

# DevOps



**Caltech**

Center for Technology &  
Management Education

## Post Graduate Program in DevOps

# DevOps



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## CI/CD Pipeline with Jenkins

# Jenkins Installation And Configuration



# Learning Objectives

By the end of this lesson, you will be able to:

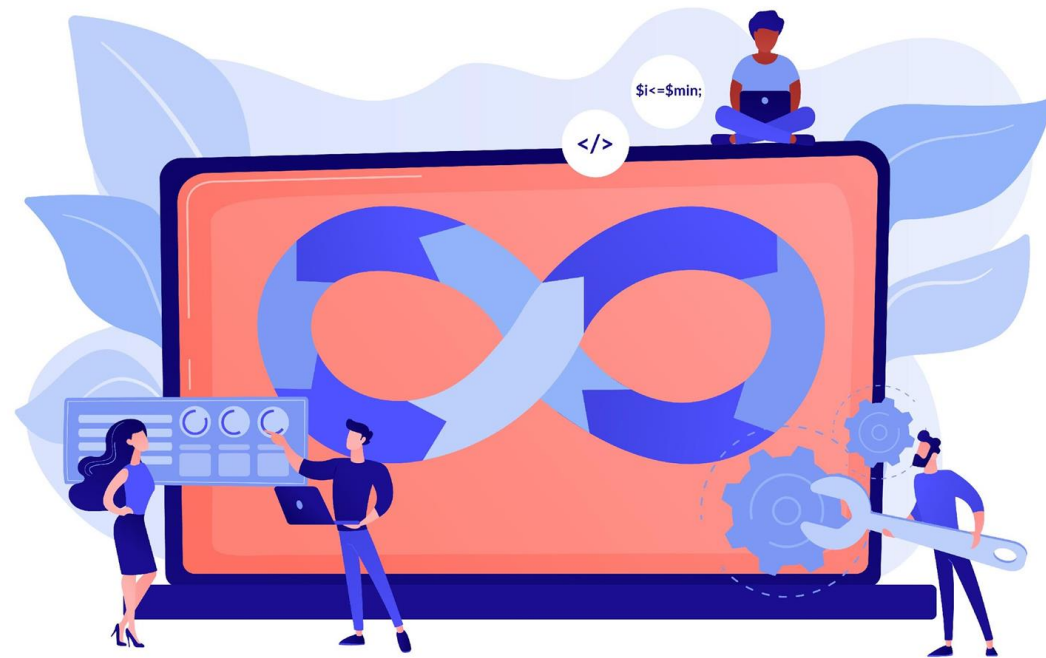
- 🕒 Achieve CI/CD automation in DevOps using CI/CD tools
- 🕒 Recognize the benefits of Jenkins
- 🕒 Install Jenkins on Docker and AWS cloud platforms
- 🕒 Configure and set up Jenkins on various operating systems



# Jenkins

# CI/CD Tools

CI/CD automation in DevOps is the foundation that makes software delivery faster and efficient.



Help the development team deliver fast, with shorter release cycles

Facilitate Build automation, test executions, and deployments

Are available as open-source enterprise tools

# Comparison of CI/CD Tools

Feature	Jenkins	Circleci	TeamCity	Bamboo	GitLab
Open-source	Yes	No	No	No	No
Ease of use & setup	Medium	Medium	Medium	Medium	Medium
Built-in features	3/5	4/5	4/5	4/5	4/5
Integration	5/5	3/5	4/5	3/5	4/5
Hosting	On Premise & Cloud	On Premise & Cloud	On Premise	On Premise & Bitbucket as Cloud	On Premise & Cloud

# Comparison of CI/CD Tools

Feature	Jenkins	Circleci	TeamCity	Bamboo	GitLab
Free Version	Yes	Yes	Yes	Yes	Yes
Build Agent License Pricing	Free	From \$39 per month	From \$299 one-off payment	From \$10 one-off payment	From \$5 per month per user
Supported OS	Windows, Linux, macOS, Unixlike OS	Linux or MacOS	Windows, Linux, macOS, Solaris, FreeBSD and more	Windows, Linux, macOS, Solaris	Linux distributions: Ubuntu, Debian, CentOS, Oracle Linux



