Thadomal Shahani Engineering College

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CERTIFICATE

Certify that Mr./~~Miss~~ Altaf Alam

of IT Department, Semester V with

Roll No. 02 has completed a course of the necessary

experiments in the subject Devops Lab under my

supervision in the **Thadomal Shahani Engineering College**

Laboratory in the year 2023 - 2024

Teacher In-Charge

Gondal
20/10/23

Date 20/10/23

Head of the Department

Principal

THADOMAL SHAHANI TSEC ENGINEERING COLLEGE

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Roll no : 02 , Batch : T11 , Subject : DevOps Lab , Date : 18/07/23

Experiment No-1

Aim:- To study Devops: principles, practices & DevOps engineer roles & responsibilities.

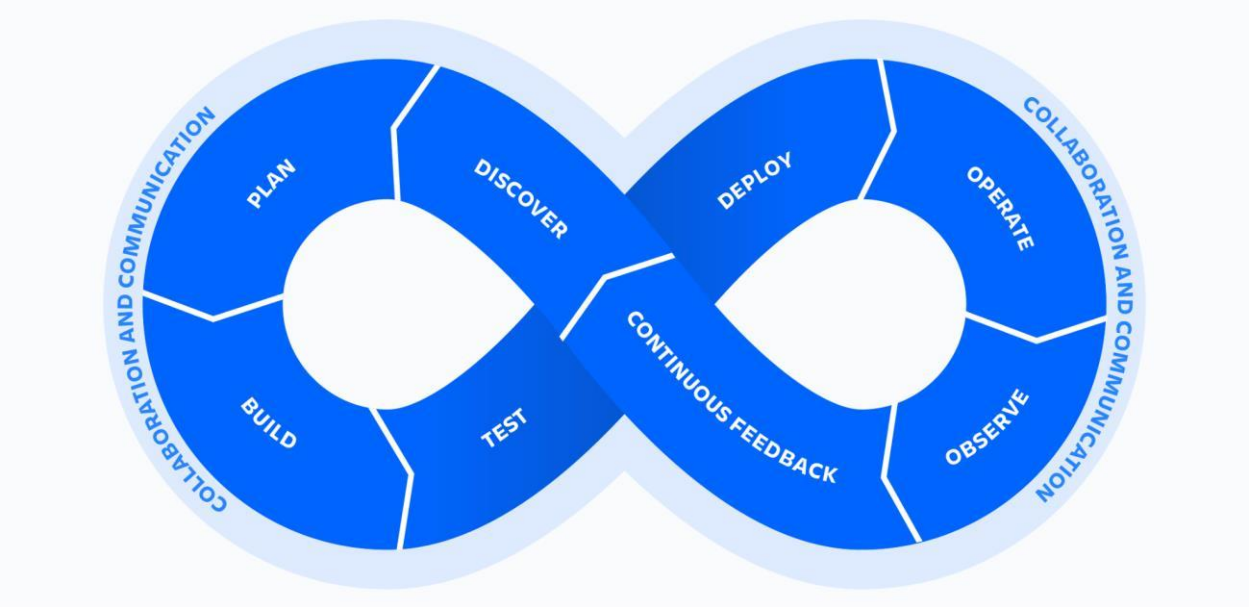
Lab Outcome:- LO1 : To understand the fundamentals of DevOps engineering and be fully proficient with DevOps terminiologies, concepts, benefits, and deployment options to meet your business requirements.

Theory:-

What is Devops?

DevOps is the combination of cultural philosophies, practices, and tools that increases an organization's ability to deliver applications and services at high velocity: evolving and improving products at a faster pace than organizations using traditional software development and infrastructure management processes.

Lifecycle:



DevOps is the next evolution of agile methodologies. Because of the continuous nature of DevOps, practitioners use the infinity loop to show how the phases of the DevOps lifecycle relate to each other. Despite appearing to flow sequentially, the loop symbolizes the need for constant collaboration and iterative improvement throughout the entire lifecycle. A cultural shift that brings development and operations teams together. DevOps is a practice that involves a cultural change, new management principles, and technology tools that help to implement best practices.

Regardless of the type of DevOps toolchain an organization uses, a DevOps process needs to use the right tools to address the key phases of the DevOps lifecycle:

- Discover
- Plan
- Build
- Test
- Monitor
- Operate
- Continuous feedback

Discover:

In the Discover phase, a DevOps team researches and defines the scope of a project. In particular, it involves activities such as user research, establishing goals, and defining success. Tools like Mural and Miro empower the entire software team to gather ideas and conduct research. Jira Product Discovery organizes this information into actionable inputs and prioritizes actions for development teams. As you're prioritizing, you'll also need to keep your backlog of user feedback in mind.

Plan:

Taking a page out of the agile handbook, we recommend tools that allow development and operations teams to break work down into smaller, manageable chunks for quicker deployments. This allows you to learn from users sooner and helps with optimizing a product based on the feedback. Look for tools that provide sprint planning, issue tracking, and allow collaboration, such as Jira.

Build:

While Puppet and Chef primarily benefit operations, developers use open source tools like Kubernetes and Docker to provision individual development environments. Coding against virtual, disposable replicas of production helps you get more work done.

Continuous Delivery:

Continuous integration is the practice of checking in code to a shared repository several times a day, and testing it each time. That way, you automatically detect problems early, fix them when they're easiest to fix, and roll out new features to your users as early as possible.Look for tools that automatically apply your tests to development branches, and give you the option to push to main when branch builds are successful. Along with that, you get continuous feedback through real-time chat alerts from your team with a simple integration.

Test:

Testing tools span many needs and capabilities, including exploratory testing, test management, and orchestration. However, for the DevOps toolchain, automation is an essential function. Automated testing pays off over time by speeding up your development and testing cycles in the long run. And in a DevOps environment, it's important for another reason: awareness. Test automation can increase software quality and reduce risk by doing it early and often. Development teams can execute automated tests repeatedly, covering several areas such

as UI testing, security scanning, or load testing. They also yield reports and trend graphs that help identify risky areas.

Deploy:

One of the most stressful parts of shipping software is getting all the change, test, and deployment information for an upcoming release into one place. The last thing anyone needs before a release is a long meeting to report on status.

Automated deployment:

There's no magic recipe for automated deployment that will work for every application and IT environment. But converting operations' runbook into a cmd-executable script using Ruby or bash is a common way to start.

Operate:

The keys to unlocking collaboration between DevOps teams is making sure they're viewing the same work. What happens when incidents are reported? Are they linked and traceable to software problems? When changes are made, are they linked to releases?
Nothing blocks Dev's collaboration with Ops more than having incidents and software development projects tracked in different systems. Look for tools that keep incidents, changes, problems, and software projects on one platform so you can identify and fix problems faster.

Observe:

There are two types of monitoring that should be automated: server monitoring and application performance monitoring.

Manually "topping" a box or hitting your API with a test is fine for spot-checking. But to understand trends and the overall health of your application (and environments), you need software that is listening and recording data 24/7. Ongoing observability is a key capability for successful DevOps teams.

Continuous Feedback:

Customers are already telling you whether you've built the right thing – you just have to listen. Continuous feedback includes both the culture and processes to collect feedback regularly, and tools to drive insights from the feedback. Continuous feedback practices include collecting and reviewing NPS data, churn surveys, bug reports, support tickets, and even tweets. In a DevOps culture, everyone on the product team has access to user comments because they help guide everything from release planning to exploratory testing sessions.

DevOps tools:

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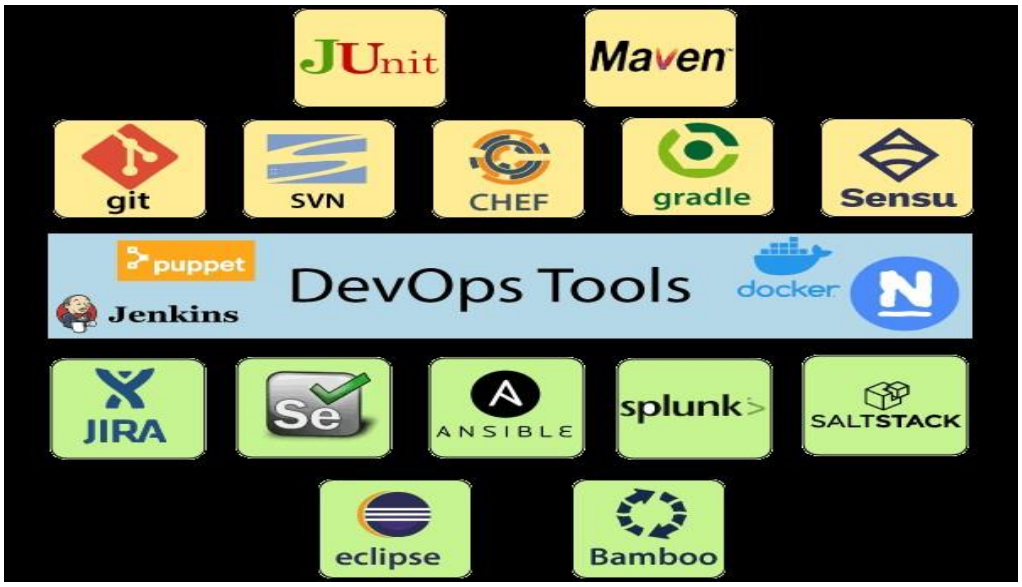

1) Puppet
Puppet is the most widely used DevOps tool. It allows the delivery and release of the technology changes quickly and frequently. It has features of versioning, automated testing, and continuous delivery. It enables to manage entire infrastructure as code without expanding the size of the team.

2) Ansible
Ansible is a leading DevOps tool. Ansible is an open-source IT engine that automates application deployment, cloud provisioning, intra service orchestration, and other IT tools. It makes it easier for DevOps teams to scale automation and speed up productivity. Ansible is easy to deploy because it does not use any agents or custom security infrastructure on the client-side, and by pushing modules to the clients. These modules are executed locally on the client-side, and the output is pushed back to the Ansible server.

3) Docker
Docker is a high-end DevOps tool that allows building, ship, and run distributed applications on multiple systems. It also helps to assemble the apps quickly from the components, and it is typically suitable for container management.

4) Nagios
Nagios is one of the more useful tools for DevOps. It can determine the errors and rectify them with the help of network, infrastructure, server, and log monitoring systems.

5) CHEF
A chef is a useful tool for achieving scale, speed, and consistency. The chef is a cloud-based system and open source technology. This technology uses Ruby encoding to develop essential building blocks such as recipes and cookbooks. The chef is used in infrastructure automation and helps in reducing manual and repetitive tasks for infrastructure management.

6) Jenkins

Jenkins is a DevOps tool for monitoring the execution of repeated tasks. Jenkins is a software that allows continuous integration. Jenkins will be installed on a server where the central build will take place. It helps to integrate project changes more efficiently by finding the issues quickly.

7) Git

Git is an open-source distributed version control system that is freely available for everyone. It is designed to handle minor to major projects with speed ,efficiency and co-ordinate the work and track the work among programmers. It is used as a critical distributed versioncontrol for the DevOps tool.

8) SALTSTACK

Stackify is a lightweight DevOps tool. It shows real-time error queries, logs, and more directly into the workstation. SALTSTACK is an ideal solution for intelligent orchestration for the software-defined data center.

9) Splunk

Splunk is a tool to make machine data usable, accessible, and valuable to everyone. It delivers operational intelligence to DevOps teams. It helps companies to be more secure, productive, and competitive.

10) Selenium

Selenium is a portable software testing framework for web applications. It provides an easy interface for developing automated tests.

What are the roles and responsibilities of a Devops engineer?

Responsibilities of devops engineer include:

1. Infrastructure Provisioning and Management: Setting up and managing infrastructure, including servers, networks, databases, and cloud services. This involves using infrastructureas-code tools like Terraform or CloudFormation.
2. Continuous Integration and Continuous Deployment (CI/CD): Implementing and maintaining CI/CD pipelines to automate the build, testing, and deployment processes. This ensures fast and reliable delivery of software.
3. Version Control and Configuration Management: Managing version control systems like Git and ensuring the consistency of configuration files across environments.
4. Automation: Automating repetitive tasks and processes to increase efficiency and reduce manual intervention. This includes tasks like environment provisioning, deployment, and monitoring.
5. Monitoring and Logging: Setting up monitoring and logging tools to track the performance, health, and availability of applications and infrastructure. This helps in detecting issues and troubleshooting problems proactively.
6. Security and Compliance: Ensuring that the systems and applications are secure by implementing security measures and best practices. Also, ensuring compliance with relevant regulations and standards.

7. Collaboration and Communication: Working closely with development, operations, and other cross-functional teams to foster collaboration and improve communication.
8. Incident Management and Troubleshooting: Responding to incidents, identifying root causes, and resolving issues quickly to minimize downtime.
9. Performance Optimization: Optimizing the performance of applications and infrastructure to achieve scalability and efficiency.
10. Disaster Recovery and High Availability: Implementing disaster recovery strategies and ensuring high availability of critical systems.
11. Capacity Planning: Estimating future resource requirements based on growth and usage patterns to avoid resource shortages.
12. Documentation: Maintaining clear and up-to-date documentation for processes, configurations, and infrastructure.
13. Continuous Learning: Staying updated with the latest DevOps tools, practices, and trends to continuously improve and enhance processes.

Roles of devops engineer include:

1. DevOps Evangelist – The principal officer (leader) responsible for implementing DevOps.
2. Release Manager – The one releasing new features & ensuring post-release product stability.
3. Automation Expert – The guy responsible for achieving automation & orchestration of tools.
4. Software Developer/ Tester – The one who develops the code and tests it.
5. Quality Assurance – The one who ensures the quality of the product confirms to its requirement.
6. Security Engineer – The one always monitoring the product's security & health.

Conclusion:-

I have successfully learnt about devops, roles and responsibilities of devops engineer and also learnt about the various phases and tools used in devops.

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Experiment No 2

Aim : To understand Version Control System, Git installation & Github account.

Lab Outcome :

LO1: To understand the fundamentals of DevOps engineering and be fully proficient with DevOps terminologies, concepts, benefits, and deployment options to meet your busines requirements.
LO2 : To obtain complete knowledge of the "version control system" to effectively track changes augmented with Git and Github.

Theory :

What is Version Control?

Version control, also known as source control, is the practice of tracking and managing changes to software code. Version control systems are software tools that help software teams manage changes to source code over time. As development environments have accelerated, version control systems help software teams work faster and smarter. They are especially useful for DevOps teams since they help them to reduce development time and increase successful deployments.

Version control software keeps track of every modification to the code in a special kind of database. If a mistake is made, developers can turn back the clock and compare earlier versions of the code to help fix the mistake while minimizing disruption to all team members.

What is Git?

Git is a specific open-source version control system created by Linus Torvalds in 2005. Specifically, Git is a distributed version control system, which means that the entire codebase and history is available on every developer's computer, which allows for easy branching and merging.

Instead, version control lets developers safely work through branching and merging. With branching, a developer duplicates part of the source code (called the repository). The developer can then safely make changes to that part of the code without affecting the rest of the project.
Then, once the developer gets his or her part of the code working properly, he or she can merge that code back into the main source code to make it official.

To understand GitHub, you must first have an understanding of Git. Git is an open-source version control system that was started by Linus Torvalds—the same person who created Linux. Git is similar to other version control systems—Subversion, CVS, and Mercurial to name a few.

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So, Git is a version control system, but what does that mean? When developers create something (an app, for example), they make constant changes to the code, releasing new versions up to and after the first official (non-beta) release.

Version control systems keep these revisions straight, storing the modifications in a central repository. This allows developers to easily collaborate, as they can download a new version of the software, make changes, and upload the newest revision. Every developer can see these new changes, download them, and contribute.

Similarly, people who have nothing to do with the development of a project can still download the files and use them. Most Linux users should be familiar with this process, as using Git, Subversion, or some other similar method is pretty common for downloading needed files—especially in preparation for compiling a program from source code (a rather common practice for Linux geeks).

Git is the preferred version control system of most developers, since it has multiple advantages over the other systems available. It stores file changes more efficiently and ensures file integrity better.

Git Installation in Windows:

1. Browse to the official Git website: https://git-scm.com/downloads 2. Click the download link for Windows and allow the download to complete.

Extract and Launch Git Installer

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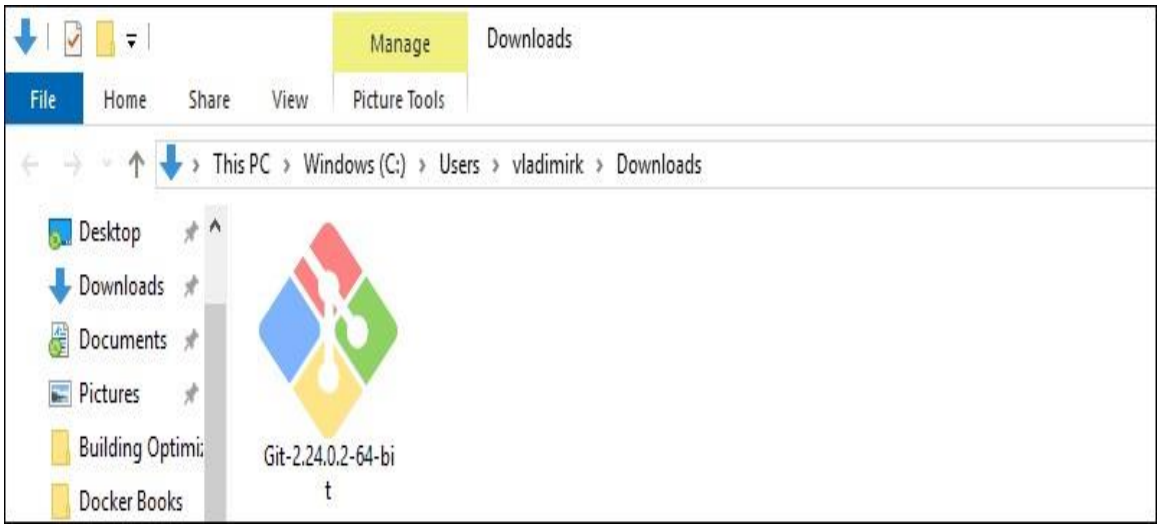
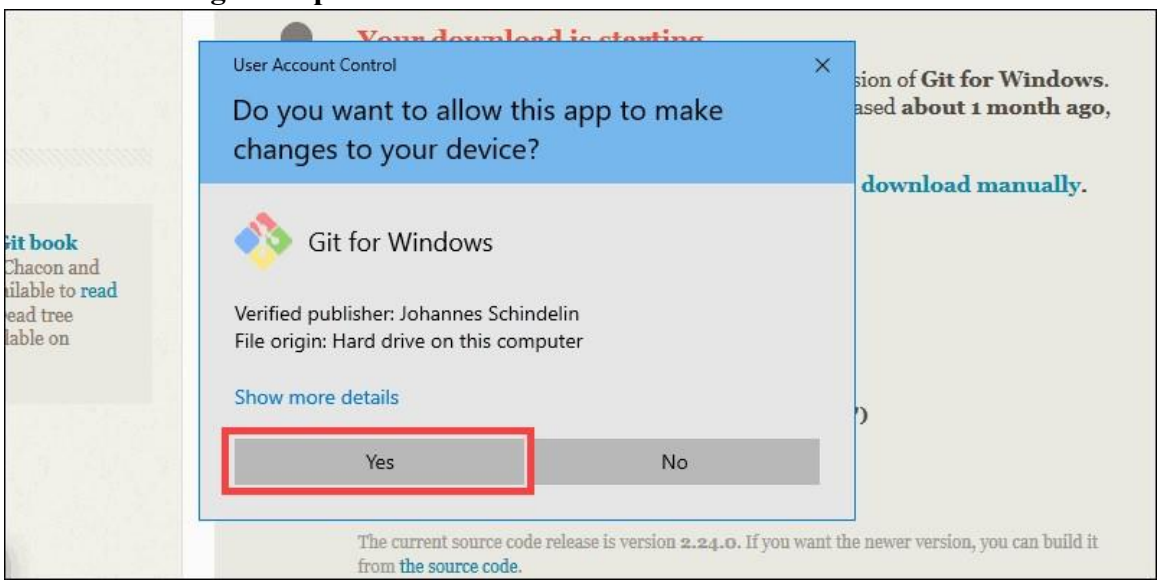
3. Browse to the download location (or use the download shortcut in your browser). Double-click the file to extract and launch the installer.



4. Allow the app to make changes to your device by clicking Yes on the User Account Control dialog that opens.



5. Review the GNU General Public License, and when you're ready to install, click Next.

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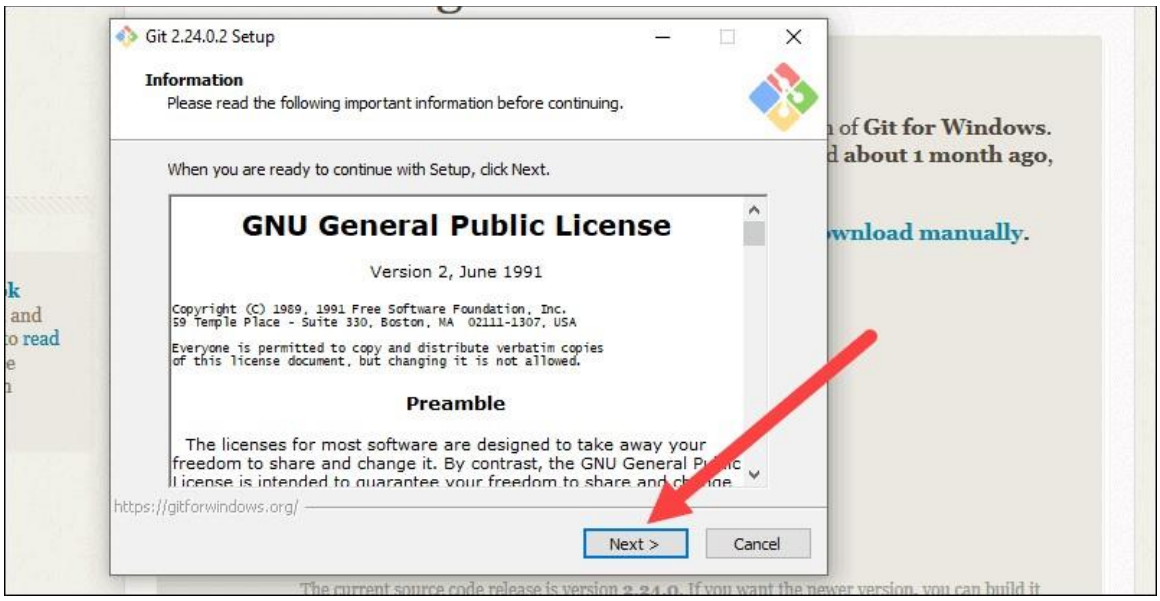
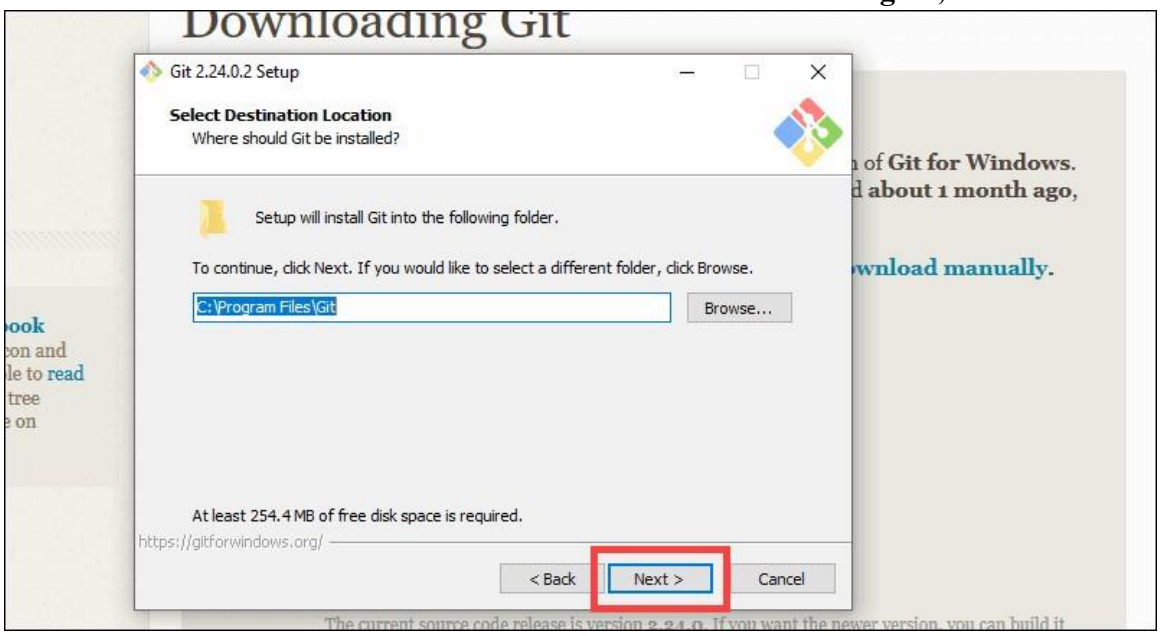


6. The installer will ask you for an installation location. Leave the default, unless you have reason to change it, and click Next.



7. A component selection screen will appear. Leave the defaults unless you have a specific need to change them and click next.

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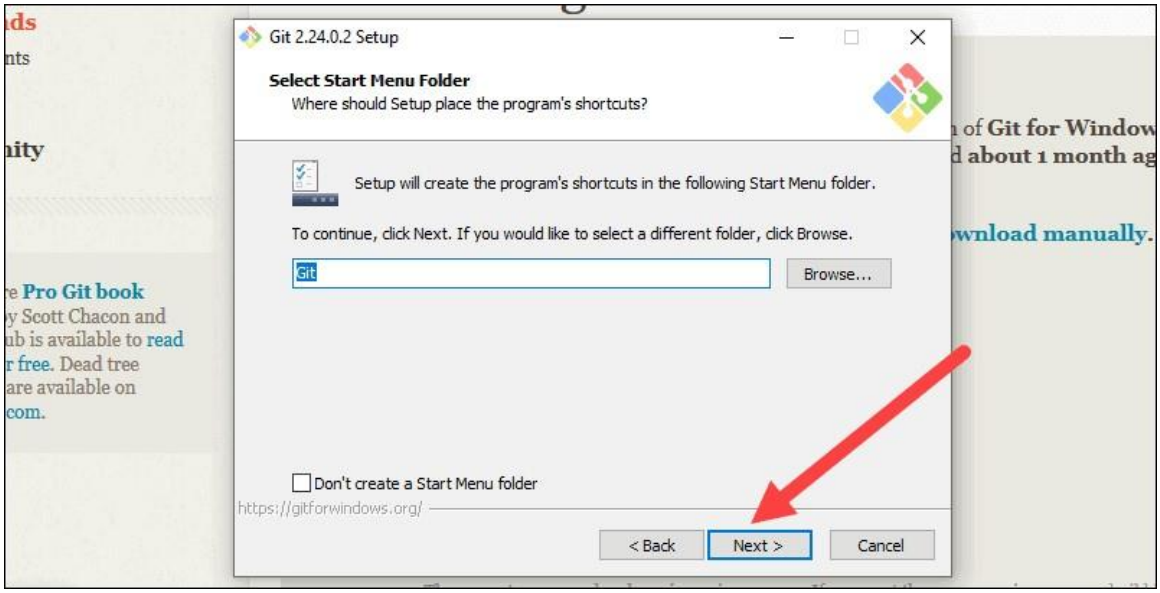
8. The installer will offer to create a start menu folder. Simply click Next.



9. Select a text editor you'd like to use with Git. Use the drop-down menu to select Notepad++ (or whichever text editor you prefer) and click Next.

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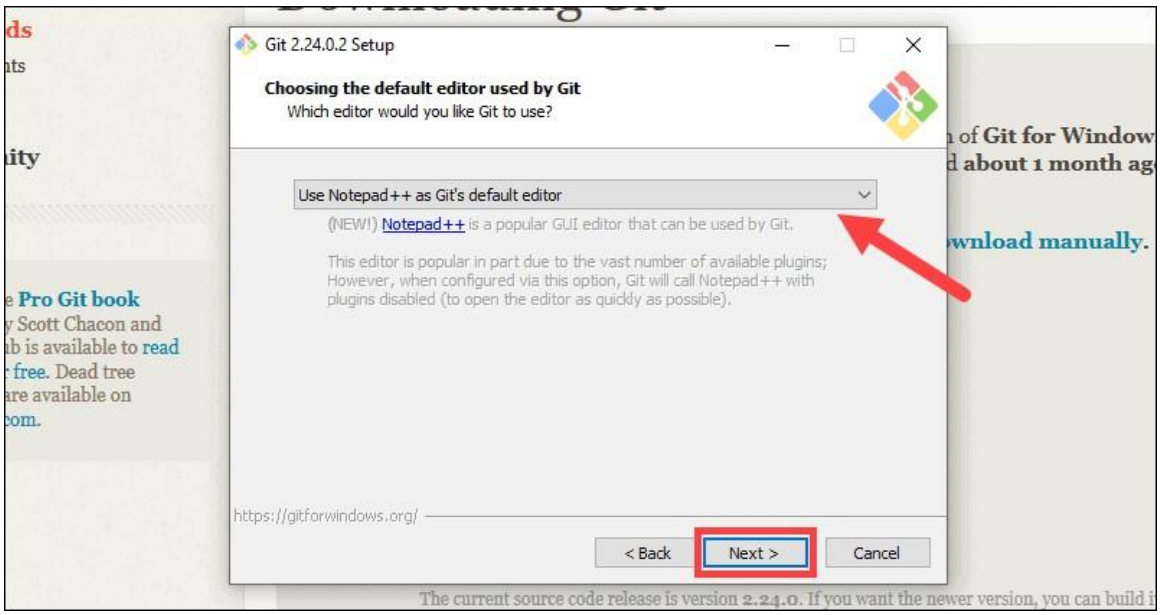
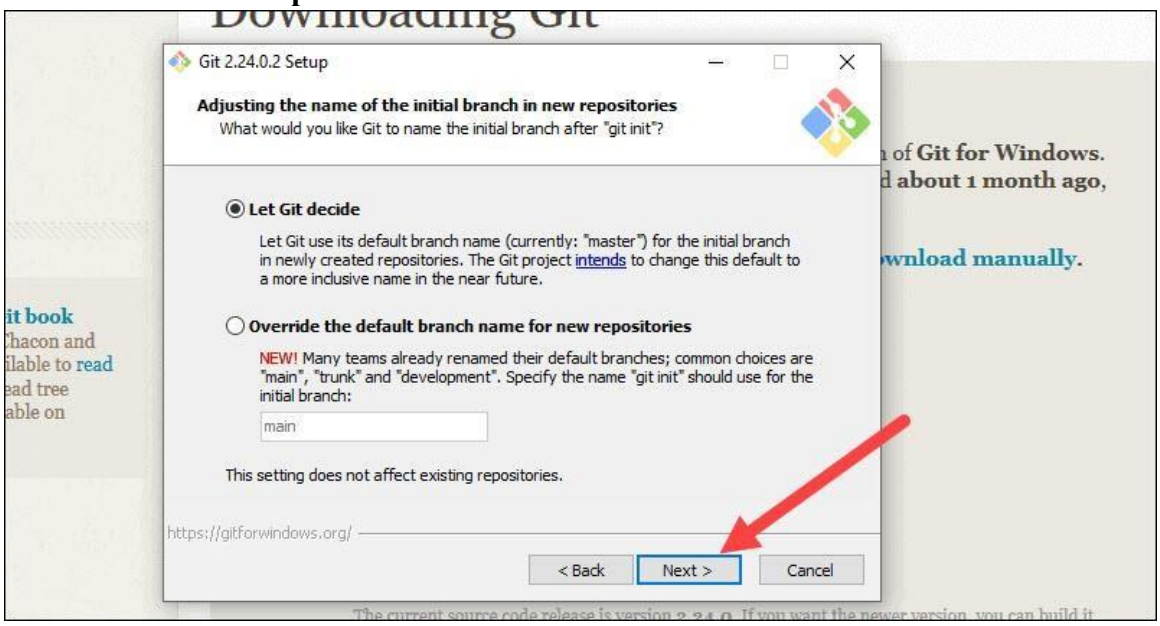


10. The next step allows you to choose a different name for your initial branch. The default is 'master.' Unless you're working in a team that requires a different name, leave the default option and click Next.



11. This installation step allows you to change the PATH environment. The PATH is the default set of directories included when you run a command from the command line. Leave this on the middle (recommended) selection and click Next.

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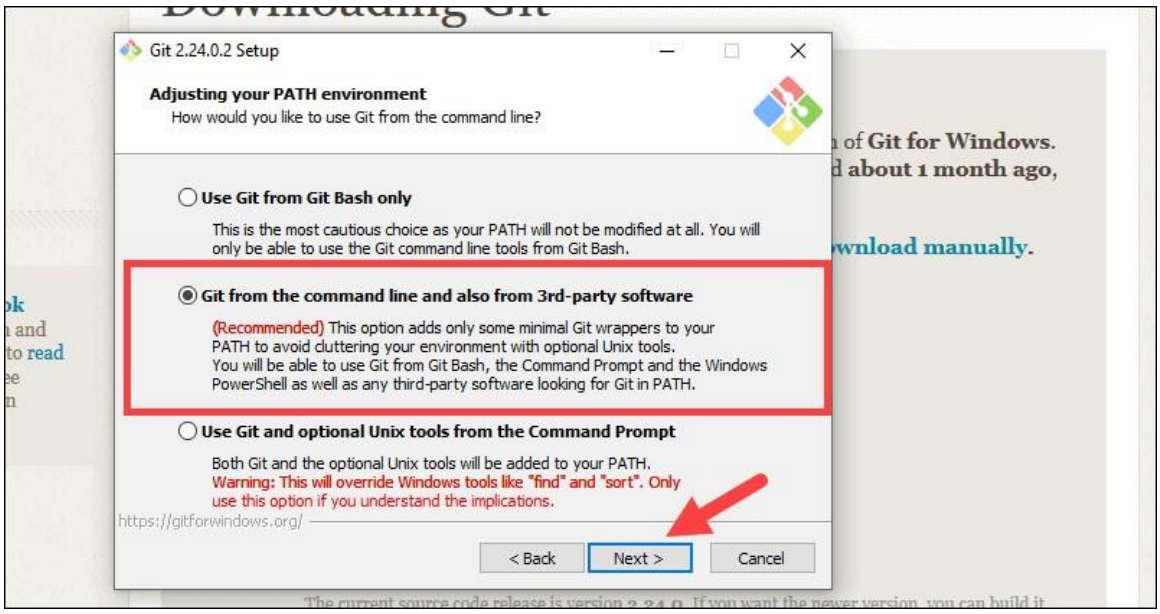

12. The installer now asks which SSH client you want Git to use. Git already comes with its own SSH client, so if you don't need a specific one, leave the default option and click Next.

13. The next option relates to server certificates. Most users should use the default. If you're working in an Active Directory environment, you may need to switch to Windows Store certificates. Click Next.

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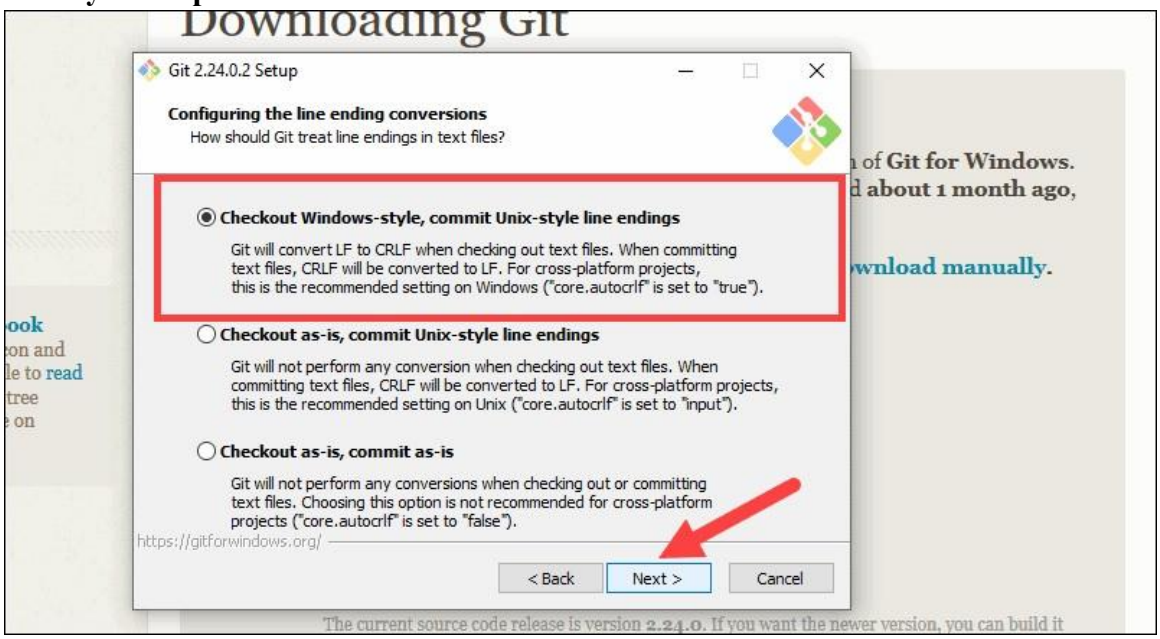
14. The next selection converts line endings. It is recommended that you leave the default selection. This relates to the way data is formatted and changing this option may cause problems. Click Next.



15. Choose the terminal emulator you want to use. The default MinTTY is recommended, for its features. Click Next.

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16. The installer now asks what the git pull command should do. The default option is recommended unless you specifically need to change its behavior. Click Next to continue with the installation.

17. Next you should choose which credential helper to use. Git uses credential helpers to fetch or save credentials. Leave the default option as it is the most stable one, and click Next.

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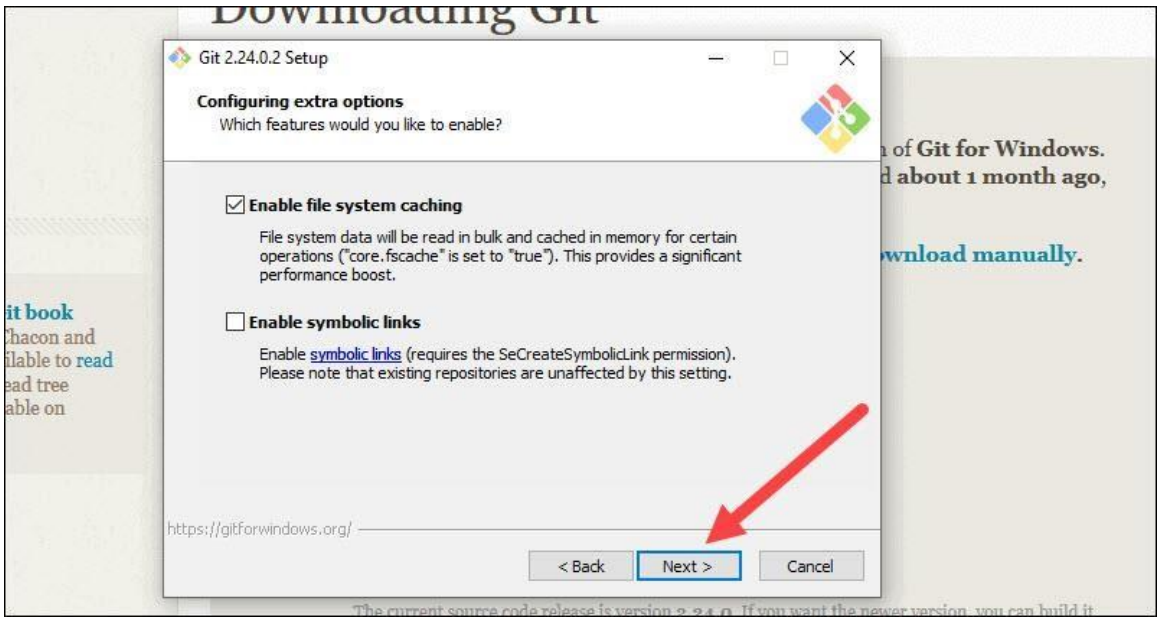
18. The default options are recommended, however this step allows you to decide which extra option you would like to enable. If you use symbolic links, which are like shortcut



19. Depending on the version of Git you're installing, it may offer to install experimental features. At the time this article was written, the options to include support for pseudo controls and a built-in file system monitor were offered. Unless you are feeling adventurous, leave them unchecked and click Install.

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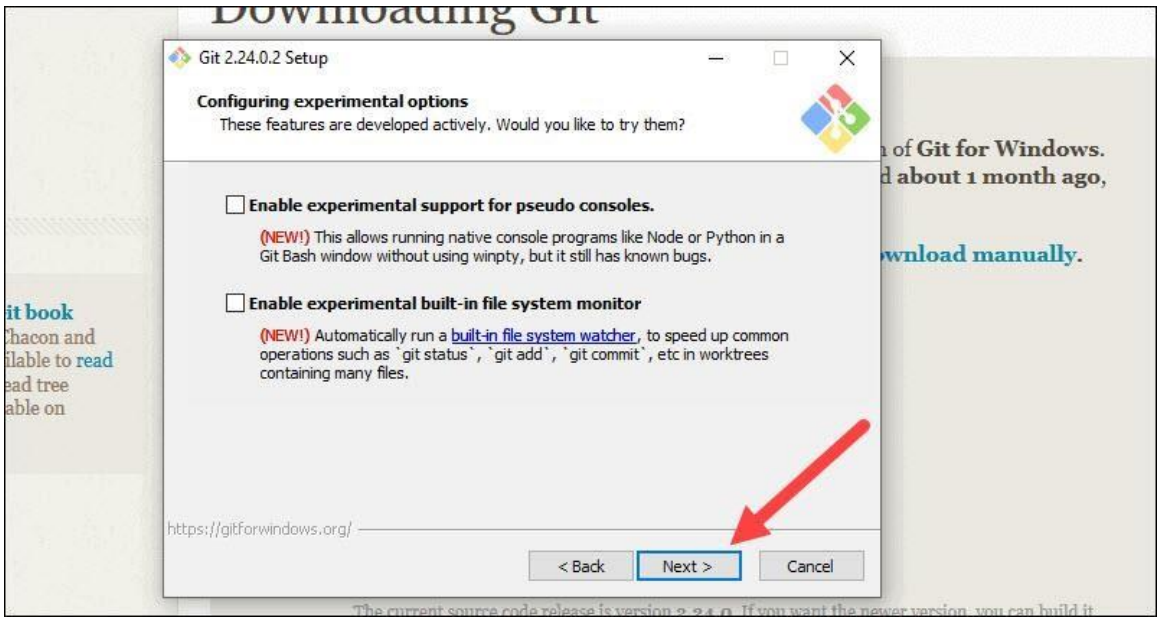

20. Once the installation is complete, tick the boxes to view the Release Notes or Launch Git Bash, then click Finish.

What is Github?

GitHub is a web-based version control and collaboration platform for software developers. Microsoft, the biggest single contributor to GitHub, acquired the platform for $7.5 billion in 2018. GitHub, which is delivered through a software as a service (SaaS) business model, was started in 2008. It was founded on Git, an open source code management system created by Linus Torvalds to make software builds faster.

