

St. Francis Institute of Technology, Mumbai-400 103
Department Of Information Technology

A.Y. 2024-2025
Class: TE-ITA/B, Semester: V

Subject: **DevOps Lab**

Experiment – 5: To implement continuous integration with Jenkins

1. **Aim:** To implement continuous integration with Jenkins
2. **Objectives:** Aim of this experiment is that, the students will be able
 - To Integrate and deploy tools like Jenkins and Maven, which is used to build applications in DevOps environment
3. **Outcomes:** After study of this experiment, the students will be able
 - To understand the importance of Jenkins to Build and deploy Software Applications on server environment.
 - Learn about Jenkins (With Architecture)
 - To have introduction to Maven / Gradle / Ant
4. **Prerequisite:** Knowledge of software engineering concept of integration
5. **Requirements:** Jenkins, JDK, python, ANT, Personal Computer, Windows operating system, browser, Internet Connection, Microsoft Word.
6. **Pre-Experiment Exercise:**
Brief Theory: Refer shared material
7. **Laboratory Exercise**
 - A. **Procedure:**
 - a. **Answer the following:**
 - Explain continuous integration
 - Why Jenkins is popular? Mention advantages.
 - b. **Execute following (Refer the shared material) and attach screenshots:**
 - Build jobs in Jenkins
8. **Post-Experiments Exercise**
 - A. **Extended Theory:**
Nil
 - B. **Questions:**
 - How is continuous integration achieved using Jenkins?
 - Have you created a build job in Jenkins? Explain how to do it.
 - What are the types of jobs or projects in Jenkins?
 - C. **Conclusion:**
 - Write what was performed in the experiment.
 - Write the significance of the topic studied in the experiment.
 - D. **References:**
 - <https://jenkins.io/doc/>
 - <https://www.cloudbees.com/jenkins/what-is-jenkins>
 - <https://vmokshagroup.com/blog/what-is-jenkins/>
 - <https://www.infoworld.com/article/3239666/what-is-jenkins-the-ci-server-explained.html>
 - <https://hackr.io/blog/jenkins-interview-questions>
 - <https://www.edureka.co/blog/interview-questions/jenkins-interview-questions/>

7. LABORATORY EXERCISE:

Continuous Integration (CI):

Answer: Continuous Integration (CI) is a software development practice where code changes are frequently integrated into a shared repository, typically several times a day. Each integration is followed by automated builds and tests to ensure that new code does not introduce errors or break existing functionality. Key benefits of CI include:

1. **Early Detection of Issues:** Regular integration helps identify and address integration problems and bugs early, before they become significant issues.
2. **Automated Testing:** CI systems automate the process of running tests, which helps maintain code quality and catch issues quickly.
3. **Better Collaboration:** Frequent integration encourages team members to work together more closely, reducing integration conflicts and improving team cohesion.
4. **Increased Efficiency:** Automating the build and testing process saves time compared to manual methods, allowing developers to focus more on coding and less on managing integrations.

Why is Jenkins popular?

Answer:

Jenkins is popular due to its:

1. **Open Source Nature:** Free and customizable.
2. **Extensive Plugin Ecosystem:** Over 1,800 plugins for integration with various tools.
3. **User-Friendly Interface:** Easy to set up and manage.
4. **Flexible Pipelines:** Supports complex workflows with scripted and declarative pipelines.
5. **Strong Community Support:** Active community and extensive resources.
6. **Scalability:** Can distribute tasks across multiple machines.
7. **CI/CD Capabilities:** Supports both continuous integration and delivery.

B. Execute following (Refer the shared material) and attach screenshots:

1. Python freestyle project – simple python script (implicit)

The image displays two screenshots of the Jenkins web interface, showing the configuration page for a job named 'Exp5.1'.

