Experiment 7

Aim: To understand Static Analysis SAST process and learn to integrate Jenkins SAST to SonarQube/GitLab.

Theory:

Static Application Security Testing (SAST)

SAST is a method of security testing that analyzes source code to identify vulnerabilities without executing the program. It is also known as white-box testing. Here's a breakdown of the SAST process:
1. Code Parsing: The source code is parsed to create an abstract syntax tree (AST), which represents the code structure.
2. Pattern Matching: The AST is analyzed using predefined rules to detect patterns that may indicate security vulnerabilities.
3. Data Flow Analysis: This step examines how data moves through the code to identify potential security issues like SQL injection or cross-site scripting (XSS).
4. Control Flow Analysis: This involves analyzing the paths that the code execution might take to find logical errors or vulnerabilities.
5. Reporting: The tool generates a report highlighting the vulnerabilities found, their severity, and recommendations for fixing them.

Benefits of SAST

● Early Detection: Identifies vulnerabilities early in the development lifecycle, reducing the cost and effort required to fix them.
● Comprehensive Coverage: Can analyze 100% of the codebase, including all possible execution paths.
● Automated and Scalable: Suitable for large codebases and can be integrated into CI/CD pipelines for continuous monitoring.

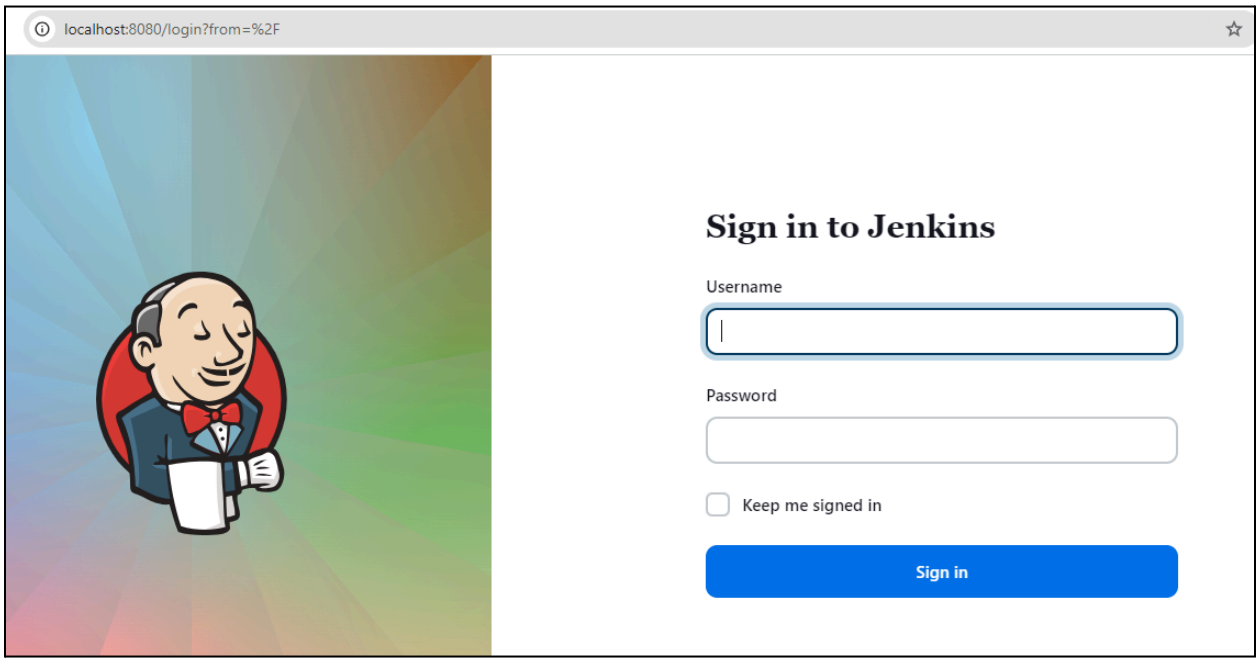
SonarQube and SAST

SonarQube is a popular tool that provides static code analysis to detect bugs, code smells, and security vulnerabilities. Here's how SonarQube fits into the SAST process:
1. Integration: SonarQube can be integrated into your CI/CD pipeline to automatically analyze code every time it is committed.
2. Rule Sets: It uses a comprehensive set of rules to detect security vulnerabilities, coding standards violations, and code quality issues.
3. Dashboards and Reports: SonarQube provides detailed dashboards and reports that help developers understand and fix issues.
4. Continuous Improvement: By continuously analyzing code, SonarQube helps maintain high code quality and security standards over time.

Implementation:

Steps:

1. Open Jenkins Dashboard
● Access your Jenkins Dashboard by navigating to http://localhost:8080 (or the port you have configured Jenkins to run on).

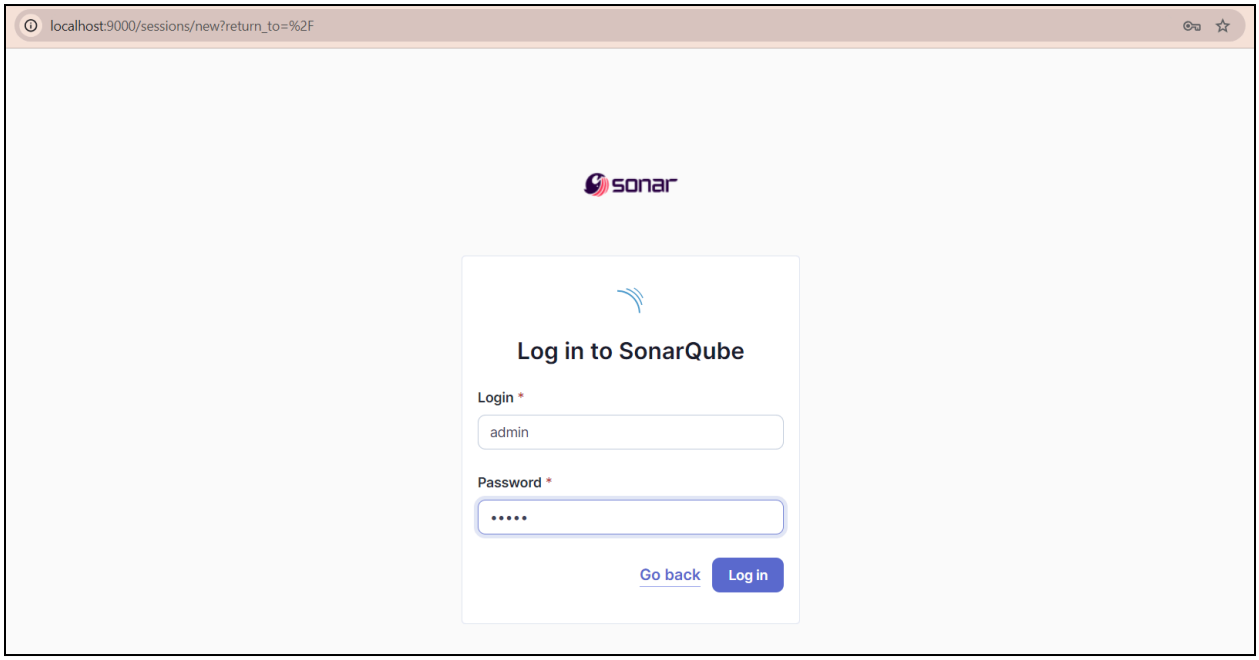


2. Run SonarQube in a Docker Container
● Open a terminal and run the following command to start SonarQube in a Docker container
Command -
docker run -d --name sonarqube -e SONAR_ES_BOOTSTRAP_CHECKS_DISABLE=true -p 9000:9000 sonarqube:latest