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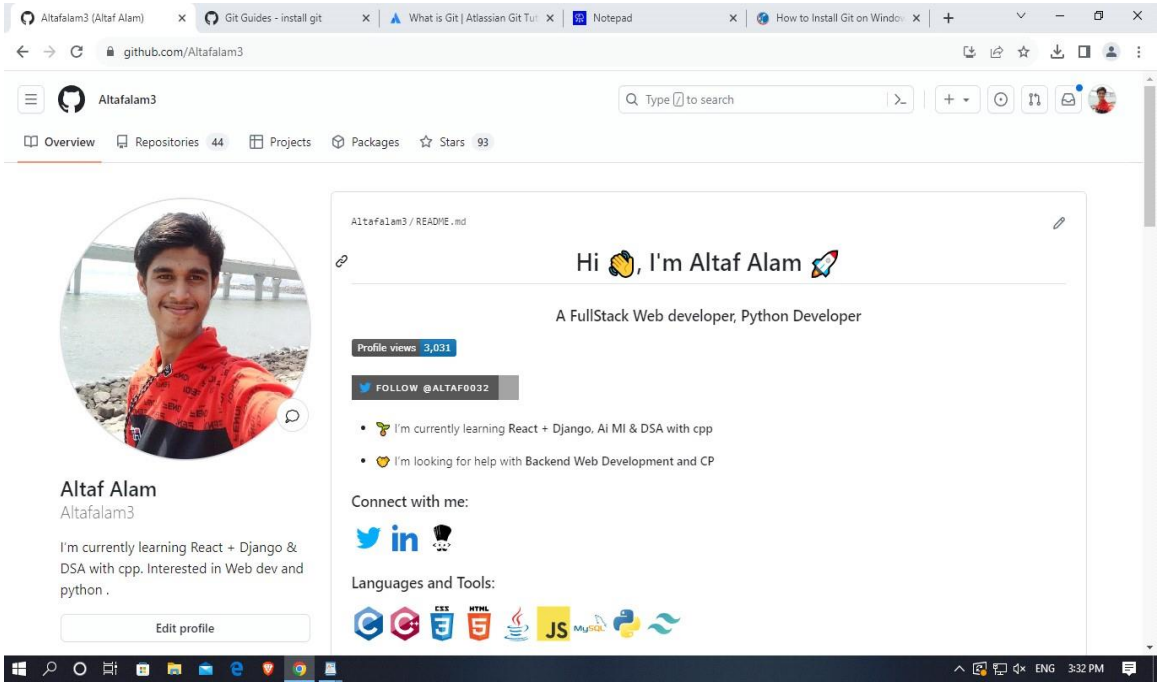

GitHub allows developers to change, adapt and improve software from its public repositories for free, but it charges for private repositories, offering various paid plans. Each public and private repository contains all of a project's files, as well as each file's revision history. Repositories can have multiple collaborators and can be either public or private.

GitHub facilitates social coding by providing a hosting service and web interface for the Git code repository, as well as management tools for collaboration. The developer platform can be thought of as a social networking site for software developers. Members can follow each other, rate each other's work, receive updates for specific open source projects, and communicate publicly or privately.

Conclusion :

Thus we have understood about control version, installation of git and creation of github account.

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Experiment No 3

Aim : To perform various Git operations.

Lab Outcome :

LO1: To understand the fundamentals of DevOps engineering and be fully proficient with DevOps terminologies, concepts, benefits, and deployment options to meet your busines requirements.

LO2 : To obtain complete knowledge of the "version control system" to effectively track changes augmented with Git and Github.

Theory :

Git operations:

1. git init:
   Initializes a new Git repository in the current directory, creating the necessary folders and files to track changes.

2. git clone \<repository>:
   Creates a copy of a remote repository on your local machine, allowing you to work with the code and contribute changes.

3. git add \<file>: Stages a file, preparing it to be committed. Use this command before committing changes.

4. git commit -m "\<message>":
   Commits the staged changes with a descriptive message, creating a snapshot of the code's current state.

5. git status: Shows the status of your repository, including changes that are staged or not yet staged.

6. git diff:
   Displays the differences between the working directory and the last committed version, helping you see the changes you've made.

7. git log:

Shows a chronological list of commits in the repository, providing information about authors, dates, and commit messages.

8. git pull:
Fetches changes from a remote repository and merges them into your current branch, ensuring you have the latest updates.

9. git push: Sends your committed changes to a remote repository, updating it with your new code.

10. git branch:
Lists all branches in the repository and highlights the branch you're currently on. Use "git branch \<name>" to create a new branch.

11. git checkout \<branch>: Switches to a different branch, allowing you to work on a different part of the codebase.

12. git merge \<branch>:
Integrates changes from one branch into another, combining the code and resolving conflicts if needed.

13. git fetch:
Retrieves changes from a remote repository without automatically merging them, allowing you to review before merging.

14. git stash:
Temporarily saves changes that you don't want to commit yet, allowing you to switch branches or pull changes without committing everything.

15. git reset \<file>: Unstages a file that you previously staged using "git add," reversing the staging process.

16. git remote -v: Lists all remote repositories associated with your local repository, showing their URLs.

17. git rm \<file>: Removes a file from the working directory and stages its deletion for the next commit.

18. git config: Configures Git settings such as your name, email, and preferred text editor.

19. git remote add \<name> \<url>:
Adds a new remote repository with a given name and URL. This enables you to fetch and push changes to/from this remote.

20. git remote remove \<name>:
Removes a remote repository from your local repository.

21. git remote show \<name>: Provides information about a specific remote repository, including fetch and push URLs.

22. git remote rename \<old-name> \<new-name>: Renames a remote repository from an old name to a new one.

23. git remote set-url \<name> \<new-url>: Changes the URL of a remote repository.

24. git tag:
Lists existing tags in the repository. Tags are used to mark specific points in the commit history.

25. git tag -a \<tag-name> -m "\<message>": Creates an annotated tag with a message. Tags are often used to mark releases.

26. git tag -d \<tag-name>: Deletes a local tag.

27. git push \<remote> --tags: Pushes tags to a remote repository, making them available to others.

28. git fetch \<remote>:
Retrieves changes from a specific remote repository without automatically merging them. It's often followed by a "git merge" to integrate the changes.

29. git merge \<branch> --no-ff:
Performs a merge with a specified branch, creating a new merge commit even if the changes could be fast-forwarded.

30. git rebase \<branch>:

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Moves your local commits to the tip of a specified branch, resulting in a linear commit history. Use with caution when working with shared branches.

31. git cherry-pick \<commit>: Applies the changes of a specific commit to your current branch.

32. git revert \<commit>: Creates a new commit that undoes the changes introduced by a specified commit.

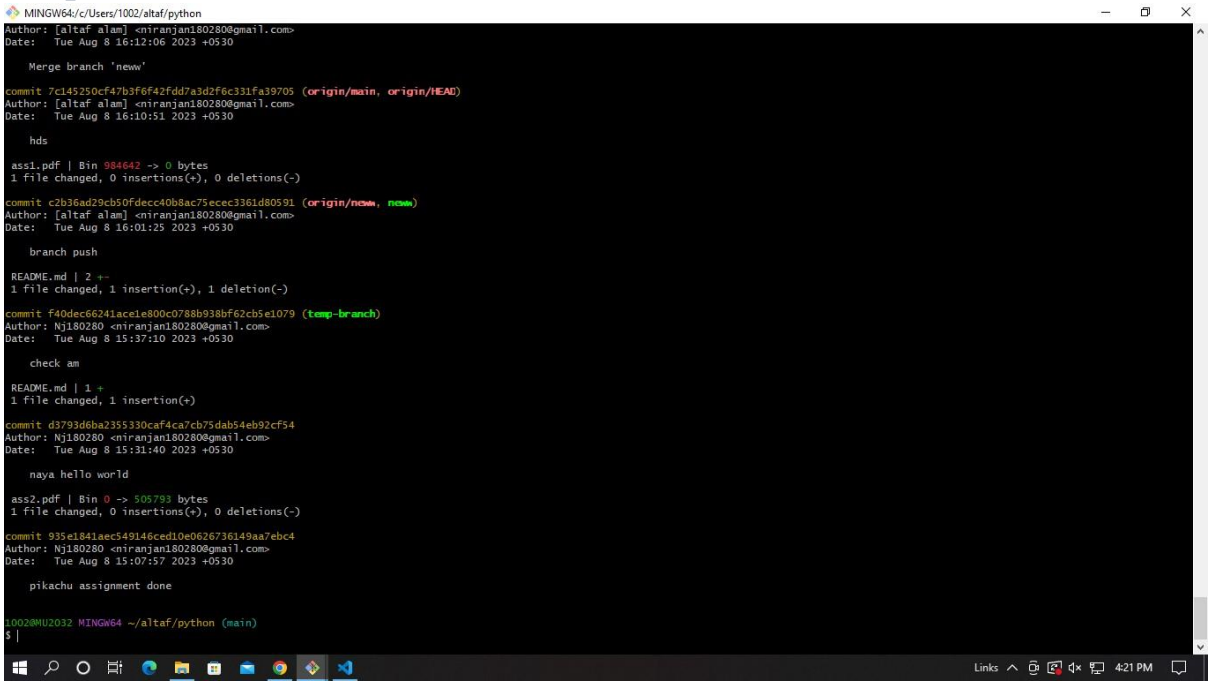
33. git bisect:
Helps you find the commit that introduced a bug by performing a binary search through the commit history.

34. git show \<commit>: Displays detailed information about a specific commit, including the changes introduced.

35. git clean -n:
Shows a preview of untracked files and directories that can be removed using "git clean f."

36. git config --global alias.\<shortcut> \<command>: Creates a custom alias to simplify frequently used Git commands.

Output :



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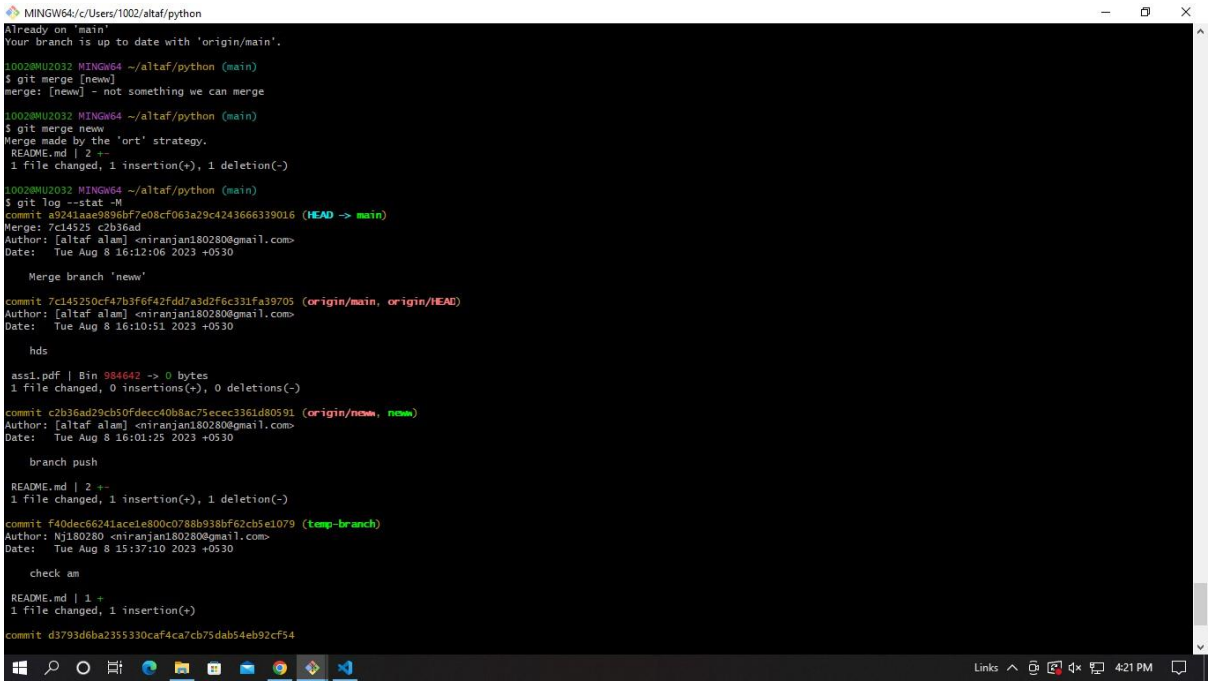

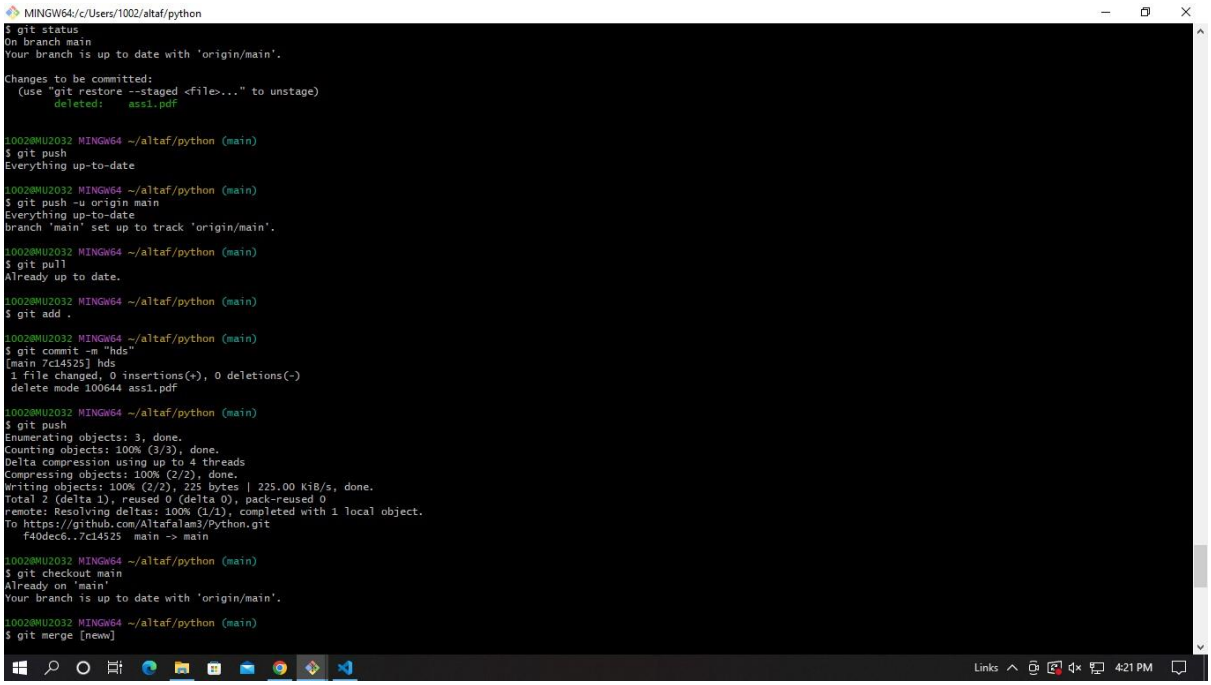

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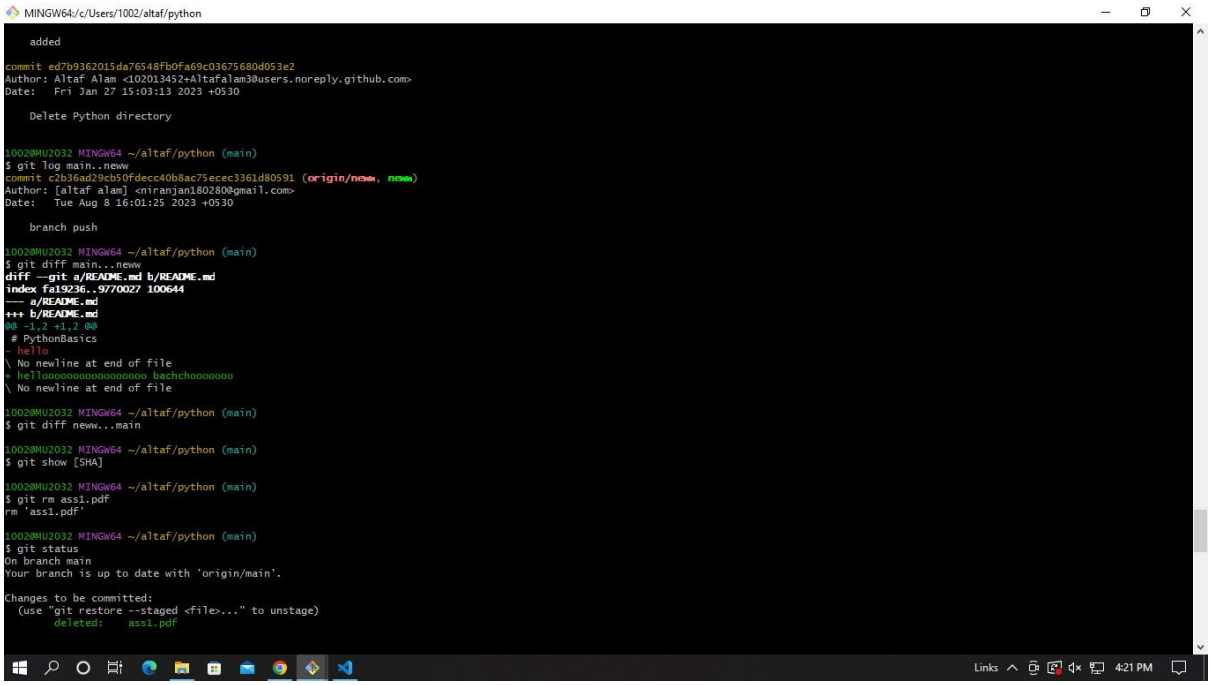

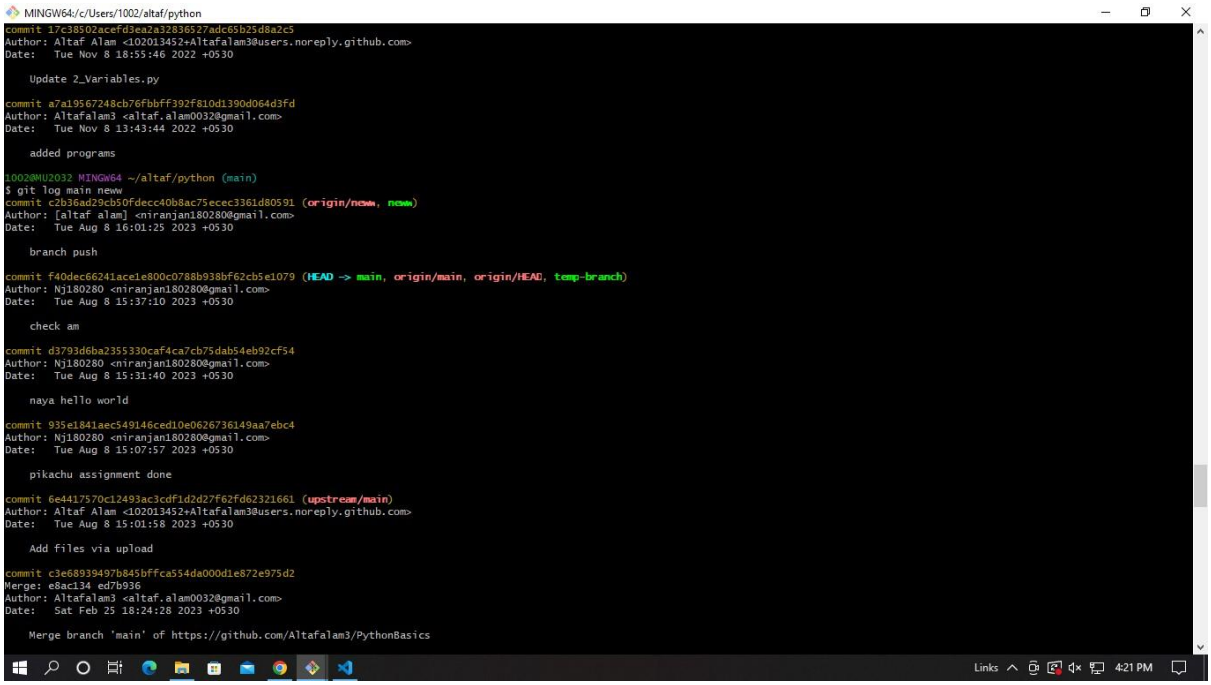

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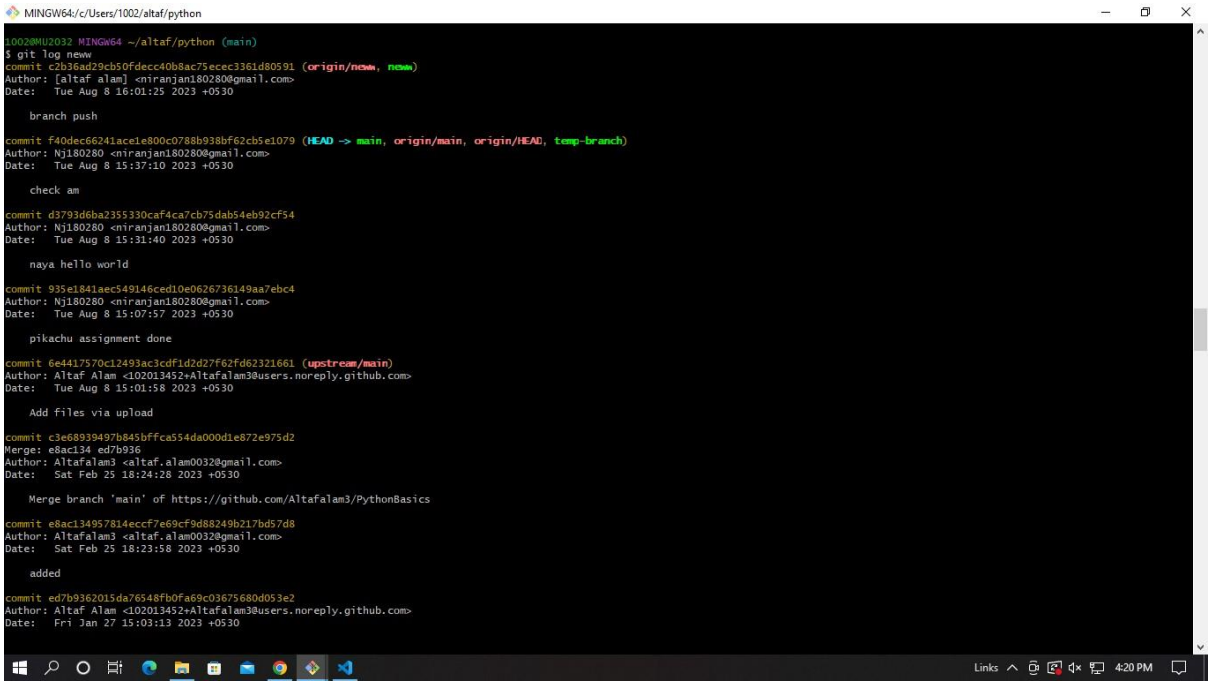

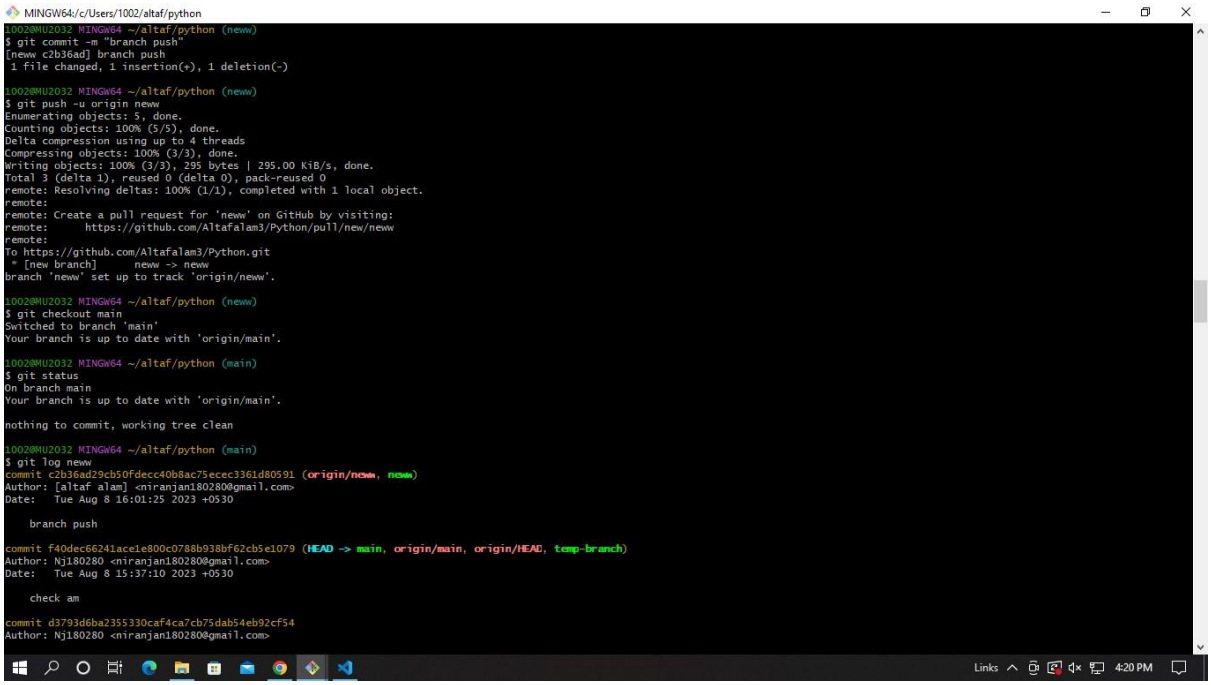

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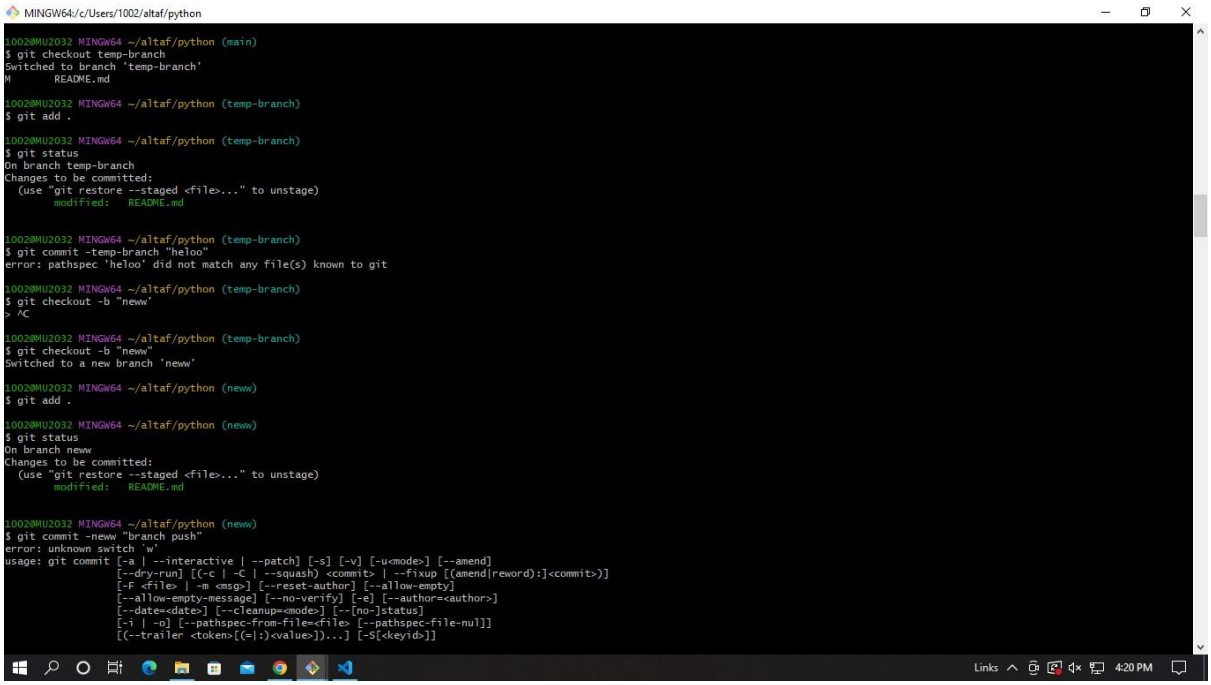

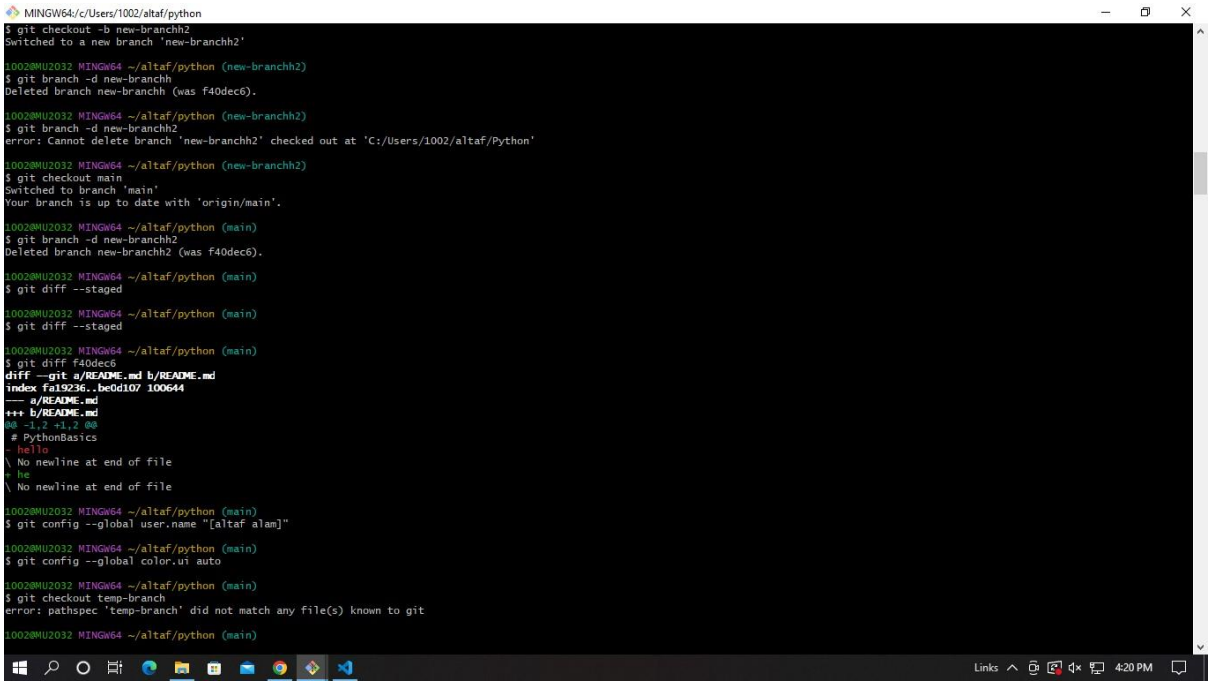

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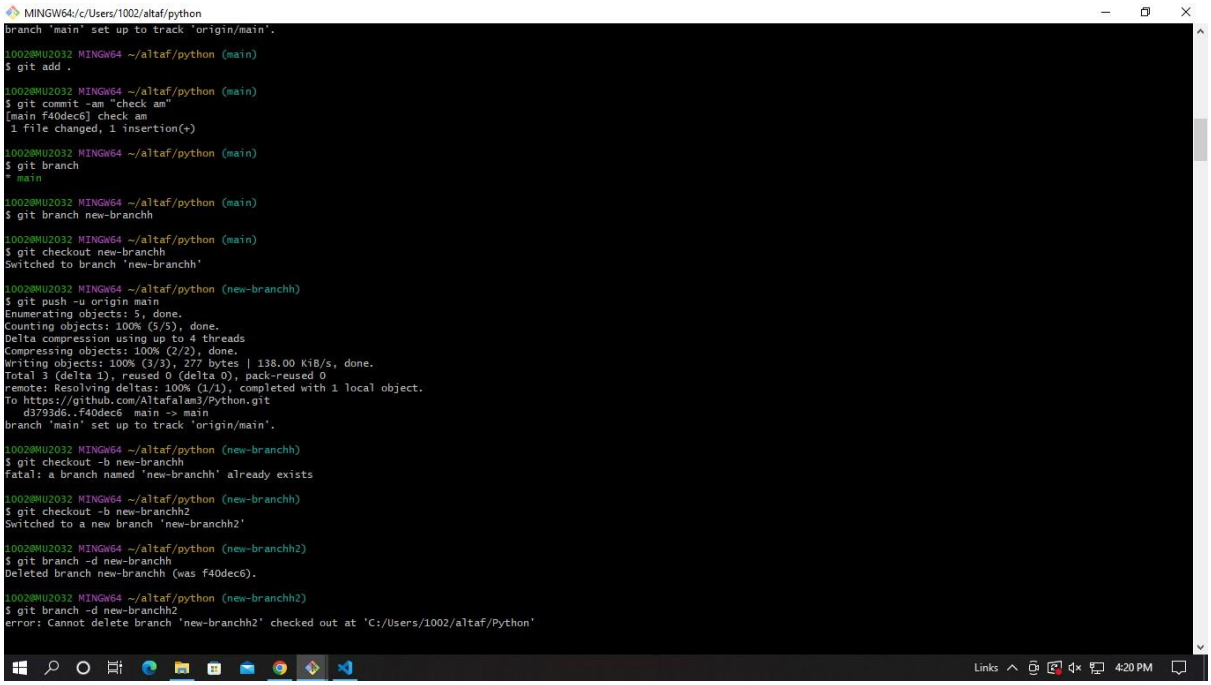

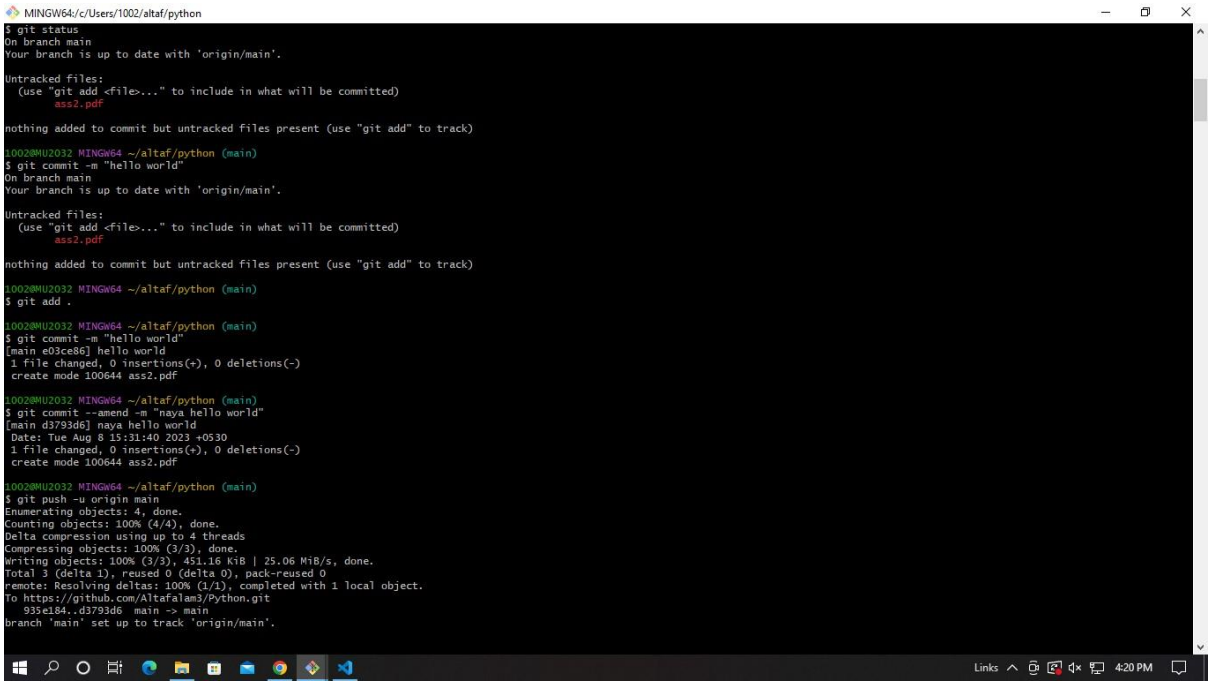

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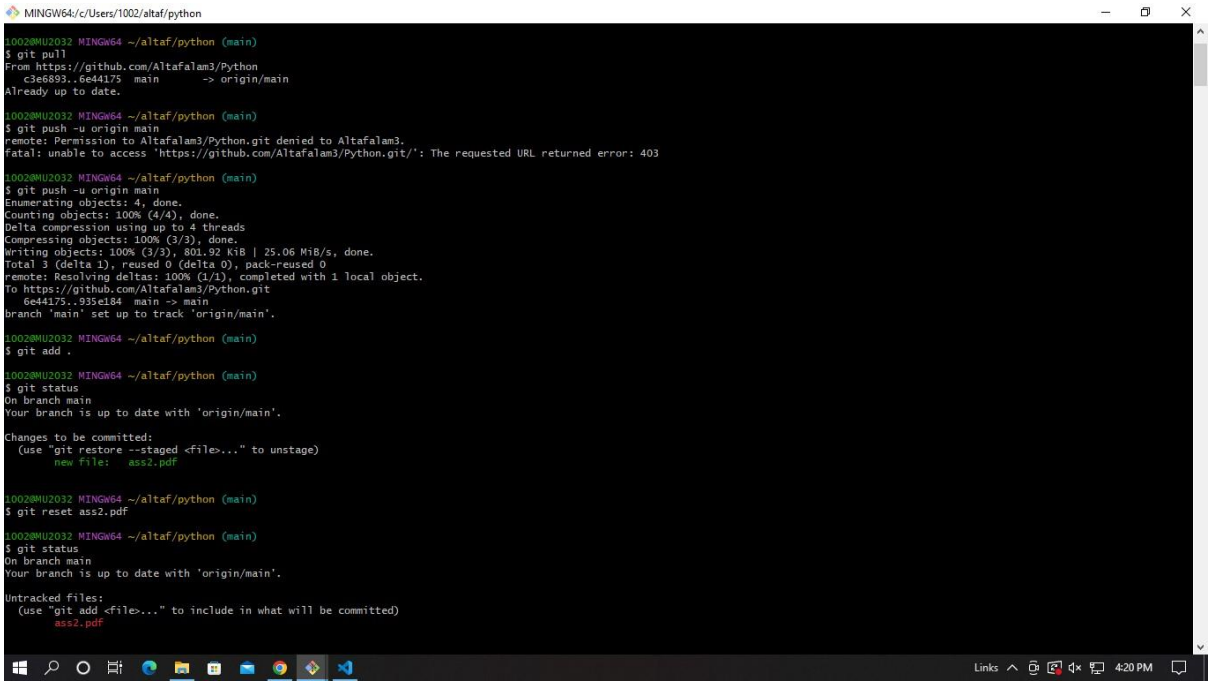

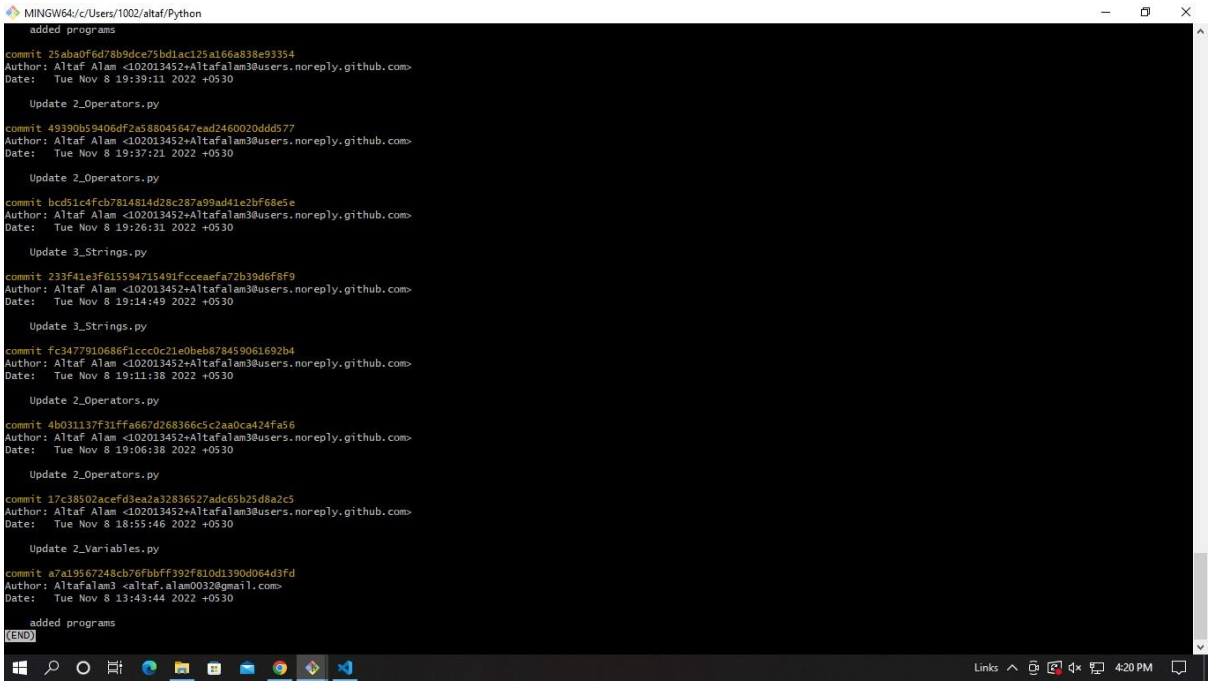

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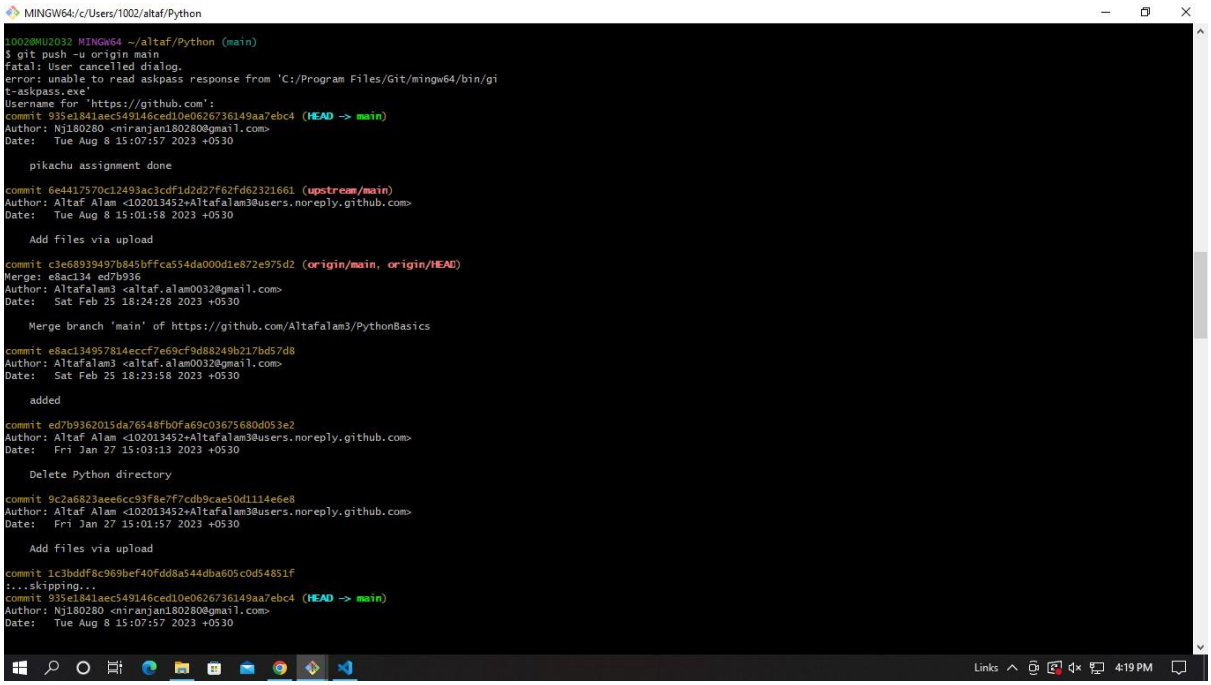

