cn=jenkinsadmin
    - cn=jenkinsusers
  - ou=users
  - Create new entry here

Search Results

Server: **My LDAP Server**
Query: **Default**

ou=groups,dc=jenkinscookbook,dc=net

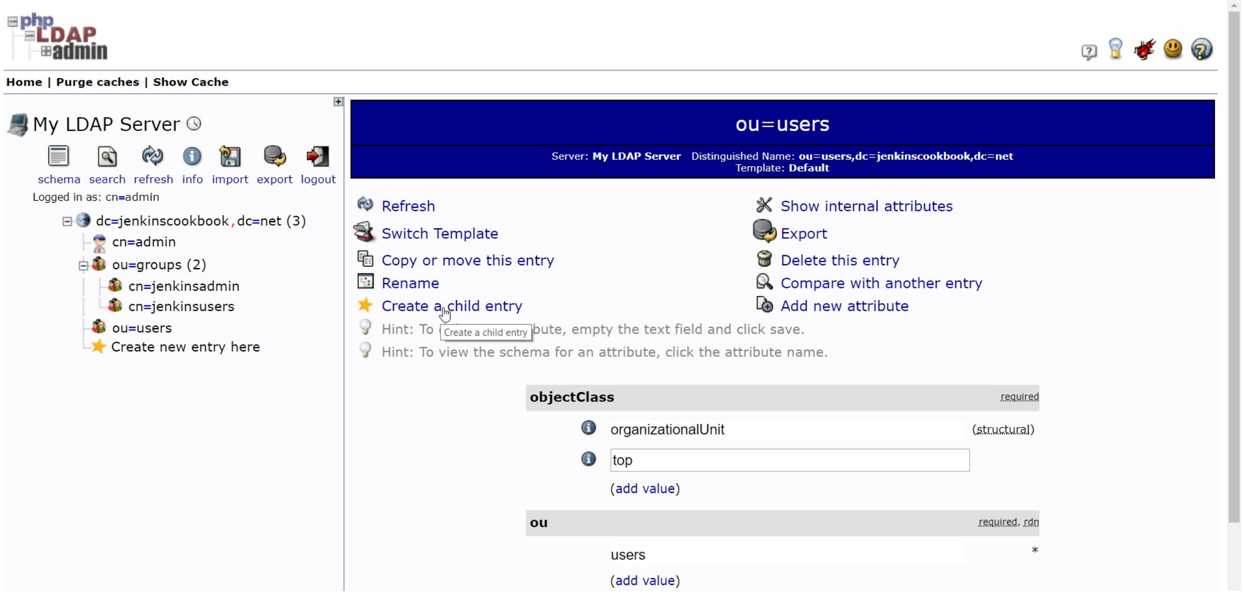
Entries found: **2** [export results][Format: **list** table]
Base DN: **ou=groups,dc=jenkinscookbook,dc=net**
(0.01 seconds) Filter performed: **objectClass=***

cn=jenkinsadmin

dn	cn=jenkinsadmin,ou=groups,dc=jenkinscookbook,dc=net
cn	jenkinsadmin
gidNumber	500
objectClass	posixGroup top

cn=jenkinsusers

dn	cn=jenkinsusers,ou=groups,dc=jenkinscookbook,dc=net
cn	jenkinsusers
gidNumber	501
objectClass	posixGroup top



Home | Purge caches | Show Cache

My LDAP Server

schema search refresh info import export logout

Logged in as: cn=admin

- dc=jenkinscookbook,dc=net (3)
  - cn=admin
  - ou=groups (2)
    - cn=jenkinsadmin
    - cn=jenkinsusers
  - ou=users
  - Create new entry here

ou=users

Server: **My LDAP Server** Distinguished Name: **ou=users,dc=jenkinscookbook,dc=net**
Template: **Default**

Refresh	Show internal attributes
Switch Template	Export
Copy or move this entry	Delete this entry
Rename	Compare with another entry
Create a child entry	Add new attribute

Hint: To [Create a child entry] bute, empty the text field and click save.

Hint: To view the schema for an attribute, click the attribute name.

objectClass required

organizationalUnit (structural)

top

(add value)

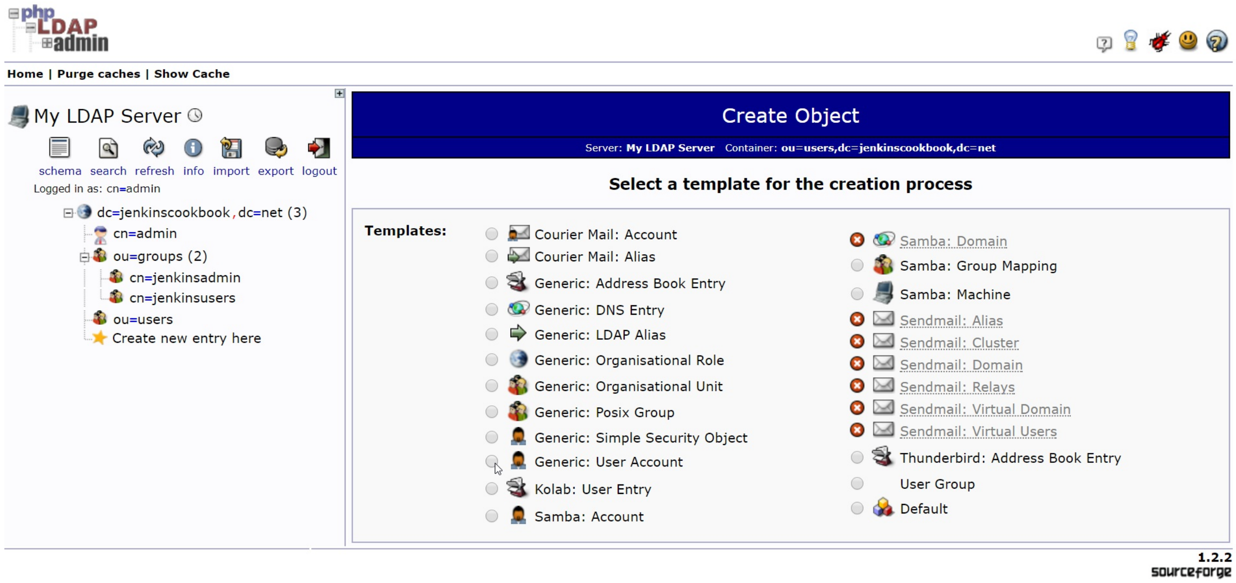
ou required, rdn

users *

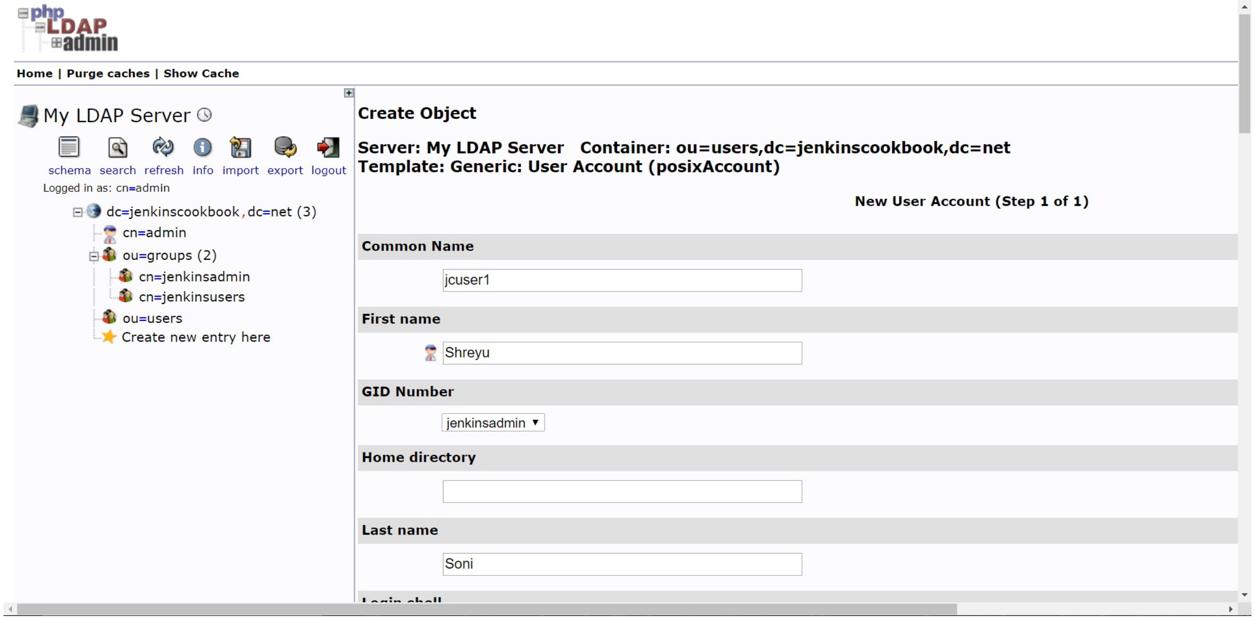
(add value)

Now it is time to create users. Click on Create new entry here.

Select Generic: User Account:



Provide all the required details for a user:



Create Object

Server: My LDAP Server Container: ou=users,dc=jenkinscookbook,dc=net
Template: Generic: User Account (posixAccount)

New User Account (Step 1 of 1)

Common Name: jcuser1

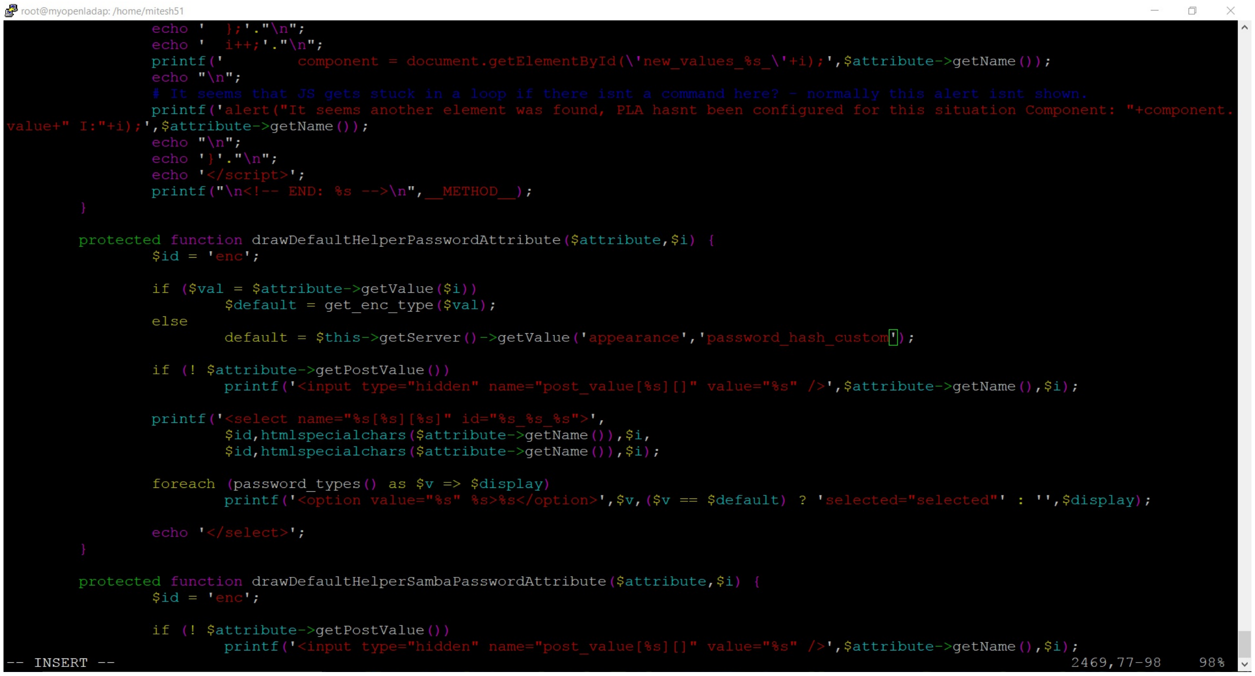
First name: Shreyu

GID Number: jenkinsadmin ▾

Home directory:

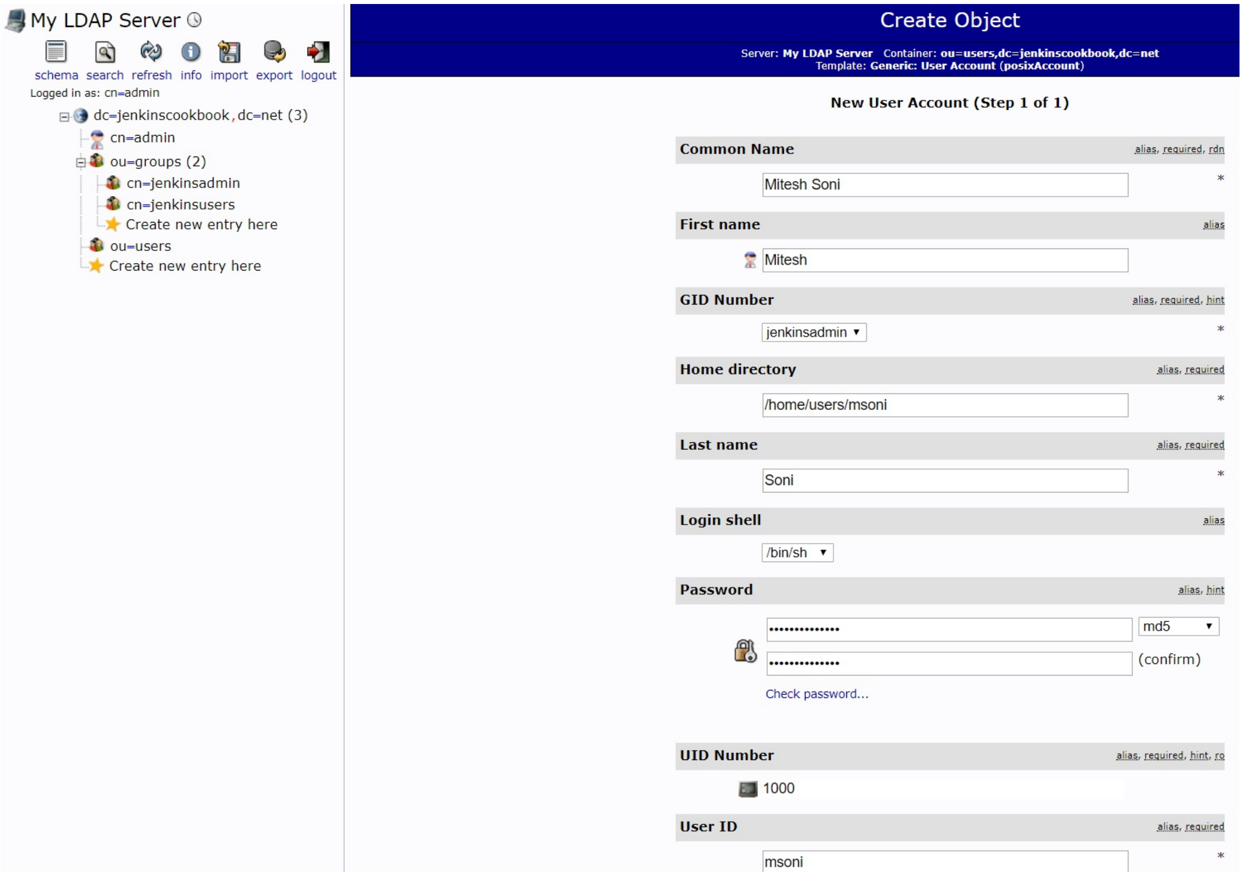
Last name: Soni

If you get an error while setting the password field when creating a generic user account in `phpldapadmin`, open `/usr/share/phpldapadmin/lib/TemplateRender.php` in edit mode and change `password_hash` to `password_hash_custom` on line 2469:



```
root@myopenladap: /home/mitesh51
                echo '  };'."\n";
                echo '  i++;'."\n";
                printf('        component = document.getElementById(\'new_values_%s_\'+i);',$attribute->getName());
                echo "\n";
                # It seems that JS gets stuck in a loop if there isnt a command here? - normally this alert isnt shown.
                printf('alert("It seems another element was found, PLA hasnt been configured for this situation Component: "+component.
value+" I:"+i);',$attribute->getName());
                echo "\n";
                echo '}'."\n";
                echo '</script>';
                printf("\n<!-- END: %s -->\n",__METHOD__);
        }

        protected function drawDefaultHelperPasswordAttribute($attribute,$i) {
                $id = 'enc';

                if ($val = $attribute->getValue($i))
                        $default = get_enc_type($val);
                else
                        default = $this->getServer()->getValue('appearance','password_hash_custom');

                if (! $attribute->getPostValue())
                        printf('<input type="hidden" name="post_value[%s][]" value="%s" />',$attribute->getName(),$i);

                printf('<select name="%s[%s][%s]" id="%s_%s_%s">',
                        $id,htmlspecialchars($attribute->getName()),$i,
                        $id,htmlspecialchars($attribute->getName()),$i);

                foreach (password_types() as $v => $display)
                        printf('<option value="%s" %s>%s</option>',$v,($v == $default) ? 'selected="selected"' : '',$display);

                echo '</select>';
        }

        protected function drawDefaultHelperSambaPasswordAttribute($attribute,$i) {
                $id = 'enc';

                if (! $attribute->getPostValue())
                        printf('<input type="hidden" name="post_value[%s][]" value="%s" />',$attribute->getName(),$i);
-- INSERT --                                                                                                    2469,77-98    98%
```

Give the password and user ID details and click on Create Object:



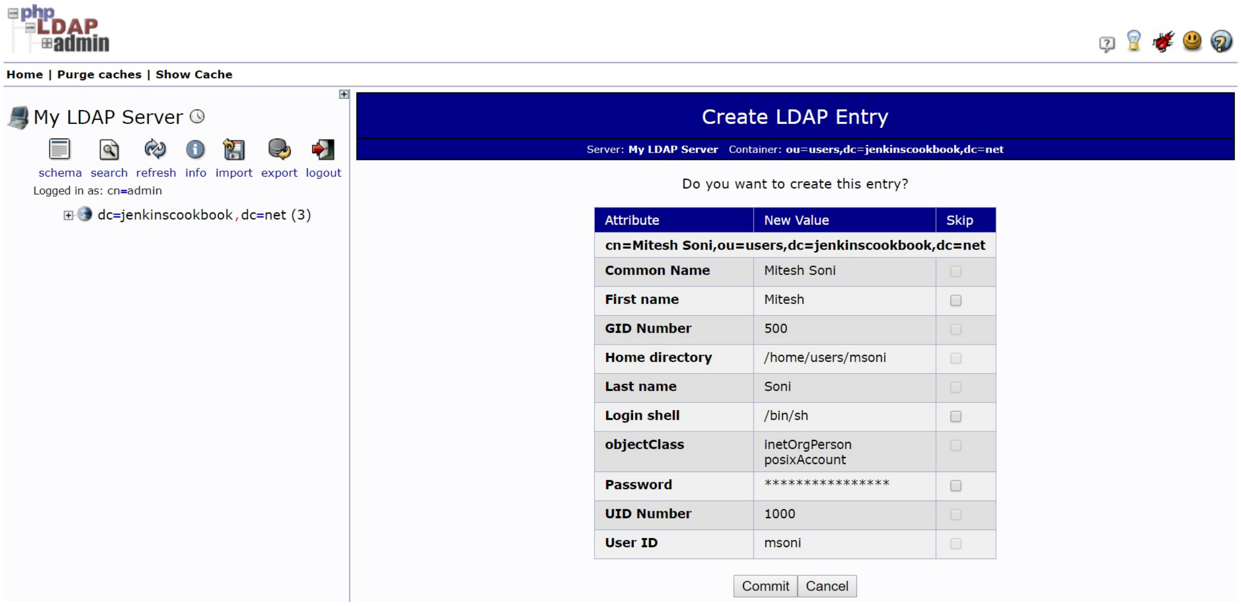
Create Object

Server: **My LDAP Server** Container: **ou=users,dc=jenkinscookbook,dc=net**
Template: **Generic: User Account (posixAccount)**

New User Account (Step 1 of 1)

Common Name	Mitesh Soni	alias, required, rdn
First name	Mitesh	alias
GID Number	jenkinsadmin ▾	alias, required, hint
Home directory	/home/users/msoni	alias, required
Last name	Soni	alias, required
Login shell	/bin/sh ▾	alias
Password	•••••••••••••• md5 ▾ •••••••••••••• (confirm) Check password...	alias, hint
UID Number	1000	alias, required, hint, ro
User ID	msoni	alias, required

Click on Commit:


phpLDAPadmin
Home | Purge caches | Show Cache
My LDAP Server
schema search refresh info import export logout
Logged in as: cn=admin
dc=jenkinscookbook,dc=net (3)

Create LDAP Entry

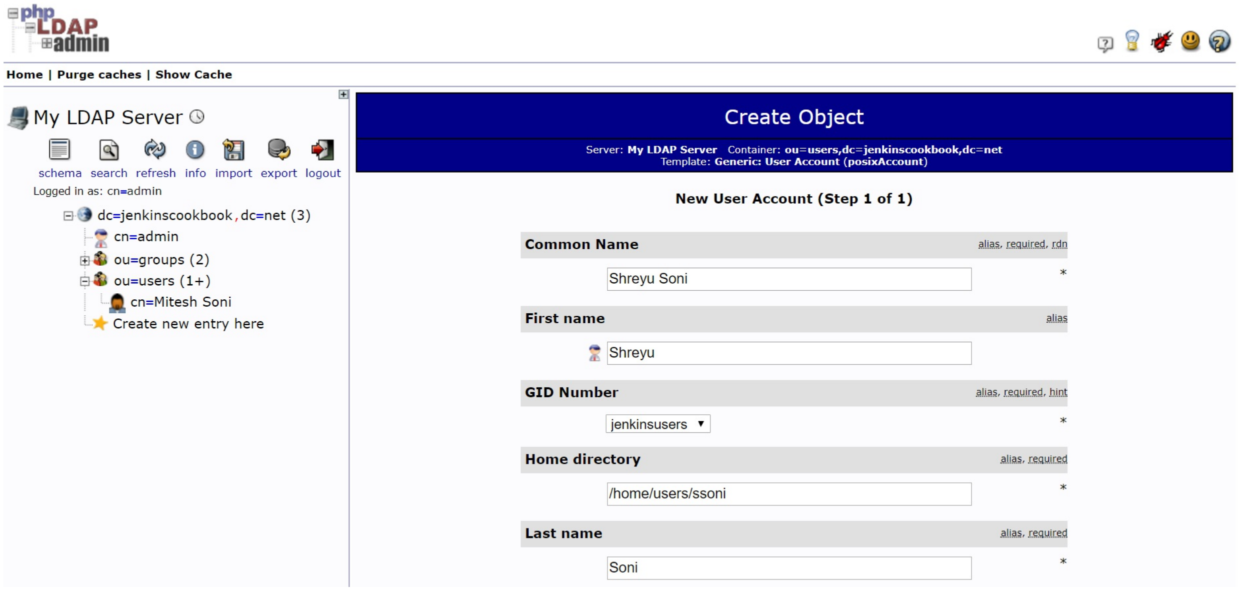
Server: **My LDAP Server** Container: **ou=users,dc=jenkinscookbook,dc=net**

Do you want to create this entry?

Attribute	New Value	Skip
cn=Mitesh Soni,ou=users,dc=jenkinscookbook,dc=net		
Common Name	Mitesh Soni	□
First name	Mitesh	□
GID Number	500	□
Home directory	/home/users/msoni	□
Last name	Soni	□
Login shell	/bin/sh	□
objectClass	inetOrgPerson posixAccount	□
Password	****************	□
UID Number	1000	□
User ID	msoni	□

Commit | Cancel

Similarly, create another user with the user ID `ssoni`:



My LDAP Server

Logged in as: cn=admin

- dc=jenkinscookbook,dc=net (3)
  - cn=admin
  - ou=groups (2)
  - ou=users (1+)
    - cn=Mitesh Soni
  - Create new entry here

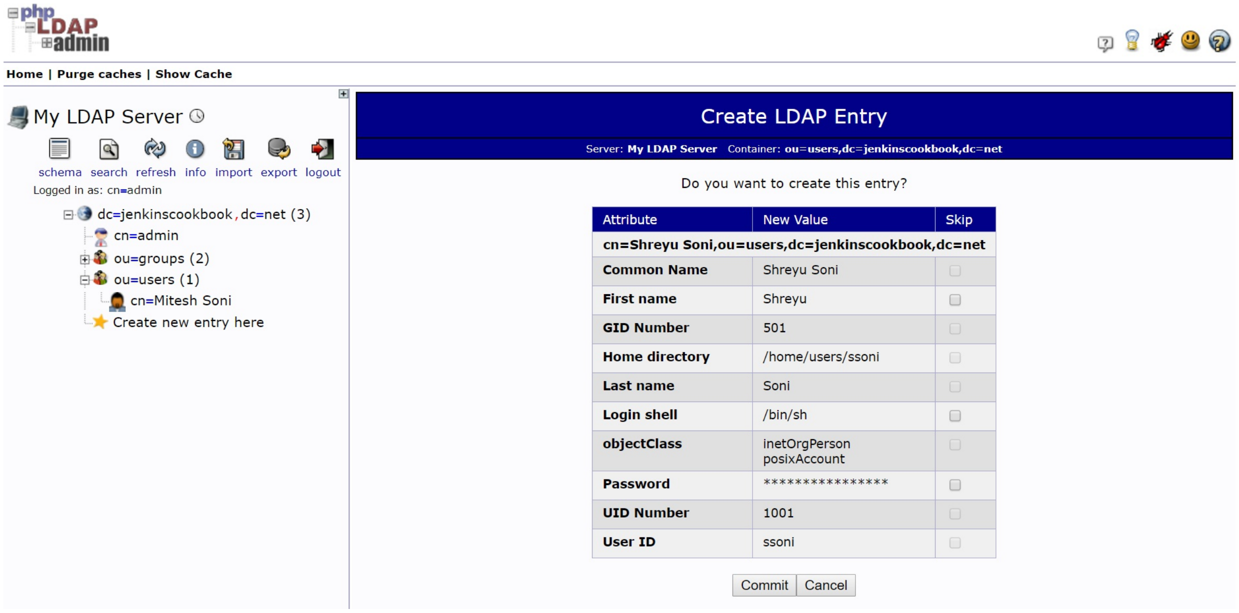
Create Object

Server: **My LDAP Server** Container: **ou=users,dc=jenkinscookbook,dc=net**
Template: **Generic: User Account (posixAccount)**

New User Account (Step 1 of 1)

Common Name	alias, required, rdn	
Shreyu Soni		*
First name	alias	
Shreyu		
GID Number	alias, required, hint	
jenkinsusers ▾		*
Home directory	alias, required	
/home/users/ssoni		*
Last name	alias, required	
Soni		*

Click on Commit:



Create LDAP Entry

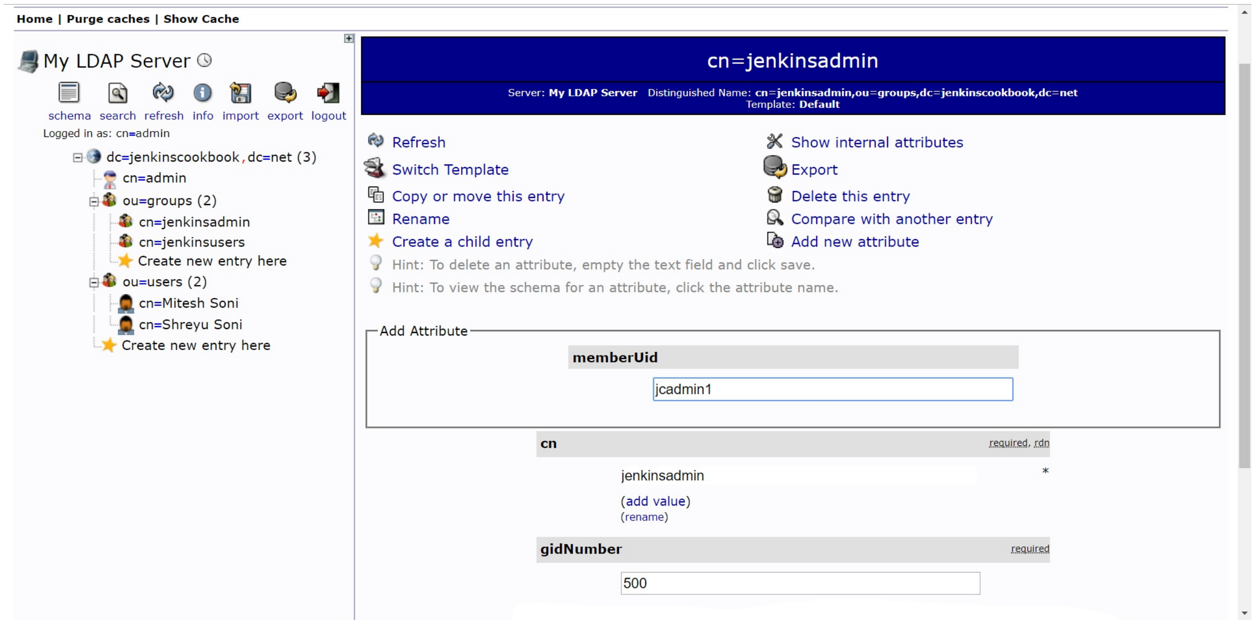
Server: **My LDAP Server** Container: **ou=users,dc=jenkinscookbook,dc=net**

Do you want to create this entry?

Attribute	New Value	Skip
cn=Shreyu Soni,ou=users,dc=jenkinscookbook,dc=net		
Common Name	Shreyu Soni	□
First name	Shreyu	□
GID Number	501	□
Home directory	/home/users/ssoni	□
Last name	Soni	□
Login shell	/bin/sh	□
objectClass	inetOrgPerson posixAccount	□
Password	****************	□
UID Number	1001	□
User ID	ssoni	□

Now you have the groups and users ready. The next step is to assign users to the groups.

Click on Add new attribute. Select memberUid:



cn=jenkinsadmin

Server: My LDAP Server Distinguished Name: cn=jenkinsadmin,ou=groups,dc=jenkinscookbook,dc=net
Template: Default

Hint: To delete an attribute, empty the text field and click save.

Hint: To view the schema for an attribute, click the attribute name.

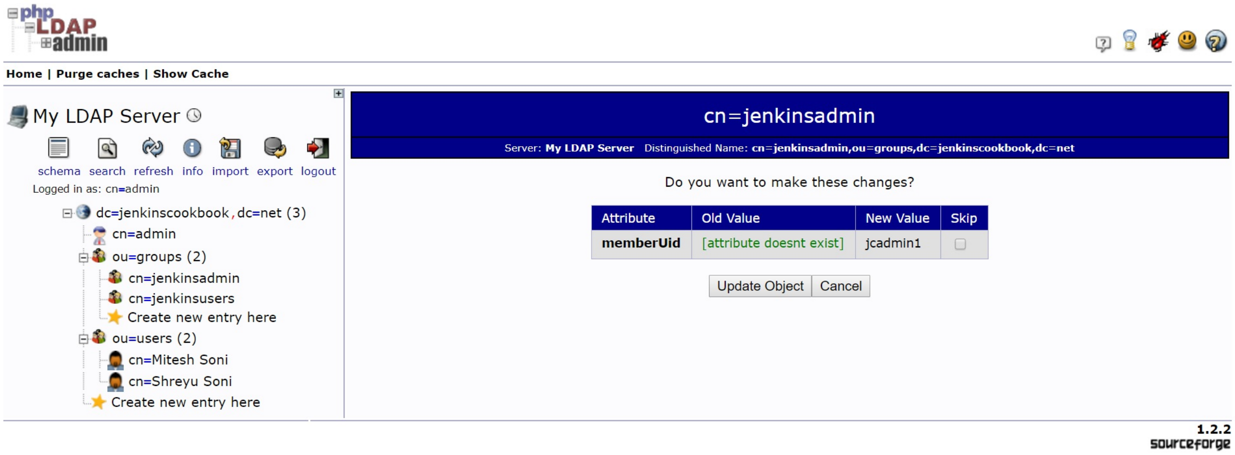
Add Attribute

memberUid: jcadmin1

cn: jenkinsadmin *

gidNumber: 500

Click on Update Object:



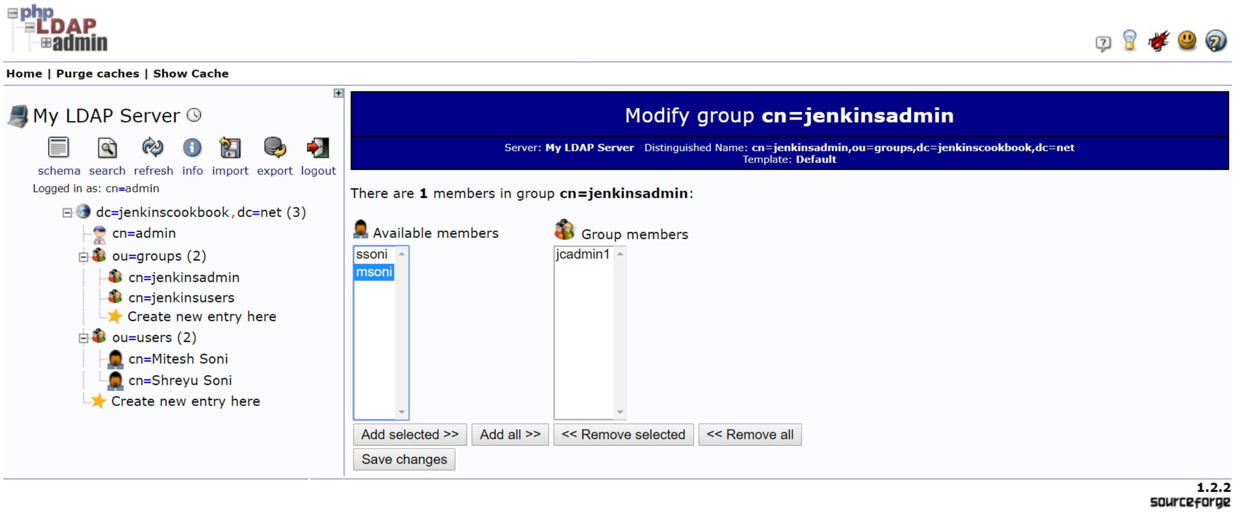
cn=jenkinsadmin

Server: My LDAP Server Distinguished Name: cn=jenkinsadmin,ou=groups,dc=jenkinscookbook,dc=net

Do you want to make these changes?

Attribute	Old Value	New Value	Skip
memberUid	[attribute doesnt exist]	jcadmin1	□

Click on Modify group members and add users to the group:



Modify group **cn=jenkinsadmin**

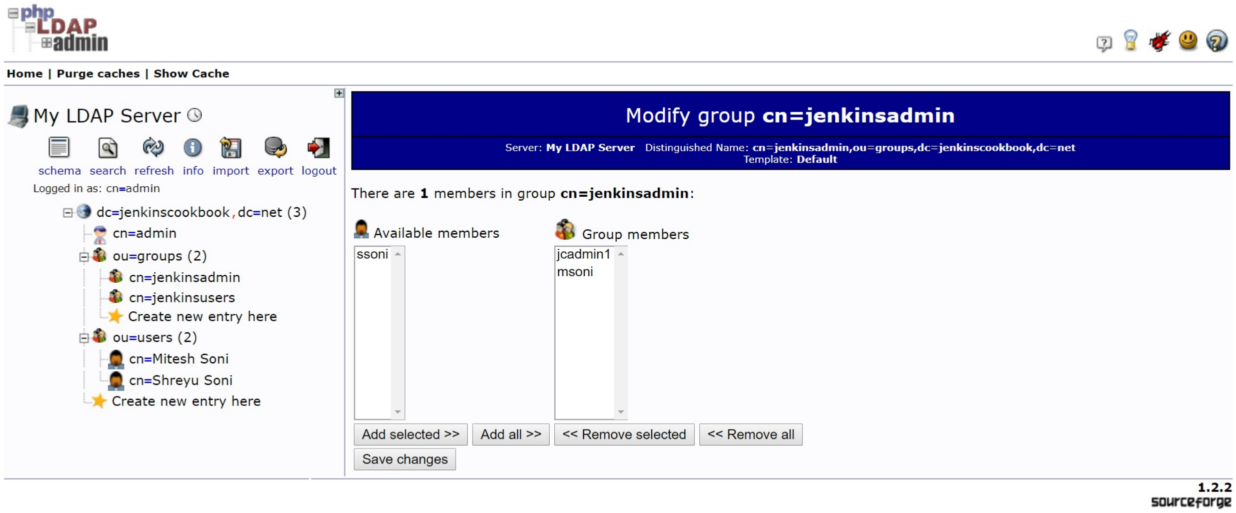
Server: My LDAP Server Distinguished Name: cn=jenkinsadmin,ou=groups,dc=jenkinscookbook,dc=net
Template: Default

There are **1** members in group **cn=jenkinsadmin**:

Available members: ssoni, msoni

Group members: jcadmin1

Click on Save changes:



Modify group **cn=jenkinsadmin**

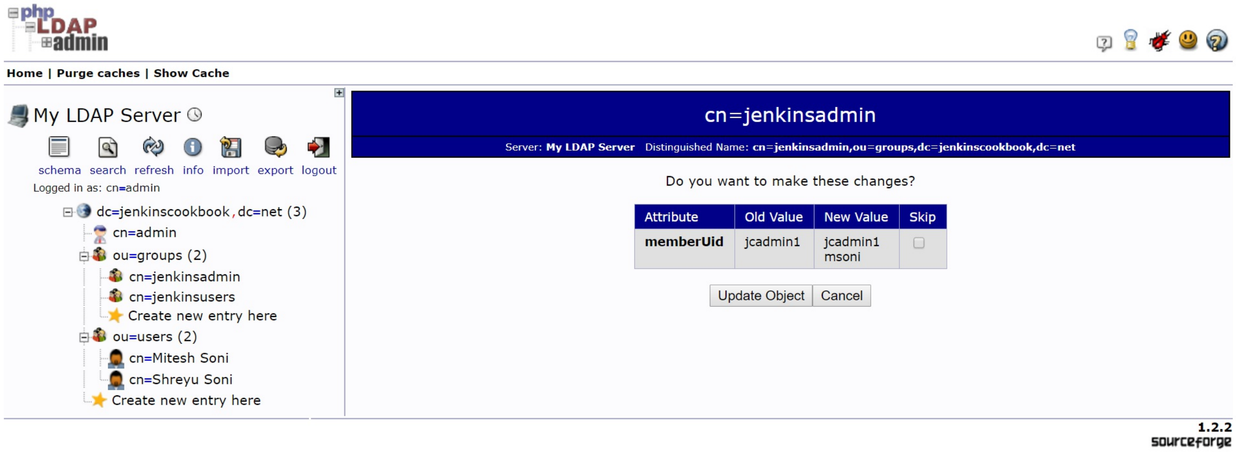
Server: **My LDAP Server** Distinguished Name: **cn=jenkinsadmin,ou=groups,dc=jenkinscookbook,dc=net**
Template: **Default**

There are **1** members in group **cn=jenkinsadmin**:

Available members: ssoni

Group members: jcadmin1, msoni

Click on Update Object:



cn=jenkinsadmin

Server: **My LDAP Server** Distinguished Name: **cn=jenkinsadmin,ou=groups,dc=jenkinscookbook,dc=net**

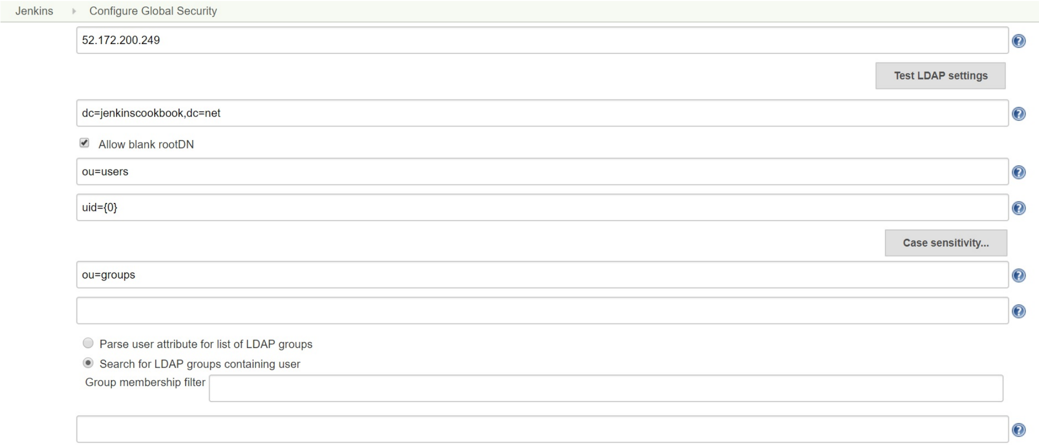
Do you want to make these changes?

Attribute	Old Value	New Value	Skip
memberUid	jcadmin1	jcadmin1 msoni	□

Now, you are ready to integrate OpenLDAP with Jenkins, as we have users available.

How to do it...

1. Go to the Jenkins dashboard | Manage Jenkins | Configure Global Security.
2. Click on Advanced and fill in the data as you have configured it in the OpenLDAP installation:



52.172.200.249

dc=jenkinscookbook,dc=net

☑ Allow blank rootDN

ou=users

uid={0}

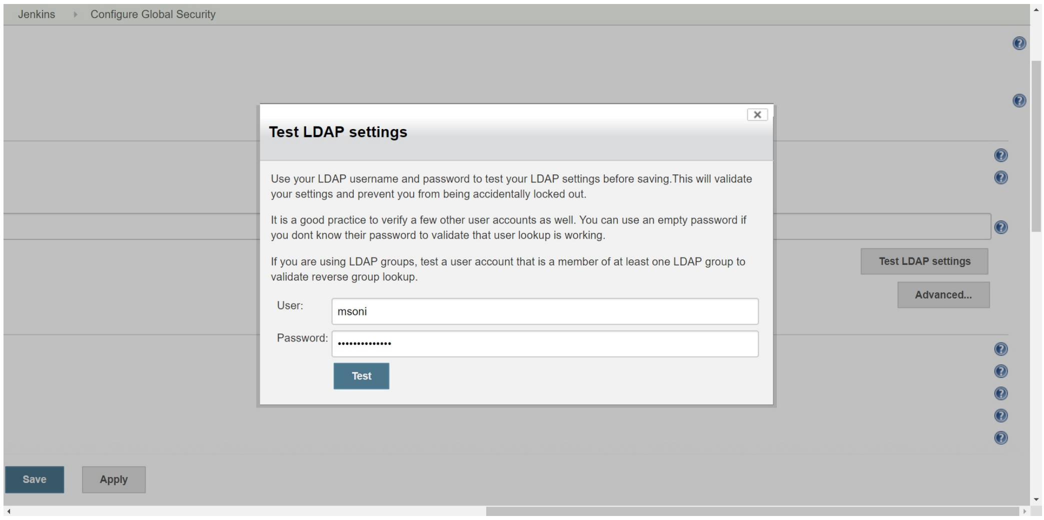
ou=groups

○ Parse user attribute for list of LDAP groups

● Search for LDAP groups containing user

Group membership filter

3. Click on Test LDAP settings. Give the User and Password. Click on Test:



Test LDAP settings

Use your LDAP username and password to test your LDAP settings before saving.This will validate your settings and prevent you from being accidentally locked out.

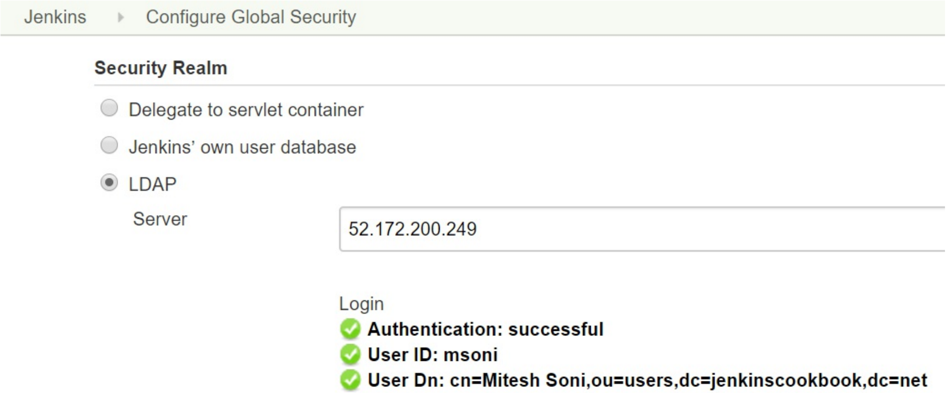
It is a good practice to verify a few other user accounts as well. You can use an empty password if you dont know their password to validate that user lookup is working.

If you are using LDAP groups, test a user account that is a member of at least one LDAP group to validate reverse group lookup.

User: msoni

Password: ••••••••••••••

4. Verify that the authentication is successful:



Security Realm

○ Delegate to servlet container

○ Jenkins' own user database

● LDAP

Server: 52.172.200.249

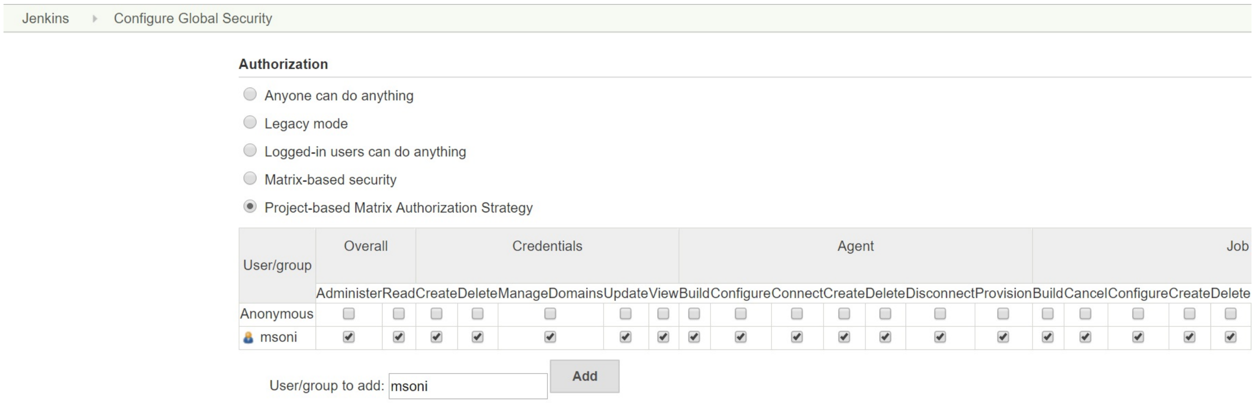
Login

✓ **Authentication: successful**

✓ **User ID: msoni**

✓ **User Dn: cn=Mitesh Soni,ou=users,dc=jenkinscookbook,dc=net**

5. In the Authorization section, go to Project-based Matrix Authorization Strategy and add the user we created in OpenLDAP:



Authorization

○ Anyone can do anything

○ Legacy mode

○ Logged-in users can do anything

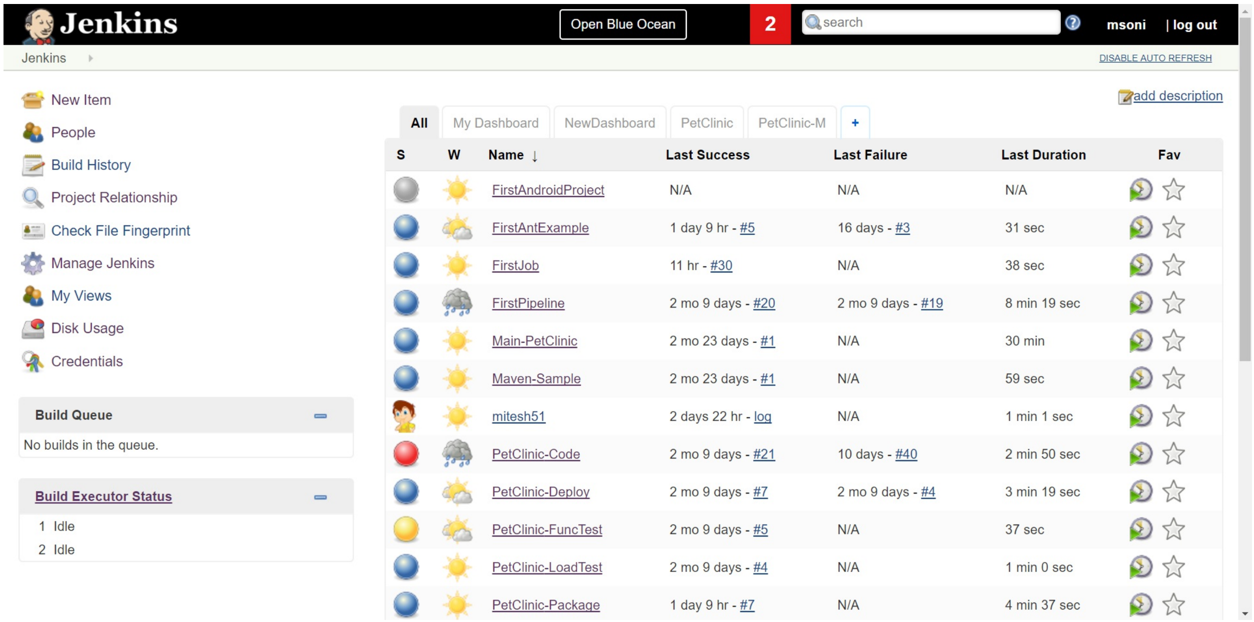
○ Matrix-based security

● Project-based Matrix Authorization Strategy

User/group	Overall		Credentials					Agent							Job				
	Administer	Read	Create	Delete	ManageDomains	Update	View	Build	Configure	Connect	Create	Delete	Disconnect	Provision	Build	Cancel	Configure	Create	Delete
Anonymous	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
msoni	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑

User/group to add: msoni

6. Save the changes and Jenkins will be logged out. Log in with your LDAP user credentials and you will be able to log in:



Jenkins | Open Blue Ocean | 2 | search | msoni | log out

Jenkins | DISABLE AUTO REFRESH

- New Item
- People
- Build History
- Project Relationship
- Check File Fingerprint
- Manage Jenkins
- My Views
- Disk Usage
- Credentials

Build Queue

No builds in the queue.

Build Executor Status

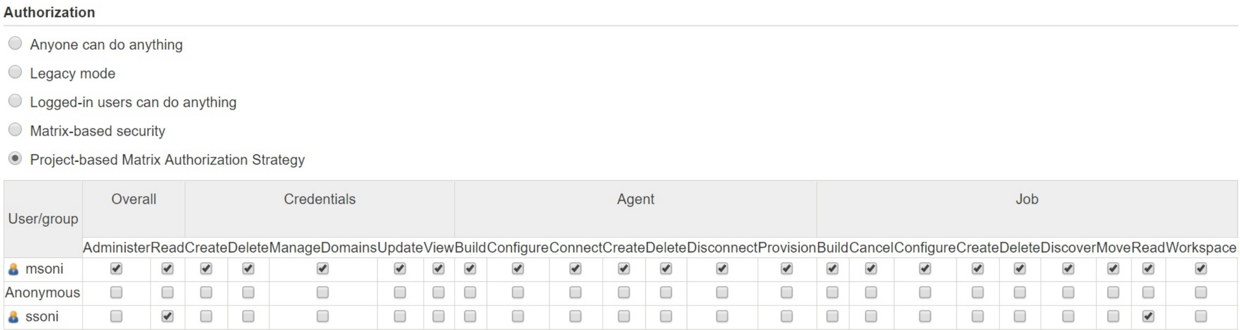
1 Idle
2 Idle

add description

All | My Dashboard | NewDashboard | PetClinic | PetClinic-M | +

S	W	Name ↓	Last Success	Last Failure	Last Duration	Fav
		FirstAndroidProject	N/A	N/A	N/A	☆
		FirstAntExample	1 day 9 hr - #5	16 days - #3	31 sec	☆
		FirstJob	11 hr - #30	N/A	38 sec	☆
		FirstPipeline	2 mo 9 days - #20	2 mo 9 days - #19	8 min 19 sec	☆
		Main-PetClinic	2 mo 23 days - #1	N/A	30 min	☆
		Maven-Sample	2 mo 23 days - #1	N/A	59 sec	☆
		mitesh51	2 days 22 hr - log	N/A	1 min 1 sec	☆
		PetClinic-Code	2 mo 9 days - #21	10 days - #40	2 min 50 sec	☆
		PetClinic-Deploy	2 mo 9 days - #7	2 mo 9 days - #4	3 min 19 sec	☆
		PetClinic-FuncTest	2 mo 9 days - #5	N/A	37 sec	☆
		PetClinic-LoadTest	2 mo 9 days - #4	N/A	1 min 0 sec	☆
		PetClinic-Package	1 day 9 hr - #7	N/A	4 min 37 sec	☆

7. Give the `ssoni` user Read rights only to verify the access:

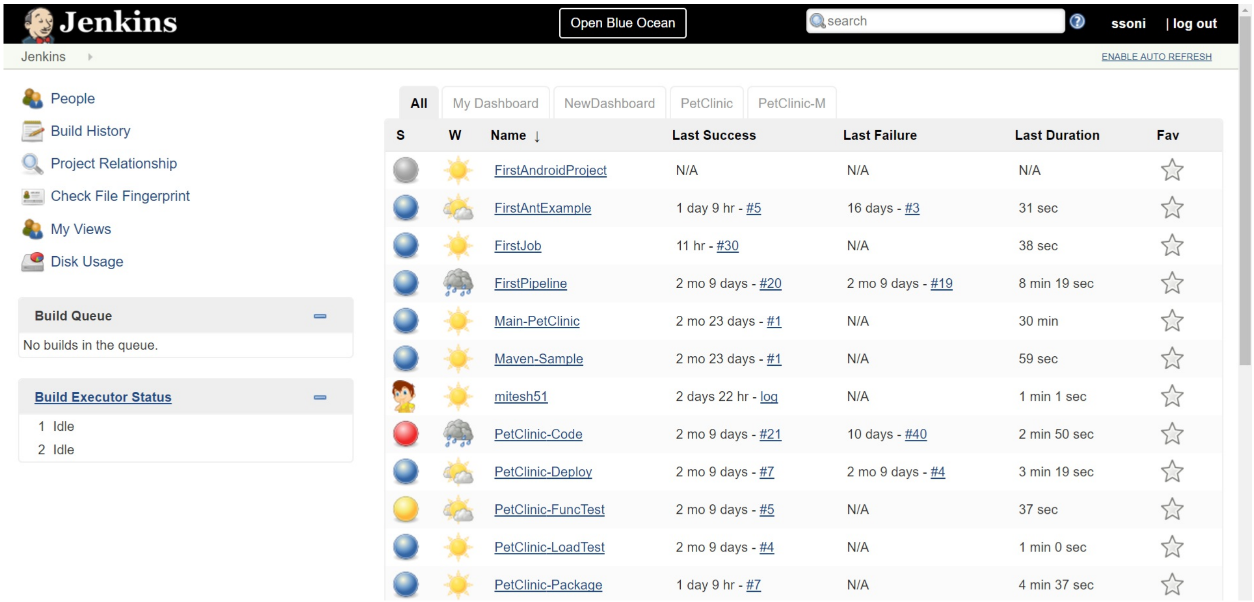


Authorization

- ○ Anyone can do anything
- ○ Legacy mode
- ○ Logged-in users can do anything
- ○ Matrix-based security
- ● Project-based Matrix Authorization Strategy

User/group	Overall		Credentials					Agent							Job								
	Administer	Read	Create	Delete	ManageDomains	Update	View	Build	Configure	Connect	Create	Delete	Disconnect	Provision	Build	Cancel	Configure	Create	Delete	Discover	Move	Read	Workspace
msoni	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Anonymous	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
ssoni	□	☑	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	☑	□

8. Login with the `ssoni` user who has limited access and see that the Manage Jenkins section is not available:



Jenkins | Open Blue Ocean | search | ssoni | log out

Jenkins | ENABLE AUTO REFRESH

- People
- Build History
- Project Relationship
- Check File Fingerprint
- My Views
- Disk Usage

Build Queue

No builds in the queue.

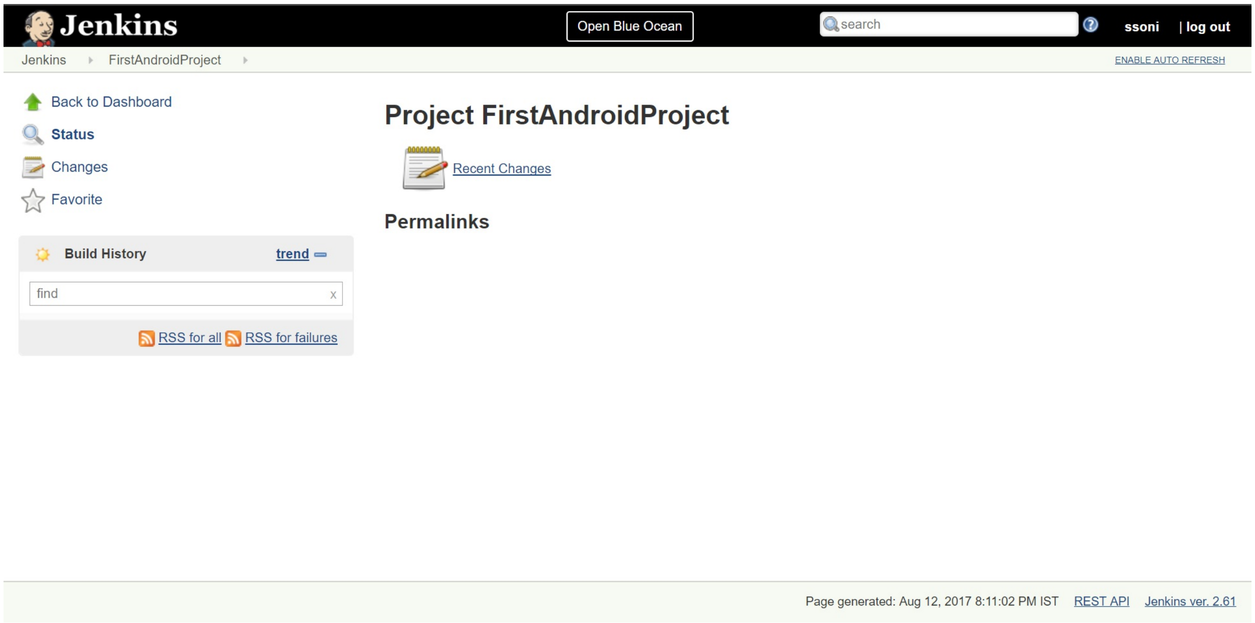
Build Executor Status

1 Idle
2 Idle

All | My Dashboard | NewDashboard | PetClinic | PetClinic-M

S	W	Name ↓	Last Success	Last Failure	Last Duration	Fav
		FirstAndroidProject	N/A	N/A	N/A	☆
		FirstAntExample	1 day 9 hr - #5	16 days - #3	31 sec	☆
		FirstJob	11 hr - #30	N/A	38 sec	☆
		FirstPipeline	2 mo 9 days - #20	2 mo 9 days - #19	8 min 19 sec	☆
		Main-PetClinic	2 mo 23 days - #1	N/A	30 min	☆
		Maven-Sample	2 mo 23 days - #1	N/A	59 sec	☆
		mitesh51	2 days 22 hr - log	N/A	1 min 1 sec	☆
		PetClinic-Code	2 mo 9 days - #21	10 days - #40	2 min 50 sec	☆
		PetClinic-Deploy	2 mo 9 days - #7	2 mo 9 days - #4	3 min 19 sec	☆
		PetClinic-FuncTest	2 mo 9 days - #5	N/A	37 sec	☆
		PetClinic-LoadTest	2 mo 9 days - #4	N/A	1 min 0 sec	☆
		PetClinic-Package	1 day 9 hr - #7	N/A	4 min 37 sec	☆

9. Click on the projects available on the Jenkins dashboard and check that only Read rights are available:



Project FirstAndroidProject

Recent Changes

Permalinks

Page generated: Aug 12, 2017 8:11:02 PM IST REST API Jenkins ver. 2.61

There's more...

The test that the LDAP server supports anonymous binding, you can search the server without authenticating. Most LDAP servers allow this approach. However, some servers are configured to enforce specific information security policies. For example, your policy might enforce being able to anonymously verify that a user's record exists, but you may not be able to retrieve specific attributes, such as their email or postal address.

Anonymous binding simplifies configuration; otherwise, you will need to add account details for a user in LDAP that has the rights to perform the searches. This account has great LDAP powers, should never be shared, and can present a chink in your security armor.

The user search filter, *uid={0}*, searches for users whose UIDs equal their usernames. Many organizations prefer to use `cn` instead of UID; the choice of attribute is a matter of taste. You can even imagine an email attribute being used to uniquely identify a person, as long as that attribute cannot be changed by the user.

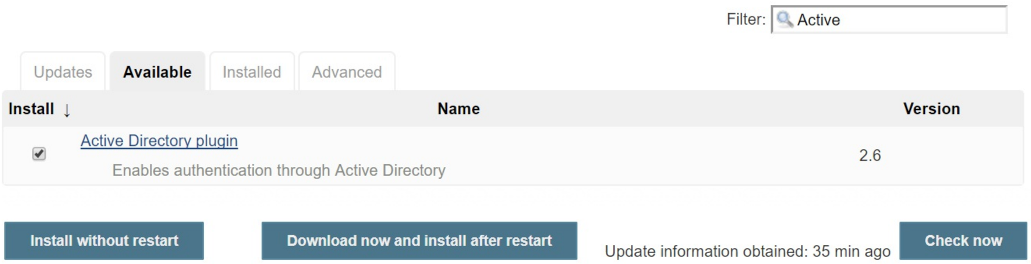
Jenkins and Active Directory integration

In this section, we will configure Active Directory, which is already available to integrate with Jenkins so all available users in a specific domain of Active Directory can utilize Jenkins with their own Active Directory credentials based on the given access.

Getting ready

Go to the Jenkins dashboard | Manage Jenkins | Manage Plugins | Available.

Install the Active Directory plugin:



Filter: Active

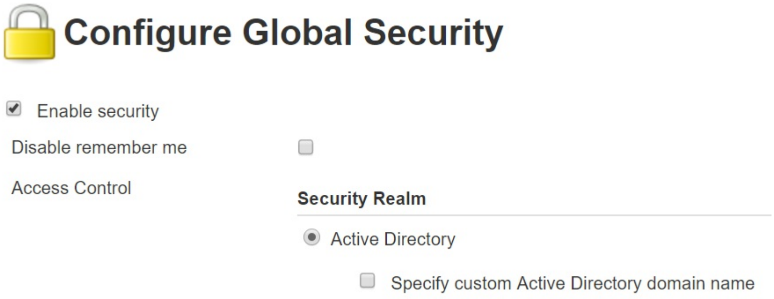
Install ↓	Name	Version
☑	Active Directory plugin Enables authentication through Active Directory	2.6

Update information obtained: 35 min ago

Now you can configure the Active Directory settings in Configure Global Security.

How to do it...

1. Go to the Jenkins dashboard | Manage Jenkins | Configure Global Security | Enable security | Select Active Directory:



Configure Global Security

☑ Enable security

Disable remember me □

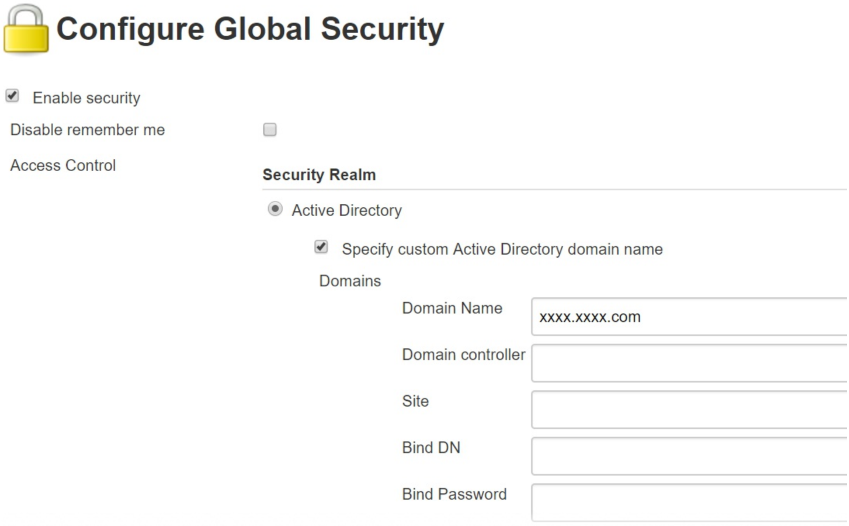
Access Control

Security Realm

● Active Directory

□ Specify custom Active Directory domain name

2. Select Specify custom Active Directory domain name, click on Add Domain, provide the Domain Name, and save it:



Configure Global Security

☑ Enable security

Disable remember me □

Access Control

Security Realm

● Active Directory

☑ Specify custom Active Directory domain name

Domains

Domain Name: xxxx.xxxx.com

Domain controller:

Site:

Bind DN:

Bind Password:

3. If the configuration and access is correct, then we can use all the users in the domain directly in Jenkins.

Jenkins and OWASP Zed Attack Proxy integration

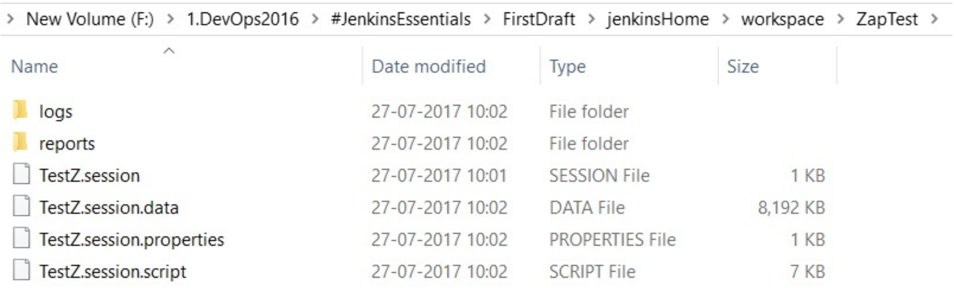
OWASP Zed Attack Proxy(**ZAP**) is an open source web application security scanner. You can integrate ZAP security tool with the Jenkins CI environment.

Getting ready

Go to https://github.com/zaproxy/zaproxy/wiki/Downloads and download the Windows (64) Installer.

Install it on Windows.

Open OWASP ZAP in Windows, click on File | Persist Session and save it in the Jenkins workspace in the directory of the build job:



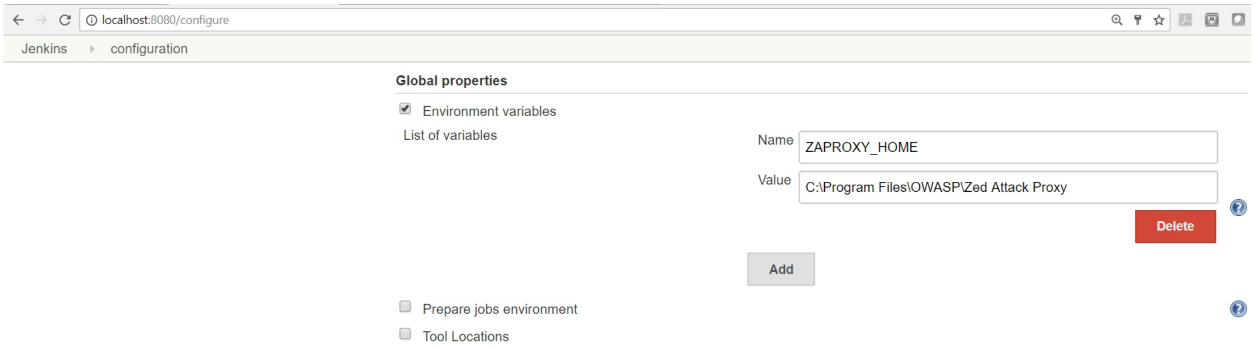
> New Volume (F:) > 1.DevOps2016 > #JenkinsEssentials > FirstDraft > jenkinsHome > workspace > ZapTest >

Name	Date modified	Type	Size
logs	27-07-2017 10:02	File folder	
reports	27-07-2017 10:02	File folder	
TestZ.session	27-07-2017 10:01	SESSION File	1 KB
TestZ.session.data	27-07-2017 10:02	DATA File	8,192 KB
TestZ.session.properties	27-07-2017 10:02	PROPERTIES File	1 KB
TestZ.session.script	27-07-2017 10:02	SCRIPT File	7 KB

Now you are good to configure ZAP plugins in Jenkins.

How to do it...

1. Go to the Jenkins dashboard | Configure system | Global properties | Environment variables and create the `ZAPPROXY_HOME` variable:



localhost:8080/configure

Jenkins › configuration

Global properties

☑ Environment variables

List of variables

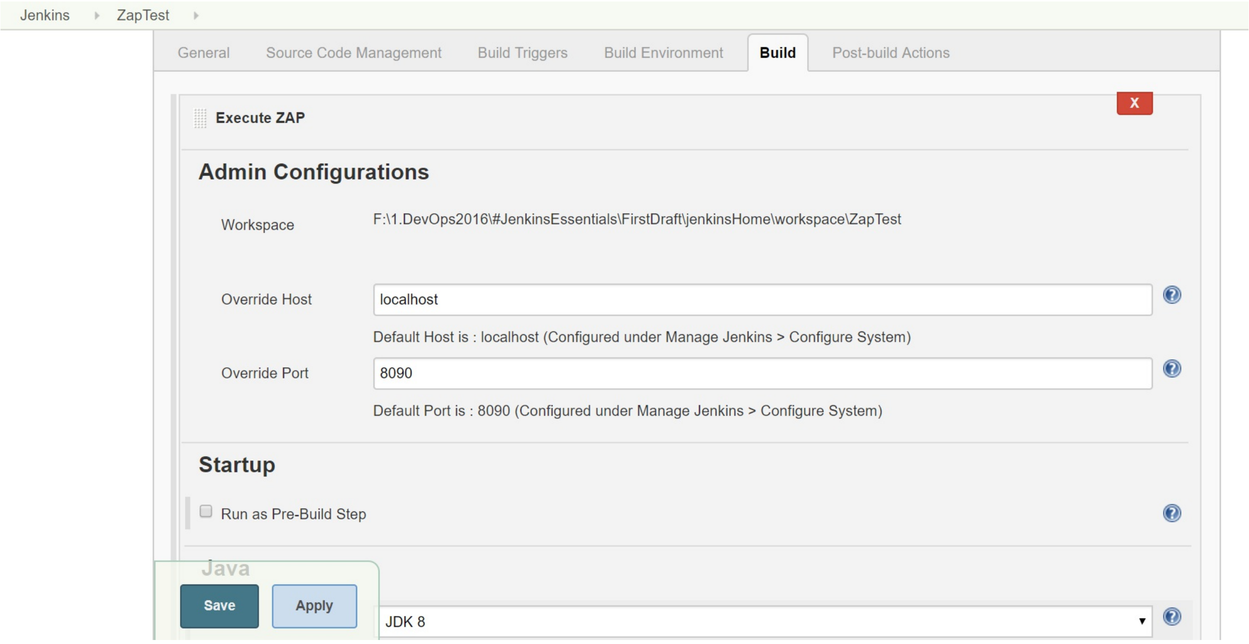
Name: ZAPPROXY_HOME

Value: C:\Program Files\OWASP\Zed Attack Proxy

□ Prepare jobs environment

□ Tool Locations

2. Go to the Jenkins dashboard | Zap project | Build | Add build step | Execute ZAP.
3. Keep the host and port settings as default or change them according to your installation of OWAASP ZAP:



Jenkins › ZapTest ›

Execute ZAP

Admin Configurations

Workspace: F:\1.DevOps2016\#JenkinsEssentials\FirstDraft\jenkinsHome\workspace\ZapTest

Override Host: localhost

Default Host is : localhost (Configured under Manage Jenkins > Configure System)

Override Port: 8090

Default Port is : 8090 (Configured under Manage Jenkins > Configure System)

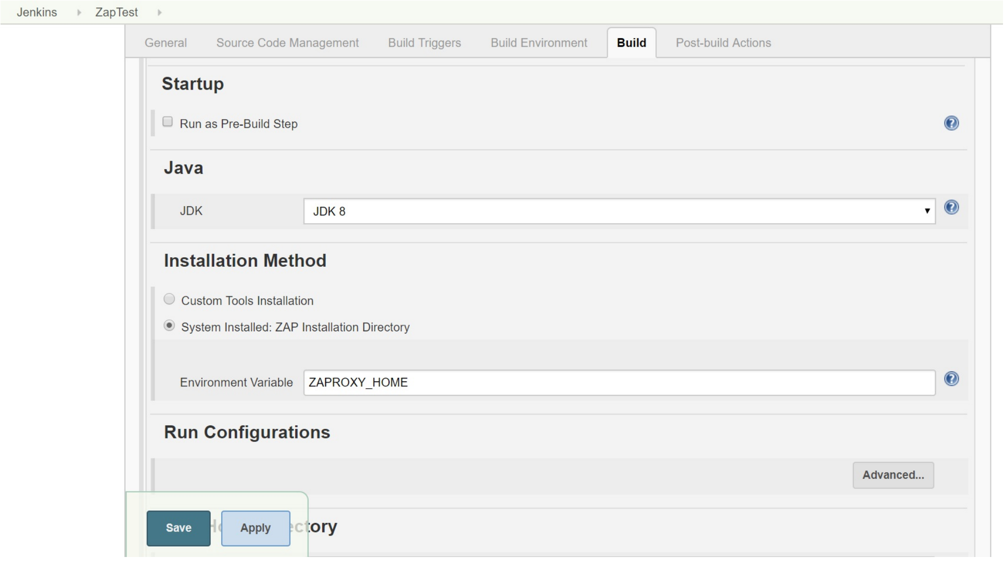
Startup

□ Run as Pre-Build Step

Java

JDK 8

4. Provide `ZAPPROXY_HOME`:



Startup

□ Run as Pre-Build Step

Java

JDK: JDK 8

Installation Method

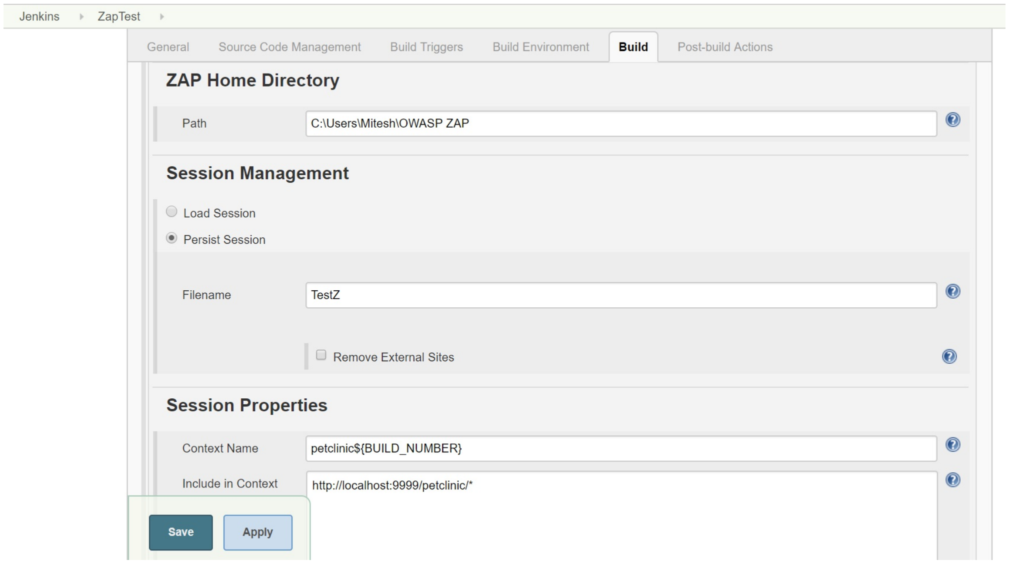
○ Custom Tools Installation

● System Installed: ZAP Installation Directory

Environment Variable: ZAPROXY_HOME

Run Configurations

5. Give the Path to the ZAP home directory that is not the installation directory.
6. Give the session name that you saved in the workspace:



ZAP Home Directory

Path: C:\Users\Mitesh\OWASP ZAP

Session Management

○ Load Session

● Persist Session

Filename: TestZ

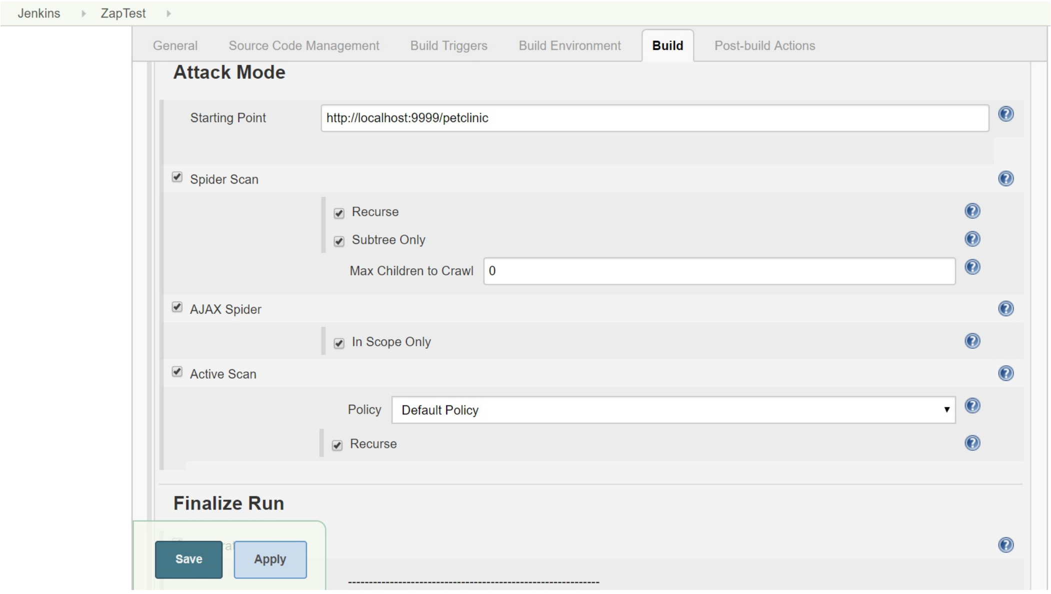
□ Remove External Sites

Session Properties

Context Name: petclinic${BUILD_NUMBER}

Include in Context: http://localhost:9999/petclinic/*

7. Configure the Attack Mode:



Attack Mode

Starting Point: http://localhost:9999/petclinic

☑ Spider Scan

☑ Recurse

☑ Subtree Only

Max Children to Crawl: 0

☑ AJAX Spider

☑ In Scope Only

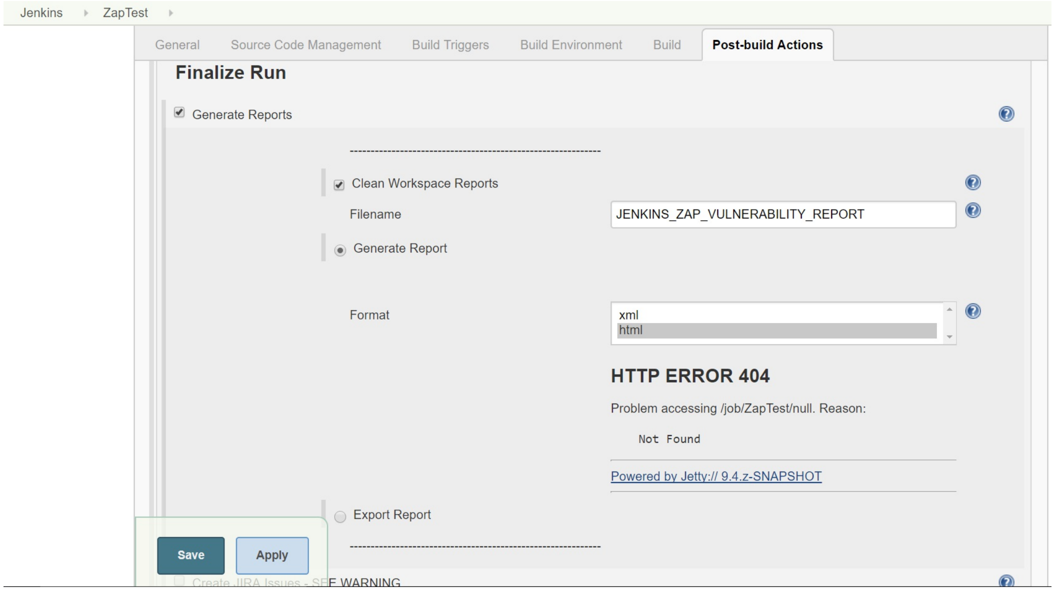
☑ Active Scan

Policy: Default Policy

☑ Recurse

Finalize Run

8. Configure the Generate Report section:



Finalize Run

☑ Generate Reports

☑ Clean Workspace Reports

Filename: JENKINS_ZAP_VULNERABILITY_REPORT

● Generate Report

Format: xml, html

HTTP ERROR 404

Problem accessing /job/ZapTest/null. Reason:

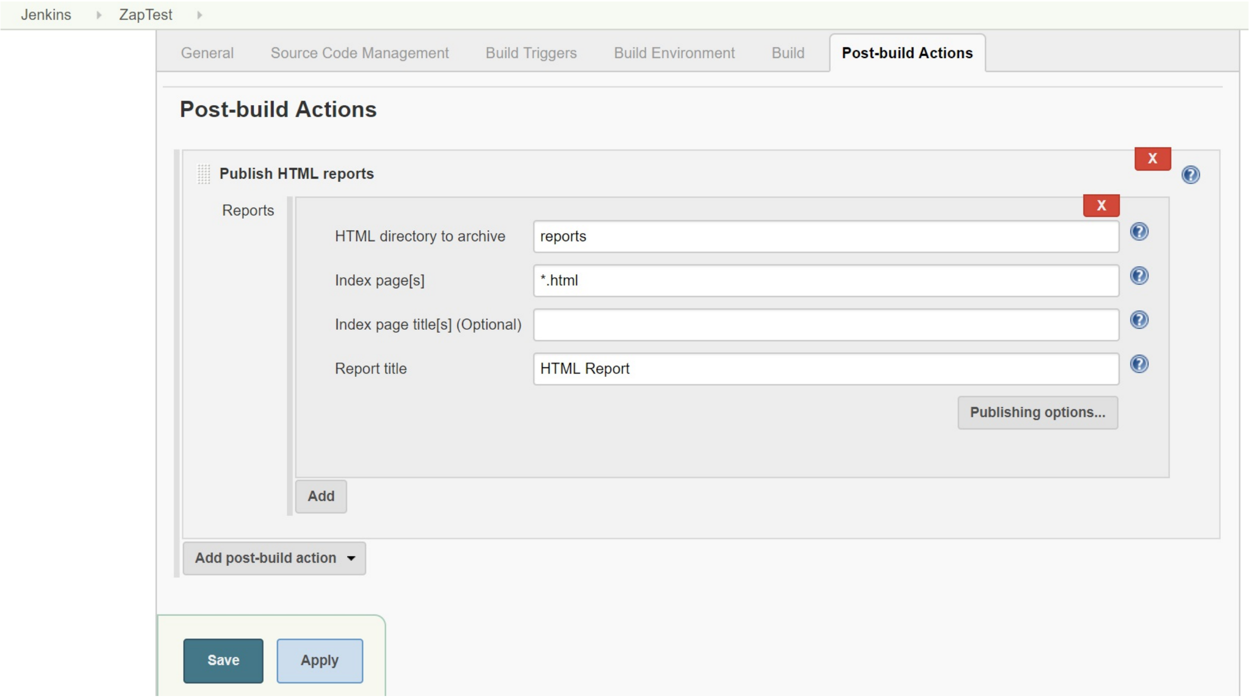
```
Not Found
```

Powered by Jetty:// 9.4.z-SNAPSHOT

○ Export Report

□ Create JIRA Issues - SEE WARNING

9. Publish HTML Reports. Click on Save:



Post-build Actions

Publish HTML reports

Reports

HTML directory to archive: reports

Index page[s]: *.html

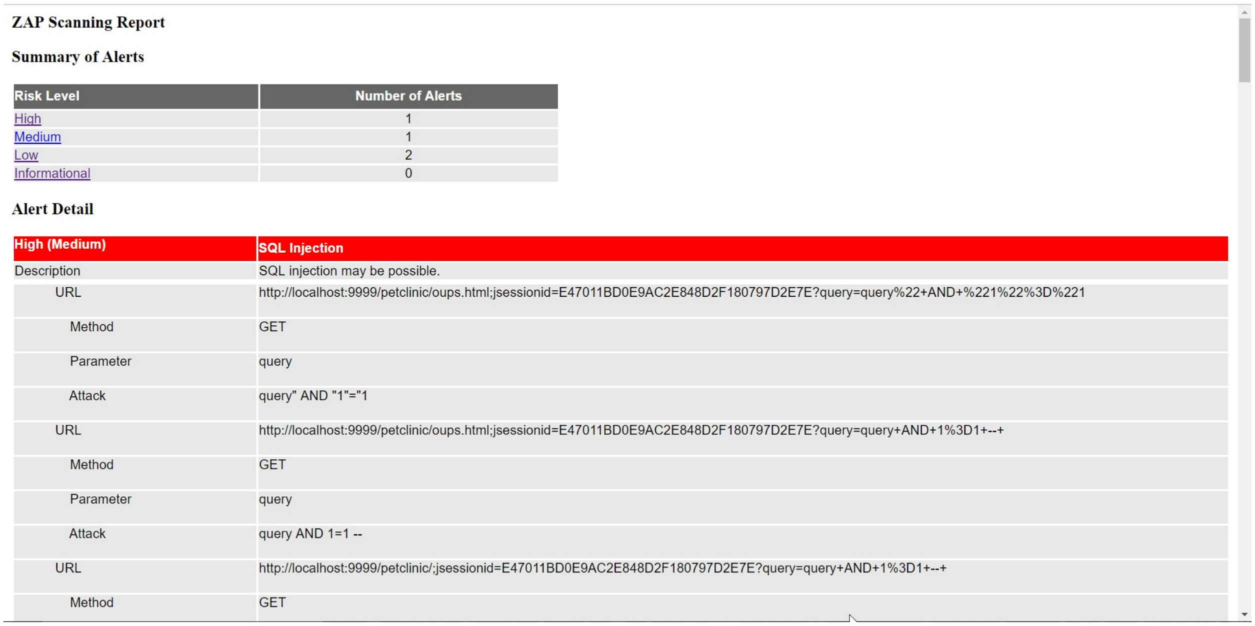
Index page title[s] (Optional):

Report title: HTML Report

10. Make sure the application is running in the local or remote environment.

See also

- Run the Jenkins build and it will create an HTML report. Navigate to the HTML report and verify the scanning report:



ZAP Scanning Report

Summary of Alerts

Risk Level	Number of Alerts
High	1
Medium	1
Low	2
Informational	0

Alert Detail

High (Medium)	SQL Injection
Description	SQL injection may be possible.
URL	http://localhost:9999/petclinic/oups.html;jsessionid=E47011BD0E9AC2E848D2F180797D2E7E?query=query%22+AND+%221%22%3D%221
Method	GET
Parameter	query
Attack	query" AND "1"="1
URL	http://localhost:9999/petclinic/oups.html;jsessionid=E47011BD0E9AC2E848D2F180797D2E7E?query=query+AND+1%3D1+--+
Method	GET
Parameter	query
Attack	query AND 1=1 --
URL	http://localhost:9999/petclinic/;jsessionid=E47011BD0E9AC2E848D2F180797D2E7E?query=query+AND+1%3D1+--+
Method	GET

- You have integrated Jenkins and OWASP ZAP for security testing using Jenkins and you can integrate it in the pipeline too.

Testing for OWASP's top 10 security issues

This recipe details the automatic testing of Jenkins for well-known security issues with w3af, a penetration testing tool from the **Open Web Application Security Project** (**OWASP**). For more information, visit http://w3af.sourceforge.net. OWASP's purpose is to make application security visible. The OWASP's top 10 lists of insecurities for 2010 include the following:

- **A2-Cross-site Scripting (XSS)**: An XSS attack can occur when an application returns an unescaped input to a client's browser. The Jenkins administrator can do this by default through the job description.
- **A6-Security Misconfiguration**: A Jenkins plugin gives you the power to write custom authentication scripts. It is easy to get scripts wrong through misconfiguration.
- **A7-Insecure Cryptographic Storage**: There are over 600 plugins for Jenkins, each storing its configuration in separate XML files. It is quite possible that there could be a rare mistake with the storage of passwords in plain text. You will need to double-check.
- **A9-Insufficient Transport Layer Protection**: Jenkins runs over HTTP by default. It can be a hassle and involves extra costs to obtain a trusted certificate. You might be tempted not to implement TLS, leaving your packets open.

You will find that OWASP's top 10 lists of insecurities for 2013 have some changes compared with the 2010 version. The most significant change is the inclusion of **A9-Using Known Vulnerable Components**. If your software depends on older libraries, then there is a window of opportunity for the manipulation of known weaknesses.

Jenkins has a large set of plugins written by a motivated, diffuse, and hardworking community. It is possible, due to the large churn of code, that security defects are inadvertently added. Examples include leaving passwords in plain text in configuration files or using unsafe rendering that does not remove suspicious JavaScript. You can find the first type of defect by reviewing the configuration files manually. The second type is accessible to a wider audience and is thus more readily crackable. You can attack the new plugins by hand. There are helpful cheat sheets available on the internet (http://hackers.org/xss.html). The effort required is tedious; automated tests can cover more ground and can be scheduled as part of a Jenkins job.

In the recipe named *Exploring the OWASP dependency-check plugin*, you will configure Jenkins to give you warning of known attack vectors, based on automatically reviewing your code dependencies.

OWASP storefront:

OWASP publish a list of the top 10 most common security attack vectors for web applications each year. They publish this document and a wide range of books through http://lulu.com. At Lulu, you have free access to PDF versions of OWASP's documents, or you can buy cheap, on-demand printed versions. You can find the official storefront at: http://stores.lulu.com/owasp.

Getting ready

Penetration tests have the potential to damage a running application. Make sure that you have a backed-up copy of your Jenkins workspace. You might have to reinstall. Also, turn off any enabled security within Jenkins: this allows w3af to freely roam the security surface.

Download the newest version of w3af from SourceForge (http://w3af.org/download/) and also download and read OWASP's top 10 list of well-known attacks from https://www.owasp.org/index.php/Category:OWASP_Top_Ten_Project.

w3af has both Windows and *NIX installation packages; use the OS installation of your choice. However, the Windows Installer is no longer supported and the installation process without the Installer is complex. Therefore, it's better to use a *NIX version of the tool.

The `Debian` package for w3af is older and more unstable than the `SourceForge` package for Linux. Therefore, do not use the `apt-get` and `yum` methods of installation, but rather, use the downloaded package from `SourceForge`.

How to do it...

1. To install w3af, follow the instructions given on the developer site (http://w3af.org/download/). If there are any unsolvable dependency issues for Ubuntu, fall back to the `apt-get` installation approach and install an older version of the tool as follows:

   ```
   sudo apt-get install w3af
   ```

2. Run `w3af`.
3. Under the Profiles tab, select OWASP_TOP10.
4. Under the Target address window, fill in `http://localhost:8080/`, changing the hostname to suit your environment.
5. Click on the Start button. The penetration tests will now take place and the Start button will change to Stop. At the end of the scan, the Stop button will change to Clear.
6. View the attack history by selecting the Log tab.
7. Review the results by clicking on the Results tab.

8. After the first scan, select full_audit under Profiles.
9. Click on the Clear button.
10. Type `http://localhost:8080/` in the Target address window.
11. Click on the Start button.
12. Wait until the scan has finished and review the Results tab.

How it works...

w3af is written by security professionals. It is a pluggable framework with extensions written for different types of attacks. The profiles define which plugins and their associated configurations you are going to use in the penetration test.

You first attack using the OWASP_TOP10 profile and then attack again with a fuller set of plugins.

The results will vary according to your setup. Depending on the plugin, security issues are occasionally flagged that do not exist. You will need to verify any issues mentioned by hand.

At the time of writing, no significant defects were found using this approach. However, the tool pointed out slow links and generated server-side exceptions. This is the sort of information you would like to note in bug reports.

There's more...

Consistently securing your applications requires experienced attention to detail. Here are a few more things for you to review.

Target practice with WebGoat

The top 10 list of security defects can at times seem difficult to understand. If you have some spare time and would like to practice against a deliberately insecure application, you should try WebGoat (https://www.owasp.org/index.php/Category:OWASP_WebGoat_Project).

WebGoat is well-documented with a hints system and links to video tutorials; it leaves little room for misunderstanding the attacks.

More tools of the trade

w3af is a powerful tool, but works better in conjunction with the following tools:

- **Nmap (**http://nmap.org/**)**: A simple to use, highly popular, award-winning network scanner.
- **Nikto (**http://cirt.net/nikto2**)**: A Perl script that quickly summarizes system details and looks for the most obvious defects.
- **Skipfish (**https://code.google.com/p/skipfish/downloads/list**)**: A C program that bashes away at many requests over a prolonged period. You can choose from different dictionaries of attacks. This is an excellent poor man's stress test; if your system stays up, you know that it has reached a minimal level of stability.
- **Wapiti (**http://wapiti.sourceforge.net/**)**: A Python-based script that discovers attackable URLs and then cycles through a list of evil parameters.

Jenkins is flexible, so you can call a wide range of tools through scripts running in jobs, including the security tools mentioned:

There are a number of great resources for securing native OSes, including the Debian security how-to (https://www.debian.org/doc/manuals/securing-debian-howto/); for Windows, articles found underneath the MSDN security center (http://msdn.microsoft.com/en-us/security/); and for Mac, Apple's official security guides (https://www.apple.com/support/security/guides/). Online services need vigorous attention to their security surface.

See also

- The *Finding 500 errors and XSS attacks in Jenkins through fuzzing* recipe
- The *Exploring the OWASP dependency-check plugin* recipe

Finding 500 errors and XSS attacks in Jenkins through fuzzing

This recipe describes using a fuzzer to find server-side errors and XSS attacks in your Jenkins servers.

A fuzzer goes through a series of URLs, appends different parameters blindly, and checks the server's response. The inputted parameters are variations on scripting commands, such as `<script>alert("random string");</script>`. An attack vector is found if the server's response includes the unescaped version of the script.

Cross-site scripting attacks are currently one of the more popular forms of attack (http://en.wikipedia.org/wiki/Cross-site_scripting). The attack involves injecting script fragments into the client's browser so that the script runs as if it comes from a trusted website. For example, once you have logged in to an application, it is probable that your session ID is stored in a cookie. The injected script might read the value in the cookie and then send the information to another server ready for an attempt at reuse.

A fuzzer discovers the links on the site it is attacking and the form variables that exist within the site's web pages. For the web pages discovered, it repeatedly sends input based on historic attacks and lots of minor variations. If responses are returned with the same random strings sent, the fuzzer knows it has found an evil URL.

To fully integrate with the build process of a web-based application, you will need to build the application, deploy and run the application, run the fuzzer from a script, and finally, use log parsing to fail the build if evil URLs are mentioned in the output. This process will be similar for other command-line tools you wish to integrate. For more information about log parsing, refer to the *Deliberately failing builds through log parsing* recipe in Chapter 1, Getting Started with Jenkins.

Getting ready

Back up your sacrificial Jenkins server and turn off its security. Expect the application to be unstable by the end of the attack.

You will need the Python programming language installed on your computer. To download and install Wapiti, you will need to follow the instructions found at http://wapiti.sourceforge.net.

If you're attacking your local machine from your local machine, then you can afford to turn off its networking. The attack will stay in the loopback network driver and no packets should escape to the internet.

In this recipe, the methodology and command-line options are correct. However, at the time of writing, the results mentioned may not exist. Jenkins goes through a rapid life cycle where developers remove bugs rapidly.

How to do it...

1. Within the `wapiti` bin directory, run the following command:

```
python wapiti  http://localhost:8080 -m "-all,xss,exec" -x
http://localhost:8080/pluginManager/* -v2
```

2. When the command has finished running, you will see the location of the final report on the console output:

```
Report
------
A report has been generated in the file
~/.wapiti/generated_report
~/.wapiti/generated_report/index.html with a browser to see this report.
```

3. Open the report in a web browser and review it.
4. Click on the Internal Server Error link.
5. For one of the items named Anomaly found in /iconSize, copy the URL from the URL command line tab:
6. Open the URL in a web browser. You will now see a newly generated Jenkins bug report page, as shown in the following screenshot:
7. Run the following command:

```
python wapiti http://localhost:8080 -m "-all,xss,permanentxss" -x
http://localhost:8080/pluginManager/*
```

8. View the output to verify that the `permanentxss` module was run:

```
[*] Loading modules :
mod_crlf, mod_exec, mod_file, mod_sql, mod_xss,      mod_backup, mod_htaccess,
mod_blindsql,   mod_permanentxss, mod_nikto
[+] Launching module xss
[+] Launching module permanentxss
```

How it works...

Wapiti loads in different modules. By default, all modules are used. You will have to be selective; for Version 2.2.1 on Ubuntu Linux, this causes Wapiti to crash or timeout.

To load in specific modules, use the `-m` option.

The `-m "-all,xss,exec"` statement tells Wapiti to ignore all modules except the `xss` and `exec` modules.

The `exec` module is very good at finding 500 errors in Jenkins. This is mostly due to unexpected input, which Jenkins does not handle well. This is purely a cosmetic set of issues. However, if you start to see errors associated with resources such as files or database services, then you should give the issues higher priority and send in bug reports.

The `-x` option specifies which URLs to ignore. In this case, we don't want to cause work for the plugin manager. If we do, it will then generate a lot of requests to an innocent external service.

Wapiti crawls websites. If you are not careful, the tool might follow a link to locations that you do not want testing. To avoid embarrassment, carefully use the exclude URL's option, `-x`.

The `-v2` option sets the verbosity of logging up to its highest so that you can see all the attacks.

In the second run of Wapiti, you also used the `permanentxss` module, which at times finds bonafide XSS attacks, depending on the race between developers building features and cleaning bugs:

Fuzzers are good at covering a large portion of an application's URL space, triggering errors that would be costly in terms of time to search out. Consider automating through a Jenkins job as part of a project's QA process.

There's more...

The reports you generated in this recipe mention many more server errors than XSS attacks. This is because many of the errors generated are due to unexpected input causing failures that are only caught by the final layer of error handling; in this case, the bug report page. If you consider the error worth reporting, then follow the instructions found on the bug report page.

Here are some guidelines for the meaning behind the output of the stack traces:

- `java.lang.SecurityException`: If a Jenkins user is doing something that the programmer considers insecure, such as hitting a URL, this should only be reachable once you have logged in.
- `java.lang.IllegalArgumentException`: Jenkins checked for a valid range for your parameter and the parameter value was outside that range. This is a deliberately thrown exception.
- `java.lang.NumberFormatException`: Jenkins did not check for a valid string and then tried to parse a non-conformant string to a number.
- `java.lang.NullPointerException`: This normally happens when you hit a URL without all the parameters set that Jenkins expects. In programmer's language, the code is expecting an object that does not exist, and then tries to call a method of the nonexistent object without checking that the object exists. The programmer needs to add more error-checking. Write a bug report.

See also

- The *Testing for OWASP's top 10 security issues* recipe

Avoiding sign-up bots with JCaptcha

CAPTCHA stands for **Completely Automated Public Turing test to tell Computers and Humans Apart**. The most commonly viewed CAPTCHAs are sequential letters and numbers displayed as graphics that you have to correctly feed into a text input.

If you let anyone sign up for an account on your Jenkins server, then the last thing you want are bots (automated scripts) creating accounts. Bots have an economy of scale, being able to scan the internet rapidly and never getting bored. CAPTCHAs are a necessary defense against these dumb attacks.

The negative purposes of bots are as follows:

- Performing a **Denial Of Service** (**DOS**) attack on your server, for example, by automatically creating numerous heavyweight jobs
- **Distributed Denial Of Service attack** (**DDOS**) on other servers by harvesting many Jenkins servers to fire off large numbers of requests
- Injecting unwanted advertisements or content that then points to malicious sites
- Adding scripts that are stored permanently and run when a user accidentally browses the Jenkins site

There are commercial motivations for criminals to circumvent CAPTCHAs that have led to well-documented law cases. You can find one such law case at http://www.wired.com/2010/10/hacking-captcha/.

Getting ready

Make sure you have backed up your sacrificial Jenkins server. You are going to modify its security settings. It is easy to make a service-changing mistake.

The `JCaptcha` plugin is based on Java implementation that you can find at https://jcaptcha.atlassian.net/wiki/display/general/Home.

How to do it...

1. Log in as an administrator.
2. Click on the Configure Global Security link.
3. Select Jenkins' own user database under Security Realm.
4. Select Allow users to sign up:
5. Press Save.
6. Browse to the signup location, `http://localhost:8080/signup`.
7. Click on the Manage Plugins link in the Manage Jenkins page.
8. Select the Available tab.
9. Install the `JCaptcha` plugin.
10. Click on the Configure Global Security link under the Manage Jenkins page.
11. Select Jenkins' own user database under Security Realm.
12. Select Enable captcha on sign up.
13. Press Save and then click on the Log Out link.
14. Browse to the signup location, `http://localhost:8080/signup`. The page is now defended by a CAPTCHA.

How it works...

Installing the plugin adds the CAPTCHA image to the signup process. The image needs pattern recognition to decipher it. Humans are very good at this; automated processes are a lot worse, but improving.

Improving Code Quality

In this chapter, we will cover the following recipes:

- Integrating Jenkins with SonarQube
- The updating center in SonarQube
- Quality gates, quality profiles, and rules
- Verifying HTML, CSS, and JavaScript validity using SonarQube
- Verifying Java code using SonarQube
- Configuring SonarQube as a Windows service

Introduction

This chapter explores the use of Jenkins plugins to display code metrics and failed builds. Automation lowers costs and improves consistency. The process does not get tired. If you decide the success and failure criteria before a project starts, then this will remove a degree of subjective debate from release meetings.

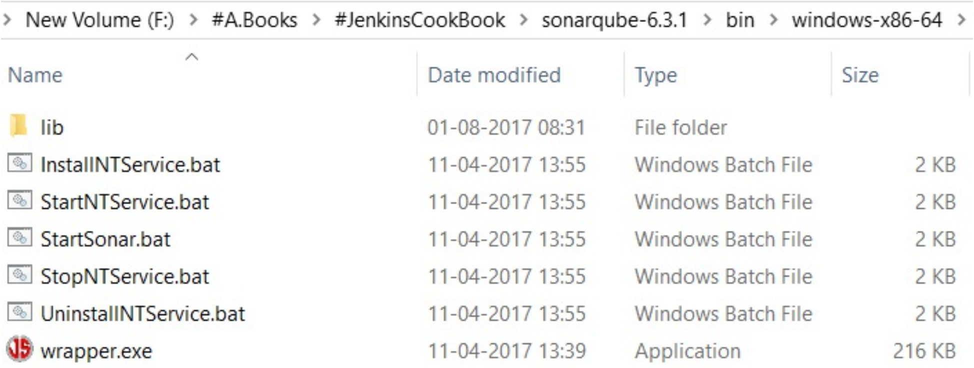
In 2002, NIST estimated that software defects were costing America around 60 billion dollars per year (http://www.abeacha.com/NIST_press_release_bugs_cost.html). Expect the cost to have increased considerably since. To save money and improve quality, you need to remove defects as early in the software lifecycle as possible.

You will also find recipes in this chapter on static code review through SonarQube. Static means that you can look at the code without running it. Good documentation and source code structure aid the maintainability and readability of your code.

There are a number of good introductions to software metrics. These include a Wikibook on the details of the metrics (http://en.wikibooks.org/wiki/Introduction_to_Software_Engineering/Quality/Metrics) and a well-written book called *Code Quality: The Open Source Perspective*, by Diomidis Spinellis.

In the *Integrating Jenkins with SonarQube* recipe of this chapter, you will link Jenkins projects to Sonar reports. Sonar is a specialized tool that collects software metrics and breaks them down into understandable reports. Sonar details the quality of a project. It uses a wide range of metrics including the results of tools such as FindBugs and PMD, mentioned in this chapter. The project itself is evolving rapidly. Consider using Jenkins for early warnings and to spot obvious defects, such as a bad commit. You can then use Sonar for a deeper review.

Download SonarQube from https://www.sonarqube.org/downloads/ and extract it in the system:



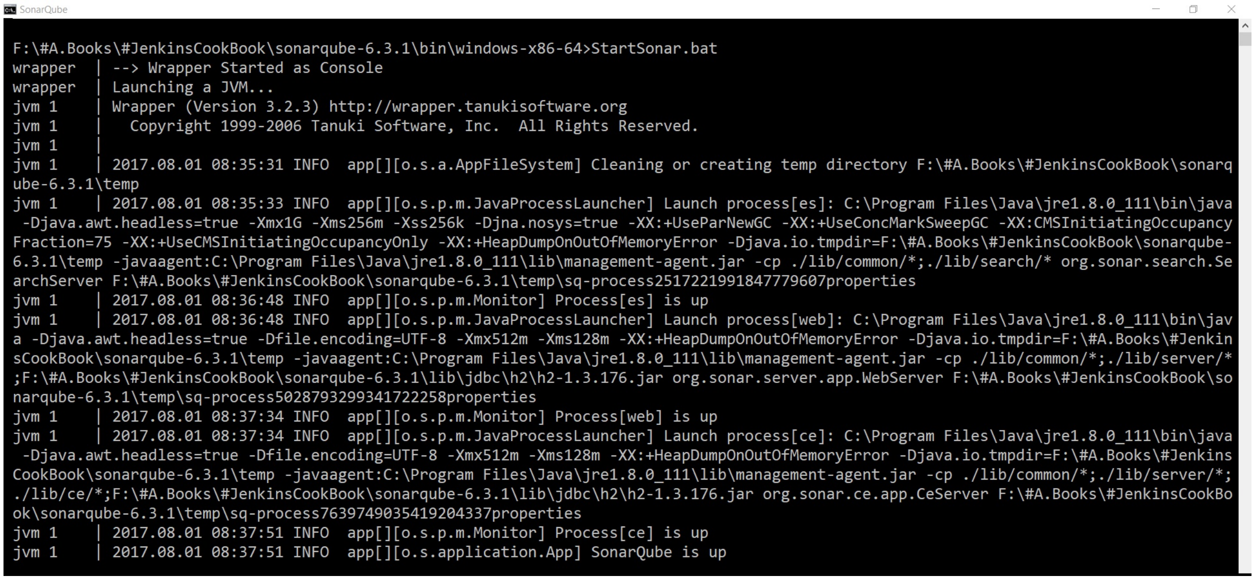
> New Volume (F:) > #A.Books > #JenkinsCookBook > sonarqube-6.3.1 > bin > windows-x86-64 >

Name	Date modified	Type	Size
lib	01-08-2017 08:31	File folder	
InstallNTService.bat	11-04-2017 13:55	Windows Batch File	2 KB
StartNTService.bat	11-04-2017 13:55	Windows Batch File	2 KB
StartSonar.bat	11-04-2017 13:55	Windows Batch File	2 KB
StopNTService.bat	11-04-2017 13:55	Windows Batch File	2 KB
UninstallNTService.bat	11-04-2017 13:55	Windows Batch File	2 KB
wrapper.exe	11-04-2017 13:39	Application	216 KB

SonarQube supports 20+ programming languages: Java Android, JavaScript, HTML, CSS, Objective-C, C#, C/C++, PHP, Python, PL/SQL, Flex, Groovy, COBOL, Swift (paid plugin), and so on. It allows reports on bugs, vulnerabilities, code smells, duplicate code, code coverage, comments, and so on.

1. Java 8 is a prerequisite for running SonarQube.
2. In the Windows OS, go to the `bin` directory and, based on the operating system and platform of the operating system, go to the specific directory.

3. Execute `StartSonar.bat` in the command window, as we are using the Windows OS:



```
F:\#A.Books\#JenkinsCookBook\sonarqube-6.3.1\bin\windows-x86-64>StartSonar.bat
wrapper  | --> Wrapper Started as Console
wrapper  | Launching a JVM...
jvm 1    | Wrapper (Version 3.2.3) http://wrapper.tanukisoftware.org
jvm 1    |   Copyright 1999-2006 Tanuki Software, Inc.  All Rights Reserved.
jvm 1    |
jvm 1    | 2017.08.01 08:35:31 INFO  app[][o.s.a.AppFileSystem] Cleaning or creating temp directory F:\#A.Books\#JenkinsCookBook\sonarq
ube-6.3.1\temp
jvm 1    | 2017.08.01 08:35:33 INFO  app[][o.s.p.m.JavaProcessLauncher] Launch process[es]: C:\Program Files\Java\jre1.8.0_111\bin\java
 -Djava.awt.headless=true -Xmx1G -Xms256m -Xss256k -Djna.nosys=true -XX:+UseParNewGC -XX:+UseConcMarkSweepGC -XX:CMSInitiatingOccupancy
Fraction=75 -XX:+UseCMSInitiatingOccupancyOnly -XX:+HeapDumpOnOutOfMemoryError -Djava.io.tmpdir=F:\#A.Books\#JenkinsCookBook\sonarqube-
6.3.1\temp -javaagent:C:\Program Files\Java\jre1.8.0_111\lib\management-agent.jar -cp ./lib/common/*;./lib/search/* org.sonar.search.Se
archServer F:\#A.Books\#JenkinsCookBook\sonarqube-6.3.1\temp\sq-process2517221991847779607properties
jvm 1    | 2017.08.01 08:36:48 INFO  app[][o.s.p.m.Monitor] Process[es] is up
jvm 1    | 2017.08.01 08:36:48 INFO  app[][o.s.p.m.JavaProcessLauncher] Launch process[web]: C:\Program Files\Java\jre1.8.0_111\bin\jav
a -Djava.awt.headless=true -Dfile.encoding=UTF-8 -Xmx512m -Xms128m -XX:+HeapDumpOnOutOfMemoryError -Djava.io.tmpdir=F:\#A.Books\#Jenkin
sCookBook\sonarqube-6.3.1\temp -javaagent:C:\Program Files\Java\jre1.8.0_111\lib\management-agent.jar -cp ./lib/common/*;./lib/server/*
;F:\#A.Books\#JenkinsCookBook\sonarqube-6.3.1\lib\jdbc\h2\h2-1.3.176.jar org.sonar.server.app.WebServer F:\#A.Books\#JenkinsCookBook\so
narqube-6.3.1\temp\sq-process5028793299341722258properties
jvm 1    | 2017.08.01 08:37:34 INFO  app[][o.s.p.m.Monitor] Process[web] is up
jvm 1    | 2017.08.01 08:37:34 INFO  app[][o.s.p.m.JavaProcessLauncher] Launch process[ce]: C:\Program Files\Java\jre1.8.0_111\bin\java
 -Djava.awt.headless=true -Dfile.encoding=UTF-8 -Xmx512m -Xms128m -XX:+HeapDumpOnOutOfMemoryError -Djava.io.tmpdir=F:\#A.Books\#Jenkins
CookBook\sonarqube-6.3.1\temp -javaagent:C:\Program Files\Java\jre1.8.0_111\lib\management-agent.jar -cp ./lib/common/*;./lib/server/*;
./lib/ce/*;F:\#A.Books\#JenkinsCookBook\sonarqube-6.3.1\lib\jdbc\h2\h2-1.3.176.jar org.sonar.ce.app.CeServer F:\#A.Books\#JenkinsCookBo
ok\sonarqube-6.3.1\temp\sq-process7639749035419204337properties
jvm 1    | 2017.08.01 08:37:51 INFO  app[][o.s.p.m.Monitor] Process[ce] is up
jvm 1    | 2017.08.01 08:37:51 INFO  app[][o.s.application.App] SonarQube is up
```

You will find the SonarQube is up message in the console if it starts successfully.

- Once SonarQube is up and running, open the browser at `http://localhost:9000` to visit the SonarQube dashboard
- You may want to check the requirements at https://docs.sonarqube.org/display/SONAR/Requirements and set up and upgrade at https://docs.sonarqube.org/display/SONAR/Setup+and+Upgrade

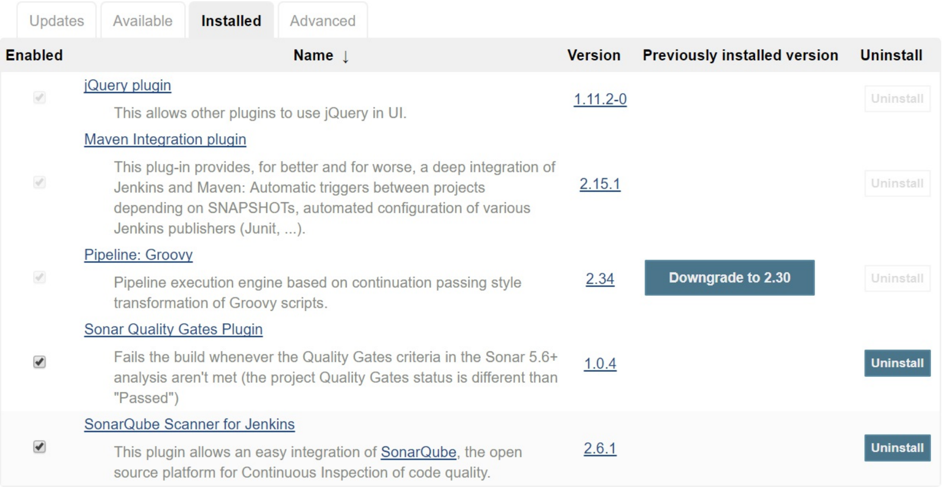
Integrating Jenkins with SonarQube

SonarQube, previously known as Sonar, is a rapidly evolving application for reporting quality metrics and finding code hotspots. This recipe details how to generate code metrics through a Jenkins plugin, and then push them directly to a Sonar database.

Getting ready...

