CA - VTU DevOps Course Code : BCSL657D Syllabus

DevOps Lab Manual – Table of Contents (VTU)

Sl. No	Experiment Title	Topics Covered
1	**Introduction to Maven and Gradle**	Overview of Build Automation Tools, Key Differences Between Maven and Gradle, Installation and Setup
2	**Working with Maven**	Creating a Maven Project, Understanding the POM File, Dependency Management and Plugins
3	**Working with Gradle**	Setting Up a Gradle Project, Understanding Build Scripts (Groovy and Kotlin DSL), Dependency Management and Task Automation
4	**Practical Exercise: Build and Run a Java Application**	Build and Run a Java Application with Maven, Migrate the Same Application to Gradle
5	**Introduction to Jenkins**	What is Jenkins?, Installing Jenkins on Local or Cloud Environment, Configuring Jenkins for First Use
6	**Continuous Integration with Jenkins**	Setting Up a CI Pipeline, Integrating Jenkins with Maven/Gradle, Running Automated Builds and Tests
7	**Configuration Management with Ansible**	Basics of Ansible: Inventory, Playbooks, and Modules, Automating Server Configurations with Playbooks, Hands-On: Writing and Running a Basic Playbook
8	**Practical Exercise: CI/CD with Jenkins and Ansible**	Set Up a Jenkins CI Pipeline for a Maven Project, Use Ansible to Deploy Artifacts Generated by Jenkins

9	**Introduction to Azure DevOps**	Overview of Azure DevOps Services, Setting Up an Azure DevOps Account and Project
10	**Creating Build Pipelines in Azure DevOps**	Building a Maven/Gradle Project with Azure Pipelines, Integrating Code Repositories (e.g., GitHub, Azure Repos), Running Unit Tests and Generating Reports
11	**Creating Release Pipelines in Azure DevOps**	Deploying Applications to Azure App Services, Managing Secrets and Configurations with Azure Key Vault, Hands-On: Continuous Deployment with Azure Pipelines
12	**Final Practical Exercise and Wrap-Up**	Build and Deploy a Complete DevOps Pipeline, Discussion on Best Practices and Q&A

Prologue || Commit To Achieve

🎯 About Coders Arcade

🌟 **Coders Arcade** is your go-to edtech platform for mastering programming, DevOps, automation, and cloud technologies. We offer structured, hands-on training designed for both **beginners and professionals**, with a special focus on **VTU subjects** to help students ace their curriculum.

📚 Our content covers **C, C++, Java, Python, SQL, Data Science, Machine Learning, AWS, DevOps tools (Maven, Gradle, Jenkins, Ansible, Azure DevOps), and more!** Whether you're preparing for placements or upskilling for your career, ***Coders Arcade*** provides the right guidance with **industry-oriented** courses, real-world projects, and expert mentorship.

💡 **Why Choose Us?**

✅ Beginner-friendly & advanced tutorials
✅ Industry-relevant projects & hands-on exercises
✅ 100% practical approach for better learning
✅ Affordable & high-quality training
✅ Strong **VTU** syllabus alignment

👨‍💻 About the Author

🚀 With **14+ years of experience** in the software industry, I have worked with leading companies like **Zaloni, TCS, and Flipkart**, taking on roles from **Test Automation Engineer** to **Backend Developer**. Currently, I am a **Senior Program Manager at Coders Arcade**, dedicated to delivering high-quality, accessible technical education.

🏆 I have provided **placement trainings & FDPs** in various esteemed institutions across **Karnataka**, helping students bridge the gap between **academics and industry requirements**. Passionate about software development and teaching, I believe in making **learning simple, engaging, and career-focused**.

💬 **Let's Learn. Let's Code. Let's Grow. Commit To Achieve...!!!**

📌 **Connect with me:**
🔗 **LinkedIn:** Saurav Sarkar
▶️ **YouTube:** Coders Arcade

CA - VTU DevOps FDP TOC With Program Outcomes

Table Of Contents

Sl. No	Experiment Title	Topics Covered	Program Outcome	Key Takeaways
1	**Introduction to Maven and Gradle**	Overview of Build Automation Tools, Key Differences Between Maven and Gradle, Installation and Setup	Understand the importance of build automation tools and their role in DevOps workflows	Learn to install and configure Maven and Gradle for project builds
2	**Working with Maven**	Creating a Maven Project, Understanding the POM File, Dependency Management and Plugins	Gain hands-on experience in managing dependencies and plugins using Maven	Learn to structure a Maven project and configure the `pom.xml` file
3	**Working with Gradle**	Setting Up a Gradle Project, Understanding Build Scripts (Groovy and Kotlin DSL), Dependency Management and Task Automation	Learn to automate builds using Gradle and understand its scripting capabilities	Understand the difference between Groovy and Kotlin DSL for build automation
4	**Practical Exercise: Build and Run a Java Application**	Build and Run a Java Application with Maven, Migrate the Same Application to Gradle	Gain practical experience in building and running Java applications with both tools	Learn how to migrate an existing Maven-based project to Gradle
5	**Introduction to Jenkins**	What is Jenkins?, Installing Jenkins on Local or Cloud Environment, Configuring Jenkins for First Use	Understand the fundamentals of Jenkins and its role in Continuous Integration	Learn to install, configure, and access Jenkins for project automation

6	**Continuous Integration with Jenkins**	Setting Up a CI Pipeline, Integrating Jenkins with Maven/Gradle, Running Automated Builds and Tests	Learn to automate the software build and testing process	Implement CI/CD pipelines using Jenkins for better development efficiency
7	**Configuration Management with Ansible**	Basics of Ansible: Inventory, Playbooks, and Modules, Automating Server Configurations with Playbooks, Hands-On: Writing and Running a Basic Playbook	Understand configuration management and automation with Ansible	Learn to write and execute Ansible playbooks for server configurations
8	**Practical Exercise: CI/CD with Jenkins and Ansible**	Set Up a Jenkins CI Pipeline for a Maven Project, Use Ansible to Deploy Artifacts Generated by Jenkins	Apply Jenkins and Ansible together for an automated deployment pipeline	Understand the integration of Jenkins CI/CD with Ansible automation
9	**Introduction to Azure DevOps**	Overview of Azure DevOps Services, Setting Up an Azure DevOps Account and Project	Learn about cloud-based DevOps tools and their benefits	Gain hands-on experience in setting up and navigating Azure DevOps
10	**Creating Build Pipelines in Azure DevOps**	Building a Maven/Gradle Project with Azure Pipelines, Integrating Code Repositories (e.g., GitHub, Azure Repos), Running Unit Tests and Generating Reports	Implement automated build pipelines in a cloud environment	Learn to connect repositories and run tests in Azure Pipelines
11	**Creating Release Pipelines in Azure DevOps**	Deploying Applications to Azure App Services, Managing Secrets and Configurations with Azure Key Vault, Hands-On: Continuous Deployment with Azure Pipelines	Understand the release management process in a DevOps environment	Deploy applications securely using Azure Key Vault and Azure Pipelines
12	**Final Practical Exercise and Wrap-Up**	Build and Deploy a Complete DevOps Pipeline, Discussion on Best Practices and Q&A	Gain end-to-end experience in setting up a DevOps pipeline	Understand best practices in DevOps and real-world applications

🌟 **Overall Program Benefits For Participants:**

✅ **Master DevOps Workflows & Tools – Gain a comprehensive understanding of DevOps methodologies, including automation, CI/CD, and infrastructure management.**

✅ **Hands-On Experience with Industry Tools – Work with Git (Version Control), Jenkins & Azure DevOps (CI/CD), and Ansible (Automation) to build real-world expertise.**

✅ **Enhance Your Practical Skills – Apply your knowledge through live demonstrations, hands-on labs, and project-based learning to solidify your understanding.**

✅ **Stay Aligned with Industry Best Practices – Learn cutting-edge DevOps techniques used by top organizations and apply them in real-world scenarios.**

📌 **Upgrade your skill set. Gain practical expertise. Accelerate your career in DevOps!** 🚀

CA - FDP Pre-requisites and Software Requirements

Pre-requisites and Software Requirements

Pre-requisites

1. **Java Programming Knowledge**:
   - Basic understanding of Java syntax, OOP concepts, and familiarity with building Java applications.
2. **Operating System**:
   - Windows, macOS, or Linux (64-bit recommended).
3. **Internet Connectivity**:
   - Reliable internet connection for downloading software, accessing GitHub, and Azure resources.
4. **GitHub Account**:
   - All participants must have a fully functional **GitHub account** for version control and source code management.

Software Requirements

Software/Tool	Version	Purpose	Installation Notes
Java JDK	17.0 or above (preferred)	Required for building and running Java-based applications.	Download from Oracle or OpenJDK distributions.
IntelliJ IDEA	2022.2 or above	Integrated Development Environment (IDE) for Java development and project management.	Download from JetBrains.
Eclipse For Developers	2022-09 or above	Integrated Development Environment (IDE) for Java development and project management.	Download from Eclipse Packages.
Apache Tomcat Server	10 or above	Local Server For Basic WebSite Deployment.	Download from Apache Tomcat.

Git	Latest stable version	Version control system for managing source code and collaborating via GitHub.	Download from Git.
Maven	Latest stable version	Build automation tool for Java projects.	Download from Apache Maven.
Gradle	Latest stable version	Alternative build automation tool for managing dependencies and tasks.	Download from Gradle.
Jenkins	Latest stable version	CI/CD tool for automating builds, tests, and deployments.	Download from Jenkins.
Oracle VM VirtualBox	Latest stable version	Virtualization tool for creating and managing virtual machines.	Download from VirtualBox.
Vagrant	Latest stable version	Tool for managing and provisioning virtual machine environments.	Download from Vagrant.
Ansible	Latest stable version	Configuration management and automation tool.	Install via Ansible documentation.
Microsoft Azure	Free Tier Account	Needed for DevOps CI-CD Pipelines & Deployments.	Install via Microsoft Azure SignUp.

Important Installation Video Links :

Java : Installing Java and its Dependencies (VTU Syllabus)

Eclipse : Installing Eclipse IDE and Running Your First Java Program.

Apache Tomcat : Apache Tomcat Installation - Tomcat 10 Server on Windows 10/11 (Coders Arcade)

Git : Git Tutorials for Beginners - Installing Git || Step-by-Step Guide

Maven : The Best Way to Install Maven - Coders Arcade - Maven Installation: What is Maven? || Coders Arcade

Gradle : How to Install Gradle on Windows? - GeeksforGeeks

Jenkins : Jenkins Installation - Step by Step Guide

Oracle Virtual Box : 🚀Installing Oracle Virtual Box On Windows 11 || Step By Step Guide 🚀

Ubuntu VM On Windows : Installing Ubuntu 23 On Windows 11 Using Oracle Virtual Box || Step By Step Guide || Coders Arcade

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Important Note for Azure DevOps Setup

- **An active Azure account is required for the Azure DevOps sessions.**
- **Azure accounts should only be created one week prior to the commencement of Azure DevOps topics in college laboratories.**
- **This ensures compliance with Microsoft's 30-day free tier policy and avoids restricted access to parallelism.**

Resources for Practice:

- **Additional learning materials and resources are available for participants to practice Azure DevOps concepts here → DevOps VTU Resources Click Here .**

CA - Introduction To SDLC & Need For Version Control & Build Tools

Introduction to DevOps & the Need for Build Tools

1. Understanding the Software Development Lifecycle (SDLC)

Before diving into build tools like **Maven and Gradle**, it's essential to understand how software has traditionally been developed. The **Software Development Lifecycle (SDLC)** provides a structured approach to building software efficiently.

One of the earliest models of SDLC is the **Waterfall Model**, which follows a **linear and sequential** process where each phase must be **fully completed** before moving to the next. However, this model has several limitations, which led to the adoption of **Agile and DevOps** methodologies.

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2. Waterfall Model: A Step-by-Step Approach

The **Waterfall Model** consists of six distinct phases:

1️⃣ Requirement Analysis

📌 The first interaction always happens between the **Business Analyst (BA) and the Client**.
📌 The BA prepares the **CRS (Client Requirement Specification)** before even preparing the **SRS (Software Requirement Specification)**.
📌 The final **SRS document** defines all system functionalities before development begins.

2️⃣ Design

📌 The **architecture of the software** is planned based on the requirements.
📌 High-Level Design (**HLD**) and Low-Level Design (**LLD**) are created.
📌 Technologies, frameworks, and databases are chosen.

3️⃣ Coding (Implementation)

📌 Developers **write the code** based on the design.
📌 Code is divided into modules and integrated later.
📌 Best practices like version control (e.g., **Git**) are followed.

4️⃣ Testing

📌 Testers verify if the software meets the **SRS specifications**.
📌 Types of testing include **unit testing, integration testing, and system testing**.
📌 Bugs are reported to developers for fixing.

5️⃣ Deployment

📌 The software is **released** to production.
📌 Deployment can be **on-premises or cloud-based**.
📌 The software becomes available for real-world users.

6️⃣ Maintenance

📌 Post-deployment, updates, bug fixes, and improvements are continuously made.
📌 Performance monitoring and security patches are applied.

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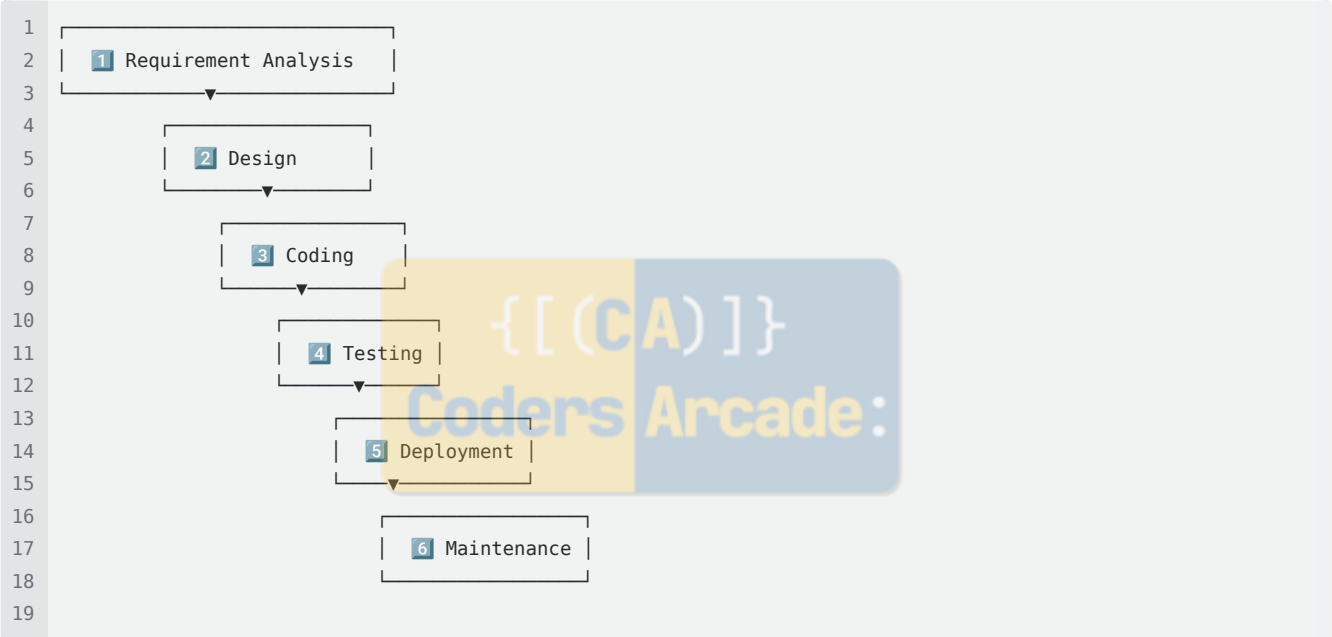
3. Waterfall Model - Block-Based Diagram



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4. Problems with the Waterfall Model

🚩 **Rigid & Inflexible** – Changes cannot be made once a phase is completed.
🚩 **Late Bug Detection** – Testing happens after coding, making bug fixes costly.
🚩 **Slow Development Process** – Each phase must be completed before the next starts.
🚩 **Not Suitable for Modern Agile Environments** – Does not support rapid iteration.

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5. Introduction to Agile Methodology

To overcome Waterfall's limitations, the **Agile Model** was introduced. Agile promotes **iterative and incremental development**, allowing teams to deliver software faster with continuous feedback.

Key Agile Concepts

✅ **Sprints** – Development happens in short cycles, usually lasting **7-14 days**.
✅ **Scrum Master** – Facilitates Agile processes and removes blockers for the team.
✅ **Daily Stand-up Meetings** – Short meetings where team members discuss:
1️⃣ **What they did yesterday?**
2️⃣ **What they plan to do today?**
3️⃣ **Any blockers?**
✅ **Retrospective Meetings** – At the end of each sprint, the team reflects on what worked well and what can be improved.

Sprint Retrospective: The 4Ls Framework

The **4Ls retrospective** is a common technique used in tech interviews:

- **Loved** – What went well in the sprint?
- **Longed for** – What do we wish had happened?
- **Loathed** – What went wrong or was frustrating?
- **Learned** – What new knowledge or skills were gained?

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6. The Transition from Agile to DevOps

While Agile improved development, **deployment and operations remained slow**. This led to the birth of **DevOps**, which introduced:

- **Continuous Integration & Deployment (CI/CD)**
- **Automation of Builds, Testing, and Deployment**
- **Faster & More Reliable Software Releases**

To make DevOps efficient, we need **Build Tools** like **Maven & Gradle**, which simplify project management.

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7. The Clumsy Manual Approach to Project Setup

Before introducing **Maven & Gradle**, let's look at how we manually created a **Selenium Automation Test Project**.

Manual Setup Process

1️⃣ **Created a Simple Java Project** in IntelliJ IDEA (**Selenium Automation Test**).
2️⃣ **Manually Downloaded the Selenium JAR** from:
🔗 https://www.selenium.dev
3️⃣ **Created a `lib` folder** and placed `selenium-server-4.28.1.jar` inside it.
4️⃣ **Manually Added the Dependency** in IntelliJ IDEA:

- **File → Project Structure → Libraries → Add Selenium JAR → Apply → OK**
  5️⃣ **Wrote a Selenium Test in Java (`LoginTest.java`)** to validate login at **https://www.saucedemo.com**.
  6️⃣ **Ran the test manually** in IntelliJ IDEA.

Java Selenium Code for Login Automation

```java
import org.openqa.selenium.By;
import org.openqa.selenium.WebDriver;
import org.openqa.selenium.chrome.ChromeDriver;

public class LoginTest {
    public static void main(String[] args) throws InterruptedException {
        WebDriver driver = new ChromeDriver();
        driver.get("https://www.saucedemo.com/");
        driver.manage().window().maximize();
        Thread.sleep(2000);
        driver.findElement(By.id("user-name")).sendKeys("standard_user");
        Thread.sleep(2000);
        driver.findElement(By.id("password")).sendKeys("secret_sauce");
        Thread.sleep(2000);
        driver.findElement(By.id("login-button")).click();
        Thread.sleep(2000);
        driver.quit();
    }
}

```

ℹ️ Explanation of the Selenium Code (`LoginTest.java`)

This Java program automates the login process for **SauceDemo** using **Selenium WebDriver**. Below is a detailed explanation of each part of the code:

1️⃣ Importing Required Selenium Libraries

```
import org.openqa.selenium.By;
import org.openqa.selenium.WebDriver;
import org.openqa.selenium.chrome.ChromeDriver;

```

- `By` – Helps locate web elements on the page (e.g., text fields, buttons).
- `WebDriver` – Interface for automating browsers.
- `ChromeDriver` – A class that implements WebDriver to control Google Chrome.

2️⃣ Main Method Execution

```
public class LoginTest {
    public static void main(String[] args) throws InterruptedException {

```

- The program starts execution from `main()`.
- The `throws InterruptedException` handles the `Thread.sleep()` method, which pauses execution temporarily.

3️⃣ Launching Chrome Browser

```
WebDriver driver = new ChromeDriver();

```

- **Creates an instance of ChromeDriver**, which opens a new Chrome browser window.
- Selenium **versions after 4.11** do not require separate browser drivers.

4️⃣ Navigating to the Website

```
driver.get("https://www.saucedemo.com/");
driver.manage().window().maximize();
Thread.sleep(2000);

```

- `driver.get(URL)` – Opens the given website (`https://www.saucedemo.com/`).
- `manage().window().maximize()` – Maximizes the browser window.
- `Thread.sleep(2000)` – Waits for **2 seconds** to allow elements to load.

5️⃣ Entering Username & Password

```
driver.findElement(By.id("user-name")).sendKeys("standard_user");
Thread.sleep(2000);
driver.findElement(By.id("password")).sendKeys("secret_sauce");
Thread.sleep(2000);

```

- **Locating elements by their `id` attribute** and entering values:
  - **Username:** `"standard_user"`
  - **Password:** `"secret_sauce"`
- `sendKeys(value)` – Types the provided text into the input field.

6️⃣ Clicking the Login Button

```
driver.findElement(By.id("login-button")).click();
Thread.sleep(2000);

```

- **Finds the login button using `id="login-button"` and clicks it.**
- **Waits for 2 seconds** to observe the login action.

7️⃣ Closing the Browser

```
driver.quit();

```

- **Closes the browser** after execution to free up system resources.

Summary of the Automation Process

✅ Opens **Google Chrome**
✅ Navigates to **SauceDemo Login Page**
✅ Enters **Username and Password**
✅ Clicks **Login Button**
✅ Closes **the browser**

This simple example shows the **power of Selenium for web automation**, highlighting the disadvantages of manually managing dependencies. This is why **build tools like Maven & Gradle** are needed, which we will explore after **Version Control Systems (Git & GitHub).** 🚀

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8. Problems with the Manual Approach

🚩 **Time-Consuming** – Downloading and adding dependencies manually is inefficient.
🚩 **Error-Prone** – Missing JAR files or incorrect configurations can break the project.
🚩 **Difficult to Manage** – Dependencies are not automatically updated.
🚩 **Not Scalable** – Every team member must manually configure their setup.

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9. Why Do We Need Build Tools?

To **overcome these inefficiencies**, we use **Maven & Gradle**, which:

✅ **Automatically manage dependencies** – No need to download JARs manually.
✅ **Simplify project configuration** – A single configuration file (`pom.xml` for Maven, `build.gradle.kts` for Gradle) handles everything.
✅ **Enable easy build & testing** – Run tests and package applications using simple commands.
✅ **Ensure consistency** – The same project setup works on different machines.