Top Screenshot: General Configuration

- Page Title:** Jenkins
- URL:** localhost:8080/view/VishalRMahajan/job/Exp5.1/configure
- Configuration Type:** Freestyle project (Enabled)
- Description:** This is Python freestyle project – simple python script (implicit). EXP 5. 1
- Options:**
 - ☐ Commit agent's Docker container
 - ☐ Define a Docker template
 - ☐ Discard old builds
 - ☐ GitHub project
 - ☐ This project is parameterized
 - ☐ Throttle builds
- Buttons:** Save, Apply

Bottom Screenshot: Build Steps Configuration

- Page Title:** Jenkins
- URL:** localhost:8080/view/VishalRMahajan/job/Exp5.1/configure
- Configuration Type:** Freestyle project (Enabled)
- Build Steps:**
 - Execute Python script**
 - Script:**

```
num = 5
factorial = 1
if num < 0:
    print(" Factorial does not exist for negative numbers")
elif num == 0:
    print(" Factorial of 0 is 1")
```
- Post-build Actions:**
 - Add post-build action**
- Buttons:** Save, Apply

Footer: REST API, Jenkins 2.414.1

Code/Scripts added in Execute Python Scripts:

```
num = 5
factorial = 1
if num < 0:
    print(" Factorial does not exist for negative numbers")
elif num == 0:
    print("The factorial of 0 is 1")
else:
    for i in range(1,num + 1):
        factorial = factorial*i
    print("The factorial of",num,"is",factorial)
```

Console Output After Building the freestyle project.



Console Output

```
Started by user admin
Running as SYSTEM
Building in workspace C:\ProgramData\Jenkins\.jenkins\workspace\Exp5.1
[Exp5.1] $ python C:\WINDOWS\TEMP\jenkins18275334987029875731.py
The factorial of 5 is 120
Finished: SUCCESS
```

2. Python freestyle project – simple python file (explicit)

The screenshot shows the Jenkins configuration page for a project named 'EXP5.2'. The 'General' tab is selected in the left sidebar. The 'Description' field contains the text: 'This is Python freestyle project – simple python file (explicit). Vishal Rajesh Mahajan SE IT A 4'. Below the description, there are several checkboxes for configuration options, all of which are currently unchecked: 'Commit agent's Docker container', 'Define a Docker template', 'Discard old builds', 'GitHub project', 'This project is parameterized', and 'Throttle builds'. At the bottom of the configuration area, there are 'Save' and 'Apply' buttons. The top of the page shows the Jenkins logo, a search bar, and user information (admin).

The screenshot shows the Jenkins configuration page for the same project, but with the 'Build Steps' tab selected in the left sidebar. The 'Build Steps' section shows a single step named 'Execute Windows batch command'. The 'Command' field for this step contains the following text:

```
cd E:\Users\Student\Desktop\VishalRMahajan
python sumofnaturalNumber.py
```

 Below the command field, there is an 'Advanced' dropdown menu and an 'Add build step' button. The 'Post-build Actions' section is visible at the bottom, with an 'Add post-build action' button. At the very bottom of the page, there are 'Save' and 'Apply' buttons. The footer of the page indicates 'REST API' and 'Jenkins 2.414.1'.

Code/Scripts added in sumofnaturalnumber.py file:

```
num=10

if num < 0:
    print("Enter a positive number")
else:
    sum = 0
    # use while loop to iterate un till zero
    while(num > 0):
        sum += num
        num -= 1
    print("The sum is",sum)
```

Console Output After Building the freestyle project.