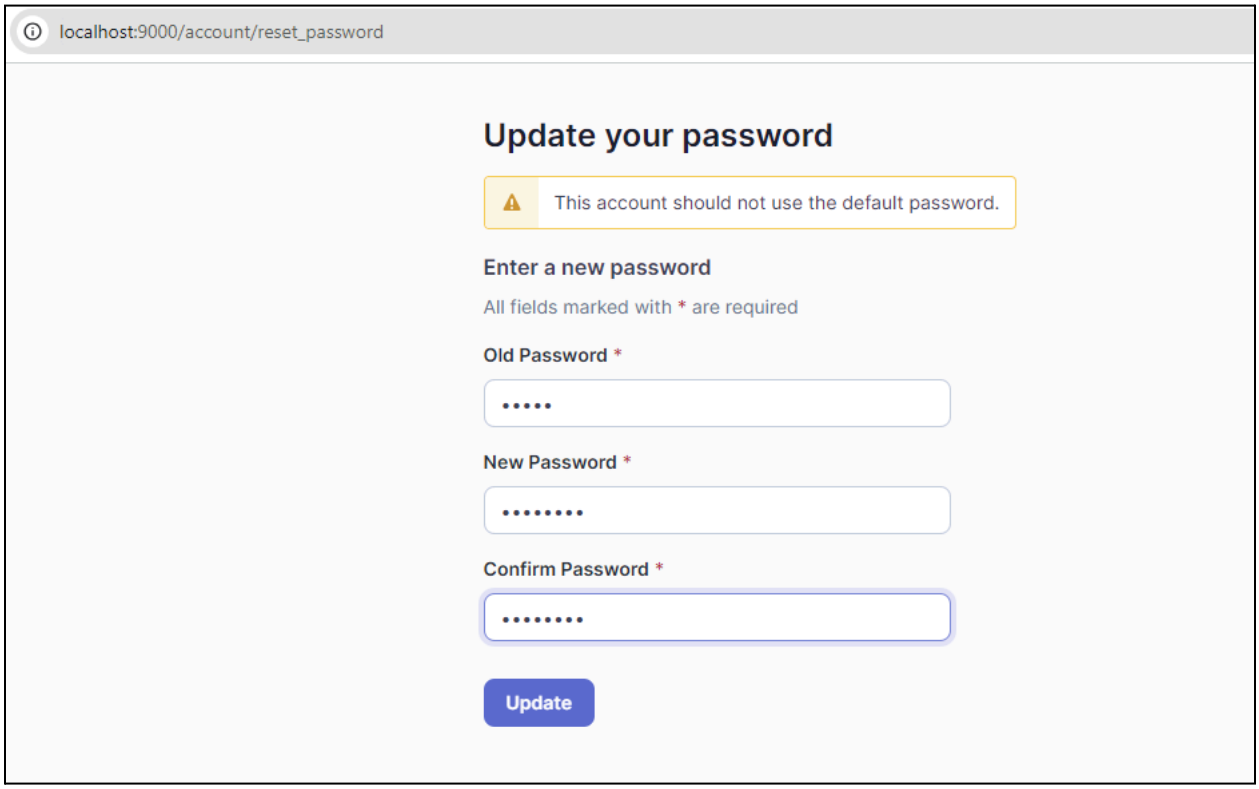
```
C:\Users\272241>docker run -d --name sonarqube -e SONAR_ES_BOOTSTRAP_CHECKS_
DISABLE=true -p 9000:9000 sonarqube:latest
Unable to find image 'sonarqube:latest' locally
latest: Pulling from library/sonarqube
7478e0ac0f23: Pull complete
90a925ab929a: Pull complete
7d9a34308537: Pull complete
80338217a4ab: Pull complete
1a5fd5c7e184: Pull complete
7b87d6fa783d: Pull complete
bd819c9b5ead: Pull complete
4f4fb700ef54: Pull complete
Digest: sha256:72e9feec71242af83faf65f95a40d5e3bb2822a6c3b2cda8568790f3d31ae
cde
Status: Downloaded newer image for sonarqube:latest
8b62aeca4d09887a0db32d349116529581a639b59222a8b20987b42d8cec6ef3
```

3. Check SonarQube Status
    - Once the container is up and running, check the status of SonarQube by navigating to http://localhost:9000

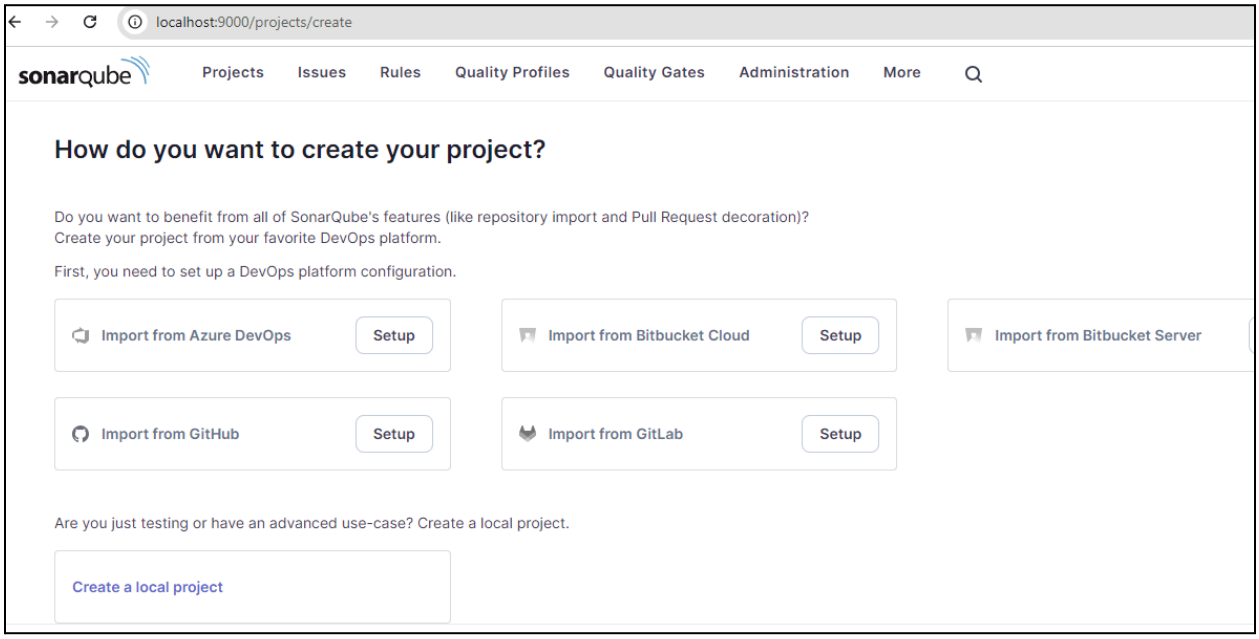
4. Login to SonarQube
    - Use the default credentials to log in:
        - ☐ Login: admin
        - ☐ Password: admin