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10. What's Next? Understanding Version Control

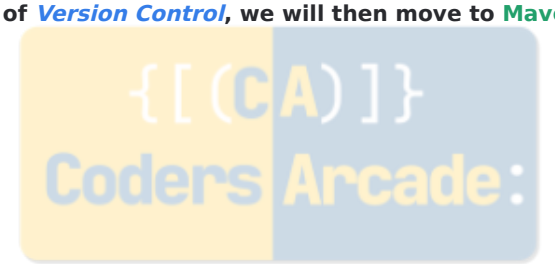
Before moving to Maven & Gradle, we must first understand Version Control Systems (VCS) like Git. Version control plays a crucial role in DevOps, enabling:

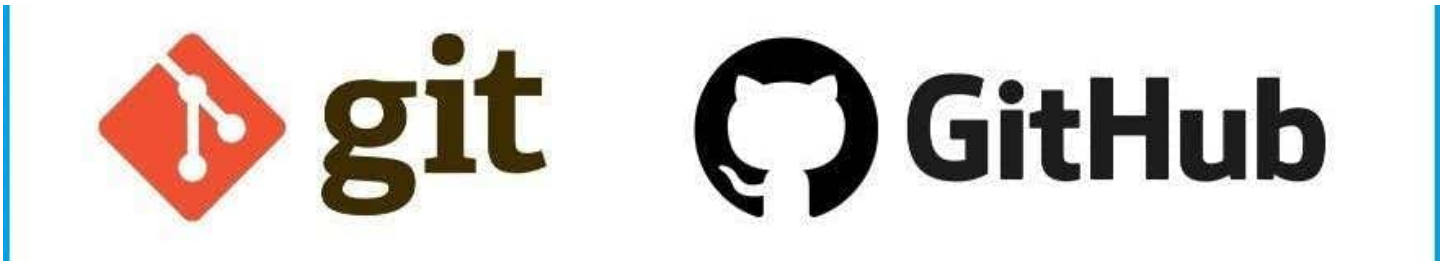
- **Efficient Code Management – Track changes, revert to previous versions, and collaborate seamlessly.**
- **Team Collaboration – Multiple developers can work on the same project without conflicts.**
- **Integration with CI/CD Pipelines – Automates builds, testing, and deployment.**

In the next section, we will explore Git, covering:

✅ **What is Version Control?**
✅ **Introduction to Git & GitHub**
✅ **Basic Git Commands & Repository Setup**
✅ **Branching, Merging & Collaboration**

Once we have a strong grasp of *Version Control*, we will then move to Maven & Gradle for efficient build automation. 🚀





CA - Git & GitHub Notes & Documentation

Git & GitHub

Introduction

Git is a free and open source distributed version control system designed to handle everything from small to very large projects with speed and efficiency.

Git is easy to learn and has a tiny footprint with lightning fast performance. It outclasses SCM tools like Subversion, CVS, Perforce, and ClearCase with features like cheap local branching, convenient staging areas, and multiple workflows.

Version Control

Watch This Video To Understand More About Version Control : What Is Version Control? | Git Version Control | Version Control In Software Engineering

About Version Control

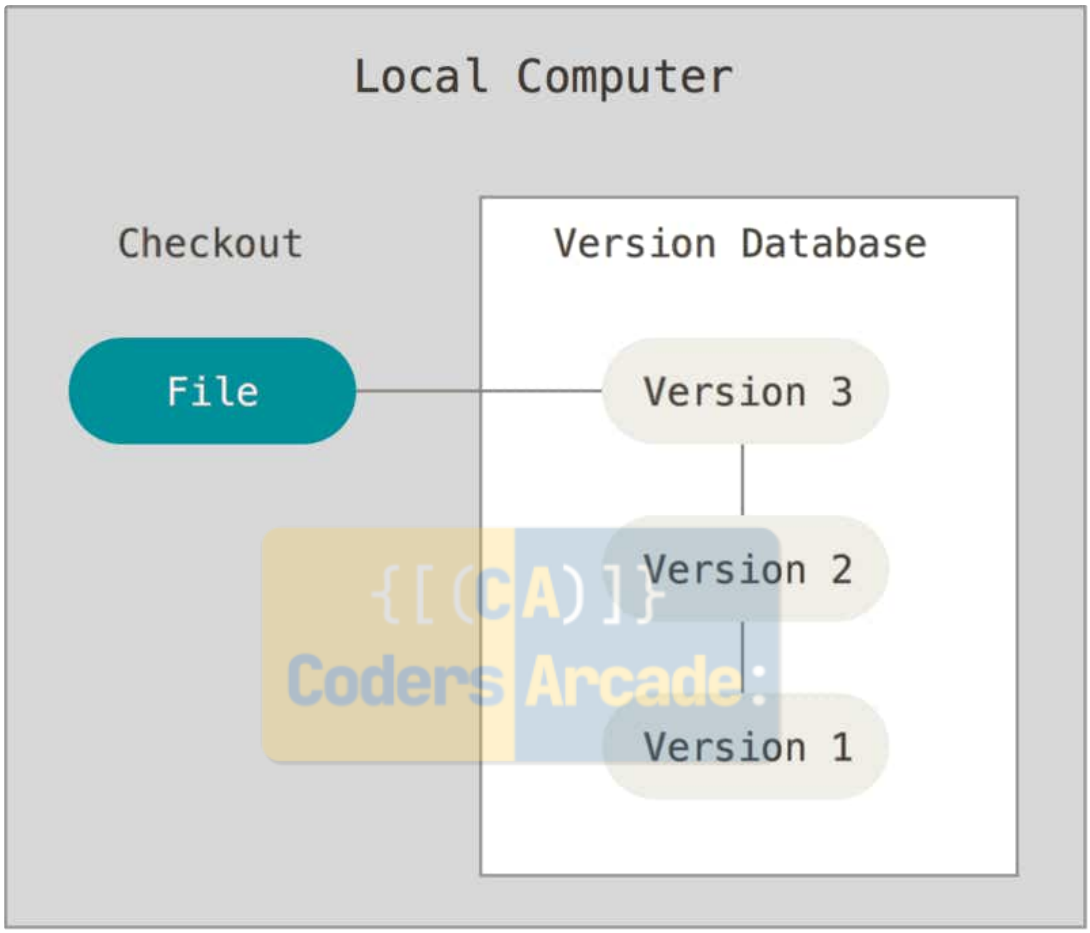
What is “version control”, and why should you care? Version control is a system that records changes to a file or set of files over time so that you can recall specific versions later. For the examples in this book, you will use software source code as the files being version controlled, though in reality you can do this with nearly any type of file on a computer.

If you are a graphic or web designer and want to keep every version of an image or layout (which you would most certainly want to), a Version Control System (VCS) is a very wise thing to use. It allows you to revert selected files back to a previous state, revert the entire project back to a previous state, compare changes over time, see who last modified something that might be causing a problem, who introduced an issue and when, and more. Using a VCS also generally means that if you screw things up or lose files, you can easily recover. In addition, you get all this for very little overhead.

Local Version Control Systems

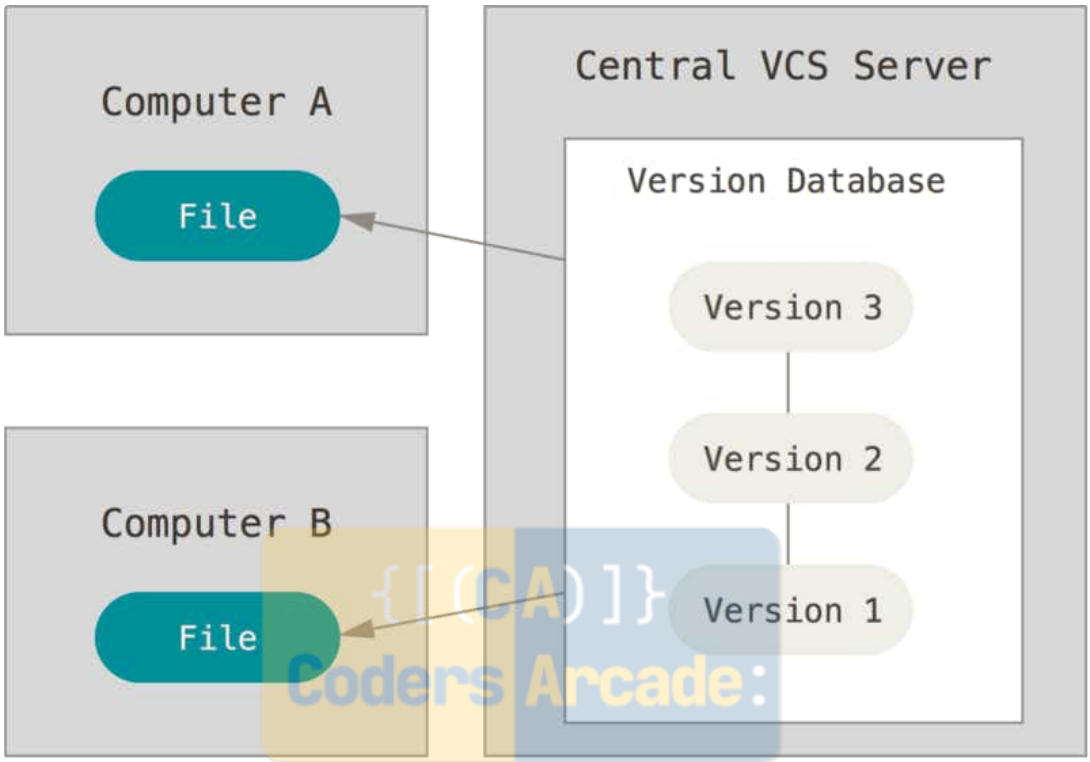
Many people’s version-control method of choice is to copy files into another directory (perhaps a time-stamped directory, if they’re clever). This approach is very common because it is so simple, but it is also incredibly error prone. It is easy to forget which directory you’re in and accidentally write to the wrong file or copy over files you don’t mean to.

To deal with this issue, programmers long ago developed local VCSs that had a simple database that kept all the changes to files under revision control.



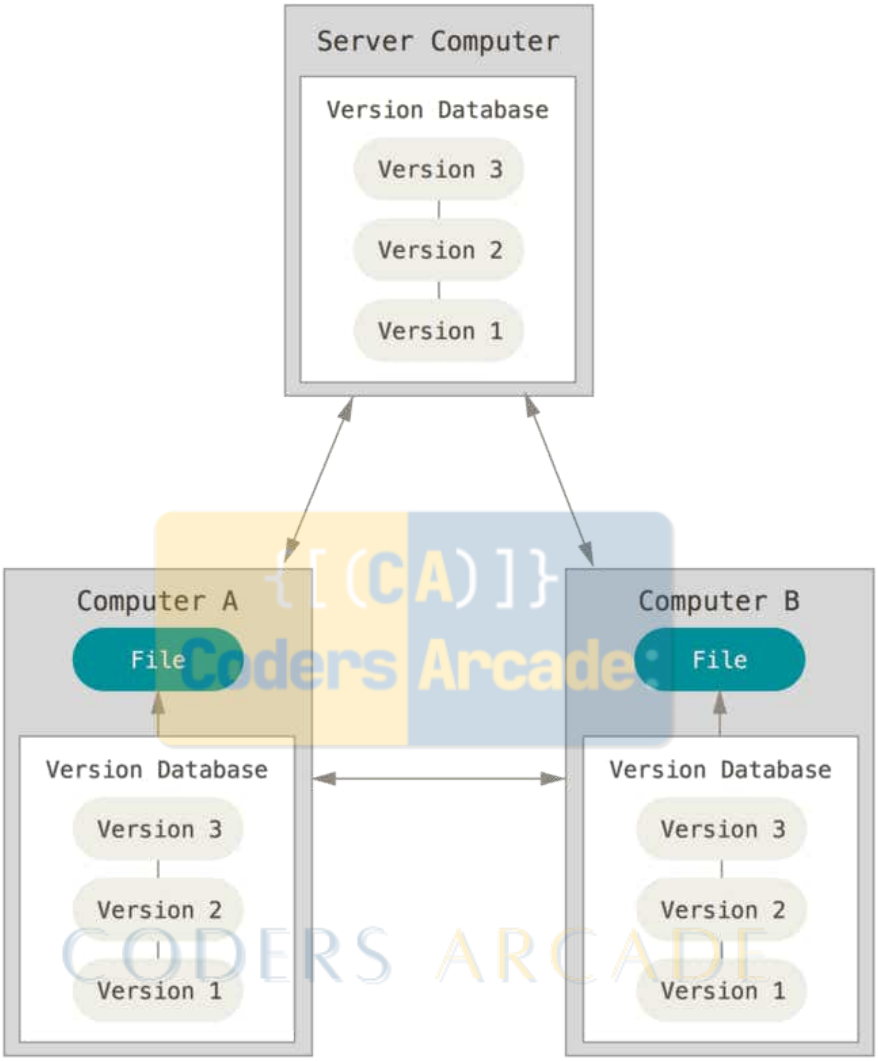
Centralized Version Control Systems

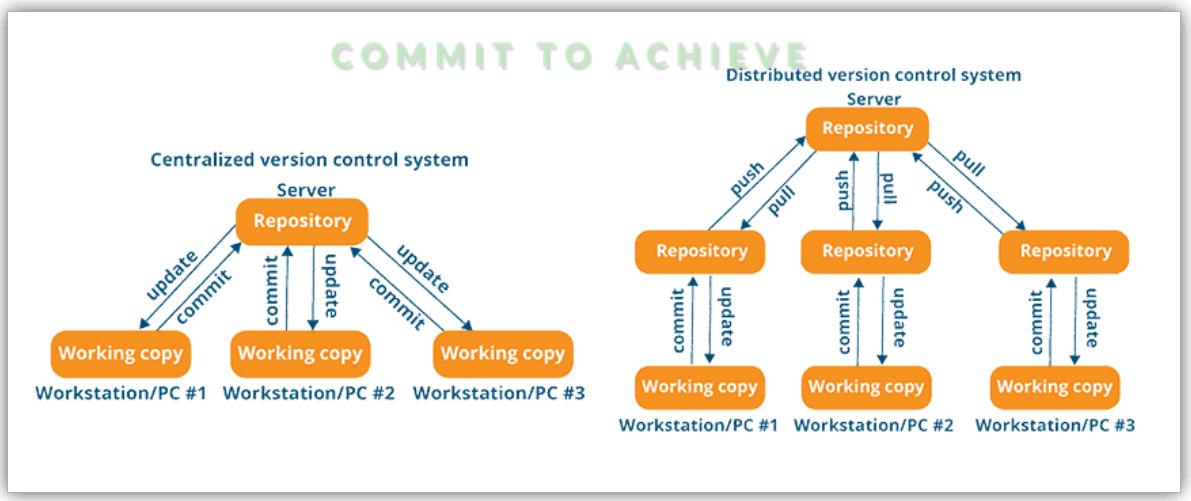
The next major issue that people encounter is that they need to collaborate with developers on other systems. To deal with this problem, Centralized Version Control Systems (CVCSs) were developed. These systems (such as CVS, Subversion, and Perforce) have a single server that contains all the versioned files, and a number of clients that check out files from that central place. For many years, this has been the standard for version control.



Distributed Version Control Systems

This is where Distributed Version Control Systems (DVCSs) step in. In a DVCS (such as Git, Mercurial, Bazaar or Darcs), clients don’t just check out the latest snapshot of the files; rather, they fully mirror the repository, including its full history. Thus, if any server dies, and these systems were collaborating via that server, any of the client repositories can be copied back up to the server to restore it. Every clone is really a full backup of all the data.


Server Computer
Version Database
Version 3
Version 2
Version 1
Computer A
File
Version Database
Version 3
Version 2
Version 1
Computer B
File
Version Database
Version 3
Version 2
Version 1


Centralized version control system
Server
Repository
update
commit
commit
update
update
commit
Working copy
Working copy
Working copy
Workstation/PC #1
Workstation/PC #2
Workstation/PC #3
Distributed version control system
Server
Repository
push
pull
push
pull
push
pull
Repository
Repository
Repository
commit
update
commit
update
commit
update
Working copy
Working copy
Working copy
Workstation/PC #1
Workstation/PC #2
Workstation/PC #3

CVCS vs DVCS

Setting Up Git on Local System

Browse This **Playlist** To Learn **GIT & GITHUB** From Scratch : Git Tutorial for Beginners

Step 1 : Check if git is already installed

```
git --version
```

Step 2 : If not installed download Git installer from https://git-scm.com/

Step 3 : Run installer and install git

Step 4 : Check if git is installed

```
git --version
```

Create GitHub Account

Step 1 : Go to https://github.com/ and sign up for a new account

Step 2 : Login to GitHub

Step 3 : Create a new Repository (Private or Public)

Basic Git Commands

Step 1 : Create a new folder and open Git Bash/Cmd and go to the folder location

Step 2 : Run these commands for git configuration

```
git config --global user.email "sampleGitHub@email.com"
git config --global user.name "sampleGitHub_username"
```

Step 3 : Initialize git using this command

```
git init
```

Step 4 : Add some sample files in the folder by using this command

```
git touch <filename1.txt>
git touch <filename2.html>
git touch <filename3.py>
git touch <filename4.js>
```

Step 5 : Run these commands to check status, add files and commit your changes/updates

```
git status                          [ To check status ]
git add <filename>                  [ To add a particular file ]
git add .                           [ To add all the files ]
git commit -m "Commit Message"      [ To commit all your changes ]

git remote add origin "github-url"  [ To add remote repo link to local repo]

git push -u origin master           [ To push your local changes to remote ]
```

Create a banch and add some files and make some changes and then add the branch

to remote by :

git push -u origin “branch-name“ **[To push a particular branch to remote]**

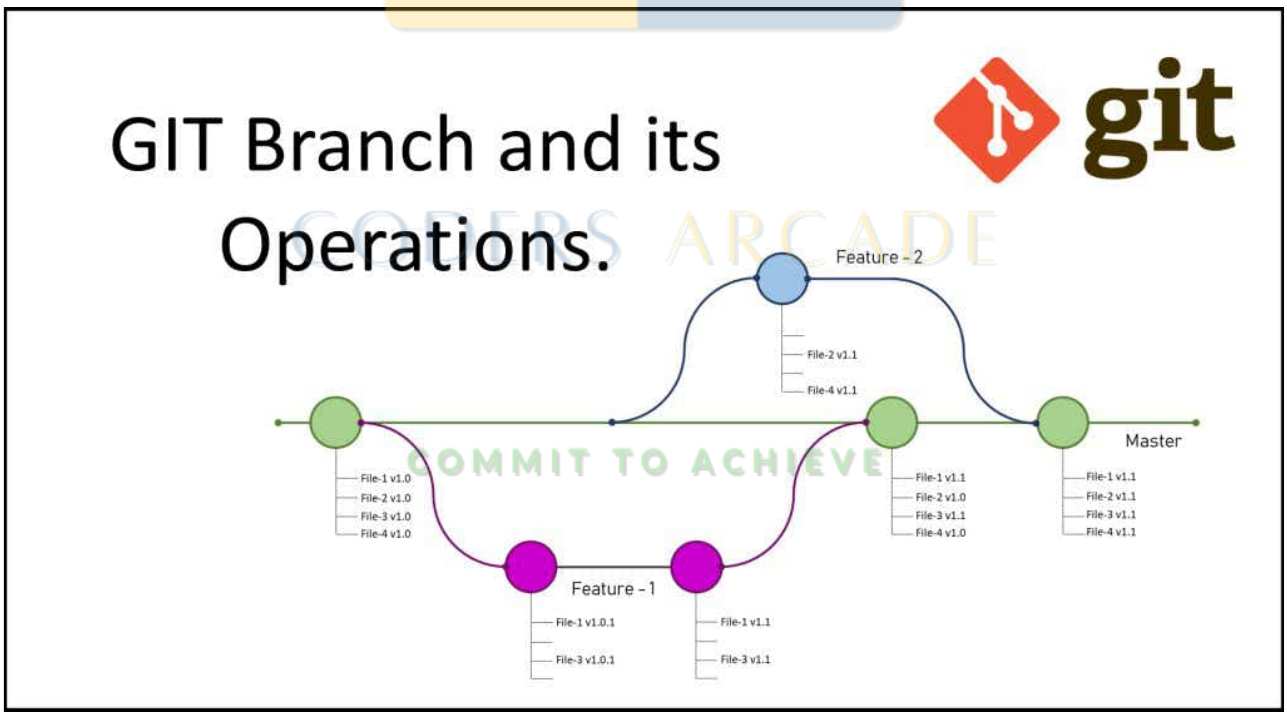
git clone “github url“ **[To clone a GitHub Repo]**

Git Branches

In this section you will be learning about :

- **What are branches**
- **How to create a branch in git repository**
- **How to checkout to a particular branch in git repository**
- **How to merge a particular branch to the master branch in git repository**
- **How to delete a branch from local & remote repositories**

- **What are branches**
  - Branches **allow you to develop features, fix bugs, or safely experiment with new ideas in a contained area of your repository**. You always create a branch from an existing branch. Typically, you might create a new branch from the default branch (**master**) of your repository.



Branching In Git

- **How to create a branch in git repository**
  - **The “git branch” command can be used to create a new branch**. When you want to start a new feature, you create a new branch off main using “**git branch new_branch”** .
- **How to checkout to a particular branch in git repository**
  - Once a branch is created you can then use “**git checkout new_branch”** to switch to that branch.
- **How to merge a particular branch to the master branch in git repository**
  - First we run **git checkout master** to change the active branch back to the master branch. Then we run the command **git merge new-branch** to merge the new feature into the master branch.

git merge merges the specified branch into the currently active branch. So we need to be on the branch that we are merging into.

- **How to delete a branch from local & remote repositories**
  - To delete the local branch, just **run the git branch command again, this time with the -d (delete) flag, followed by the name of the branch you want to delete.**
  - You'll often need to delete a branch not only locally but also remotely. To do that, you use the following command: **git push <remote_name> --delete <branch_name>**. The branch still exists locally, if you haven't deleted it from your local repository.

Steps to follow while working with branches in Git

Step 1 : Create branch git branch "branch_name"

Step 2 : Checkout branch git checkout "branch_name"

Step 3 : Make some changes to your project

- **Add files, commit, push** **git push -u origin new_branch**
- **Check if the branch is visible in GitHub repository**

Step 4 : On local repo checkout to master branch "git checkout master"

Step 5 : Merge new branch in master branch "git merge branch_name"

Step 6 : Push all your changes "git push -u origin master"

Step 7 : Delete a particular branch

- **git branch -d "branch_name"** **// Will delete from local repository**
- **git push origin --delete "branch_name"** **// Will delete from remote repository**

Git Tags

A Tag in Git is a **reference that points to a specific point in Git history**. **Tagging** is generally used to capture a point in history that is used for **marking** a **version release** (**for example : v1.0**). A tag is like a branch that doesn't change. Unlike branches, tags, after being created, have no further history of commits.

