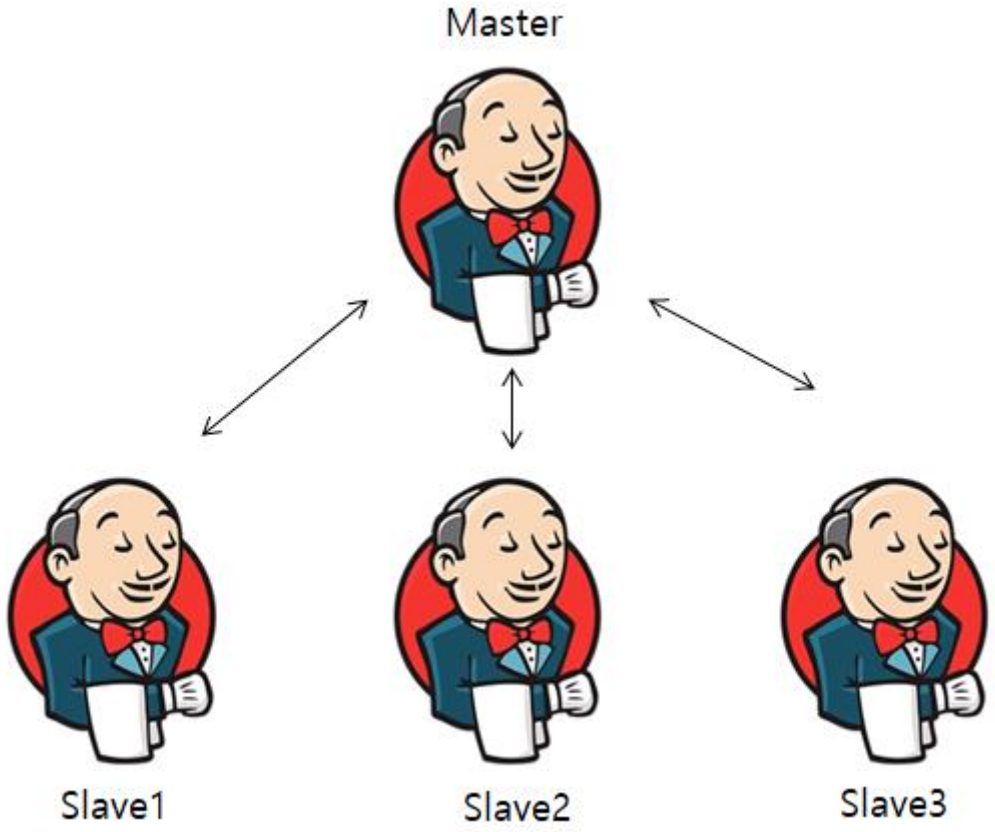
JENKINS MASTER AND SLAVE

INTRODUCTION

In today's fast-paced software development landscape, continuous integration and delivery (CI/CD) have become indispensable practices for ensuring rapid and reliable software releases. At the heart of CI/CD automation lies Jenkins, an open-source automation server that enables developers to automate various stages of the software development lifecycle. In this blog, we'll delve into the concept of Jenkins and explore the significance of its master-slave architecture in scaling CI/CD pipelines.



Understanding Jenkins

Jenkins is a widely-used automation server that facilitates the automation of building, testing, and deploying software applications. It

provides a flexible and extensible platform for orchestrating CI/CD workflows, allowing teams to automate repetitive tasks and streamline the software delivery process. Jenkins supports integration with a myriad of tools and technologies, making it a versatile solution for modern software development teams.

Master-Slave Architecture

The master-slave architecture in Jenkins enables the distribution of workload across multiple nodes, thereby improving efficiency and scalability. In this setup, the Jenkins master node serves as the central controller responsible for managing job execution and distributing tasks to one or more slave nodes. Each slave node operates independently and executes build jobs assigned to it by the master. This distributed approach allows for parallel execution of tasks, reducing build times and enhancing resource utilization.

Benefits and Use Cases

The master-slave architecture offers several benefits, including:

- **Scalability**: Easily scale Jenkins infrastructure by adding or removing slave nodes based on workload demands.
- **Fault Tolerance**: Distributed architecture enhances fault tolerance and resilience against node failures.
- **Resource Optimization**: Efficiently utilize computing resources by distributing workload across multiple nodes.
- **Parallel Execution**: Execute multiple build jobs concurrently, accelerating the software delivery pipeline.

Use cases for Jenkins master-slave architecture include:

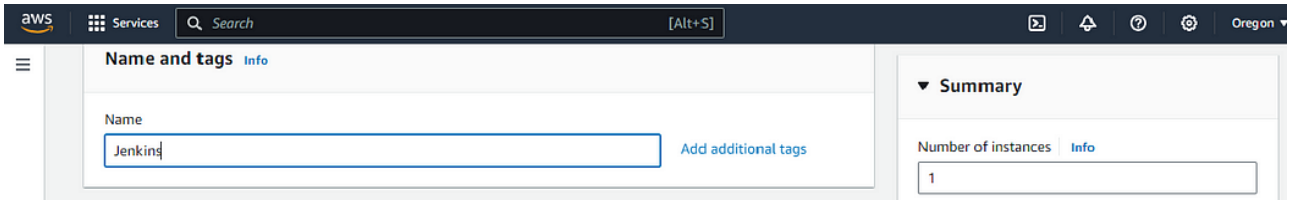
- **Large-Scale Builds**: Handle large and complex builds more effectively by distributing workload across multiple nodes.
- **Geographic Distribution**: Deploy slave nodes in different geographical regions to minimize latency and improve performance.
- **Specialized Environments**: Utilize dedicated slave nodes for specific tasks such as integration testing, deployment, or performance testing.