5. Update the password:

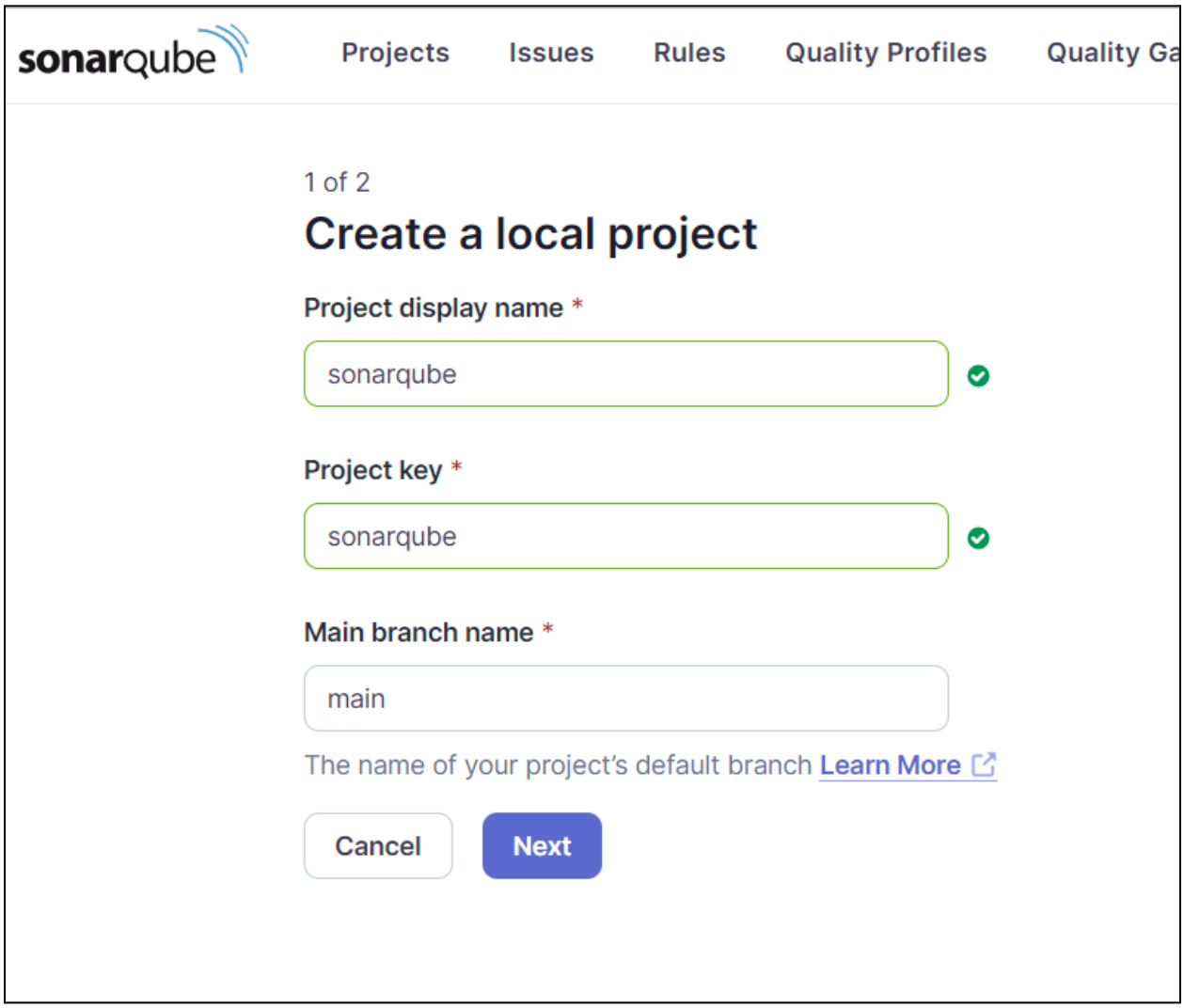


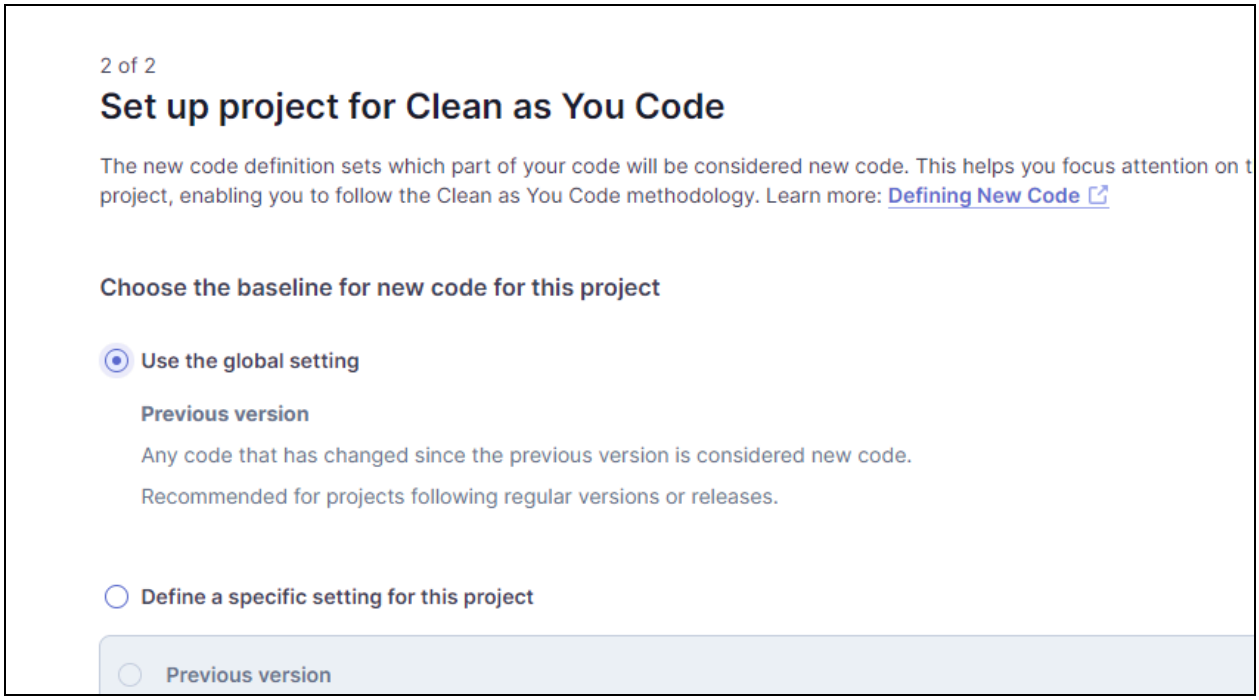
6. After Logging in you will see this:



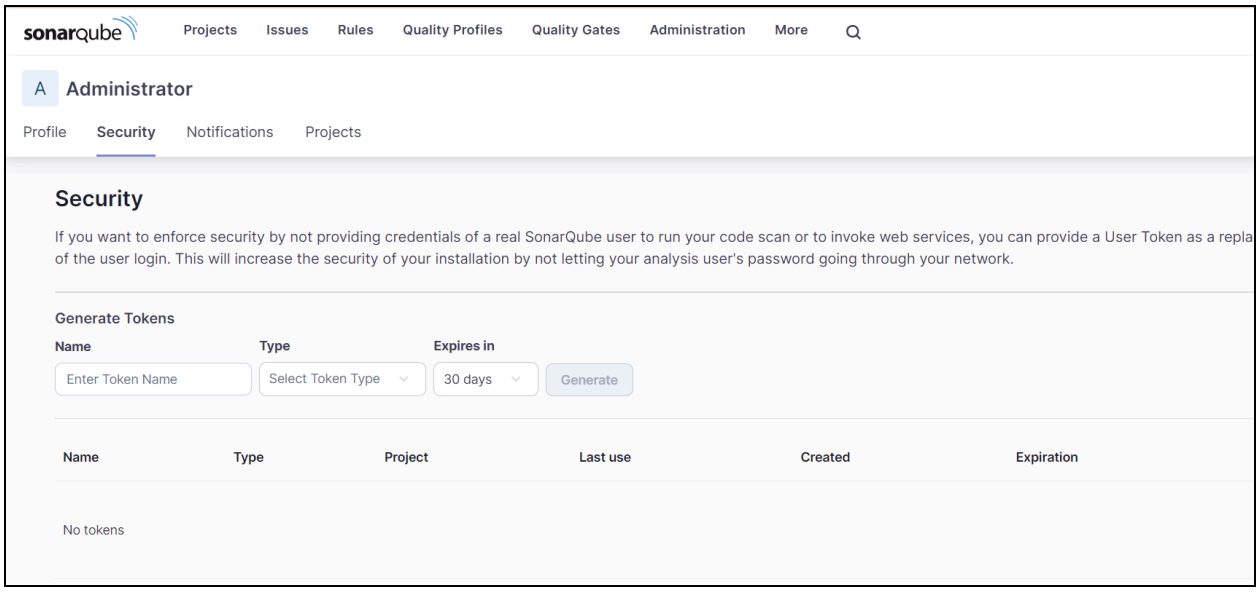
7. After that click on create a local project.