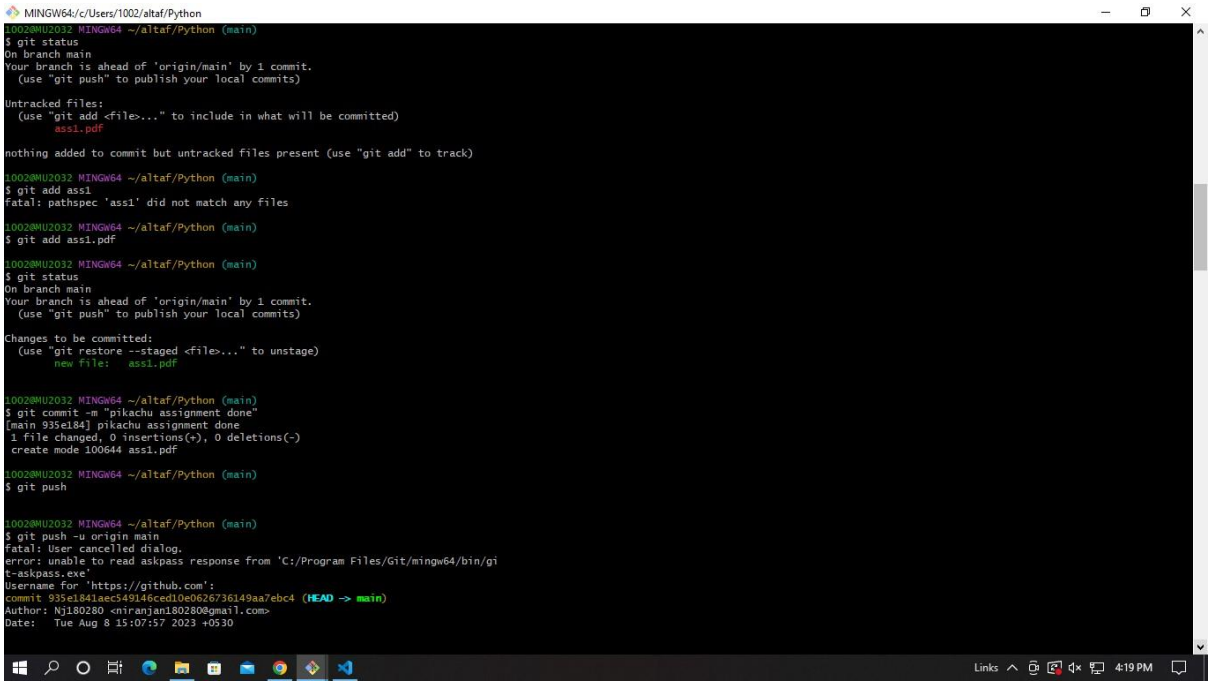

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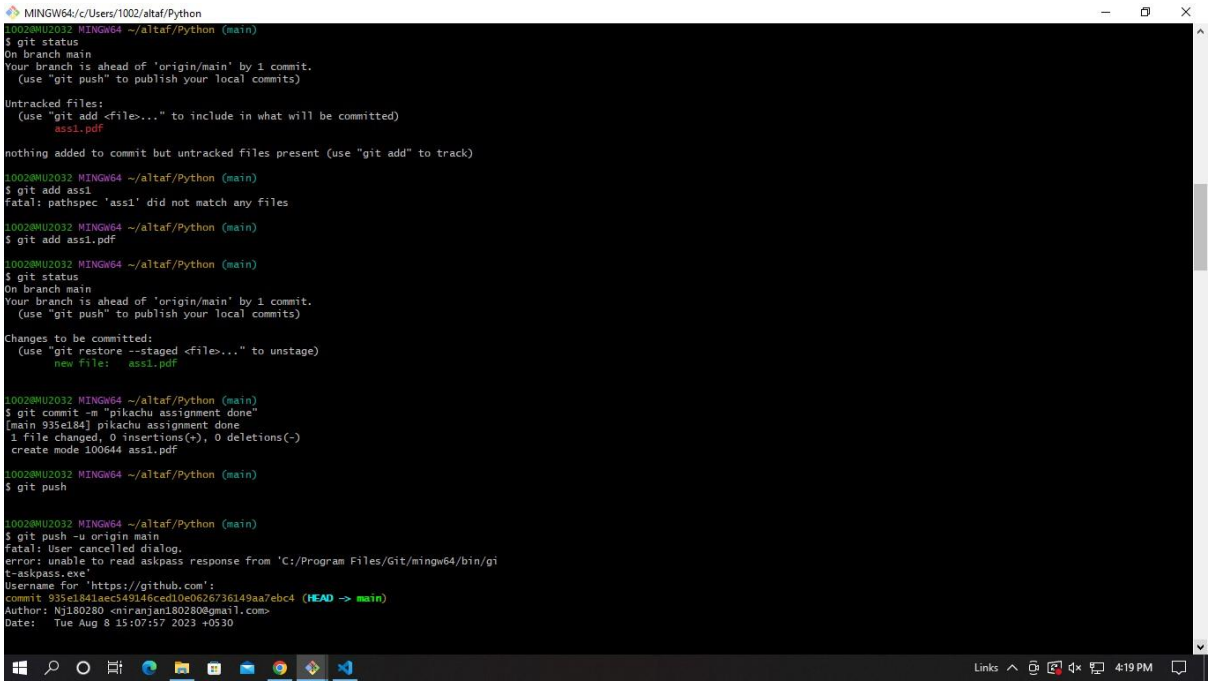

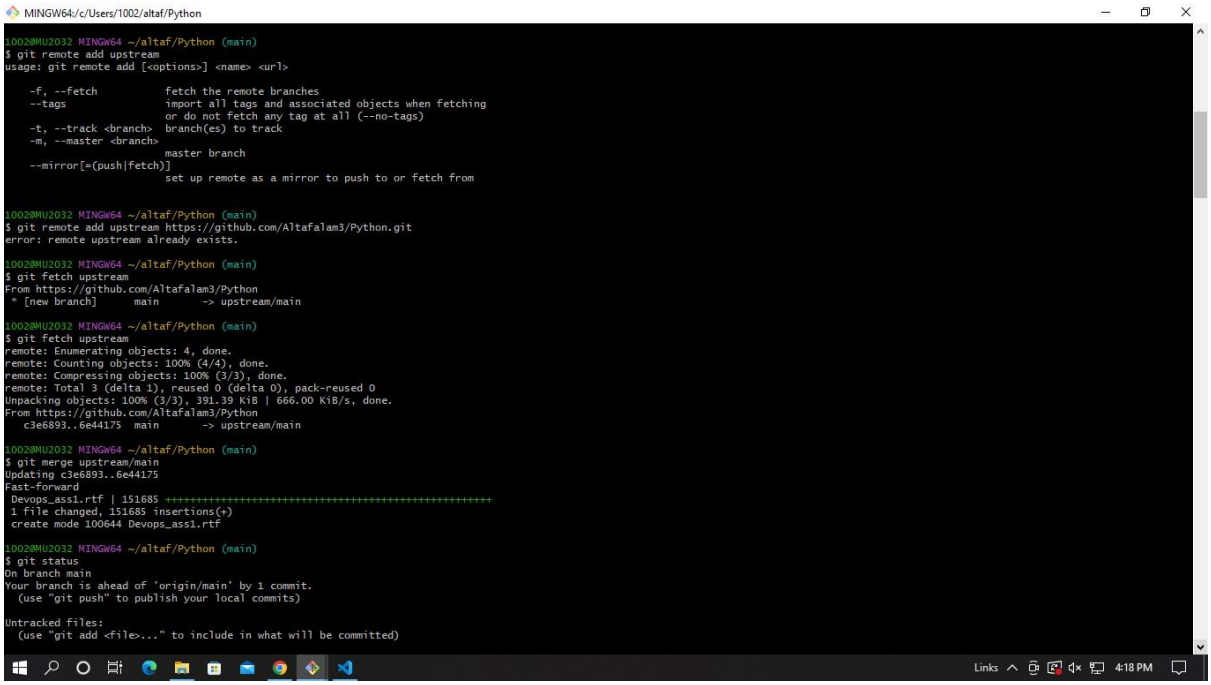

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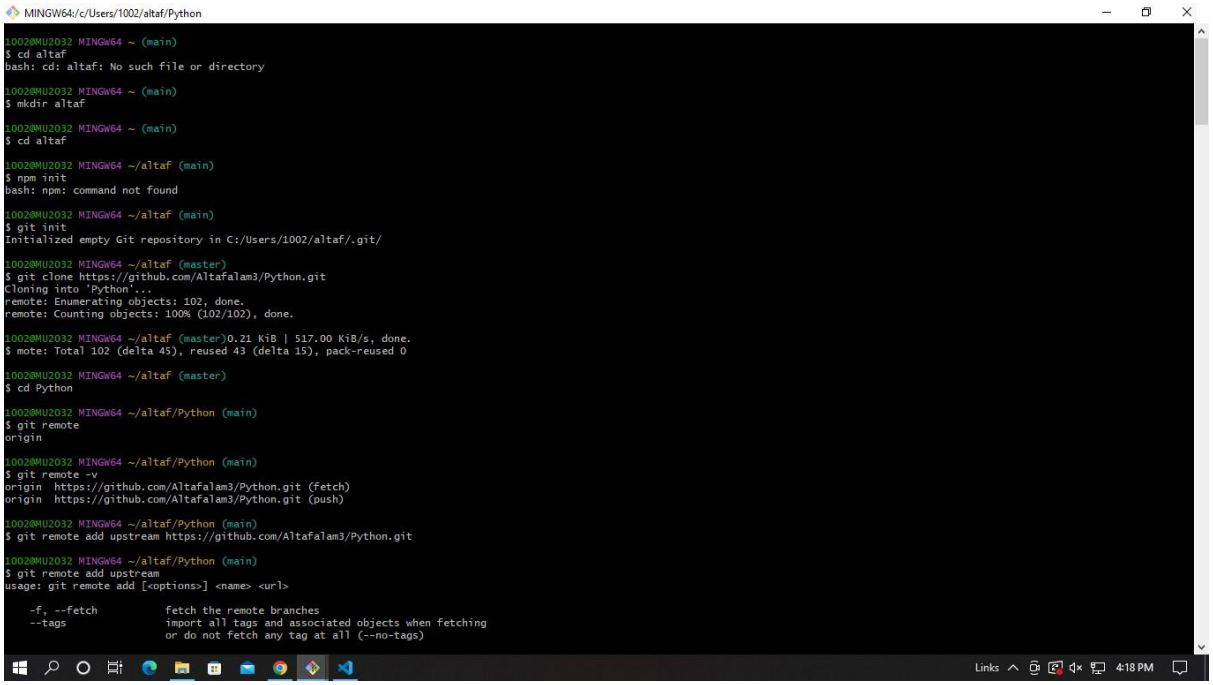

Conclusion :

Mastering these Git commands empowers effective version control and collaborative coding. Learning them facilitates seamless collaboration and efficient management of code repositories.

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Experiment No 4

Aim : To understand Continous Integration, Jenkins installation.

Lab Outcome :

LO1: To understand the fundamentals of DevOps engineering and be fully proficient with DevOps terminologies, concepts, benefits, and deployment options to meet your busines requirements.

LO3 : To understand the importance of Jenkins to build and deploy software applications on server environment.

Theory :

Steps :

Jenkins is an open-source automation server that facilitates continuous integration and delivery. It automates software building, testing, and deployment processes, enabling teams to achieve faster development cycles and better code quality. Jenkins supports various plugins, allowing integration with version control systems, testing frameworks, and deployment tools. Through pipelines, Jenkins orchestrates workflows, ensuring consistent and automated execution of tasks. Developers receive rapid feedback on code changes, and the system helps identify and address issues early in the development lifecycle. Jenkins promotes collaboration, scalability, and efficiency in software development by automating repetitive tasks and fostering seamless integration within the development ecosystem.

STEPS TO INSTALL

Step 1: Check System Requirements

Ensure your system meets the following requirements:
- Operating System: Windows 7 or later
- Java: Java 8 or Java 11 (required for Jenkins)
- Minimum RAM: 1 GB (2 GB recommended)
- Disk Space: 10 GB free space

Step 2: Install Java

1. Download and install Java Development Kit (JDK) 8 or 11 from the official Oracle website or OpenJDK. 2. Set the `JAVA_HOME` environment variable to point to the JDK installation directory.

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Step 3: Download Jenkins

1. Visit the Jenkins official website: https://www.jenkins.io/download/ 2. Download the Windows installer package (`.msi` file).

Step 4: Install Jenkins

1. Double-click the downloaded `.msi` file to start the installer.
2. Choose the installation directory (default is usually fine).
3. Select "Install as a Windows Service" and choose a service name (e.g., "Jenkins").
4. Choose whether Jenkins should run as a Local System account or as a specific user. Using a specific user is recommended for security reasons.
5. Specify the location for Jenkins to store its data (e.g., `C:\Jenkins`).
6. Review your choices and click "Install."

Step 5: Complete Setup

1. Once the installation is complete, a window will open in your default web browser to the Jenkins setup wizard.
2. Retrieve the initial admin password. The password can be found in a file named `initialAdminPassword`, located in the Jenkins installation directory (e.g., `C:\Program Files\Jenkins\secrets\initialAdminPassword`).
3. Copy and paste the password from the file into the setup wizard and click "Continue."

Step 6: Customize Plugins (Optional)

1. Choose either the "Install suggested plugins" option or the "Select plugins to install" option.
2. If you choose the second option, select the plugins you want to install. For starters, you can select the suggested plugins.

Step 7: Create Admin User

1. Enter the required details to create an admin user (username, password, full name, and email).
2. Click "Save and Finish."

Step 8: Instance Configuration (Optional)

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1. If needed, you can change the Jenkins instance's URL. Otherwise, you can leave it as the default value.
2. Click "Save and Finish."

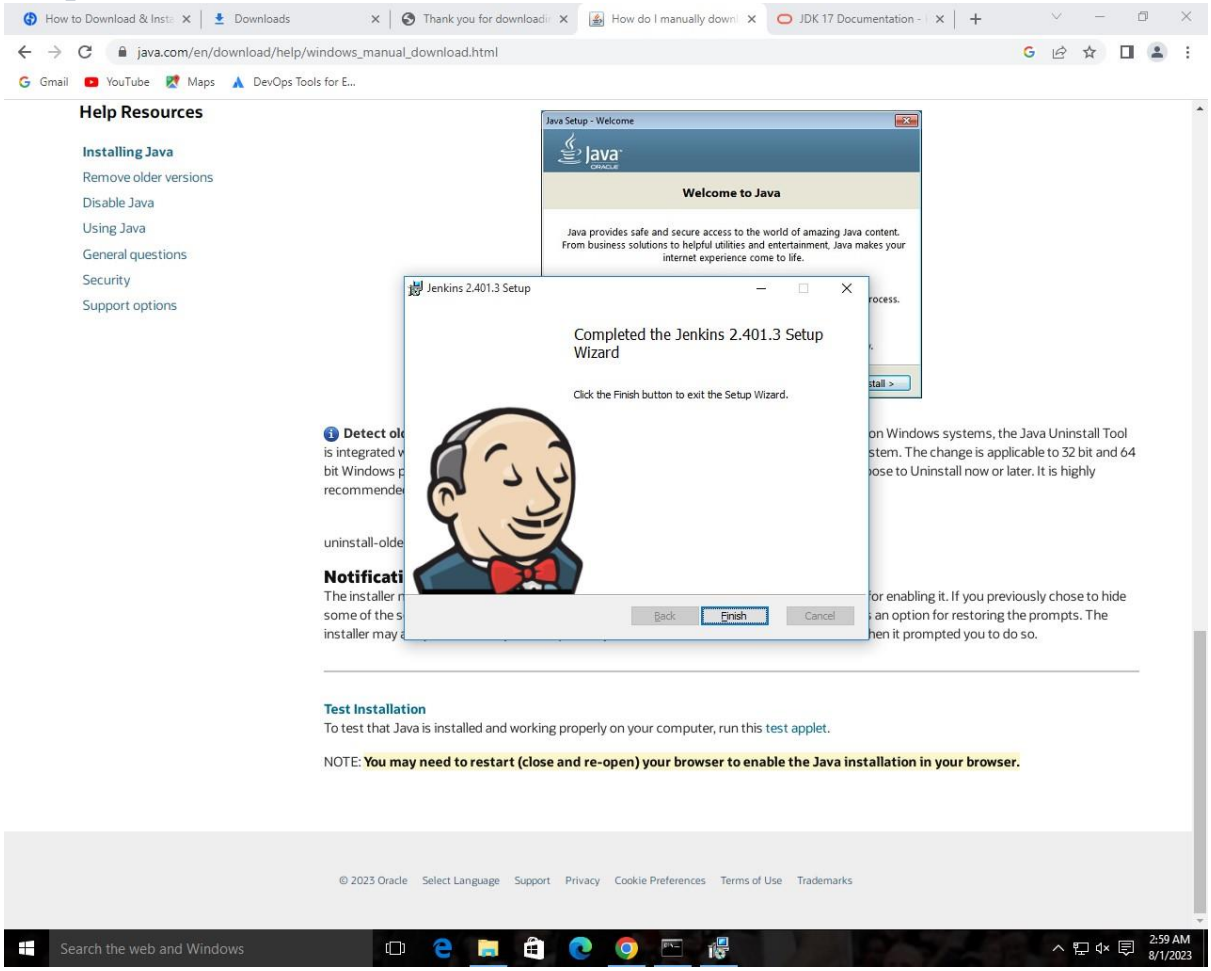
Step 9: Start Jenkins

1. Click "Start using Jenkins."
2. Jenkins will redirect you to the dashboard.

Step 10: Access Jenkins Dashboard

1. Open your web browser and navigate to `http://localhost:8080` (or the custom URL you configured). 2. Log in using the admin credentials you created earlier.

Output :



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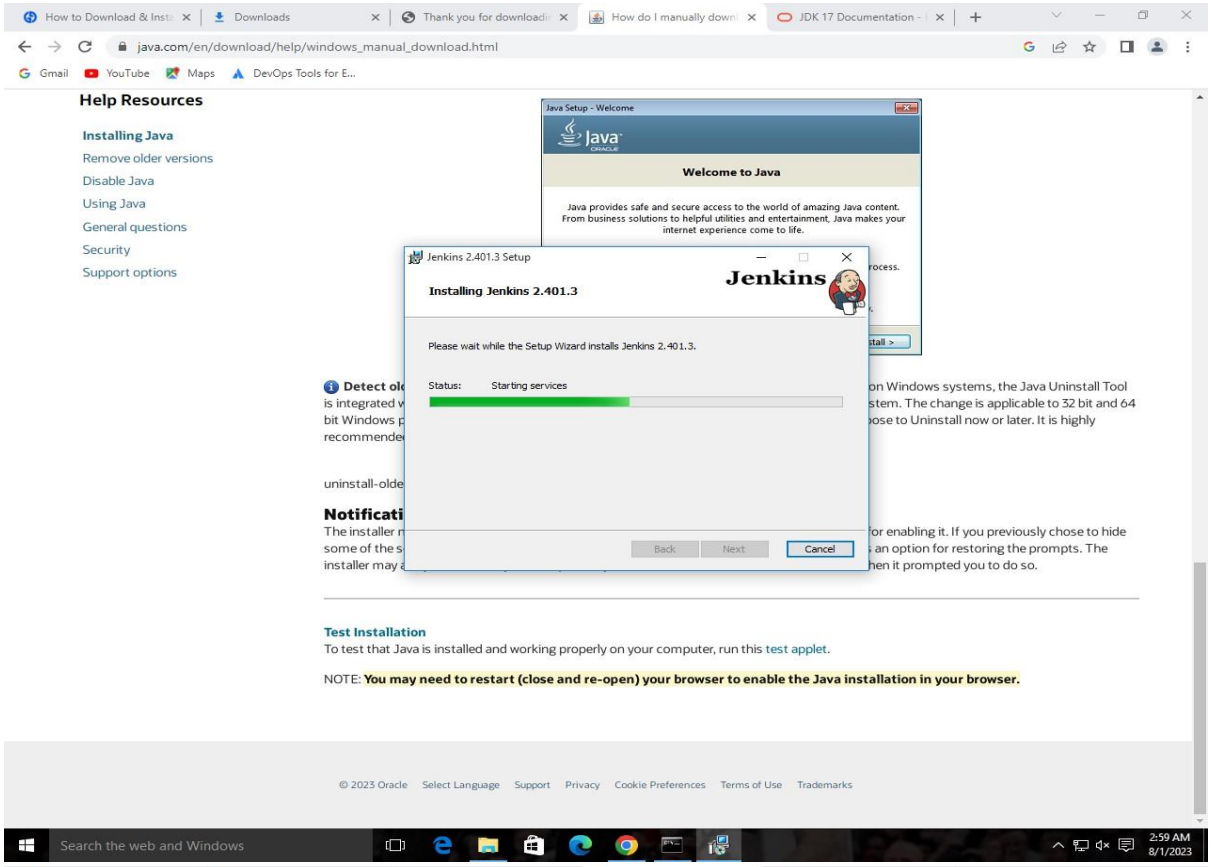

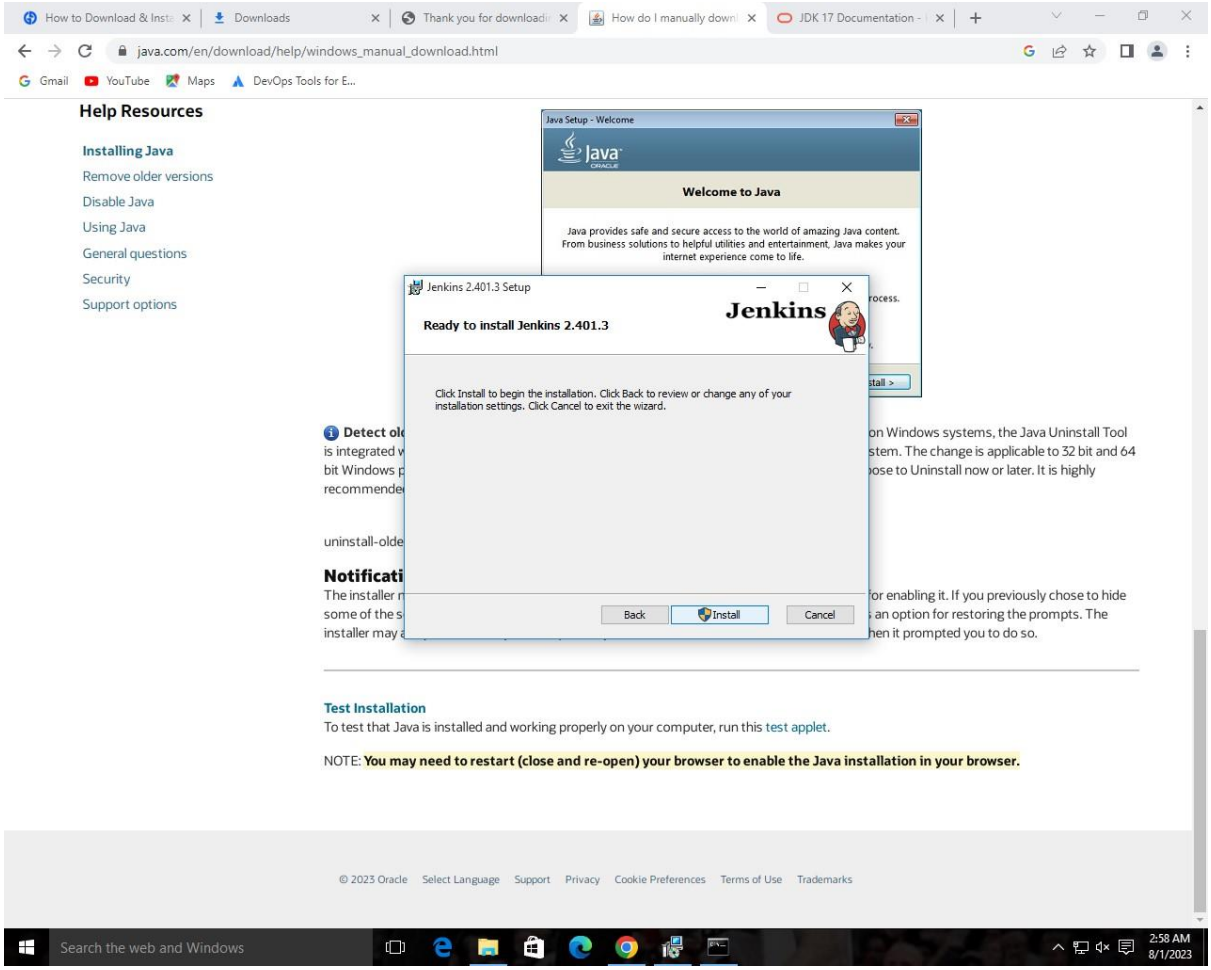

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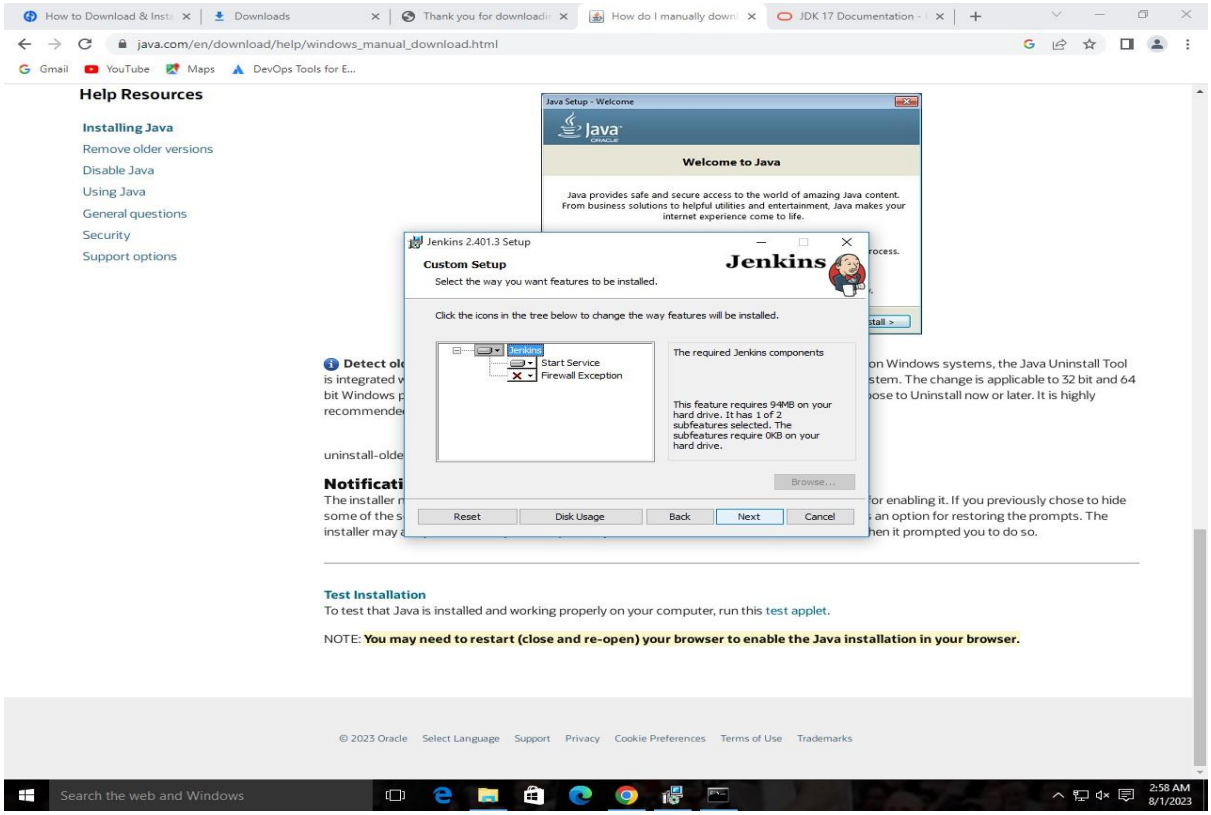

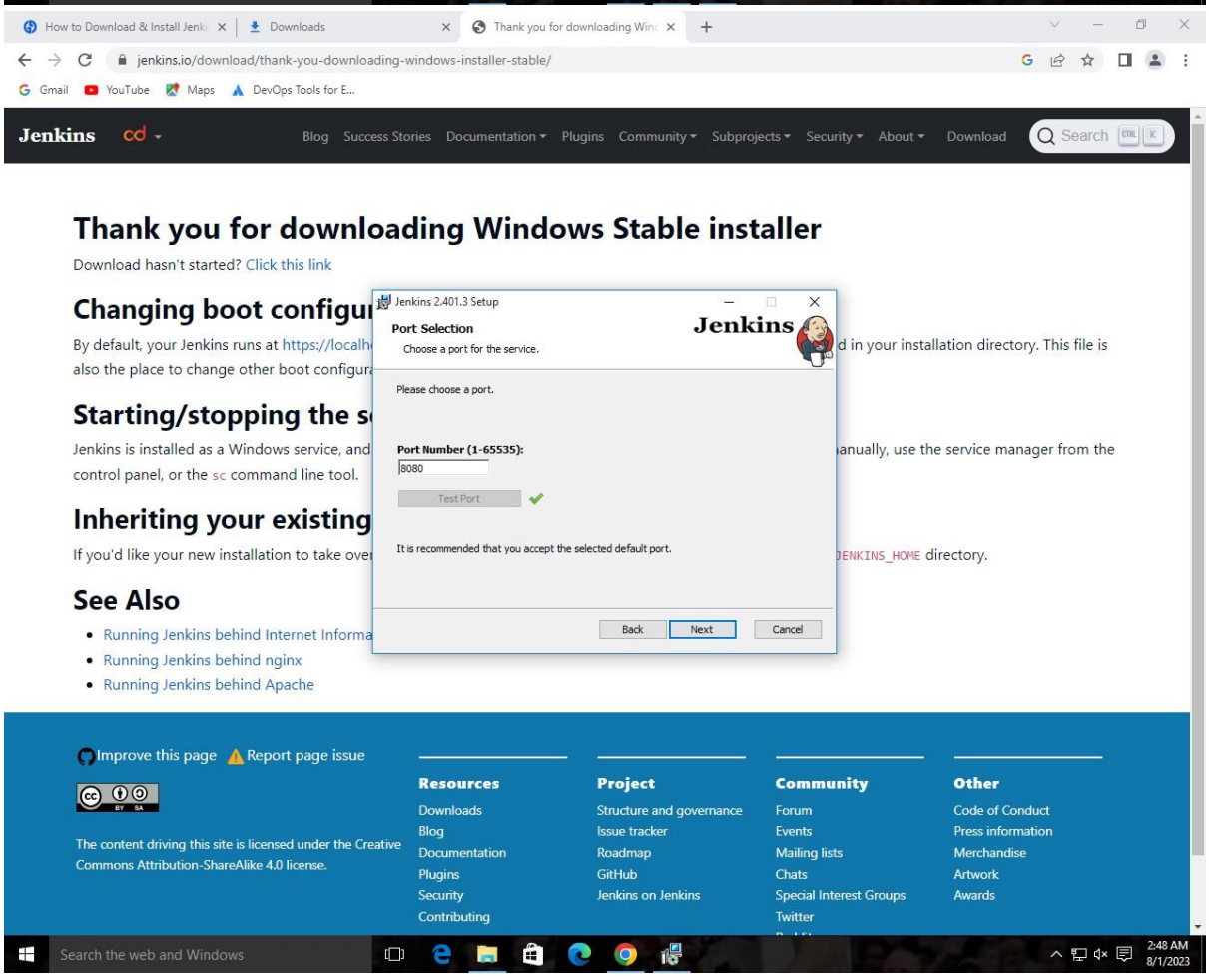

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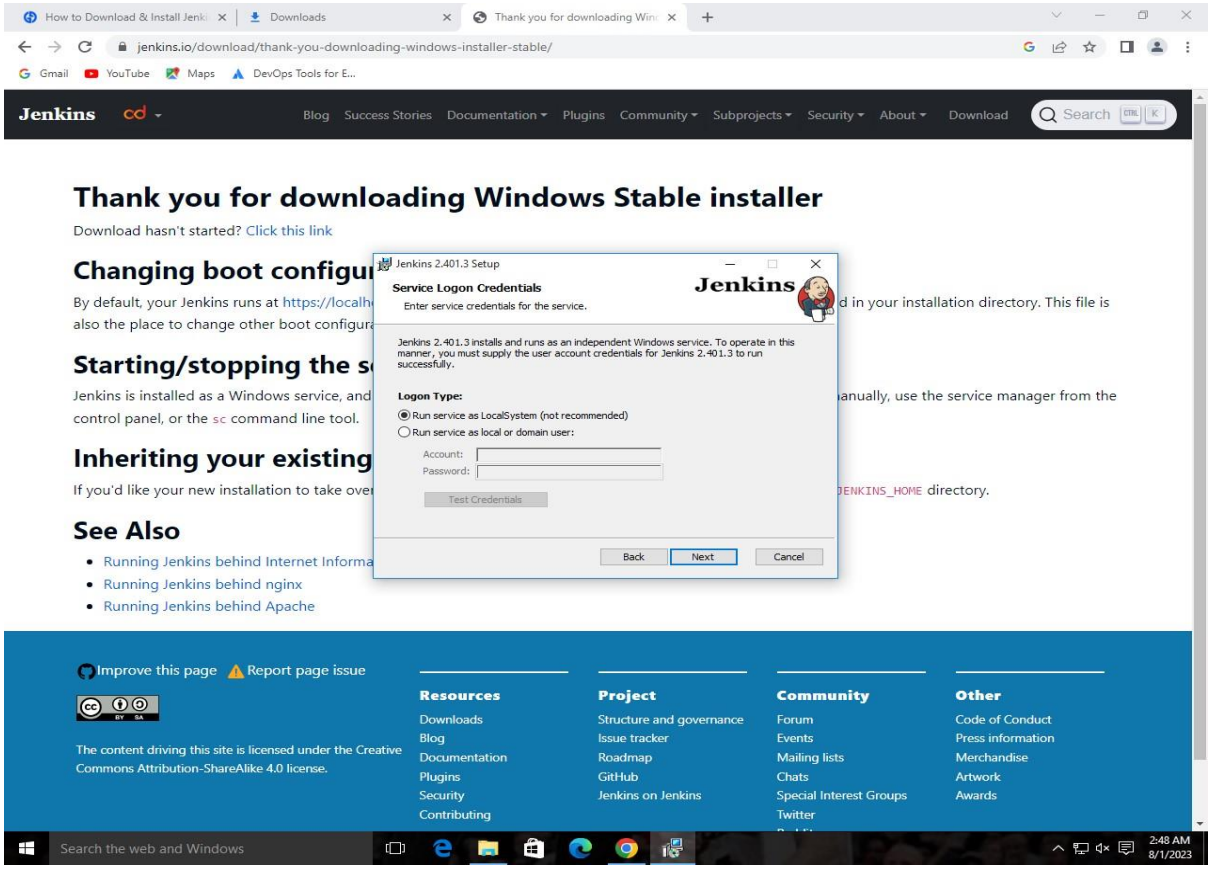

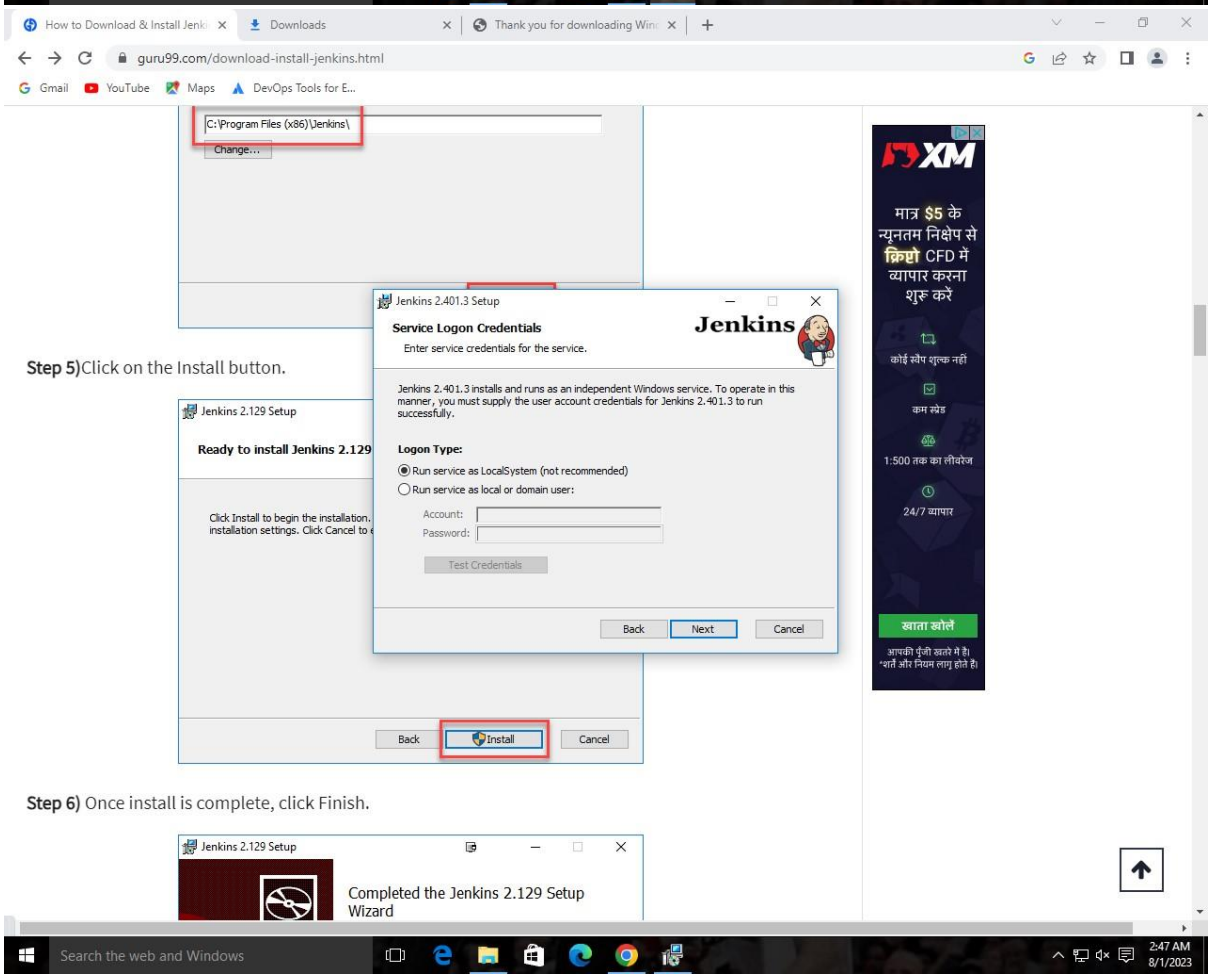

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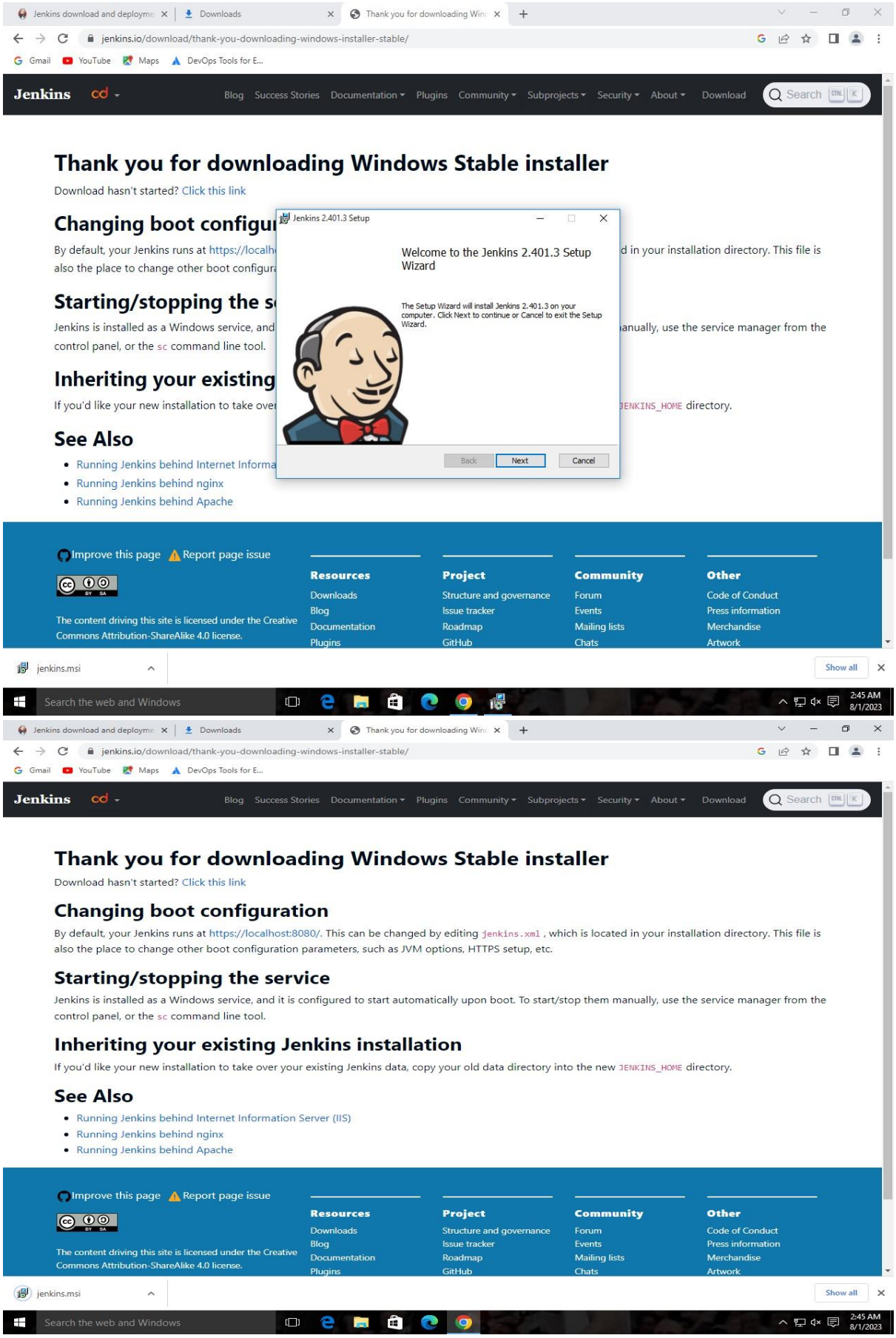

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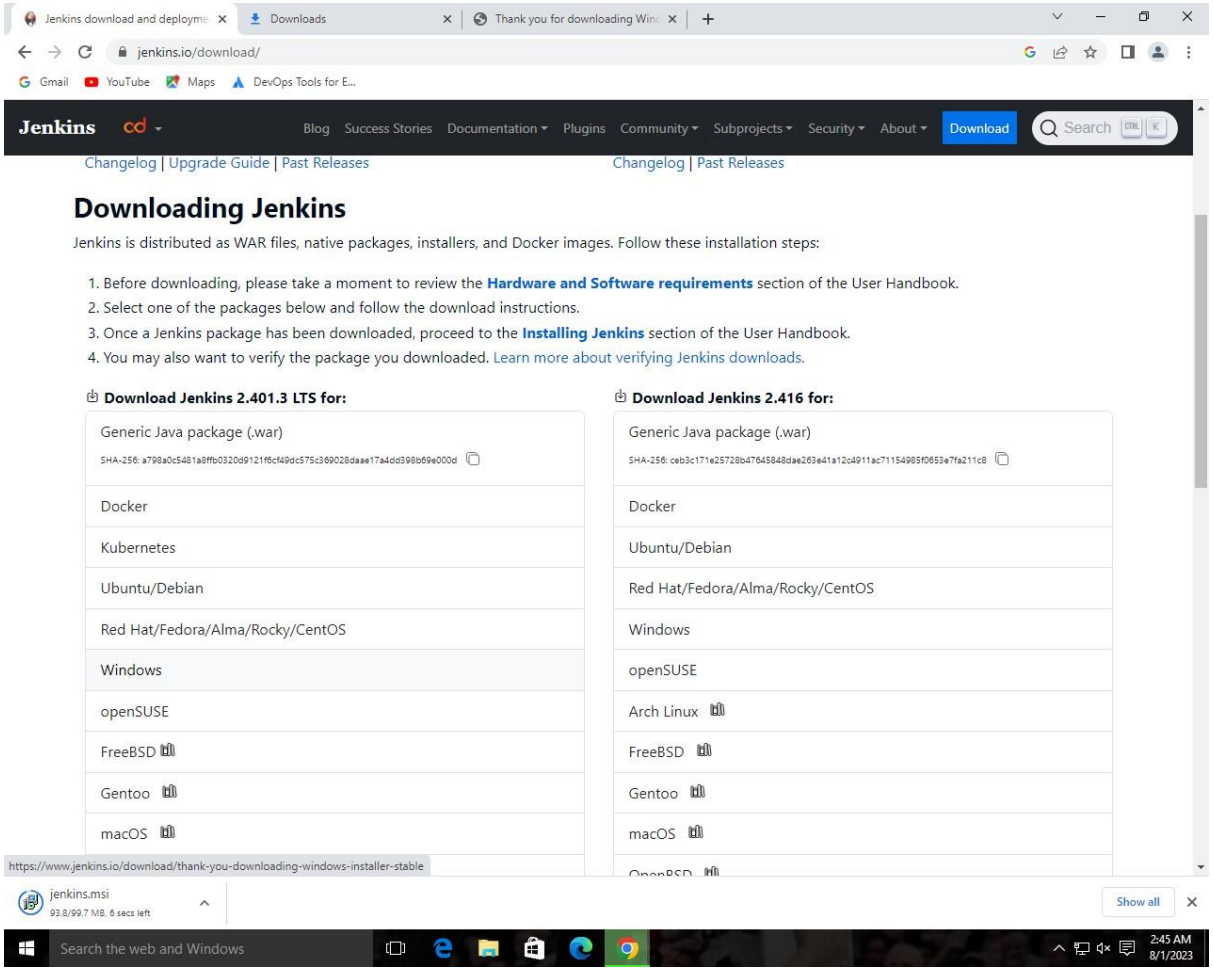

Conclusion :

Hence, we understood about the Jenkins and the step by step process to install the Jenkins in the window software and all the requirements needed for it .

