

# Integrate Chef with a CI/CD pipeline for automated deployments

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## Description

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Integrating Chef with a CI/CD pipeline allows automated testing, configuration, and deployment of infrastructure changes. In this guide, you will configure a CI/CD pipeline using Chef to manage infrastructure and application deployment. This setup provides a consistent, testable approach to infrastructure provisioning and deployment.

## Problem Statement

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When managing infrastructure across environments, manual configurations can lead to inconsistencies. Automating deployment with Chef and integrating it into a CI/CD pipeline solves these issues by:

- Testing and validating configuration changes automatically.
- Applying configurations consistently across environments.
- Reducing human error in repetitive tasks.

## Prerequisites

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### Software Required

- **Chef Workstation:** To write and test Chef configurations.
- **Chef Server:** For managing node configurations.
- **Docker:** For installing Jenkins.
- **Jenkins or another CI/CD tool:** To set up automated testing and deployment.
- **Git:** For version control and Chef cookbook management.

## Hardware Requirement

- **Chef Server:** 4 GB RAM, 2 CPU cores minimum.
- **Workstation:** 4 GB RAM, 2 CPU cores minimum.
- **CI/CD Server** (e.g., Jenkins): 8 GB RAM, 4 CPU cores recommended.

## Implementation Steps

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### Step 1: Install Jenkins Using Docker

#### 1. Create Docker Network:

- Create a Docker network named "jenkins" to allow communication between containers.

```
docker network create jenkins
```

#### 2. Run Docker Daemon Exposed with Port 2376:

- Start a Docker daemon with necessary configurations for Jenkins usage.

```
docker run --name jenkins-docker --rm --detach ^  
--privileged --network jenkins --network-alias docker ^  
--env DOCKER_TLS_CERTDIR=/certs ^  
--volume jenkins-docker-certs:/certs/client ^  
--volume jenkins-data:/var/jenkins_home ^  
--publish 2376:2376 ^  
docker:dind
```

#### 3. Run Jenkins Image:

- Start Jenkins container using a custom image or the official Jenkins image, ensuring it's properly configured.

```
docker run --name jenkins-blueocean --restart=on-failure --detach ^  
--network jenkins --env DOCKER_HOST=tcp://docker:2376 ^  
--env DOCKER_CERT_PATH=/certs/client --env DOCKER_TLS_VERIFY=1 ^  
--volume jenkins-data:/var/jenkins_home ^  
--volume jenkins-docker-certs:/certs/client:ro ^  
--publish 8080:8080 --publish 50000:50000 vijaynvb/jenkins:1.0
```

- Open a browser and navigate to <http://localhost:8080>.

### Setup admin details

- Access the jenkins application in [localhost:8080](http://localhost:8080)