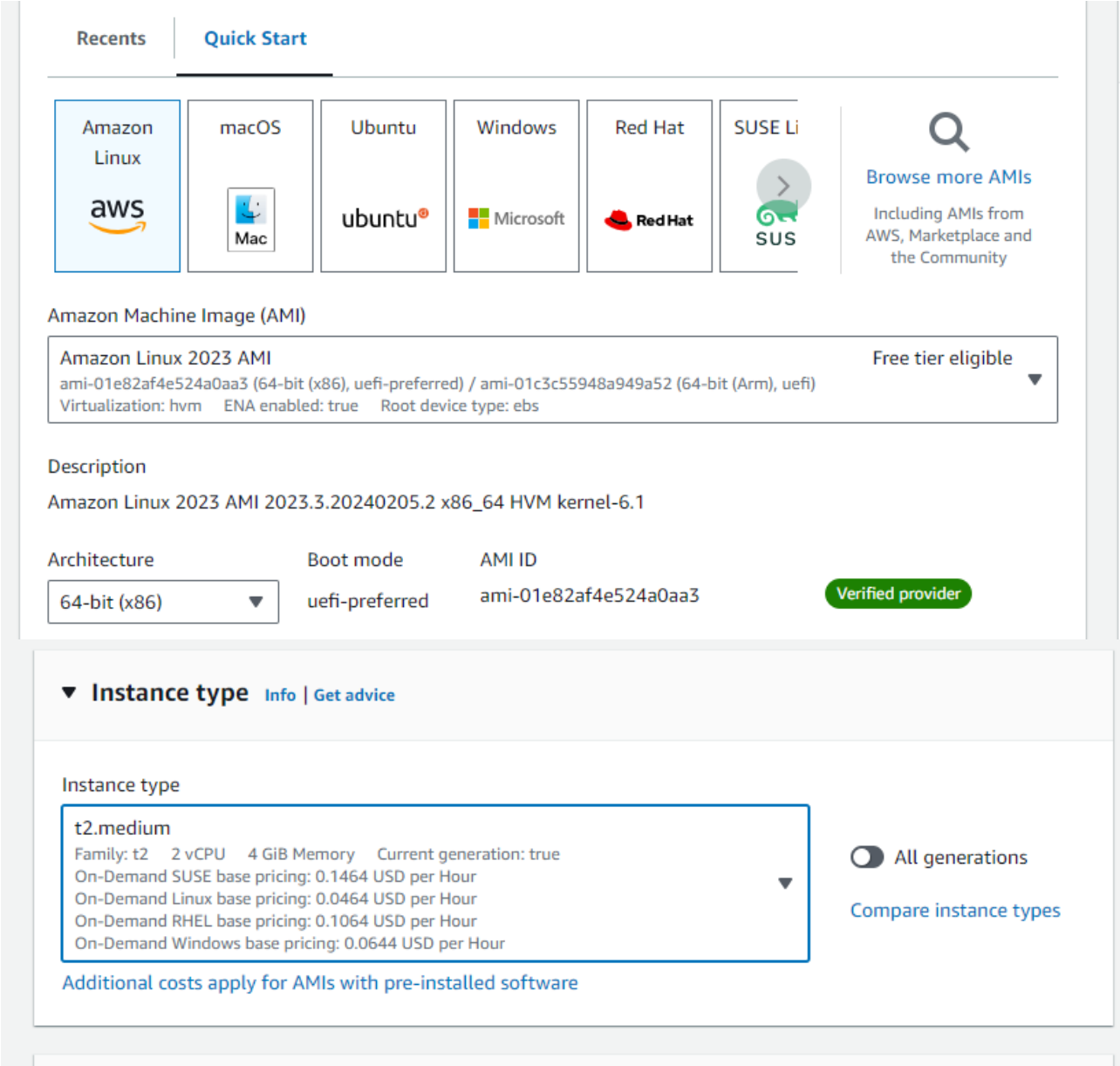
Practical Guide: Setting Up Jenkins Master-Slave Architecture on AWS EC2

Prepare AWS Environment:

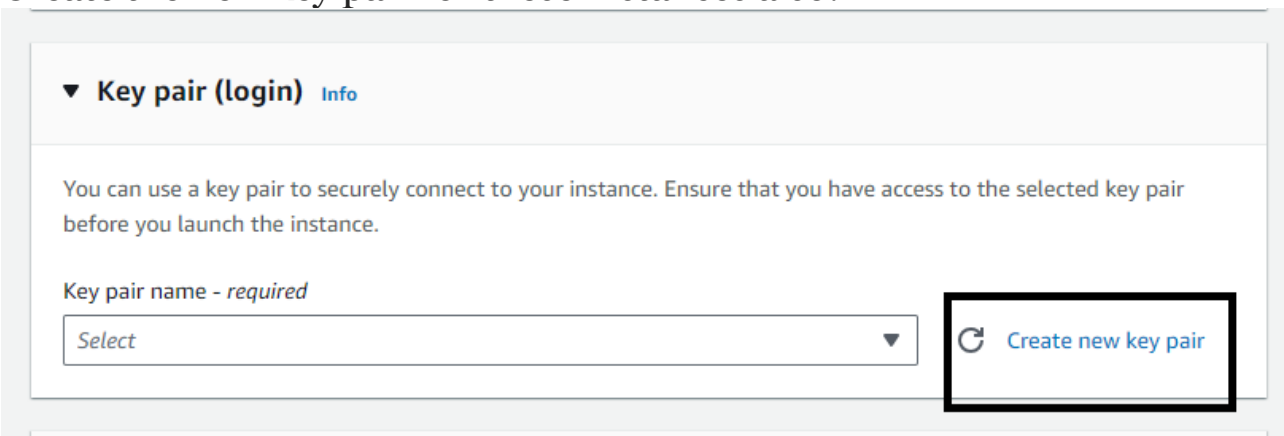
Launch EC2 instances for Jenkins master and slave nodes, ensuring proper network configuration and security group settings.

Jenkins Master Node:





Create the new key pair for these instances also:



Firewall (security groups) Info

A security group is a set of firewall rules that control the traffic for your instance. Add rules to allow specific traffic to reach your instance.

Create security group | Select existing security group

We'll create a new security group called '**launch-wizard-2**' with the following rules:

- [x] Allow SSH traffic from
  Helps you connect to your instance
  Anywhere
  0.0.0.0/0
- [x] Allow HTTPS traffic from the internet
  To set up an endpoint, for example when creating a web server
- [x] Allow HTTP traffic from the internet
  To set up an endpoint, for example when creating a web server

After successfully launching instance, install the Jenkins in master node and also install java.

Jenkins slave nodes

With the same instance configurations, we will launch the 1 Jenkins slave node and configure it from inside to launch the slave node

Basic Pre-requisite in slave node for its successful configuration:

```
[ec2-user@ip-172-31-22-79 ~]$ sudo yum install java -y
Last metadata expiration check: 0:39:15 ago on Sun Feb 18 18:55:45 2024.
Dependencies resolved.
================================================================================
 Package                                    Architecture        Version
================================================================================
Installing:
 java-21-amazon-corretto                    x86_64              1:21.0.2+13-1.amzn2023.1
Installing dependencies:
 alsa-lib                                   x86_64              1.2.7.2-1.amzn2023.0.2
 cairo                                      x86_64              1.17.6-2.amzn2023.0.1
 dejavu-sans-fonts                          noarch              2.37-16.amzn2023.0.2
 dejavu-sans-mono-fonts                     noarch              2.37-16.amzn2023.0.2
 dejavu-serif-fonts                         noarch              2.37-16.amzn2023.0.2
 fontconfig                                 x86_64              2.13.94-2.amzn2023.0.2
 fonts-filesystem                           noarch              1:2.0.5-12.amzn2023.0.2
 freetype                                   x86_64              2.13.0-2.amzn2023.0.1
 giflib                                     x86_64              5.2.1-9.amzn2023.0.1
 google-noto-fonts-common                   noarch              20201206-2.amzn2023.0.2
 google-noto-sans-vf-fonts                  noarch              20201206-2.amzn2023.0.2
 graphite2                                  x86_64              1.3.14-7.amzn2023.0.2
```

Now our plan is to set up one slave node for **Docker** builds.

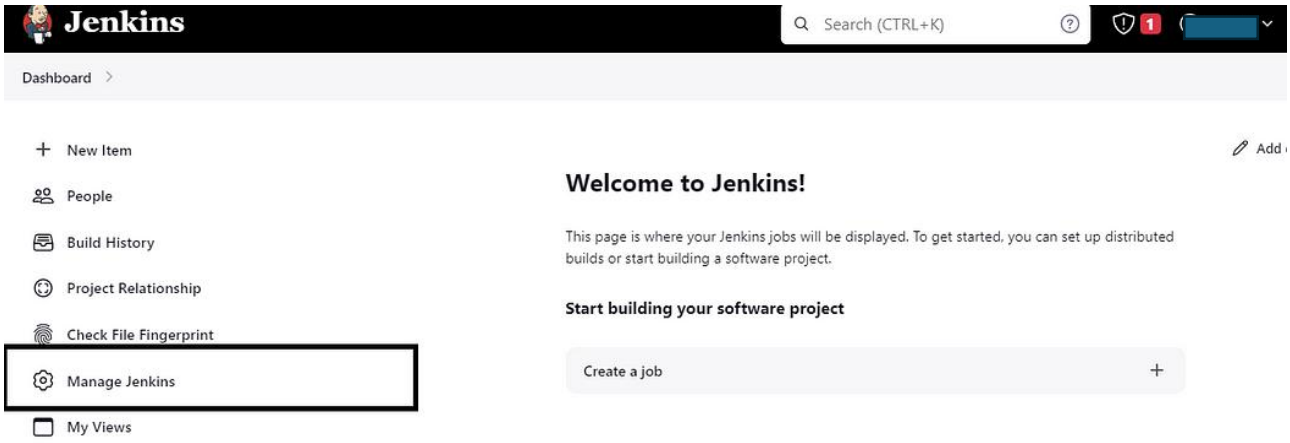
So first set up node as docker slave, run below command in that slave node:

- `sudo yum install docker -y #linux 2023`
- `sudo usermod -aG docker ec2-user`
- `newgrp docker`
- `sudo service docker start`
- `sudo chmod 777 /var/run/docker.sock`

Access the Jenkins Master Node from WebUI

Access the Jenkins master node on the browser using its public IP at port number 8080.