Step 1 : Checkout the branch where you want to create the tag

- **git checkout "branch_name"** **// Example : git checkout master**

Step 2 : Create a tag with some name

- **git tag "tag_name"** **// Example: git tag v1.0**
- **git tag -a v1.1 -m "tag for release ver 1.1"** **// Annotated Tag**

Step 3 : Display or Show tags

- **git tag** // Show all the tags
- **git show v1.0** // Show a particular tag
- **git tag -l “v1.*“** // Show all tags starting with v1

Step 3 : Push tags to remote repository git push origin v1.0

- **push all tags to remote : git push --tags**

Step 4 : Delete tags (Only if required)

- **To delete tags from local repository**
  - **git tag -d v1.0**
  - **git tag --delete v1.0**
- **To delete tags from remote repository**
  - **git push origin -d v1.0**
  - **git push origin --delete v1.0**
  - **git push origin :v1.0**
- **To delete multiple tags at one go**
  - **git tag -d v1.0 v1.1 (local repository)**
  - **git push origin -d v1.0 v1.1 (remote repository)**

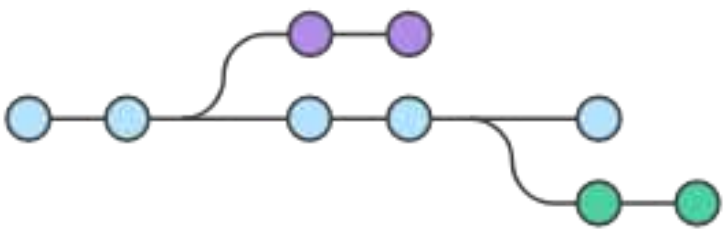
Checking out with tags

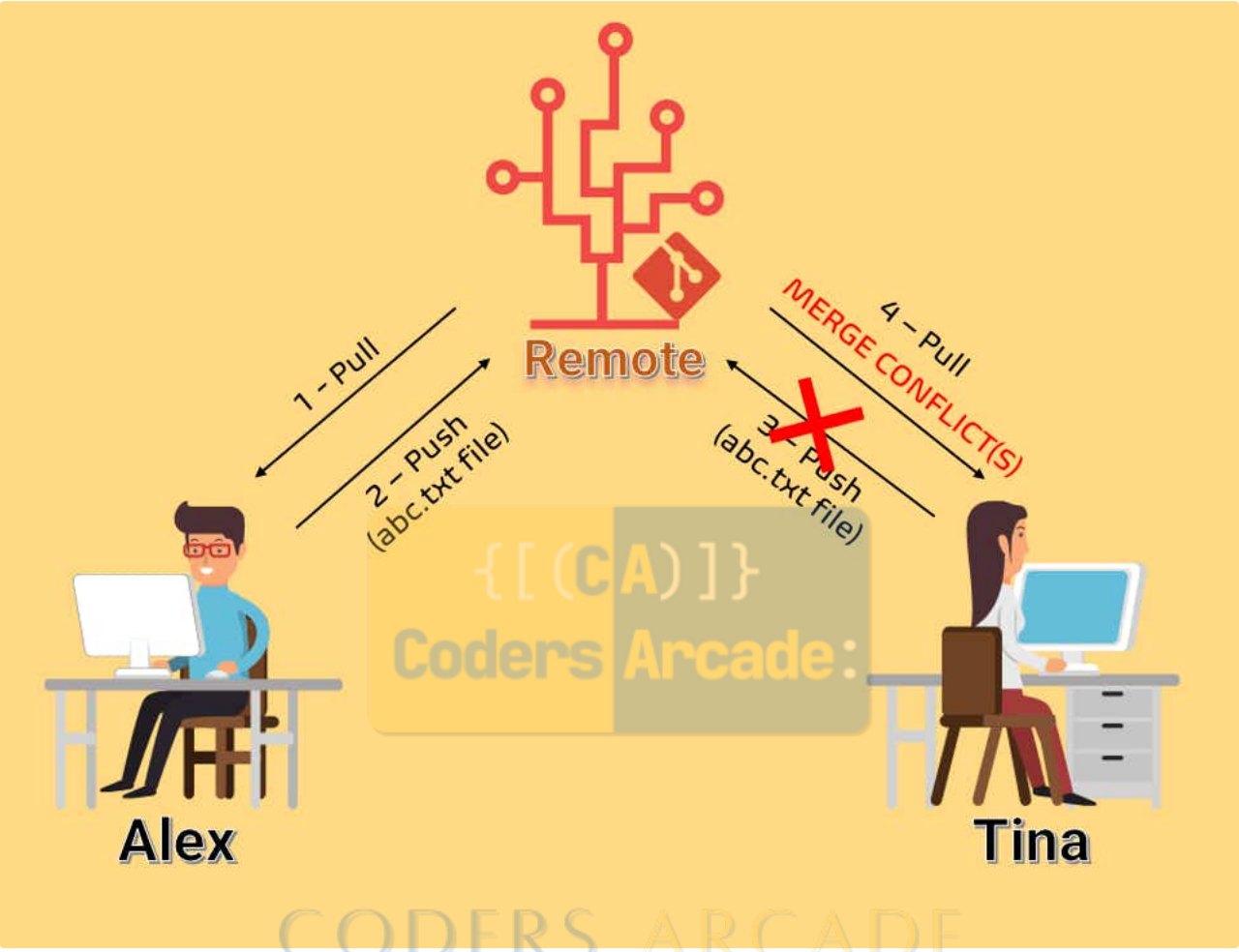
- **We cannot checkout tags in Git**
- **We can create a branch from a tag and checkout the branch**
  - **git checkout -b “branch_name“ “tag_name“**
  - **Example : git checkout -b ReleaseVer1 v1.0**

Creating tags from past commits

- **git tag “tag_name“ “reference of the past commit“**
- **Example : git tag v1.3 6gecf05**

Git Merge Conflicts





- Version control systems are all about managing contributions between multiple distributed authors (usually developers).
- Sometimes multiple developers may try to edit the same content.
- If Developer A tries to edit code that Developer B is editing a conflict may occur.
- To alleviate the occurrence of conflicts developers will work in separate **isolated branches**.
- The `git merge` command's primary responsibility is to combine separate branches and resolve any conflicting edits.

Understanding merge conflicts

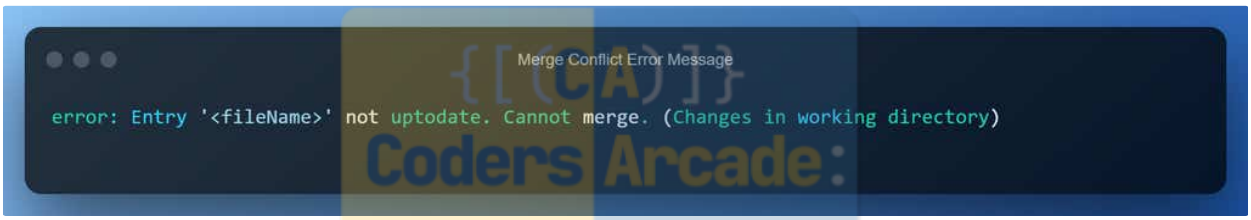
- Merging and conflicts are a common part of the Git experience.
- Conflicts in other version control tools like SVN can be costly and time-consuming.
- Git makes merging super easy.
- Most of the time, Git will figure out how to automatically integrate new changes.
- Conflicts generally arise when two people have changed the same lines in a file, or if one developer deleted a file while another developer was modifying it.
- In these cases, Git cannot automatically determine what is correct.
- Conflicts only affect the developer conducting the merge, the rest of the team is unaware of the conflict.
- Git will mark the file as being conflicted and halt the merging process.
- It is then the developers' responsibility to resolve the conflict.

Types of merge conflicts

A merge can enter a conflicted state at two separate points. When starting and during a merge process. The following is a discussion of how to address each of these conflict scenarios.

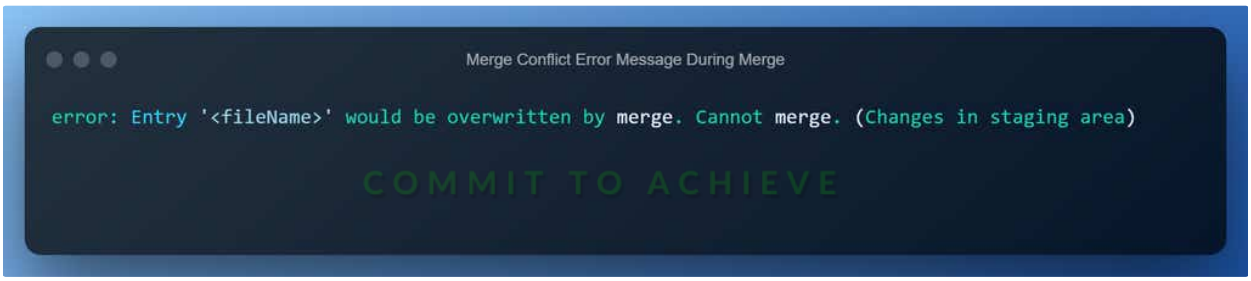
Git fails to start the merge

- A merge will fail to start when Git sees there are changes in either the working directory or staging area of the current project.
- Git fails to start the merge because these pending changes could be written over by the commits that are being merged in.
- When this happens, it is not because of conflicts with other developer's, but conflicts with pending local changes.
- The local state will need to be stabilized using `git stash`, `git checkout`, `git commit` or `git reset`. A merge failure on start will output the following error message:



Git fails during the merge

- A failure DURING a merge indicates a conflict between the current local branch and the branch being merged.
- This indicates a conflict with another developers code.
- Git will do its best to merge the files but will leave things for you to resolve manually in the conflicted files.
- A mid-merge failure will output the following error message:



How to identify merge conflicts

- As we have experienced from the proceeding example, Git will produce some descriptive output letting us know that a **CONFLICT** has occcured.
- We can gain further insight by running the `git status` command as shown below :

Identifying A Merge Conflict

```
$ git status
On branch main
You have unmerged paths.
(fix conflicts and run "git commit")
(use "git merge --abort" to abort the merge)

Unmerged paths:
(use "git add <file>..." to mark resolution)

both modified:   merge.txt
```


- The output from `git status` indicates that there are unmerged paths due to a conflict.
- The `merge.text` file now appears in a modified state.
- Below is a sample merge conflict example :

Merge Conflict

```
$ cat merge.txt
<<<<<<< HEAD
this is some content to mess with
content to append
=======
totally different content to merge later
>>>>>>> new_branch_to_merge_later
```

How to Resolve Merge Conflicts in Git?

There are a few steps that could reduce the steps needed to resolve merge conflicts in Git.

1. The easiest way to resolve a conflicted file is to open it and make any necessary changes
2. After editing the file, we can use the git add a command to stage the new merged content
3. The final step is to create a new commit with the help of the git commit command
4. Git will create a new merge commit to finalize the merge

Let us now look into the Git commands that may play a significant role in resolving conflicts.

Git Commands to Resolve Conflicts

1. git log --merge

The git log --merge command helps to produce the list of commits that are causing the conflict

2. git diff

The git diff command helps to identify the differences between the states repositories or files

3. git checkout

The git checkout command is used to undo the changes made to the file, or for changing branches

4. git reset --mixed

The git reset --mixed command is used to undo changes to the working directory and staging area

5. git merge --abort

The git merge --abort command helps in exiting the merge process and returning back to the state before the merging began

6. git reset

The git reset command is used at the time of merge conflict to reset the conflicted files to their original state

Note : We can also use the Git Merge Tool for resolving Merge Conflicts. Merge Conflicts can be resolved in different ways based on the user's convenience. But, prior to that, one should be familiar with the *git commands* required to resolve Merge Conflicts.

CA - Git & GitHub Simplified For DevOps VTU Lab

Git & GitHub – A Beginner's Guide

Introduction

Git is a **distributed version control system (DVCS)** that helps in tracking changes in files and enables collaboration among developers.

Why Use Git?

✔ Keeps track of changes in files
✔ Allows you to revert to previous versions
✔ Enables collaboration in teams
✔ Helps in recovering lost files

🔹 Understanding Git Workflow

A project in Git moves through **four key areas**:

1️⃣ **Working Directory** – Where you edit files
2️⃣ **Staging Area** – Where you mark files for commit
3️⃣ **Local Repository** – Where Git stores committed versions
4️⃣ **Remote Repository** – Where you push code to share with others

📌 Git Workflow Diagram


```
+----------------+      +----------------+      +-------------------+      +-----------------------+
|  Working Dir   | ---> |  Staging Area  | ---> |  Local Repository | ---> | Remote Repo (GitHub)  |
+----------------+      +----------------+      +-------------------+      +-----------------------+
       |                       |                        |                            |
       | Modify Files          | git add                | git commit                 | git push
       |                       |                        |                            |
       V                       V                        V                            V
  Untracked Files       Staged for Commit        Stored in .git Folder       Uploaded to GitHub

```

🔹 Setting Up Git on Your System

Step 1: Check if Git is Installed

```
git --version

```

If not installed, download from git-scm.com and install it.

Step 2: Configure Git (One-Time Setup)

```
git config --global user.name "Your Name"
git config --global user.email "your-email@example.com"

```

🔹 Basic Git Commands

1️⃣ Initialize a New Git Repository

```
git init

```

This creates a **hidden** `.git` **folder** in your project directory.

2️⃣ Check the Status of Your Files

```
git status

```

This shows which files are **untracked, modified, or staged**.

3️⃣ Add Files to the Staging Area

```
git add index.html    # Add a specific file
git add .             # Add all files

```

4️⃣ Commit Your Changes

```
git commit -m "Initial commit with project files"

```

Commits are **snapshots** of your project at different stages.

5️⃣ Connect to a Remote Repository (GitHub)

```
git remote add origin https://github.com/your-username/your-repo.git

```

6️⃣ Push Code to GitHub

```
git push -u origin master

```

🔹 Cloning a Repository (Downloading a Project)

To download a repository from GitHub:

```
git clone https://github.com/your-username/your-repo.git

```

🔹 Summary of Common Git Commands

Command	Description
`git init`	Initialize a new Git repository
`git status`	Check the status of your files
`git add <file>`	Stage a specific file
`git add .`	Stage all files
`git commit -m "message"`	Save changes with a commit message
`git remote add origin <url>`	Link local repo to GitHub
`git push -u origin master`	Upload changes to GitHub
`git clone <url>`	Download a GitHub repository

🎯 Key Takeaways

✔ **Git tracks your project changes efficiently**
✔ **Use `git add` to stage, `git commit` to save, and `git push` to upload**
✔ **GitHub allows easy collaboration and version control**

🚀 Moving Forward: Build Tools (Maven & Gradle)

Now that we understand **Version Control with Git & GitHub**, we can move on to **build tools like Maven & Gradle** to manage dependencies and automate the build process efficiently.

CA - Maven Notes & Documentation

Introduction to Maven

Maven is a popular open-source build tool that the **Apache** Group developed for building, publishing, and deploying several projects. Maven is written in Java and is used to create projects written in C#, Scala, Ruby, and so on. The tool is used to build and manage any Java-based project. It simplifies the day-to-day work of Java developers and helps them with various tasks.

<details>
<summary>General Info from Apache Maven Site</summary>

> Maven, a Yiddish word meaning *accumulator of knowledge*, began as an attempt to simplify the build processes in the Jakarta Turbine project. There were several projects, each with their own Ant build files, that were all slightly different. JARs were checked into CVS. We wanted a standard way to build the projects, a clear definition of what the project consisted of, an easy way to publish project information, and a way to share JARs across several projects.

</details>

Maven is a powerful **build and *project management tool*** that is based on POM (project object model). It is used for projects build, dependency and documentation.

ℹ️ What is a build tool?

A build tool is essential for the process of building, as these are the tools that automate the process of creating applications from the source code. The build tool compiles and packages the code into an executable form.

A build tool does the following tasks:

- Generates source code
- Generates documentation from the source code
- Compiles source code
- Packages the compiled codes into JAR files
- Installs the packaged code in the local repository, server, or central repository

🤔 Why We Use Maven?

Let's us understand the problem we face without maven:

- Adding set of Jars in the Java Project : When creating any Java project, we need to manually download multiple jar files and their dependency jars and configure manually to build paths. Sharing and storing these projects are also heavy and time consuming.
- Creating right project structure : Deciding and creating right project structure is very important. Sometime because of wrong project structure, the project won't get executed.

- Building and Deploying the project: We have to manually build and deploy the project for it to work.

To solve all the above problems and automate the above process we use Maven and it performs following activities:

- Repository to get the dependencies.
- Having a similar folder structure across the organization.
- Integration with Continuous Integration tools like Jenkins.
- Plugins for test execution.
- It provides information on how the software/ project is being developed.
- The build process is made simpler and consistent.
- Provides guidelines for the best practices to be followed in the project.
- Enhances project performance.
- Easy to move to new attributes of Maven.
- Integration with version control tools like Git.

🛠️ Install Maven and Environment Setup

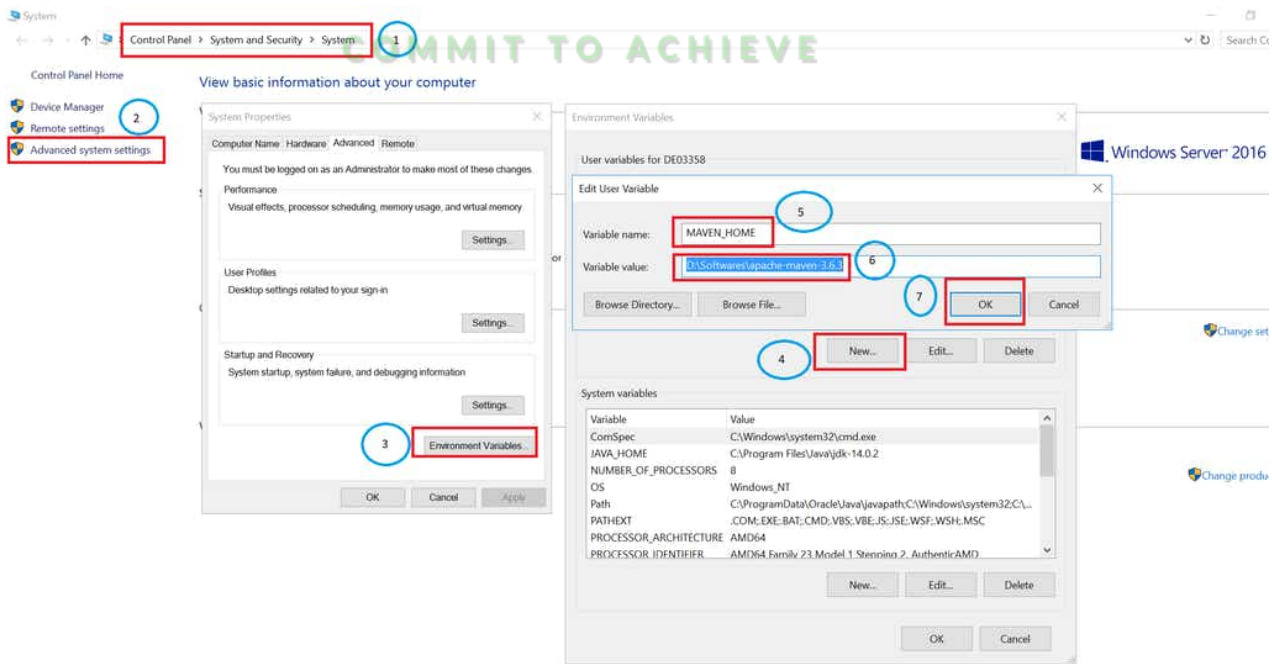
📘 Instructions to Install Maven and Setup

1. Download latest maven “Binary zip archive” file from Download Apache Maven – Maven

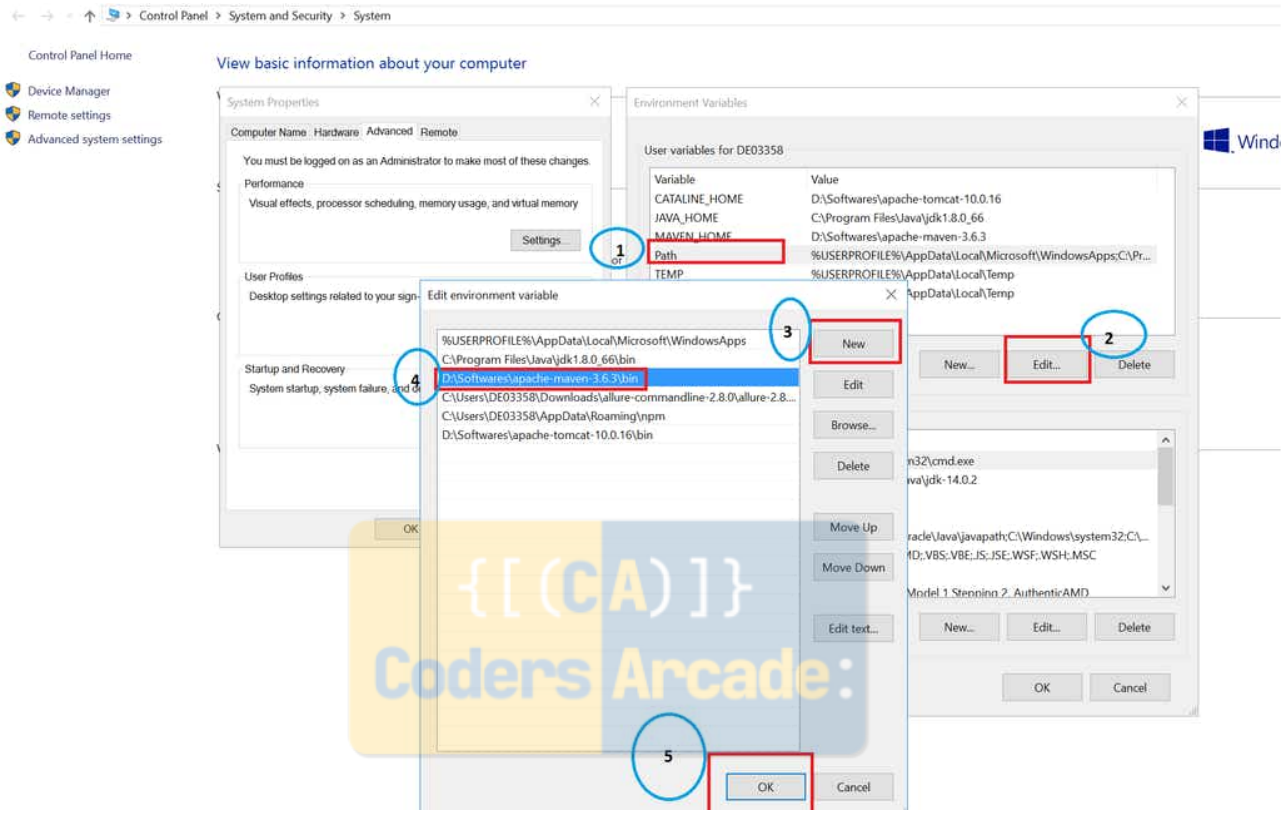
	Link	Checksums	Signature
Binary tar.gz archive	apache-maven-3.8.5-bin.tar.gz	apache-maven-3.8.5-bin.tar.gz.sha512	apache-maven-3.8.5-bin.tar.gz.asc
Binary zip archive	apache-maven-3.8.5-bin.zip	apache-maven-3.8.5-bin.zip.sha512	apache-maven-3.8.5-bin.zip.asc
Source tar.gz archive	apache-maven-3.8.5-src.tar.gz	apache-maven-3.8.5-src.tar.gz.sha512	apache-maven-3.8.5-src.tar.gz.asc
Source zip archive	apache-maven-3.8.5-src.zip	apache-maven-3.8.5-src.zip.sha512	apache-maven-3.8.5-src.zip.asc

Maven Binary Zip File

2. Unzip the content of the downloaded file and place it any desired location in your drive (either C or D).
3. Navigate inside the folder up to bin and copy the full path.
4. Setting up Environment variables
   a. M2_HOME and MAVEN_HOME



5. Editing “Path” environment variable and adding the maven directory path up until “bin” folder.



6. Verify if Maven has been setup properly. Open command prompt and write the below command

```
mvn -version
```

If Maven has been setup correctly then we will get following output of the above command:

```
C:\Users\[redacted]>mvn -version
Apache Maven 3.6.3 (cecedd343002696d0abb50b32b541b8a6ba2883f)
Maven home: D:\Softwares\apache-maven-3.6.3\bin\..
Java version: 1.8.0_66, vendor: Oracle Corporation, runtime: C:\Program Files\Java\jdk1.8.0_66\jre
Default locale: en_AU, platform encoding: Cp1252
OS name: "windows nt (unknown)", version: "10.0", arch: "amd64", family: "windows"
```


📫 Maven Repository

A repository is a directory where all the project jars, library jar, plugins or any other project specific artifacts are stored and can be used by Maven easily.