Experiment No 5

Aim : To build java programs using Jenkins.

Lab Outcome :

LO1: To understand the fundamentals of DevOps engineering and be fully proficient with DevOps terminologies, concepts, benefits, and deployment options to meet your busines requirements.

LO3 : To understand the importance of Jenkins to build and deploy software applications on server environment.

Theory :

Steps :

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Building Java programs using Jenkins involves setting up a continuous integration and continuous deployment (CI/CD) pipeline that automates the process of building, testing, and deploying Java applications. Jenkins is a popular open-source automation server that can help achieve this. Here's a step-by-step process to build Java programs using Jenkins:

Step 1: Install Jenkins

1. Install Jenkins on a server or local machine.
2. Access Jenkins through a web browser using the provided URL. 3. Follow the initial setup steps to unlock Jenkins and install recommended plugins.

Step 2: Configure Jenkins

1. Navigate to "Manage Jenkins" > "Global Tool Configuration."
2. Install and configure JDK:
   - Click on "JDK installations..." - Add a new JDK installation and provide the required details.

Step 3: Create a New Jenkins Job

1. From the Jenkins dashboard, click on "New Item."
2. Enter a name for your project and select "Freestyle project." 3. Click "OK" to create the project.

Step 4: Configure Source Code Repository

1. Under "Source Code Management," choose your version control system (e.g., Git).
2. Provide the repository URL and credentials, if required.

Step 5: Configure Build

1. Under the "Build" section, add a build step:
- Choose "Invoke top-level Maven targets" or "Execute shell" (for Ant or custom build scripts).
- Configure the build command (e.g., `mvn clean install` for Maven projects). - Specify the JDK version you configured earlier.

Step 6: Configure Post-Build Actions

1. Under the "Post-build Actions" section:
   - Choose actions like archiving artifacts, triggering other builds, or sending notifications.
- For example, archive the built JAR files.

Step 7: Save and Build

1. Save your Jenkins job configuration.
2. Trigger a manual build to test the setup. 3. Observe the build process, console output, and any issues.

Step 8: Set Up Webhooks or Polling

1. Configure webhooks or polling in your version control system to trigger builds on code changes.

Step 9: Advanced Steps (Optional)

1. Integrate with a testing framework (JUnit, TestNG) to run automated tests.
2. Set up deployment to different environments using plugins or scripts. 3. Use Jenkins pipeline DSL to define complex build and deployment workflows.

Step 10: Monitor and Improve

1. Monitor build status, logs, and performance.
2. Review test results and identify areas for improvement. 3. Adjust your Jenkins setup and build configuration as needed.

By following these steps, you can create a robust CI/CD pipeline for building Java applications using Jenkins. This process automates the build and deployment steps, ensuring that your Java programs are consistently built and tested whenever changes are made to your codebase.

Output :

1) **Building Java Programs**

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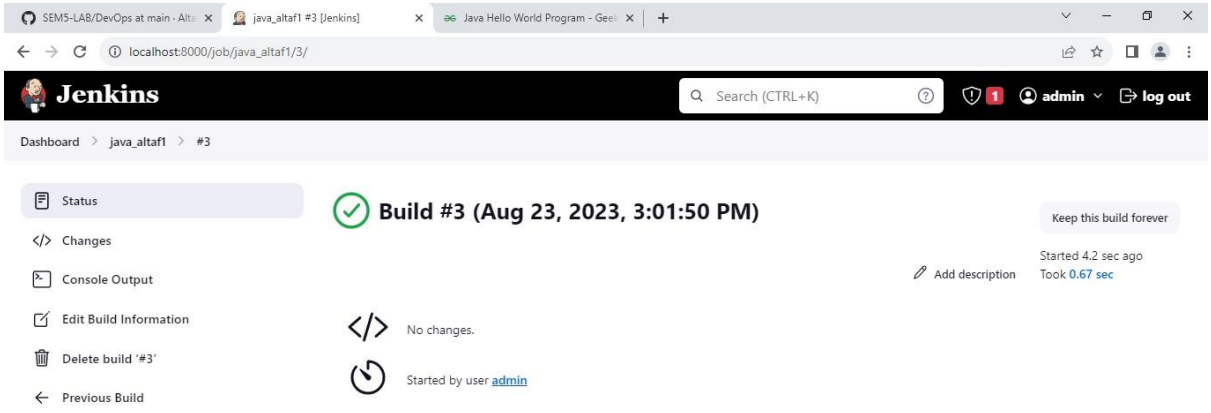

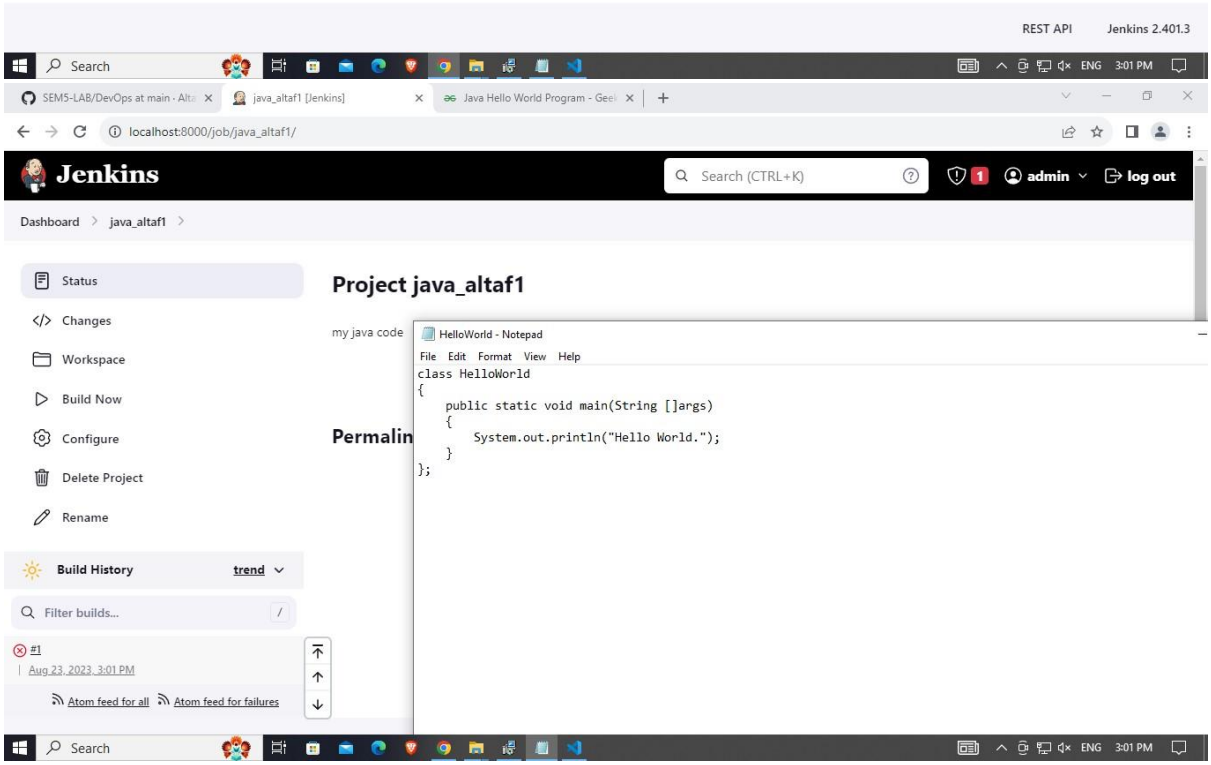

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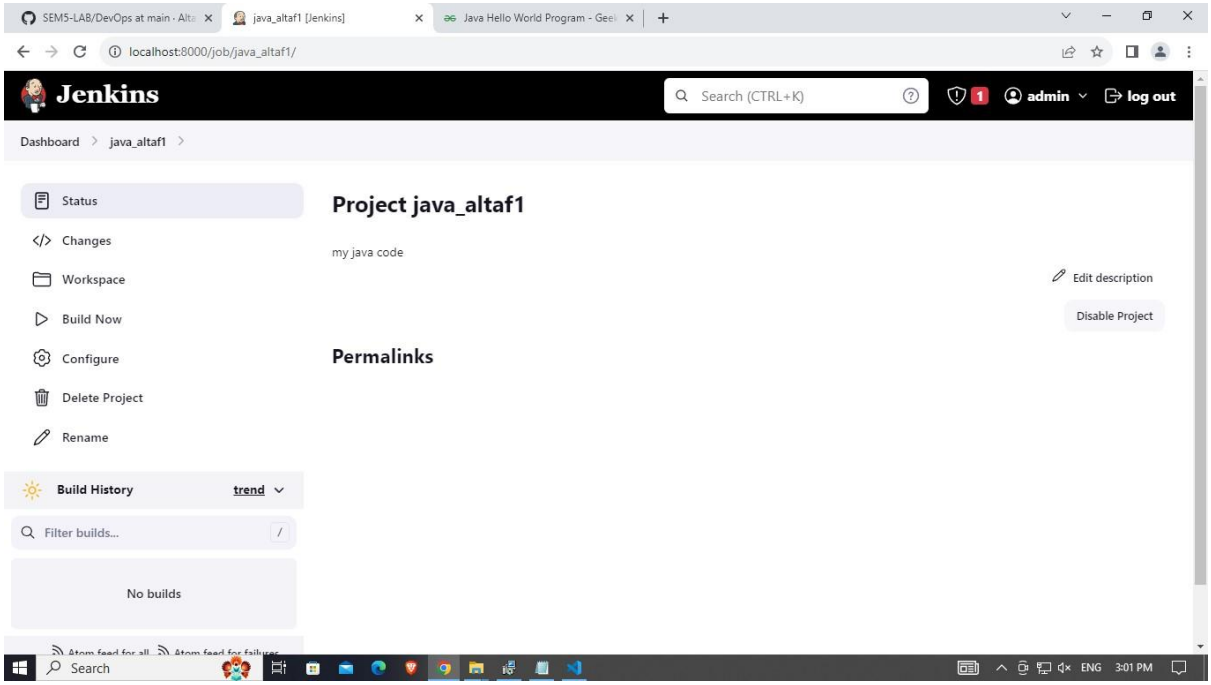

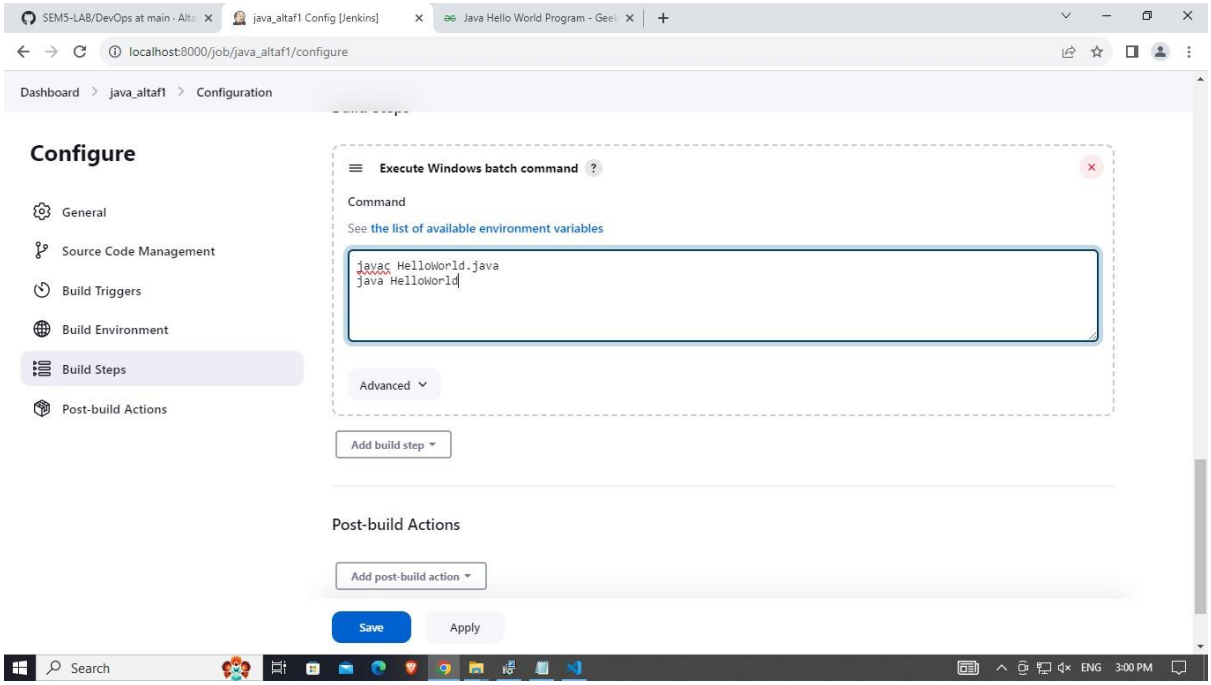

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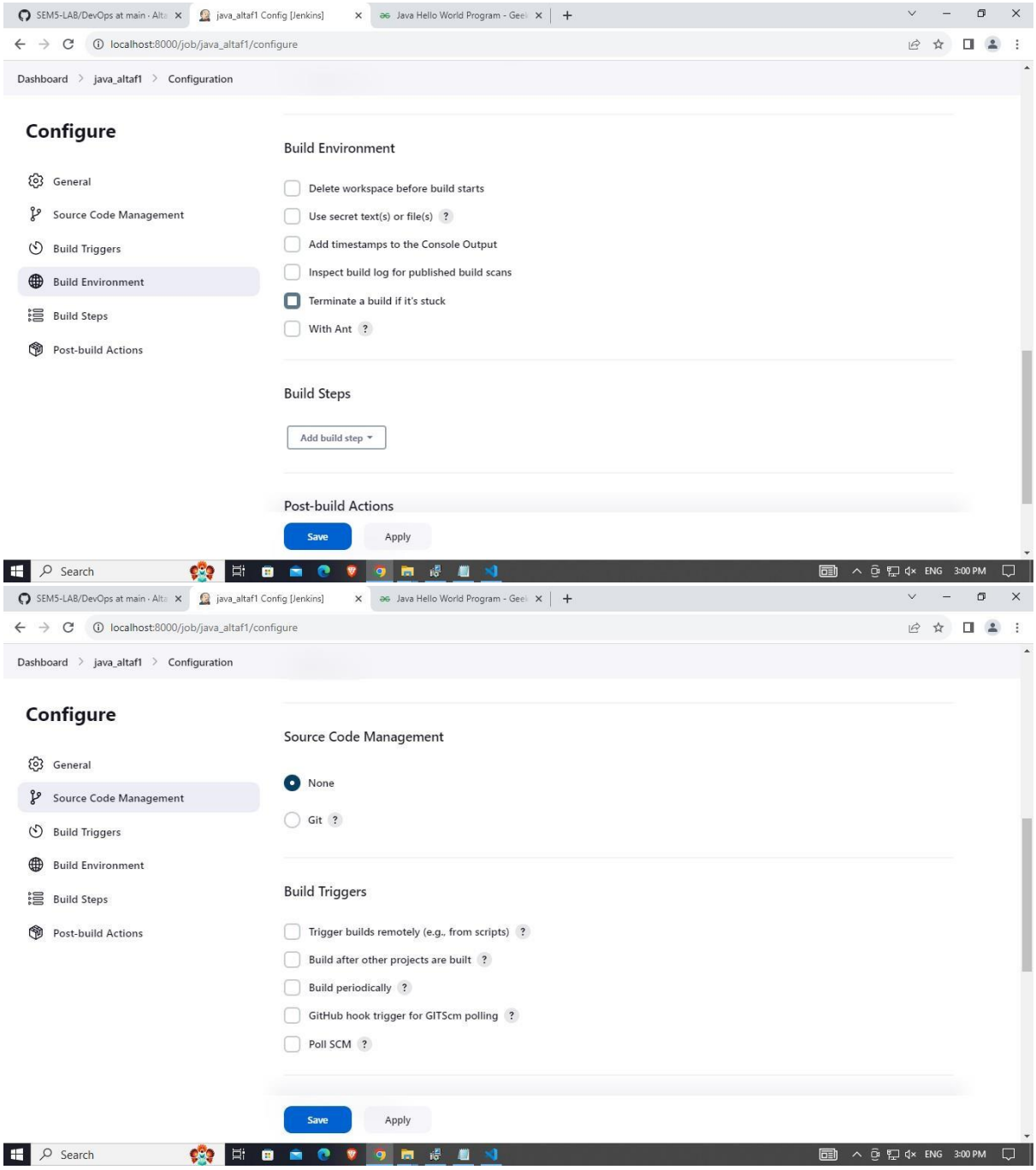

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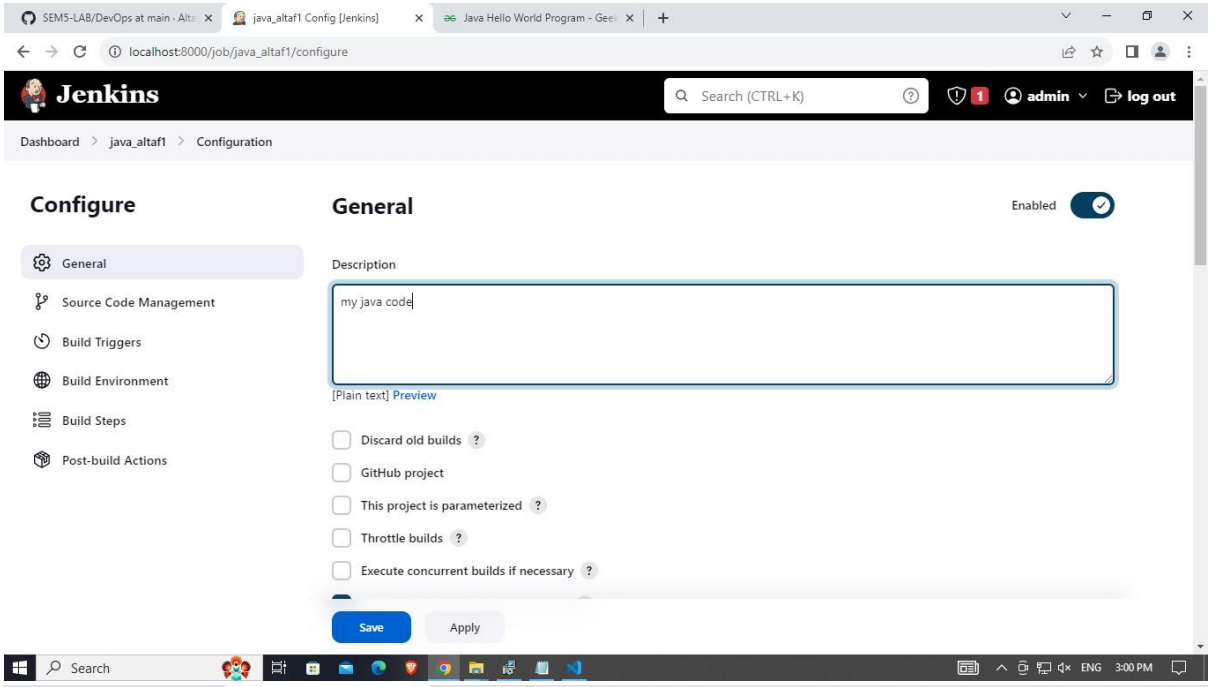

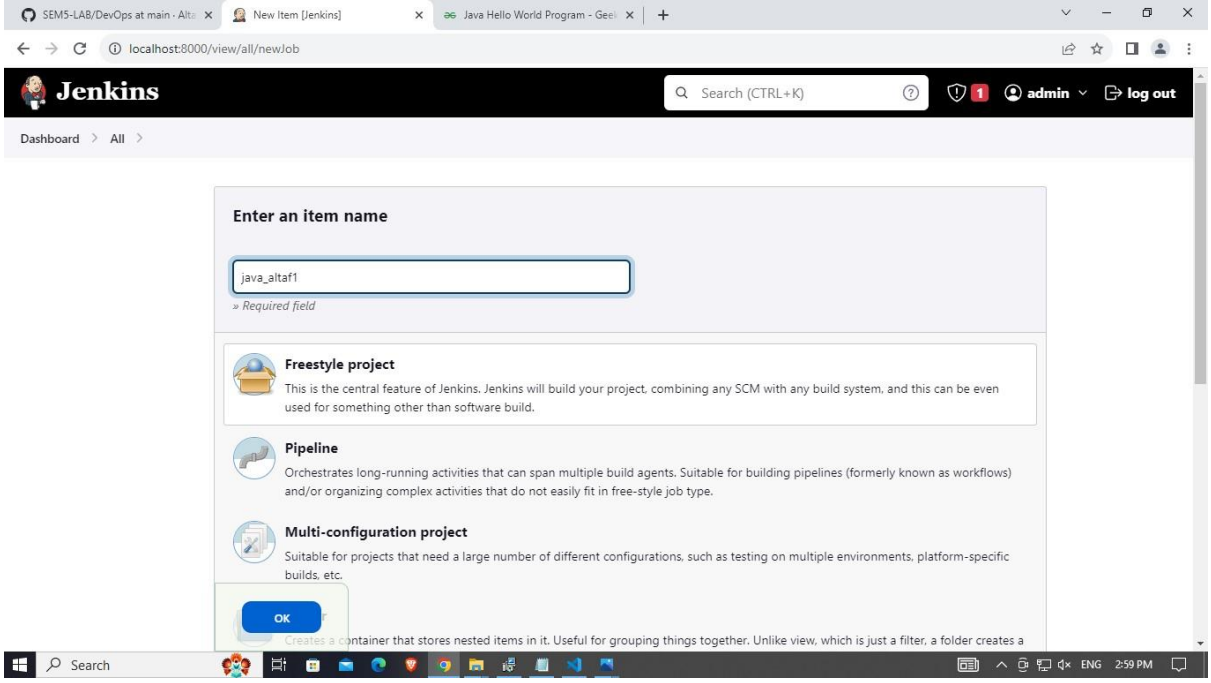

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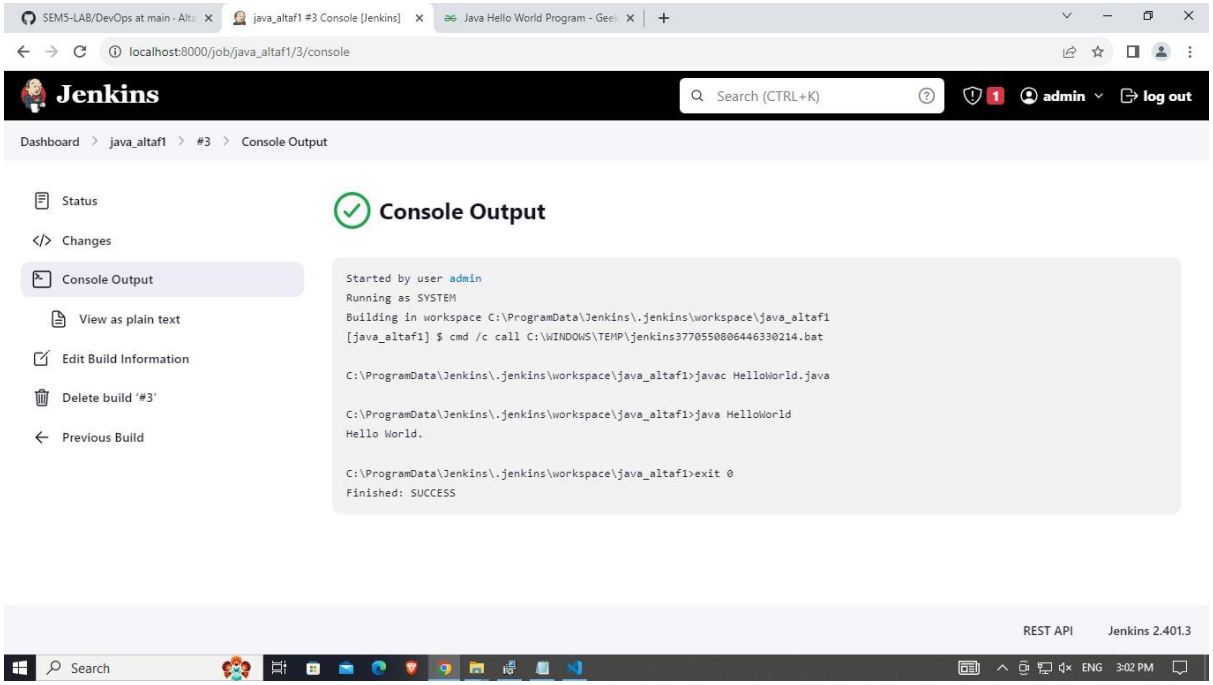

2) Building Java Program using Git

Name : Altaf Alam

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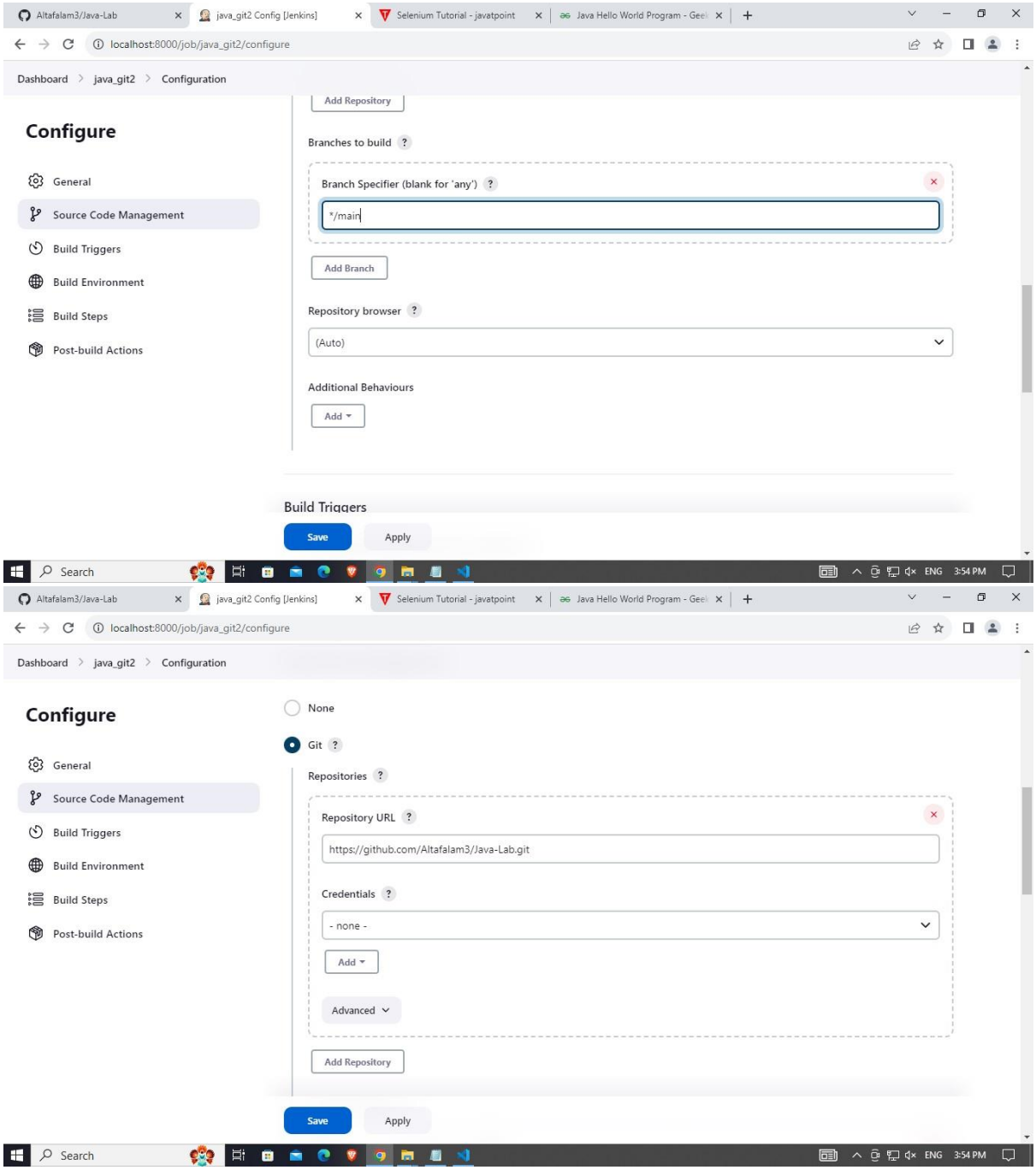

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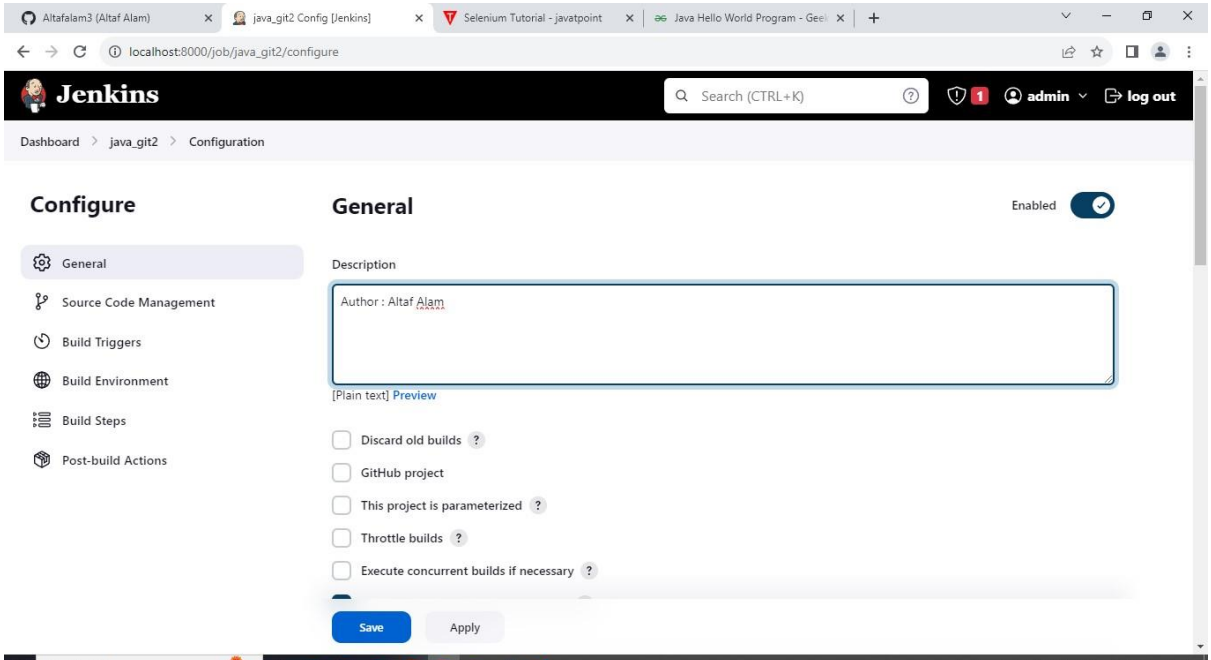

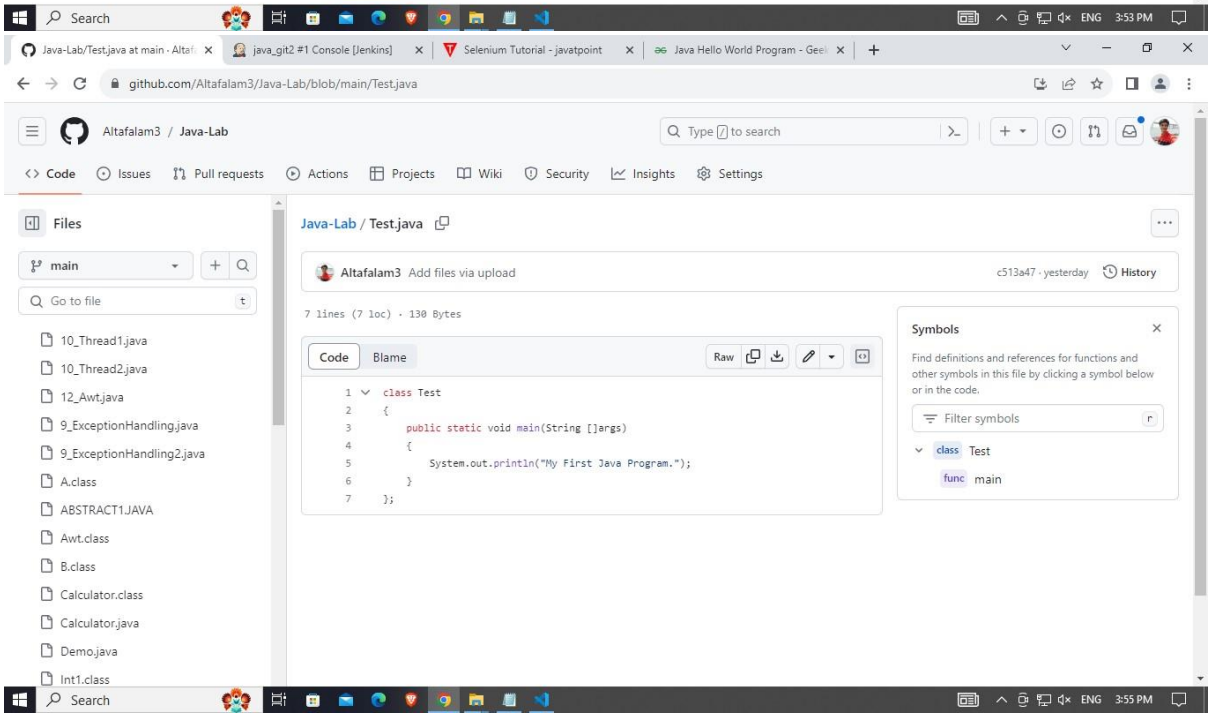

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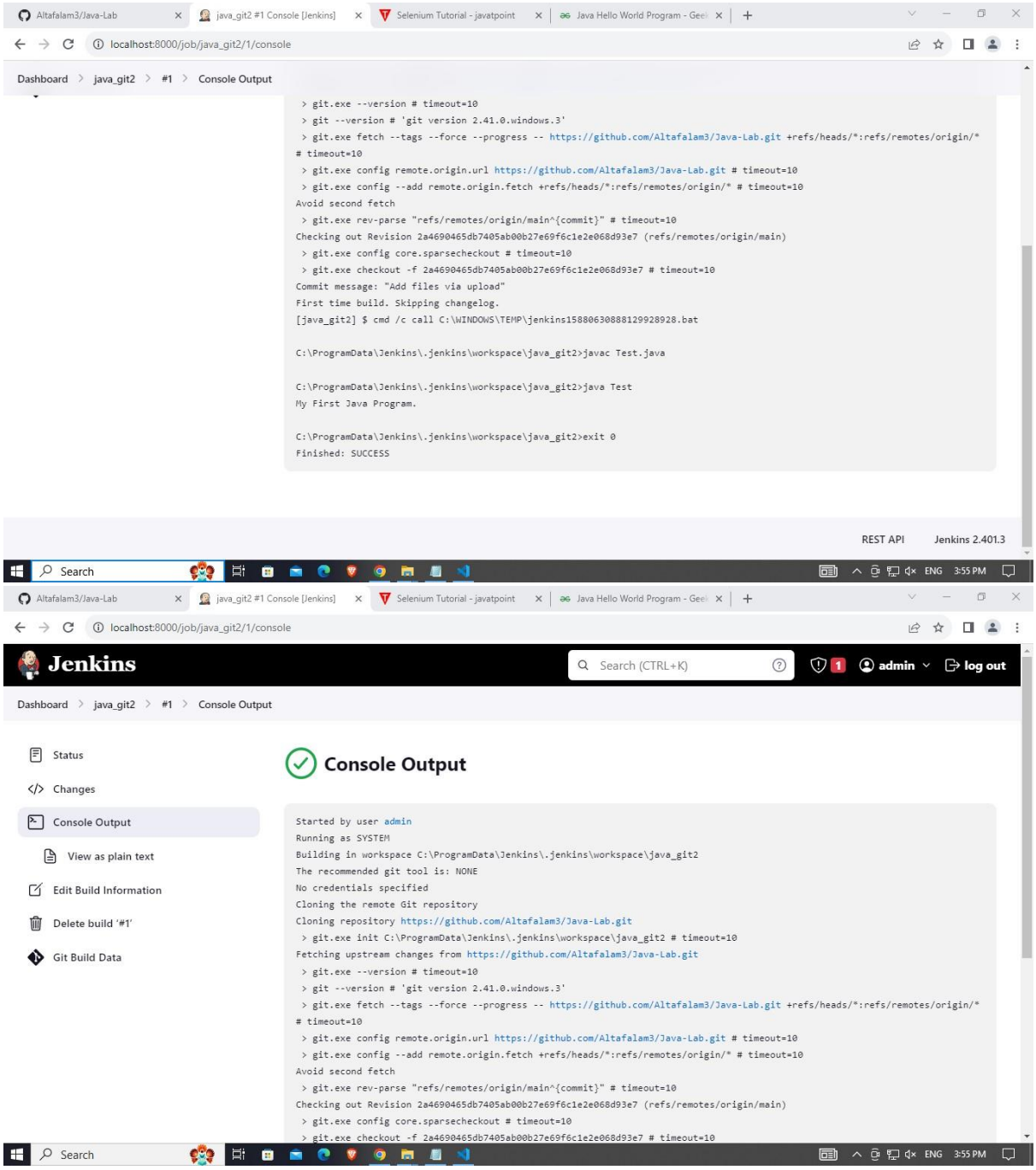

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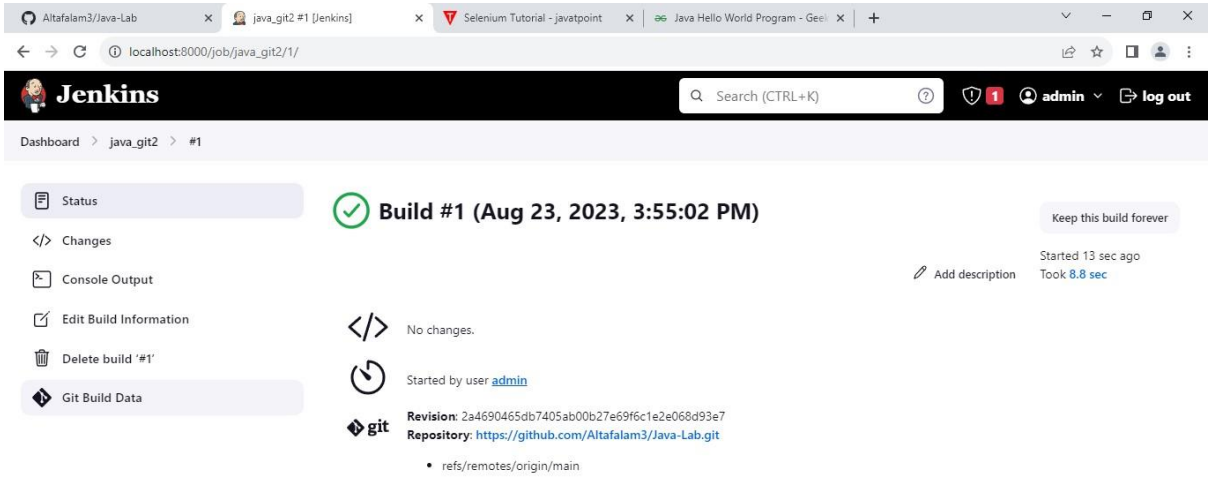

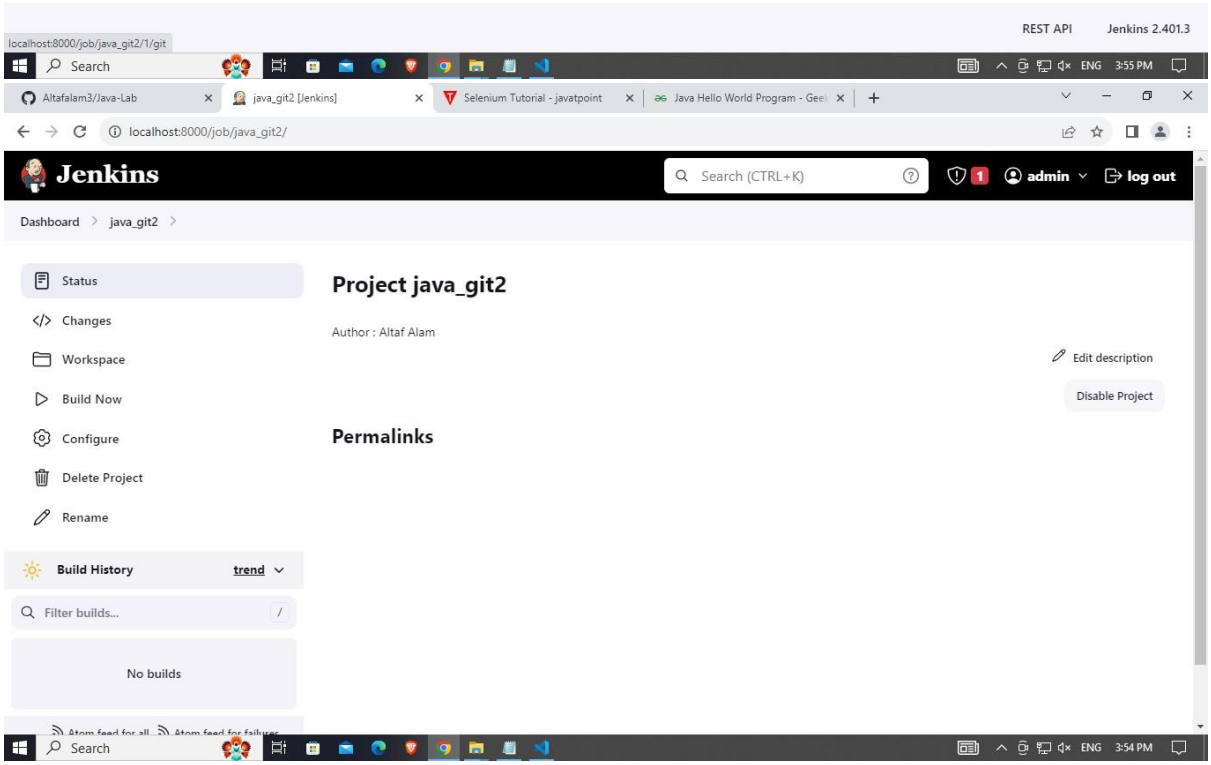

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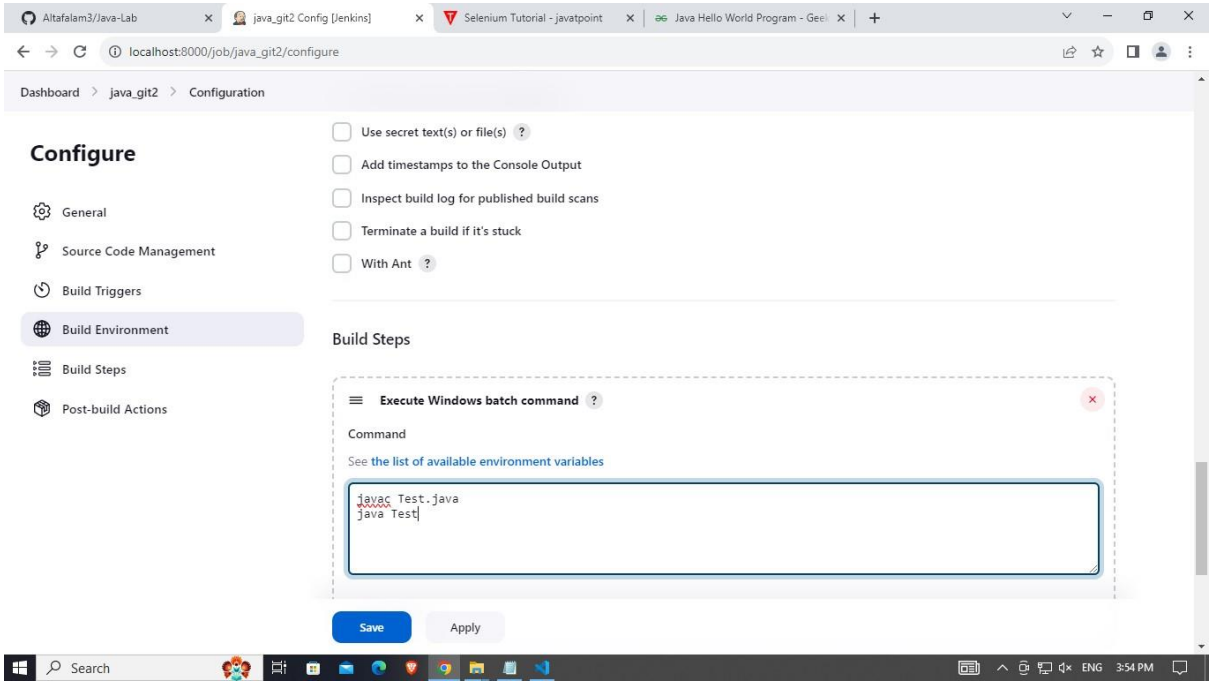

Conclusion :

Hence, we understood about Jenkins and how to build programs of java directly and by using git.