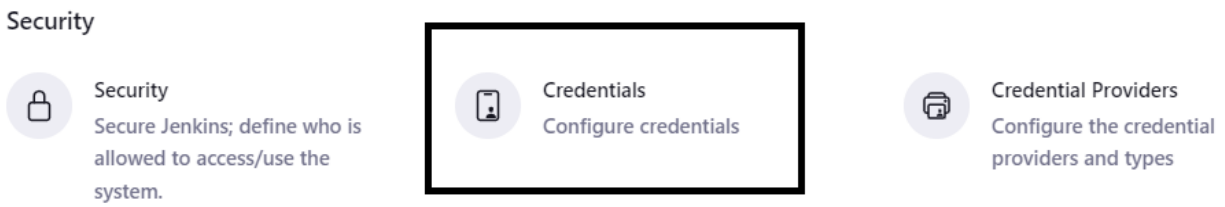
Go to the “Manage Jenkins” option from your dashboard :



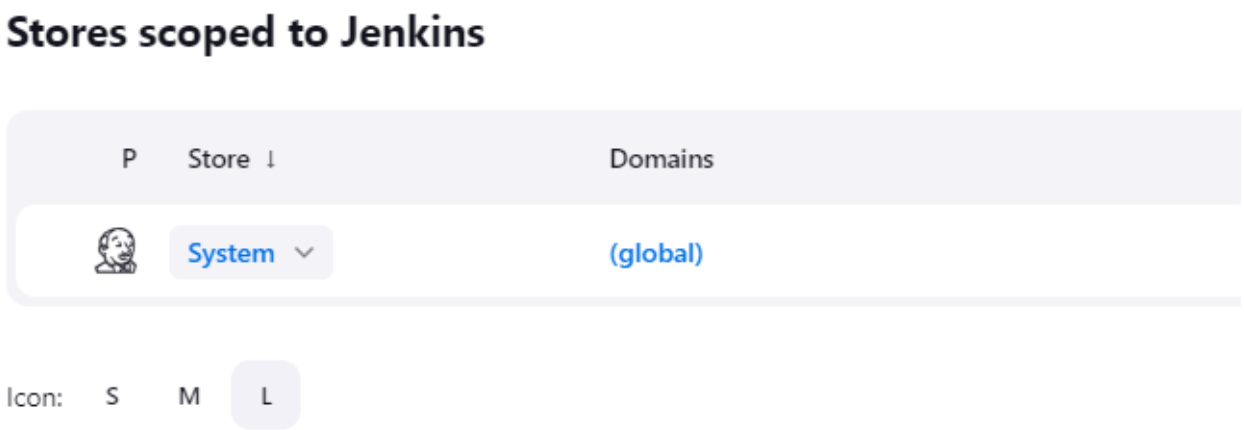
--Go to plugins install ssh agent.

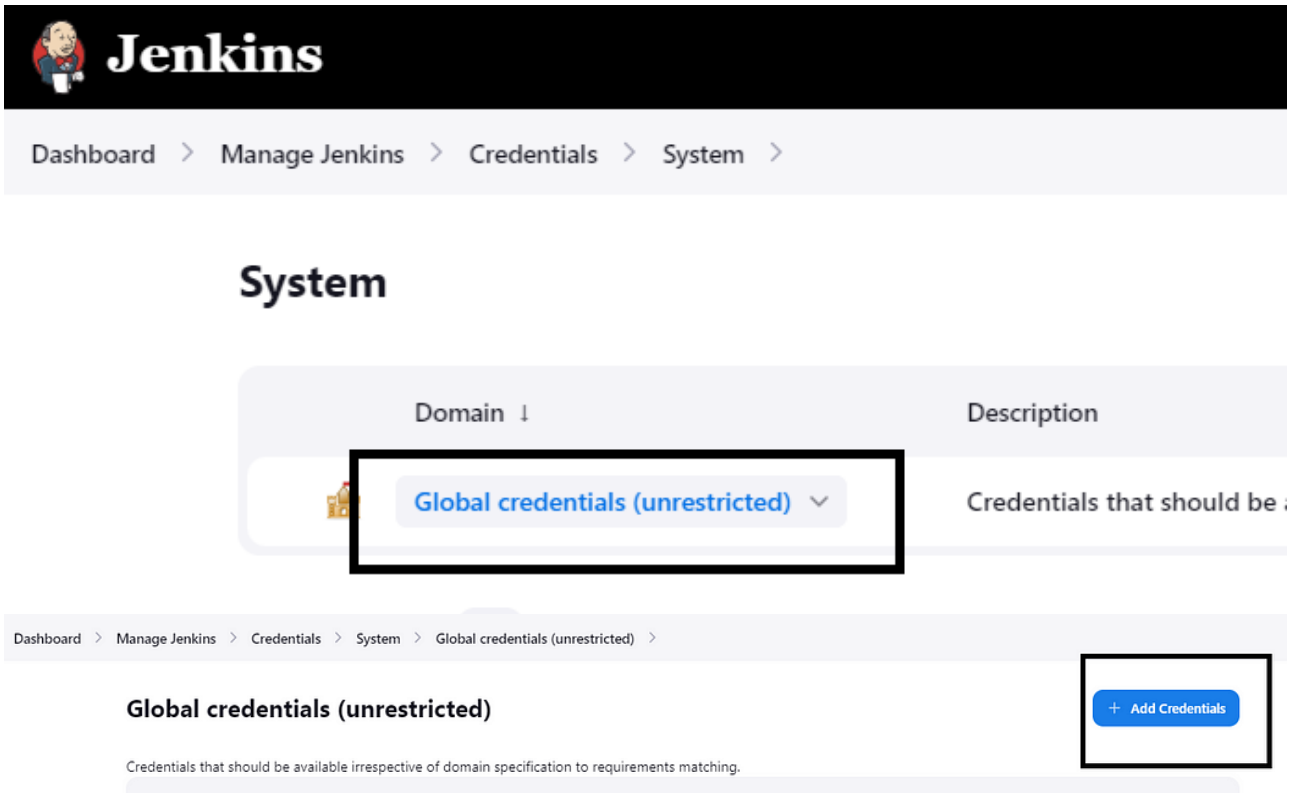
Setting Credentials :

On the “Manage Jenkins” section, click on the “Credentials” in security section :