8. Then enter the name of the project:

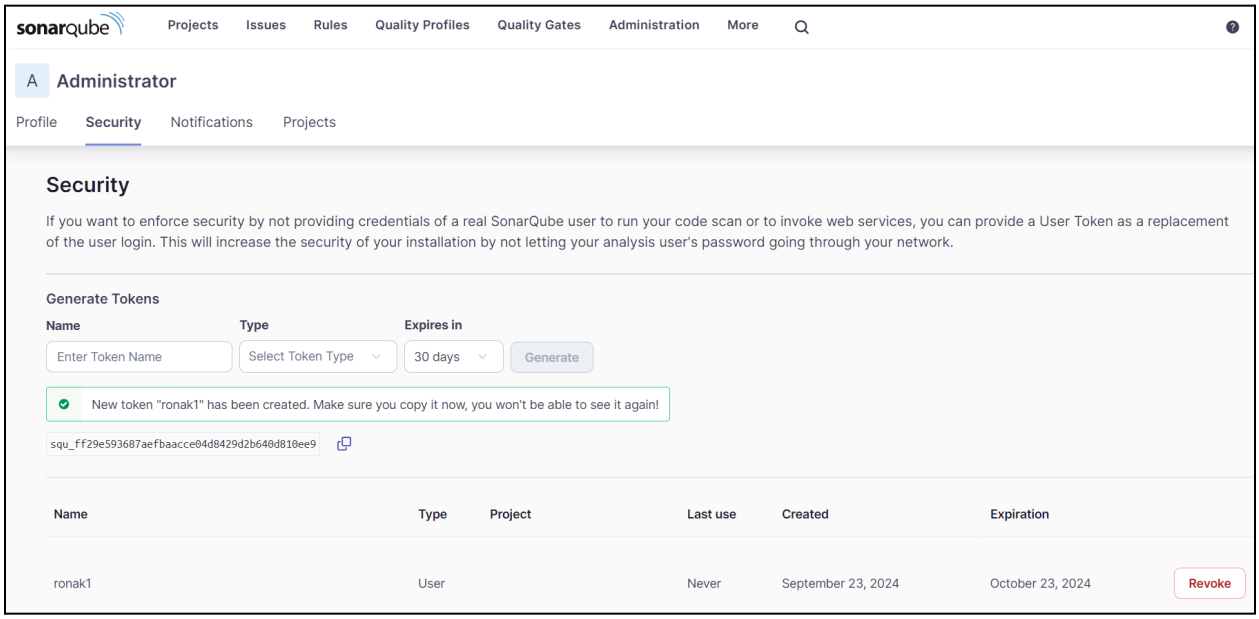




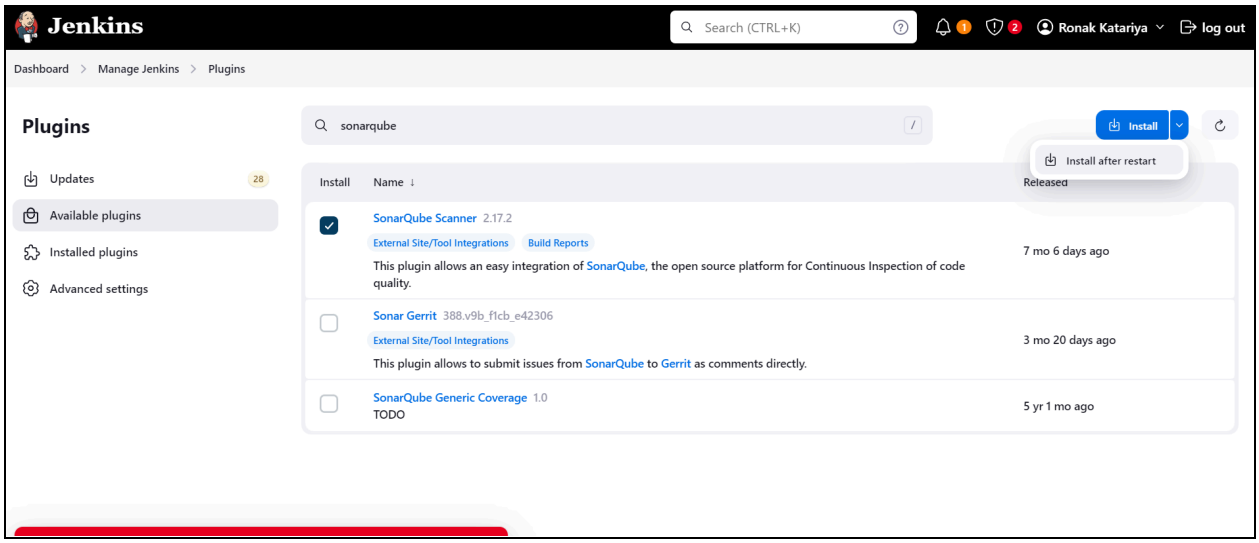
9. Then click on the ‘My Account’ tab:
    - Under that select security.
    - Then name a token you want to generate.
    - Make sure you save it in notepad or somewhere else.



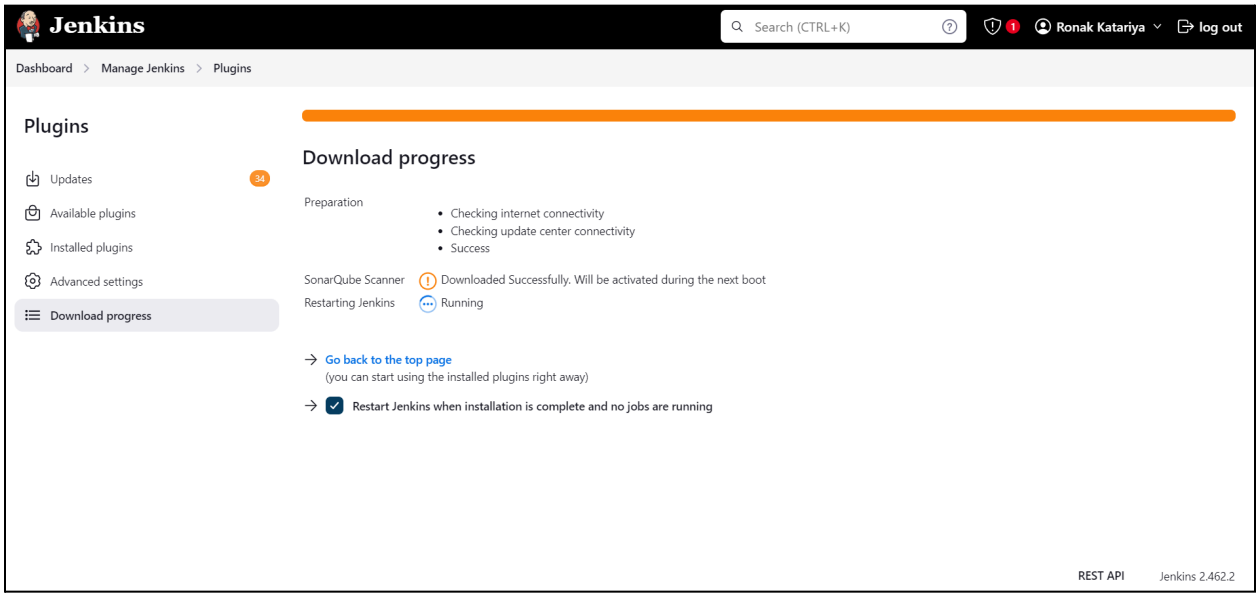
10. After adding the token you can see the list of tokens and the token you just generated:



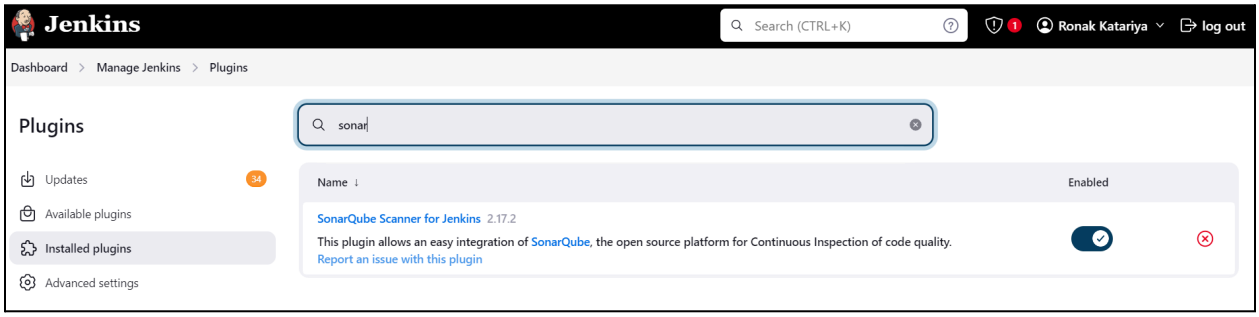
11. Install SonarQube Scanner for Jenkins
    - Go back to the Jenkins Dashboard.
    - Navigate to Manage Jenkins > Manage Plugins.
    - Search for SonarQube Scanner for Jenkins and install it.



