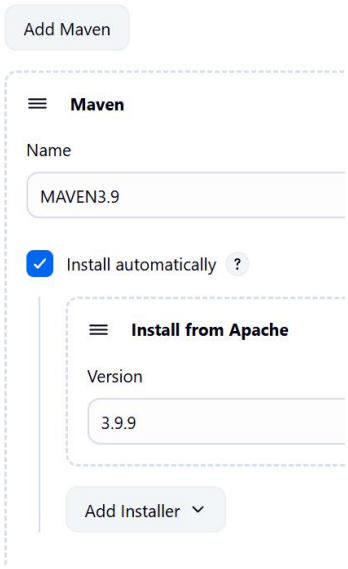
CI/CD With Jenkins

- To install Jenkins in Ubuntu:
  - You need to install Java because *Jenkins is written in Java*.
  - Its not a native program (like .exe or .bin), rather it's a **.war** file (Java Web Application Archive).
  - To run it, you need JVM (Java Virtual Machine), which comes from JDE/JRE.
  -
```
sudo apt update

sudo apt install openjdk-21-jdk -y

sudo wget -O /etc/apt/keyrings/jenkins-keyring.asc \
  https://pkg.jenkins.io/debian-stable/jenkins.io-2023.key

echo "deb [signed-by=/etc/apt/keyrings/jenkins-keyring.asc]" \
  https://pkg.jenkins.io/debian-stable binary/ | sudo tee \
  /etc/apt/sources.list.d/jenkins.list > /dev/null

sudo apt-get update

sudo apt-get install jenkins
```
  - **/var/lib/jenkins** is the home directory of Jenkins. You can see this inside /etc/passwd
  - Inside **/var/lib/jenkins** the jenkins configuration (**config.xml**) file exists.
  - After installing jenkins, you can copy the *public IP* of the instance and open in the browser with port *8080* (remember: TCP with port 8080 should be present in the security group attached to the ubuntu instance).
    - After opening the browser, it'll show one path where the initial password is present.
    - **/var/lib/jenkins/secrets/initialAdminPassword** : In this file the initial password is stored.
  - *If you can't open the jenkins ui through browser, then try updating the security inbound rule for TCP 8080 traffic for all IPv4. sometimes, My IP doesn't work.*
  - Change the **jenkins url** to a random domain. Otherwise it'll try to access that public ip only. If your instance is rebooted, then the public IP will be changed, and Jenkins will become slow.

- **Jobs in Jenkins**
  - **Freestyle Job**
    - In freestyle, everything is configured in the Jenkins UI.
    - ***Graphical Jobs.***
    - Each job has a GUI form where you define:
      - Where to get code (GitHub, SVN, etc.)
      - Build steps (e.g., mvn clean install, npm build)
      - Post-build actions (e.g., deploy, send email)
    - **Pros:**
      - Easy to create (beginner friendly)
      - Great for simple projects
      - No need to learn syntax.
    - **Cons:**
      - Hard to maintain (if there are many jobs, have to edit each of them manually)
      - Not portable (configs only stay in Jenkins server, not git repo)
      - Limited flexibility (complex workflows are difficult to manage)
      - If jenkins crashes, you loose job definitions (unless backed up)
  - **Pipeline As A Code**
    - Instead of configuring Jobs in UI, **Jenkinsfile** is used.
    - Jenkins read the file and runs the pipeline automatically.
    - Written in Groovy based DSL (Domain Specific Language)
- **Plugins vs Tools**
  - Simple analogy:
    - Keywords:
      - Programmer (Jenkins)
      - Programming Language (Plugin)
      - Tools (Laptop with compiler installed)
    - If a programmer knows the language (jenkins have plugins installed) but doesn't have a laptop (the server where jenkins present, doesn't have that tool): then it'll be of no use
    - If a programmer doesn't know the language (jenkins don't have the plugin) and he is given a laptop (the server where jenkins is present, have the tools installed): then it'll be of no use
  - ***Plugins** tell Jenkins how to do things; **Tools** let Jenkins actually do the work.*

- You can install the tools in the server directly executing the command like **apt install maven** ..etc. OR you can do from the Jenkins GUI as well.
  - Note:
    - In GUI, it'll display only those Tools, whose Plugins are installed.
    - If you don't see the particular Tool you want, then install its Plugin first.
    - If you'll install the Tools via system CLI directly; then also it'll be of no use if the Plugin is not installed in Jenkins.
- Ex: I am installing Maven (tool) via GUI
  - 

  - Its simple, just give a name and select the version.
- Ex-2: I am installing JDK via GUI. Its little different
  - 

  - Its little different. Installed java-17 version in cli, then gave its home directory path in GUI.