- Login with default credentials - To get the **password** , go to the shown directory or simply run **docker logs containerId** & get the password from logs.

```
c:\Users\vijay>docker logs 61c76b4423c195725627c7688a316da3ecd547985eb7802920934e3b7c7bce5
Running from /usr/share/jenkins/jenkins.war
webroot: /var/jenkins_home/war
2024-10-04 07:14:45.425+0000 [id=1] INFO winstone.Logger#logInternal: Beginning extraction from war file
2024-10-04 07:14:46.227+0000 [id=1] WARNING o.e.j.s.handler.ContextHandler#setContextPath: Empty contextPath
2024-10-04 07:14:46.271+0000 [id=1] INFO org.eclipse.jetty.server.Server#doStart: jetty-10.0.15; built: 2023-04-11T17:25:14.480Z; git: 68017dbd00236bb7e18733bd7585a859610f661d; jvm
17.0.8-7
2024-10-04 07:14:46.466+0000 [id=1] INFO o.e.j.w.StandardDescriptorProcessor#visitServlet: NO JSP Support for /, did not find org.eclipse.jetty.jsp.JettyJspServlet
2024-10-04 07:14:46.506+0000 [id=1] INFO o.e.j.s.s.DefaultSessionIdManager#doStart: Session workerName=node0
2024-10-04 07:14:47.135+0000 [id=1] INFO hudson.WebAppMain#contextInitialized: Jenkins home directory: /var/jenkins_home found at: EnvVars.masterEnvVars.get("JENKINS_HOME")
2024-10-04 07:14:47.310+0000 [id=1] INFO o.e.j.s.handler.ContextHandler#doStart: Started w.@2c8662ac{Jenkins v2.414.1,/,file:///var/jenkins_home/war/,AVAILABLE}{/var/jenkins_home/wa
r}
2024-10-04 07:14:47.329+0000 [id=1] INFO o.e.j.server.AbstractConnector#doStart: Started ServerConnector@3569fc08{HTTP/1.1, (http/1.1)}{0.0.0.0:8080}
2024-10-04 07:14:47.344+0000 [id=1] INFO org.eclipse.jetty.server.Server#doStart: Started Server@42f33b5d{STARTING}[10.0.15,sto=0] @2944ms
2024-10-04 07:14:47.346+0000 [id=27] INFO winstone.Logger#logInternal: Winstone Servlet Engine running: controlPort=disabled
2024-10-04 07:14:47.640+0000 [id=34] INFO jenkins.InitReactorRunner$1#onAttained: Started initialization
2024-10-04 07:14:48.264+0000 [id=32] INFO hudson.PluginManager#considerDetachedPlugin: Loading a detached plugin as a dependency: /var/jenkins_home/plugins/javax-mail-api.jpi
2024-10-04 07:14:49.665+0000 [id=32] INFO jenkins.InitReactorRunner$1#onAttained: Listed all plugins
2024-10-04 07:14:53.539+0000 [id=47] INFO jenkins.InitReactorRunner$1#onAttained: Prepared all plugins
2024-10-04 07:14:53.553+0000 [id=37] INFO jenkins.InitReactorRunner$1#onAttained: Started all plugins
2024-10-04 07:14:53.557+0000 [id=46] INFO jenkins.InitReactorRunner$1#onAttained: Augmented all extensions
2024-10-04 07:14:55.309+0000 [id=45] INFO jenkins.InitReactorRunner$1#onAttained: System config loaded
2024-10-04 07:14:55.310+0000 [id=32] INFO jenkins.InitReactorRunner$1#onAttained: System config adapted
2024-10-04 07:14:55.314+0000 [id=40] INFO jenkins.InitReactorRunner$1#onAttained: Loaded all jobs
2024-10-04 07:14:55.327+0000 [id=36] INFO jenkins.InitReactorRunner$1#onAttained: Configuration for all jobs updated
2024-10-04 07:14:55.350+0000 [id=61] INFO hudson.util.Retrier#start: Attempt #1 to do the action check updates server
2024-10-04 07:14:55.753+0000 [id=33] INFO jenkins.install.SetupWizard#init:

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

Jenkins initial setup is required. An admin user has been created and a password generated.
Please use the following password to proceed to installation:

779a25b998c3486e98b5250d1abe4a76

This may also be found at: /var/jenkins_home/secrets/initialAdminPassword

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

2024-10-04 07:15:15.700+0000 [id=33] INFO jenkins.InitReactorRunner$1#onAttained: Completed initialization
2024-10-04 07:15:15.775+0000 [id=26] INFO hudson.lifecycle.Lifecycle#onReady: Jenkins is fully up and running
2024-10-04 07:15:16.692+0000 [id=61] INFO h.m.DownloadService$Downloadable#load: Obtained the updated data file for hudson.tasks.Maven.MavenInstaller
2024-10-04 07:15:16.693+0000 [id=61] INFO hudson.util.Retrier#start: Attempt #1 to do the action check updates server successfully at the attempt #1
```

- copy the password from console paste it in login page.

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:

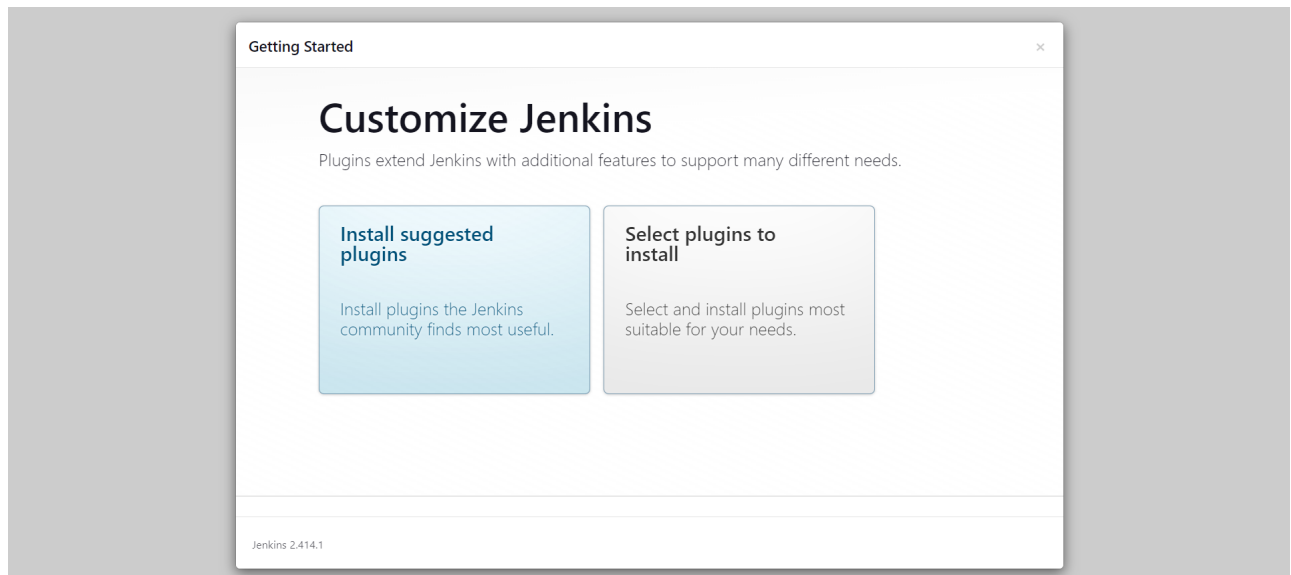
```
/var/jenkins_home/secrets/initialAdminPassword
```

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

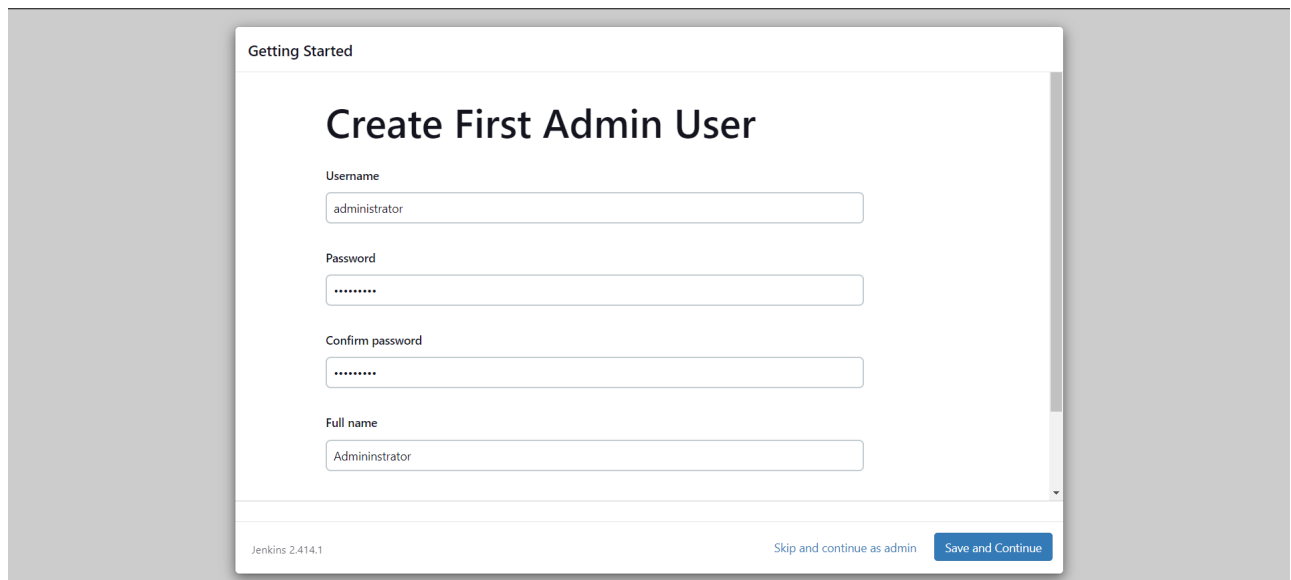
Administrator password

Continue

- Select **Install suggested plugins**



- Create new user 'administrator' with password '\*\*\*\*'











- Save and Continue

## Step 2: Create a Windows Agent in Jenkins

### 1. Go to Manage Jenkins:






- On the Jenkins dashboard, click **Manage Jenkins**.