Console Output

```
Started by user admin
Running as SYSTEM
Building in workspace C:\ProgramData\Jenkins\.jenkins\workspace\EXP5.2
[EXP5.2] $ cmd /c call C:\WINDOWS\TEMP\jenkins13783224302011969897.bat

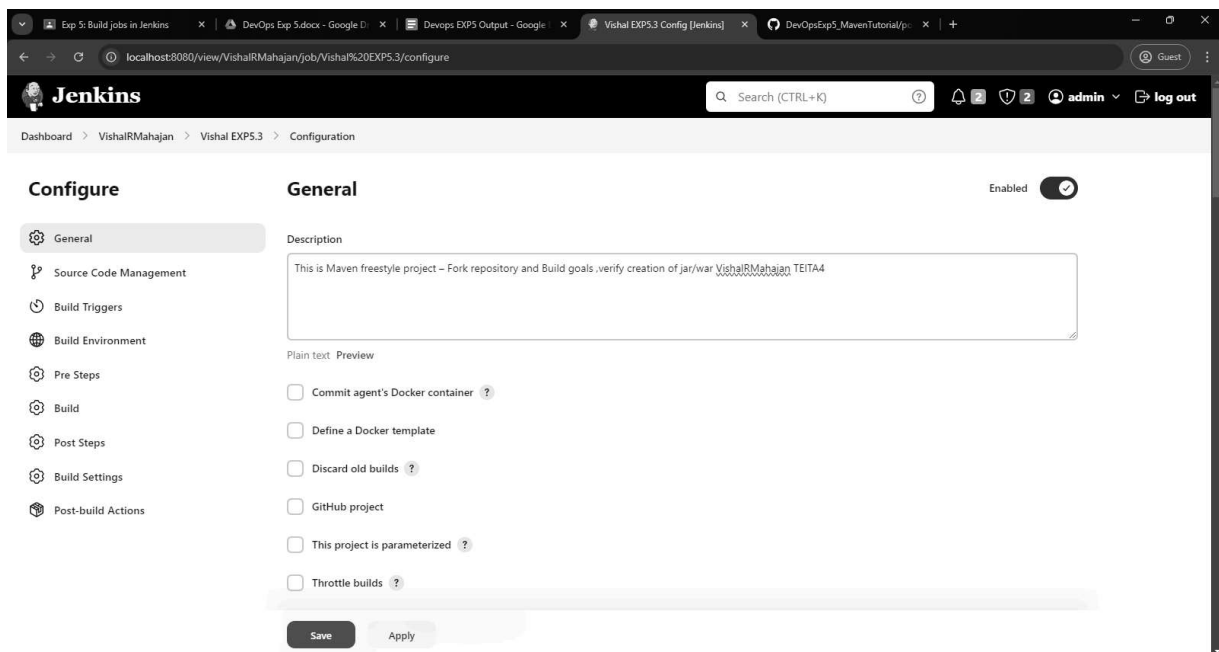
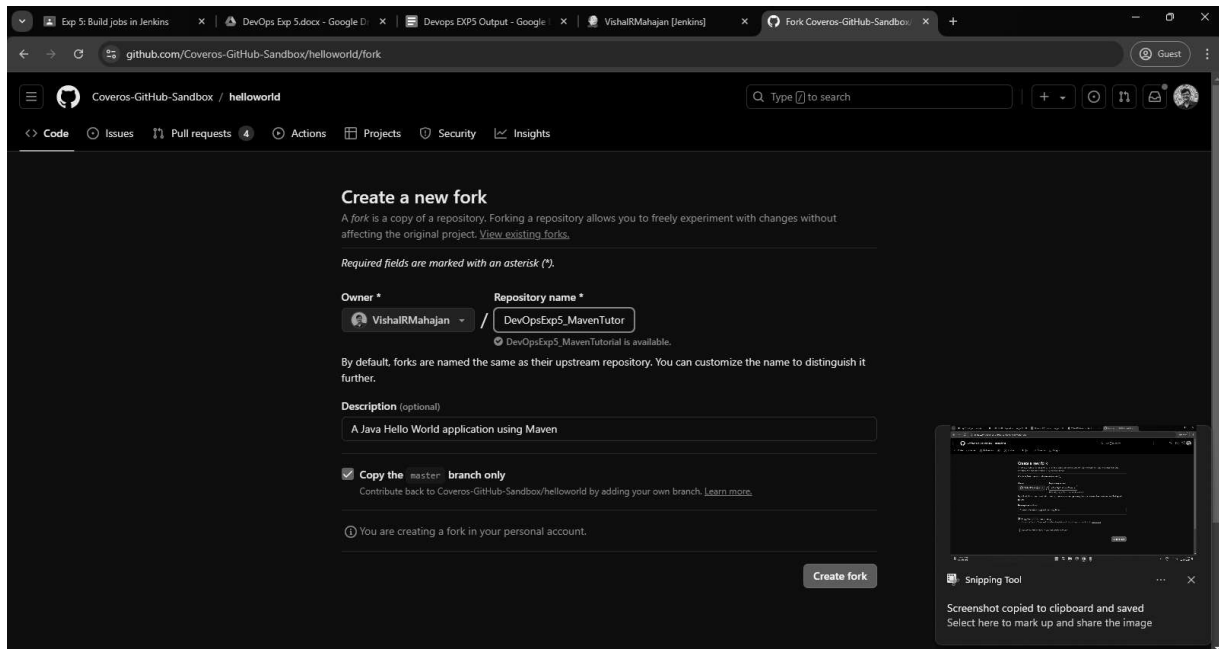
C:\ProgramData\Jenkins\.jenkins\workspace\EXP5.2>cd C:\Users\Student\Desktop\VishalRMahajan

C:\Users\Student\Desktop\VishalRMahajan>python sumofnaturalnumber.py
The sum is 55

C:\Users\Student\Desktop\VishalRMahajan>exit 0
Finished: SUCCESS
```