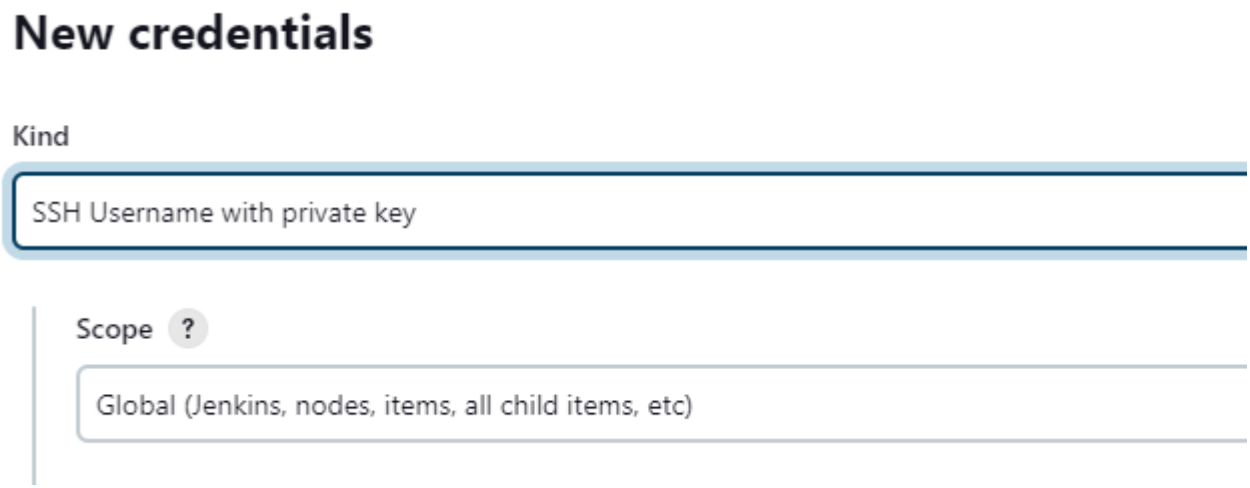


Click on “system” :

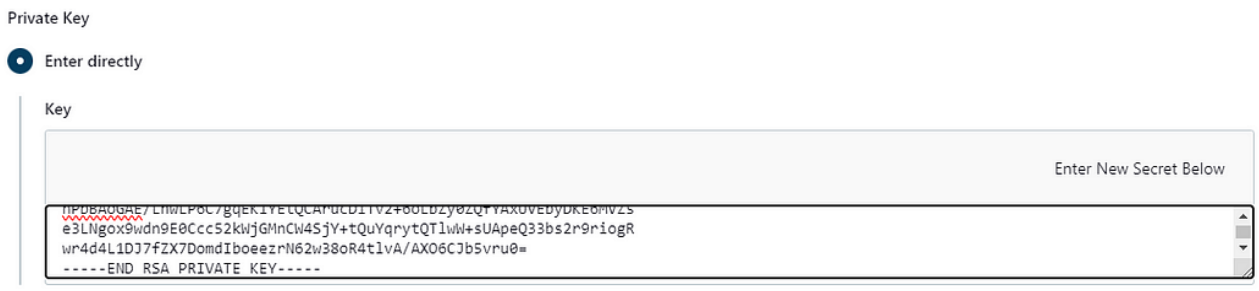




Choose “SSH Username with private key” on this option:

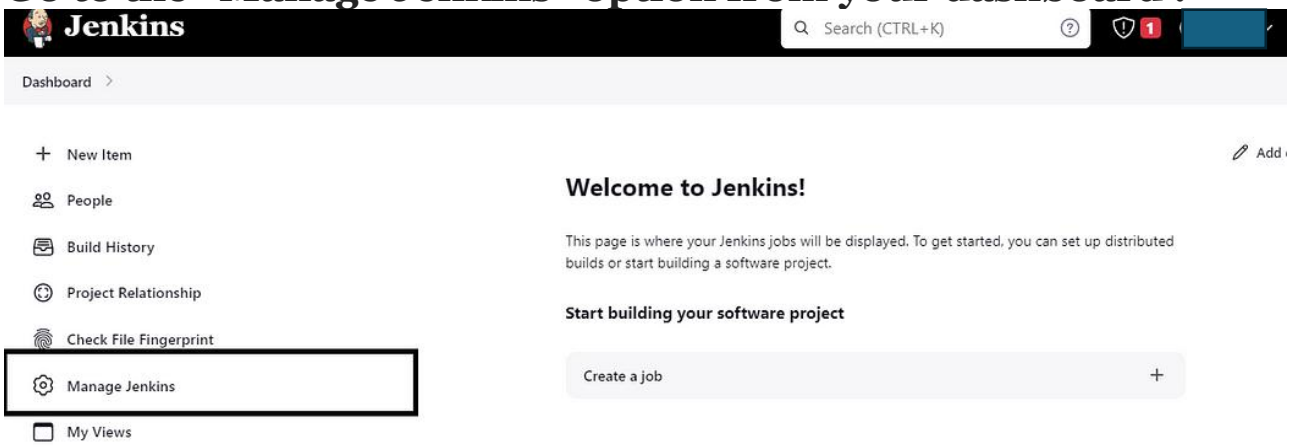


Then give the username you want to access, here we will give “ec2-user” and then copy the same key that we have created while launching the slave node.



And create this credentials, so that we can use it while adding the slave node on the Jenkins.

Go to the "Manage Jenkins" option from your dashboard :



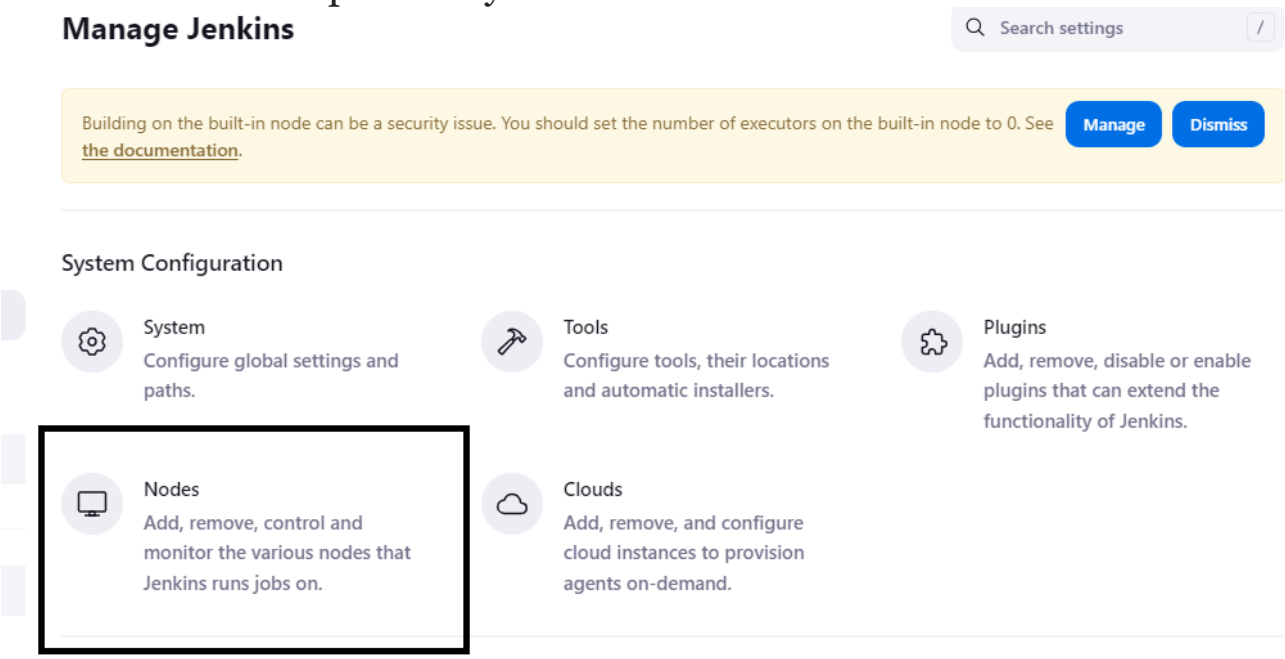
Go and search java path in master node and copy the java path

```
[ec2-user@ip-172-31-54-32 ~]$ cd /usr/lib/jvm/java-17-amazon-corretto.x86_64/
[ec2-user@ip-172-31-54-32 java-17-amazon-corretto.x86_64]$ ls
bin  conf  legal  lib  man  release
[ec2-user@ip-172-31-54-32 java-17-amazon-corretto.x86_64]$ pwd
/usr/lib/jvm/java-17-amazon-corretto.x86_64
[ec2-user@ip-172-31-54-32 java-17-amazon-corretto.x86_64]$
```