-  **New Item**
-  **People**
-  **Build History**
-  **Project Relationship**
-  **Check File Fingerprint**
-  **Manage Jenkins**
-  **My Views**
-  **Open Blue Ocean**

## 2. Go to Manage Nodes:

- Scroll down and click **Nodes** (or **Manage Nodes and Clouds**).

### System Configuration

- |   |  |  |
|---|--|--|
|  <b>System</b><br>Configure global settings and paths.   |  <b>Tools</b><br>Configure tools, their locations and automatic installers.                 |  <b>Plugins</b><br>Add, remove, disable or enable plugins that can extend the functionality of Jenkins. |
|  <b>Nodes</b><br>Add, remove, control and monitor the various nodes that Jenkins runs jobs on. |  <b>Clouds</b><br>Add, remove, and configure cloud instances to provision agents on-demand. |  |

## 3. Create New Node:

- Click **New Node** on the left sidebar.
- Give the node a name (e.g., **windows-node**).
- Select **Permanent Agent** and click **OK**.

## New node

Node name

Type

☐ 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.

☐ Copy Existing Node

Create

### 4. Configure the Windows Node:

- **Description:** Add an optional description.
- **# Executors:** Set the number of executors (typically **1**).
- **Remote Root Directory:** Set the directory where Jenkins stores the workspace (e.g., **C:\jenkins**).
- **Labels:** Add a label (e.g., **windows**) to easily reference the node in your pipeline.
- **Launch Method:**
  - Select **\*\*Launch agent by connecting it to the controller**

Remote root directory ?

C:\jenkins

Labels ?

windows

Usage ?

Use this node as much as possible

Launch method ?

Launch agent by connecting it to the controller





### 5. Save the configuration.

## Step 3: Start the Jenkins Agent on the Windows Node

1. Click on the **windows-node**

Nodes

+ New Node

S	Name	Architecture	Clock Difference	Free Disk Space	Free Swap Space	Free Temp Space	Response Time
	Built-In Node	Linux (amd64)	In sync	54.14 GB	864.90 MB	54.14 GB	0ms 
	windows-node		N/A	N/A	N/A	N/A	N/A 
Data obtained		15 min	15 min	15 min	15 min	15 min	15 min

2. Run the Jenkins Agent on Windows:

- Open **Command Prompt** (CMD) on the Windows node.
- Copy the command from **Run from agent command line (Windows)** and run it in the windows **Command Prompt**.

Run from agent command line: (Windows)

```
curl.exe -sO http://172.19.4.192:8080/jnlpJars/agent.jar
java -jar agent.jar -jnlpUrl http://172.19.4.192:8080/computer/windows%2Dnode/jenkins-agent.jnlp -secret 68d850d43c092ea18c2d2de56dfb17719fcac291f4dfa16180f79ce24fb2d5fc -workDir "C:\jenkins"
```

```
C:\Users\Administrator>curl.exe -sO http://172.19.4.192:8080/jnlpJars/agent.jar & java -jar agent.jar -jnlpUrl http://172.19.4.192:8080/computer/windows%2Dnode/jenkins-agent.jnlp -secret 68d850d43c092ea18c2d2de56dfb17719fcac291f4dfa16180f79ce24fb2d5fc -workDir "C:\jenkins"
Nov 20, 2024 11:02:28 AM org.jenkinsci.remoting.engine.WorkDirManager initializeWorkDir
INFO: Using C:\jenkins\remoting as a remoting work directory
Nov 20, 2024 11:02:28 AM org.jenkinsci.remoting.engine.WorkDirManager setupLogging
INFO: Both error and output logs will be printed to C:\jenkins\remoting
Nov 20, 2024 11:02:29 AM hudson.remoting.jnlp.Main createEngine
INFO: Setting up agent: windows-node
Nov 20, 2024 11:02:29 AM hudson.remoting.Engine startEngine
INFO: Using Remoting version: 3131.vf2b_b798b_ce99
Nov 20, 2024 11:02:29 AM org.jenkinsci.remoting.engine.WorkDirManager initializeWorkDir
INFO: Using C:\jenkins\remoting as a remoting work directory
Nov 20, 2024 11:02:29 AM hudson.remoting.jnlp.Main$CuiListener status
INFO: Locating server among [http://172.19.4.192:8080/]
Nov 20, 2024 11:02:29 AM org.jenkinsci.remoting.engine.JnlpAgentEndpointResolver resolve
INFO: Remoting server accepts the following protocols: [JNLP4-connect, Ping]
Nov 20, 2024 11:02:29 AM hudson.remoting.jnlp.Main$CuiListener status
INFO: Agent discovery successful
Agent address: 172.19.4.192
Agent port: 50000
Identity: 31:5c:68:04:fa:b7:2a:40:12:2d:cc:70:c1:59:f3:74
Nov 20, 2024 11:02:29 AM hudson.remoting.jnlp.Main$CuiListener status
INFO: Handshaking
Nov 20, 2024 11:02:29 AM hudson.remoting.jnlp.Main$CuiListener status
INFO: Connecting to 172.19.4.192:50000
Nov 20, 2024 11:02:29 AM hudson.remoting.jnlp.Main$CuiListener status
INFO: Trying protocol: JNLP4-connect
Nov 20, 2024 11:02:29 AM org.jenkinsci.remoting.protocol.impl.BIONetworkLayer$Reader run
INFO: Waiting for ProtocolStack to start.
```