12. You will see such window :



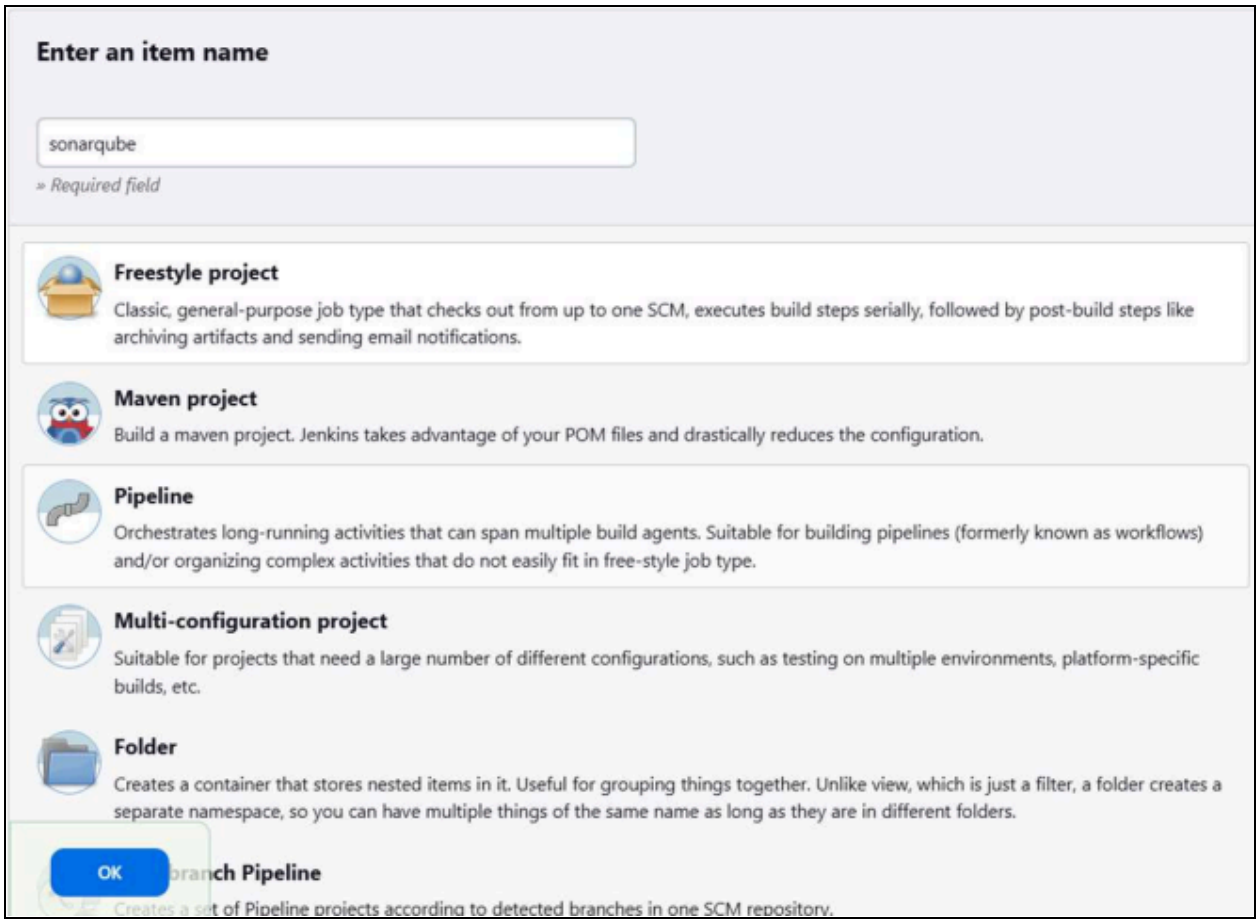
13. You can see the plugins has been downloaded:



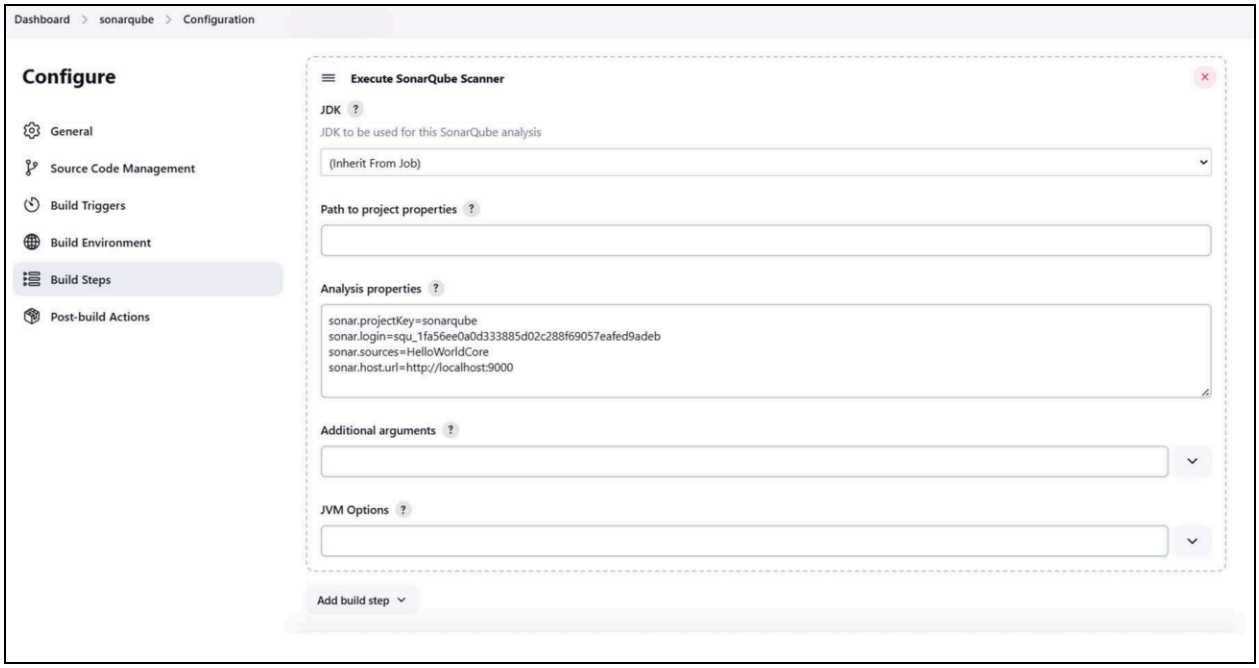
14. Configure SonarQube in Jenkins
    - Go to Manage Jenkins > Configure System.
    - Scroll down to the SonarQube Servers section and enter the required details:
        - Name: Any name you prefer.
        - Server URL: http://localhost:9000
        - Server Authentication Token: (Generate this token in SonarQube under My Account > Security > Generate Tokens).
        - Add Jenkins: Select Kind - Secret Text > Secret (Paste Generated Token)

15. Configure SonarQube Scanner in Jenkins
    - Go to Manage Jenkins > Global Tool Configuration.
    - Scroll down to SonarQube Scanner.
    - Choose the latest version and select Install automatically