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Experiment No 6

Aim : To build pipelines using Jenkins.

Lab Outcome :

LO1: To understand the fundamentals of DevOps engineering and be fully proficient with DevOps terminologies, concepts, benefits, and deployment options to meet your busines requirements.

LO3 : To understand the importance of Jenkins to build and deploy software applications on server environment.

Theory :

Jenkins is a popular open-source automation server used for building, testing, and deploying software. Jenkins Pipelines are a powerful feature that allows you to define and manage your continuous delivery (CD) and continuous integration (CI) processes as code. Here's an indepth explanation of Jenkins Pipelines:

1. Continuous Delivery Pipelines:

- Continuous Delivery (CD) pipelines are a set of automated steps that code goes through, from development to production, ensuring that it is tested, reviewed, and deployed in a controlled and consistent manner.
- Jenkins Pipelines allow you to define, version, and execute these CD processes in a structured and repeatable way.

2. Jenkins Pipeline:

- A Jenkins Pipeline is a suite of plugins that enable implementing and integrating CD and CI workflows as code. It provides two main types of pipelines: Declarative and Scripted.

3. Declaration and Scripted Pipeline Syntax:

- Declarative Pipeline: This is a simplified and structured way to define pipelines. It uses a predefined set of directives to specify stages, steps, and conditions. Declarative pipelines are easier to read and maintain.
- Scripted Pipeline: This provides more flexibility by allowing you to write custom scripts in Groovy to define your pipeline. It gives you complete control over the workflow but can be more complex.

4. Benefits of Jenkins Pipelines:

- Version Control: Pipelines are defined as code, which means you can store them in version control systems like Git. This enables collaboration and history tracking.

- Reusability: Pipelines can be reused across different projects, promoting consistency and reducing duplication of effort.
- Visibility: Pipelines provide clear visibility into the entire CD process. You can see where failures occur, making troubleshooting easier.
- Parallel Execution: Pipelines can execute multiple tasks in parallel, improving build and deployment speed.
- Extensibility: You can extend pipelines with custom scripts or integrate with other tools and services.
- Scalability: Pipelines can be distributed across multiple Jenkins agents or nodes, scaling to handle complex workflows and high workloads.

5. How Jenkins Pipelines Work:

- Jenkins Pipelines typically start with a trigger, such as code commits to a version control system.
- The pipeline definition specifies stages, steps, and conditions. Each stage represents a phase in the CD process (e.g., build, test, deploy).
- Jenkins agents (or nodes) execute the defined steps, which can include building, testing, and deploying the application.
- The pipeline can be configured to run automated tests, send notifications, and trigger deployments to various environments (e.g., development, staging, production). - If any step fails, the pipeline can be configured to send alerts or halt further execution.

Jenkins Pipelines provide a structured, code-driven approach to continuous delivery, making it easier to manage, automate, and visualize your software delivery process while promoting collaboration and consistency.

1st script :

Make a pipeline using add item and select pipeline

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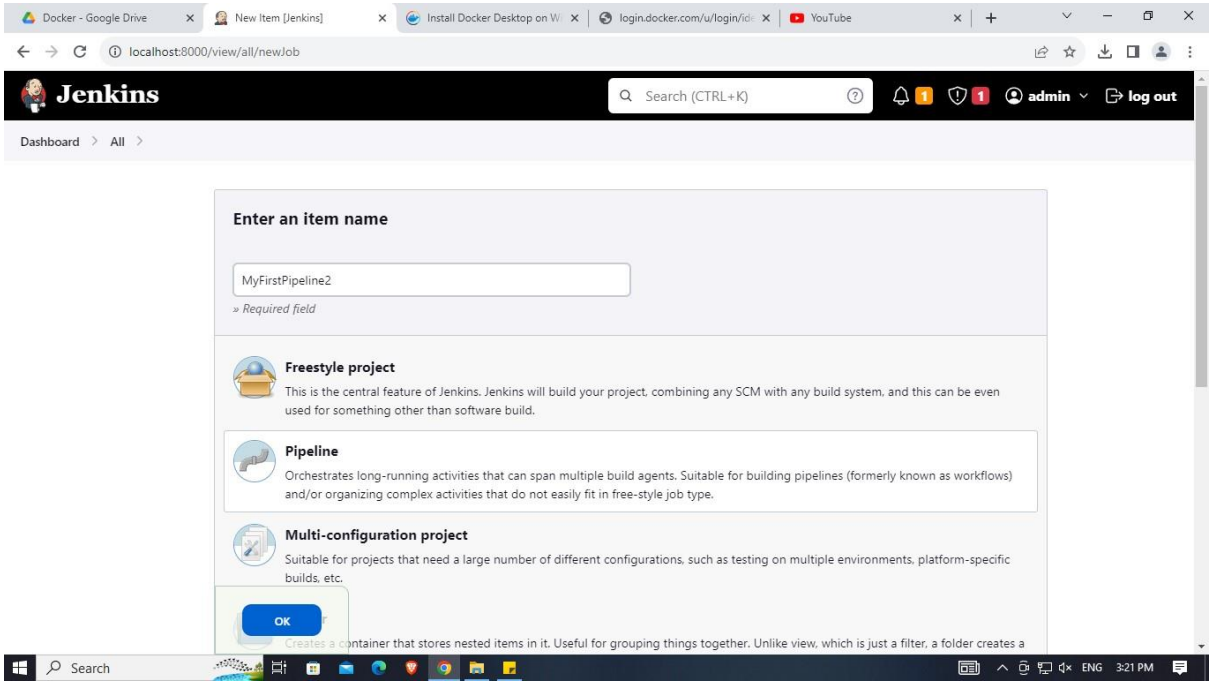
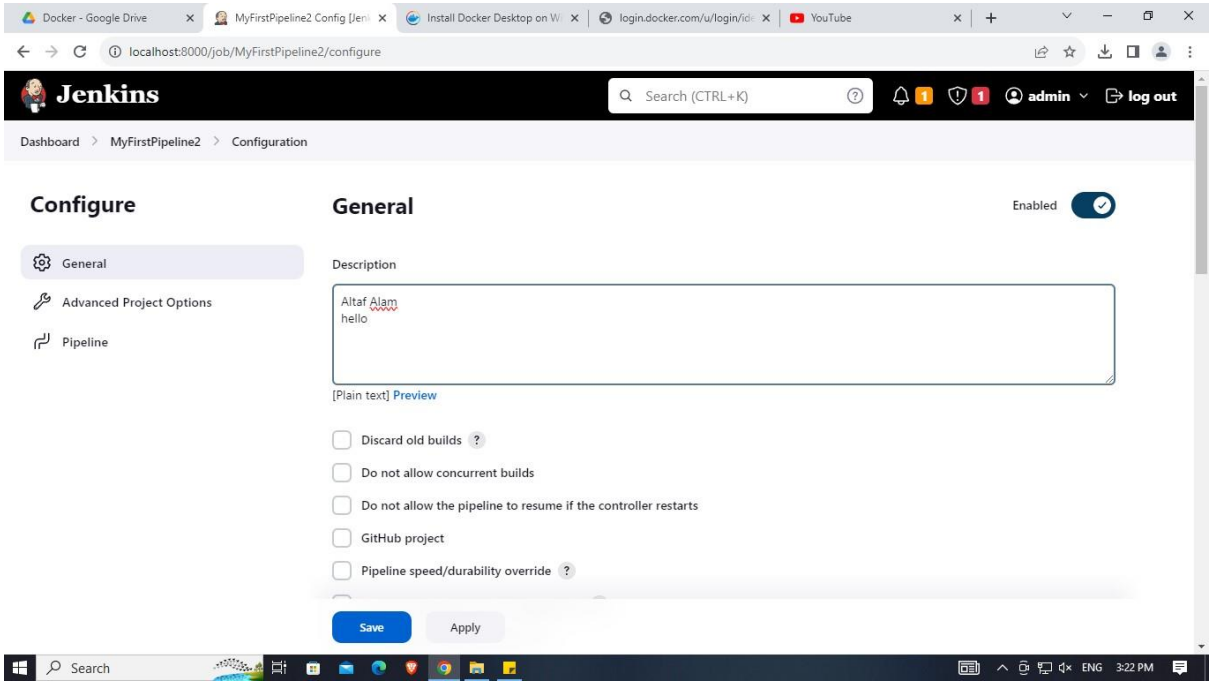


Add description



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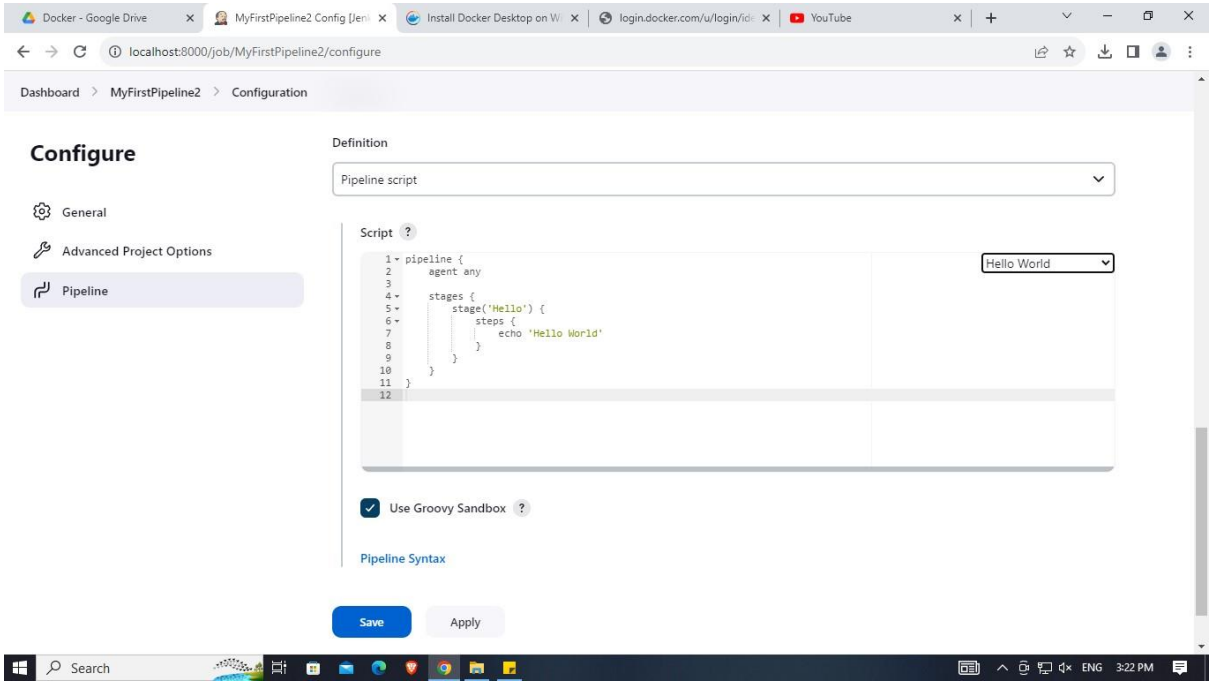
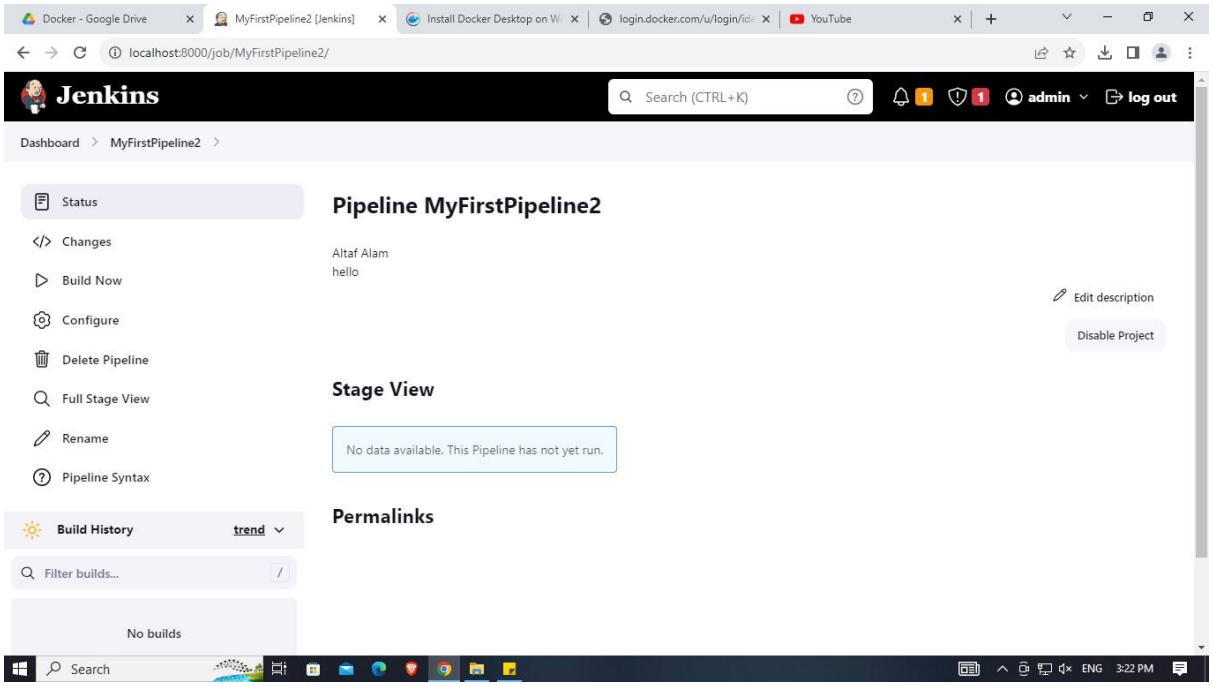
Add scripts to it hello world



Save and build now



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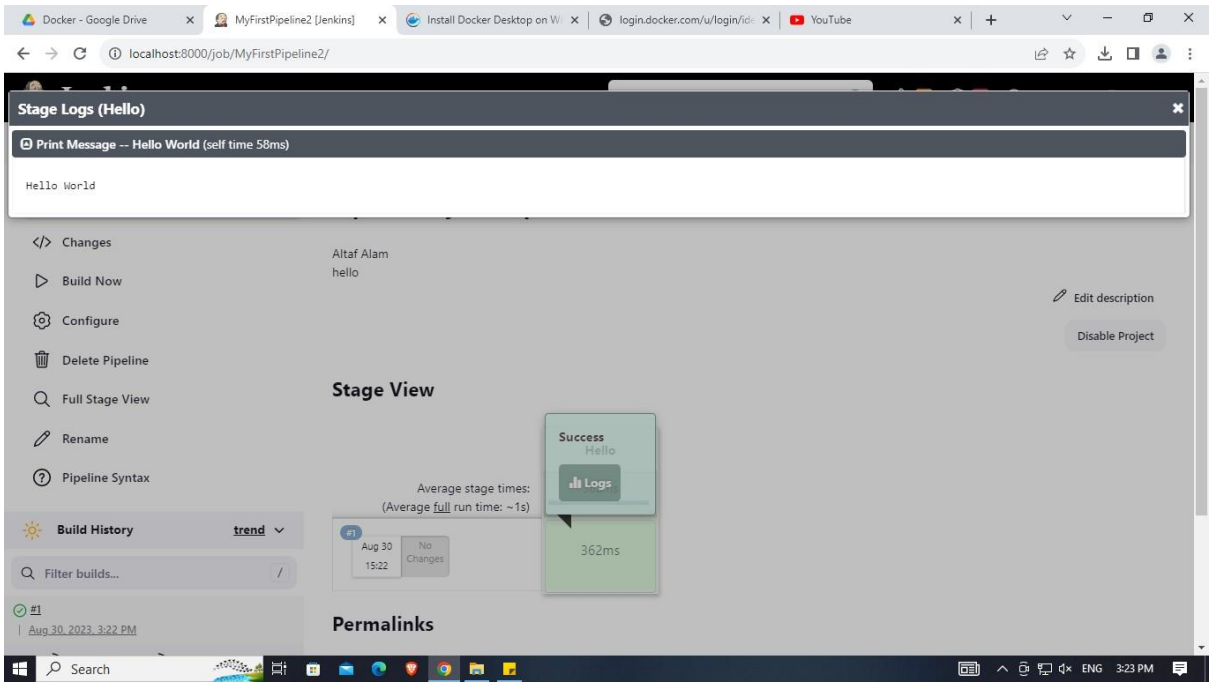
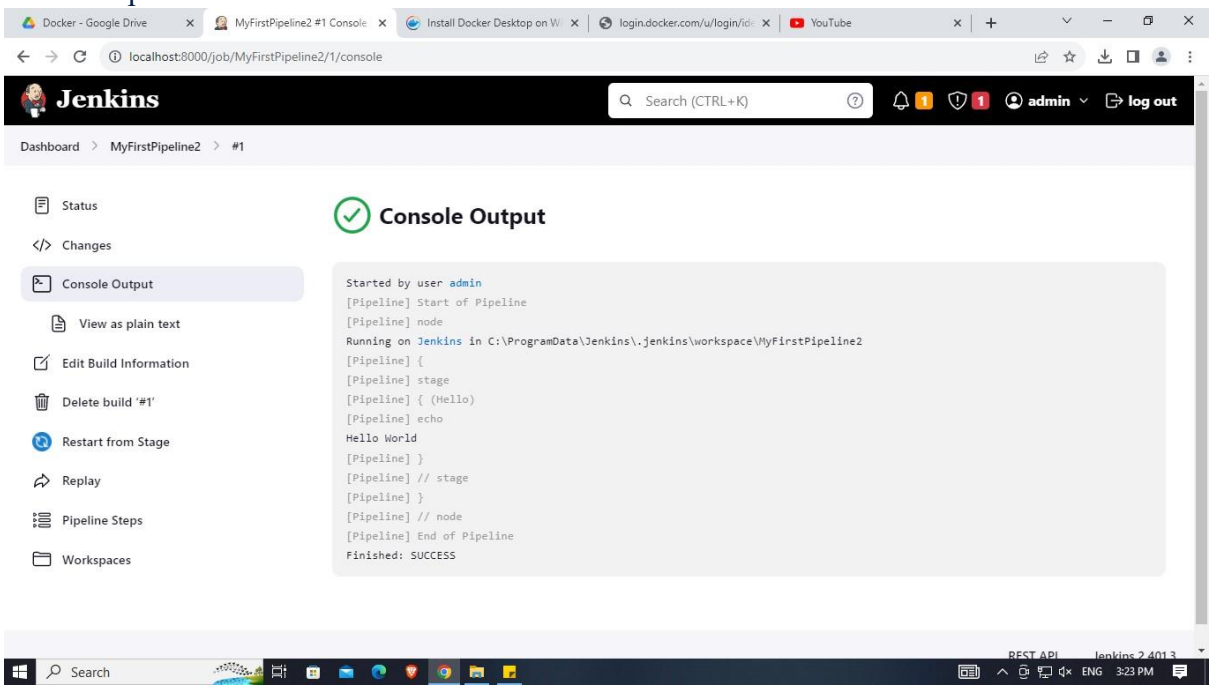


See the ouput in console



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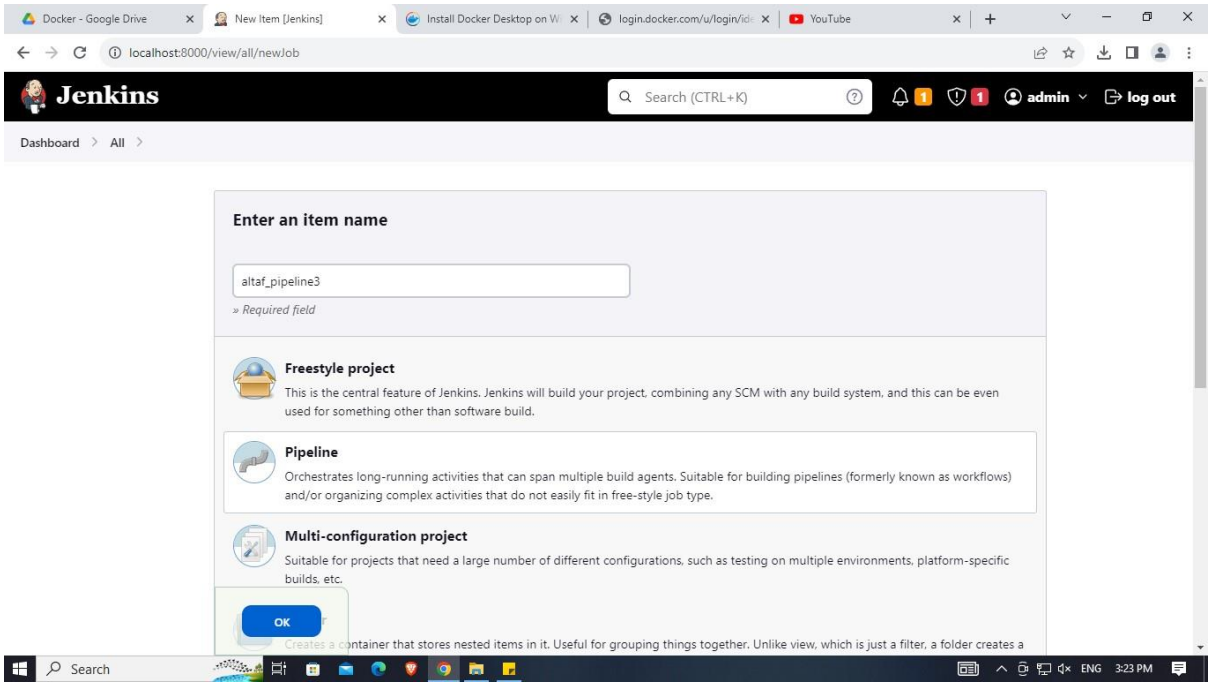
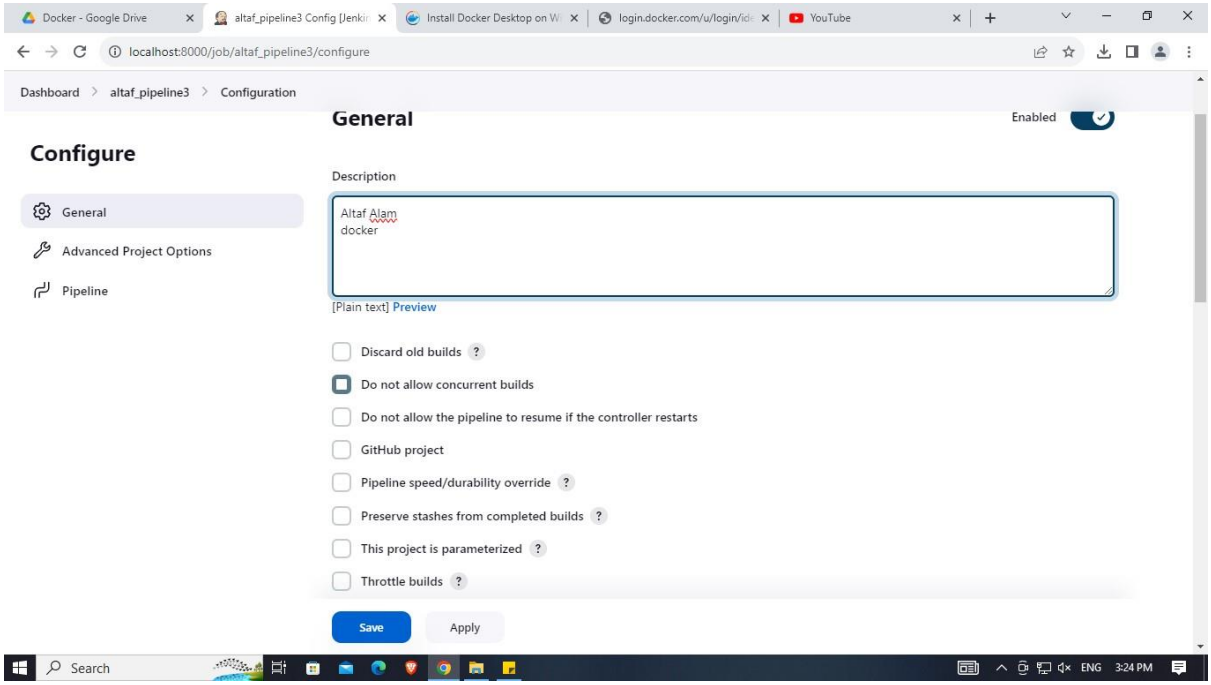
2nd Script pipeline:





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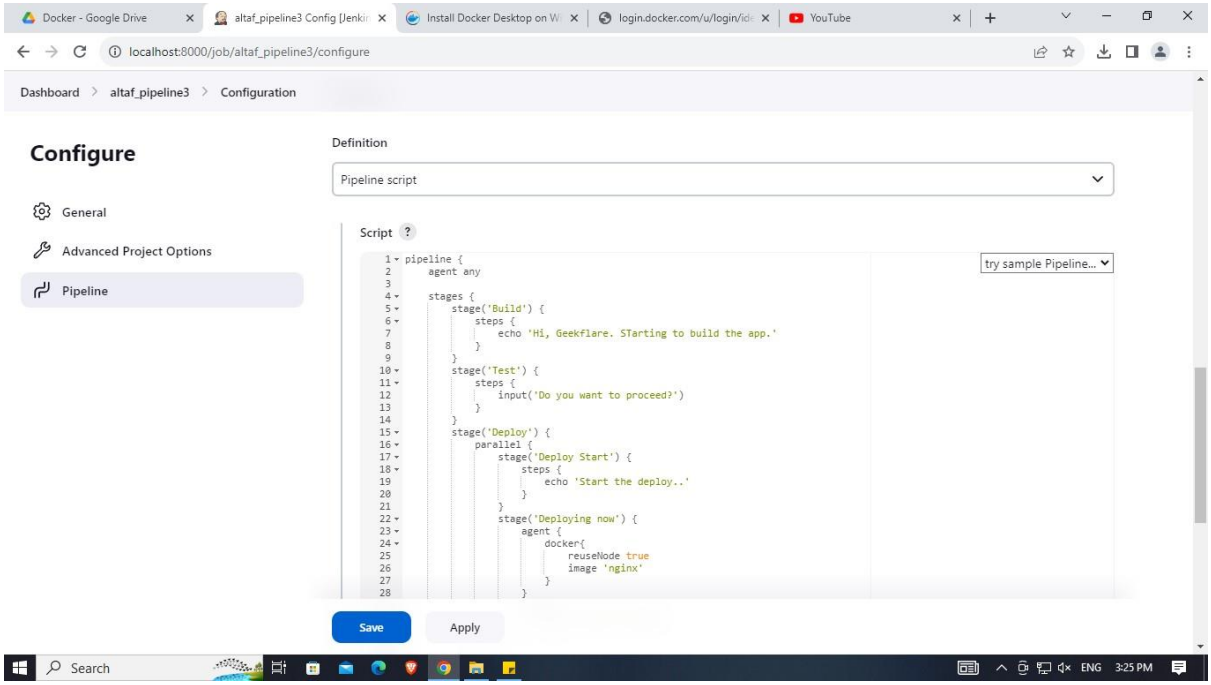

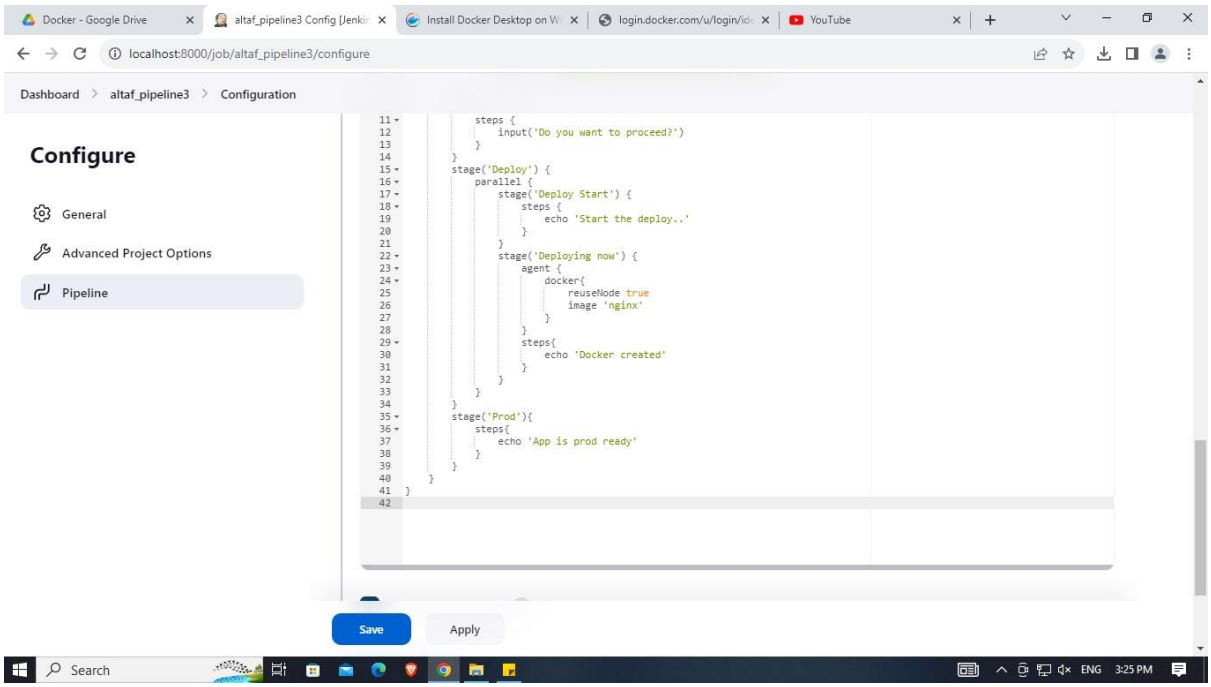

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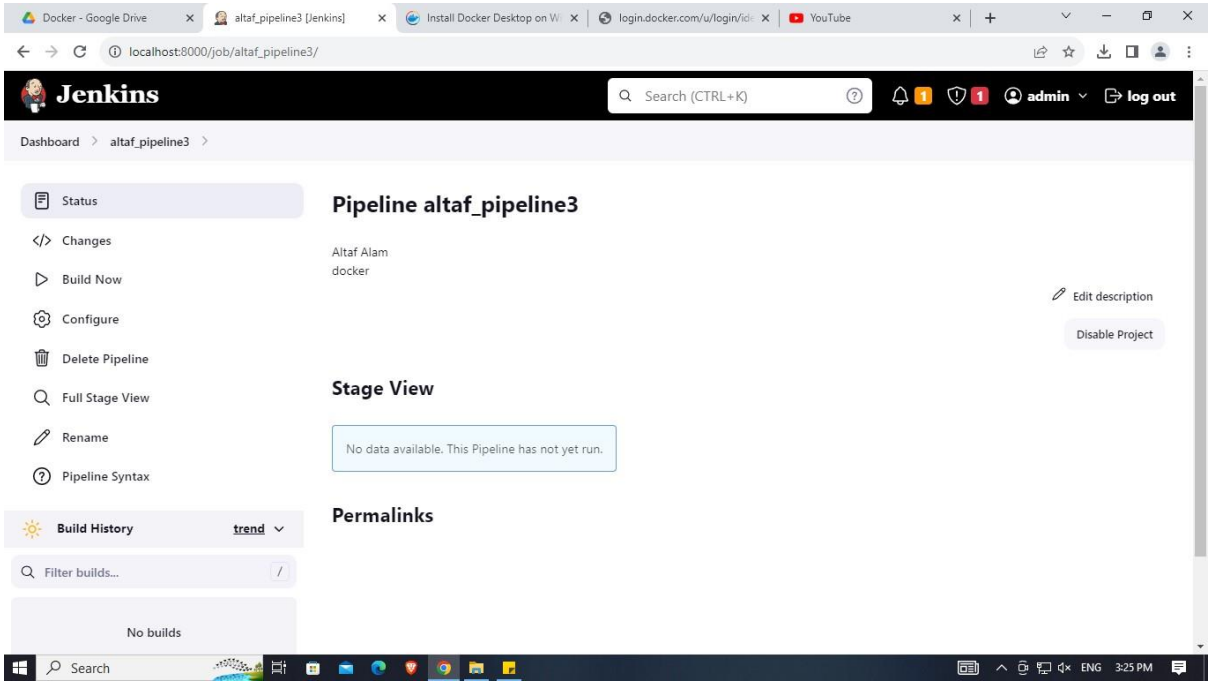

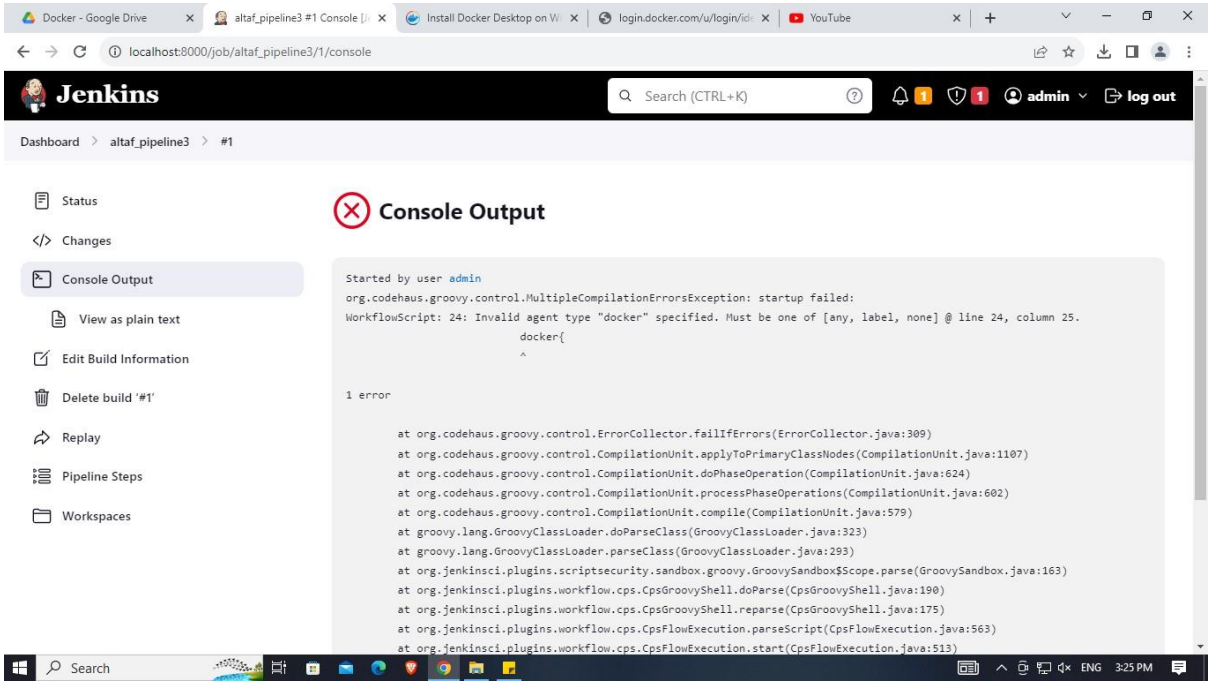

Conclusion :

Hence learn about the pipelines in Jenkins and running the scripts in jenkin.

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Experiment No 7

Aim : To understand Docker architecture and container life cycle, install docker, deploy container in docker.

Lab Outcome :

LO1: To understand the fundamentals of DevOps engineering and be fully proficient with DevOps terminologies, concepts, benefits, and deployment options to meet your busines requirements.
LO5 : To understand the concept of containerization and analyze the containerization of OS images and deployment of applications over Docker.

Theory :

What is Docker ?

Docker is a containerization platform that allows developers to package applications and their dependencies into a standardized unit called a container. These containers can run consistently across various environments, such as development, testing, and production, making it easier to build, ship, and deploy software.

At its core, Docker containers are lightweight, standalone, and executable packages that include everything needed to run an application, including code, runtime, libraries, and system tools. This encapsulation ensures that an application behaves the same way regardless of where it runs, whether it's on a developer's laptop, a testing server, or in the cloud.

Key concepts and components of Docker include:

1. Docker Engine: This is the core component of Docker that manages containers. It includes a server, a REST API, and a command-line interface (CLI). The Docker Engine is responsible for building, running, and managing containers.

2. Images: Docker images are read-only templates that define the application and its dependencies. Images serve as the basis for creating containers. They can be stored in a registry, such as Docker Hub, and shared among developers and teams.

3. Containers: Containers are instances of Docker images that are runnable and isolated from the host system and other containers. They encapsulate an application and its environment, ensuring consistency and portability.

4. Dockerfile: A Dockerfile is a text file that contains instructions for building a Docker image. It specifies the base image, adds application code, sets environment variables, and configures the container.

5. Docker Compose: Docker Compose is a tool for defining and running multi-container applications. It allows developers to define the services, networks, and volumes in a single YAML file, simplifying the orchestration of complex applications.

Docker offers several advantages, including:

- Portability: Docker containers can run consistently across different environments, reducing "it works on my machine" issues.

- Isolation: Containers provide process and file system isolation, allowing multiple applications to run securely on the same host.

- Efficiency: Containers are lightweight and share the host OS kernel, resulting in minimal resource overhead and quick startup times.

- Scalability: Docker simplifies the scaling of applications by creating multiple containers from the same image.

- Version Control: Docker images are versioned, allowing for easy rollbacks and updates.

Docker Architecture:

Docker's architecture consists of several key components that work together to manage containers efficiently. Understanding this architecture is essential for effectively using Docker in containerization. Here's a simplified explanation:

1. Docker Client: The Docker command-line interface (CLI) is the primary way users interact with Docker. It sends commands to the Docker daemon, which in turn communicates with the underlying Docker engine.

2. Docker Daemon: The Docker daemon (also known as the Docker engine) is responsible for managing containers on the host system. It listens for Docker API requests from the Docker client and handles container lifecycle operations.

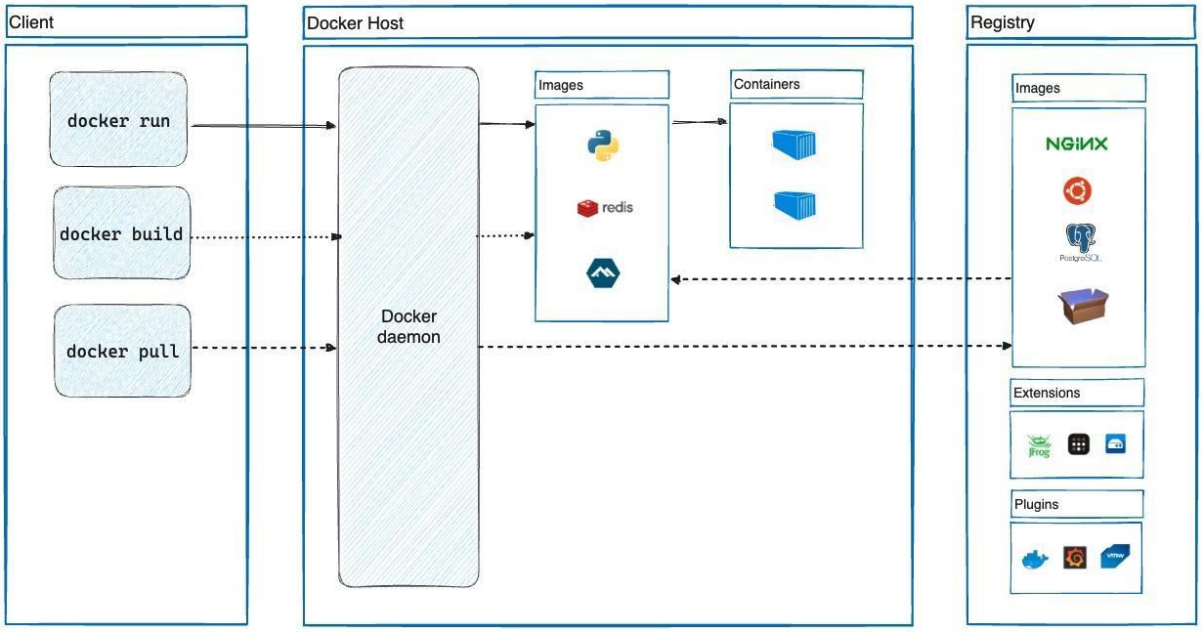
3. Docker Images: Docker images are read-only templates that serve as the basis for creating containers. They contain the application code, libraries, dependencies, and configurations required to run an application. Images are stored in a local registry on the host system.

4. Docker Registry: Docker images can be stored and shared in registries like Docker Hub or private registries. Registries are repositories where users can upload and access images. When you run a container, Docker pulls the required image from the registry if it's not available locally.