# Introduction to Jenkins

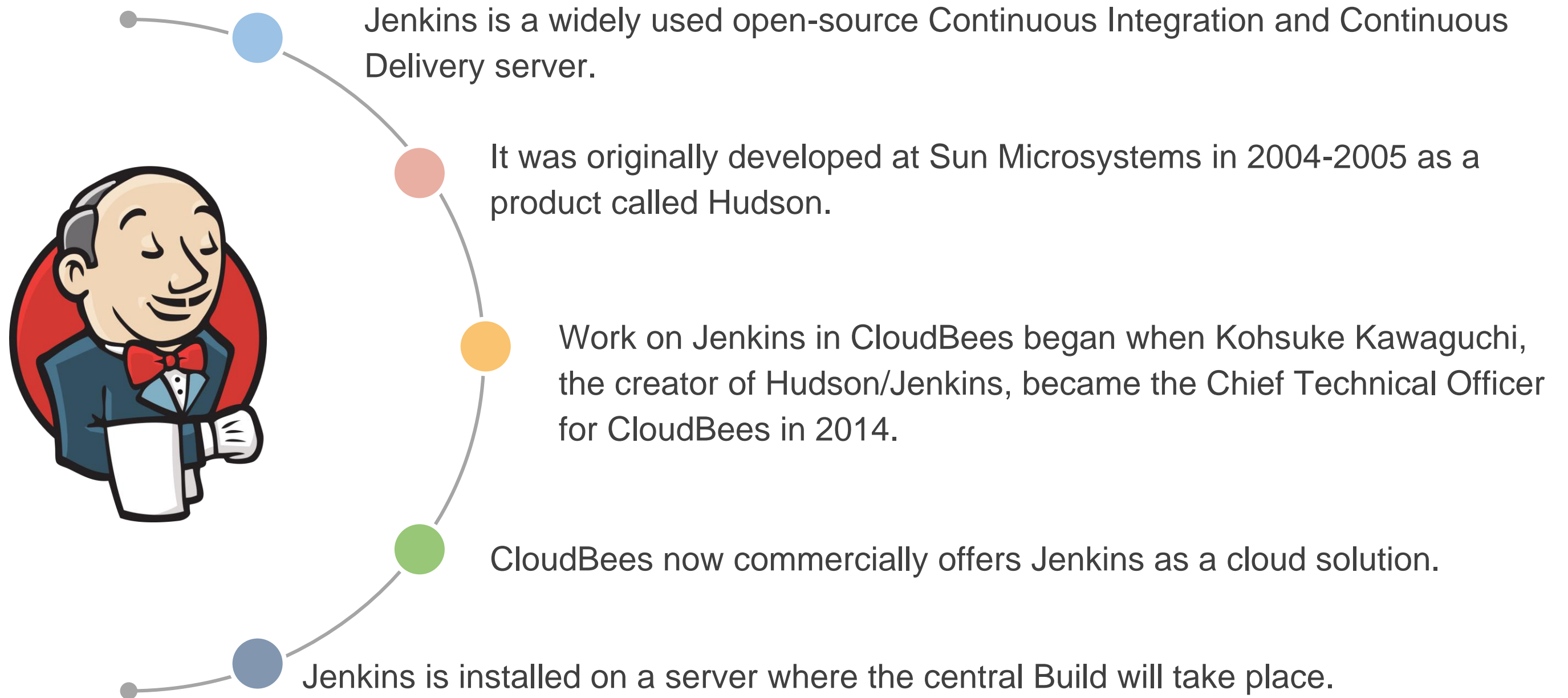
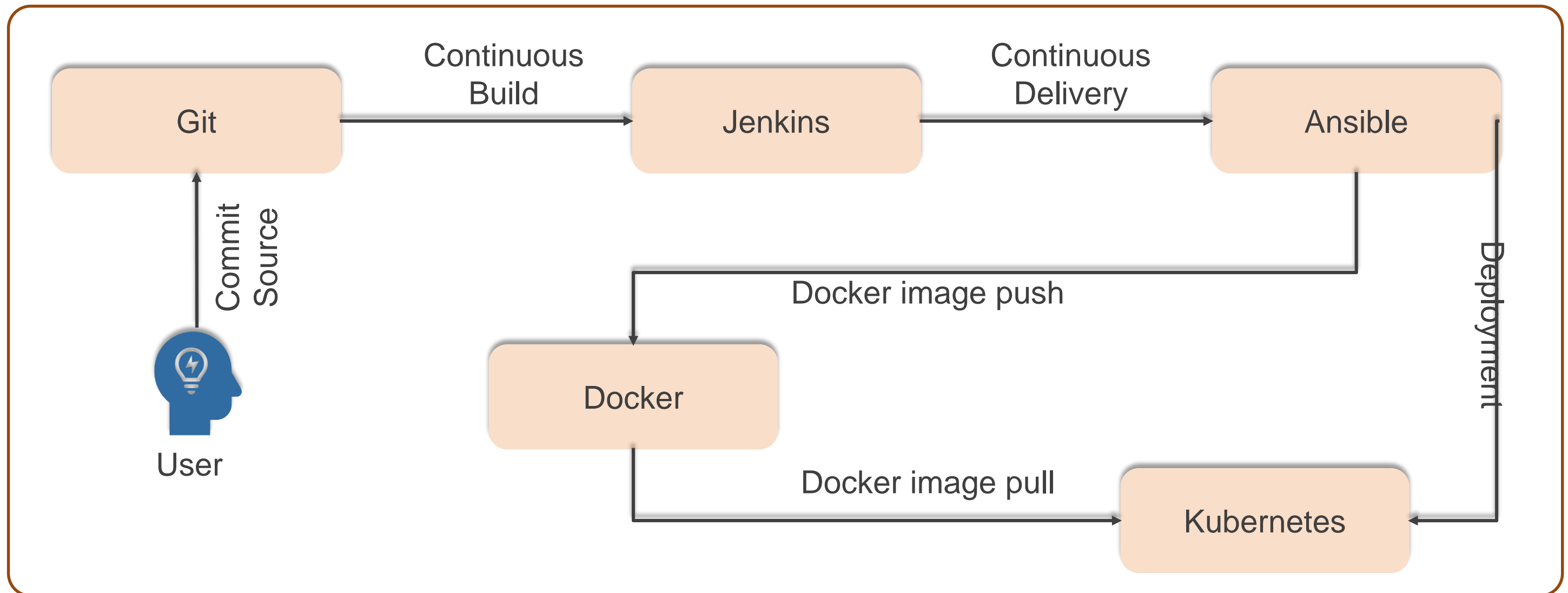