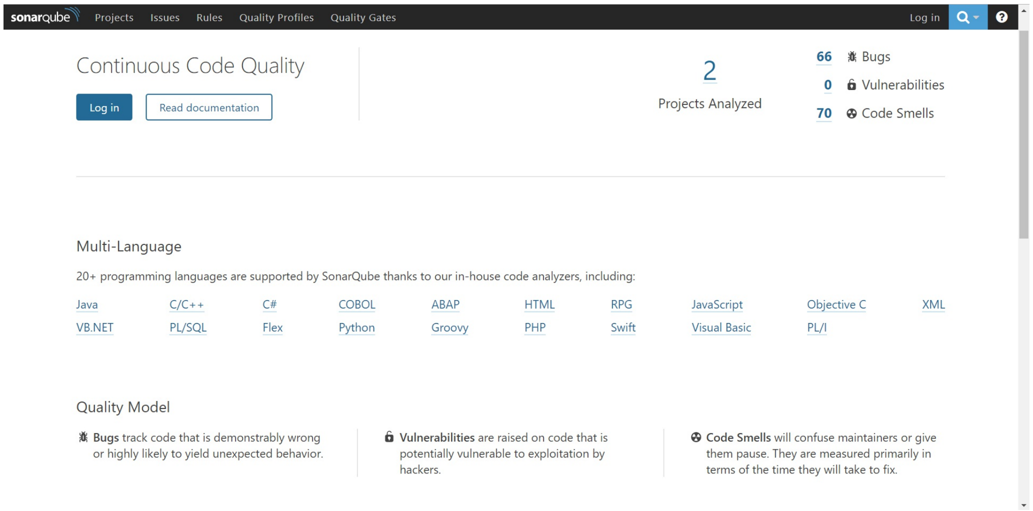
1. Go to the Jenkins dashboard and click on Manage Jenkins. Go to Manage Plugins and in the Available tab find the SonarQube plugin.

2. Click on Install without restart:



Enabled	Name ↓	Version	Previously installed version	Uninstall
☑	jQuery plugin This allows other plugins to use jQuery in UI.	1.11.2-0		Uninstall
☑	Maven Integration plugin This plug-in provides, for better and for worse, a deep integration of Jenkins and Maven: Automatic triggers between projects depending on SNAPSHOTs, automated configuration of various Jenkins publishers (Junit, ...).	2.15.1		Uninstall
☑	Pipeline: Groovy Pipeline execution engine based on continuation passing style transformation of Groovy scripts.	2.34	Downgrade to 2.30	Uninstall
☑	Sonar Quality Gates Plugin Fails the build whenever the Quality Gates criteria in the Sonar 5.6+ analysis aren't met (the project Quality Gates status is different than "Passed")	1.0.4		Uninstall
☑	SonarQube Scanner for Jenkins This plugin allows an easy integration of SonarQube, the open source platform for Continuous Inspection of code quality.	2.6.1		Uninstall

3. Go to the Jenkins dashboard and click on Manage Jenkins.
4. Click on Configure system and find the SonarQube section.
5. Now, let's go to SonarQube to get the token to integrate Jenkins and SonarQube.
6. Once SonarQube is up and running, open the browser at `http://localhost:9000` to visit the SonarQube dashboard:



Continuous Code Quality

2 Projects Analyzed

66 Bugs
0 Vulnerabilities
70 Code Smells

Multi-Language

20+ programming languages are supported by SonarQube thanks to our in-house code analyzers, including:

Java, C/C++, C#, COBOL, ABAP, HTML, RPG, JavaScript, Objective C, XML, VB.NET, PL/SQL, Flex, Python, Groovy, PHP, Swift, Visual Basic, PL/I

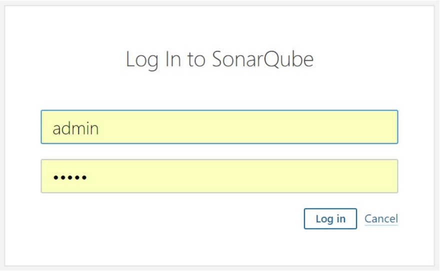
Quality Model

Bugs track code that is demonstrably wrong or highly likely to yield unexpected behavior.

Vulnerabilities are raised on code that is potentially vulnerable to exploitation by hackers.

Code Smells will confuse maintainers or give them pause. They are measured primarily in terms of the time they will take to fix.

7. Click on Login and give the default username and password as `admin` and `default` to log in as an administrator.
8. Click on Login:

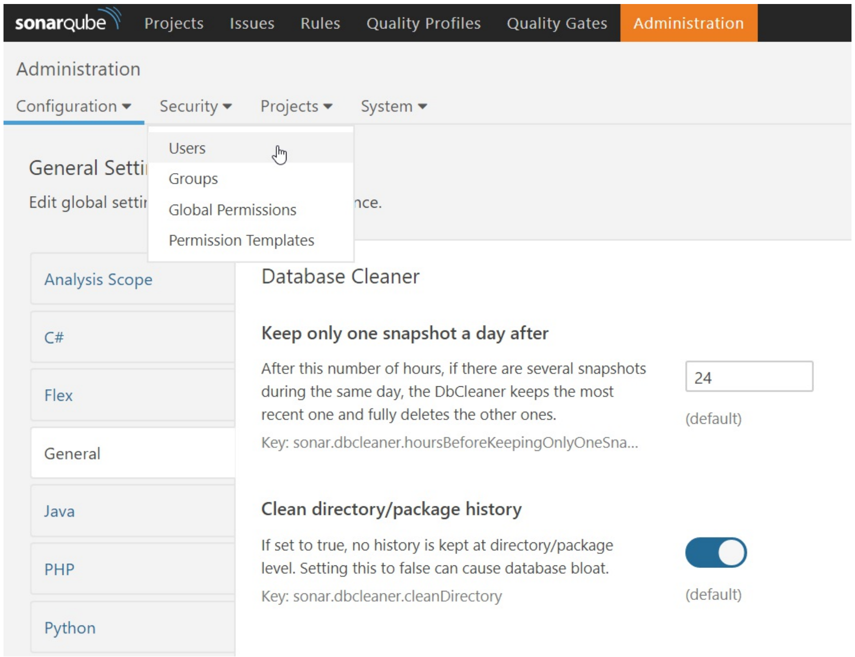


Log In to SonarQube

admin

•••••

9. As of now, there is no project available in the SonarQube dashboard.
10. Click on the Administration tab and in the Security menu click on Users:



General Setti

Edit global setti nce.

Database Cleaner

Keep only one snapshot a day after

After this number of hours, if there are several snapshots during the same day, the DbCleaner keeps the most recent one and fully deletes the other ones.

Key: sonar.dbcleaner.hoursBeforeKeepingOnlyOneSna...

24

(default)

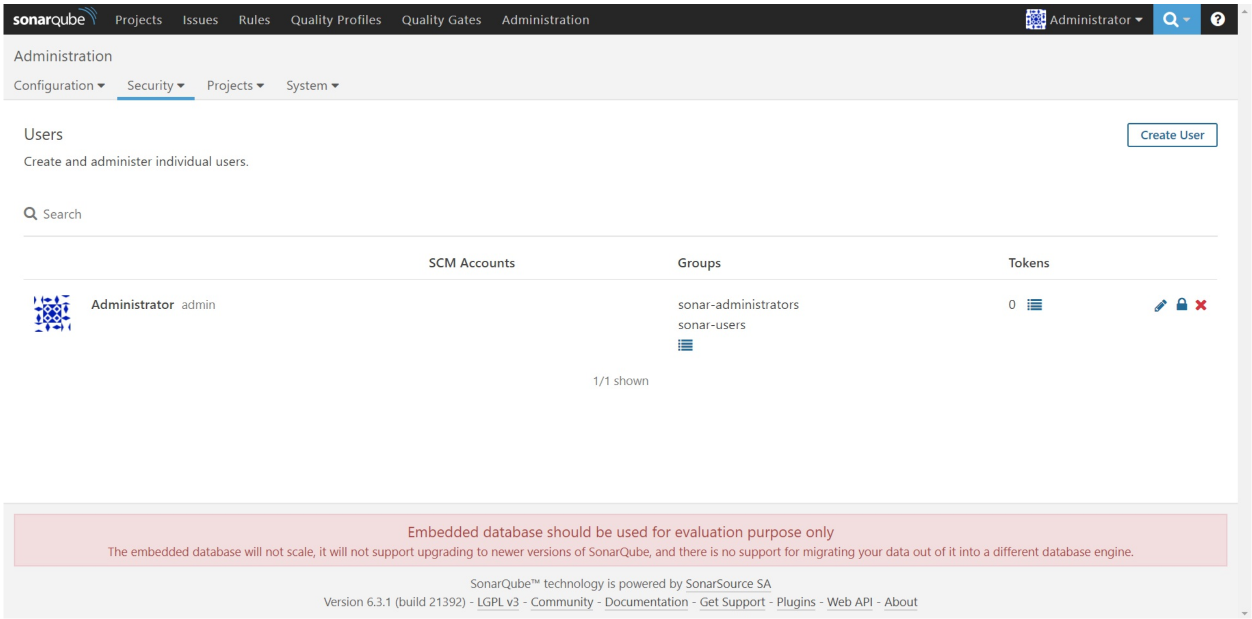
Clean directory/package history

If set to true, no history is kept at directory/package level. Setting this to false can cause database bloat.

Key: sonar.dbcleaner.cleanDirectory

(default)

11. Initially, there are no tokens issued; there is a 0 token for Administrator:



Users

Create and administer individual users.

	SCM Accounts	Groups	Tokens
Administrator admin		sonar-administrators sonar-users	0

1/1 shown

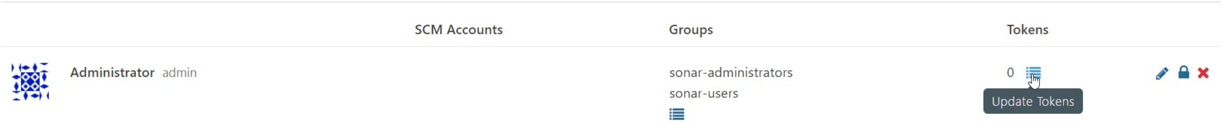
Embedded database should be used for evaluation purpose only

The embedded database will not scale, it will not support upgrading to newer versions of SonarQube, and there is no support for migrating your data out of it into a different database engine.

SonarQube™ technology is powered by SonarSource SA

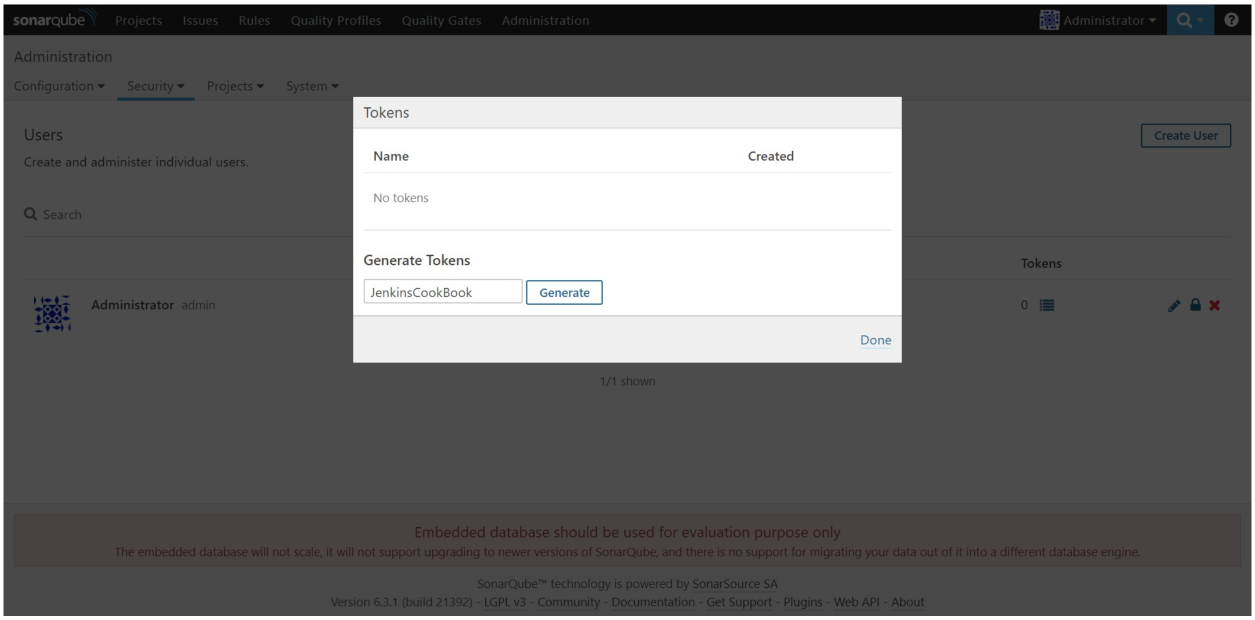
Version 6.3.1 (build 21392) - LGPL v3 - Community - Documentation - Get Support - Plugins - Web API - About

12. Click on Tokens:



	SCM Accounts	Groups	Tokens
Administrator admin		sonar-administrators sonar-users	0

13. Give a name in the Generate Tokens section and click on Generate:



Administration

Users

Create and administer individual users.

Tokens

Name	Created
No tokens	

Generate Tokens

JenkinsCookBook

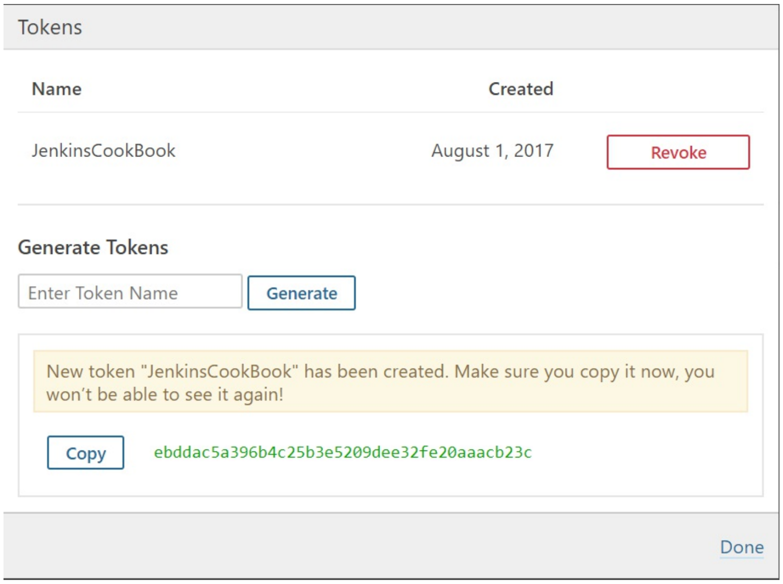
Embedded database should be used for evaluation purpose only

The embedded database will not scale, it will not support upgrading to newer versions of SonarQube, and there is no support for migrating your data out of it into a different database engine.

SonarQube™ technology is powered by SonarSource SA

Version 6.3.1 (build 21392) - LGPL v3 - Community - Documentation - Get Support - Plugins - Web API - About

14. Copy the newly created token. Click on Done:



Tokens

Name	Created
JenkinsCookBook	August 1, 2017

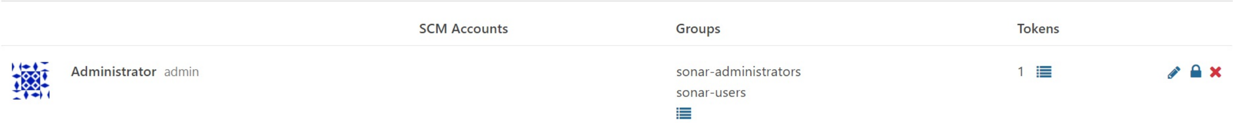
Generate Tokens

Enter Token Name

New token "JenkinsCookBook" has been created. Make sure you copy it now, you won't be able to see it again!

ebddac5a396b4c25b3e5209dee32fe20aaacb23c

15. Verify the number of Tokens for the Administrator user:

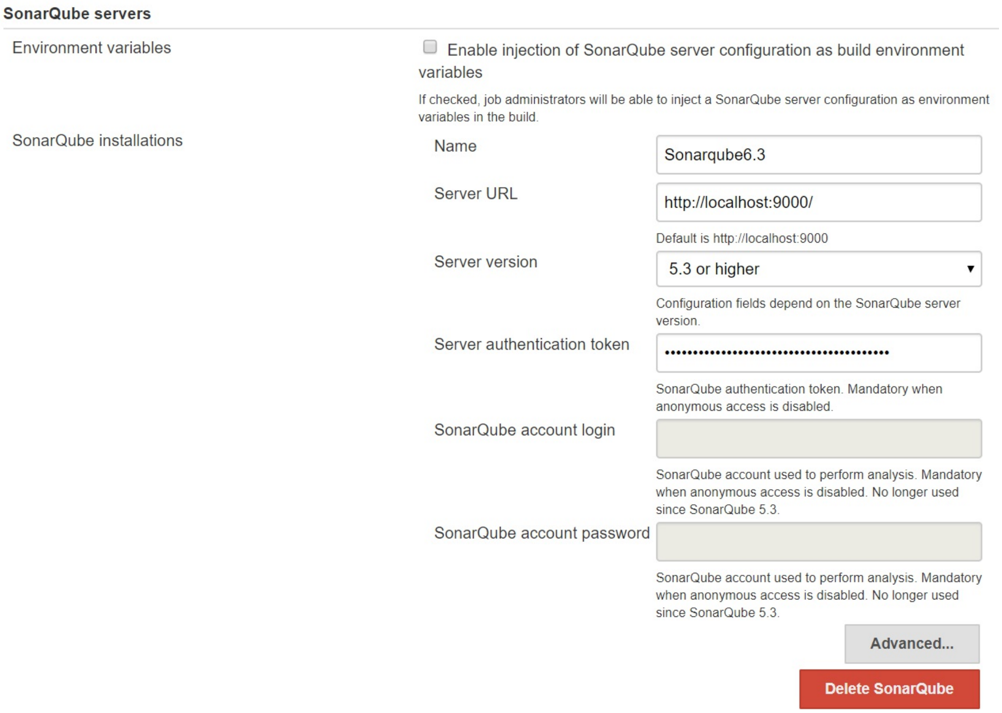


	SCM Accounts	Groups	Tokens
Administrator admin		sonar-administrators sonar-users	1

16. Now we have all the required parameters to integrate Jenkins and SonarQube:

How to do it...

1. Go to the Jenkins dashboard and click on Manage Jenkins.
2. Click on Configure system and find the SonarQube section.
3. Click on Add SonarQube.
4. Provide the Name, Server URL, and Server version.
5. Paste the token value in Jenkins and save it:



SonarQube servers

Environment variables: ☐ Enable injection of SonarQube server configuration as build environment variables

If checked, job administrators will be able to inject a SonarQube server configuration as environment variables in the build.

SonarQube installations

Name: Sonarqube6.3

Server URL: http://localhost:9000/

Default is http://localhost:9000

Server version: 5.3 or higher

Configuration fields depend on the SonarQube server version.

Server authentication token: ••

SonarQube authentication token. Mandatory when anonymous access is disabled.

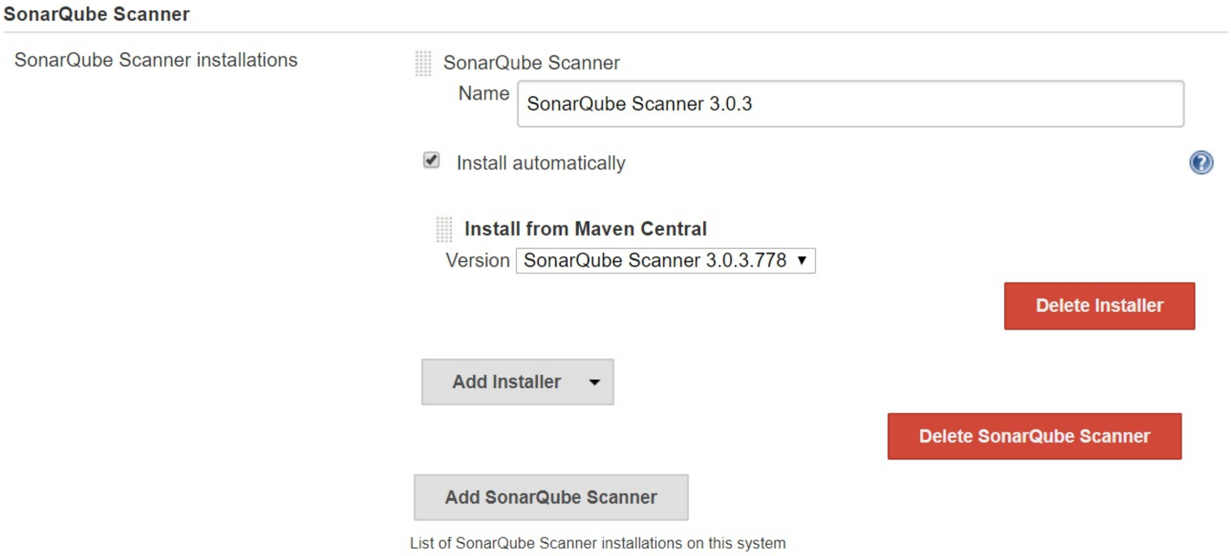
SonarQube account login:

SonarQube account used to perform analysis. Mandatory when anonymous access is disabled. No longer used since SonarQube 5.3.

SonarQube account password:

SonarQube account used to perform analysis. Mandatory when anonymous access is disabled. No longer used since SonarQube 5.3.

6. Go to Global Tool Configuration and configure Add SonarQube Scanner:



SonarQube Scanner

SonarQube Scanner installations

SonarQube Scanner

Name: SonarQube Scanner 3.0.3

☑ Install automatically

Install from Maven Central

Version: SonarQube Scanner 3.0.3.778

List of SonarQube Scanner installations on this system

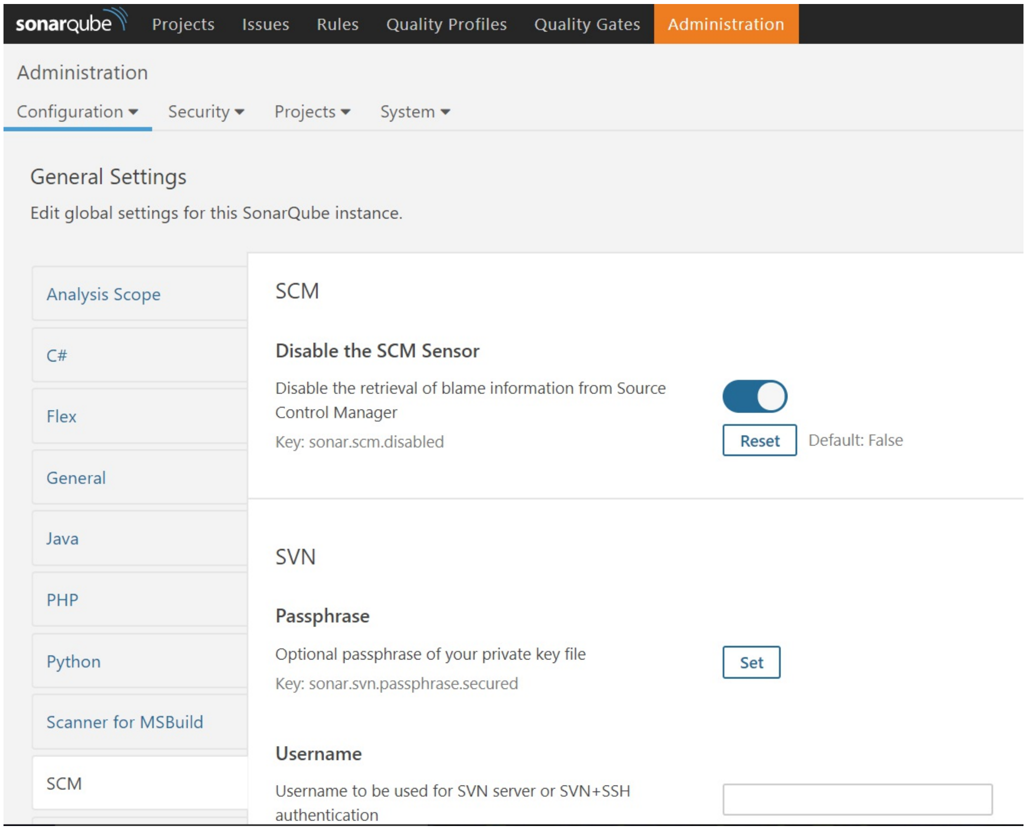
7. Now, you are ready for the static code analysis of the project.

There's more

The default SonarQube instance is preconfigured with an in-memory database. The Jenkins plugin already knows the default configuration and requires little extra configuration.

Just for troubleshooting, if you come across a Jenkins job failure due to SCM blame, you need to fix that by configuring it in SonarQube.

Go to SonarQube and Disable the SCM sensor:



Administration

General Settings

Edit global settings for this SonarQube instance.

SCM

Disable the SCM Sensor

Disable the retrieval of blame information from Source Control Manager

Key: sonar.scm.disabled

Default: False

SVN

Passphrase

Optional passphrase of your private key file

Key: sonar.svn.passphrase.secured

Username

Username to be used for SVN server or SVN+SSH authentication

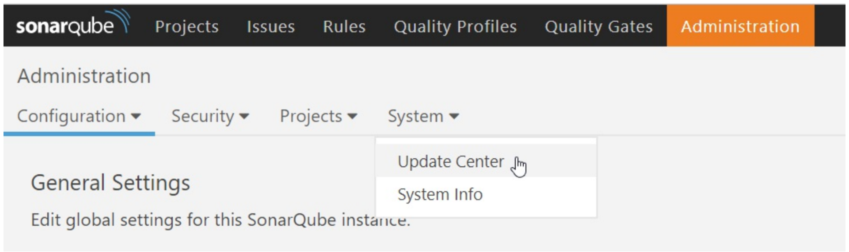
Sonar is a dedicated application for measuring software-quality metrics. Like Jenkins, it has a dedicated and active community. You can expect an aggressive roadmap of improvements. Features such as its ability to point out hotspots of suspicious code, a visually appealing report dashboard, ease of configuration, and detailed control of inspection rules to view, all currently differentiate it from Jenkins.

The updating center in SonarQube

Administrators can utilize the Update Center to keep SonarQube up to date by installing plugins and updating plugins.

Getting ready

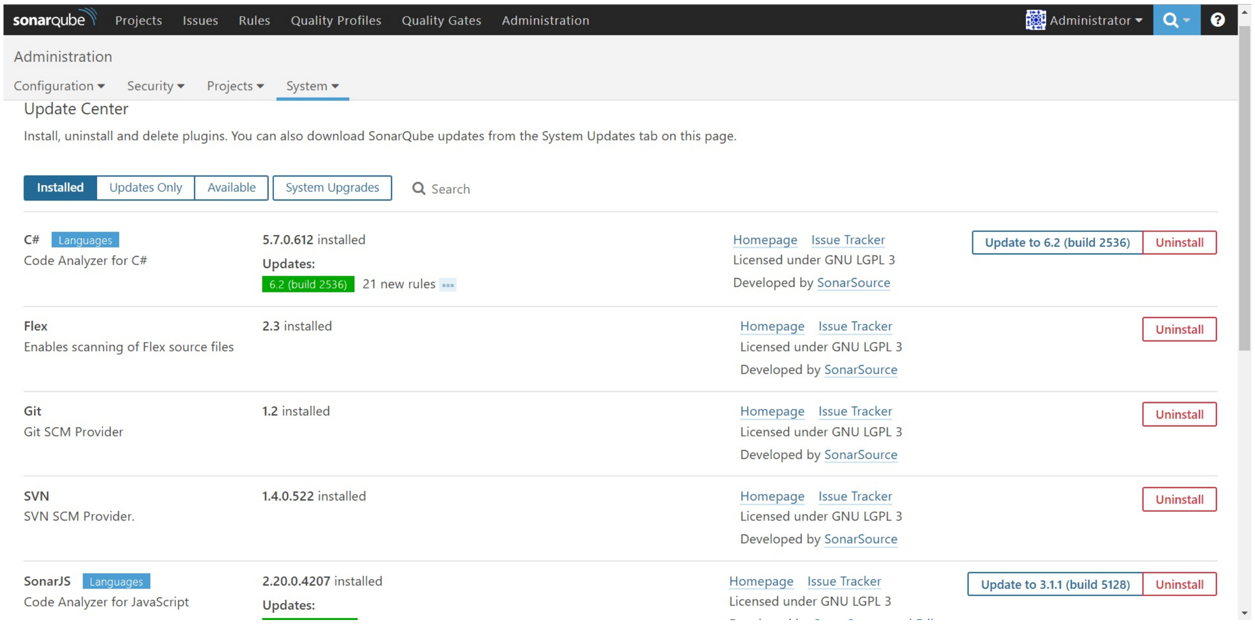
1. Go to Administration | System | Update Center:



General Settings

Edit global settings for this SonarQube instance.

2. The Update Center contains four tabs: Installed, Updates Only, Available, and System Upgrades:



Administration

Update Center

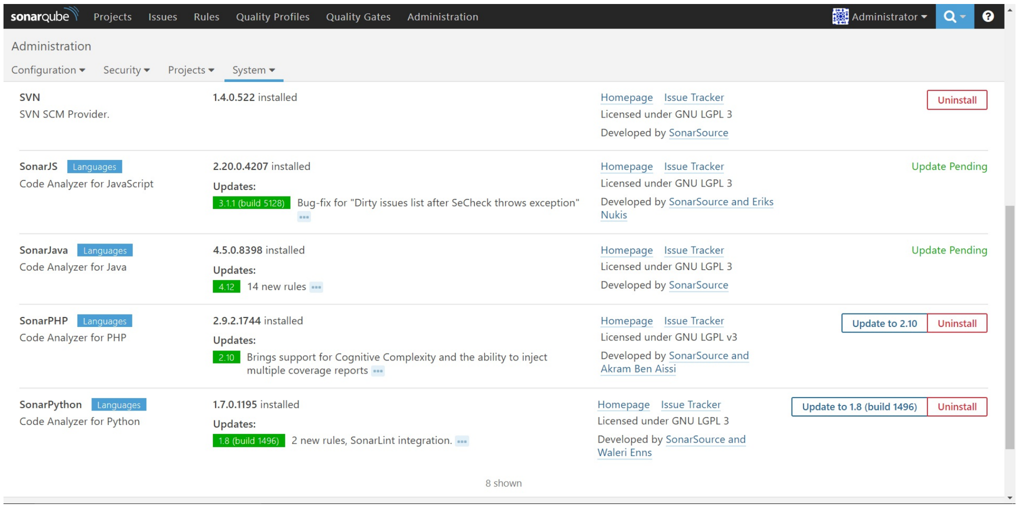
Install, uninstall and delete plugins. You can also download SonarQube updates from the System Updates tab on this page.

C# Languages Code Analyzer for C#	5.7.0.612 installed Updates: 6.2 (build 2536) 21 new rules	Homepage Issue Tracker Licensed under GNU LGPL 3 Developed by SonarSource	Update to 6.2 (build 2536) Uninstall
Flex Enables scanning of Flex source files	2.3 installed	Homepage Issue Tracker Licensed under GNU LGPL 3 Developed by SonarSource	Uninstall
Git Git SCM Provider	1.2 installed	Homepage Issue Tracker Licensed under GNU LGPL 3 Developed by SonarSource	Uninstall
SVN SVN SCM Provider.	1.4.0.522 installed	Homepage Issue Tracker Licensed under GNU LGPL 3 Developed by SonarSource	Uninstall
SonarJS Languages Code Analyzer for JavaScript	2.20.0.4207 installed Updates:	Homepage Issue Tracker Licensed under GNU LGPL 3	Update to 3.1.1 (build 5128) Uninstall

3. As mentioned earlier, we can install and update different plugins so we can perform static code analysis.

How to do it...

1. Go to Administration | System | Update Center.
2. Click on Update or Uninstall to perform those operations in the SonarQube portal:



SVN
SVN SCM Provider.
1.4.0.522 installed
Homepage Issue Tracker
Licensed under GNU LGPL 3
Developed by SonarSource

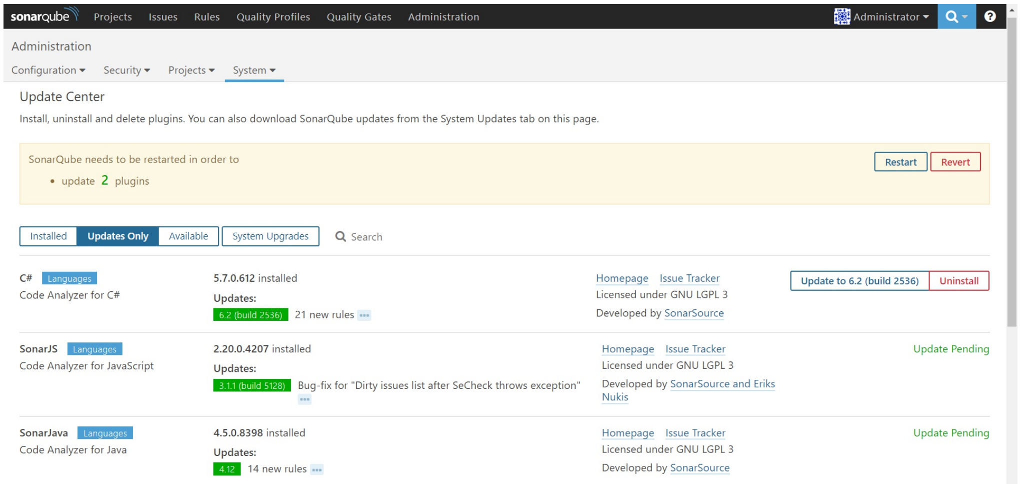
SonarJS Languages
Code Analyzer for JavaScript
2.20.0.4207 installed
Updates:
3.1.1 (build 5128) Bug-fix for "Dirty issues list after SeCheck throws exception"
Homepage Issue Tracker
Licensed under GNU LGPL 3
Developed by SonarSource and Eriks Nukis

SonarJava Languages
Code Analyzer for Java
4.5.0.8398 installed
Updates:
4.12 14 new rules
Homepage Issue Tracker
Licensed under GNU LGPL 3
Developed by SonarSource

SonarPHP Languages
Code Analyzer for PHP
2.9.2.1744 installed
Updates:
2.10 Brings support for Cognitive Complexity and the ability to inject multiple coverage reports
Homepage Issue Tracker
Licensed under GNU LGPL v3
Developed by SonarSource and Akram Ben Aissi

SonarPython Languages
Code Analyzer for Python
1.7.0.1195 installed
Updates:
1.8 (build 1496) 2 new rules, SonarLint integration.
Homepage Issue Tracker
Licensed under GNU LGPL 3
Developed by SonarSource and Waleri Enns

3. Updates will be pending if you don't Restart SonarQube:



Update Center
Install, uninstall and delete plugins. You can also download SonarQube updates from the System Updates tab on this page.

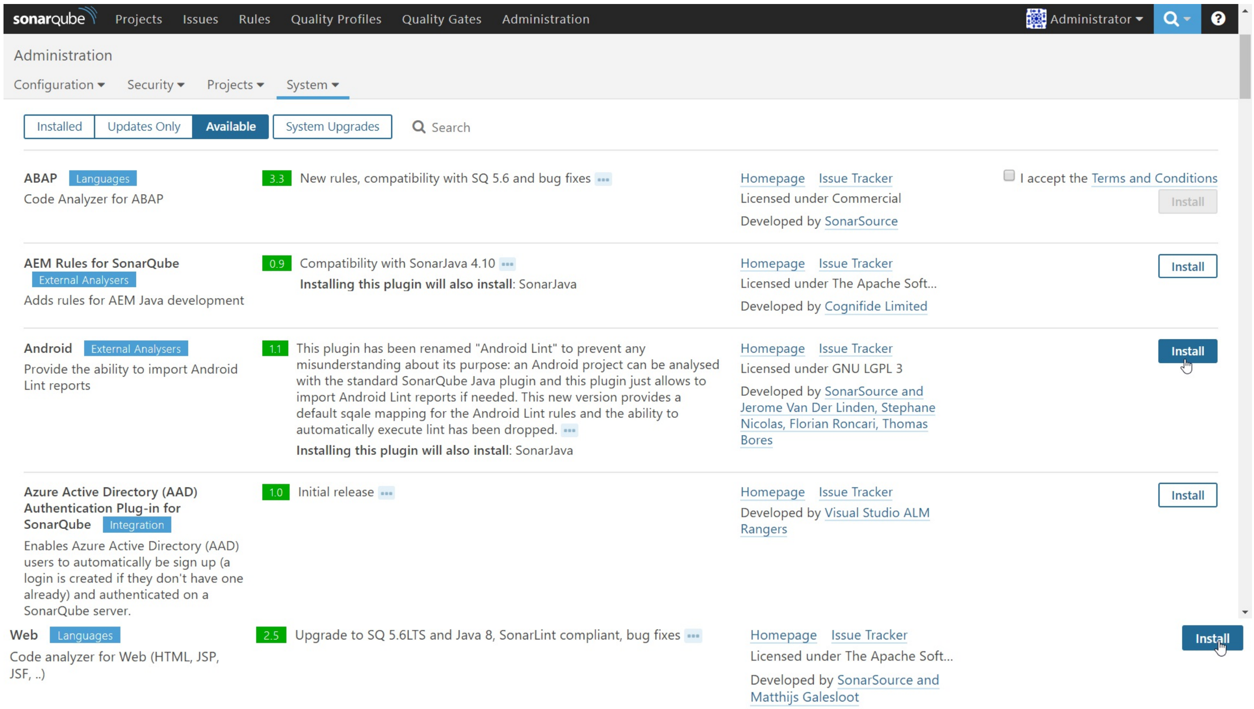
SonarQube needs to be restarted in order to
- update 2 plugins

C# Languages
Code Analyzer for C#
5.7.0.612 installed
Updates:
6.2 (build 2536) 21 new rules
Homepage Issue Tracker
Licensed under GNU LGPL 3
Developed by SonarSource

SonarJS Languages
Code Analyzer for JavaScript
2.20.0.4207 installed
Updates:
3.1.1 (build 5128) Bug-fix for "Dirty issues list after SeCheck throws exception"
Homepage Issue Tracker
Licensed under GNU LGPL 3
Developed by SonarSource and Eriks Nukis

SonarJava Languages
Code Analyzer for Java
4.5.0.8398 installed
Updates:
4.12 14 new rules
Homepage Issue Tracker
Licensed under GNU LGPL 3
Developed by SonarSource

4. Go to Administration | System | Update Center | Available to install new plugins:



Administration

ABAP Languages
Code Analyzer for ABAP
3.3 New rules, compatibility with SQ 5.6 and bug fixes
Homepage Issue Tracker
Licensed under Commercial
Developed by SonarSource
□ I accept the Terms and Conditions

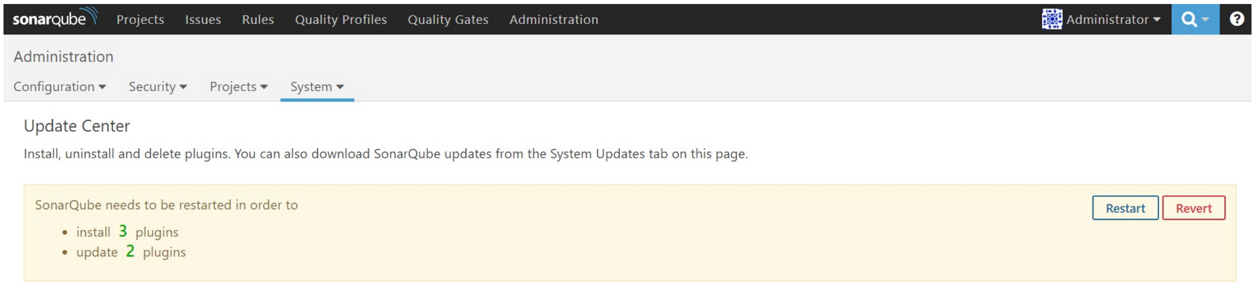
AEM Rules for SonarQube External Analysers
Adds rules for AEM Java development
0.9 Compatibility with SonarJava 4.10
Installing this plugin will also install: SonarJava
Homepage Issue Tracker
Licensed under The Apache Soft...
Developed by Cognifide Limited

Android External Analysers
Provide the ability to import Android Lint reports
1.1 This plugin has been renamed "Android Lint" to prevent any misunderstanding about its purpose: an Android project can be analysed with the standard SonarQube Java plugin and this plugin just allows to import Android Lint reports if needed. This new version provides a default sqale mapping for the Android Lint rules and the ability to automatically execute lint has been dropped.
Installing this plugin will also install: SonarJava
Homepage Issue Tracker
Licensed under GNU LGPL 3
Developed by SonarSource and Jerome Van Der Linden, Stephane Nicolas, Florian Roncari, Thomas Bores

Azure Active Directory (AAD) Authentication Plug-in for SonarQube Integration
Enables Azure Active Directory (AAD) users to automatically be sign up (a login is created if they don't have one already) and authenticated on a SonarQube server.
1.0 Initial release
Homepage Issue Tracker
Developed by Visual Studio ALM Rangers

Web Languages
Code analyzer for Web (HTML, JSP, JSF, ..)
2.5 Upgrade to SQ 5.6LTS and Java 8, SonarLint compliant, bug fixes
Homepage Issue Tracker
Licensed under The Apache Soft...
Developed by SonarSource and Matthijs Galesloot

5. Click on Restart:



Administration

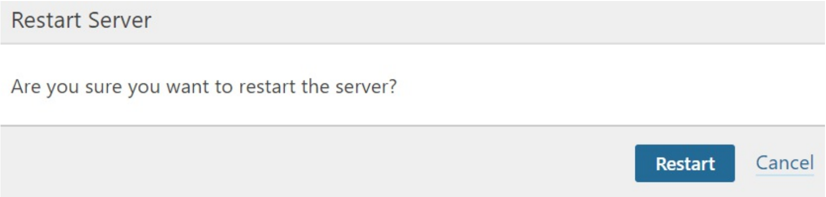
Update Center

Install, uninstall and delete plugins. You can also download SonarQube updates from the System Updates tab on this page.

SonarQube needs to be restarted in order to

- install 3 plugins
- update 2 plugins

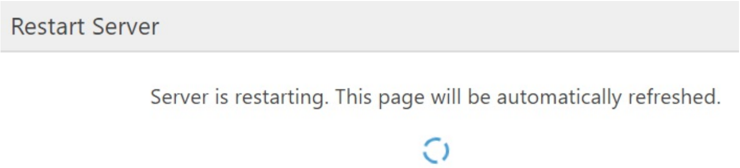
6. Restart SonarQube:



Restart Server

Are you sure you want to restart the server?

7. Wait until the server restarts:



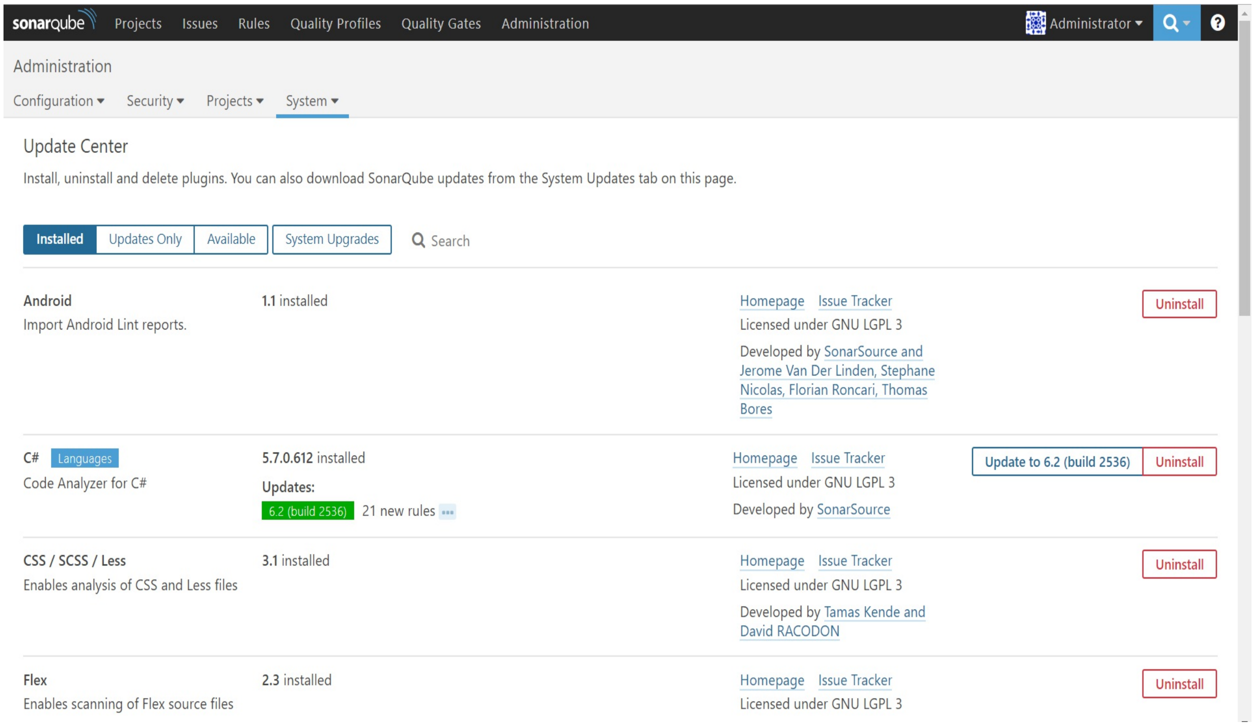
Restart Server

Server is restarting. This page will be automatically refreshed.

8. This is how we can use the Update Center to install, uninstall, and update the plugins available in SonarQube.

There's more...

1. Go to the Administration | System | Update Center | Installed tab to verify all the newly installed plugins:



Update Center

Install, uninstall and delete plugins. You can also download SonarQube updates from the System Updates tab on this page.

Android Import Android Lint reports.	**1.1** installed	Licensed under GNU LGPL 3 Developed by SonarSource and Jerome Van Der Linden, Stephane Nicolas, Florian Roncari, Thomas Bores
C# Languages Code Analyzer for C#	**5.7.0.612** installed **Updates:** 6.2 (build 2536) 21 new rules	Licensed under GNU LGPL 3 Developed by SonarSource
CSS / SCSS / Less Enables analysis of CSS and Less files	**3.1** installed	Licensed under GNU LGPL 3 Developed by Tamas Kende and David RACODON
Flex Enables scanning of Flex source files	**2.3** installed	Licensed under GNU LGPL 3

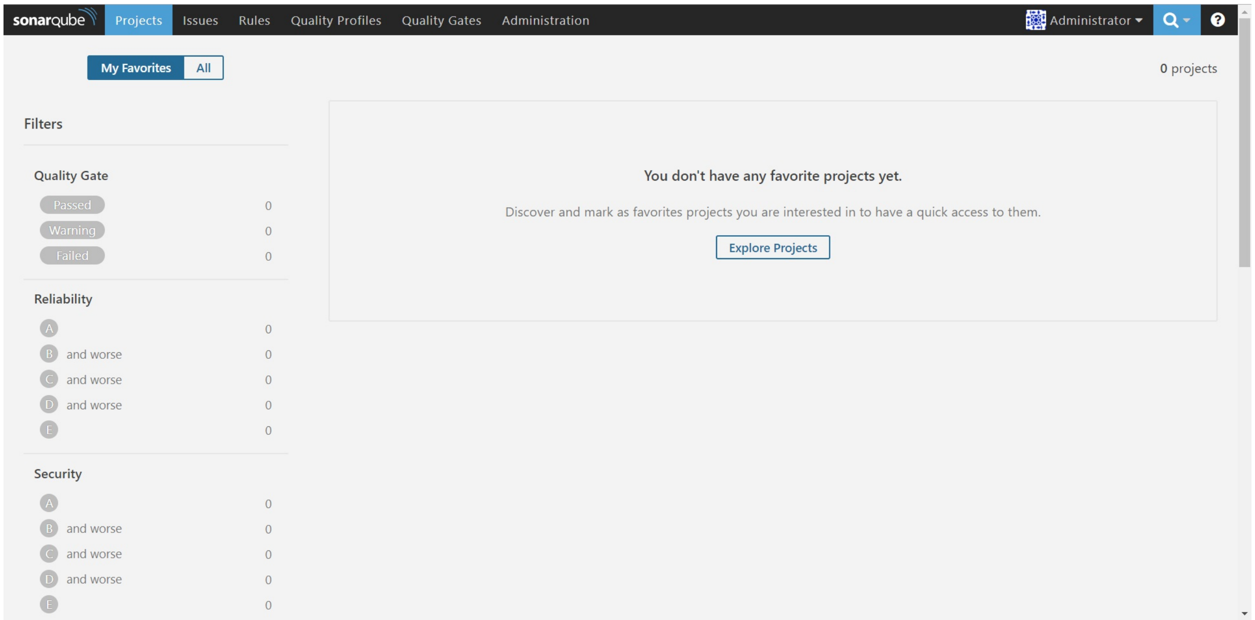
2. You can uninstall plugins from the Installed tab also.

Quality gates, quality profiles, and rules

In this section, we will look at the default quality gate that defines the base level for passing or failing code analysis, and quality profiles is rule specific to a particular programming language.

How to do it...

1. As of now there is no project available in the SonarQube dashboard:



0 projects

Filters

Quality Gate	
Passed	0
Warning	0
Failed	0

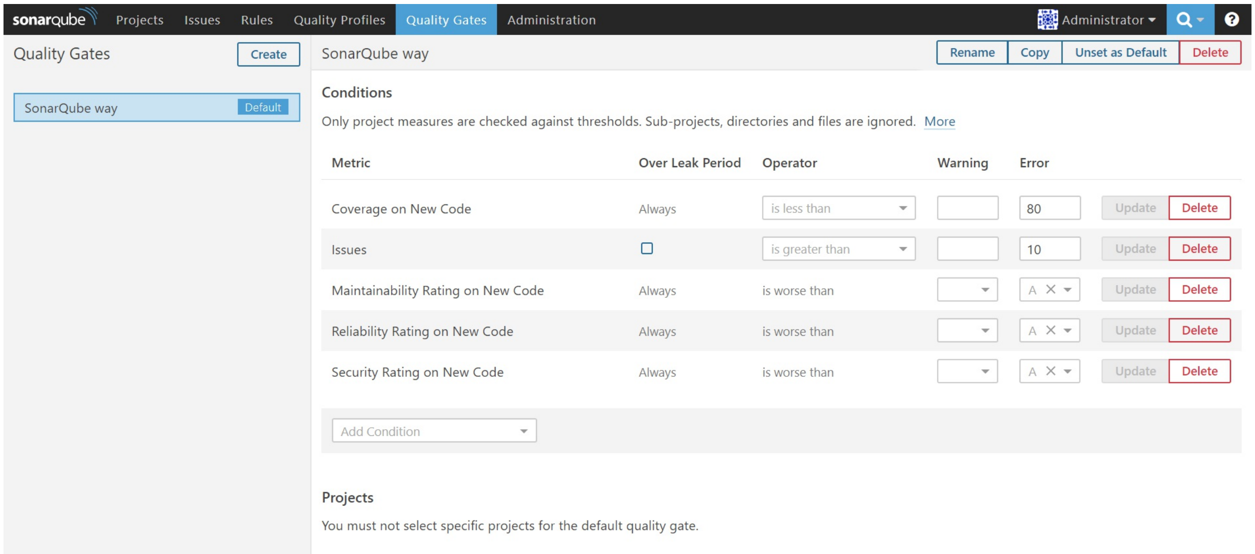
Reliability	
A	0
B and worse	0
C and worse	0
D and worse	0
E	0

Security	
A	0
B and worse	0
C and worse	0
D and worse	0
E	0

You don't have any favorite projects yet.

Discover and mark as favorites projects you are interested in to have a quick access to them.

2. Quality Gate is used to enforce policy in the organization for static code analysis.
3. The SonarQube way is the default Quality Gate and you assign it to different projects based on the policies required.
4. You can also add conditions based on your requirement and policies you want to enforce:



SonarQube way

Conditions

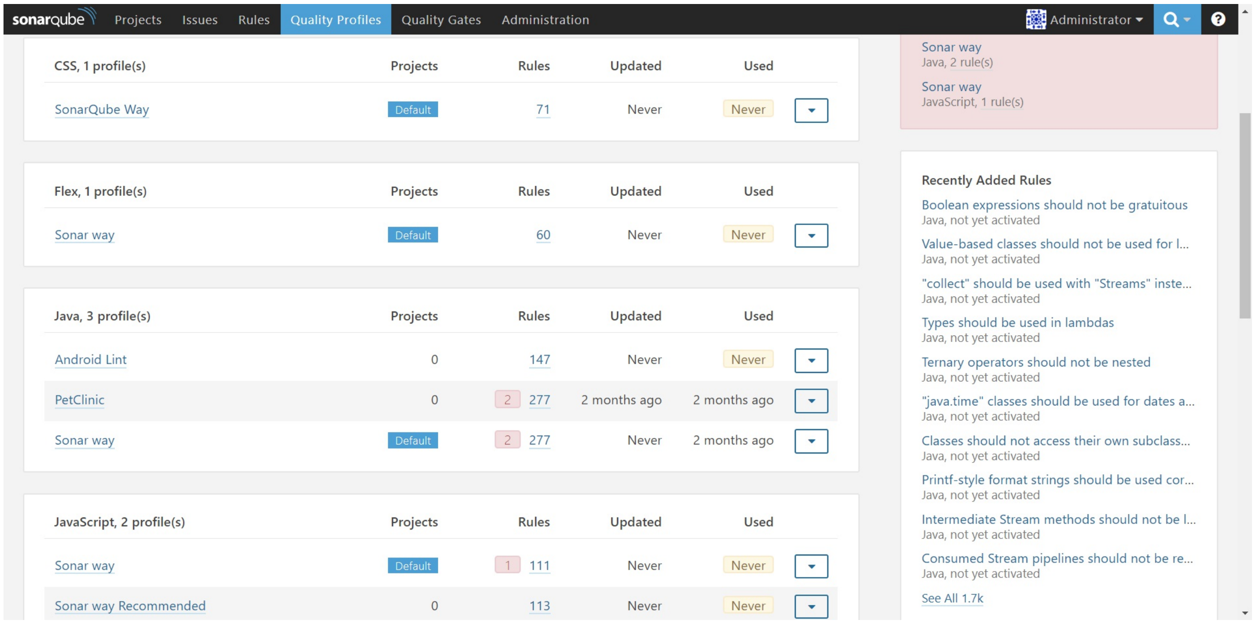
Only project measures are checked against thresholds. Sub-projects, directories and files are ignored. More

Metric	Over Leak Period	Operator	Warning	Error		
Coverage on New Code	Always	is less than		80	Update	Delete
Issues	□	is greater than		10	Update	Delete
Maintainability Rating on New Code	Always	is worse than		A	Update	Delete
Reliability Rating on New Code	Always	is worse than		A	Update	Delete
Security Rating on New Code	Always	is worse than		A	Update	Delete

Projects

You must not select specific projects for the default quality gate.

5. Click on the Quality Profiles tab to get details on the default quality profiles available in SonarQube.
6. Quality Profiles is at the heart of SonarQube; it is just a set of rules specific to a language. If not mentioned explicitly, all the projects are analyzed with default profiles. However, it is ideal to have a profile for each project so that specific rules can be set or deactivated. Each language has a default profile named Sonar way:



CSS, 1 profile(s)	Projects	Rules	Updated	Used
SonarQube Way	Default	71	Never	Never

Flex, 1 profile(s)	Projects	Rules	Updated	Used
Sonar way	Default	60	Never	Never

Java, 3 profile(s)	Projects	Rules	Updated	Used
Android Lint	0	147	Never	Never
PetClinic	0	2 277	2 months ago	2 months ago
Sonar way	Default	2 277	Never	2 months ago

JavaScript, 2 profile(s)	Projects	Rules	Updated	Used
Sonar way	Default	1 111	Never	Never
Sonar way Recommended	0	113	Never	Never

Sonar way
Java, 2 rule(s)

Sonar way
JavaScript, 1 rule(s)

Recently Added Rules

Boolean expressions should not be gratuitous
Java, not yet activated

Value-based classes should not be used for l...
Java, not yet activated

"collect" should be used with "Streams" inste...
Java, not yet activated

Types should be used in lambdas
Java, not yet activated

Ternary operators should not be nested
Java, not yet activated

"java.time" classes should be used for dates a...
Java, not yet activated

Classes should not access their own subclass...
Java, not yet activated

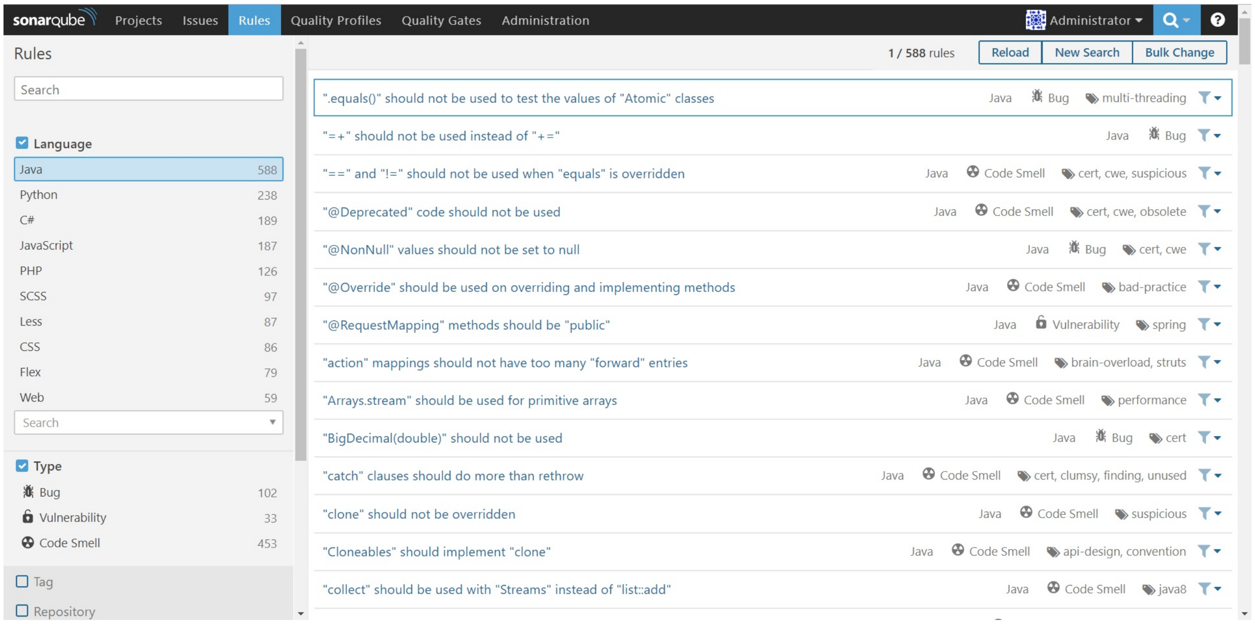
Printf-style format strings should be used cor...
Java, not yet activated

Intermediate Stream methods should not be l...
Java, not yet activated

Consumed Stream pipelines should not be re...
Java, not yet activated

See All 1.7k

7. Click on the Rules tab to get more details about the existing rules available in profiles:



Rules

1 / 588 rules

☑ Language

Java	588
Python	238
C#	189
JavaScript	187
PHP	126
SCSS	97
Less	87
CSS	86
Flex	79
Web	59

☑ Type

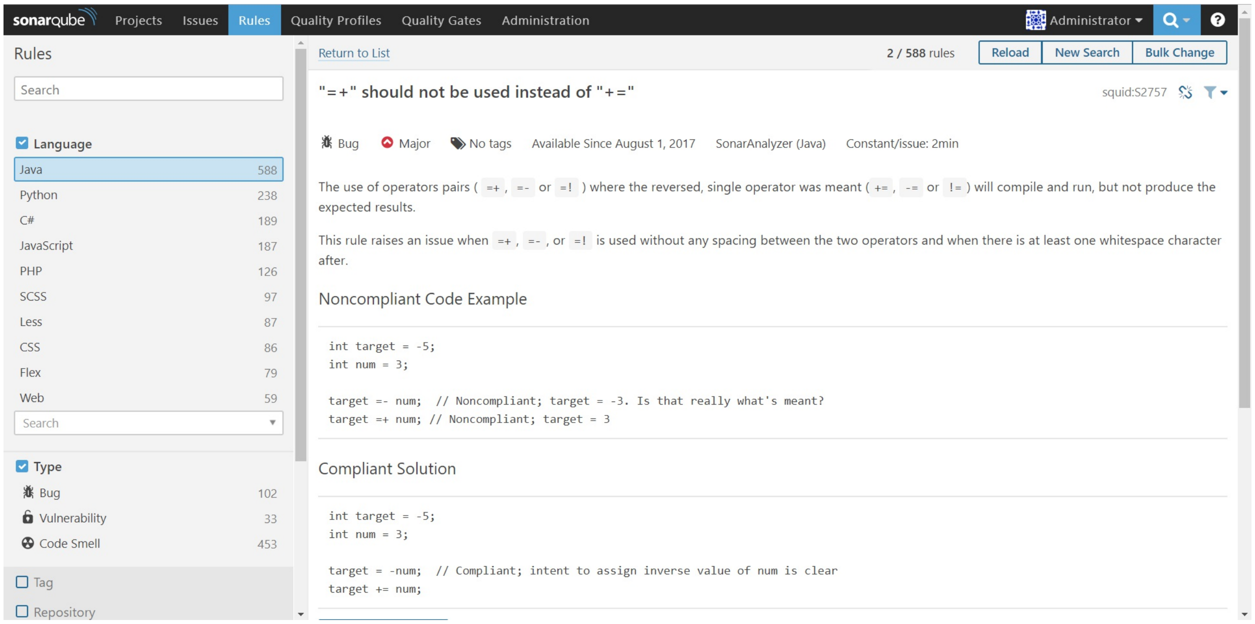
Bug	102
Vulnerability	33
Code Smell	453

☐ Tag

☐ Repository

".equals()" should not be used to test the values of "Atomic" classes	Java	Bug	multi-threading
"=+" should not be used instead of "+="	Java	Bug	
"==" and "!=" should not be used when "equals" is overridden	Java	Code Smell	cert, cwe, suspicious
"@Deprecated" code should not be used	Java	Code Smell	cert, cwe, obsolete
"@NonNull" values should not be set to null	Java	Bug	cert, cwe
"@Override" should be used on overriding and implementing methods	Java	Code Smell	bad-practice
"@RequestMapping" methods should be "public"	Java	Vulnerability	spring
"action" mappings should not have too many "forward" entries	Java	Code Smell	brain-overload, struts
"Arrays.stream" should be used for primitive arrays	Java	Code Smell	performance
"BigDecimal(double)" should not be used	Java	Bug	cert
"catch" clauses should do more than rethrow	Java	Code Smell	cert, clumsy, finding, unused
"clone" should not be overridden	Java	Code Smell	suspicious
"Cloneables" should implement "clone"	Java	Code Smell	api-design, convention
"collect" should be used with "Streams" instead of "list::add"	Java	Code Smell	java8

8. Click on rule to get more insight into it:



"=+" should not be used instead of "+="

Bug Major No tags Available Since August 1, 2017 SonarAnalyzer (Java) Constant/issue: 2min

The use of operators pairs (`=+` , `=-` or `=!`) where the reversed, single operator was meant (`+=` , `-=` or `!=`) will compile and run, but not produce the expected results.

This rule raises an issue when `=+` , `=-` , or `=!` is used without any spacing between the two operators and when there is at least one whitespace character after.

Noncompliant Code Example

```
int target = -5;
int num = 3;

target =- num;  // Noncompliant; target = -3. Is that really what's meant?
target =+ num; // Noncompliant; target = 3
```

Compliant Solution

```
int target = -5;
int num = 3;

target = -num;  // Compliant; intent to assign inverse value of num is clear
target += num;
```

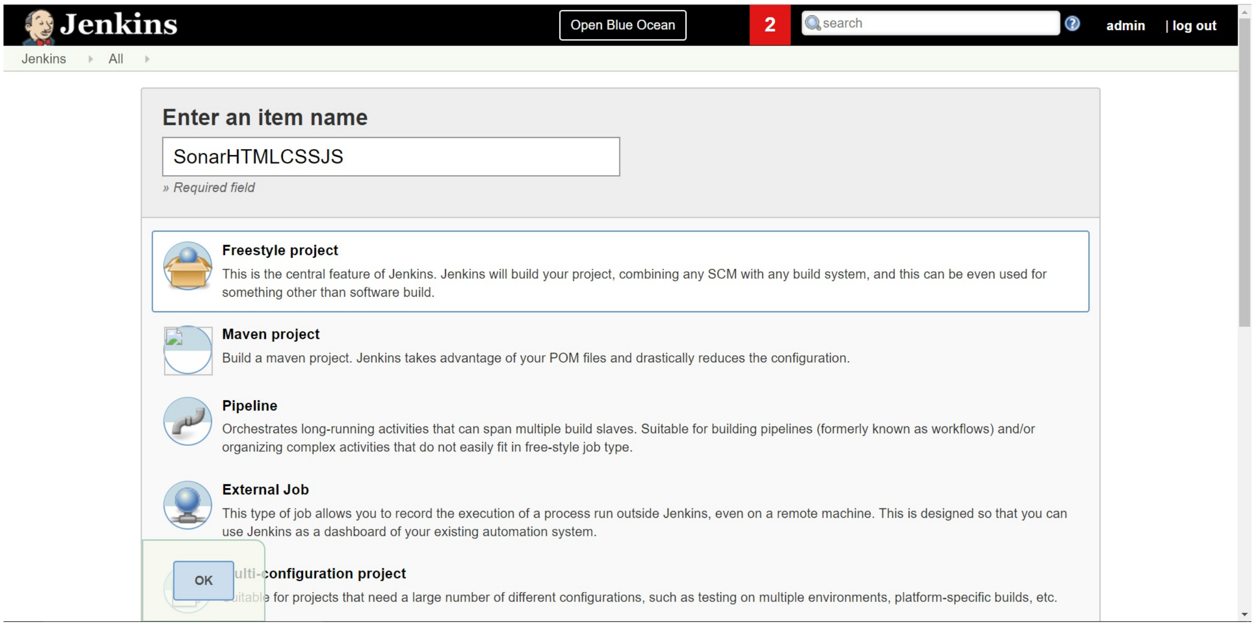
9. Go to Quality Profiles and select the Sonar way default profile. Observe the total Active and Inactive Rules.

Verifying HTML, CSS and JavaScript validity using SonarQube

You are going to perform static code analysis on the sample application that comprises HTML, CSS, and JavaScript files.

Getting ready

1. Go to the Jenkins dashboard and click on New Item.
2. Give the Name and select Freestyle project:



Enter an item name

SonarHTMLCSSJS

» Required field

Freestyle project
This is the central feature of Jenkins. Jenkins will build your project, combining any SCM with any build system, and this can be even used for something other than software build.

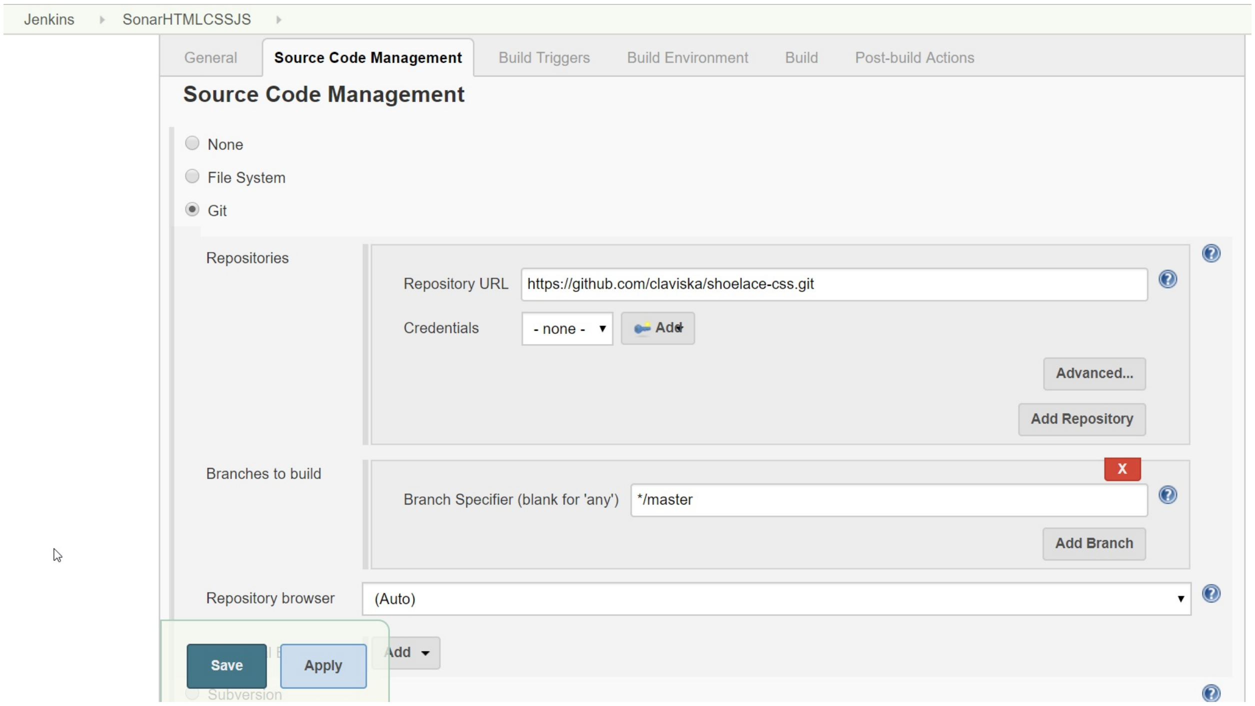
Maven project
Build a maven project. Jenkins takes advantage of your POM files and drastically reduces the configuration.

Pipeline
Orchestrates long-running activities that can span multiple build slaves. Suitable for building pipelines (formerly known as workflows) and/or organizing complex activities that do not easily fit in free-style job type.

External Job
This type of job allows you to record the execution of a process run outside Jenkins, even on a remote machine. This is designed so that you can use Jenkins as a dashboard of your existing automation system.

ulti-configuration project
itable for projects that need a large number of different configurations, such as testing on multiple environments, platform-specific builds, etc.

3. Provide the Repository URL in the Source Code Management section:



Source Code Management

○ None

○ File System

● Git

Repositories

Repository URL https://github.com/claviska/shoelace-css.git

Credentials - none -

Branches to build

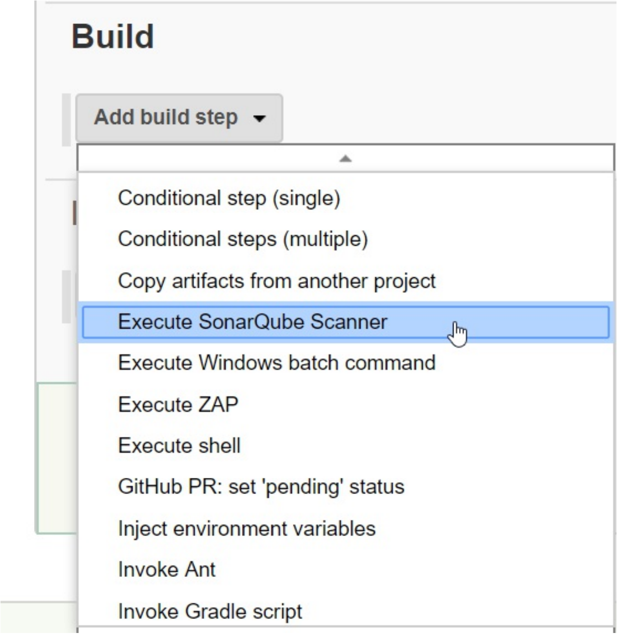
Branch Specifier (blank for 'any') */master

Repository browser (Auto)

4. Any project that has HTML, CSS, and JavaScript files can be utilized.

How to do it...

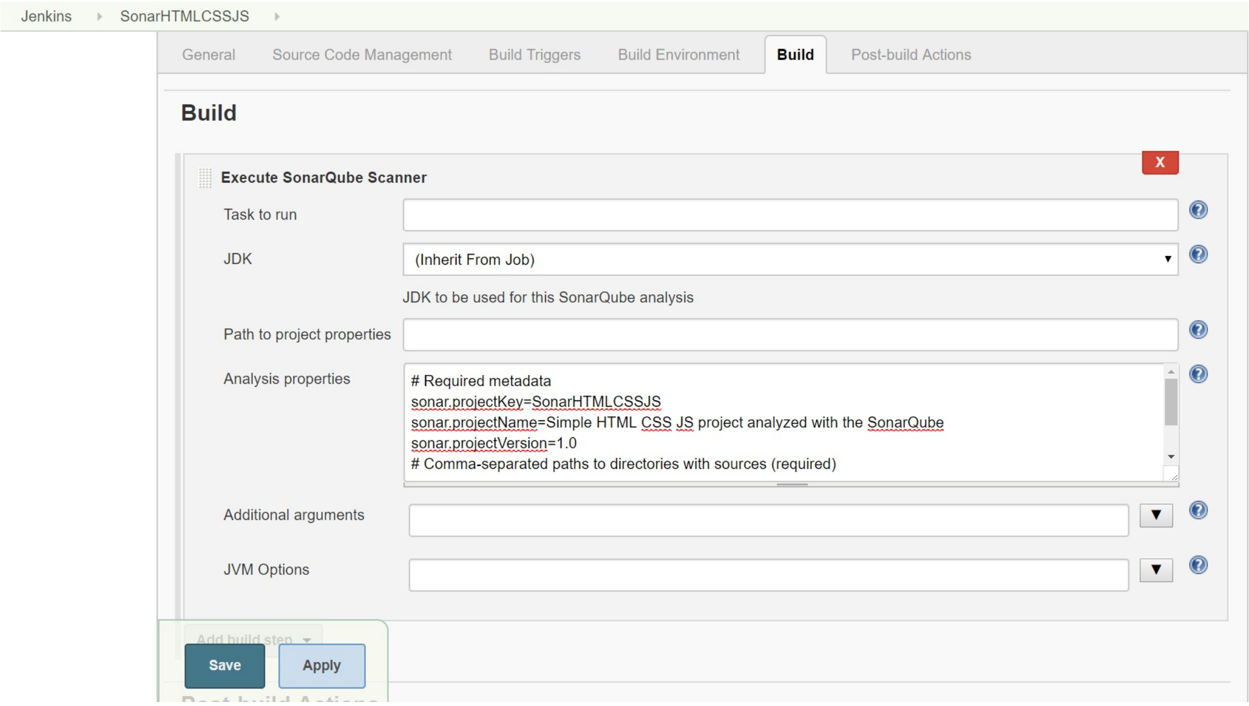
1. Go to the Build section and select Execute SonarQube Scanner:


Build
Add build step
Conditional step (single)
Conditional steps (multiple)
Copy artifacts from another project
Execute SonarQube Scanner
Execute Windows batch command
Execute ZAP
Execute shell
GitHub PR: set 'pending' status
Inject environment variables
Invoke Ant
Invoke Gradle script

2. You can provide the location of `sonar-project.properties` or provide details directly for static code analysis.

```
# Required metadata
sonar.projectKey=SonarHTMLCSSJS
sonar.projectName=Simple HTML CSS JS project analyzed with the SonarQube
sonar.projectVersion=1.0
# Comma-separated paths to directories with sources (required)
sonar.sources=.
# Encoding of the source files
sonar.sourceEncoding=UTF-8
```

3. `sonar.sources` is the main property for static code analysis. With this property, you inform SonarQube which directory needs to be analyzed:



Build

Execute SonarQube Scanner

Task to run:

JDK: (Inherit From Job)

JDK to be used for this SonarQube analysis

Path to project properties:

Analysis properties:

```
# Required metadata
sonar.projectKey=SonarHTMLCSSJS
sonar.projectName=Simple HTML CSS JS project analyzed with the SonarQube
sonar.projectVersion=1.0
# Comma-separated paths to directories with sources (required)
```

Additional arguments:

JVM Options:

4. Click on Save.
5. Go to Jenkins Project and click on Build now.
6. Go to Console output to check the logs.
7. Just observe the logs given in the following code.
8. You will notice that based on the available files, SonarQube automatically selects different quality profiles and analyzes the code:
9. Started by user admin.
10. `[EnvInject]` - Loading node environment variables.
11. Building in workspace:
    `F:\1.DevOps2016\#JenkinsEssentials\FirstDraft\jenkinsHome\workspace\SonarHTMLCSSJS`
12. Cloning the remote Git repository:

```
Cloning repository https://github.com/claviska/shoelace-css.git
>git.exe init
F:\1.DevOps2016\#JenkinsEssentials\FirstDraft\jenkinsHome\workspace\SonarHTMLCSSJ
 # timeout=10
```

13. Fetching upstream changes from https://github.com/claviska/shoelace-css.git:

```
> git.exe --version # timeout=10
>git.exe fetch --tags --progress https://github.com/claviska/shoelace-css.git
+refs/heads/*:refs/remotes/origin/*
>git.exe config remote.origin.url https://github.com/claviska/shoelace-css.git #
timeout=10
>git.exe config --add remote.origin.fetch +refs/heads/*:refs/remotes/origin/* #
timeout=10
>git.exe config remote.origin.url https://github.com/claviska/shoelace-css.git #
timeout=10
```

14. Fetching upstream changes from https://github.com/claviska/shoelace-css.git:

```
>git.exe fetch --tags --progress https://github.com/claviska/shoelace-css.git
+refs/heads/*:refs/remotes/origin/*
>git.exe rev-parse "refs/remotes/origin/master{commit}" # timeout=10
>git.exe rev-parse "refs/remotes/origin/origin/master{commit}" # timeout=10
```

15. Checking out revision `39b44e9519e5050675e01527c421c5e0f3a046b7` (`refs/remotes/origin/master`):

```
>git.exe config core.sparsecheckout # timeout=10
>git.exe checkout -f 39b44e9519e5050675e01527c421c5e0f3a046b7
```

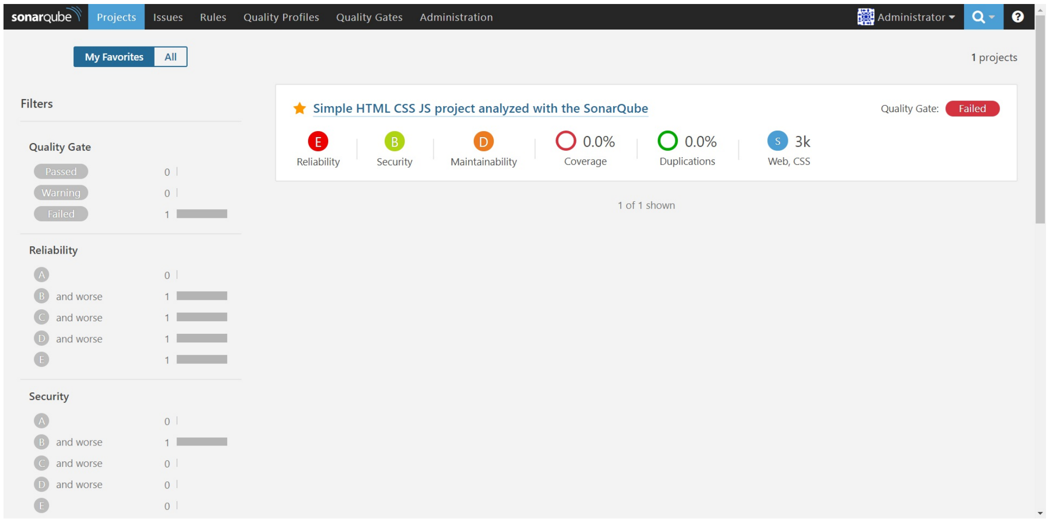
16. First time build. Skipping changelog:

```
[SonarHTMLCSSJS] $
F:\1.DevOps2016\#JenkinsEssentials\FirstDraft\jenkinsHome\tools\hudson.plugins.so
scanner.bat -e -Dsonar.host.url=http://localhost:9000/ ******** "-
Dsonar.projectName=Simple HTML CSS JS project analyzed with the SonarQube" -
Dsonar.projectVersion=1.0 -Dsonar.sourceEncoding=UTF-8 -
Dsonar.projectKey=SonarHTMLCSSJS -Dsonar.sources=. -
Dsonar.projectBaseDir=F:\1.DevOps2016\#JenkinsEssentials\FirstDraft\jenkinsHome\w


INFO: Option -e/--errors is no longer supported and will be ignored
INFO: Scanner configuration file:
F:\1.DevOps2016\#JenkinsEssentials\FirstDraft\jenkinsHome\tools\hudson.plugins.so
scanner.properties
INFO: Project root configuration file: NONE
INFO: SonarQube Scanner 3.0.3.778
INFO: Java 1.8.0_111 Oracle Corporation (64-bit)
INFO: Windows 10 10.0 amd64
INFO: User cache: C:\WINDOWS\system32\config\systemprofile\.sonar\cache
INFO: Load global settings
INFO: Load global settings (done) | time=557ms
INFO: User cache: C:\WINDOWS\system32\config\systemprofile\.sonar\cache
INFO: Load plugins index
INFO: Load plugins index (done) | time=113ms
INFO: Download sonar-csharp-plugin-5.7.0.612.jar
INFO: Download sonar-python-plugin-1.7.0.1195.jar
INFO: Download sonar-css-plugin-3.1.jar
INFO: Download sonar-java-plugin-4.12.0.11033.jar
INFO: Download sonar-scm-git-plugin-1.2.jar
INFO: Download sonar-android-plugin-1.1.jar
INFO: Download sonar-php-plugin-2.9.2.1744.jar
INFO: Download sonar-scm-svn-plugin-1.4.0.522.jar
INFO: SonarQube server 6.3.1
INFO: Default locale: "en_IN", source code encoding: "UTF-8"
INFO: Process project properties
INFO: Load project repositories
INFO: Load project repositories (done) | time=140ms
INFO: Load quality profiles
INFO: Load quality profiles (done) | time=437ms
INFO: Load active rules
INFO: Load active rules (done) | time=6984ms
INFO: Load metrics repository
INFO: Load metrics repository (done) | time=752ms
INFO: Publish mode
INFO: Project key: SonarHTMLCSSJS
INFO: ------------- Scan Simple HTML CSS JS project analyzed with the SonarQube
INFO: Load server rules
INFO: Load server rules (done) | time=1241ms
INFO: Initializer GenericCoverageSensor
INFO: Initializer GenericCoverageSensor (done) | time=0ms
INFO: Base dir:
F:\1.DevOps2016\#JenkinsEssentials\FirstDraft\jenkinsHome\workspace\SonarHTMLCSSJ
INFO: Working dir:
F:\1.DevOps2016\#JenkinsEssentials\FirstDraft\jenkinsHome\workspace\SonarHTMLCSSJ
INFO: Source paths: .
INFO: Source encoding: UTF-8, default locale: en_IN
INFO: Index files
INFO: 30 files indexed
INFO: Quality profile for css: SonarQube Way
INFO: Quality profile for js: Sonar way
INFO: Quality profile for web: Sonar way
INFO: Sensor NoSonar Sensor [php]
INFO: Sensor NoSonar Sensor [php] (done) | time=0ms
INFO: Sensor Coverage Report Import [csharp]
INFO: Sensor Coverage Report Import [csharp] (done) | time=0ms
```

```
INFO: Sensor Coverage Report Import [csharp]
INFO: Sensor Coverage Report Import [csharp] (done) | time=0ms
INFO: Sensor Unit Test Results Import [csharp]
INFO: Sensor Unit Test Results Import [csharp] (done) | time=1ms
INFO: Sensor CSS Analyzer Sensor [css]
INFO: 15 source files to be analyzed
INFO: Sensor CSS Analyzer Sensor [css] (done) | time=8774ms
INFO: 15/15 source files have been analyzed
INFO: Sensor Embedded CSS Analyzer Sensor [css]
INFO: 1 source files to be analyzed
INFO: Sensor Embedded CSS Analyzer Sensor [css] (done) | time=631ms
INFO: Sensor SonarJavaXmlFileSensor [java]
INFO: Sensor SonarJavaXmlFileSensor [java] (done) | time=0ms
INFO: Sensor Web [web]
INFO: 1/1 source files have been analyzed
INFO: Sensor Web [web] (done) | time=3667ms
INFO: Sensor Analyzer for "php.ini" files [php]
INFO: Sensor Analyzer for "php.ini" files [php] (done) | time=0ms
INFO: Sensor JavaScript Squid Sensor [javascript]
INFO: 2 source files to be analyzed
INFO: Unit Test Coverage Sensor is started
INFO: 2/2 source files have been analyzed
INFO: Integration Test Coverage Sensor is started
INFO: Overall Coverage Sensor is started
INFO: Sensor JavaScript Squid Sensor [javascript] (done) | time=1949ms
INFO: Sensor Zero Coverage Sensor
INFO: Sensor Zero Coverage Sensor (done) | time=334ms
INFO: Sensor Code Colorizer Sensor
INFO: Sensor Code Colorizer Sensor (done) | time=4ms
INFO: Sensor CPD Block Indexer
INFO: org.sonar.scanner.cpd.deprecated.DefaultCpdBlockIndexer@511a307e is used
for css
INFO: org.sonar.scanner.cpd.deprecated.DefaultCpdBlockIndexer@511a307e is used
for js
INFO: org.sonar.scanner.cpd.deprecated.DefaultCpdBlockIndexer@511a307e is used
for web
INFO: Sensor CPD Block Indexer (done) | time=3ms
INFO: SCM Publisher is disabled
INFO: Calculating CPD for 18 files
INFO: CPD calculation finished
INFO: Analysis report generated in 1401ms, dir size=475 KB
INFO: Analysis reports compressed in 244ms, zip size=111 KB
INFO: Analysis report uploaded in 13680ms
INFO: ANALYSIS SUCCESSFUL, you can browse
http://localhost:9000/dashboard/index/SonarHTMLCSSJS
INFO: Note that you will be able to access the updated dashboard once the server
has processed the submitted analysis report
INFO: More about the report processing at http://localhost:9000/api/ce/task?
id=AV2b4vtMnc_wgjAawYBq
INFO: Task total time: 56.134 s
INFO: ------------------------------------------------------------------------
INFO: EXECUTION SUCCESS
INFO: ------------------------------------------------------------------------
INFO: Total time: 1:09.022s
INFO: Final Memory: 50M/219M
INFO: ------------------------------------------------------------------------
Started calculate disk usage of build
Finished Calculation of disk usage of build in 0 seconds
Started calculate disk usage of workspace
Finished Calculation of disk usage of workspace in 0 seconds
Finished: SUCCESS
```

17. Go to http://localhost:9000/ where SonarQube is available and check whether static code analysis for our project is available or not.

18. Click on the Project link in SonarQube:



Quality Gate

Passed	0	
Warning	0	
Failed	1	▬

Reliability

A	0	
B and worse	1	▬
C and worse	1	▬
D and worse	1	▬
E	1	▬

Security

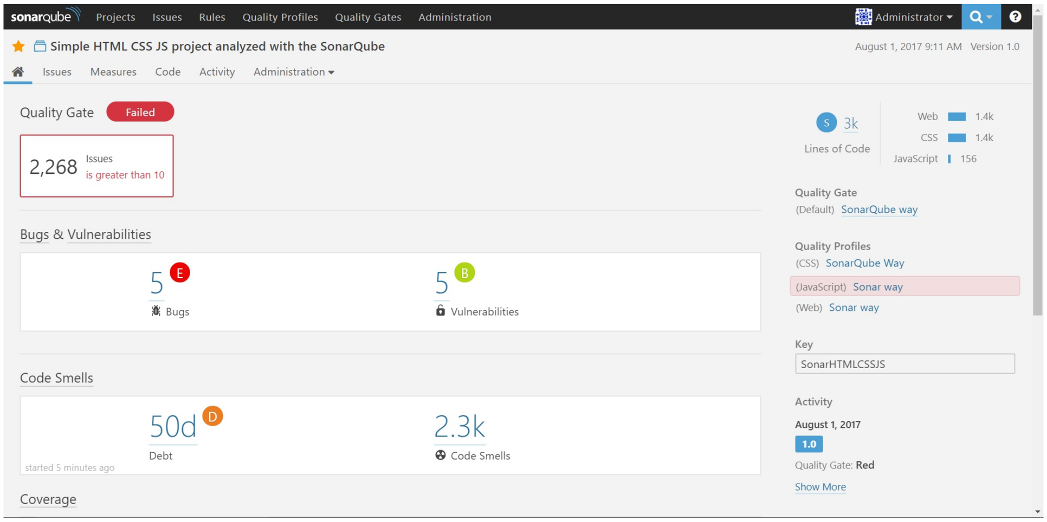
A	0	
B and worse	1	▬
C and worse	0	
D and worse	0	
E	0	

Simple HTML CSS JS project analyzed with the SonarQube — Quality Gate: Failed

Reliability	Security	Maintainability	Coverage	Duplications	Web, CSS
E	B	D	0.0%	0.0%	3k

1 of 1 shown

19. The default Quality Profiles and Quality Gate are used in static code analysis.
20. There are Bugs &Vulnerabilities, and Code Smells related details available. Click on each of them to get more details based on the files.
21. Quality Gate has Failed here and conditions are not met:



Simple HTML CSS JS project analyzed with the SonarQube — August 1, 2017 9:11 AM Version 1.0

Quality Gate Failed

2,268 Issues is greater than 10

Bugs & Vulnerabilities

5 E Bugs — 5 B Vulnerabilities

Code Smells

50d D Debt — 2.3k Code Smells

started 5 minutes ago

Coverage

S 3k Lines of Code

Web	1.4k
CSS	1.4k
JavaScript	156

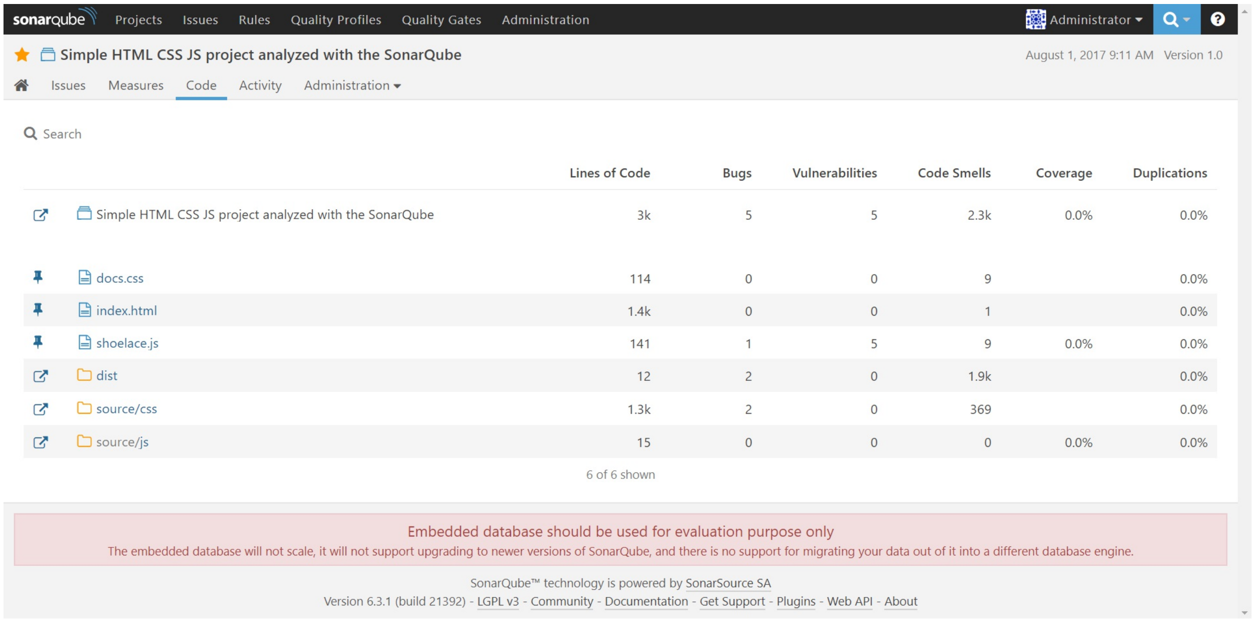
Quality Gate
(Default) SonarQube way

Quality Profiles
(CSS) SonarQube Way
(JavaScript) Sonar way
(Web) Sonar way

Key
SonarHTMLCSSJS

Activity
August 1, 2017
1.0
Quality Gate: Red

22. Go to the Code tab to get the file and directory Bugs & Vulnerabilities and Code Smells:



		Lines of Code	Bugs	Vulnerabilities	Code Smells	Coverage	Duplications
	Simple HTML CSS JS project analyzed with the SonarQube	3k	5	5	2.3k	0.0%	0.0%
	docs.css	114	0	0	9		0.0%
	index.html	1.4k	0	0	1		0.0%
	shoelace.js	141	1	5	9	0.0%	0.0%
	dist	12	2	0	1.9k		0.0%
	source/css	1.3k	2	0	369		0.0%
	source/js	15	0	0	0	0.0%	0.0%

6 of 6 shown

Embedded database should be used for evaluation purpose only

The embedded database will not scale, it will not support upgrading to newer versions of SonarQube, and there is no support for migrating your data out of it into a different database engine.

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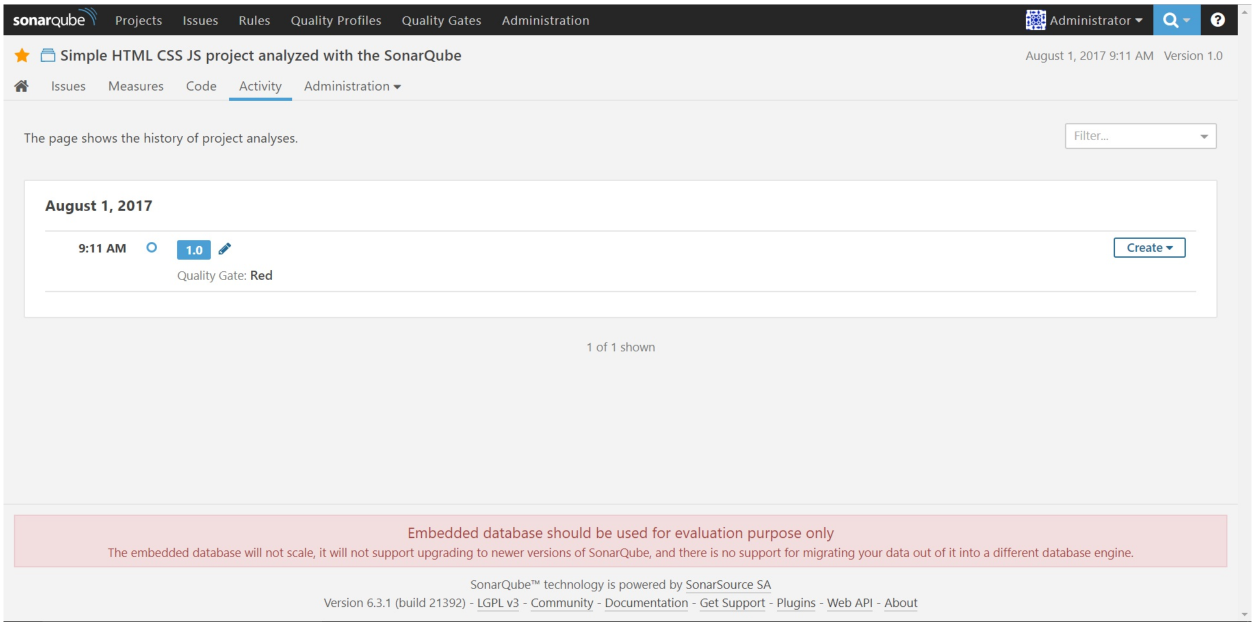
23. Click on Activity to get the history of project analysis:



Simple HTML CSS JS project analyzed with the SonarQube

August 1, 2017 9:11 AM Version 1.0

The page shows the history of project analyses.

August 1, 2017

9:11 AM 1.0

Quality Gate: Red

1 of 1 shown

Embedded database should be used for evaluation purpose only

The embedded database will not scale, it will not support upgrading to newer versions of SonarQube, and there is no support for migrating your data out of it into a different database engine.

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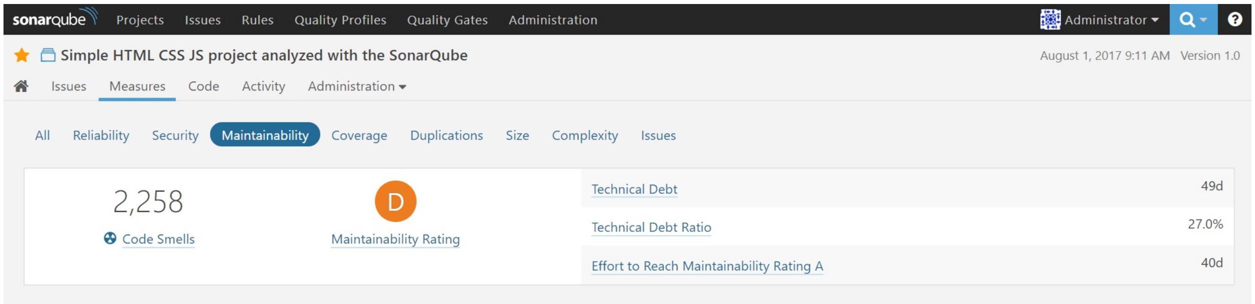
24. Go to Measures | Maintainability to get details on rating and technical debt:



Simple HTML CSS JS project analyzed with the SonarQube

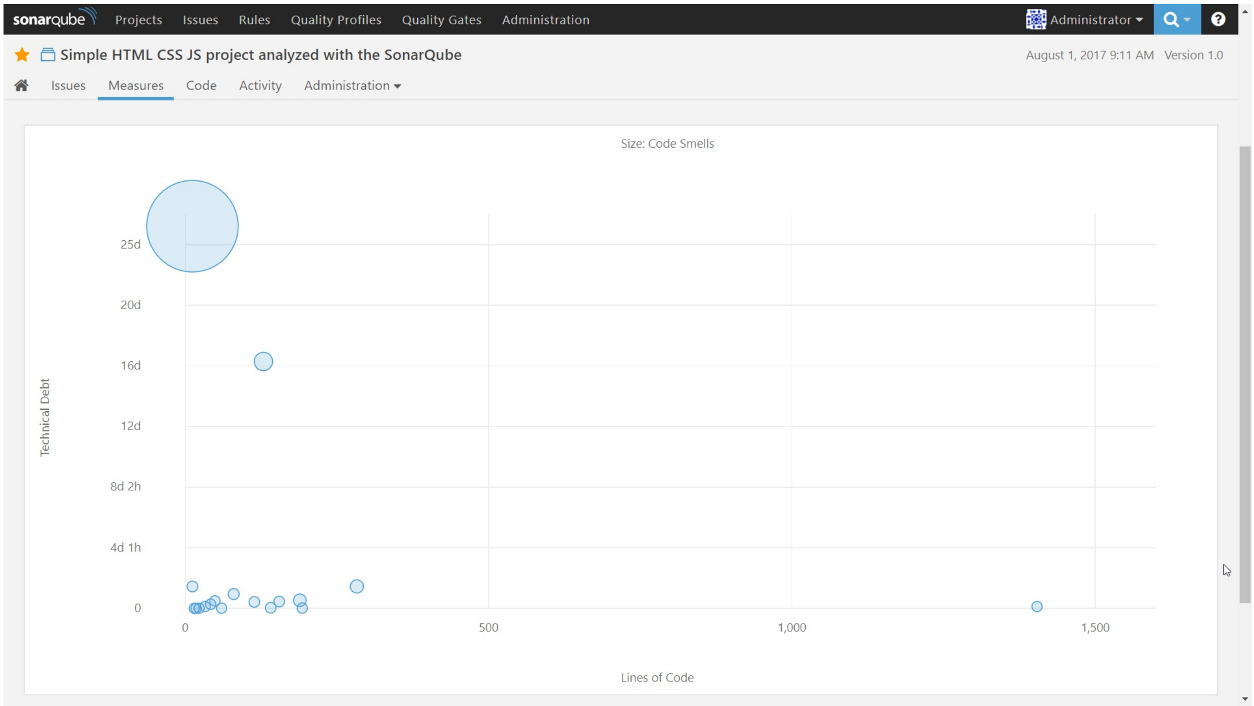
August 1, 2017 9:11 AM Version 1.0

2,258 Code Smells

D Maintainability Rating

Technical Debt	49d
Technical Debt Ratio	27.0%
Effort to Reach Maintainability Rating A	40d

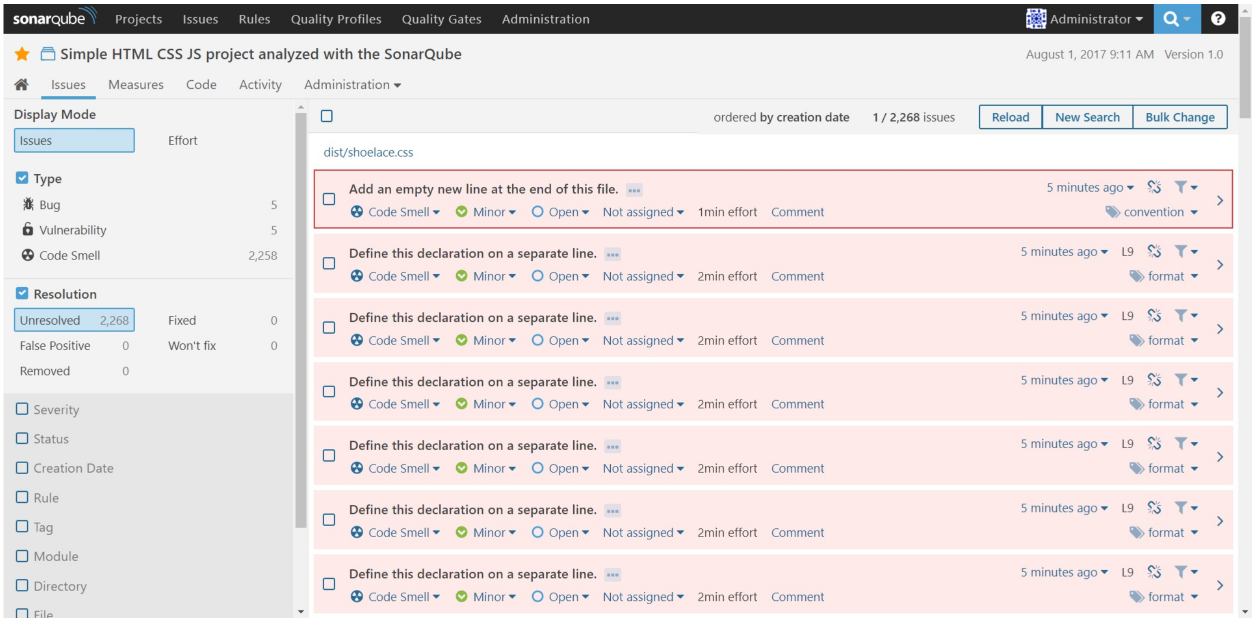
25. Go to Measures | Size to get the chart for code smell size:



26. Go to different subsections of the same hierarchy and observe the details in depth to gain more understanding.

There's more

1. Go to Issues Unresolved | Errors and click on it to get more details:



Simple HTML CSS JS project analyzed with the SonarQube

August 1, 2017 9:11 AM Version 1.0

Display Mode: Issues | Effort

☑ Type
- Bug 5
- Vulnerability 5
- Code Smell 2,258

☑ Resolution

Unresolved	2,268	Fixed	0
False Positive	0	Won't fix	0
Removed	0		

□ Severity
□ Status
□ Creation Date
□ Rule
□ Tag
□ Module
□ Directory
□ File

ordered by creation date 1 / 2,268 issues

dist/shoelace.css

□ Add an empty new line at the end of this file. — Code Smell, Minor, Open, Not assigned, 1min effort, Comment — 5 minutes ago — convention

□ Define this declaration on a separate line. — Code Smell, Minor, Open, Not assigned, 2min effort, Comment — 5 minutes ago, L9 — format

□ Define this declaration on a separate line. — Code Smell, Minor, Open, Not assigned, 2min effort, Comment — 5 minutes ago, L9 — format

□ Define this declaration on a separate line. — Code Smell, Minor, Open, Not assigned, 2min effort, Comment — 5 minutes ago, L9 — format

□ Define this declaration on a separate line. — Code Smell, Minor, Open, Not assigned, 2min effort, Comment — 5 minutes ago, L9 — format

□ Define this declaration on a separate line. — Code Smell, Minor, Open, Not assigned, 2min effort, Comment — 5 minutes ago, L9 — format

□ Define this declaration on a separate line. — Code Smell, Minor, Open, Not assigned, 2min effort, Comment — 5 minutes ago, L9 — format

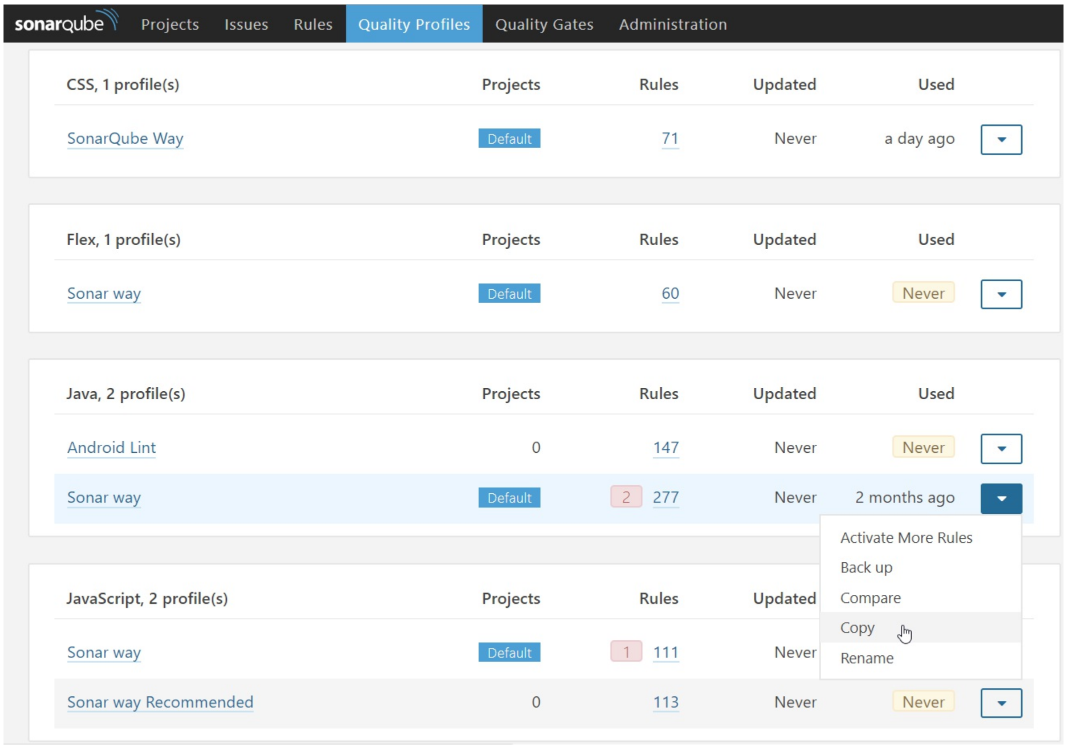
2. There are situations where some issues are false positives. In such cases, configure themes fixed from the SonarQube dashboard.

Verifying Java code using SonarQube

Now let's create a new Quality Profile and assign the project so every time static code analysis is performed, the default profile is not used but a custom profile is utilized.

Getting ready

1. Go to Quality Profiles and in the Java section, copy the default profile:



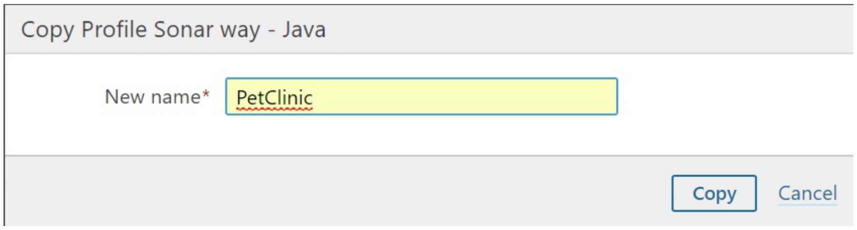
CSS, 1 profile(s)	Projects	Rules	Updated	Used
SonarQube Way	Default	71	Never	a day ago

Flex, 1 profile(s)	Projects	Rules	Updated	Used
Sonar way	Default	60	Never	Never

Java, 2 profile(s)	Projects	Rules	Updated	Used
Android Lint	0	147	Never	Never
Sonar way	Default	2 277	Never	2 months ago

JavaScript, 2 profile(s)	Projects	Rules	Updated	Used
Sonar way	Default	1 111	Never	
Sonar way Recommended	0	113	Never	Never

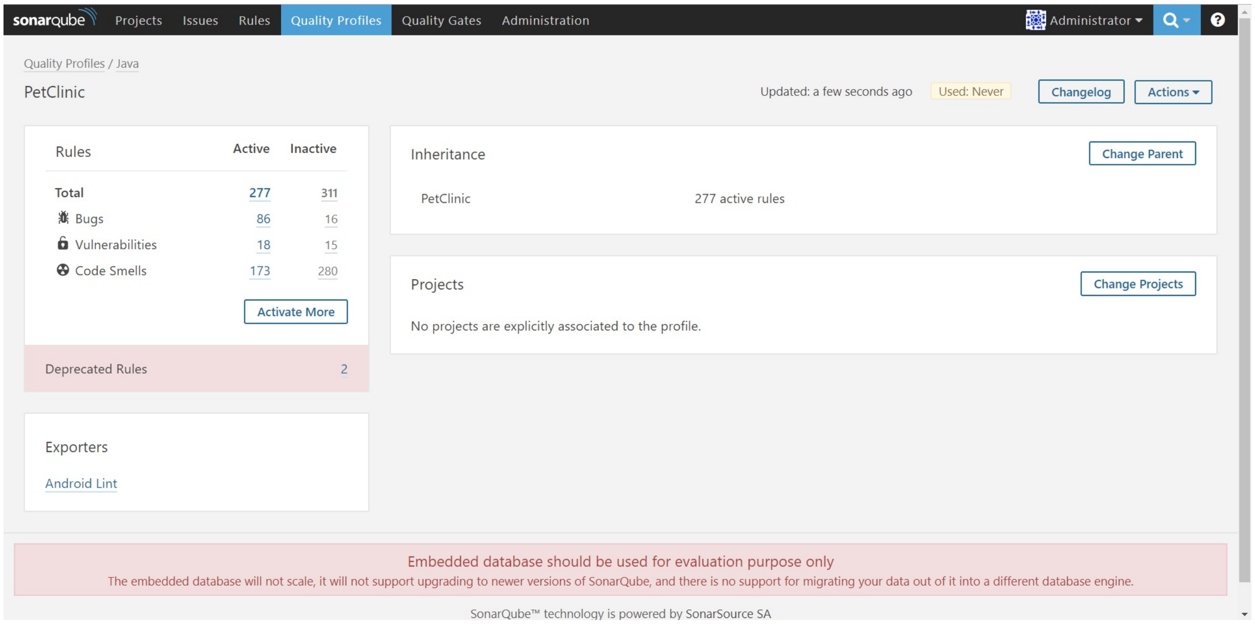
2. Give a specific name to it and click on Copy:



Copy Profile Sonar way - Java

New name* PetClinic

3. We can specify projects for a specific Quality Profile by clicking on Change Projects as well:



Quality Profiles / Java

PetClinic

Updated: a few seconds ago Used: Never

Rules	Active	Inactive
Total	277	311
Bugs	86	16
Vulnerabilities	18	15
Code Smells	173	280

Deprecated Rules	2

Exporters

Android Lint

Inheritance

PetClinic 277 active rules

Projects

No projects are explicitly associated to the profile.

Embedded database should be used for evaluation purpose only

The embedded database will not scale, it will not support upgrading to newer versions of SonarQube, and there is no support for migrating your data out of it into a different database engine.

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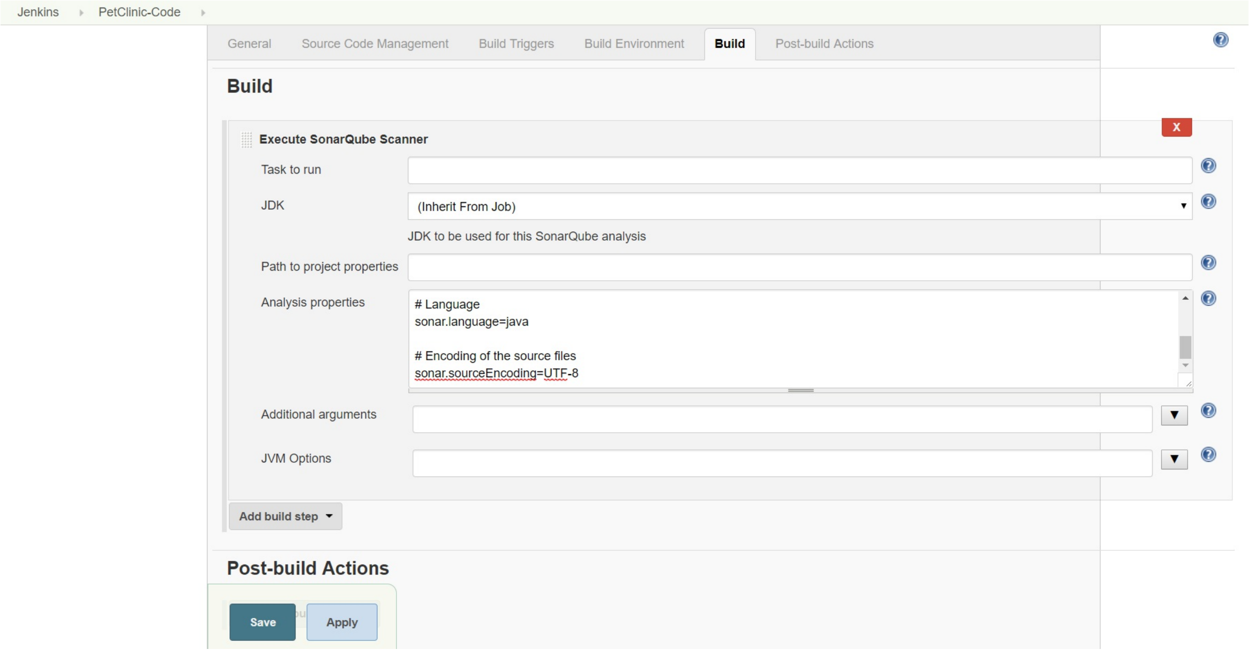
4. Assign a Quality Profile to your project so that the same profile is used every time a static code analysis is performed. Hence, we can use different profiles for different projects based on our requirements.

How to do it...