3. Maven freestyle project – Fork repository and Build goals, verify creation of jar/war

Forking a maven Github Repository:



Exp 5: Build jobs in Jenkins x DevOps Exp 5.docx - Google D... DevOps EXP5 Output - Google Vishal EXP5.3 Config [Jenkins] x DevOpsExp5_MavenTutorial/p... | +

localhost:8080/view/VishalRMahajan/job/Vishal%20EXP5.3/configure

Dashboard > VishalRMahajan > Vishal EXP5.3 > Configuration

Configure

- General
- Source Code Management**
- Build Triggers
- Build Environment
- Pre Steps
- Build
- Post Steps
- Build Settings
- Post-build Actions

☐ None

☒ **Git** ?

Repositories ?

Repository URL ?

https://github.com/VishalRMahajan/DevOpsExp5_MavenTutorial

Credentials ?

- none -

Add

Advanced

Add Repository

Branches to build ?

Branch Specifier (blank for 'any') ?

Save Apply

Exp 5: Build jobs in Jenkins x DevOps Exp 5.docx - Google D... DevOps EXP5 Output - Google Vishal EXP5.3 Config [Jenkins] x DevOpsExp5_MavenTutorial/p... | +

localhost:8080/view/VishalRMahajan/job/Vishal%20EXP5.3/configure

Dashboard > VishalRMahajan > Vishal EXP5.3 > Configuration

Configure

- General
- Source Code Management
- Build Triggers
- Build Environment
- Pre Steps**
- Build
- Post Steps
- Build Settings
- Post-build Actions

Add pre-build step

Build

Root POM ?

pom.xml

Goals and options ?

clean compile package

Advanced

Post Steps

☐ Run only if build succeeds

☐ Run only if build succeeds or is unstable

Save Apply

Console Output After Building the Maven project.

✓ Console Output

```
Started by user admin
Running as SYSTEM
Building in workspace C:\ProgramData\Jenkins\.jenkins\workspace\Vishal EXP5.3
The recommended git tool is: NONE
No credentials specified
Cloning the remote Git repository
Cloning repository https://github.com/VishalRMahajan/DevOpsExp5_MavenTutorial
> C:\Program Files\Git\bin\git.exe init C:\ProgramData\Jenkins\.jenkins\workspace\Vishal EXP5.3 # timeout=10
Fetching upstream changes from https://github.com/VishalRMahajan/DevOpsExp5_MavenTutorial
> C:\Program Files\Git\bin\git.exe --version # timeout=10
> git --version # 'git version 2.34.1.windows.1'
> C:\Program Files\Git\bin\git.exe fetch --tags --force --progress -- https://github.com/VishalRMahajan/DevOpsExp5_MavenTutorial
+refs/heads/*:refs/remotes/origin/* # timeout=10
```

```
[INFO] Building jar: C:\ProgramData\Jenkins\.jenkins\workspace\Vishal EXP5.3\target\helloworld-1.1.jar
[INFO] -----
[INFO] BUILD SUCCESS
[INFO] -----
[INFO] Total time: 7.486 s
[INFO] Finished at: 2024-08-13T11:00:19+05:30
[INFO] -----
Waiting for Jenkins to finish collecting data
[JENKINS] Archiving C:\ProgramData\Jenkins\.jenkins\workspace\Vishal EXP5.3\pom.xml to com.coveros.demo/helloworld/1.1/helloworld-1.1.pom
[JENKINS] Archiving C:\ProgramData\Jenkins\.jenkins\workspace\Vishal EXP5.3\target\helloworld-1.1.jar to com.coveros.demo/helloworld/1.1/helloworld-1.1.jar
channel stopped
Finished: SUCCESS
```