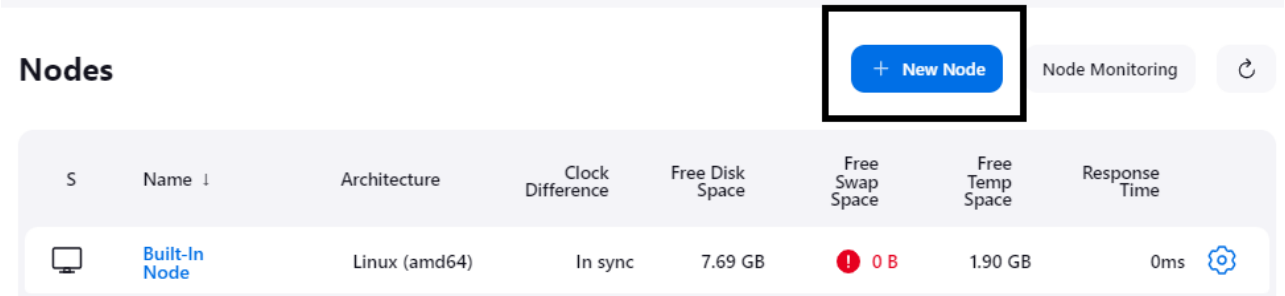
Manage Jenkins—tools- add jdk {java path}

Paste java path here and save

Click on “Nodes” option on your screen :



Then click on “+New Node” button.



Then write the name you want to give to this slave node:

New node

Node name

Slave 1 - Docker

Type

Permanent Agent

Adds a plain, permanent agent to Jenkins. This is called "permanent" because Jenkins doesn't provide higher level of integration with these agents, such as dynamic provisioning. Select this type if no other agent types apply — for example such as when you are adding a physical computer, virtual machines managed outside Jenkins, etc.

Then we will add further details for that node, i.e, number of executors and that workspace remote root directory is default other wise we can create and pass here:

Number of executors ?

2

Remote root directory ?

/home/ec2-user

Then we will set label for that Slave node :

Labels ?

Node_For_Docker

Usage ?

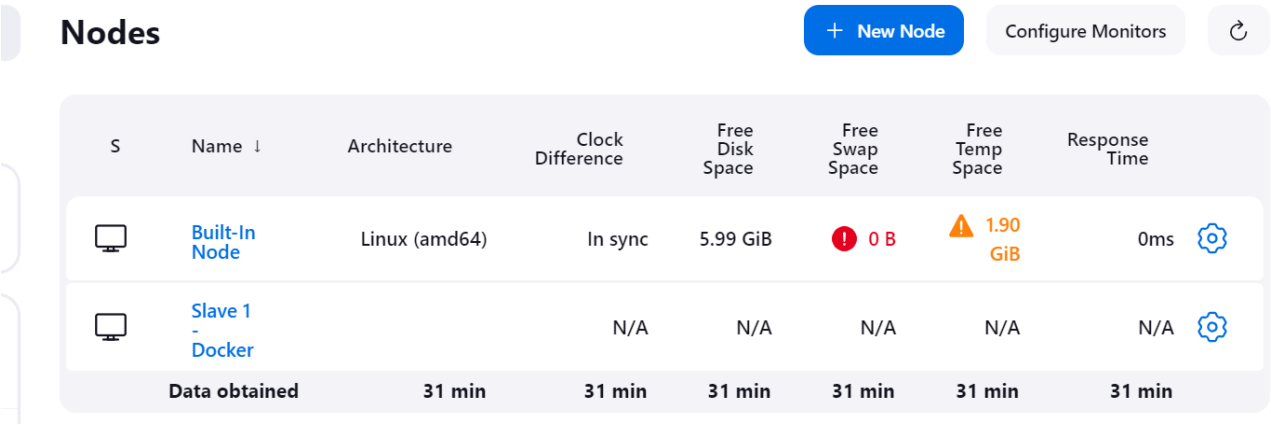
Use this node as much as possible

Then finally we will give the slave host details, i.e, its private IP and method of launching agent :

Keep the Host-key Verification Strategy to “Non verifying Strategy”.

For giving the “ec2-user” credentials that we can see here, we first have to create it separately on “Credentials” section of Jenkins :

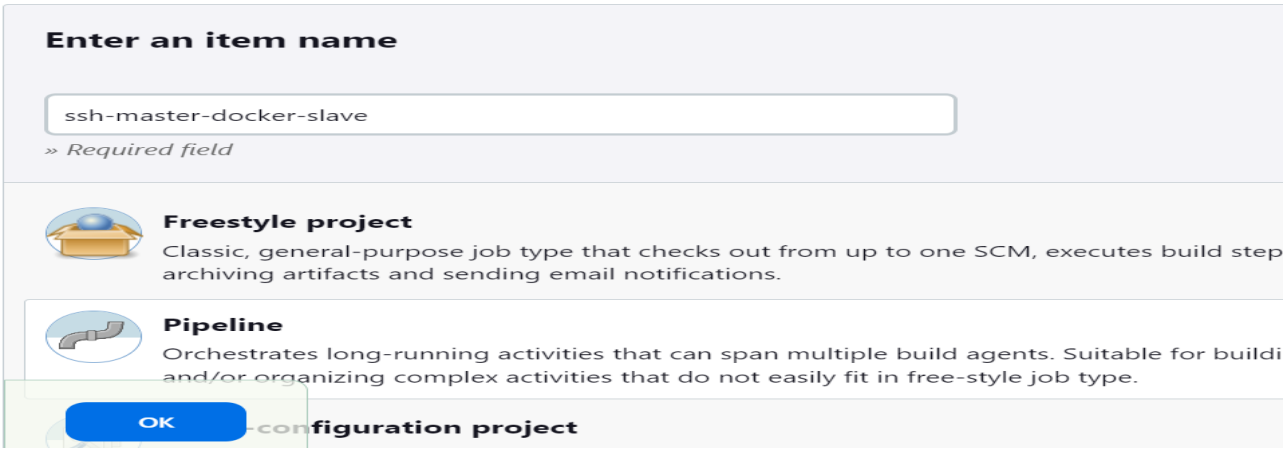
And finally our setup would be look like this :



By implementing Jenkins master-slave architecture on AWS EC2, organizations can harness the power of distributed computing to accelerate their CI/CD pipelines and deliver high-quality software with greater efficiency and reliability.

equipped to leverage Jenkins' distributed capabilities and propel your software delivery process to new heights of efficiency and agility.