1. Go to the Jenkins dashboard and click on New Item.
2. Give the Name and select Freestyle project.
3. Provide the Repository URL in the Source Code Management section.
4. Go to the Build section and select Execute SonarQube Scanner.
5. You can provide the location of `sonar-project.properties` or provide details directly for static code analysis:

```
# Required metadata sonar.projectKey=java-sonar-runner-simple
sonar.projectName=Java project analyzed with the SonarQube Runner
sonar.projectVersion=1.0 # Comma-separated paths to directories with sources
(required) sonar.sources=src # Encoding of the source files
sonar.sourceEncoding=UTF-8
```



Build

Execute SonarQube Scanner

Task to run:

JDK: (Inherit From Job)

JDK to be used for this SonarQube analysis

Path to project properties:

Analysis properties:

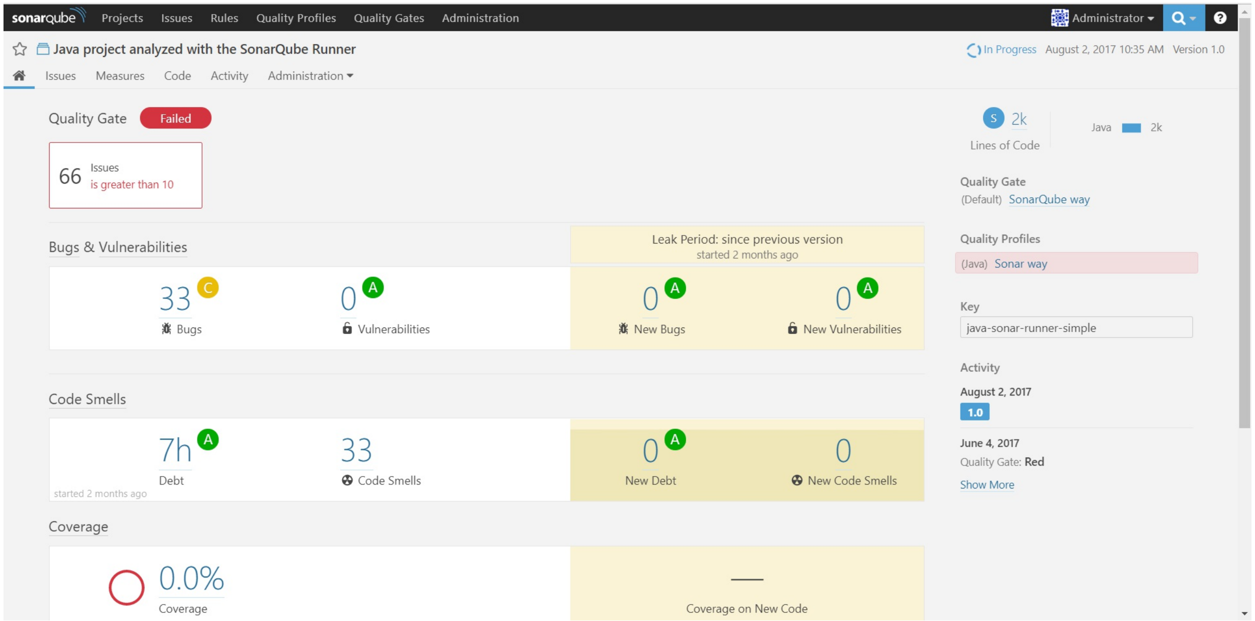
```
# Language
sonar.language=java

# Encoding of the source files
sonar.sourceEncoding=UTF-8
```

Additional arguments:

JVM Options:

6. Click on Save and then Build now.
7. Go to the SonarQube dashboard and check Quality Gate and Quality Profiles:



Java project analyzed with the SonarQube Runner

In Progress August 2, 2017 10:35 AM Version 1.0

Quality Gate Failed

66 Issues is greater than 10

Bugs & Vulnerabilities

Leak Period: since previous version
started 2 months ago

33 C Bugs	0 A Vulnerabilities	0 A New Bugs	0 A New Vulnerabilities

Code Smells

7h A Debt started 2 months ago	33 Code Smells	0 A New Debt	0 New Code Smells

Coverage

0.0% Coverage	— Coverage on New Code

S 2k Lines of Code

Java 2k

Quality Gate
(Default) SonarQube way

Quality Profiles
(Java) Sonar way

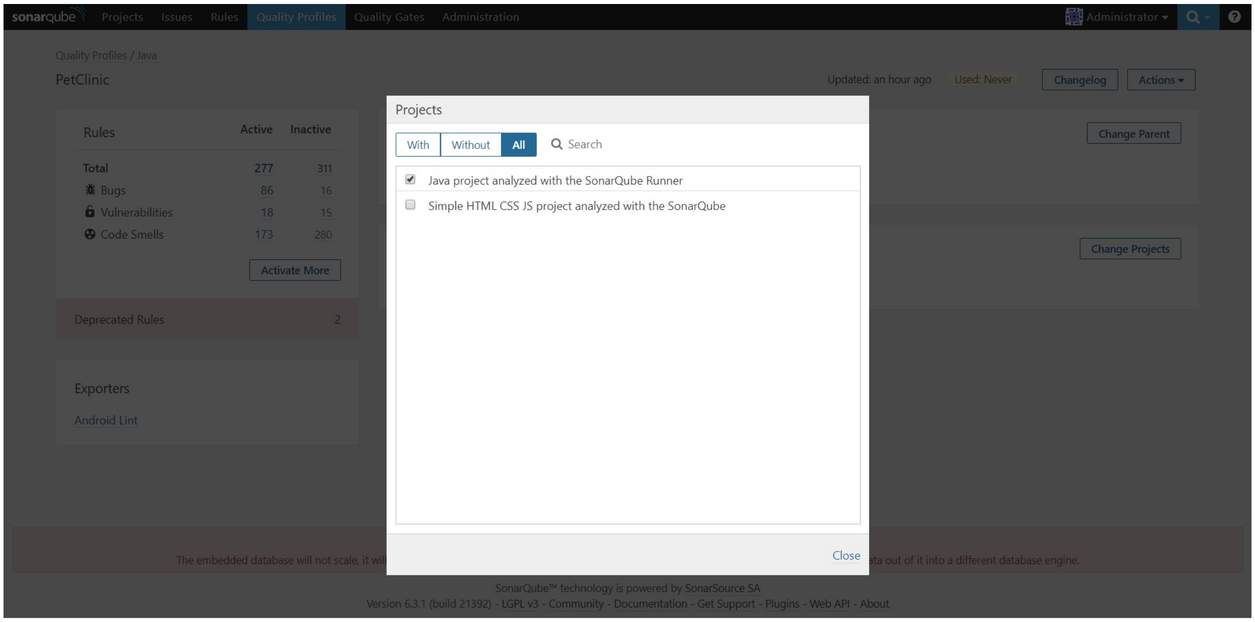
Key
java-sonar-runner-simple

Activity
August 2, 2017
1.0

June 4, 2017
Quality Gate: Red

Show More

8. Now go to PetClinic Quality Profile and click on Change Projects.
9. Select Java project analyzed with the SonarQube Runner and click on Close:



Rules	Active	Inactive
Total	277	311
Bugs	86	16
Vulnerabilities	18	15
Code Smells	173	280

Deprecated Rules	2

☑ Java project analyzed with the SonarQube Runner

☐ Simple HTML CSS JS project analyzed with the SonarQube

The embedded database will not scale, it wil … ata out of it into a different database engine.

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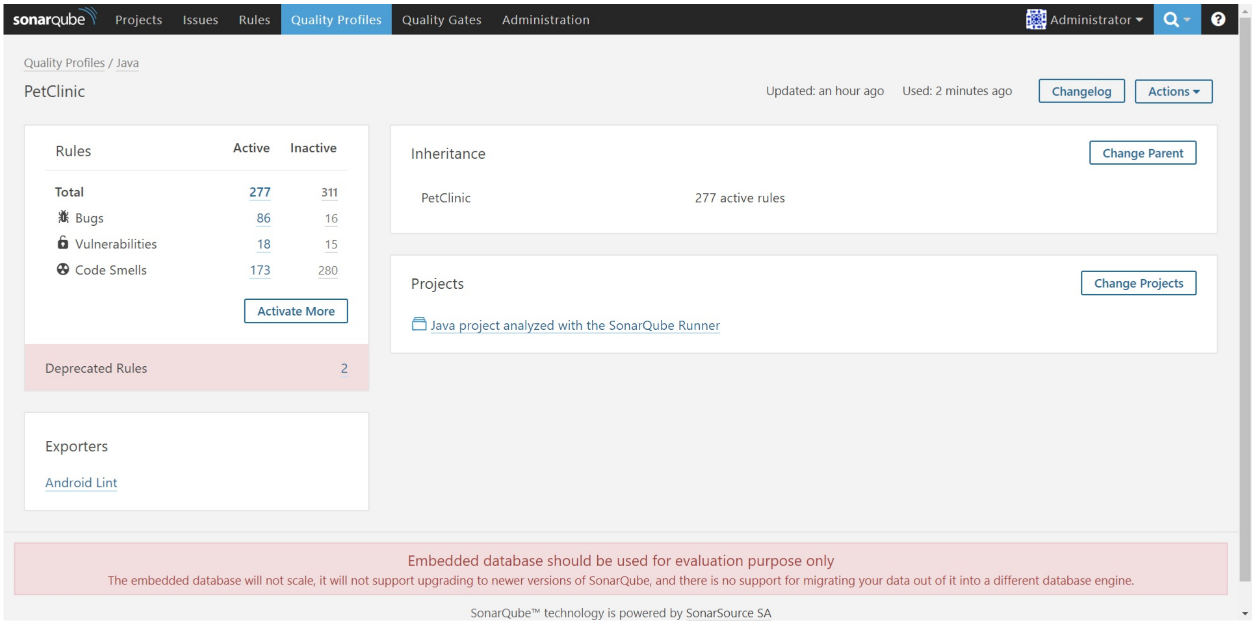
10. Check the Projects in PetClinic Quality Profiles:



Quality Profiles / Java

PetClinic

Updated: an hour ago   Used: 2 minutes ago

Rules	Active	Inactive
Total	277	311
Bugs	86	16
Vulnerabilities	18	15
Code Smells	173	280

Deprecated Rules 2

Exporters

Android Lint

Inheritance

PetClinic   277 active rules

Projects

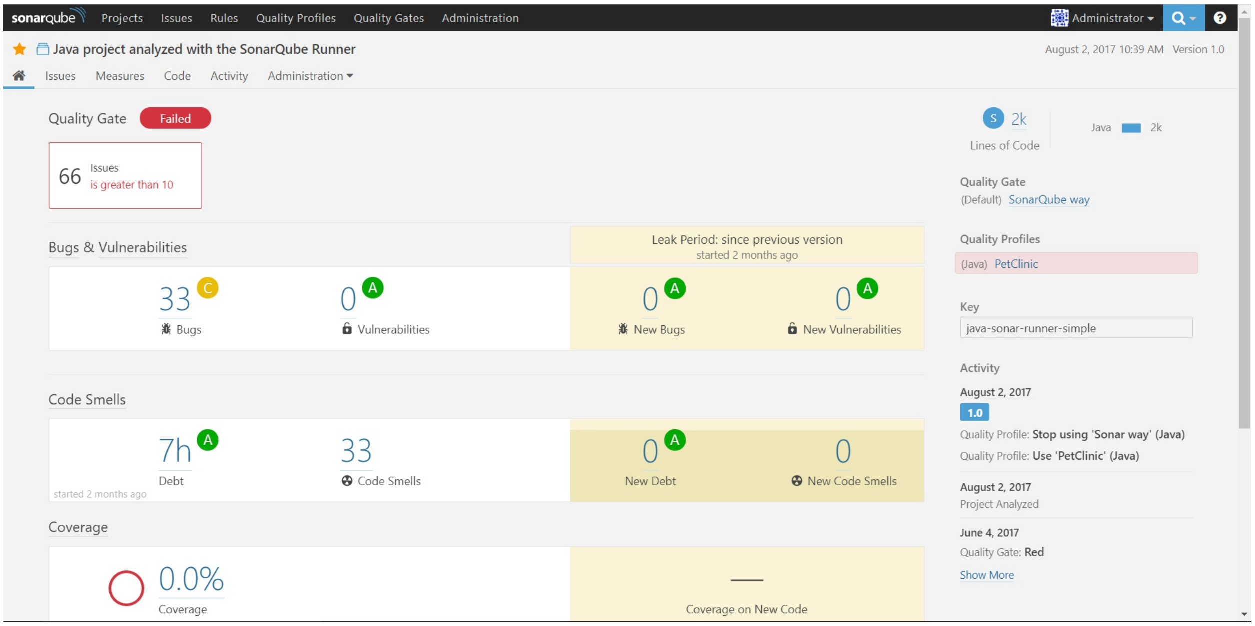
Java project analyzed with the SonarQube Runner

Embedded database should be used for evaluation purpose only

The embedded database will not scale, it will not support upgrading to newer versions of SonarQube, and there is no support for migrating your data out of it into a different database engine.

SonarQube™ technology is powered by SonarSource SA

11. Go to Jenkins and click on Build now:



Java project analyzed with the SonarQube Runner

August 2, 2017 10:39 AM Version 1.0

Quality Gate Failed

66 Issues is greater than 10

Bugs & Vulnerabilities

Leak Period: since previous version
started 2 months ago

33 C Bugs

0 A Vulnerabilities

0 A New Bugs

0 A New Vulnerabilities

Code Smells

7h A Debt

started 2 months ago

33 Code Smells

0 A New Debt

0 New Code Smells

Coverage

0.0% Coverage

— Coverage on New Code

2k Lines of Code

Java 2k

Quality Gate
(Default) SonarQube way

Quality Profiles
(Java) PetClinic

Key
java-sonar-runner-simple

Activity

August 2, 2017
1.0
Quality Profile: Stop using 'Sonar way' (Java)
Quality Profile: Use 'PetClinic' (Java)

August 2, 2017
Project Analyzed

June 4, 2017
Quality Gate: Red

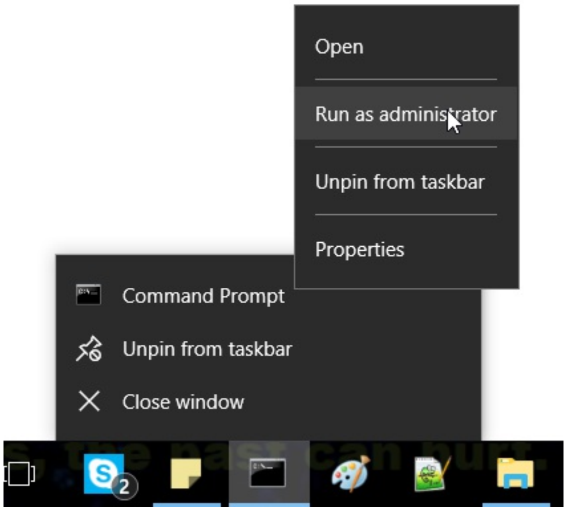
12. Create a new quality gate and assign the quality gate to the Java project.
13. We don't need to mention the language explicitly as SonarQube is intelligent enough to find the programming language and analyze it based on the default profiles.

Configuring SonarQube as a Windows service

It is a pain to start SonarQube every time we start the system. It is better to have a situation where SonarQube has started automatically when the system is started.

Getting ready

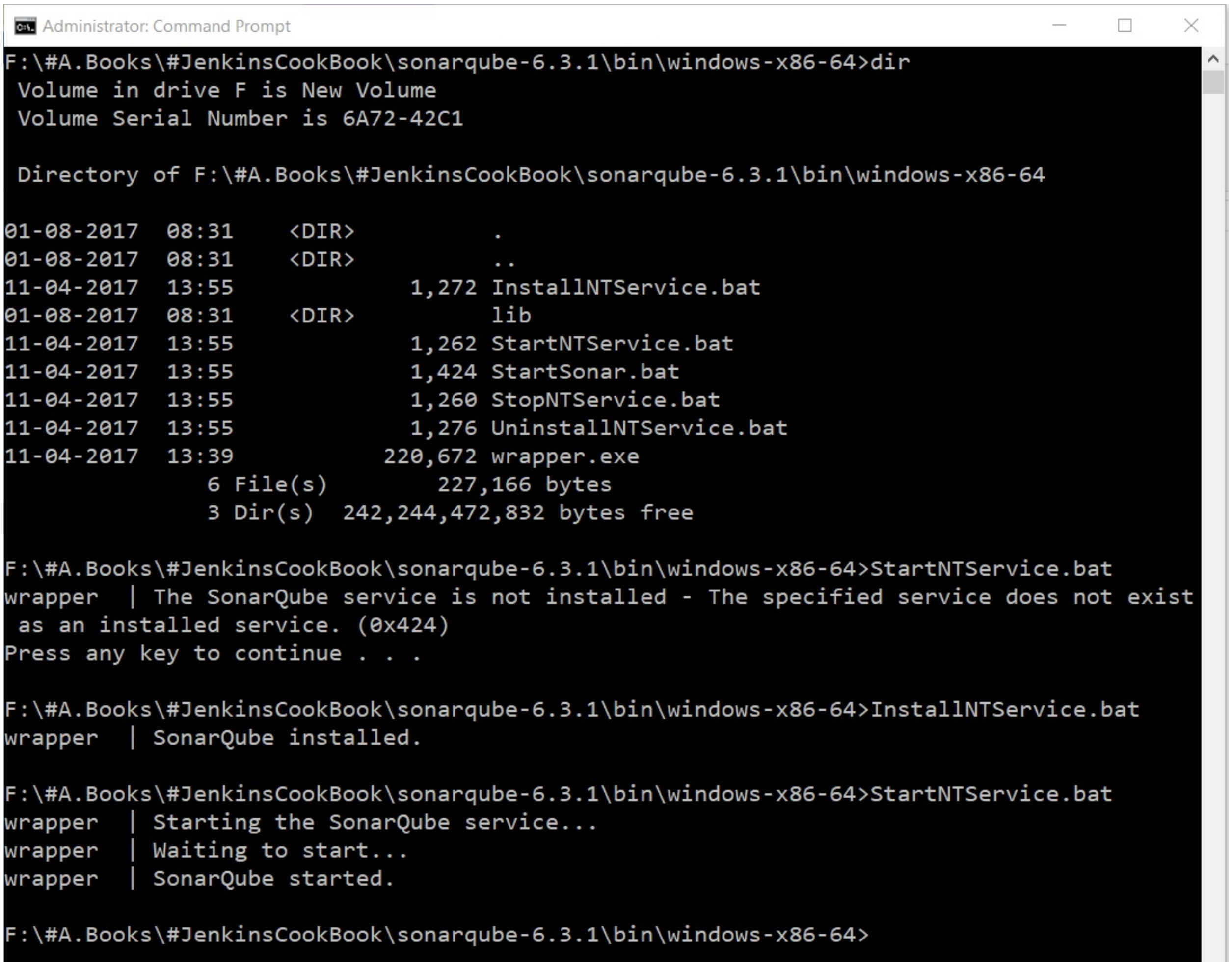
Open Command Prompt by selecting Run as administrator:



It is important to start Command Prompt as Administrator.

How to do it...

1. Go to `SonarQube` | `bin` | `Specific OS Directory` | `Execute InstallNTService`:

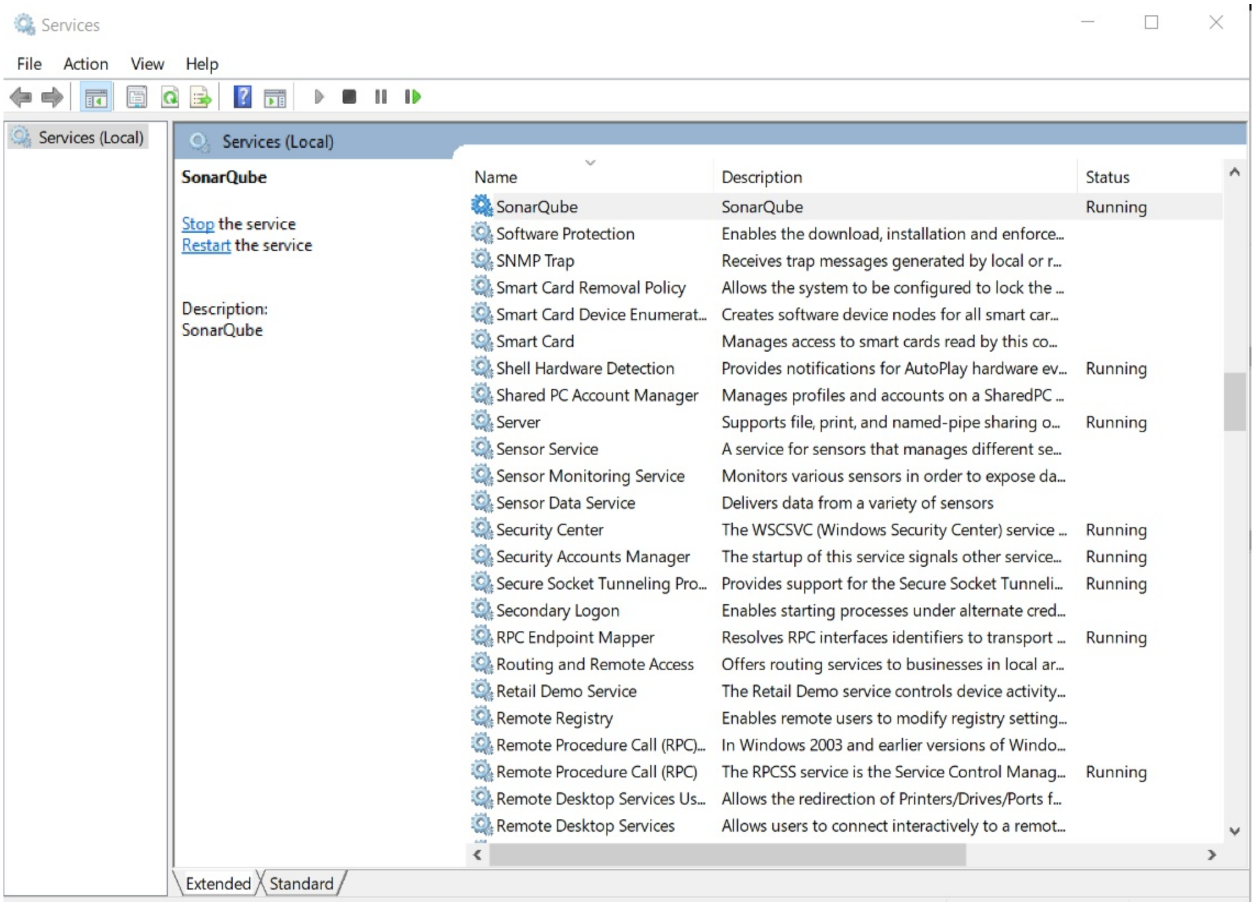


```
F:\#A.Books\#JenkinsCookBook\sonarqube-6.3.1\bin\windows-x86-64>dir
 Volume in drive F is New Volume
 Volume Serial Number is 6A72-42C1

 Directory of F:\#A.Books\#JenkinsCookBook\sonarqube-6.3.1\bin\windows-x86-64

01-08-2017  08:31    <DIR>          .
01-08-2017  08:31    <DIR>          ..
11-04-2017  13:55             1,272 InstallNTService.bat
01-08-2017  08:31    <DIR>          lib
11-04-2017  13:55             1,262 StartNTService.bat
11-04-2017  13:55             1,424 StartSonar.bat
11-04-2017  13:55             1,260 StopNTService.bat
11-04-2017  13:55             1,276 UninstallNTService.bat
11-04-2017  13:39           220,672 wrapper.exe
               6 File(s)        227,166 bytes
               3 Dir(s)  242,244,472,832 bytes free

F:\#A.Books\#JenkinsCookBook\sonarqube-6.3.1\bin\windows-x86-64>StartNTService.bat
wrapper  | The SonarQube service is not installed - The specified service does not exist
 as an installed service. (0x424)
Press any key to continue . . .

F:\#A.Books\#JenkinsCookBook\sonarqube-6.3.1\bin\windows-x86-64>InstallNTService.bat
wrapper  | SonarQube installed.

F:\#A.Books\#JenkinsCookBook\sonarqube-6.3.1\bin\windows-x86-64>StartNTService.bat
wrapper  | Starting the SonarQube service...
wrapper  | Waiting to start...
wrapper  | SonarQube started.

F:\#A.Books\#JenkinsCookBook\sonarqube-6.3.1\bin\windows-x86-64>
```

2. Execute `StartNTService.bat`.

There's more

Go to Services in Windows, and verify whether the SonarQube service is available now or not:



SonarQube

Stop the service
Restart the service

Description:
SonarQube

Name	Description	Status
SonarQube	SonarQube	Running
Software Protection	Enables the download, installation and enforce...	
SNMP Trap	Receives trap messages generated by local or r...	
Smart Card Removal Policy	Allows the system to be configured to lock the ...	
Smart Card Device Enumerat...	Creates software device nodes for all smart car...	
Smart Card	Manages access to smart cards read by this co...	
Shell Hardware Detection	Provides notifications for AutoPlay hardware ev...	Running
Shared PC Account Manager	Manages profiles and accounts on a SharedPC ...	
Server	Supports file, print, and named-pipe sharing o...	Running
Sensor Service	A service for sensors that manages different se...	
Sensor Monitoring Service	Monitors various sensors in order to expose da...	
Sensor Data Service	Delivers data from a variety of sensors	
Security Center	The WSCSVC (Windows Security Center) service ...	Running
Security Accounts Manager	The startup of this service signals other service...	Running
Secure Socket Tunneling Pro...	Provides support for the Secure Socket Tunneli...	Running
Secondary Logon	Enables starting processes under alternate cred...	
RPC Endpoint Mapper	Resolves RPC interfaces identifiers to transport ...	Running
Routing and Remote Access	Offers routing services to businesses in local ar...	
Retail Demo Service	The Retail Demo service controls device activity...	
Remote Registry	Enables remote users to modify registry setting...	
Remote Procedure Call (RPC)...	In Windows 2003 and earlier versions of Windo...	
Remote Procedure Call (RPC)	The RPCSS service is the Service Control Manag...	Running
Remote Desktop Services Us...	Allows the redirection of Printers/Drives/Ports f...	
Remote Desktop Services	Allows users to connect interactively to a remot...	

You can start, stop, or restart services once it is available.

Building Applications in Jenkins

In this chapter, we will cover the following recipes:

- Configuring an Ant project for execution
- Configuring a Maven project for execution
- Configuring an Android project for execution
- Manipulating environmental variables
- Running Ant through Groovy in Maven
- Failed Jenkins jobs based on JSP syntax errors
- Remotely triggering jobs through the Jenkins API

Introduction

This chapter reviews the relationship between Jenkins, Ant, Gradle, and Maven builds, and there is also a small amount of scripting with Groovy and Ant.

Jenkins is the master of flexibility. It works well across multiple platforms and technologies. Jenkins has an intuitive interface with clear configuration settings. This is great for getting the job done. However, it is also important that you clearly define the boundaries between Jenkins plugins and Maven build files. A lack of separation will make you unnecessarily dependent on Jenkins. If you know that you will always run your builds through Jenkins, then you can afford to place some of the core work in Jenkins plugins, gaining interesting extra functionality.

Jenkins is technology agnostic and can glue together project technologies across the organization, development teams, and software position in their life cycle. Jenkins lets you run scripting languages of choice, and makes it easy to pull in source code using Git, Subversion, CVS, and a number of other version control systems. If Jenkins is not compatible, developers with a little practice can write their own integration.

In this book, you will see both Subversion and Git projects mentioned. This represents a realistic mix. Many consider Git more versatile than Subversion. Feel free to use Git as your repository of choice for the examples in this book. Designed in from the start, Jenkins makes it easy for you to choose between the different revision control systems.

If you look at the relative use of Git and Subversion for a representative collection from Ohoh in early 2014, for Git there were 247,103 repositories (37 percent of the total) and Subversion had 324,895 repositories (48 percent of the total).

Typical enterprises lag behind when using the most modern offerings because of their resistance to changing their working processes. Therefore, expect this category of businesses to have a higher percentage of Subversion repositories compared to smaller organizations.

Configuring an Ant project for execution

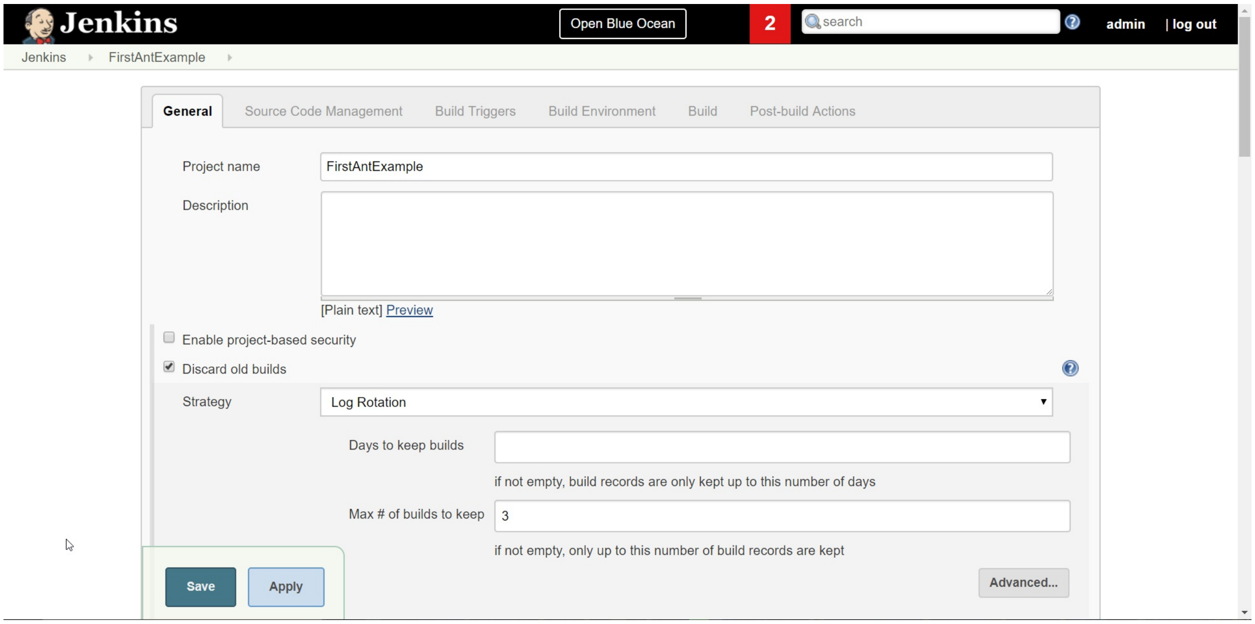
Let's configure an Ant project in Jenkins with static code analysis, compilation of files, creation of a package file, and archiving it so you can use it later in another build job or project.

Getting ready

You have already created an Ant project in Jenkins in Chapter 1, *Getting Started with Jenkins* in the recipe *Creating a Freestyle Job for an Ant project*.

How to do it...

1. Go to Jenkins dashboard | Ant project | General section.
2. Select Discard old builds | Configure Max # of builds to keep (to avoid too many builds and save disk space):



Project name: FirstAntExample

Description:

[Plain text] Preview

□ Enable project-based security

☑ Discard old builds

Strategy: Log Rotation

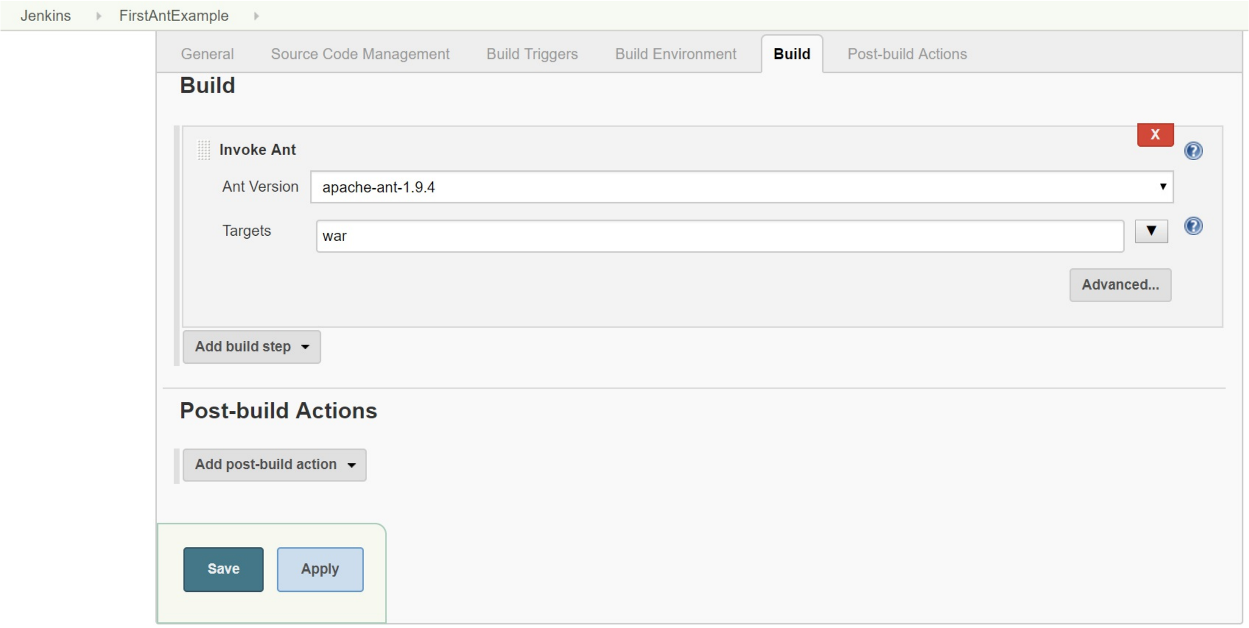
Days to keep builds:

if not empty, build records are only kept up to this number of days

Max # of builds to keep: 3

if not empty, only up to this number of build records are kept

3. Go to Build | Add build step | Invoke Ant | Provide Targets based on the `build.xml`:



Build

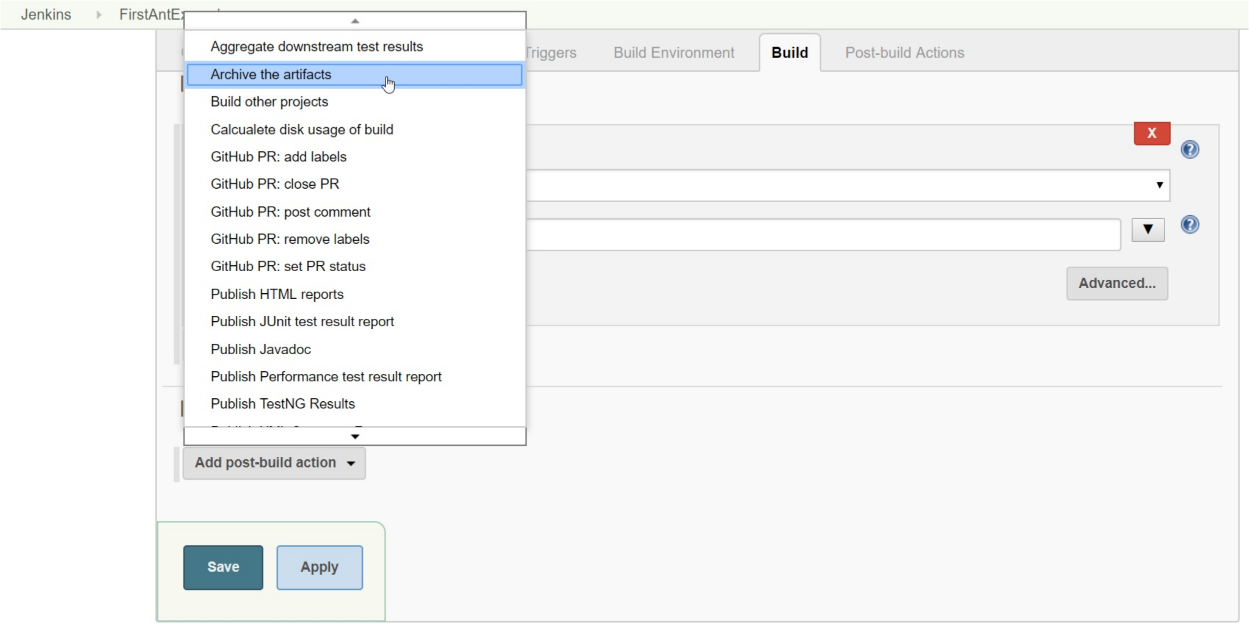
Invoke Ant

Ant Version: apache-ant-1.9.4

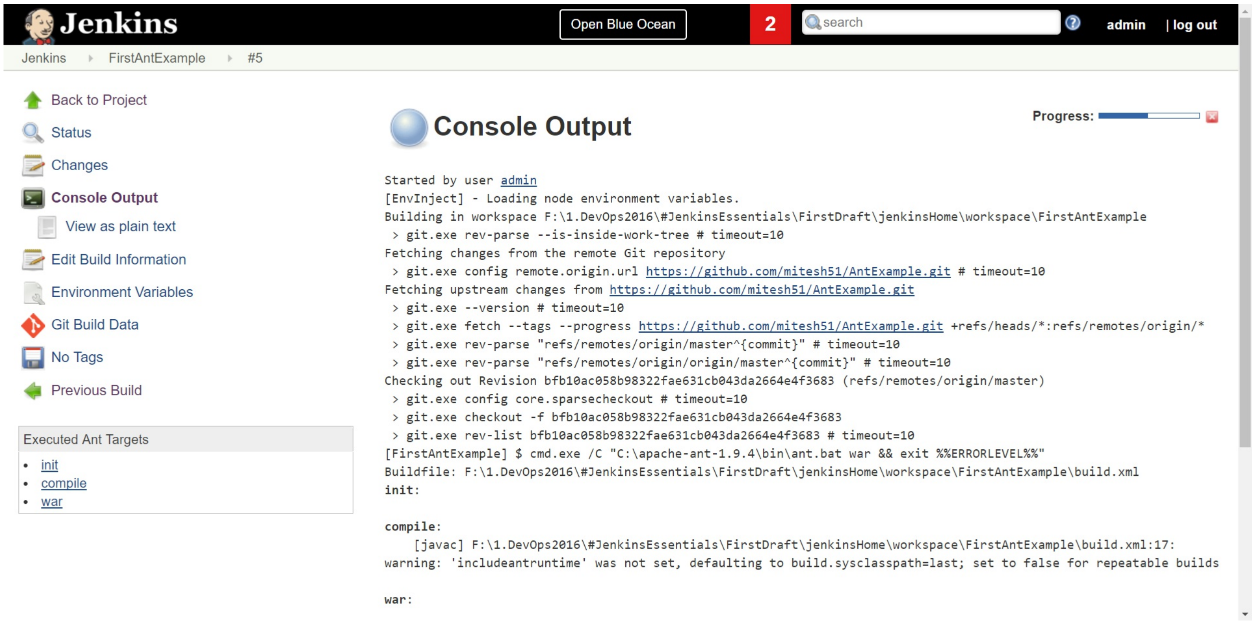
Targets: war

Post-build Actions

4. Go to Post-build Actions | Add post-build action | Archive the artifacts.
5. Provide the path of the `.WAR` file that needs to be archived so another project can utilize the package file if required:



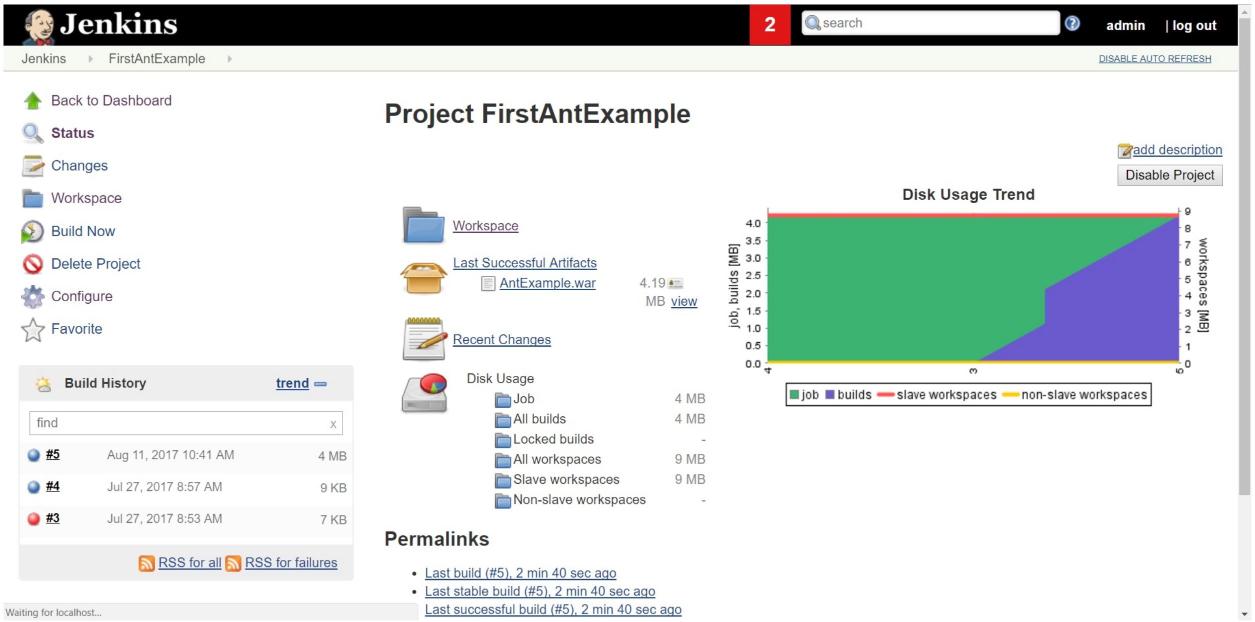
6. Click on Build now.
7. Go to Console Output (as shown in the following screenshot) and verify the build execution log for all the operations or actions that we have configured:



Console Output

```
Started by user admin
[EnvInject] - Loading node environment variables.
Building in workspace F:\1.DevOps2016\#JenkinsEssentials\FirstDraft\jenkinsHome\workspace\FirstAntExample
 > git.exe rev-parse --is-inside-work-tree # timeout=10
Fetching changes from the remote Git repository
 > git.exe config remote.origin.url https://github.com/mitesh51/AntExample.git # timeout=10
Fetching upstream changes from https://github.com/mitesh51/AntExample.git
 > git.exe --version # timeout=10
 > git.exe fetch --tags --progress https://github.com/mitesh51/AntExample.git +refs/heads/*:refs/remotes/origin/*
 > git.exe rev-parse "refs/remotes/origin/master^{commit}" # timeout=10
 > git.exe rev-parse "refs/remotes/origin/origin/master^{commit}" # timeout=10
Checking out Revision bfb10ac058b98322fae631cb043da2664e4f3683 (refs/remotes/origin/master)
 > git.exe config core.sparsecheckout # timeout=10
 > git.exe checkout -f bfb10ac058b98322fae631cb043da2664e4f3683
 > git.exe rev-list bfb10ac058b98322fae631cb043da2664e4f3683 # timeout=10
[FirstAntExample] $ cmd.exe /C "C:\apache-ant-1.9.4\bin\ant.bat war && exit %%ERRORLEVEL%%"
Buildfile: F:\1.DevOps2016\#JenkinsEssentials\FirstDraft\jenkinsHome\workspace\FirstAntExample\build.xml
init:

compile:
    [javac] F:\1.DevOps2016\#JenkinsEssentials\FirstDraft\jenkinsHome\workspace\FirstAntExample\build.xml:17:
warning: 'includeantruntime' was not set, defaulting to build.sysclasspath=last; set to false for repeatable builds

war:
```

8. Go to Project dashboard and verify the number of builds in the Build History, in the bottom left-hand corner. Go to Project dashboard and verify Workspace. You will find the package file. Both are demonstrated in this screenshot:



Jenkins

2 | search | admin | log out

Jenkins ▸ FirstAntExample ▸

DISABLE AUTO REFRESH

- Back to Dashboard
- Status
- Changes
- Workspace
- Build Now
- Delete Project
- Configure
- Favorite

Build History trend

find x

#5	Aug 11, 2017 10:41 AM	4 MB
#4	Jul 27, 2017 8:57 AM	9 KB
#3	Jul 27, 2017 8:53 AM	7 KB

RSS for all RSS for failures

Waiting for localhost...

Project FirstAntExample

add description

Disable Project

Workspace

Last Successful Artifacts

AntExample.war 4.19 MB view

Recent Changes

Disk Usage

Job	4 MB
All builds	4 MB
Locked builds	-
All workspaces	9 MB
Slave workspaces	9 MB
Non-slave workspaces	-

Disk Usage Trend

Permalinks

- Last build (#5), 2 min 40 sec ago
- Last stable build (#5), 2 min 40 sec ago
- Last successful build (#5), 2 min 40 sec ago

There's more...

- Check the Console Output, given here in depth. All the targets mentioned in `build.xml` are available:

```
buildfile:
F:\1.DevOps2016\#JenkinsEssentials\FirstDraft\jenkinsHome\workspace\FirstAntExamp
init:
compile:
    [javac]
F:\1.DevOps2016\#JenkinsEssentials\FirstDraft\jenkinsHome\workspace\FirstAntExamp
 warning: 'includeantruntime' was not set, defaulting to
build.sysclasspath=last; set to false for repeatable builds war:
BUILD SUCCESSFUL
Total time: 1 second
Archiving artifacts
Started calculation of disk usage of build
Finished calculation of disk usage of build in 0 seconds
Started calculation of disk usage of workspace
Finished calculation of disk usage of workspace in 0 seconds
Finished: SUCCESS
```

- Once the build is successful, the artifact or the package file was recovered successfully.

Configuring a Maven project for execution

Let's configure a Maven project in Jenkins with static code analysis, compilation of files, creation of the package file, and archiving it so you can use it later in another build job or project.

Getting ready

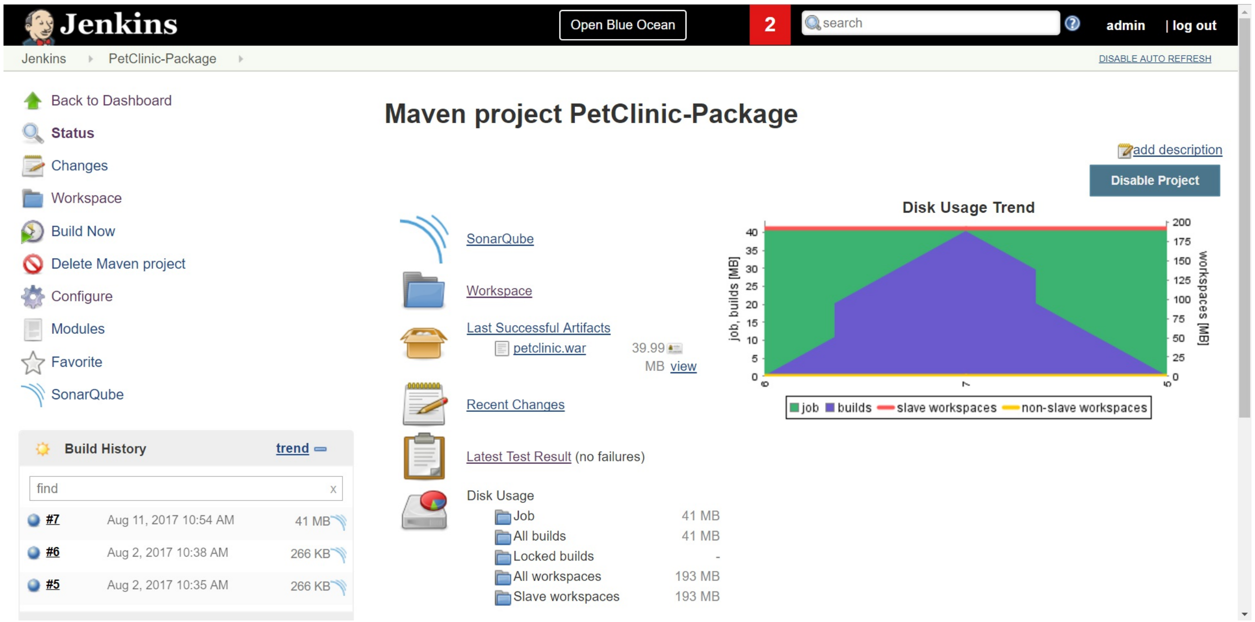
You have already created a Maven project in Jenkins in Chapter 1, *Getting Started with Jenkins*, in the recipe, *Creating a Maven Job for a Maven project*.

How to do it...

1. Go to Jenkins dashboard | Maven Project | General Section.
2. Select Discard old builds | Configure Max # of builds to keep (to avoid too many builds and save disk space).
3. As the Maven template was selected at the time the build job or project was created, we only need to verify the path of `pom.xml` and then we can give package as a goal to create a package or WAR file in case of Java.
4. Go to Post-build Actions | Add post-build action | Archive the artifacts.
5. Provide the path of the war file that needs to be archived so another project can utilize the package file if required.
6. Click on Build now.
7. Go to Console Output and verify the build execution log for all the operations or actions that we have configured.

```
INFO: Task total time: 1:02.260 s
INFO: ------------------------------------------------------------------------
INFO: EXECUTION SUCCESS
INFO: ------------------------------------------------------------------------
INFO: Total time: 1:37.380s
INFO: Final Memory: 51M/223M
INFO: ------------------------------------------------------------------------
Archiving artifacts
Started calculation of disk usage of build
Finished calculation of disk usage of build in 0 seconds
Started calculation of disk usage of workspace
Finished calculation of disk usage of workspace in 0 seconds
Finished: SUCCESS
```

8. Go to the Project dashboard and verify the number of builds in the Build History:



Maven project PetClinic-Package

petclinic.war 39.99 MB

Latest Test Result (no failures)

Disk Usage

Job	41 MB
All builds	41 MB
Locked builds	-
All workspaces	193 MB
Slave workspaces	193 MB

Build History

find

#7	Aug 11, 2017 10:54 AM	41 MB
#6	Aug 2, 2017 10:38 AM	266 KB
#5	Aug 2, 2017 10:35 AM	266 KB

9. Go to the Project dashboard and check Workspace. You will find the `package` file.

Configuring an Android project for execution

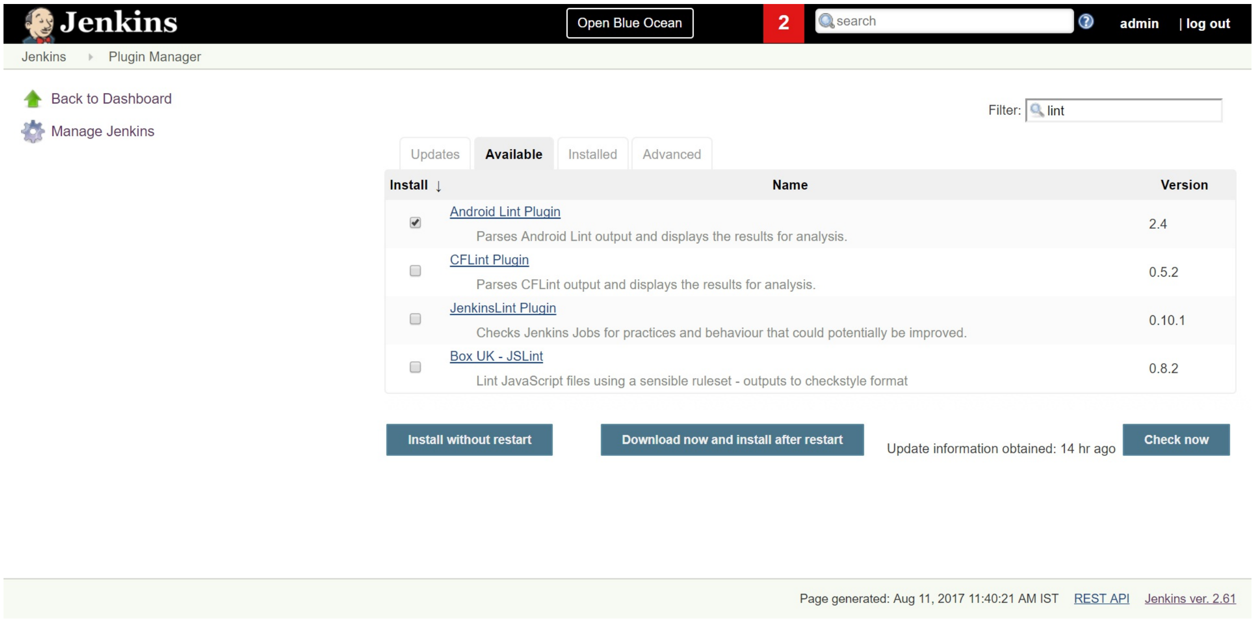
You have already created a Freestyle project in Jenkins in Chapter 1, *getting Started with Jenkins*, in the recipe *Creating a Freestyle Job for an Ant project*. You need to create Freestyle project for an Android project.

Getting ready

You can use Android Lint for static code analysis. Before configuring Continuous Integration, install the required plugins.

Go to Jenkins dashboard | Manage Jenkins | ManagePlugins | Available

Install the Android Lint plugin:

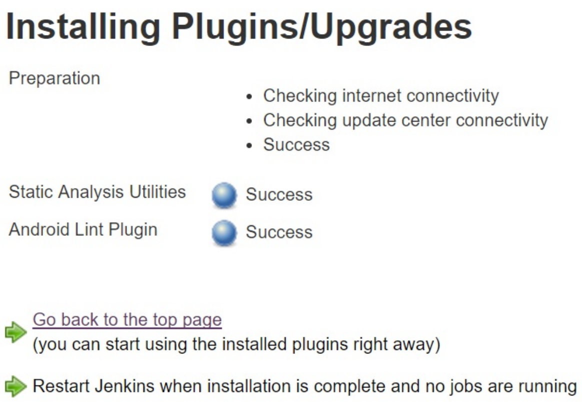


Install ↓	Name	Version
☑	Android Lint Plugin Parses Android Lint output and displays the results for analysis.	2.4
□	CFLint Plugin Parses CFLint output and displays the results for analysis.	0.5.2
□	JenkinsLint Plugin Checks Jenkins Jobs for practices and behaviour that could potentially be improved.	0.10.1
□	Box UK - JSLint Lint JavaScript files using a sensible ruleset - outputs to checkstyle format	0.8.2

Update information obtained: 14 hr ago

Page generated: Aug 11, 2017 11:40:21 AM IST REST API Jenkins ver. 2.61

Wait until the plugin has been installed successfully:



Installing Plugins/Upgrades

Preparation

- Checking internet connectivity
- Checking update center connectivity
- Success

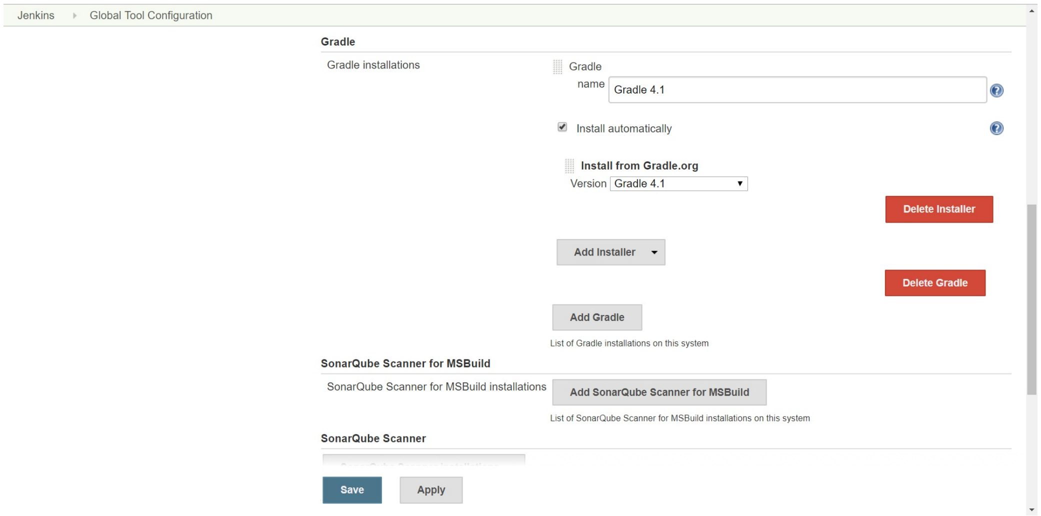
Static Analysis Utilities ● Success

Android Lint Plugin ● Success

Go back to the top page
(you can start using the installed plugins right away)

Restart Jenkins when installation is complete and no jobs are running

Go to Jenkins dashboard | Manage Jenkins | Global Tool Configuration | Gradle | Add Gradle, as shown in this screenshot:



Gradle

Gradle installations

Gradle
name Gradle 4.1

☑ Install automatically

Install from Gradle.org
Version Gradle 4.1

List of Gradle installations on this system

SonarQube Scanner for MSBuild

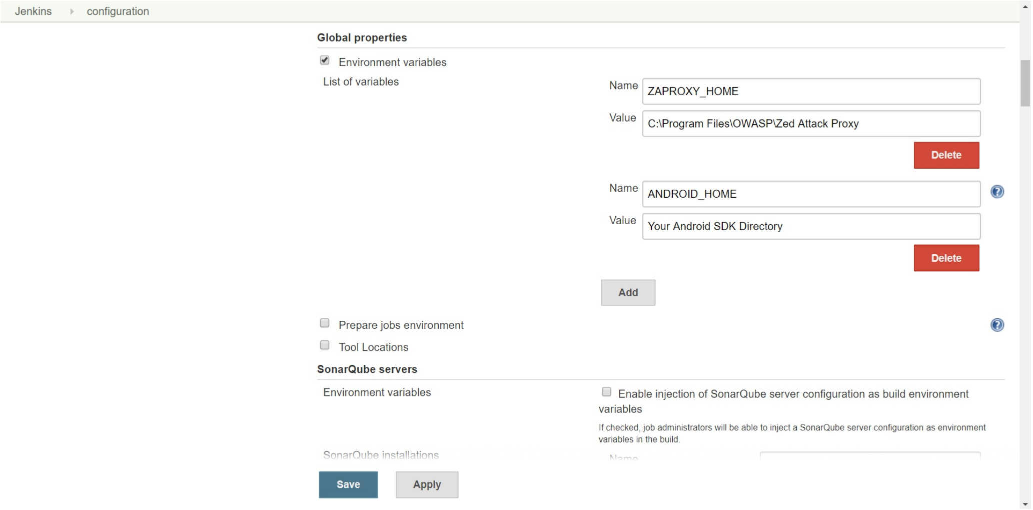
SonarQube Scanner for MSBuild installations

List of SonarQube Scanner for MSBuild installations on this system

SonarQube Scanner

Go to Jenkins dashboard | Manage Jenkins|Configure system | Global properties | Environment variables.

Provide the Android SDK path for `ANDROID_HOME`:



Jenkins ▸ configuration

Global properties

☑ Environment variables

List of variables

Name: ZAPROXY_HOME

Value: C:\Program Files\OWASP\Zed Attack Proxy

Name: ANDROID_HOME

Value: Your Android SDK Directory

□ Prepare jobs environment

□ Tool Locations

SonarQube servers

Environment variables: □ Enable injection of SonarQube server configuration as build environment variables

If checked, job administrators will be able to inject a SonarQube server configuration as environment variables in the build.

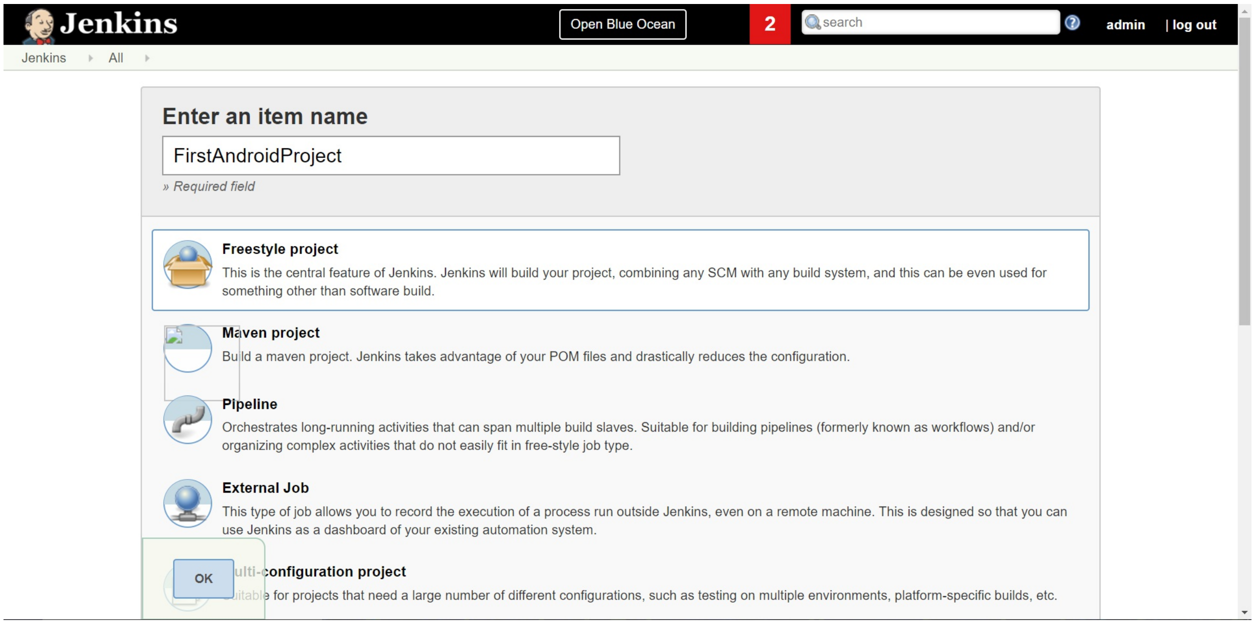
SonarQube installations

Name

Now, you can configure the Android build and code analysis using Lint and publish the Android Lint results in Jenkins.

How to do it...

1. Go to Jenkins dashboard | New Item | Freestyle project:



Enter an item name

FirstAndroidProject

» Required field

Freestyle project
This is the central feature of Jenkins. Jenkins will build your project, combining any SCM with any build system, and this can be even used for something other than software build.

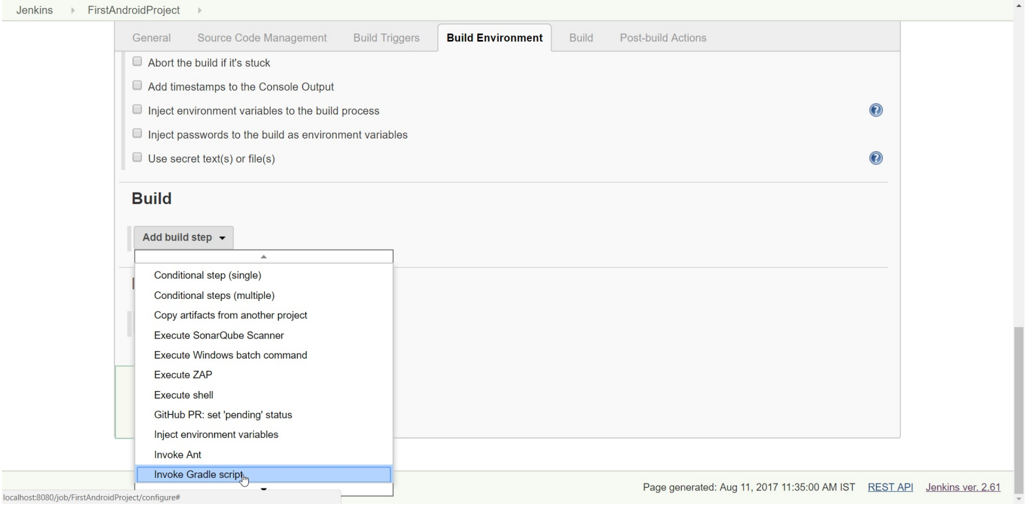
Maven project
Build a maven project. Jenkins takes advantage of your POM files and drastically reduces the configuration.

Pipeline
Orchestrates long-running activities that can span multiple build slaves. Suitable for building pipelines (formerly known as workflows) and/or organizing complex activities that do not easily fit in free-style job type.

External Job
This type of job allows you to record the execution of a process run outside Jenkins, even on a remote machine. This is designed so that you can use Jenkins as a dashboard of your existing automation system.

Multi-configuration project
Suitable for projects that need a large number of different configurations, such as testing on multiple environments, platform-specific builds, etc.

2. Go to Build Environment | Add build step | Invoke Gradle script:


Jenkins
FirstAndroidProject
General
Source Code Management
Build Triggers
Build Environment
Build
Post-build Actions
Build
Add build step
Conditional step (single)
Conditional steps (multiple)
Copy artifacts from another project
Execute SonarQube Scanner
Execute Windows batch command
Execute ZAP
Execute shell
GitHub PR: set 'pending' status
Inject environment variables
Invoke Ant
Invoke Gradle script
REST API
Jenkins ver. 2.61
localhost:8080/job/FirstAndroidProject/configure#

□ Abort the build if it's stuck

□ Add timestamps to the Console Output

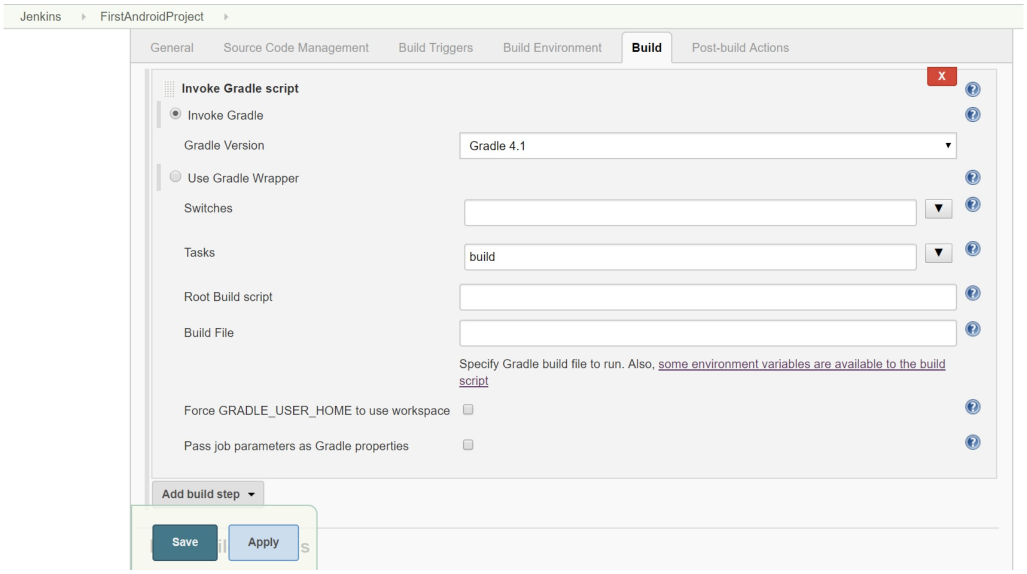
□ Inject environment variables to the build process

□ Inject passwords to the build as environment variables

□ Use secret text(s) or file(s)

Page generated: Aug 11, 2017 11:35:00 AM IST

3. Select Gradle version.
4. Write `build` in the Tasks bar and then click Save. Click on Build now to execute the Android build and create an APK file:



Invoke Gradle script

● Invoke Gradle

Gradle Version: Gradle 4.1

○ Use Gradle Wrapper

Switches:

Tasks: build

Root Build script:

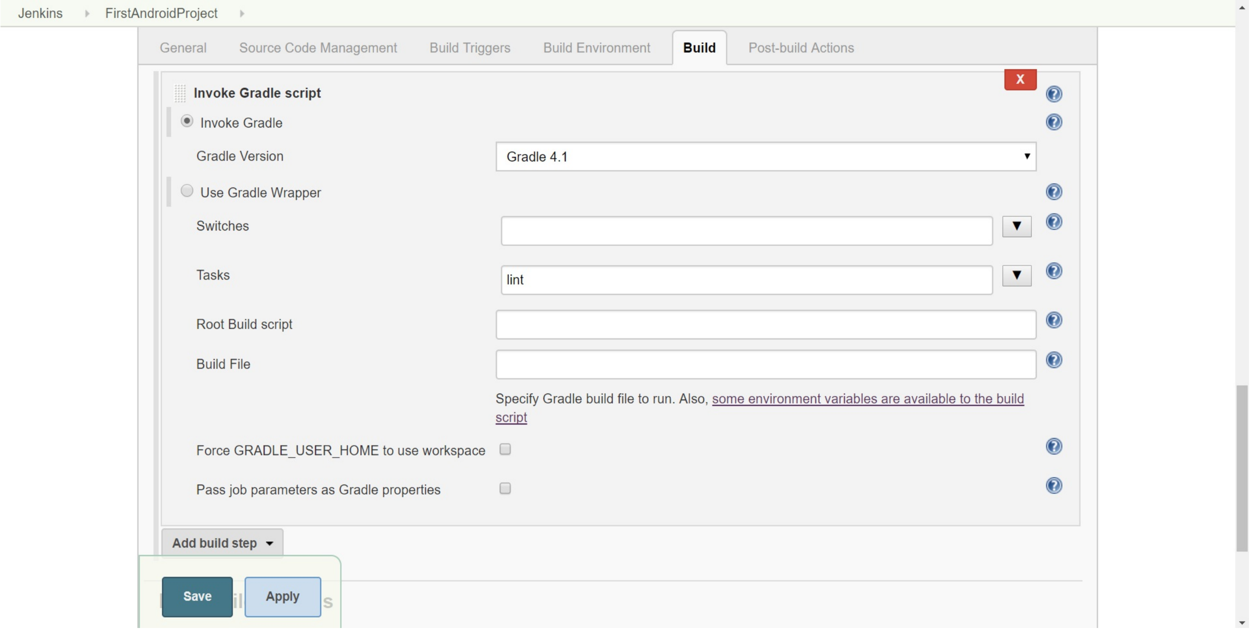
Build File:

Specify Gradle build file to run. Also, some environment variables are available to the build script

Force GRADLE_USER_HOME to use workspace □

Pass job parameters as Gradle properties □

5. To analyze the code with Android Lint, use lint in the Tasks bar:



Invoke Gradle script

● Invoke Gradle

Gradle Version: Gradle 4.1

○ Use Gradle Wrapper

Switches:

Tasks: lint

Root Build script:

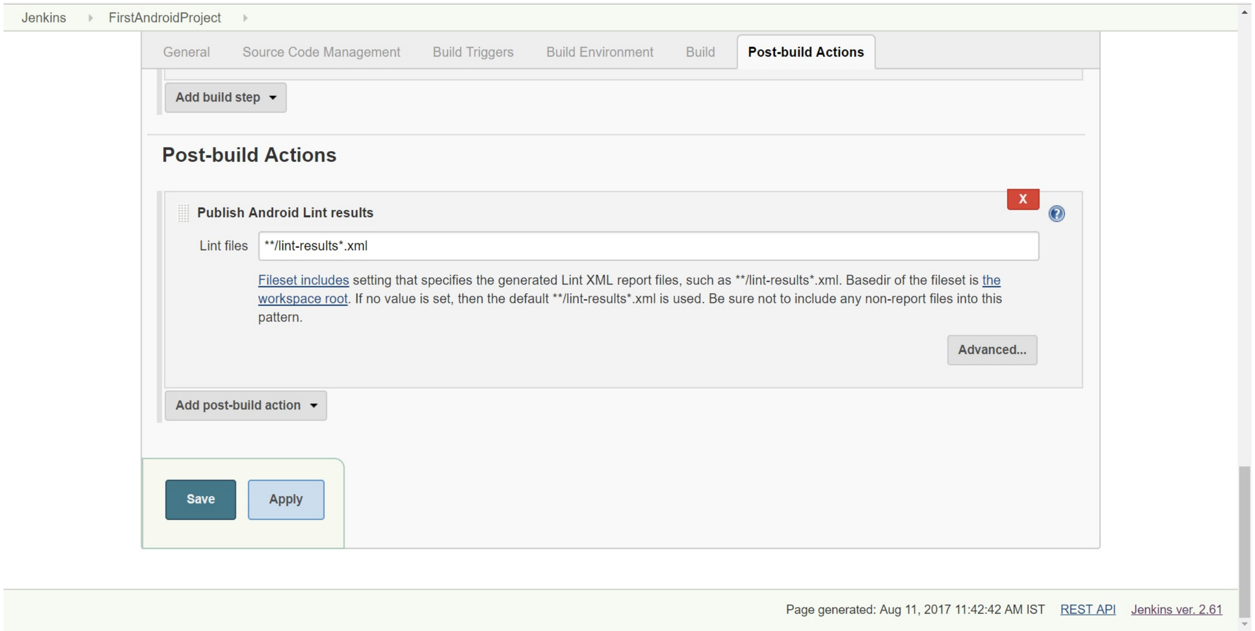
Build File:

Specify Gradle build file to run. Also, some environment variables are available to the build script

Force GRADLE_USER_HOME to use workspace □

Pass job parameters as Gradle properties □

6. Publish Android Lint results from Post-build Actions, as demonstrated in the following screenshot:



Post-build Actions

Publish Android Lint results

Lint files: **/lint-results*.xml

Fileset includes setting that specifies the generated Lint XML report files, such as **/lint-results*.xml. Basedir of the fileset is the workspace root. If no value is set, then the default **/lint-results*.xml is used. Be sure not to include any non-report files into this pattern.

Page generated: Aug 11, 2017 11:42:42 AM IST

7. In this way, we can configure Ant, Maven, and Android projects for Continuous Integration or execution to create a package file that we can distribute or deploy.

Manipulating environmental variables

This recipe shows you how to pass variables from Jenkins to your build job, and how different variables are overwritten. It also describes one way of failing the build if crucial information has not been correctly passed.

In a typical development/acceptance/production environment, you will want to keep the same `pom.xml` files, but pass different configurations. One example is the extension names of property files such as `.dev`, `.acc`, and `.prd`. You would want to fail the build if critical configuration values are missing due to human error.

Jenkins has a number of plugins for passing information to builds, including the `EnvFile` plugin (https://wiki.jenkins-ci.org/display/JENKINS/Envfile+Plugin) and the `EnvInject` plugin (https://wiki.jenkins-ci.org/display/JENKINS/EnvInject+Plugin). The `EnvInject` plugin was chosen for this recipe as it is reported to work with nodes and offers a wide range of property injection options.

Getting ready

Install the EnvInject plugin (https://wiki.jenkins-ci.org/display/JENKINS/EnvInject+Plugin). Create a recipe directory named ch3.building_software/environment.

How to do it...

1. Create a `pom.xml` file that is readable by Jenkins with the following lines of code:

    ```
    <project xmlns="http://maven.apache.org/POM/4.0.0"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="http://maven.apache.org/POM/4.0.0
    http://maven.apache.org/maven-v4_0_0.xsd">
    <modelVersion>4.0.0</modelVersion>
    <groupId>org.berg</groupId>
    <artifactId>ch3.jenkins.builds.properties</artifactId>
    <version>1.0-SNAPSHOT</version>
    <name>${name.from.jenkins}</name>
    <properties><project.build.sourceEncoding>UTF8</project.build.sourceEncoding>
    </properties>
    <build>
    <plugins><plugin>
    <groupId>org.codehaus.gmaven</groupId>
    <artifactId>gmaven-plugin</artifactId>
    <version>1.3</version>
    <executions><execution>
    <id>run-myGroovy</id>
    <goals><goal>execute</goal></goals>
    <phase>verify</phase>
    <configuration>
    <source>
    def environment = System.getenv()
    println "----Environment"
    environment.each{println it }
    println "----Property"
    println(System.getProperty("longname"))
    println "----Project and session"
    println "Project: ${project.class}"
    println "Session: ${session.class}"
    println "longname: ${project.properties.longname}"
    println "Project name: ${project.name}"
    println "JENKINS_HOME: ${project.properties.JENKINS_HOME}"
    </source>
    </configuration>
    </execution></executions>
    </plugin></plugins>
    </build>
    </project>
    ```

2. Create a file named `my.properties` and place it in the same directory as the `pom.xml` file. Then, add the following lines of code in the `my.properties` file:

    ```
    project.type=prod
    secrets.file=/etc/secrets
    enable.email=true
    JOB_URL=I AM REALLY NOT WHAT I SEEM
    ```

3. Create a blank Freestyle job with the job name `ch3.environment`.

4. In the Source Code Management section, check File System and add a fully qualified path for your directory, such as `/var/lib/jenkins/cookbook/ch3.building_software/environment`, in the Path field.
5. In the Build section, select Add a build step for Invoke top-level Maven targets. In the newly expanded section, add the following details:

    ```
    Maven Version: 3.2.1
    Goals: verify
    ```

6. Click on the Advanced button and type `longname=SuperGood` in Properties.

7. Inject the values in my.properties by selecting the Prepare an environment for the job checkbox (near the top of the job configuration page).
8. For the Properties filepath, add `/full_path/my.properties`, for example,`/home/var/lib/cookbook/ch3.building_software/environment/my.properties`.
9. Run the job. The build will fail:

```
----Project and session
Project: class org.apache.Maven.model.Model
Session: class org.apache.Maven.execution.MavenSession
longname: SuperGood
[INFO] ------------------------------------------------------
[ERROR] BUILD ERROR[INFO] -----------------------------------------------------
-
[INFO] Groovy.lang.MissingPropertyException: No such property: namefor class:
script1315151939046
```

10. In the Build section, for Invoke top-level Maven targets, click on the Advanced button. In the newly expanded section, add an extra property, `name.from.jenkins=The build with a name`.
11. Run the job. It should now succeed.

How it works...

The `EnvInject` plugin is useful for injecting properties into a build.

During the recipe, Maven is run twice. The first time, it is run without the `name.from.jenkins` variable defined, and the Jenkins job fails. The second time, it is run with the variable defined, and the Jenkins job now succeeds.

Maven expects that the `name.from.jenkins` variable is defined, or the name of the project will also not be defined. Normally, this would not be enough to stop your job succeeding. However, when running the Groovy code, the `println` "`Project name: ${project.name}`" line, specifically the `project.name` call, will fail the build. This is great for protecting against missing property values.

The Groovy code can see instances of the `org.apache.Maven.model.Model` project and the `org.apache.Maven.execution.MavenSession` class. The project instance is a model of the XML configuration that you can programmatically access. You can get the longname property by referencing it through `project.properties.longname`. Your Maven goal will fail if the property does not exist. You can also get to the property through the `System.getProperty("longname")` call. However, you cannot get to the property by using the `System.getenv()environment` call.

It is well worth learning the various options:

- **Keep Jenkins environment variables and keep Jenkins build variables**: Both these options affect the Jenkins-related variables that your job sees. It is good to keep your environment as clean as possible as it will aid you in debugging later.
- **Properties content**: You can override specific values in the properties files.
- **Environment script file path**: This option points to a script that will set up your environment. This is useful if you want to detect specific details of the running environment and configure your build accordingly.
- **Populate build cause**: You enable Jenkins to set the `BUILD_CAUSE` environment variable. The variable contains information about the event that triggered the job.

There's more...

Maven has a plugin for reading properties (http://mojo.codehaus.org/properties-maven-plugin/). To choose between property files, you will need to set a variable in the plugin configuration and call it as part of the Jenkins job, as follows:

```
<build>
<plugins>
<plugin>
<groupId>org.codehaus.mojo</groupId>
<artifactId>properties-maven-plugin</artifactId>
<version>1.0-alpha-2</version>
<executions>
<execution>
<phase>initialize</phase>
<goals>
<goal>read-project-properties</goal>
</goals>
<configuration>
<files>
<file>${fullpath.to.properties}</file>
</files>
</configuration>
</execution>
</executions>
</plugin>
</plugins>
</build>
```

If you use a relative path to the `properties` file, then the file can reside in your source code. If you use a full path, then the `properties` file can be stored on the Jenkins server. The second option is preferable if sensitive passwords, such as those for database connections, are included.

Jenkins has the ability to ask for variables when you run a job manually. This is called a parameterized build (https://wiki.jenkins-ci.org/display/JENKINS/Parameterized+Build). At build time, you can choose your property files by selecting from a choice of property file locations.

See also

- The *Running Ant through Groovy in Maven* recipe

Running Ant through Groovy in Maven

Jenkins interacts with an audience with a wide technological background. There are many developers who became proficient in Ant scripting before moving on to using Maven, developers who might be happier with writing an Ant task than editing a `pom.xml` file. There are mission-critical Ant scripts that still run in a significant proportion of organizations.

In Maven, you can run Ant tasks directly with the `AntRun` plugin (http://maven.apache.org/plugins/maven-antrun-plugin/), or through Groovy (http://docs.codehaus.org/display/GROOVY/Using+Ant+from+Groovy). AntRun represents a natural migration path. This is the path of least initial work.

The Groovy approach makes sense for Jenkins administrators who use Groovy as part of their tasks. Groovy, being a first-class programming language, has a wide range of control structures that are hard to replicate in Ant. You can partially do this by using the `Ant-contrib` library (http://ant-contrib.sourceforge.net). However, Groovy, as a feature-rich programming language, is much more expressive.

This recipe details how you can run two Maven POMs involving Groovy and Ant. The first POM shows you how to run the simplest of Ant tasks within Groovy, and the second performs an Ant-Contrib task to securely copy files from a large number of computers.

Getting ready

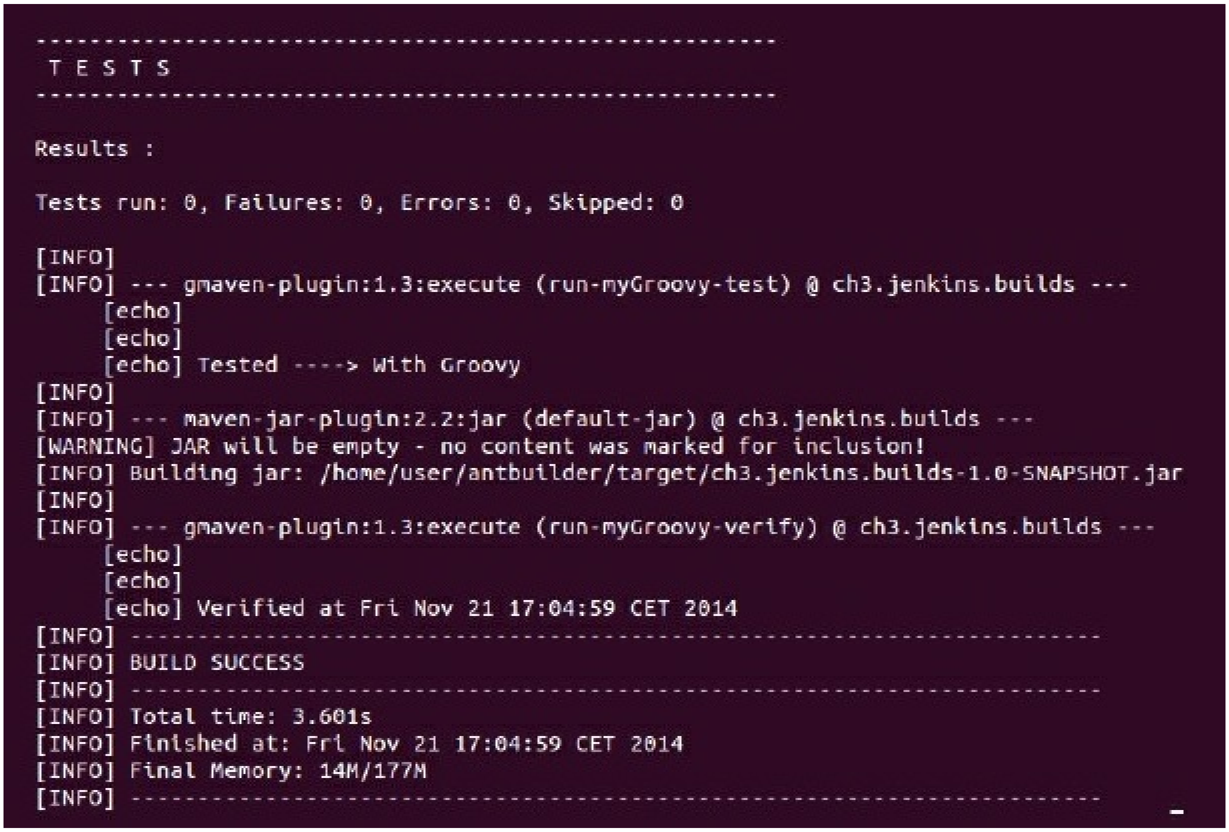
Create a directory named `ch3.building_software/antbuilder`.

How to do it...

1. Create a template file and name it `pom_ant_simple.xml`.
2. Change the values of `groupId`, `artifactId`, `version`, and name to suit your preferences.
3. Add the following XML fragment just before the `</project>` tag:

```
<build>
<plugins><plugin>
<groupId>org.codehaus.gmaven</groupId>
<artifactId>gmaven-plugin</artifactId>
<version>1.3</version>
<executions>
<execution>
<id>run-myGroovy-test</id>
<goals><goal>execute</goal></goals>
<phase>test</phase>
<configuration>
<source>
def ant = new AntBuilder()
ant.echo("\n\nTested ----> With Groovy")
</source>
</configuration>
</execution>
<execution>
<id>run-myGroovy-verify</id>
<goals><goal>execute</goal></goals>
<phase>verify</phase>
<configuration>
<source>
def ant = new AntBuilder()
ant.echo("\n\nVerified at ${new Date()}")
</source>
</configuration>
</execution>
</executions>
</plugin></plugins>
</build>
```

4. Run `mvn test -f pom_ant_simple.xml`. Review the output (note that there are no warnings about empty JAR files):
5. Run `mvn verify -f pom_ant_simple.xml`. Review the output; it should look similar to the following screenshot:



```
-------------------------------------------------------
 T E S T S
-------------------------------------------------------

Results :

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

[INFO]
[INFO] --- gmaven-plugin:1.3:execute (run-myGroovy-test) @ ch3.jenkins.builds ---
     [echo]
     [echo]
     [echo] Tested ----> With Groovy
[INFO]
[INFO] --- maven-jar-plugin:2.2:jar (default-jar) @ ch3.jenkins.builds ---
[WARNING] JAR will be empty - no content was marked for inclusion!
[INFO] Building jar: /home/user/antbuilder/target/ch3.jenkins.builds-1.0-SNAPSHOT.jar
[INFO]
[INFO] --- gmaven-plugin:1.3:execute (run-myGroovy-verify) @ ch3.jenkins.builds ---
     [echo]
     [echo]
     [echo] Verified at Fri Nov 21 17:04:59 CET 2014
[INFO] ------------------------------------------------------------------------
[INFO] BUILD SUCCESS
[INFO] ------------------------------------------------------------------------
[INFO] Total time: 3.601s
[INFO] Finished at: Fri Nov 21 17:04:59 CET 2014
[INFO] Final Memory: 14M/177M
[INFO] ------------------------------------------------------------------------
```

4. Create a second template file named `pom_ant_contrib.xml`.

5. Change the values of `groupId`, `artifactId`, `version`, and name to suit your preferences.
6. Add the following XML fragment just before the `</project>` tag:

```
<build>
<plugins><plugin>
<groupId>org.codehaus.gmaven</groupId>
<artifactId>gmaven-plugin</artifactId>
<version>1.3</version>
<executions><execution>
<id>run-myGroovy</id>
<goals><goal>execute</goal></goals>
<phase>verify</phase>
<configuration>
<source>
def ant = new AntBuilder()
host="Myhost_series"
print "user: "
user = new String(System.console().readPassword())
print "password: "
pw = new String(System.console().readPassword())

for ( i in 1..920) {
counterStr=String.format('%02d',i)
ant.scp(trust:'true',file:"${user}:${pw}${host}${counterStr}:/${full_path_to_loca

localTofile:"${myfile}-${counterStr}", verbose:"true")
}
</source>
</configuration>
</execution></executions>
<dependencies>
<dependency>
<groupId>ant</groupId>
<artifactId>ant</artifactId>
<version>1.6.5</version>
</dependency>
<dependency>
```

```
<groupId>ant</groupId>
<artifactId>ant-launcher</artifactId>
<version>1.6.5</version>
</dependency>
<dependency>
<groupId>ant</groupId>
<artifactId>ant-jsch</artifactId>
<version>1.6.5</version>
</dependency>
<dependency>
<groupId>com.jcraft</groupId>
<artifactId>jsch</artifactId>
<version>0.1.42</version>
</dependency>
</dependencies>
</plugin></plugins>
</build>
```

This is only representative code, unless you have set it up to point to real files on real servers:

`mvn verify -f pom_ant_simple.xml will fail`

How it works...

Groovy runs basic Ant tasks without the need for extra dependencies. An `AntBuilder` instance (http://groovy.codehaus.org/Using+Ant+Libraries+with+AntBuilder) is created and then the Ant echo task is called. Under the bonnet, Groovy calls the Java classes that Ant uses to perform the `echo` command. Within the `echo` command, a date is printed by directly creating an anonymous object:

```
ant.echo("\n\nVerified at ${new Date()}").
```

You configured the `pom.xml` file to fire off the Groovy scripts in two phases: the test phase, and then later in the verify phase. The test phase occurs before the generation of a JAR file, and thus avoids creating a warning about an empty JAR file. As the name suggests, this phase is useful for testing before packaging.

The second example script highlights the strength of combining Groovy with Ant. The SCP task (http://ant.apache.org/manual/Tasks/scp.html) is run many times across many servers. The script first asks for the username and password, avoiding storage on your filesystem or your revision control system. The Groovy script expects you to inject the `host`, `full_path_to_location`, and `myfile` variables.

Observe the similarity between the Ant SCP task and the way it is expressed in the `pom_ant_contrib.xml` file.

There's more...

Another example of running Ant through Groovy is the creation of custom property files on the fly. This allows you to pass on information from one Jenkins job to another.

You can create property files through AntBuilder using the echo task. The following lines of code create a value.properties file with two lines, `x=1` and `y=2`:

```
def ant = new AntBuilder()
ant.echo(message: "x=1\n", append: "false", file: "values.properties")
ant.echo(message: "y=2\n", append: "true", file: "values.properties")
```

The first `echo` command sets append to false, so that every time a build occurs, a new properties file is created. The second `echo` appends its message.

You can remove the second `append` attribute as the default value is set to `true`.

See also

- The *Running Groovy scripts through Maven* recipe

Failed Jenkins jobs based on JSP syntax errors

JavaServer Pages (**JSP**) (http://www.oracle.com/technetwork/java/overview-138580.html) is a standard that makes the creation of simple web applications straightforward. You write HTML, such as pages with extra tags interspersed with Java coding, into a text file. If you do this in a running web application, then the code recompiles on the next page call. This process supports agile programming practices, but the risk is that developers make messy, hard-to-read JSP code that is difficult to maintain. It would be nice if Jenkins could display metrics about the code to defend quality.

JSP pages are compiled on the fly the first time a user request for the page is received. The user will perceive this as a slow loading of the page, and this may deter them from future visits. To avoid this situation, you can compile the JSP page during the build process and place the compiled code in the `WEB-INF/classes` directory, or packaged in the `WEB-INF/lib` directory of your web app. This approach has the advantage of a faster first-page load.

A secondary advantage of having compiled source code is that you can run a number of statistical code review tools over the code base and obtain testability metrics. This generates testing data ready for Jenkins plugins to display.

This recipe describes how to compile JSP pages based on the `maven-jetty-jspc-plugin` (http://www.eclipse.org/jetty/documentation/current/jetty-jspc-maven-plugin.html). The compiled code will work with the Jetty server, which is often used for integration tests.

The JSP mentioned in this recipe is deliberately insecure, and hence ready for testing later in this book.

A complementary plugin specifically for Tomcat deployment is the Tomcat Maven plugin (http://tomcat.apache.org/maven-plugin.html).

Getting ready

Create a directory named `ch3.building_software/jsp_example`.

How to do it...

1. Create a WAR project from a Maven archetype by typing the following command:

   ```
   mvnarchetype:generate -DarchetypeArtifactId=maven-archetype-webapp
   ```

2. Enter the following values:
   - `groupId`: `ch3.packt.builds`
   - `artifactId`: `jsp_example`
   - `version`: `1.0-SNAPSHOT`
   - `package`: `ch3.packt.builds<build> <finalName>jsp_example</finalName>`
3. Click on Enter to confirm the values.
4. Edit the `jsp_example/pom.xml` file by adding the following `build` section:

   ```
   <build>
   <finalName>jsp_example</finalName>
   <plugins>
   <plugin>
   <groupId>org.mortbay.jetty</groupId>
   <artifactId>maven-jetty-jspc-plugin</artifactId>
   <version>6.1.14</version>
   <executions>
   <execution>
   <id>jspc</id>
   <goals>
   <goal>jspc</goal>
   </goals>
   <configuration>
   </configuration>
   </execution>
   </executions>
   </plugin>
   <plugin>
   <groupId>org.apache.maven.plugins</groupId>
   <artifactId>maven-war-plugin</artifactId>
   <version>2.4</version>
   <configuration>
   <webXml>${basedir}/target/web.xml</webXml>
   </configuration>
   </plugin>
   </plugins>
   </build>
   ```

5. Replace the code snippet in the `src/main/webapp/index.jsp` file with the following lines of code:

   ```
   <html>
   <head>
   <meta http-equiv="Content-Type" content="text/html; charset=UTF-8">
   <title>Hello World Example</title>
   </head>
   <body>
   <%
          String evilInput= null;
   evilInput =
    request.getParameter("someUnfilteredInput");
   if (evilInput==null){evilInput="Hello Kind Person";}
       %>
   <form action="index.jsp">
         The big head says: <%=evilInput%><p>
         Please add input:<input type='text'
            name='someUnfilteredInput'>
   <input type="submit">
   </form>
   </body>
   ```

```
</html>
```

6. Create a WAR file by using the `mvn package` command.
7. Modify `./src/main/webapp/index.jsp` by adding `if (evilInput==null)` underneath the line starting with if, so that it is no longer a valid JSP file.
8. Run the `mvn package` command. The build will now fail with the following error message:

```
[ERROR] Failed to execute goal org.mortbay.jetty:maven-jetty-jspc-
plugin:6.1.14:jspc (jspc) on project jsp_example: Failure processing jsps ->
[Help 1]
```

How it works...

You created a template project using an archetype.

The Maven plugin, upon seeing the `index.jsp` page, compiles it into a class with the name `jsp.index_jsp`, placing the compiled class under `WEB-INF/classes`. The plugin then defines the class as a servlet in `WEB-INF/web.xml` with a mapping to `/index.jsp`. Let's take a look at the following example:

```
<servlet>
<servlet-name>jsp.index_jsp</servlet-name>
<servlet-class>jsp.index_jsp</servlet-class>
</servlet>

<servlet-mapping>
<servlet-name>jsp.index_jsp</servlet-name>
<url-pattern>/index.jsp</url-pattern>
</servlet-mapping>
```

The list of archetypes is increasing over time. You can find the full list at http://maven-repository.com/archetypes. If you are running Ubuntu, you will find a local XML catalog listing all the archetypes named `archetype-catalog.xml` in the`~/.m2` directory.

There's more...

Here are a few things you should consider.

Different server types

By default, the Jetty Maven plugin (Version 6.1.14) loads JSP 2.1 libraries with JDK 1.5. This will not work for all server types. For example, if you deploy the WAR file generated by this recipe to a Tomcat 7 server, it will fail to deploy properly. If you look at logs/catalina.out, you will see the following error:

```
javax.servlet.ServletException: Error instantiating servlet class jsp.index_jsp
Root Cause
java.lang.NoClassDefFoundError: Lorg/apache/jasper/runtime/ResourceInjector;
```

This is because different servers have different assumptions about how JSP code is compiled, and which libraries they depend on to run. For Tomcat, you will need to tweak the compiler used and the Maven plugin dependencies. For more details, visit http://wiki.eclipse.org/Jetty/Feature/Jetty_Maven_Plugin.

Eclipse templates for JSP pages

Eclipse is a popular open source IDE for Java developers (http://www.eclipse.org/). If you are using Eclipse with its default template for JSP pages, then your pages may fail to compile. This is because, at the time of writing, the default compiler does not like the meta-information mentioned before the `<html>` tag, as follows:

```
<%@ page language="java" contentType="text/html;charset=UTF-8"
pageEncoding="UTF-8"%>
<!DOCTYPE html PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN"
"http://www.w3.org/TR/html4/loose.dtd">
```

As the meta-information follows the JSP specification, it is likely that later the JSP compiler will accept the information. Until that day, simply remove the lines before compiling, or change the JSP compiler that you use.

Remotely triggering jobs through the Jenkins API

Jenkins has a remote API that allows you to enable, disable, run, and delete jobs; it also lets you change the configuration. The API is increasing with each Jenkins version. To get the most up-to-date details, you will need to review `http://yourhost/job/Name_of_Job/api/`. Where `yourhost` is the location of your Jenkins server, `Name_of_Job` is the name of a job that exists on your server.

This recipe details how you can trigger builds remotely by using security tokens. This will allow you to run other jobs from within Maven.

Getting ready

This recipe expects Jenkins security to be turned on so that you can log in as a user. It also assumes you have a modern version of `wget` (http://www.gnu.org/software/wget/) installed.

How to do it...

1. Create a Freestyle project with the project name `ch3.RunMe`.
2. Check This Build is parameterized, select String Parameter, and add the following details:
    1. Name: `myvariable`
    2. DefaultValue: `Default`
    3. Description: `This is my example variable`
3. Under the Build Triggers section, check Trigger builds remotely (for example, from scripts).
4. In the Authentication Token textbox, add `changeme`.
5. Click on the Save button.
6. Click on the Build with Parameters link.
7. You will be asked for the variable named `myvariable`. Click on Build.
8. Visit your personal configuration page, such as `http://localhost:8080/`, where you replace `your_user` with your Jenkins username.
9. In the API Token section, click on the Show API Token... button.
10. Copy the token to `apiToken`.
11. From a terminal console, run `wget` to log in and run the job remotely:

    ```
    wget --auth-no-challenge --http-user=username --http-password=apiToken
    http://localhost:8080/job/ch3.RunMe/build?token=changeme
    ```

12. Check the Jenkins job to verify that it has not run and returns a `405` HTTP status code:

    ```
    Resolving localhost (localhost)... 127.0.0.1
    Connecting to localhost (localhost)|127.0.0.1|:8080... connected.
    HTTP request sent, awaiting response... 405 Method Not Allowed
    2014-08-14 15:08:43 ERROR 405: Method Not Allowed.
    ```

13. From a terminal console, run `wget` to log in and run the job, returning a `201` HTTP status code:

    ```
    wget --auth-no-challenge --http-user=username --http-password=apiToken
    http://localhost:8080/job/ch3.RunMe/buildWithParameters?
    token=changeme\&myvariable='Hello World'
    Connecting to localhost (localhost)|127.0.0.1|:8080... connected.
    HTTP request sent, awaiting response... 201 Created
    ```

HTTP can be packet-sniffed by a third party. Use HTTPS when transporting passwords.

How it works...

To run a job, you need to authenticate as a user and then obtain permission to run the specific job. This is achieved through `apiTokens`, which you should consider to be the same as passwords.

There are two remote method calls. The first is `build`, which is used to run the build without passing parameters. The method is currently not accepted. The second working method is `buildWithParameters`, which expects you to pass at least one parameter to Jenkins. The parameters are separated by `\&`.

The `wget` tool does the heavy lifting; otherwise, you would have to write some tricky Groovy code. We have chosen simplicity and OS dependence for the sake of a short recipe. Running an executable risks making your build OS-specific. The executable will depend on how the underlying environment has been set up. However, sometimes you will need to make compromises to avoid complexity.

For more details, visit https://wiki.jenkins-ci.org/display/JENKINS/Authenticating+scripted+clients.

You can find the equivalent Java code at the following URL: https://wiki.jenkins-ci.org/display/JENKINS/Remote+access+API.

There's more...

Here are a few things you should consider.

Running jobs from within Maven

With little fuss, you can run `wget` through the `Maven-AntRun` plugin. The following is the equivalent `pom.xml` fragment:

```
<build>
<plugin>
<groupId>org.apache.maven.plugins</groupId>
<artifactId>maven-antrun-plugin</artifactId>
<version>1.7</version>
<executions><execution>
<phase>compile</phase>
<configuration>
<tasks>
<exec executable="wget">
<arg line="--auth-no-challenge --http-user=username --http-password=apiToken
http://localhost:8080/job/ch3.RunMe/build?token=changeme" />
</exec>
</tasks>
</configuration>
<goals><goal>run</goal></goals>
</execution></executions>
</plugin>
</build>
```

You can use the Exec Maven plugin for the same purpose as the `Maven-AntRun` plugin. For more details, visit http://mojo.codehaus.org/exec-maven-plugin/.

Remotely generating jobs

There is also a project that allows you to create Jenkins jobs through Maven remotely (https://github.com/evgeny-goldin/maven-plugins/tree/master/jenkins-maven-plugin). The advantage of this approach is its ability to enforce consistency and reuse between jobs. You can use one parameter to choose a Jenkins server and populate it. This is useful for generating a large set of consistently structured jobs.

See also

- The *Running Ant through Groovy in Maven* recipe

Continuous Delivery

In this chapter, we will cover the following recipes:

- Archiving artifacts
- Copying an artifact from another build job
- Integrating Jenkins with Artifactory
- Deploying a WAR file from Jenkins to Tomcat
- Deploying a WAR file from Jenkins to AWS Beanstalk
- Deploying a WAR file from Jenkins to Azure App Services
- Promoting builds

Introduction

Continuous Delivery (**CD**) is a DevOps practice that is used to deploy an application quickly while maintaining a high quality with an automated approach in a non-production environment. It is about the way application package is deployed in the Web Server or in the Application Server in environment such as dev, test or staging. Deployment of an application can be done using shell script, batch file, or plugins available in Jenkins. Approach of automated deployment in case of Continuous Delivery and Continuous Deployment will be always same most of the time. In the case of Continuous Delivery, the application package is always production ready.

Archiving artifacts

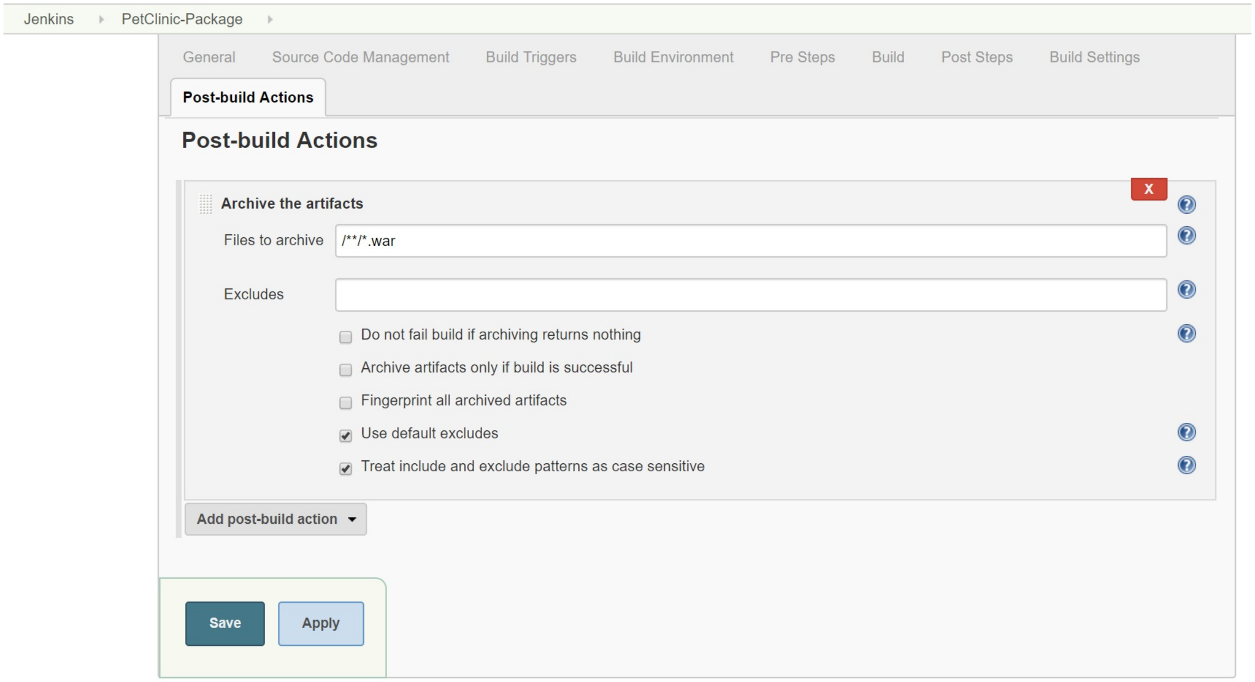
Artifact archiving is useful when you want to use an installable or distribution package in another project or build job. Normally, you create a different project to achieve a pipeline for end-to-end automation.

Getting ready

You need to have a project in Jenkins that creates a package file or distribution file, or any artifact that you want to utilize later from another project.

How to do it...

1. Go to Jenkins dashboard | Jenkins project or build job | Post-build Actions | Add post-build action | Archive the artifacts:



Archive the artifacts

Files to archive: /**/*.war

Excludes:

☐ Do not fail build if archiving returns nothing

☐ Archive artifacts only if build is successful

☐ Fingerprint all archived artifacts

☑ Use default excludes

☑ Treat include and exclude patterns as case sensitive

2. You can use wildcards, such as `module/dist/**/*.zip`. The artifact archiver uses `Ant org.apache.tools.ant.DirectoryScanner`, which excludes the following patterns by default: `**/%*%,**/.git/**,**/SCCS,**/.bzr,**/.hg/**,**/.bzrignore,**/.git,**/SCCS/**,**/.hg,**/.`

See also

- The *Copying an artifact from other build job* recipe is useful for copying an archived artifact from another project into Jenkins

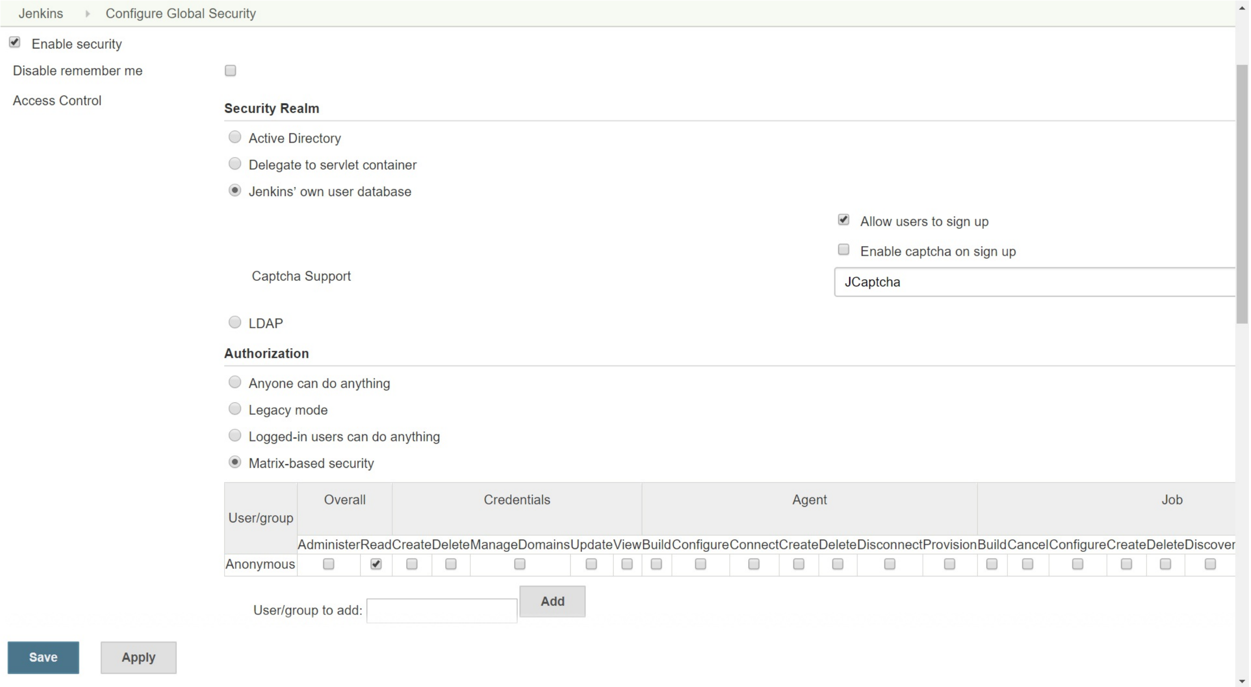
Copying an artifact from another build job

n this recipe, we will copy artifact/file/package from one build to other. It helps in the deployment or copy operations. Even with Master/Agent architecture, we can copy artifacts effortlessly using the `Copy Artifact` Plugin.

Getting ready

You need to allow read access to anonymous users, as the `Copyartifact` plugin treats builds running as an anonymous. To allow read access to anonymous, do the following:

Go to Manage Jenkins | Global Security Configuration:



☑ Enable security

Disable remember me □

Access Control

Security Realm

○ Active Directory

○ Delegate to servlet container

● Jenkins' own user database

☑ Allow users to sign up

□ Enable captcha on sign up

Captcha Support: JCaptcha

○ LDAP

Authorization

○ Anyone can do anything

○ Legacy mode

○ Logged-in users can do anything

● Matrix-based security

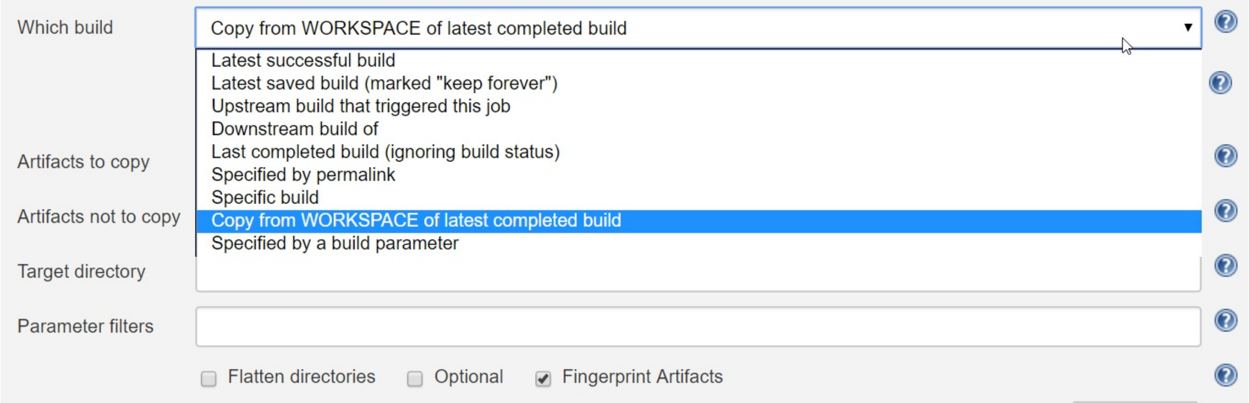
User/group	Overall		Credentials					Agent							Job					
	Administer	Read	Create	Delete	ManageDomains	Update	View	Build	Configure	Connect	Create	Delete	Disconnect	Provision	Build	Cancel	Configure	Create	Delete	Discover
Anonymous	□	☑	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□

User/group to add:

Click on Save.

How to do it...

1. Go to Jenkins dashboard | Project | Configure | Build | Add build step | Copy artifacts from another project.
2. Give the Project name from which you want to copy the artifact.
3. For the Which build field, select appropriate options from the available list:



Which build: Copy from WORKSPACE of latest completed build

Latest successful build
Latest saved build (marked "keep forever")
Upstream build that triggered this job
Downstream build of
Last completed build (ignoring build status)
Specified by permalink
Specific build
Copy from WORKSPACE of latest completed build
Specified by a build parameter

Artifacts to copy

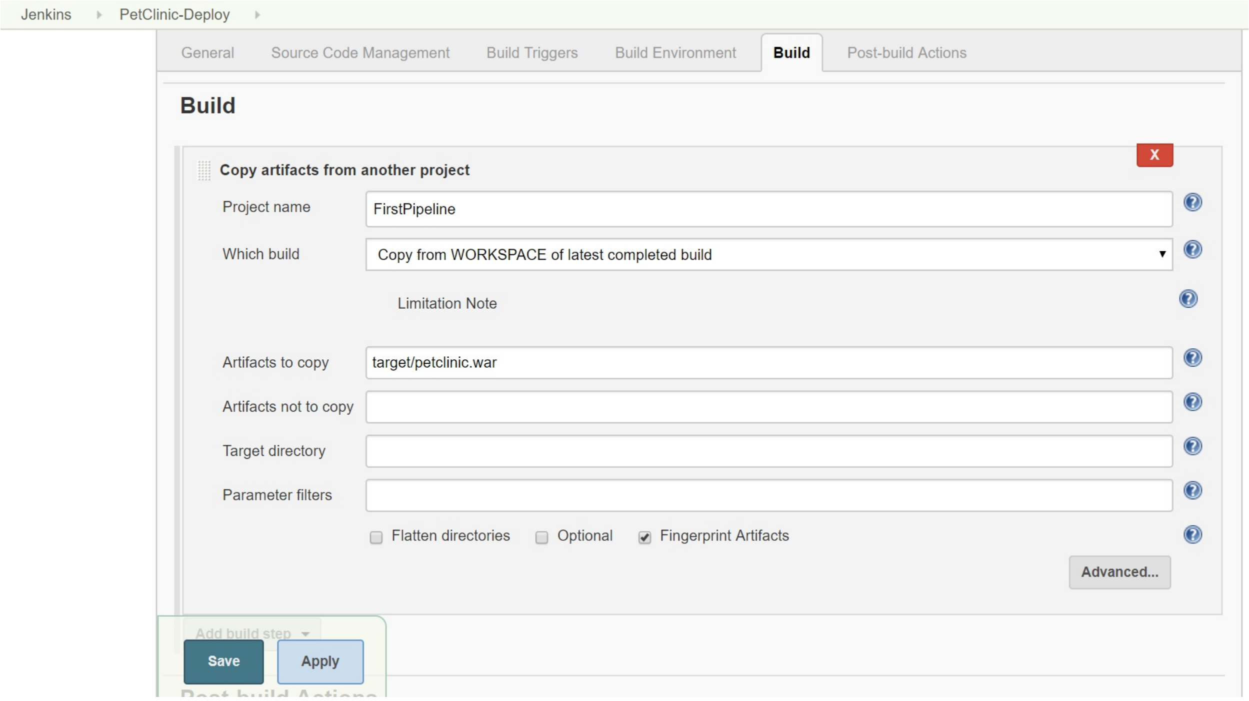
Artifacts not to copy

Target directory

Parameter filters

□ Flatten directories □ Optional ☑ Fingerprint Artifacts

4. Provide the name of the Artifacts to copy:



Build

Copy artifacts from another project

Project name: FirstPipeline

Which build: Copy from WORKSPACE of latest completed build

Artifacts to copy: target/petclinic.war

Artifacts not to copy:

Target directory:

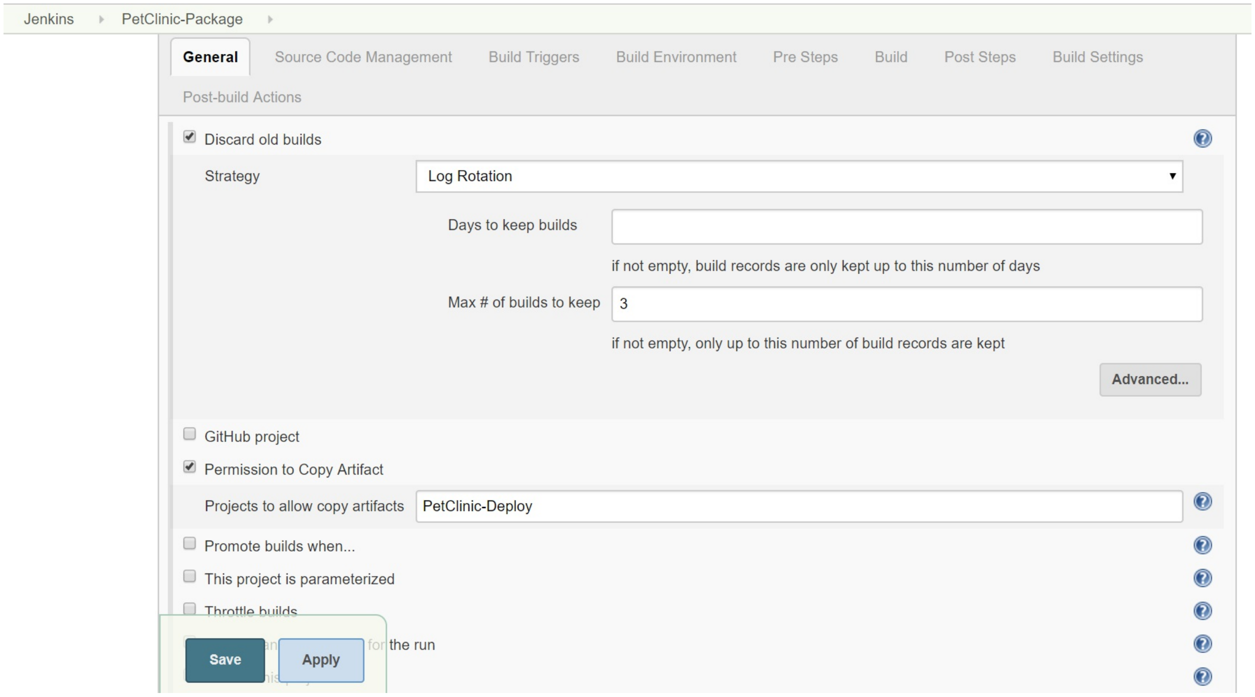
Parameter filters:

☐ Flatten directories ☐ Optional ☑ Fingerprint Artifacts

5. Click on Save.

There's more...