- There are three types of maven repository 💫
  - Local
  - Central
  - Remote

Maven searches for dependency in following order

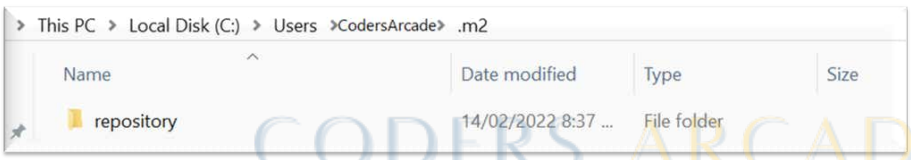
Dependency Search Order

When we execute Maven build commands, Maven starts looking for dependency libraries in the following sequence −

- **Step 1** − Search dependency in local repository, if not found, move to step 2 else perform the further processing.
- **Step 2** − Search dependency in central repository, if not found and remote repository/repositories is/are mentioned then move to step 4. Else it is downloaded to local repository for future reference.
- **Step 3** − If a remote repository has not been mentioned, Maven simply stops the processing and throws error (Unable to find dependency).
- **Step 4** − Search dependency in remote repository or repositories, if found then it is downloaded to local repository for future reference. Otherwise, Maven stops processing and throws error (Unable to find dependency).

Local Repository

- Maven local repository is a folder location in developer's machine (local system). It gets created when we run any maven command for the first time.
- Maven local repository gets created by Maven in %USER_HOME%/.m2 directory.



- To change the default location, we can change the path in Maven settings.xml file available at %MAVEN_HOME%/conf directory. Enable the local repository and mention the correct path to your local repository.

```
<settings xmlns="http://maven.apache.org/SETTINGS/1.0.0"
          xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
          xsi:schemaLocation="http://maven.apache.org/SETTINGS/1.0.0 http://maven.apache.org/xsd/settings-1.0.0.xsd">
  <!-- localRepository
   | The path to the local repository maven will use to store artifacts.
   |
   | Default: ${user.home}/.m2/repository
  <localRepository>/path/to/local/repo</localRepository>
  -->
```

- When the maven command is run for the first time, all the dependencies get downloaded from central and remote repository to the local repository. This helps to avoid references to dependencies stored on remote machine every time the project is build and saves time.

Central Repository

- Maven central repository refers to the repository available on a web server provided by Maven community.
- It contains a large number of commonly used libraries.
- When maven doesn't find a dependency in our local repository, it starts searching in central repository using the URL: Central Repository:
- Maven community has provided a website to search details of dependencies Maven Central Repository Search
- There is another website where we can search for all commonly used libraries https://mvnrepository.com/

> - Maven central repository doesn't require any configuration
> - Internet access is needed for searching the dependencies.

Remote Repository

Sometimes, there will be need of self developed or companies internal libraries which obviously won't be found in Maven central repository. In that case, maven stops the build process and throws the error message.

To prevent these situations, Maven provides concepts of Remote Repository, which is developer's own custom repository which contains required Jar files.

There are two ways of doing this

1. A little dirty way of doing this is creating a directory in the project and providing the path of the jar in the pom as shown below:

```
<dependency>
    <groupId>com.sample</groupId>
    <artifactId>samplifact</artifactId>
    <version>1.0</version>
    <scope>system</scope>
    <systemPath>C:\DEV\myfunnylib\yourJar.jar</systemPath>
</dependency>
```

2. The other (proper) way of achieving remote repository is to move your internal Jar file to an archive location (some where on internet).

```
<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.companyname.projectgroup</groupId>
   <artifactId>project</artifactId>
   <version>1.0</version>
   <dependencies>
      <dependency>
         <groupId>com.companyname.common-lib</groupId>
         <artifactId>common-lib</artifactId>
         <version>1.0.0</version>
      </dependency>
   <dependencies>
   <repositories>
      <repository>
         <id>companyname.lib1</id>
         <url>http://download.companyname.org/maven2/lib1</url>
      </repository>
      <repository>
         <id>companyname.lib2</id>
         <url>http://download.companyname.org/maven2/lib2</url>
      </repository>
   </repositories>
</project>
```

Maven – POM

- Project Object Model (POM) refers to the XML files with all the information regarding project and configuration details.
- It contains the project description, as well as details regarding the versioning and configuration management of the project.

- The XML file is in the project home directory. Maven searches for the POM in the current directory when any given task needs to be executed.
- Some of the configuration that can be specified in the POM are following −
  - project dependencies
  - plugins
  - goals
  - build profiles
  - project version
  - developers
  - mailing list
- POM Example:

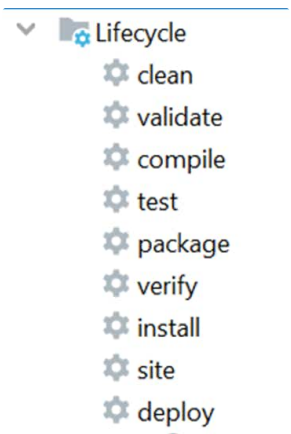
```
<project xmlns = "http://maven.apache.org/POM/4.0.0"
   xmlns:xsi = "http://www.w3.org/2001/XMLSchema-instance"
   xsi:schemaLocation = "http://maven.apache.org/POM/4.0.0
   http://maven.apache.org/xsd/maven-4.0.0.xsd">
   <modelVersion>4.0.0</modelVersion>

   <groupId>com.companyname.project-group</groupId>
   <artifactId>project</artifactId>
   <version>1.0</version>
</project>
```

- **groupId** : This is an Id of project's group. This is generally unique amongst an organization or a project. For example, a banking group com.company.bank has all bank related projects.
- **artifactId :** This is an Id of the project. This is generally name of the project. For example, consumer-banking. Along with the groupId, the artifactId defines the artifact's location within the repository.
- **version :** This is the version of the project. Along with the groupId, It is used within an artifact's repository to separate versions from each other. For example −
  - **com.company.bank:consumer-banking:1.0**
  - **com.company.bank:consumer-banking:1.1.**

Maven Build Life Cycle

Maven has three standard life cycles

- clean
- default/build
- site



Clean Life Cycle

The clean life cycle handles project cleaning. The clean phase consists of the following three steps:

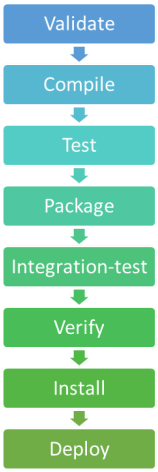
- Pre-clean
- Clean
- Post-clean

The mvn post-clean command is used to invoke the clean lifestyle phases in Maven. When *mvn clean* command executes, Maven deletes the build directory.

Default/Build Life Cycle

Default/Build Life Cycle contains these most important life cycle.

- *validate* – checks the correctness of the project
- *compile* – compiles the provided source code into binary artifacts
- *test* – executes unit tests
- *package* – packages compiled code into an archive file
- *integration-test* – executes additional tests, which require the packaging
- *verify* – checks if the package is valid
- *install* – installs the package file into the local Maven repository
- *deploy* – deploys the package file to a remote server or repository



Site Life Cycle

The Maven site plugin handles the project site's documentation, which is used to create reports, deploy sites, etc.

The phase has four different stages:

- Pre-site
- Site
- Post-site
- Site-deploy

Ultimately, the site that is created contains the project report.

Manage Dependencies

One of the core features of Maven is Dependency Management. Managing dependencies is a difficult task once we've to deal with multi-module projects (consisting of hundreds of modules/sub-projects). Maven provides a high degree of control to manage such scenarios.

Transitive Dependencies Discovery

It is pretty often a case, when a library, say A, depends upon other library, say B. In case another project C wants to use A, then that project requires to use library B too.

Maven helps to avoid such requirements to discover all the libraries required. Maven does so by reading project files (pom.xml) of dependencies, figure out their dependencies and so on.

We only need to define direct dependency in each project pom. Maven handles the rest automatically.

Dependency Scope

Scope & Description
compile This scope indicates that dependency is available in classpath of project. It is default scope.
provided This scope indicates that dependency is to be provided by JDK or web-Server/Container at runtime.
runtime This scope indicates that dependency is not required for compilation, but is required during execution.
test This scope indicates that the dependency is only available for the test compilation and execution phases.
system This scope indicates that you have to provide the system path.
import This scope is only used when dependency is of type pom. This scope indicates that the specified POM should be replaced with the dependencies in that POM's <dependencyManagement> section.

Maven Plugins

Maven is actually a plugin execution framework where every task is actually done by plugins. Maven Plugins are generally used to −

- create jar file
- create war file
- compile code files
- unit testing of code
- create project documentation
- create project reports

Command to execute any plugin is

```
mvn [plugin-name]:[goal-name]
```

There are two types of maven plugins according to Apache Maven,

1. Build Plugins
2. Reporting Plugins

Build Plugins

These plugins are executed at the time of build. These plugins should be declared inside the **<build>** element.

Reporting Plugins

These plugins are executed at the time of site generation. These plugins should be declared inside the **<reporting>** element.

Maven Core Plugins

A list of maven core plugins are given below:

Plugin	Description
clean	clean up after build.
compiler	compiles java source code.
deploy	deploys the artifact to the remote repository.
failsafe	runs the JUnit integration tests in an isolated classloader.
install	installs the built artifact into the local repository.
resources	copies the resources to the output directory for including in the JAR.
site	generates a site for the current project.
surefire	runs the JUnit unit tests in an isolated classloader.
verifier	verifies the existence of certain conditions. It is useful for integration tests.

To see the list of maven plugins, you may visit apache maven official website http://repo.maven.apache.org/maven2/org/apache/maven/plugins/

CA - Experiment 1 - Introduction To Maven & Gradle Build Tools 🖥️⚙️🏗️

Experiment 1: Introduction to Maven and Gradle

🌟 Objective

To understand build automation tools, compare **Maven** and **Gradle**, and set up both tools for software development.

🔹 1. Overview of Build Automation Tools

Build automation tools simplify the process of **compiling, testing, packaging, and deploying** software projects. They manage dependencies, execute tasks, and integrate seamlessly with CI/CD pipelines.

✨ Why Use Build Automation?

✅ Ensures **consistency** across builds
✅ Handles **dependency management** automatically
✅ Reduces **manual errors** and increases efficiency
✅ Integrates with tools like **Jenkins & Azure DevOps**

🚀 Popular Build Automation Tools

- **Apache Ant** → Script-based, manual dependency management
- **Apache Maven** → XML-based, convention-over-configuration model
- **Gradle** → Flexible, fast, and supports Groovy/Kotlin DSL

🔹 2. Key Differences Between Maven and Gradle

Feature	🟠 Maven (XML)	🟢 Gradle (Groovy/Kotlin)
Build Script	`pom.xml`	`build.gradle` / `build.gradle.kts`
Performance	Sequential, slower	Parallel execution, faster
Flexibility	Convention-based	Highly customizable
Dependency Mgmt.	Uses Maven Repository	Supports multiple repositories
Ease of Use	Simple XML structure	Slightly complex but powerful
Caching Support	No build caching	Supports incremental builds
Best For	Standard Java projects	Complex, high-performance builds

📌 **Maven** is great for structured, **enterprise-level** projects.
📌 **Gradle** is ideal for **scalable and performance-driven** applications.

🔹 3. Installation and Setup

🔵 3.1 Installing Maven

✅ Step 1: Install Java (JDK 17 Recommended)

Check if Java is installed:

```
java -version
javac -version

```

✅ Step 2: Download and Install Maven

🔗 **Download from:** Download Apache Maven – Maven
📁 Extract it to a folder (e.g., `C:\Maven`).

✅ Step 3: Configure Environment Variables

📌 **Windows:**

- Add `MAVEN_HOME` → `C:\Maven\apache-maven-<version>`
- Update `Path` → `%MAVEN_HOME%\bin`

📌 **Linux/macOS:**
Add the following to `.bashrc` or `.zshrc`:

```
export MAVEN_HOME=/opt/maven/apache-maven-<version>
export PATH=$MAVEN_HOME/bin:$PATH

```

✅ Step 4: Verify Installation

Run:

```
mvn -version

```

Expected Output:

```
Apache Maven 3.x.x
Maven home: C:\Maven\apache-maven-<version>
Java version: 17.0.4

```

🟢 3.2 Installing Gradle

✅ Step 1: Install Java (JDK 17 Recommended)

Same steps as Maven.

✅ Step 2: Download and Install Gradle

🔗 **Download from:** Gradle | Releases
📁 Extract it to a folder (e.g., `C:\Gradle`).

✅ Step 3: Configure Environment Variables

📌 **Windows:**

- Add `GRADLE_HOME` → `C:\Gradle\gradle-<version>`

- Update `Path` → `%GRADLE_HOME%\bin`

📌 Linux/macOS:

Add the following to `.bashrc` or `.zshrc`:

```
export GRADLE_HOME=/opt/gradle/gradle-<version>
export PATH=$GRADLE_HOME/bin:$PATH

```

✅ Step 4: Verify Installation

Run:

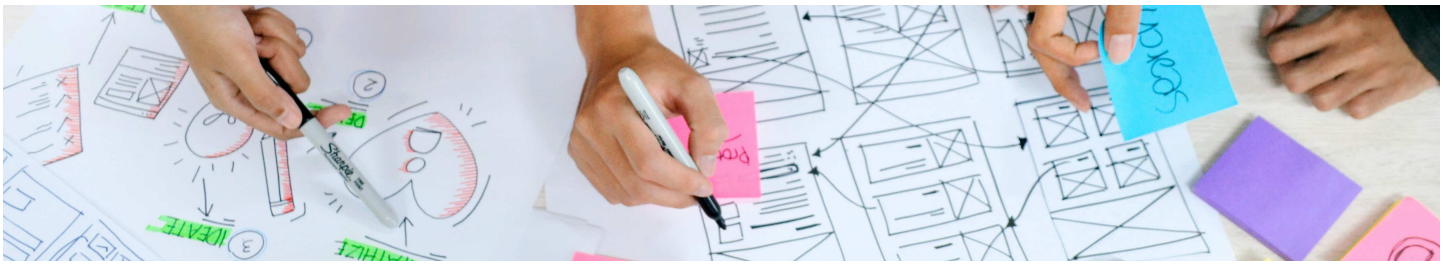
```
gradle -v

```

Expected Output:

```
Gradle 8.x
Build time: YYYY-MM-DD HH:MM:SS
Kotlin: X.Y
Groovy: X.Y

```

📌 Assessment Questions

1️⃣ What are the **key advantages** of using a build automation tool?
2️⃣ Mention **three** major differences between Maven and Gradle.
3️⃣ How does Gradle achieve **faster build times** compared to Maven?
4️⃣ What are the **necessary environment variables** for setting up Maven and Gradle?
5️⃣ How do you **verify** that Maven and Gradle are installed correctly?



CA - Experiment 2 - Working with Maven: Creating a Maven Project, Understanding the POM File, Dependency Management and Plugins

Maven: Basic Introduction

Maven is a build automation tool primarily used for Java projects. It simplifies the build process, manages project dependencies, and supports plugins for different tasks. It uses XML files (called `pom.xml`) for project configuration and dependency management.

Key Benefits of Maven:

- Dependency management (automates downloading and including libraries).
- Build automation (compiles code, runs tests, creates artifacts).
- Consistent project structure (standardizes how Java projects are set up).
- Integration with CI tools (like Jenkins).

Key Features of Maven:

- **Project Management**: Handles project dependencies, configurations, and builds.
- **Standard Directory Structure**: Encourages a consistent project layout across Java projects.
- **Build Automation**: Automates tasks such as compilation, testing, packaging, and deployment.
- **Dependency Management**: Downloads and manages libraries and dependencies from repositories (e.g., Maven Central).
- **Plugins**: Supports many plugins for various tasks like code analysis, packaging, and deploying.

Steps to Create a Maven Project in IntelliJ IDEA

1. **Install Maven (if not already installed)**:
   - Download Maven from the official website.
   - Set the `MAVEN_HOME` environment variable and update the system `PATH`.
2. **Create a New Maven Project**:
   - Open IntelliJ IDEA.
   - Go to `File` > `New` > `Project`.
   - Select `Maven` from the project types.
   - Choose `Create from Archetype` (optional) or proceed without.
   - Set the project name and location, then click `Finish`.
3. **Set Up the `pom.xml` File**:
   - The `pom.xml` file is where you define dependencies, plugins, and other configurations for your Maven project.
   - Example of a basic `pom.xml`:

```
1 <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.example</groupId>
    <artifactId>simple-project</artifactId>
    <version>1.0-SNAPSHOT</version>

    <dependencies>
        <!-- Add your dependencies here -->
    </dependencies>

</project>

```

4. **Add Dependencies for Selenium and TestNG**:
   - In the `pom.xml`, add Selenium and TestNG dependencies under the `<dependencies>` section.

```
<dependencies>
    <dependency>
        <groupId>org.seleniumhq.selenium</groupId>
        <artifactId>selenium-java</artifactId>
        <version>3.141.59</version>
    </dependency>
    <dependency>
        <groupId>org.testng</groupId>
        <artifactId>testng</artifactId>
        <version>7.4.0</version>
        <scope>test</scope>
    </dependency>
</dependencies>

```

5. **Create a Simple Website (HTML, CSS, and Logo)**:
   - In the `src/main/resources` folder, create an `index.html` file, a `style.css` file, and place the `logo.png` image.

Example of a simple `index.html`:

```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>My Simple Website</title>
    <link rel="stylesheet" href="style.css">
</head>
<body>
    <header>
        <img src="logo.png" alt="Logo">
    </header>
    <h1>Welcome to My Simple Website</h1>
</body>
</html>

```

Example of a simple `style.css`:

```
body {
```

```
    font-family: Arial, sans-serif;
    background-color: #f4f4f4;
    text-align: center;
}
header img {
    width: 100px;
}

```

6. **Upload the Website to GitHub**:
   - Initialize a Git repository in your project folder:

```
git init

```

   - Add your files and commit them:

```
git add .
git commit -m "Initial commit"

```

   - Create a GitHub repository and push the local project to GitHub:

```
git remote add origin <your-repository-url>
git push -u origin master

```

ℹ️ Deployment :

To deploy your Maven project to **GitHub Pages** using the `/docs` folder (** ***having all files inside root folder/dir not recommended***), you can follow these simple steps. This method is easy and doesn't require switching branches—just use the `/docs` folder of your main branch.

Steps to Deploy to GitHub Pages Using `/docs` Folder

1. **Modify Maven Configuration to Copy Static Files to `/docs` Folder**: First, you need to ensure that Maven places your static files (`index.html` , `style.css` , `logo.png`) into the `/docs` folder instead of the `target` directory.

   To do this, configure the **Maven Resources Plugin** in your `pom.xml` to copy the files directly into `/docs` :

```
<build>
    <plugins>
        <plugin>
            <groupId>org.apache.maven.plugins</groupId>
            <artifactId>maven-resources-plugin</artifactId>
            <version>3.2.0</version>
            <executions>
                <execution>
                    <phase>prepare-package</phase> <!-- Before packaging -->
                    <goals>
                        <goal>copy-resources</goal>
                    </goals>
                    <configuration>
                        <outputDirectory>${project.basedir}/docs</outputDirectory> <!-- Deploy to /docs
folder -->
                        <resources>
                            <resource>
                                <directory>src/main/resources</directory>
```

```
                                <includes>
                                    <include>**/*</include> <!-- Copy all files in src/main/resources -->
                                </includes>
                            </resource>
                        </resources>
                    </configuration>
                </execution>
            </executions>
        </plugin>
    </plugins>
</build>

```

In this configuration:

- The `maven-resources-plugin` copies all files from `src/main/resources` to the `/docs` folder in the root of your project (not the `target` directory).
- This is done during the `prepare-package` phase, just before Maven prepares the package.

2. **Build the Project**: Run the following Maven command to build your project and copy the resources to the `/docs` folder:

```
mvn clean install

```

After this, your `index.html`, `style.css`, and `logo.png` files should now be inside the `docs` folder in the root of your project.

3. **Push Changes to GitHub**: Now that the files are in the `/docs` folder, they are ready to be served by GitHub Pages. Follow these steps:
   - **Stage the changes** (the updated `/docs` folder):

```
git add docs/*
git commit -m "Deploy site to GitHub Pages"

```

   - **Push to GitHub**:

```
git push origin master  # Or the branch you are using, maybe 'main' in some cases

```

4. **Enable GitHub Pages**: After pushing to the main branch, follow these steps to enable GitHub Pages:
   - Go to your GitHub repository.
   - Navigate to **Settings** > **Pages** (on the left sidebar).
   - Under the **Source** section, select the `main` branch and `/docs` folder as the source.
   - Click **Save**.
5. **Access Your Website**: Your static website is now hosted on GitHub Pages! You can access it at:

```
https://<your-github-username>.github.io/<your-repository-name>/

```

Summary:

- **Maven Resources Plugin** is configured to copy static files (`index.html`, `style.css`, `logo.png`) into the `/docs` folder.
- **Build and push** the changes to your GitHub repository.
- Enable **GitHub Pages** using the `/docs` folder as the source.

By using the `/docs` folder in the main branch, you avoid the complexities of working with a separate `gh-pages` branch, and it's easier to maintain your website alongside your project.

Information about the /docs folder

The `/docs` folder does **not need to be manually created**. When you configure the Maven build to copy resources to the `/docs` folder, Maven will automatically create this folder when you run the `mvn clean install` command (if it doesn't already exist).

Here's a clearer breakdown:

1. **The `/docs` Folder**:
   - This folder will be automatically created during the build process when Maven runs the `maven-resources-plugin`.
   - Maven will copy the contents from `src/main/resources` into the `/docs` folder.
2. **No Need for Manual Creation**: You don't need to manually create the `/docs` folder. Maven handles this automatically based on the configuration in your `pom.xml` file.

After the Build:

Once the build completes, check the root of your project directory, and you should see a `docs` folder with all the copied files inside it.

Summary:

The `/docs` folder is not something you need to create manually. Maven will generate it automatically and place the static files inside it based on your configuration in the `pom.xml` file. After building and pushing the changes to GitHub, you can enable GitHub Pages to serve the content from this folder.

Concise step-by-step guide to deploy your Maven project to GitHub Pages using the `/docs` folder, assuming you already have necessary files inside it.

Here's a concise step-by-step guide to deploy your Maven project to GitHub Pages using the `/docs` folder, assuming you already have your `index.html`, `style.css`, and other necessary files:

1. Prepare Your Maven Project

- Open your `pom.xml` file and configure the `maven-resources-plugin` to copy your static files (like `index.html`, `style.css`, etc.) into the `/docs` folder:

```
<build>
    <plugins>
        <plugin>
            <groupId>org.apache.maven.plugins</groupId>
            <artifactId>maven-resources-plugin</artifactId>
            <version>3.2.0</version>
            <executions>
                <execution>
                    <phase>prepare-package</phase>
                    <goals>
                        <goal>copy-resources</goal>
                    </goals>
                    <configuration>
                        <outputDirectory>${project.basedir}/docs</outputDirectory>
                        <resources>
```

```
                            <resource>
                                <directory>src/main/resources</directory>
                                <includes>
                                    <include>**/*</include>
                                </includes>
                            </resource>
                        </resources>
                    </configuration>
                </execution>
            </executions>
        </plugin>
    </plugins>
</build>

```

This ensures that all your static files from `src/main/resources` are copied into the `docs` folder.