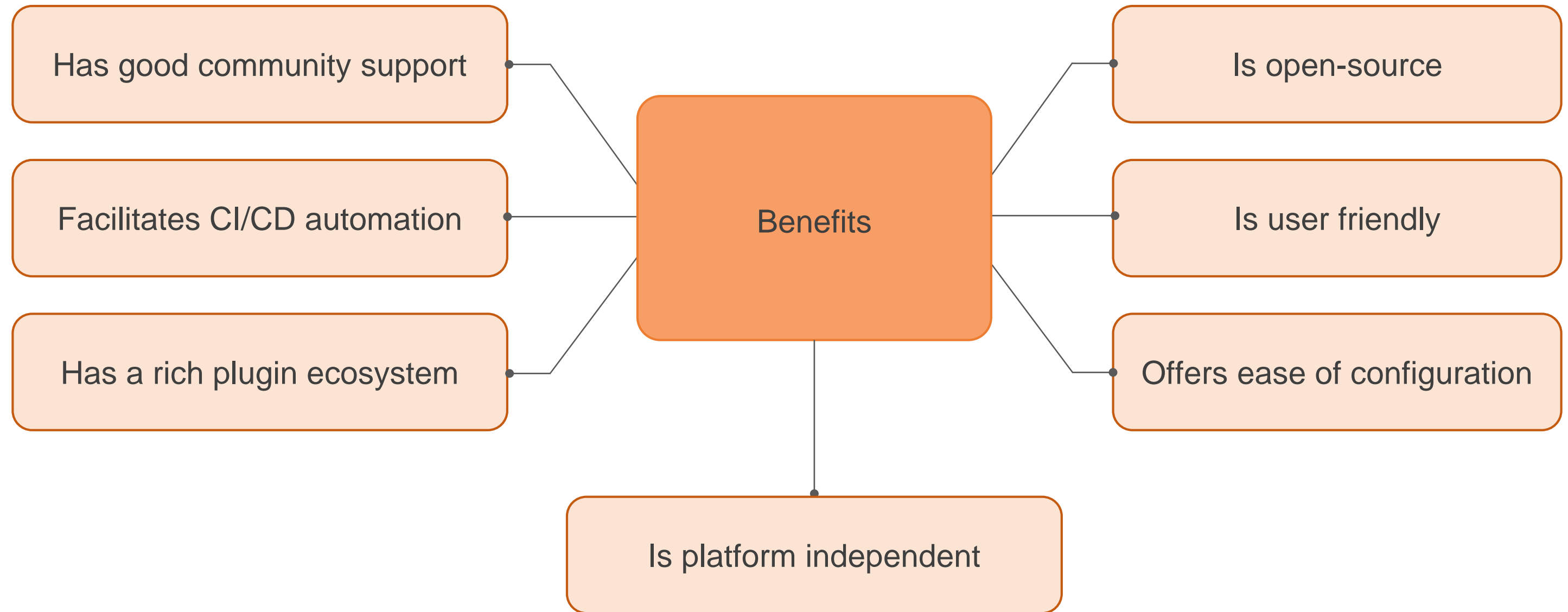
Image Source: <https://jenkins.io/>

# Introduction to Jenkins

Shown below is the DevOps workflow:



# Jenkins



# Introduction to Jenkins

Jenkins offers the following functionalities:



Provides the features and functionalities required to build a robust CI/CD Pipeline

Supports all popular source code management (SCM) systems, including Git, Subversion, Mercurial, and CVS

Supports popular Build tools like Maven, Ant, Gulp, and Grunt, as well as testing frameworks and report generators

Verifies the integration process with automated Build and test execution to detect issues; provides feedback

# CloudBees Enterprise Jenkins

- ✦ Is a Jenkins-based Continuous Delivery solution for enterprise software development teams
- ✦ Is one of the major contributors to Jenkins and Jenkins X projects
- ✦ Provides assistance during upgrades, patching, or breakdown
- ✦ Provides better security and scalability



# Jenkins Open-Source vs. CloudBees Enterprise

## Jenkins Open-source

Provides open-source installation

Does not support incremental security upgrades

Does not support any templates to automate Pipeline creation

## CloudBees Enterprise

Provides enterprise solution

Supports incremental security upgrades to make sure CI server is secure

Provides Pipeline templates to automate CI/CD Pipelines creation

# Jenkins Open-Source vs. CloudBees Enterprise

## Jenkins Open-source

Does not support centralized credentials management

Does not support backup and recovery by default

Does not support health monitoring and alerting

## CloudBees Enterprise

Supports centralized credentials management

Provides automated backup and recovery for maximum availability

Supports complete infrastructure monitoring and altering mechanism

# Jenkins Installation

# Platforms Supported by Jenkins

Jenkins supports all major platforms and can be easily hosted on any operating system.



It can be installed either standalone using built-in Jetty servlet container or can be deployed on different Java servlet containers such as Tomcat or Glassfish.

It supports two release lines: Long Term Support (LTS) and Weekly release.

# Jenkins Release Lines

The LTS release line is suitable for conservative users.

## Long term support

- Release rolled out every 12 weeks
- Suitable for organizations that require a stable and reliable version of Jenkins for their production environment

## Weekly release

- Release rolled out every week
- Rapid delivery of bug fixes and new features



# Jenkins Prerequisites

Operating System	Linux Operating System (Ubuntu or Debian, CentOS or Fedora or Red hat, FreeBSD, Gentoo, openSUSE, Windows, macOS)
CPU	Minimum requirement: one core; recommended: two core
Disk	Minimum requirement: 10 GB; recommended 50 GB
Memory	Minimum requirement: 1 GB; recommended: 4 GB
JDK Version	JDK 8 or JDK 11

# Jenkins for Debian and Ubuntu Family

Jenkins supports different Linux flavors including Ubuntu and Debian.