- The tools whose multiple versions can be installed at once in a system *(multiple versions of JDK can be installed in a system)*, we need to tell jenkins that which version is to be used by giving that version's home directory path.
- The installed plugins stay in the directory: /var/lib/jenkins/plugins

```
root@ip-172-31-40-120:/var/lib/jenkins/plugins# pwd
/var/lib/jenkins/plugins
root@ip-172-31-40-120:/var/lib/jenkins/plugins# ls
ant                                 config-file-provider      github-api.jpi              jquery3-
ant.jpi                             config-file-provider.jpi  github-branch-source        jquery3-
antisamy-markup-formatter           credentials               github-branch-source.jpi    json-api
antisamy-markup-formatter.jpi       credentials-binding       github.jpi                  json-api
apache-httpcomponents-client-4-api  credentials-binding.jpi   gradle                      json-pat
apache-httpcomponents-client-4-api.jpi  credentials.jpi       gradle.jpi                  json-pat
asm-api                             dark-theme                gson-api                    jsoup
asm-api.jpi                         dark-theme.jpi            gson-api.jpi                jsoup.jp
bootstrap5-api                      display-url-api           instance-identity           junit
bootstrap5-api.jpi                  display-url-api.jpi       instance-identity.jpi       junit.jp
bouncycastle-api                    durable-task              ionicons-api                ldap
bouncycastle-api.jpi                durable-task.jpi          ionicons-api.jpi            ldap.jpi
branch-api                          echarts-api               jackson2-api                mailer
branch-api.jpi                      echarts-api.jpi           jackson2-api.jpi            mailer.j
build-timeout                       eddsa-api                 jakarta-activation-api      matrix-a
build-timeout.jpi                   eddsa-api.jpi             jakarta-activation-api.jpi  matrix-a
caffeine-api                        email-ext                 jakarta-mail-api            matrix-p
caffeine-api.jpi                    email-ext.jpi             jakarta-mail-api.jpi        matrix-p
checks-api                          font-awesome-api          javax-activation-api        metrics
checks-api.jpi                      font-awesome-api.jpi      javax-activation-api.jpi    metrics.
cloudbees-folder                    git                       jaxb                        mina-ssh
cloudbees-folder.jpi                git-client                jaxb.jpi                    mina-ssh
commons-lang3-api                   git-client.jpi            jjwt-api                    mina-ssh
commons-lang3-api.jpi               git.jpi                   jjwt-api.jpi                mina-ssh
commons-text-api                    github                    joda-time-api               nodejs
commons-text-api.jpi                github-api                joda-time-api.jpi           nodejs.j
```

- All global tools configurations (JDK, Maven, Git, Node.js etc) are stored inside: /var/lib/jenkins/hudson.tasks.*
  - Exception: JDKs are stored inside **/var/lib/jenkins/config.xml** because Jenkins treats them as a core runtime tool
  - If you have not updated the JDK in Jenkins UI, then you can't see the JDK inside that **config.xml**. And Jenkins will use the default JDK that is present globally (in my case, global default was JDK version 21).