2. Build the Project

Run Maven to build the project:

```
mvn clean install

```

This will generate the `/docs` folder and place your static files there.

3. Push Changes to GitHub

- Stage and commit the changes (i.e., the new `/docs` folder with your static files):

```
git add docs/*
git commit -m "Deploy site to GitHub Pages"

```

- Push to your repository (assuming you're working with the `master` branch):

```
git push origin master

```

4. Enable GitHub Pages

- Go to your **GitHub repository**.
- Navigate to **Settings** > **Pages** (in the sidebar).
- Under the **Source** section, select:
  - **Branch**: `main`
  - **Folder**: `/docs`
- Click **Save**.

5. Access Your Website

Your website will now be live at:

```
https://<your-github-username>.github.io/<your-repository-name>/

```

Summary:

1. **Configure Maven**: Set up `maven-resources-plugin` in `pom.xml` to copy files to `/docs`.

2. **Build the Project**: Run `mvn clean install` to generate the `/docs` folder.
3. **Push to GitHub**: Stage and commit the `/docs` folder, then push to the `main` branch.
4. **Enable GitHub Pages**: Configure GitHub Pages to use the `/docs` folder.
5. **Access**: Your site will be hosted on GitHub Pages at `https://<your-username>.github.io/<repo-name>/`.

---

7. **Write a Simple Selenium Test with TestNG**:
   - Create a new Java class `WebPageTest.java` in the `src/test/java` directory.

   Example of a simple TestNG test using Selenium:

```
package org.test;

import org.openqa.selenium.WebDriver;
import org.openqa.selenium.chrome.ChromeDriver;
import org.testng.Assert;
import org.testng.annotations.AfterTest;
import org.testng.annotations.BeforeTest;
import org.testng.annotations.Test;

import static org.testng.Assert.assertTrue;

public class WebpageTest {
    private static WebDriver driver;

    @BeforeTest
    public void openBrowser() throws InterruptedException {
        driver = new ChromeDriver();
        driver.manage().window().maximize();
        Thread.sleep(2000);
        driver.get("https://sauravsarkar-codersarcade.github.io/CA-MVN/"); // "Note: You should use your GITHUB-URL here...!!!"
    }

    @Test
    public void titleValidationTest(){
        String actualTitle = driver.getTitle();
        String expectedTitle = "Tripillar Solutions";
        Assert.assertEquals(actualTitle, expectedTitle);
        assertTrue(true, "Title should contain 'Tripillar'");
    }

    @AfterTest
    public void closeBrowser() throws InterruptedException {
        Thread.sleep(1000);
        driver.quit();
    }
}


```

8. **Run the Test**:
   - In IntelliJ, right-click the `WebPageTest` class and select `Run 'WebPageTest'`.
   - The test will launch Chrome, open the webpage, and validate the title.

Summary of Steps:

1. Set up Maven project and configure `pom.xml`.
2. Create a simple website with HTML, CSS, and a logo image.
3. Upload the project to GitHub.
4. Write and run a Selenium test with TestNG to validate the webpage title.

Testing the title of your website using **Selenium**, **Java**, and **TestNG**:

To test the title of your website using **Selenium**, **Java**, and **TestNG**, follow these steps. This will include the installation of necessary dependencies, creating test scripts, and running tests.

1. Set Up Selenium and TestNG Dependencies

In your Maven project, add the necessary dependencies for **Selenium WebDriver** and **TestNG** to the `pom.xml` file: (**Skip if already added..!!**)

```
<dependencies>
    <!-- Selenium WebDriver dependency -->
    <dependency>
        <groupId>org.seleniumhq.selenium</groupId>
        <artifactId>selenium-java</artifactId>
        <version>4.8.0</version> <!-- Ensure this is the latest version -->
    </dependency>

    <!-- TestNG dependency -->
    <dependency>
        <groupId>org.testng</groupId>
        <artifactId>testng</artifactId>
        <version>7.7.0</version> <!-- Ensure this is the latest version -->
        <scope>test</scope>
    </dependency>
</dependencies>

```


- **Selenium WebDriver**: This is used for browser automation.
- **TestNG**: This is a testing framework used to run Selenium tests.

2. Create Selenium Test Class Using TestNG

Next, create a test class in your `src/test/java` directory. You can name it `WebsiteTitleTest.java`.

Sample Code for Testing Website Title:

```
package org.test;

import org.openqa.selenium.WebDriver;
import org.openqa.selenium.chrome.ChromeDriver;
import org.testng.Assert;
import org.testng.annotations.AfterTest;
import org.testng.annotations.BeforeTest;
import org.testng.annotations.Test;

import static org.testng.Assert.assertTrue;

public class WebpageTest {

```

```
    private static WebDriver driver;

    @BeforeTest
    public void openBrowser() throws InterruptedException {
        driver = new ChromeDriver();
        driver.manage().window().maximize();
        Thread.sleep(2000);
        driver.get("https://sauravsarkar-codersarcade.github.io/CA-MVN/"); // "Note: You should use your GITHUB-URL here...!!!"
    }

    @Test
    public void titleValidationTest(){
        String actualTitle = driver.getTitle();
        String expectedTitle = "Tripillar Solutions"; // "Replace with Your HTML WebPage Title"
        Assert.assertEquals(actualTitle, expectedTitle);
    }

    @AfterTest
    public void closeBrowser() throws InterruptedException {
        Thread.sleep(1000);
        driver.quit();
    }

}

```

Code Explanation (Step-by-Step)

📌 Package Declaration

- `package org.test;`
  - Defines the package name as `org.test` (helps organize code).

📌 Imports Required Libraries

- `import org.openqa.selenium.WebDriver;` → Selenium WebDriver interface.
- `import org.openqa.selenium.chrome.ChromeDriver;` → Controls Google Chrome.
- `import org.testng.Assert;` → Provides assertion methods for validation.
- `import org.testng.annotations.*;` → TestNG annotations for test execution.
- `import static org.testng.Assert.assertTrue;` → Allows direct usage of `assertTrue()`.

📌 Class Declaration

- `public class WebpageTest {}` → Defines a **test class** for webpage testing.

📌 WebDriver Declaration

- `private static WebDriver driver;`
  - Declares a static WebDriver instance for browser control.

1️⃣ `@BeforeTest` - Setup Method

```
@BeforeTest
public void openBrowser() throws InterruptedException {

```

- Runs **before any test case** in this class.

- Initializes `ChromeDriver()` (opens Chrome).
- Maximizes the browser window.
- Waits for **2 seconds** (`Thread.sleep(2000)`).
- Navigates to `"https://sauravsarkar-codersarcade.github.io/CA-MVN/"`.

2️⃣ `@Test` - Title Validation Test

```
@Test
public void titleValidationTest() {

```

- Retrieves the **actual title** of the web page using `driver.getTitle()`.
- Defines the **expected title** as `"Tripillar Solutions"`.
- Uses `Assert.assertEquals(actualTitle, expectedTitle);`
  - **Passes** if the title matches `"Tripillar Solutions"`.
  - **Fails** if the title is different.

3️⃣ `@AfterTest` - Cleanup Method

```
@AfterTest
public void closeBrowser() throws InterruptedException {

```

- Runs **after all test cases** in this class.
- Waits for **1 second** (`Thread.sleep(1000)`).
- Closes the browser using `driver.quit();`.

Key Takeaways

✅ **Selenium WebDriver** automates browser interaction.
✅ **TestNG Annotations** manage test setup (`@BeforeTest`), execution (`@Test`), and teardown (`@AfterTest`).
✅ **Assertions (`Assert.assertEquals()`)** validate webpage content.

3. Run the Test Using TestNG

Option 1: Run TestNG from IntelliJ IDEA

1. Right-click the `WebpageTest.java` file.
2. Select **Run WebpageTest**.
   - IntelliJ IDEA will execute the TestNG test and show the results in the output console.

Option 2: Run TestNG via Command Line

If you want to run the tests from the command line, use the following Maven command:

```
mvn test

```

This will trigger the TestNG tests and execute all the tests in the `src/test/java` directory.

4. Verify the Test Results

After running the test, TestNG will output the results:

- If the website title matches the expected title, the test will pass.
- If the title is incorrect, the test will fail, and you will get an assertion error with a message indicating that the title doesn't match.

Summary of Steps:

1. **Add Dependencies**:
   - Add `selenium-java`, `testng`, and `webdrivermanager` dependencies in `pom.xml`.
2. **Write Test Class**:
   - Create a class `WebpageTest.java` with methods to launch the browser, navigate to the website, and verify the title.
3. **Run the Tests**:
   - Use IntelliJ IDEA or Maven to run the tests and check the output for validation.
4. **Verify Results**:
   - Ensure that the actual title matches the expected title. If they match, the test passes; if not, it fails.

This approach tests whether the website is correctly deployed and whether the title is as expected on your GitHub Pages site.

Use of **maven-jar-plugin** to **package** the project into a **jar file.** | | Showing how to **run** a **main class** and show simple **output**:

Great! You're on the right track. Here's a quick summary of what we have covered and additional steps you can take to demonstrate the use of **maven-jar-plugin** and how to package the project into a JAR file, including running a `main` class and showing simple output.

Summary of What We've Done So Far:

1. **Website Deployment**:
   - You've deployed your simple HTML, CSS, and assets (like logo.png) to **GitHub Pages** using Maven.
   - You've created a **Selenium Test** to validate the website title using **TestNG** and ran the test to ensure the website is functioning as expected.
2. **Next Steps**:
   - We can show how to use the **maven-jar-plugin** to create a runnable JAR file.
   - Demonstrate running a **main class** inside this JAR to produce a simple output.

Steps to Package the Project as a JAR and Run a Main Class

1. Add `maven-jar-plugin` to `pom.xml`:

To package your Maven project as a JAR file and specify the `main` class, we need to configure the **maven-jar-plugin** in the `pom.xml`.

Add the following configuration to your `pom.xml`:

```
<build>
    <plugins>
        <!-- Maven JAR Plugin -->
        <plugin>
```

```
            <groupId>org.apache.maven.plugins</groupId>
            <artifactId>maven-jar-plugin</artifactId>
            <version>3.2.0</version>
            <configuration>
                <!-- Specify the main class to be executed -->
                <archive>
                    <manifestEntries>
                        <Main-Class>com.example.MainClass</Main-Class> <!-- Replace with your main class path
-->
                    </manifestEntries>
                </archive>
            </configuration>
        </plugin>
    </plugins>
</build>

```

This will tell Maven to include the **Main-Class** in the JAR manifest and specify the main class that should be executed when the JAR is run.

2. Create a Main Class:

In your `src/main/java` directory, create a class with a `main` method. For example, create a `MainClass.java` under `com.example`:

```
package com.example;

public class MainClass {
    public static void main(String[] args) {
        System.out.println("Hello, this is a simple output from the main class!");
    }
}

```

This class contains a simple `main` method that prints output when run.

3. Package the Project into a JAR:

After configuring the plugin and creating the `MainClass`, run the following Maven command to build the project and package it into a JAR file:

```
mvn clean package

```

This will clean any previous builds, compile the source code, and package it into a JAR file located in the `target` directory (e.g., `target/your-project-name.jar`).

4. Run the JAR File:

Once the JAR is created, you can run it with the following command:

```
java -jar target/your-project-name.jar

```

This will execute the `main` method from your `MainClass` and print the message:

```
Hello, this is a simple output from the main class!

```

Summary:

1. **Add maven-jar-plugin**: Configure the plugin in `pom.xml` to specify the `main class`.
2. **Create Main Class**: Write a simple `MainClass` with a `main` method that outputs a message.
3. **Package with Maven**: Run `mvn clean package` to package the project into a JAR file.
4. **Run the JAR**: Use `java -jar target/your-project-name.jar` to run the packaged JAR and print the output.

Final Thoughts:

- By showing this process, you demonstrate how Maven is used to automate the build, test, deployment, and packaging of projects.
- The **maven-jar-plugin** allows you to easily create runnable JAR files, and running the `main` class from the JAR file is a common way to run Java applications.

This provides a good conclusion to the topic, demonstrating not only the deployment and testing of the website but also the power of Maven for packaging and managing Java projects.

Important Note :

The **maven-resources-plugin** that we used earlier for copying files (like HTML, CSS, images) to the `/docs` folder doesn't get replaced or removed when you configure the **maven-jar-plugin** for packaging the project. These two plugins serve different purposes and can coexist in your `pom.xml`.

How They Work Together:

1. **maven-resources-plugin**: This plugin is responsible for copying your resources (like HTML, CSS, images, etc.) to the appropriate location in the target directory (e.g., `/docs` or `/target/classes`). We used it to ensure that all static assets were copied to the correct folder for GitHub Pages deployment.
2. **maven-jar-plugin**: This plugin handles the packaging of your Java code into a JAR file. It creates the JAR with the specified resources, including the class files and any configured files (like your `MainClass`), but it doesn't interfere with the static files used for GitHub Pages.

Key Points:

- **maven-resources-plugin** will still be used to copy your static resources to the `/docs` folder as configured.
- **maven-jar-plugin** will only package your Java classes and any other necessary resources for the JAR file.
- Both plugins can run independently during the build process, so there's no conflict between them.

Example Setup for Both Plugins:

Here's how both plugins would coexist in your `pom.xml`:

```
<build>
    <plugins>
        <!-- maven-resources-plugin for copying static resources (HTML, CSS, images) -->
        <plugin>
            <groupId>org.apache.maven.plugins</groupId>
            <artifactId>maven-resources-plugin</artifactId>
            <version>3.2.0</version>
            <executions>
                <execution>
                    <phase>process-resources</phase>
                    <goals>
                        <goal>copy-resources</goal>
                    </goals>
```

```
                    <configuration>
                        <outputDirectory>${project.build.directory}/docs</outputDirectory>
                        <resources>
                            <resource>
                                <directory>src/main/resources</directory>
                                <includes>
                                    <include>**/*</include>
                                </includes>
                            </resource>
                        </resources>
                    </configuration>
                </execution>
            </executions>
        </plugin>

        <!-- maven-jar-plugin for packaging the project into a JAR -->
        <plugin>
            <groupId>org.apache.maven.plugins</groupId>
            <artifactId>maven-jar-plugin</artifactId>
            <version>3.2.0</version>
            <configuration>
                <archive>
                    <manifestEntries>
                        <Main-Class>com.example.MainClass</Main-Class> <!-- Replace with your main class path
-->
                    </manifestEntries>
                </archive>
            </configuration>
        </plugin>
    </plugins>
</build>

```


When You Run `mvn clean package`:

1. **maven-resources-plugin** will copy the static files from `src/main/resources` to the `/docs` folder.
2. **maven-jar-plugin** will package your project's Java classes into a JAR file and add the necessary **Main-Class** entry to the JAR's manifest.

Conclusion:

You don't need to worry about the **maven-resources-plugin** being overridden or replaced. Both plugins work independently, and you can use them together in the same build process to handle different aspects of your project (static resources for GitHub Pages and packaging the Java code into a JAR).

Maven Build Lifecycle Explained :

Here's a **clear, concise, and easy-to-understand** documentation on the **Maven Build Lifecycle**:

Introduction

Maven follows a structured build lifecycle, consisting of a sequence of predefined phases. These phases automate tasks like compiling code, running tests, packaging, and deploying the project.

Maven's Three Built-in Lifecycles

1. **Clean Lifecycle** – Cleans the project.
2. **Default (Build) Lifecycle** – Handles project compilation, testing, packaging, and deployment.
3. **Site Lifecycle** – Generates project documentation.

Each lifecycle has a sequence of phases, which execute in order.

---

1. Clean Lifecycle

Used to remove old build files before a new build.

Phases:

- `pre-clean` → Executes tasks before cleaning.
- `clean` → Deletes the `/target` directory (removes compiled files).
- `post-clean` → Executes tasks after cleaning.

Command to Run:

```
mvn clean

```

(This removes all compiled files and resets the build environment.)

---

2. Default (Build) Lifecycle

This is the **main lifecycle** that compiles, tests, and packages the project.

Phases & Explanation:

1. **validate** → Ensures project structure and configuration are correct.
2. **compile** → Compiles the source code.
3. **test** → Runs unit tests using **JUnit/TestNG** (does not require deployment).
4. **package** → Packages the compiled code into a deployable format (e.g., JAR/WAR).
5. **verify** → Runs integration tests to check if the package is valid.
6. **install** → Installs the package into the local repository (`~/.m2/repository`).
7. **deploy** → Uploads the package to a remote repository (e.g., Nexus, Artifactory).

Commands to Run Each Phase:

```
mvn validate     # Check project structure
mvn compile      # Compile the source code
mvn test         # Run unit tests
mvn package      # Create JAR/WAR file
mvn verify       # Run integration tests
mvn install      # Install JAR to local repository
mvn deploy       # Deploy to remote repository

```

> **Note:** Running `mvn package` will also execute **validate, compile, and test** (because earlier phases are executed automatically).

---

3. Site Lifecycle

This lifecycle generates project documentation.

Phases:

- `pre-site` → Prepares documentation.
- `site` → Generates site documentation.
- `post-site` → Finalizes site generation.
- `site-deploy` → Deploys documentation to a web server.

Command to Run:

```
mvn site

```

(This generates a project documentation site inside `target/site`.)

Summary Table:

Lifecycle	Phase	Description
Clean	`clean`	Deletes previous build files.
Build	`validate`	Ensures project correctness.
	`compile`	Compiles Java code.
	`test`	Runs unit tests.
	`package`	Creates JAR/WAR.
	`verify`	Runs integration tests.
	`install`	Installs JAR to local repo.
	`deploy`	Deploys to remote repo.
Site	`site`	Generates documentation.
	`site-deploy`	Deploys documentation.

Conclusion

Maven's lifecycle ensures an automated, structured build process. Running any phase also executes all previous phases automatically, making builds efficient and repeatable.

For daily use, the most common commands are:

```
mvn clean package   # Clean & build the project
mvn clean install   # Clean, build & install in local repo
mvn deploy          # Deploy to a remote repository

```

Now, you have a **simple and complete** understanding of Maven's lifecycle! 🚀

📌 Maven `site` & `deploy` Commands - Documentation

🚀 1. `mvn site` Command

The `mvn site` command is used to **generate a project website** containing reports like dependencies, build details, test results, and more.

🔹 Steps to Use `mvn site`

📝 Step 1: Add Site Plugin in `pom.xml`

Before running the `site` command, you need to add the **Maven Site Plugin** inside the `<build>` section of your `pom.xml`:

```
<build>
    <plugins>
        <plugin>
            <groupId>org.apache.maven.plugins</groupId>
            <artifactId>maven-site-plugin</artifactId>
            <version>3.12.1</version> <!-- Use latest version -->
        </plugin>
    </plugins>
</build>

```

📢 Step 2: Run the Site Command

Once the plugin is added, execute:

```
mvn site

```

✅ What Happens?

- Maven scans your project for available reports.
- Generates an **HTML-based website** inside `target/site/`.
- Includes various reports like dependencies, plugin management, and test results.

🌍 Step 3: Open the Generated Site

After successful execution, open the following file in a browser:

```
D:\Idea Projects\CA-MVN\target\site\index.html

```

🔎 You'll See Reports Like:

✔ Project Summary
✔ Dependencies Report
✔ Plugin Management
✔ Unit Test Results (if configured)
✔ Code Coverage (if applicable)

📤 2. `mvn deploy` Command

The `mvn deploy` command is used to **upload the built artifact (JAR, POM, etc.)** to a repository for distribution and sharing.

🔹 Steps to Use `mvn deploy`

Since you don't have a remote repository, we will configure a **local repository**.

📝 Step 1: Create a Local Repository

```
mkdir D:\my-local-maven-repo

```

🔧 Step 2: Configure `pom.xml` for Local Deployment

Add the following inside `<project>` in `pom.xml`:

```
<distributionManagement>
    <repository>
        <id>local-repo</id>
        <url>file:///D:/my-local-maven-repo</url>
    </repository>
</distributionManagement>

```

📦 Step 3: Run the Deploy Command

```
mvn deploy

```

✅ What Happens?

- Maven **builds** the project.
- Stores the artifact (JAR, POM, etc.) in `D:/my-local-maven-repo`.

📁 Step 4: Verify Deployment

Navigate to `D:/my-local-maven-repo/` and check if the project is stored correctly:

```
D:/my-local-maven-repo/
├── org/example/CA-MVN/1.0-SNAPSHOT/
│   ├── CA-MVN-1.0-SNAPSHOT.jar
│   ├── CA-MVN-1.0-SNAPSHOT.pom

```

🎯 Conclusion

✔ Use `mvn site` to generate a project website with reports.
✔ Use `mvn deploy` to store artifacts in a local or remote repository.

✔ Ensure you configure the **Maven Site Plugin** and **Distribution Management** in `pom.xml` before running these commands.

Now, you're all set to **document and deploy** your Maven project efficiently! 🚀🎯

✅ **Optional : Adding to Remote Repository || Out Of Syllabus || Just For Information**

You **can deploy your Maven artifacts** (JARs, POMs, etc.) to **GitHub Packages** as a remote repository. 🚀

GitHub Packages acts as a **private Maven repository**, and you can deploy artifacts using **Maven Deploy Plugin** with authentication.

🛠️ Steps to Deploy a Maven Project to GitHub Packages

🔹 1. Create a GitHub Repository

- Go to **GitHub → Create a new repository**
- Name it something like `maven-repo`
- **DO NOT initialize** with a `README`, `.gitignore`, or license.
- Copy your **GitHub Username** and **Personal Access Token (PAT)** (for authentication).

🔧 2. Modify `pom.xml` for GitHub Deployment

Add the **GitHub repository** under `<distributionManagement>` in your `pom.xml`:

```
<distributionManagement>
    <repository>
        <id>github</id>
        <url>https://maven.pkg.github.com/YOUR_GITHUB_USERNAME/maven-repo</url>
    </repository>
</distributionManagement>

```

✅ **Replace** `YOUR_GITHUB_USERNAME` with your actual GitHub username.

🔐 3. Configure Authentication (`settings.xml`)

You need to add **GitHub authentication credentials** inside Maven's `settings.xml` file (found in `C:\Users\YourUser\.m2\` on Windows or `~/.m2/` on Linux/macOS).

Add the following inside `<servers>`:

```
<server>
    <id>github</id>
    <username>YOUR_GITHUB_USERNAME</username>
    <password>YOUR_GITHUB_PERSONAL_ACCESS_TOKEN</password>
</server>

```

✅ **Replace** `YOUR_GITHUB_PERSONAL_ACCESS_TOKEN` with a **GitHub Personal Access Token (PAT)** that has `read:packages` and `write:packages` permissions.

📦 4. Run the Deploy Command

Now, deploy your Maven project using:

```
mvn deploy

```

✅ What Happens?