Complete JDK installation on the Ubuntu server prior to installing Jenkins, using the following commands:

## Demo

```
# JDK installation on Ubuntu server  
apt update  
apt install openjdk-8-jdk
```

## Note

Installation steps for various platforms are present in the Jenkins official page (<https://jenkins.io/download/>).

# Jenkins for Debian and Ubuntu Family

Next, use the following command to install Jenkins:

## Demo

```
# to Install Jenkins
wget -q -O - https://pkg.jenkins.io/debian-stable/jenkins.io.key |
sudo apt-key add -
```

Add Jenkins package URL to the apt sources list using the command shown below:

## Demo

```
# to add Jenkins package URL to apt sources list
echo "deb https://pkg.jenkins.io/debian-stable binary/"
> etc/apt/sources.d/jenkins.list
```

# Jenkins for Debian and Ubuntu Family

Then execute the commands shown below to install the Jenkins package using the apt command:

## Demo

```
# to Install Jenkins using apt command  
apt-get update  
apt-get install Jenkins
```

Open the browser on the local machine and enter the URL: x.x.x.x:8080

## Note

Replace x.x.x.x with actual public IP of server to make it accessible from the browser. Once Jenkins opens on the browser, proceed with the installation, and enter the admin password on the first screen.

# Jenkins for CentOS, Fedora, and RedHat Family

Jenkins can be installed using Yum utility on Red Hat, CentOS or Fedora. Complete JDK installation on the server prior to the installation of Jenkins.

## Demo

```
#for JDK installation on server
yum update
yum install jenkins java-11-openjdk-devel
```

Once JDK is installed, follow the commands given below to install Jenkins:

## Demo

```
# to install Jenkins
sudo wget -O /etc/yum.repos.d/jenkins.repo
https://pkg.jenkins.io/redhat-stable/jenkins.repo
sudo rpm --import https://pkg.jenkins.io/redhat-stable/jenkins.io.key
sudo yum upgrade
sudo yum install jenkins
sudo systemctl daemon-reload
```



# Jenkins for CentOS, Fedora, and RedHat Family

Upon successful installation of Jenkins:

Open the browser on the local machine and enter the URL: x.x.x.x:8080.

## Note

Replace x.x.x.x with actual public IP of server to make it accessible from the browser. Once Jenkins opens on the browser, proceed with the installation, and enter the admin password on the first screen.