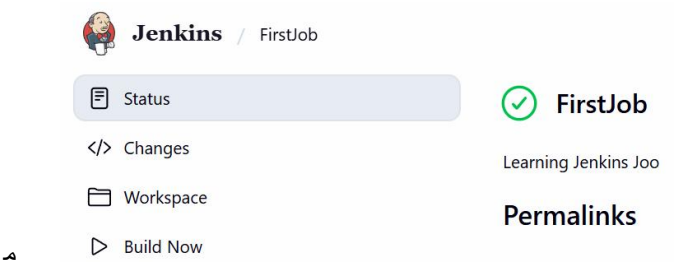
```
root@ip-172-31-40-120:/var/lib/jenkins# cat config.xml | grep -i jdk
  <jdks>
    <jdk>
      <name>JDK17</name>
      <home>/usr/lib/jvm/java-17-openjdk-amd64</home>
    </jdk>
  </jdks>
```

  - If multiples JDKs are configured inside this, then whatever version mentioned in the Job will be used while running the Job inside pipeline.

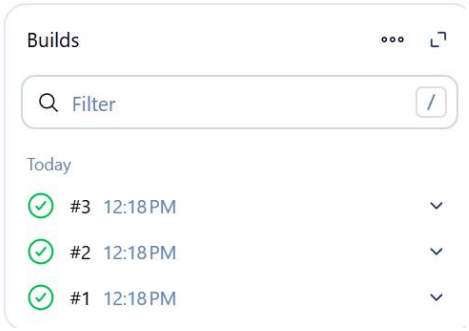
Lets create out first Job

- Create **FreeStyle** project.
  - Give one description like "Learning Jenkins Jobs"
  - Skip **Triggers** and **Environments** for now.

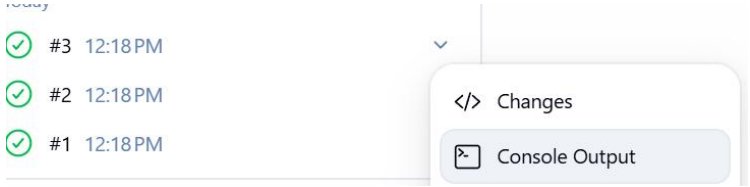
- Under **Build Steps**, select **Execute Shell** (the windows part like **execute windows batch commands** will not work as the Jenkins is hosted in Ubuntu in our case).
- **Save** this now.



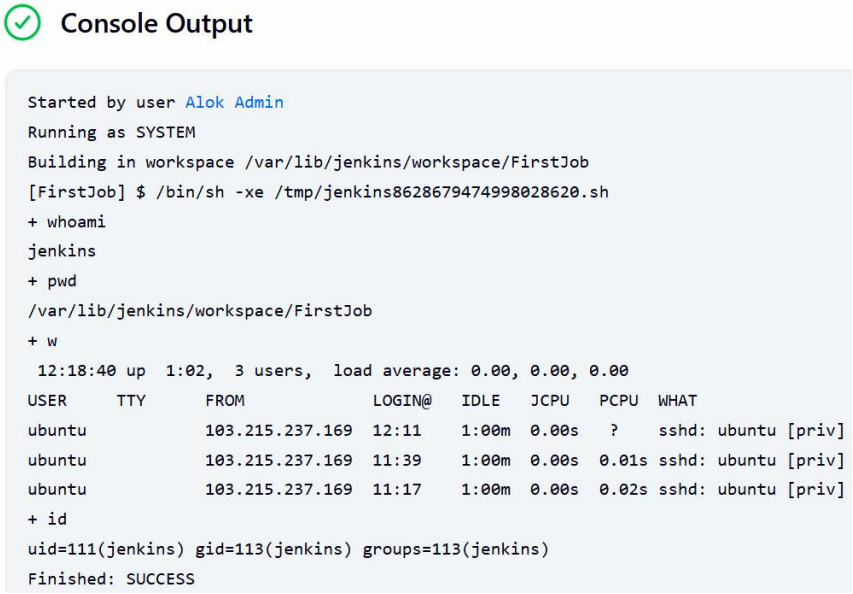
- Under the created Job, click on that **Build Now** button 2 or 3 times.



- You'll see something like this.