- Maven builds the project.
- Uploads the artifact (`JAR` , `POM` , etc.) to **GitHub Packages**.
- You can now **use this package in other projects!** 🎯

📥 5. Use Your GitHub Package in Another Maven Project

To **use the deployed package in another project**, add this to the new project's `pom.xml` :

```
<repositories>
    <repository>
        <id>github</id>
        <url>https://maven.pkg.github.com/YOUR_GITHUB_USERNAME/maven-repo</url>
    </repository>
</repositories>

<dependencies>
    <dependency>
        <groupId>com.example</groupId>
        <artifactId>YOUR_ARTIFACT_NAME</artifactId>
        <version>1.0-SNAPSHOT</version>
    </dependency>
</dependencies>

```

Now, your Maven project will **download the dependency from GitHub Packages** instead of Maven Central. 🎯

🚀 Conclusion

✔ You **can deploy** Maven artifacts to **GitHub Packages**.
✔ Requires **GitHub authentication** (username + PAT).
✔ Can be **used in other projects** like a private Maven repository.

CA - Gradle Notes & Documentation

Introduction to Gradle 🌟

Gradle is a **powerful open-source build automation tool** used for **developing, testing, deploying, and publishing** software applications. It was created by **Hans Dockter, Szczepan Faber, Adam Murdoch, Luke Daley, Peter Niederwieser, Daz DeBoer, and Rene Gröschke** around **13 years ago** as an improvement over **Apache Ant and Apache Maven**. 🚀

Unlike its predecessors, **Gradle supports multiple programming languages** including **Java, Kotlin, Groovy, Scala, and C++**, making it a **versatile** and **industry-standard build tool**. It is used for tasks ranging from **compilation and dependency management** to **packaging and deployment**.

🌍 History of Gradle

Gradle was first introduced in **late 2007** as a **more stable and flexible alternative** to **Apache Ant and Maven**. It addressed many of their limitations while **enhancing performance and scalability**.

- Its **first stable version** was released in **2019**.
- The latest version (as of the last update) is **Gradle 6.6**.

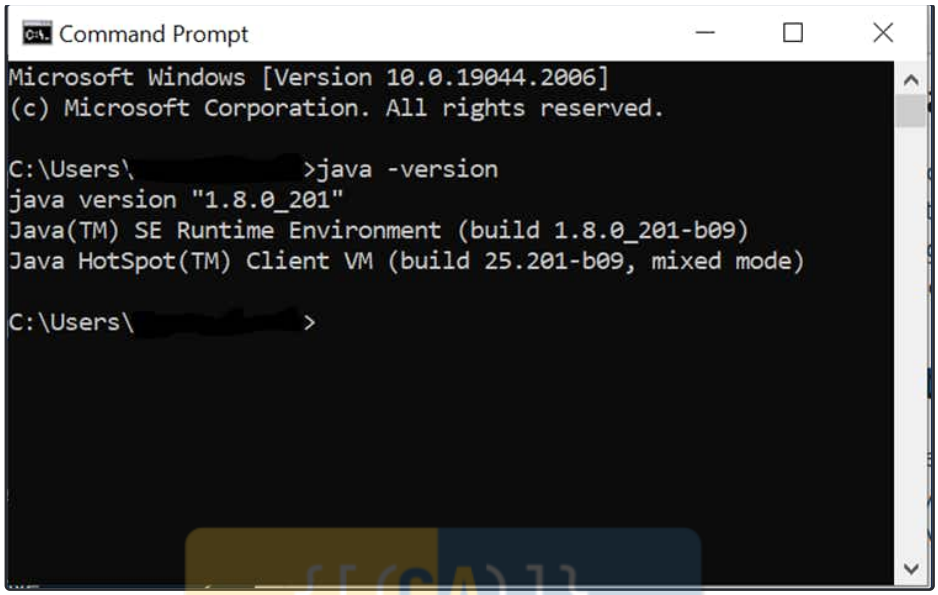
Gradle has now become a **popular choice for developers** due to its **speed, flexibility, and powerful dependency management system**.

🏗️ How to Install Gradle on Windows?

Gradle is a flexible build automation tool to build software. It is open-source, and also capable of building almost any type of software. A build automation tool automates the build process of applications. The Software building process includes compiling, linking, and packaging the code, etc. Gradle makes the build process more consistent. Using Gradle we can build **Android, Java, Groovy, Kotlin JVM, Scala, C++, Swift** Libraries, and Applications.

Prerequisites to Install Gradle

To install Gradle, we have to make sure that we have Java JDK version 8 or higher to be installed on our operating system because Gradle runs on major operating systems only Java Development Kit version 8 or higher. To confirm that we have JDK installed on our system. The '**Java -version** 'command is used to verify if you run it on a windows machine.



You should see output like in the above image it confirms that you have JDK installed and the JAVA_HOME path set properly if you don't have JDK Install. then you should install it first before going to the next step. in this tutorial, we are not covering the installation of JDK. we consider that we have JDK already on the system.

Installing Gradle Manually

Gradle Enterprise provides the installation of Gradle with package manager SDKMAN! but here we are covering the manual installation of Gradle for Microsoft windows machines. before starting we confirmed we have JDK installed properly on the machine.

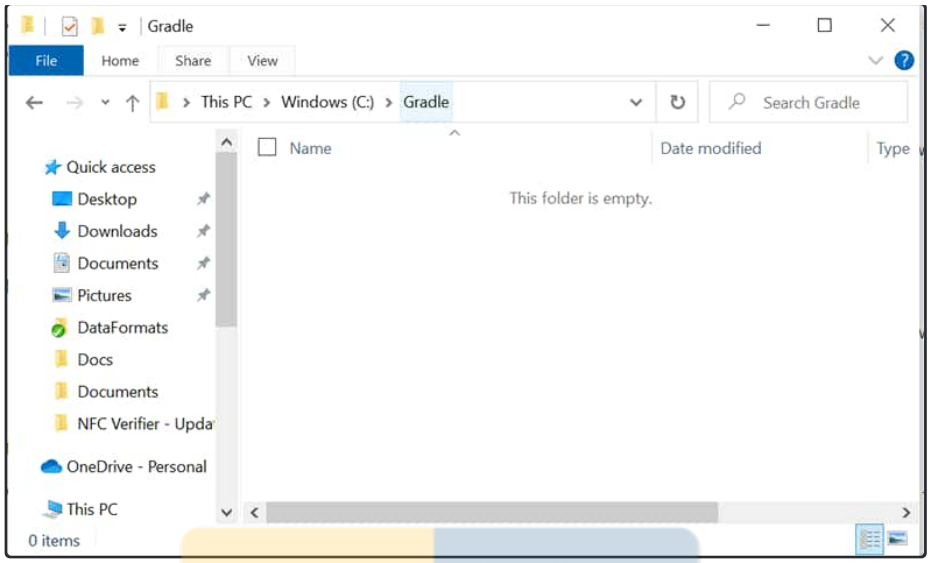
Step 1. Download the latest Gradle distribution

To install Gradle we need the Gradle distribution ZIP file, we can download the latest version of Gradle from the official website. there are other versions of Gradle available but we will strongly suggest using the official. The current release of Gradle is version v8.12.1, released on Jan 24, 2025. it might be another latest release available when you read this article. Always download the latest version. The Gradle distribution zip file is available in two flavors:

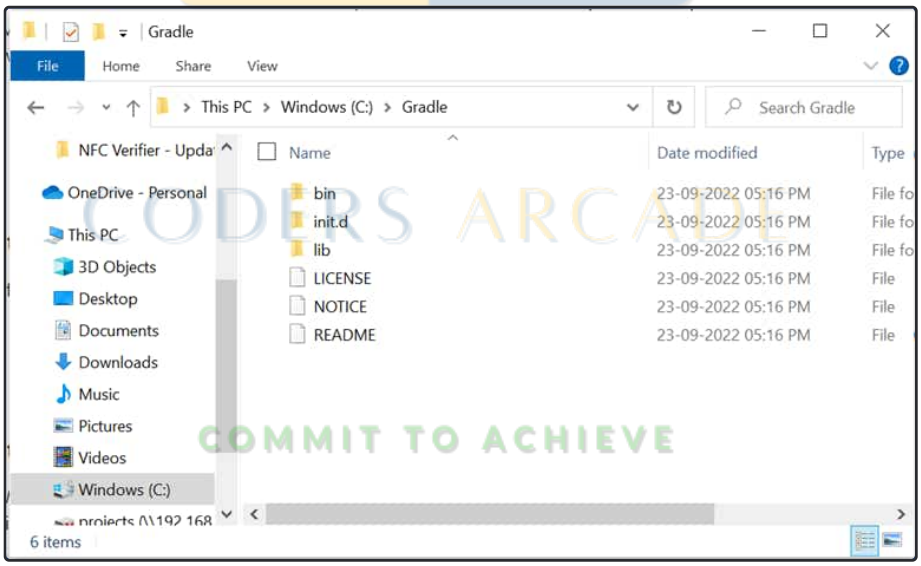
1. Binary-only: Binary version contains only executable files no source code and documentation. You can browse docs, and sources online.
2. Complete, with docs and sources: This package contains docs and sources offline. I recommend going with binary-only.

Step 2. Unpack the Gradle distribution zip file

After successfully downloading the Gradle distribution ZIP file, we need to unzip/unpack the compressed file. In File Explorer, create a new directory **C:\Gradle** (you can choose any path according to your choice) as shown In the image.



Now unpack the Gradle distribution ZIP into **C:\Gradle** using an archiver tool of your choice.



Step 3. Configure your system environment

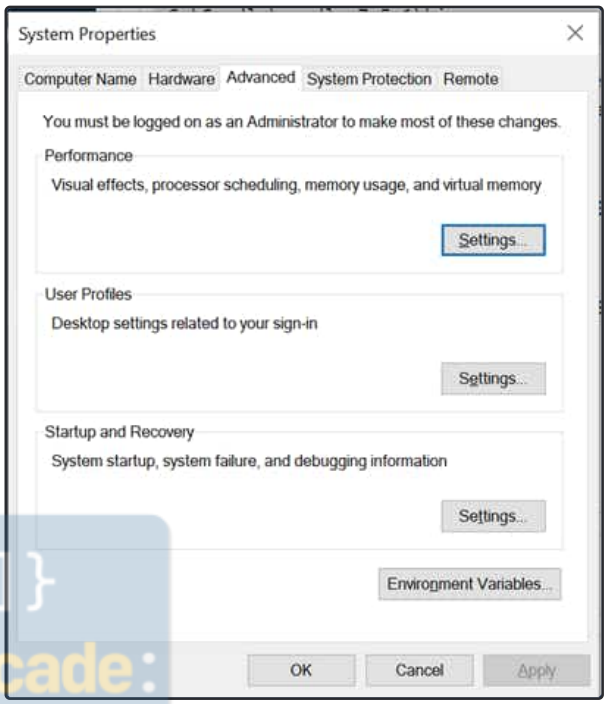
We have successfully unzipped the Gradle distribution Zip file. Now set the System environment **PATH** variable to the bin directory of the unzipped distribution. We have extracted files in the following location. you can choose any location to unzip:

C:\Gradle\bin

To set the Environment variable, Right-click on the "**This PC /Computer"** icon, then select **Properties -> Advanced System Settings -> Environmental Variables.** The following screenshot may help you.

As shown in the following image, In the section **System Variables** select **Path**, then select the **Edit** option.

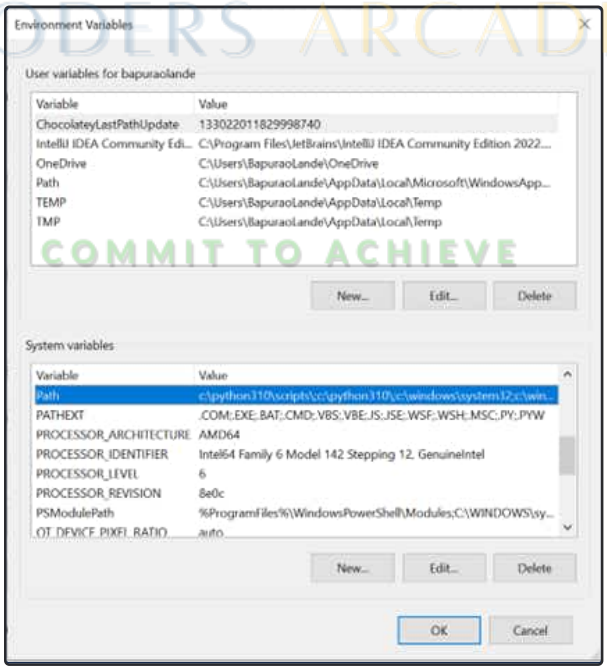
You will now see the following screen Select **New,** then add an entry for **C:\Gradle\bin** as shown in the image, now click on the **OK** button to save changes.

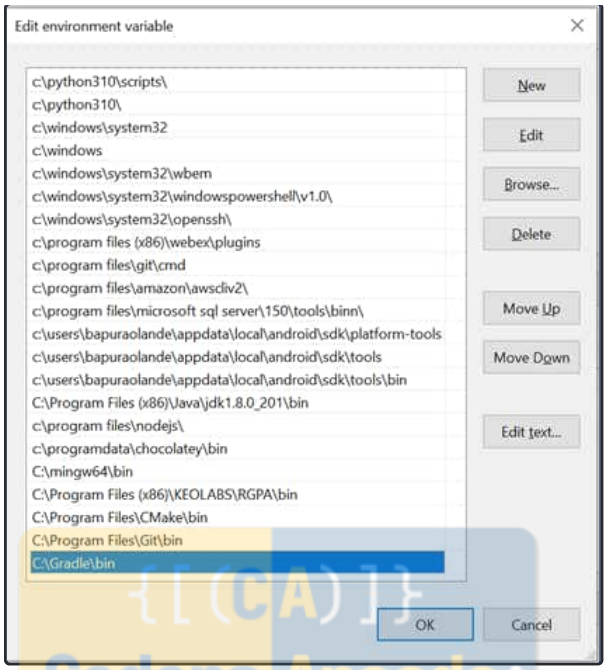


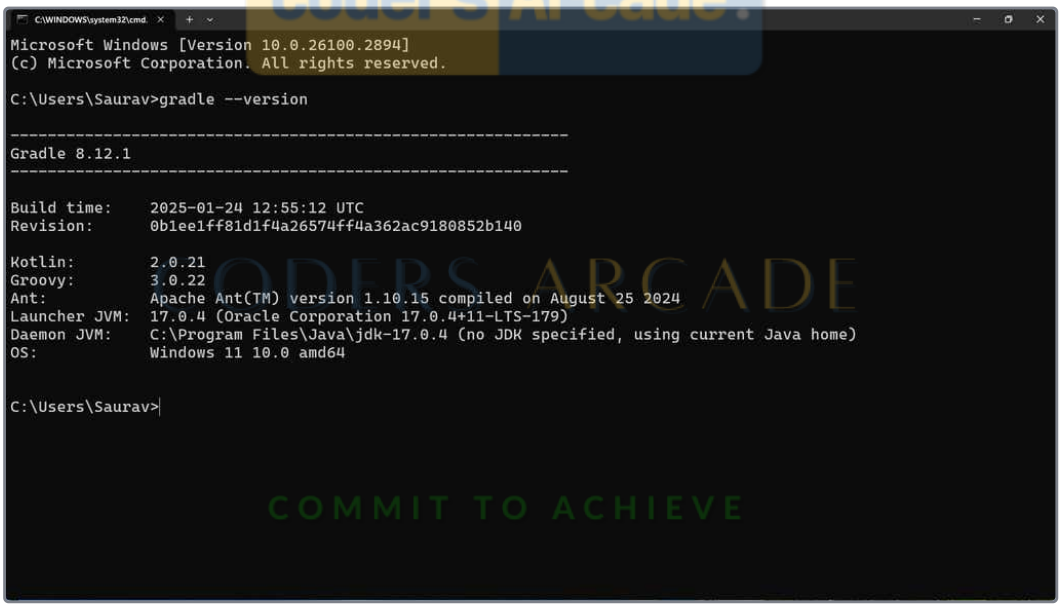
Step 4. Verifying and confirming the installation

After the successful setting of the environment variable, now it's time to verify the installation. Run the "**gradle -v"** command on the Windows command prompt, which displays the details of the Gradle version installed on the PC. If you get

similar output as in the image, Gradle has been installed successfully, and you can now use Gradle in your projects.







🛠️ How Gradle Works?

A **Gradle project** consists of **one or more subprojects**, and each project is made up of **tasks**. Let's break it down:

📌 Gradle Projects

- A **Gradle project** can be a **web application, JAR file, or even a collection of scripts**.
- Each project is made up of **tasks** that perform specific actions, such as **compiling, testing, and packaging**.
- Think of a **Gradle project like a wall**, where **each brick (task) builds up the structure**.

📌 Gradle Tasks

Tasks in Gradle define **what needs to be executed** in a project.
There are **two main types of tasks**:

1️⃣ Default Tasks:

- These are **predefined by Gradle** and **execute automatically** when no specific task is mentioned.
- Example: `init` and `wrapper` tasks.

2️⃣ **Custom Tasks:**

- These are **user-defined tasks** that allow developers to **customize** the build process.
- Example: Let's create a simple **Gradle task** that prints a message:

```
// build.gradle
task hello {
    doLast {
        println 'Welcome to Gradle!'
    }
}

```

💻 **Running the task:**

```
gradle -q hello

```


🖥️ **Output:**

```
Welcome to Gradle!

```

✨ Features of Gradle

Gradle comes with a variety of **powerful features** that make it a preferred build tool for developers. 🚀

🔹 IDE Support 🖥️

- Works with **IntelliJ IDEA, Eclipse, NetBeans, and Visual Studio**.

🔹 Java-Friendly ☕

- Gradle projects run on **JVM (Java Virtual Machine)** and support **Java-based APIs**.

🔹 Tasks & Repository Support 📦

- Supports **Maven** and **Ant repositories**.
- Allows easy **integration** with existing **Maven** and **Ant** projects.

🔹 Incremental Builds ⚡

- **Only compiles changes** made after the last build, reducing build time significantly.

🔹 Dependency Management 🔄

- Automatically **resolves and downloads dependencies**.
- Works with **Maven and Ivy repositories**.

🔹 Build Caching 🔁

- Stores results from previous builds and **reuses them**, reducing build times.

🔹 Plugin System 🔌

- Supports **plugins** for various languages (**Java, Kotlin, Scala, C++, Android, and more**).

🔹 **Extensibility** 🚀

- Highly **customizable** with **user-defined** tasks and configurations.

🔹 **Continuous Integration Support** 🏗️

- Works seamlessly with **Jenkins, GitHub Actions, Travis CI, and Azure DevOps**.

🔹 **Multi-Project Support** 🏗️

- Allows **managing multiple projects within the same build**.

💡 Pros & Cons of Using Gradle

✅ Pros

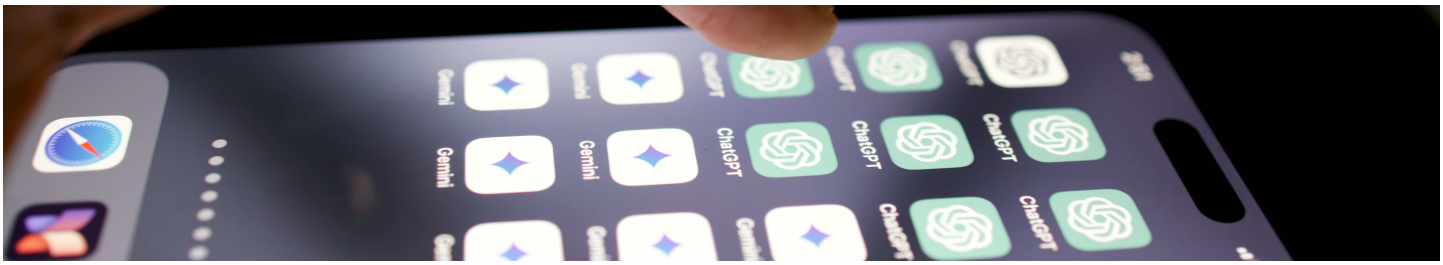
✔ **Declarative Builds** – Uses **Groovy/Kotlin DSL** for configuration.
✔ **Highly Scalable** – Efficient for both **small** and **large projects**.
✔ **Performance Boost** – **Incremental builds** and **parallel execution** speed up the process.
✔ **Cross-Language Support** – Works with **Java, Groovy, Kotlin, Scala, C++**, etc.
✔ **Strong Dependency Management** – Handles **dependencies** efficiently.
✔ **Free & Open Source** – Available under **Apache License 2.0**.

❌ Cons

❗ **Requires Technical Knowledge** – Needs prior understanding of **Groovy/Kotlin DSL**.
❗ **Complex Configurations** – Initial **setup can be tricky** for beginners.
❗ **Resource Consumption** – **Uses more memory** compared to **Maven**.
❗ **Migration Difficulty** – Moving from **Maven/Ant to Gradle** requires effort.

📚 Conclusion

Gradle is a **powerful, flexible, and efficient** build automation tool. It has become a **developer-favorite** for projects of all sizes, from **small applications to large enterprise systems**. With **incremental builds, dependency management, and extensive plugin support**, Gradle makes software development **faster and smoother**. 🚀



CA - Experiment 3 Part 1 - Working with Gradle: Setting Up a Gradle Project, Understanding Build Scripts (Groovy and Kotlin DSL), Dependency Management and Task Automation

Here's the **full step-by-step guide** for working with **Gradle in IntelliJ IDEA**, including **setup, project creation, website deployment, Selenium testing, and JAR packaging**.

🚀 Gradle in IntelliJ IDEA: A Complete Guide

1️⃣ Introduction to Gradle

Gradle is a powerful build automation tool used for **Java, Kotlin, and Android projects**. It provides **fast builds, dependency management, and flexibility** using Groovy/Kotlin-based scripts.

🔹 **Why Use Gradle?**

- **Incremental builds** (faster execution)
- **Dependency management** (supports Maven/Ivy)
- **Customizable tasks**
- **Multi-project support**

2️⃣ Installing and Setting Up Gradle in IntelliJ IDEA (Already Covered In Experiment 1)

Step 1: Install Gradle

- **Windows** (using Chocolatey):

```
choco install gradle

```

- **macOS** (using Homebrew):

```
brew install gradle

```

- **Linux**:

```
sdk install gradle

```

Step 2: Verify Installation

```
gradle -v
gradle --version
```

This should display the Gradle version.

3️⃣ Creating a Gradle Project in IntelliJ IDEA

Step 1: Open IntelliJ IDEA and Create a New Project

1. Click on **"New Project"**.
2. Select **"Gradle"** (under Java/Kotlin).
3. Choose **Groovy or Kotlin DSL (Domain Specific Language)** for the build script.
4. Set the **Group ID** (e.g., `com.example`).
5. Click **Finish**.

Step 2: Understanding Project Structure

```
my-gradle-project
├── build.gradle  (Groovy Build Script)
├── settings.gradle
├── src
│   ├── main
│   │   ├── java
│   │   └── resources
│   ├── test
│   │   ├── java
│   │   └── resources

```

4️⃣ Build and Run a Simple Java Application

Step 1: Modify `build.gradle` (Groovy DSL)

```
plugins {
    id 'application'
}

repositories {
    mavenCentral()
}

dependencies {
    testImplementation 'org.junit.jupiter:junit-jupiter:5.8.1'
}

application {
    mainClass = 'com.example.Main'
}

```

Step 2: Create `Main.java` in `src/main/java/com/example`

```
package com.example;

public class Main {
    public static void main(String[] args) {
        System.out.println("Hello from Gradle!");
    }
}

```

Step 3: Build and Run the Project

- **In IntelliJ IDEA**, open the **Gradle tool window** (View → Tool Windows → Gradle).
- Click `Tasks > application > run`.
- Or run from terminal:

```
gradle run

```

5️⃣ Hosting a Static Website on GitHub Pages

Step 1: Create a `/docs` Directory

- Create `docs` inside the **root folder** (not in `src`).
- Add your **HTML, CSS, and images** inside `/docs`.