JAR File getting created.

```
Administrator: Command Prompt

C:\Windows\System32>dir "C:\ProgramData\Jenkins\.jenkins\workspace\Vishal EXP5.3\target\helloworld-1.1.jar"
Volume in drive C has no label.
Volume Serial Number is 50D5-6323

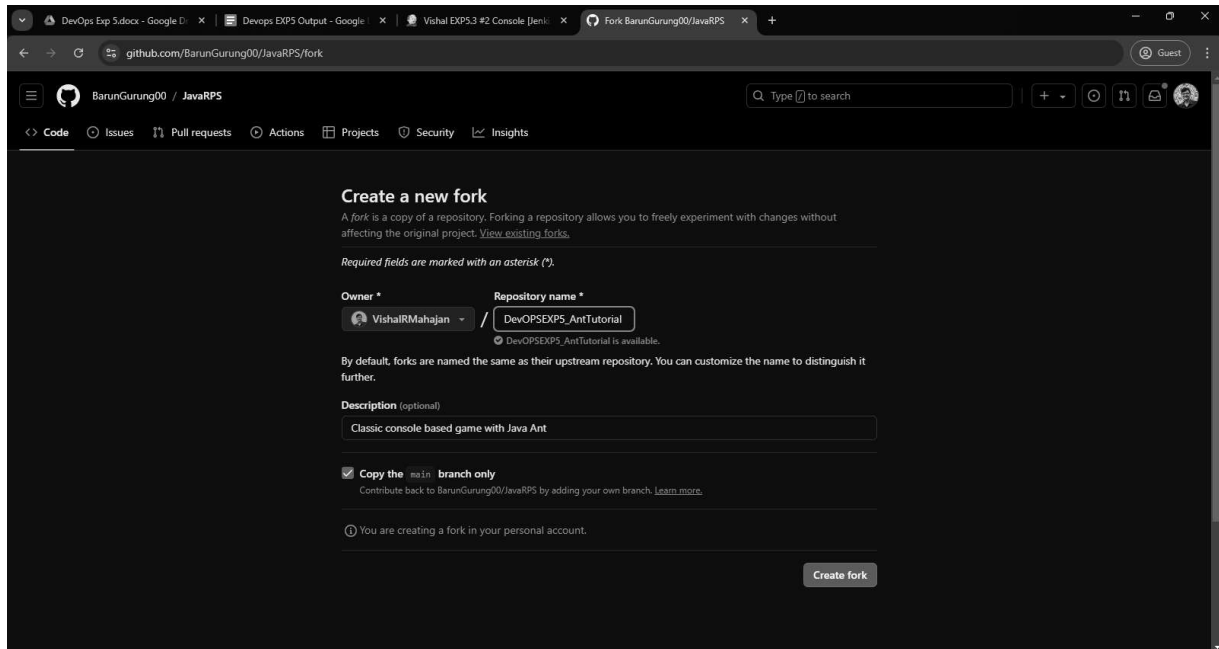
Directory of C:\ProgramData\Jenkins\.jenkins\workspace\Vishal EXP5.3\target

13-08-2024  11:00                2,896 helloworld-1.1.jar
             1 File(s)                2,896 bytes
             0 Dir(s)  77,774,647,296 bytes free

C:\Windows\System32>
```

4. Ant freestyle project - Fork repository and Build goals, verify creation of jar/war

Forking a maven Github Repository:



The screenshot shows the GitHub 'Create a new fork' page for the repository `BarunGurung00/JavaRPS`. The page is in dark mode. At the top, there's a navigation bar with the repository name and a search bar. Below the navigation bar, there are tabs for Code, Issues, Pull requests, Actions, Projects, Security, and Insights. The main content area is titled 'Create a new fork' and includes a brief explanation of forking. The 'Owner' is set to 'VishalRMahajan' and the 'Repository name' is 'DevOPSEXP5_AntTutorial'. A description is provided: 'Classic console based game with Java Ant'. The 'Copy the main branch only' checkbox is checked. At the bottom right, there is a 'Create fork' button.

github.com/BarunGurung00/JavaRPS/fork

BarunGurung00 / JavaRPS

Create a new fork

A fork is a copy of a repository. Forking a repository allows you to freely experiment with changes without affecting the original project. [View existing forks.](#)

Required fields are marked with an asterisk (*).