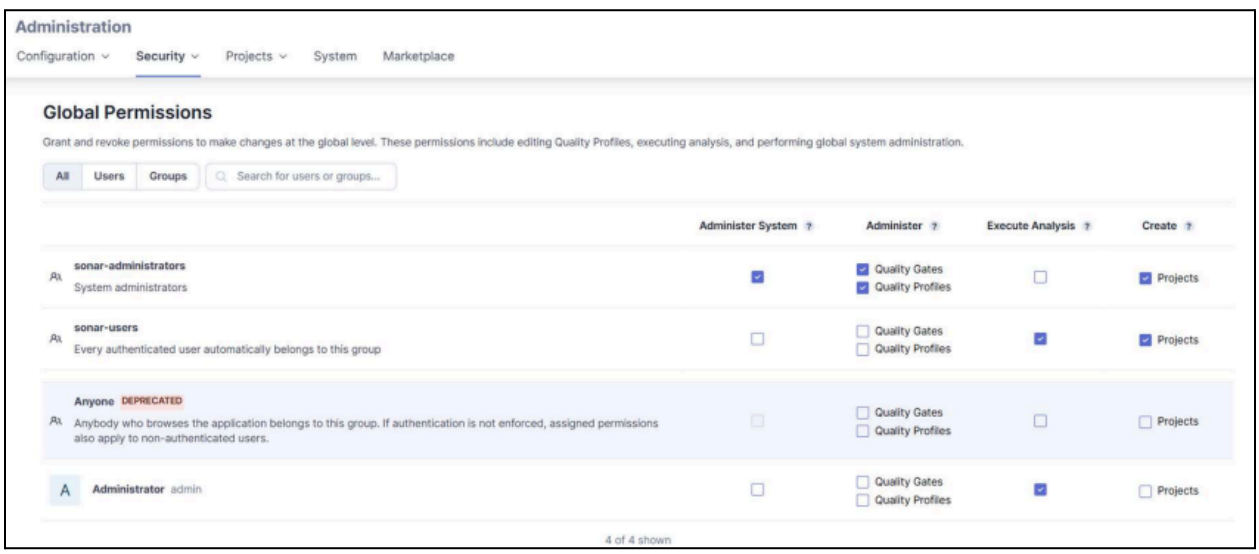
16. Create a New Jenkins Job
    - In Jenkins, create a new item and select Freestyle project.
    - Under Source Code Management, choose Git and enter the repository URL:
    - https://github.com/shazforiot/MSBuild_firstproject.git



17. Configure Build Steps
    - Under the Build section, add a build step to Execute SonarQube Scanner.
    - Enter the following analysis properties:
        - sonar.projectKey=my_project_name
        - sonar.login=your_generated_token
        - sonar.sources=HelloWorldCore
        - sonar.host.url=http://localhost:9000



18. Set Permissions in SonarQube
    - Navigate to http://localhost:9000//permissions.
    - Allow Execute Permissions to the Admin user.



19. Run the Build
    - Go back to Jenkins and run the build.
    - Check the console output for any errors or issues.

Failed output:

Dashboard > sonarqube > #4 > Console Output

Status
Changes
Console Output
Edit Build Information
Delete build '#4'
Timings
Git Build Data
Previous Build

Console Output

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```
Started by user Ronak Katariya
Running as SYSTEM
Building on the built-in node in workspace C:\ProgramData\Jenkins\.jenkins\workspace\sonarqube
The recommended git tool is: NONE
No credentials specified
 > git.exe rev-parse --resolve-git-dir C:\ProgramData\Jenkins\.jenkins\workspace\sonarqube\.git # timeout=10
Fetching changes from the remote Git repository
 > git.exe config remote.origin.url https://github.com/shazforiot/MSBuild_firstproject.git # timeout=10
Fetching upstream changes from https://github.com/shazforiot/MSBuild_firstproject.git
 > git.exe --version # timeout=10
 > git --version # 'git version 2.43.0.windows.1'
 > git.exe fetch --tags --force --progress -- https://github.com/shazforiot/MSBuild_firstproject.git +refs/heads/*:refs/remotes/origin/* # timeout=10
 > git.exe rev-parse "refs/remotes/origin/master^{commit}" # timeout=10
Checking out Revision f2bc042c04c6e72427c380bcaee6d6fee7b49adf (refs/remotes/origin/master)
 > git.exe config core.sparsecheckout # timeout=10
 > git.exe checkout -f f2bc042c04c6e72427c380bcaee6d6fee7b49adf # timeout=10
Commit message: "updated"
 > git.exe rev-list --no-walk f2bc042c04c6e72427c380bcaee6d6fee7b49adf # timeout=10
[sonarqube] $ C:\ProgramData\Jenkins\.jenkins\tools\hudson.plugins.sonar.SonarRunnerInstallation\sonarqube\bin\sonar-scanner.bat -
Dsonar.host.url=http://localhost:9000 "-Dproject.settings=C:\Users\272241\AppData\Local\Programs\Eclipse Adoptium\jdk-21.0.4.7-hotspot" -
Dsonar.projectKey=sonarqube -Dsonar.login=squ_e1bac8ee4a480693b1a8e9408e247b8ed0b2323d -Dsonar.host.url=http://localhost:9000 -
Dsonar.sources=HelloWorldCore -Dsonar.projectBaseDir=C:\ProgramData\Jenkins\.jenkins\workspace\sonarqube

ERROR: JAVA_HOME not found in your environment, and no Java
       executable present in the PATH.
Please set the JAVA_HOME variable in your environment to match the
location of your Java installation, or add "java.exe" to the PATH