5. Containerization: Containers are instances of Docker images that are isolated from each other and the host system. Each container runs as a separate process with its own file

system and network, allowing multiple containers to run on the same host without interfering with one another.

6. Docker Compose: Docker Compose is a tool for defining and managing multi-container applications. It uses a YAML file to define services, networks, and volumes, making it easier to manage complex applications with multiple containers.



Lifecycle of a Docker Container:

The lifecycle of a Docker container can be summarized in several stages:

1. Creating a Container: You start by creating a container from a Docker image using the `docker run` command. This action creates a writable container layer on top of the image.

2. Running the Container: Once created, you can start the container with the `docker start` command. The container runs as a separate process on the host, executing the application defined in the image.

3. Interacting with the Container: You can interact with a running container through the `docker exec` command, which allows you to execute commands within the container. This is useful for debugging or configuring the container.

4. Stopping the Container: To stop a running container, you use the `docker stop` command. The container is gracefully terminated, and its resources are freed.

5. Restarting the Container: Containers can be restarted with the `docker start` command, either manually or automatically based on certain conditions, such as system restarts or failures.

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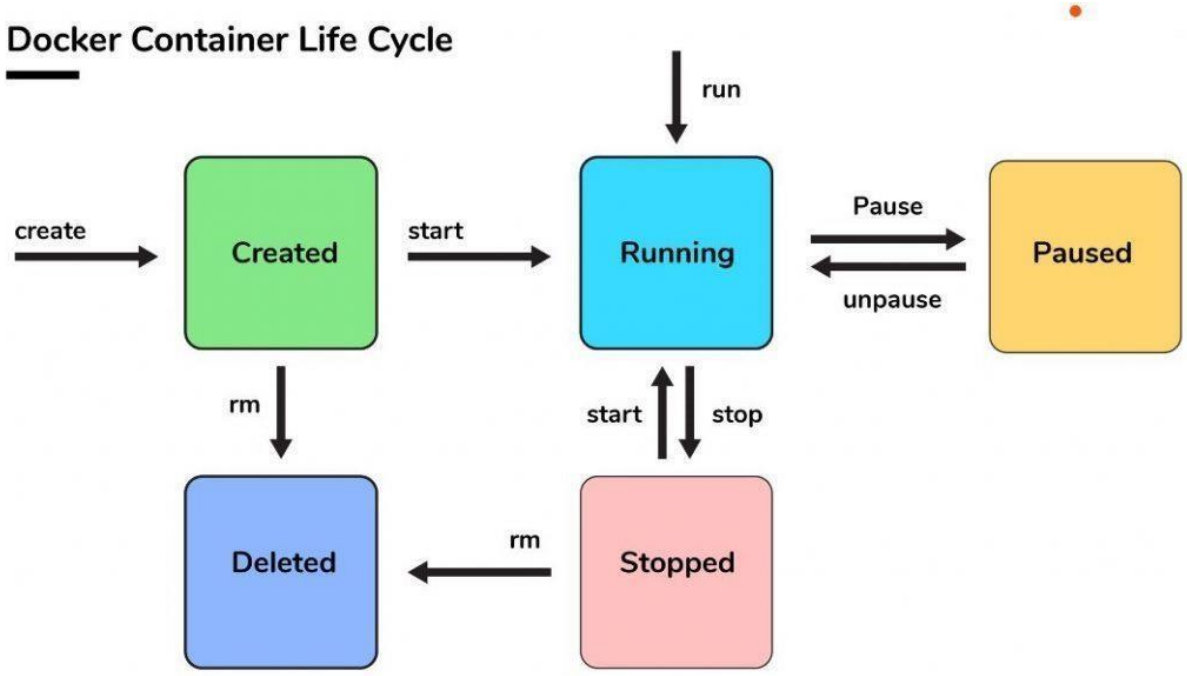
6. Pausing and Resuming: Docker allows you to pause and resume containers with the `docker pause` and `docker unpause` commands. Paused containers retain their state, including open network connections.

7. Removing the Container: When you're done with a container, you can remove it using the `docker rm` command. This action deletes the container and its associated filesystem.



Output:

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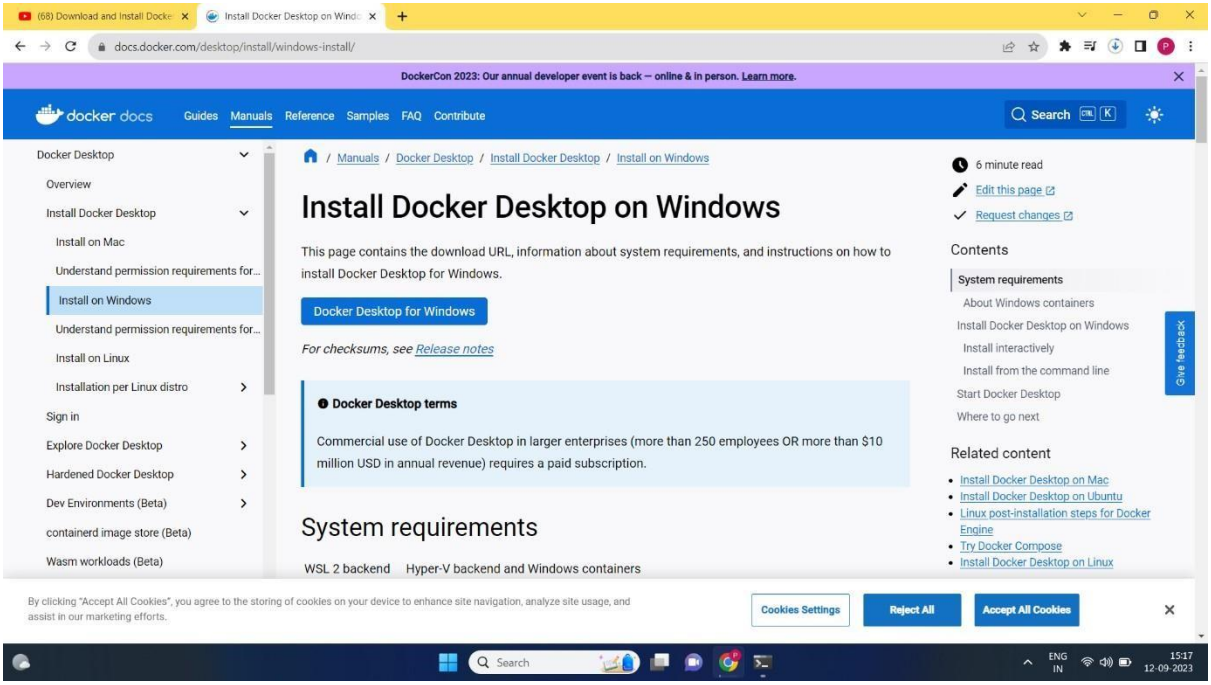

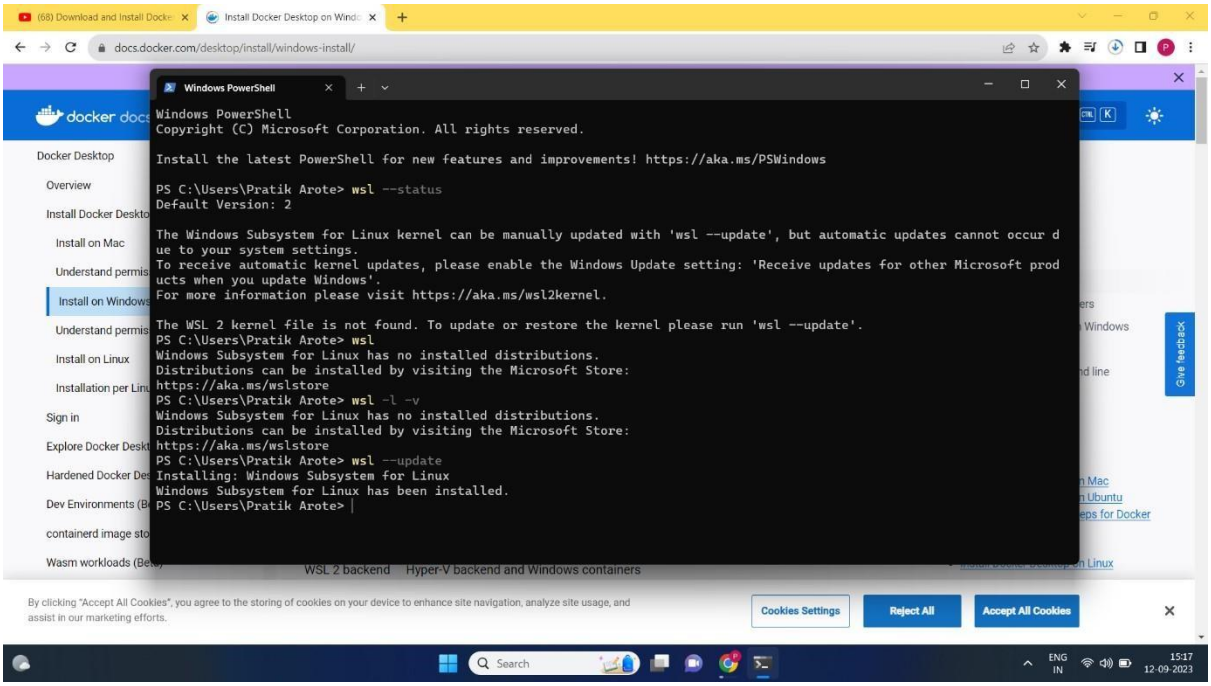

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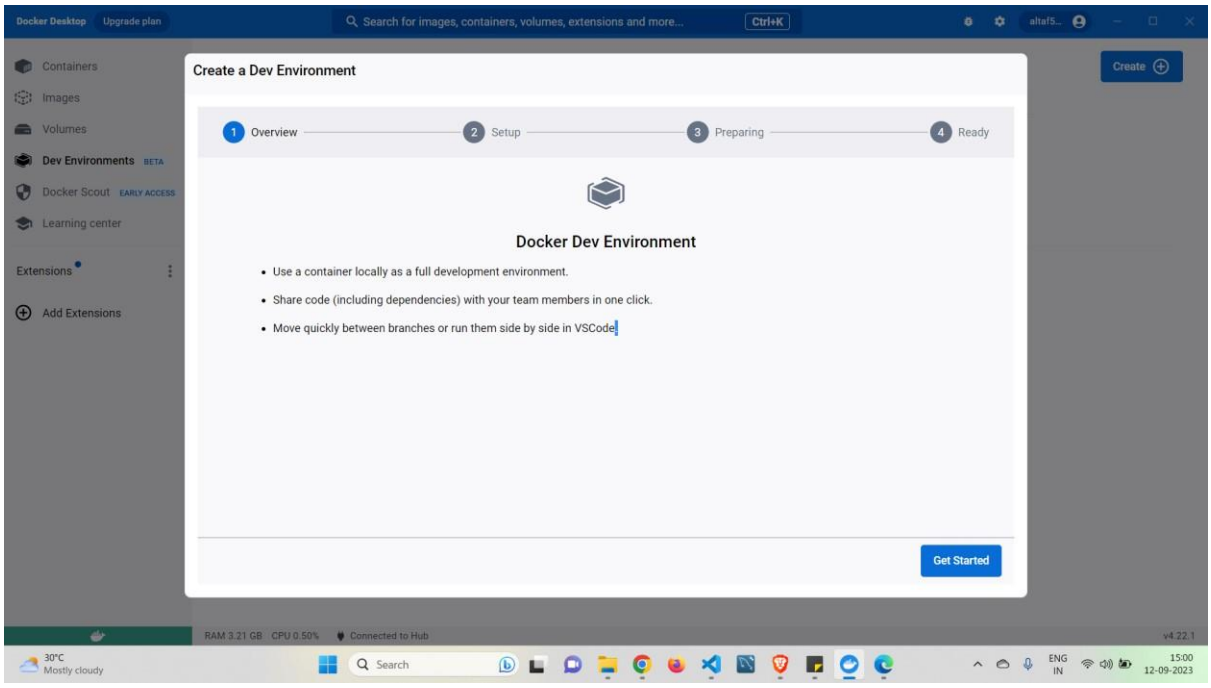

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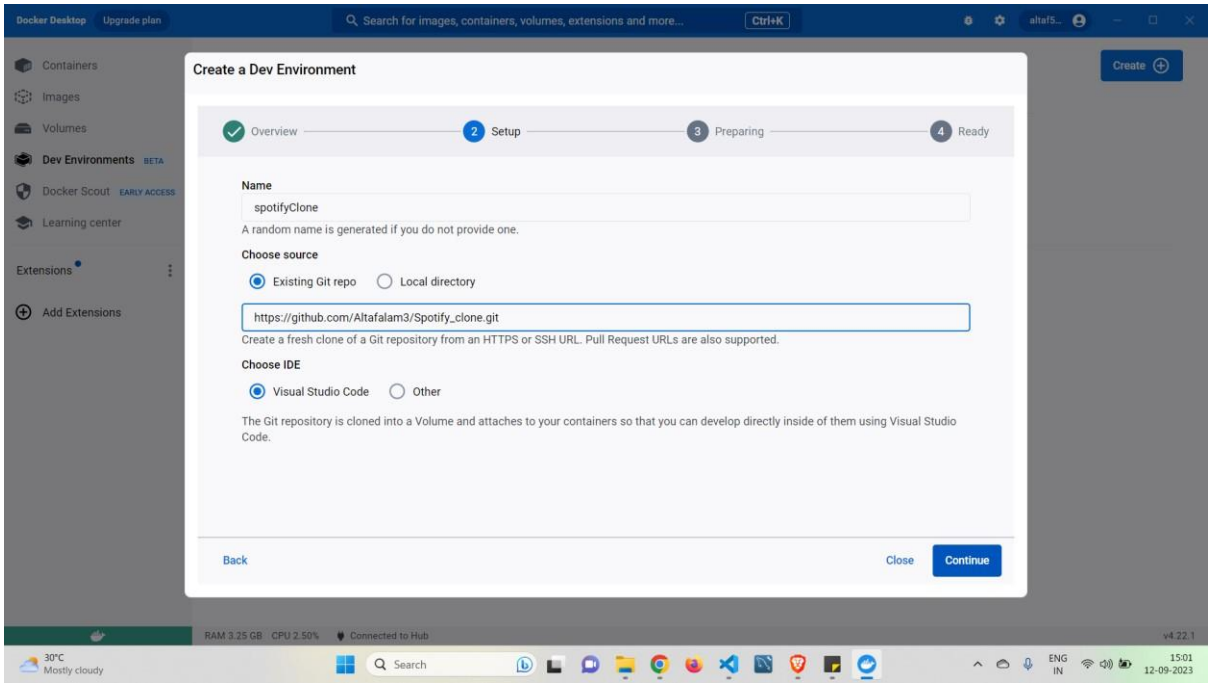

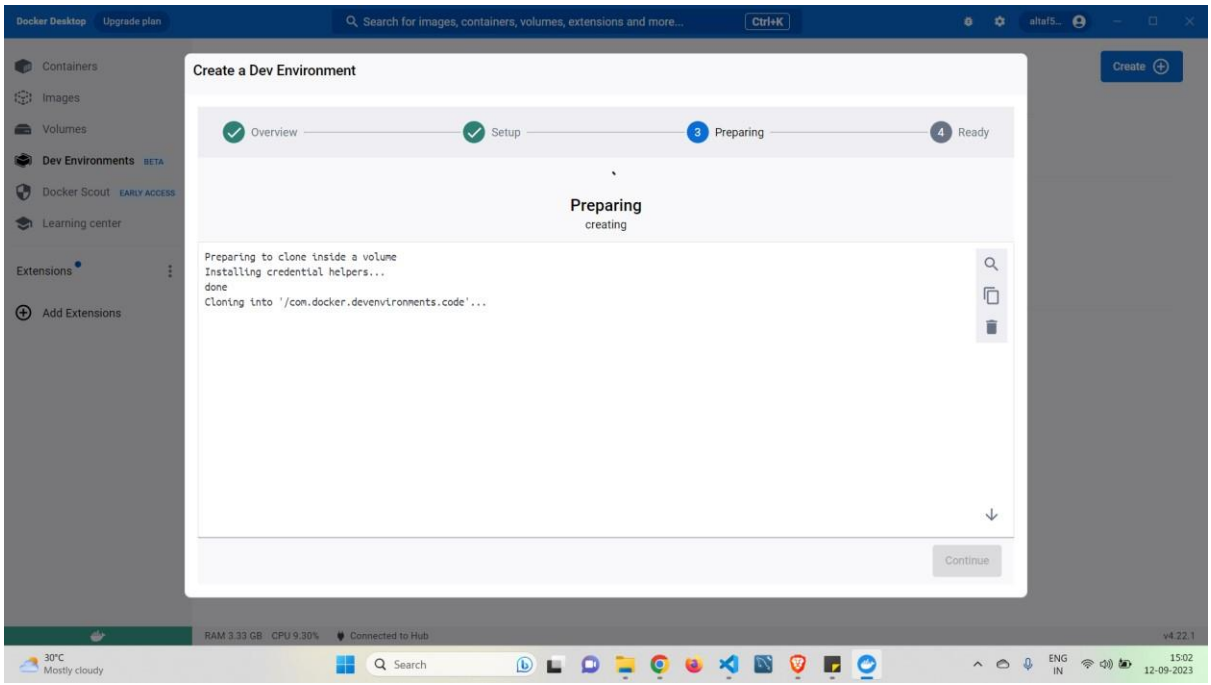

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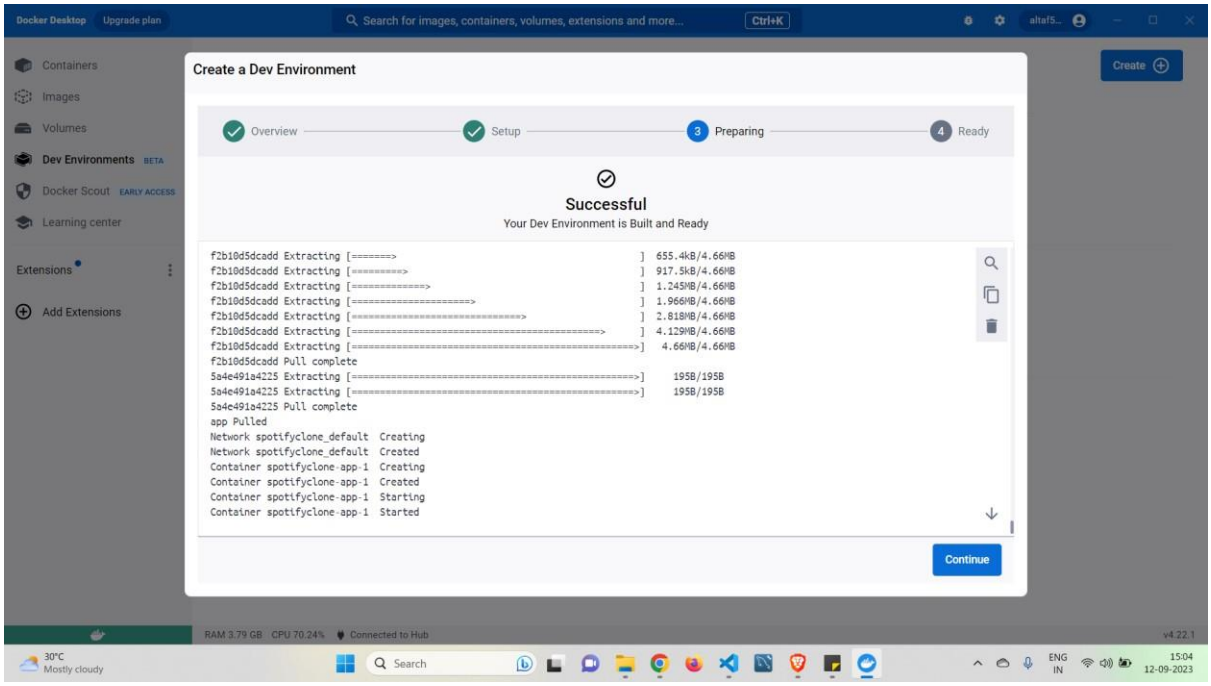

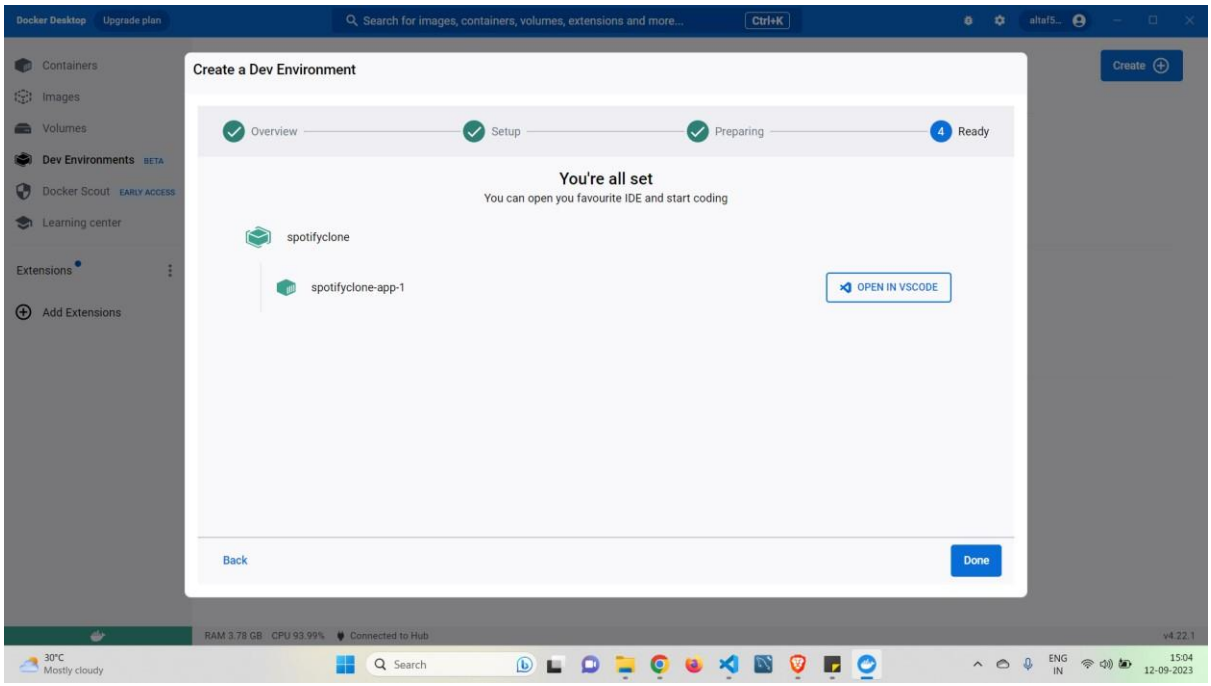

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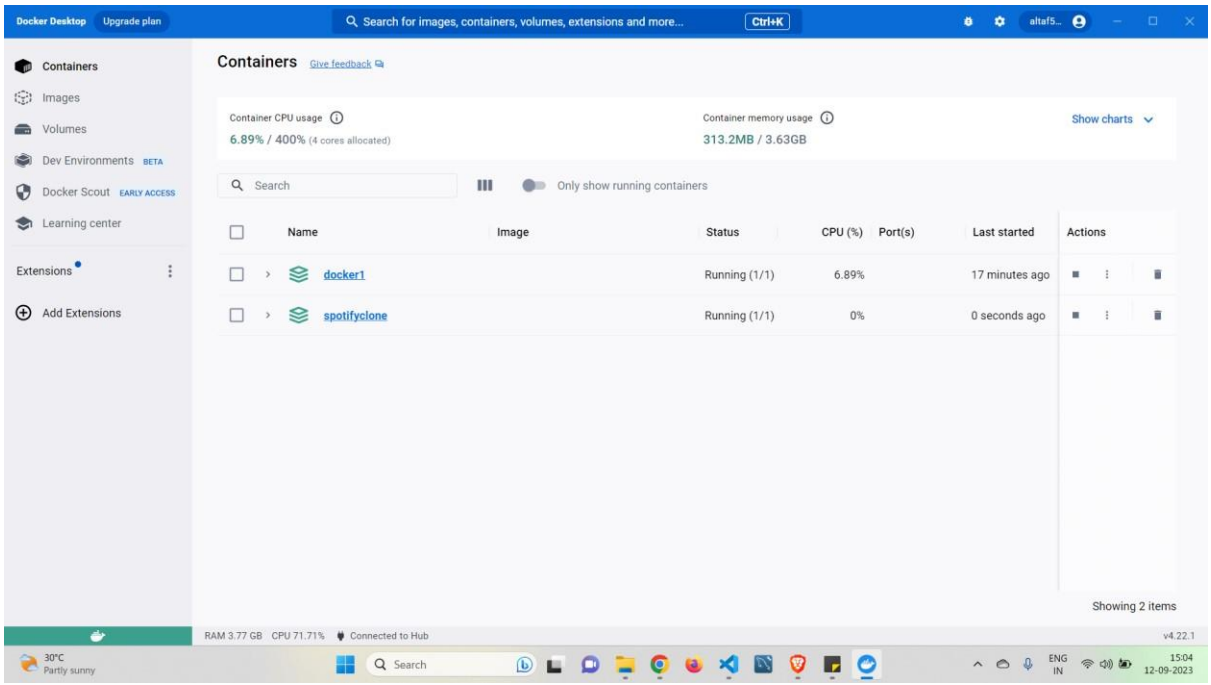

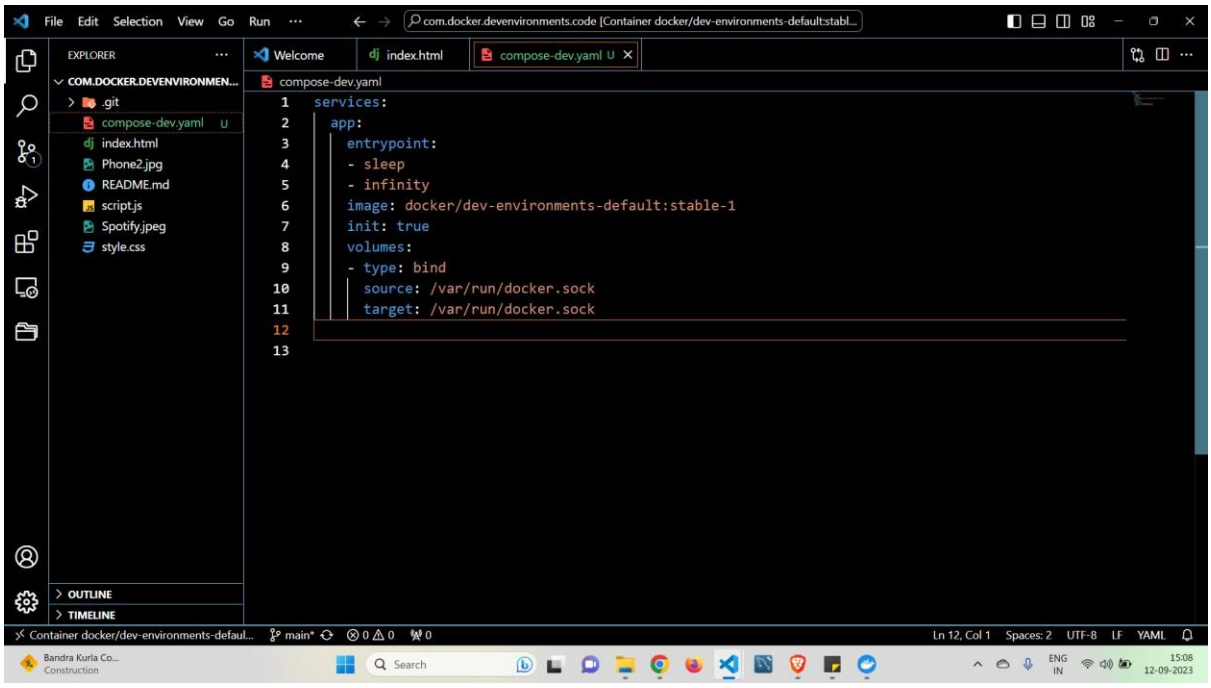

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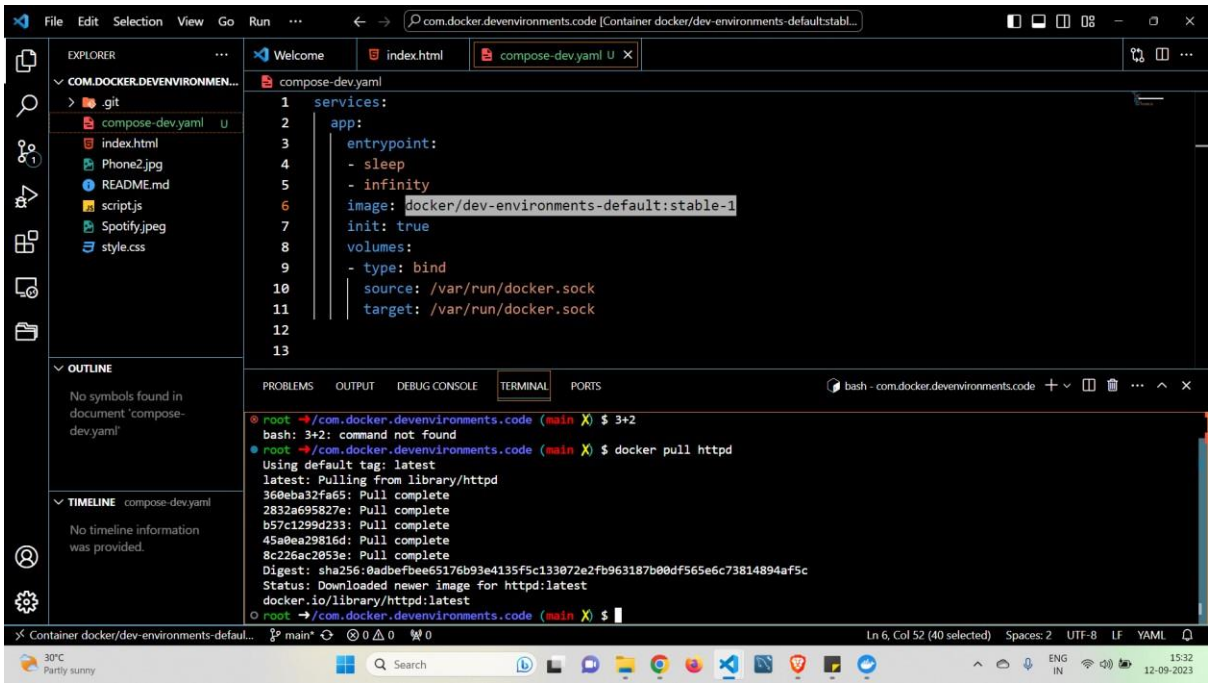

Conclusion:

Here, we have studied about docker, its architecture and lifecycle of a docker container. Also we have successfully created and run a container in docker.

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Experiment No 8

Aim : To deploy static web application on docker.

Lab Outcome :

LO1: To understand the fundamentals of DevOps engineering and be fully proficient with DevOps terminologies, concepts, benefits, and deployment options to meet your busines requirements.

LO5 : To understand the concept of containerization and analyze the containerization of OS images and deployment of applications over Docker.

Theory :

In the ever-evolving world of web development and deployment, containers have gained immense popularity due to their efficiency, scalability, and portability. Docker, a leading containerization platform, has become the de facto choice for packaging and deploying applications. While Docker is frequently associated with complex microservices and multicontainer applications, it can also be used effectively for deploying simple static web applications. This article will delve into the theory and steps involved in deploying a static web application on Docker.

Docker is an open-source platform designed to automate the deployment, scaling, and management of applications inside lightweight, portable containers. These containers encapsulate the application code, runtime, system tools, and libraries, ensuring that the application runs consistently in any environment.

Before we begin deploying a static web application on Docker, there are a few prerequisites to consider:

1. Docker Installation: Ensure that Docker is installed on your system. Docker provides a user-friendly installation process for various operating systems.

2. Static Web Application: You should have a static web application ready for deployment. A static web application typically consists of HTML, CSS, JavaScript, and other static assets.

Steps to Deploy a Static Web Application on Docker

1. Create a Dockerfile

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A Dockerfile is a script containing a set of instructions that Docker will use to build a Docker image. For a static web application, the Dockerfile is straightforward. Here's a sample Dockerfile:

In this Dockerfile, we start with a base image that contains Node.js, set the working directory, copy the application files, expose port 80, define an environment variable, and finally, run the static web application.

2. Build a Docker Image

To build a Docker image from the Dockerfile, navigate to the directory containing the Dockerfile and the web application files and execute the following command:

```bash docker build -t my-static-
web-app .
```

This command will create a Docker image tagged as "my-static-web-app." Make sure to replace it with your preferred image name.

3. Run a Docker Container

Now that we have a Docker image, we can run a Docker container based on that image. Use the following command:

```bash docker run -p 8080:80 my-static-
web-app
```

This command will start a Docker container from the "my-static-web-app" image, mapping port 8080 on your host machine to port 80 inside the container. You can access your static web application by opening a web browser and navigating to http://localhost:8080.

Benefits of Docker for Deploying Static Web Applications

1. Portability: Docker containers encapsulate the application and its dependencies, ensuring consistent behavior across different environments.

2. Isolation: Each container operates independently, avoiding conflicts and ensuring a clean environment.

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3. Scalability: Docker simplifies scaling by allowing the deployment of multiple containers and load balancing between them.

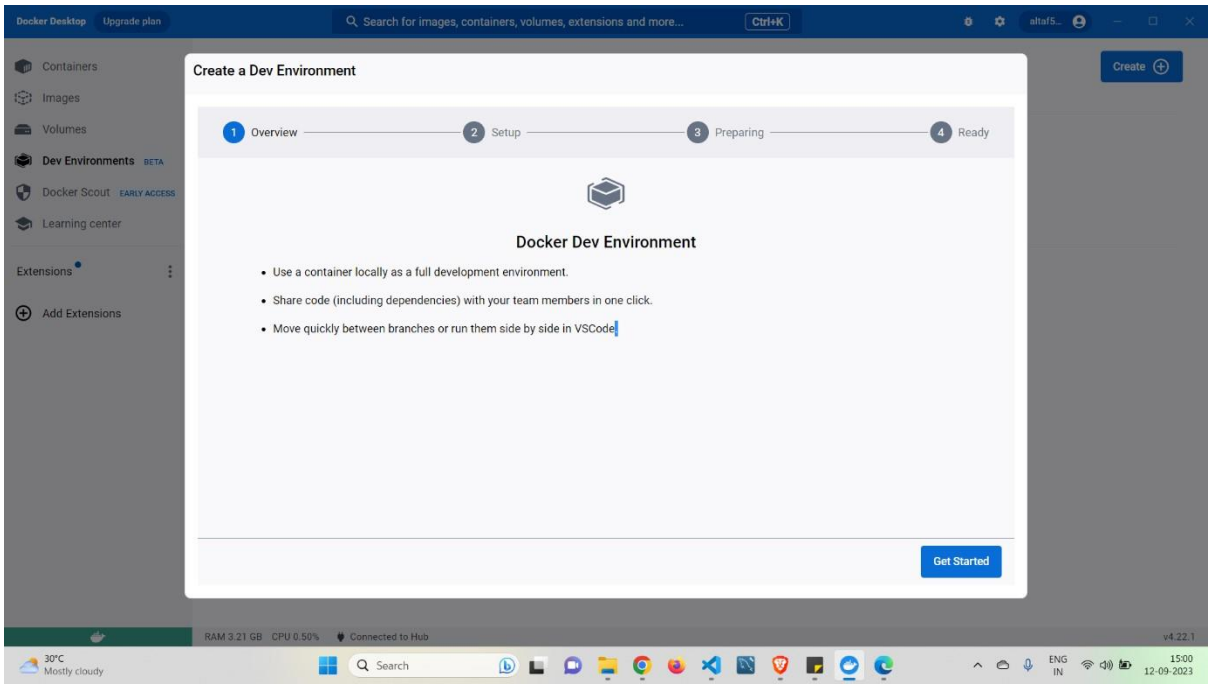
4. Resource Efficiency: Containers are lightweight and share the host OS kernel, leading to efficient resource utilization.

5. Easy Version Control: Images and containers can be versioned, making it easy to roll back to previous states if needed.

6. Security: Docker provides security features to isolate containers and control access.

7. Community and Ecosystem: Docker has a vast community and ecosystem, with a wealth of pre-built images and tools.

Output:



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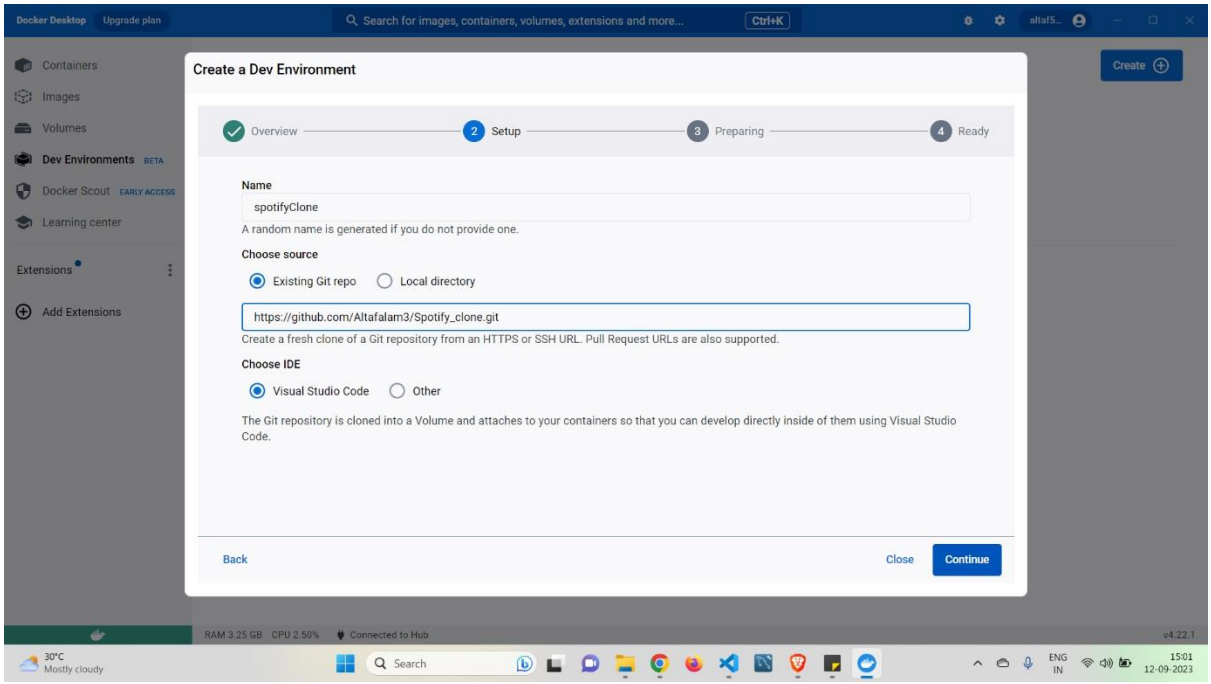

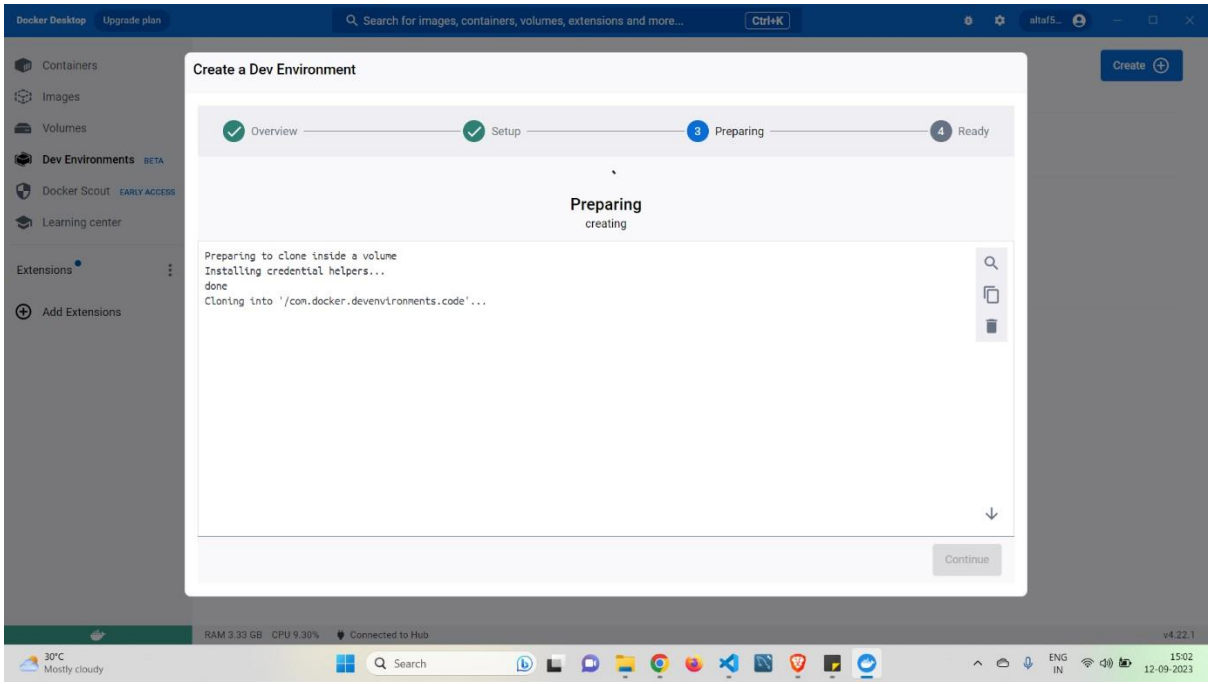

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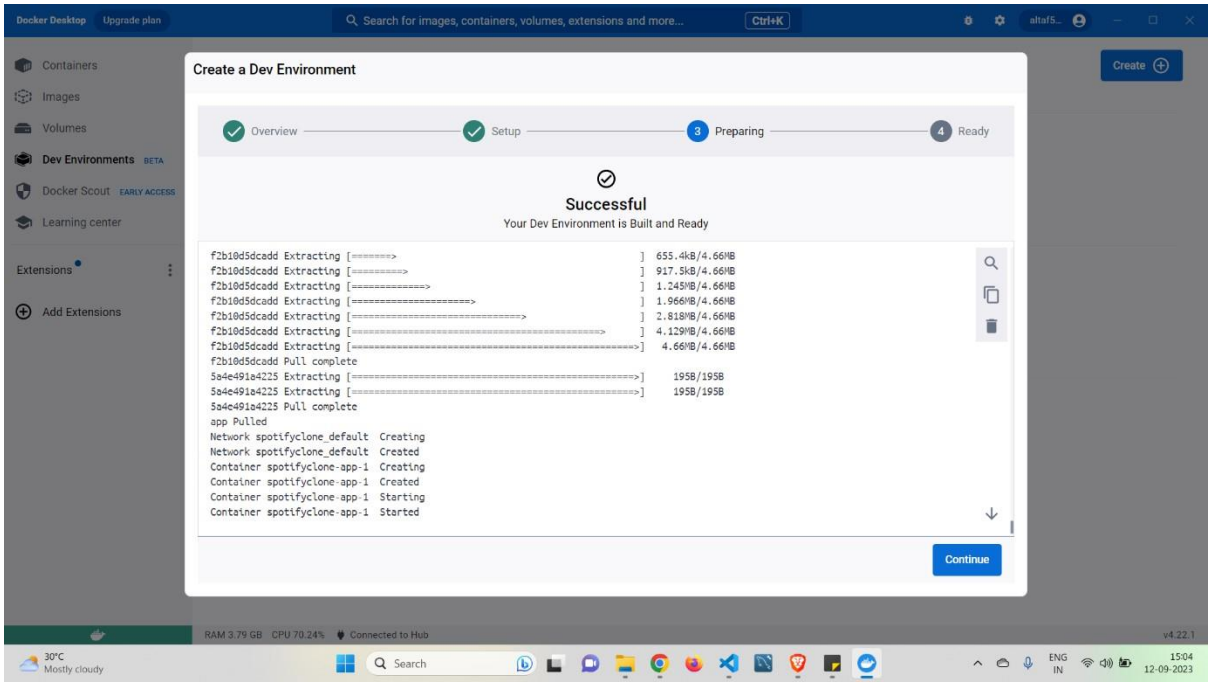