Owner * Repository name *

VishalRMahajan / DevOPSEXP5_AntTutorial

DevOPSEXP5_AntTutorial is available.

By default, forks are named the same as their upstream repository. You can customize the name to distinguish it further.

Description (optional)

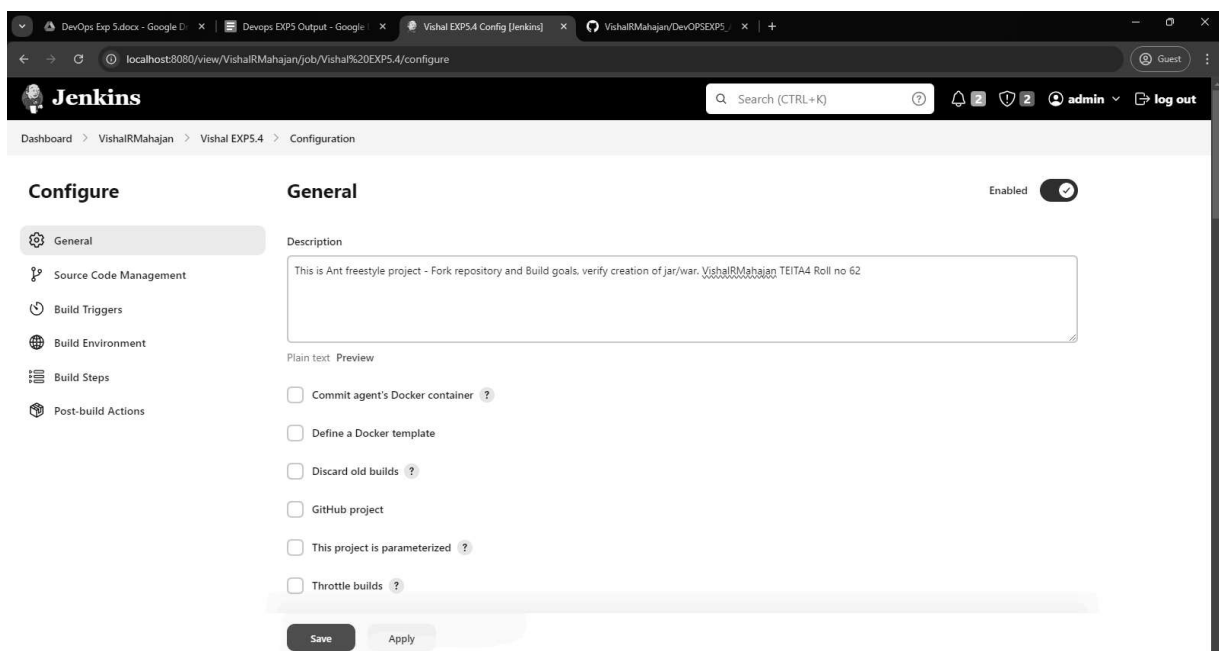
Classic console based game with Java Ant

☒ Copy the main branch only

Contribute back to BarunGurung00/JavaRPS by adding your own branch. [Learn more.](#)

① You are creating a fork in your personal account.

Create fork



The screenshot shows the Jenkins 'Configure' page for the job 'Vishal EXP5.4'. The page is in light mode. At the top, there's a navigation bar with the Jenkins logo and a search bar. Below the navigation bar, there's a breadcrumb trail: Dashboard > VishalRMahajan > Vishal EXP5.4 > Configuration. The main content area is titled 'Configure' and includes a sidebar with tabs for General, Source Code Management, Build Triggers, Build Environment, Build Steps, and Post-build Actions. The 'General' tab is selected. The 'Description' field contains the text: 'This is Ant freestyle project - Fork repository and Build goals, verify creation of jar/war. VishalRMahajan TEITA4 Roll no 62'. Below the description, there are several checkboxes: 'Commit agent's Docker container', 'Define a Docker template', 'Discard old builds', 'GitHub project', 'This project is parameterized', and 'Throttle builds'. At the bottom, there are 'Save' and 'Apply' buttons.