- You can also specify projects that can copy artifacts.
- For example, in the `PetClinic-Package` project you can create a WAR file that you can deploy to the application server.
- In the General section of `PetClinic-Package`, check Permission to Copy Artifact and provide the name of the project that can copy the artifact:



☑ Discard old builds

Strategy: Log Rotation

Days to keep builds:

if not empty, build records are only kept up to this number of days

Max # of builds to keep: 3

if not empty, only up to this number of build records are kept

□ GitHub project

☑ Permission to Copy Artifact

Projects to allow copy artifacts: PetClinic-Deploy

□ Promote builds when...

□ This project is parameterized

□ Throttle builds

the run

- Click on Save.

Integrating Jenkins with Artifactory

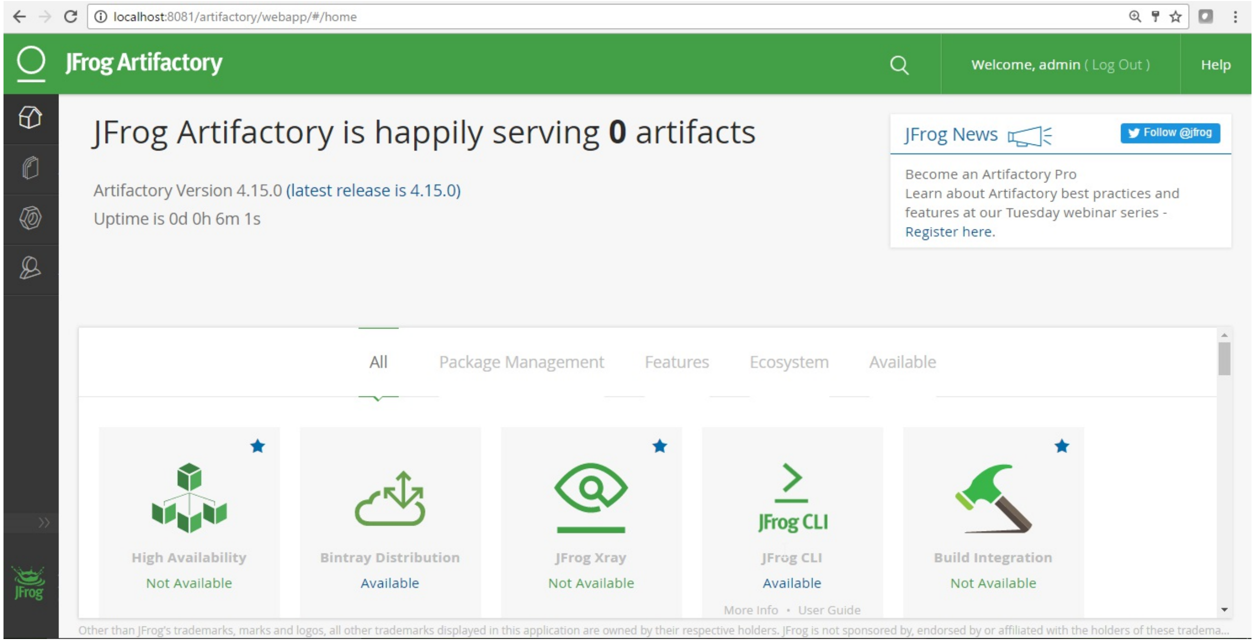
Artifactory is a repository manager that allows you to store and retrieve artifacts, such as dependencies or package files. It is like a local repository in the organization.

Getting ready

In this recipe, https://bintray.com/jfrog/artifactory/jfrog-artifactory-oss-zip/4.15.0 is used for Artifactory.

To start Artifactory, go to artifactory-oss-4.15.0 | bin and execute `artifactory.bat`. Use a `.sh` script to start Artifactory if the operating system is Linux-based.

Go to your browser and visit `IP_ADDRESS:8081` to visit Artifactory in the browser:


localhost:8081/artifactory/webapp/#/home

JFrog Artifactory is happily serving **0** artifacts

Artifactory Version 4.15.0 (latest release is 4.15.0)

Uptime is 0d 0h 6m 1s

Become an Artifactory Pro
Learn about Artifactory best practices and features at our Tuesday webinar series - Register here.

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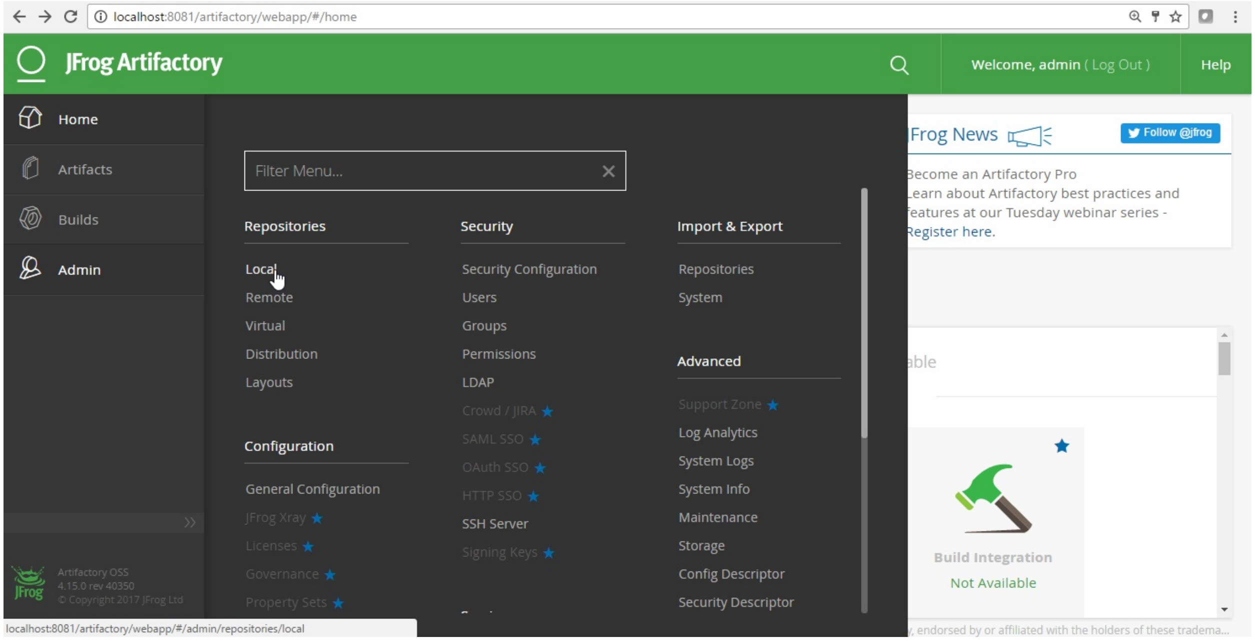
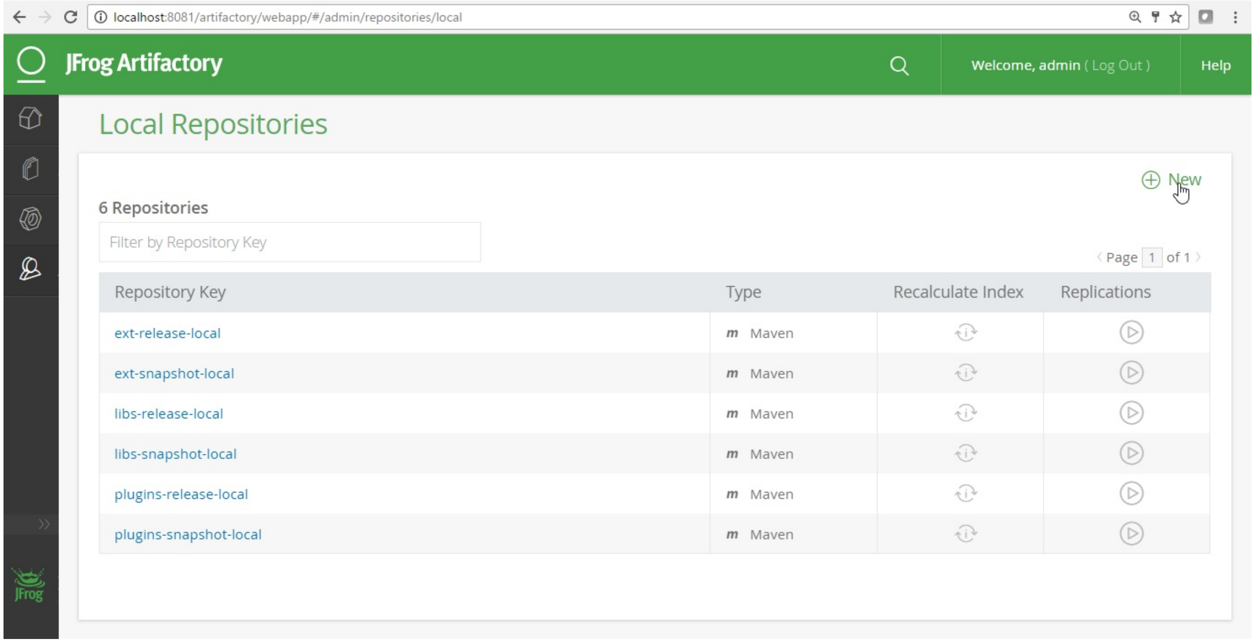
Create a Local repository to store package files created by the Jenkins project:


localhost:8081/artifactory/webapp/#/home

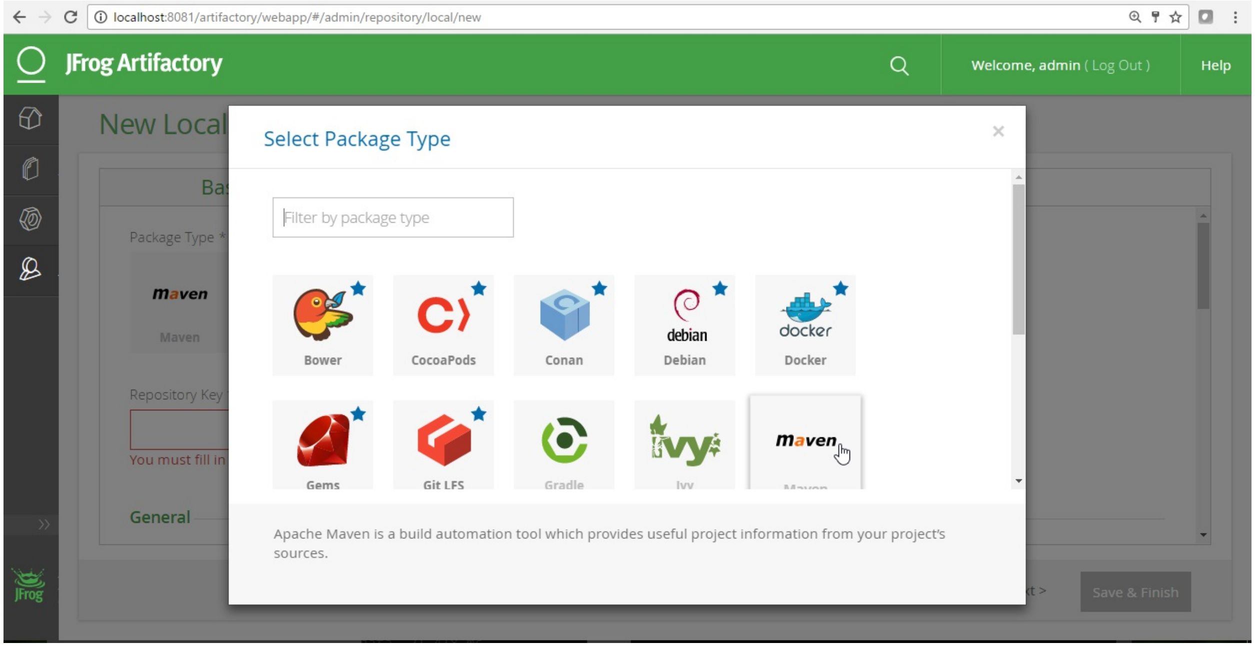
localhost:8081/artifactory/webapp/#/admin/repositories/local

Click on New:



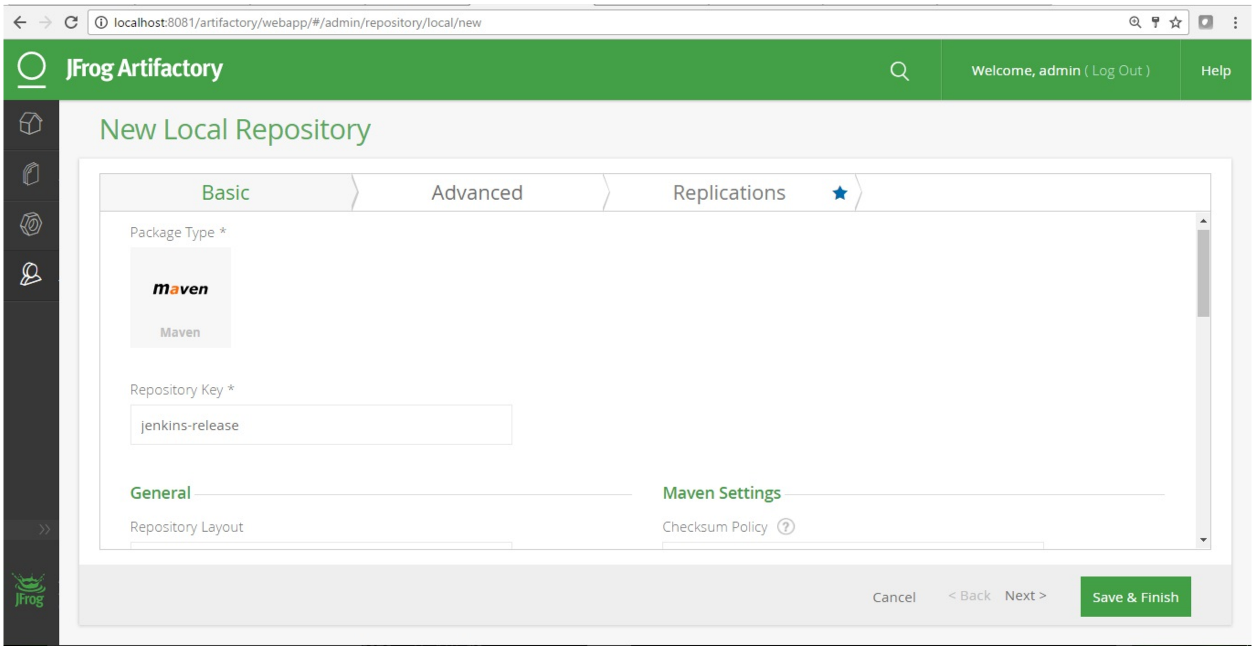
Repository Key	Type	Recalculate Index	Replications
ext-release-local	Maven		
ext-snapshot-local	Maven		
libs-release-local	Maven		
libs-snapshot-local	Maven		
plugins-release-local	Maven		
plugins-snapshot-local	Maven		

Select Maven as a Project Type:



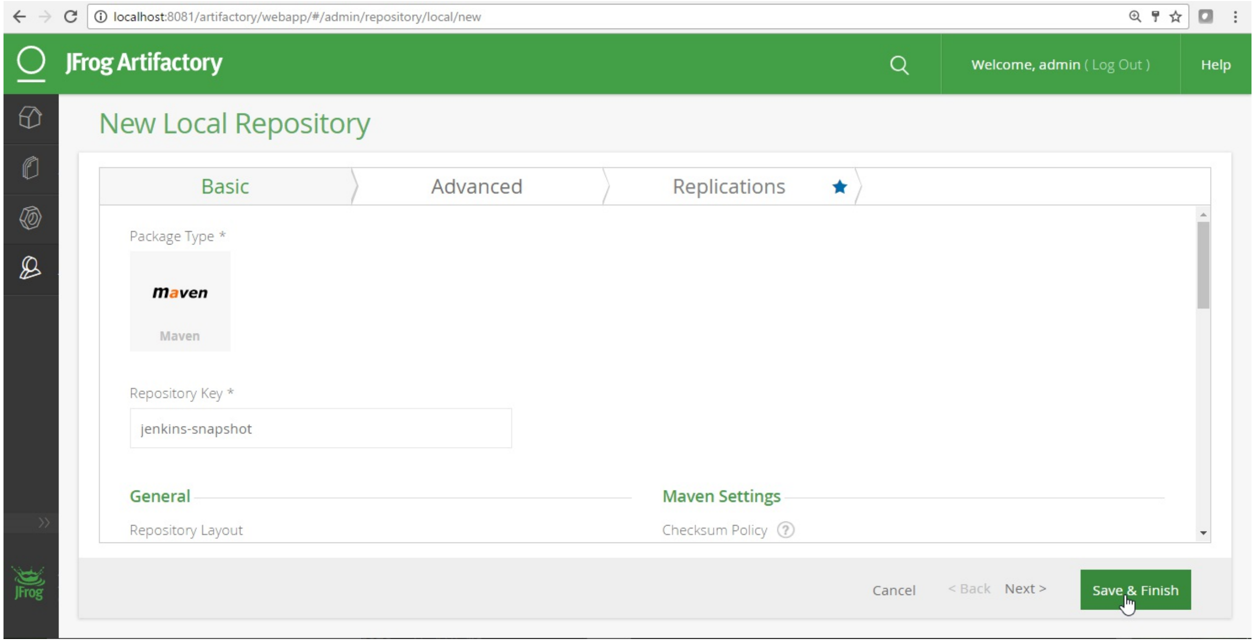
Apache Maven is a build automation tool which provides useful project information from your project's sources.

Give a Repository Key * and click on Save and Finish:



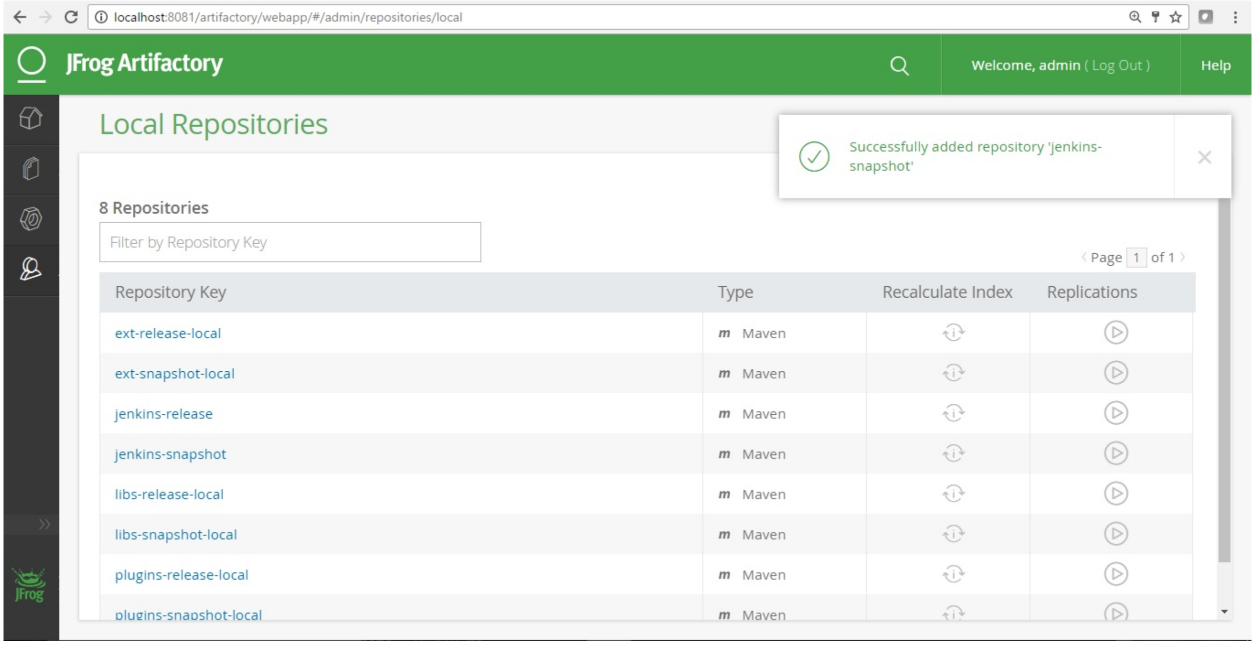
Repository Key *: jenkins-release

Similarly, create a `Jenkins-snapshot` repository:



Repository Key *: jenkins-snapshot

Verify all repositories in the list:


localhost:8081/artifactory/webapp/#/admin/repositories/local
JFrog Artifactory
Welcome, admin (Log Out)
Help

Local Repositories

Successfully added repository 'jenkins-snapshot'

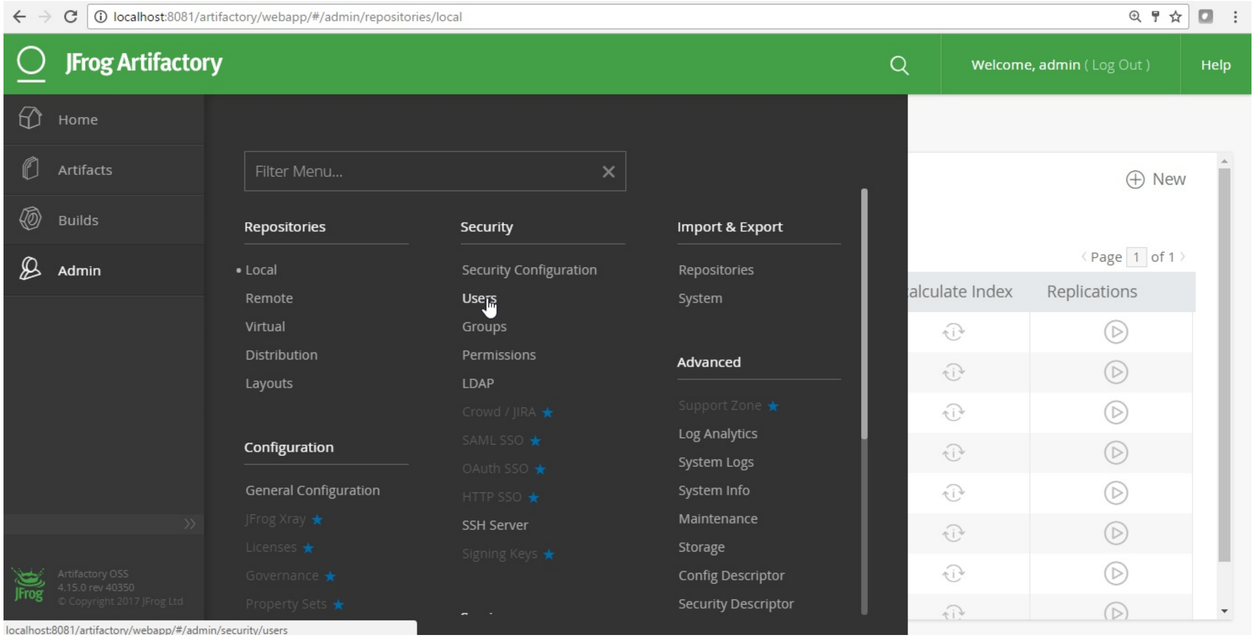
8 Repositories

Filter by Repository Key

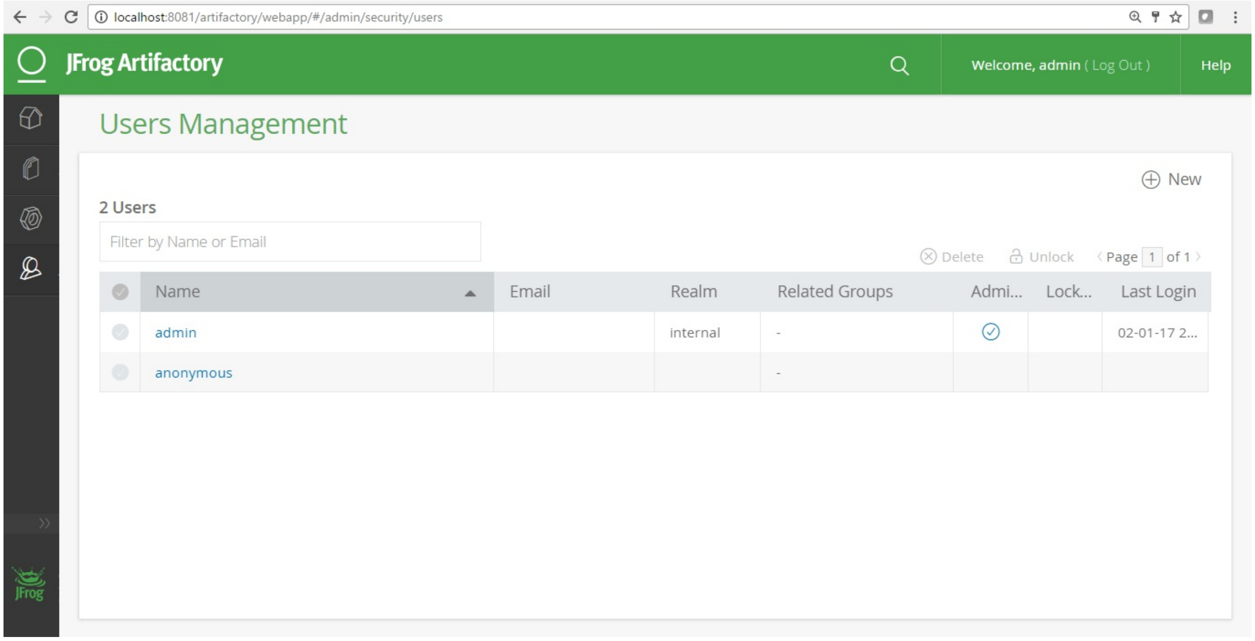
Page 1 of 1

Repository Key	Type	Recalculate Index	Replications
ext-release-local	m Maven		
ext-snapshot-local	m Maven		
jenkins-release	m Maven		
jenkins-snapshot	m Maven		
libs-release-local	m Maven		
libs-snapshot-local	m Maven		
plugins-release-local	m Maven		
plugins-snapshot-local	m Maven		

Create a user that you can utilize from Jenkins to access Artifactory:



Click on New:

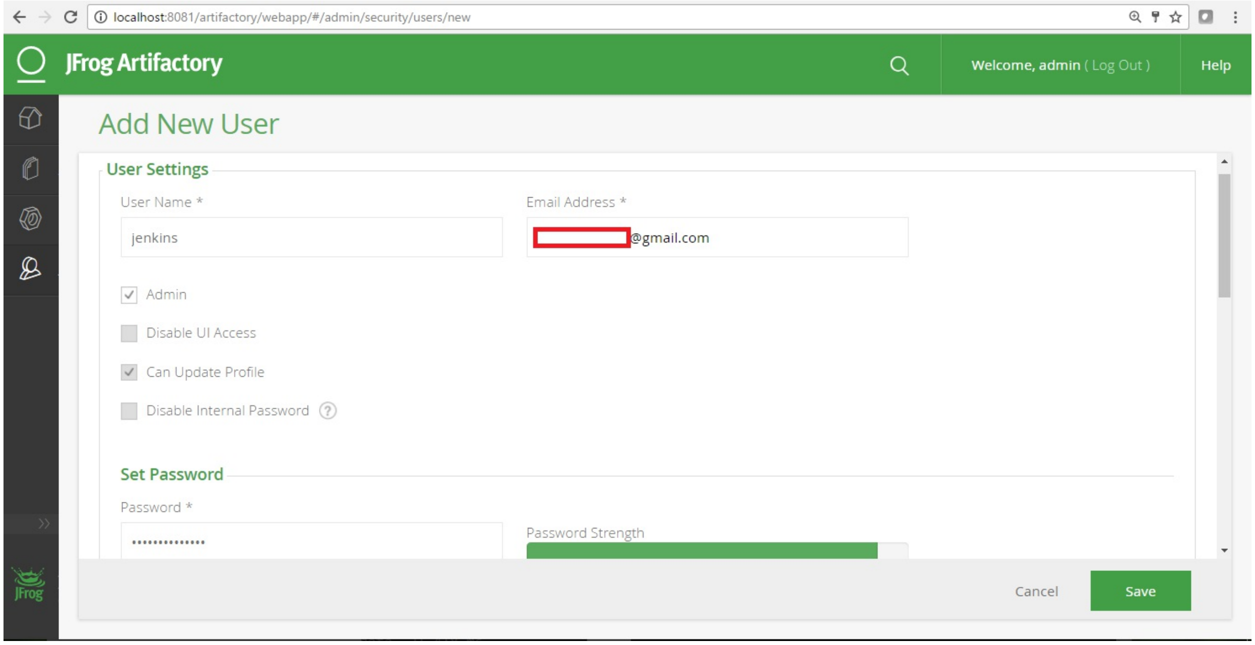

localhost:8081/artifactory/webapp/#/admin/security/users
JFrog Artifactory
Welcome, admin (Log Out)
Help
New
Filter by Name or Email
Delete
Unlock
Page 1 of 1

Users Management

2 Users

Name	Email	Realm	Related Groups	Admi...	Lock...	Last Login
admin		internal	-	✓		02-01-17 2...
anonymous			-			

Provide user details and Save:


localhost:8081/artifactory/webapp/#/admin/security/users/new
JFrog Artifactory
Welcome, admin (Log Out)
Help
Cancel
Save

Add New User

User Settings

User Name *: jenkins

Email Address *: [redacted]@gmail.com

☑ Admin

□ Disable UI Access

☑ Can Update Profile

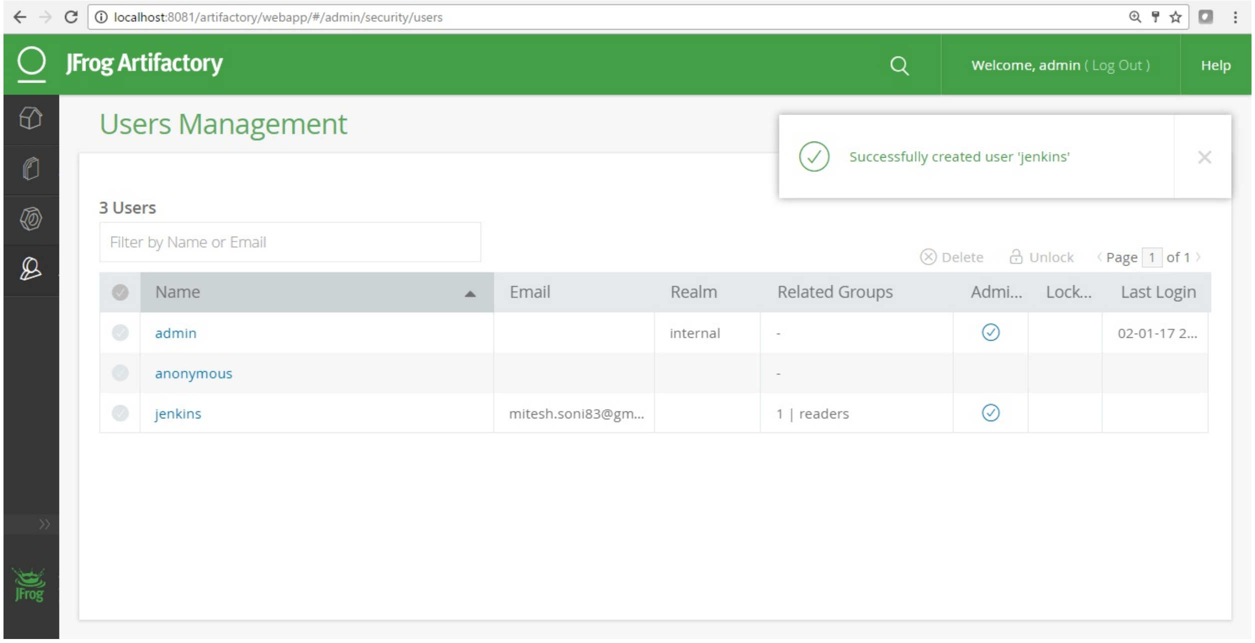
□ Disable Internal Password

Set Password

Password *: ••••••••••••••

Password Strength

Verify the list of users:



localhost:8081/artifactory/webapp/#/admin/security/users

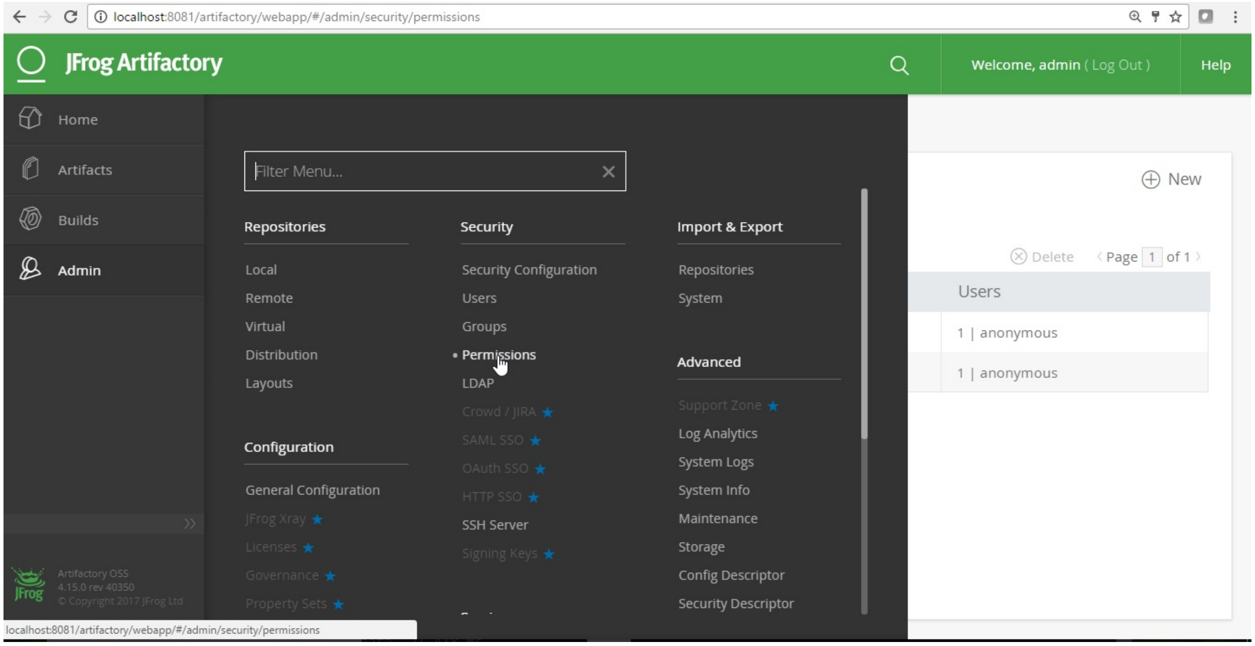
Users Management

Successfully created user 'jenkins'

3 Users

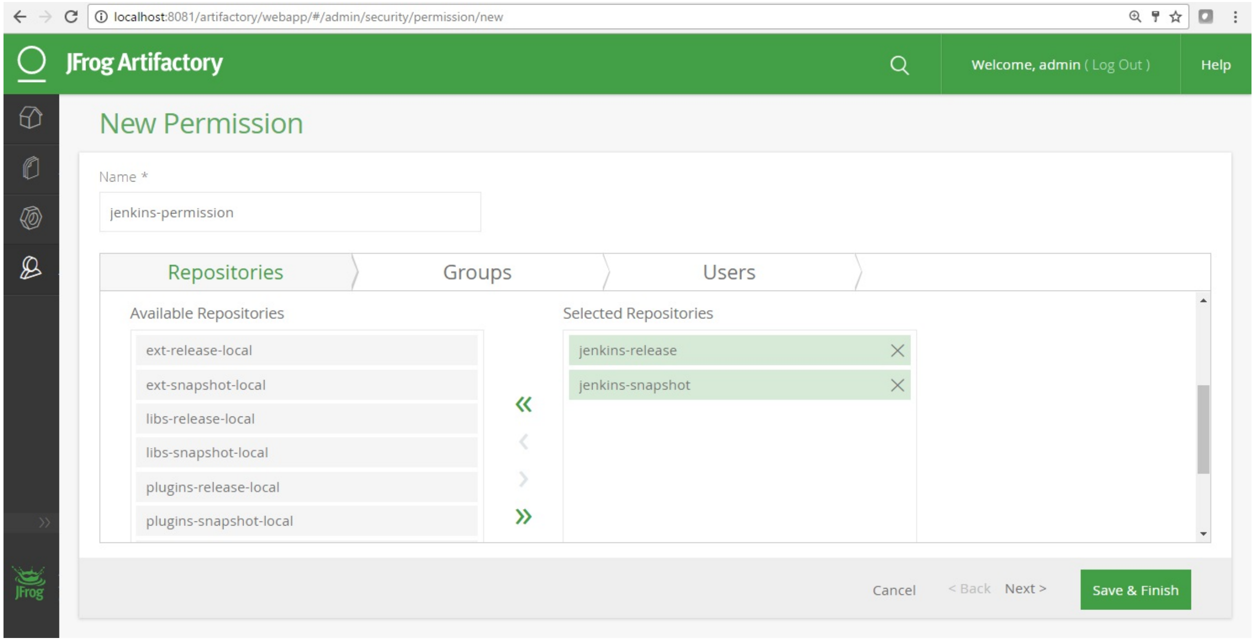
Name	Email	Realm	Related Groups	Admi...	Lock...	Last Login
admin		internal	-	✓		02-01-17 2...
anonymous			-			
jenkins	mitesh.soni83@gm...		1 | readers	✓		

Provide the newly created user with permissions to the repositories:



localhost:8081/artifactory/webapp/#/admin/security/permissions

Select Repositories and click on Save & Finish:



localhost:8081/artifactory/webapp/#/admin/security/permission/new

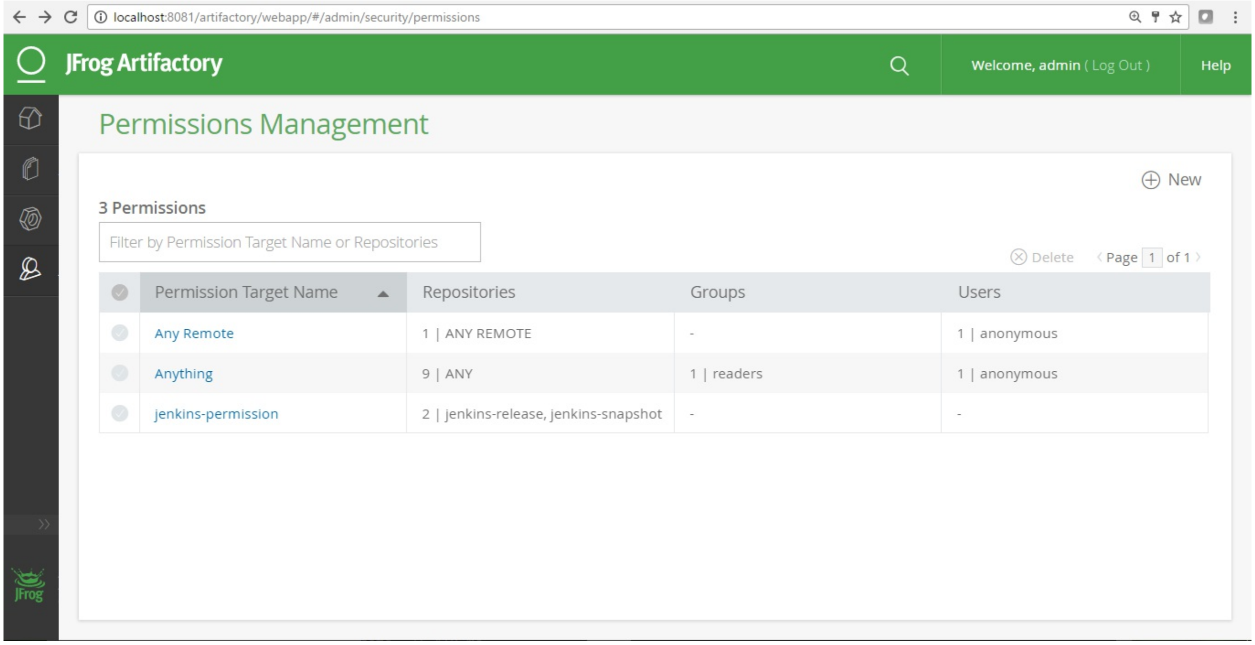
New Permission

Name *: jenkins-permission

Available Repositories:
- ext-release-local
- ext-snapshot-local
- libs-release-local
- libs-snapshot-local
- plugins-release-local
- plugins-snapshot-local

Selected Repositories:
- jenkins-release
- jenkins-snapshot

Check the Permissions Management section in Artifactory for recent changes:


JFrog Artifactory
Welcome, admin (Log Out)
Help
New
Filter by Permission Target Name or Repositories
Delete
Page 1 of 1

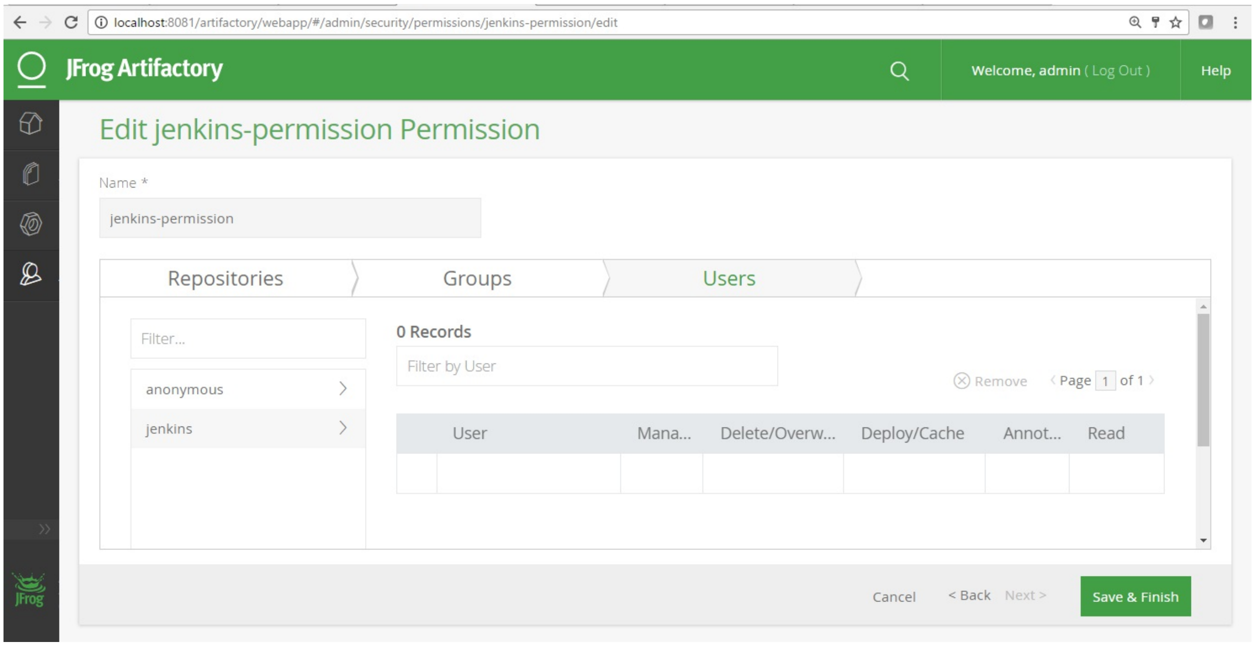
localhost:8081/artifactory/webapp/#/admin/security/permissions

Permissions Management

3 Permissions

Permission Target Name	Repositories	Groups	Users
Any Remote	1 | ANY REMOTE	-	1 | anonymous
Anything	9 | ANY	1 | readers	1 | anonymous
jenkins-permission	2 | jenkins-release, jenkins-snapshot	-	-

Edit the permissions and assign the user:


localhost:8081/artifactory/webapp/#/admin/security/permissions/jenkins-permission/edit
JFrog Artifactory
Welcome, admin (Log Out)
Help

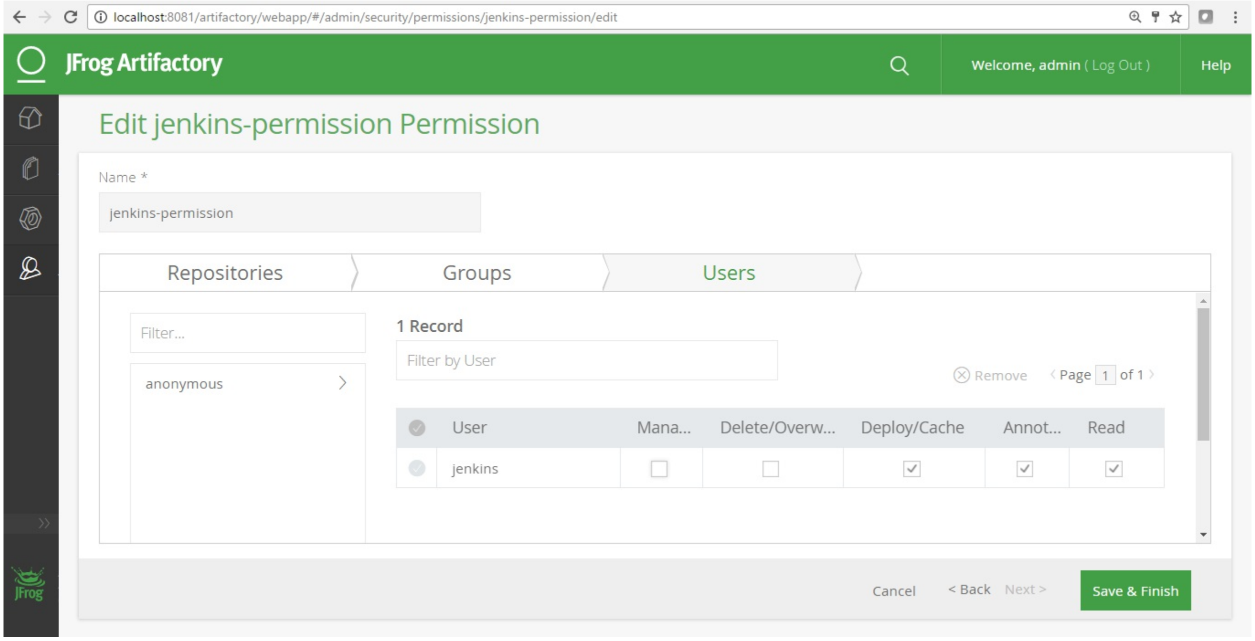
Edit jenkins-permission Permission

Name *: jenkins-permission

0 Records

User	Mana...	Delete/Overw...	Deploy/Cache	Annot...	Read

Click on Save & Finish:


localhost:8081/artifactory/webapp/#/admin/security/permissions/jenkins-permission/edit
JFrog Artifactory
Welcome, admin (Log Out)
Help

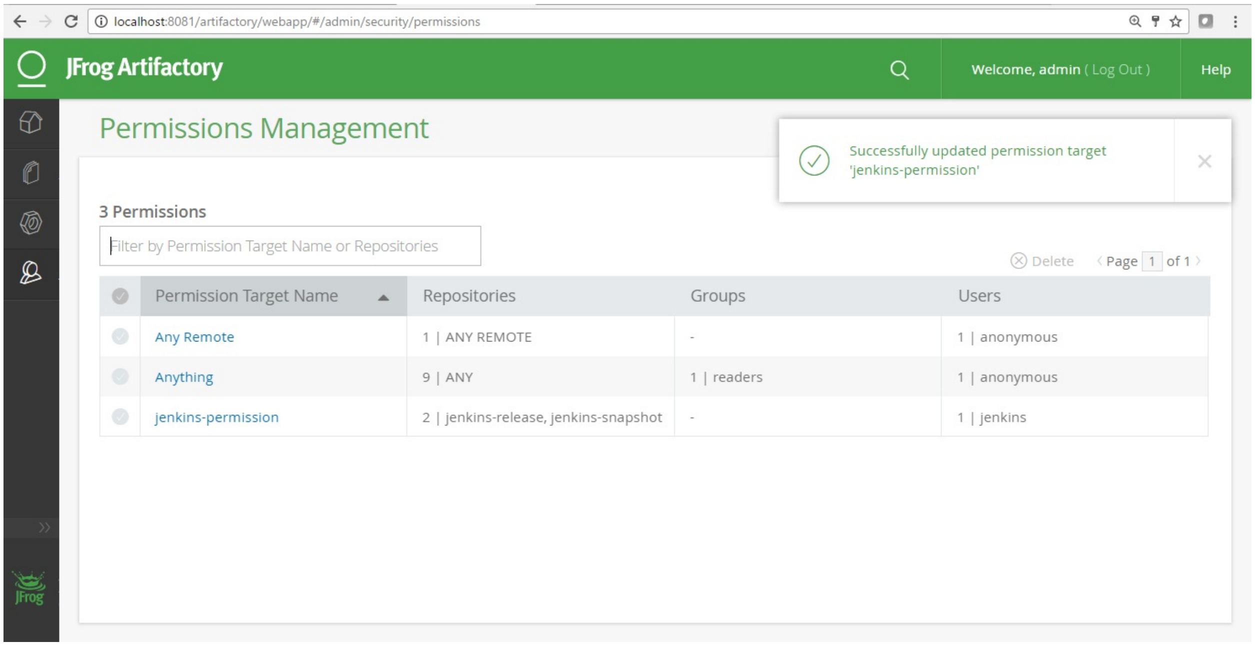
Edit jenkins-permission Permission

Name *: jenkins-permission

1 Record

User	Mana...	Delete/Overw...	Deploy/Cache	Annot...	Read
jenkins	□	□	☑	☑	☑

Check the Permissions Management section in Artifactory for recent changes:


localhost:8081/artifactory/webapp/#/admin/security/permissions
JFrog Artifactory
Welcome, admin (Log Out)
Help

Permissions Management

Successfully updated permission target 'jenkins-permission'

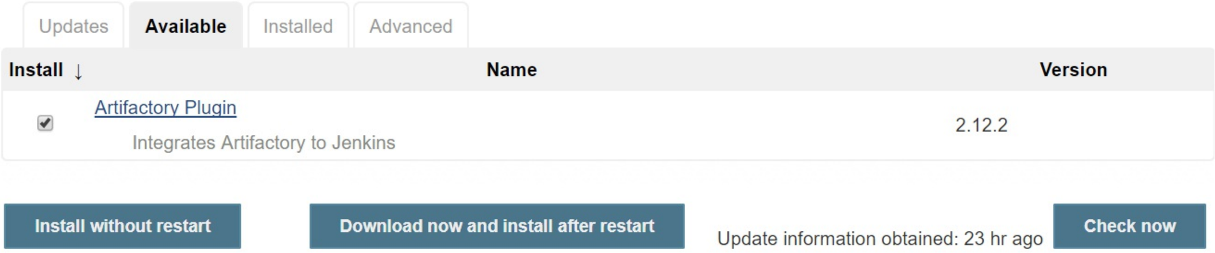
3 Permissions

Filter by Permission Target Name or Repositories

	Permission Target Name	Repositories	Groups	Users
○	Any Remote	1 | ANY REMOTE	-	1 | anonymous
○	Anything	9 | ANY	1 | readers	1 | anonymous
○	jenkins-permission	2 | jenkins-release, jenkins-snapshot	-	1 | jenkins

Now, you are ready to integrate Artifactory with Jenkins.

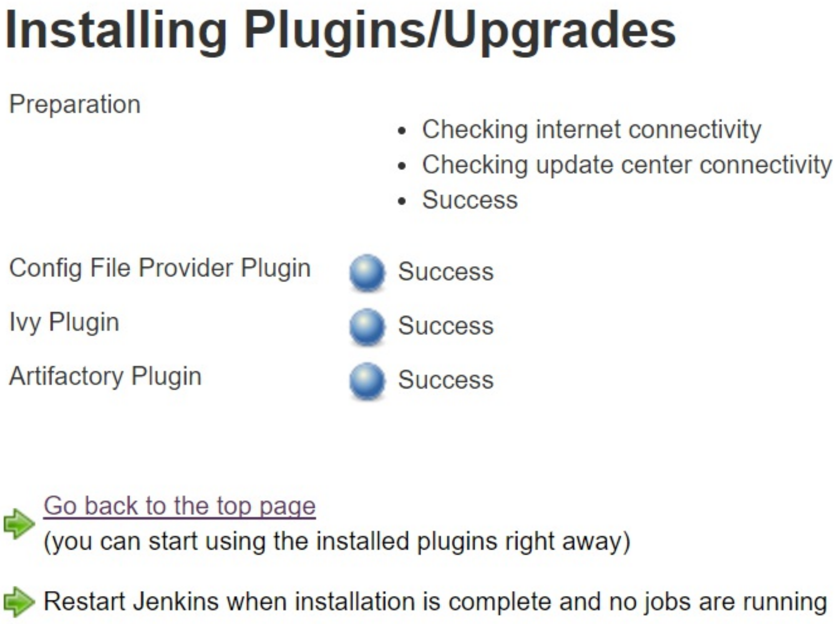
Install the Artifactory Plugin in Jenkins:



Install ↓	Name	Version
☑	Artifactory Plugin Integrates Artifactory to Jenkins	2.12.2

Update information obtained: 23 hr ago

Once plugin installation is successful, you can configure Artifactory-related settings in Jenkins:



Installing Plugins/Upgrades

Preparation

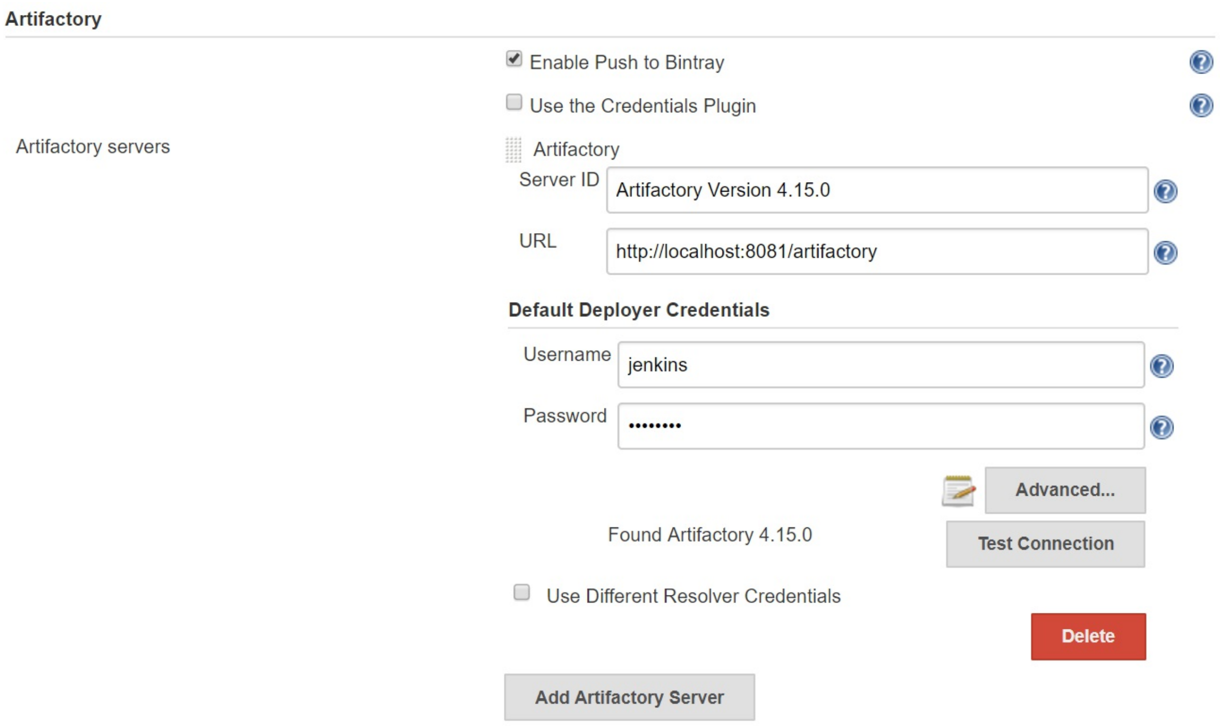
- Checking internet connectivity
- Checking update center connectivity
- Success

Config File Provider Plugin	● Success
Ivy Plugin	● Success
Artifactory Plugin	● Success

Go back to the top page
(you can start using the installed plugins right away)

Restart Jenkins when installation is complete and no jobs are running

Configure Artifactory in Jenkins:



Artifactory

☑ Enable Push to Bintray

☐ Use the Credentials Plugin

Artifactory servers

Artifactory

Server ID: Artifactory Version 4.15.0

URL: http://localhost:8081/artifactory

Default Deployer Credentials

Username: jenkins

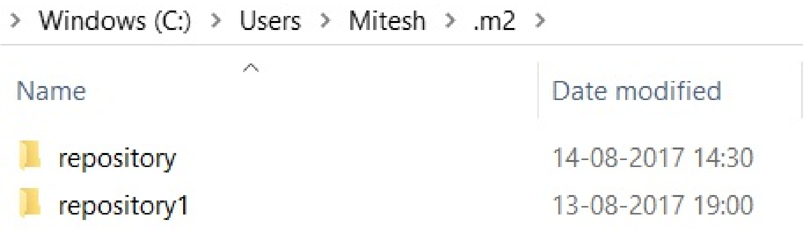
Password: ••••••••

Found Artifactory 4.15.0

☐ Use Different Resolver Credentials

When you use Maven as a build tool, it creates the `.m2` directory. This keeps all the dependencies in the repository directory when it downloads dependencies from Maven repositories available on the internet.

For the sake of verification, change the directory name in the `.m2` directory to `repository1`:



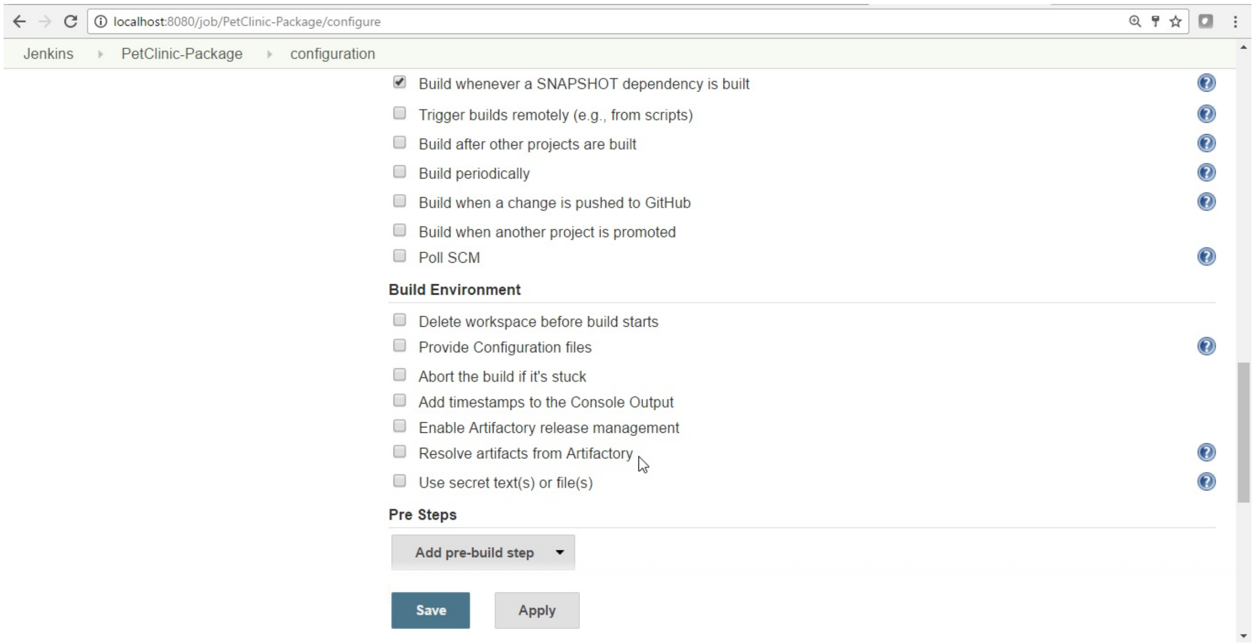
› Windows (C:) › Users › Mitesh › .m2 ›

Name	Date modified
repository	14-08-2017 14:30
repository1	13-08-2017 19:00

The moment Jenkins build execution starts, it will fetch dependencies from Artifactory and create a repository directory in `.m2`.

How to do it...

1. Go to a Jenkins project that creates a package file after compiling all of the source files.
2. Select Resolve artifacts from Artifactory:



localhost:8080/job/PetClinic-Package/configure

Jenkins ▸ PetClinic-Package ▸ configuration

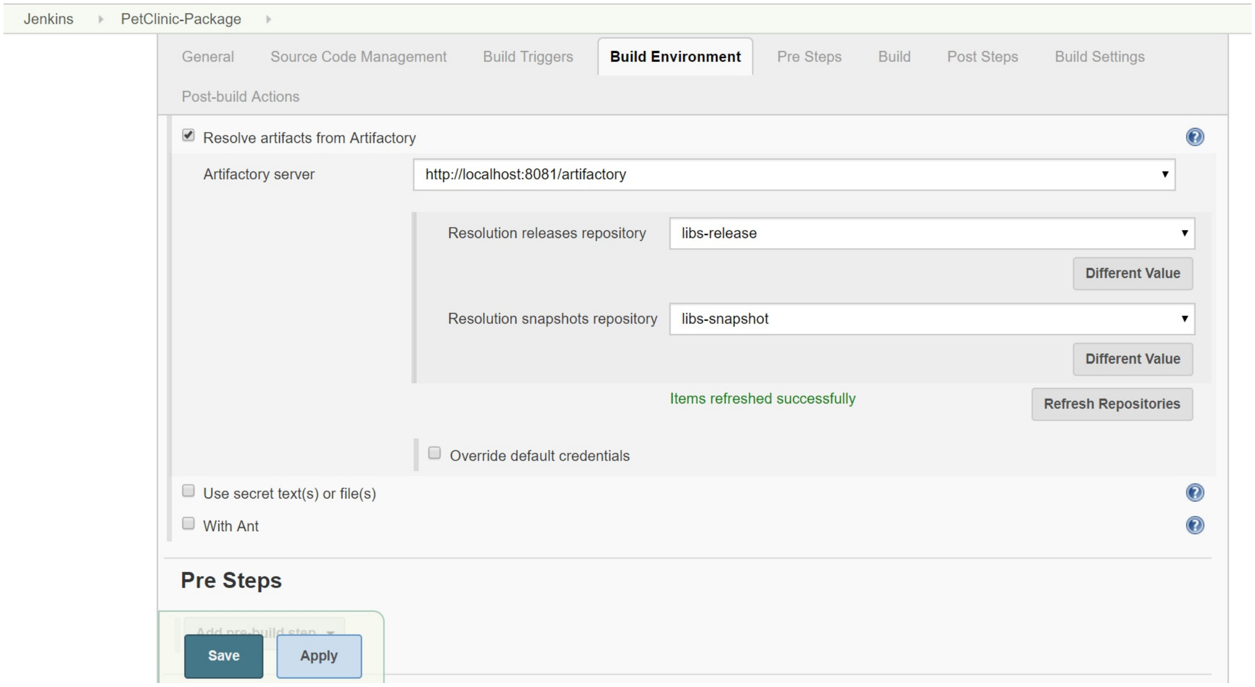
☑ Build whenever a SNAPSHOT dependency is built
□ Trigger builds remotely (e.g., from scripts)
□ Build after other projects are built
□ Build periodically
□ Build when a change is pushed to GitHub
□ Build when another project is promoted
□ Poll SCM

Build Environment

□ Delete workspace before build starts
□ Provide Configuration files
□ Abort the build if it's stuck
□ Add timestamps to the Console Output
□ Enable Artifactory release management
□ Resolve artifacts from Artifactory
□ Use secret text(s) or file(s)

Pre Steps

3. Click on Refresh Repositories and select the repository in the release and snapshot field from the lists:



☑ Resolve artifacts from Artifactory

Artifactory server: http://localhost:8081/artifactory

Resolution releases repository: libs-release

Resolution snapshots repository: libs-snapshot

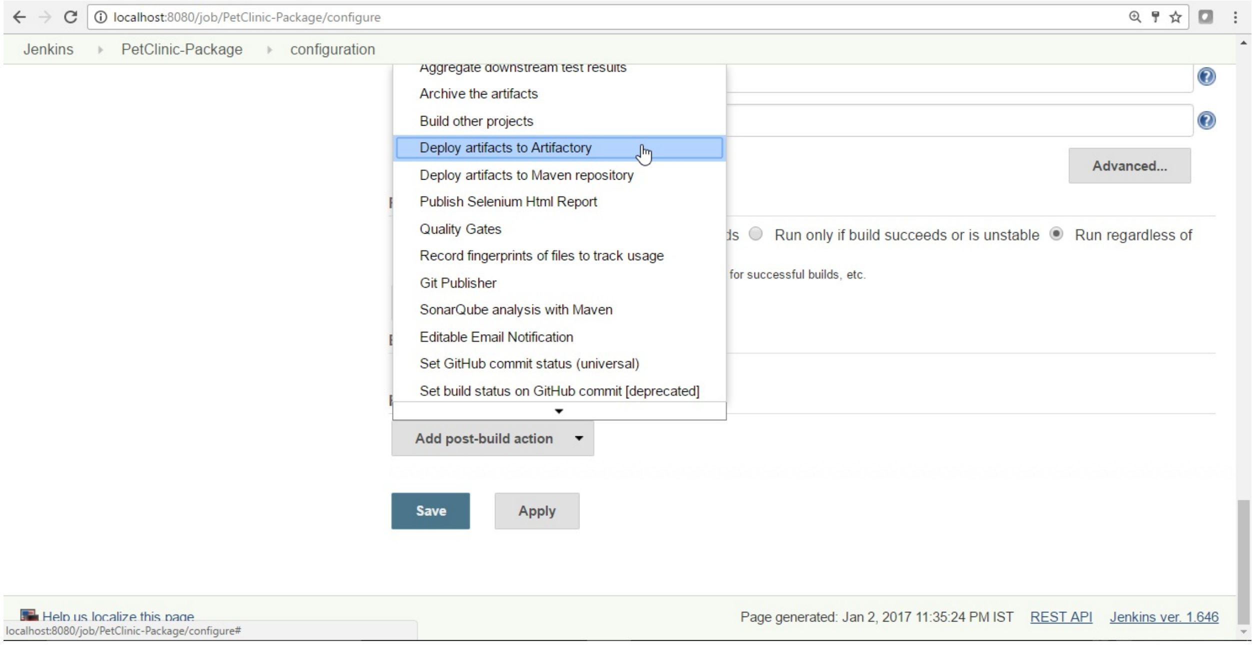
Items refreshed successfully

□ Override default credentials

□ Use secret text(s) or file(s)

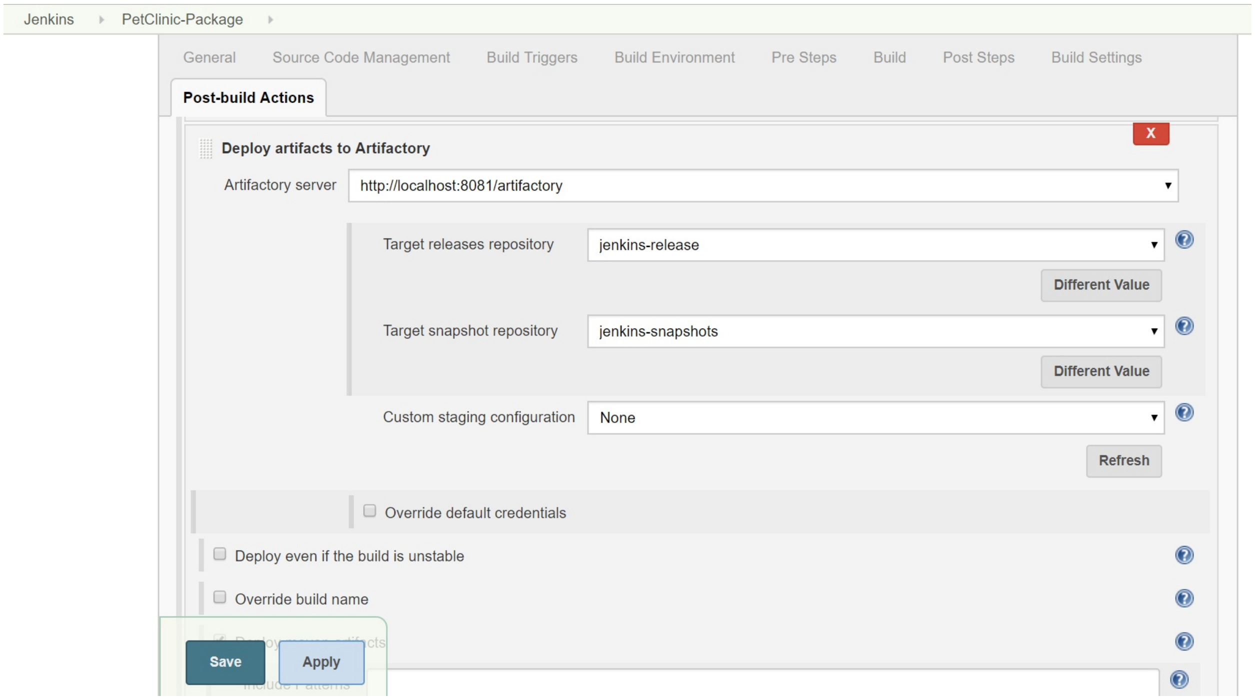
□ With Ant

4. Select Deploy artifacts to Artifactory from Add post-build action:



localhost:8080/job/PetClinic-Package/configure
Jenkins
PetClinic-Package
configuration
Aggregate downstream test results
Archive the artifacts
Build other projects
Deploy artifacts to Artifactory
Deploy artifacts to Maven repository
Publish Selenium Html Report
Quality Gates
Record fingerprints of files to track usage
Git Publisher
SonarQube analysis with Maven
Editable Email Notification
Set GitHub commit status (universal)
Set build status on GitHub commit [deprecated]
Add post-build action
Advanced...
ds ○ Run only if build succeeds or is unstable ● Run regardless of
for successful builds, etc.
Save
Apply
Help us localize this page
Page generated: Jan 2, 2017 11:35:24 PM IST
REST API
Jenkins ver. 1.646
localhost:8080/job/PetClinic-Package/configure#

5. Click on Refresh and select the repositories you created earlier:



Deploy artifacts to Artifactory

Artifactory server: http://localhost:8081/artifactory

Target releases repository: jenkins-release

Target snapshot repository: jenkins-snapshots

Custom staging configuration: None

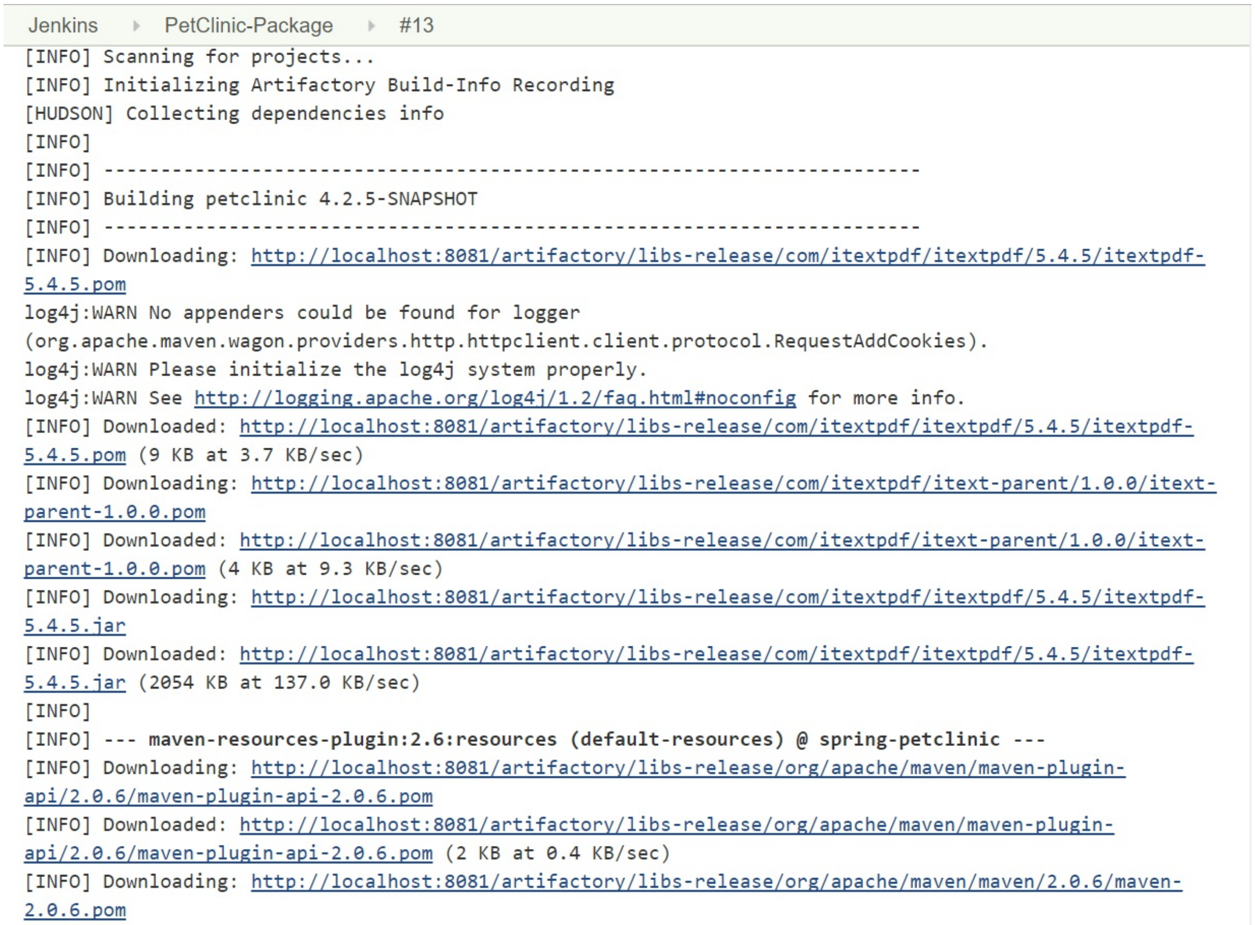
□ Override default credentials

□ Deploy even if the build is unstable

□ Override build name

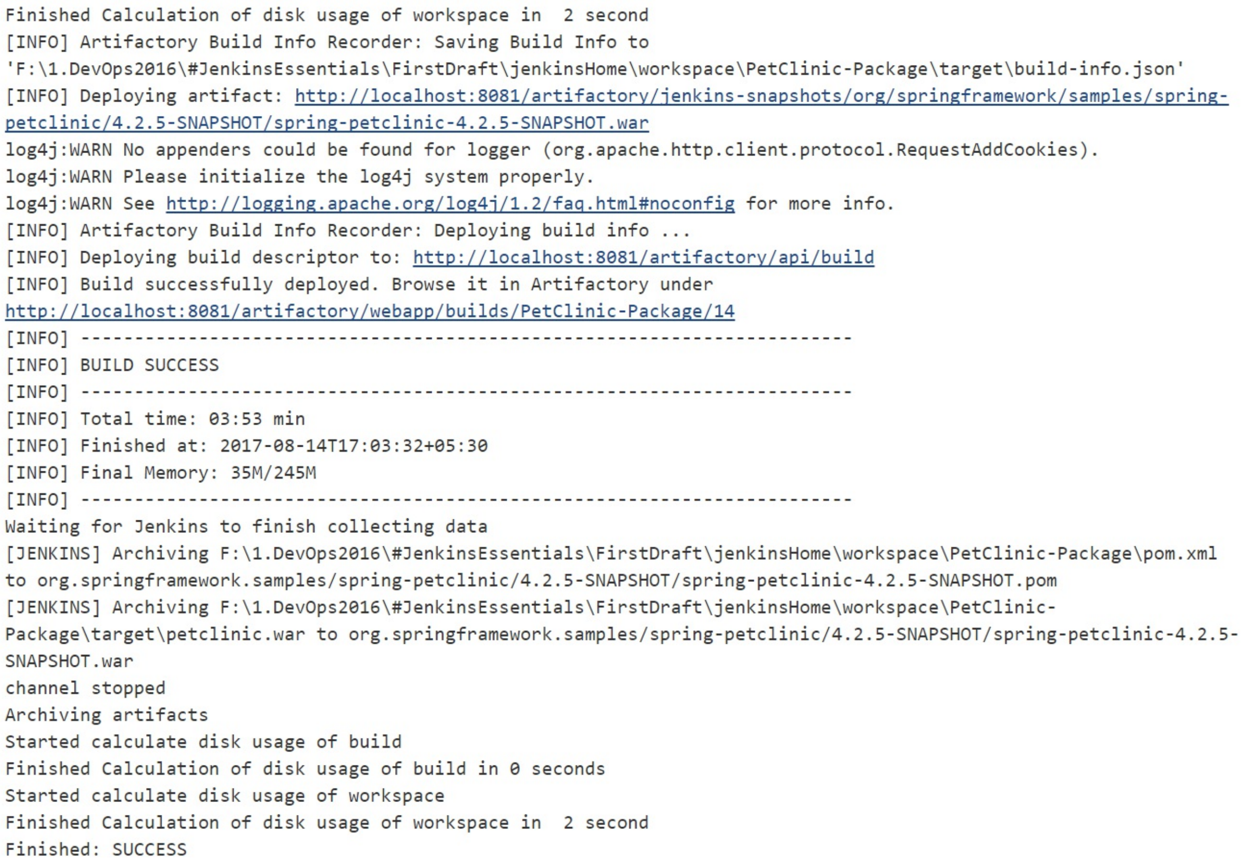
6. Click on Save.

7. Click on Build now and verify logs in the Console Output. Jar files are resolved from the local repository or Artifactory:



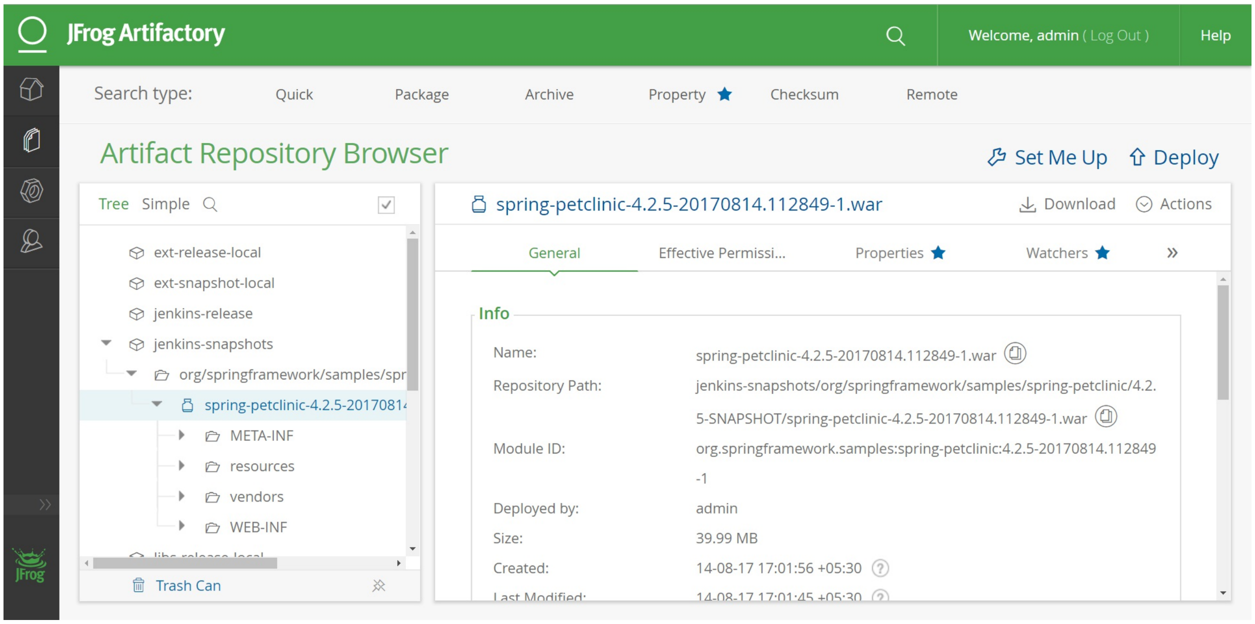
```
[INFO] Scanning for projects...
[INFO] Initializing Artifactory Build-Info Recording
[HUDSON] Collecting dependencies info
[INFO]
[INFO] ------------------------------------------------------------------------
[INFO] Building petclinic 4.2.5-SNAPSHOT
[INFO] ------------------------------------------------------------------------
[INFO] Downloading: http://localhost:8081/artifactory/libs-release/com/itextpdf/itextpdf/5.4.5/itextpdf-
5.4.5.pom
log4j:WARN No appenders could be found for logger
(org.apache.maven.wagon.providers.http.httpclient.client.protocol.RequestAddCookies).
log4j:WARN Please initialize the log4j system properly.
log4j:WARN See http://logging.apache.org/log4j/1.2/faq.html#noconfig for more info.
[INFO] Downloaded: http://localhost:8081/artifactory/libs-release/com/itextpdf/itextpdf/5.4.5/itextpdf-
5.4.5.pom (9 KB at 3.7 KB/sec)
[INFO] Downloading: http://localhost:8081/artifactory/libs-release/com/itextpdf/itext-parent/1.0.0/itext-
parent-1.0.0.pom
[INFO] Downloaded: http://localhost:8081/artifactory/libs-release/com/itextpdf/itext-parent/1.0.0/itext-
parent-1.0.0.pom (4 KB at 9.3 KB/sec)
[INFO] Downloading: http://localhost:8081/artifactory/libs-release/com/itextpdf/itextpdf/5.4.5/itextpdf-
5.4.5.jar
[INFO] Downloaded: http://localhost:8081/artifactory/libs-release/com/itextpdf/itextpdf/5.4.5/itextpdf-
5.4.5.jar (2054 KB at 137.0 KB/sec)
[INFO]
[INFO] --- maven-resources-plugin:2.6:resources (default-resources) @ spring-petclinic ---
[INFO] Downloading: http://localhost:8081/artifactory/libs-release/org/apache/maven/maven-plugin-
api/2.0.6/maven-plugin-api-2.0.6.pom
[INFO] Downloaded: http://localhost:8081/artifactory/libs-release/org/apache/maven/maven-plugin-
api/2.0.6/maven-plugin-api-2.0.6.pom (2 KB at 0.4 KB/sec)
[INFO] Downloading: http://localhost:8081/artifactory/libs-release/org/apache/maven/maven/2.0.6/maven-
2.0.6.pom
```

8. Once the package is created, it is stored in Artifactory too:



```
Finished Calculation of disk usage of workspace in  2 second
[INFO] Artifactory Build Info Recorder: Saving Build Info to
'F:\1.DevOps2016\#JenkinsEssentials\FirstDraft\jenkinsHome\workspace\PetClinic-Package\target\build-info.json'
[INFO] Deploying artifact: http://localhost:8081/artifactory/jenkins-snapshots/org/springframework/samples/spring-
petclinic/4.2.5-SNAPSHOT/spring-petclinic-4.2.5-SNAPSHOT.war
log4j:WARN No appenders could be found for logger (org.apache.http.client.protocol.RequestAddCookies).
log4j:WARN Please initialize the log4j system properly.
log4j:WARN See http://logging.apache.org/log4j/1.2/faq.html#noconfig for more info.
[INFO] Artifactory Build Info Recorder: Deploying build info ...
[INFO] Deploying build descriptor to: http://localhost:8081/artifactory/api/build
[INFO] Build successfully deployed. Browse it in Artifactory under
http://localhost:8081/artifactory/webapp/builds/PetClinic-Package/14
[INFO] ------------------------------------------------------------------------
[INFO] BUILD SUCCESS
[INFO] ------------------------------------------------------------------------
[INFO] Total time: 03:53 min
[INFO] Finished at: 2017-08-14T17:03:32+05:30
[INFO] Final Memory: 35M/245M
[INFO] ------------------------------------------------------------------------
Waiting for Jenkins to finish collecting data
[JENKINS] Archiving F:\1.DevOps2016\#JenkinsEssentials\FirstDraft\jenkinsHome\workspace\PetClinic-Package\pom.xml
to org.springframework.samples/spring-petclinic/4.2.5-SNAPSHOT/spring-petclinic-4.2.5-SNAPSHOT.pom
[JENKINS] Archiving F:\1.DevOps2016\#JenkinsEssentials\FirstDraft\jenkinsHome\workspace\PetClinic-
Package\target\petclinic.war to org.springframework.samples/spring-petclinic/4.2.5-SNAPSHOT/spring-petclinic-4.2.5-
SNAPSHOT.war
channel stopped
Archiving artifacts
Started calculate disk usage of build
Finished Calculation of disk usage of build in 0 seconds
Started calculate disk usage of workspace
Finished Calculation of disk usage of workspace in  2 second
Finished: SUCCESS
```

9. Go to Artifactory and verify the package:



Name: spring-petclinic-4.2.5-20170814.112849-1.war

Repository Path: jenkins-snapshots/org/springframework/samples/spring-petclinic/4.2.5-SNAPSHOT/spring-petclinic-4.2.5-20170814.112849-1.war

Module ID: org.springframework.samples:spring-petclinic:4.2.5-20170814.112849-1

Deployed by: admin

Size: 39.99 MB

Created: 14-08-17 17:01:56 +05:30

Last Modified: 14-08-17 17:01:45 +05:30

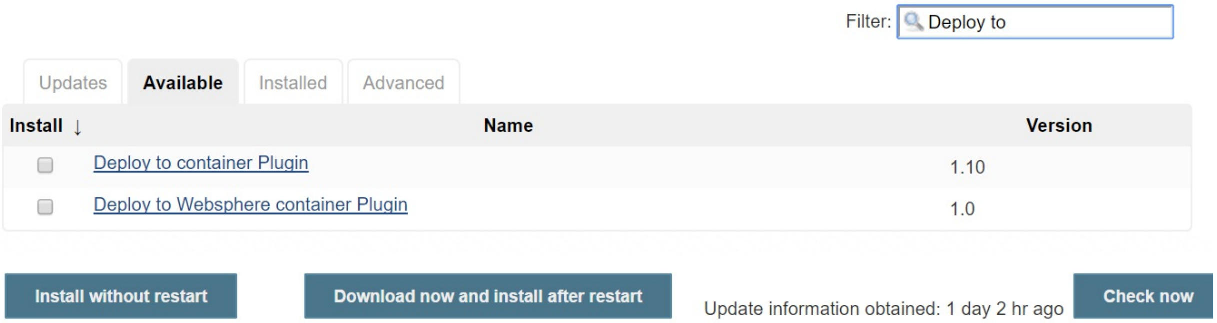
10. Verify the local repository, `libs-release`, in Artifactory and you will find all Jar files available in it.

Deploying a WAR file from Jenkins to Tomcat

For application deployment, we can utilize multiple methods to deploy an application to a web server or application server. We can use a batch script or shell script to copy the Package file created after the Continuous Integration process, or we can use the Jenkins plugin to deploy an application.

Getting ready

Go to Manage Jenkins | Manage Plugins and install Deploy to container Plugin:



Filter: Deploy to

Install ↓	Name	Version
□	Deploy to container Plugin	1.10
□	Deploy to Websphere container Plugin	1.0

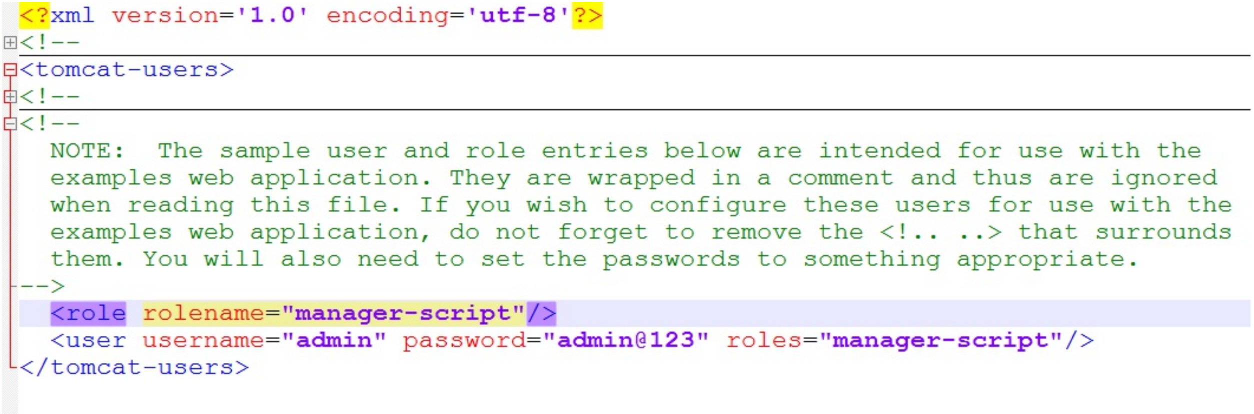
Update information obtained: 1 day 2 hr ago

Wait until the plugin has installed successfully.

How to do it...

To allow deployment using the Jenkins plugin, go to the Tomcat installation directory and open `conf\tomcat-users.xml`.

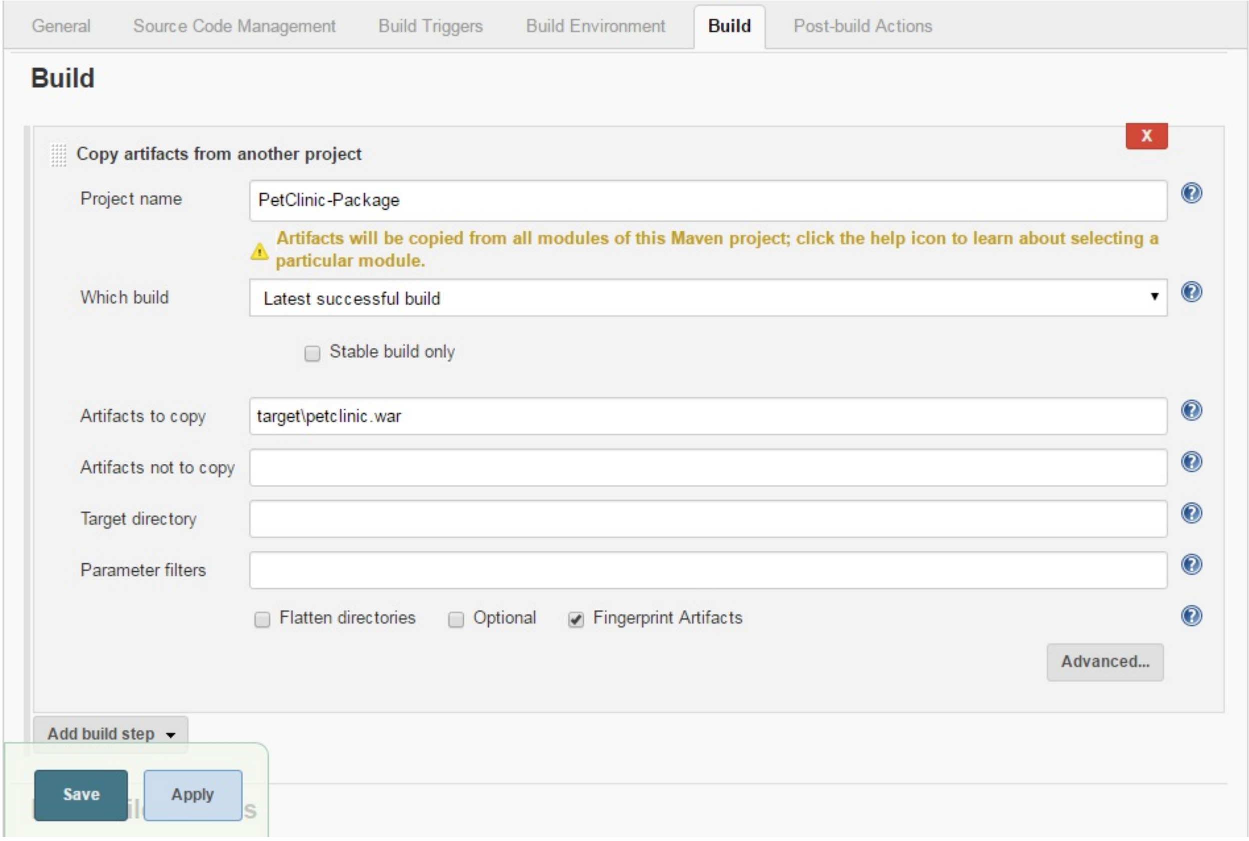
1. Create a new role and a new user, as follows:



```
<?xml version='1.0' encoding='utf-8'?>
<!--
<tomcat-users>
<!--
<!--
  NOTE:  The sample user and role entries below are intended for use with the
  examples web application. They are wrapped in a comment and thus are ignored
  when reading this file. If you wish to configure these users for use with the
  examples web application, do not forget to remove the <!.. ..> that surrounds
  them. You will also need to set the passwords to something appropriate.
-->
  <role rolename="manager-script"/>
  <user username="admin" password="admin@123" roles="manager-script"/>
</tomcat-users>
```

2. Restart Tomcat.

3. Create a new Freestyle build in the Jenkins named `PetClinic-Deploy`.
4. What we will do here is copy the artifact created for the `PetClinic-Package` job and deploy it in Tomcat. Install the Copy Artifact plugin to perform this action. Give the Project name and path from which we need to copy the WAR file:



Build

Copy artifacts from another project

Project name: PetClinic-Package

⚠ Artifacts will be copied from all modules of this Maven project; click the help icon to learn about selecting a particular module.

Which build: Latest successful build

□ Stable build only

Artifacts to copy: target\petclinic.war

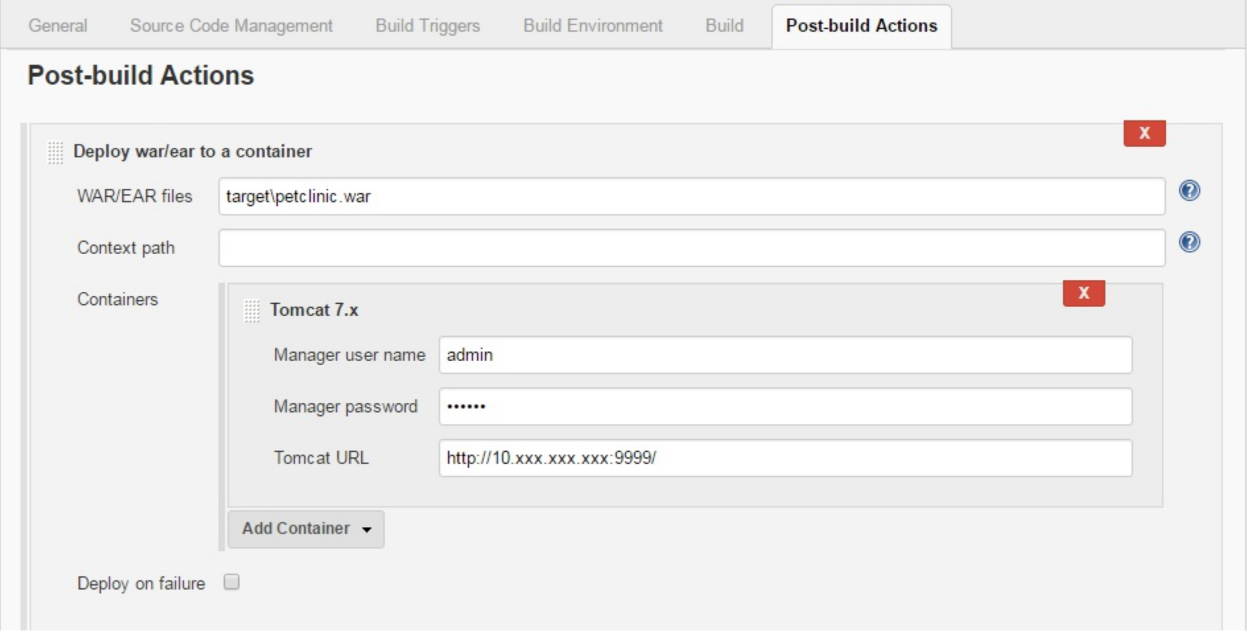
Artifacts not to copy:

Target directory:

Parameter filters:

□ Flatten directories □ Optional ☑ Fingerprint Artifacts

5. Give the path to the WAR file for deployment using the Jenkins plugin. Select Deploy war/ear to a container from Post-build Actions. Click on Add Container and select the latest version of Tomcat. Give the Tomcat URL. Give the username and password we have defined in `tomcat-users.xml`:



Post-build Actions

Deploy war/ear to a container

WAR/EAR files: target\petclinic.war

Context path:

Containers:

Tomcat 7.x

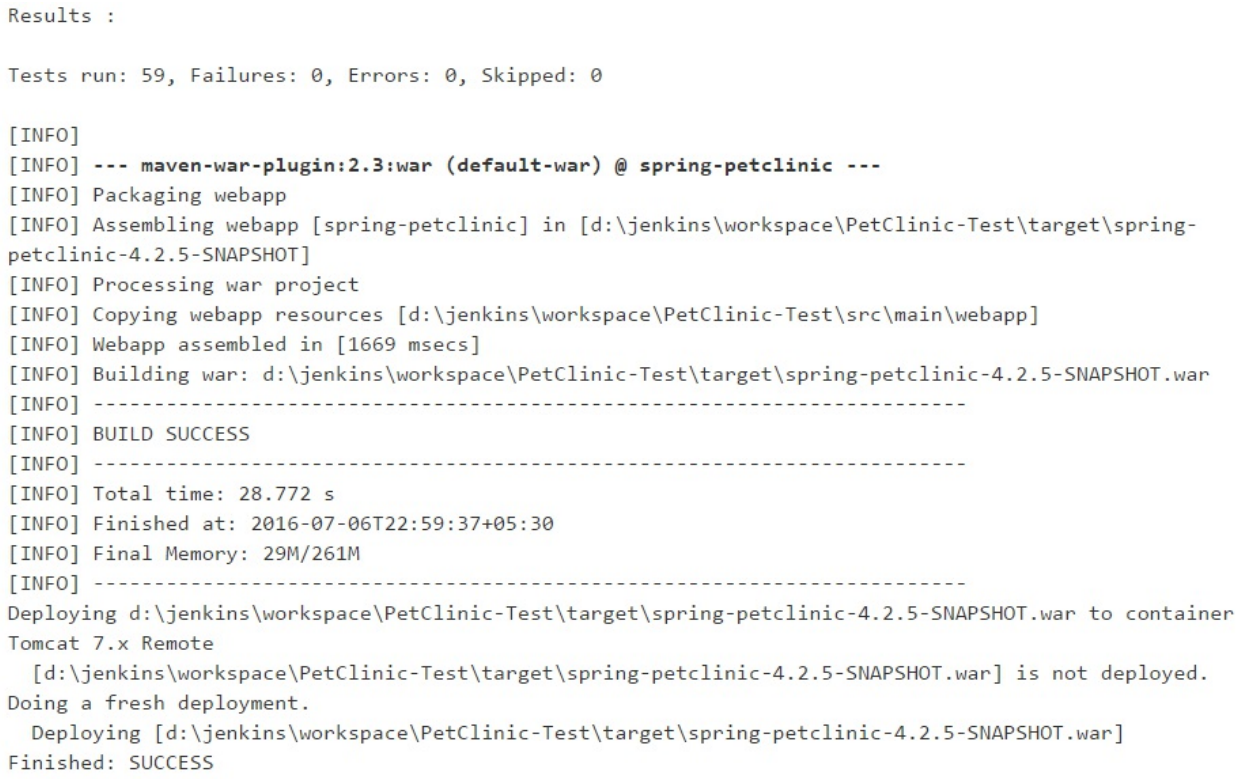
Manager user name: admin

Manager password: ••••••

Tomcat URL: http://10.xxx.xxx.xxx:9999/

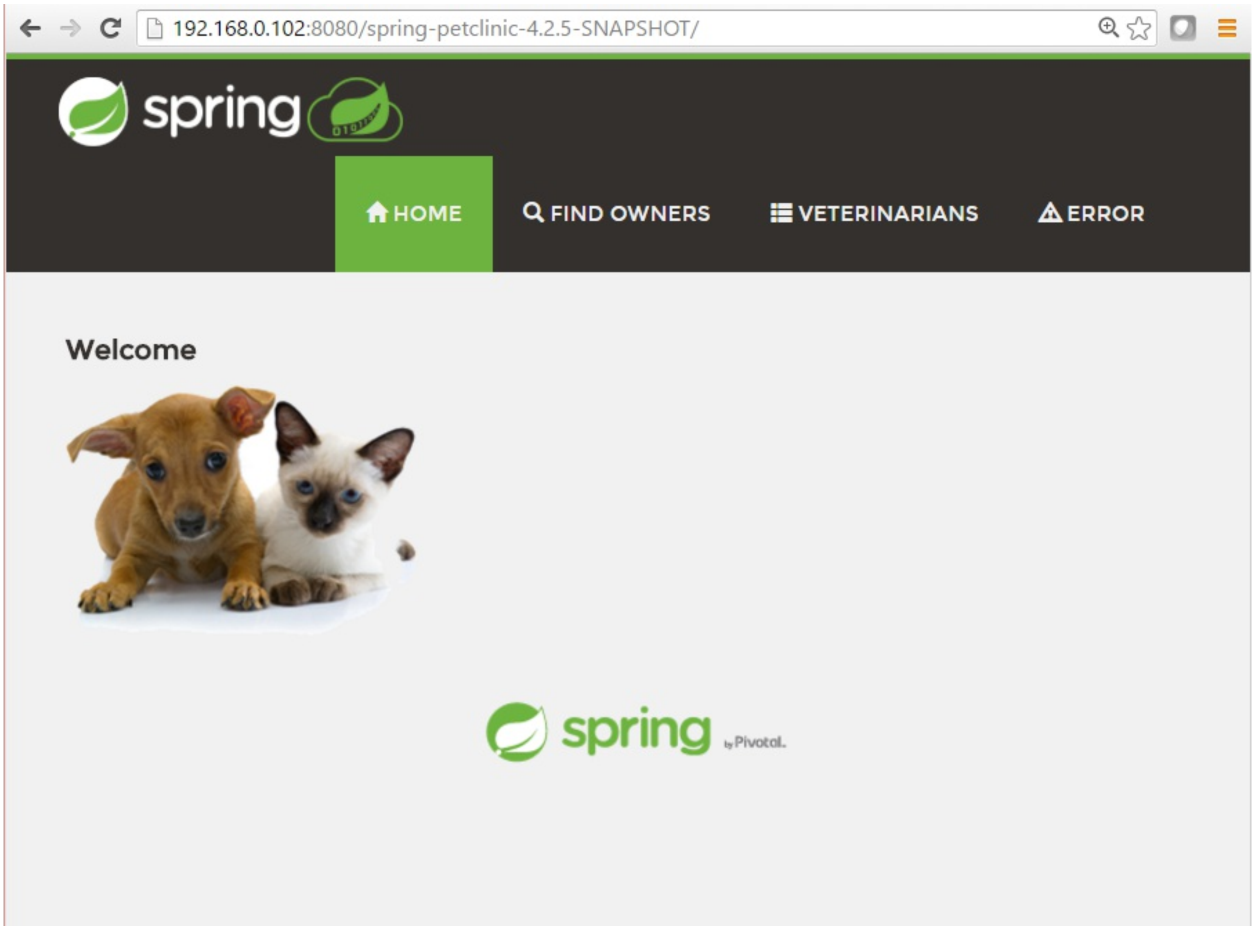
Deploy on failure □

6. Execute the build by clicking Build now. Verify the logs for application deployment:



```
Results :

Tests run: 59, Failures: 0, Errors: 0, Skipped: 0

[INFO]
[INFO] --- maven-war-plugin:2.3:war (default-war) @ spring-petclinic ---
[INFO] Packaging webapp
[INFO] Assembling webapp [spring-petclinic] in [d:\jenkins\workspace\PetClinic-Test\target\spring-
petclinic-4.2.5-SNAPSHOT]
[INFO] Processing war project
[INFO] Copying webapp resources [d:\jenkins\workspace\PetClinic-Test\src\main\webapp]
[INFO] Webapp assembled in [1669 msecs]
[INFO] Building war: d:\jenkins\workspace\PetClinic-Test\target\spring-petclinic-4.2.5-SNAPSHOT.war
[INFO] ------------------------------------------------------------------------
[INFO] BUILD SUCCESS
[INFO] ------------------------------------------------------------------------
[INFO] Total time: 28.772 s
[INFO] Finished at: 2016-07-06T22:59:37+05:30
[INFO] Final Memory: 29M/261M
[INFO] ------------------------------------------------------------------------
Deploying d:\jenkins\workspace\PetClinic-Test\target\spring-petclinic-4.2.5-SNAPSHOT.war to container
Tomcat 7.x Remote
  [d:\jenkins\workspace\PetClinic-Test\target\spring-petclinic-4.2.5-SNAPSHOT.war] is not deployed.
Doing a fresh deployment.
  Deploying [d:\jenkins\workspace\PetClinic-Test\target\spring-petclinic-4.2.5-SNAPSHOT.war]
Finished: SUCCESS
```

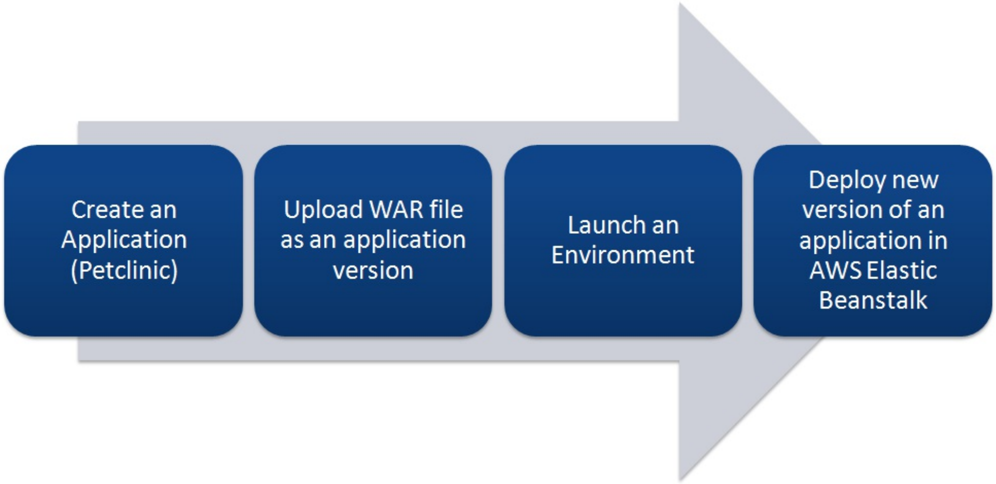
7. Go to your browser and visit the application with the Tomcat URL and the context of the application:



8. In the next section, we will deploy the PetClinic application to Tomcat, which resides in the AWS EC2 instance.

Deploying a WAR file from Jenkins to AWS Beanstalk

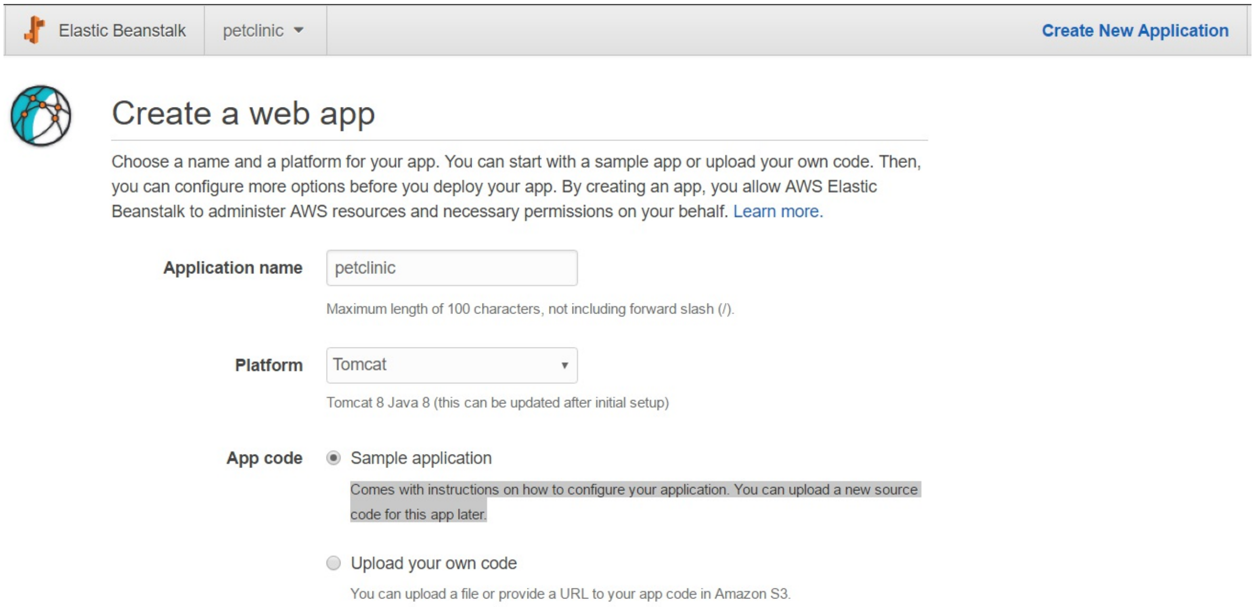
AWS Elastic Beanstalk is a **Platform as a Service** (**PaaS**). We will use it to deploy the PetClinic application. These are the steps you need to follow to deploy an application on AWS Elastic Beanstalk:


Create an Application (Petclinic)
Upload WAR file as an application version
Launch an Environment
Deploy new version of an application in AWS Elastic Beanstalk

Getting ready

Let's create a sample application in Elastic Beanstalk to understand how Elastic Beanstalk works. Then, we will use the Jenkins plugin to deploy an application into it.

Click on Services in the AWS management console and select AWS Elastic Beanstalk. Create a new application named `petclinic`. Select Tomcat as a Platform and select the Sample application radio button:



Create a web app

Choose a name and a platform for your app. You can start with a sample app or upload your own code. Then, you can configure more options before you deploy your app. By creating an app, you allow AWS Elastic Beanstalk to administer AWS resources and necessary permissions on your behalf. Learn more.

Application name petclinic

Maximum length of 100 characters, not including forward slash (/).

Platform Tomcat ▾

Tomcat 8 Java 8 (this can be updated after initial setup)

App code

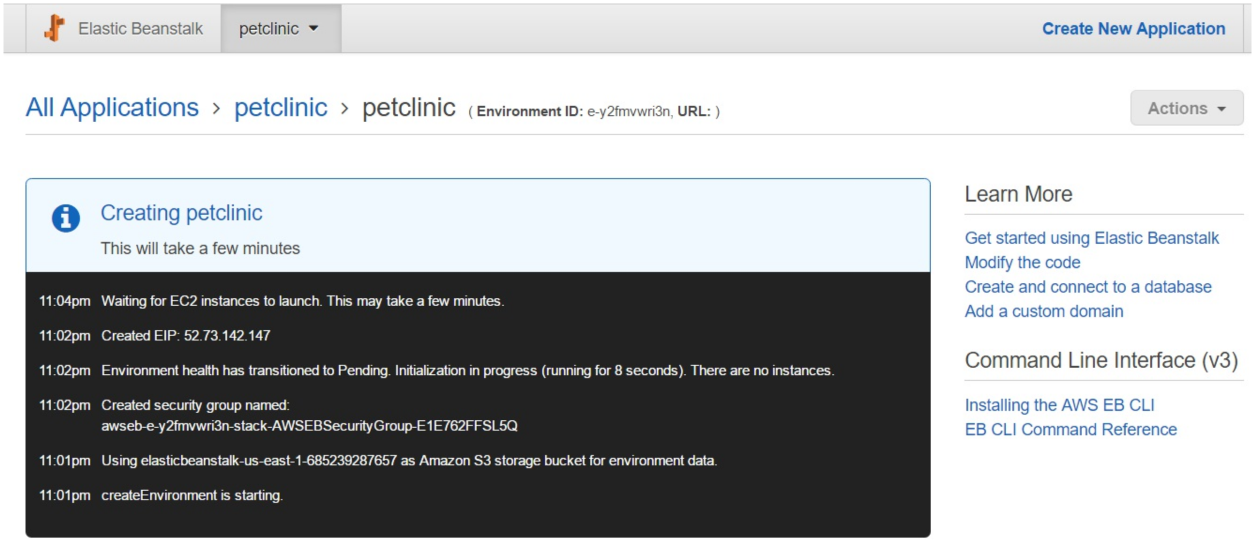
● Sample application

Comes with instructions on how to configure your application. You can upload a new source code for this app later.

○ Upload your own code

You can upload a file or provide a URL to your app code in Amazon S3.

