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Department Of Information Technology

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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 for a Python freestyle project named 'Exp5.1'.

Top Screenshot: General Configuration

- Configuration:** General (selected), Source Code Management, Build Triggers, Build Environment, Build Steps, Post-build Actions.
- General:** Enabled (checked).
- Description:** This is Python freestyle project – simple python script (implicit). EXP 5. 1
- Plain text:** [Preview](#)
- 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

- Configuration:** General, Source Code Management, Build Triggers, Build Environment, Build Steps (selected), Post-build Actions.
- Build Steps:**
 - Execute Python script ?**
 - Script:** See [the list of available environment variables](#)
 - ```
num = 5
factorial = 1
if num < 0:
 print("Factorial does not exist for negative numbers")
elif num == 0:
 print("Factorial of 0 is 1")
else:
 while num > 1:
 factorial = factorial * num
 num = num - 1
 print("Factorial of " + str(num) + " is " + str(factorial))
```
  - [Add build step](#)
- 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 image displays two screenshots of the Jenkins web interface, showing the configuration for a project named 'EXP5.2'.

**Top Screenshot: General Configuration**

- Page Title:** Jenkins
- Breadcrumbs:** Dashboard > VishalRMahajan > EXP5.2 > Configuration
- Section:** Configure
- Sub-section:** General (Enabled)
- Description:** This is Python freestyle project – simple python file (explicit). Vishal Rajesh Mahajan SE IT A 4
- 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
- Breadcrumbs:** Dashboard > VishalRMahajan > EXP5.2 > Configuration
- Section:** Configure
- Sub-section:** Build Steps
- Build Step:** Execute Windows batch command
  - Command:** cd %USERPROFILE%\Desktop\VishalRMahajan  
python sumofnaturalnumber.py
  - Buttons:** Advanced, Add build step
- Post-build Actions:**
  - Buttons:** Add post-build action, Save, Apply

**Footer:** REST API 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:

The image consists of two screenshots. The top screenshot shows the GitHub 'Create a new fork' page for the repository 'Coversos-GitHub-Sandbox/helloworld'. The 'Owner' is 'VishalRMahajan' and the 'Repository name' is 'DevOpsExp5\_MavenTutorial'. A green checkmark indicates 'DevOpsExp5\_MavenTutorial is available'. The 'Description' is 'A Java Hello World application using Maven'. The 'Copy the master branch only' checkbox is checked. A 'Create fork' button is at the bottom right. A 'Snipping Tool' notification is visible on the right side.

The bottom screenshot shows the Jenkins 'Configure' page for the job 'Vishal EXP5.3'. The 'General' tab is selected. The 'Description' field contains the text: 'This is Maven freestyle project – Fork repository and Build goals ,verify creation of jar/war VishalRMahajan TEITA4'. The 'Plain text' option is selected. 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'. The 'Save' button is at the bottom left.

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

### Source Code Management

☐ 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 | DevOps Exp 5.docx - Google D... | DevOps EXP5 Output - Google | Vishal EXP5.3 Config [Jenkins] | 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

### Pre Steps

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



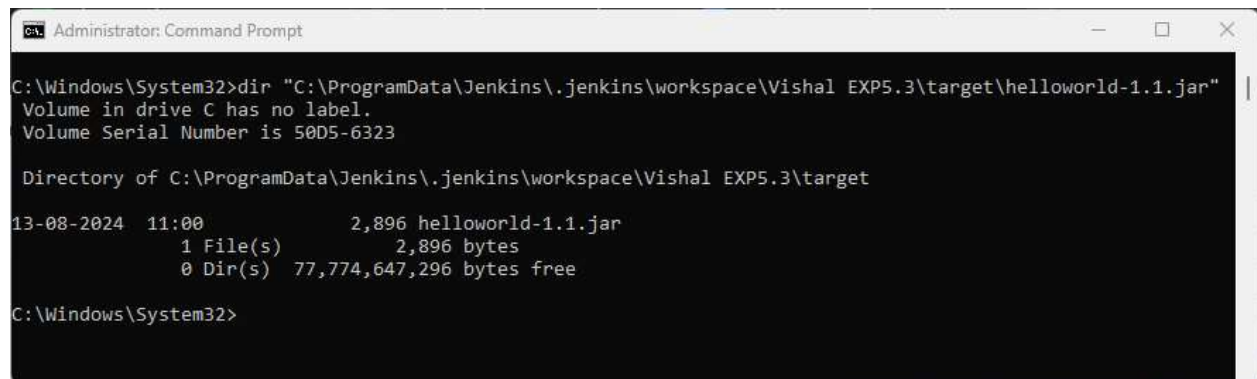
## Console Output After Building the Maven project.