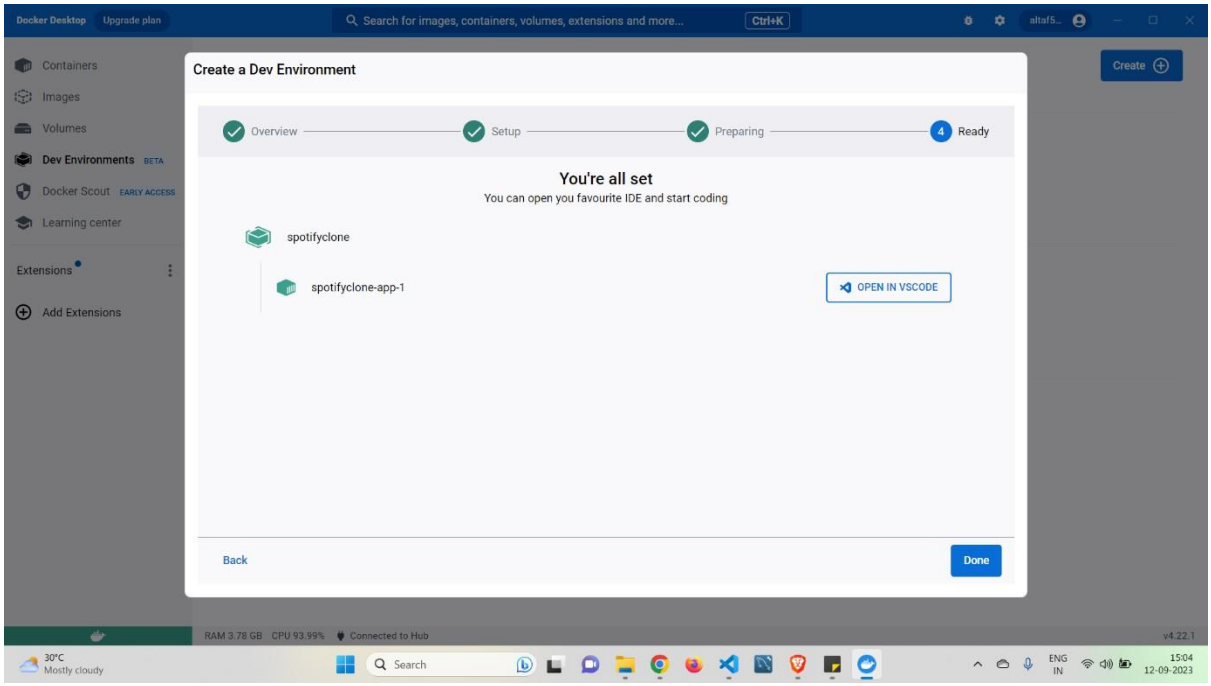

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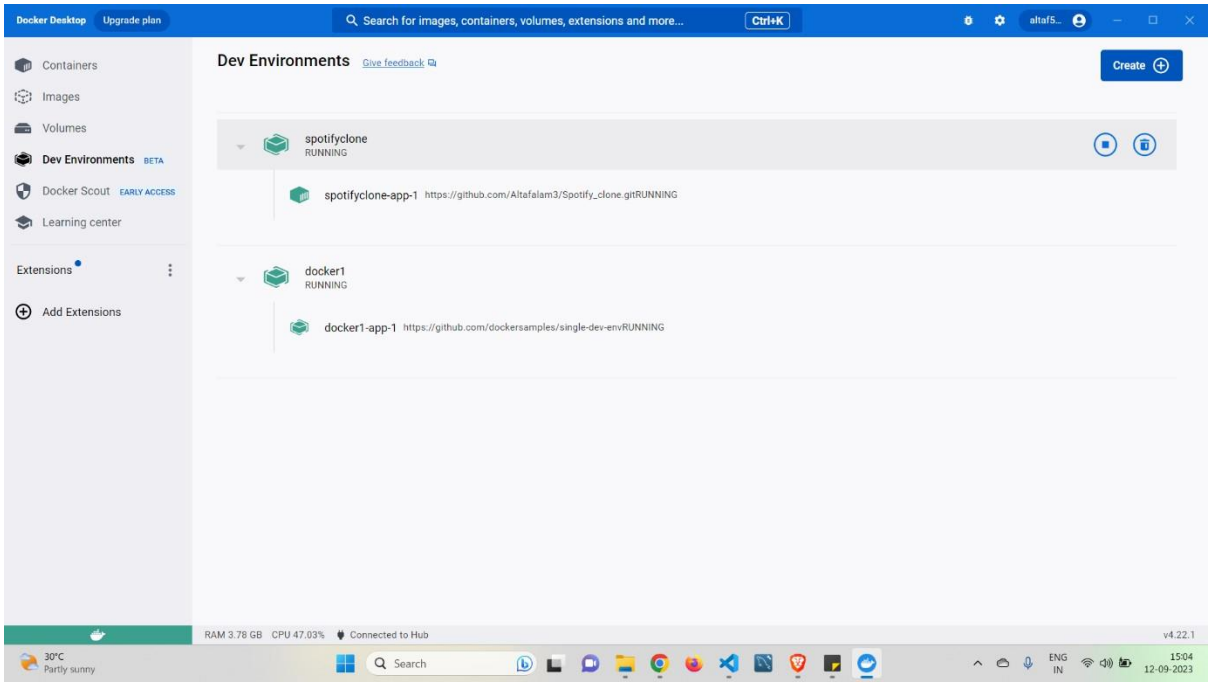

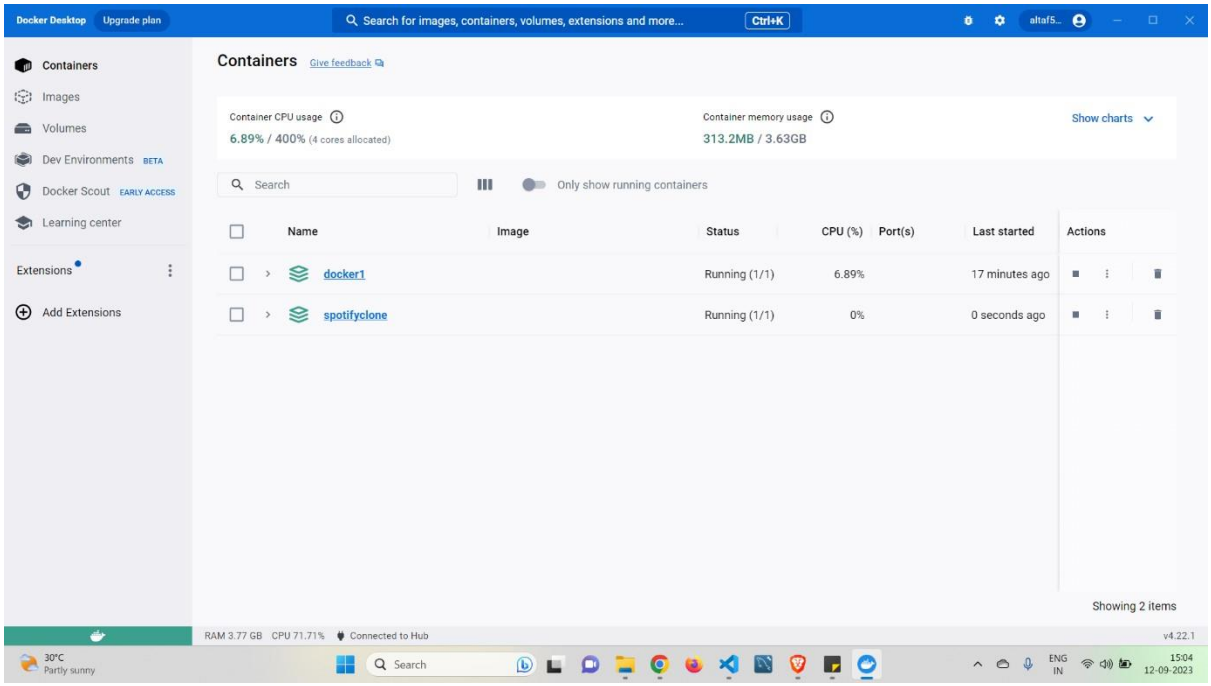

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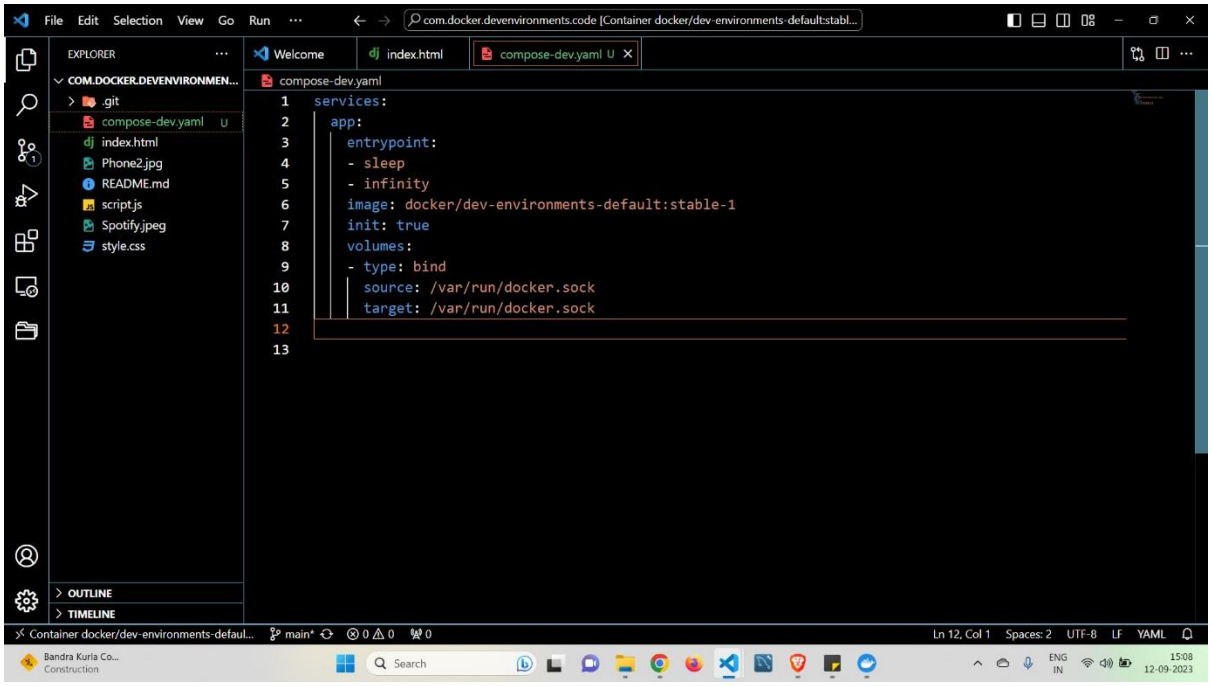

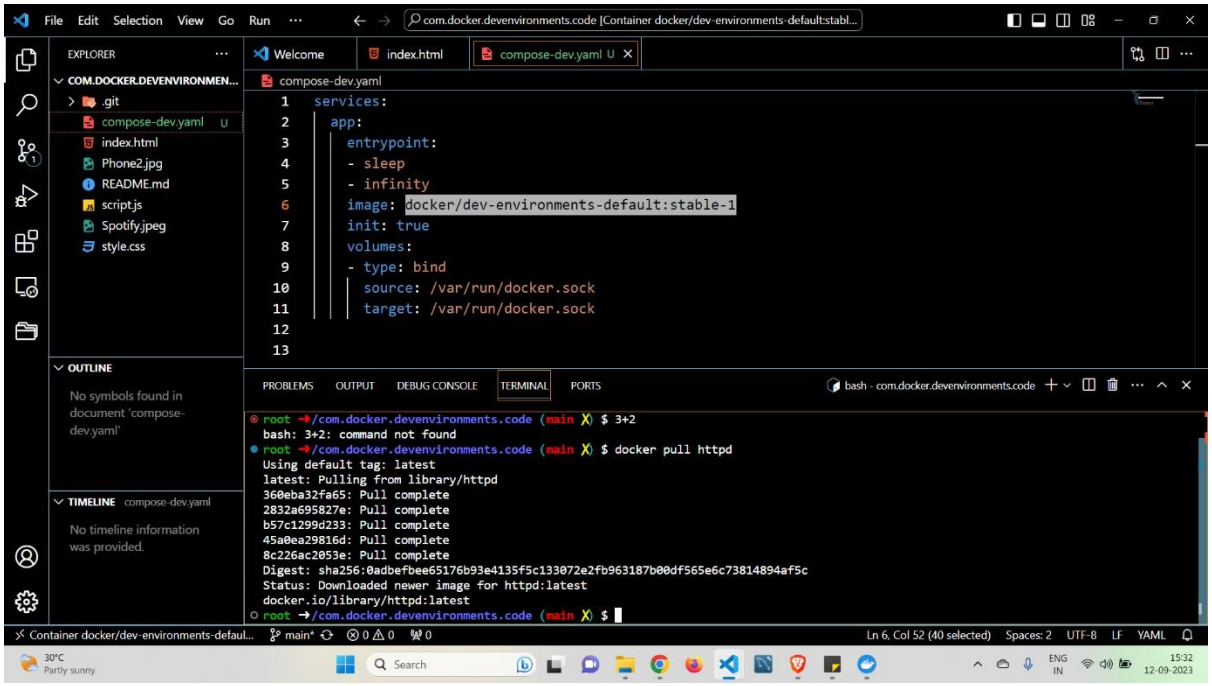

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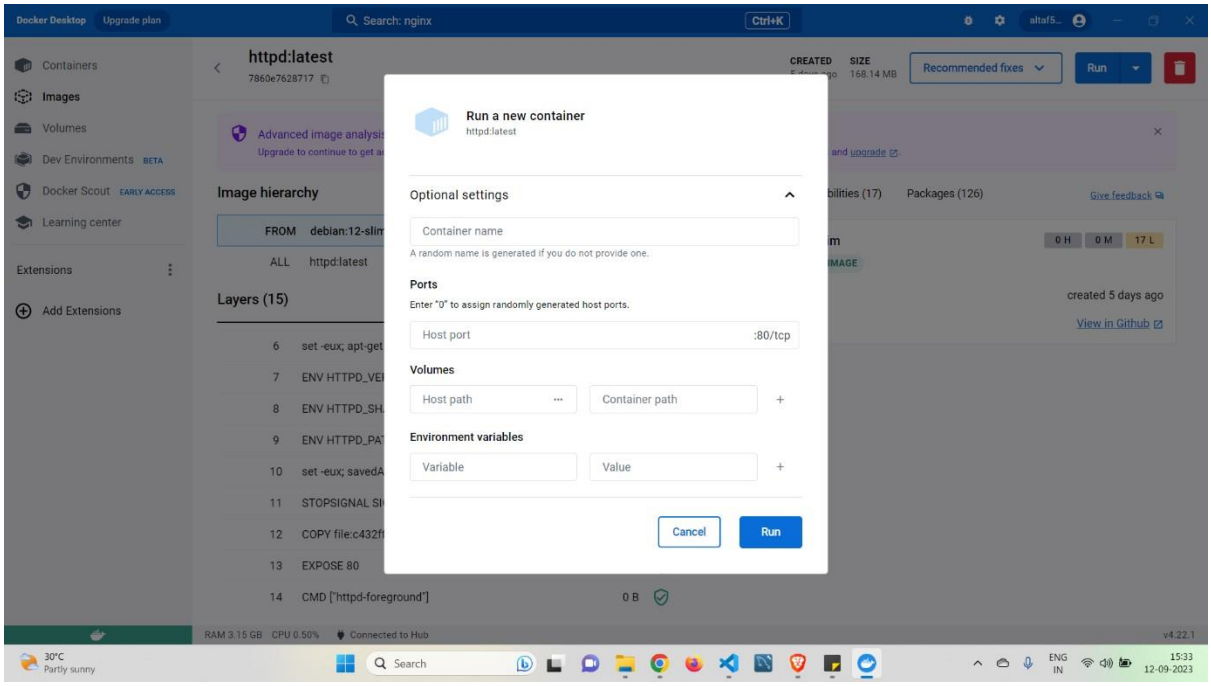

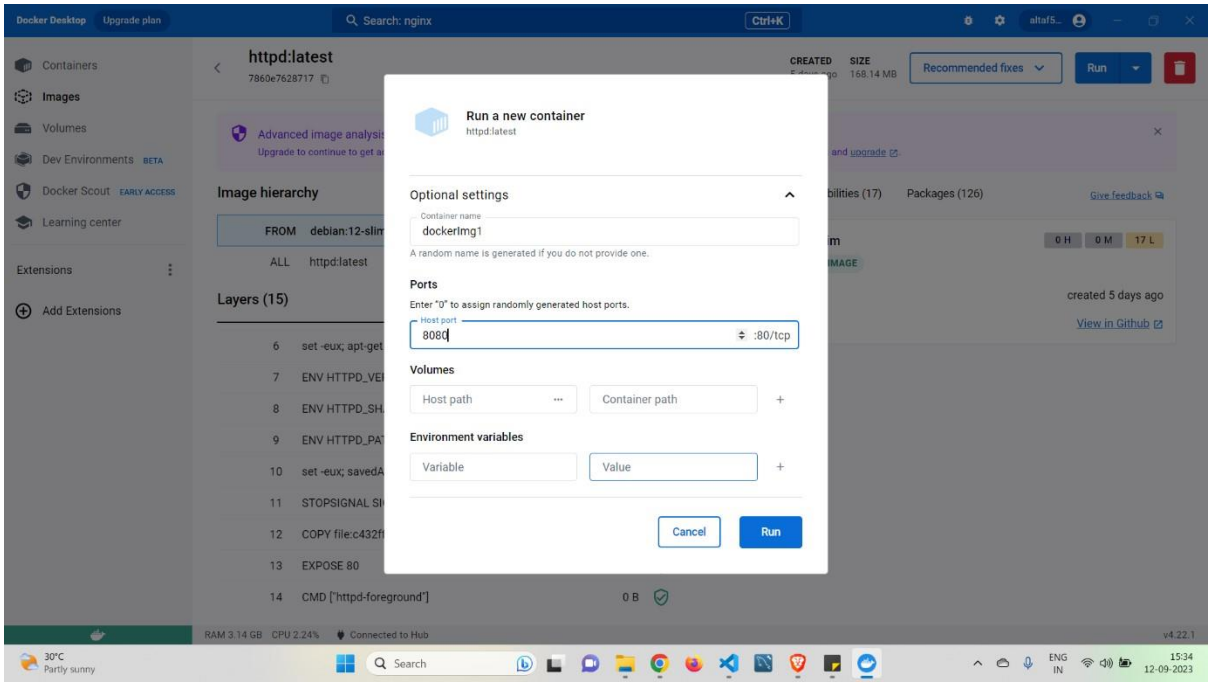

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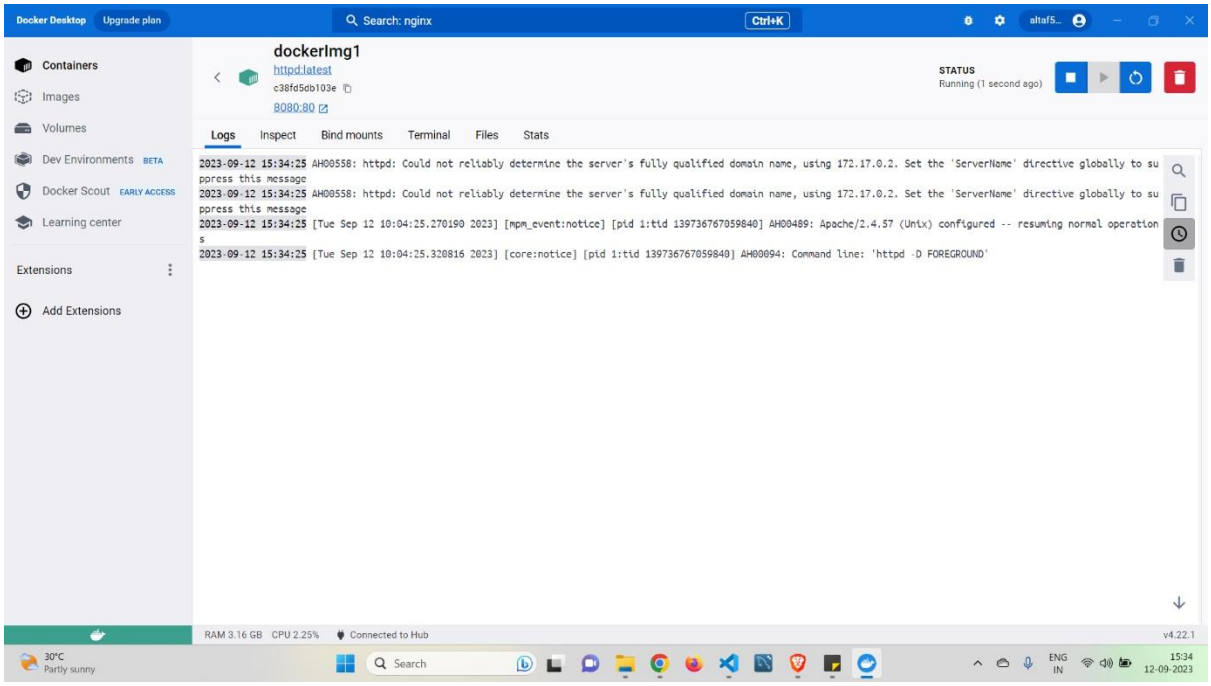

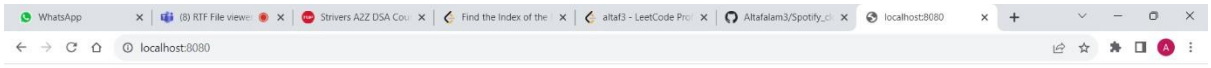

It works!

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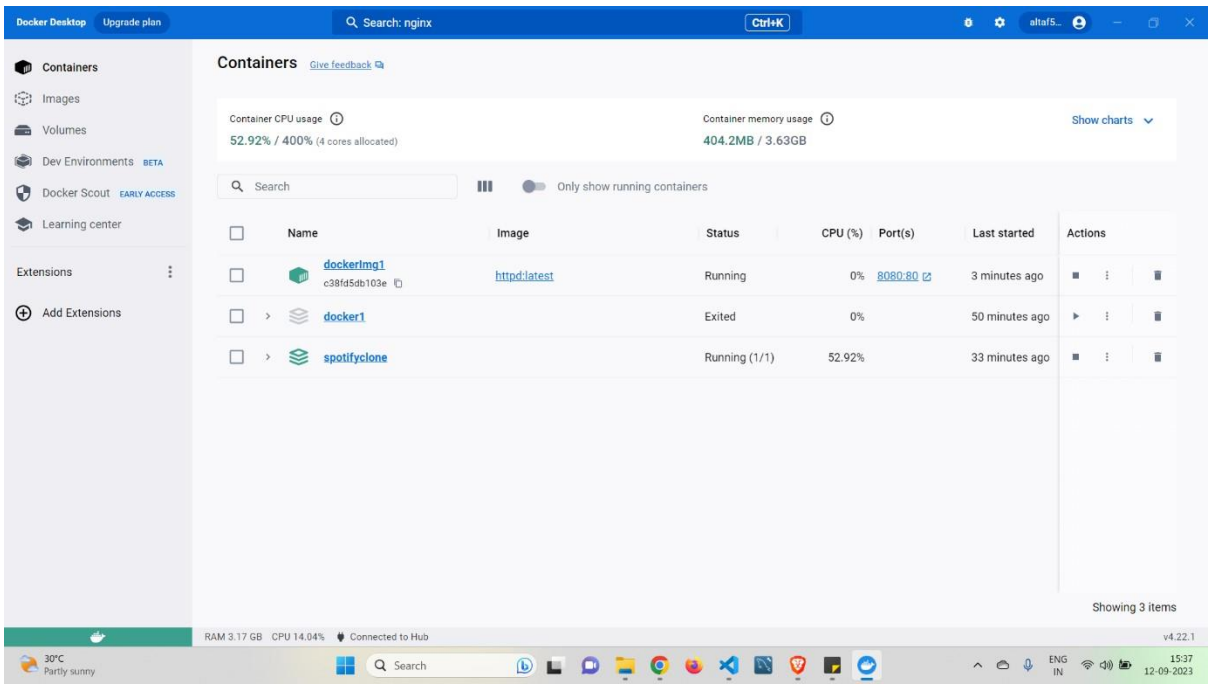

Conclusion :

In conclusion, deploying a static web application on Docker is a straightforward yet powerful way to leverage containerization for web development. Docker simplifies the process of packaging and deploying your application, providing the benefits of portability, isolation, scalability, and resource efficiency. With Docker, you can streamline the deployment of static web applications and ensure a consistent experience across different environments.

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Experiment No 9

Aim : Installation of nagios on ubuntu system.

Lab Outcome :

LO1: To understand the fundamentals of DevOps engineering and be fully proficient with DevOps terminologies, concepts, benefits, and deployment options to meet your busines requirements.

LO5 : To understand concept of containerization and analyze the containerization of os images and deployment of applications over docker.

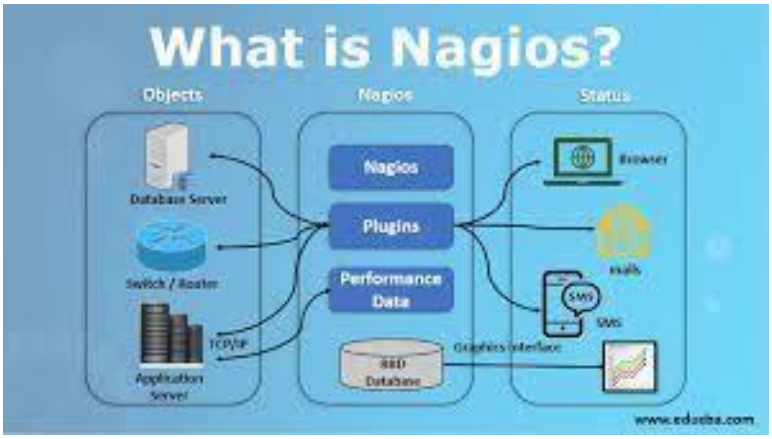
Theory :

What is Nagios?

Nagios is an open source IT system monitoring tool. It was designed to run on the Linux operating system and can monitor devices running Linux, Windows and Unix OSes.

Nagios software runs periodic checks on critical parameters of application, network and server resources. For example, Nagios can monitor memory use, disk use and microprocessor load, as well as the number of currently running processes and log files. Nagios also can monitor services such as Simple Mail Transfer Protocol (SMTP), Post Office Protocol 3, Hypertext Transfer Protocol (HTTP) and other common network protocols. Nagios initiates active checks, while passive checks come from external applications connected to the monitoring tool.

Originally released in 1999 as NetSaint, Nagios was developed by Ethan Galstad and subsequently refined by numerous contributors as an open source project. Nagios Enterprises, a company based around the Nagios Core technology, offers multiple products, such as Nagios XI, Log Server, Network Analyzer and Fusion.



How Nagios works

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Users can choose to work in the command-line interface or select a web-based graphical user interface in some versions of Nagios and from third parties. Nagios' dashboard provides an overview of the critical parameters monitored on assets.

Based on the parameters and thresholds defined, Nagios can send out alerts if critical levels are reached. These notifications can be sent through email and text messages. An authorization system enables administrators to restrict access.

Nagios runs both agent-based and agentless configurations. Independent agents are installed on any hardware or software system to collect data that is then reported back to the management server. Agentless monitoring uses existing protocols to emulate an agent. Both approaches can monitor file system use, OS metrics, service and process states. Examples of Nagios agents include Nagios Remote Data Processor (NRDP), Nagios Cross Platform Agent and NSClient++.

Nagios plugins

Nagios can also run remote scripts and plugins using the Nagios Remote Plugin Executor (NRPE) agent. NRPE enables remote monitoring of system metrics such as system load, memory and disk use. It consists of the check_nrpe plugin, which is stored on the local monitoring machine, and NRDP, which runs on the remote machine. Nagios uses a plugin to consolidate data from the NRPE agent before it goes to the management server for processing. NRPE can also communicate with Windows agents to monitor Windows machines.

Nagios supports plugins that are stand-alone add-ons and extensions so users can define targets and which target parameters to monitor. Nagios plugins process command-line arguments and communicate commands with Nagios Core.

There are around 50 plugins developed and maintained by Nagios, while there are over 3,000 from the community. These plugins are categorized into lists including hardware, software, cloud, OSes, security, log files and network connections. As an example, when used in conjunction with environmental-sensing systems, a Nagios plugin can share data on environmental variables, such as temperature, humidity or barometric pressure.

Nagios tools

Nagios has proven popular among small and large businesses, as well as internet service providers, educational institutions, government agencies, healthcare institutions, manufacturing companies and financial institutions.

Users can choose among free and paid options, depending on the needed services and support.

Nagios Core

The service that was originally known as Nagios is now referred to as Nagios Core. Core is freely available as an open source monitoring software for IT systems, networks and infrastructure. Core contains a wide array of infrastructure monitoring through allowing plugins to extend its monitoring capabilities. It is the base for paid Nagios monitoring systems.

Nagios Core has an optional web interface, which displays network status, notifications and log files. Core can notify its user when there are server or host issues. Additionally, Core can monitor network services such as SMTP, HTTP and Ping.

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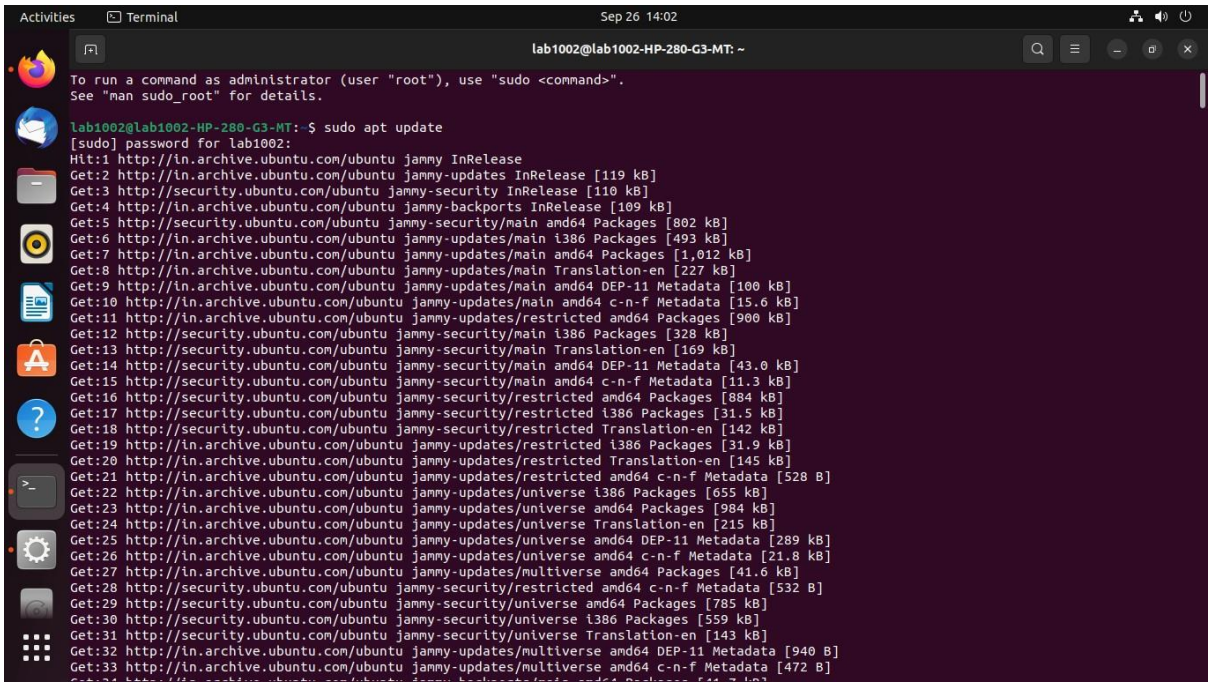
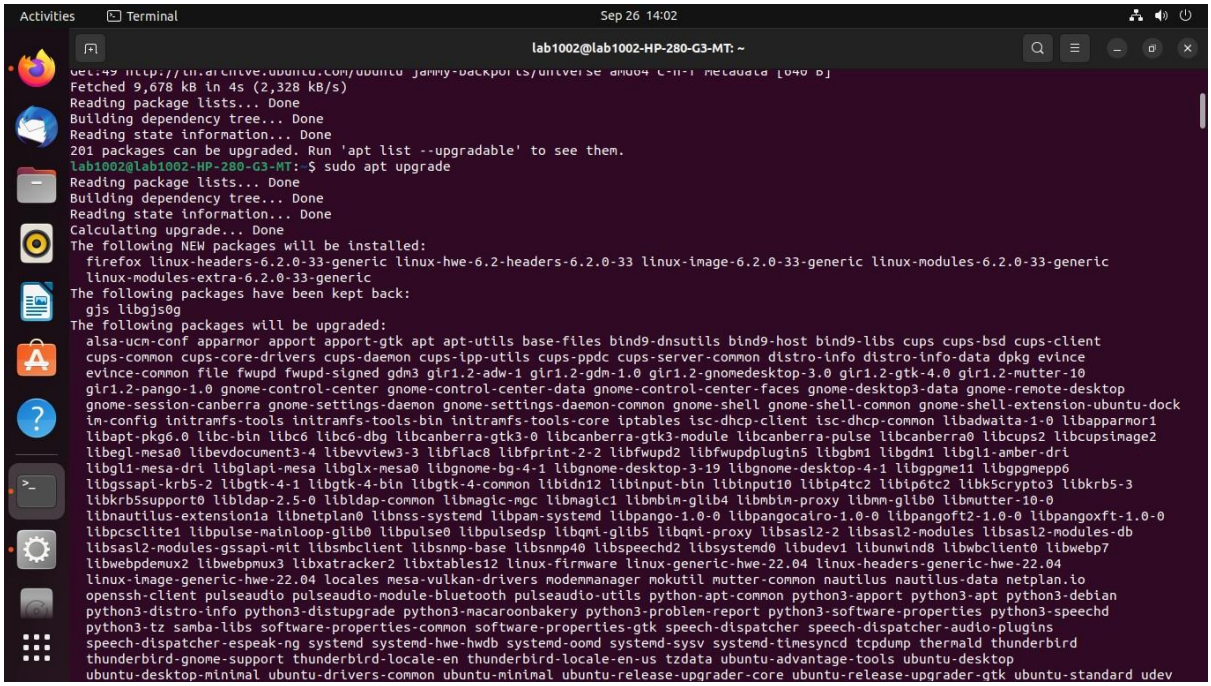
Installation in Ubuntu:





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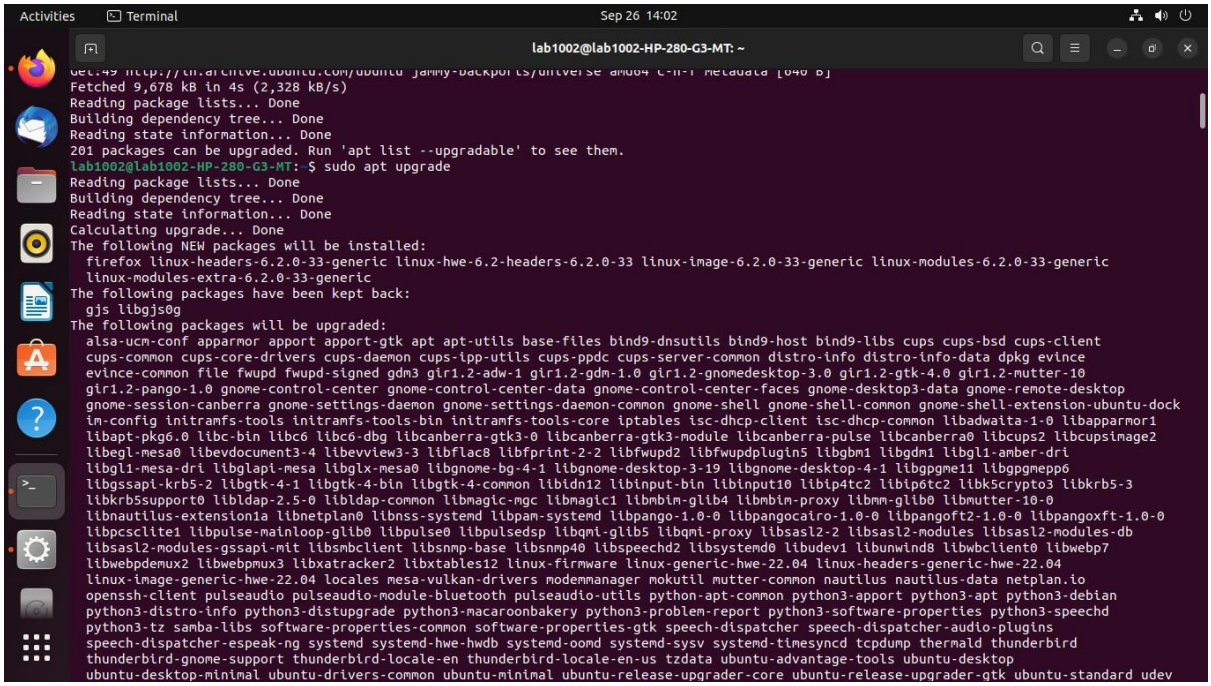

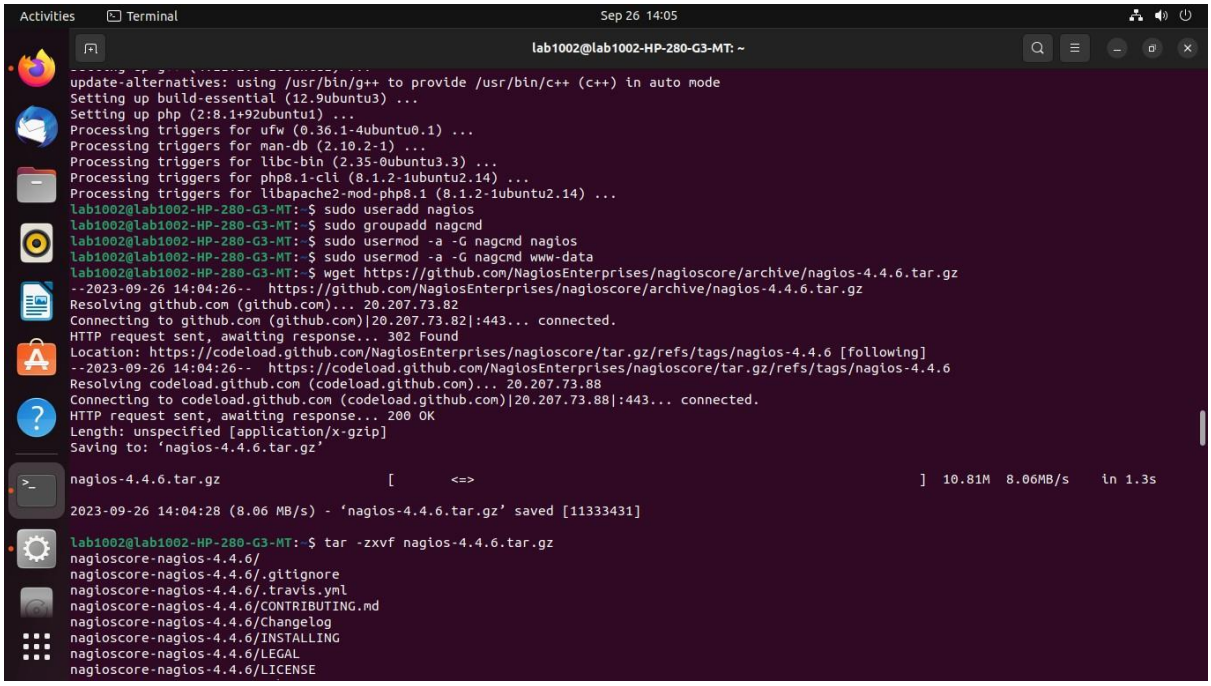

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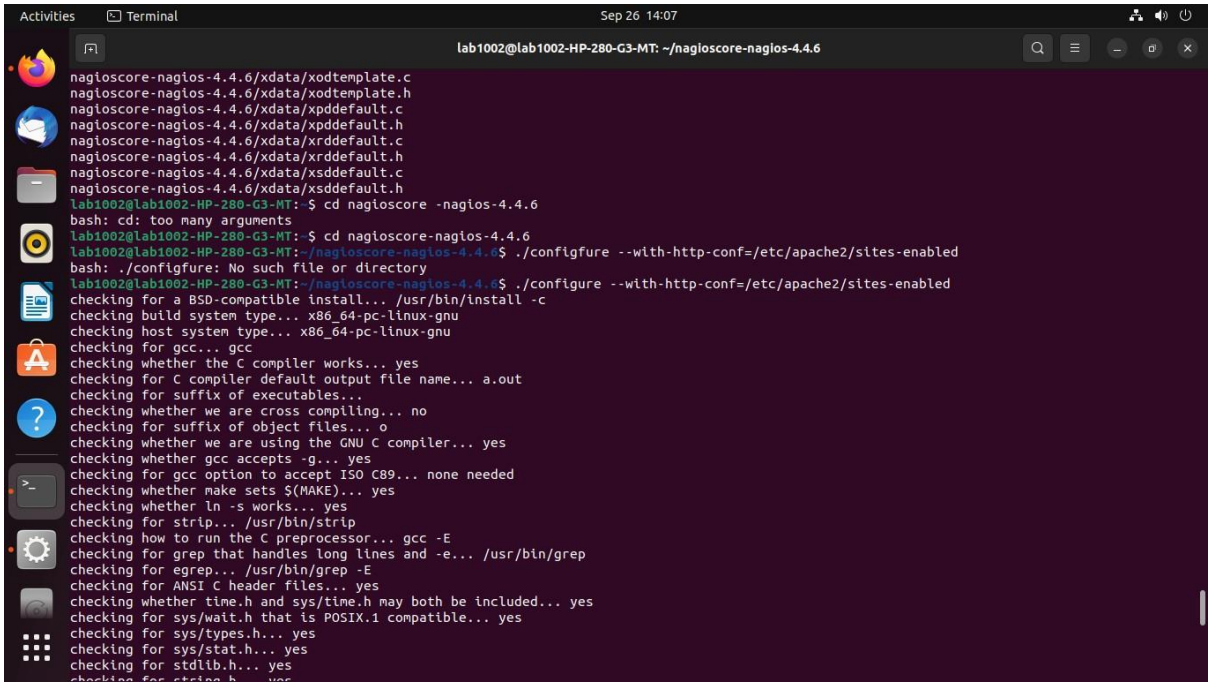