Step 2: Modify `build.gradle` to Copy Website Files (This is optional)

```
task copyWebsite(type: Copy) {
    from 'src/main/resources/website'
    into 'docs'
}

```

Step 3: Commit and Push to GitHub

```
git add .
git commit -m "Deploy website using Gradle"
git push origin main

```

Step 4: Enable GitHub Pages

- Go to **GitHub Repo → Settings → Pages**.
- Select the `/docs` **folder** as the source.

Your website will be hosted at:

```
https://yourusername.github.io/repository-name/

```

6️⃣ Testing the Website using Selenium & TestNG in IntelliJ IDEA

Step 1: Add Selenium & TestNG Dependencies in `build.gradle`

```
dependencies {
    testImplementation 'org.seleniumhq.selenium:selenium-java:4.28.1' // use the latest stable version
    testImplementation 'org.testng:testng:7.4.0' // use the latest stable version
}

test {
    useTestNG()
}

```

Step 2: Write a Test Script (`src/test/java/org/test/WebpageTest.java`)

```
package org.test;

import org.openqa.selenium.WebDriver;
import org.openqa.selenium.chrome.ChromeDriver;
import org.testng.Assert;
import org.testng.annotations.AfterTest;
import org.testng.annotations.BeforeTest;
import org.testng.annotations.Test;

import static org.testng.Assert.assertTrue;

public class WebpageTest {
    private static WebDriver driver;

    @BeforeTest
    public void openBrowser() throws InterruptedException {
        driver = new ChromeDriver();
        driver.manage().window().maximize();
        Thread.sleep(2000);
        driver.get("https://sauravsarkar-codersarcade.github.io/CA-GRADLE/");
    }

    @Test
    public void titleValidationTest(){
        String actualTitle = driver.getTitle();
        String expectedTitle = "Tripillar Solutions";
        Assert.assertEquals(actualTitle, expectedTitle);
        assertTrue(true, "Title should contain 'Tripillar'");

    }

    @AfterTest
    public void closeBrowser() throws InterruptedException {
        Thread.sleep(1000);
        driver.quit();
    }


}

```

Step 3: Run the Tests

- Open the **Gradle tool window** in IntelliJ.
- Click `Tasks > verification > test`. **"Recommended"**
- Or run from terminal:

```
gradle test // Fails sometimes due to terminal issues

```

7️⃣ Packaging a Gradle Project as a JAR

Step 1: Modify `build.gradle` for JAR Packaging

```
plugins {
    id 'java'
    id 'application'
}

application {
    mainClass = 'com.example.Main'
}
jar {
    manifest {
        attributes 'Main-Class': 'com.example.Main'  // This tells Java where to start execution
    }
}

```


Step 2: Build and Package the JAR

```
gradle jar

```

The JAR file will be generated in `build/libs/`.

Step 3: Run the JAR

```
java -jar build/libs/<my-gradle-project>.jar

Expected output:
Hello from Gradle!

```

8️⃣ Gradle Lifecycle & Common Commands

Task	Command	Description
Initialize Project	`gradle init`	Creates a new Gradle project.
Compile Code	`gradle build`	Compiles the project.
Run Application	`gradle run`	Runs the application.
Clean Build Files	`gradle clean`	Deletes old build files.

Run Tests	`gradle test`	Executes unit tests.
Generate JAR	`gradle jar`	Packages the project into a JAR.
Deploy to GitHub Pages	`git push origin main`	Pushes website to GitHub.

9️⃣ Conclusion

Gradle provides a **fast, flexible, and scalable build automation system**.

We covered:

1️⃣ **Project Setup** in IntelliJ IDEA
2️⃣ **Building & Running a Java Application**
3️⃣ **Hosting a Static Website on GitHub Pages**
4️⃣ **Testing with Selenium & TestNG**
5️⃣ **Packaging as a JAR**

✅ Now you are **ready to use Gradle for build automation!** 🚀

🌟 Gradle Build Lifecycle: A Simple & Colorful Guide 🚀

Gradle follows a **flexible, task-based lifecycle**, unlike Maven's fixed phases. The build lifecycle in Gradle is divided into three key stages:

🔹 1. Initialization Phase

📌 **What happens here?**

- Determines which projects are part of the build (for multi-project builds).
- Creates an instance of each project.

📌 **Example Command:**

```
gradle help

```

(Shows project details and verifies Gradle setup.)

🔹 2. Configuration Phase

📌 **What happens here?**

- Gradle loads and executes the `build.gradle` file.
- It **configures** tasks but does **not** execute them yet.

📌 **Example Command:**

```
gradle tasks

```

(Lists all available Gradle tasks in the project.)

🔹 3. Execution Phase

📌 **What happens here?**

- Gradle executes the **tasks requested by the user**.
- Dependencies are resolved dynamically.
- Supports **incremental builds** (only modified files are compiled).

📌 **Example Command:**

```
gradle build

```

(Builds the project by compiling and packaging files.)

🎯 Key Gradle Tasks & Commands

Task 🛠️	Command	Description
🧹 **Clean**	`gradle clean`	Deletes previous build files.
🛠️ **Compile**	`gradle compileJava`	Compiles the Java source code.
📦 **Package (JAR/WAR)**	`gradle jar`	Packages the project into a JAR file.
✅ **Test**	`gradle test`	Runs unit tests.
🚀 **Run Application**	`gradle run`	Executes the main Java application.
📥 **Dependency Resolution**	`gradle dependencies`	Displays dependency tree.
⏩ **Parallel Execution**	`gradle build --parallel`	Speeds up builds by running tasks in parallel.

🎨 Gradle Lifecycle Visualized

```
Initialization  →  Configuration  →  Execution
(Project setup)    (Tasks loaded)    (Tasks executed)

```

✅ **Gradle is flexible** – tasks can be **customized or skipped** based on project needs. Unlike Maven, Gradle allows **on-demand task execution** rather than following a strict lifecycle.

🌟 Conclusion

🎯 **Gradle is powerful because:**
✅ It **only executes what's necessary** (faster builds).
✅ It **supports parallel execution** for large projects.
✅ It gives developers **more control over task execution**.

With Gradle, you can **automate builds efficiently** and **improve performance** for Java, Kotlin, and Android projects. 🚀

🔄 Maven vs. Gradle: A Detailed Comparison

Feature	Maven 🏗️	Gradle 🚀
Build Script Language	XML (`pom.xml`)	Groovy/Kotlin (`build.gradle` or `build.gradle.kts`)
Performance	Slower due to full rebuilds	Faster with **incremental builds** and parallel execution
Dependency Management	Uses Maven Central & local repository	Supports Maven, Ivy, and custom repositories
Configuration Style	**Declarative** (XML-based, verbose)	**Declarative + Imperative** (more concise, script-based)
Ease of Use	More structured, but verbose	More flexible, but has a learning curve
Incremental Builds	No support (always rebuilds everything)	Supports **incremental builds** (only recompiles changed files)
Build Performance	Slower, builds from scratch	Faster due to task caching and incremental execution
Customization & Extensibility	Limited custom scripts, plugin-based	Highly customizable with dynamic tasks and scripts
Multi-Project Builds	Complex and slower	Native support, optimized for large projects
IDE Support	Supported by IntelliJ IDEA, Eclipse, VS Code	Supported by IntelliJ IDEA, Eclipse, VS Code
Dependency Resolution	Resolves dependencies sequentially	**Parallel dependency resolution** (faster)
Popularity	Older and widely used in enterprise projects	Gaining popularity, especially in **Android & Kotlin** projects
Default Lifecycle Phases	3 lifecycle phases (clean, build, site)	More flexible task execution model
Learning Curve	Easier for beginners due to structured XML	Slightly steeper due to script-based configuration
Best Suited For	**Stable Java projects**, enterprises, and legacy codebases	**Modern Java, Android, and Kotlin projects** needing high performance

🛠️ Which One Should You Choose?

✅ **Use Maven** if you need **stability, structured builds, and an easier learning curve**.
✅ **Use Gradle** if you want **faster builds, better performance, and flexibility** for complex projects.

🎯 **Final Verdict:** If you're working on a simple Java project, **Maven** is a good choice. However, for modern, large-scale, or Android projects, **Gradle** is the better option due to its **speed, flexibility, and scalability**. 🚀

Here is a KOTLIN DSL version for Gradle "This is Optional"

🎯 Gradle Kotlin Build Script (`build.gradle.kts`)

Here's a **simple Gradle build script** written in **Kotlin DSL (`build.gradle.kts`)** for a Java application. 🚀

📌 `build.gradle.kts` (Kotlin DSL for Gradle)

```
// Apply necessary plugins
plugins {
    kotlin("jvm") version "1.9.10"  // Kotlin plugin for JVM
    application  // Enables the `run` task
}

// Define project properties
group = "com.example"
version = "1.0.0"
application.mainClass.set("com.example.MainKt")  // Define the main class

// Repositories for dependencies
repositories {
    mavenCentral()  // Fetch dependencies from Maven Central
}

// Dependencies
dependencies {
    implementation(kotlin("stdlib"))  // Standard Kotlin library
    testImplementation("org.junit.jupiter:junit-jupiter:5.9.1")  // JUnit 5 for testing
}

// Enable JUnit 5 for tests
tasks.test {
    useJUnitPlatform()
}

// JAR packaging
tasks.jar {
    manifest {
        attributes["Main-Class"] = "com.example.MainKt"
    }
}

```

📌 `Main.kt` (Inside `src/main/kotlin/com/example/`)

```
package com.example

fun main() {
    println("Hello, Gradle with Kotlin DSL! 🚀")
```

```
}

```

📌 Running the Project

💻 Run the application

```
gradle run

```

📦 Build the project

```
gradle build

```

🧹 Clean the build files

```
gradle clean

```

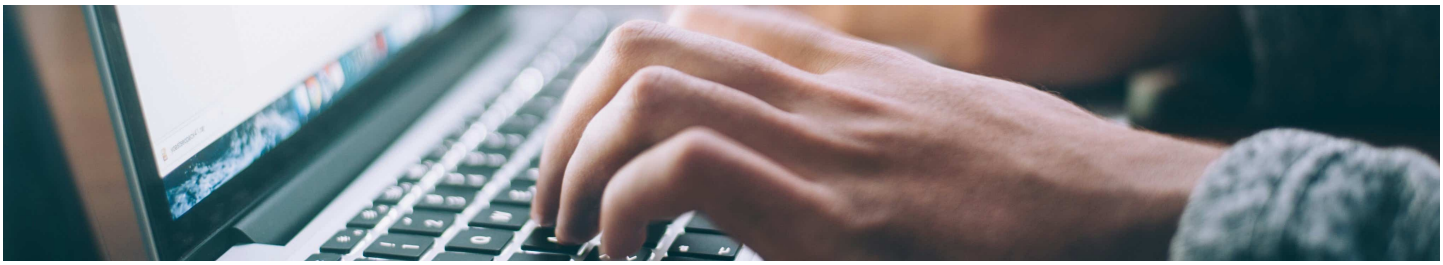
📂 Generate a JAR file

```
gradle jar

```

🌟 Why Use Kotlin DSL for Gradle?

✅ **Type-Safety** - Catch errors at compile-time.
✅ **Better IDE Support** - IntelliJ IDEA provides autocomplete and suggestions.
✅ **Interoperability** - Works seamlessly with Java and Kotlin projects.

This script sets up a **basic Kotlin/Java project with JUnit 5 support, dependency management, and a runnable JAR file**! 🚀



CA - Experiment 2 Part 2 : GRADLE KOTLIN DSL WORKFLOW || IntelliJ Idea

Here's a **detailed and well-formatted** documentation Gradle Kotlin DSL setup, including explanations, code snippets, and color-coded syntax (for reference when viewing in an IDE).

⚠️ **Important Note** : This experiment is only required if **students** or **VTU** asks you to show **GRADLE** with **KOTLIN DSL**, or else you can skip this.

Gradle Kotlin DSL: Setting Up & Building a Kotlin Project in IntelliJ IDEA

1️⃣ Setting Up the Gradle Project

Step 1: Create a New Project

1. Open **IntelliJ IDEA**.
2. Click on **File > New > Project**.
3. Select **Gradle** as the build system.
4. Choose **Kotlin** as the language.
5. Select **Gradle Kotlin DSL** (it will generate `build.gradle.kts`).
6. Name your project (e.g., `MVNGRDKOTLINDEMO`).
7. Set the **JDK** (use **JDK 17.0.4**, since that's your version).
8. Click **Finish**.

2️⃣ Understanding `build.gradle.kts`

After creating the project, the default `build.gradle.kts` file looks like this:

```
import org.jetbrains.kotlin.gradle.tasks.KotlinCompile

plugins {
    kotlin("jvm") version "1.8.10"  // Use latest stable Kotlin version
    application
}

group = "org.example"
version = "1.0-SNAPSHOT"

```

```
repositories {
    mavenCentral()
}

dependencies {
    implementation(kotlin("stdlib"))  // Kotlin Standard Library
    testImplementation("org.junit.jupiter:junit-jupiter-api:5.8.2")
    testRuntimeOnly("org.junit.jupiter:junit-jupiter-engine:5.8.2")
}

tasks.test {
    useJUnitPlatform()
}

tasks.withType<KotlinCompile> {
    kotlinOptions.jvmTarget = "17"  // Match with your JDK version
}

application {
    mainClass.set("MainKt")  // Update this if using a package
}

```

3️⃣ Creating the Main Kotlin File

Now, create your `Main.kt` file inside `src/main/kotlin/`.
If you're using a package (e.g., `org.example`), it should look like:


```
package org.example

fun main() {
    println("Hello, Gradle with Kotlin DSL!")
}

```


If you're **not** using a package, remove the `package` line and ensure `mainClass.set("MainKt")` in `build.gradle.kts`.

4️⃣ Building and Running the Project

Build the Project

```
./gradlew build

```

Run the Project

```
./gradlew run

```

5️⃣ Packaging as a JAR

To run the project without IntelliJ, we need a **JAR file**.

Step 1: Create a Fat (Uber) JAR

Modify `build.gradle.kts`:

```
tasks.register<Jar>("fatJar") {
    archiveClassifier.set("all")
    duplicatesStrategy = DuplicatesStrategy.EXCLUDE
    manifest {
        attributes["Main-Class"] = "MainKt"
    }
    from(configurations.runtimeClasspath.get().map { if (it.isDirectory) it else zipTree(it) })
    with(tasks.jar.get() as CopySpec)
}

```

Step 2: Build the Fat JAR

```
./gradlew fatJar

```


Step 3: Run the Fat JAR

```
java -jar build/libs/MVNGRDKOTLINDEMO-1.0-SNAPSHOT-all.jar

```

6️⃣ Common Gradle Commands

Command	Description
`./gradlew build`	Builds the project
`./gradlew run`	Runs the application
`./gradlew test`	Runs the tests
`./gradlew clean`	Cleans the build directory
`./gradlew fatJar`	Creates a runnable JAR

7️⃣ Additional Features

Adding Custom Gradle Tasks

Example: A simple task that prints "Hello, Gradle!"

```
tasks.register("hello") {
    doLast {
        println("Hello, Gradle!")
    }
}

```

Run it with:

```
./gradlew hello
```

```
2
```

8️⃣ Troubleshooting & Fixes

1. `java.lang.NoClassDefFoundError: kotlin/jvm/internal/Intrinsics`

✅ **Fix**: Use a Fat JAR (`fatJar`) to include Kotlin dependencies.

2. `mainClass` **Not Found**

✅ **Fix**: Ensure `mainClass.set("MainKt")` or use the correct package (`org.example.MainKt`).

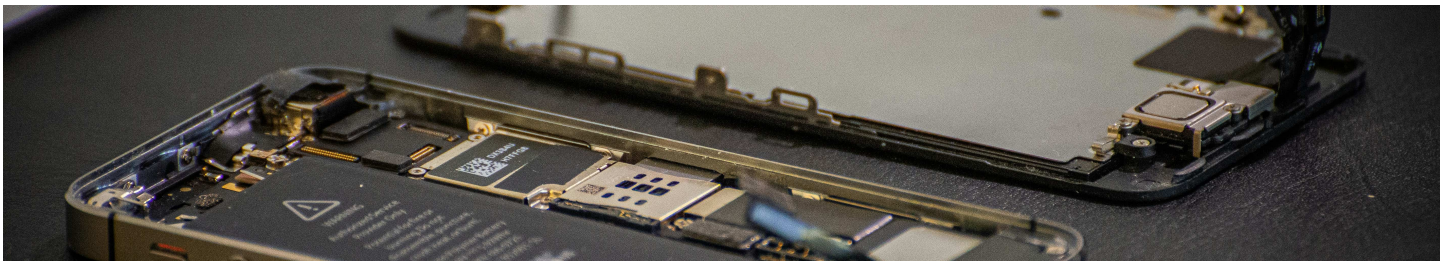
3. Gradle Wrapper Missing

✅ **Fix**: Generate it using:

```
gradle wrapper
```

✅ You're all set! 🚀

This guide ensures you have a **fully working** Gradle project with Kotlin DSL, dependency management, custom tasks, and a runnable JAR. 😊



CA - Experiment 4 - Practical Exercise: Build and Run a Java Application with Maven, Migrate the Same Application to Gradle

🎯 Part 1: Create and Build a Java Application with Maven

🛠️ Step 1: Create a Maven Project in IntelliJ IDEA

1. **Open IntelliJ IDEA**
   - Launch **IntelliJ IDEA** and click on **File → New → Project**. 🌟
2. **Select Maven**
   - In the **New Project** window, choose **Maven** from the options on the left.
   - Check **Create from archetype** and select **maven-archetype-quickstart**.
   - Click **Next**. 👨‍💻
3. **Enter Project Details**
   - **GroupId**: `com.example`
   - **ArtifactId**: `MVNGRDLDEMO`
   - Click **Next** and then **Finish**. ✨
4. **Wait for IntelliJ to Load Dependencies**
   - IntelliJ will automatically download the Maven dependencies, so just relax for a moment. 😊

📝 Step 2: Update `pom.xml` to Add Build Plugin

To compile and package your project into a `.jar` file, you need to add the **Maven Compiler** and **Jar** plugins. 🔧

1. Open the `pom.xml` file. 📄
2. Add the following inside the `<project>` tag:

```
<build>
    <plugins>
        <!-- Compiler Plugin -->
        <plugin>
            <groupId>org.apache.maven.plugins</groupId>
            <artifactId>maven-compiler-plugin</artifactId>
            <version>3.8.1</version>
            <configuration>
                <source>1.8</source>
                <target>1.8</target>
```

```
            </configuration>
        </plugin>

        <!-- Jar Plugin -->
        <plugin>
            <groupId>org.apache.maven.plugins</groupId>
            <artifactId>maven-jar-plugin</artifactId>
            <version>3.2.0</version>
            <configuration>
                <archive>
                    <manifest>
                        <mainClass>com.example.App</mainClass>
                    </manifest>
                </archive>
            </configuration>
        </plugin>
    </plugins>
</build>

```


🔨 Step 3: Build and Run the Maven Project

1. **Open IntelliJ IDEA Terminal**
   Press **Alt + F12** to open the terminal. 🖥️
2. **Compile and Package the Project**
   Run the following commands to build the project:

```
mvn clean compile
mvn package

```


3. **Locate the JAR File**
   After running the above, your `.jar` file will be located at:

```
D:\Idea Projects\MVNGRDLDEMO\target\MVNGRDLDEMO-1.0-SNAPSHOT.jar

```


4. **Run the JAR File**
   To run the generated JAR file, use:

```
java -jar target\MVNGRDLDEMO-1.0-SNAPSHOT.jar

```

🚀 Part 2: Migrate Maven Project to Gradle

🔄 Step 1: Initialize Gradle in Your Project

1. **Open Terminal in IntelliJ IDEA**
   Make sure you're in the project directory:

```
cd "D:\Idea Projects\MVNGRDLDEMO"

```

2. **Run Gradle Init Command**
   Execute the following command to migrate your Maven project to Gradle:

```
gradle init --type pom

```

This command will convert your Maven `pom.xml` into a Gradle `build.gradle` file. 🏗️

🛠️ Step 2: Review and Update `build.gradle`

1. **Open** `build.gradle` in IntelliJ IDEA.
2. Ensure the following configurations are correct:

```
plugins {
    id 'java'
}

group = 'com.example'
version = '1.0-SNAPSHOT'

repositories {
    mavenCentral()
}

dependencies {
    testImplementation 'junit:junit:4.13.2'
}

jar {
    manifest {
        attributes(
            'Main-Class': 'com.example.App'
        )
    }
}

```

🔨 Step 3: Build and Run the Gradle Project

1. **Clean and Build the Project**
   To clean and build your Gradle project, run:

```
gradle clean build

```

2. **Run the Generated JAR File**
   Now, run the generated JAR file using:

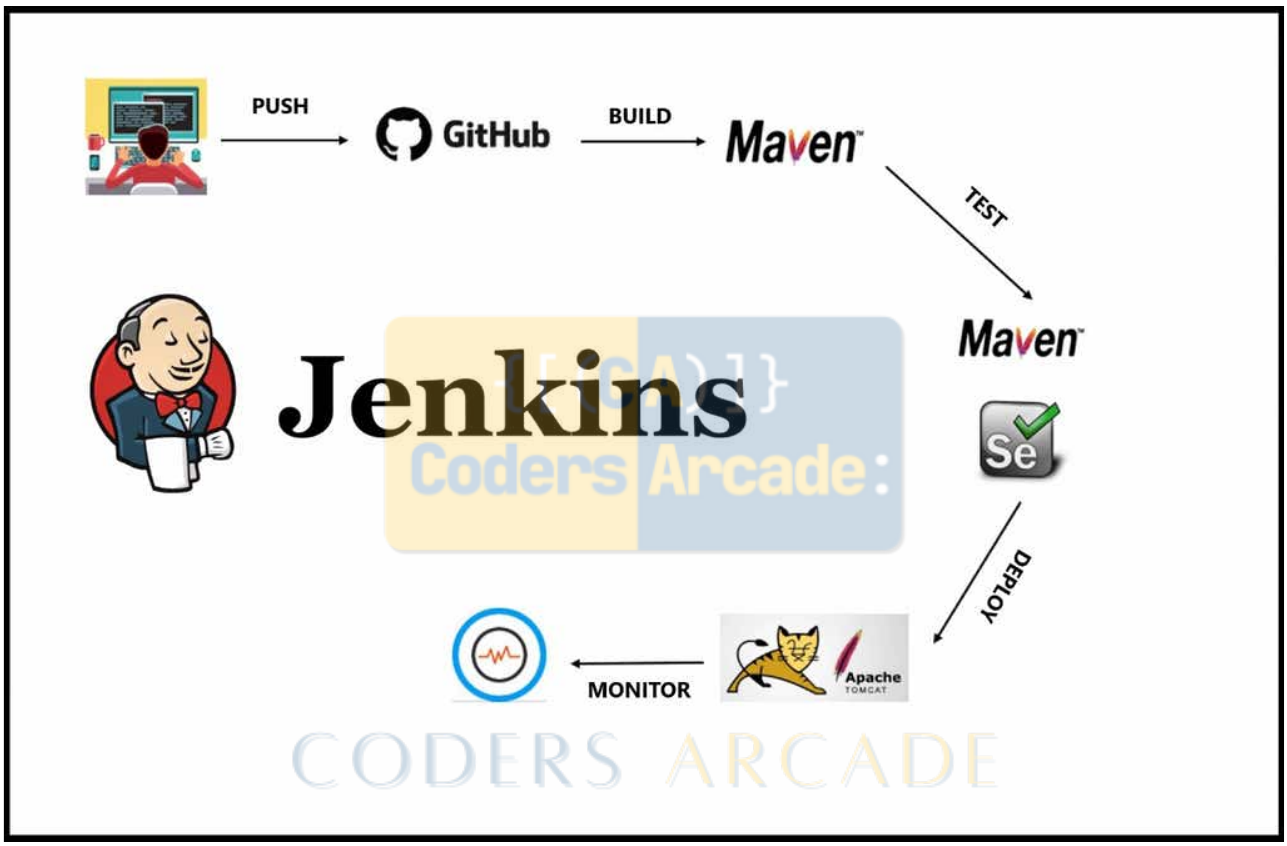
```
java -jar build/libs/MVNGRDLDEMO-1.0-SNAPSHOT.jar

```

🎉 Conclusion

Congratulations! You have successfully:

1. **Created a Maven project** in IntelliJ IDEA. 🎉
2. **Built and packaged** it into a JAR file using Maven. 🛠️
3. **Migrated** the project from Maven to Gradle. 🔄
4. **Built and ran** the project using Gradle. 🚀

CA - Jenkins Notes & Documentation



What is Jenkins

- **Jenkins is a CI CD tool**

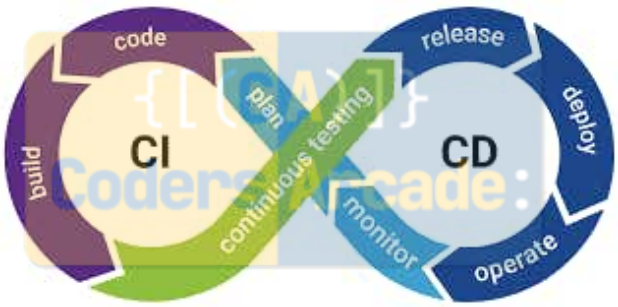
- **Free & Open Source**
- **Written in Java**

What is CI & CD

Watch This Video To Get Detailed Idea About CI/CD Pipeline : DevOps CI CD Pipeline || Simple & Detailed Explanation

Continuous Integration, Delivery & Deployment

CI/CD is **a method to frequently deliver apps to customers by introducing automation into the stages of app development**. The main concepts attributed to CI/CD are continuous integration, continuous delivery, and continuous deployment.