3. Verify Connection:


- After running the command, the Jenkins agent should connect to the Jenkins master.
- The node will show as **online** on the **Manage Nodes** page in Jenkins.

Step 4: Create and Configure Credentials in Jenkins


4.1 Add Chef Server Credentials

- Go to **Manage Jenkins > Credentials > System > Global Credentials>Add Credentials**.


Security




**Security**  
Secure Jenkins; define who is allowed to access/use the system.




**Credentials**  
Configure credentials



**Credential Providers**  
Configure the credential providers and types





**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. 2 scripts pending approval.

# Credentials

T	P	Store ↓	Domain
		System	(global)

System

+ Add domain

Domain ↓	Description
 Global credentials (unrestricted)	Credentials that should be available irrespective of domain specification to requirements matching.

Icon: S M L

Global credentials (unrestricted)

+ Add Credentials

- Add a new credential:
  - **ID:** chef-server-id
  - **Username:** Chef Server username
  - **Password:** Chef Server password





The image shows a Jenkins configuration form for creating a new item. The form has the following fields and options:






- Scope**: A dropdown menu with the selected value "Global (Jenkins, nodes, items, all child items, etc)".
- Username**: A text input field containing the placeholder text "<chef-server-username>".
- Treat username as secret**: An unchecked checkbox.
- Password**: An empty text input field.
- ID**: A text input field containing the placeholder text "<Chef-server-id>".
- Description**: An empty text input field.
- Create**: A blue button at the bottom left of the form.

## Step 5: Add CHEF\_WORKSTATION\_PATH as a Global Environment Variable

### 5.1 Configure Global Properties

- Navigate to **Manage Jenkins > Configure System**.

#### System Configuration

 <b>System</b> Configure global settings and paths.	 <b>Tools</b> Configure tools, their locations and automatic installers.	 <b>54 Plugins</b> Add, remove, disable or enable plugins that can extend the functionality of Jenkins.
 <b>Nodes</b> Add, remove, control and monitor the various nodes that Jenkins runs jobs on.	 <b>Clouds</b> Add, remove, and configure cloud instances to provision agents on-demand.	

- Enable **Global Properties > Environment Variables**.
- Add the following variable:
  - **Name:** CHEF\_WORKSTATION\_PATH
  - **Value:** C:/opscode/chef-workstation/bin

## Global properties

☐ Disable deferred wipeout on this node ?☒ Environment variables

List of variables ?

Name

CHEF\_WORKSTATION\_PATH

Value

C:\opscode\chef-workstation\bin

Add


## Step 6: Run the Pipeline

Once the agent is online, you can use the node in your pipeline as follows:

- Create a Pipeline


**Enter an item name**

» 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.