Verify the sequence of events for the creation of a sample application:



All Applications › petclinic › petclinic (**Environment ID:** e-y2fmvwri3n, **URL:**)

Creating petclinic

This will take a few minutes

```
11:04pm  Waiting for EC2 instances to launch. This may take a few minutes.
11:02pm  Created EIP: 52.73.142.147
11:02pm  Environment health has transitioned to Pending. Initialization in progress (running for 8 seconds). There are no instances.
11:02pm  Created security group named:
         awseb-e-y2fmvwri3n-stack-AWSEBSecurityGroup-E1E762FFSL5Q
11:01pm  Using elasticbeanstalk-us-east-1-685239287657 as Amazon S3 storage bucket for environment data.
11:01pm  createEnvironment is starting.
```

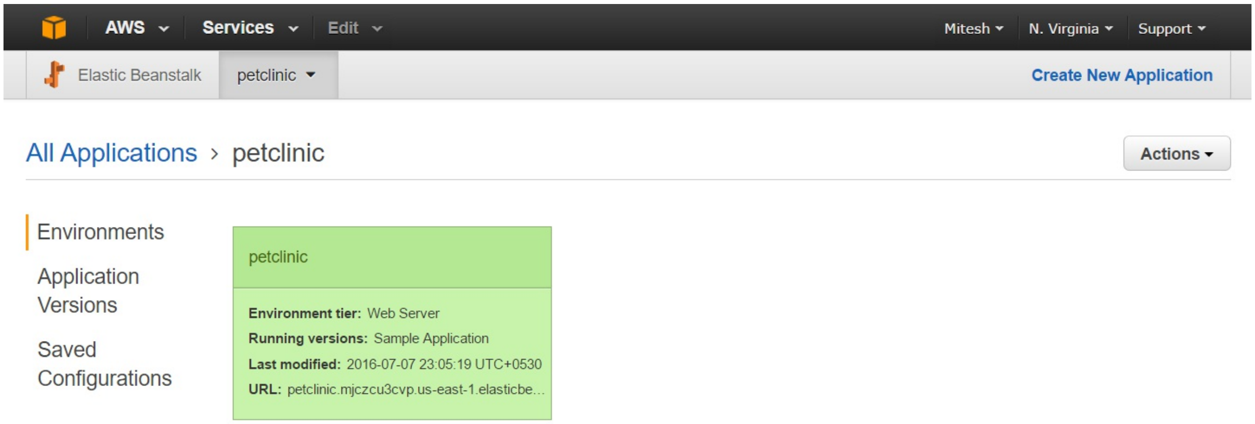
Learn More

Get started using Elastic Beanstalk
Modify the code
Create and connect to a database
Add a custom domain

Command Line Interface (v3)

Installing the AWS EB CLI
EB CLI Command Reference

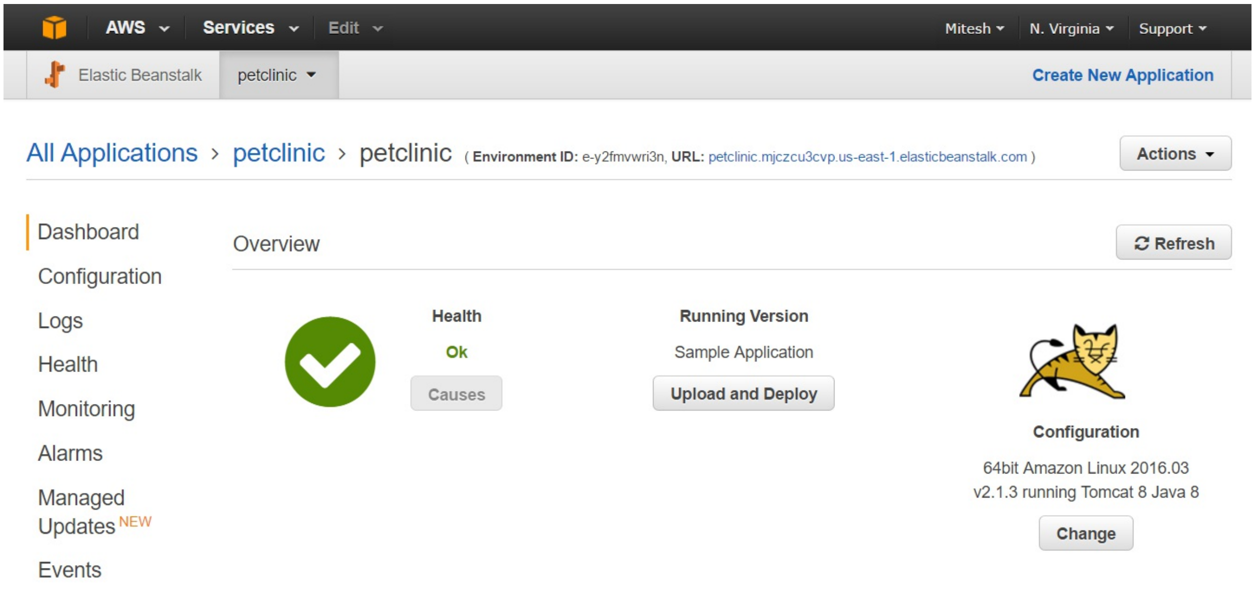
It will take some time and, once the environment has been created, it will be highlighted in green:



petclinic

Environment tier: Web Server
Running versions: Sample Application
Last modified: 2016-07-07 23:05:19 UTC+0530
URL: petclinic.mjczcu3cvp.us-east-1.elasticbe...

Click on the petclinic environment and verify Health and Running Version in the dashboard:



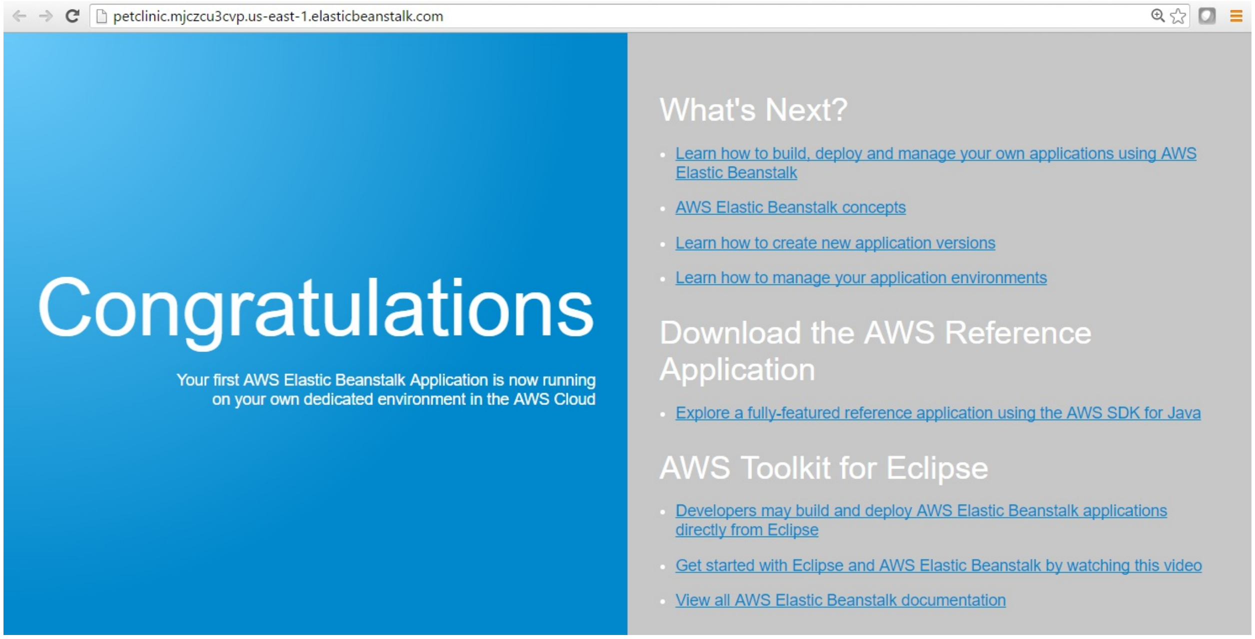
(**Environment ID:** e-y2fmvwri3n, **URL:** petclinic.mjczcu3cvp.us-east-1.elasticbeanstalk.com)

Health
Ok

Running Version
Sample Application

Configuration
64bit Amazon Linux 2016.03 v2.1.3 running Tomcat 8 Java 8

Verify the environment ID and URL. Click on the URL and verify the default page:


petclinic.mjczcu3cvp.us-east-1.elasticbeanstalk.com

Congratulations

Your first AWS Elastic Beanstalk Application is now running
on your own dedicated environment in the AWS Cloud

What's Next?

- Learn how to build, deploy and manage your own applications using AWS Elastic Beanstalk
- AWS Elastic Beanstalk concepts
- Learn how to create new application versions
- Learn how to manage your application environments

Download the AWS Reference Application

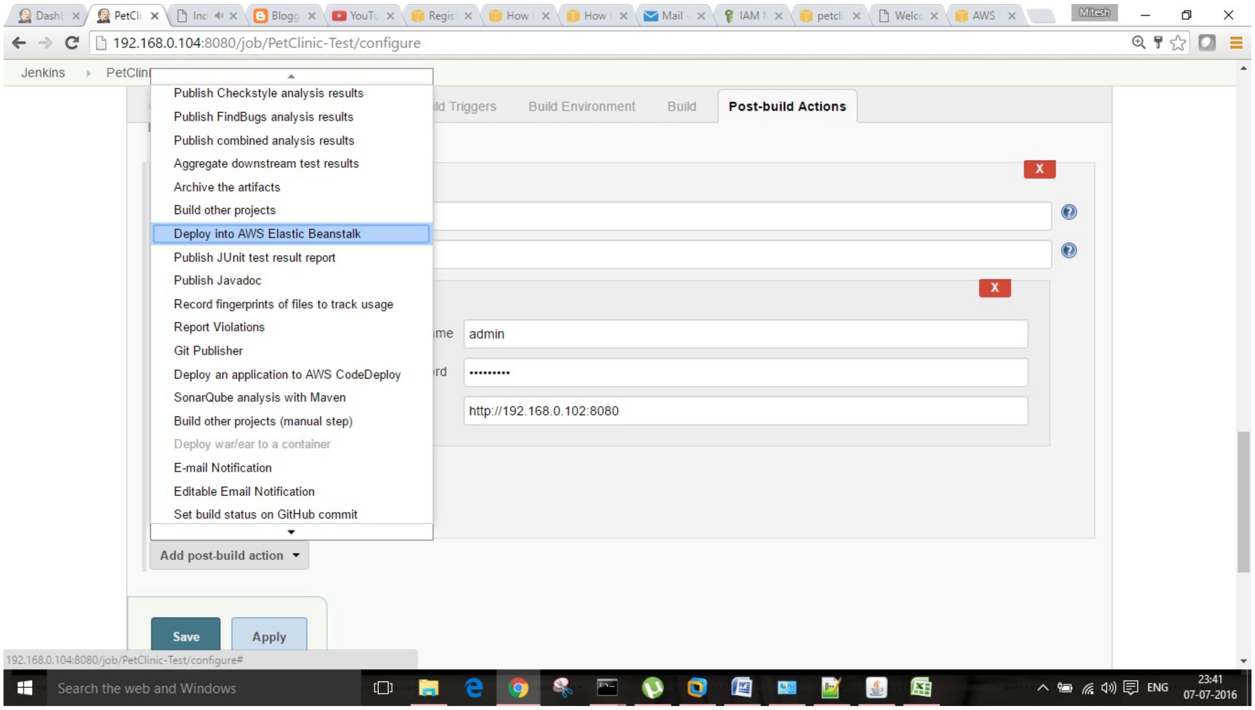
- Explore a fully-featured reference application using the AWS SDK for Java

AWS Toolkit for Eclipse

- Developers may build and deploy AWS Elastic Beanstalk applications directly from Eclipse
- Get started with Eclipse and AWS Elastic Beanstalk by watching this video
- View all AWS Elastic Beanstalk documentation

How to do it...

1. Install the AWS Elastic Beanstalk Publisher plugin. For more details, visit https://wiki.jenkins-ci.org/display/JENKINS/AWS+Beanstalk+Publisher+Plugin:


Jenkins
PetClin
ild Triggers
Build Environment
Build
Post-build Actions
Publish Checkstyle analysis results
Publish FindBugs analysis results
Publish combined analysis results
Aggregate downstream test results
Archive the artifacts
Build other projects
Deploy into AWS Elastic Beanstalk
Publish JUnit test result report
Publish Javadoc
Record fingerprints of files to track usage
Report Violations
Git Publisher
Deploy an application to AWS CodeDeploy
SonarQube analysis with Maven
Build other projects (manual step)
Deploy war/ear to a container
E-mail Notification
Editable Email Notification
Set build status on GitHub commit
Add post-build action
Save
Apply

192.168.0.104:8080/job/PetClinic-Test/configure

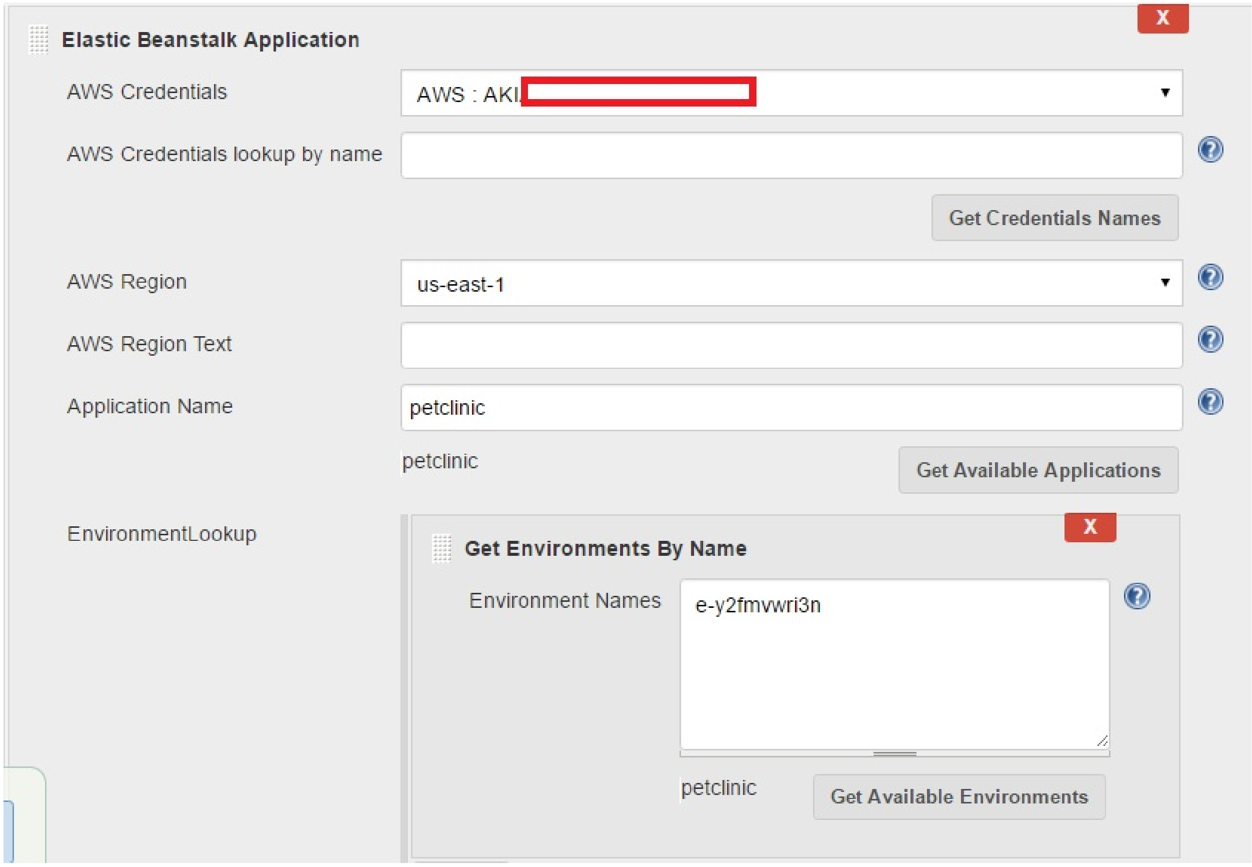
me: admin

rd: ••••••••••

http://192.168.0.102:8080

2. A new section will come up in Post-build Actions for Elastic Beanstalk.
3. Click on the Jenkins dashboard and select Credentials; add your AWS Credentials.
4. Go to your Jenkins build and select AWS Credentials, which is set in the global configuration.
5. Select AWS Region from the list and click on Get Available Applications. As we have created a sample application, it will show up like this.

6. In EnvironmentLookup, provide an environment ID in the Get Environments By Name box and click on Get Available Environments:


Elastic Beanstalk Application

AWS Credentials: AWS : AKI[redacted]

AWS Credentials lookup by name:

AWS Region: us-east-1

AWS Region Text:

Application Name: petclinic

petclinic

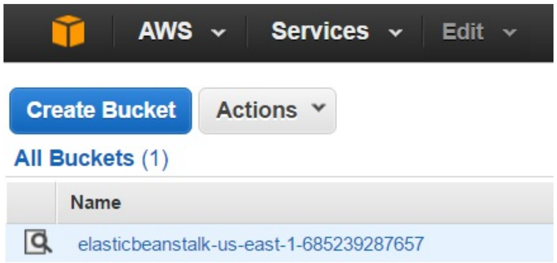
EnvironmentLookup

Get Environments By Name

Environment Names: e-y2fmvwri3n

petclinic

7. Save the configuration and click on Build now.
8. Now, let's go to the AWS management console to check whether the WAR file is being copied in Amazon S3 or not:
9. Go to S3 Services and check the available buckets:

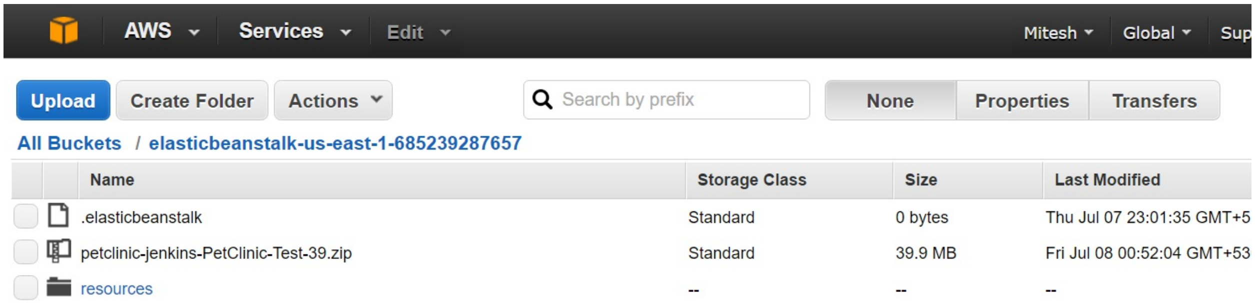

All Buckets (1)

Name
elasticbeanstalk-us-east-1-685239287657

10. Since the WAR file is large, it will take a while to upload to Amazon S3. Once it is uploaded, it will be available in the Amazon S3 bucket.
11. Check the build job's execution status in Jenkins. Some sections of the expected output are the following:

- The test case execution and WAR file creation were successful
- The build was successful

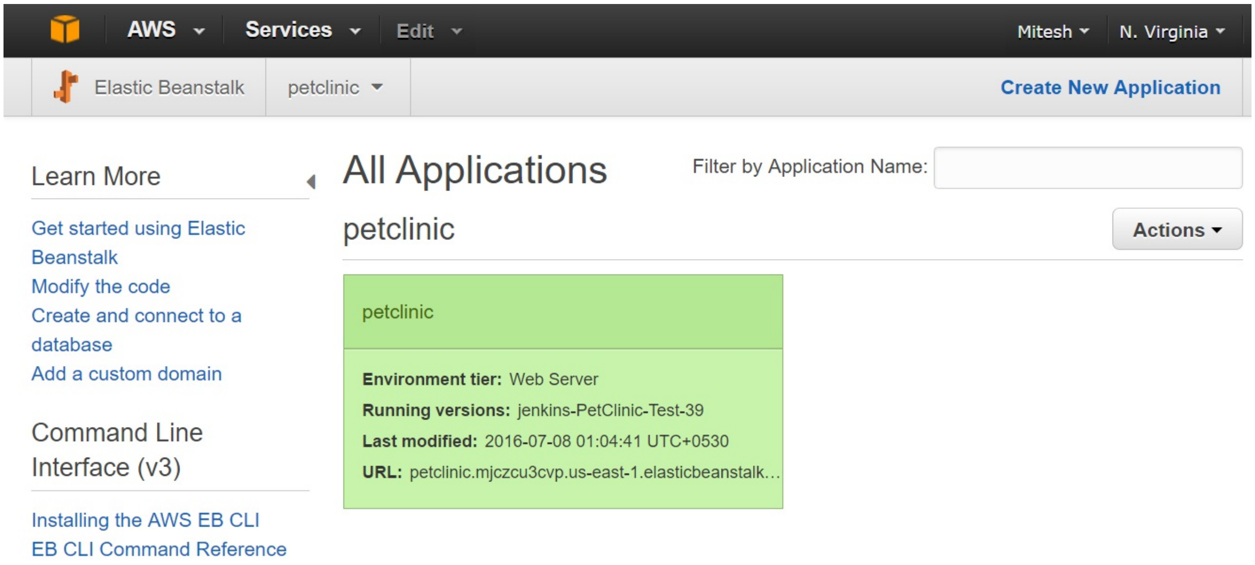
12. Now, check the AWS management console:



All Buckets / elasticbeanstalk-us-east-1-685239287657

Name	Storage Class	Size	Last Modified
.elasticbeanstalk	Standard	0 bytes	Thu Jul 07 23:01:35 GMT+5
petclinic-jenkins-PetClinic-Test-39.zip	Standard	39.9 MB	Fri Jul 08 00:52:04 GMT+53
resources	--	--	--

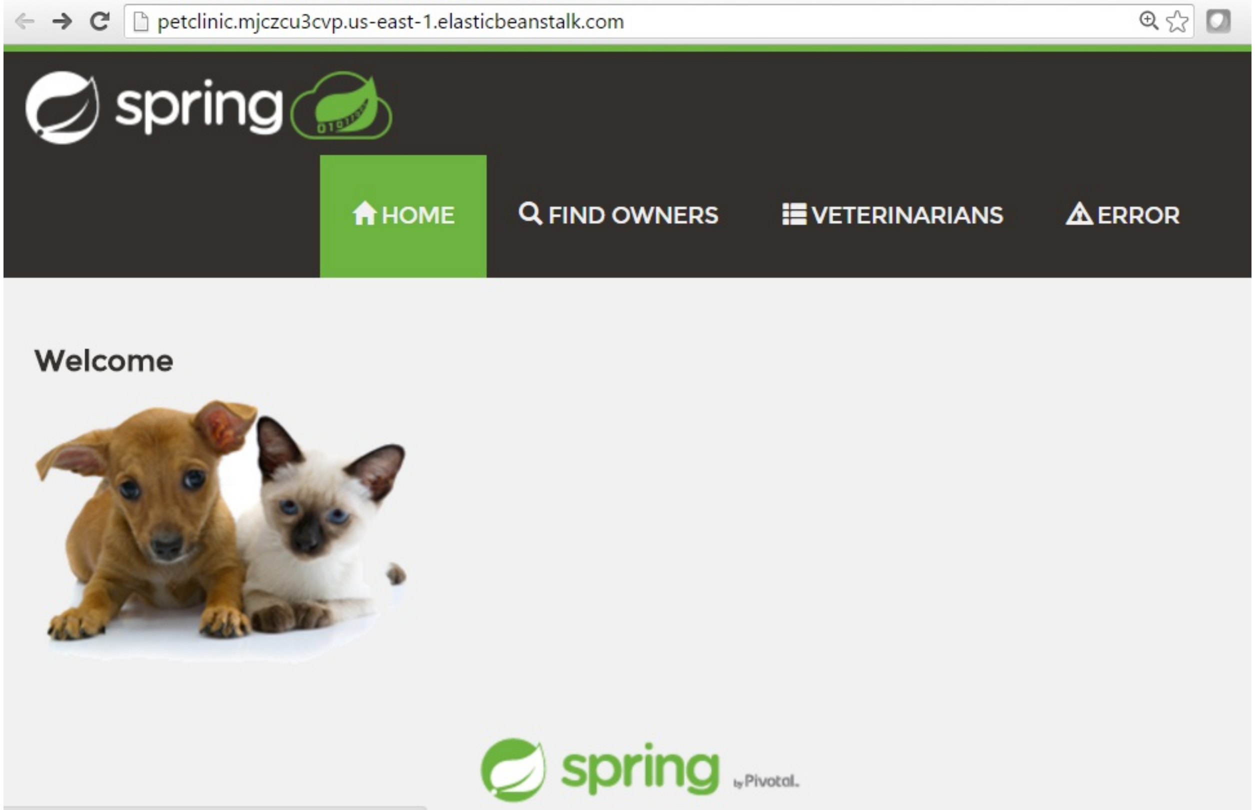
13. Go to Services, click on AWS Elastic Beanstalk, and verify the environment. The previous version was Sample Application. Now, the version has been updated to what is provided in Version Label Format in the Jenkins build job configuration:



petclinic

Environment tier: Web Server
Running versions: jenkins-PetClinic-Test-39
Last modified: 2016-07-08 01:04:41 UTC+0530
URL: petclinic.mjczcu3cvp.us-east-1.elasticbeanstalk...

14. Go to the dashboard and verify Health and Running Version again.
15. Once everything has been verified, click on the URL for the environment, and our PetClinic application will be live:



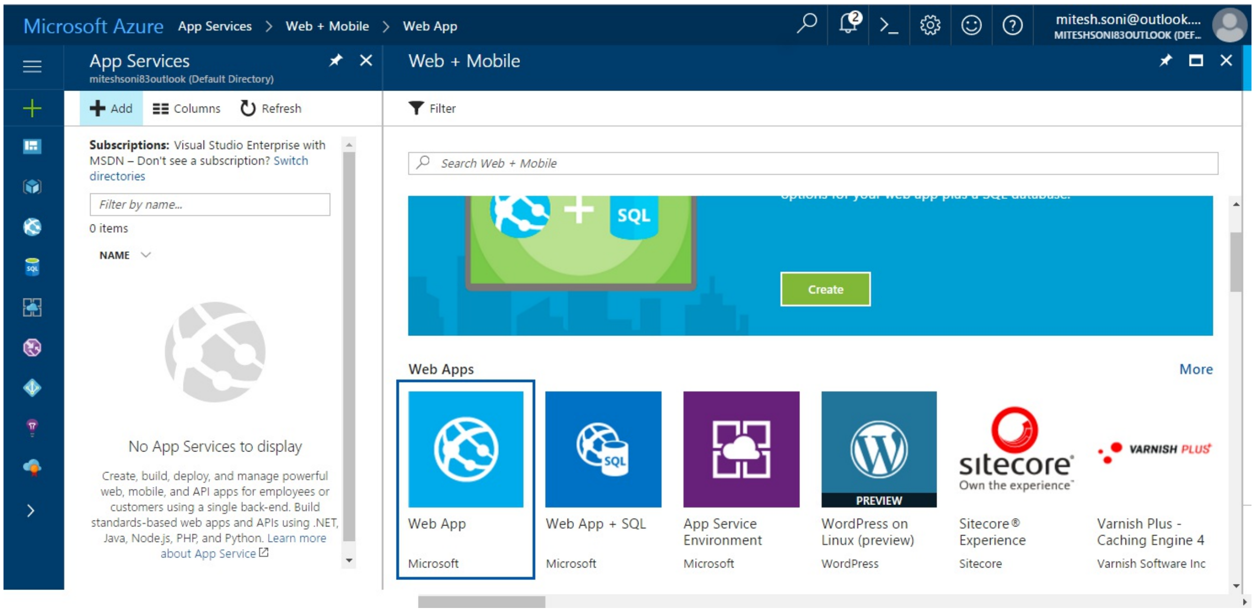
16. Once the application deployment is successful, terminate the environment. Go to Specific environment and click on Actions to Terminate the environment. We have successfully deployed our application on Elastic Beanstalk.

Deploying a WAR file from Jenkins to Azure App Services

Microsoft Azure App services is a PaaS. In this section, we will look at the Azure web app and how we can deploy our PetClinic application.

Getting ready

We need to have a Microsoft Azure subscription. Go to App Services and click + Add:

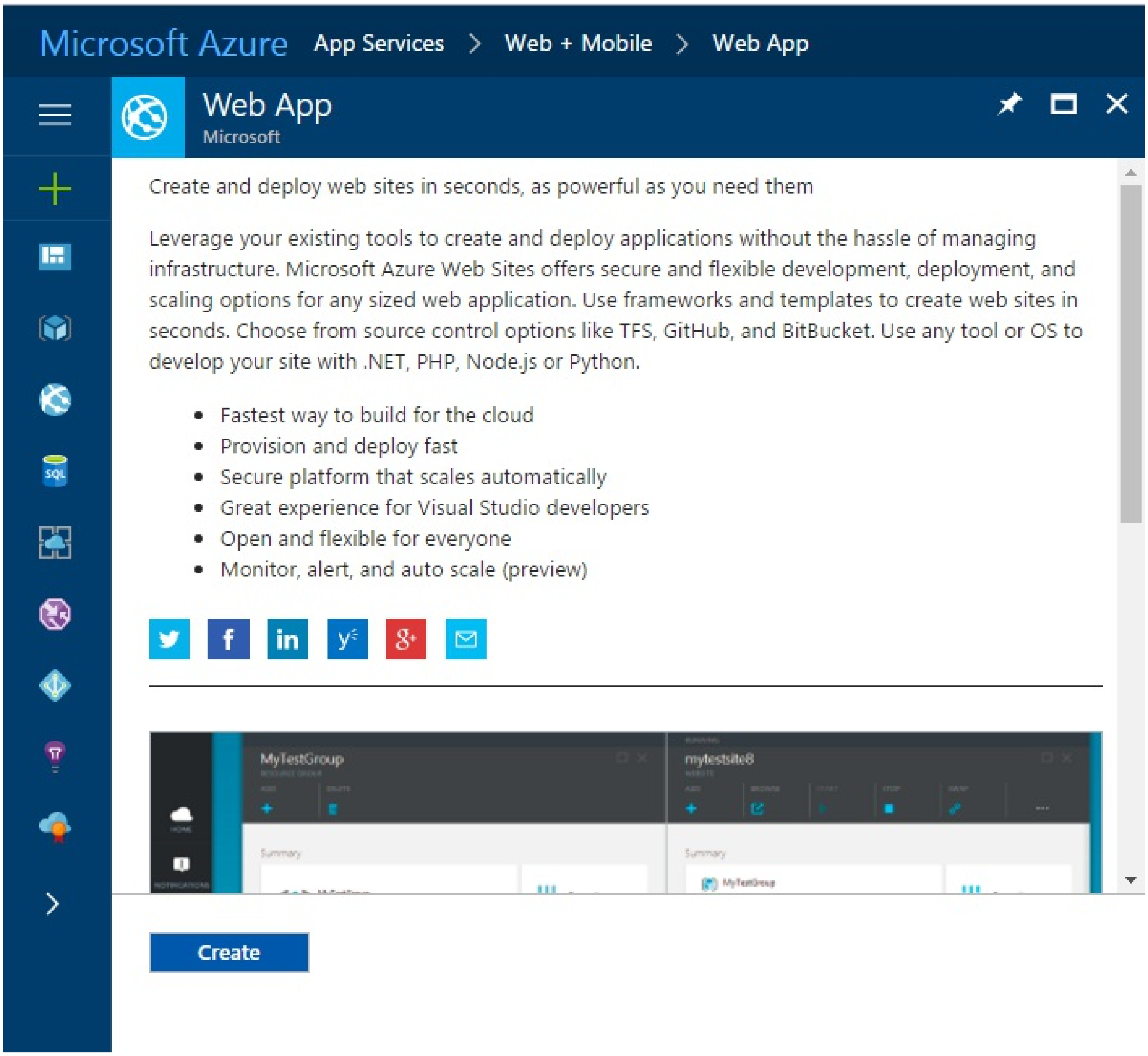


Subscriptions: Visual Studio Enterprise with MSDN – Don't see a subscription? Switch directories

No App Services to display

Create, build, deploy, and manage powerful web, mobile, and API apps for employees or customers using a single back-end. Build standards-based web apps and APIs using .NET, Java, Node.js, PHP, and Python. Learn more about App Service

Then, click on Create:

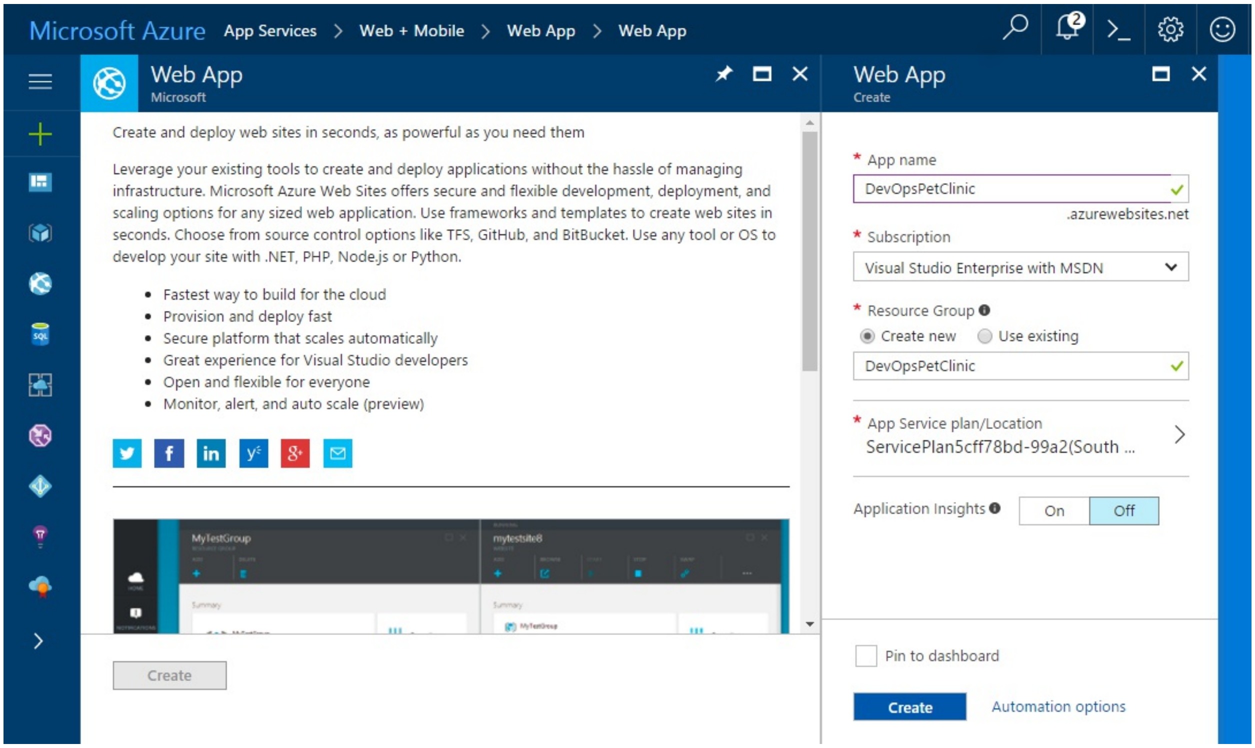


Create and deploy web sites in seconds, as powerful as you need them

Leverage your existing tools to create and deploy applications without the hassle of managing infrastructure. Microsoft Azure Web Sites offers secure and flexible development, deployment, and scaling options for any sized web application. Use frameworks and templates to create web sites in seconds. Choose from source control options like TFS, GitHub, and BitBucket. Use any tool or OS to develop your site with .NET, PHP, Node.js or Python.

- Fastest way to build for the cloud
- Provision and deploy fast
- Secure platform that scales automatically
- Great experience for Visual Studio developers
- Open and flexible for everyone
- Monitor, alert, and auto scale (preview)

Go to the Microsoft Azure portal at https://portal.azure.com. Click on App Services and then on + Add. Provide values for App name, Subscription, Resource Group, and App Service plan/Location. Then, click on Create:



Create and deploy web sites in seconds, as powerful as you need them

Leverage your existing tools to create and deploy applications without the hassle of managing infrastructure. Microsoft Azure Web Sites offers secure and flexible development, deployment, and scaling options for any sized web application. Use frameworks and templates to create web sites in seconds. Choose from source control options like TFS, GitHub, and BitBucket. Use any tool or OS to develop your site with .NET, PHP, Node.js or Python.

- Fastest way to build for the cloud
- Provision and deploy fast
- Secure platform that scales automatically
- Great experience for Visual Studio developers
- Open and flexible for everyone
- Monitor, alert, and auto scale (preview)

* App name: DevOpsPetClinic ✓ .azurewebsites.net

* Subscription: Visual Studio Enterprise with MSDN

* Resource Group: ● Create new ○ Use existing

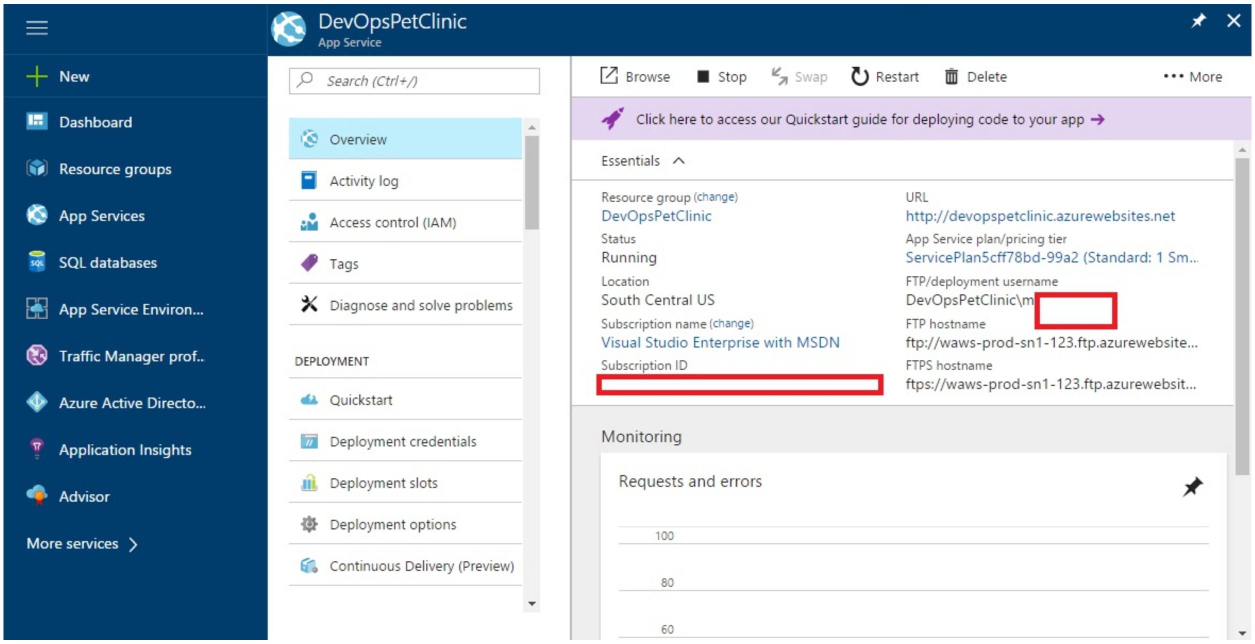
DevOpsPetClinic ✓

* App Service plan/Location: ServicePlan5cff78bd-99a2(South ...

Application Insights: On [✓ Off]

□ Pin to dashboard

Once the Azure Web App is created, see whether it shows up in the Azure portal. Click on DevOpsPetClinic and its details related to the URL, Status, Location, and so on:



Click here to access our Quickstart guide for deploying code to your app →

Resource group (change): DevOpsPetClinic

Status: Running

Location: South Central US

Subscription name (change): Visual Studio Enterprise with MSDN

Subscription ID: [redacted]

URL: http://devopspetclinic.azurewebsites.net

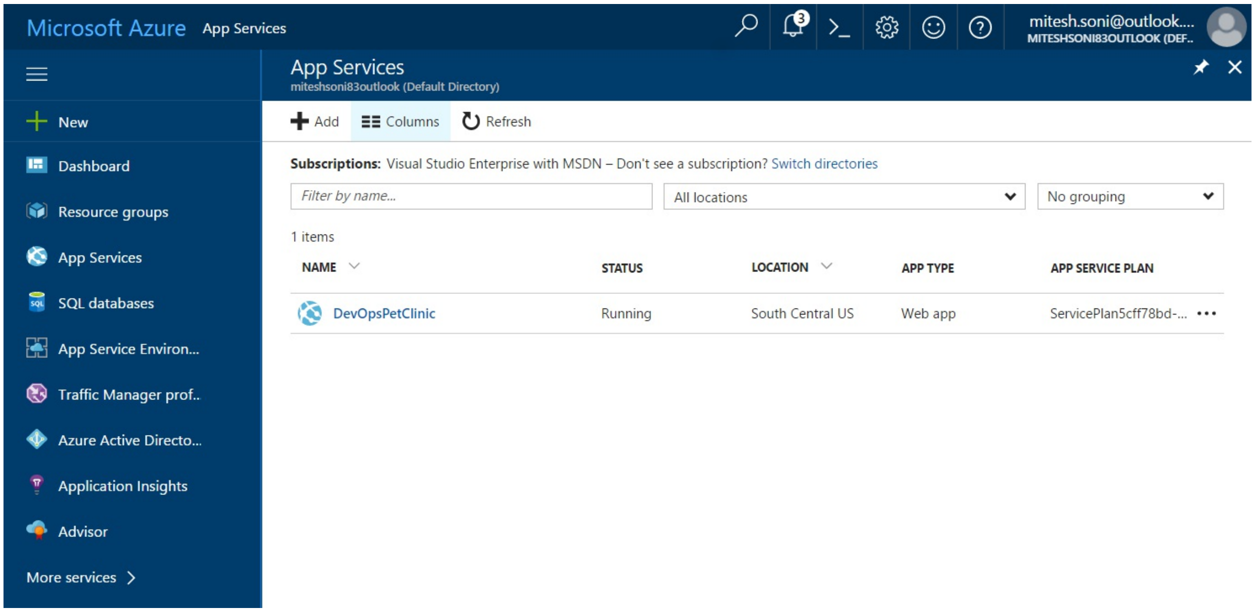
App Service plan/pricing tier: ServicePlan5cff78bd-99a2 (Standard: 1 Sm...

FTP/deployment username: DevOpsPetClinic\m[redacted]

FTP hostname: ftp://waws-prod-sn1-123.ftp.azurewebsite...

FTPS hostname: ftps://waws-prod-sn1-123.ftp.azurewebsit...

Verify on the App Services section too:

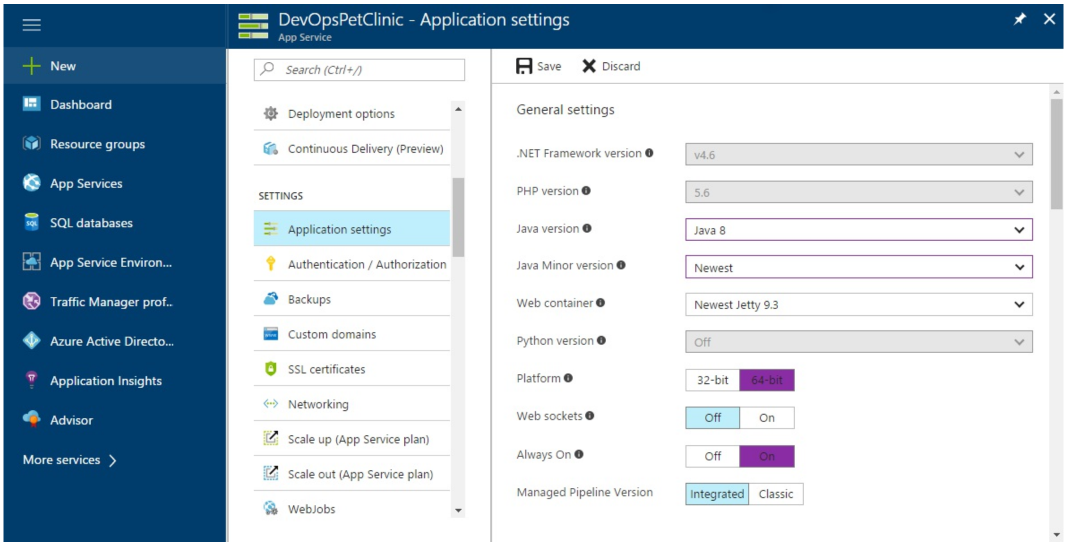


Subscriptions: Visual Studio Enterprise with MSDN – Don't see a subscription? Switch directories

1 items

NAME	STATUS	LOCATION	APP TYPE	APP SERVICE PLAN
DevOpsPetClinic	Running	South Central US	Web app	ServicePlan5cff78bd-...

Click on All Settings, go to the SETTINGS section, and click on Application settings to configure the Azure Web App for Java web application hosting. Select the Java version, Java Minor version, Web container, and Platform, and click on Always On:



General settings

.NET Framework version: v4.6

PHP version: 5.6

Java version: Java 8

Java Minor version: Newest

Web container: Newest Jetty 9.3

Python version: Off

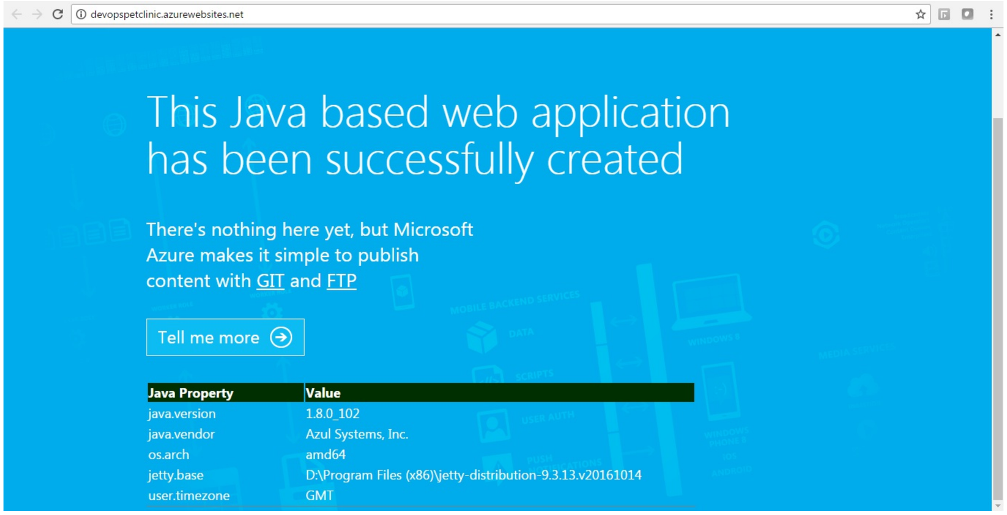
Platform: 32-bit [✓ 64-bit]

Web sockets: [✓ Off] On

Always On: Off [✓ On]

Managed Pipeline Version: [✓ Integrated] Classic

Visit the URL of an Azure Web App from your browser and verify that it is ready for hosting our sample spring application, PetClinic:

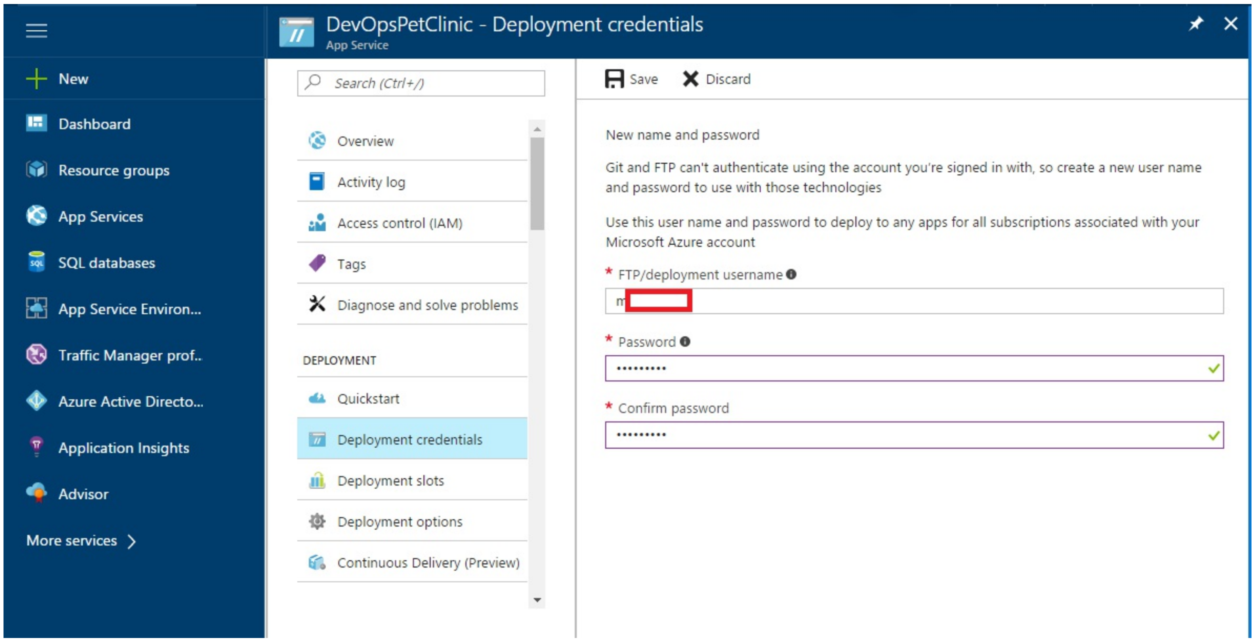


This Java based web application has been successfully created

There's nothing here yet, but Microsoft Azure makes it simple to publish content with GIT and FTP

Java Property	Value
java.version	1.8.0_102
java.vendor	Azul Systems, Inc.
os.arch	amd64
jetty.base	D:\Program Files (x86)\jetty-distribution-9.3.13.v20161014
user.timezone	GMT

Click on All Settings, and go to Deployment credentials in the DEPLOYMENT section. Provide an FTP/deployment username and Password, and save your changes:



New name and password

Git and FTP can't authenticate using the account you're signed in with, so create a new user name and password to use with those technologies

Use this user name and password to deploy to any apps for all subscriptions associated with your Microsoft Azure account

* FTP/deployment username: m[redacted]

* Password: •••••••••

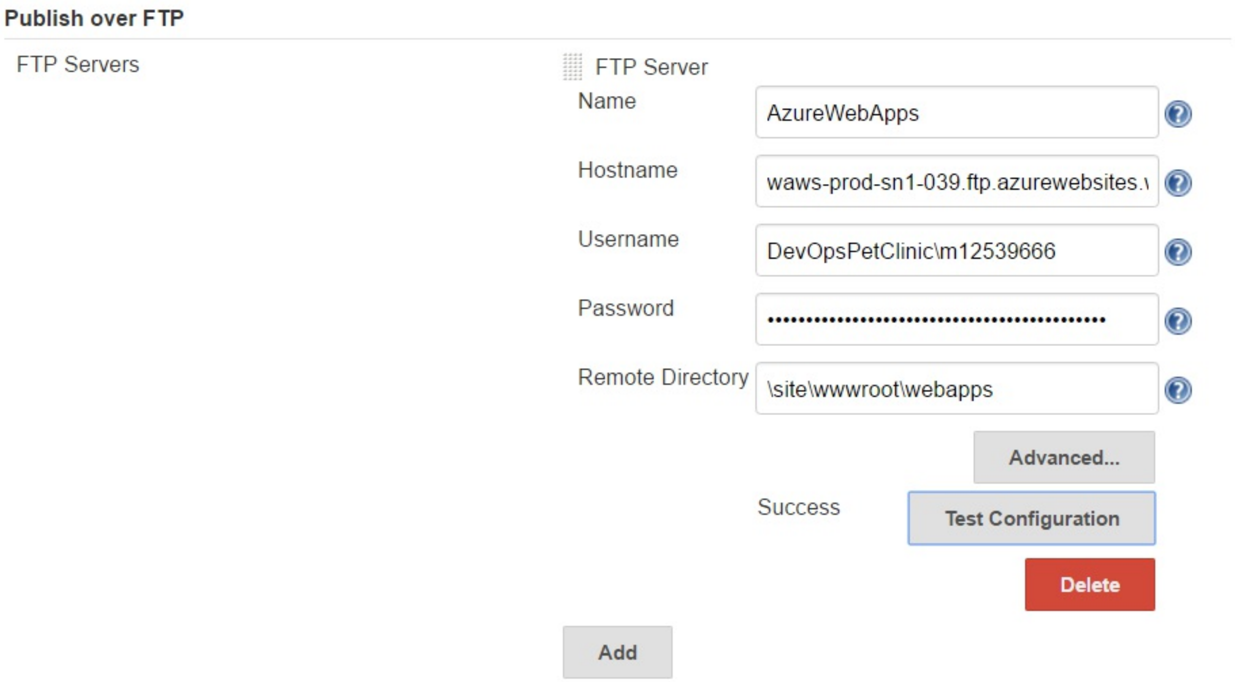
* Confirm password: •••••••••

Let's install the `Publish Over FTP` plugin in Jenkins. We will use the Azure Web App's FTP details to publish the `PetClinic WAR` file.

How to do it...

1. Let's go to the Jenkins dashboard. Click on New Item and select Freestyle project.
2. In Jenkins, go to Manage Jenkins and click on Configure | Configure FTP settings. Provide a Hostname, Username, and Password, available in the Azure portal.
3. Go to azurewebsites.net and go to the Kudu console. Navigate through the different options and find the `site` directory and `webapps` directory. In the App Service URL, add `.scm` after the name of the Web App.

4. Click on Test Configuration and, once you get a Success message, you are ready to deploy the PetClinic application:



Publish over FTP

FTP Servers

FTP Server

Name: AzureWebApps

Hostname: waws-prod-sn1-039.ftp.azurewebsites.\

Username: DevOpsPetClinic\m12539666

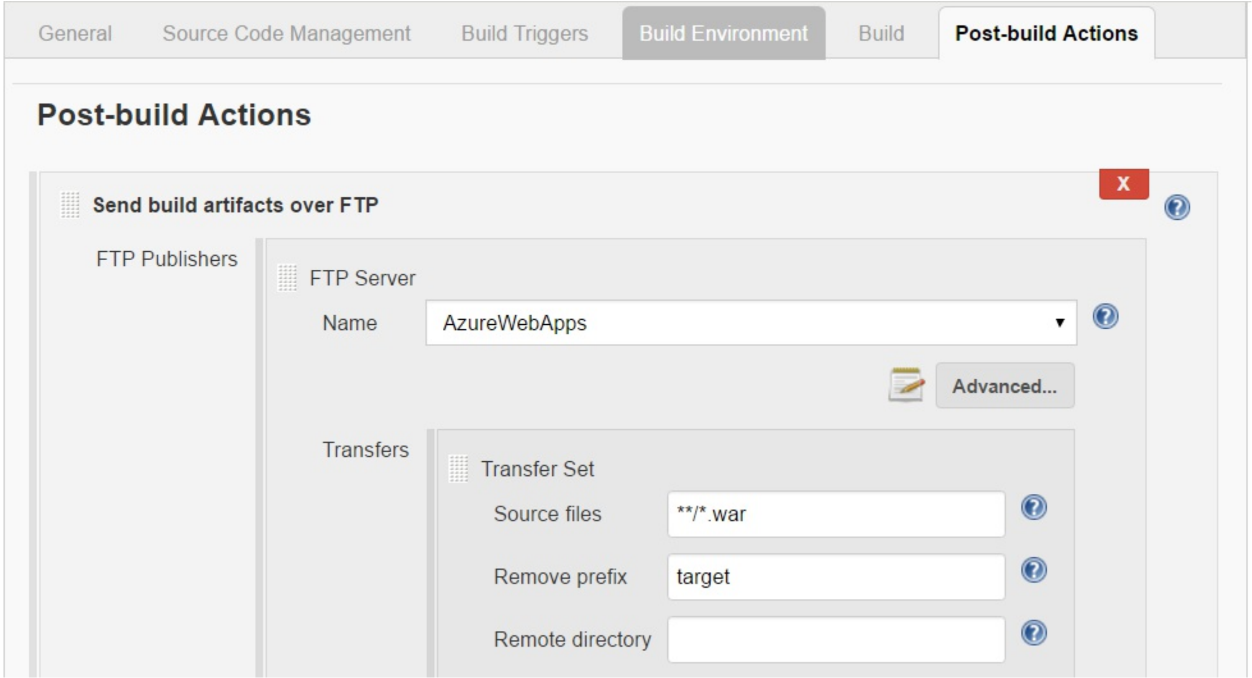
Password: ••

Remote Directory: \site\wwwroot\webapps

Success

5. In the build job we created, go to the Build section and configure Copy artifacts from another project. We will copy the WAR file to a specific location on a virtual machine.
6. In Post-build Actions, click on Send build artifacts over FTP. Select the FTP Server Name that is configured in Jenkins. Configure Source files and the Remove prefix for the deployment of an Azure Web App.

7. Select Verbose output in the Console:



Post-build Actions

Send build artifacts over FTP

FTP Publishers

FTP Server

Name: AzureWebApps

Transfers

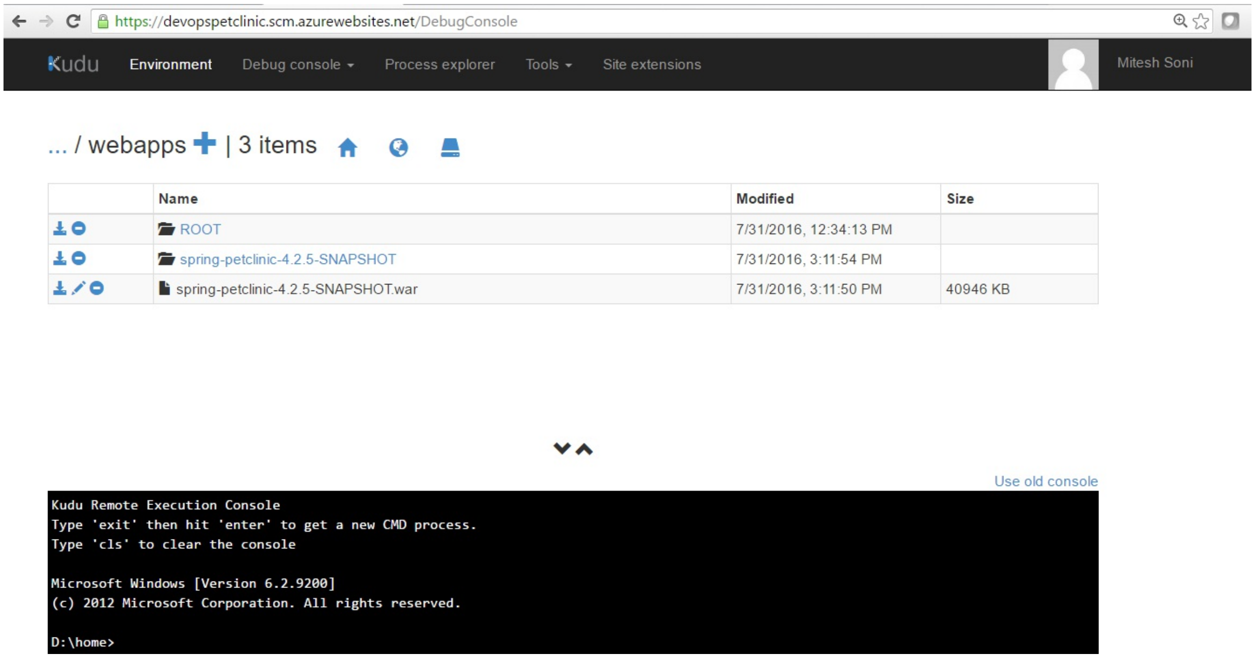
Transfer Set

Source files: **/*.war

Remove prefix: target

Remote directory:

8. Click on Build now and see what happens behind the scenes:
9. Go to the Kudu console, click on DebugConsole, and go to Powershell. Go to site | wwwroot | webapps. Check whether the WAR file has been copied:



... / webapps + | 3 items

	Name	Modified	Size
	ROOT	7/31/2016, 12:34:13 PM	
	spring-petclinic-4.2.5-SNAPSHOT	7/31/2016, 3:11:54 PM	
	spring-petclinic-4.2.5-SNAPSHOT.war	7/31/2016, 3:11:50 PM	40946 KB

```
Kudu Remote Execution Console
Type 'exit' then hit 'enter' to get a new CMD process.
Type 'cls' to clear the console

Microsoft Windows [Version 6.2.9200]
(c) 2012 Microsoft Corporation. All rights reserved.

D:\home>
```

8. Now we have an application deployed on an Azure Web App.

Promoting builds

It is essential to differentiate builds from each other, based on verification or passing certain stages.

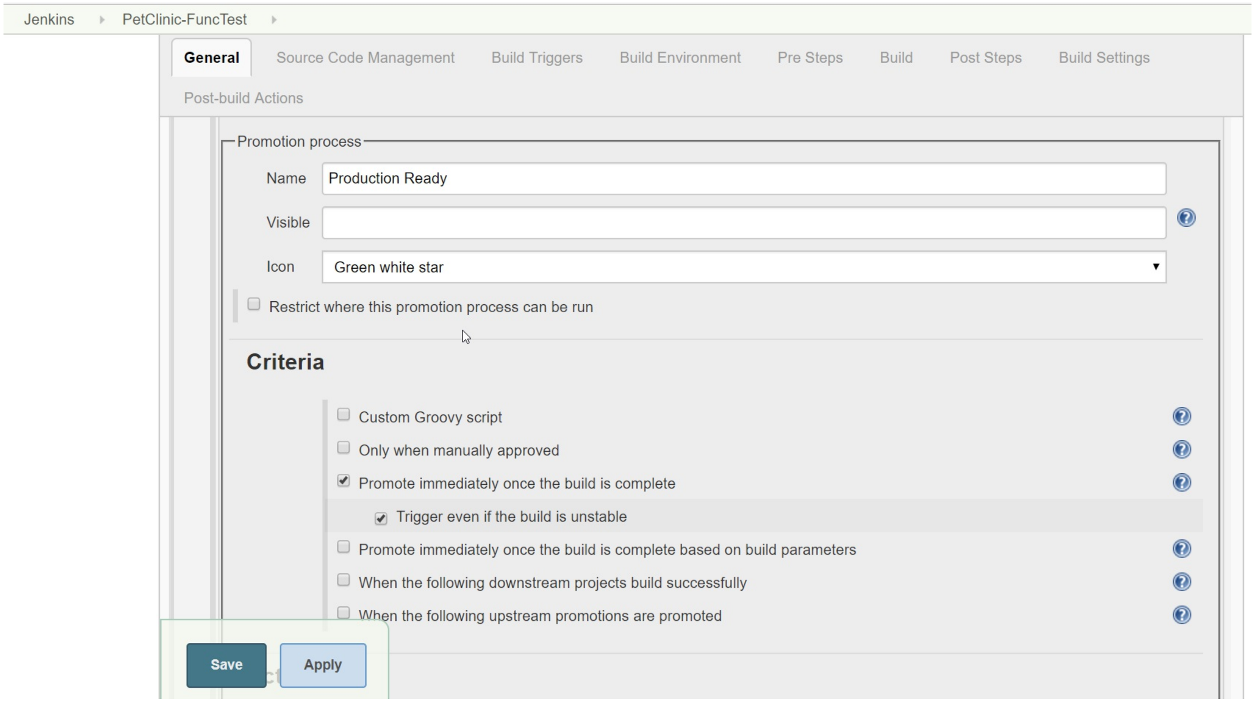
Getting ready

Go to Manage Jenkins | Manage Plugins | Available.

Install the promoted builds plugin.

How to do it...

1. Go to project configuration and check Promote builds when...:



Promotion process

Name: Production Ready

Visible:

Icon: Green white star

□ Restrict where this promotion process can be run

Criteria

□ Custom Groovy script

□ Only when manually approved

☑ Promote immediately once the build is complete

☑ Trigger even if the build is unstable

□ Promote immediately once the build is complete based on build parameters

□ When the following downstream projects build successfully

□ When the following upstream promotions are promoted

2. This build is promoted immediately once the build is complete, irrespective of its status.
3. You can configure promotion for manual approval too.

Continuous Testing

In this chapter, we will cover the following recipes:

- Getting started with continuous testing
- Creating a Selenium test case using Eclipse
- Integrating Jenkins and Selenium for functional testing
- Jenkins and Cucumber test reports
- Creating a load test in Apache JMeter
- Executing a load test from Jenkins
- Reporting JMeter performance metrics
- Testing with FitNesse

Getting started with continuous testing

Continuous testing is one of the most important DevOps practices available for the end-to-end automation of application life cycle management.

It not only considers automation, but it also includes aspects such as culture changes and tools. It is essential to integrate automated tests early in application life cycle management, to test quickly and in a timely manner, and to repeat the test execution process efficiently.

By the end of this chapter, you will have run performance and functional tests against a web application and web services.

This chapter emphasizes the need to make test writing accessible to a large audience. Embracing the largest possible audience improves the chances that testing will defend the intent of the application.

The technologies highlighted include:

- **Selenium**: This is the defacto industry standard for the functional testing of web applications. With Selenium IDE, you can record your actions within Firefox or Chrome, saving them in HTML format to replay later. The tests can be rerun through Maven using Selenium RC (Remote Control). It is common to use Jenkins slaves with different OSes and browser types to run tests. The alternative is to use Selenium Grid (https://code.google.com/p/selenium/wiki/Grid2).
- **JMeter**: This is a popular open source tool for stress testing. It can also be used to functionally test through the use of assertions. JMeter has a GUI that allows you to build test plans. The test plans are then stored in XML format. JMeter is executable through a Maven or Ant script. JMeter is very efficient and one instance is normally enough to hit your infrastructure hard. However, for super-high-load scenarios, JMeter can trigger an array of JMeter instances.
- **FitNesse**: This is a wiki with which you can write different types of tests. Having a wiki-like language to express and change tests on the fly gives functional administrators, consultants, and the end user a place to express their needs. You will be shown how to run FitNesse tests through Jenkins. FitNesse is also a framework where you can extend Java interfaces to create new testing types. These testing types are called fixtures; there are a number of fixtures available, including ones for database testing, running tools from the command line, and the functional testing of web applications.

Creating a Selenium test case using Eclipse

Let's go step by step to create a sample functional test case and then execute it using Jenkins.

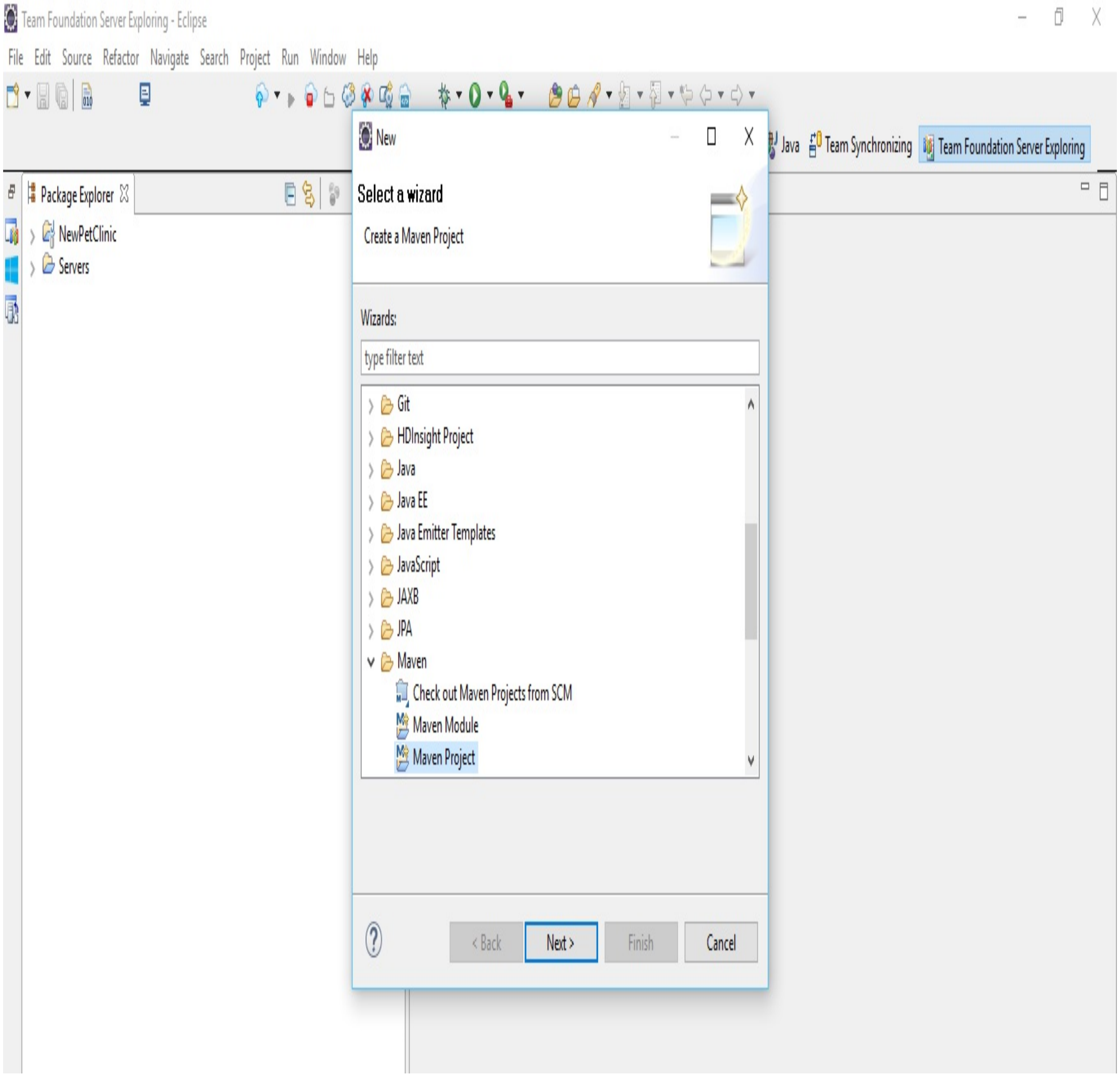
The `PetClinic` project is a Maven-based Spring application and we will create a test case using Eclipse and Maven. Hence, we will utilize the `m2eclipse` plugin in Eclipse.

Getting ready

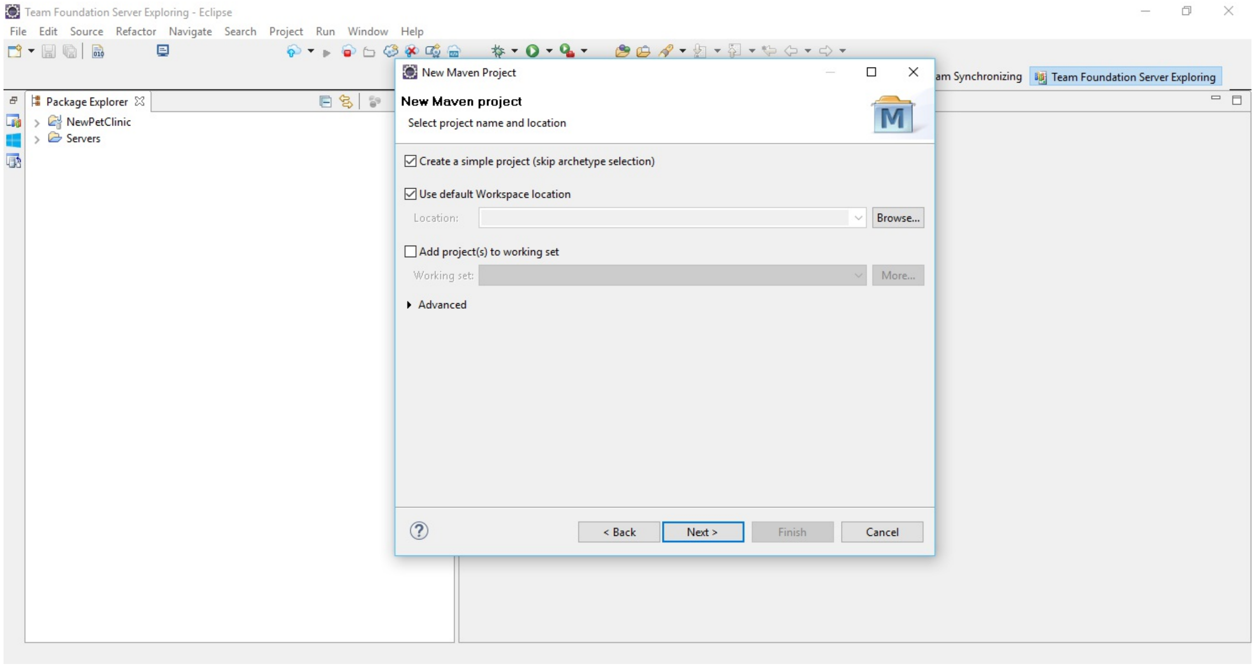
You will need Eclipse Java EE IDE for Web Developers, Version: Mars.2 Release (4.5.2), Build ID: 20160218-0600.

Go to the Eclipse Marketplace and install the Maven integration for the Eclipse plugin:

1. Create a Maven Project using a wizard in Eclipse IDE:



2. Select Create a simple project (skip archetype selection) and click on Next:


Team Foundation Server Exploring - Eclipse
File Edit Source Refactor Navigate Search Project Run Window Help
Package Explorer
NewPetClinic
Servers
am Synchronizing
Team Foundation Server Exploring
New Maven Project
M
< Back
Next >
Finish
Cancel

New Maven project

Select project name and location

☑ Create a simple project (skip archetype selection)

☑ Use default Workspace location

Location: [ ] Browse...

☐ Add project(s) to working set

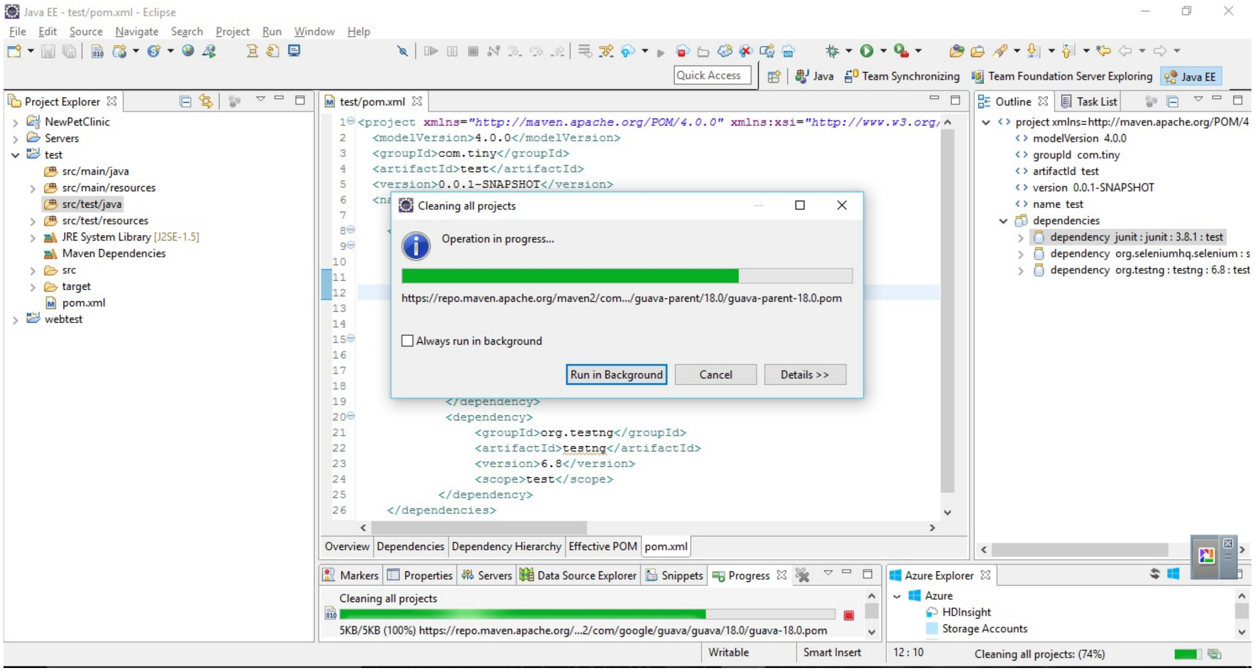
Working set: [ ] More...

▸ Advanced

3. Go through the wizard and create a project. It will take some time to create a project in Eclipse. Provide the Artifact, Version, Packaging, Name, and Description. Click on Finish.
4. Wait until the Maven project is created and configured. Make sure that Maven is installed and configured properly. In the case of the Maven behind the proxy, configure the proxy details into `conf.xml`, available in the `Maven` directory.
5. In `Pom.xml`, we need to add Maven, Selenium, TestNG, and JUnit dependencies in the `<project>` node. The following is a modified `Pom.xml`:

```
<project xmlns="http://maven.apache.org/POM/4.0.0"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://maven.apache.org/POM/4.0.0
http://maven.apache.org/xsd/maven-4.0.0.xsd">
  <modelVersion>4.0.0</modelVersion>
  <groupId>com.tiny</groupId>
  <artifactId>test</artifactId>
  <version>0.0.1-SNAPSHOT</version>
  <name>test</name>
  <build>
    <plugins>
      <plugin>
        <groupId>org.apache.maven.plugins</groupId>
        <artifactId>maven-compiler-plugin</artifactId>
        <version>3.6.1</version>
        <configuration>
          <source>1.8</source>
          <target>1.8</target>
        </configuration>
      </plugin>
      <plugin>
        <groupId>org.apache.maven.plugins</groupId>
        <artifactId>maven-surefire-plugin</artifactId>
        <version>2.19.1</version>
        <configuration>
          <suiteXmlFiles>
            <suiteXmlFile>testng.xml</suiteXmlFile>
          </suiteXmlFiles>
        </configuration>
      </plugin>
    </plugins>
  </build>
  <dependencies>

    <dependency>
      <groupId>org.seleniumhq.selenium</groupId>
      <artifactId>selenium-java</artifactId>
      <version>3.6.0</version>
    </dependency>
    <dependency>
      <groupId>org.testng</groupId>
      <artifactId>testng</artifactId>
      <version>6.10</version>
      <scope>test</scope>
    </dependency>
  </dependencies>
</project>
```

6. Save Pom.xml after adding these changes and build the project again from the Project menu. It will download new dependencies:



```
<project xmlns="http://maven.apache.org/POM/4.0.0" xmlns:xsi="http://www.w3.org/
  <modelVersion>4.0.0</modelVersion>
  <groupId>com.tiny</groupId>
  <artifactId>test</artifactId>
  <version>0.0.1-SNAPSHOT</version>
  <na
...
            </dependency>
            <dependency>
                <groupId>org.testng</groupId>
                <artifactId>testng</artifactId>
                <version>6.8</version>
                <scope>test</scope>
            </dependency>
    </dependencies>
```

Cleaning all projects

Operation in progress...

https://repo.maven.apache.org/maven2/com.../guava-parent/18.0/guava-parent-18.0.pom

☐ Always run in background

Run in Background | Cancel | Details >>

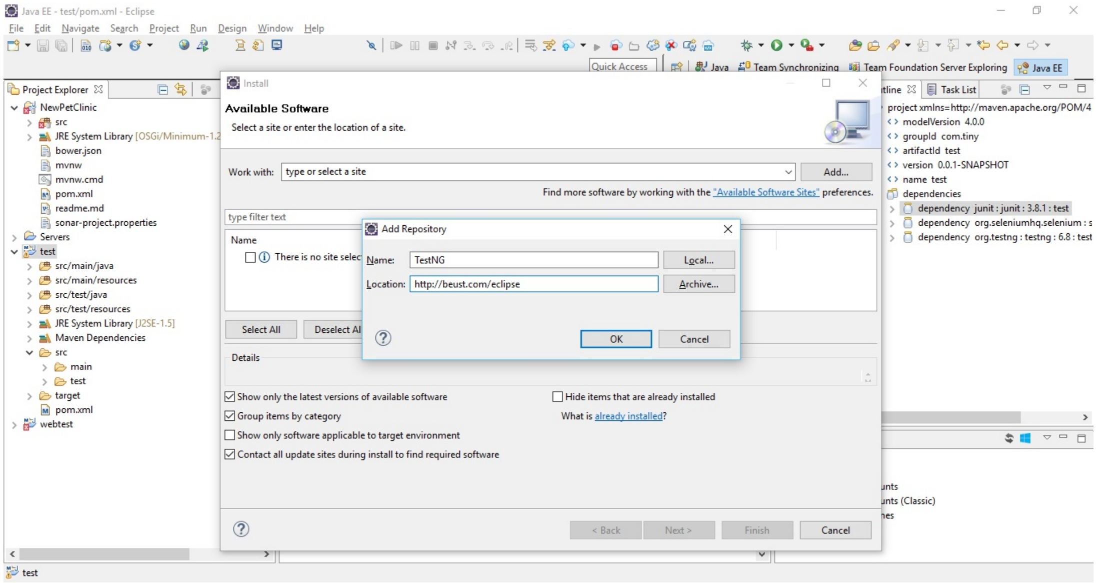
Cleaning all projects

5KB/5KB (100%) https://repo.maven.apache.org/...2/com/google/guava/guava/18.0/guava-18.0.pom

Cleaning all projects: (74%)

7. Click on the Details button of the dialog box to verify the operation in progress.

8. The next task is to write the TestNG class. Install the TestNG plugin. Go to Help and click on Install New Software. Add Repository:



Available Software

Select a site or enter the location of a site.

Work with: type or select a site

Find more software by working with the "Available Software Sites" preferences.

type filter text

Name

□ There is no site selec

Name: TestNG

Location: http://beust.com/eclipse

☑ Show only the latest versions of available software

☐ Hide items that are already installed

☑ Group items by category

What is already installed?

☐ Show only software applicable to target environment

☑ Contact all update sites during install to find required software

project xmlns=http://maven.apache.org/POM/4

modelVersion 4.0.0

groupId com.tiny

artifactId test

version 0.0.1-SNAPSHOT

name test

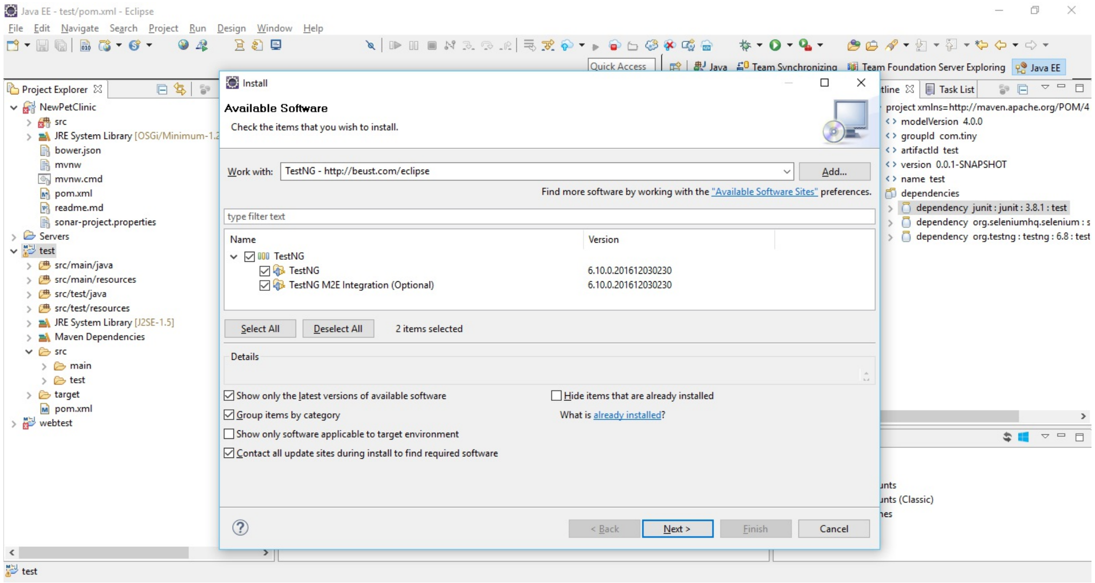
dependencies

dependency junit : junit : 3.8.1 : test

dependency org.seleniumhq.selenium : s

dependency org.testng : testng : 6.8 : test

9. Select the items we need to install:



Available Software

Check the items that you wish to install.

Work with: TestNG - http://beust.com/eclipse

Find more software by working with the "Available Software Sites" preferences.

type filter text

Name	Version
☑ TestNG	
☑ TestNG	6.10.0.201612030230
☑ TestNG M2E Integration (Optional)	6.10.0.201612030230

2 items selected

☑ Show only the latest versions of available software

☐ Hide items that are already installed

☑ Group items by category

What is already installed?

☐ Show only software applicable to target environment

☑ Contact all update sites during install to find required software

project xmlns=http://maven.apache.org/POM/4

modelVersion 4.0.0

groupId com.tiny

artifactId test

version 0.0.1-SNAPSHOT

name test

dependencies

dependency junit : junit : 3.8.1 : test

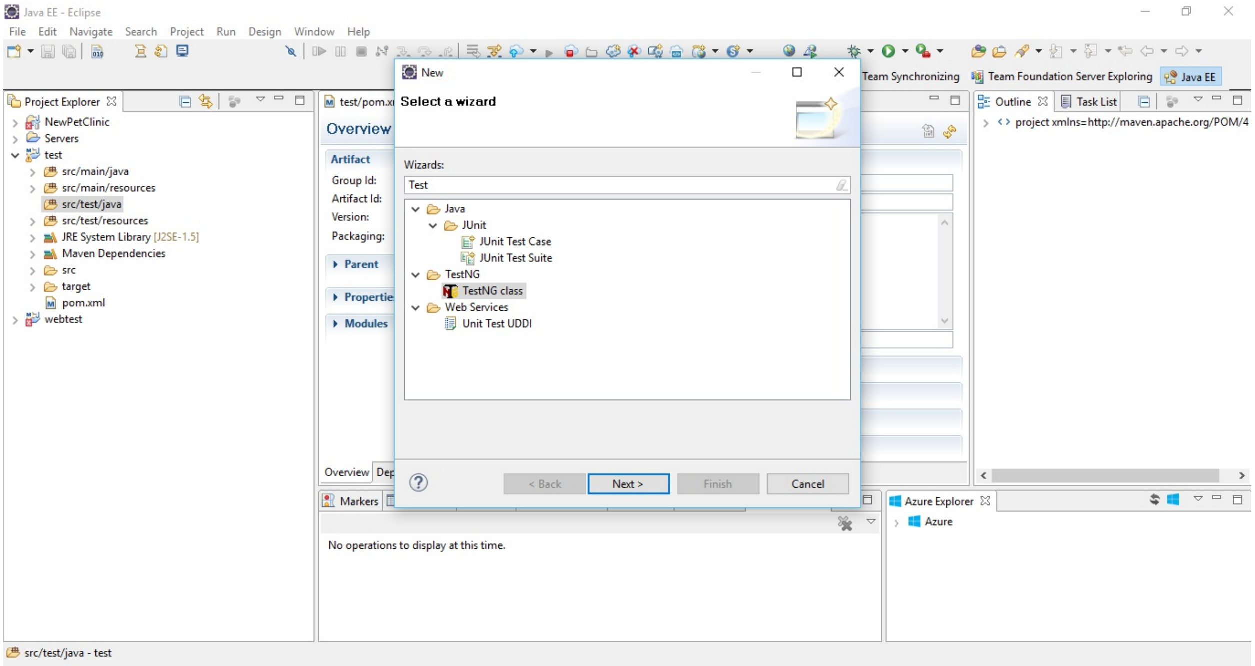
dependency org.seleniumhq.selenium : s

dependency org.testng : testng : 6.8 : test

10. Review all the items that need to be installed and click on Next.
11. Accept the license and click on Finish.
12. Verify the installation progress in Eclipse.

How to do it...

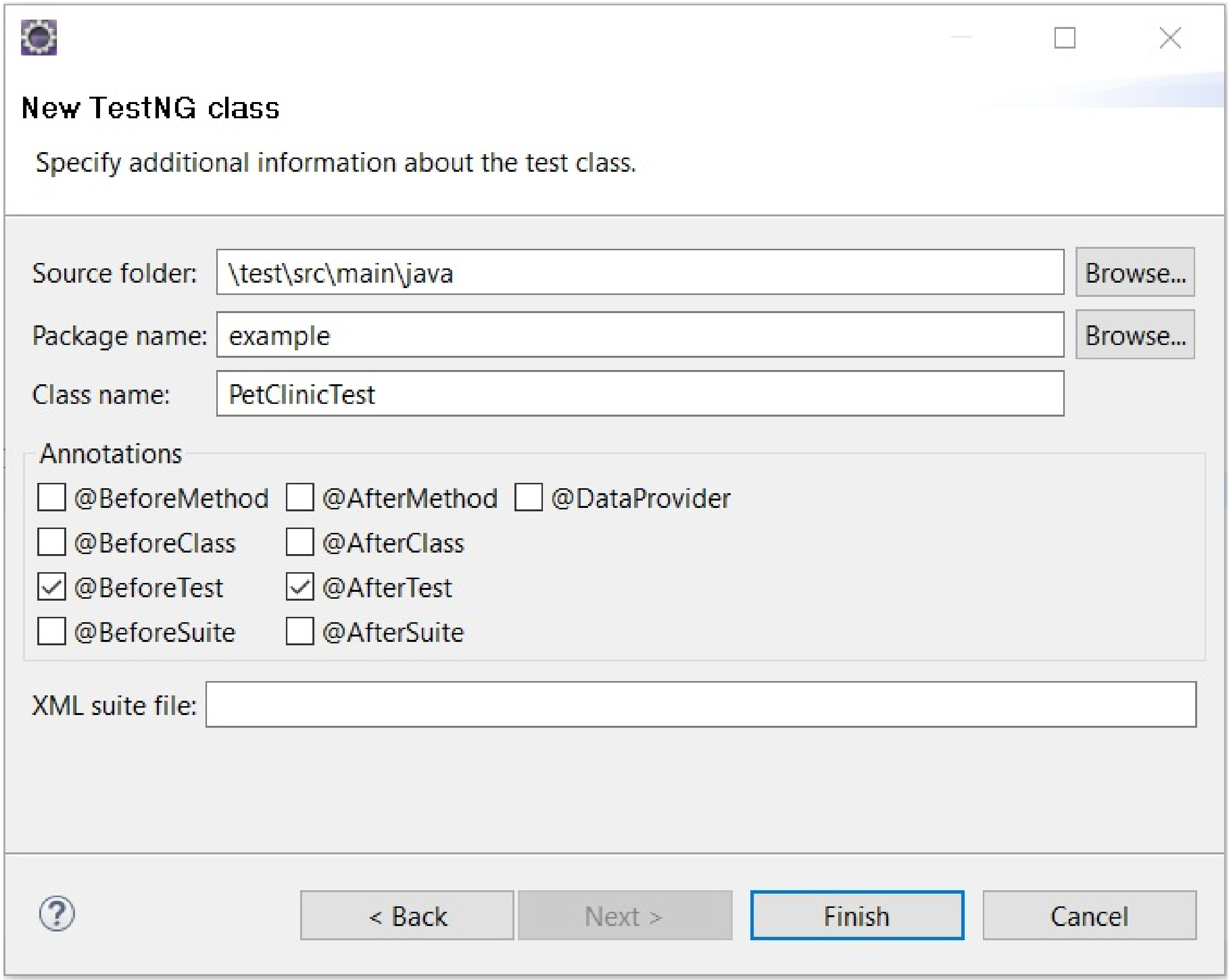
1. Now let's create a TestNG class:



Wizards: Test

No operations to display at this time.

2. Provide a Class name:



New TestNG class

Specify additional information about the test class.

Source folder: \test\src\main\java

Package name: example

Class name: PetClinicTest

Annotations

□ @BeforeMethod □ @AfterMethod □ @DataProvider

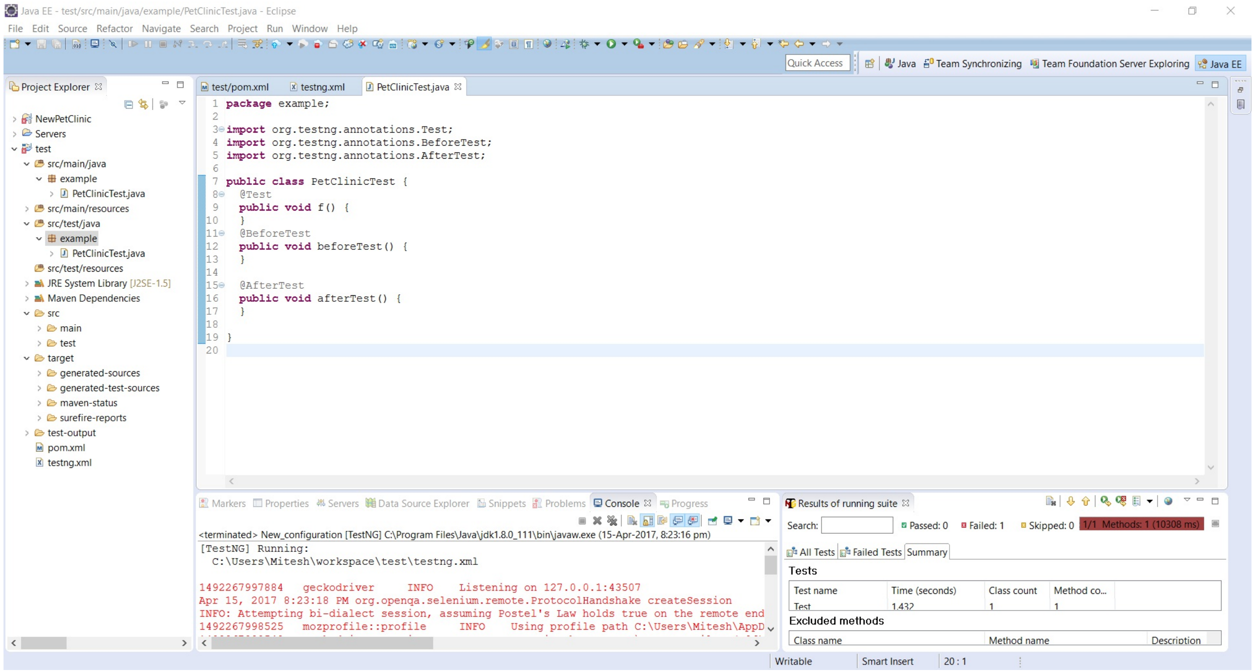
□ @BeforeClass □ @AfterClass

☑ @BeforeTest ☑ @AfterTest

□ @BeforeSuite □ @AfterSuite

XML suite file:

3. Give a Package name and click on Finish.
4. The newly created class will look like the following screenshot:



```
package example;

import org.testng.annotations.Test;
import org.testng.annotations.BeforeTest;
import org.testng.annotations.AfterTest;

public class PetClinicTest {
  @Test
  public void f() {
  }
  @BeforeTest
  public void beforeTest() {
  }

  @AfterTest
  public void afterTest() {
  }

}
```

```
<terminated> New_configuration [TestNG] C:\Program Files\Java\jdk1.8.0_111\bin\javaw.exe (15-Apr-2017, 8:23:16 pm)
[TestNG] Running:
  C:\Users\Mitesh\workspace\test\testng.xml

1492267997884   geckodriver     INFO    Listening on 127.0.0.1:43507
Apr 15, 2017 8:23:18 PM org.openqa.selenium.remote.ProtocolHandshake createSession
INFO: Attempting bi-dialect session, assuming Postel's Law holds true on the remote end
1492267998525   mozprofile::profile     INFO    Using profile path C:\Users\Mitesh\AppD
```

Search: Passed: 0 Failed: 1 Skipped: 0 1/1 Methods: 1 (10308 ms)

Tests

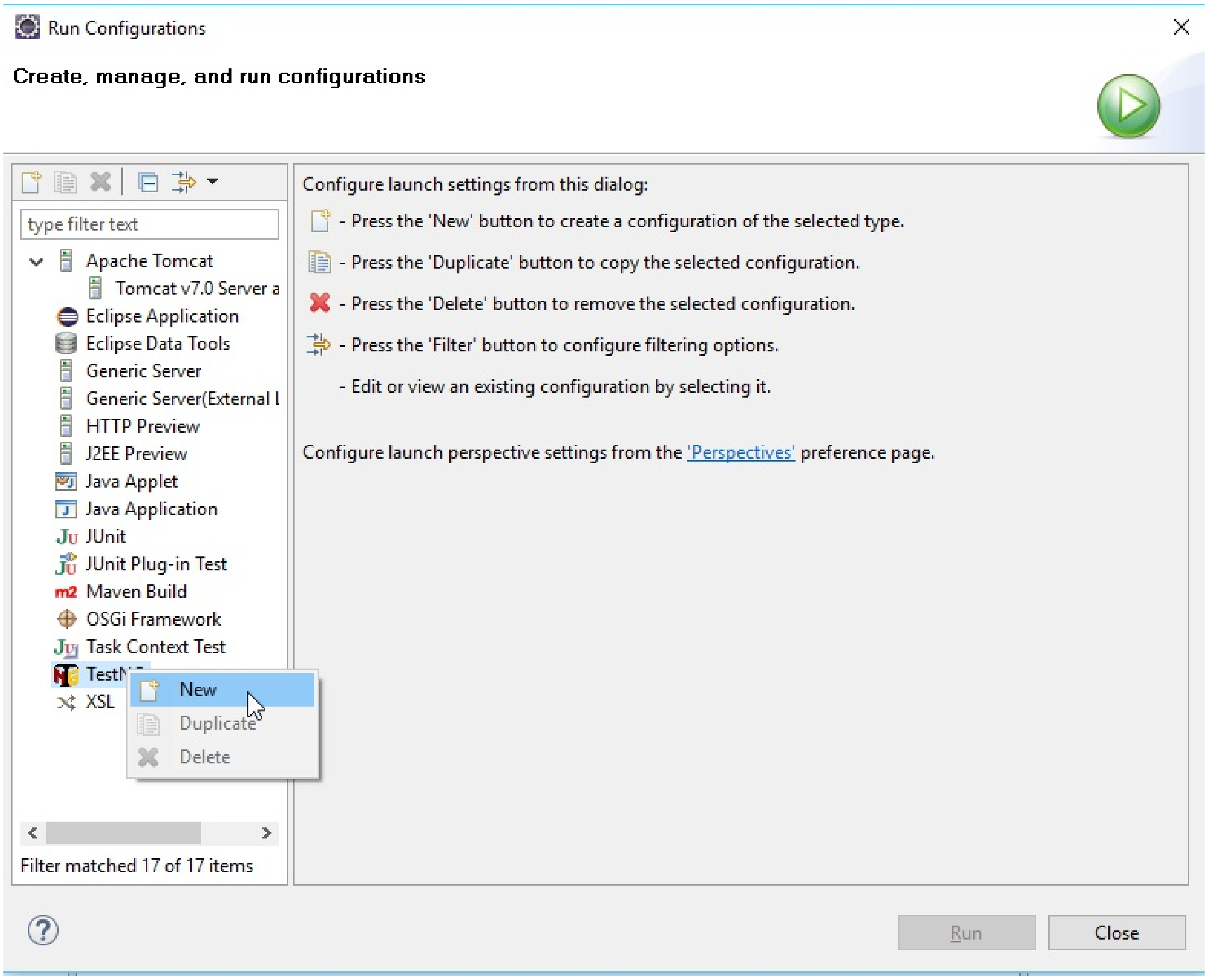
Test name	Time (seconds)	Class count	Method co...
Test	1.432	1	1

Excluded methods

Class name	Method name	Description

5. Right-click on the test file and click on TestNG, convert to TestNG.
6. It will create a `testing.xml` file that has details about the test suite.
7. Right-click on Project and click on Run Configurations.

8. Right-click on TestNG and click on New:

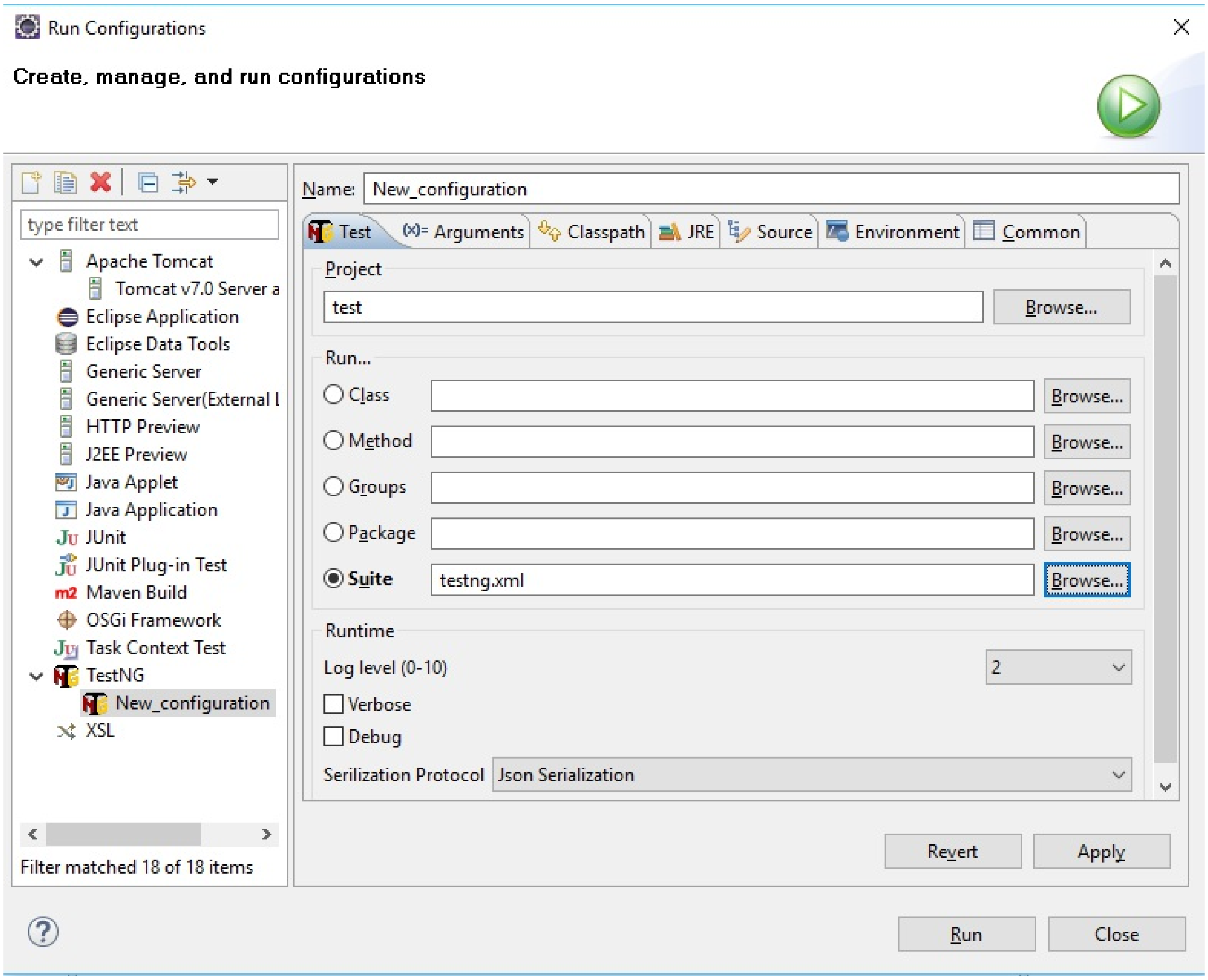


Configure launch settings from this dialog:

- Press the 'New' button to create a configuration of the selected type.
- Press the 'Duplicate' button to copy the selected configuration.
- Press the 'Delete' button to remove the selected configuration.
- Press the 'Filter' button to configure filtering options.
- Edit or view an existing configuration by selecting it.

Configure launch perspective settings from the 'Perspectives' preference page.

9. Provide the Project name and select `testing.xml` in the Suite.
10. Click OK and Apply.
11. Click on Run:



Run Configurations

Create, manage, and run configurations

Name: New_configuration

Project: test

Run...

○ Class

○ Method

○ Groups

○ Package

● Suite testng.xml

Runtime

Log level (0-10): 2

□ Verbose

□ Debug

Serilization Protocol: Json Serialization

Filter matched 18 of 18 items

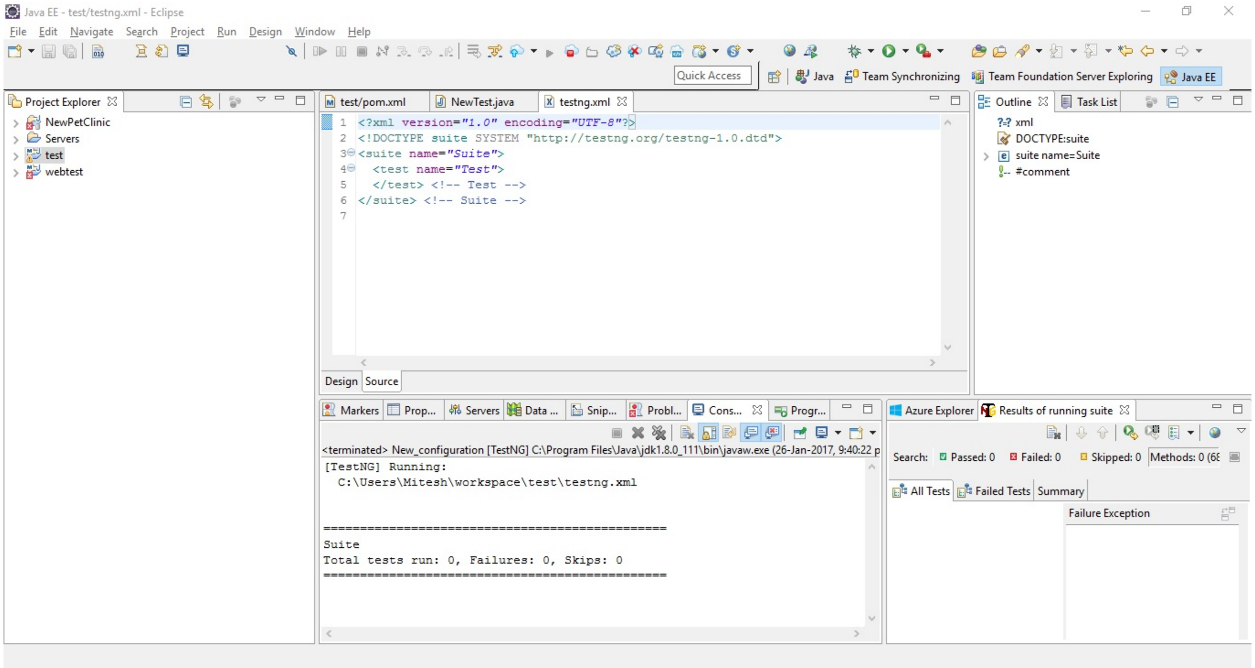
12. If Windows Firewall blocks it, then click on Allow Access.

There is no configuration available in `testing.xml` for execution, hence, even if the Maven execution runs successfully, no suite will be executed.

Generate the `TestNG` class under the `test` folder.