- Build the Jenkins pipe line

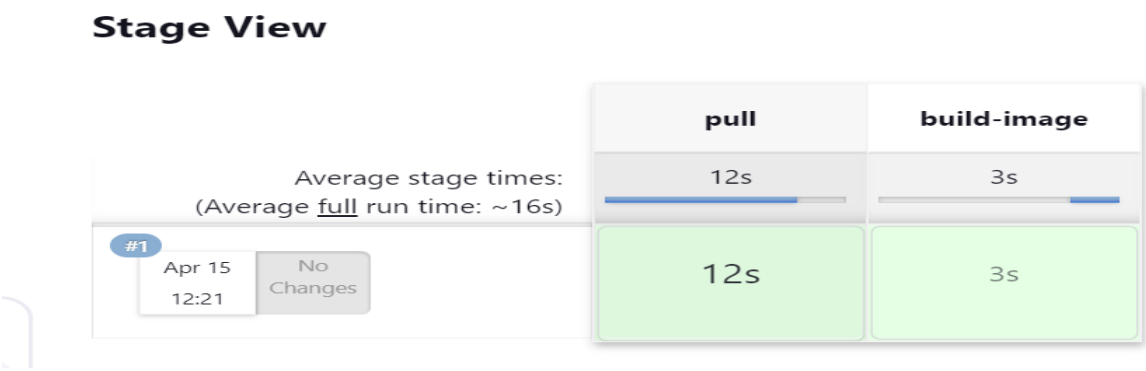


Write the pipe line script

```
pipeline {

  agent {

    label 'Node_For_Docker'

  }

  stages {

    stage('pull') {

      steps {

        sh 'docker pull jenkins/jenkins'

      }

    }

    stage('build-image') {

      steps {

sh 'docker run -dt -p 8081:8080 jenkins/jenkins'

      }

    }
```

```
    }

}
```

- Build the code

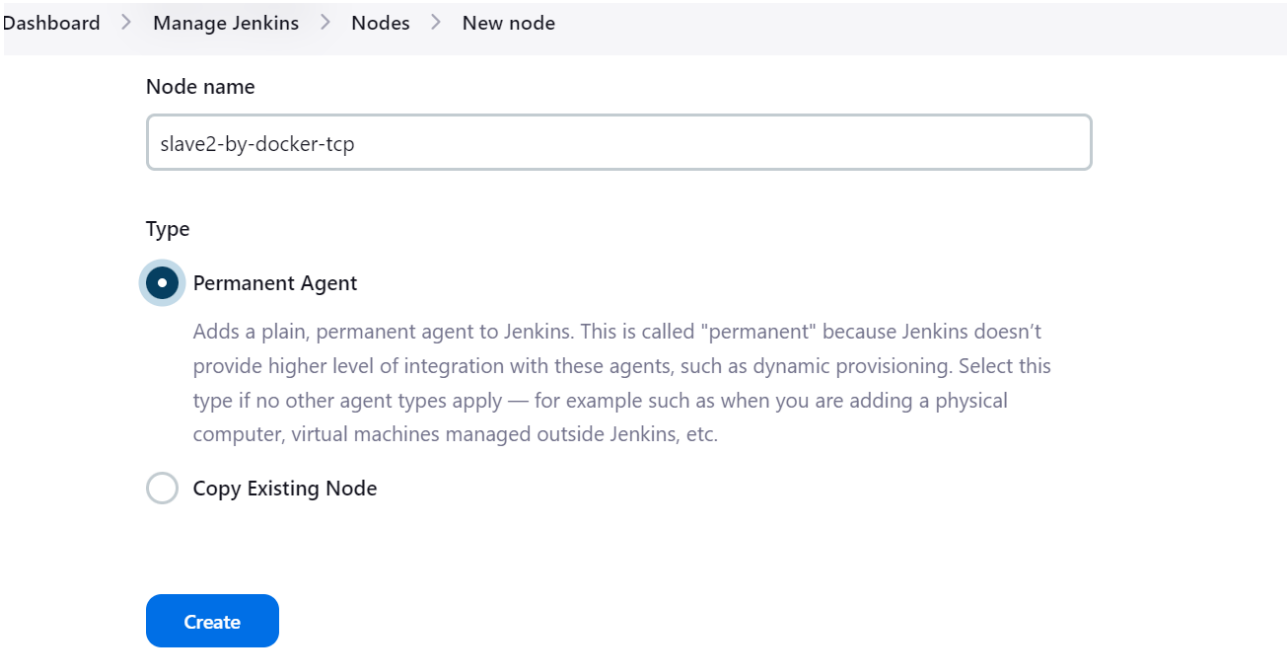


- Go to slave node and check workspace, docker image, docker container created or not.

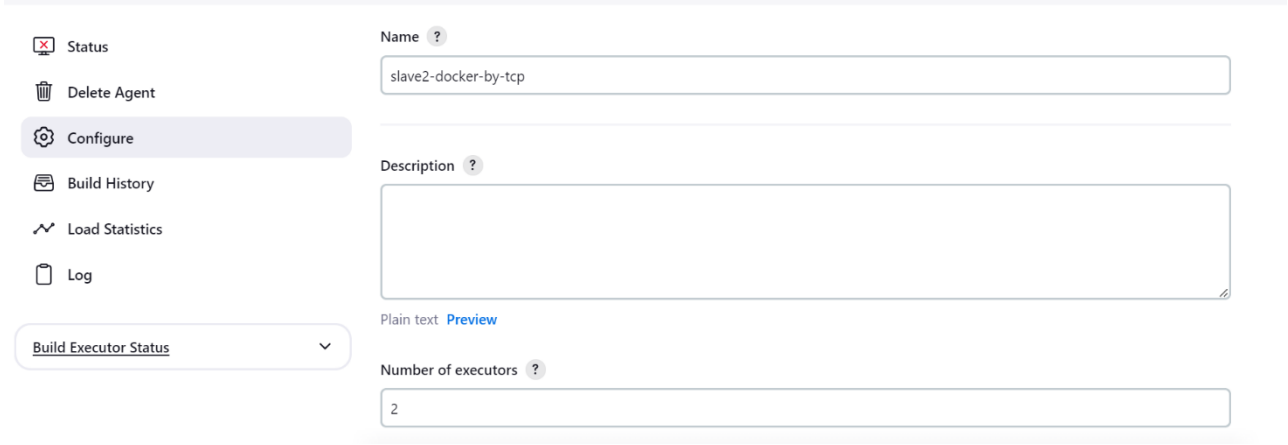
```
[ec2-user@ip-172-31-53-48 ~]$ pwd
/home/ec2-user
[ec2-user@ip-172-31-53-48 ~]$ ls
caches  remoting  remoting.jar  workspace
[ec2-user@ip-172-31-53-48 ~]$ cd workspace/
[ec2-user@ip-172-31-53-48 workspace]$ ls
ssh-master-docker-slave  ssh-master-docker-slave@tmp
[ec2-user@ip-172-31-53-48 workspace]$ docker images
REPOSITORY        TAG       IMAGE ID       CREATED      SIZE
jenkins/jenkins   latest    8e7bd57a40fa   5 days ago   470MB
[ec2-user@ip-172-31-53-48 workspace]$ docker ps -a
CONTAINER ID   IMAGE             COMMAND                  CREATED          STATUS          PORTS
       NAMES
12383e99a049   jenkins/jenkins   "/usr/bin/tini -- /u…"   51 seconds ago   Up 48 seconds   50000/tcp, 0.0.0.0:8081->8080/tcp, :::8081->8080
/tcp   objective_archimedes
```

- The master and slave is completed by ssh agent method.

➔ **<u>Master and slave by other approach (launch agent connecting it to the controller.</u>**



Step 5: Add a description of the node.



Step 6: Select the Number of executors to 2, generally equal to the number of vCPUs your machine has. It means how many parallel tasks this node can handle. If a task/ process requires one thread, then it consumes one core of your machine, which is how many vCPUs your machine has. So, we will be selecting this based on vCPUs.