# Jenkins for Windows

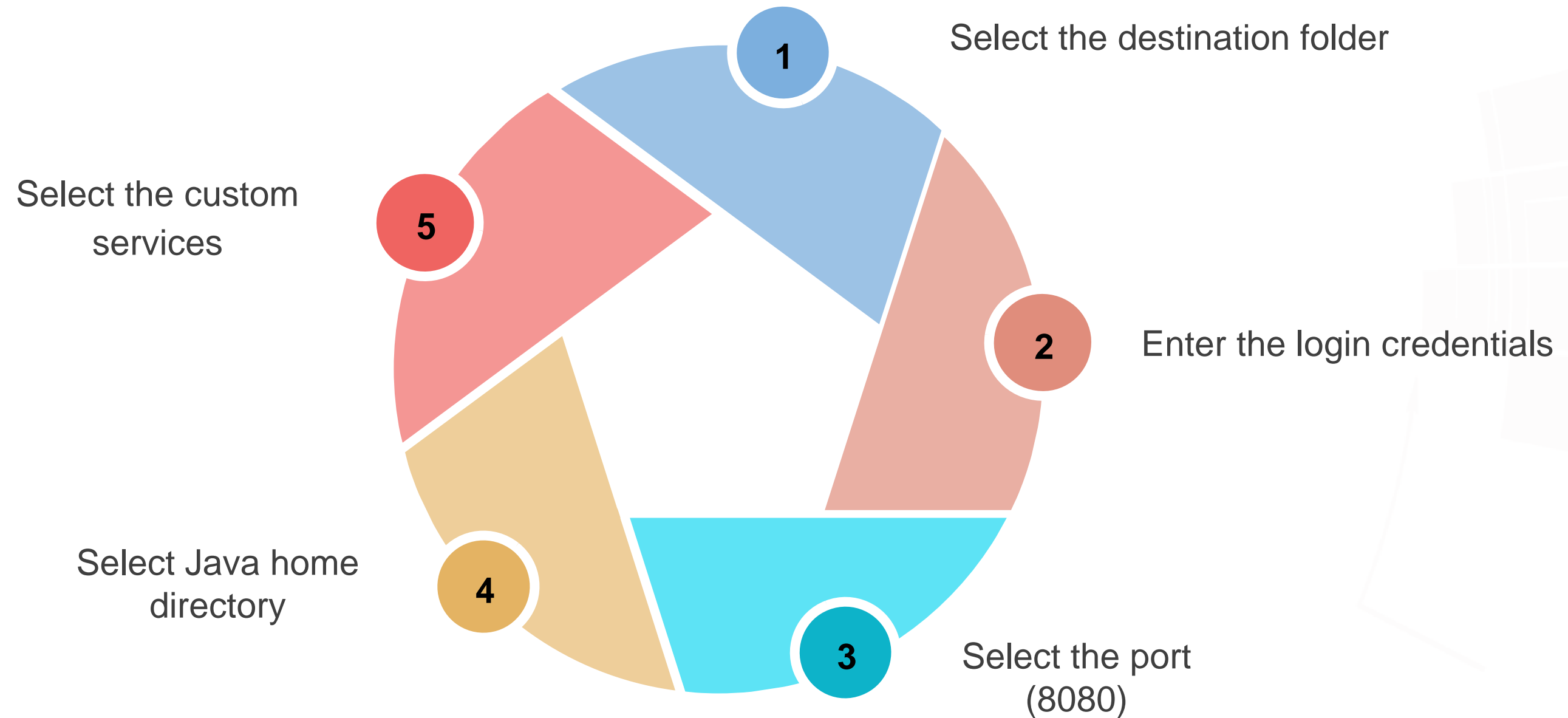
Jenkins will be installed as a service on the Windows platform.  
Jenkins Installer (Windows MSI installer) can be used for installing Jenkins.

## Prerequisites

- Software: JDK
- Hardware for a small team: 4GB+ RAM, 50GB+ drive space

# Jenkins for Windows

Steps for installing Jenkins using Windows MSI installer:



# Jenkins for MacOS

Jenkins can be installed on MacOS using Homebrew package manager.

To complete installation, execute the following commands:

## Demo

```
# Install the latest LTS version:
brew install jenkins-lts

# Install a specific LTS version:
brew install jenkins-lts@JENKINS-VERSION

# Start the Jenkins service:
brew services start jenkins-lts

# Restart the Jenkins service:
brew services restart jenkins-lts

# Update the Jenkins version :
brew upgrade jenkins-lts
```

# Jenkins for Docker

Jenkins supports installation on Docker host for Long Term Support release. The official Docker image can be downloaded from the Docker hub.

To deploy Docker image on the Docker host, execute the following commands:

## Demo

```
# to deploy Docker image on Docker host use:
```

```
docker pull jenkins/jenkins
```

```
docker run --name jenkins -p 8080:8080 -p 50000:50000 jenkins/jenkins
```



# Jenkins for Docker

The following screen will appear upon installation of Jenkins:

```
root@ip-172-31-72-160:~# docker run --name jenkins -p 8080:8080 -p 50000:50000 jenkins/jenkins
Unable to find image 'jenkins/jenkins:latest' locally
latest: Pulling from jenkins/jenkins
d960726af2be: Pull complete
971efeb01290: Pull complete
63355dfa68bf: Pull complete
7e4efd84be57: Pull complete
5f4dc6ce5f68: Pull complete
1845b40ff179: Pull complete
63560e572de5: Pull complete
2778c0fb363c: Pull complete
b1bfe419e51c: Pull complete
a89ef4e70367: Pull complete
1ba4a3f12fb0: Pull complete
5d997a158691: Pull complete
e6817fe55377: Pull complete
e3f0fcf07941: Pull complete
d4c19a039946: Pull complete
21bafef74bc6: Pull complete
Digest: sha256:dff60a7e1f6e476be850c0abdaa9c1ad783c68e9abc0e3907de2a24ef274bfd2
Status: Downloaded newer image for jenkins/jenkins:latest
Running from: /usr/share/jenkins/jenkins.war
webroot: EnvVars.masterEnvVars.get("JENKINS_HOME")
2021-06-06 06:21:18.262+0000 [id=1] INFO org.eclipse.jetty.util.log.Log#initialized: Logging initialized
vaUtilLog
2021-06-06 06:21:18.373+0000 [id=1] INFO winstone.Logger#logInternal: Beginning extraction from war file
2021-06-06 06:21:19.517+0000 [id=1] WARNING o.e.j.s.handler.ContextHandler#setContextPath: Empty contextPath
2021-06-06 06:21:19.568+0000 [id=1] INFO org.eclipse.jetty.server.Server#doStart: jetty-9.4.41.v20210516;
98607f93c7833e7dc59489b13f3cb0a114fb9f4c; jvm 1.8.0_292-b10
```