1. Select the `location`, `suite name`, and `class name`:

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE suite SYSTEM "http://testng.org/testng-1.0.dtd">
<suite name="Suite">
<test name="Test">
<classes>
<class name="example.PetClinicTest"/>
</classes>
</test><!-- Test -->
</suite><!-- Suite -->
```



```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE suite SYSTEM "http://testng.org/testng-1.0.dtd">
<suite name="Suite">
  <test name="Test">
  </test> <!-- Test -->
</suite> <!-- Suite -->
```

```
<terminated> New_configuration [TestNG] C:\Program Files\Java\jdk1.8.0_111\bin\javaw.exe (26-Jan-2017, 9:40:22 p
[TestNG] Running:
  C:\Users\Mitesh\workspace\test\testng.xml


===============================================
Suite
Total tests run: 0, Failures: 0, Skips: 0
===============================================
```

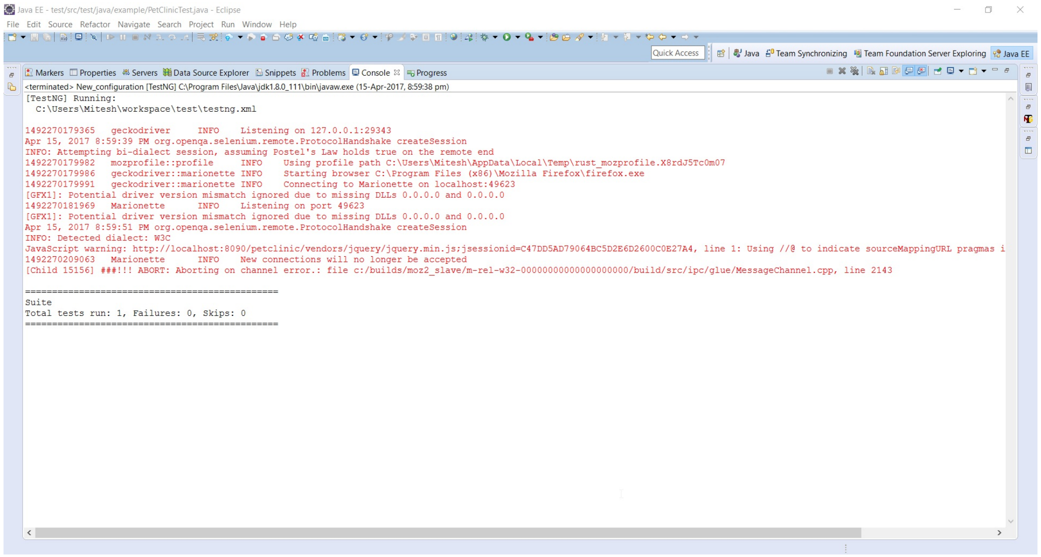
2. Go to https://github.com/mozilla/geckodriver/releases and download a version.
3. Extract the file available in the downloaded ZIP file based on the system configuration we have. In our case, we have downloaded `geckodriver-v0.13.0-win64`. Download the latest version available.
4. Click on it and verify the driver details.

5. Let's write some code as well. It will check whether the title of the web page contains a specific string or not. The result or the outcome of the following code is based on the title of the page. If it contains a given string, then the test case will pass; otherwise, it will fail the package example:

```
importjava.io.File;
importorg.openqa.selenium.WebDriver;
importorg.openqa.selenium.firefox.FirefoxDriver;
importorg.testng.Assert;
importorg.testng.annotations.Test;
importorg.testng.annotations.BeforeTest;
importorg.testng.annotations.AfterTest;
public class PetClinicTest {
  private WebDriver driver;
    @Test
    public void testPetClinic() {
      driver.get("http://localhost:8090/petclinic/");
      String title = driver.getTitle();
      Assert.assertTrue(title.contains("a Spring Frameworkk"));
    }
    @BeforeTest
    public void beforeTest() {
      File file = new File("F:\\##JenkinsEssentials\\geckodriver-v0.13.0-
win64\\geckodriver.exe");
      System.setProperty("webdriver.gecko.driver", file.getAbsolutePath());
      driver = new FirefoxDriver();
    }
    @AfterTest
    public void afterTest() {
      driver.quit();
    }
}
```

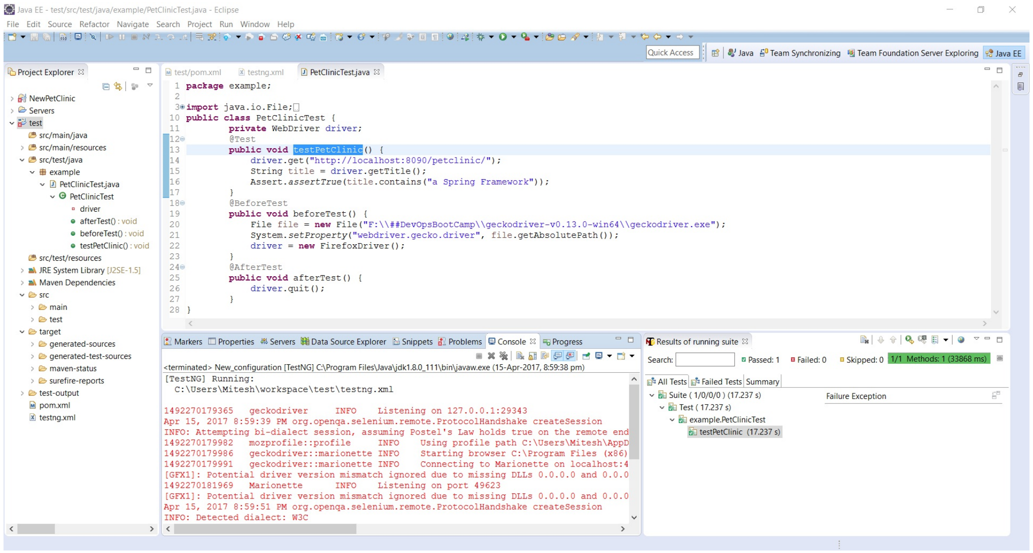
6. The same file is available in the IDE, as shown in the following screenshot.
7. Let's run the Maven test again from Eclipse.

8. The following is the output when the test case is executed successfully:



```
<terminated> New_configuration [TestNG] C:\Program Files\Java\jdk1.8.0_111\bin\javaw.exe (15-Apr-2017, 8:59:38 pm)
[TestNG] Running:
  C:\Users\Mitesh\workspace\test\testng.xml

1492270179365   geckodriver     INFO    Listening on 127.0.0.1:29343
Apr 15, 2017 8:59:39 PM org.openqa.selenium.remote.ProtocolHandshake createSession
INFO: Attempting bi-dialect session, assuming Postel's Law holds true on the remote end
1492270179982   mozprofile::profile     INFO    Using profile path C:\Users\Mitesh\AppData\Local\Temp\rust_mozprofile.X8rdJ5Tc0m07
1492270179986   geckodriver::marionette INFO    Starting browser C:\Program Files (x86)\Mozilla Firefox\firefox.exe
1492270179991   geckodriver::marionette INFO    Connecting to Marionette on localhost:49623
[GFX1]: Potential driver version mismatch ignored due to missing DLLs 0.0.0.0 and 0.0.0.0
1492270181969   Marionette      INFO    Listening on port 49623
[GFX1]: Potential driver version mismatch ignored due to missing DLLs 0.0.0.0 and 0.0.0.0
Apr 15, 2017 8:59:51 PM org.openqa.selenium.remote.ProtocolHandshake createSession
INFO: Detected dialect: W3C
JavaScript warning: http://localhost:8090/petclinic/vendors/jquery/jquery.min.js;jsessionid=C47DD5AD79064BC5D2E6D2600C0E27A4, line 1: Using //@ to indicate sourceMappingURL pragmas i
1492270209063   Marionette      INFO    New connections will no longer be accepted
[Child 15156] ###!!! ABORT: Aborting on channel error.: file c:/builds/moz2_slave/m-rel-w32-00000000000000000000/build/src/ipc/glue/MessageChannel.cpp, line 2143

===============================================
Suite
Total tests run: 1, Failures: 0, Skips: 0
===============================================
```

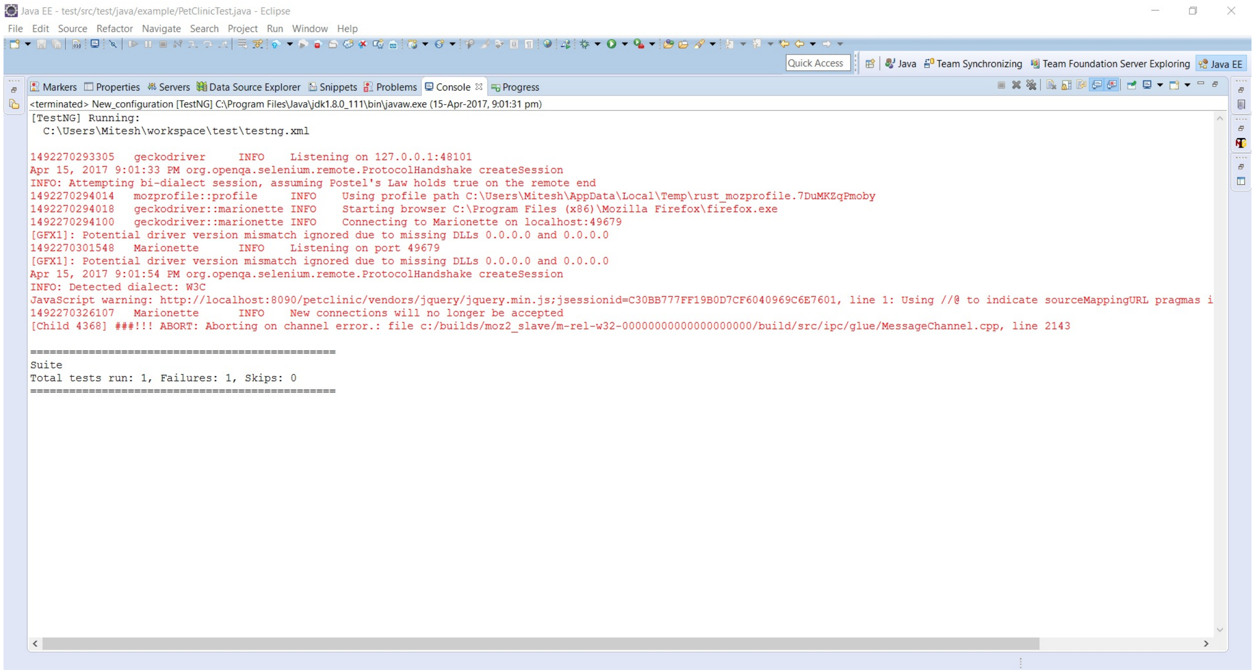
9. Verify the All Tests tab in the Results of the running suite section in Eclipse. We can see the successful execution here:



```
package example;

import java.io.File;
public class PetClinicTest {
        private WebDriver driver;
        @Test
        public void testPetClinic() {
            driver.get("http://localhost:8090/petclinic/");
            String title = driver.getTitle();
            Assert.assertTrue(title.contains("a Spring Framework"));
        }
        @BeforeTest
        public void beforeTest() {
            File file = new File("F:\\##DevOpsBootCamp\\geckodriver-v0.13.0-win64\\geckodriver.exe");
            System.setProperty("webdriver.gecko.driver", file.getAbsolutePath());
            driver = new FirefoxDriver();
        }
        @AfterTest
        public void afterTest() {
            driver.quit();
        }
}
```

```
Passed: 1   Failed: 0   Skipped: 0   1/1 Methods: 1 (33868 ms)
Suite ( 1/0/0/0 ) (17.237 s)
  Test ( 17.237 s)
    example.PetClinicTest
      testPetClinic (17.237 s)
```

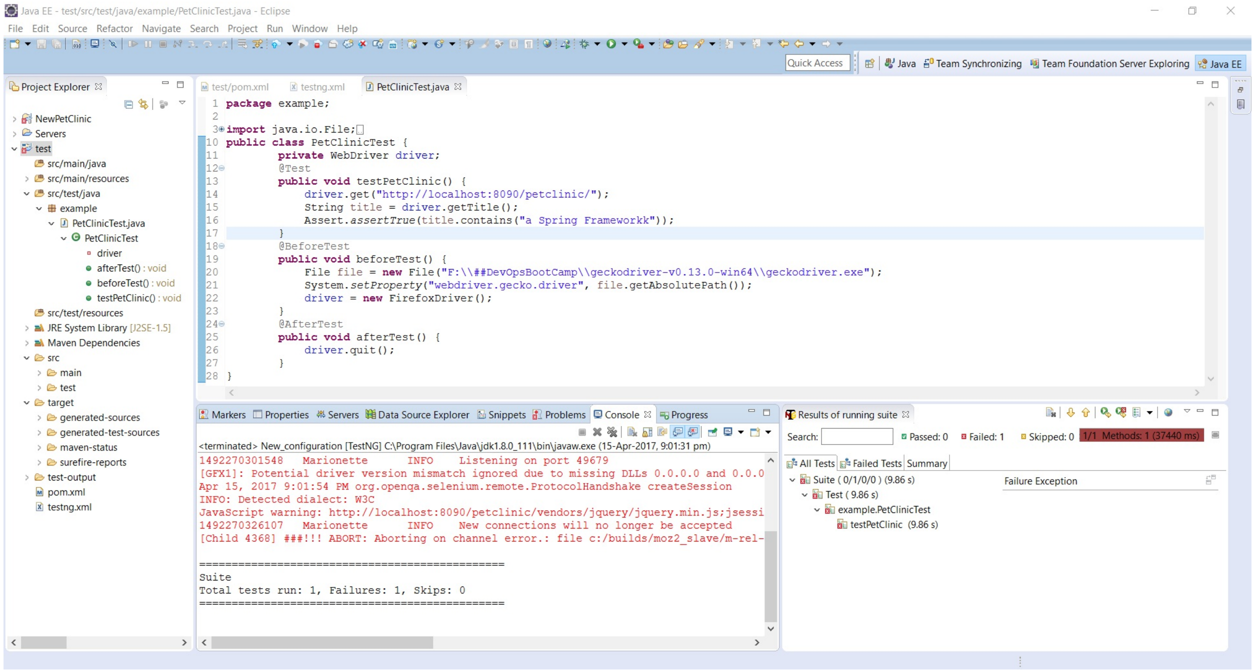
10. Verify the Failed Tests tab in the Results of the running suite section in Eclipse.
11. Verify the Summary tab in the Results of the running suite section in Eclipse in the successful scenario.
12. In the code, change the text available for title comparison so the test case fails.
13. Verify the output in the Console:



Java EE - test/src/test/java/example/PetClinicTest.java - Eclipse
File Edit Source Refactor Navigate Search Project Run Window Help
Quick Access
Java
Team Synchronizing
Team Foundation Server Exploring
Java EE
Markers
Properties
Servers
Data Source Explorer
Snippets
Problems
Console
Progress

```
<terminated> New_configuration [TestNG] C:\Program Files\Java\jdk1.8.0_111\bin\javaw.exe (15-Apr-2017, 9:01:31 pm)
[TestNG] Running:
  C:\Users\Mitesh\workspace\test\testng.xml

1492270293305   geckodriver     INFO    Listening on 127.0.0.1:48101
Apr 15, 2017 9:01:33 PM org.openqa.selenium.remote.ProtocolHandshake createSession
INFO: Attempting bi-dialect session, assuming Postel's Law holds true on the remote end
1492270294014   mozprofile::profile     INFO    Using profile path C:\Users\Mitesh\AppData\Local\Temp\rust_mozprofile.7DuMKZqPmoby
1492270294018   geckodriver::marionette INFO    Starting browser C:\Program Files (x86)\Mozilla Firefox\firefox.exe
1492270294100   geckodriver::marionette INFO    Connecting to Marionette on localhost:49679
[GFX1]: Potential driver version mismatch ignored due to missing DLLs 0.0.0.0 and 0.0.0.0
1492270301548   Marionette      INFO    Listening on port 49679
[GFX1]: Potential driver version mismatch ignored due to missing DLLs 0.0.0.0 and 0.0.0.0
Apr 15, 2017 9:01:54 PM org.openqa.selenium.remote.ProtocolHandshake createSession
INFO: Detected dialect: W3C
JavaScript warning: http://localhost:8090/petclinic/vendors/jquery/jquery.min.js;jsessionid=C30BB777FF19B0D7CF6040969C6E7601, line 1: Using //@ to indicate sourceMappingURL pragmas i
1492270326107   Marionette      INFO    New connections will no longer be accepted
[Child 4368] ###!!! ABORT: Aborting on channel error.: file c:/builds/moz2_slave/m-rel-w32-00000000000000000000/build/src/ipc/glue/MessageChannel.cpp, line 2143

===============================================
Suite
Total tests run: 1, Failures: 1, Skips: 0
===============================================
```

14. Verify the All Tests tab in the Results of the running suite section in Eclipse and notice the failure icon:



```
package example;

import java.io.File;
public class PetClinicTest {
        private WebDriver driver;
        @Test
        public void testPetClinic() {
            driver.get("http://localhost:8090/petclinic/");
            String title = driver.getTitle();
            Assert.assertTrue(title.contains("a Spring Frameworkk"));
        }
        @BeforeTest
        public void beforeTest() {
            File file = new File("F:\\##DevOpsBootCamp\\geckodriver-v0.13.0-win64\\geckodriver.exe");
            System.setProperty("webdriver.gecko.driver", file.getAbsolutePath());
            driver = new FirefoxDriver();
        }
        @AfterTest
        public void afterTest() {
            driver.quit();
        }
}
```

```
<terminated> New_configuration [TestNG] C:\Program Files\Java\jdk1.8.0_111\bin\javaw.exe (15-Apr-2017, 9:01:31 pm)
1492270301548   Marionette      INFO    Listening on port 49679
[GFX1]: Potential driver version mismatch ignored due to missing DLLs 0.0.0.0 and 0.0.0
Apr 15, 2017 9:01:54 PM org.openqa.selenium.remote.ProtocolHandshake createSession
INFO: Detected dialect: W3C
JavaScript warning: http://localhost:8090/petclinic/vendors/jquery/jquery.min.js;jsessi
1492270326107   Marionette      INFO    New connections will no longer be accepted
[Child 4368] ###!!! ABORT: Aborting on channel error.: file c:/builds/moz2_slave/m-rel-

===============================================
Suite
Total tests run: 1, Failures: 1, Skips: 0
===============================================
```

```
Passed: 0   Failed: 1   Skipped: 0   1/1  Methods: 1 (37440 ms)

Suite ( 0/1/0/0 ) (9.86 s)              Failure Exception
  Test ( 9.86 s)
    example.PetClinicTest
      testPetClinic  (9.86 s)
```

15. Verify the Failed Tests tab in the Results of the running suite section in Eclipse.
16. Click on testPetClinic and verify the Failure Exception.
17. Verify the Summary tab in the Results of the running suite section in Eclipse.

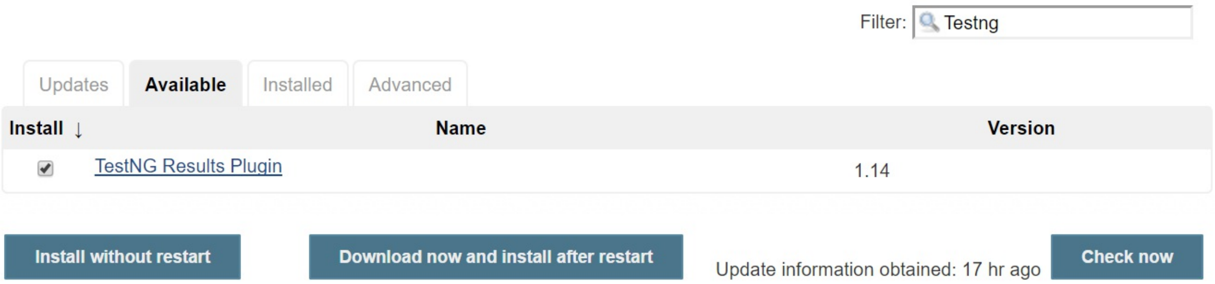
So, we have created a sample test case based on Selenium to verify the title of the PetClinic home page.

Integrating Jenkins and Selenium for functional testing

In this recipe, we will write a sample functional test using Selenium.

Getting ready

Install the TestNG Results Plugin:



Filter: Testng

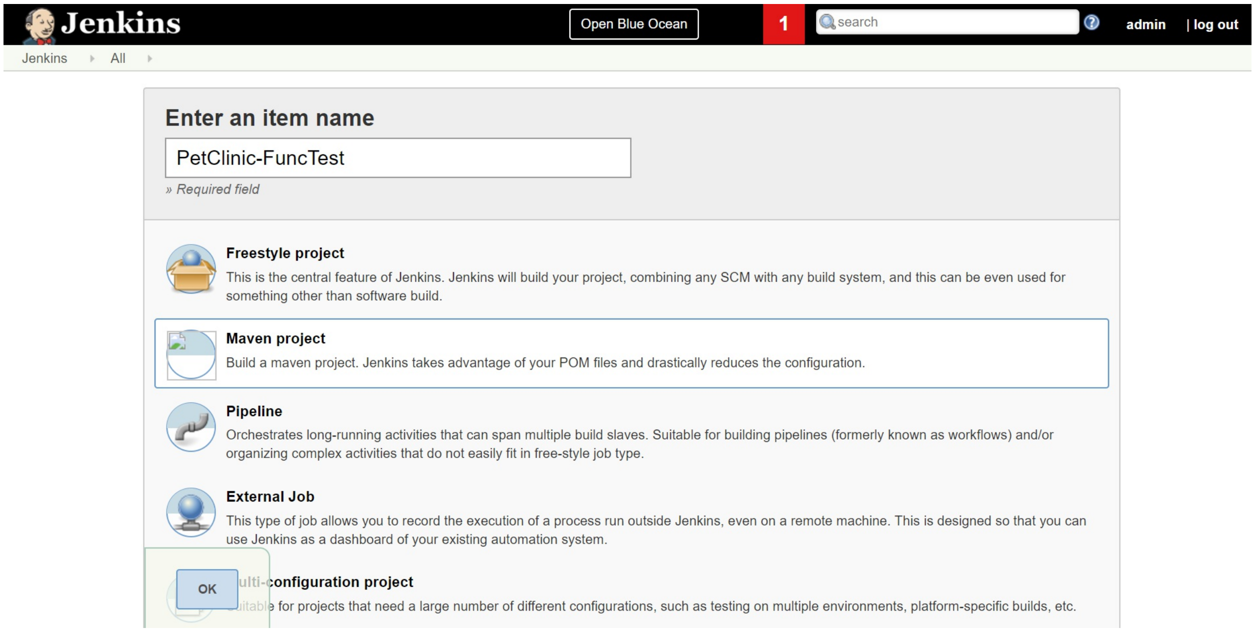
Install ↓	Name	Version
☑	TestNG Results Plugin	1.14

Update information obtained: 17 hr ago

Create a new project or build job in Jenkins.

How to do it...

Now let's try to execute the from Jenkins:



Enter an item name

PetClinic-FuncTest

» Required field

Freestyle project
This is the central feature of Jenkins. Jenkins will build your project, combining any SCM with any build system, and this can be even used for something other than software build.

Maven project
Build a maven project. Jenkins takes advantage of your POM files and drastically reduces the configuration.

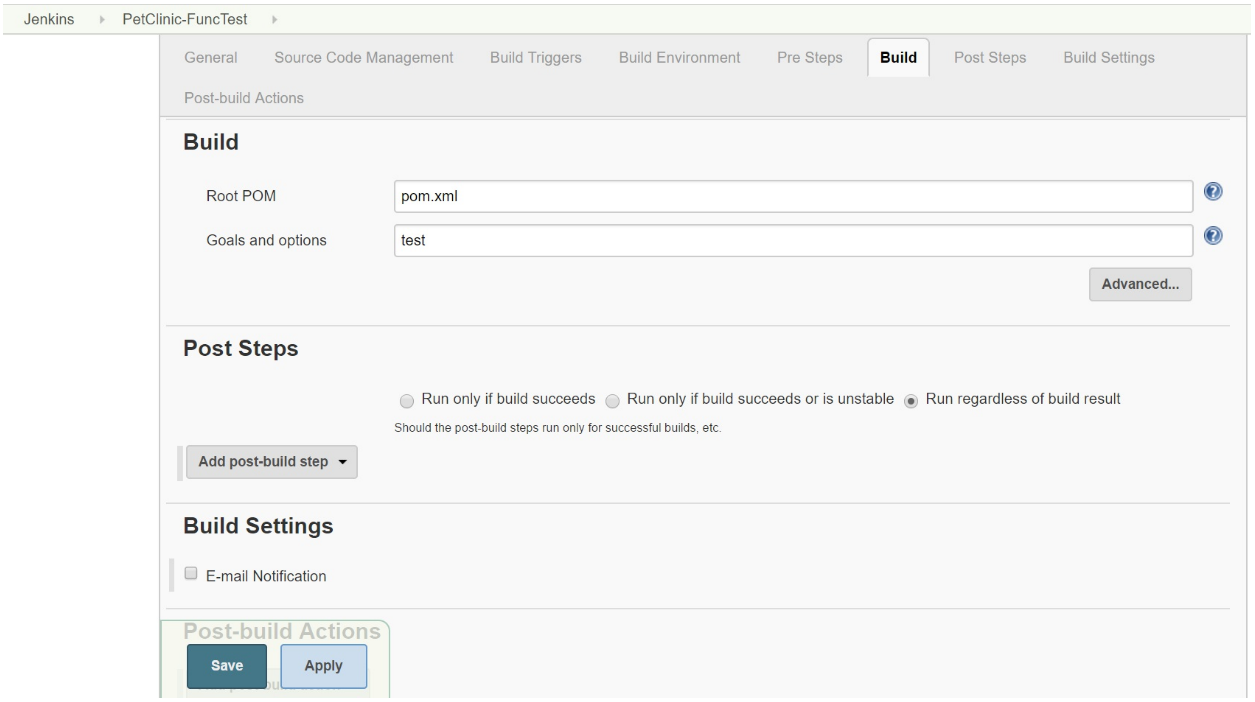
Pipeline
Orchestrates long-running activities that can span multiple build slaves. Suitable for building pipelines (formerly known as workflows) and/or organizing complex activities that do not easily fit in free-style job type.

External Job
This type of job allows you to record the execution of a process run outside Jenkins, even on a remote machine. This is designed so that you can use Jenkins as a dashboard of your existing automation system.

ulti-configuration project
uitable for projects that need a large number of different configurations, such as testing on multiple environments, platform-specific builds, etc.

1. Check in the Test Project in Repository. Create a `PetClinic-FuncTest` freestyle job in Jenkins.

2. In the Build section, provide the Root POM location and Goals and options to execute:



Build

Root POM: pom.xml

Goals and options: test

Post Steps

○ Run only if build succeeds ○ Run only if build succeeds or is unstable ● Run regardless of build result

Should the post-build steps run only for successful builds, etc.

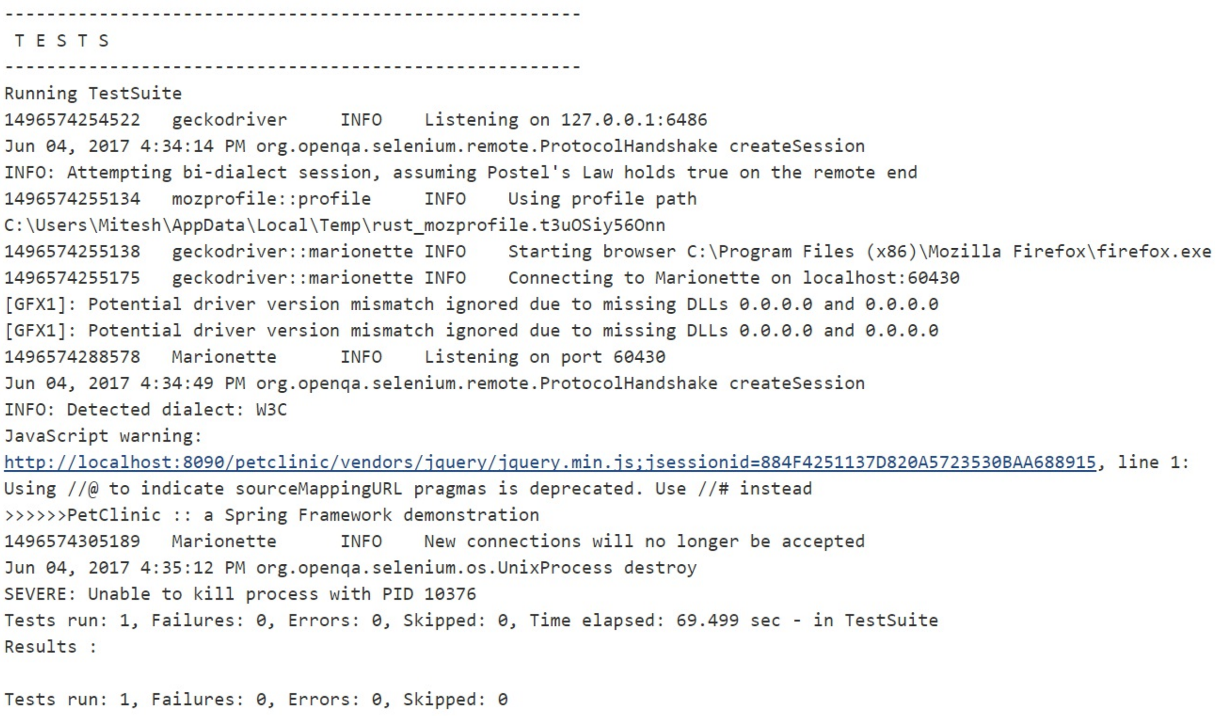
Build Settings

□ E-mail Notification

Post-build Actions

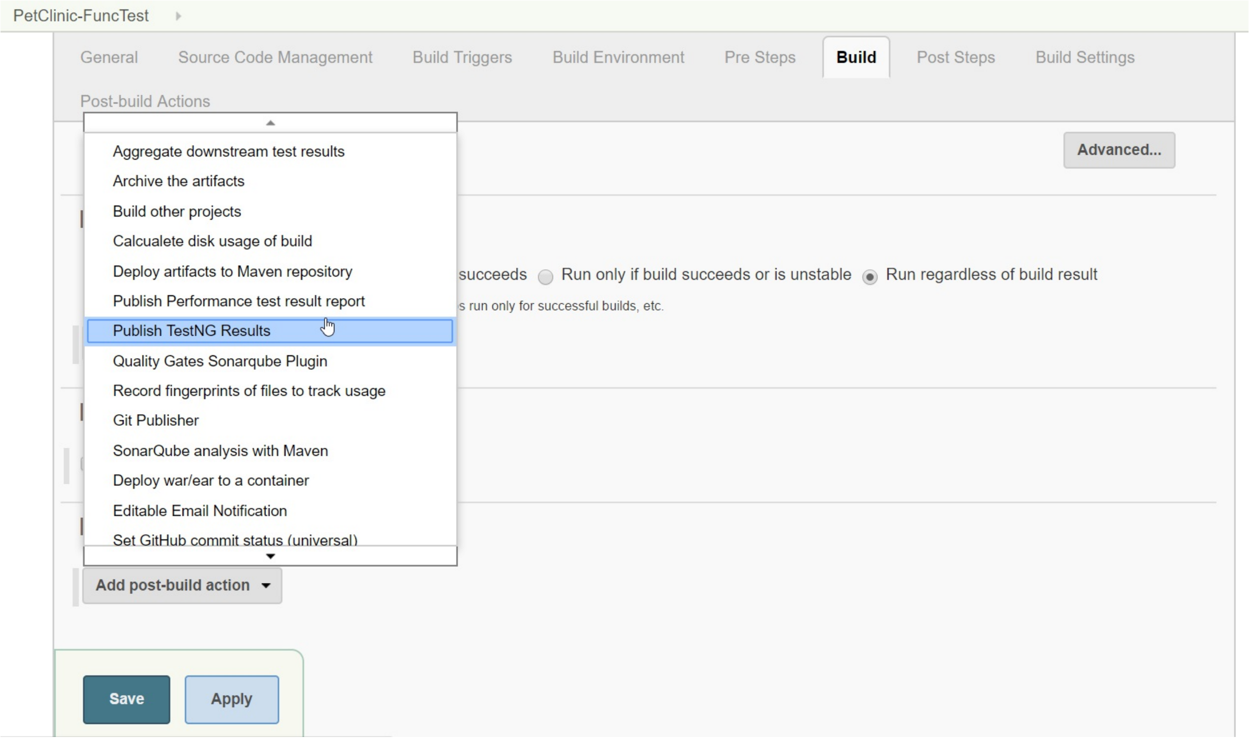
3. Save the build job and click on Build now.
4. Verify the execution of the build job in the Console Output.

5. It will open a Mozilla Firefox window and open a URL that is given in the code. This requires our PetClinic application to be deployed in a web server and running without any issues:

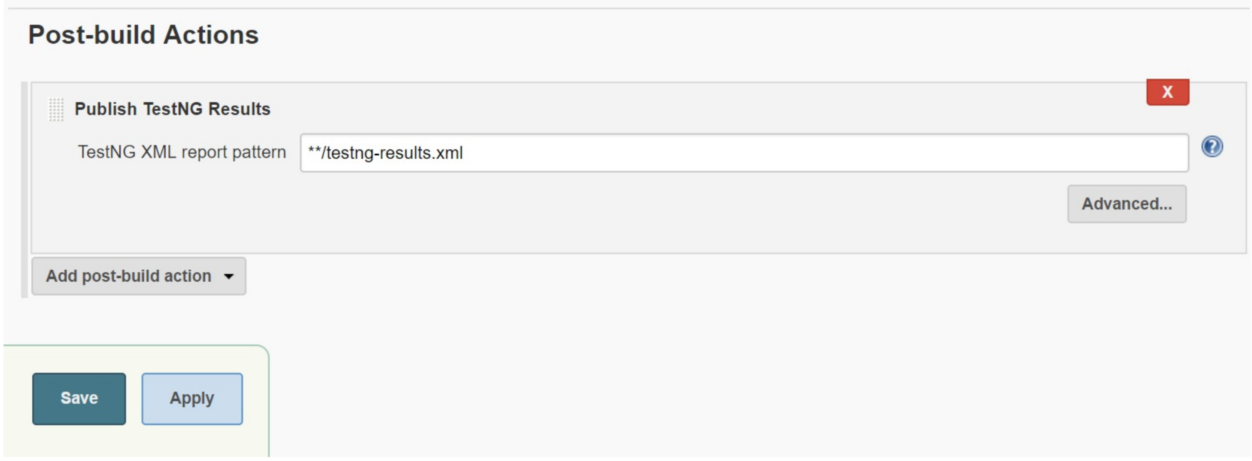


```
-------------------------------------------------------
 T E S T S
-------------------------------------------------------
Running TestSuite
1496574254522   geckodriver     INFO    Listening on 127.0.0.1:6486
Jun 04, 2017 4:34:14 PM org.openqa.selenium.remote.ProtocolHandshake createSession
INFO: Attempting bi-dialect session, assuming Postel's Law holds true on the remote end
1496574255134   mozprofile::profile     INFO    Using profile path
C:\Users\Mitesh\AppData\Local\Temp\rust_mozprofile.t3uOSiy56Onn
1496574255138   geckodriver::marionette INFO    Starting browser C:\Program Files (x86)\Mozilla Firefox\firefox.exe
1496574255175   geckodriver::marionette INFO    Connecting to Marionette on localhost:60430
[GFX1]: Potential driver version mismatch ignored due to missing DLLs 0.0.0.0 and 0.0.0.0
[GFX1]: Potential driver version mismatch ignored due to missing DLLs 0.0.0.0 and 0.0.0.0
1496574288578   Marionette      INFO    Listening on port 60430
Jun 04, 2017 4:34:49 PM org.openqa.selenium.remote.ProtocolHandshake createSession
INFO: Detected dialect: W3C
JavaScript warning:
http://localhost:8090/petclinic/vendors/jquery/jquery.min.js;jsessionid=884F4251137D820A5723530BAA688915, line 1:
Using //@ to indicate sourceMappingURL pragmas is deprecated. Use //# instead
>>>>>>PetClinic :: a Spring Framework demonstration
1496574305189   Marionette      INFO    New connections will no longer be accepted
Jun 04, 2017 4:35:12 PM org.openqa.selenium.os.UnixProcess destroy
SEVERE: Unable to kill process with PID 10376
Tests run: 1, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 69.499 sec - in TestSuite
Results :

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

6. Go to Post-build Actions and select Publish TestNG Results:

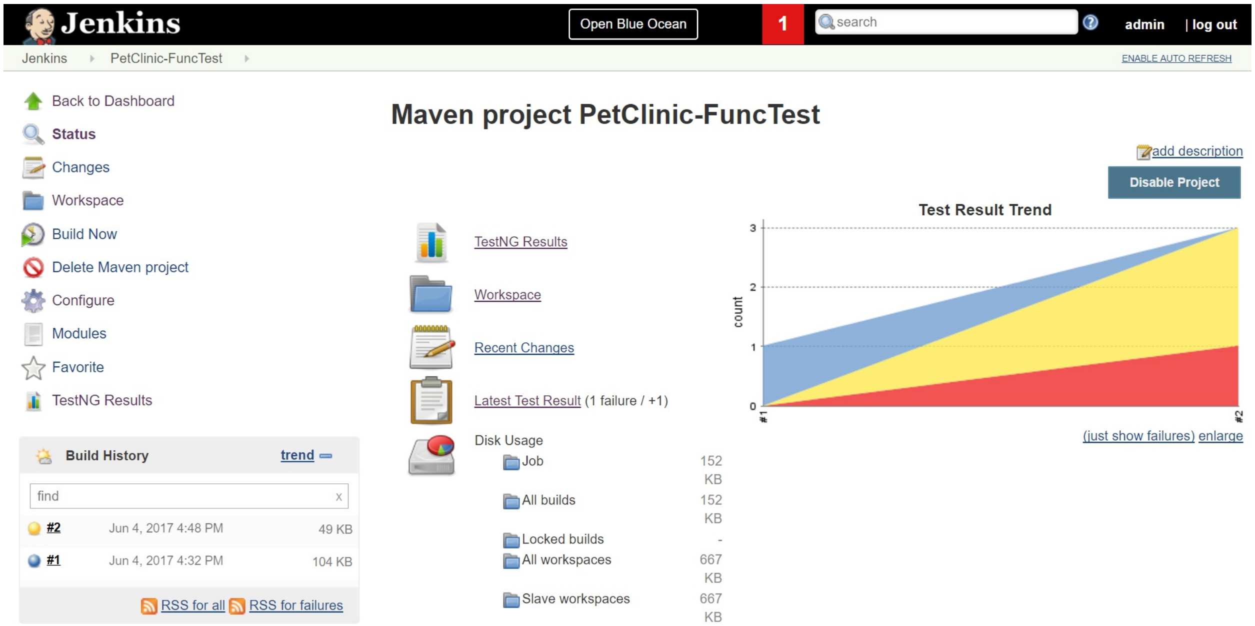

PetClinic-FuncTest
General
Source Code Management
Build Triggers
Build Environment
Pre Steps
Build
Post Steps
Build Settings
Post-build Actions
Aggregate downstream test results
Archive the artifacts
Build other projects
Calculete disk usage of build
Deploy artifacts to Maven repository
Publish Performance test result report
Publish TestNG Results
Quality Gates Sonarqube Plugin
Record fingerprints of files to track usage
Git Publisher
SonarQube analysis with Maven
Deploy war/ear to a container
Editable Email Notification
Set GitHub commit status (universal)
Advanced...
succeeds
○ Run only if build succeeds or is unstable
● Run regardless of build result
s run only for successful builds, etc.
Add post-build action
Save
Apply

7. Provide the TestNG XML report pattern:



TestNG XML report pattern: **/testng-results.xml

8. Click on Build now:



Maven project PetClinic-FuncTest

#2	Jun 4, 2017 4:48 PM	49 KB
#1	Jun 4, 2017 4:32 PM	104 KB

TestNG Results

Workspace

Recent Changes

Latest Test Result (1 failure / +1)

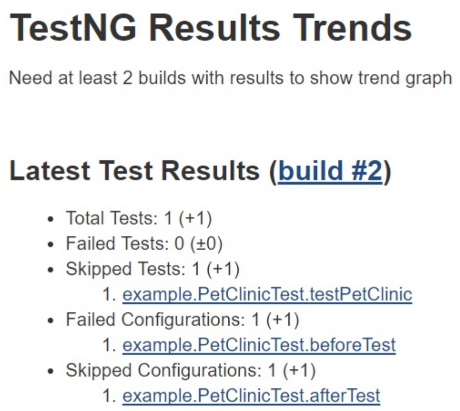
Disk Usage

Job	152 KB
All builds	152 KB
Locked builds	-
All workspaces	667 KB
Slave workspaces	667 KB

We have now seen how to execute Selenium-based test cases in Jenkins.

There's more

Go to the project dashboard and verify the graphs for TestNG results:



TestNG Results Trends

Need at least 2 builds with results to show trend graph

Latest Test Results (build #2)

- Total Tests: 1 (+1)
- Failed Tests: 0 (±0)
- Skipped Tests: 1 (+1)
  1. example.PetClinicTest.testPetClinic
- Failed Configurations: 1 (+1)
  1. example.PetClinicTest.beforeTest
- Skipped Configurations: 1 (+1)
  1. example.PetClinicTest.afterTest

In the next section, we will see how to execute a load test using Jenkins.

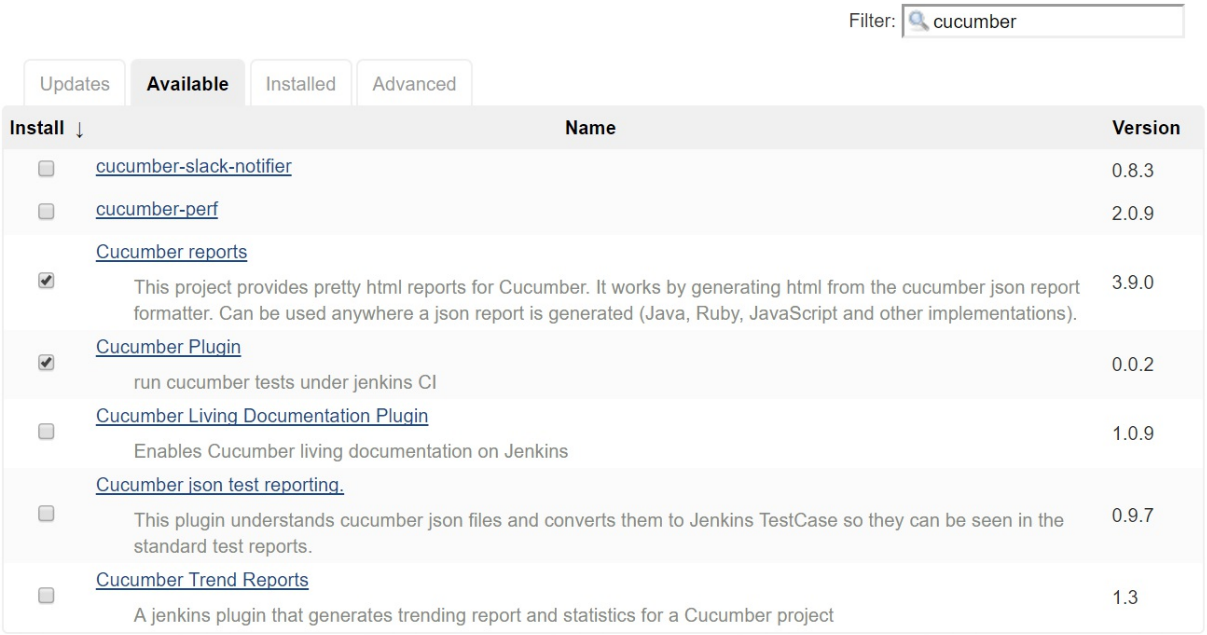
Jenkins and Cucumber test reports

In this recipe, we will integrate Jenkins and Cucumber to publish Cucumber reports using Jenkins.

Getting ready

Go to the Jenkins dashboard | Manage Jenkins | Manage Plugins | Available.

Install the Cucumber reports plugin:



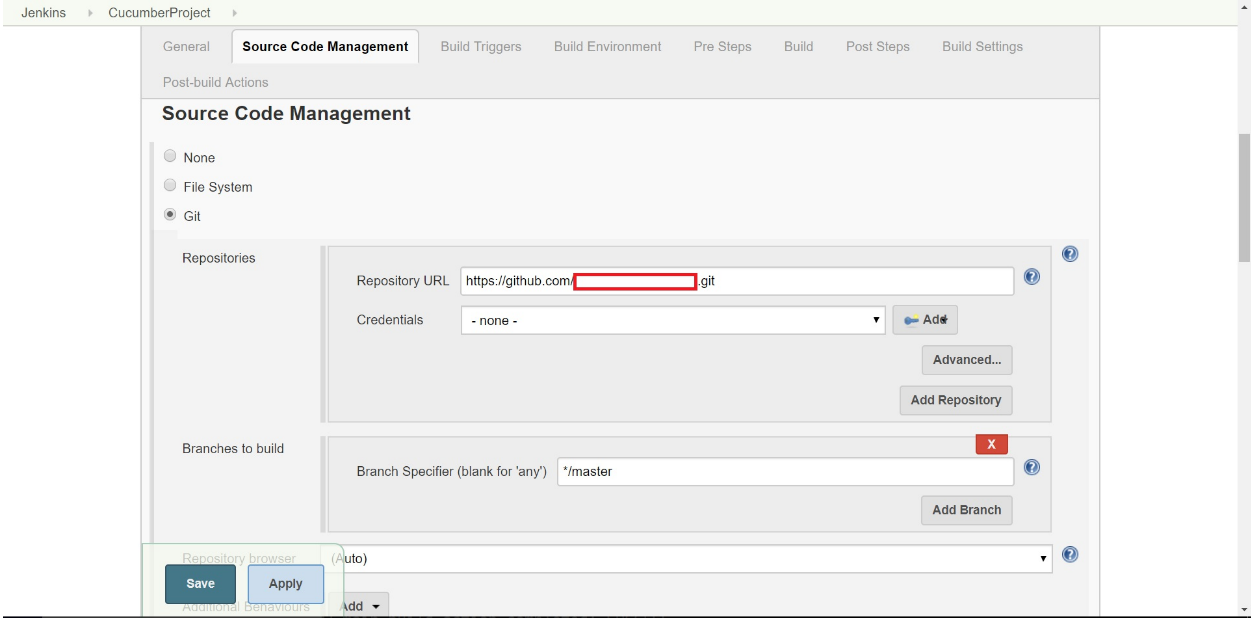
Filter: cucumber

Install ↓	Name	Version
□	cucumber-slack-notifier	0.8.3
□	cucumber-perf	2.0.9
☑	Cucumber reports This project provides pretty html reports for Cucumber. It works by generating html from the cucumber json report formatter. Can be used anywhere a json report is generated (Java, Ruby, JavaScript and other implementations).	3.9.0
☑	Cucumber Plugin run cucumber tests under jenkins CI	0.0.2
□	Cucumber Living Documentation Plugin Enables Cucumber living documentation on Jenkins	1.0.9
□	Cucumber json test reporting. This plugin understands cucumber json files and converts them to Jenkins TestCase so they can be seen in the standard test reports.	0.9.7
□	Cucumber Trend Reports A jenkins plugin that generates trending report and statistics for a Cucumber project	1.3

Click on Install without restart.

How to do it...

1. Create a Maven Project in Jenkins.
2. Select any GitHub project that has Cucumber integrated in it and which generates a `.JSON` file as a report:



Jenkins › CucumberProject ›

General | Source Code Management | Build Triggers | Build Environment | Pre Steps | Build | Post Steps | Build Settings | Post-build Actions

Source Code Management

○ None
○ File System
● Git

Repositories

Repository URL: https://github.com/[redacted].git

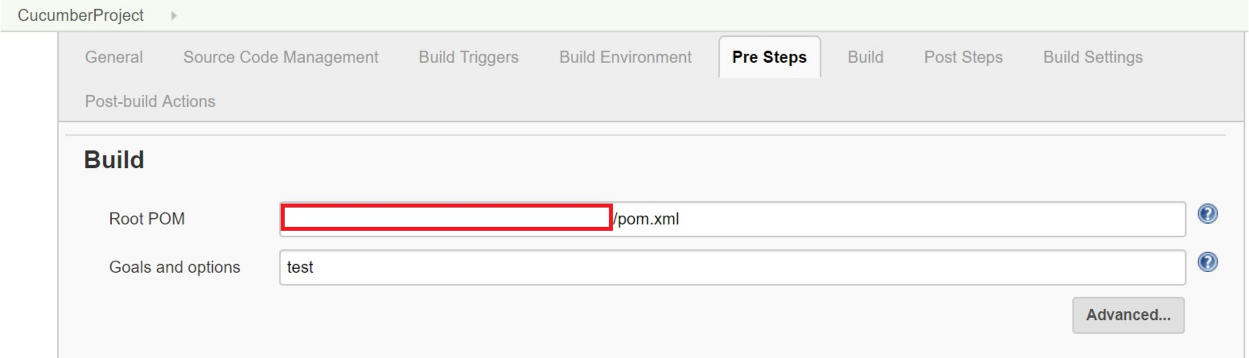
Credentials: - none -

Branches to build

Branch Specifier (blank for 'any'): */master

Repository browser: (Auto)

3. Configure Root POM and the test goal in the Build section:



CucumberProject ›

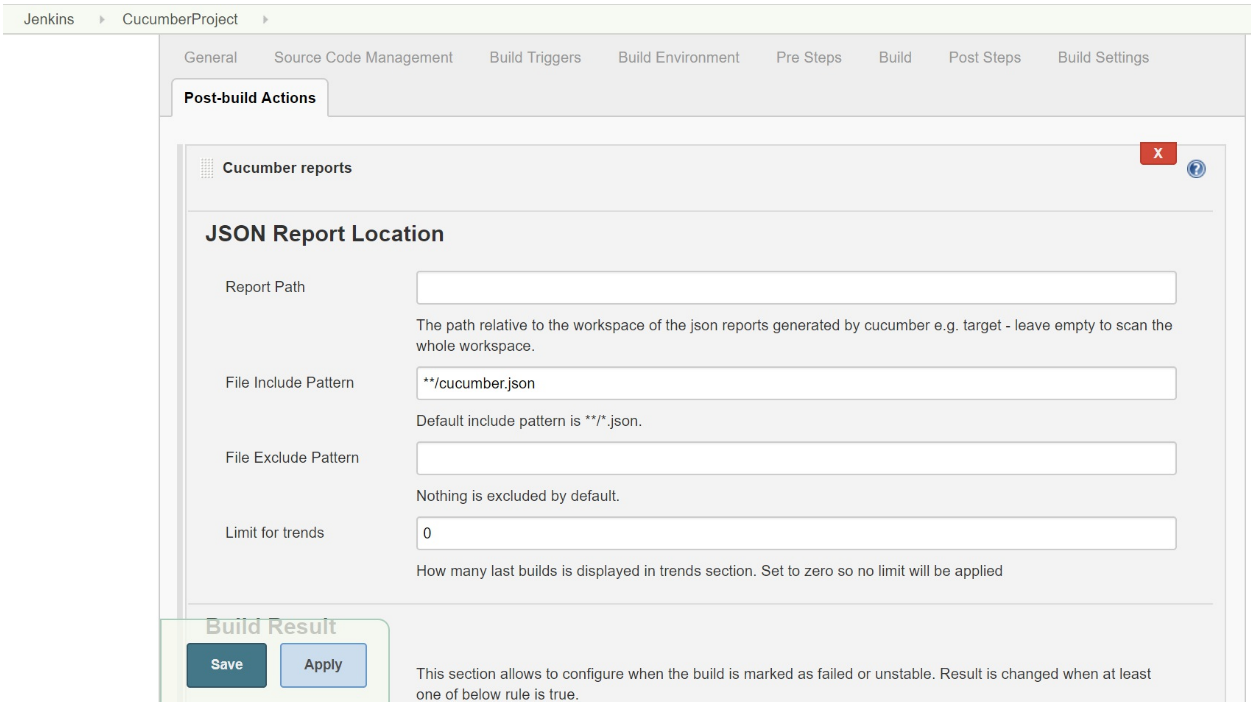
General | Source Code Management | Build Triggers | Build Environment | Pre Steps | Build | Post Steps | Build Settings | Post-build Actions

Build

Root POM: [redacted]/pom.xml

Goals and options: test

4. Select Cucumber reports from Post-build Actions.
5. Add the `*.json` file that will be generated after the test execution:



JSON Report Location

Report Path:

The path relative to the workspace of the json reports generated by cucumber e.g. target - leave empty to scan the whole workspace.

File Include Pattern: **/cucumber.json

Default include pattern is **/*.json.

File Exclude Pattern:

Nothing is excluded by default.

Limit for trends: 0

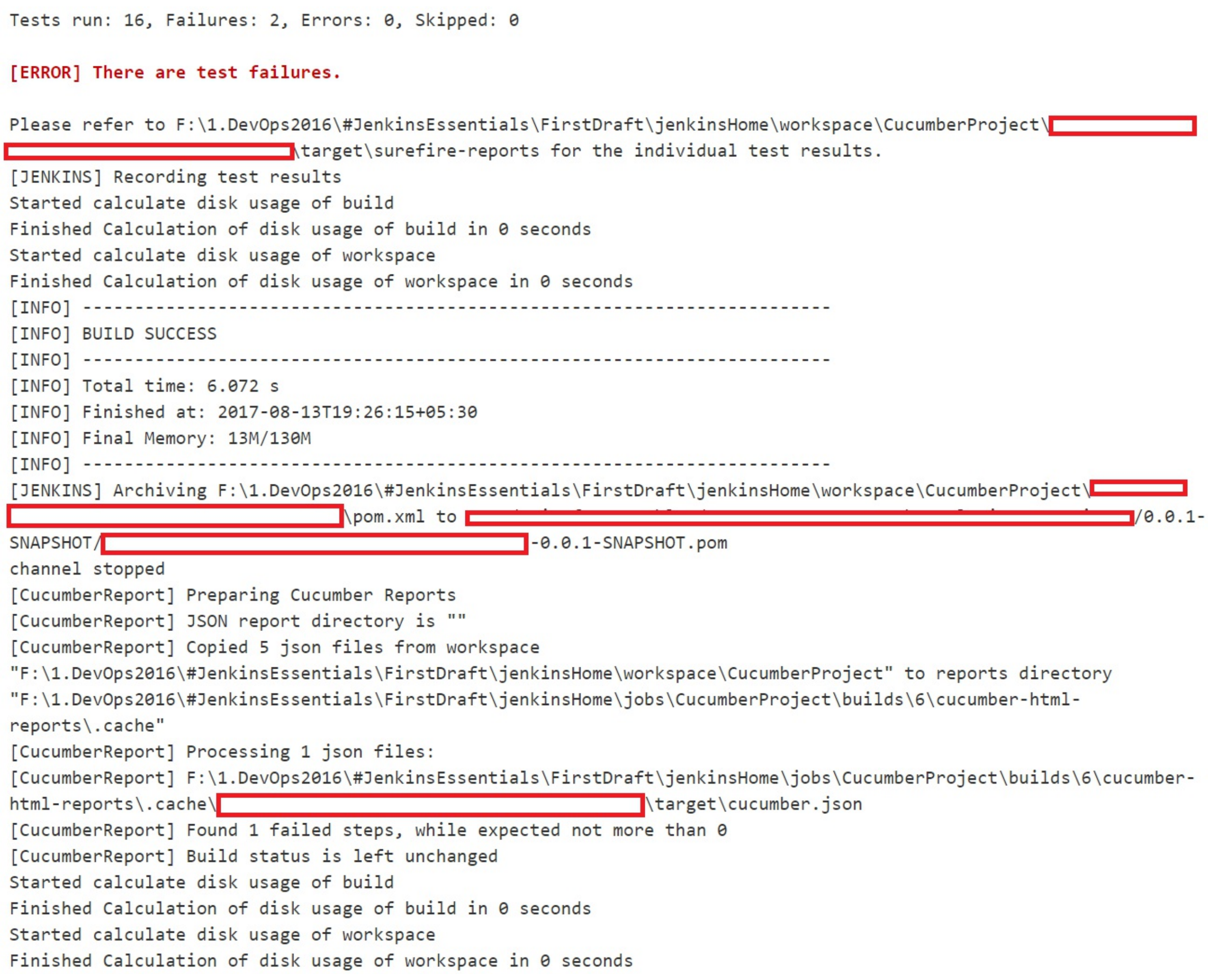
How many last builds is displayed in trends section. Set to zero so no limit will be applied

Build Result

This section allows to configure when the build is marked as failed or unstable. Result is changed when at least one of below rule is true.

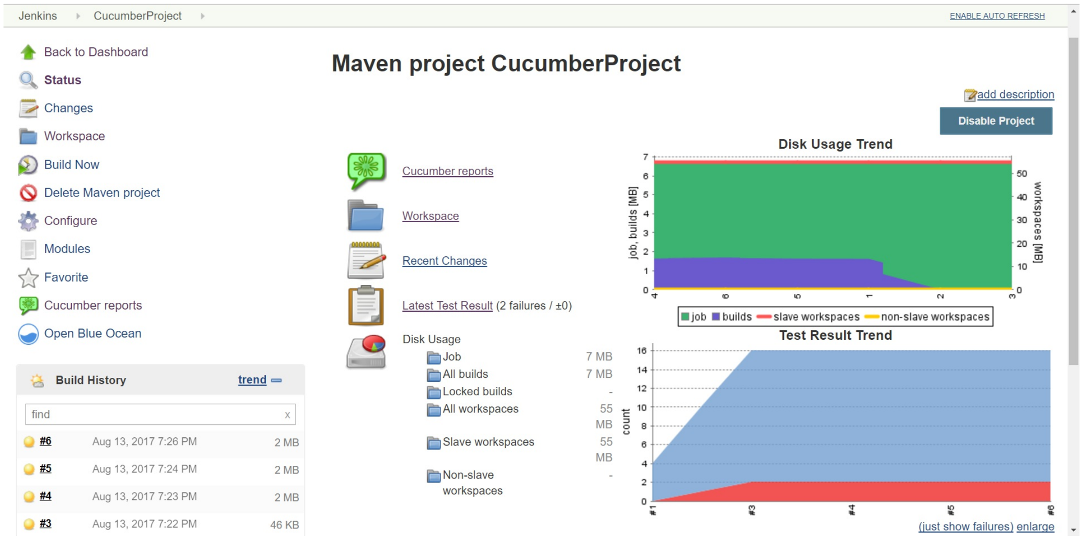
6. Save the build job.
7. Click on Build now.

8. Go to the Console Output and verify the test execution logs:



```
Tests run: 16, Failures: 2, Errors: 0, Skipped: 0

[ERROR] There are test failures.

Please refer to F:\1.DevOps2016\#JenkinsEssentials\FirstDraft\jenkinsHome\workspace\CucumberProject\[redacted]
\target\surefire-reports for the individual test results.
[JENKINS] Recording test results
Started calculate disk usage of build
Finished Calculation of disk usage of build in 0 seconds
Started calculate disk usage of workspace
Finished Calculation of disk usage of workspace in 0 seconds
[INFO] ------------------------------------------------------------------------
[INFO] BUILD SUCCESS
[INFO] ------------------------------------------------------------------------
[INFO] Total time: 6.072 s
[INFO] Finished at: 2017-08-13T19:26:15+05:30
[INFO] Final Memory: 13M/130M
[INFO] ------------------------------------------------------------------------
[JENKINS] Archiving F:\1.DevOps2016\#JenkinsEssentials\FirstDraft\jenkinsHome\workspace\CucumberProject\[redacted]
\pom.xml to [redacted]/0.0.1-
SNAPSHOT/[redacted]-0.0.1-SNAPSHOT.pom
channel stopped
[CucumberReport] Preparing Cucumber Reports
[CucumberReport] JSON report directory is ""
[CucumberReport] Copied 5 json files from workspace
"F:\1.DevOps2016\#JenkinsEssentials\FirstDraft\jenkinsHome\workspace\CucumberProject" to reports directory
"F:\1.DevOps2016\#JenkinsEssentials\FirstDraft\jenkinsHome\jobs\CucumberProject\builds\6\cucumber-html-
reports\.cache"
[CucumberReport] Processing 1 json files:
[CucumberReport] F:\1.DevOps2016\#JenkinsEssentials\FirstDraft\jenkinsHome\jobs\CucumberProject\builds\6\cucumber-
html-reports\.cache\[redacted]\target\cucumber.json
[CucumberReport] Found 1 failed steps, while expected not more than 0
[CucumberReport] Build status is left unchanged
Started calculate disk usage of build
Finished Calculation of disk usage of build in 0 seconds
Started calculate disk usage of workspace
Finished Calculation of disk usage of workspace in 0 seconds
```

9. On the CucumberProject dashboard, you will find Test Result Trend and the Cucumber reports link:



Maven project CucumberProject

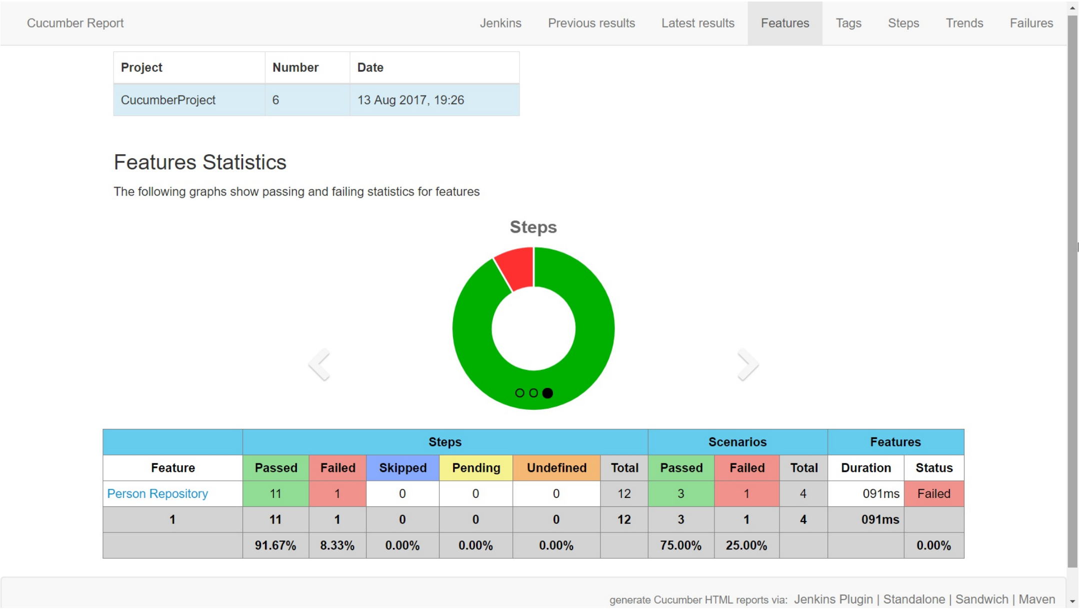
Latest Test Result (2 failures / ±0)

Disk Usage	
Job	7 MB
All builds	7 MB
Locked builds	-
All workspaces	55 MB
Slave workspaces	55 MB
Non-slave workspaces	-

Build History

#6	Aug 13, 2017 7:26 PM	2 MB
#5	Aug 13, 2017 7:24 PM	2 MB
#4	Aug 13, 2017 7:23 PM	2 MB
#3	Aug 13, 2017 7:22 PM	46 KB

10. Click on the Cucumber Reports link:



Project	Number	Date
CucumberProject	6	13 Aug 2017, 19:26

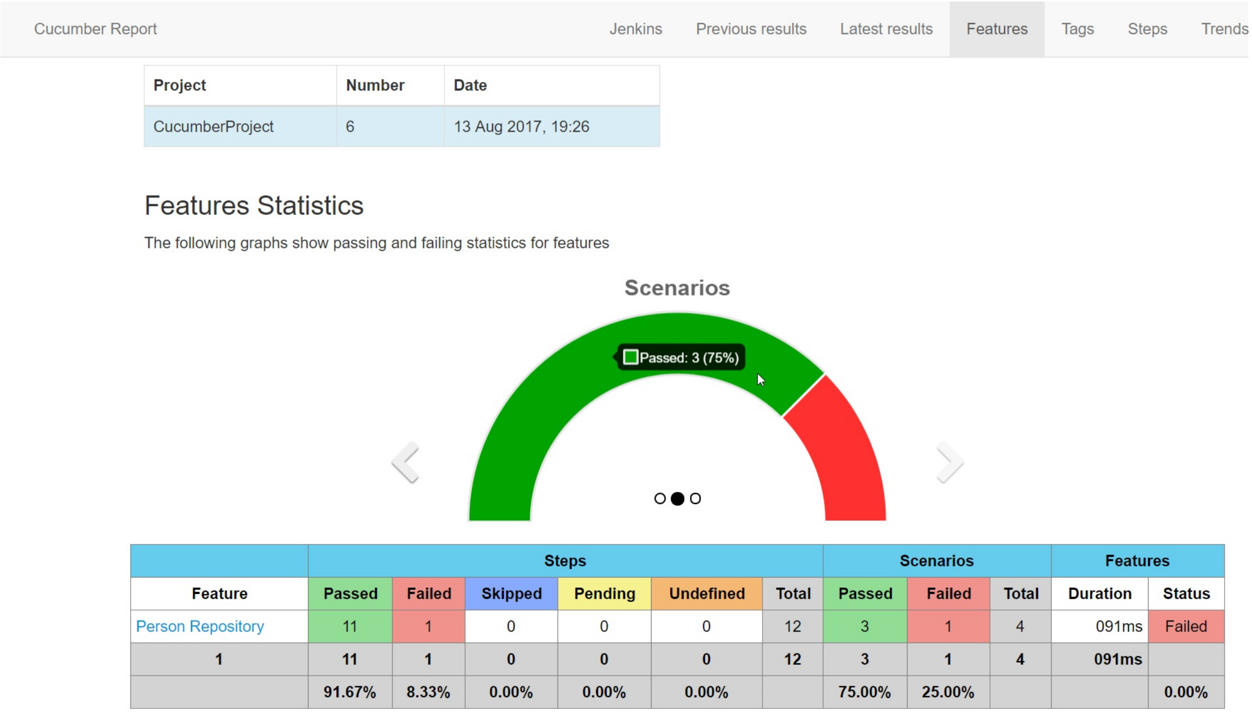
Features Statistics

The following graphs show passing and failing statistics for features

	Steps						Scenarios			Features	
Feature	Passed	Failed	Skipped	Pending	Undefined	Total	Passed	Failed	Total	Duration	Status
Person Repository	11	1	0	0	0	12	3	1	4	091ms	Failed
1	11	1	0	0	0	12	3	1	4	091ms	
	91.67%	8.33%	0.00%	0.00%	0.00%		75.00%	25.00%			0.00%

generate Cucumber HTML reports via: Jenkins Plugin | Standalone | Sandwich | Maven

11. Check the steps, scenarios, and features-related graphs and data:



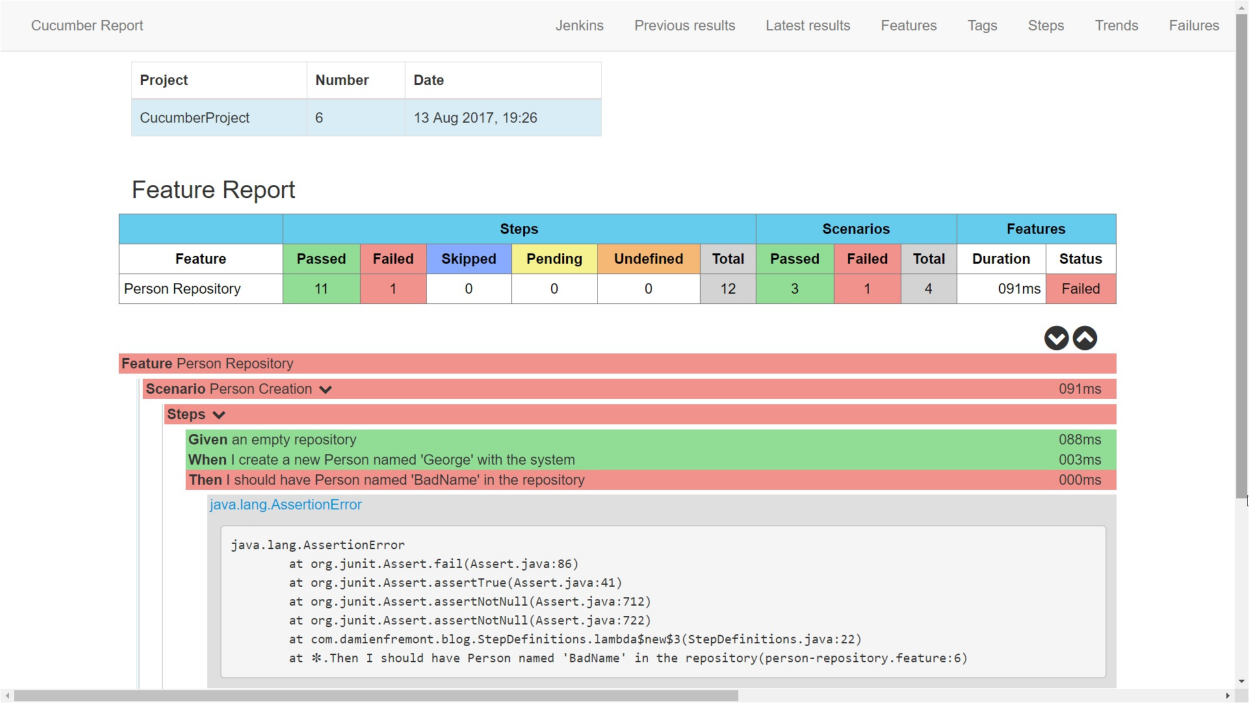
Project	Number	Date
CucumberProject	6	13 Aug 2017, 19:26

Features Statistics

The following graphs show passing and failing statistics for features

	Steps						Scenarios			Features	
Feature	Passed	Failed	Skipped	Pending	Undefined	Total	Passed	Failed	Total	Duration	Status
Person Repository	11	1	0	0	0	12	3	1	4	091ms	Failed
1	11	1	0	0	0	12	3	1	4	091ms	
	91.67%	8.33%	0.00%	0.00%	0.00%		75.00%	25.00%			0.00%

12. Verify the Feature Report:



Project	Number	Date
CucumberProject	6	13 Aug 2017, 19:26

Feature Report

	Steps						Scenarios			Features	
Feature	Passed	Failed	Skipped	Pending	Undefined	Total	Passed	Failed	Total	Duration	Status
Person Repository	11	1	0	0	0	12	3	1	4	091ms	Failed

Feature Person Repository

Scenario Person Creation 091ms

Steps

Given an empty repository 088ms

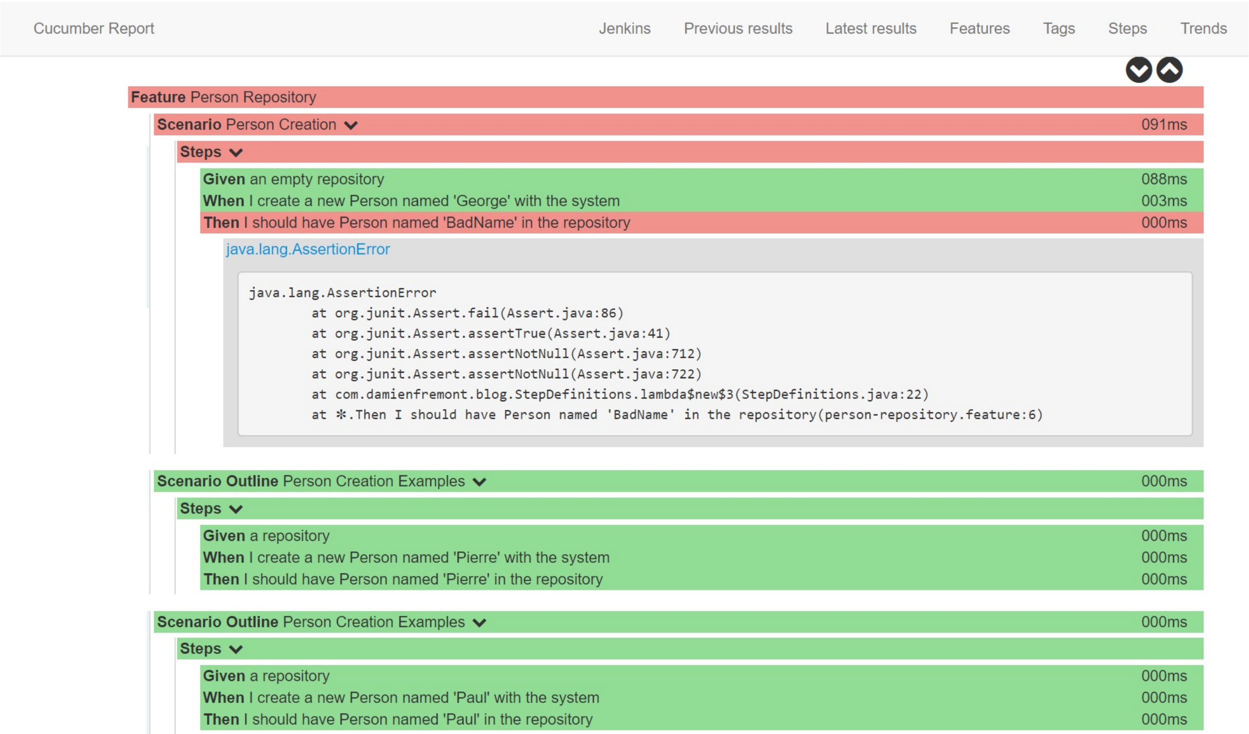
When I create a new Person named 'George' with the system 003ms

Then I should have Person named 'BadName' in the repository 000ms

java.lang.AssertionError

```
java.lang.AssertionError
        at org.junit.Assert.fail(Assert.java:86)
        at org.junit.Assert.assertTrue(Assert.java:41)
        at org.junit.Assert.assertNotNull(Assert.java:712)
        at org.junit.Assert.assertNotNull(Assert.java:722)
        at com.damienfremont.blog.StepDefinitions.lambda$new$3(StepDefinitions.java:22)
        at ✽.Then I should have Person named 'BadName' in the repository(person-repository.feature:6)
```

13. Click on Features and check the Feature, Scenario, and Steps in detail:



Feature Person Repository

Scenario Person Creation 091ms

Steps

Given an empty repository 088ms
When I create a new Person named 'George' with the system 003ms
Then I should have Person named 'BadName' in the repository 000ms

java.lang.AssertionError

```
java.lang.AssertionError
        at org.junit.Assert.fail(Assert.java:86)
        at org.junit.Assert.assertTrue(Assert.java:41)
        at org.junit.Assert.assertNotNull(Assert.java:712)
        at org.junit.Assert.assertNotNull(Assert.java:722)
        at com.damienfremont.blog.StepDefinitions.lambda$new$3(StepDefinitions.java:22)
        at ✽.Then I should have Person named 'BadName' in the repository(person-repository.feature:6)
```

Scenario Outline Person Creation Examples 000ms

Steps

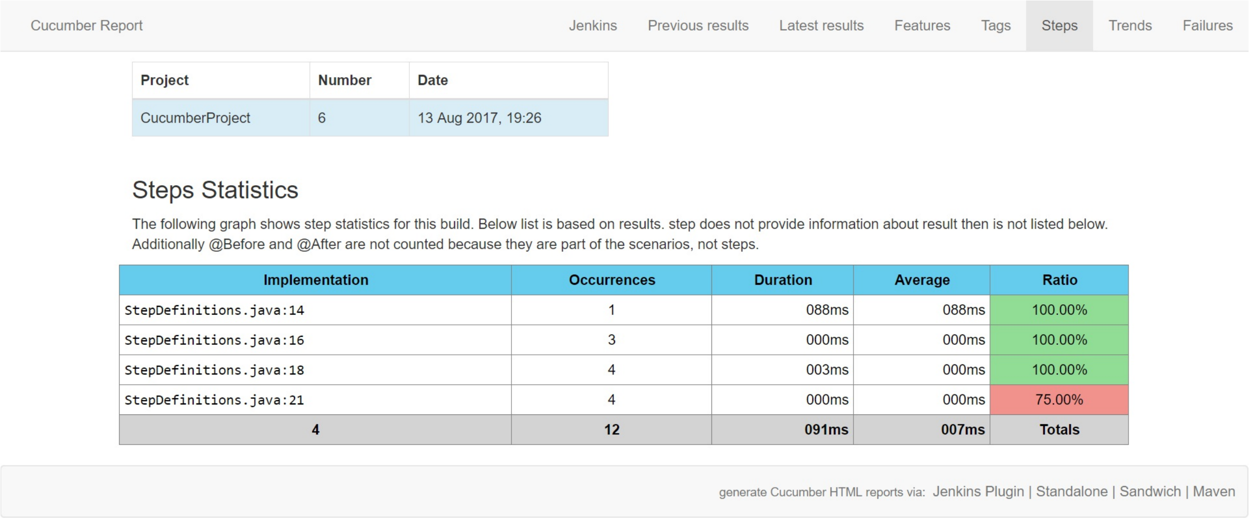
Given a repository 000ms
When I create a new Person named 'Pierre' with the system 000ms
Then I should have Person named 'Pierre' in the repository 000ms

Scenario Outline Person Creation Examples 000ms

Steps

Given a repository 000ms
When I create a new Person named 'Paul' with the system 000ms
Then I should have Person named 'Paul' in the repository 000ms

14. The following graph shows the Steps Statistics for this build. The following list is based on the results:



Project	Number	Date
CucumberProject	6	13 Aug 2017, 19:26

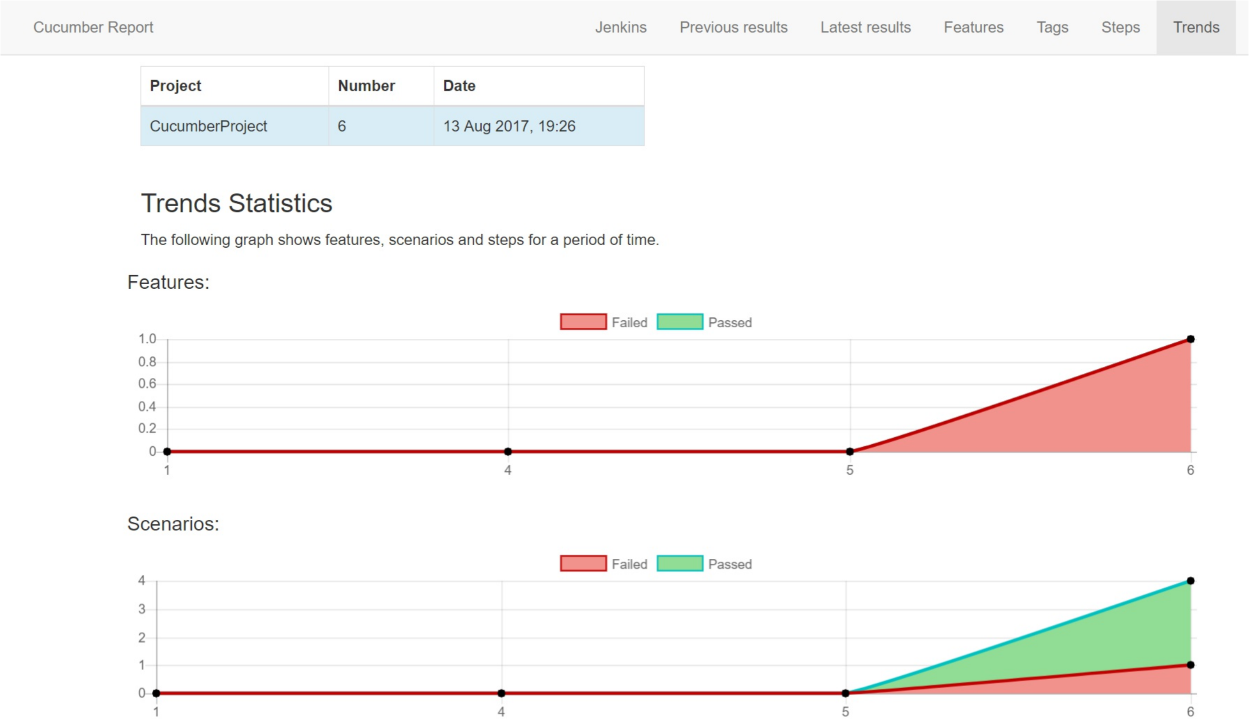
Steps Statistics

The following graph shows step statistics for this build. Below list is based on results. step does not provide information about result then is not listed below. Additionally @Before and @After are not counted because they are part of the scenarios, not steps.

Implementation	Occurrences	Duration	Average	Ratio
StepDefinitions.java:14	1	088ms	088ms	100.00%
StepDefinitions.java:16	3	000ms	000ms	100.00%
StepDefinitions.java:18	4	003ms	000ms	100.00%
StepDefinitions.java:21	4	000ms	000ms	75.00%
4	12	091ms	007ms	Totals

generate Cucumber HTML reports via: Jenkins Plugin | Standalone | Sandwich | Maven

15. The Trends Statistics graph shows Features, Scenarios, and Steps for a period of time:



Project	Number	Date
CucumberProject	6	13 Aug 2017, 19:26

Trends Statistics

The following graph shows features, scenarios and steps for a period of time.

Features:

Scenarios:

Try to find similar kinds of projects on GitHub and configure them in Jenkins to verify Cucumber reports in Jenkins.

Creating a load test in Apache JMeter

Apache JMeter is an open source Apache project. It is a pure Java application. Apache JMeter is used to load test, analyze, and measure the performance of services.

JMeter (http://jmeter.apache.org) is an open source tool for stress testing. It allows you to visually create a test plan and then hammer systems based on that plan.

JMeter can make many types of requests, known as samplers. It can sample HTTP, LDAP, and databases, use scripts, and much more. It can report back visually with listeners.

A beginner's book on JMeter is *Apache JMeter* by Emily H. Halili, published by Packt Publishing, ISBN 1847192955 (http://www.packtpub.com/beginning-apache-jmeter).

Two more advanced books from the same publisher are https://www.packtpub.com/application-development/performance-testing-jmeter-29 and https://www.packtpub.com/application-development/jmeter-cookbook-raw.

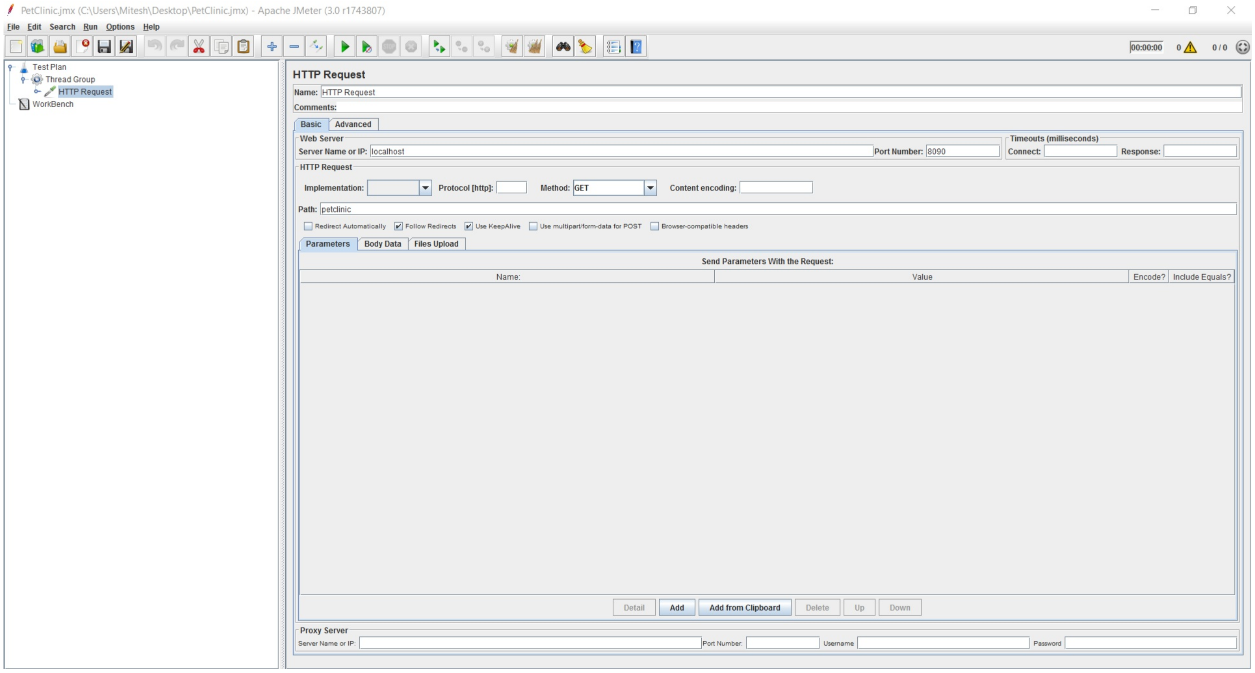
In this recipe, you will write a test plan for hitting web pages whose URLs are defined in a text file. In the next recipe, *Reporting JMeter test plans*, you will configure Jenkins to run JMeter test plans.

Getting ready

Download Apache JMeter from http://jmeter.apache.org/download_jmeter.cgi. Extract the files and go to the `bin` directory. Execute `jmeter.bat` or `jmeter.sh`.

How to do it...

1. Jenkins' stable and recent versions are available in a `YUM` repository.
2. Open the Apache JMeter console and create a Test Plan.
3. Right-click on the Test Plan and click on Add; select Threads (Users).
4. Select Thread Group.
5. Provide the Thread Group name.
6. In the Thread Group properties, provide the Number of Threads, Ramp-up Period, and Loop Count.
7. Right-click on Thread Group. Click on Add. Click on Sampler. Click on HTTP Request.
8. In HTTP Request, provide the Server Name or IP. In our case, it will be localhost or an IP address.
9. Give the Port Number where your web server is running.
10. Select the `GET` method and provide a path to the load test:


PetClinic.jmx (C:\Users\Mitesh\Desktop\PetClinic.jmx) - Apache JMeter (3.0 r1743807)
File Edit Search Run Options Help
00:00:00 0 0 / 0
Test Plan
Thread Group
HTTP Request
WorkBench
Basic Advanced
Parameters Body Data Files Upload
Send Parameters With the Request:
Name: Value Encode? Include Equals?
Detail Add Add from Clipboard Delete Up Down

HTTP Request

Name: HTTP Request

Comments:

Web Server

Server Name or IP: localhost Port Number: 8090

Timeouts (milliseconds) Connect: Response:

HTTP Request

Implementation: Protocol [http]: Method: GET Content encoding:

Path: petclinic

☐ Redirect Automatically ☑ Follow Redirects ☑ Use KeepAlive ☐ Use multipart/form-data for POST ☐ Browser-compatible headers

Proxy Server

Server Name or IP: Port Number: Username Password

Apache JMeter HTTP Request Configuration

11. Save the `.jmx` file.
12. Run the test plan by pressing *Ctrl* + *R*.
13. Click on View Results Tree.

There's more

JMeter uses threads to run requests in parallel. Each thread is supposed to approximately simulate one user. In reality, a real user hits the system a lot less hard than a thread. Threads can hit the system many times a second, whereas, typically, a user clicks approximately once every 20 seconds.

The test plan uses a number of elements:

- Thread Group: This defines the number of threads that run.
- Cookie manager: This keeps the track of cookies per thread. This is important if you want to keep track of cookies between requests. For example, if a thread logs in to a Tomcat server, the unique JSESSIONID needs to be stored for each thread.
- CSV Data Set Config: This element parses the content of a CSV file, putting values in the HOST, PORT, and URL variables. A new line of the CSV file is read for each thread, once per iteration. The variables are expanded in the elements by using the `${variable_name}` notation.
- View Results Tree: This listener displays the results in the GUI as a tree of requests and responses. This is great for debugging but should be removed later.

A common mistake is to assume that a thread is equivalent to a user. The main difference is that threads can respond faster than an average user. If you do not add delay factors in the request, then you can really hammer your applications with a few threads. For example, a delay of 25 seconds per click is typical for the online systems at the University of Amsterdam.

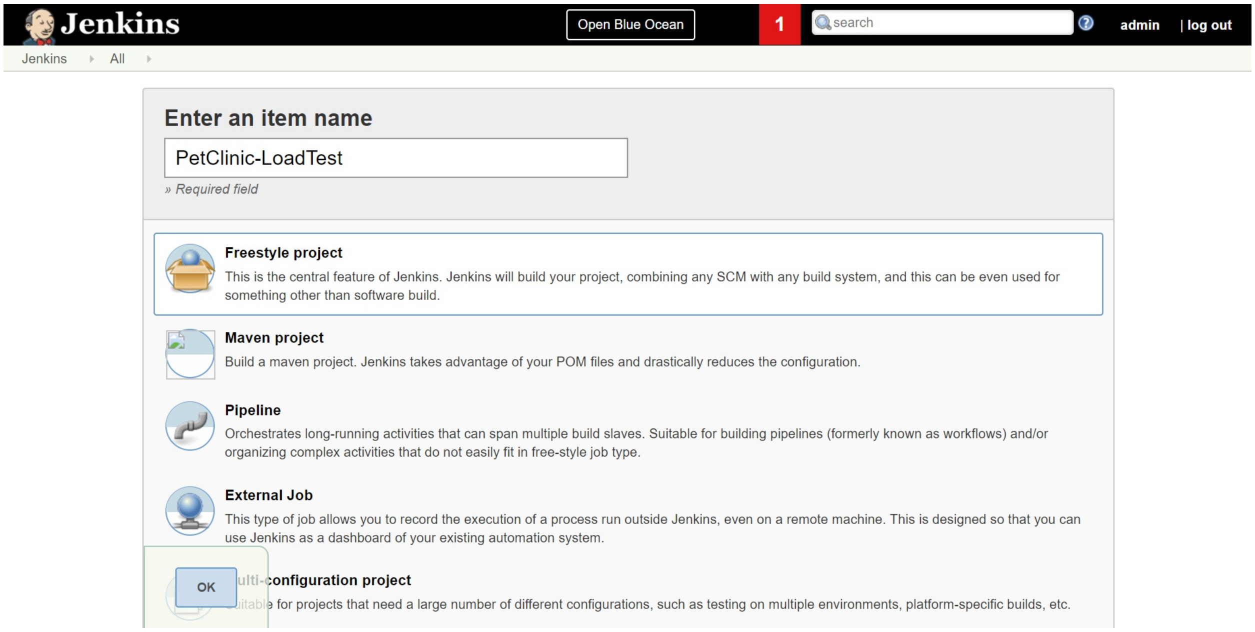
If you are looking to coax out multithreading issues in your applications, then use a random delay element rather than a constant delay. This is also a better simulation of a typical user interaction.

Executing a load test from Jenkins

Now let's create a Jenkins job.

Getting ready

Create a Freestyle project in Jenkins:



Enter an item name

PetClinic-LoadTest

» Required field

Freestyle project
This is the central feature of Jenkins. Jenkins will build your project, combining any SCM with any build system, and this can be even used for something other than software build.

Maven project
Build a maven project. Jenkins takes advantage of your POM files and drastically reduces the configuration.

Pipeline
Orchestrates long-running activities that can span multiple build slaves. Suitable for building pipelines (formerly known as workflows) and/or organizing complex activities that do not easily fit in free-style job type.

External Job
This type of job allows you to record the execution of a process run outside Jenkins, even on a remote machine. This is designed so that you can use Jenkins as a dashboard of your existing automation system.

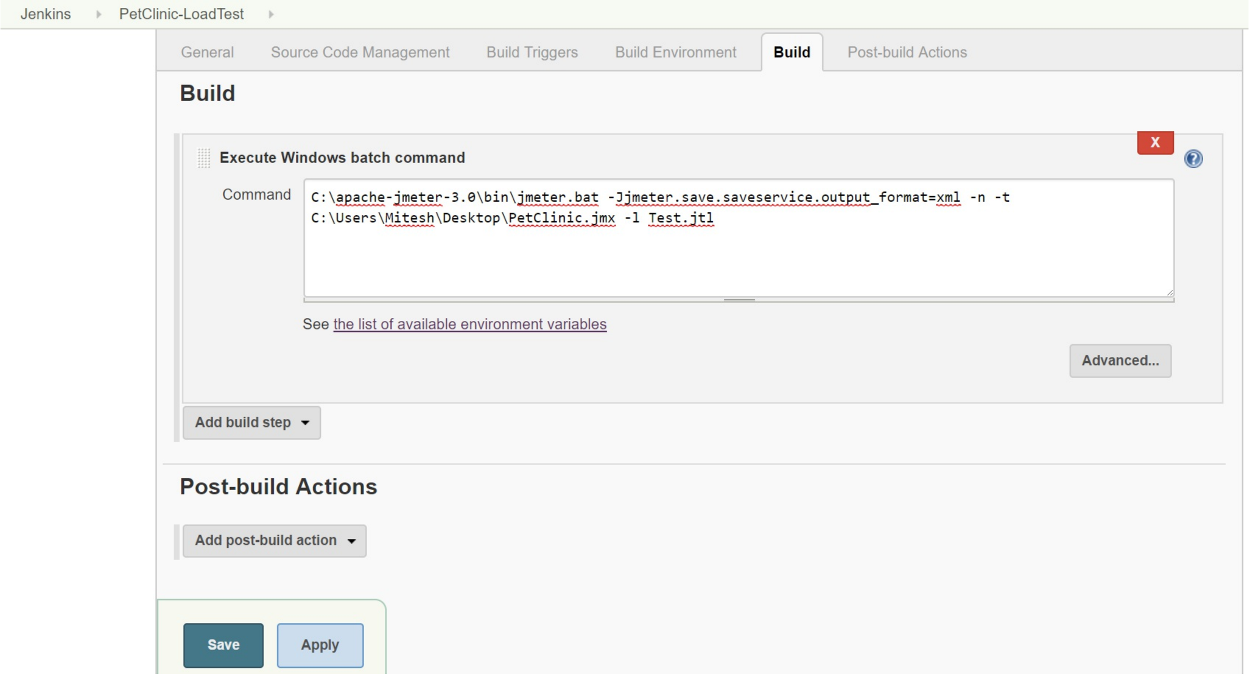
Multi-configuration project
Suitable for projects that need a large number of different configurations, such as testing on multiple environments, platform-specific builds, etc.

Add the build step Execute Windows `batch` command.

How to do it...

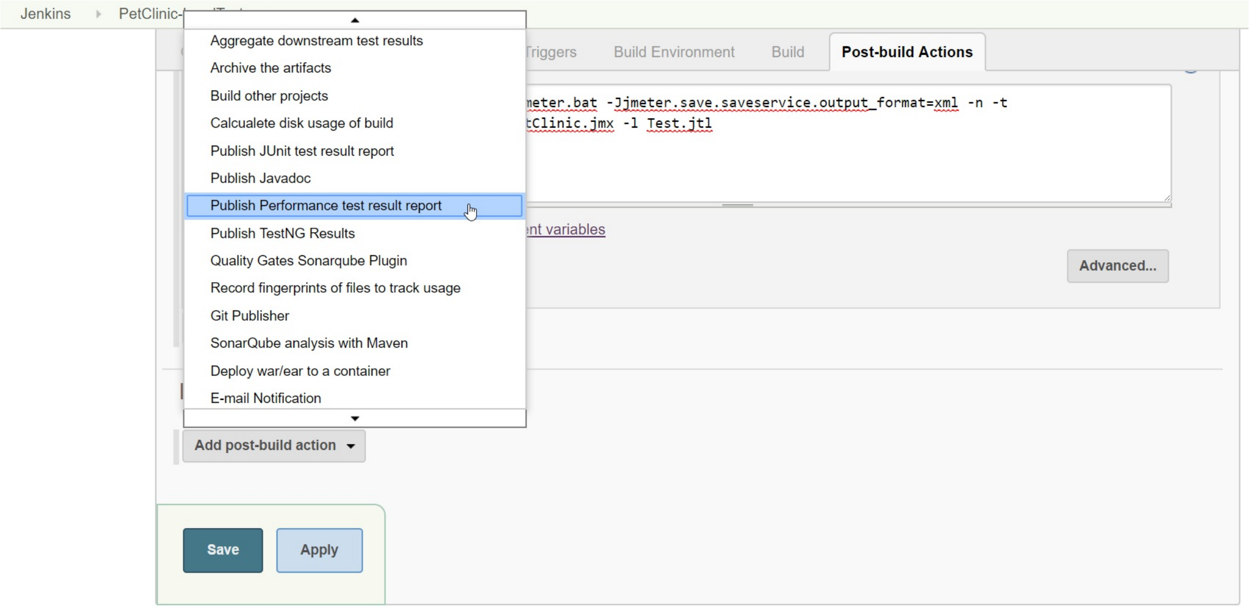
1. Add the following command. Replace the location of `jmeter.bat` based on the installation directory and the location of the `.jmx file` too:

```
C:\apache-jmeter-3.0\bin\jmeter.bat -Jjmeter.save.saveservice.output_format=xml
-n -t C:\Users\Mitesh\Desktop\PetClinic.jmx -l Test.jtl
```



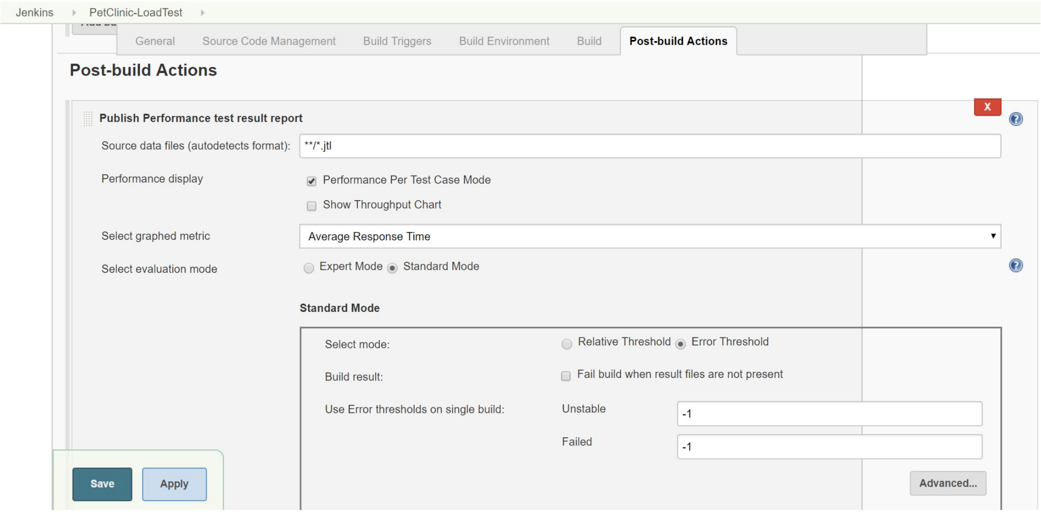
```
C:\apache-jmeter-3.0\bin\jmeter.bat -Jjmeter.save.saveservice.output_format=xml -n -t
C:\Users\Mitesh\Desktop\PetClinic.jmx -l Test.jtl
```

2. Add a Post-build Actions:


Jenkins
PetClinic-
Aggregate downstream test results
Archive the artifacts
Build other projects
Calcualete disk usage of build
Publish JUnit test result report
Publish Javadoc
Publish Performance test result report
Publish TestNG Results
Quality Gates Sonarqube Plugin
Record fingerprints of files to track usage
Git Publisher
SonarQube analysis with Maven
Deploy war/ear to a container
E-mail Notification
Triggers
Build Environment
Build
Post-build Actions
nt variables
Advanced...
Add post-build action
Save
Apply

```
meter.bat -Jjmeter.save.saveservice.output_format=xml -n -t
tClinic.jmx -l Test.jtl
```

3. In the Publish Performance test result report, add `**/*.jtl` file:



Post-build Actions

Publish Performance test result report

Source data files (autodetects format): **/*.jtl

Performance display: ☑ Performance Per Test Case Mode ☐ Show Throughput Chart

Select graphed metric: Average Response Time

Select evaluation mode: ○ Expert Mode ● Standard Mode

Standard Mode

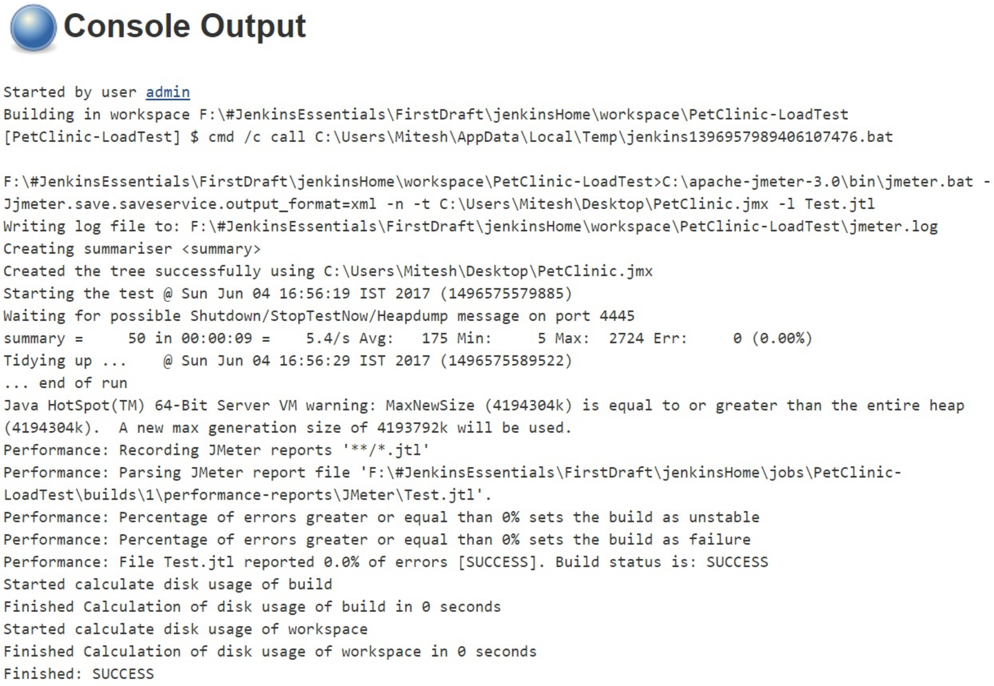
Select mode: ○ Relative Threshold ● Error Threshold

Build result: ☐ Fail build when result files are not present

Use Error thresholds on single build: Unstable -1

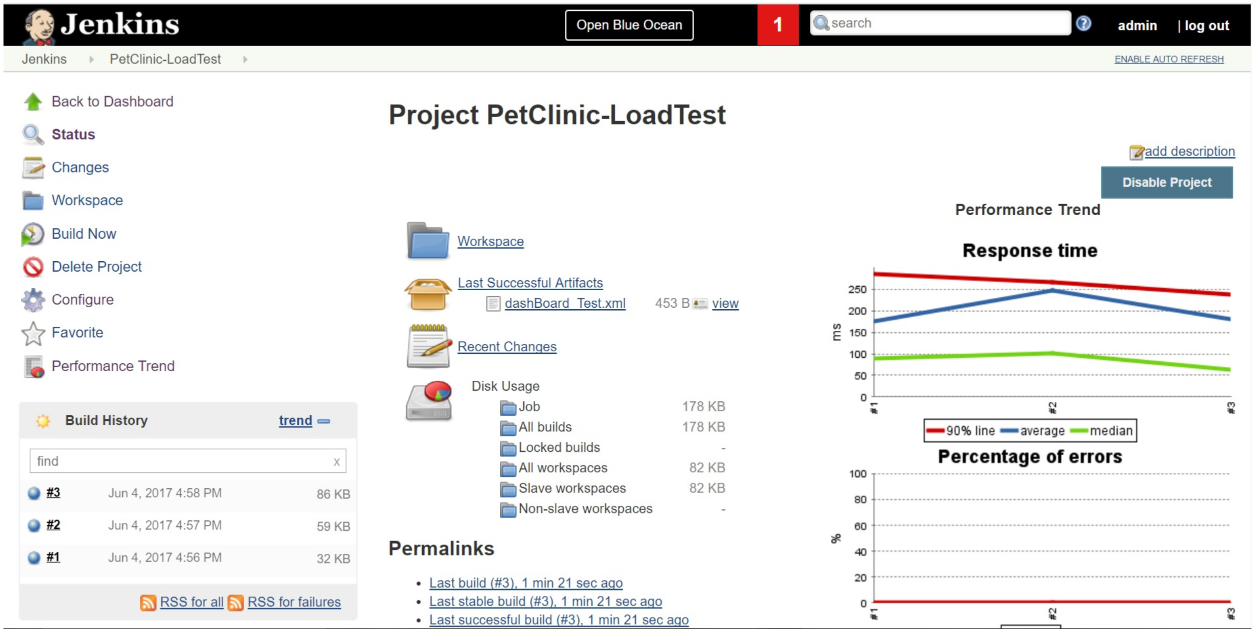
Failed -1

4. Click on Build now:



```
Started by user admin
Building in workspace F:\#JenkinsEssentials\FirstDraft\jenkinsHome\workspace\PetClinic-LoadTest
[PetClinic-LoadTest] $ cmd /c call C:\Users\Mitesh\AppData\Local\Temp\jenkins1396957989406107476.bat

F:\#JenkinsEssentials\FirstDraft\jenkinsHome\workspace\PetClinic-LoadTest>C:\apache-jmeter-3.0\bin\jmeter.bat -
Jjmeter.save.saveservice.output_format=xml -n -t C:\Users\Mitesh\Desktop\PetClinic.jmx -l Test.jtl
Writing log file to: F:\#JenkinsEssentials\FirstDraft\jenkinsHome\workspace\PetClinic-LoadTest\jmeter.log
Creating summariser <summary>
Created the tree successfully using C:\Users\Mitesh\Desktop\PetClinic.jmx
Starting the test @ Sun Jun 04 16:56:19 IST 2017 (1496575579885)
Waiting for possible Shutdown/StopTestNow/Heapdump message on port 4445
summary =     50 in 00:00:09 =    5.4/s Avg:   175 Min:     5 Max:  2724 Err:     0 (0.00%)
Tidying up ...    @ Sun Jun 04 16:56:29 IST 2017 (1496575589522)
... end of run
Java HotSpot(TM) 64-Bit Server VM warning: MaxNewSize (4194304k) is equal to or greater than the entire heap
(4194304k).  A new max generation size of 4193792k will be used.
Performance: Recording JMeter reports '**/*.jtl'
Performance: Parsing JMeter report file 'F:\#JenkinsEssentials\FirstDraft\jenkinsHome\jobs\PetClinic-
LoadTest\builds\1\performance-reports\JMeter\Test.jtl'.
Performance: Percentage of errors greater or equal than 0% sets the build as unstable
Performance: Percentage of errors greater or equal than 0% sets the build as failure
Performance: File Test.jtl reported 0.0% of errors [SUCCESS]. Build status is: SUCCESS
Started calculate disk usage of build
Finished Calculation of disk usage of build in 0 seconds
Started calculate disk usage of workspace
Finished Calculation of disk usage of workspace in 0 seconds
Finished: SUCCESS
```

5. Verify the Performance Trend on the Project dashboard.
6. Click on Performance Trend:



Project PetClinic-LoadTest

Workspace

Last Successful Artifacts

dashBoard_Test.xml 453 B view

Recent Changes

Disk Usage

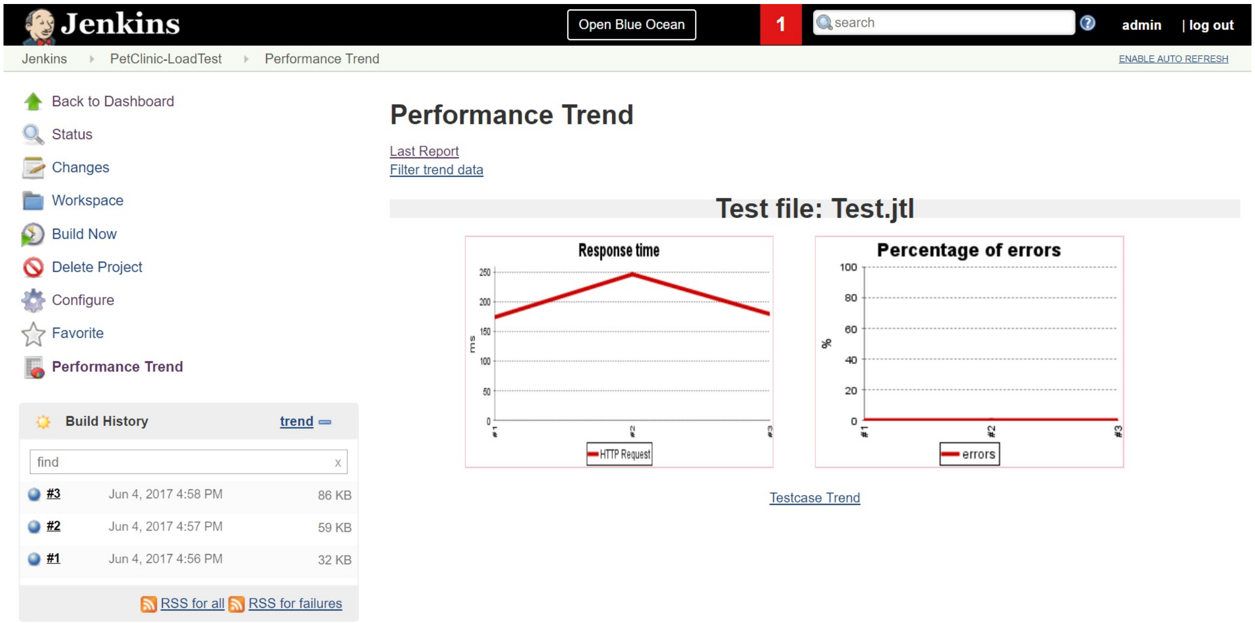
Job	178 KB
All builds	178 KB
Locked builds	-
All workspaces	82 KB
Slave workspaces	82 KB
Non-slave workspaces	-

#3	Jun 4, 2017 4:58 PM	86 KB
#2	Jun 4, 2017 4:57 PM	59 KB
#1	Jun 4, 2017 4:56 PM	32 KB

Permalinks

- Last build (#3), 1 min 21 sec ago
- Last stable build (#3), 1 min 21 sec ago
- Last successful build (#3), 1 min 21 sec ago

7. Verify performance breakdown:



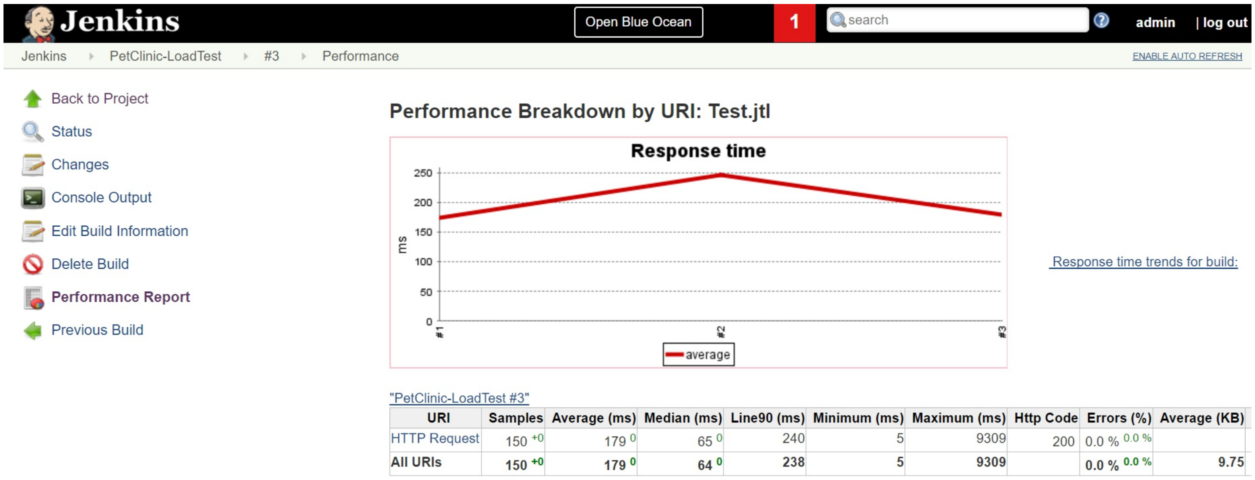
Performance Trend

Last Report
Filter trend data

Test file: Test.jtl

#3	Jun 4, 2017 4:58 PM	86 KB
#2	Jun 4, 2017 4:57 PM	59 KB
#1	Jun 4, 2017 4:56 PM	32 KB

8. Click on the Last Report and get more details on the load test results:



Performance Breakdown by URI: Test.jtl

"PetClinic-LoadTest #3"

URI	Samples	Average (ms)	Median (ms)	Line90 (ms)	Minimum (ms)	Maximum (ms)	Http Code	Errors (%)	Average (KB)
HTTP Request	150 +0	179 0	65 0	240	5	9309	200	0.0 % 0.0 %	
All URIs	**150 +0**	**179 0**	**64 0**	**238**	**5**	**9309**		**0.0 % 0.0 %**	**9.75**

9. Done!

Reporting JMeter performance metrics

In this recipe, you will be shown how to configure Jenkins to run a JMeter test plan, and then collect and report the results. The passing of variables from an Ant script to JMeter will also be explained.

Getting ready

It is assumed that you have run through the last recipe creating the JMeter test plan. You will also need to install the Jenkins performance plugin (https://wiki.jenkins-ci.org/display/JENKINS/Performance+Plugin).

How to do it...

1. Open `./examples/jmeter_example.jmx` in JMeter and save as `./plans/URL_ping.jmx`.
2. Select CSV Data Set Config changing the filename to `${__property(csv)}`.
3. Under the File menu, select the Save option.

4. Create a build.xml file at the top level of your project with the following content:

```
<project default="jmeter.tests">
<property name="jmeter" location="/var/lib/jenkins/jmeter"
 />
<property name="target" location="${basedir}/target" />
<echo message="Running... Expecting variables [jvarg,desc]"
 />
<echo message="For help please read ${basedir}/README"/>
<echo message="[DESCRIPTION] ${desc}" />
<taskdef  name="jmeter"
 classname="org.programmerplanet.ant.taskdefs.jmeter.JMeterT
 ask" classpath="${jmeter}/extras/ant-jmeter-1.0.9.jar" />
      <target name="jmeter.init">
      <mkdir  dir="${basedir}/jmeter_results"/>
      <delete includeemptydirs="true">
      <fileset dir="${basedir}/jmeter_results"
 includes="**/*" />
      </delete>
    </target>
    <target name="jmeter.tests" depends="jmeter.init"
 description="launch jmeter load tests">
    <echo message="[Running] jmeter tests..." />
<jmeter jmeterhome="${jmeter}"
 resultlog="${basedir}/jmeter_results/LoadTestResults.jtl">
    <testplans dir="${basedir}/plans" includes="*.jmx"/>
    <jvmarg value="${jvarg}" />
    <property name="csv" value="${basedir}/data/URLS.csv"
 />
    </jmeter>
  </target>
</project>
```

5. Commit the updates to your subversion project.
6. Log in to Jenkins.
7. Create a new freestyle job with the name `ch6.remote.jmeter`.
8. Under Source Code Management, check Subversion, adding your subversion repository URL to the repository URL.
9. Within the Build section, add the build step, Invoke Ant.
10. Click on Advanced in the new Invoke Ant subsection, adding the following for properties:

```
jvarg=-Xmx512m
desc= This is the first iteration in a performance test
 environment - Driven by Jenkins
```

11. In the Post-build Actions section, check Publish Performance test result report. Add the input jmeter_results/*.jtl to Report Files.
12. Click on Save.
13. Run the job a couple of times and review the results found under the Performance trend link.

How it works...

The build.xml file is an Ant script that sets up the environment and then calls the JMeter Ant tasks defined in the library /extras/ant-jmeter-1.0.9.jar. The JAR file is installed as part of the standard JMeter distribution.

Any JMeter test plan found under the plans directory will be run. Moving the test plan from the examples directory to the plans directory activates it. The results are aggregated in jmeter_results/LoadTestResults.jtl.

The Ant script passes the csv variable to the JMeter test plan; the location of the .CSV file, ${basedir}/data/URLS.csv. ${basedir}, is automatically defined by Ant. As the name suggests, it is the base directory of the Ant project.

You can call JMeter functions within its elements using the structure ${__functioncall(parameters)}. You have added the function call ${__property(csv)} to the test plan CSV Data Set Config element. The function pulls in the value of .csv that was defined in the Ant script.

The Jenkins job runs the Ant script, which in turn runs the JMeter test plans and aggregates the results. The Jenkins performance plugin then parses the results, creating a report.

There's more...

To build complex test plans speedily, consider using the transparent proxy (http://jmeter.apache.org/usermanual/component_reference.html#HTTP_Proxy_Server) built into JMeter. You can run it on a given port on your local machine, setting the proxy preferences in your web browser to match. The recorded JMeter elements will then give you a good idea of the parameters sent in the captured requests.

An alternative is Badboy (http://www.badboysoftware.biz/docs/jmeter.html), which has its own built-in web browser. It allows you to record your actions in a similar way to Selenium IDE and then save them to a JMeter plan.

Testing with FitNesse

FitNesse (http://fitnesse.org) is a fully integrated standalone wiki and acceptance-testing framework. You can write tests in tables and run them. Writing tests in a wiki language widens the audience of potential test writers and decreases the initial efforts required to learn a new framework.

If a test passes, the table row is displayed in green. If it fails, it is displayed in red. The tests can be surrounded by wiki content delivering context information, such as user stories, at the same location as the tests. You can also consider creating mock-ups of your web applications in FitNesse next to the tests, and pointing the tests at those mock-ups.

This recipe describes how to run FitNesse remotely and display the results within Jenkins.

Getting ready

Download the latest stable FitNesse JAR from http://fitnesse.org/FitNesseDownload. Install the FitNesse plugins for Jenkins from https://wiki.jenkins-ci.org/display/JENKINS/FitNesse+Plugin.

How to do it...

1. Create the `fit/logs` directories and place them in the `fit` directory, `fitnesse-standalone.jar`.
2. Run the FitNesse help from the command line and review the options:

```
java -jar fitnesse-standalone.jar -help
Usage: java -jar fitnesse.jar [-vpdrleoab]
-p <port number> {80}
-d <working directory> {.}
-r <page root directory> {FitNesseRoot}
-l <log directory> {no logging}
-f <config properties file> {plugins.properties}
-e <days> {14} Number of days before page versions expire
-o omit updates
-a {user:pwd | user-file-name} enable authentication.
-i Install only, then quit.
-c <command> execute single command.
-b <filename> redirect command output.
-v {off} Verbose logging
```

3. Run `FitNesse` from the command line and review the startup output:

```
java -jar fitnesse-standalone.jar -p 39996 -l logs -a tester:test
Bootstrapping FitNesse, the fully integrated standalone wiki and acceptance
testing framework.
root page: fitnesse.wiki.fs.FileSystemPage at ./FitNesseRoot#latest
logger: /home/alan/Desktop/X/fitness/logs
authenticator: fitnesse.authentication.OneUserAuthenticator
page factory: fitnesse.html.template.PageFactory
page theme: fitnesse_straight
Starting FitNesse on port: 39996
```

4. Using a web browser, visit `http://localhost:39996`.
5. Click on the Acceptance Test link.
6. Click on the Suite link. This will activate a set of tests. Depending on your computer, the tests may take a few minutes to complete. The direct link is `http://localhost:39996/FitNesse.SuiteAcceptanceTests?suite`.
7. Click on the `Test History` link. You will need to log on as user `tester` with the password `test`.
8. Review the log in the `fit/logs` directory. After running the suite again, you will now see an entry similar to the following:

```
127.0.0.1 - tester [01/Oct/2014:11:14:59 +0100] "GET
 /FitNesse.SuiteAcceptanceTests?suite HTTP/1.1" 200 6086667
```

9. Log in to Jenkins and create a freestyle software project named `ch6.remote.fitnesse`.
10. In the Build section, select the Execute fitnesse tests option from the Add Build step.
11. Check the option FitNesse instance is already running, adding:
    - Fitnesses Host: `localhost`
    - Fitnesses Port: `39996`
    - Target Page: `FitNesse.SuiteAcceptanceTests?suite`
    - Check the Is target a suite option
    - HTTP Timeout (ms): `180000`
    - `Path to fitnesse xml results` file: `fitnesse-results.xml`
12. In the Post-build Actions section, check the Publish FitNesse results report option.
13. Add the fitnesse-results.xml value to the input Path to fitnesse xml results file.

14. Click on Save.
15. Run the job.
16. Review the latest job by clicking on the link FitNesse Results.

How it works...

FitNesse has a built-in set of acceptance tests that it uses to check itself for regressions. The Jenkins plugin calls the test and asks for the results to be returned in XML format using an HTTP `GET` request with the URL: `http://localhost:39996/FitNesse.SuiteAcceptanceTests?suite&format=xml`. The results look similar to the following:

```
<testResults>
<FitNesseVersion>v20140901</FitNesseVersion>
<rootPath>FitNesse.SuiteAcceptanceTests</rootPath>
<result>
<counts><right>103</right>
<wrong>0</wrong>
<ignores>0</ignores>
<exceptions>0</exceptions>
</counts>
<runTimeInMillis>27</runTimeInMillis>
<relativePageName>CopyAndAppendLastRow</relativePageName>
<pageHistoryLink>
FitNesse.SuiteAcceptanceTests.SuiteFitDecoratorTests.CopyAndAppend
 LastRow?pageHistory&resultDate=20141101164526
</pageHistoryLink>
</result>
```

The Jenkins plugin then parses the XML and generates a report.

By default, there is no security enabled on FitNesse pages. In this recipe, a username and password were defined during startup. However, we did not take this further and define the security permissions on the page. To activate, you will need to go to the properties link on the left-hand side of the page and check the security permission for secure-test.

You can also authenticate through a list of users in a text file or Kerberos/Active Directory. For more details, review http://fitnesse.org/FitNesse.FullReferenceGuide.UserGuide.AdministeringFitNesse.SecurityDesc

There is also a contributed plugin for LDAP authentication: https://github.com/timander/fitnesse-ldap-authenticator.