localhost:8080/view/VishalRMahajan/job/Vishal%20EXP5.4/configure

Jenkins

Search (CTRL+K)

admin log out

Dashboard > VishalRMahajan > Vishal EXP5.4 > Configuration

Configure

General

Source Code Management

Build Triggers

Build Environment

Build Steps

Post-build Actions

General

Enabled

Description

This is Ant freestyle project - Fork repository and Build goals, verify creation of jar/war. VishalRMahajan TEITA4 Roll no 62

Plain text Preview

☐ Commit agent's Docker container

☐ Define a Docker template

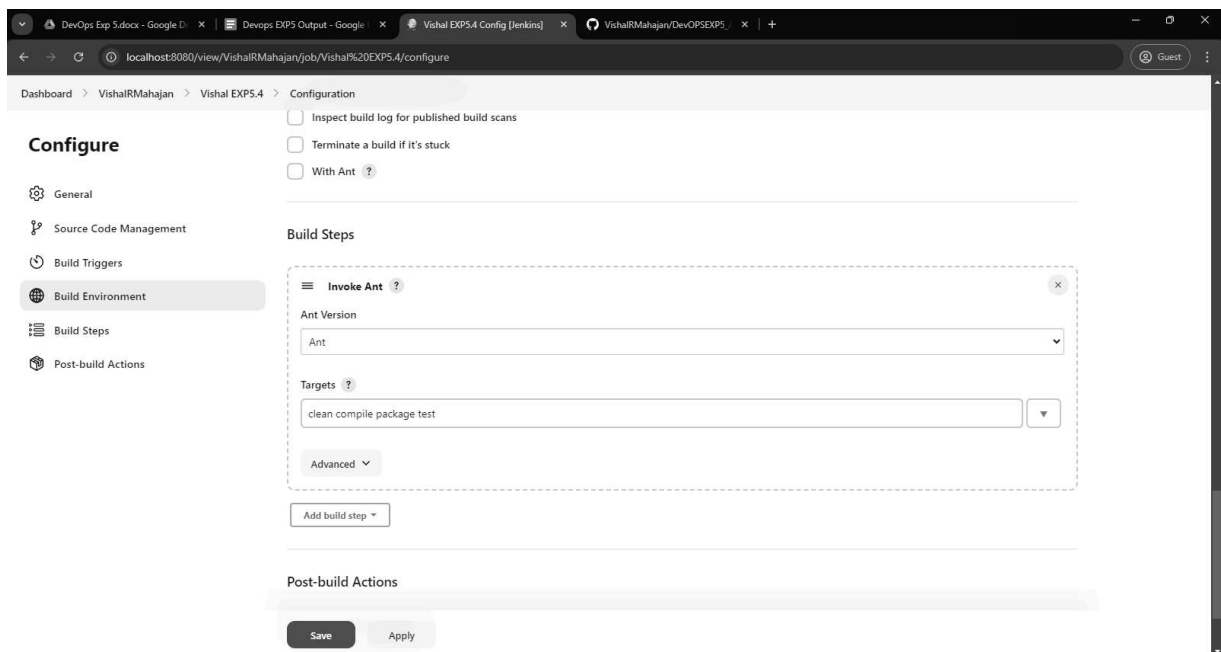
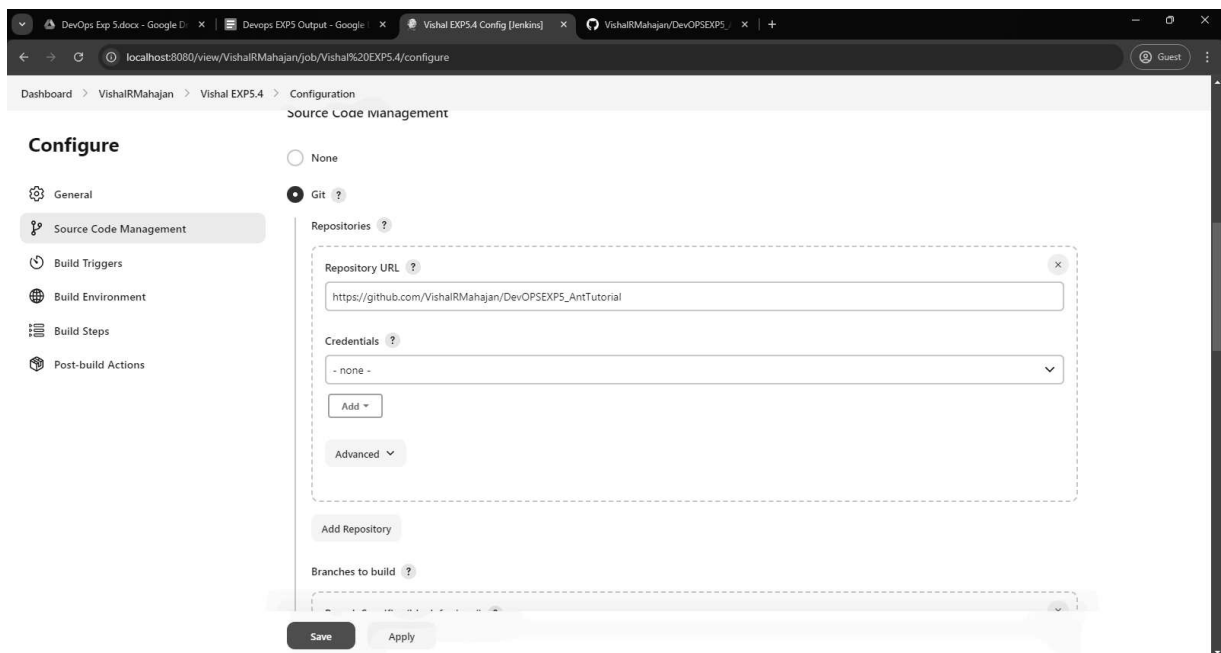
☐ Discard old builds