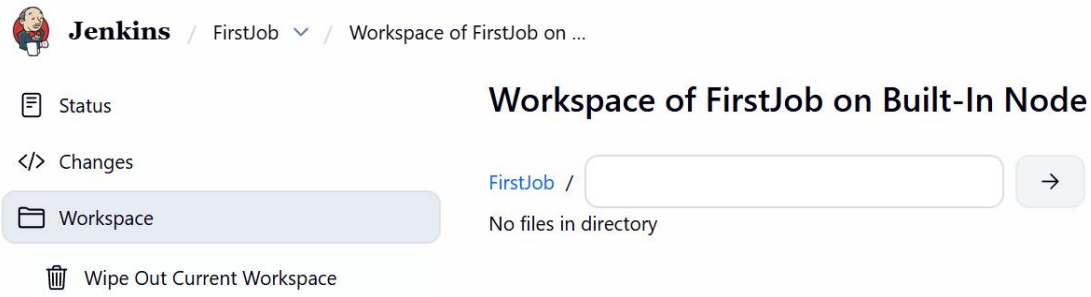


- You can also see the console output of the build.



- You can see the path where the Job ran was **/var/lib/jenkins/workspace/FirstJob**

- You can see some folders inside the path **/var/lib/jenkins**, in which **jobs** and **workspace** are there.
  - **jobs**
    - It contains every detail about the job.
    - Like the build history, configurations, metadata etc.
  - **workspace**
    - It is where **Jenkins** actually run build the code and do stuffs.
    - You can think it like it's a local folder for the **Jenkins user** where it does the things like pulling any repo, building that and testing etc etc.



    - Here there is an option **Workspace**, which remain in sync with the path **/var/lib/jenkins/workspace**.
    - I created one folder inside that path manually using **mkdir** command inside the linux and now it came inside the Jenkins website as well.

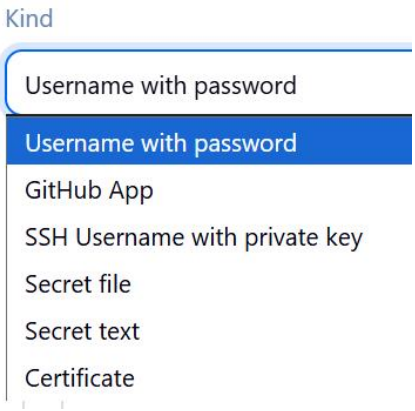
Note

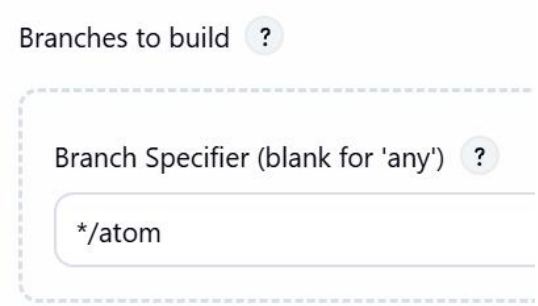
- The tools that we configure are available globally for all the jobs. Its not bounded to any particular job.
- Lets suppost JDK, if I have 2 different JDK present inside the tools, then inside the Job, I can select which JDK will be used in my current Job.

Creating another job to build the vprofile project from github

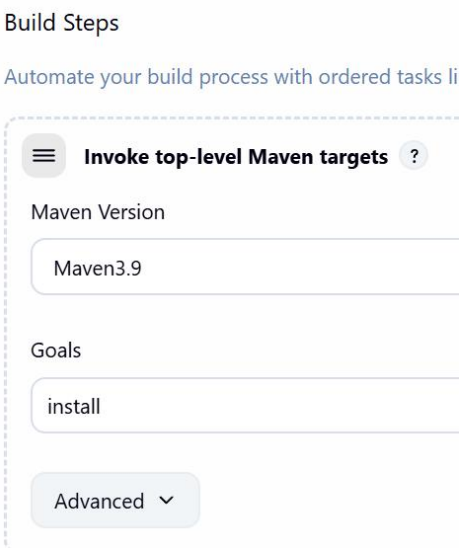
- Give a name and description to the job. (it is also **Free Style**).
- Select the JDK version. (I chose 17)
- Source Code Management: Choose **Git**.
  - If the repo is public, then no need to give the credentials.