Consider applying security in depth; adding IP restrictions through a firewall on the FitNesse server creates an extra layer of defense. For example, you can place an Apache server in front of the wiki, and enabling SSL/TLS ensures encrypted passwords. A thinner alternative to Apache is NGINX: http://wiki.nginx.org.

See also...

You will find the source code with information on building the newest version of FitNesse at its GitHub home: https://github.com/unclebob/fitnesse.

Orchestration

In this chapter, we will cover the following recipes:

- Introduction
- Understanding upstream and downstream jobs
- Configuring upstream and downstream jobs
- Configuring a build pipeline
- Creating a pipeline job
- Using a sample pipeline for execution
- Configuring a pipeline job for end-to-end automation
- Getting started with the Blue Ocean dashboard

Introduction

An orchestration or pipeline is all about defining a sequence of execution to manage an application life cycle based on requirements.

A simple example can be that you may want to perform a static code analysis first; if it complies to the defined quality gate, then it should only perform Continuous Integration and create an application package that can be deployed in a specific environment.

Once the package is ready, deploy it into a test environment for manual or automated testing based on the requirements and defined policies in the organization. Once it is promoted for UAT or the staging environment, then you may want to perform functional test execution and performance testing.

Once this flow is completed, you may want to deploy it in a production environment, but not without the approval of the specific stakeholder.

This is the orchestration of build jobs or the defined flow of execution.

Understanding upstream and downstream jobs

An upstream job is a configured project that triggers a project as part of its execution.

A downstream job is a configured project that is triggered as part of a execution of pipeline.

Upstream and downstream jobs help you to configure the sequence of execution for different operations and hence you can orchestrate the flow of execution. We can configure one or more projects as downstream jobs in Jenkins.

Getting ready

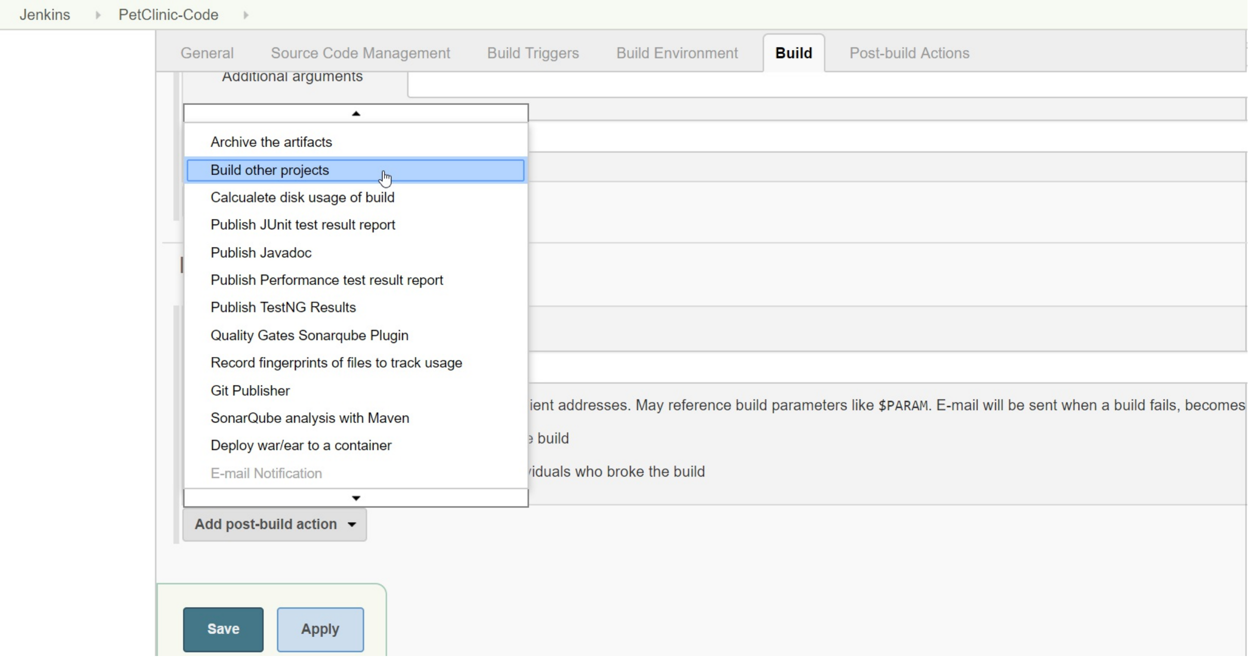
You need to divide the end-to-end automation of the application life cycle management process into multiple distinct projects.

The benefit of this strategy is that you can isolate automation tasks and execute independently on different agents.

How to do it...

Let's start with the first job for upstream and downstream jobs configuration. Keep a project that executes static code analysis as the first job:

1. Go to the Post-build Actions section in the configuration of the PetClinic-Code build job.
2. Select Build other projects from the available options:


Jenkins
PetClinic-Code
General
Source Code Management
Build Triggers
Build Environment
Build
Post-build Actions
Additional arguments
Archive the artifacts
Build other projects
Calculete disk usage of build
Publish JUnit test result report
Publish Javadoc
Publish Performance test result report
Publish TestNG Results
Quality Gates Sonarqube Plugin
Record fingerprints of files to track usage
Git Publisher
SonarQube analysis with Maven
Deploy war/ear to a container
E-mail Notification
ient addresses. May reference build parameters like $PARAM. E-mail will be sent when a build fails, becomes
build
viduals who broke the build
Add post-build action
Save
Apply

3. You should create the package after static code analysis is done, so you should select PetClinic-Package where Continuous Integration is configured for compilation of the source code, unit test execution, and package file creation.
4. Click Save.

Thus, for PetClinic-Code, PetClinic-Package is a downstream job while for PetClinic-Package, PetClinic-Code is an upstream job.

Configuring upstream and downstream jobs

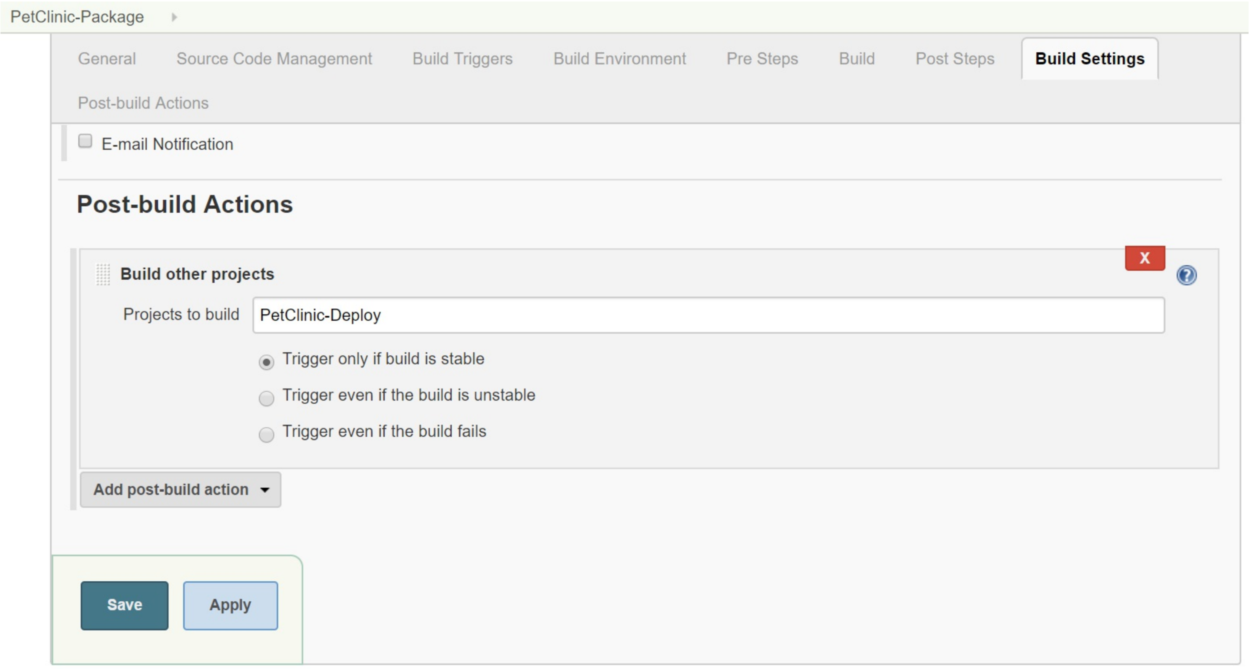
Let's configure a complete flow using upstream and downstream jobs.

Getting ready

Make sure that you have all the build jobs available that you created in earlier chapters, such as the deployment of WAR files, functional testing, and load testing.

How to do it...

Once your package is ready, you should deploy it, so from the PetClinic-Package job, you will configure PetClinic-Deploy as a downstream job in Post-build Actions:



□ E-mail Notification

Post-build Actions

Build other projects

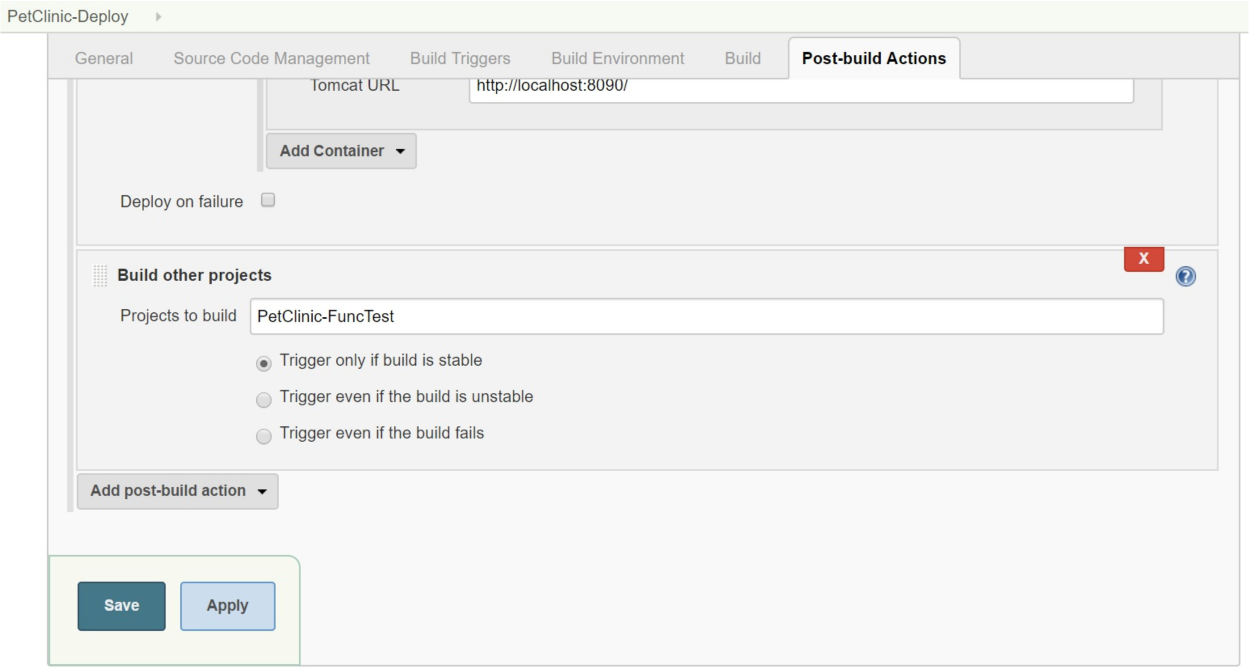
Projects to build: PetClinic-Deploy

● Trigger only if build is stable

○ Trigger even if the build is unstable

○ Trigger even if the build fails

Once your application is deployed on the server, you should perform functional test cases, so from the `PetClinic-Deploy` job, you will configure `PetClinic-FuncTest` as a downstream job in Post-build Actions:



Tomcat URL: http://localhost:8090/

Deploy on failure □

Build other projects

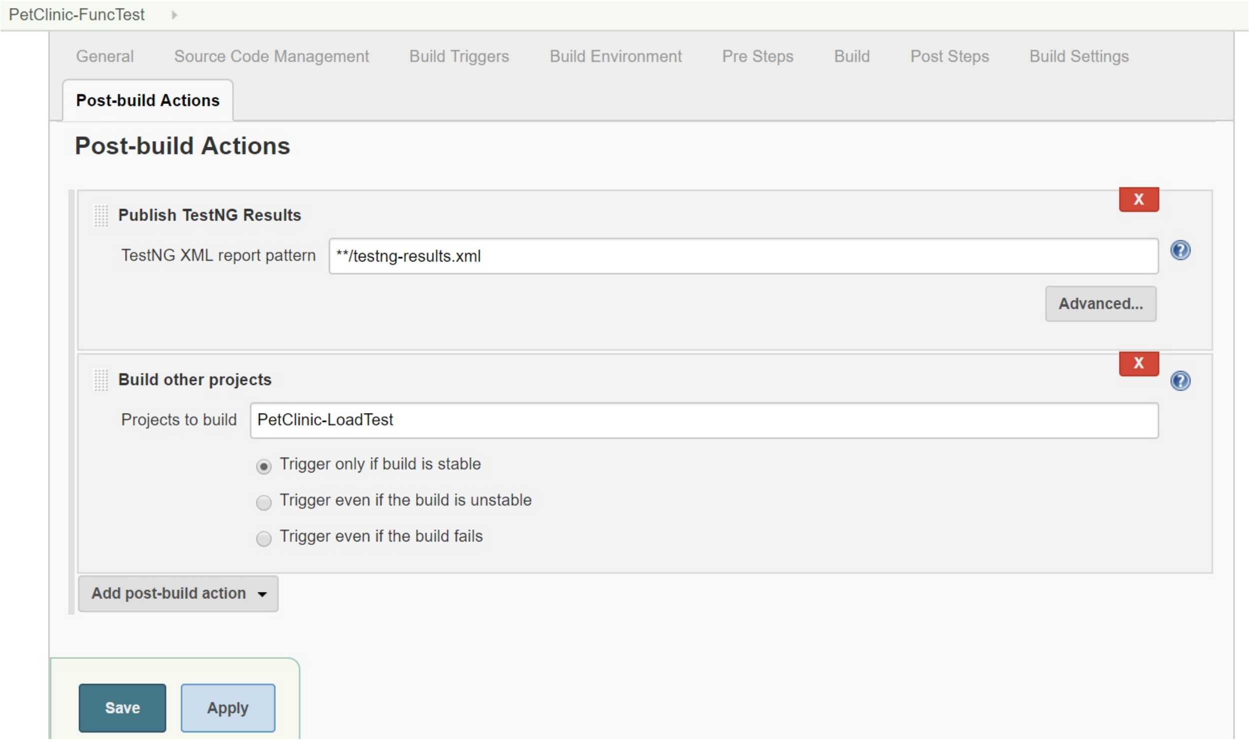
Projects to build: PetClinic-FuncTest

● Trigger only if build is stable

○ Trigger even if the build is unstable

○ Trigger even if the build fails

Once the functional test cases are executed successfully, you should perform load testing, so, from the `PetClinic-FuncTest` job, you will configure `PetClinic-LoadTest` as a downstream job in Post-build Actions:



Post-build Actions

Publish TestNG Results

TestNG XML report pattern: **/testng-results.xml

Build other projects

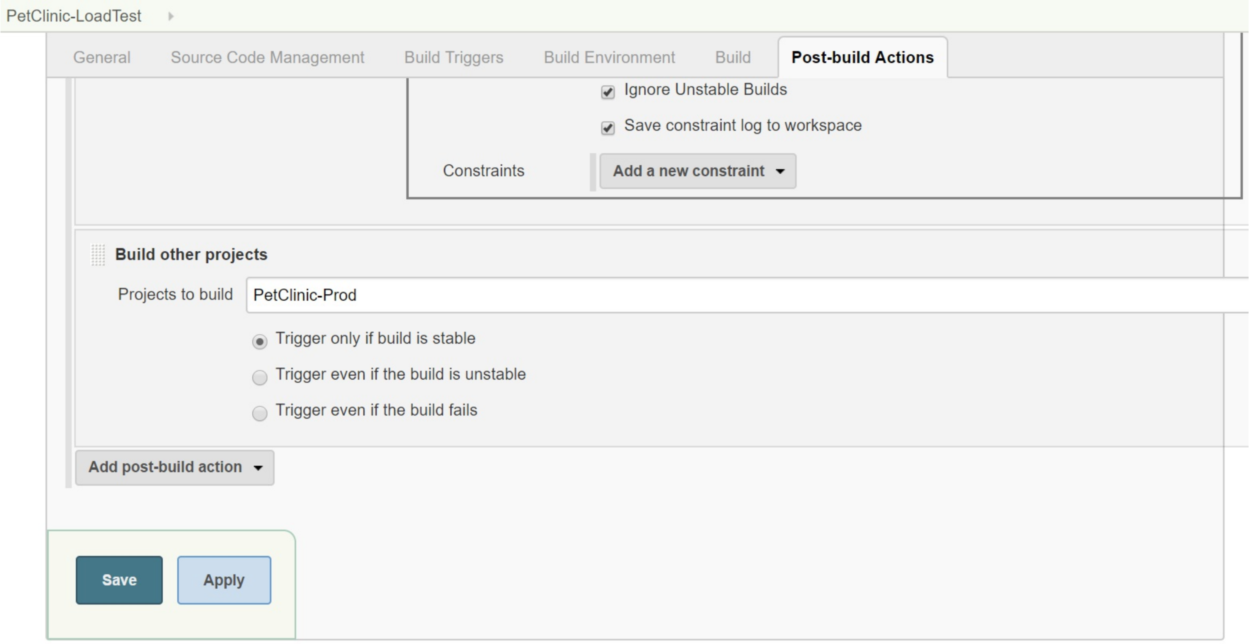
Projects to build: PetClinic-LoadTest

● Trigger only if build is stable

○ Trigger even if the build is unstable

○ Trigger even if the build fails

Once load testing is completed, you should deploy the application in the `Prod` environment, so from the `PetClinic-LoadTest` job, you will configure `PetClinic-Prod` as a downstream job in Post-build Actions:



☑ Ignore Unstable Builds

☑ Save constraint log to workspace

Constraints

Build other projects

Projects to build: PetClinic-Prod

● Trigger only if build is stable

○ Trigger even if the build is unstable

○ Trigger even if the build fails

Configuring a build pipeline

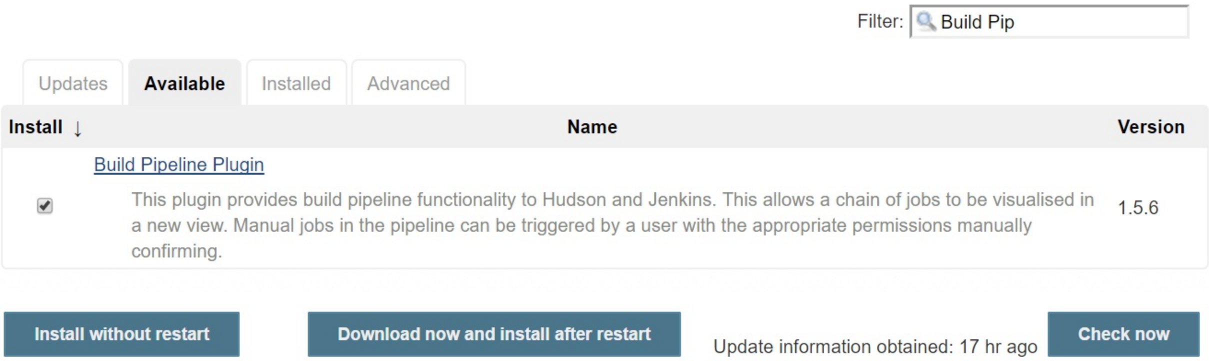
Now you have configured all upstream and downstream jobs. You know the sequence so you can execute the first build and the rest of the builds will follow until any job fails in the sequence. You can configure to move ahead with unstable builds as well.

However, it is more useful if you have the visualization of the flow of execution you have configured as upstream and downstream jobs.

The build pipeline plugin provides visualization of the execution flow based on the upstream and downstream jobs configuration.

Getting ready

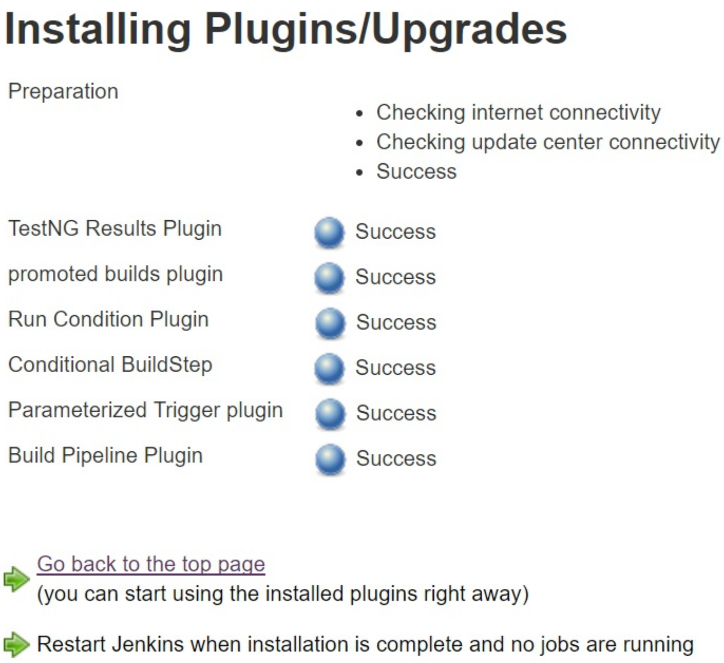
Install the plugin from Manage Jenkins | Manage Plugins:



Install ↓	Name	Version
☑	Build Pipeline Plugin This plugin provides build pipeline functionality to Hudson and Jenkins. This allows a chain of jobs to be visualised in a new view. Manual jobs in the pipeline can be triggered by a user with the appropriate permissions manually confirming.	1.5.6

Update information obtained: 17 hr ago

Verify the successful installation of the Build Pipeline Plugin:



Installing Plugins/Upgrades

Preparation

- Checking internet connectivity
- Checking update center connectivity
- Success

TestNG Results Plugin	● Success
promoted builds plugin	● Success
Run Condition Plugin	● Success
Conditional BuildStep	● Success
Parameterized Trigger plugin	● Success
Build Pipeline Plugin	● Success

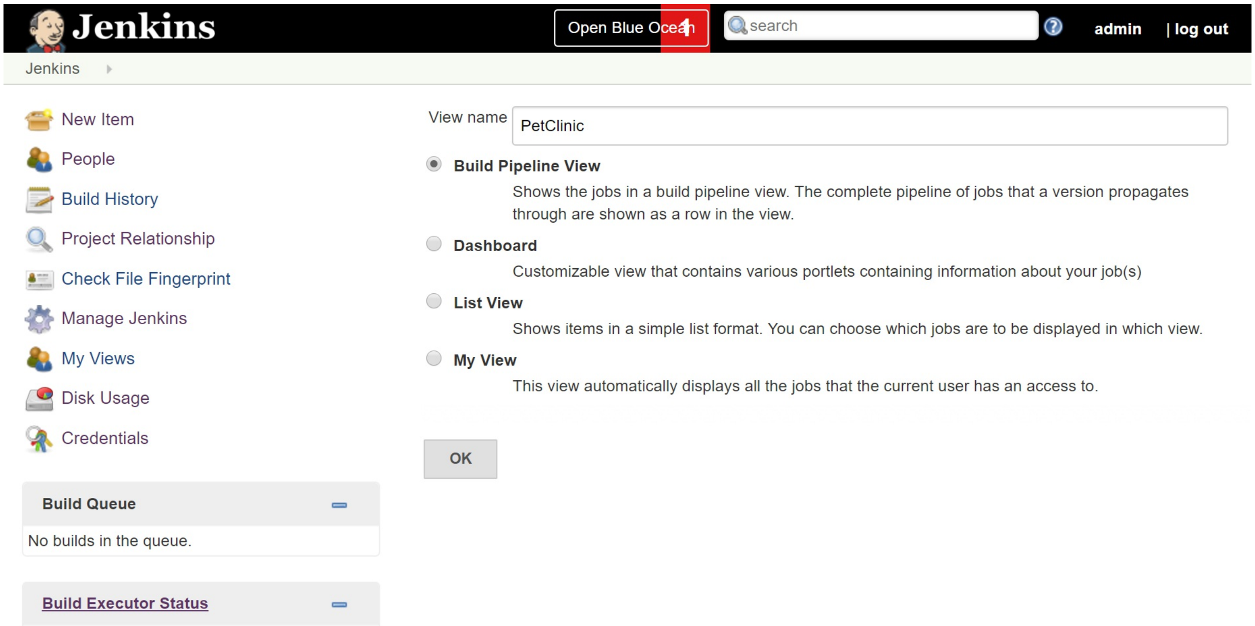
Go back to the top page
(you can start using the installed plugins right away)

Restart Jenkins when installation is complete and no jobs are running

Now, you are ready to create a build pipeline and configure it with an initial job.

How to do it...

1. Go to the Jenkins dashboard and click on the + sign on the tabs available.
2. Provide the View name and select Build Pipeline View.
3. Click on Save:



View name: PetClinic

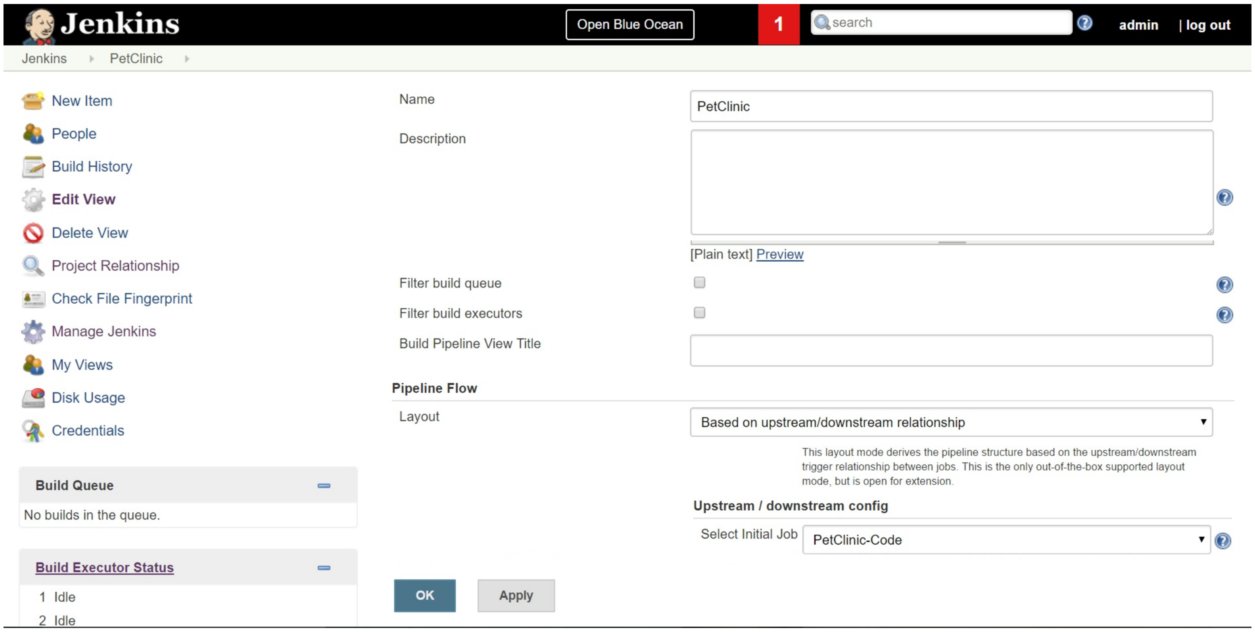
● **Build Pipeline View**
Shows the jobs in a build pipeline view. The complete pipeline of jobs that a version propagates through are shown as a row in the view.

○ **Dashboard**
Customizable view that contains various portlets containing information about your job(s)

○ **List View**
Shows items in a simple list format. You can choose which jobs are to be displayed in which view.

○ **My View**
This view automatically displays all the jobs that the current user has an access to.

4. Verify that the Layout is configured as Based on upstream/downstream relationship.
5. You want to execute `PetClinic-Code` as a first job and you want to see the visualization from that job, so select it in the Select Initial Job:



Name: PetClinic

Description:

[Plain text] Preview

Filter build queue ☐

Filter build executors ☐

Build Pipeline View Title:

Pipeline Flow

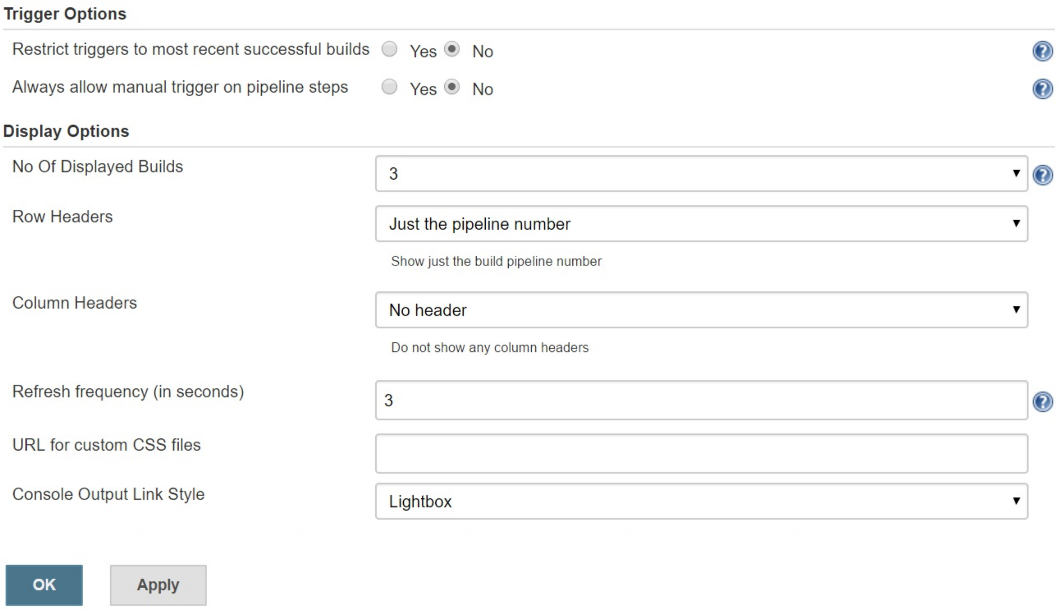
Layout: Based on upstream/downstream relationship

This layout mode derives the pipeline structure based on the upstream/downstream trigger relationship between jobs. This is the only out-of-the-box supported layout mode, but is open for extension.

Upstream / downstream config

Select Initial Job: PetClinic-Code

6. Select the rest of the configuration as per your requirements.
7. Change the No Of Displayed Builds from 1 to 3 so it will display the latest three build pipelines executed.
8. Click on OK:



Trigger Options

Restrict triggers to most recent successful builds ○ Yes ● No

Always allow manual trigger on pipeline steps ○ Yes ● No

Display Options

No Of Displayed Builds: 3

Row Headers: Just the pipeline number

Show just the build pipeline number

Column Headers: No header

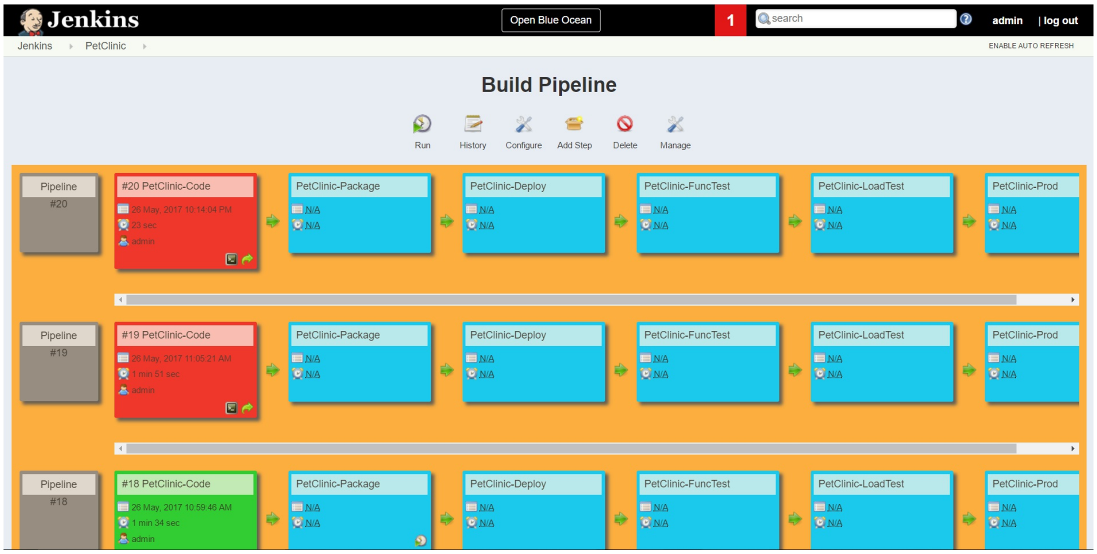
Do not show any column headers

Refresh frequency (in seconds): 3

URL for custom CSS files:

Console Output Link Style: Lightbox

9. Verify the Build Pipeline view in the Jenkins dashboard:

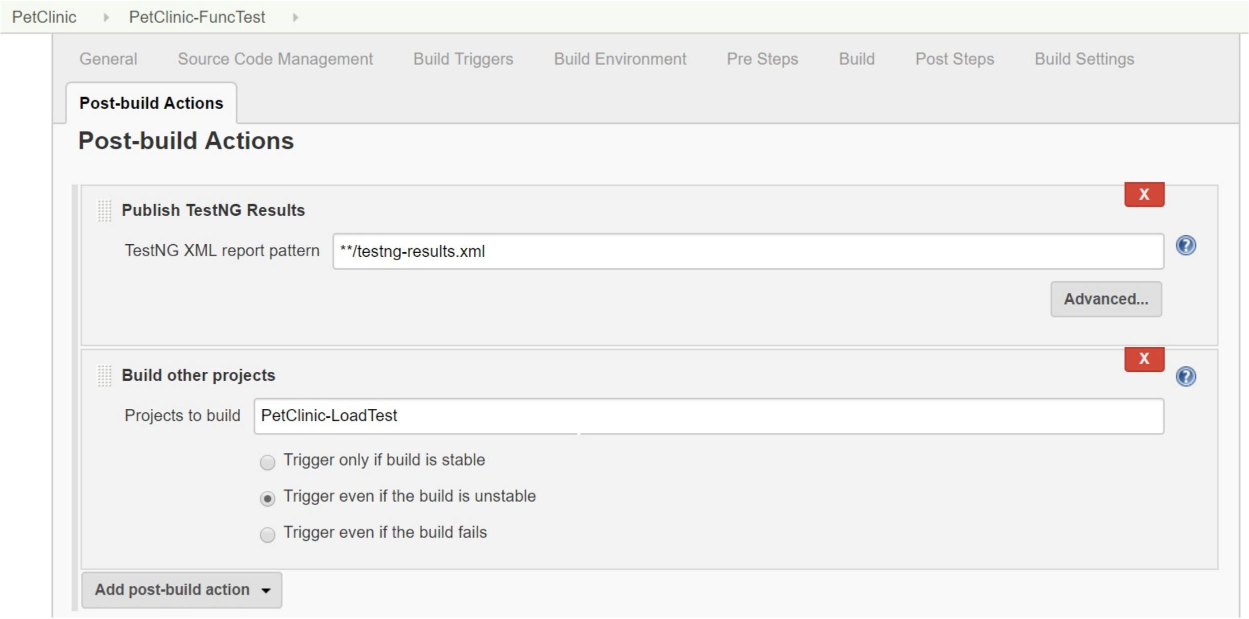


Build Pipeline

Pipeline #20	#20 PetClinic-Code 26 May, 2017 10:14:04 PM 23 sec admin	PetClinic-Package N/A N/A	PetClinic-Deploy N/A N/A	PetClinic-FuncTest N/A N/A	PetClinic-LoadTest N/A N/A	PetClinic-Prod N/A N/A
Pipeline #19	#19 PetClinic-Code 26 May, 2017 11:05:21 AM 1 min 51 sec admin	PetClinic-Package N/A N/A	PetClinic-Deploy N/A N/A	PetClinic-FuncTest N/A N/A	PetClinic-LoadTest N/A N/A	PetClinic-Prod N/A N/A
Pipeline #18	#18 PetClinic-Code 26 May, 2017 10:59:46 AM 1 min 34 sec admin	PetClinic-Package N/A N/A	PetClinic-Deploy N/A N/A	PetClinic-FuncTest N/A N/A	PetClinic-LoadTest N/A N/A	PetClinic-Prod N/A N/A

Build Pipeline in Initial Phase

10. What if you want to continue the execution of the pipeline even if some build is unstable? In such cases, you need to select Trigger even if the build is unstable option in Post-build Actions, as seen in the following screenshot:



Post-build Actions

Publish TestNG Results

TestNG XML report pattern: **/testng-results.xml

Build other projects

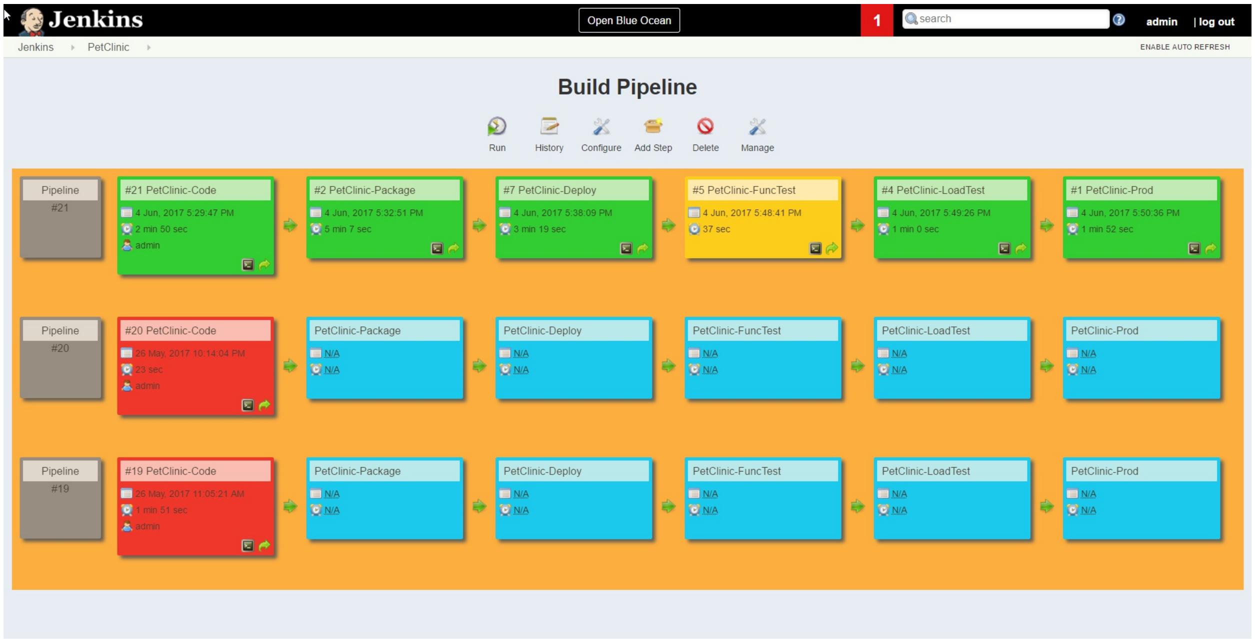
Projects to build: PetClinic-LoadTest

○ Trigger only if build is stable

● Trigger even if the build is unstable

○ Trigger even if the build fails

11. Click on the run in Build Pipeline view. Wait till the complete pipeline is executed:



Pipeline #21	#21 PetClinic-Code 4 Jun, 2017 5:29:47 PM 2 min 50 sec admin	#2 PetClinic-Package 4 Jun, 2017 5:32:51 PM 5 min 7 sec	#7 PetClinic-Deploy 4 Jun, 2017 5:38:09 PM 3 min 19 sec	#5 PetClinic-FuncTest 4 Jun, 2017 5:48:41 PM 37 sec	#4 PetClinic-LoadTest 4 Jun, 2017 5:49:26 PM 1 min 0 sec	#1 PetClinic-Prod 4 Jun, 2017 5:50:36 PM 1 min 52 sec
Pipeline #20	#20 PetClinic-Code 26 May, 2017 10:14:04 PM 23 sec admin	PetClinic-Package N/A N/A	PetClinic-Deploy N/A N/A	PetClinic-FuncTest N/A N/A	PetClinic-LoadTest N/A N/A	PetClinic-Prod N/A N/A
Pipeline #19	#19 PetClinic-Code 26 May, 2017 11:05:21 AM 1 min 51 sec admin	PetClinic-Package N/A N/A	PetClinic-Deploy N/A N/A	PetClinic-FuncTest N/A N/A	PetClinic-LoadTest N/A N/A	PetClinic-Prod N/A N/A

Successful Build Pipeline Execution

12. Done. This is how you can create a sequence of execution for different build jobs and achieve end-to-end automation for the application life cycle management. In the next recipe, you will achieve similar things using a the pipeline as a code feature.

Creating a pipeline job

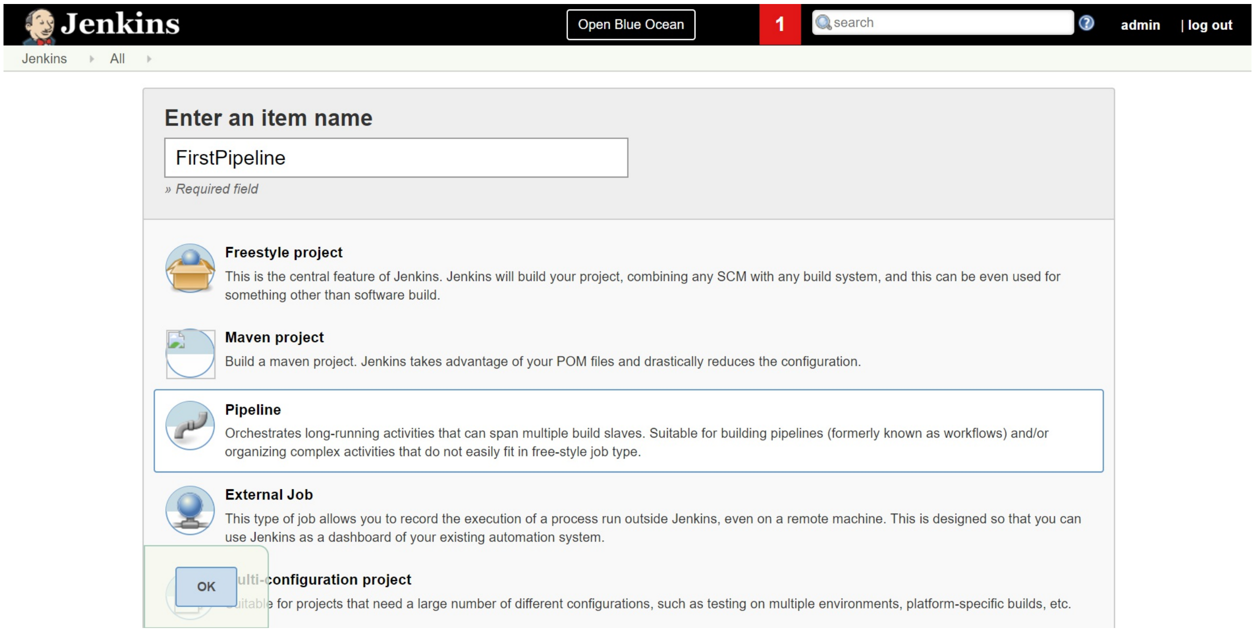
In a pipeline, you model all related tasks to decide the sequence of execution. You will perform the same tasks you performed with the build pipeline, but with code.

Getting ready

Open the Jenkins dashboard.

How to do it...

1. Click on New Item. Enter an item name and select Pipeline.
2. Click OK:



Enter an item name

FirstPipeline

» Required field

Freestyle project

This is the central feature of Jenkins. Jenkins will build your project, combining any SCM with any build system, and this can be even used for something other than software build.

Maven project

Build a maven project. Jenkins takes advantage of your POM files and drastically reduces the configuration.

Pipeline

Orchestrates long-running activities that can span multiple build slaves. Suitable for building pipelines (formerly known as workflows) and/or organizing complex activities that do not easily fit in free-style job type.

External Job

This type of job allows you to record the execution of a process run outside Jenkins, even on a remote machine. This is designed so that you can use Jenkins as a dashboard of your existing automation system.

ulti-configuration project

uitable for projects that need a large number of different configurations, such as testing on multiple environments, platform-specific builds, etc.

Using a sample pipeline for execution

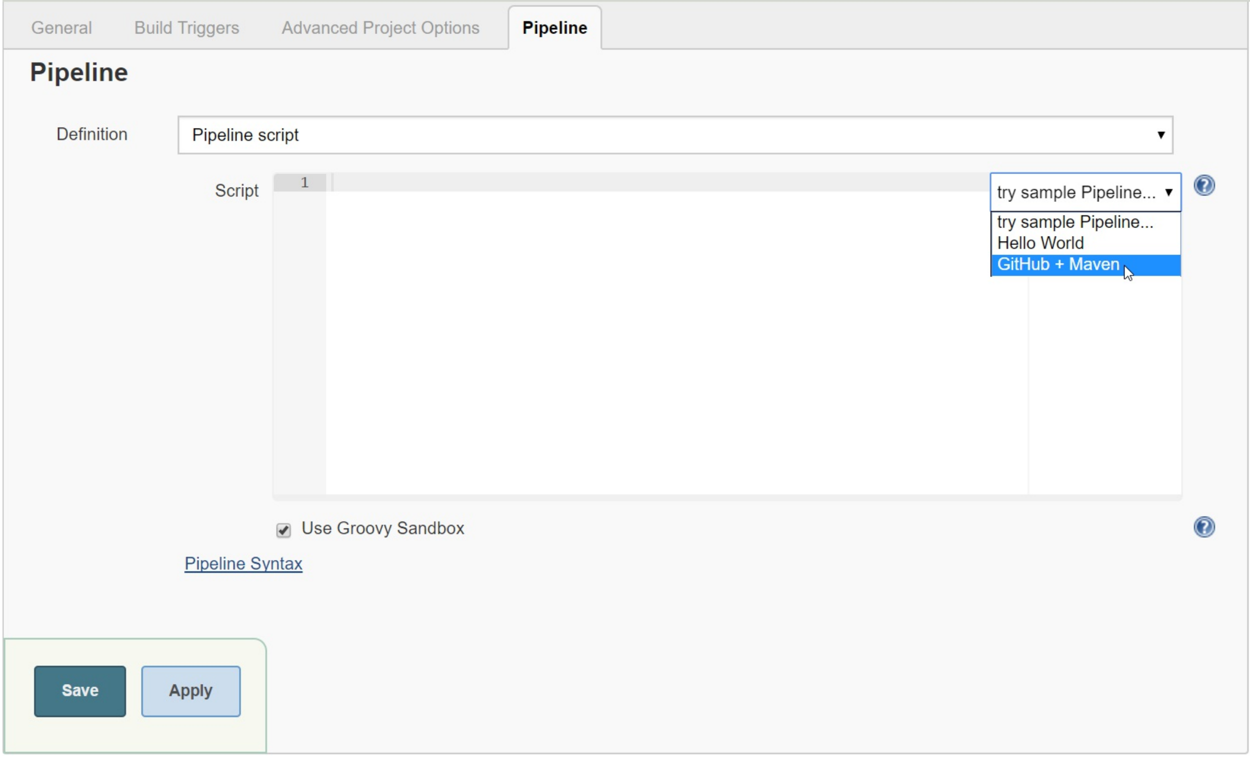
Jenkins provides sample syntax to get a feel for how to configure a pipeline.

Getting ready

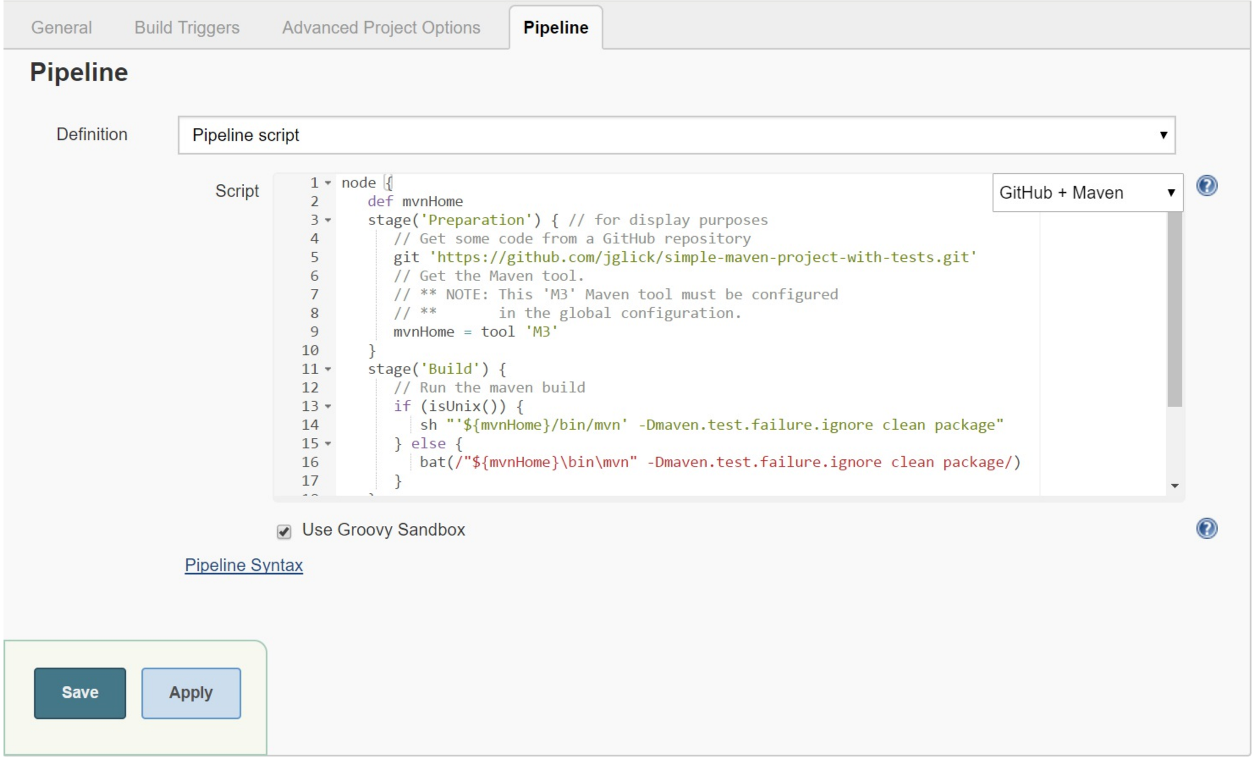
With Jenkins 2, the pipeline and other features are installed with the default installation with the suggested plugins.

How to do it...

1. Go to the Jenkins dashboard | New item | Pipeline.
2. It will open the configuration of a newly created pipeline job.
3. Go to the Pipeline section:



4. In the try sample Pipeline... dropdown, select GitHub + Maven. It will automatically generate the syntax for the sample code. Make sure that `mvnHome` has the proper value as per the path given for Maven in your system:



Pipeline

Definition: Pipeline script

Script: GitHub + Maven

```
node {
   def mvnHome
   stage('Preparation') { // for display purposes
      // Get some code from a GitHub repository
      git 'https://github.com/jglick/simple-maven-project-with-tests.git'
      // Get the Maven tool.
      // ** NOTE: This 'M3' Maven tool must be configured
      // **       in the global configuration.
      mvnHome = tool 'M3'
   }
   stage('Build') {
      // Run the maven build
      if (isUnix()) {
         sh "'${mvnHome}/bin/mvn' -Dmaven.test.failure.ignore clean package"
      } else {
         bat(/"${mvnHome}\bin\mvn" -Dmaven.test.failure.ignore clean package/)
      }
```

☑ Use Groovy Sandbox

5. Click on Save and execute the build to verify it.
6. However, you will create your own pipeline with the same sequence you tried with the `Build Pipeline` plugin in the next recipe.

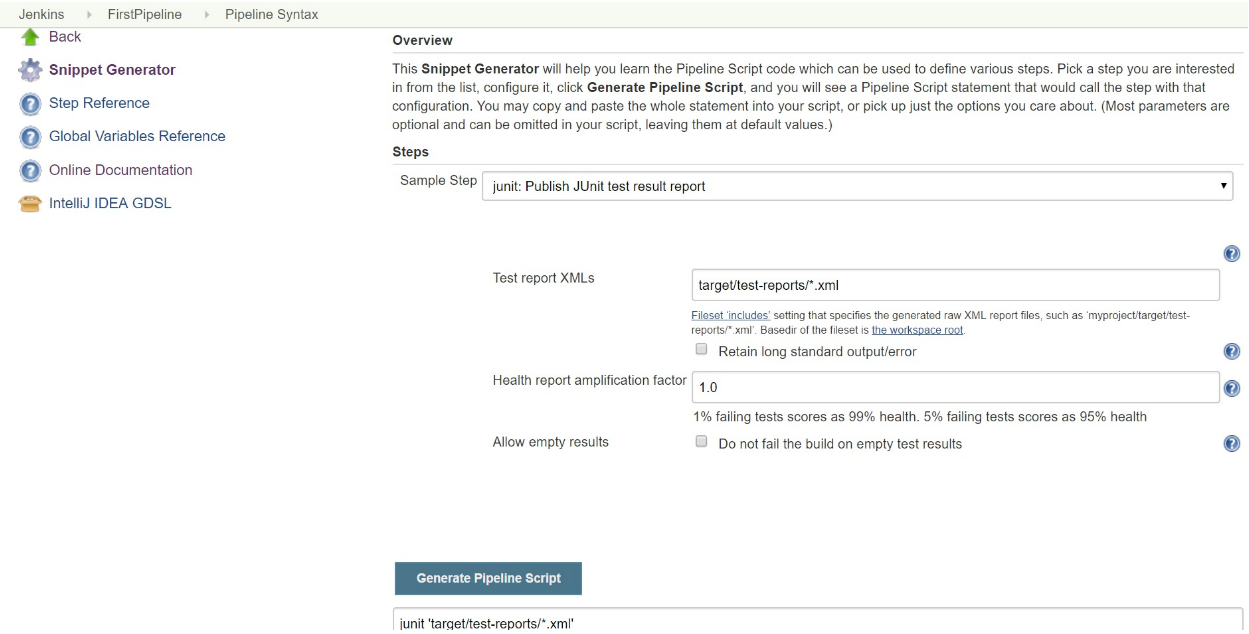
Configuring a pipeline job for end-to-end automation

In this recipe, you will create script to create a pipeline similar to what you configured with the `Build Pipeline` plugin.

Getting ready

Click on Pipeline Syntax to generate the syntax for specific tasks you want to execute.

You can select the steps and configure the required things, and then click on Generate Pipeline Script to get the syntax that you can directly utilize in your pipeline:



Overview

This **Snippet Generator** will help you learn the Pipeline Script code which can be used to define various steps. Pick a step you are interested in from the list, configure it, click **Generate Pipeline Script**, and you will see a Pipeline Script statement that would call the step with that configuration. You may copy and paste the whole statement into your script, or pick up just the options you care about. (Most parameters are optional and can be omitted in your script, leaving them at default values.)

Steps

Sample Step: junit: Publish JUnit test result report

Test report XMLs: target/test-reports/*.xml

Fileset 'includes' setting that specifies the generated raw XML report files, such as 'myproject/target/test-reports/*.xml'. Basedir of the fileset is the workspace root.

□ Retain long standard output/error

Health report amplification factor: 1.0

1% failing tests scores as 99% health. 5% failing tests scores as 95% health

Allow empty results: □ Do not fail the build on empty test results

```
junit 'target/test-reports/*.xml'
```

Before creating your first script for a pipeline, let's understand some important terms.

The `node` defines the node created in the context of the Jenkins' master agent architecture. It executes the step the moment the executor is available on node. It creates a workspace or a directory for the pipeline to keep files. The following is the sample syntax:

```
node {
    // execute the pipeline on Master node
}
node('windows') {
    // execute the pipeline on node labelled as Windows
}
```

The `stage` is a step that can be considered as a logically separate step, such as `Init`, `Build`, `Test`, `Deploy`, and so on.

A step or a build step is a task that can be executed to perform some activity such as copy artifact, archive artifact, checkout code from GitHub, and define an environment variable.

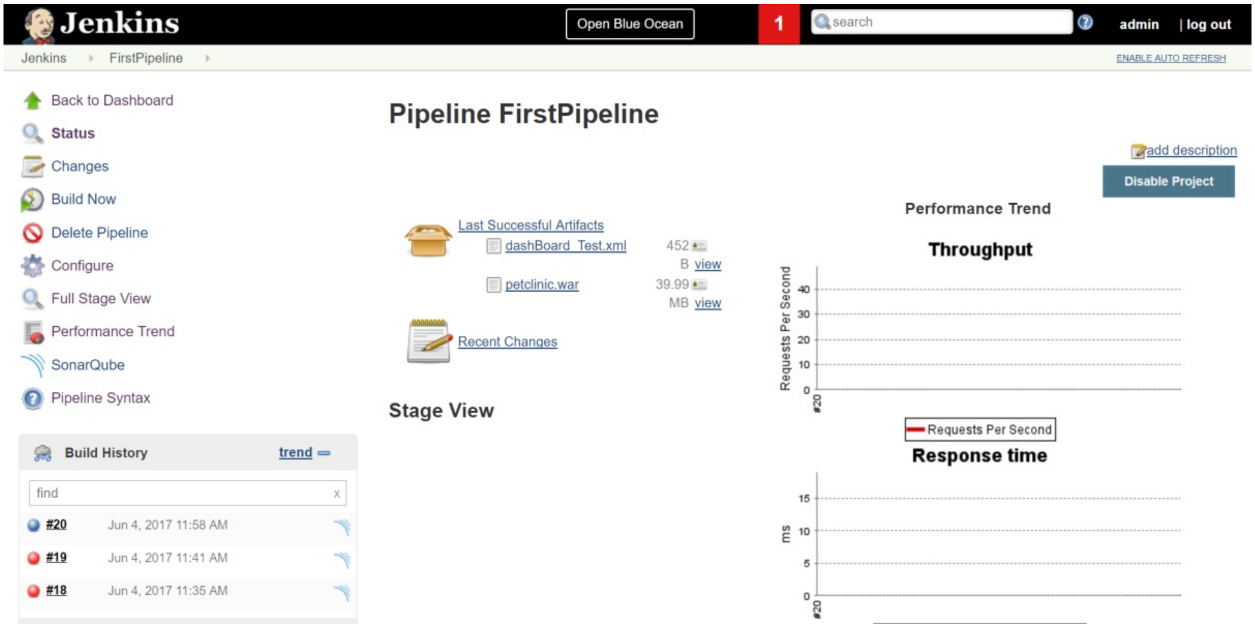
The script for the pipeline follows:

```
node {
def mvnHome
stage('Preparation') { // for display purposes
      // Get PetClinic code from a GitHub repository
git 'https://github.com/mitesh51/spring-
 petclinic.git'
      // Get the Maven tool.
      // ** NOTE: This 'apache-maven-3.3.1' Maven tool must
 be configured in the global configuration.
mvnHome = tool 'apache-maven-3.3.1'
   }
stage('SonarQube analysis') {
    // requires SonarQube Scanner 3.0+
def scannerHome = tool 'SonarQube Scanner 3.0.3';
// Sonarqube6.3 must be configured in the Jenkins
 Configuration -> Add SonarWube server
withSonarQubeEnv('Sonarqube6.3') {
//provide all required properties for Sonar
 execution
bat "${scannerHome}/bin/sonar-scanner -
 Dsonar.host.url=http://localhost:9000/ -
 Dsonar.login=1335c62cbfceab5
 954a5101ab7477cc974f58d56 -
 Dsonar.projectVersion=1.0
 -Dsonar.projectKey=petclinicKey -
 Dsonar.sources=src"
        }
   }

stage('Build') {
      // Run the maven build based on the Operating system
if (isUnix()) {
         sh "'${mvnHome}/bin/mvn' -
 Dmaven.test.failure.ignore clean package"
  // Publish JUnit Report
junit '**/target/surefire-reports/TEST-*.xml'
      } else {
bat(/"${mvnHome}\bin\mvn" clean package/)
  // Publish JUnit Report
junit '**/target/surefire-reports/TEST-*.xml'

      }
   }

stage('Deploy') {
  // Archieve the artifact
archive 'target/*.war'
  // Execute the PetClinic-Deploy build to deploy war file into tomcat
  // Copy Artifact from this Pipeline Project into
 PetClinic-Deploy using Copy Artifact plugin
build 'PetClinic-Deploy'
   }

stage('Functional Test'){
// Checkout the code from Github to execute
 Functional test
git 'https://github.com/mitesh51/petclinic-
 func.git'
// Go to GitHub Directory and Fork it ... Change the URL in petclinic-
func/src/test/java/example/NewTest.java
//driver.get("http://localhost:8090/petclinic/");
//In the same file Change location of Gecko driver, you have used Firefox here on Windows...
File = new File("C:\\Users\\Mitesh\\Downloads\\geckodriver-v0.13.0-win64\\geckodriver.exe");
// Run the maven build with test goal to execute
 functional test
bat(/"${mvnHome}\bin\mvn" test/)
   }

// This stage can be optional based on the requirements
stage('Load Test'){
// Execute command to perform load testing with the
 use of Apache JMeter. In our case we are using the JMeter that is already installed on
Windows hence the bat file is used. Make sure to change this location based on the Apache
JMeter installation directory available on your system.
bat "C:/apache-jmeter-3.0/bin/jmeter.bat -
 Jjmeter.save.saveservice.output_format=xml -n -t
 C:/Users/Mitesh/Desktop/PetClinic.jmx -l Test.jtl"
// Publish Apache JMeter results
perfReport errorFailedThreshold: 50,
 errorUnstableThreshold: 30, ignoreFailedBuilds:
 true, ignoreUnstableBuilds: true,
 persistConstraintLog: true, sourceDataFiles:
 'Test.jtl'
   }
   //Done!
}
```

How to do it...

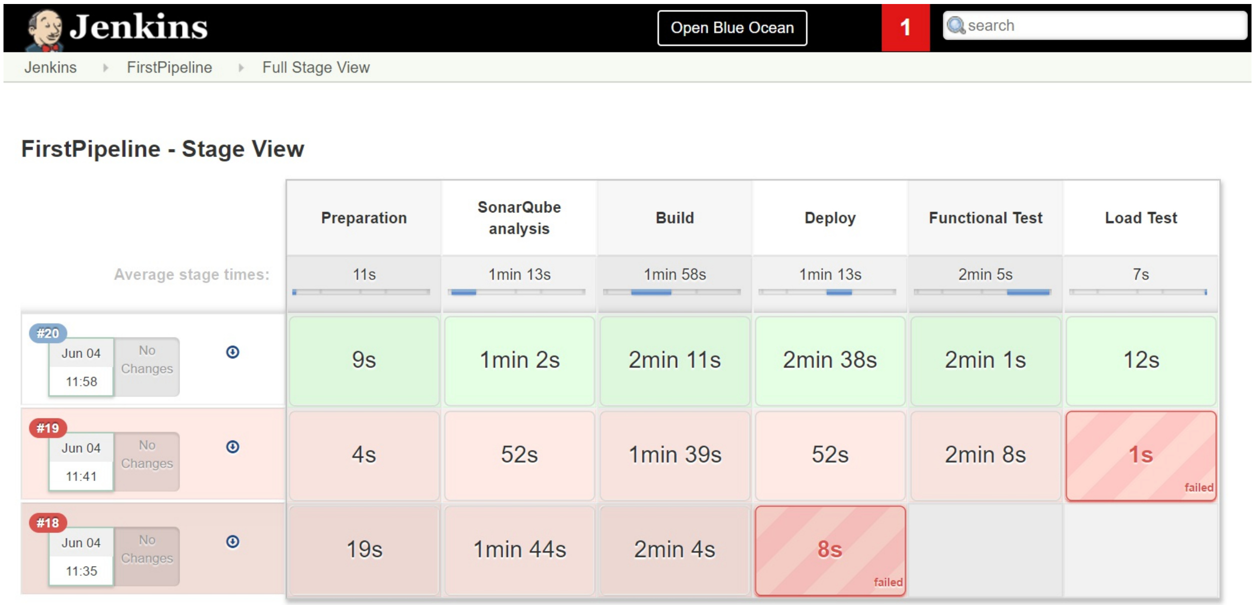
Let's see how to execute the Pipeline as a Code feature in Jenkins:

1. Click on Build now for the pipeline execution:



#20	Jun 4, 2017 11:58 AM	
#19	Jun 4, 2017 11:41 AM	
#18	Jun 4, 2017 11:35 AM	

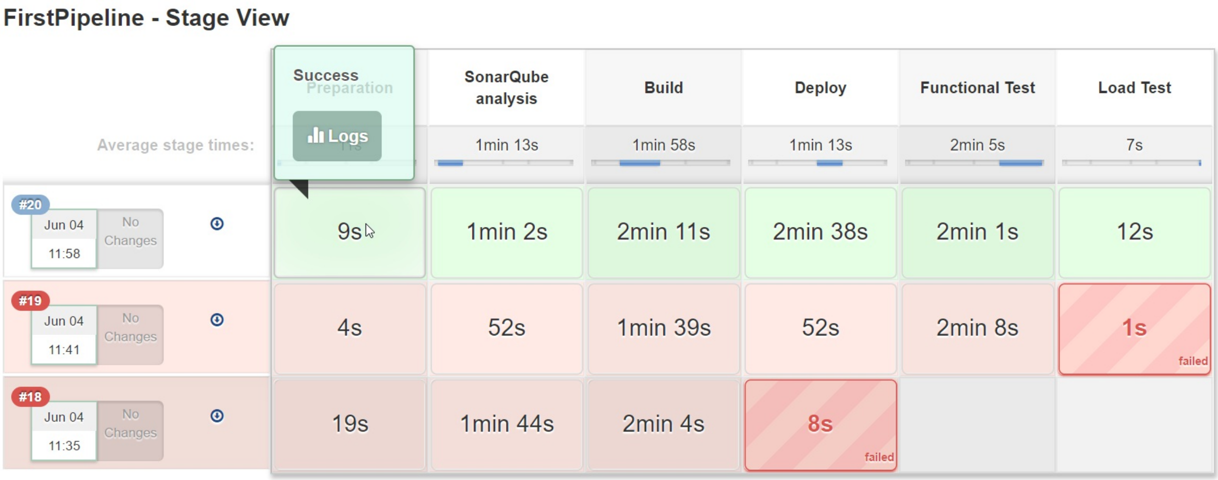
2. Verify the stage view of the pipeline you have created by clicking on Full Stage View on the Jenkins dashboard:



FirstPipeline - Stage View

	Preparation	SonarQube analysis	Build	Deploy	Functional Test	Load Test
Average stage times:	11s	1min 13s	1min 58s	1min 13s	2min 5s	7s
#20 Jun 04 11:58 No Changes	9s	1min 2s	2min 11s	2min 38s	2min 1s	12s
#19 Jun 04 11:41 No Changes	4s	52s	1min 39s	52s	2min 8s	1s failed
#18 Jun 04 11:35 No Changes	19s	1min 44s	2min 4s	8s failed		

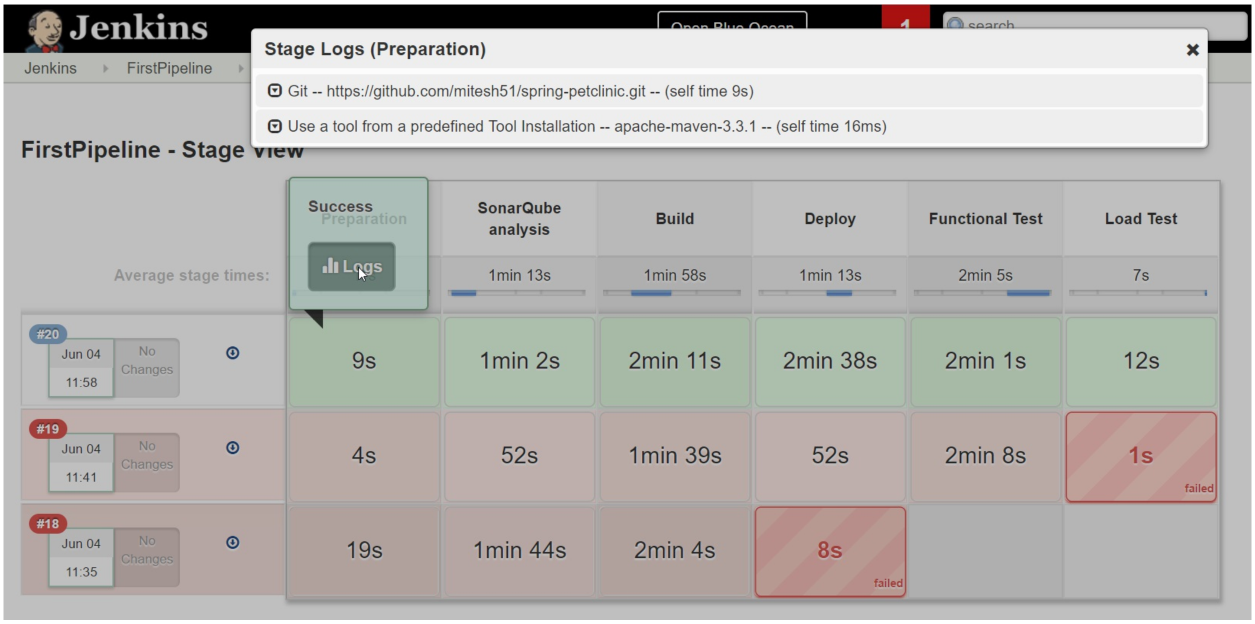
3. Mouse over the specific stage and click on Logs:



FirstPipeline - Stage View

	Preparation	SonarQube analysis	Build	Deploy	Functional Test	Load Test
Average stage times:		1min 13s	1min 58s	1min 13s	2min 5s	7s
#20 Jun 04 11:58 No Changes	9s	1min 2s	2min 11s	2min 38s	2min 1s	12s
#19 Jun 04 11:41 No Changes	4s	52s	1min 39s	52s	2min 8s	1s failed
#18 Jun 04 11:35 No Changes	19s	1min 44s	2min 4s	8s failed		

4. You can see and verify the stage logs directly from the stage view:



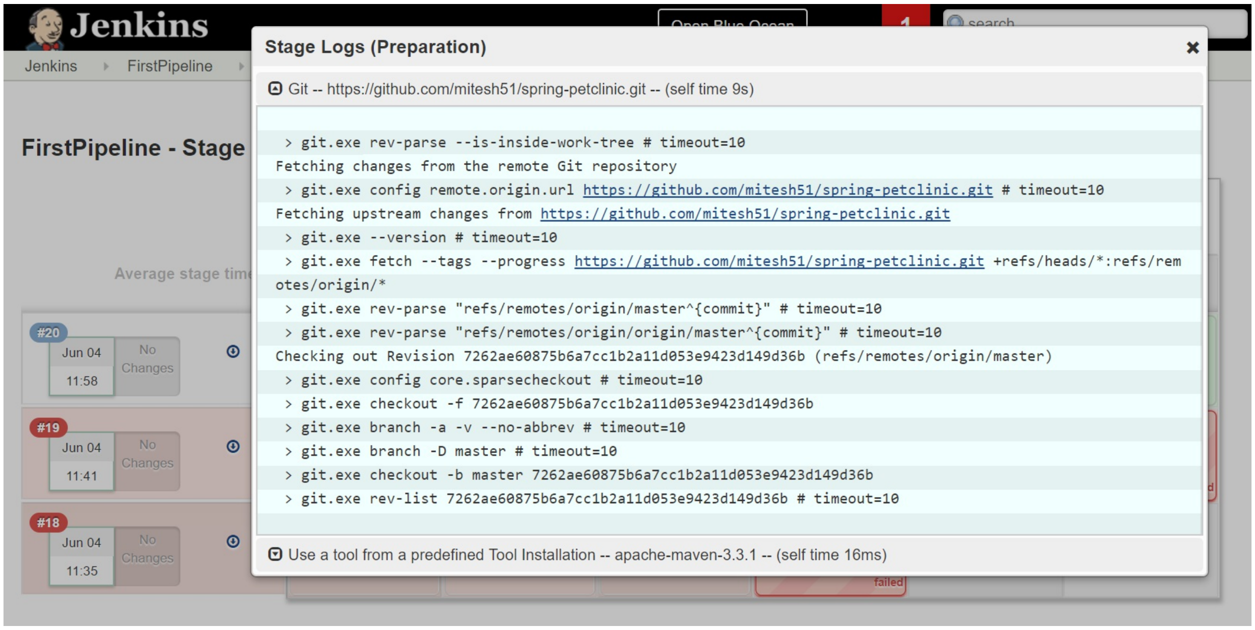
Stage Logs (Preparation)

```
Git -- https://github.com/mitesh51/spring-petclinic.git -- (self time 9s)
Use a tool from a predefined Tool Installation -- apache-maven-3.3.1 -- (self time 16ms)
```

FirstPipeline - Stage View

	Preparation	SonarQube analysis	Build	Deploy	Functional Test	Load Test
Average stage times:		1min 13s	1min 58s	1min 13s	2min 5s	7s
#20 Jun 04 11:58 No Changes	9s	1min 2s	2min 11s	2min 38s	2min 1s	12s
#19 Jun 04 11:41 No Changes	4s	52s	1min 39s	52s	2min 8s	1s failed
#18 Jun 04 11:35 No Changes	19s	1min 44s	2min 4s	8s failed		

5. Click on the dropdown to get more details on the log:



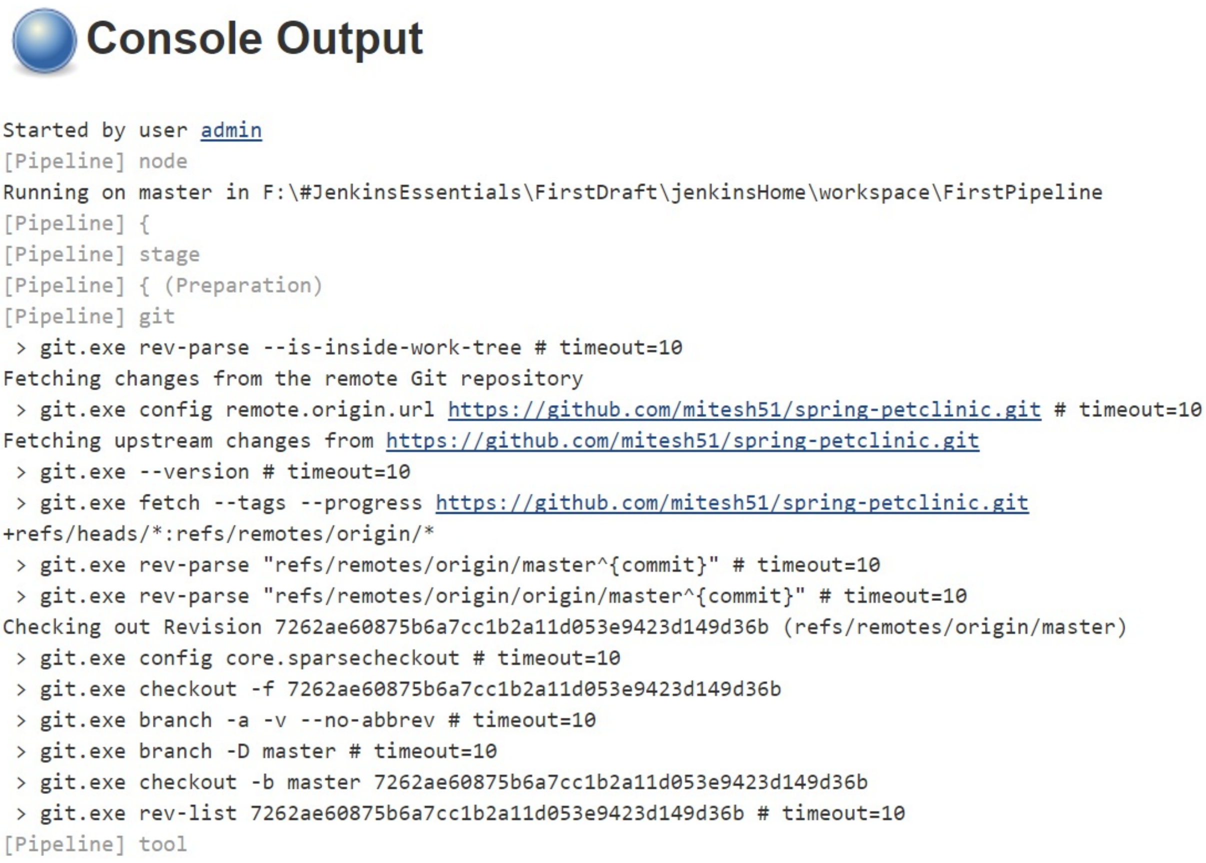
Stage Logs (Preparation)

Git -- https://github.com/mitesh51/spring-petclinic.git -- (self time 9s)

```
 > git.exe rev-parse --is-inside-work-tree # timeout=10
Fetching changes from the remote Git repository
 > git.exe config remote.origin.url https://github.com/mitesh51/spring-petclinic.git # timeout=10
Fetching upstream changes from https://github.com/mitesh51/spring-petclinic.git
 > git.exe --version # timeout=10
 > git.exe fetch --tags --progress https://github.com/mitesh51/spring-petclinic.git +refs/heads/*:refs/rem
otes/origin/*
 > git.exe rev-parse "refs/remotes/origin/master^{commit}" # timeout=10
 > git.exe rev-parse "refs/remotes/origin/origin/master^{commit}" # timeout=10
Checking out Revision 7262ae60875b6a7cc1b2a11d053e9423d149d36b (refs/remotes/origin/master)
 > git.exe config core.sparsecheckout # timeout=10
 > git.exe checkout -f 7262ae60875b6a7cc1b2a11d053e9423d149d36b
 > git.exe branch -a -v --no-abbrev # timeout=10
 > git.exe branch -D master # timeout=10
 > git.exe checkout -b master 7262ae60875b6a7cc1b2a11d053e9423d149d36b
 > git.exe rev-list 7262ae60875b6a7cc1b2a11d053e9423d149d36b # timeout=10
```

Use a tool from a predefined Tool Installation -- apache-maven-3.3.1 -- (self time 16ms)

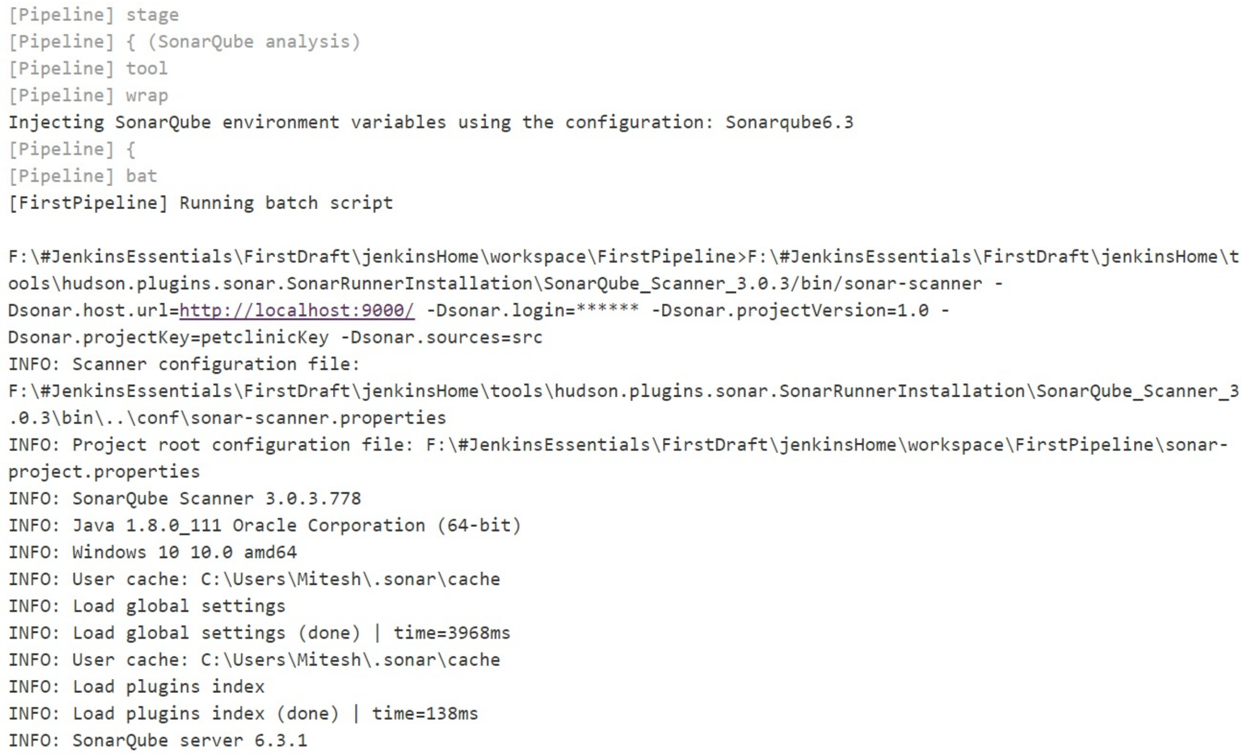
6. Let's go to the individual stage logs in the Console Output.
7. Look at the log for the preparation stage:



Console Output

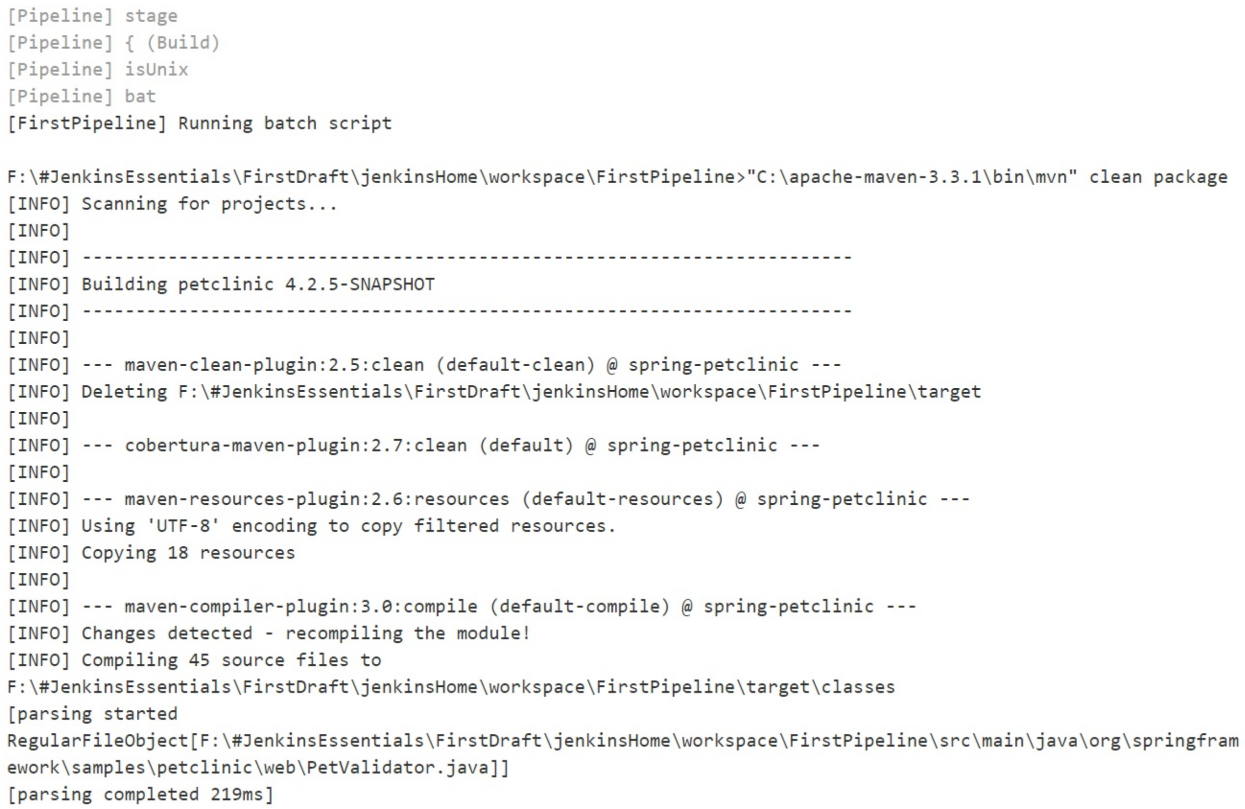
```
Started by user admin
[Pipeline] node
Running on master in F:\#JenkinsEssentials\FirstDraft\jenkinsHome\workspace\FirstPipeline
[Pipeline] {
[Pipeline] stage
[Pipeline] { (Preparation)
[Pipeline] git
 > git.exe rev-parse --is-inside-work-tree # timeout=10
Fetching changes from the remote Git repository
 > git.exe config remote.origin.url https://github.com/mitesh51/spring-petclinic.git # timeout=10
Fetching upstream changes from https://github.com/mitesh51/spring-petclinic.git
 > git.exe --version # timeout=10
 > git.exe fetch --tags --progress https://github.com/mitesh51/spring-petclinic.git
+refs/heads/*:refs/remotes/origin/*
 > git.exe rev-parse "refs/remotes/origin/master^{commit}" # timeout=10
 > git.exe rev-parse "refs/remotes/origin/origin/master^{commit}" # timeout=10
Checking out Revision 7262ae60875b6a7cc1b2a11d053e9423d149d36b (refs/remotes/origin/master)
 > git.exe config core.sparsecheckout # timeout=10
 > git.exe checkout -f 7262ae60875b6a7cc1b2a11d053e9423d149d36b
 > git.exe branch -a -v --no-abbrev # timeout=10
 > git.exe branch -D master # timeout=10
 > git.exe checkout -b master 7262ae60875b6a7cc1b2a11d053e9423d149d36b
 > git.exe rev-list 7262ae60875b6a7cc1b2a11d053e9423d149d36b # timeout=10
[Pipeline] tool
```

8. Look at the log for `Sonarqube Analysis Stage`:



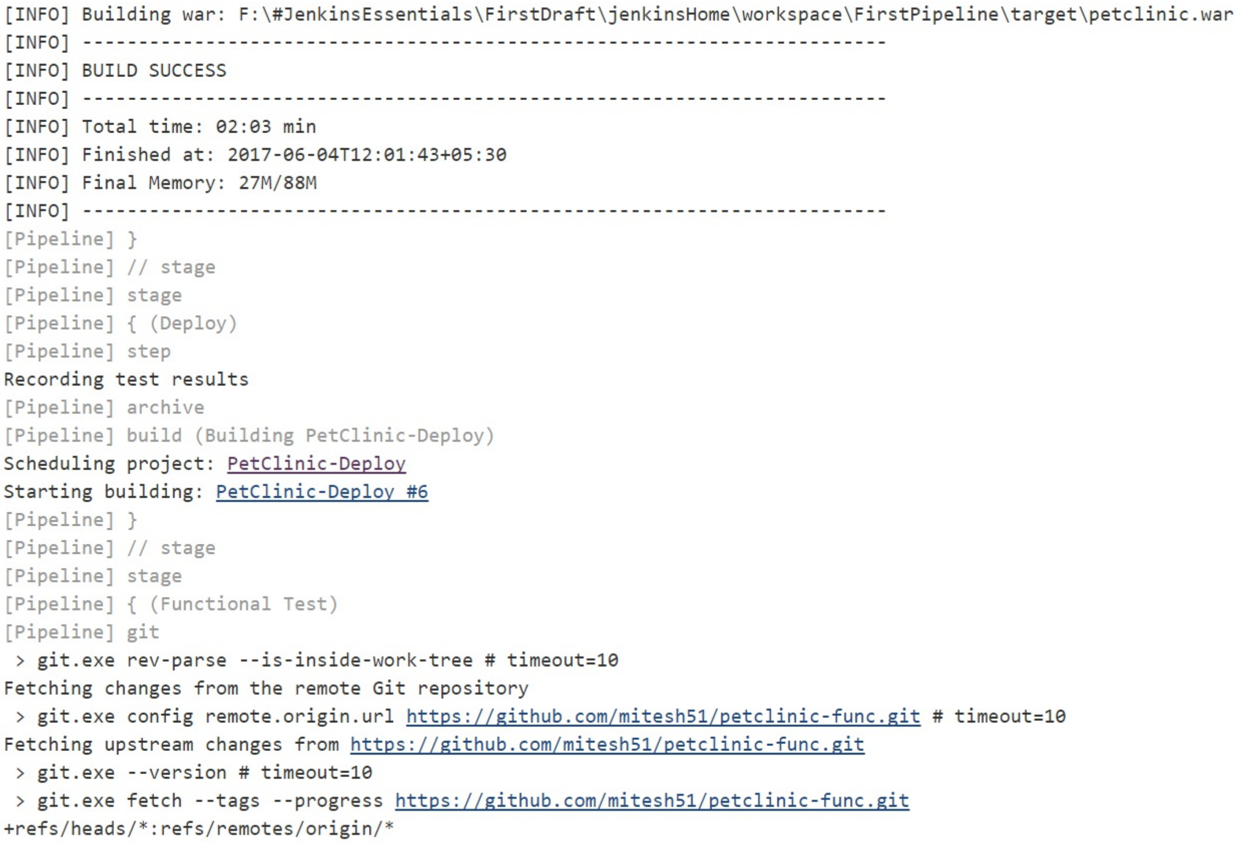
```
[Pipeline] stage
[Pipeline] { (SonarQube analysis)
[Pipeline] tool
[Pipeline] wrap
Injecting SonarQube environment variables using the configuration: Sonarqube6.3
[Pipeline] {
[Pipeline] bat
[FirstPipeline] Running batch script

F:\#JenkinsEssentials\FirstDraft\jenkinsHome\workspace\FirstPipeline>F:\#JenkinsEssentials\FirstDraft\jenkinsHome\t
ools\hudson.plugins.sonar.SonarRunnerInstallation\SonarQube_Scanner_3.0.3/bin/sonar-scanner -
Dsonar.host.url=http://localhost:9000/ -Dsonar.login=****** -Dsonar.projectVersion=1.0 -
Dsonar.projectKey=petclinicKey -Dsonar.sources=src
INFO: Scanner configuration file:
F:\#JenkinsEssentials\FirstDraft\jenkinsHome\tools\hudson.plugins.sonar.SonarRunnerInstallation\SonarQube_Scanner_3
.0.3\bin\..\conf\sonar-scanner.properties
INFO: Project root configuration file: F:\#JenkinsEssentials\FirstDraft\jenkinsHome\workspace\FirstPipeline\sonar-
project.properties
INFO: SonarQube Scanner 3.0.3.778
INFO: Java 1.8.0_111 Oracle Corporation (64-bit)
INFO: Windows 10 10.0 amd64
INFO: User cache: C:\Users\Mitesh\.sonar\cache
INFO: Load global settings
INFO: Load global settings (done) | time=3968ms
INFO: User cache: C:\Users\Mitesh\.sonar\cache
INFO: Load plugins index
INFO: Load plugins index (done) | time=138ms
INFO: SonarQube server 6.3.1
```

9. Look at the log for Build Stage:



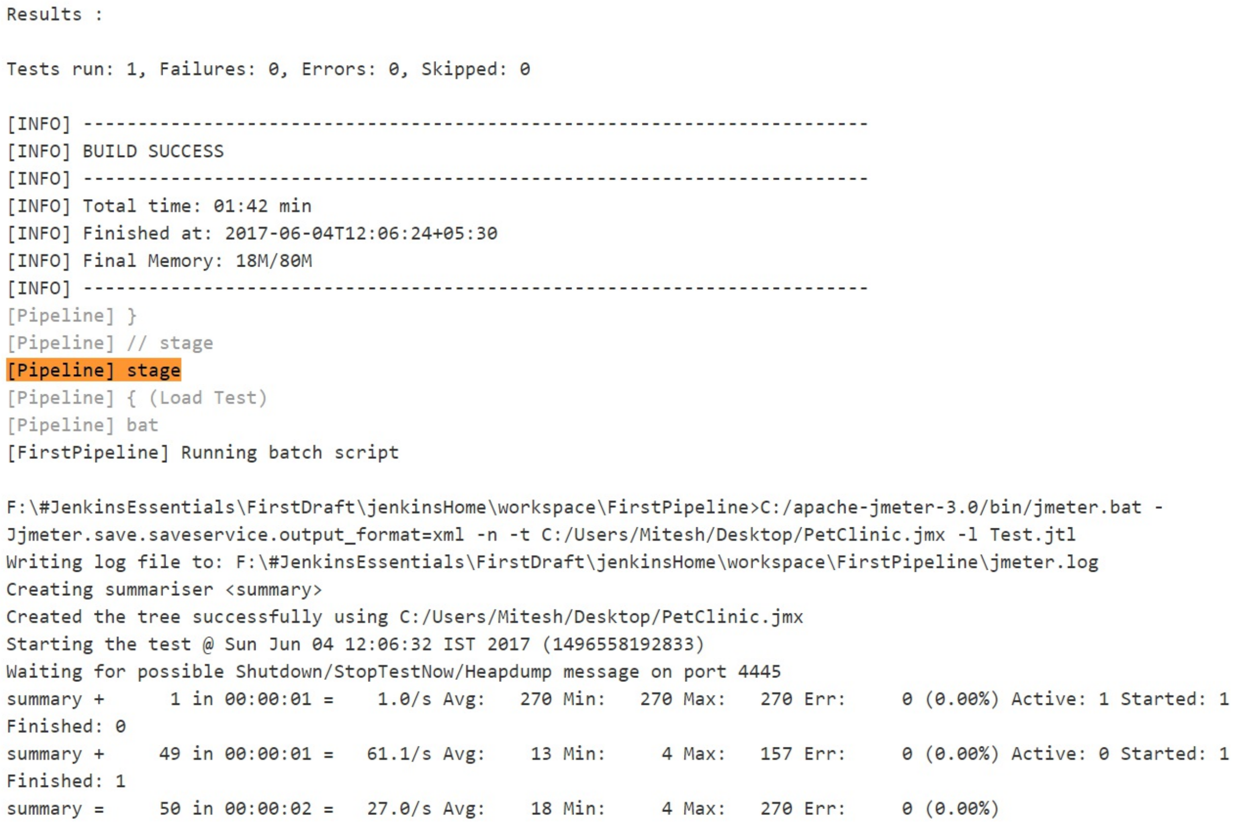
```
[Pipeline] stage
[Pipeline] { (Build)
[Pipeline] isUnix
[Pipeline] bat
[FirstPipeline] Running batch script

F:\#JenkinsEssentials\FirstDraft\jenkinsHome\workspace\FirstPipeline>"C:\apache-maven-3.3.1\bin\mvn" clean package
[INFO] Scanning for projects...
[INFO]
[INFO] ------------------------------------------------------------------------
[INFO] Building petclinic 4.2.5-SNAPSHOT
[INFO] ------------------------------------------------------------------------
[INFO]
[INFO] --- maven-clean-plugin:2.5:clean (default-clean) @ spring-petclinic ---
[INFO] Deleting F:\#JenkinsEssentials\FirstDraft\jenkinsHome\workspace\FirstPipeline\target
[INFO]
[INFO] --- cobertura-maven-plugin:2.7:clean (default) @ spring-petclinic ---
[INFO]
[INFO] --- maven-resources-plugin:2.6:resources (default-resources) @ spring-petclinic ---
[INFO] Using 'UTF-8' encoding to copy filtered resources.
[INFO] Copying 18 resources
[INFO]
[INFO] --- maven-compiler-plugin:3.0:compile (default-compile) @ spring-petclinic ---
[INFO] Changes detected - recompiling the module!
[INFO] Compiling 45 source files to
F:\#JenkinsEssentials\FirstDraft\jenkinsHome\workspace\FirstPipeline\target\classes
[parsing started
RegularFileObject[F:\#JenkinsEssentials\FirstDraft\jenkinsHome\workspace\FirstPipeline\src\main\java\org\springfram
ework\samples\petclinic\web\PetValidator.java]]
[parsing completed 219ms]
```

10. Look at the log for deploy and functional test stage:



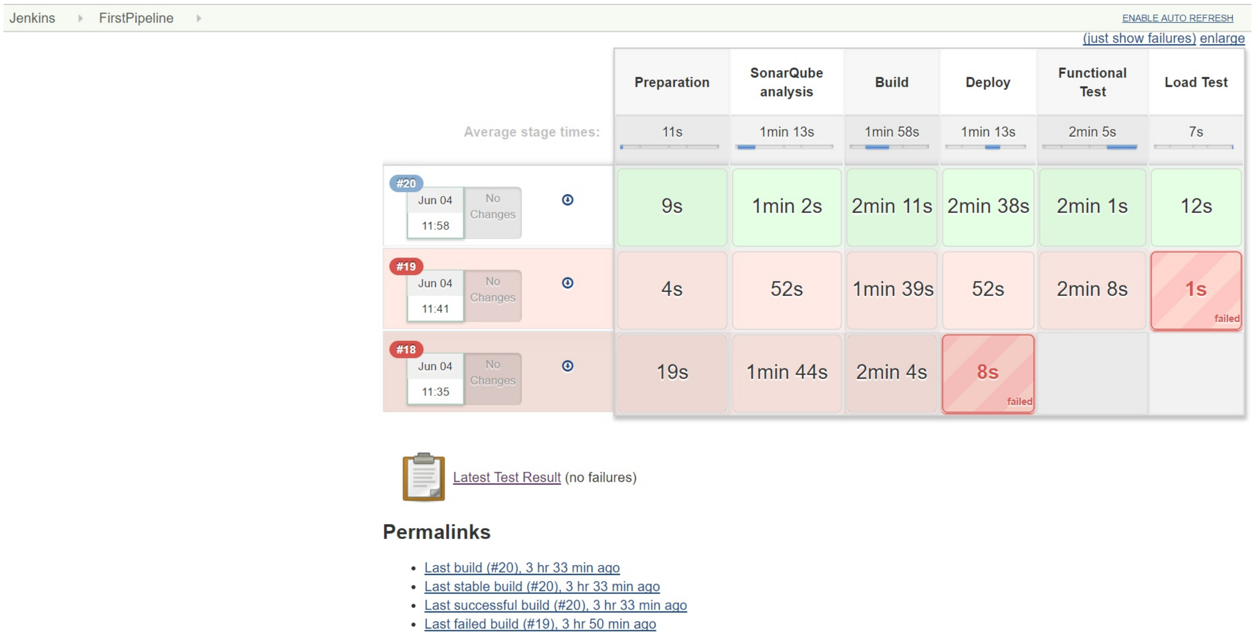
```
[INFO] Building war: F:\#JenkinsEssentials\FirstDraft\jenkinsHome\workspace\FirstPipeline\target\petclinic.war
[INFO] ------------------------------------------------------------------------
[INFO] BUILD SUCCESS
[INFO] ------------------------------------------------------------------------
[INFO] Total time: 02:03 min
[INFO] Finished at: 2017-06-04T12:01:43+05:30
[INFO] Final Memory: 27M/88M
[INFO] ------------------------------------------------------------------------
[Pipeline] }
[Pipeline] // stage
[Pipeline] stage
[Pipeline] { (Deploy)
[Pipeline] step
Recording test results
[Pipeline] archive
[Pipeline] build (Building PetClinic-Deploy)
Scheduling project: PetClinic-Deploy
Starting building: PetClinic-Deploy #6
[Pipeline] }
[Pipeline] // stage
[Pipeline] stage
[Pipeline] { (Functional Test)
[Pipeline] git
 > git.exe rev-parse --is-inside-work-tree # timeout=10
Fetching changes from the remote Git repository
 > git.exe config remote.origin.url https://github.com/mitesh51/petclinic-func.git # timeout=10
Fetching upstream changes from https://github.com/mitesh51/petclinic-func.git
 > git.exe --version # timeout=10
 > git.exe fetch --tags --progress https://github.com/mitesh51/petclinic-func.git
+refs/heads/*:refs/remotes/origin/*
```

11. Look at the log for load test stage:



```
Results :

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

[INFO] ------------------------------------------------------------------------
[INFO] BUILD SUCCESS
[INFO] ------------------------------------------------------------------------
[INFO] Total time: 01:42 min
[INFO] Finished at: 2017-06-04T12:06:24+05:30
[INFO] Final Memory: 18M/80M
[INFO] ------------------------------------------------------------------------
[Pipeline] }
[Pipeline] // stage
[Pipeline] stage
[Pipeline] { (Load Test)
[Pipeline] bat
[FirstPipeline] Running batch script

F:\#JenkinsEssentials\FirstDraft\jenkinsHome\workspace\FirstPipeline>C:/apache-jmeter-3.0/bin/jmeter.bat -
Jjmeter.save.saveservice.output_format=xml -n -t C:/Users/Mitesh/Desktop/PetClinic.jmx -l Test.jtl
Writing log file to: F:\#JenkinsEssentials\FirstDraft\jenkinsHome\workspace\FirstPipeline\jmeter.log
Creating summariser <summary>
Created the tree successfully using C:/Users/Mitesh/Desktop/PetClinic.jmx
Starting the test @ Sun Jun 04 12:06:32 IST 2017 (1496558192833)
Waiting for possible Shutdown/StopTestNow/Heapdump message on port 4445
summary +      1 in 00:00:01 =    1.0/s Avg:   270 Min:   270 Max:   270 Err:     0 (0.00%) Active: 1 Started: 1
Finished: 0
summary +     49 in 00:00:01 =   61.1/s Avg:    13 Min:     4 Max:   157 Err:     0 (0.00%) Active: 0 Started: 1
Finished: 1
summary =     50 in 00:00:02 =   27.0/s Avg:    18 Min:     4 Max:   270 Err:     0 (0.00%)
```

12. On the project dashboard, look at the stage view at the bottom:



	Preparation	SonarQube analysis	Build	Deploy	Functional Test	Load Test
Average stage times:	11s	1min 13s	1min 58s	1min 13s	2min 5s	7s
#20 Jun 04 11:58 No Changes	9s	1min 2s	2min 11s	2min 38s	2min 1s	12s
#19 Jun 04 11:41 No Changes	4s	52s	1min 39s	52s	2min 8s	1s failed
#18 Jun 04 11:35 No Changes	19s	1min 44s	2min 4s	8s failed		

Latest Test Result (no failures)

Permalinks

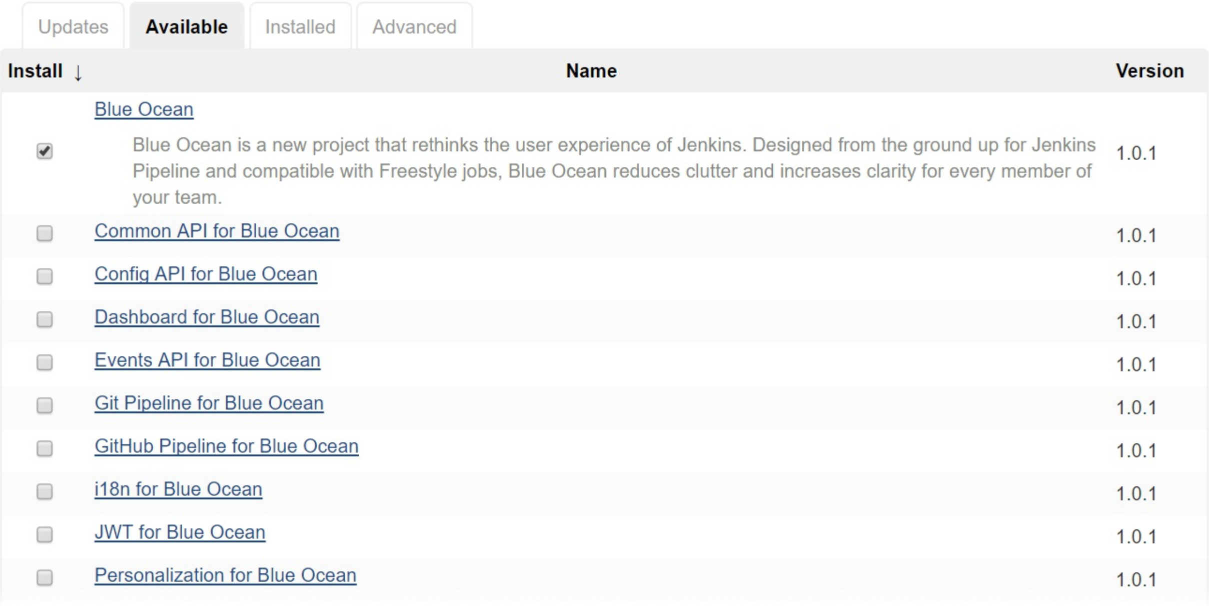
- Last build (#20), 3 hr 33 min ago
- Last stable build (#20), 3 hr 33 min ago
- Last successful build (#20), 3 hr 33 min ago
- Last failed build (#19), 3 hr 50 min ago

Getting started with the Blue Ocean dashboard

Blue Ocean is a new user interface for Jenkins. The idea of introducing Blue Ocean is to make Jenkins and Continuous Delivery approachable to all team members.

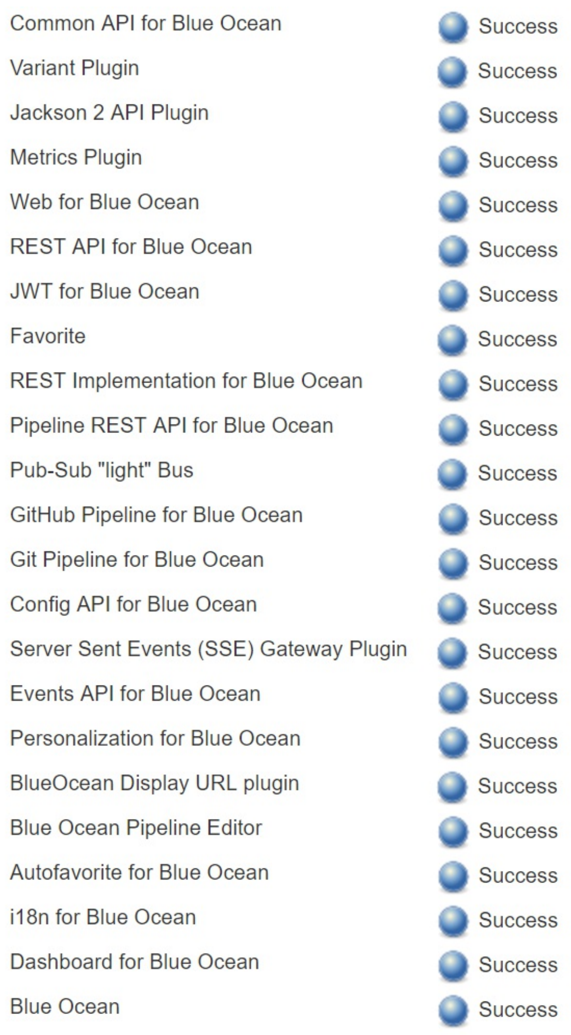
Getting ready

You will use Blue Ocean later in the chapter but you will install it here:



Install ↓	Name	Version
☑	Blue Ocean Blue Ocean is a new project that rethinks the user experience of Jenkins. Designed from the ground up for Jenkins Pipeline and compatible with Freestyle jobs, Blue Ocean reduces clutter and increases clarity for every member of your team.	1.0.1
□	Common API for Blue Ocean	1.0.1
□	Config API for Blue Ocean	1.0.1
□	Dashboard for Blue Ocean	1.0.1
□	Events API for Blue Ocean	1.0.1
□	Git Pipeline for Blue Ocean	1.0.1
□	GitHub Pipeline for Blue Ocean	1.0.1
□	i18n for Blue Ocean	1.0.1
□	JWT for Blue Ocean	1.0.1
□	Personalization for Blue Ocean	1.0.1

Verify in the Jenkins dashboard regarding the successful installation of the plugin:



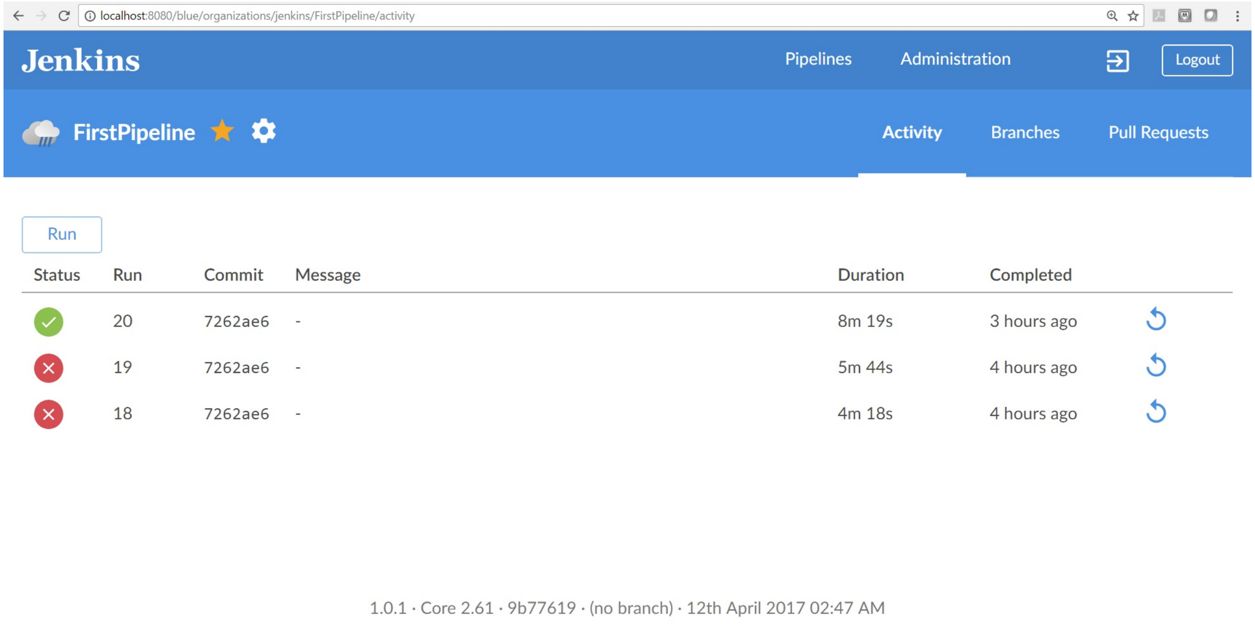
Common API for Blue Ocean	● Success
Variant Plugin	● Success
Jackson 2 API Plugin	● Success
Metrics Plugin	● Success
Web for Blue Ocean	● Success
REST API for Blue Ocean	● Success
JWT for Blue Ocean	● Success
Favorite	● Success
REST Implementation for Blue Ocean	● Success
Pipeline REST API for Blue Ocean	● Success
Pub-Sub "light" Bus	● Success
GitHub Pipeline for Blue Ocean	● Success
Git Pipeline for Blue Ocean	● Success
Config API for Blue Ocean	● Success
Server Sent Events (SSE) Gateway Plugin	● Success
Events API for Blue Ocean	● Success
Personalization for Blue Ocean	● Success
BlueOcean Display URL plugin	● Success
Blue Ocean Pipeline Editor	● Success
Autofavorite for Blue Ocean	● Success
i18n for Blue Ocean	● Success
Dashboard for Blue Ocean	● Success
Blue Ocean	● Success

Now you will create your first pipeline in Jenkins.

How to do it...

Now let's see how your pipeline looks in the Blue Ocean user interface. Go to the FirstPipeline pipeline job that you have created. Click on the Blue Ocean link in the top bar on the Jenkins dashboard.