Installation

System Requirements

Memory 256 MB of RAM
Disk Space Depends on your projects
OS Windows, Mac, Ubuntu, Linux
Java 8 or 11 (JDK or JRE)

Installation on Windows

Watch This Video To Seamlessly Install Jenkins : Jenkins Installation - Step by Step Guide
Step 1 : Check Java is installed
Step 2 : Download Jenkins.war file
Step 3 : Goto cmd prompt and run command
java -jar jenkins.war --httpPort=8080
Step 4 : On browser goto http://localhost:8080
Step 5 : Provide admin password and complete the setup

Installation on Mac

Homebrew

Installation on Linux

How to install Jenkins on Amazon AWS EC2 Linux | 8 Steps

2. Jenkins Tutorials: How to install Jenkins on Ubuntu 22.04

Jenkins Configuration

How to change Home Directory

Step 1: Check your Jenkins Home > Manage Jenkins > Configure System
Step 2 : Create a new folder
Step 3 : Copy the data from old folder to new folder
Step 4 : Create/Update env variable JENKINS_HOME
Step 5 : Restart Jenkins
jenkins.xml
JENKINS_HOME

How to setup Git on Jenkins

Step 1 : Goto Manage Jenkins > Manage Plugins
Step 2 : Check if git is already installed in Installed tab
Step 3 : Else goto Available tab and search for git
Step 4 : Install Git
Step 5 : Check git option is present in Job Configuration

Create the first Job on Jenkins

How to connect to Git Remote Repository in Jenkins (GitHub)

Step 1 : Get the url of the remote repository
Step 2 : Add the git credentials on Jenkins
Step 3 : In the jobs configuration goto SCM and provide git repo url in git section
Step 4 : Add the credentials
Step 5 : Run job and check if the repository is cloned

How to use Command Line in Jenkins CLI

Faster, easier, integration
Step 1 : start Jenkins
Step 2 : goto Manage Jenkins - Configure Global Security - enable security
Step 3 : goto - http://localhost:8080/cli/
Step 4 : download jerkins-cli jar. Place at any location.
Step 5 : test the jenkins command line is working

java -jar jenkins-cli.jar -s http://localhost:8080 /help --username <userName> --password <password>

How to create Users + Manage + Assign Roles

How to create New Users
How to configure users

How to create new roles
How to assign users to roles
How to Control user access on projects

Step 1 : Create new users
Step 2 : Configure users
Step 3 : Create and manage user roles Role Based Authorization Strategy Plugin - download - restart jenkins
Step 4 : Manage Jenkins - Configure Global Security - Authorization - Role Based Strategy
Step 5 : Create Roles and Assign roles to users
Step 6 : Validate authorization and authentication are working properly

Jenkins Pipeline Beginner Tutorial

How to create Jenkinsfile

- **What is pipeline**
- **What is jenkins pipeline**
- **What is jenkinsfile**
- **How to create jenkinsfile**

Build > Deploy > Test > Release
Jenkinsfile : Pipeline as a code

Step 1 : Start Jenkins
Step 2 : Install Pipeline Plugin
Step 3 : Create a new job
Step 4 : Create or get Jenkinsfile in Pipeline section
Step 5 : Run and check the output

Jenkins Pipeline
How to get jenkinsfile from Git SCM

Step 1 : Create a new job or use existing job (type : Pipeline)
Step 2 : Create a repository or GitHub
Step 3 : Add Jenkinsfile in the repo
Step 4 : Under Jenkins job > Pipeline section > Select Definition Pipeline script from SCM
Step 5 : Add repo and jenkinsfile location in the job under Pipeline section
Step 6 : Save & Run

Jenkins Pipeline
How to clone a git repo using Jenkinsfile

Show Live Demonstration.

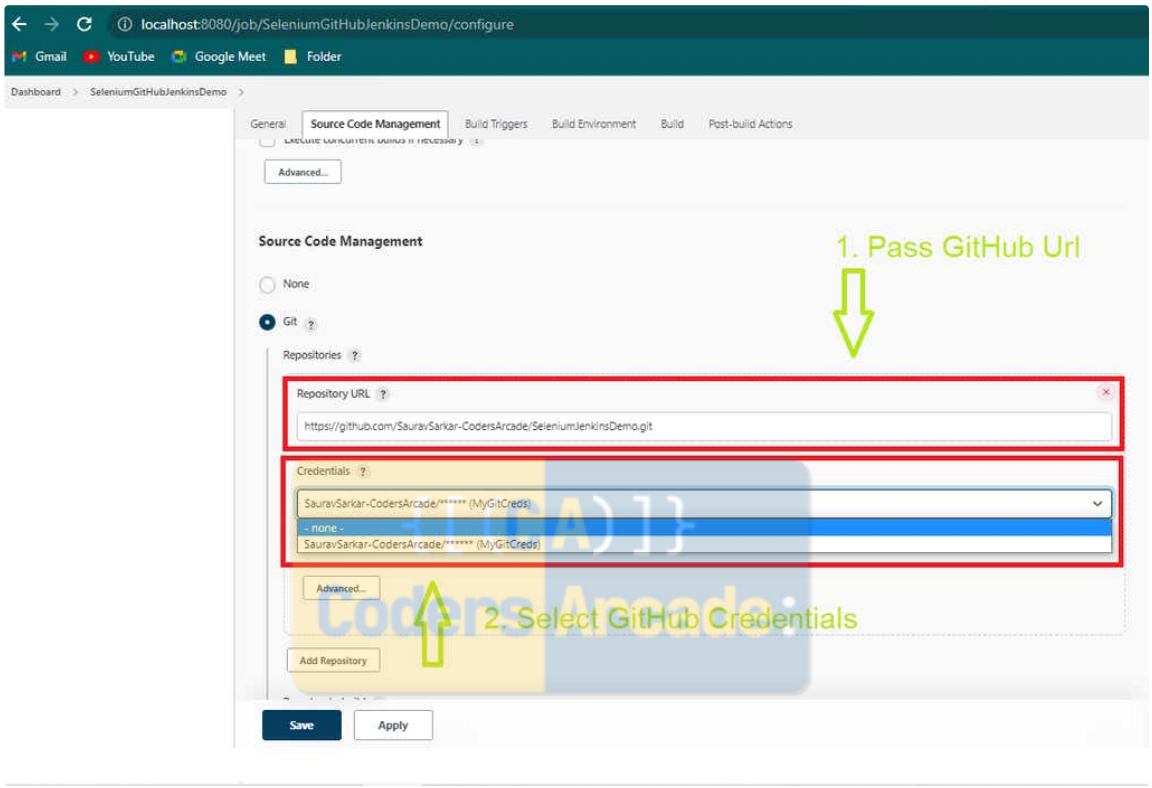
Running Selenium Automation Tests from GitHub via Jenkins CI Agent :

There are two ways in which we can perform Selenium Automation tests from GitHub via Jenkins

- Via **Git Credentials**
- Via **GitHub access token**
- The steps are shown with images.
- In the build, you have to execute the maven commands like: **mvn clean test, etc.**

Method 1:

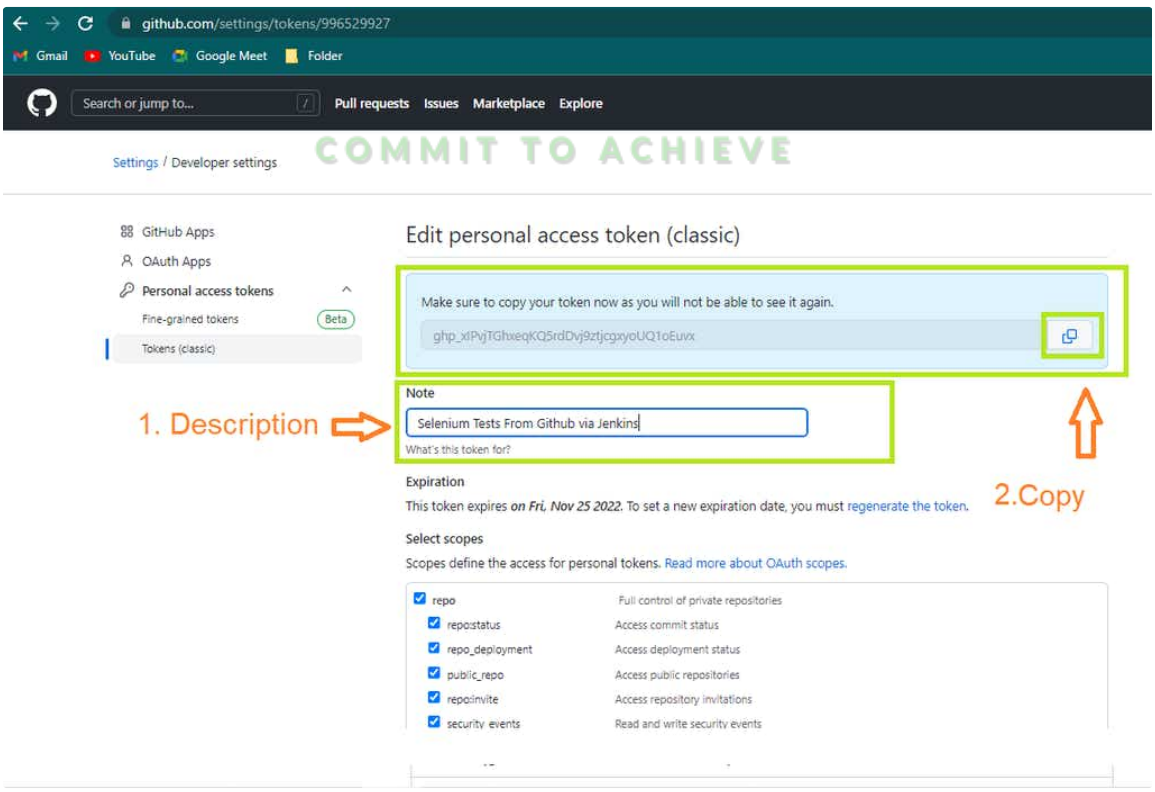
- Via **Git Credentials**



GitHub + Jenkins With Git Credentials

Method 2:

- Via **GitHub Access Token**



GitHub + Jenkins Via Access Token

CODERS ARCADE

COMMIT TO ACHIEVE

CA - Experiment 5 - Introduction to Jenkins: What is Jenkins?, Installing Jenkins on Local or Cloud Environment, Configuring Jenkins for First Use

Experiment 5: Introduction to Jenkins

🌟 Objective

To understand the fundamentals of **Jenkins**, install it on a local or cloud environment, and configure it for first-time use.

🔹 1. What is Jenkins?

Jenkins is an **open-source automation server** used for:
✅ **Continuous Integration (CI)** – Automatically testing and integrating code changes
✅ **Continuous Deployment (CD)** – Automating application deployment
✅ **Building Pipelines** – Managing end-to-end software development workflows
✅ **Plugin-Based Extensibility** – Supporting tools like Maven, Gradle, Ansible, Docker, and Azure DevOps

🚀 Why Use Jenkins?

✔ Automates builds and tests
✔ Reduces manual intervention
✔ Improves software quality
✔ Works with multiple tools and platforms

🔹 2. Installing Jenkins

Jenkins can be installed using multiple methods:
1️⃣ **Windows Installer (.msi) – Recommended for Windows**
2️⃣ **Linux Package Manager – Best for Linux Users**
3️⃣ **Jenkins WAR File – Universal method using Java**

We'll cover all three approaches.

🟢 2.1 Prerequisites

🔹 **Java 11 or 17** is required for Jenkins.
Check Java version:

```
java -version

```

If Java is not installed, download it from:
Download the Latest Java LTS Free

🟠 2.2 Installing Jenkins on Windows (MSI Installer) – Recommended

✅ Step 1: Download Jenkins

🔗 **Download from:** Download and deploy
Choose **Windows Installer (.msi)** for an easy setup.

✅ Step 2: Install Jenkins

1️⃣ Run the downloaded `.msi` file.
2️⃣ Follow the installation wizard.
3️⃣ Select **Run Jenkins as a Windows Service** (recommended).
4️⃣ Choose the **installation directory** (default: `C:\Program Files\Jenkins`).
5️⃣ Click **Install** and wait for the setup to complete.

✅ Step 3: Start Jenkins

1️⃣ Open **Services** (`services.msc`) and ensure **Jenkins** is running.
2️⃣ Open a web browser and go to:

```
http://localhost:8080

```

✅ Step 4: Unlock Jenkins

1️⃣ Find the initial **Admin Password** in:

```
C:\Program Files\Jenkins\secrets\initialAdminPassword

```

2️⃣ Copy the password and paste it into the Jenkins setup page.

✅ Step 5: Install Recommended Plugins

Jenkins will prompt you to install plugins. Click **"Install Suggested Plugins"**.

✅ Step 6: Create Admin User

1️⃣ Set up a **Username**, **Password**, and **Email**.
2️⃣ Click **Save and Finish**.

🔹 **Jenkins is now ready!** 🎉
Access it anytime at:

```
http://localhost:8080

```

🟢 2.3 Installing Jenkins on Linux (Ubuntu/Debian)

✅ Step 1: Add Jenkins Repository

```
wget -q -O - https://pkg.jenkins.io/debian/jenkins.io.key | sudo apt-key add -
sudo sh -c 'echo deb http://pkg.jenkins.io/debian-stable binary/ > /etc/apt/sources.list.d/jenkins.list'

```

✅ Step 2: Install Jenkins

```
sudo apt update
sudo apt install jenkins -y

```

✅ Step 3: Start Jenkins

```
sudo systemctl start jenkins
sudo systemctl enable jenkins

```

✅ **Step 4: Access Jenkins**

Find the **initial password** in:

```
sudo cat /var/lib/jenkins/secrets/initialAdminPassword

```

Then open Jenkins in a browser:

```
http://localhost:8080

```

🟠 2.4 Installing Jenkins Using WAR File (Works on Any OS)

This method allows you to run Jenkins without installing it as a service.

✅ **Step 1: Download the Jenkins WAR File**

🔗 Download from: Download and deploy
Choose **Generic Java Package (.war)**.

✅ **Step 2: Run Jenkins Using Java**

Navigate to the folder where the `.war` file is downloaded and run:

```
java -jar jenkins.war --httpPort=8080

```

🔹 This will start Jenkins on port **8080**.

✅ **Step 3: Open Jenkins in Browser**

Go to:

```
http://localhost:8080

```

✅ **Step 4: Unlock Jenkins & Setup**

Follow the **same steps** as the Windows/Linux installation:
✔ Find the initial password
✔ Install plugins
✔ Create an admin user

🔹 **Jenkins is now running without installation!**

To stop Jenkins, press **CTRL + C** in the terminal.

🔹 3. Configuring Jenkins for First Use

✅ 3.1 Understanding the Jenkins Dashboard

After logging in, you will see:
🔹 **New Item** → Create Jobs/Pipelines

- 🔹 **Manage Jenkins** → Configure System, Users, and Plugins
- 🔹 **Build History** → View previous builds
- 🔹 **Credentials** → Store secure authentication details

✅ 3.2 Installing Additional Plugins

Jenkins supports **plugins** for various tools like Maven, Gradle, Docker, and Azure DevOps.

🔹 To install a plugin:
1️⃣ Go to **Manage Jenkins → Manage Plugins**
2️⃣ Search for the required plugin
3️⃣ Click **Install without Restart**

✅ 3.3 Setting Up Global Tool Configuration

Configure Java, Maven, and Gradle in Jenkins:
1️⃣ Go to **Manage Jenkins → Global Tool Configuration**
2️⃣ Add paths for:

- **JDK** (`C:\Program Files\Java\jdk-17`)
- **Maven** (`C:\Maven\apache-maven-<version>`)
- **Gradle** (`C:\Gradle\gradle-<version>`)

3️⃣ Click **Save**

📌 Assessment Questions

1️⃣ What is **Jenkins** used for in DevOps?
2️⃣ Explain the **difference** between CI and CD in Jenkins.
3️⃣ How do you **install Jenkins** on Windows, Linux, and using the WAR file?
4️⃣ Where can you find the **initial Jenkins password** after installation?
5️⃣ What are some **essential Jenkins plugins** for automation?

📌 Important Note

You can use the below links to easily install **Jenkins** & understand **CI/CD Pipelines** in **DevOps**.

🔹 **Jenkins Installation Video** 🎥 – Follow this step-by-step guide for a **seamless Jenkins setup**: Jenkins Installation - Step by Step Guide

🔹 **Understanding CI/CD in DevOps** 🚀 – Learn how Jenkins fits into the **CI/CD pipeline**: DevOps CI CD Pipeline || Simple & Detailed Explanation

Ensure you have **Java installed** before setting up Jenkins. If you face any issues, check the **Jenkins logs** for troubleshooting. ✅

CA - Experiment 6 - Continuous Integration with Jenkins: Setting Up a CI Pipeline, Integrating Jenkins with Maven/Gradle, Running Automated Builds and Tests

---

Experiment 6: Continuous Integration with Jenkins

Objective

To set up a Continuous Integration (CI) pipeline in Jenkins, integrate it with Git, and run Selenium Java tests using Maven.

Prerequisites

Before proceeding, ensure the following:

✅ **Jenkins is installed and running** on your system. If not, refer to [Experiment 5].
✅ **Git is installed** and configured in Jenkins. (Verify with `git --version`).
✅ **Maven is installed** and configured in Jenkins. (Check with `mvn -version`).
✅ **Selenium Maven Project is ready** with test cases (`src/test/java`).
✅ **Project is stored in two places**:

- Locally on your system (e.g., `D:\Idea Projects\MVNGRDLDEMO`).
- Pushed to **GitHub** with a valid repository link.
  ✅ **Jenkins has access to the GitHub repository** (via credentials).

---

1. Configuring Jenkins & Git Integration

Step 1: Verify Git Installation in Jenkins

1. Open **Jenkins Dashboard** → **Manage Jenkins** → **Global Tool Configuration**.
2. Under **Git**, verify the installation path (e.g., `C:\Program Files\Git\bin\git.exe`).
3. Click **Save**.

Step 2: Add GitHub Credentials in Jenkins

1. Navigate to **Manage Jenkins** → **Manage Credentials**.
2. Select **Global credentials (unrestricted)** → Click **Add Credentials**.
3. Choose **Username with password** or **SSH Key**, provide details, and click **OK**.

---

2. Running a Selenium Java Test from a Local Maven Project

Step 1: Create a New Jenkins Job

1. Go to **Jenkins Dashboard** → Click **New Item**.
2. Enter a project name → Select **Freestyle Project**.
3. Click **OK**.

Step 2: Configure the Build Step

1. Scroll to **Build** → Click **Add build step** → **Execute Windows Batch Command**.
2. Enter the following commands (**ensure correct navigation to project directory**):

```
cd D:\Idea Projects\MVNGRDLDEMO
mvn test

```

3. Click **Save** → Click **Build Now** to execute the test.

---

3. Running Selenium Tests from a GitHub Repository via Jenkins

Step 1: Set Up a New Jenkins Job for GitHub Project

1. Go to **Jenkins Dashboard** → Click **New Item**.
2. Enter a project name → Select **Freestyle Project**.
3. Click **OK**.

Step 2: Configure Git Repository in Jenkins

1. Under **Source Code Management**, select **Git**.
2. Enter your GitHub repository URL (e.g., `https://github.com/your-repo-name.git`).
3. Select the **Git credentials** configured earlier.

Step 3: Add Build Step for Maven

1. Scroll to **Build** → Click **Add build step** → **Execute Windows Batch Command**.
2. Enter the Maven test command:

```
mvn test

```

3. Click **Save**.

Step 4: Trigger the Build

1. Click **Build Now** to fetch the code from GitHub and execute the Selenium tests.
2. Check the **Console Output** to verify test execution.

Important Notes

📌 **Prerequisites are crucial!** Make sure Jenkins, Git, Maven, and Selenium projects are set up correctly before proceeding.
📌 **Always navigate to the project directory** before running `mvn test` from a local system.
📌 **Use webhooks** in GitHub to automatically trigger builds when new code is pushed.
📌 **Configure email notifications** in Jenkins for build status updates.

🔗 **Jenkins & Git Integration Video:** [To Be Added - Version 1.2]
🔗 **Running Selenium Tests in Jenkins:** [To Be Added - Version 1.2]