- Otherwise you need to give clicking on that Add button present in the right.
  - 

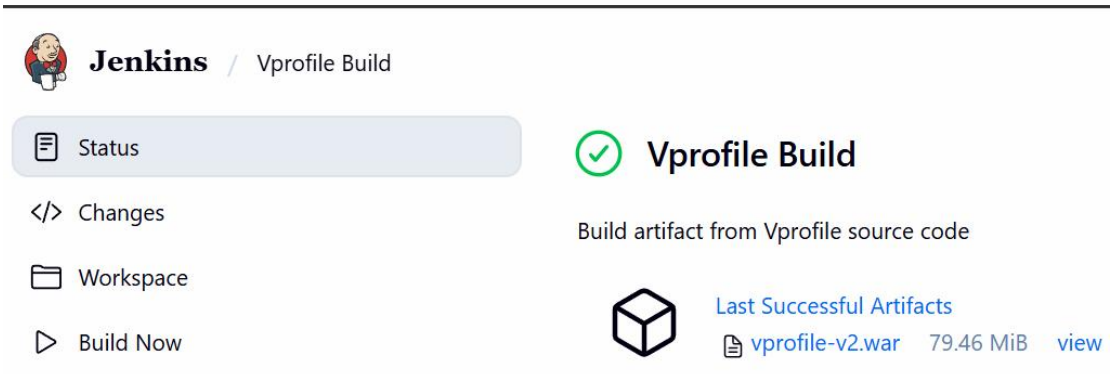
- You have so many methods using which you can connect to Github.
  - 

  - 

  - Also select the branch from which the code will be build.
- In the previous job, we used **Execution Shell**. But its not recommended.
  - Every time use Plugins to do some specific task.
  - If there is no plugin to do the task you are interested in, then only you should write commands in **Execution Shell**.
  - Here, I chose **Invoke top-level Maven targets**, chose the maven version and the command in the goal i.e. **install** because I want to build the source code.
  - You have some advanced settings as well that you can checkout.



- Now Lets see the **Post-Build Actions**
  - I chose **Archive the artifacts** and gave ****/*.war** inside the input field *Files to archive*.
    - ****** means it'll go to every sub-directory and check if any ***.war** file present and archive that.
  - It stores the archived file in somewhere else and give you one link to download or view that. (in the **status** section)



- **IMPORTANT**
  - When we install any tools from the Jenkins, it install the tool in the Linux (or whatever server where Jenkins is hosted) for the **Jenkins** user only; not **globally**.
  - I installed **maven3.9** in the tools section of **Jenkins**.
  - Ran one job 2 or 3 times (PS: inside the job under the **invoke top-level Maven targets** the **maven3.9** was selected).
  - Then I selected **Default** instead of **maven3.9** in that drop-down and ran built the job again. Now it **failed**.

- Because, when you choose **default** in that option, it checks **system default maven**, i.e. inside **/usr/bin/mvn** folder which is accessible globally. But maven is not installed in our server globally.
- So, you need to install **maven** in the **linux server *globally*** then build the job again. Now it'll **pass**.
-

- When you create a new job, at the bottom there is an option **Copy from**, there you can give the name of any existing job you have.
  - It'll copy all the configs from there to this new job by default.
  - Means all the fields will be **auto-selected** according to that reference Job.
- When you install any plugins, then only it'll be visible in the job.

➢ Just like Gitlab CI/CD, Jenkins also has **environment variables** like **BUILD_ID, BUILD_NUMBER** ..etc etc.

➢ You can use your own **variables** inside the job.

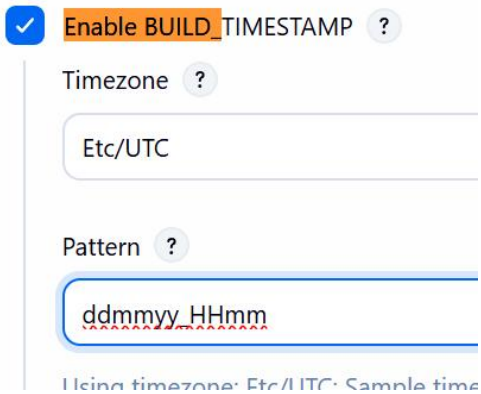
- 

  - Inside the configure section, select this checkbox **"This project is parameterized"**
- Then you'll get the button **Build with Parameters** in place of **Build now**.
  - 

- When you click that **Build with parameters** button, you'll get one page where you can enter the values.
  - 

- Also, you can add the **default value** in that **configure** page.