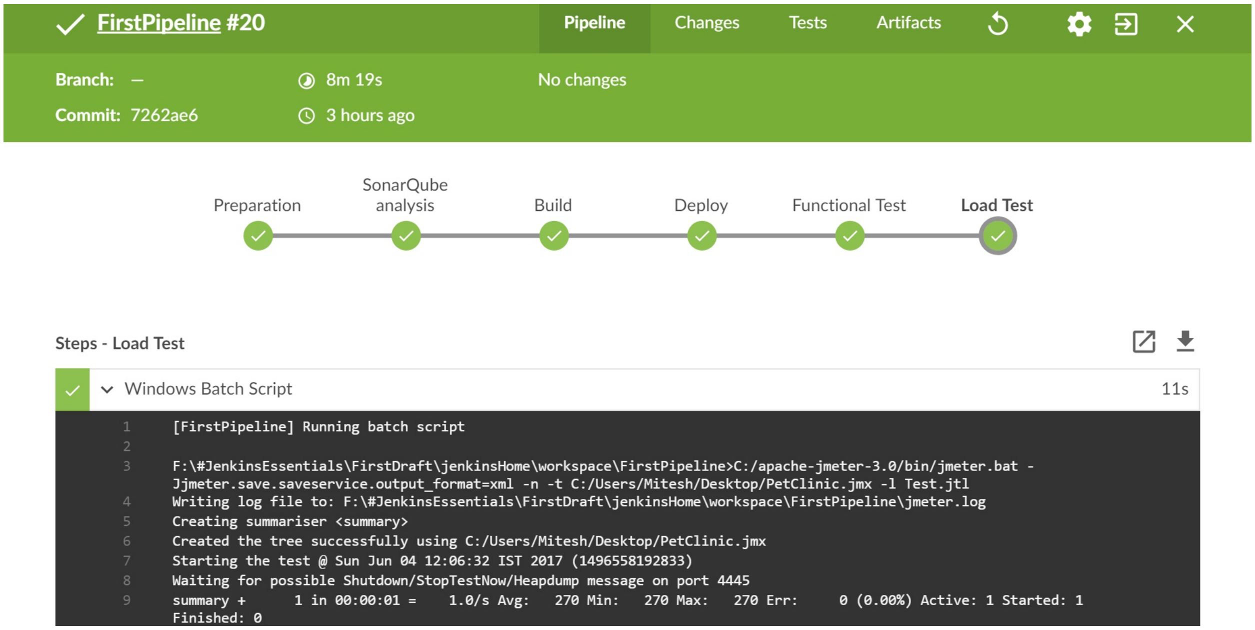
Click on Successful pipeline 20:



Status	Run	Commit	Message	Duration	Completed
✓	20	7262ae6	-	8m 19s	3 hours ago
✗	19	7262ae6	-	5m 44s	4 hours ago
✗	18	7262ae6	-	4m 18s	4 hours ago

1.0.1 · Core 2.61 · 9b77619 · (no branch) · 12th April 2017 02:47 AM

It will give details of the execution status of each stage in the Blue Ocean dashboard. Logs are available on the same page:



Branch: –

Commit: 7262ae6

8m 19s

3 hours ago

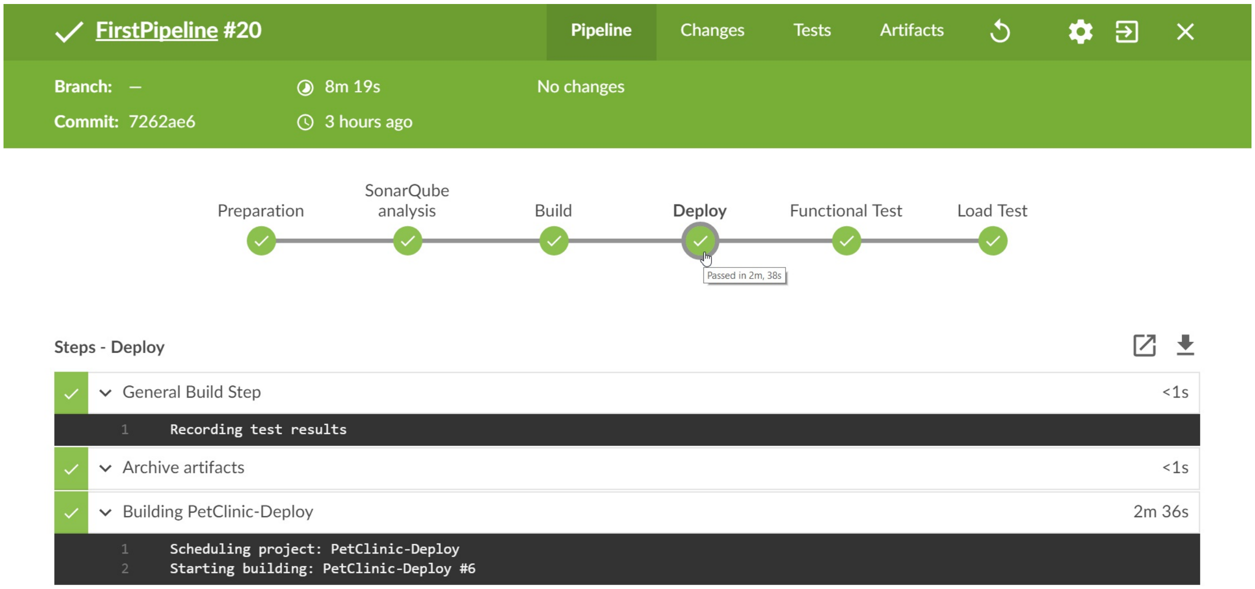
No changes

Steps - Load Test

Windows Batch Script 11s

```
[FirstPipeline] Running batch script

F:\#JenkinsEssentials\FirstDraft\jenkinsHome\workspace\FirstPipeline>C:/apache-jmeter-3.0/bin/jmeter.bat -
Jjmeter.save.saveservice.output_format=xml -n -t C:/Users/Mitesh/Desktop/PetClinic.jmx -l Test.jtl
Writing log file to: F:\#JenkinsEssentials\FirstDraft\jenkinsHome\workspace\FirstPipeline\jmeter.log
Creating summariser <summary>
Created the tree successfully using C:/Users/Mitesh/Desktop/PetClinic.jmx
Starting the test @ Sun Jun 04 12:06:32 IST 2017 (1496558192833)
Waiting for possible Shutdown/StopTestNow/Heapdump message on port 4445
summary +      1 in 00:00:01 =    1.0/s Avg:   270 Min:   270 Max:   270 Err:     0 (0.00%) Active: 1 Started: 1
Finished: 0
```

Select any stage and check the logs for the stage on the same page:



Branch: –

Commit: 7262ae6

8m 19s

3 hours ago

No changes

Steps - Deploy

General Build Step <1s

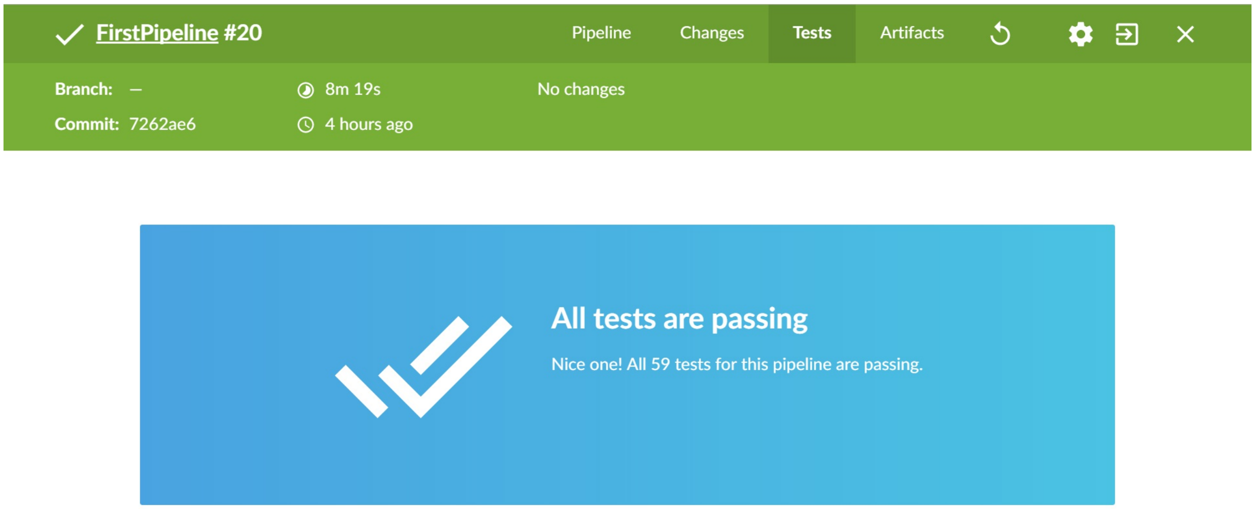
```
Recording test results
```

Archive artifacts <1s

Building PetClinic-Deploy 2m 36s

```
Scheduling project: PetClinic-Deploy
Starting building: PetClinic-Deploy #6
```

Click on the Tests link on the top bar to verify the status of the Junit test cases executed in the pipeline:



FirstPipeline #20

Branch: —

Commit: 7262ae6

8m 19s

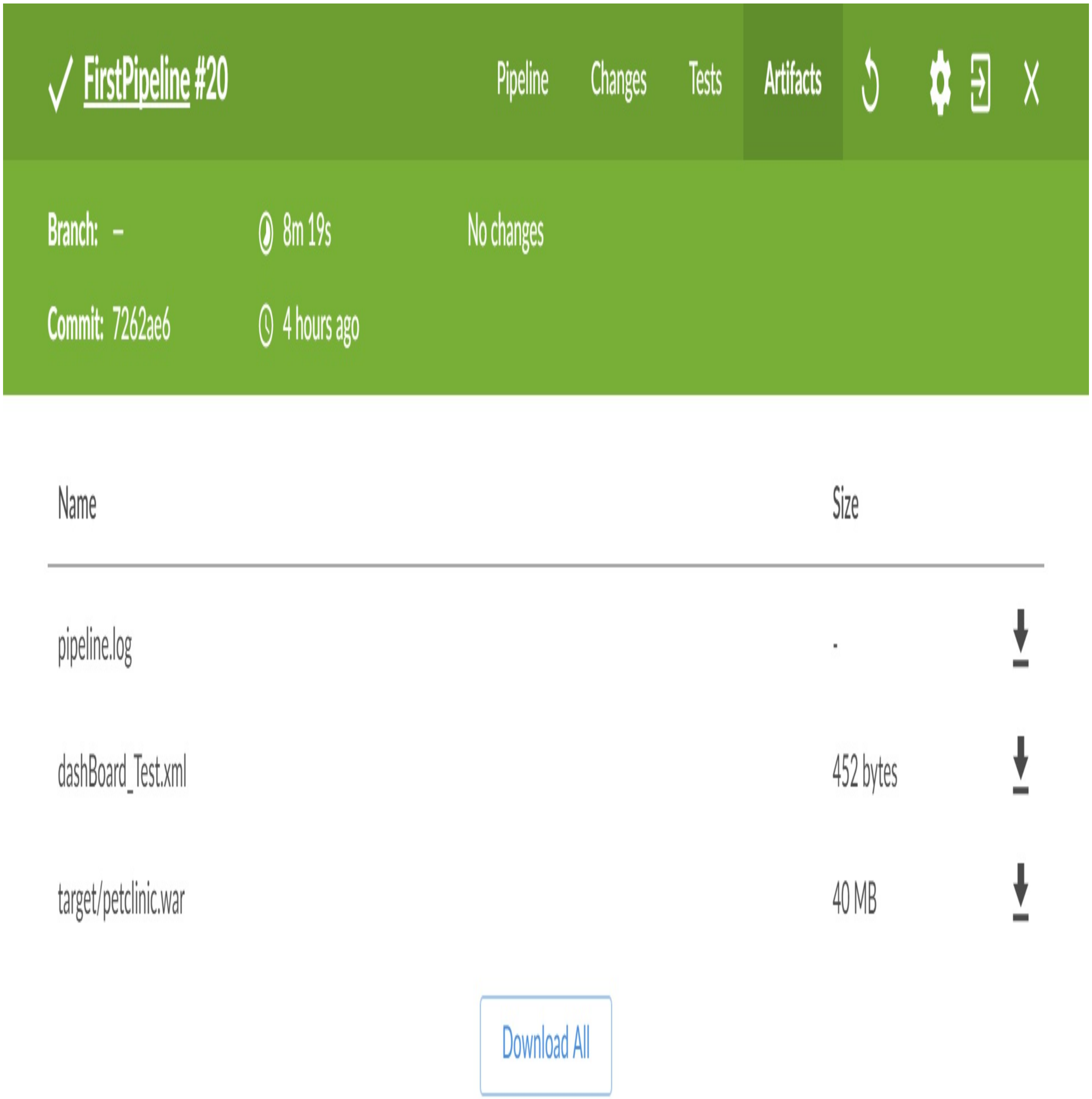
4 hours ago

No changes

All tests are passing

Nice one! All 59 tests for this pipeline are passing.

Click on the Artifacts link on the top bar to verify all the artifacts available in this pipeline:



✓ FirstPipeline #20

Branch: –
8m 19s
No changes

Commit: 7262ae6
4 hours ago

Name	Size
pipeline.log	-
dashBoard_Test.xml	452 bytes
target/petclinic.war	40 MB

In this chapter, you have created a pipeline using the `Build Pipeline` plugin and `pipeline as a code` feature available in Jenkins 2 and later.

Jenkins UI Customization

In this chapter, we will cover the following recipes:

- Skinning Jenkins with the simple themes plugin
- Skinning and provisioning Jenkins using a WAR overlay
- Generating a home page
- Creating HTML reports
- Efficient use of views
- Saving screen space with the Dashboard View plugin
- Making noise with HTML5 browsers
- An extreme view for reception areas

Introduction

This chapter explores communication through Jenkins, recognizing that there are different target audiences.

Jenkins is a talented communicator. Its home page displays the status of all jobs, allowing you to make quick decisions. You can easily set up multiple views, prioritizing information naturally. Jenkins, with its hordes of plugins, notifies you by email, dashboards, and Google services. It shouts at you through mobile devices, radiates information as you walk past big screens, and fires at you with USB sponge missile launchers.

Its primary audience is developers, but don't forget the wider audience that wants to use the software being developed. Seeing Jenkins regularly building with consistent views and a corporate look and feel builds confidence in the software's roadmap. This chapter includes recipes to help you reach this wider audience.

When creating a coherent communication strategy, there are many Jenkins-specific details to configure. Here are a few that will be considered in this chapter:

- **Notifications**: Developers need to know quickly when something is broken. Jenkins has many plugins; you should select a few that suit the team's ethos.
- **Page decoration**: A page decorator is a plugin that adds content to each page. You can cheaply generate a corporate look and feel by adding your own style sheets and JavaScript.
- **Overlaying Jenkins**: Using the Maven WAR plugin, you can overlay your own content on top of Jenkins. You can use this to add custom content and provision resources such as home pages, which will enhance the corporate look and feel.
- **Optimize the views**: Front page views are lists of jobs that are displayed in a tab. The front page is used by the audience to quickly decide which job to select for review. Plugins expand the choice of view types and optimize information digestion. This potentially avoids the need to look further, saving precious time.
- **Drive by notification**: Extreme views that radiate information visually look great on large monitors. If you place a monitor by watering holes such as receptions or coffee machines, then passers-by will absorb the ebb and flow of job status changes. The view sublimely hints at the professionalism of your company and the stability of your product's roadmap.
- **Keeping track of your audience**: If you are openly communicating, then you should track usage patterns so that you can improve services. Consider connecting your Jenkins pages to Google Analytics or Piwik, an open source analytics application.

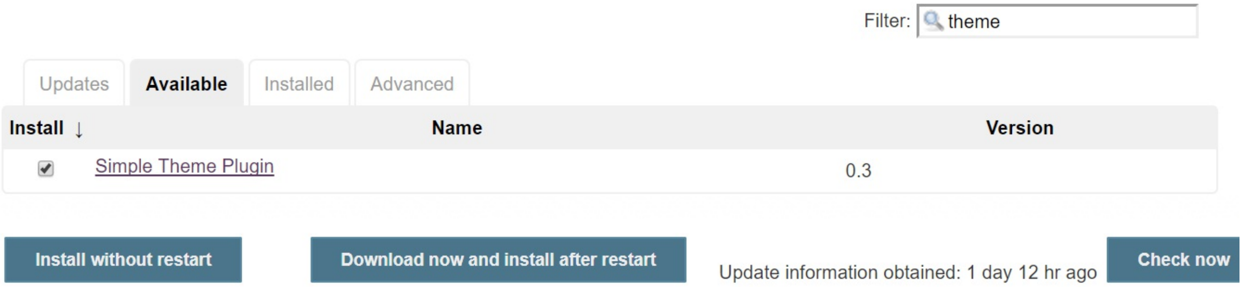
Skinning Jenkins with the simple themes plugin

This recipe modifies the Jenkins look and feel through the themes plugin.

The themes plugin is a page decorator; it decorates each page with extra HTML tags. The plugin allows you to upload a style sheet and JavaScript file. The files are then reachable through a local URL. Each Jenkins page is then decorated with HTML tags that use the URLs to pull in your uploaded files. Although straightforward, when properly crafted, the visual effects are powerful.

Getting ready

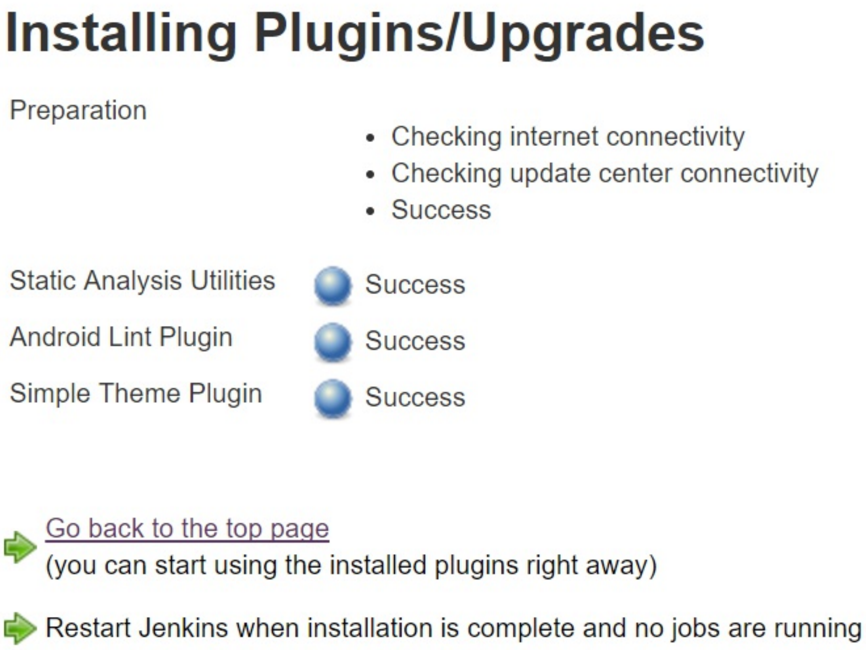
1. Install the themes plugin (https://wiki.jenkins-ci.org/display/JENKINS/Simple+Theme+Plugin).
2. Click on Install without restart:



Install ↓	Name	Version
☑	Simple Theme Plugin	0.3

Update information obtained: 1 day 12 hr ago

3. Wait until the plugin is installed successfully:



Installing Plugins/Upgrades

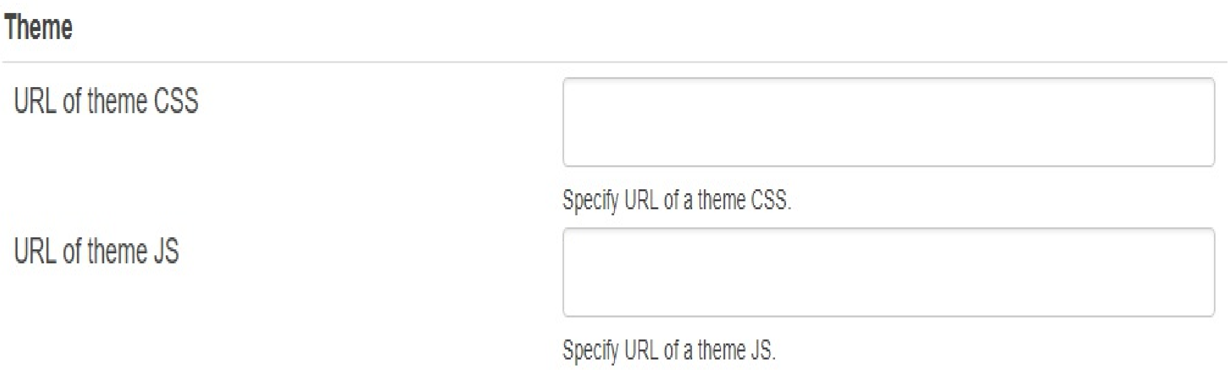
Preparation
- Checking internet connectivity
- Checking update center connectivity
- Success

Static Analysis Utilities	● Success
Android Lint Plugin	● Success
Simple Theme Plugin	● Success

Go back to the top page
(you can start using the installed plugins right away)

Restart Jenkins when installation is complete and no jobs are running

4. Go to the Jenkins dashboard and Manage Jenkins | Configure System | Theme:



Theme

URL of theme CSS

Specify URL of a theme CSS.

URL of theme JS

Specify URL of a theme JS.

You need to provide custom CSS and custom JS files here to change the look and feel of the Jenkins dashboard.

How to do it...

1. Under the Jenkins `userContent` directory, create a file named `my.js` with the following line of code:

```
document.write("<h1 id='test'>Example Location</h1>")
```

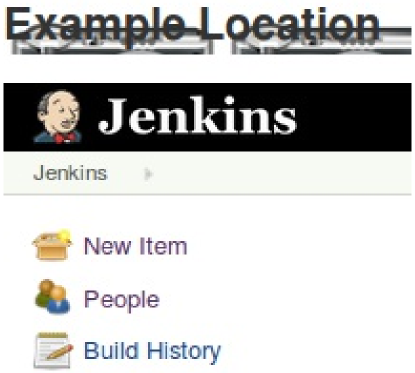
2. Create a `mycss.css` file in the Jenkins `userContent` directory with the following lines of code:

```
@charset "utf-8";
#test {
background-image: url(/userContent/camera.png);
}
#main-table{
background-image: url(/userContent/camera.png)
 !important;
```

3. Download and unpack the icon archive from http://sourceforge.net/projects/openiconlibrary/files/0.11/open_icon_library-standard-0.11.tar.bz2/download and review the available icons. Alternatively, you can use the icon included in the download from the book's website (www.packtpub.com/support). Add an icon to the `userContent` directory renaming it to `camera.png`.

4. Visit the Jenkins main configuration page: `/configure`. Under the Theme section, fill in the location of the CSS and JavaScript files:
   - URL of theme CSS: `/userContent/mycss.css`
   - URL of theme JS: `/userContent/myjavascript.js`

5. Click on Save.
6. Return to the Jenkins home page and review your work, as shown in the following screenshot:



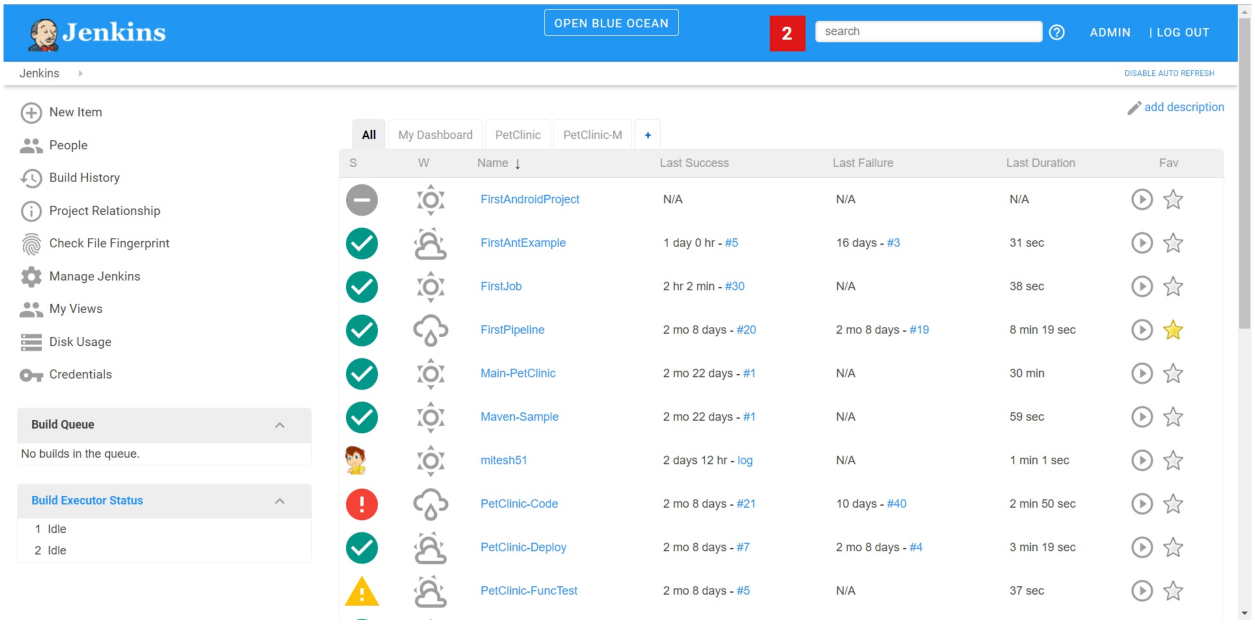
Another way to change the Jenkins theme is to use any one of the following URLs in the CSS field to change the look and feel:

- https://jenkins-contrib-themes.github.io/jenkins-material-theme/dist/material-red.css
- https://jenkins-contrib-themes.github.io/jenkins-material-theme/dist/material-pink.css
- https://jenkins-contrib-themes.github.io/jenkins-material-theme/dist/material-purple.css

- https://jenkins-contrib-themes.github.io/jenkins-material-theme/dist/material-deep-purple.css
- https://jenkins-contrib-themes.github.io/jenkins-material-theme/dist/material-indigo.css
- https://jenkins-contrib-themes.github.io/jenkins-material-theme/dist/material-blue.css
- https://jenkins-contrib-themes.github.io/jenkins-material-theme/dist/material-light-blue.css

- https://jenkins-contrib-themes.github.io/jenkins-material-theme/dist/material-cyan.css
- https://jenkins-contrib-themes.github.io/jenkins-material-theme/dist/material-teal.css
- https://jenkins-contrib-themes.github.io/jenkins-material-theme/dist/material-green.css
- https://jenkins-contrib-themes.github.io/jenkins-material-theme/dist/material-light-green.css
- https://jenkins-contrib-themes.github.io/jenkins-material-theme/dist/material-lime.css
- https://jenkins-contrib-themes.github.io/jenkins-material-theme/dist/material-yellow.css
- https://jenkins-contrib-themes.github.io/jenkins-material-theme/dist/material-amber.css
- https://jenkins-contrib-themes.github.io/jenkins-material-theme/dist/material-orange.css
- https://jenkins-contrib-themes.github.io/jenkins-material-theme/dist/material-deep-orange.css
- https://jenkins-contrib-themes.github.io/jenkins-material-theme/dist/material-brown.css
- https://jenkins-contrib-themes.github.io/jenkins-material-theme/dist/material-grey.css
- https://jenkins-contrib-themes.github.io/jenkins-material-theme/dist/material-blue-grey.css

You can also go to the mentioned location and copy the content of the file and paste it in `/userContent/mycss.css`:



Build Queue

No builds in the queue.

Build Executor Status

1 Idle

2 Idle

S	W	Name ↓	Last Success	Last Failure	Last Duration	Fav
⊖		FirstAndroidProject	N/A	N/A	N/A	▷ ☆
✓		FirstAntExample	1 day 0 hr - #5	16 days - #3	31 sec	▷ ☆
✓		FirstJob	2 hr 2 min - #30	N/A	38 sec	▷ ☆
✓		FirstPipeline	2 mo 8 days - #20	2 mo 8 days - #19	8 min 19 sec	▷ ★
✓		Main-PetClinic	2 mo 22 days - #1	N/A	30 min	▷ ☆
✓		Maven-Sample	2 mo 22 days - #1	N/A	59 sec	▷ ☆
		mitesh51	2 days 12 hr - log	N/A	1 min 1 sec	▷ ☆
!		PetClinic-Code	2 mo 8 days - #21	10 days - #40	2 min 50 sec	▷ ☆
✓		PetClinic-Deploy	2 mo 8 days - #7	2 mo 8 days - #4	3 min 19 sec	▷ ☆
⚠		PetClinic-FuncTest	2 mo 8 days - #5	N/A	37 sec	▷ ☆

You can make changes to CSS and customize based on your needs.

How it works...

The simple themes plugin is a page decorator. It adds the following information to every page:

```
<script>
<link rel="stylesheet" type="text/css"
 href="/userContent/mycss.css" /><script
 src="/userContent/myjavascript.js" type="text/javascript">
</script>
```

The JavaScript writes a heading near the top of the generated pages with `id="test"`. Triggering the cascading style sheet rule through the CSS locator `#test` adds the camera icon to the background.

The picture dimensions are not properly tailored for the top of the screen; they are trimmed by the browser. This is a problem you can solve later by experimenting.

The second CSS rule is triggered for `main-table`, which is part of the standard front page generated by Jenkins. The full camera icon is displayed there.

On visiting other parts of Jenkins, you will notice that the camera icon looks out of context and is oversized. You will need time to modify the CSS and JavaScript to generate better effects. With care and custom code, you can skin Jenkins to fit your corporate image.

CSS 3 quirks:

There are quirks in the support for the various CSS standards between browser types and versions. For an overview, please visit http://www.quirksmode.org/css/contents.html.

There's more...

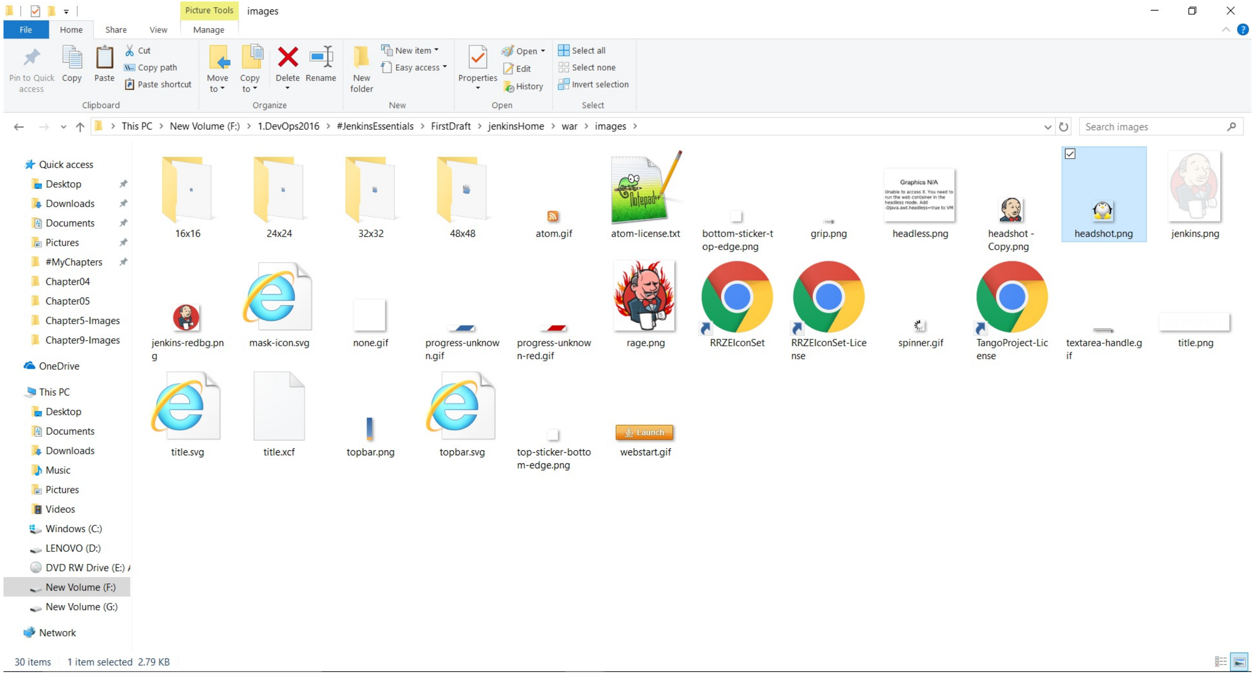
Here are a few more things for you to consider.

CSS 3

CSS 3 has a number of features. To draw a button around the header generated by JavaScript, change the `#test` section of the CSS file to the following code:

```
#test {
width: 180px; height: 60px;
background: red; color: yellow;
text-align: center;
  -moz-border-radius: 40px; -webkit-border-radius: 40px;
}
```

Using Firefox, the CSS rule generates the following button:



Images in JENKINS_HOME

For the impatient, you can download a CSS 3 cheat sheet at the Smashing Magazine website: http://coding.smashingmagazine.com/wp-content/uploads/images/css3-cheat-sheet/css3-cheat-sheet.pdf.

Included JavaScript library frameworks

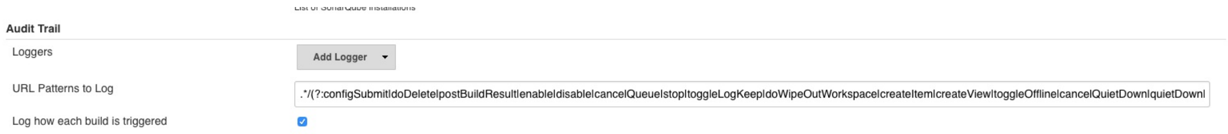
Jenkins uses the YUI library: http://yuilibrary.com/. Decorated in each HTML page, the core YUI library (/scripts/yui/yahoo/yahoo-min.js) is pulled in ready for reuse. However, many web developers are used to jQuery. You can include this library as well by installing the jQuery plugin (https://wiki.jenkins-ci.org/display/JENKINS/jQuery+Plugin). You can also consider adding your favorite JavaScript library to the Jenkins/scripts directory through a WAR overlay (refer to the next recipe).

Trust but verify

With great power comes great responsibility. If only a few administrators maintain your Jenkins deployment, then you can most likely trust everyone to add JavaScript with no harmful side effects. However, if you have a large set of administrators who use a wide range of Java libraries, then your maintenance and security risks increase rapidly. Consider your security policy and at least add the audit trail plugin (https://wiki.jenkins-ci.org/display/JENKINS/Audit+Trail+Plugin) to keep track of the actions.

This plugin adds an **Audit Trail** section in the main Jenkins configuration page. Here you can configure log location and settings (file size and number of rotating log files), and a URI pattern for requests to be logged. The default options select most actions with significant effect such as creating/configuring/deleting jobs and views or delete/save-forever/start a build. The log is written to disk as configured and recent entries can also be viewed in the Manage/System Log section.

Also, see the JobConfigHistory plugin for recording actual changes made to job configurations:



List of SonarQube installations

Audit Trail

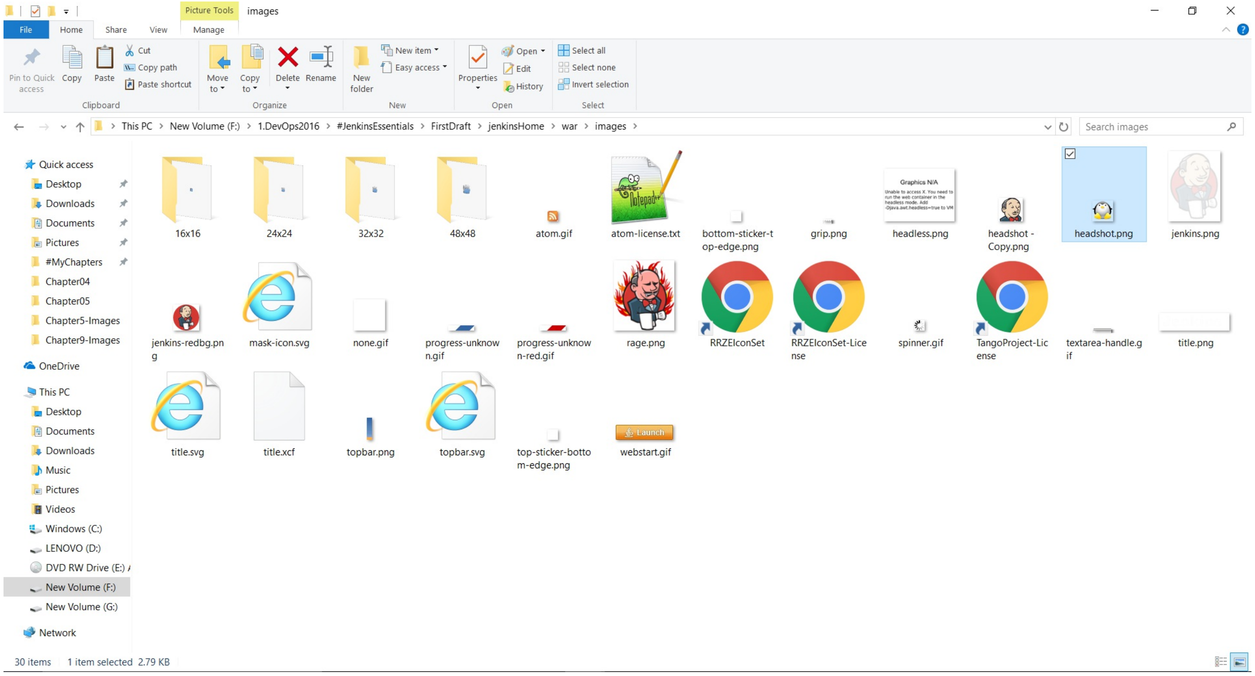
Loggers: Add Logger ▾

URL Patterns to Log: `.*/(?:configSubmit|doDelete|postBuildResult|enable|disable|cancelQueue|stop|toggleLogKeep|doWipeOutWorkspace|createItem|createView|toggleOffline|cancelQuietDown|quietDown|`

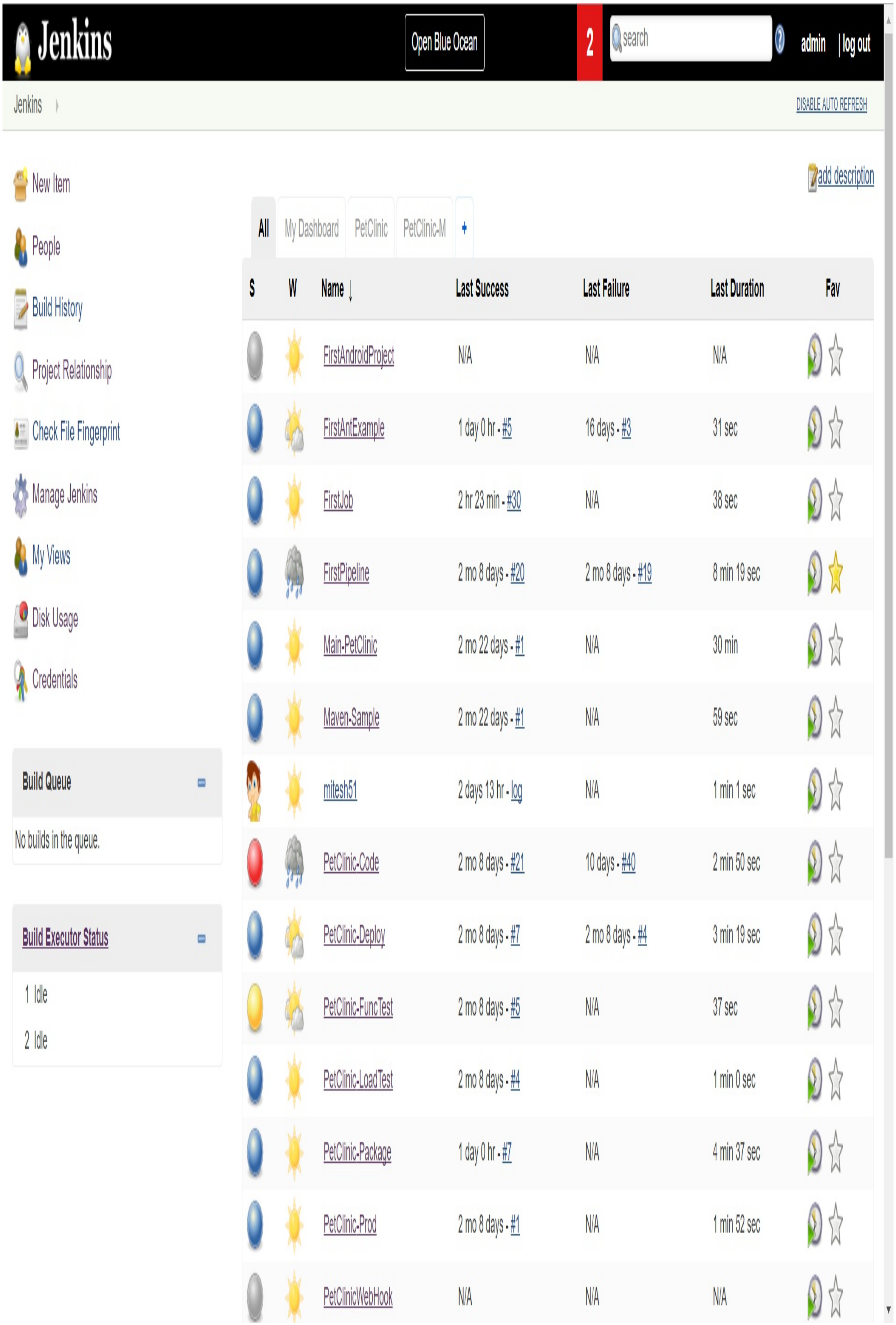
Log how each build is triggered: ☑

There's more

- To directly change any images or icon, you can go to JENKINS_HOME **|** war **|** images:



- Restart Jenkins and verify the changes:



- New Item
- People
- Build History
- Project Relationship
- Check File Fingerprint
- Manage Jenkins
- My Views
- Disk Usage
- Credentials

Build Queue

No builds in the queue.

Build Executor Status

1 Idle

2 Idle

add description

All | My Dashboard | PetClinic | PetClinic-M | +

S	W	Name ↓	Last Success	Last Failure	Last Duration	Fav
●	☀	FirstAndroidProject	N/A	N/A	N/A	☆
●	⛅	FirstAntExample	1 day 0 hr - #5	16 days - #3	31 sec	☆
●	☀	FirstJob	2 hr 23 min - #30	N/A	38 sec	☆
●	🌧	FirstPipeline	2 mo 8 days - #20	2 mo 8 days - #19	8 min 19 sec	★
●	☀	Main-PetClinic	2 mo 22 days - #1	N/A	30 min	☆
●	☀	Maven-Sample	2 mo 22 days - #1	N/A	59 sec	☆
	☀	mitesh51	2 days 13 hr - log	N/A	1 min 1 sec	☆
●	🌧	PetClinic-Code	2 mo 8 days - #21	10 days - #40	2 min 50 sec	☆
●	⛅	PetClinic-Deploy	2 mo 8 days - #7	2 mo 8 days - #4	3 min 19 sec	☆
●	⛅	PetClinic-FuncTest	2 mo 8 days - #5	N/A	37 sec	☆
●	☀	PetClinic-LoadTest	2 mo 8 days - #4	N/A	1 min 0 sec	☆
●	☀	PetClinic-Package	1 day 0 hr - #7	N/A	4 min 37 sec	☆
●	☀	PetClinic-Prod	2 mo 8 days - #1	N/A	1 min 52 sec	☆
●	☀	PetClinicWebHook	N/A	N/A	N/A	☆

See also

- The *Skinning and provisioning Jenkins using a WAR overlay* recipe
- The *Generating a home page* recipe

Skinning and provisioning Jenkins using a WAR overlay

This recipe describes how to overlay content onto the Jenkins WAR file. With a WAR overlay, you can change the Jenkins look and feel ready for corporate branding and content provisioning of home pages. The basic example of adding your own custom favicon.ico (the icon in your web browser's address bar) is used. It requires little effort to include more content.

Jenkins keeps its versions as dependencies in a Maven repository. You can use Maven to pull in the WAR file, expand it, add content, and then repackage. This enables you to provision resources such as images, home pages, the icon in the address bar called a fav icon, and `robots.txt` that affects how search engines look through your content.

Be careful, using a WAR overlay will be cheap if the structure and the graphical content of Jenkins do not radically change over time. However, if the overlay does break the structure, then you might not spot this until you perform detailed functional tests.

You can also consider minimal changes through a WAR overlay, perhaps only changing `favicon.ico`, adding images and `userContent`, then using the simple theme plugin (see the preceding recipe) to do the styling.

Getting ready

Create the directory named `CH9.communicating/war_overlay` for the files in this recipe.

How to do it...

1. Browse to the Maven repository at http://repo.jenkins-ci.org/releases/org/jenkins-ci/main/jenkins-war/ and review the Jenkins dependencies.

2. Create the following pom.xml file. Feel free to update to a newer Jenkins version:

```
<project xmlns="http://maven.apache.org/POM/4.0.0"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://maven.apache.org/POM/4.0.0
 http://maven.apache.org/maven-v4_0_0.xsd">
<modelVersion>4.0.0</modelVersion>
<groupId>nl.uva.berg</groupId>
<artifactId>overlay</artifactId>
<packaging>war</packaging>
<!-- Keep version the same as Jenkins as a hint -->
<version>1.437</version>
<name>overlay Maven Webapp</name>
<url>http://maven.apache.org</url>
<dependencies>
<dependency>
<groupId>org.jenkins-ci.main</groupId>
<artifactId>jenkins-war</artifactId>
<version>1.437</version>
<type>war</type>
<scope>runtime</scope>
</dependency>
</dependencies>
<repositories>
<repository>
 <id>Jenkins</id>
 <url>http://repo.jenkins-ci.org/releases</url>
 </repository>
</repositories>
</project>
```

3. Visit a favicon.ico generation website such as http://www.favicon.cc/. Following their instructions, create your own favicon.ico. Alternatively, use the example provided.
4. Add favicon.ico to the src/main/webapp location.
5. Create the directory src/main/webapp/META-INF and add a file named context.xml with the following line of code:

```
<Context logEffectiveWebXml="true" path="/"></Context>
```

6. In your top-level directory, run the following command:

```
mvnpackage
```

7. In the newly-generated target directory, you will see the WAR file overlay-1.437.war. Review the content verifying that you have modified favicon.ico.

8. (Optional) Deploy the WAR file to a local Tomcat server, verify, and browse the updated Jenkins server:

How it works...

Jenkins has its WAR files exposed through a central Maven repository. This allows you to pull in specific versions of Jenkins through standard Maven dependency management.

Maven uses conventions. It expects to find the content to overlay at `src/main/webapp`or`src/main/resources`.

The `context.xml` file defines certain behaviors for a web application such as database settings. In this example, the `logEffectiveWebXML` setting is asking Tomcat to log specific information on startup of the application (http://tomcat.apache.org/tomcat-7.0-doc/config/context.html). The setting was recommended in the Jenkins Wiki (https://wiki.jenkins-ci.org/display/JENKINS/Installation+via+Maven+WAR+Overlay). The file is placed in the `META-INF` directory as Tomcat picks up the settings here without the need for a server restart.

The `<packaging>war</packaging>` tag tells Maven to use the WAR plugin for packaging.

You used the same version number in the name of the final overlayed WAR as the original Jenkins WAR version. It makes it easier to spot if the Jenkins version changes. This again highlights that using conventions aids readability and decreases the opportunity for mistakes. When deploying from your acceptance environment to production, you should remove the version number.

In the `pom.xml` file, you defined http://repo.jenkins-ci.org/ as the repository in which to find Jenkins.

The Jenkins WAR file is pulled in as a dependency of type `war` and scope `runtime`. The runtime scope indicates that the dependency is not required for compilation, but is for execution. For more detailed information on scoping, review http://maven.apache.org/guides/introduction/introduction-to-dependency-mechanism.html#Dependency_Scope.

For further details about WAR overlays, review http://maven.apache.org/plugins/maven-war-plugin/index.html.

Avoiding work:

To limit maintenance effort, it is better to install extra content rather than replacing content that might be used elsewhere or by third-party plugins.

There's more...

There are a lot of details that you need to cover if you wish to fully modify the look and feel of Jenkins. The following sections mention some of the details.

Which types of content can you replace?

The Jenkins server deploys to two main locations. The first location is the core application and the second is the workspace, which stores information that changes. To gain a fuller understanding of the content, review the directory structure. A useful command in Linux is the `tree` command, which displays the directory structure. To install under Ubuntu, use the following command:

```
apt-get install tree
```

In Windows OS it's available by default in the Command Prompt.

For the Jenkins Ubuntu workspace, using the following command helps you to generate a tree view of the workspace:

```
tree -d -L 1 /var/lib/Jenkins
```

- `fingerprints`: This is the directory that is used to store checksums to uniquely identify files
- `jobs`: This stores job configuration and build results
- `plugins`: This is where plugins are deployed and usually configured
- `tools`: This is where tools such as Maven and Ant are deployed
- `updates`: This is used for updates
- `userContent`: The content is made available under the URL `/userContent`
- `users`: This is the user information displayed under the `/me` URL

The default Ubuntu location of the web app is `/var/run/jenkins/war`. If you are running Jenkins from the command line, then the option for placing the web app is as follows:

```
-webroot
```

- `css`: This is the location of Jenkins style sheets
- `executable`: This is used for running Jenkins from the command line
- `favicon.ico`: This is the icon we replaced in this recipe
- `help`: This is the directory with help content
- `images`: This includes the graphics in different sizes
- `META-INF`: This is the location for the manifest file and the`pom.xml` file that generated the WAR
- `robots.txt`: This is used to tell search engines where they are allowed to crawl
- `scripts`: This is the location of the JavaScript library
- `WEB-INF`: This is the main location for the servlet part of the web application
- `winstone.jar`: This is the servlet container available at http://winstone.sourceforge.net/

Search engines and robots.txt

If you are adding your own custom content, such as user home pages, company contact information, or product details, then consider modifying the top-level `robots.txt` file. At present, it excludes search engines from all content:

```
# we don't want robots to click "build" links
User-agent: *
Disallow: /
```

You can find the full details of the structure of the `robots.txt` at http://www.w3.org/TR/html4/appendix/notes.html#h-B.4.1.1.

Google uses richer structures that allow as well as disallow; refer to https://developers.google.com/webmasters/control-crawl-index/docs/robots_txt?csw=1.

The following `robots.txt` allows access by the Google crawler to the directory `/userContent/corporate/`. It is an open question whether all web crawlers will honor the intent.

```
User-agent: *
Disallow: /
User-agent: Googlebot
Allow: /userContent/corporate/
```

To help secure your Jenkins infrastructure, refer to the recipes in Chapter 3, *Managing Security*.

See also

- The *Skinning Jenkins with the simple themes plugin* recipe
- The *Generating a home page* recipe

Generating a home page

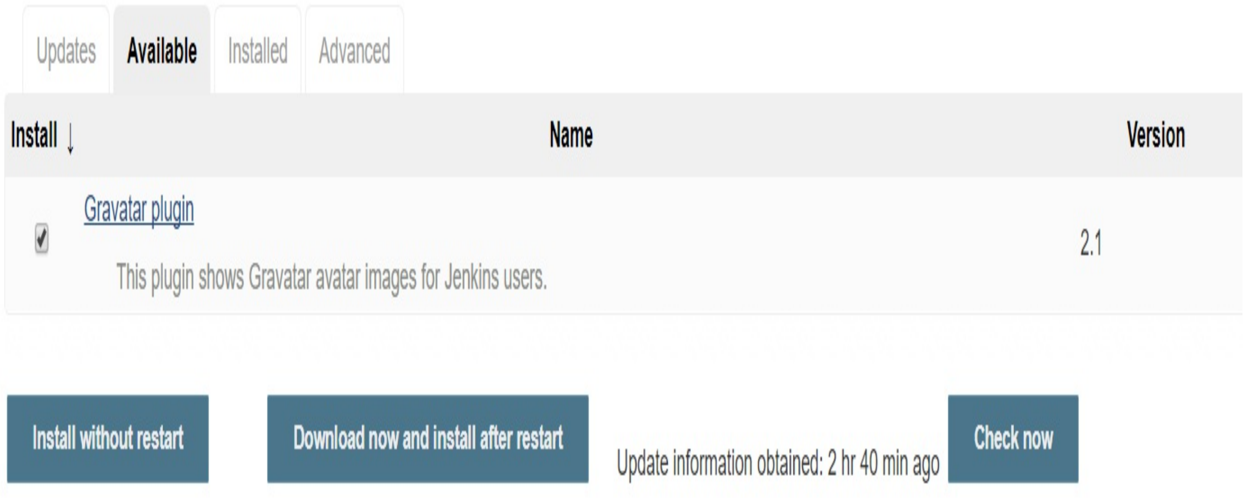
The user's home page is a great place to express your organization's identity. You can create a consistent look and feel that expresses your team's spirit.

This recipe will explore the manipulation of home pages found under the`/user/userid` directory and configured by the user through the `Jenkins/me` URL.

A similar plugin worth reviewing is the Gravatar plugin. You can find the plugin's home page at https://wiki.jenkins-ci.org/display/JENKINS/Gravatar+plugin.

Getting ready

Install the `Avatar` plugin (https://wiki.jenkins-ci.org/display/JENKINS/Avatar+Plugin):



Install ↓	Name	Version
☑	Gravatar plugin This plugin shows Gravatar avatar images for Jenkins users.	2.1

Update information obtained: 2 hr 40 min ago

How to do it...

1. Install the plugin on a Jenkins and it will automatically show Gravatars for the users that has an email and a Gravatar. No configuration is required except installing the plugin.

Creating HTML reports

The left-hand side menu of a job's dashboard is valuable real estate. The developer's eyes naturally scan this area. This recipe describes how you can add a link from a custom HTML report to the menu, getting the report noticed more quickly.

Getting ready

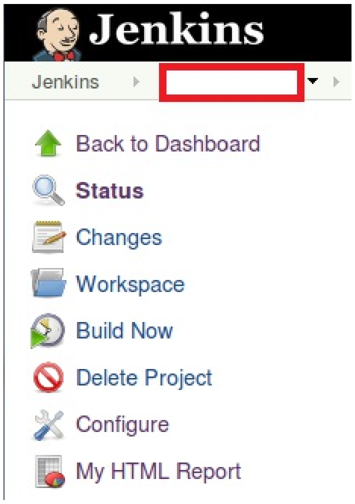
Install the HTML publisher plugin (https://wiki.jenkins-ci.org/display/JENKINS/HTML+Publisher+Plugin). We assume that you have a subversion repository with the Packt code committed.

How to do it...

1. Create a free-style software project and name it `CH9.html_report`.
2. Under the Source Code Management section, click on Subversion.
3. Under the Modules section, add `Repo/CH9.communicating/html_report` to Repository URL, where `Repo` is the URL to your subversion repository.
4. Under the Post-build Actions section, check Publish HTML reports. Add the following details:

    - HTML directory to archive: `target/custom_report`
    - Index pages[s]: `index.html`
    - Report title: `My HTML Report`
    - Tick the Keep past HTML reports checkbox

5. Click on Save.
6. Run the job and review the left-hand side menu. You will now see a link to your report, as shown in the following screenshot:



How it works...

Your subversion repo contains an `index.html` file that is pulled into the workspace of the job. The plugin works as advertised and adds a link pointing to the HTML report. This allows your audience to efficiently find your custom-generated information.

There's more...

The example report is shown as follows:

```
<html><head><title>Example Report</title>
<link rel="stylesheet" type="text/css" href="/css/style.css" /></head>
<body>
<h2>Generated Report</h2>
Example icon: <img title="A Jenkins Icon" alt="Schedule a build" src="/images/24x24/clock.png"
/>
</body></html>
```

It pulls in the main Jenkins style sheet `/css/style.css`.

It is possible that when you update a style sheet in an application, you do not see the changes in your browser until you have cleaned your browser cache. Jenkins gets around this latency issue in a clever way. It uses a URL with a unique number that changes with each Jenkins version. For example, for the `css` directory, you have two URLs:

- `/css`
- `/static/uniquenumber/css`

Most Jenkins URLs use the latter form. Consider doing so for your style sheets.

The unique number changes per version, so you will need to update the URL for each upgrade

When running the site goal in a Maven build, a local website is generated (http://maven.apache.org/plugins/maven-site-plugin). This website has a fixed URL inside the Jenkins job that you can point at with the My HTML Report link. This brings documentation such as test results within easy reach.

See also

- The *Efficient use of views* recipe
- The *Saving screen space with the Dashboard View plugin* recipe

Efficient use of views

Jenkins' addictive ease of configuration lends itself to creating a large number of jobs. This increases the volume of information exposed to developers. Jenkins needs to avoid chaos by utilizing browser space efficiently. One approach is to define minimal views. In this recipe, you will use the `DropDownViewsTabBar` plugin. It removes views as tabs and replaces the tabs with one select box. This aids in quicker navigation. You will also be shown how to provision lots of jobs quickly using a simple HTML form generated by a script.

In this recipe, you will be creating a large number of views that you may want to delete later. If you are using a virtual box image, consider cloning the image and deleting it after you have finished.

Getting ready

Install the `DropDownViewsTabBar` plugin (https://wiki.jenkins-ci.org/display/JENKINS/DropDown+ViewsTabBar+Plugin).

How to do it...

1. Copy and paste the following Perl script into an executable file named `create.pl`:

```
#!/usr/bin/perl
$counter=0;
$end=20;
$host='http://localhost:8080';
while($end > $counter){
  $counter++;
print "<form action=$host/createItem?mode=copy
 method=POST>\n";print "<input type=text name=name
 value=CH9.fake.$counter>\n";
print "<input type=text name=from value=Template1 >\n";
print "<input type=submit value='Create
 CH9.fake.$counter'>\n";
print "</form><br>\n";
print "<form action=$host/job/CH9.fake.$counter/doDelete
 method=POST>\n";print "<input type=submit value='Delete
 CH9.fake.$counter'>\n";
print "</form><br>\n";
}
```

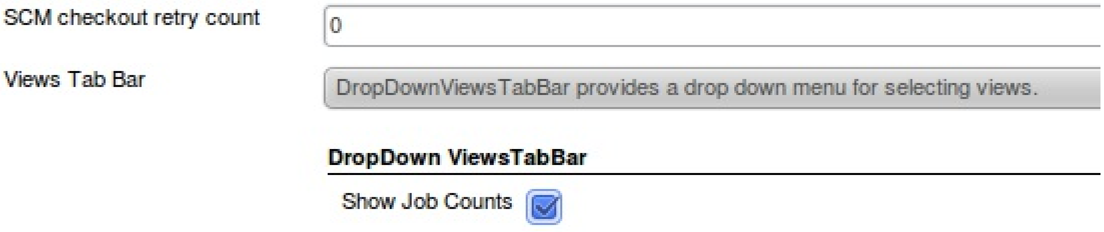
2. Create an HTML file from the output of the Perl script, for example:

```
perl create.pl > form.html
```

3. In a web browser, as an administrator, log in to Jenkins.
4. Create the `Template1` job, adding any details you wish. This is your template job that will be copied into many other jobs.
5. Load `form.html` into the same browser.
6. Click on one of the Create CH9.fake buttons. Jenkins returns an error message:

```
HTTP ERROR 403
 Problem accessing /createItem. Reason:
No valid crumb was included in the request
```

7. Visit Configure Global Security on `http://localhost:8080/configureSecurity` and uncheck the Prevent Cross Site Request Forgery exploits box.
8. Click on Save.
9. Click on all of the Create CH9.fake buttons.
10. Visit the front page of Jenkins and verify that the jobs have been created and are based on the `Template1` job.
11. Create a large number of views with a random selection of jobs. Review the front page, noting the chaos.
12. Visit the configuration screen /configure; selecting DropDownViewsTabBar provides a drop-down menu for selecting views in the View Tab Bar select box. In the DropDown ViewsTabBar subsection, check the Show Job Counts box, as shown in the following screenshot:



SCM checkout retry count: 0

Views Tab Bar: DropDownViewsTabBar provides a drop down menu for selecting views.

DropDown ViewsTabBar

Show Job Counts ☑

13. Click on the Save button:
14. In Jenkins, visit Configure Global Security at `http://localhost:8080/configureSecurity` and check the Prevent Cross Site Request Forgery exploits box.
15. Click on Save.

How it works...

The form works as long as the bread crumbing security feature in Jenkins is turned off. The feature, when turned on, generates a random number that the form has to return when you submit. This allows Jenkins to know that the form is part of a valid conversation with the server. The HTTP status error generated is in the 4xx range, which implies that the client input is invalid. If Jenkins returned a 5xx error, then that would imply a server error. We therefore had to turn the feature off when submitting our own data. We do not recommend this in a production environment.

Once you have logged in to Jenkins as an administrator, you can create jobs. You can do this through the GUI or by sending POST information. In this recipe, we copied a job named `Template1` to new jobs starting with the name `CH9.fake`, as shown in the following code:

```
<form action=http://localhost:8080/createItem?mode=copy
 method=POST>
<input type=text name=name value=CH9.fake.1>
<input type=text name=from value=Template1 >
<input type=submit value='Create CH9.fake.1'>
</form>
```

The `POST` variables you used were `name` for the name of the new job, and `from` for the name of your template job. The URL for the `POST` action is `/createItem?mode=copy`.

To change the hostname and port number, you will have to update the `$host` variable found in the Perl script.

To delete a job, the Perl script generated forms with actions pointing to `/job/Jobname/doDelete` (for example, `/job/CH9.fake.1/doDelete`). No extra variables were needed.

To increase the number of form entries, you can change the variable `$end` from `20`.

There's more...

Jenkins uses a standard library, Stapler (http://stapler.kohsuke.org/what-is.html), to bind services to URLs. Plugins also use Stapler. When you install plugins, the number of potential actions also increases. This means that you can activate a lot of actions through HTML forms similar to this recipe. You will learn in Chapter 7, *Exploring Plugins*, that writing binding code to Stapler requires minimal effort.

See also

- The *Saving screen space with the Dashboard View plugin* recipe

Saving screen space with the Dashboard View plugin

In the *Efficient use of views* recipe, you discovered that you can save horizontal tab space using the `Views` plugin. In this recipe, you will use the `Dashboard View` plugin to condense the use of the horizontal space. Condensing the horizontal space aids in assimilating information efficiently.

The `Dashboard View` plugin allows you to configure areas of a view to display specific functionality, for example, a grid view of the jobs or an area of the view that shows the subset of jobs failing. The user can drag and drop the areas around the screen.

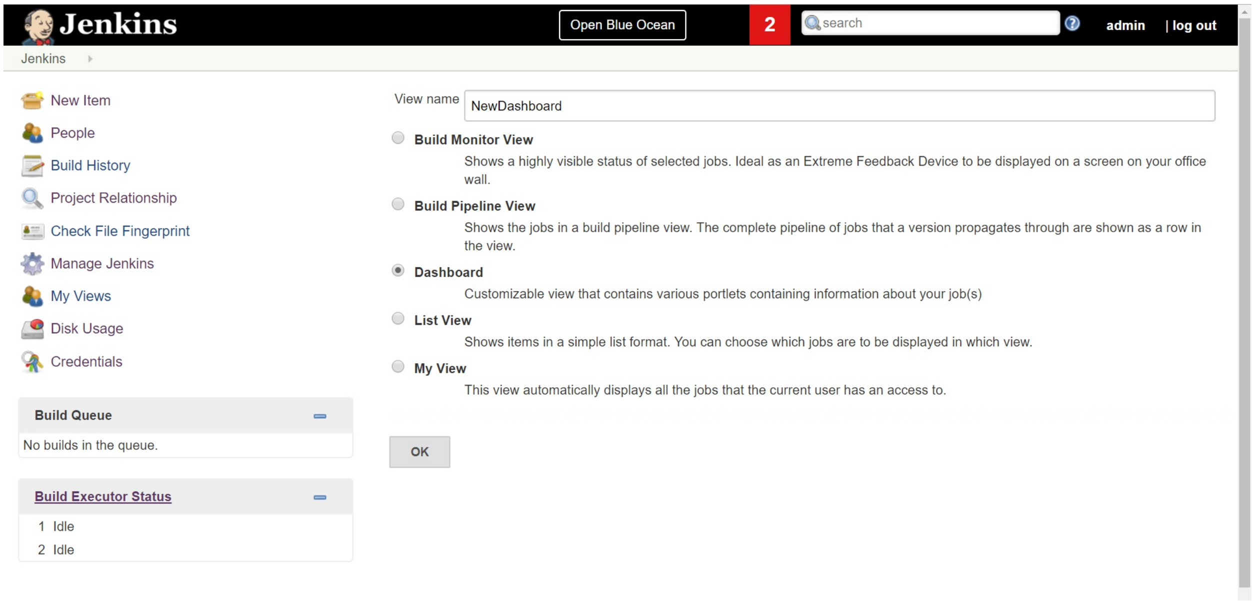
The developers have made the dashboard easily extensible, so expect more choices later.

Getting ready

Install the `Dashboard View` plugin (https://wiki.jenkins-ci.org/display/JENKINS/Dashboard+View). Either create a few jobs by hand or use the HTML form that provisioned jobs in the last recipe.

How to do it...

1. The `Dashboard View` plugin divides up the screen into areas. During dashboard configuration, you choose the jobs grid and the unstable job portlets. Other dashboard portlets include a jobs list, latest builds, slave statistics, test statistics chart or grid, and the test trend chart. There will be more choices as the plugin matures.
2. As a Jenkins administrator, log in to the home page of your Jenkins instance.
3. Create a new view by clicking on the plus sign in the second tab at the top of the screen.
4. Choose the Dashboard view.
5. Click on OK:



View name NewDashboard

○ **Build Monitor View**
Shows a highly visible status of selected jobs. Ideal as an Extreme Feedback Device to be displayed on a screen on your office wall.

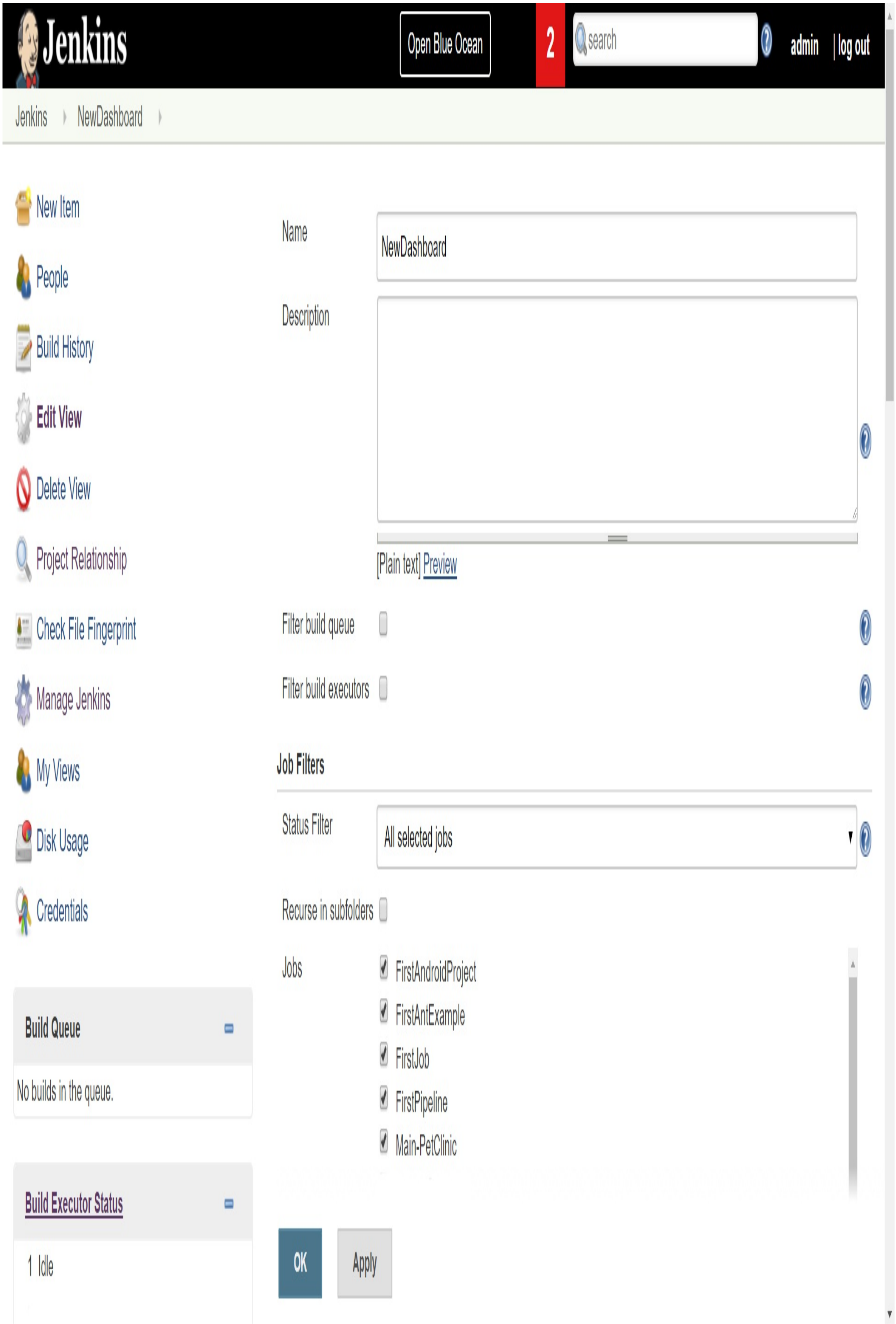
○ **Build Pipeline View**
Shows the jobs in a build pipeline view. The complete pipeline of jobs that a version propagates through are shown as a row in the view.

● **Dashboard**
Customizable view that contains various portlets containing information about your job(s)

○ **List View**
Shows items in a simple list format. You can choose which jobs are to be displayed in which view.

○ **My View**
This view automatically displays all the jobs that the current user has an access to.

6. Select Jobs in Job Filters:



Name: NewDashboard

Description:

[Plain text] Preview

Filter build queue □

Filter build executors □

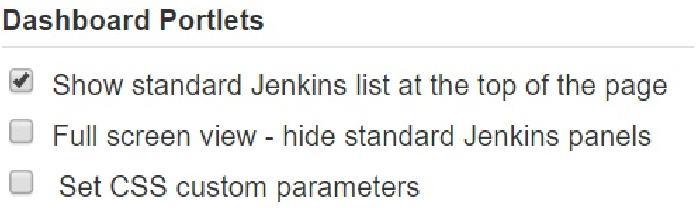
Job Filters

Status Filter: All selected jobs

Recurse in subfolders □

Jobs
☑ FirstAndroidProject
☑ FirstAntExample
☑ FirstJob
☑ FirstPipeline
☑ Main-PetClinic

7. Select the Dashboard Portlets:



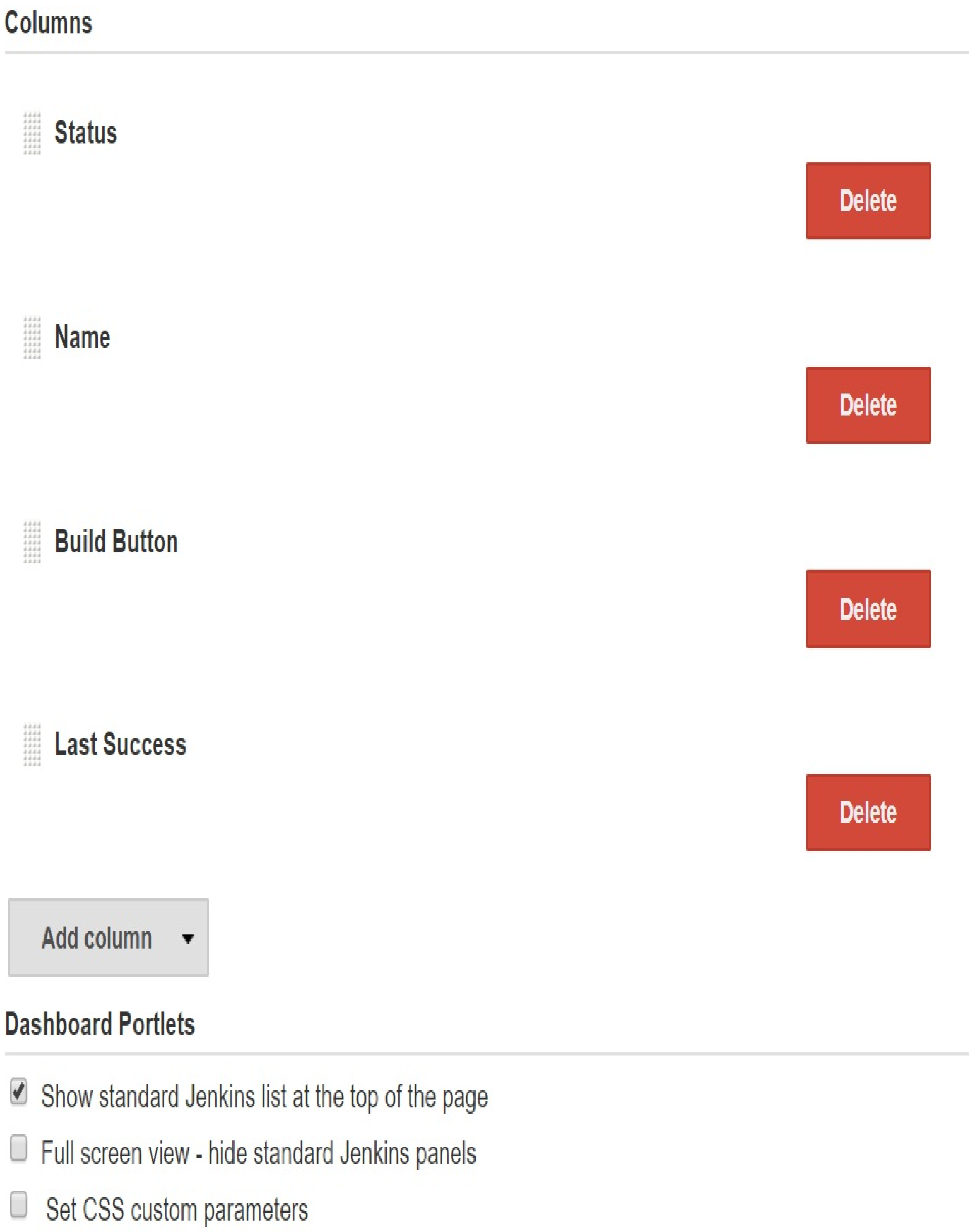
Dashboard Portlets

☑ Show standard Jenkins list at the top of the page

□ Full screen view - hide standard Jenkins panels

□ Set CSS custom parameters

8. Add or remove columns to keep in Dashboard view:



Columns

Status

Name

Build Button

Last Success

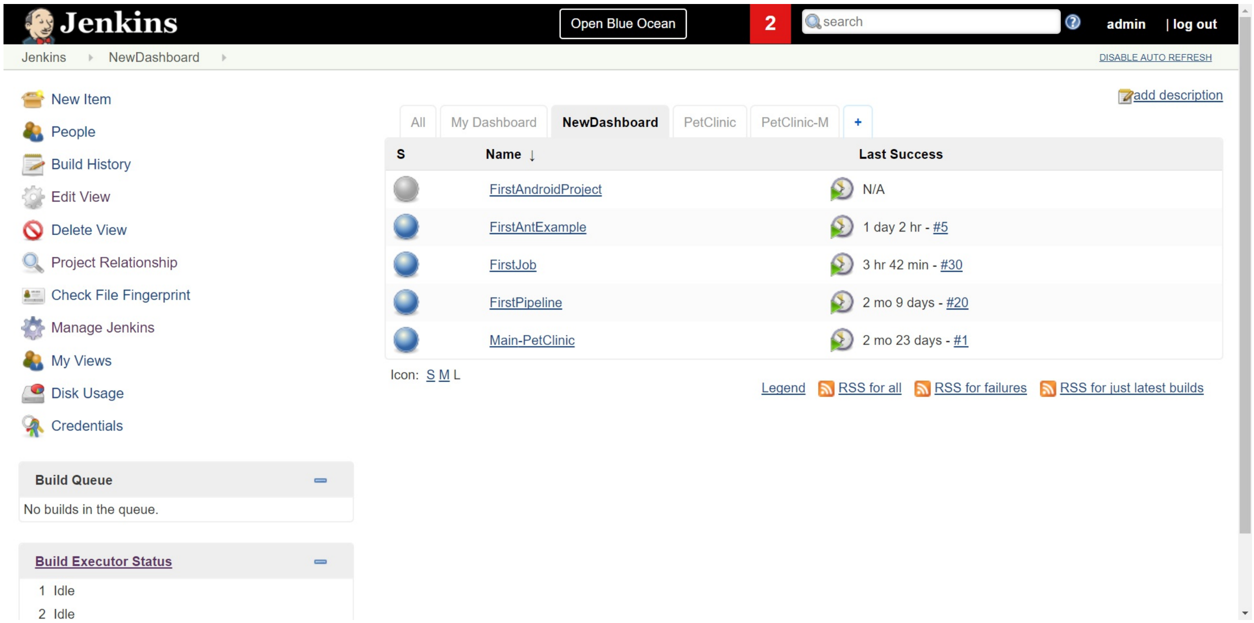
Dashboard Portlets

☑ Show standard Jenkins list at the top of the page

☐ Full screen view - hide standard Jenkins panels

☐ Set CSS custom parameters

9. Click on Save and verify the New Dashboard view:



S	Name ↓	Last Success
●	FirstAndroidProject	N/A
●	FirstAntExample	1 day 2 hr - #5
●	FirstJob	3 hr 42 min - #30
●	FirstPipeline	2 mo 9 days - #20
●	Main-PetClinic	2 mo 23 days - #1

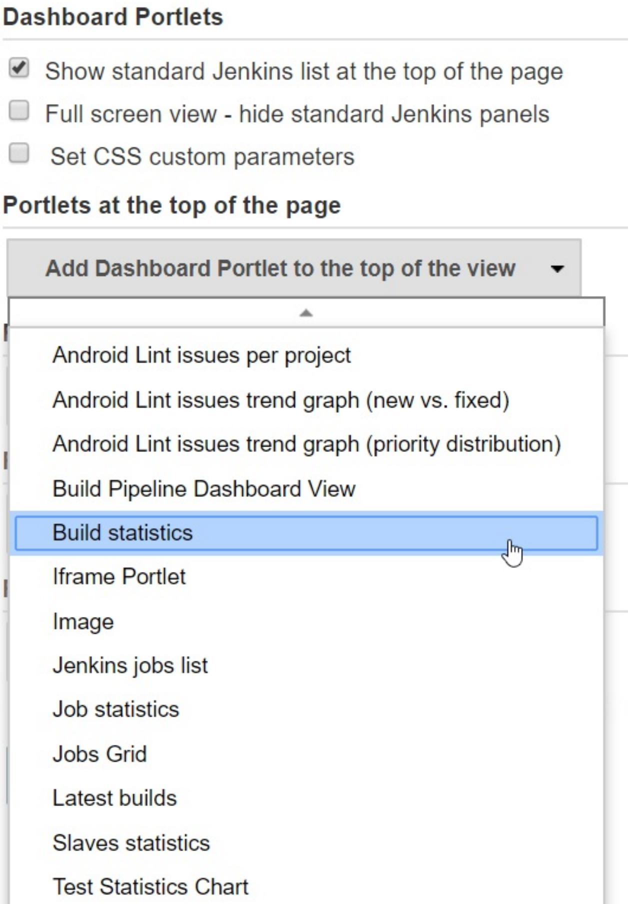
Build Queue

No builds in the queue.

Build Executor Status

1 Idle
2 Idle

10. You can add Dashboard Portlets in different sections of the page:


Dashboard Portlets

☑ Show standard Jenkins list at the top of the page

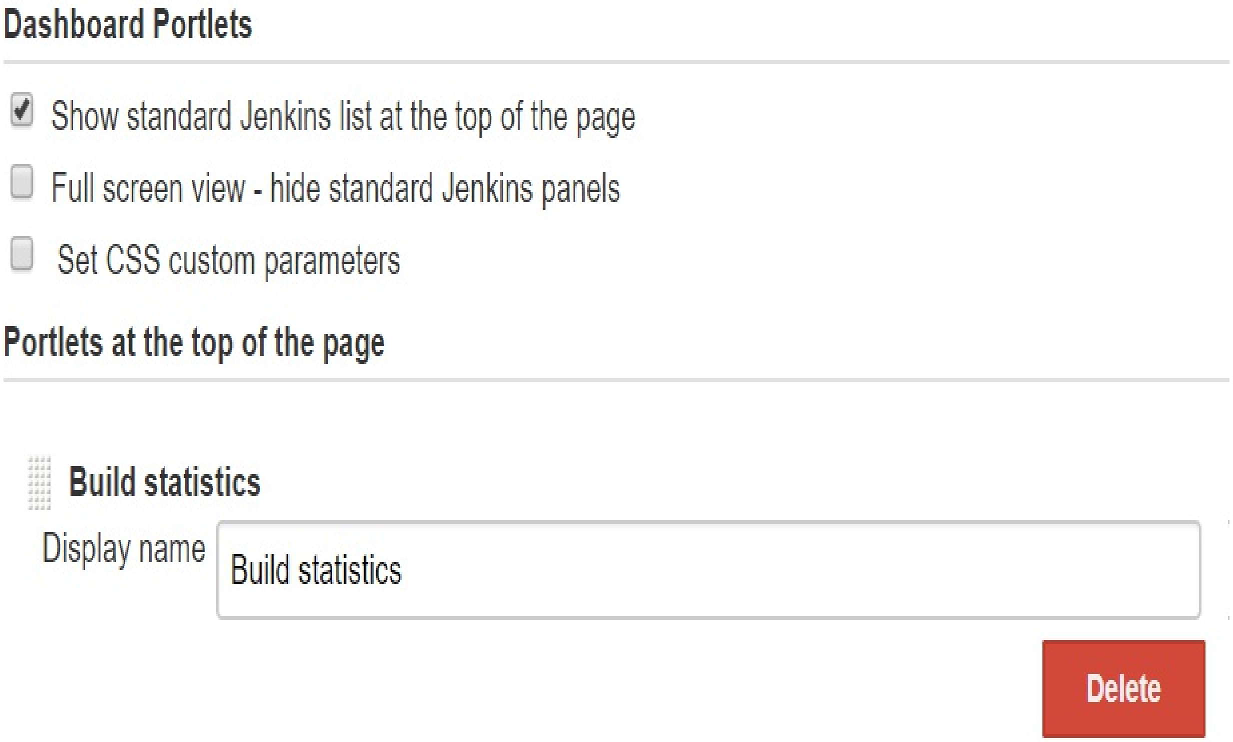
☐ Full screen view - hide standard Jenkins panels

☐ Set CSS custom parameters

Portlets at the top of the page

Add Dashboard Portlet to the top of the view
Android Lint issues per project
Android Lint issues trend graph (new vs. fixed)
Android Lint issues trend graph (priority distribution)
Build Pipeline Dashboard View
Build statistics
Iframe Portlet
Image
Jenkins jobs list
Job statistics
Jobs Grid
Latest builds
Slaves statistics
Test Statistics Chart

11. Select the Build statistics portlet and Save:



Dashboard Portlets

☑ Show standard Jenkins list at the top of the page

□ Full screen view - hide standard Jenkins panels

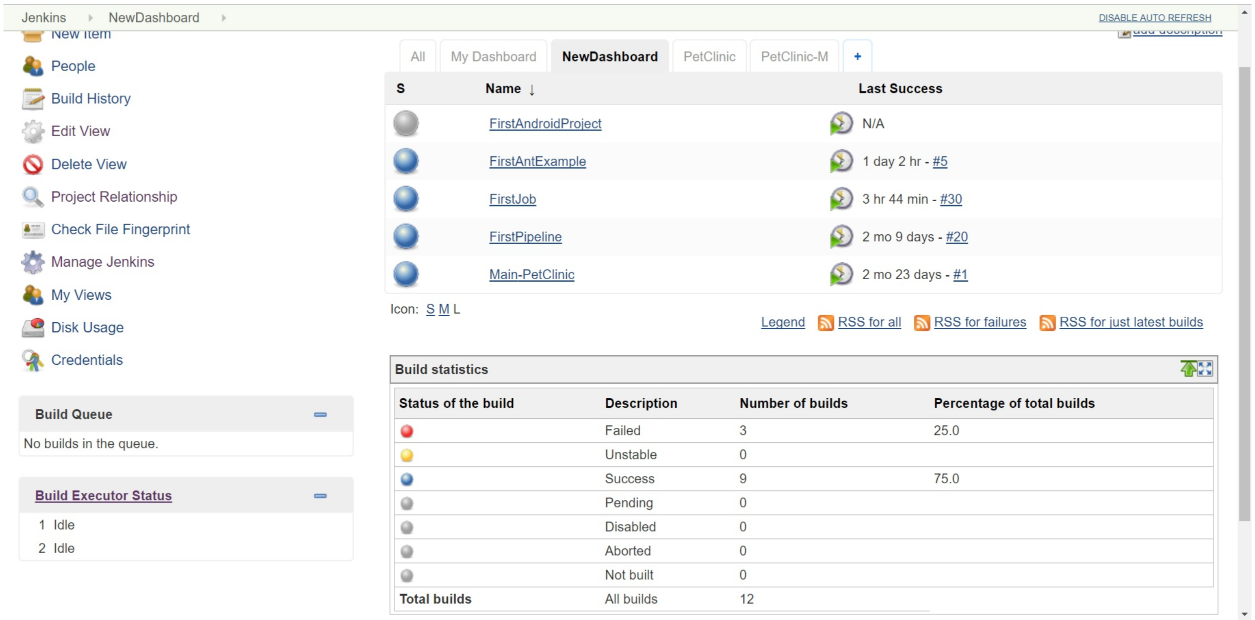
□ Set CSS custom parameters

Portlets at the top of the page

Build statistics

Display name: Build statistics

12. Verify the new portlet after saving the configuration in the Jenkins dashboard:



Jenkins ▸ NewDashboard ▸ DISABLE AUTO REFRESH

New Item

People

Build History

Edit View

Delete View

Project Relationship

Check File Fingerprint

Manage Jenkins

My Views

Disk Usage

Credentials

add description

All | My Dashboard | **NewDashboard** | PetClinic | PetClinic-M | +

S	Name ↓	Last Success
●	FirstAndroidProject	N/A
●	FirstAntExample	1 day 2 hr - #5
●	FirstJob	3 hr 44 min - #30
●	FirstPipeline	2 mo 9 days - #20
●	Main-PetClinic	2 mo 23 days - #1

Icon: S M L

Legend RSS for all RSS for failures RSS for just latest builds

Build Queue

No builds in the queue.

Build Executor Status

1 Idle

2 Idle

Build statistics

Status of the build	Description	Number of builds	Percentage of total builds
●	Failed	3	25.0
●	Unstable	0	
●	Success	9	75.0
●	Pending	0	
●	Disabled	0	
●	Aborted	0	
●	Not built	0	
Total builds	All builds	12	

The Job grid portlet saves space compared to other views, as the density of jobs displayed is high.

If you are also using the Many Views tab (see the preceding recipe) there is a little glitch. When you click on the dashboard tag, the original set of views is displayed rather than the select box.

There's more...

The Dashboard plugin provides a framework for other plugin developers to create dashboard views. One example of this type of usage is the `Project Statistics` plugin (https://wiki.jenkins-ci.org/display/JENKINS/Project+Statistics+Plugin).

See also

- The *Creating HTML reports* recipe
- The *Efficient use of views* recipe

Making noise with HTML5 browsers

This recipe describes how to send a custom sound to a Jenkins user's browser when an event occurs, such as a successful build. You can also send sound messages at arbitrary times. Not only is this good for developers who enjoy being shouted at, sang at by famous actors, and so on, but also for system administrators who are looking for a computer in a large server farm.

Getting ready

Install the Jenkins sounds plugin (https://wiki.jenkins-ci.org/display/JENKINS/Jenkins+Sounds+plugin). Make sure that you have a compliant web browser installed, such as a current version of Firefox or Chrome.

For more details of HTML5 compliancy in browsers, consider reviewing: http://en.wikipedia.org/wiki/Comparison_of_layout_engines_%28HTML5%29.

How to do it...

1. Log in as a Jenkins administrator and visit the Configure System screen `/configure`.
2. Under the Jenkins Sound section, check Play through HTML5 Audio enabled Browser.

If Jenkins has problems finding the sound archive with an error message such as `File not found 'file:/C:/Users/Alan/.jenkins/jar:file:/C:/Users/Alan/.jenkins/plugins/sounds/WEB-INF/lib/classes.jar/sound-archive.zip'`, then unzip the `classes.jar` file and move the `sounds-archive.zip` file to the same directory mentioned in the error message. Finally, point the configuration to the archive, for example, `file:/C:/Users/Alan/.jenkins/plugins/sounds/WEB-INF/lib/sound-archive.zip`.

3. Click on the Save button.
4. Select the Job creation link found on the Jenkins home page.
5. Create a New Job with the Job name `ch4.sound`.
6. Select Build a free-style software project.
7. Click on OK.
8. In the Post-build Actions section, check the Jenkins Sounds option.
9. Add two sounds: EXPLODE and doh.
10. Click on Save.
11. Click on the Build now link.
12. On success, your browser will play the `EXPLODE` wav file.
13. Edit your job so that it fails, for example, by adding a non-existent source code repository.
14. Build the job again. On failure, your web browser will play the `doh` wav file.

How it works...

You have successfully configured your job to play different sounds based on the success or failure of the build.

You can refine how the plugin reacts further by configuring which event transitions will trigger a sound, for example, if the previous build result was a failure and the current build result is a success. This is defined in the For previous build result set of checkboxes.

The plugin works as a page decorator. It adds the following JavaScript that asynchronously polls for new sounds. Your browser is doing the majority of the work, freeing server resources:

```
<script src="/sounds/script"
 type="text/javascript"></script><script type="text/javascript"
 defer="defer">function _sounds_ajaxJsonFetcherFactory(onSuccess,
 onFailure) {
return function() {
newAjax.Request("/sounds/getSounds", {
parameters: { version: VERSION },
onSuccess: function(rsp) {
onSuccess(eval('x='+rsp.responseText))
      },
onFailure: onFailure
    });
  }
}
if (AUDIO_CAPABLE) {
    _sounds_pollForSounds(_sounds_ajaxJsonFetcherFactory);
}</script>
```

There's more...

The sound plugin also allows you to stream arbitrary sounds to connected web browsers. Not only is this useful for practical jokes and motivational speeches directed at your distributed team, you can also perform useful actions such as a 10-minute warning alert before restarting a server.

You can find some decent sound collections at http://www.archive.org/details/opensource_audio.

For example, you can find a copy of the One Laptop per Child music library at http://www.archive.org/details/OpenPathMusic44V2. Within the collection, you will discover `shenai.wav`. First, add the sound somewhere on the internet where it can be found. A good place is the Jenkins `userContent` directory. To play the sound on any connected web browser, you will need to visit the trigger address (replacing `localhost:8080` with your own address):

```
http://localhost:8080/sounds/playSound?src=http://localhost:8080/userContent/shenai.wav
```

See also

- The *Keeping in contact with Jenkins through Firefox* recipe in Chapter 1, *Getting Started with Jenkins*

An extreme view for reception areas

Agile projects emphasize the role of communication over the need to document. Information radiators aid in returning feedback quickly. Information radiators have two main characteristics: they change over time and the data presented is easy to digest.

The `eXtreme Feedback Panel` plugin is one example of an information radiator. It is a highly visual Jenkins view. If the layout is formatted consistently and displayed on a large monitor, it is ideal for the task. Consider this also as a positive advertisement of your development process. You can display it behind your reception desk or in a well-visited social area such as near the coffee machine or project room.

In this recipe, you will add the `eXtreme Feedback Panel` plugin and modify its appearance through HTML tags in the description.

Getting ready

Install the `eXtreme Feedback Panel` plugin (https://wiki.jenkins-ci.org/display/JENKINS/eXtreme+Feedback+Panel+Plugin).

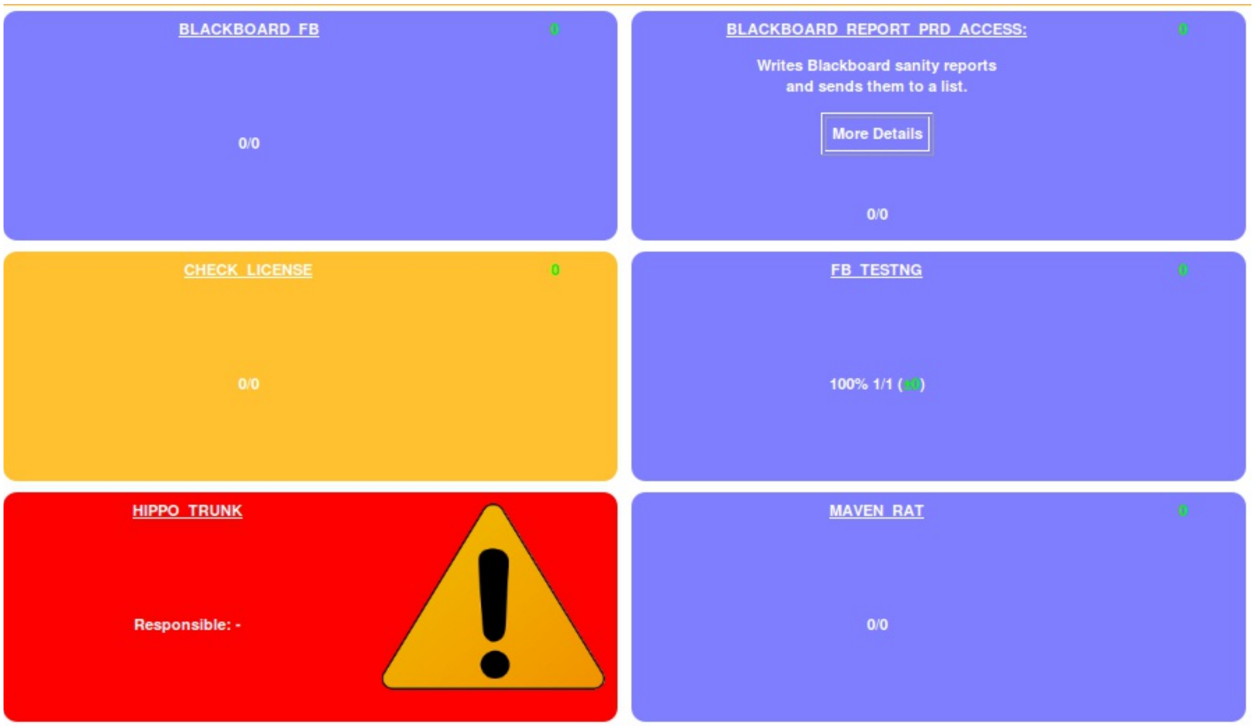
How to do it...

1. Create a job with a descriptive name such as `Blackboard Report Pro Access` and add the following description:

```
<center>
<p>Writes Blackboard sanity reports<br>
and sends them to a list.
<table border="1" class="myclass"><tr><td>More Details</td></tr></table>
</center>
```

2. Create a new view (`/newView`) named `eXtreme`. Check the eXtremeFeedBack Panel and then click on OK.
3. Select 6-24 already created jobs, including the one previously created in this recipe.
4. Set the number of columns as 2.
5. Select the refresh time in seconds as 20.
6. Click on Show Job descriptions.
7. Click on OK.

8. Experiment with the settings (especially the pixel size of the fonts). Optimizing the view depends on the monitors used and the distance from the monitor that the audience view at, as shown in the following screenshot:



Writes Blackboard sanity reports
and sends them to a list.

How it works...

Setting up and running this information radiator was easy. The results deliver a beautifully rendered view of the dynamics of your software process.

Setting the refresh rate to 20 seconds is debatable. A long delay between updates dulls the viewer's interest.

You have written one description that is partially formatted in the extreme view, but HTML escaped in the jobs configuration page and elsewhere in Jenkins. You can see that the information area is easier to digest than the other projects. This highlights the need to write consistent descriptions that follow in-house conventions, following a certain length to fit naturally on the screen. A longer, more descriptive name for a job helps the viewer understand the job's context better.

A shortcut to configuring views is through the URL `http://localhost:8080/view/Jobname/configure`, replacing any spaces in `Jobname` with `%20`.

There's more...

Information radiators are fun and take a rich variety of shapes and forms. From different views displayed in large monitors, to USB sponge missile firing and abuse from the voices of famous actors (see the *Making noise with HTML5 browsers* recipe).

A number of example electronic projects worth exploring in Jenkins are given as follows:

- **Lava Lamps**: https://wiki.jenkins-ci.org/display/JENKINS/Lava+Lamp+Notifier
- **USB missile launcher**: https://github.com/codedance/Retaliation
- **Traffic lights**: http://code.google.com/p/hudsontrafficlights/

Remember, let's be careful out there.

See also

- The *Saving screen space with the Dashboard View plugin* recipe
- The *Making noise with HTML5 browsers* recipe

Processes that Improve Quality

Quality assurance requires that the experts pay attention to a wide range of details. Rather than being purely technical, many of these details relate to human behavior. This chapter mentions both the soft skills needed to run successful projects and the configuration skills codified in the recipes of this book. Here are a few hard-learned observations.

Culture and collaboration

- DevOps is a cultural movement and it is all about changing the culture of an organization to make the processes more effective and to make people more productive with the use of tools.
- Culture of an organization is the key to success. Over the years, templates, best practices, and patterns are created in the organizations considering the resource capabilities, environment, and many other factors. If the culture of an organization can adapt to change, then it is a blessing in a dynamic environment of today's day and age.
- If the culture of an organization supports knowledge sharing and collaboration, then it not only creates robust assets that can be utilized over and over, but it also creates scopes of innovation and applies them across different business units.
- Planning for processes to setup Continuous Development, Continuous Integration, Continuous Testing, and Continuous Deployment require collaboration across different stakeholders for better implementation and effective results.

Fail early or fail faster

It is always better to avoid or prevent problems rather than solving them later in a situation where lot of things are at stake and the cost interms of price, reputation, and market scenario is much harder to deal with. The later in the software life cycle you correct a problem, the costlier it will prove to be. Failing early is significantly cheaper than failing later. Continuous Integration allows you to automatically fail software early. Adding extra tests through plugins or connected cloud services gives greater opportunity to face your issues early, improving quality and decreasing costs. Embrace acknowledging issues because you are saving time and money. Failing later in the project creates a situation of no point of return. Even in case of infrastructure provisioning, cloud computing has changed a scenario. Because of pay-as-you-go billing models, organizations and SMBs can also afford resources that they wouldn't have dreamt of earlier. You can use the same type of resources in Dev and Test environments for a specific amount of time and you know exactly what kind of issues will take place and how to solve them. Environment is going to be same in production as well, and hence you won't have to deal with any major issues later in the application development life cycle because you have already faced these issues and you are very well aware how to deal with them quickly.

Often, the experience of failing early helps to create a framework or best practices that not only solves the issues but also makes the overall scenario more robust and leads to the creation of design patterns of specific solutions.

Data-driven testing

You can efficiently cover your testing surface if you use a data-driven testing approach. For example, when writing JMeter test plans, you can use the CSV configuration element to read in variables from text files. This allows JMeter to read out parameters from your CSV files, such as hostname, and transverse your infrastructure. This enables one test plan to attack many servers. The same is true for SoapUI; by adding an Excel data source and looping through the rows, you can test an application with many different test users who each have a range of roles. Data-driven testing has a tendency to be maintainable. During refactoring, instead of changing your test plan as the URLs in your application change, you can factor the URLs out into CSV files.

Learning from history

Teams tend to have their own coding habits and this varies from organization to organization because of the tools they use and coding standards they follow. If a project fails because of the quality of the code, try to work out which code metrics would have stopped the code reaching production. Which mistakes are seen repeatedly? Take a look at the following examples:

- **Friday afternoon code failure**: We all are human and have secondary agendas. By the end of the week, programmers may have their minds focused elsewhere other than on the code. A small subset of programmers have their code quality affected, consistently injecting more defects toward the tail end of their roster. Consider scheduling a weekly Jenkins job that has harsher thresholds for quality metrics near the time of least attention.
- **Code churn**: A sudden surge in code commits just before a product is being moved from an acceptance environment to product indicates that there is a last-minute rush. For some teams with a strong sense of code quality, this is also a sign of extra vigilance. For other less-disciplined teams, this could be a naïve push toward destruction. If a project fails and QA is overwhelmed due to a surge of code changes, look at setting up a warning Jenkins job based on commit velocity. If necessary, you can display your own custom metrics.
- **A rogue coder**: Not all developers create code of the same uniform high quality. It is possible that there is consistent underachievement within a project. Rogue coders are caught by human code review. However, for a secondary defense, consider setting thresholds on static code review reports from SonarQube, FindBugs, and PMD. If a particular developer is not following accepted practice, builds will fail with great regularity.
- **The GUI does not make sense**: Isn't it painful when you build a web application only to be told at the last moment that the GUI does not quite interact in the way that the product owner expected? One solution is to write a mockup in FitNesse and surround it with automatic functional tests, using fixtures. When the GUI diverges from the planned workflow, then Jenkins will start shouting.
- **Tracking responsibility**: Mistakes are made and lessons need to be learned. However, if there is no clear chain of documented responsibility, it is difficult to pin down who needs the learning opportunity. One approach is to structure the workflow in Jenkins through a series of connected jobs and use the promoted builds plugin to make sure the right group verifies at the right point. This methodology is also good for reminding the team of the short-term tasks.

For better code quality, you can create a Jenkins build that takes the code from the central repository every night, performs static code analysis using SonarQube, and sends the results to stakeholders daily. By doing this, we are not only communicating issues daily, but we are also creating a culture for Continuous Improvement by cultivating habits. There may come a time when programmers will know exactly what kind of programming they need to avoid and hence the quality of the code will start getting better.

Considering test automation as a software project

If you see automated testing as a software project and apply well-known principles, then you will save on maintenance costs and increase the reliability of tests.

The **Don't Repeat Yourself** (**DRY**) principle is a great example. Under time pressure, it is tempting to cut and paste similar tests from one area of the code base to another, don't. Projects evolve bending the shape of the code base; the tests need to be reusable to adapt to that change. Fragile tests push up maintenance costs. If you separate the code into pages, then when the workflow between pages changes, most of the testing code remains intact.

The **Keep It Simple Stupid** (**KISS**) principle implies keeping every aspect of the project as simple as possible. For example, it is possible to use real browsers for automated functional tests or the HtmlUnit framework to simulate a browser. The second choice avoids the need to set up an in-memory X server or VNC (http://en.wikipedia.org/wiki/Virtual_Network_Computing) and will also keep track of browser versioning. These extra chores decrease the reliability of running a Jenkins job, but do increase the value of the tests. Therefore, for small projects, consider starting with `HtmlUnit`. For larger projects, the extra effort is worth the cost.

Consider if you need a standalone integration server or if you can get away with using a Jetty server called during the integration goal in Maven.

Visualize, visualize, and visualize!

There is a popular phrase in India called *entertainment, entertainment, and entertainment*. Visualization is extremely effective to keep things robust. When you have many projects scattered across multiple servers developed by different teams and individuals, it is difficult to understand the key metrics and emerging issues.

With 80 percent of information going through to your brain being visual and your brain being an excellent pattern recognizer, one of the tricks to understand the underlying complexity is to visualize the results of your Jenkins jobs.

SonarQube is an excellent starting point to visualize and gain an overview of the overall quality of projects and for delving into relationships and couplings between different areas of the code.

However, if you have specialized requirements, you will need to build graph generation. Test results are usually stored in XML or CSV format. Once you have accumulated the results, you can easily transform them with your language of choice.

You can also create a monitoring view or build pipeline to have visualization of different jobs running in Jenkins.

Conventions are good

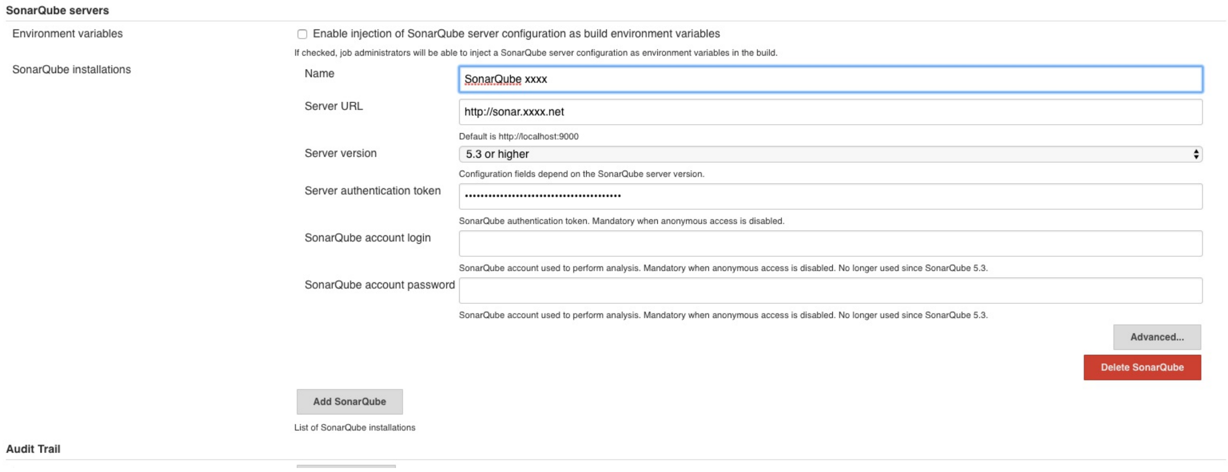
By following conventions, you decrease the amount of maintenance and lower the number of defects hidden in your code. Coding conventions are particularly important when more than one developer is involved in writing the code. Conventions aid readability. Consistently indented code focuses the eye on poorly-written sections. Well-structured variable names help avoid naming collisions between code written in different parts of the organization. Structure in naming highlights the data that you can later move to configuration files and it also increases the opportunity for semi-automatic refactoring using regular expressions, for example, you can write a short piece of R code to visualize the number of global variables you have per module. The more global variables you have, the greater the risk of using the same variable for multiple purposes. Hence, the plot is a rough indicator of smelly code.

Properly followed conventions help to minimize the issues and also help in troubleshooting. It creates a unique culture in the organization.

Test frameworks and commercial choices are increasing

Test frameworks and commercial choices are increasing. In the past few years, there has been a lot of improvement in test automation. One example is that static code review is being used more thoroughly for security checks. SonarQube is an all-encompassing reporter of project quality and new frameworks are emerging to improve on the old. Here are a few implications:

- **SonarQube**: This measures the project quality. Its community is active. SonarQube will evolve faster than the full range of Jenkins quality metrics plugins. Consider using Jenkins plugins for early warnings of negative quality changes and SonarQube for in-depth reporting.
- You can find the SonarQube Jenkins plugin at: https://wiki.jenkins.io/display/JENKINS/SonarQube+plugin:



SonarQube servers

Environment variables

□ Enable injection of SonarQube server configuration as build environment variables

If checked, job administrators will be able to inject a SonarQube server configuration as environment variables in the build.

SonarQube installations

Name: SonarQube xxxx

Server URL: http://sonar.xxxx.net

Default is http://localhost:9000

Server version: 5.3 or higher

Configuration fields depend on the SonarQube server version.

Server authentication token: ••

SonarQube authentication token. Mandatory when anonymous access is disabled.

SonarQube account login:

SonarQube account used to perform analysis. Mandatory when anonymous access is disabled. No longer used since SonarQube 5.3.

SonarQube account password:

SonarQube account used to perform analysis. Mandatory when anonymous access is disabled. No longer used since SonarQube 5.3.

List of SonarQube installations

Audit Trail

- **Static code review tools**: These are improving. FindBugs has moved comment-making into the cloud. More bug pattern detectors are being developed. Static code review tools are getting better at finding security defects. Expect significantly improved tools over time, possibly just by updating the version of your current tools.
- **Code search**: Wouldn't it be great if code search engines ranked the position in their search results of a particular piece of code, based on the defect density or coding practice? You could then search a wide range of open source products for best practices. You could search for defects to remove and then send patches back to the code's communities.
- **The cloud**: CloudBees allows you to create on-demand slave nodes in the cloud. Expect more kinds of cloud-like integrations around Jenkins.

For more information about SonarQube's features and the CloudBees cloud service, visit http://www.sonarqube.org/features/ and http://www.CloudBees.com/products/dev.

Offsetting work to Jenkins nodes

Thanks to its wealth of plugins, Jenkins can easily connect many types of systems. Therefore, Jenkins' usage can grow virally in an organization. Testing and Javadoc generation takes up system resources. A master Jenkins is best used to report back quickly on the jobs distributed across a range of Jenkins nodes. This approach makes it easier to analyze where the failure lies in the infrastructure.

If you are using JMeter for your performance tests at scale, consider offloading from Jenkins to a cloud service such as BlazeMeter (http://blazemeter.com/).

For functional testing with Selenium, there is also a wide range of cloud services. Consider using them not only because of load, but also because of the use of a wide range of browser types and versions offered. One example of a commercial service is Sauce Labs (https://saucelabs.com/). It is worth periodically reviewing the market for new cloud services.

There are other scenarios as well where you can utilize distributed architecture in Jenkins. For example, to keep Android and iOS agents and bind them with the Jenkins master so all jobs related to Android and iOS apps are offloaded from the master Jenkins.

Starving QA/integration servers

A few hundred years ago, coal miners would die because of the build-up of methane and carbon monoxide in the mines. To give early warning of this situation, canaries were brought into the mines. Being more sensitive, the birds would faint first, giving the miners enough time to escape. Consider doing the same for your integration servers in your acceptance environment: deliberately starve them of resources. If they fall over, you will have enough time to review before watching the explosion in production.

Reading the change log of Jenkins

Jenkins practices what it preaches. Minor version number releases occur about once a week. New features appear, bugs are resolved, and new bugs introduced. In general, the great majority of changes lead to improvement, but a few do not. However, when introduced, bugs are generally caught early and removed quickly.

Before updating Jenkins for new features and potential stability glitches, it's worth reading the changelog (http://jenkins-ci.org/changelog). Occasionally, you might want to speed up a deployment to production because of a security issue or miss a version due to a stability blooper.

Avoiding human bottlenecks

The simpler your testing environment is, the less skill you'll need to maintain it. As you learn to use the plugins and explore the potential of new tools and scripting languages, the more knowledge the organization needs in order to maintain a stable system. If you wish to go on holidays without random text messages asking for advice, make sure that your knowledge is transferred to at least a second person. This sounds obvious, but in the rush of your daily load, this principle is often forgotten or put to one side.

One of the easiest ways to share knowledge is to send a couple of developers off to the same conferences and events together (https://www.CloudBees.com/company/events/juc). Learn best practices from Jenkins user conferences and other conferences too.

This is where managers play a significant role in knowledge dissemination. They need to plan in time and activities for the sharing of knowledge, rather than expecting it to happen by magic.

Avoiding groupthink

It is easy to be perfect on paper, defining the importance of a solid set of Javadocs and unit tests. However, the real world on its best days is chaotic. Project momentum, motivated by the need to deliver, is an elusive force to push back against.

Related to project momentum is the potential of groupthink (http://en.wikipedia.org/wiki/Groupthink) by the project team or resource owners. If the team has the wrong collective attitude, as a quality assurance professional it is much harder to inject hard-learned realism. Quality assurance is not only about finding and capturing defects as early as possible, it is also about injecting objective criteria for success or failure into the different phases of a project's cycle.

Consider adding measurable criteria into the Jenkins build. Obviously, if the code fails to compile, then the product should not go to acceptance and production. Less obvious, are the rules around code coverage of unit tests worth defending in release management meetings.

Try getting the whole team involved at the start of the project before any coding has taken place and agree on metrics that fail a build. One approach is to compare a small successful project to a small failed project. If later there is a disagreement, then the debate is about process and numbers rather than personality.

Training and community

Training and participating in Jenkins and the wider tester community are vital for long-term learning paths that lead to optimized environments. Here are a few relevant resources:

When starting with an online community, it is wise to first review and participate in the mailing lists. This allows you to judge your own standard and gradually become recognized. The mailing lists are summarized at http://jenkins-ci.org/content/mailing-lists. Once you are confident that you can productively participate, consider progressing to real-time interactions through the IRC channel at https://wiki.jenkins-ci.org/display/JENKINS/IRC+Channel. The ISTQB software certification body keeps example documentation on its website for its software tester exams. You can find the documentation at http://www.istqb.org/downloads.html.

Additionally, it is important to have internal trainings in the organization to train resources for end-to-end automation of application life cycle management. To make the resources and stakeholders realize the value and effectiveness of the processes are extremely vital because then only they can identify pain points or repetitive processes and automate them to make productivity better.

Visibly rewarding successful developers

This is a call to resource managers.

Developers and testers specialize in technical matters that are at times hard to explain to the ones outside their problem domain. To reach the highest level of expertise and to keep track of trends requires time (sometimes a lot of their own time), energy, and motivation. Undermining their motivation or underestimating the time required to build their skills will ultimately decrease the quality of your products and will cost more in the end.

Consider what you can do to support them, from pay scale jumps, learning paths, reserving time in the week for developers to read and practice new ideas, to conferences and gadgets. For example, after a pay rise, Kickstarter (https://www.kickstarter.com/) is a great place to look for motivational rewards and to stimulate the developers' creative muscle.

Often, the best thing to do is to trust developers and testers and give themselves proper direction to excel to achieve greater heights, and only then they will be able to create a platform to self-motivate themselves.

Train them, challenge them, reward them, and motivate them; get innovations for free. You need to remember that every small appreciation motivates team members and at times you may have healthy competition in the team as well.

Finally, do not make developers do non-development stuff. In general, they need to be highly focused on the complex task of understanding detailed requirements and turning them into rock-solid code.

Stability and code maintenance

This book mentions many plugins and a number of languages and testing tools. It is OK to experiment in development and then push to acceptance, but the more diversity you have in production, the more skills are needed to maintain and especially to write a fluent workflow. Subtle choices, such as pinning Jenkins plugins at known versions and keeping the production version of your Jenkins server stable for fixed periods, help with up-time. Just as importantly, monitoring the load and offsetting most of the jobs away from the master Jenkins ensues a high degree of determinism in the timing of the jobs.

To limit job maintenance implies keeping configuration simple and similar. This is not realistic in a complex organization with a high degree of diversity. Using a test-driven approach helps; conventions also simplify configuration. As the diversity increases, communicating and agreeing to the conventions becomes important. Simple strategies such as one source of documentation wisdom (for example, a communal wiki), regular lessons, learned meetings, and weekly reviews become vital.

Resources on quality assurance

It is a mistake to consider testing to be the sole responsibility of the testers. Coders should feel responsible for the quality of their code, architects for the quality of their designs, managers for the ethos of the project and project planning, and so on. Here are some examples of a range of practical resources on actionable quality assurance-this is not just for the testers.

There are many wise words on avoiding classic mistakes based on years of hard knocks and bruising. A well thought-out set of comments can be found at http://www.exampler.com/testing-com/writings/classic/mistakes.html.

If unit tests cover your code thoroughly, then if you break a piece of code during an update, you will know this quickly during the next build. JUnit is arguably the most well-known framework in this genre. You can find the framework's home page at http://junit.org/.

The Jenkins home page (http://jenkins-ci.org/) covers a wealth of information around the practicalities of configuration, plugins, the community, and hints and tips.

The **Open Web Application Security Project** (**OWASP**) is a great source of information and tools on security testing. OWASP is focused on improving the security of software. Its mission is to make software security visible so that individuals and organizations worldwide can make informed decisions about true software security risks. You can find the OWASP home page at https://www.owasp.org/index.php/Main_Page.

One popular example of a commercial company selling Jenkins infrastructure in the cloud is Sauce Labs (https://docs.saucelabs.com/ci-integrations/jenkins/).

There are a number of excellent and free-to-download software testing magazines. The professional tester is one such example and is available at http://www.professionaltester.com/.

uTest is the world's largest open community dedicated to professional testers and software testing. Its sole purpose is to promote and advance the testing profession, and the people who do this vital work. For more information, visit http://www.utest.com/about-us.

There are more and more free MOOC courses and a number of them support the learning paths of software testers. You can find a full list of currently running MOOC courses at https://www.mooc-list.com/.

And there's always more

There are always more points to consider. Here are a few of the cherry-picked ones:

- **Blurring the team boundary**: Tools such as FitNesse and Selenium IDE make it easier for non-Java programmers to write tests. The easier it is to write tests, the more likely it is that the relevant tests capture the quintessential details of user expectations. Look for new Jenkins plugins that support tools, which lower the learning curve.
- **Deliberately adding defects**: By rotating through Jenkins builds and then deliberately adding code that fails, you can test the alertness and response time of the team.
- **Increasing code coverage with link crawlers and security scanners**: A fuzzer discovers the inputs of the application it is attacking and then fires off unexpected input. Not only is this good for security testing, but also for boundary testing. If your server returns an unexpected error, then use a fuzzer to trigger a more thorough review. Fuzzers and link crawlers are a cheap way to increase the code coverage of your tests.

In your development environment, periodically review for new Jenkin plugins. The number of plugins is increasing rapidly and there may be new ways for Jenkins to connect different parts of your organization's infrastructure to Continuous Integration.

Final comments

The combination of Jenkins with aggressive automated testing acts as a solid safety net around coding projects. The recipes in this book support best practices.

Producing quality requires great attention to detail. Jenkins can pay attention to many of the details and then shout loudly when violations occur.

Each project is different and there are many ways to structure the workflow. Luckily, with over 1,000 plugins and the number rising rapidly, Jenkins is flexible enough to adapt to even the most obscure infrastructures.

If you do not have the exact plugin that you want, then it is straightforward for Java programmers to adapt or create their own plugin.