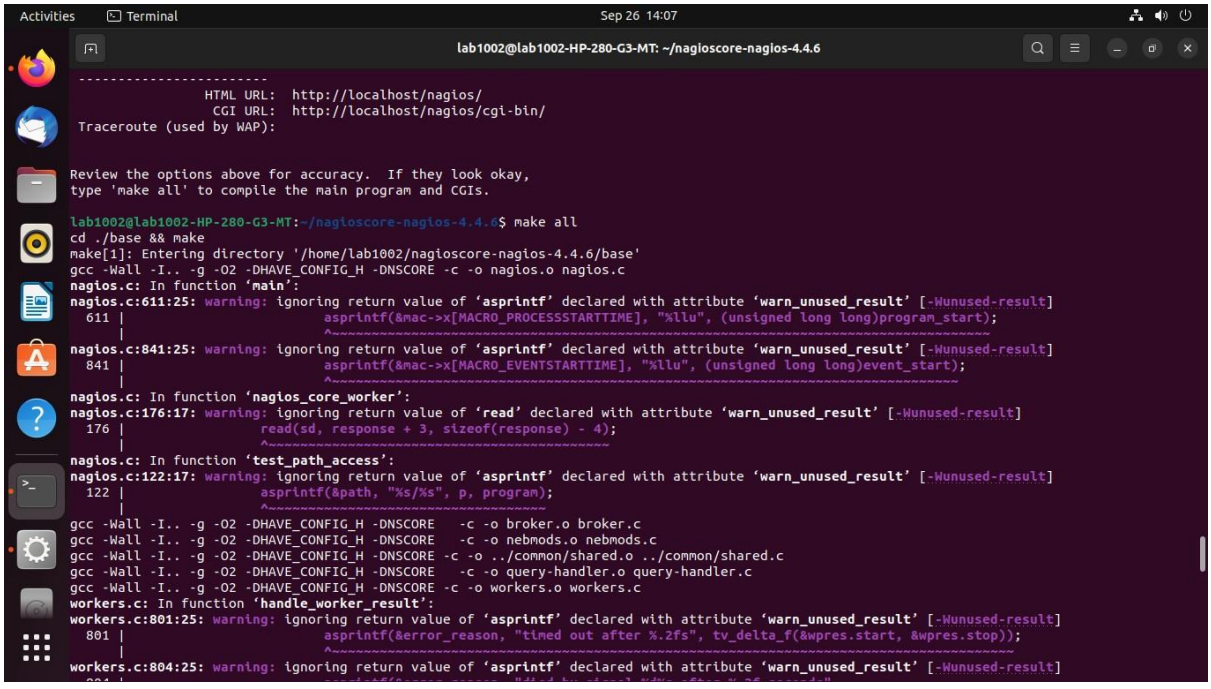

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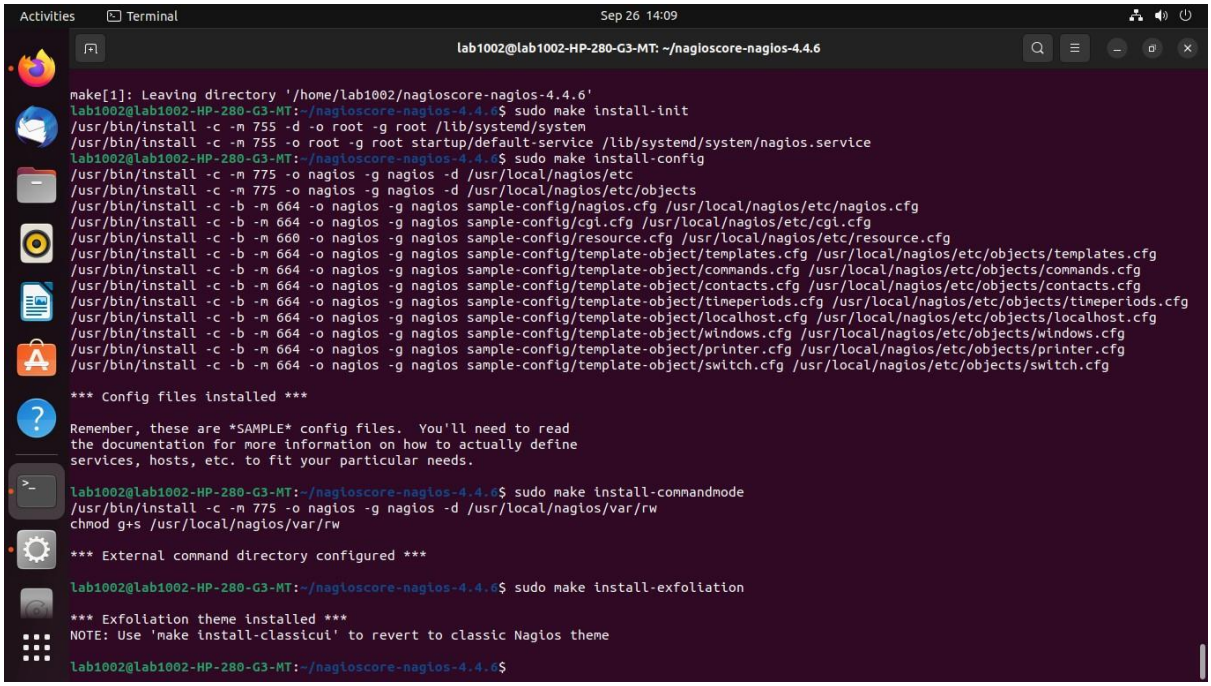

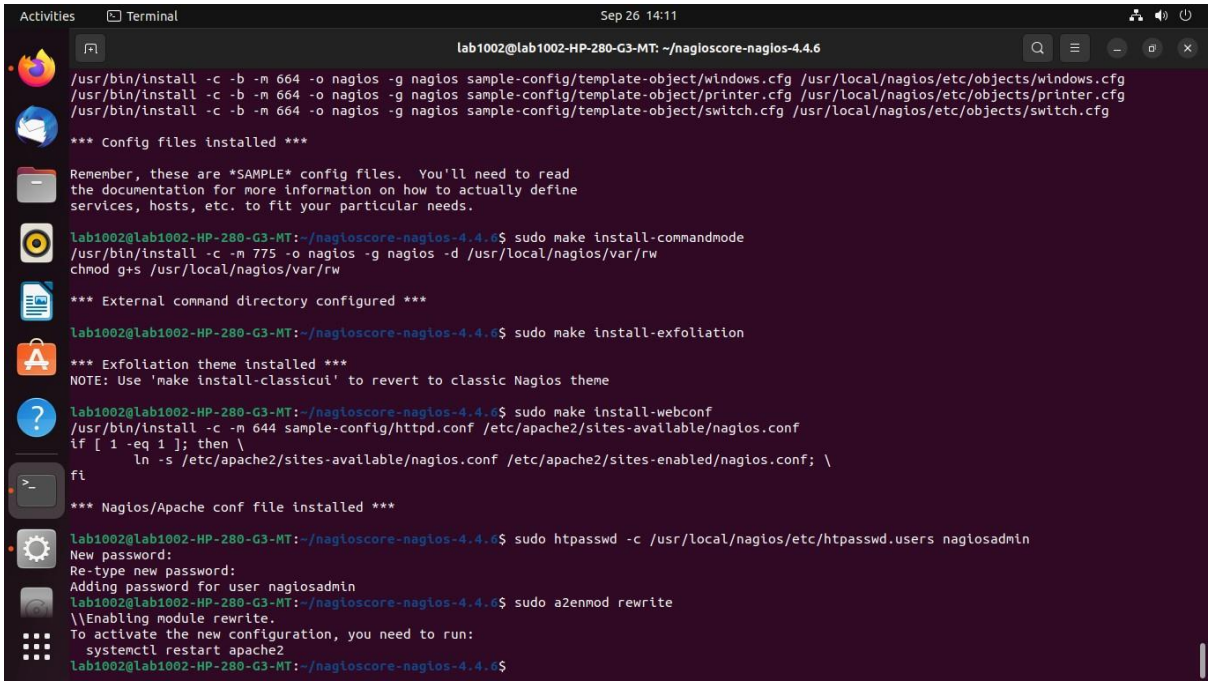

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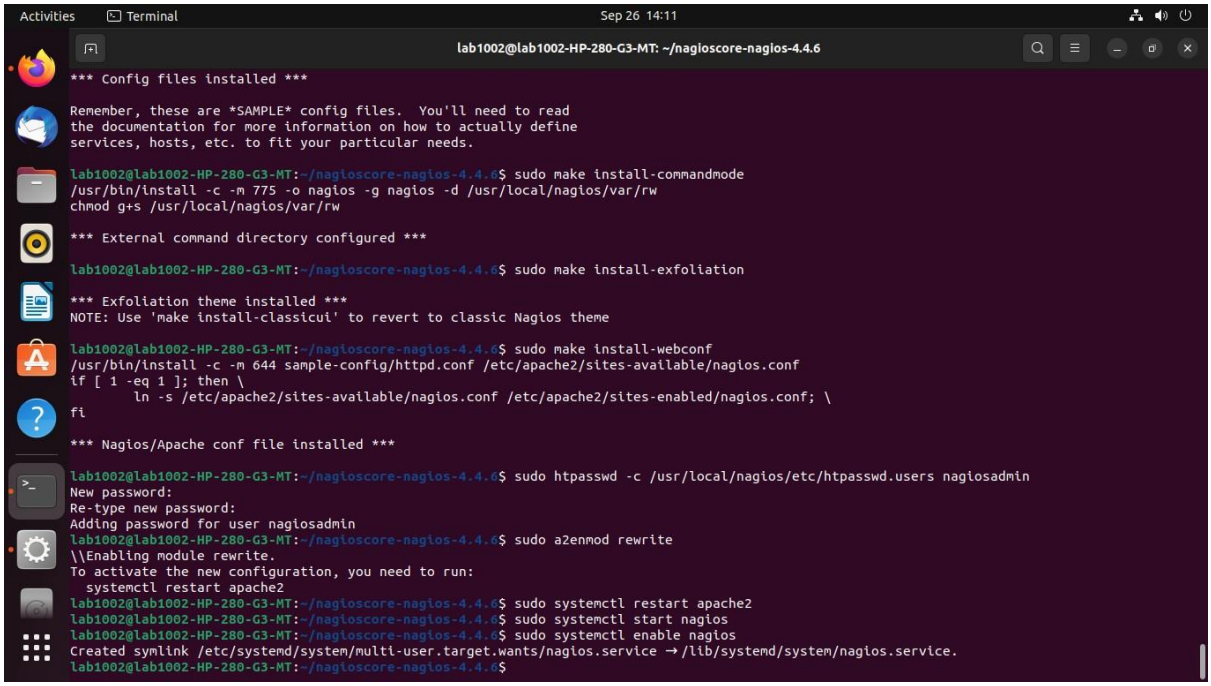

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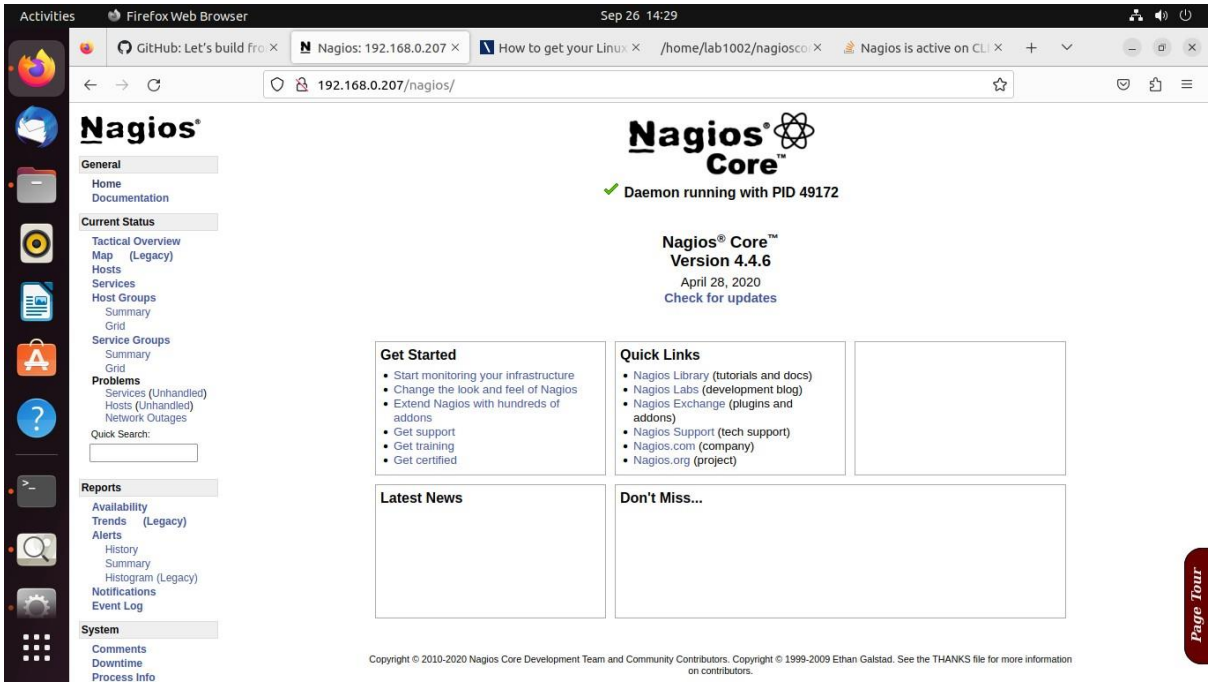

Conclusion :

Thus we have understood the steps of installation of nagios and installed the nagios on ubuntu system.

Name : Altaf Alam

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Experiment No 10

Aim : To study Puppet tools.

Lab Outcome :

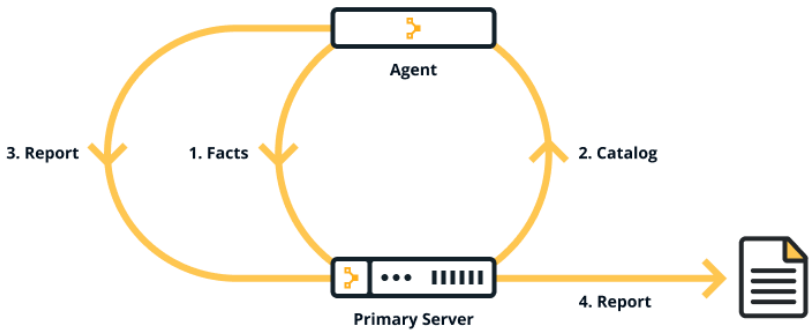
LO1: To understand the fundamentals of DevOps engineering and be fully proficient with DevOps terminologies, concepts, benefits, and deployment options to meet your busines requirements.

LO6 : To Synthesize software configuration and provisioning using Ansible.

Theory :

1) What is Puppet ?

Puppet is a powerful and widely-used configuration management and automation tool designed to simplify and streamline the management of IT infrastructure. It falls under the category of DevOps tools, which aim to bridge the gap between development and operations by automating infrastructure provisioning and configuration. Puppet allows you to define and enforce the desired state of your systems, making it easier to manage large-scale, heterogeneous IT environments efficiently.



2) What Puppet Can Do?

Puppet is a versatile tool that offers a wide range of capabilities, making it an essential component in the toolkit of DevOps and system administrators. Here are some key things Puppet can do:

1. Configuration Management

Puppet excels at configuration management. It enables you to define the desired configuration of your systems using code, called Puppet manifests. These manifests describe how each component of your infrastructure should be configured, ensuring consistency across your environment.

2. Automation

Puppet automates repetitive tasks and workflows. You can use Puppet to deploy applications, manage users and permissions, configure network settings, and perform other routine operations. This automation reduces the risk of human error and frees up valuable time for IT teams.

3. Infrastructure as Code (IaC)

Puppet treats infrastructure as code, allowing you to define, version, and manage your infrastructure using code files. This approach promotes collaboration, code reuse, and version control, similar to software development practices.

4. Scalability

Puppet is designed to handle large and complex infrastructures. Whether you manage a handful of servers or thousands of nodes, Puppet's scalability ensures that you can maintain consistent configurations and apply changes across your entire environment with ease.

5. Cross-Platform Support

Puppet supports various operating systems and platforms, making it suitable for heterogeneous environments. You can manage Linux, Windows, macOS, and other systems using a single Puppet codebase.

6. Reporting and Monitoring

Puppet provides reporting and monitoring features to track the status and compliance of your infrastructure. You can gain insights into configuration changes, troubleshoot issues, and ensure that your systems remain in the desired state.

7. Extensibility

Puppet's ecosystem includes a vast library of pre-built modules and a flexible plugin system. This extensibility allows you to customize Puppet to meet your specific needs and integrate it with other tools in your DevOps toolchain.

3) How Puppet Works?

Puppet is based on a Pull deployment model, where the agent nodes check in regularly after every **1800** seconds with the master node to see if anything needs to be updated in the agent. If anything needs to be updated the agent pulls the necessary puppet codes from the master and performs required actions.

Example: Master – Agent Setup:

The Master:

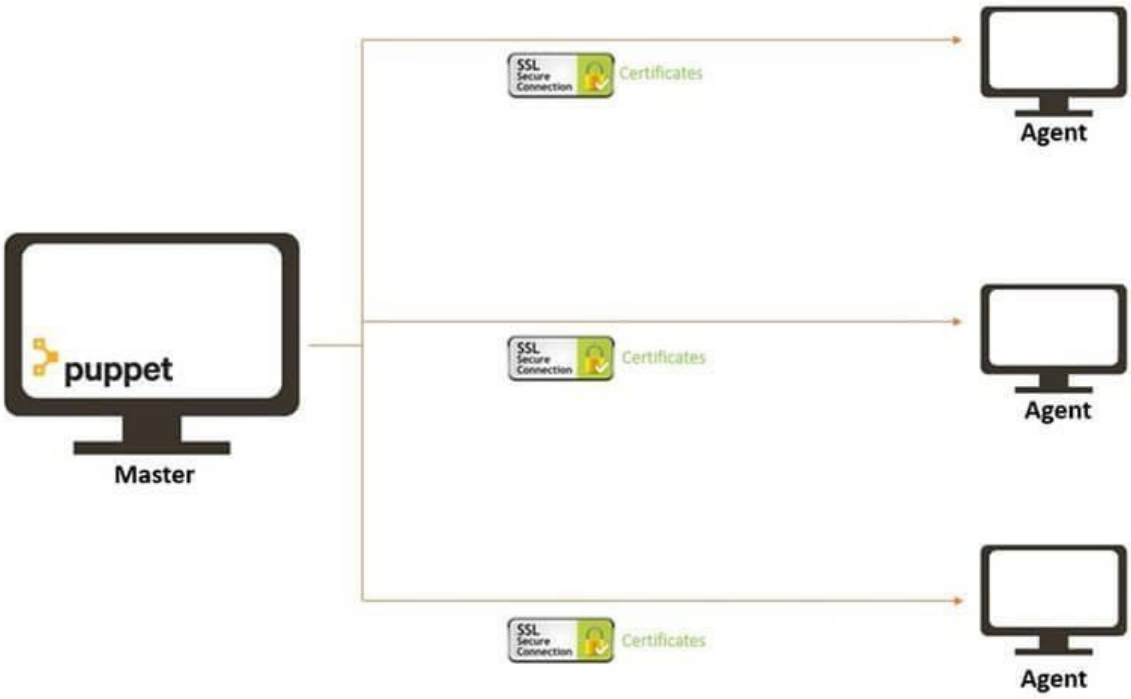
A Linux based machine with Puppet master software installed on it. It is responsible for maintaining configurations in the form of puppet codes. The master node can only be Linux.

The Agents:

The target machines managed by a puppet with the puppet agent software installed on them.

The agent can be configured on any supported operating system such as Linux or Windows or Solaris or Mac OS.

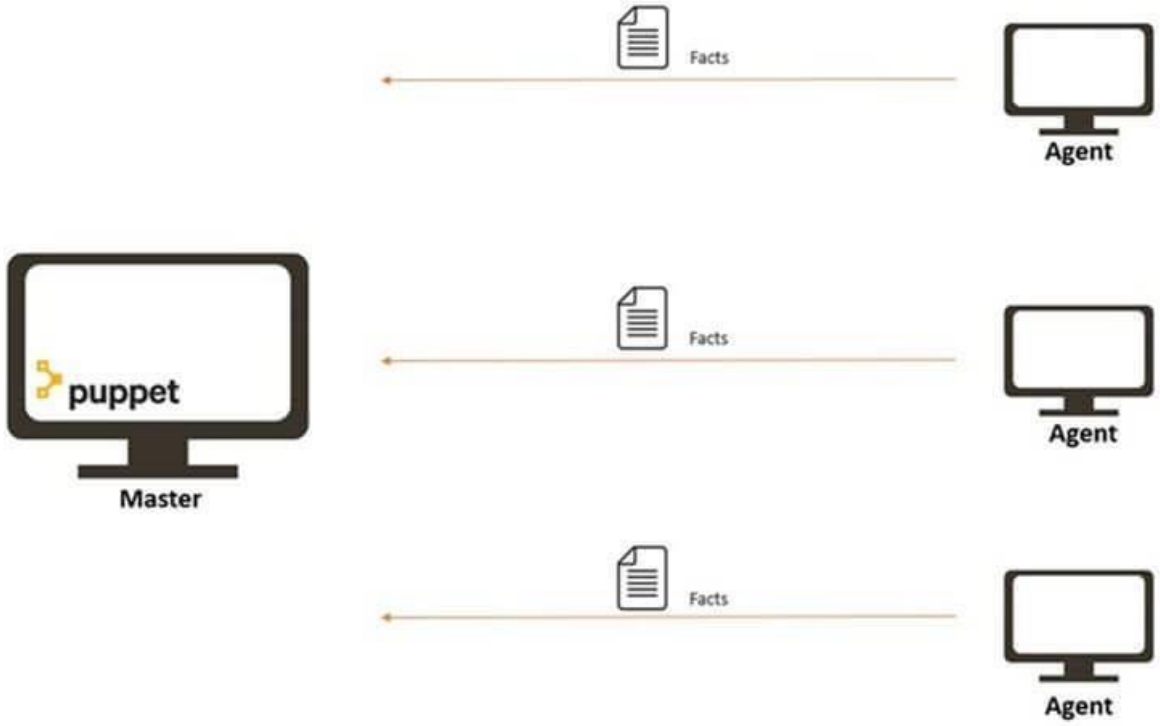
The communication between master and agent is established through secure certificates.



Puppet Master Agent Communication

Communication between the Master and the Agent:

Step 1) Once the connectivity is established between the agent and the master, the Puppet agent sends the data about its state to the Puppet master server. These are called Facts: This information includes the hostname, kernel details, IP address, file name details, etc.…



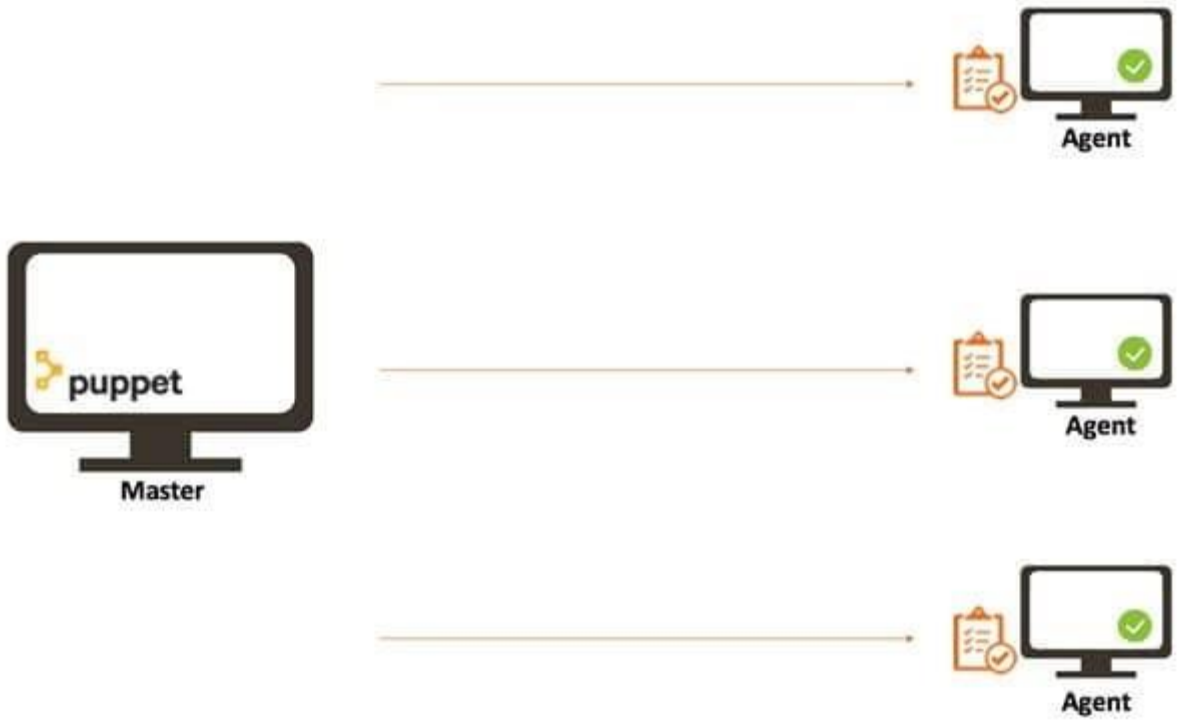
Agent Sends Facts to Master

Step 2) Puppet Master uses this data and compiles a list with the configuration to be applied to the agent. This list of configuration to be performed on an agent is known as a **catalog.** This could be changed such as package installation, upgrades or removals, File System creation, user creation or deletion, server reboot, IP configuration changes, etc.

Master sends a catalog to Agent

Step 3) The agent uses this list of configuration to apply any required configuration changes on the node.

In case there are no drifts in the configuration, Agent does not perform any configuration changes and leaves the node to run with the same configuration.



Agent applies configuration

Step 4) Once it is done the node reports back to puppet master indicating that the configuration has been applied and completed.

4) Puppet Blocks: Puppet Resources, Puppet Classes, Puppet Manifests, Puppet Modules

To understand how Puppet is organized and how it manages configuration, it's essential to grasp its fundamental building blocks:

1. Puppet Resources

Puppet resources are the basic building blocks of configuration management. A resource represents a specific aspect of a system's configuration, such as a file, package, user, or service. Resources are defined in Puppet manifests and describe what the system should look like.

Example of defining a file resource:

```puppet file {
'/etc/nginx/nginx.conf':
ensure => present,
  owner   => 'root',
group    =>  'root',
mode   => '0644',
  source => 'puppet:///modules/nginx/nginx.conf',
}
```

In this example, we're defining a file resource that ensures the presence of the Nginx configuration file with specific ownership, permissions, and content source.

2. Puppet Classes

Puppet classes are used to group related resources and provide structure to your Puppet manifests. Classes make it easier to organize and manage configurations for specific roles or applications. They can be included in manifests to apply the associated configuration to nodes.

Example of defining and including a class:

```puppet class
nginx {
   Define resources related to Nginx here
}

node 'webserver.example.com' {
  include nginx
}
```

In this example, we've defined an "nginx" class and included it in a specific node's configuration.

3. Puppet Manifests

Puppet manifests are the code files that define your desired system configuration. Manifests contain a collection of resource definitions, classes, and node configurations. Puppet manifests are written in Puppet's declarative language.

Example of a simple Puppet manifest:

```puppet     file     {
'/etc/motd':    ensure
=> present,
  content => "Welcome to our server.\n",
```

```
}

package { 'nginx':
ensure => installed,
}
```

This manifest ensures the presence of a message of the day (motd) file and installs the Nginx package.

4. Puppet Modules

Puppet modules are reusable units of Puppet code that encapsulate configurations, resources, and classes for specific tasks or applications. Modules are stored in a directory structure and can be easily shared and reused across different Puppet environments.

Benefits of using Puppet modules:

- Reusability: Modules can be shared across teams and projects, reducing duplication of effort.
- Modularity: Modules promote organization and separation of concerns in your Puppet code. - Versioning: Modules can be versioned, making it easier to track changes and updates.
- Community Ecosystem: Puppet Forge hosts a vast collection of community-contributed Puppet modules for various purposes.

5) Benefits of Puppet as a DevOps Tool

Puppet offers several benefits as a DevOps tool, facilitating collaboration between development and operations teams and improving the overall management of IT infrastructure:

1. Consistency and Compliance

Puppet ensures that all systems in your environment adhere to a consistent and compliant configuration. This reduces the risk of configuration drift and security vulnerabilities.

2. Automation

Puppet automates repetitive tasks and workflows, allowing teams to focus on more strategic activities. This increases efficiency and reduces the potential for human error.

3. Scalability

Puppet scales effortlessly, making it suitable for managing both small and large infrastructures. As

your environment grows, Puppet can accommodate your needs.

4. Infrastructure as Code (IaC)

By treating infrastructure as code, Puppet promotes collaboration, version control, and best practices similar to software development. This aligns with the DevOps philosophy of automating and codifying processes.

5. Reporting and Monitoring

Puppet provides reporting and monitoring capabilities, giving you visibility into your infrastructure's state and helping you identify and resolve issues proactively.

6. Cross-Platform Support

Puppet supports a wide range of operating systems and platforms, simplifying the management of heterogeneous environments.

7. Ecosystem and Community

Puppet has a thriving community and ecosystem, with numerous pre-built modules and resources available on Puppet Forge. This accelerates development and configuration efforts.

6) What are Puppet Manifest Files?

Puppet manifest files are the core configuration files in Puppet. They define the desired state of your systems by declaring resources and their properties. Manifests are written in Puppet's declarative language and are used to manage and configure resources on target nodes.

A Puppet manifest typically has a `.pp` file extension and contains resource definitions, class declarations, and node configurations.

7) Syntax of a Manifest File

The syntax of a Puppet manifest file is designed to be human-readable and easy to understand. Here's a basic structure of a Puppet manifest:

```puppet
 Comments start with a " symbol

 Resource definition
resource_type { 'resource_name':
property1 => value1,   property2
=> value2,
   ...
}
```

Class declaration class
class_name { Class
content here
}

Node configuration node
'node_name' {
Manifest content specific to the node
}
```
Key components of the syntax include:

- Resource Definition: Resources are defined with a type (e.g., `file`, `package`) and a name. Properties and values configure the resource.

- Class Declaration: Classes are declared using the `class` keyword and contain configurations specific to a role or application.

- Node Configuration: Node configurations specify which nodes should apply particular manifests or classes.

## 7) Why Do We Need Puppet Manifest Files?

Puppet manifest files serve several crucial purposes:

1. Configuration as Code: Manifests allow you to describe your infrastructure's desired state in code, making configurations easily reproducible and version-controlled.

2. Automation: Manifests automate the process of configuring and maintaining your systems. Puppet agents apply configurations based on manifest definitions.

3. Consistency: Manifests ensure that all nodes within your environment adhere to the same configuration, reducing configuration drift and errors.

4. Modularity: By organizing configurations into manifests, classes, and modules, you can maintain a modular and organized Puppet codebase, promoting reusability.

## 7) Writing a Basic Manifest File with Examples

Let's create a simple Puppet manifest to illustrate its structure and usage. In this example, we'll ensure the presence of an SSH configuration file and install the Apache web server.

```puppet
Puppet manifest to manage SSH configuration and install Apache

Resource definition for SSH configuration
file { '/etc/ssh/sshd_config': ensure =>
```
```

```
present, owner => 'root', group =>
'root', mode => '0644',
 content => template('my_module/sshd_config.erb'),
}

 Resource definition to install Apache package
package { 'apache2': ensure => installed,
}
 Node configuration for a specific node
node 'webserver.example.com' {
Include the Apache class for this node
include apache
}
```

Here:

- We define a `file` resource to ensure the presence of the SSH configuration file with specific ownership, permissions, and content sourced from a template.

- We define a `package` resource to ensure that the Apache (`apache2`) package is installed on the node.

- We specify a node configuration for a specific node ('webserver.example.com') and include the 'apache' class, which we can define elsewhere in our Puppet codebase.

This basic Puppet manifest demonstrates how to manage configuration files and packages on a node. Puppet will ensure that the SSH configuration and Apache package are in the desired state for the specified node.

Conclusion :

Puppet is a robust DevOps tool that automates and manages your computer systems using special instructions called "manifests." These manifests, acting like a blueprint for your infrastructure, ensure your systems run smoothly and consistently, making Puppet an indispensable solution for system configuration and maintenance.

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Roll no : 02 , Batch : T11 , Subject : DevOps Lab , Date : 12/10/23

Written Assignment 1

1. What is test automation or automation testing? What are the advantages of automation testing?

In the realm of software development and quality assurance, test automation, or automation testing, plays a pivotal role in ensuring the reliability and effectiveness of software applications. This process involves the use of specialized software tools and scripts to automate the execution of test cases, thereby reducing manual effort and improving the overall efficiency of the testing process.

Test automation, simply put, is the use of automation tools and frameworks to perform testing tasks, which are otherwise done manually. These testing tasks include the execution of test cases, regression testing, performance testing, load testing, and many more. The fundamental idea behind automation testing is to minimize human intervention while running repetitive and time-consuming tests. Automation can be applied at various levels of software testing, including unit testing, integration testing, functional testing, and user interface testing.

Automation testing offers a multitude of advantages that make it an indispensable part of the software development and quality assurance process. Below are some of the key benefits:

1. Improved Efficiency:
   - Automation allows for the quick and efficient execution of test cases, which significantly reduces the time and effort required for testing.
   - Test scripts can run tests simultaneously on multiple platforms, browsers, or devices, increasing coverage and speeding up the testing process.

2. Consistency:
   - Automated tests are consistent in their execution, ensuring that the same set of test cases is executed with precision every time.
   - This consistency is especially valuable in regression testing, where it is crucial to verify that recent code changes have not introduced new defects.

3. Reusability:
   - Test scripts can be reused across different test phases, saving time and effort in creating new test cases.
   - Reusable test scripts allow for comprehensive test coverage throughout the software development lifecycle.

4. Faster Feedback:

4. Faster Feedback:

- Automation testing provides rapid feedback to developers, allowing them to identify and rectify issues early in the development process.
- Early bug detection results in reduced debugging and maintenance costs.

5. Increased Test Coverage:

- Automation can execute a large number of test cases in a short time, leading to more comprehensive test coverage.
- This ensures that a wide range of scenarios and edge cases are tested, reducing the likelihood of undiscovered defects in the final product.

6. Regression Testing:

- Automation is highly beneficial for regression testing, as it allows for the repeated execution of test cases after code changes to verify that new features or modifications have not adversely impacted existing functionality.

7. Data-Driven Testing:

- Automation supports data-driven testing, where the same test script is executed with different sets of test data, enhancing the versatility and scalability of test cases.

8. Performance Testing:

- Automation can simulate a large number of virtual users to conduct performance and load testing, providing insights into how an application behaves under various conditions.

9. Cost-Effective:

- While setting up automation initially requires an investment of time and resources, it ultimately leads to cost savings by reducing the need for manual testing efforts.

10. Continuous Integration and Continuous Delivery (CI/CD):

- Automation seamlessly integrates with CI/CD pipelines, allowing for the automatic execution of tests with every code commit, ensuring that only high-quality code is deployed.

11. Enhanced Reporting:

- Automation testing tools often provide detailed test reports, logs, and dashboards, which facilitate comprehensive test result analysis and debugging.

12. Scalability:

- As the size and complexity of software projects increase, automation can easily scale to accommodate the growing number of test cases and variations.

- Automation testing tools often provide detailed test reports, logs, and dashboards, which facilitate comprehensive test result analysis and debugging.

12. Scalability:

- As the size and complexity of software projects increase, automation can easily scale to accommodate the growing number of test cases and variations.

13. Documentation:
- Automated test scripts serve as documentation for test cases, making it easier for team members to understand and maintain test procedures.

14. Reduced Human Error:
- Automation eliminates the risk of human error in test case execution, which can be especially crucial in scenarios where precision is paramount.

15. Parallel Testing:
- Automation allows the execution of test cases in parallel, which can significantly reduce testing time, especially for complex applications.

Challenges and Considerations:
While automation testing offers numerous advantages, it also comes with challenges and considerations. Some of these include:

- Initial Setup: Setting up automation frameworks and writing test scripts can be time-consuming, especially for complex applications.

- Maintenance: Test scripts require regular maintenance to adapt to changes in the application's functionality. This can be an ongoing effort.

- Skill Requirements: Automation testing requires testers to have scripting and programming skills, which may not be possessed by all team members.

- Costs: Initially, automation can incur costs in terms of tool licensing, infrastructure, and personnel training.

- Not Suitable for Everything: Not all testing scenarios are suitable for automation, such as usability testing, exploratory testing, or tests that require human judgment.

- Test Data Management: Managing test data for automation can be complex, and ensuring the privacy and security of sensitive data is critical.

In conclusion, automation testing is a critical component of modern software development and quality assurance processes. Its numerous advantages, including improved efficiency, consistency, reusability, and cost-effectiveness, make it an essential tool for ensuring the

reliability and quality of software applications. However, it is essential to approach automation with a well-defined strategy, considering the specific needs and challenges of the project, to harness its full potential and maximize the return on investment.

2. What is XPath? Explain the difference between single slash and double slash in XPath.

XPath is a language used for navigating XML documents and is often employed in web scraping, XML processing, and, notably, in locating elements within an HTML document for web automation testing.

XPath Basics:
XPath uses a path-like syntax to pinpoint elements within an XML or HTML document. It consists of a series of location steps separated by slashes ("/"). Each step helps to traverse the document's structure, identifying elements or nodes.

Single Slash ("/"):
When you use a single slash in XPath, it denotes an absolute path. It starts its search from the root node of the document and identifies elements based on the provided criteria. For example, the XPath expression `/html/body/div` will locate the `div` element that is a direct child of the `body` element, which, in turn, is a direct child of the `html` root element.

Double Slash ("//"):
Conversely, a double slash in XPath indicates a relative or partial path. It conducts a search throughout the entire document, not just from the root node. This makes it more flexible for locating elements in a nested structure or finding elements anywhere in the document. For instance, the XPath expression `//div` will locate all `div` elements, regardless of their nesting or hierarchy.

In summary, XPath is a powerful tool for navigating XML and HTML documents, and it employs both single and double slashes to define paths for locating elements. A single slash signifies an absolute path starting from the root node, while a double slash denotes a relative path, allowing for more flexible element location throughout the document. This flexibility makes XPath an essential tool in web automation testing and web scraping, where element identification is a critical aspect of the testing process.

Written Assignment 2

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1. What is Selenium? What are the Selenium suite components?

Selenium is a widely-used open-source framework for automating web browsers, primarily employed for testing web applications but also serving various other purposes in web development and web scraping. Selenium provides a suite of tools and libraries for browser automation and testing, offering cross-browser and cross-platform support. The Selenium project was initiated by Jason Huggins in 2004, and it has since evolved into a powerful and versatile set of tools.

Selenium Suite Components

Selenium is composed of several key components that facilitate different aspects of web automation and testing. These components can be categorized into two primary groups: Selenium WebDriver and Selenium IDE.

1. Selenium WebDriver:

Selenium WebDriver is the most critical and widely used component of the Selenium suite. It provides a programming interface to interact with web browsers and automate user interactions. WebDriver enables developers and testers to write scripts in various programming languages to control web browsers. Key features and components of Selenium WebDriver include:

- Browser Drivers: WebDriver communicates with web browsers through specific browser drivers. Different drivers are available for popular web browsers like Chrome, Firefox, Safari, and more.

- Programming Language Bindings: Selenium WebDriver supports multiple programming languages, including Java, Python, C#, Ruby, and more. Users can choose the language they are most comfortable with.

- Commands and API: WebDriver provides a rich set of commands and methods for interacting with web elements, such as clicking buttons, filling out forms, and navigating through web pages.

- Cross-Browser and Cross-Platform Compatibility: One of the strengths of Selenium WebDriver is its ability to work with different web browsers (cross-browser) and on various operating systems (cross-platform).
- Test Framework Integration: WebDriver can be integrated with various testing frameworks, such as JUnit and TestNG, enabling users to organize and manage their test suites effectively.

2. Selenium IDE:

Selenium IDE is a simpler, record-and-playback tool for creating test scripts. It's a browser extension that allows testers and developers to record their interactions with a web application and then play them back. While it's less powerful and flexible compared to WebDriver, it's a great tool for quick and easy test script creation. Key features of Selenium IDE include:

- Record and Playback: Selenium IDE records user interactions with a web page and generates test scripts in a user-friendly, script-like format.
- Selenium Script Export: Test scripts created in Selenium IDE can be exported to various programming languages for further customization and execution in WebDriver.
- Limited Scripting Support: While it's not as versatile as WebDriver, Selenium IDE does offer basic scripting capabilities, allowing users to add conditions and loops to their test scripts.
- Rapid Test Script Creation: Selenium IDE is known for its ease of use, making it a great choice for those who need to quickly create test scripts without in-depth programming knowledge.

In summary, Selenium is a powerful and versatile suite of tools used for automating web browsers and testing web applications. Its core components, Selenium WebDriver and Selenium IDE, provide developers and testers with the means to automate user interactions with web applications, ensuring their functionality and performance. Whether you need to conduct rigorous web testing or automate web-related tasks, Selenium's components offer a range of capabilities to suit your needs.

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2. What makes Selenium such a widely used testing tool? Give reasons. Why is it advised to select Selenium as a testing tool for web applications or systems?

Selenium is a widely used testing tool for web applications and systems, and its popularity can be attributed to several key factors. Here are the reasons why Selenium is a top choice for web application testing:

1. Open Source and Cost-Effective:
   Selenium is an open-source testing framework, which means it is freely available to anyone. This open-source nature significantly reduces testing costs, making it an attractive choice for both large enterprises and small businesses. This cost-effectiveness allows organizations to allocate resources to other critical areas of development and testing.

2. Browser and Platform Independence:
   Selenium supports multiple web browsers, including Chrome, Firefox, Internet Explorer, Edge, Safari, and more. This cross-browser compatibility is crucial as it ensures that web applications behave consistently across different browsers and platforms. It allows developers to verify that their applications are accessible and functional for a broad user base.

3. Programming Language Flexibility:
   Selenium supports various programming languages, including Java, Python, C#, Ruby, and more. This flexibility allows development and testing teams to work with the language they are most proficient in. They can leverage their existing knowledge and libraries, making Selenium adaptable to a wide range of development environments.

4. Active Community and Documentation:
   Selenium has a vibrant and active user community. This community support provides a wealth of online resources, including tutorials, forums, and discussion groups. Users can find answers to their questions, share knowledge, and troubleshoot issues. The extensive documentation helps testers and developers get started and maximize their use of Selenium.

5. Cross-Browser Testing with Selenium Grid:
   Selenium Grid, a component of the Selenium suite, enables cross-browser testing by allowing tests to run simultaneously on multiple browser and platform configurations. This reducing the risk of browser-specific issues and improving overall application quality.

6. Reusability and Maintainability:

ensures that web applications are tested comprehensively across various environments, reducing the risk of browser-specific issues and improving overall application quality.

6. Reusability and Maintainability:

Selenium promotes the creation of reusable test scripts. Test scripts are written to interact with web elements using selectors, and when the structure of a web application changes, only the relevant selectors need to be updated. This reduces the effort required to maintain test suites, especially in dynamic development environments.

7. Integration with Testing Frameworks:

Selenium seamlessly integrates with popular testing frameworks such as TestNG, JUnit, and Cucumber. These frameworks offer advanced features for test management, reporting, and test data management, making it easier to manage and execute tests efficiently.

8. Continuous Integration and Automation:

Selenium plays a vital role in enabling continuous integration and continuous delivery (CI/CD) pipelines. Tests can be automated and executed with each code change, providing early feedback on the quality of the application. Automation helps identify and address issues in real-time, accelerating the release process.

9. Scalability:

Selenium can be used to automate a wide range of test cases, from simple unit tests to complex end-to-end scenarios. Its scalability allows organizations to implement automation at different levels of their testing processes, making it adaptable to the specific needs and maturity of the project.

10. Industry-Wide Acceptance:

Many industry leaders and technology giants rely on Selenium for their web application testing needs. Its widespread adoption demonstrates its credibility and effectiveness in identifying and addressing issues in web applications, making it a trusted choice in the industry.

In summary, Selenium's open-source nature, compatibility with multiple browsers and platforms, programming language flexibility, and extensive community support make it a widely used and advised testing tool for web applications and systems. Its ability to facilitate cross-browser testing, reusability, integration with testing frameworks, and support for continuous integration and automation further strengthen its position as a valuable asset in the world of software testing. Its reliability and industry-wide acceptance make it a top choice for ensuring the quality and reliability of web applications and systems.

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