- Inside the **Manage Jenkins** path, there is an option **System**.
  - Here you can configure the global configurations. (its not specific to any particular Job)



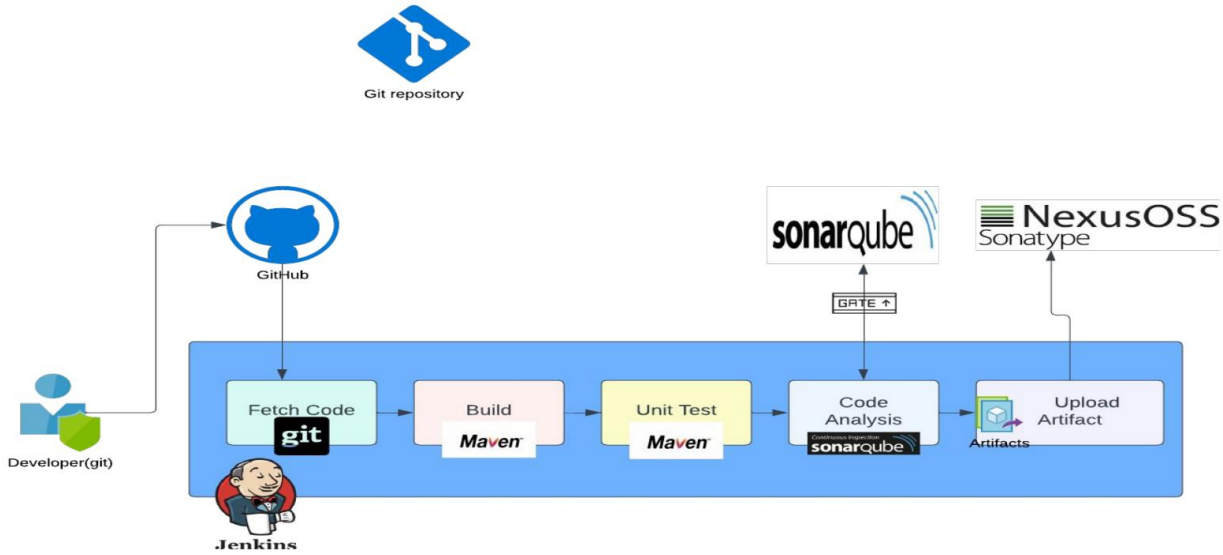
  - (Here I changed the timestamp pattern)

```
mkdir -p versions
# cp target/vprofile-v2.war versions/vpro$BUILD_ID.war
#cp target/vprofile-v2.war versions/vpro$VERSION.war
cp target/vprofile-v2.war versions/vpro$BUILD_TIMESTAMP.war
```

    - Added in the **execution shell** in **Build Steps**.

- **Disk Space Issue**
  - Whenever you get any issue for disk space, just increase the volume capacity.

➢ Flow of Continuous Integration Pipeline



- SonarQube analyse the code and generate report in **XML** format which will be uploaded to the **sonarqube** server.
  - Also we can build one quality **gate** means if the code doesn't follow the required practices then fail the build.
  - If it fails, then pipeline will stop.
- If the pipeline passes, we'll have a verified copy of the artifact.
  - Now we can distribute the artifact to be deployed on the server.
  - Before deploying, the artifacts should be versioned and uploaded to NexusSonatype repository.

- **Steps for Continuous Integration Pipeline**
  - Jenkins setup
  - Nexux setup
  - Sonarqube setup
  - Security group
  - Install necessary plugins in Jenkins (like Nexus, Sonar, Git etc)
  - Integrate
    - Nexus
    - Sonarqube
  - Write pipeline script
  - Set notification
-
-
  - Dfd
  - Dfd
  -
  -