### 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.



```
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

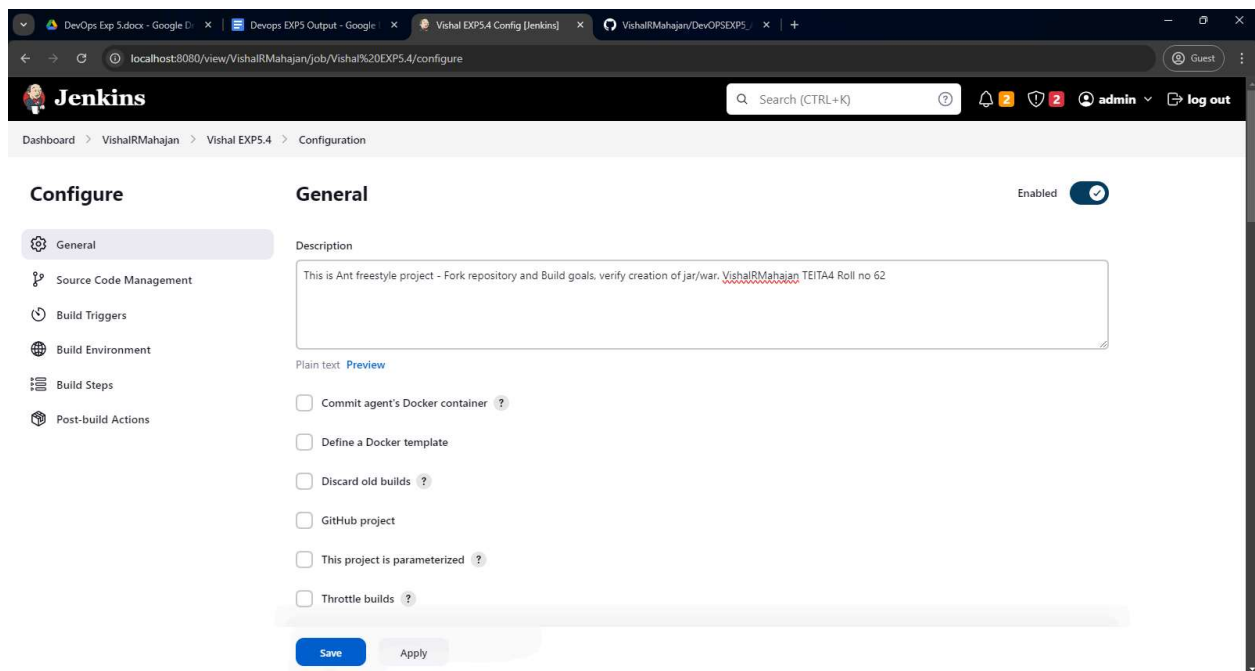
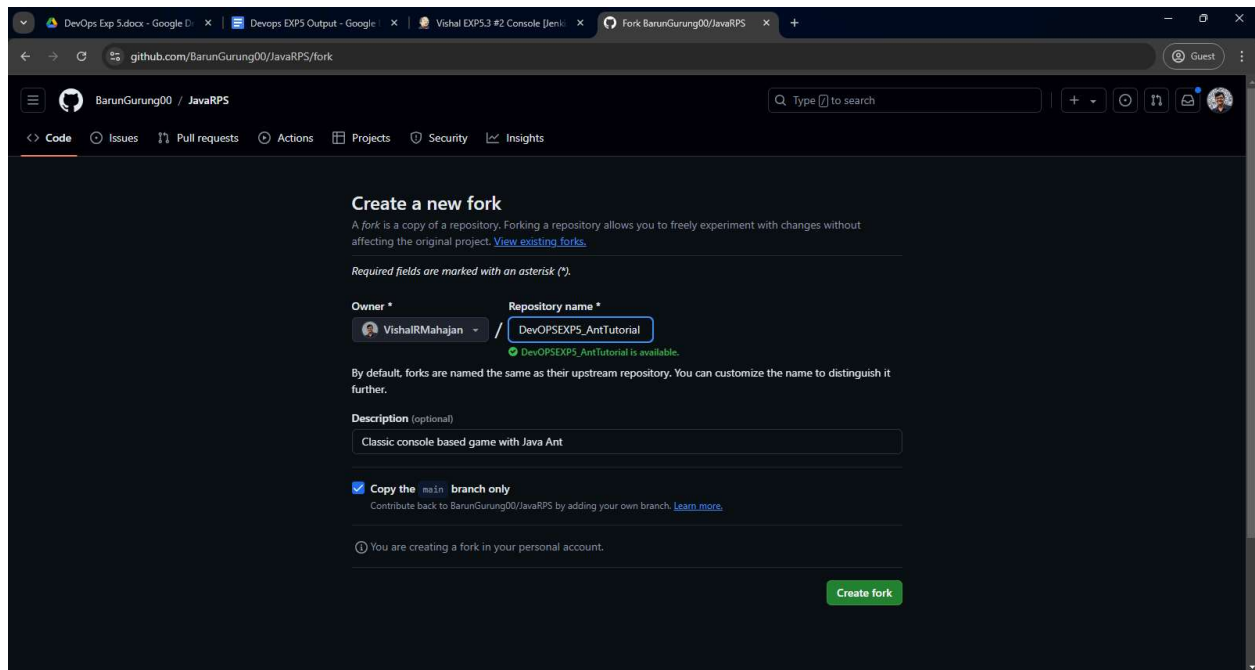
Directory of C:\ProgramData\Jenkins\.jenkins\workspace\Vishal EXP5.3\target

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:



Dashboard > VishalRMahajan > Vishal EXP5.4 > Configuration

## Configure

General

Source Code Management

Build Triggers

Build Environment

Build Steps

Post-build Actions

Source Code Management

☐ None

☒ Git ?

Repositories ?

Repository URL ?

https://github.com/VishalRMahajan/DevOPSEXP5\_AntTutorial

Credentials ?

- none -

Add

Advanced

Add Repository

Branches to build ?

Save Apply

Dashboard > VishalRMahajan > Vishal EXP5.4 > Configuration

## Configure

General

Source Code Management

Build Triggers

Build Environment

Build Steps

Post-build Actions

☐ Inspect build log for published build scans

☐ Terminate a build if it's stuck

☐ With Ant ?

Build Steps

Invoke Ant ?

Ant Version

Ant

Targets ?

clean compile package test

Advanced

Add build step

Post-build Actions

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 02f88a382dda116a84e7f3e5955f827879c04dea (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 02f88a382dda116a84e7f3e5955f827879c04dea # 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>
```