WARN: Unable to locate 'report-task.txt' in the workspace. Did the SonarScanner succeed?
ERROR: SonarQube scanner exited with non-zero code: 1
Finished: FAILURE
```

Successful Output:

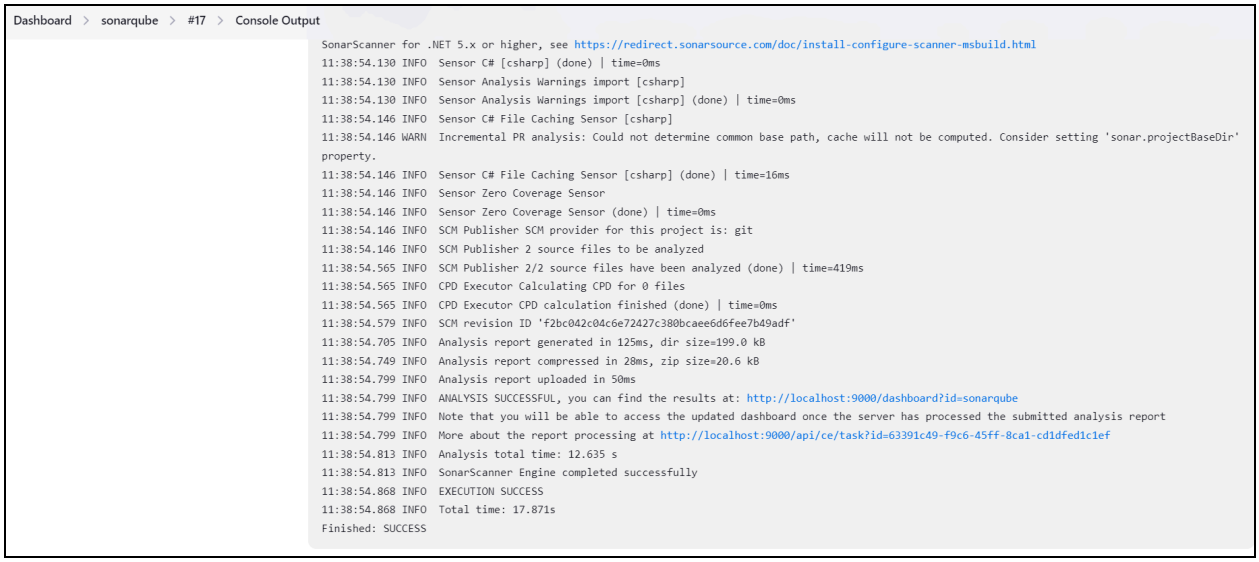
Dashboard > sonarqube > #17 > Console Output

Status
Changes
Console Output
Edit Build Information
Timings
Git Build Data
Previous Build

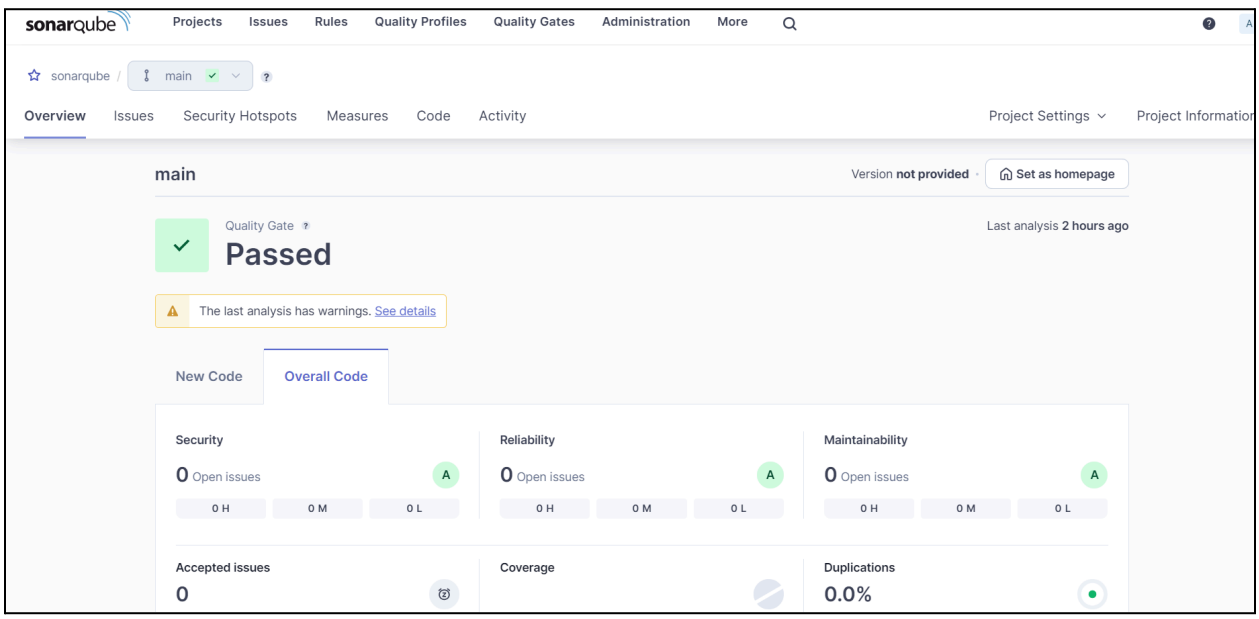
Console Output

Download | Copy | View as plain text

```
Started by user Ronak Katariya
Running as SYSTEM
Building on the built-in node in workspace C:\ProgramData\Jenkins\.jenkins\workspace\sonarqube
The recommended git tool is: NONE
No credentials specified
 > git.exe rev-parse --resolve-git-dir C:\ProgramData\Jenkins\.jenkins\workspace\sonarqube\.git # timeout=10
Fetching changes from the remote Git repository
 > git.exe config remote.origin.url https://github.com/shazforiot/MSBuild_firstproject.git # timeout=10
Fetching upstream changes from https://github.com/shazforiot/MSBuild_firstproject.git
 > git.exe --version # timeout=10
 > git --version # 'git version 2.43.0.windows.1'
 > git.exe fetch --tags --force --progress -- https://github.com/shazforiot/MSBuild_firstproject.git +refs/heads/*:refs/remotes/origin/* # timeout=10
 > git.exe rev-parse "refs/remotes/origin/master^{commit}" # timeout=10
Checking out Revision f2bc042c04c6e72427c380bcaee6d6fee7b49adf (refs/remotes/origin/master)
 > git.exe config core.sparsecheckout # timeout=10
 > git.exe checkout -f f2bc042c04c6e72427c380bcaee6d6fee7b49adf # timeout=10
Commit message: "updated"
 > git.exe rev-list --no-walk f2bc042c04c6e72427c380bcaee6d6fee7b49adf # timeout=10
[sonarqube] $ C:\ProgramData\Jenkins\.jenkins\tools\hudson.plugins.sonar.SonarRunnerInstallation\sonarqube\bin\sonar-scanner.bat -
Dsonar.host.url=http://localhost:9000 ******** -Dsonar.projectKey=sonarqube -Dsonar.login=squ_e1bac8ee4a480693b1a8e9408e247b8ed0b2323d -
Dsonar.host.url=http://localhost:9000 -Dsonar.sources=HelloWorldCore -Dsonar.projectBaseDir=C:\ProgramData\Jenkins\.jenkins\workspace\sonarqube
11:38:36.992 WARN  Property 'sonar.host.url' with value 'http://localhost:9000' is overridden with value 'http://localhost:9000'
11:38:37.000 INFO  Scanner configuration file:
C:\ProgramData\Jenkins\.jenkins\tools\hudson.plugins.sonar.SonarRunnerInstallation\sonarqube\bin\..\conf\sonar-scanner.properties
11:38:37.001 INFO  Project root configuration file: NONE
11:38:37.018 INFO  SonarScanner CLI 6.2.0.4584
11:38:37.018 INFO  Java 21.0.4 Eclipse Adoptium (64-bit)
11:38:37.018 INFO  Windows 11 10.0 amd64
11:38:37.035 INFO  User cache: C:\WINDOWS\system32\config\systemprofile\.sonar\cache
11:38:37.600 INFO  JRE provisioning: os[windows], arch[amd64]
11:38:40.300 INFO  Communicating with SonarQube Server 10.6.0.92116
11:38:40.686 INFO  Starting SonarScanner Engine...
11:38:40.686 INFO  Java 17.0.11 Eclipse Adoptium (64-bit)
```



20. Verify in SonarQube
    - Once the build is complete, check the project in SonarQube to see the analysis results.



Conclusion:

In this experiment, we have understood the importance of SAST and have successfully integrated Jenkins with SonarQube for Static Analysis and Code Testing.