**Pipeline**

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

- Add the pipeline struture as shown below.
- Click on **Apply** and **Save** the configurtion.
- Click on **Build Now** ro run the pipeline.

```

pipeline {
    agent { label 'windows' } // Ensure the pipeline runs on a Windows agent

    environment {
        CHEF_SERVER_CRED = credentials('sooryav') // Jenkins credential ID for
Chef server
        CHEF_ORG = 'chefserver02' // Chef organization name
        CHEF_NODE_IP = '172.19.3.101' // Target node IP (Ubuntu node)
        CHEF_NODE_USER = 'vagrant' // Node SSH username
        CHEF_NODE_PASS = 'vagrant' // Node SSH password
    }
}

```

```

    CHEF_WORKSTATION_PATH = "C:/opscode/chef-workstation/bin" // Chef
    Workstation path on Windows
    CHEF_LOCAL_PATH = "C:/Users/Administrator/Downloads/chef-starter/chef-
repo" // Local Chef folder path
    PATH = "${env.CHEF_WORKSTATION_PATH};${env.PATH}" // Add Chef Workstation
    path to the PATH
}

stages {
    stage('Use Local Chef Repository') {
        steps {
            echo 'Using local Chef repository...'
            bat """
            echo Copying Chef repository from local path...
            xcopy /E /I /Y "${CHEF_LOCAL_PATH}" "%WORKSPACE%\chef-repo"
            """
        }
    }

    stage('Upload Cookbooks') {
        steps {
            echo 'Uploading cookbooks to Chef server...'
            bat """
            %CHEF_WORKSTATION_PATH%/knife cookbook upload webserver --config
%WORKSPACE%\chef-repo\\.chef\\knife.rb --cookbook-path %WORKSPACE%\chef-
repo\\cookbooks
            """
        }
    }
}

post {
    success {
        echo 'Pipeline executed successfully! Chef configurations are applied
and verified.'
    }
    failure {
        echo 'Pipeline execution failed. Check the logs for detailed error
information.'
    }
}
}

```

- Check the pipeline status on **Console output**.

## Console Output

```
Started by user admin
[Pipeline] Start of Pipeline
[Pipeline] node
Running on windows-node in C:\jenkins\workspace\Chef-Pipeline-1
[Pipeline] {
[Pipeline] withCredentials
Masking supported pattern matches of %CHEF_SERVER_CRED% or %CHEF_SERVER_CRED_PSW%
[Pipeline] {
[Pipeline] withEnv
[Pipeline] {
[Pipeline] stage
[Pipeline] { (Use Local Chef Repository)
[Pipeline] echo
Using local Chef repository...
[Pipeline] bat
```

- The pipeline begins by cloning the Chef repository from GitHub into the Jenkins workspace.
- Upload the **webserver** cookbook to the Chef server using **knife**.

### Step-7: Update and Configure **knife.rb** for Jenkins Pipeline

To fix the **knife not found** error, you need to rename your **config.rb** file to **knife.rb** and ensure it is configured properly to work with the Jenkins pipeline structure. Below are the steps:

---

#### Steps to Configure **knife.rb**

##### 1. Locate the **config.rb** File:

- Navigate to the directory where **config.rb** is located. Typically, it will be in the **.chef** folder within your Chef repository.

```
cd C:/Users/Administrator/Downloads/chef-starter/chef-repo/.chef
```

##### 2. Rename **config.rb** to **knife.rb**:

- Rename the **config.rb** file using the command:

```
ren config.rb knife.rb
```

##### 3. Update **knife.rb** Configuration:

- Open the renamed **knife.rb** file in an editor (like Notepad++ or VS Code) and update it to work with your Jenkins pipeline structure:

```
# Knife configuration for Jenkins pipeline
current_dir = File.dirname(__FILE__)
log_level           :info
log_location        STDOUT
node_name           "sooryav"
client_key           "#{ENV['WORKSPACE']}\chef-
repo\\.chef\\.pem"
chef_server_url      "https://api.chef.io/organizations/chefserver02"
cookbook_path        ["#{ENV['WORKSPACE']}\chef-repo\\cookbooks"]
```

## References

1. **Chef Official Documentation:** <https://docs.chef.io/>
2. **Jenkins Official Documentation:** <https://www.jenkins.io/>
3. **Docker Documentation:** <https://docs.docker.com/>
4. **GitHub Repository Setup:** <https://github.com/>