Next, that workspace remote root directory is default otherwise we can create and pass here:.

Number of executors ?

2

Remote root directory ?

/home/ec2-user

Step 7: Add labels, for now, we have added docker-by-tcp-controller as the label; it is generally given as dev, stage, etc. Select Usage to Use this node as much as possible and the **Launch method to Launch the agent by connecting it to the controller.**

Labels ?

docker-by-tcp-controller

Usage ?

Use this node as much as possible

Launch method ?

Launch agent by connecting it to the controller

Availability ?

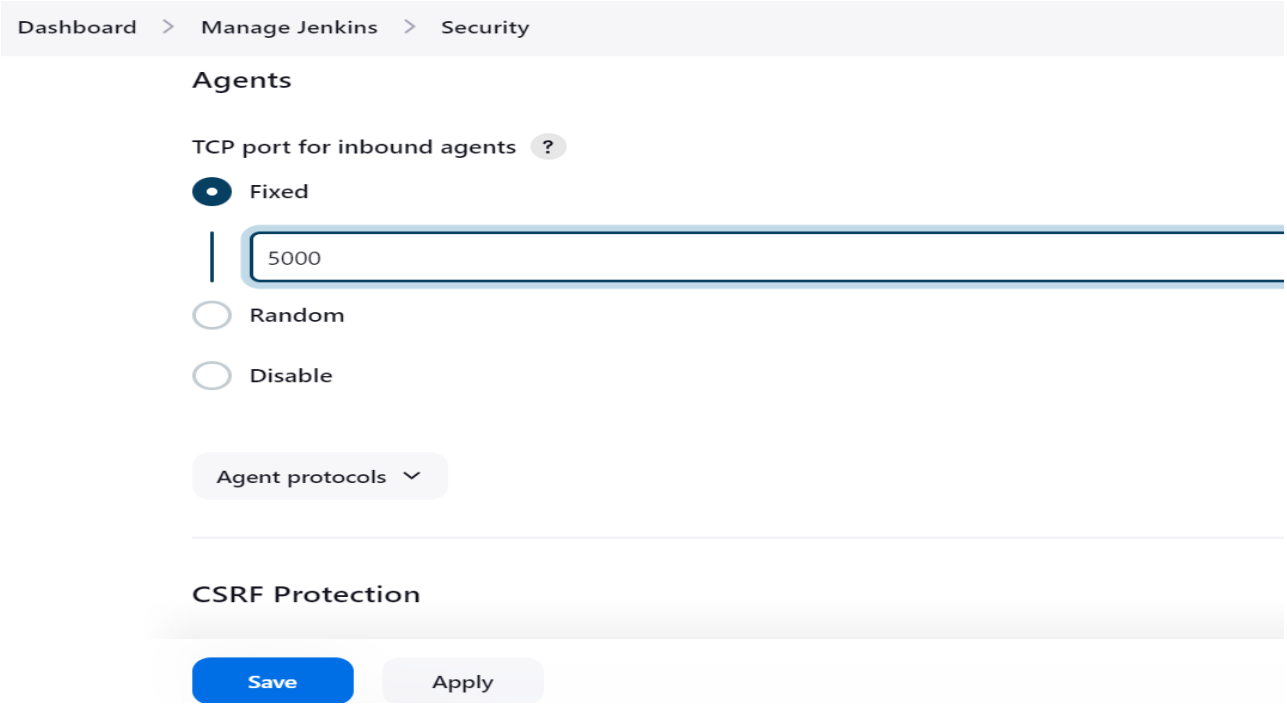
Keep this agent online as much as possible

Step 10: Click on “Save”.

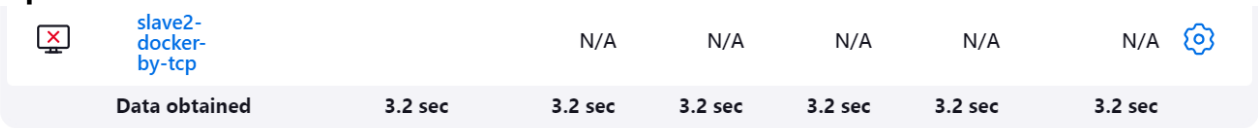
--When you click “enter”, you will see a red cross in front of our Slave node. This means our agent is not yet connected. To connect our agent with the master node,

-- we need to follow some steps.

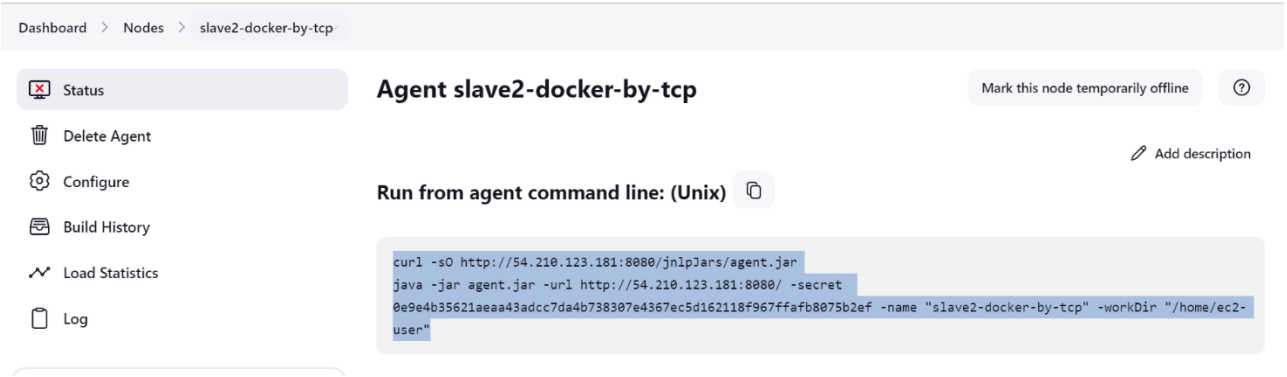
Step-1: click on manage Jenkins → click on security → go to agents→ by default it is disabled → clik on fixed → give any port number (ex:5000) → then apply and save.



Step-2 : Click on “Slave”.



Step-3: To connect with our master node, we need to install agent.jar on our master node. To install agent.jar, copy the command according to your environment and enter it onto your master node.