# Jenkins for AWS



Can be integrated with AWS DevOps services such as AWS CodeCommit, AWS CodeBuild, and AWS CodeDeploy.

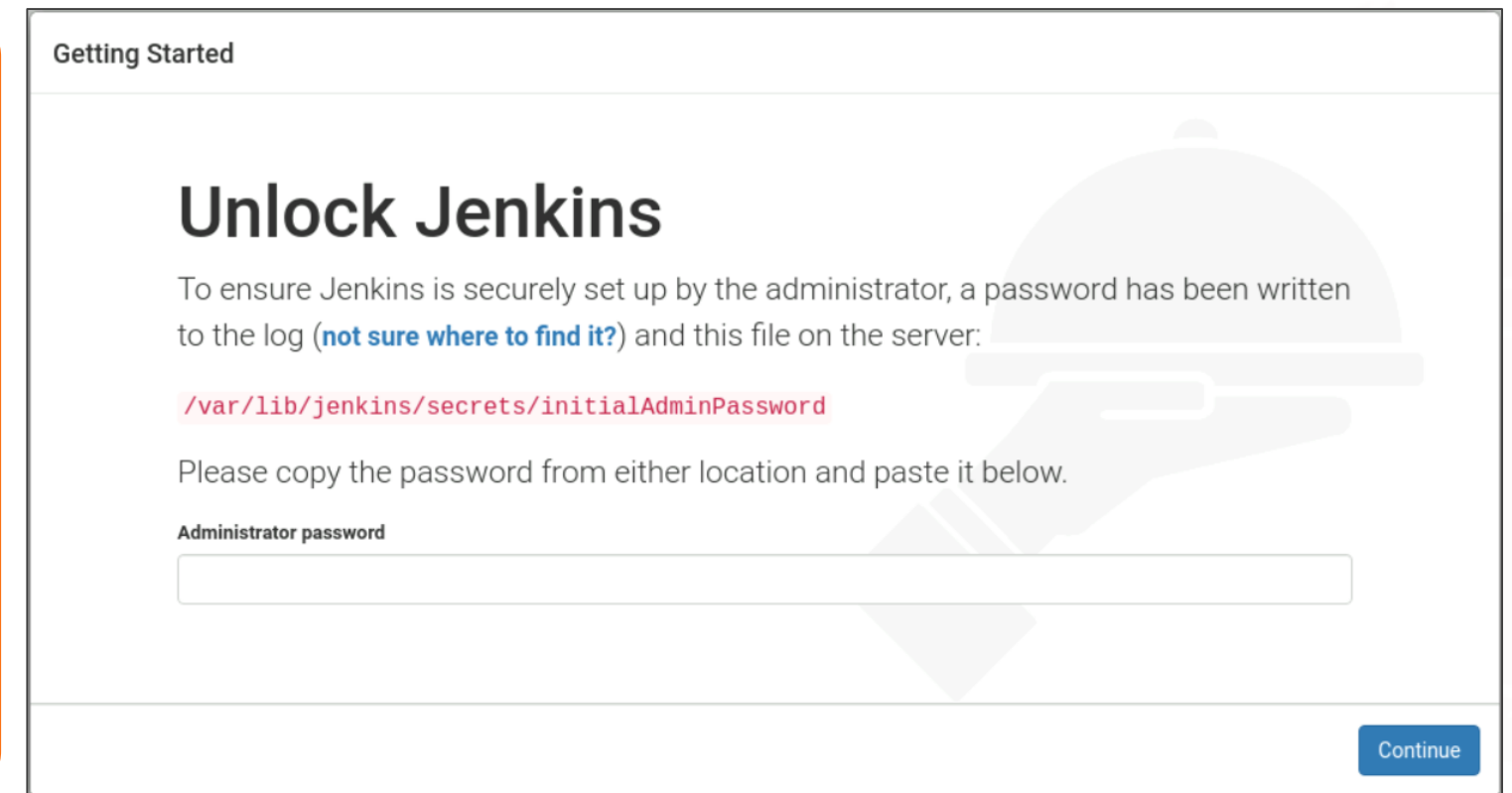
Can be launched on new EC2 virtual machine; can be configured to spin up Jenkins agents on EC2.