☐ GitHub project

☐ This project is parameterized

☐ Throttle builds

Save Apply



Console Output After Building the Ant FreeStyle project.



Console Output

```
Started by user admin
Running as SYSTEM
Building in workspace C:\ProgramData\Jenkins\.jenkins\workspace\Vishal EXP5.4
The recommended git tool is: NONE
No credentials specified
> C:\Program Files\Git\bin\git.exe rev-parse --resolve-git-dir C:\ProgramData\Jenkins\.jenkins\workspace\Vishal EXP5.4\.git # timeout=10
Fetching changes from the remote Git repository
> C:\Program Files\Git\bin\git.exe config remote.origin.url https://github.com/VishalRMahajan/DevOPSEXP5_AntTutorial.git # timeout=10
Fetching upstream changes from https://github.com/VishalRMahajan/DevOPSEXP5_AntTutorial.git
> C:\Program Files\Git\bin\git.exe --version # timeout=10
> git --version # 'git version 2.34.1.windows.1'
> C:\Program Files\Git\bin\git.exe fetch --tags --force --progress -- https://github.com/VishalRMahajan/DevOPSEXP5_AntTutorial.git
+refs/heads/*:refs/remotes/origin/* # timeout=10
> C:\Program Files\Git\bin\git.exe rev-parse "refs/remotes/origin/master^{commit}" # timeout=10
Checking out Revision 02f88a382dd116a84e7f3e5955f827879c04dea (refs/remotes/origin/master)
> C:\Program Files\Git\bin\git.exe config core.sparsecheckout # timeout=10
> C:\Program Files\Git\bin\git.exe checkout -f 02f88a382dd116a84e7f3e5955f827879c04dea # timeout=10
Commit message: "Create ant.yml"
First time build. Skipping changelog.
[Vishal EXP5.4] $ cmd.exe /C "C:\apache-ant-1.10.14\bin\ant.bat clean compile package test && exit %ERRORLEVEL%"
Buildfile: C:\ProgramData\Jenkins\.jenkins\workspace\Vishal EXP5.4\build.xml
```

WAR File getting created.

```
Administrator: Command Prompt

C:\Windows\System32>dir "C:\ProgramData\Jenkins\.jenkins\workspace\Vishal EXP5.4\target\roshambo.war"
Volume in drive C has no label.
Volume Serial Number is 50D5-6323

Directory of C:\ProgramData\Jenkins\.jenkins\workspace\Vishal EXP5.4\target

13-08-2024  11:54                9,761 roshambo.war
             1 File(s)              9,761 bytes
             0 Dir(s)  77,847,060,480 bytes free

C:\Windows\System32>
```