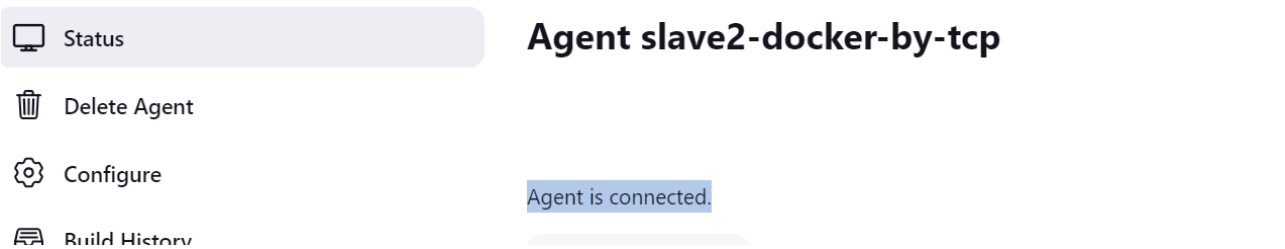


You will see something like this –

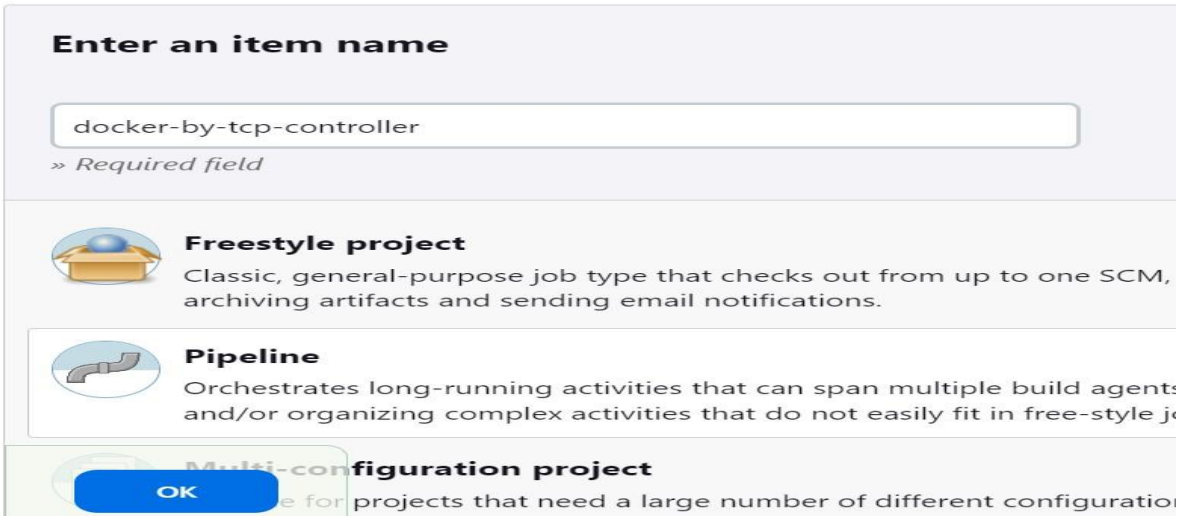
INFO: “Connected” indicates that your master node is successfully connected with your slave node.

```
ec2-user@ip-172-31-53-48 ~]$ curl -sO http://54.210.123.181:8080/jnlpJars/agent.jar
ava -jar agent.jar -url http://54.210.123.181:8080/ -secret 0e9e4b35621aeaa43adcc7da4b738307e4367ec5d162118f967ffafb8075b2ef -name "slave2
docker-by-tcp" -workDir "/home/ec2-user"
pr 15, 2024 7:15:31 AM org.jenkinsci.remoting.engine.WorkDirManager initializeWorkDir
NFO: Using /home/ec2-user/remoting as a remoting work directory
pr 15, 2024 7:15:31 AM org.jenkinsci.remoting.engine.WorkDirManager setupLogging
NFO: Both error and output logs will be printed to /home/ec2-user/remoting
pr 15, 2024 7:15:31 AM hudson.remoting.Launcher createEngine
NFO: Setting up agent: slave2-docker-by-tcp
pr 15, 2024 7:15:31 AM hudson.remoting.Engine startEngine
Apr 15, 2024 7:15:32 AM hudson.remoting.Launcher$CuiListener status
INFO: Trying protocol: JNLP4-connect
Apr 15, 2024 7:15:32 AM org.jenkinsci.remoting.protocol.impl.BIONetworkLayer$Reader run
INFO: Waiting for ProtocolStack to start.
Apr 15, 2024 7:15:32 AM hudson.remoting.Launcher$CuiListener status
INFO: Remote identity confirmed: d7:fb:2d:4a:4f:18:47:ab:07:5c:06:41:e8:96:43:6c
Apr 15, 2024 7:15:32 AM hudson.remoting.Launcher$CuiListener status
INFO: Connected
```

Step-4: Now, to check whether it is connected or not, refresh the slave2 node.



Step-5: create a pipepline

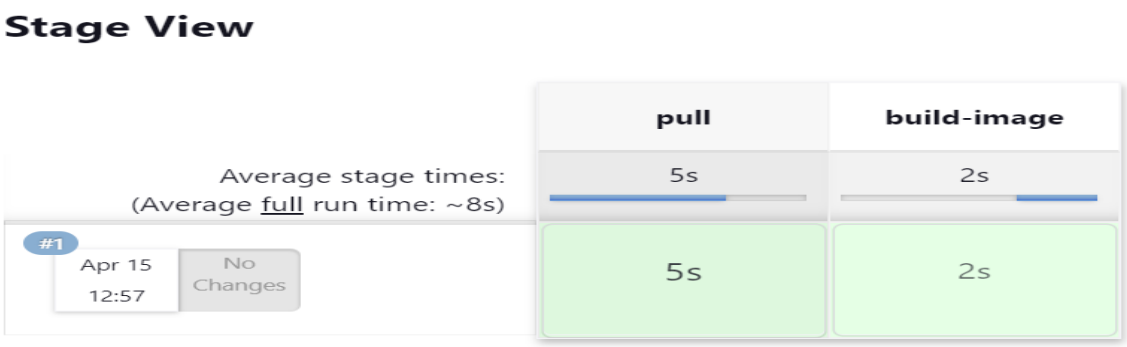


Step-6: create a pipeline script for any sample application{httpd}

```
pipeline {

   agent {

      label 'docker-by-tcp-controller'
```

```
    }
    stages {
        stage('pull') {
            steps {
                sh 'docker pull httpd'
            }
        }
        stage('build-image') {
            steps {
                sh 'docker run -dt -p 81:80 httpd'
            }
        }
    }
}
```

Step-7: build the pipe line



Step-8 : go to slave node and check docker image and container is created or not.

```
INFO: Trying protocol: JNLP4-connect
Apr 15, 2024 7:15:32 AM org.jenkinsci.remoting.protocol.impl.BIONetworkLayer$Reader run
INFO: Waiting for ProtocolStack to start.
Apr 15, 2024 7:15:32 AM hudson.remoting.Launcher$CuiListener status
INFO: Remote identity confirmed: d7:fb:2d:4a:4f:18:47:ab:07:5c:06:41:e8:96:43:6c
Apr 15, 2024 7:15:32 AM hudson.remoting.Launcher$CuiListener status
INFO: Connected
^C[ec2-user@ip-172-31-53-48 ~]$
[ec2-user@ip-172-31-53-48 ~]$ ls
agent.jar  caches  remoting  remoting.jar  workspace
[ec2-user@ip-172-31-53-48 ~]$ cd workspace/
[ec2-user@ip-172-31-53-48 workspace]$ ls
docker-by-tcp-controller  docker-by-tcp-controller@tmp  ssh-master-docker-slave  ssh-master-docker-slave@tmp
[ec2-user@ip-172-31-53-48 workspace]$ docker images
REPOSITORY        TAG       IMAGE ID       CREATED      SIZE
jenkins/jenkins   latest    8e7bd57a40fa   5 days ago   470MB
httpd             latest    fa0099f1c09d   9 days ago   148MB
[ec2-user@ip-172-31-53-48 workspace]$ docker ps -a
CONTAINER ID   IMAGE             COMMAND                  CREATED          STATUS          PORTS
     NAMES
b0609373dd68   httpd             "httpd-foreground"       50 seconds ago   Up 48 seconds   0.0.0.0:81->80/tcp, :::81->80/tcp
     sweet_mccarthy
12383e99a049   jenkins/jenkins   "/usr/bin/tini -- /u…"   37 minutes ago   Up 37 minutes   50000/tcp, 0.0.0.0:8081->8080/tcp, :::8081->8080
/tcp   objective_archimedes
[ec2-user@ip-172-31-53-48 workspace]$
```

- Master and slave other approach by (launch agent connecting it to the controller. Is competed successfully