The user will have complete control of Jenkins installation.

# Jenkins Configuration

Once the installation process is complete, Jenkins must be unlocked. This is a one-time configuration.

- Fetch initialAdminPassword from Jenkins installation path
- For Linux OS :  
`/var/lib/jenkins/secrets/initialAdminPassword`
- For Windows OS: `C:\Program Files (x86)\Jenkins\secrets\initialAdminPassword`



Getting Started

## 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

Continue

# Jenkins Configuration

Create the admin user.

Getting Started

## Create First Admin User

Username:

admin

Password:

\*\*\*\*\*

Confirm password:

\*\*\*\*\*

Full name:

Jenkins

E-mail address:

jenkins@buildserver.com

Jenkins 2.289.1

[Skip and continue as admin](#)

Save and Continue

# Jenkins Configuration

Customize Jenkins by installing required plugins.

Getting Started

## 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 2.289.1

Getting Started

## Jenkins is ready!

Your Jenkins setup is complete.

Start using Jenkins

Jenkins 2.289.1

# Assisted Practice

## Installing Docker on Ubuntu

Duration: 10 min

### Problem Statement:

Demonstrate the installation of Docker on Ubuntu.

# Assisted Practice: Guidelines

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## Steps to install Docker on Ubuntu:

1. Install Java JDK 8 or 11 on Ubuntu VM.
2. In order to download packages from Jenkins's repo, first add the key to your system.
3. Add Jenkins repository details in Apt sources.list file.
4. Install Jenkins.



# Assisted Practice

## Installing Docker on CentOS

Duration: 10 min

### Problem Statement:

Demonstrate the installation of Docker on CentOS.

# Assisted Practice: Guidelines

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## Steps to install Docker on CentOS:

1. Install Java JDK 8 or 11 on CentOS VM.
2. In order to download packages from Jenkins's repo, first add the key to your system.
3. Add Jenkins repository details as Yum repositories.
4. Install Jenkins.

# Assisted Practice

## Installing Docker on Windows

Duration: 10 min

### Problem Statement:

Demonstrate the installation of Docker on Windows.

# Assisted Practice: Guidelines

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## Steps to install Docker on Windows:

1. Install Java JDK 8 or 11 on Windows machine.
2. Download Jenkins executable to install Jenkins on windows machine.
3. Execute Jenkins executable to install Jenkins.
4. Access Jenkins using localhost as URL and port as 8080.

## Key Takeaways

- ❶ CI/CD automation helps the development team to deliver fast to market, with shorter release cycles
- ❷ Jenkins is one of the most popular open-source Continuous Integration and Continuous Delivery servers available today
- ❸ Jenkins is user-friendly, easy to configure, and platform independent.
- ❹ CloudBees provides better scalability and security as compared to open-source Jenkins.
- ❺ Jenkins supports different Linux flavors including Ubuntu and Debian.
- ❻ The Yum utility on Red Hat, CentOS, and Fedora can be used to install Jenkins.



## Lesson-End Project

## Configuring Jenkins Admin User on Ubuntu

### Problem Statement:

Perform the following:

- Install Jenkins on Ubuntu 20.04
- Configure the Admin user

**Access:** Click on the **Labs** tab on the left side panel of the LMS. Copy or note the username and password that is generated. Click on the **Launch Lab** button. On the page that appears, enter the username and password in the respective fields, and click **Login**.





Thank You