Day-2 Ghautham M

step-by-step guide to setting up a simple Python "Hello, Docker!" Flask application using Docker and Docker Compose.

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1. Install Docker

First, install Docker to get the Docker engine running on your system:

sudo apt install -y docker.io

- **Explanation:** Installs Docker on your system using the apt package manager. The -y flag auto-confirms any prompts.

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2. Start and Enable Docker Service

Start the Docker service and enable it to start automatically at boot time:

sudo systemctl start docker

sudo systemctl enable docker

- **Explanation:** The start command starts the Docker daemon, and enable ensures Docker runs on startup.

---

3. Verify Docker Installation

Verify that Docker was installed correctly by checking its version:

docker --version

- **Explanation:** Displays the installed Docker version to confirm the installation.

---

4. Install Docker Compose

Now, install Docker Compose, a tool to define and manage multi-container Docker applications:

sudo curl -L "https://github.com/docker/compose/releases/latest/download/docker-compose-$(uname -s)-$(uname -m)" -o /usr/local/bin/docker-compose

sudo chmod +x /usr/local/bin/docker-compose

- **Explanation:** The first command downloads the latest Docker Compose binary, and the second command makes it executable.

---

5. Verify Docker Compose Installation

Check the installed version of Docker Compose:

docker-compose --version

- **Explanation:** Displays the installed Docker Compose version to verify the installation.

---

6. Create Project Directory

Create a directory for your project and navigate into it:

mkdir ~/docker-python-app

cd ~/docker-python-app

- **Explanation:** Creates a directory for your project and navigates into it.

---

7. Create the app.py file

Create a Python file app.py for the Flask application:

nano app.py

Paste the following Flask application code:

```
from flask import Flask


app = Flask(__name__)


@app.route('/')
def hello_world():
    return 'Hello, world Running inside the docker!'


if __name__ == '__main__':
    app.run(host='0.0.0.0', port=5000)
```

- **Explanation:** A simple Flask app with one route (/) that returns a greeting message. The Flask server listens on all interfaces (0.0.0.0) and port 5000.

---

8. Create requirements.txt

Create a requirements.txt file to list Python dependencies:

nano requirements.txt

Add the following content:

flask

- **Explanation:** Lists the Flask library as the required dependency for your project.

---

9. Install pip (if not already installed)

Ensure pip is installed to handle Python package installations:

sudo apt update

sudo apt install python3-pip

- **Explanation:** Updates the package list and installs pip to handle Python packages.

---

10. Create Dockerfile

Create a Dockerfile that defines how the Docker image should be built:

nano Dockerfile

Add the following content:

Use the official Python image from Docker Hub

FROM python:3.9-slim

Set the working directory inside the container

WORKDIR /app

Copy the current directory contents into the container at /app

COPY . /app

Install any needed packages specified in requirements.txt

RUN pip install --no-cache-dir -r requirements.txt

Make port 5000 available to the world outside the container

EXPOSE 5000

Define the environment variable for Flask to run in production mode

```
ENV FLASK_ENV=production


# Run app.py when the container launches
CMD ["python", "app.py"]
```

- **Explanation:** This Dockerfile defines the Python environment, installs dependencies, exposes port 5000, and starts the Flask app inside the container.

---

11. Create docker-compose.yml

Create a docker-compose.yml file to manage the application's services:

```
nano docker-compose.yml
```

Add the following content:

```
version: '3.8'
services:
  web:
    build: .
    ports:
      - "5000:5000"
    environment:
      - FLASK_ENV=development
    volumes:
      - .:/app
    restart: always
```

- **Explanation:** This Compose file:
    - Defines the web service.
    - Builds the image from the current directory.
    - Maps port 5000 from the host to the container.
    - Mounts the current directory (.) into the container to enable live code reloading.
    - Restarts the container if it crashes.

---

12. Add User to Docker Group (if needed)

To avoid using sudo with Docker commands, add your user to the Docker group:

sudo usermod -aG docker $USER

newgrp docker

- **Explanation:** The first command adds your user to the Docker group, and the second command applies the changes to your current session.

---

13. Build and Run the Application

Now, you can build and start the Flask app container using Docker Compose:

docker-compose up --build

- **Explanation:** This command builds the Docker image and starts the container based on the docker-compose.yml configuration. The --build flag forces a rebuild of the Docker image.

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14. Access the Application

Once the container is running, open your browser and navigate to:

http://localhost:5000

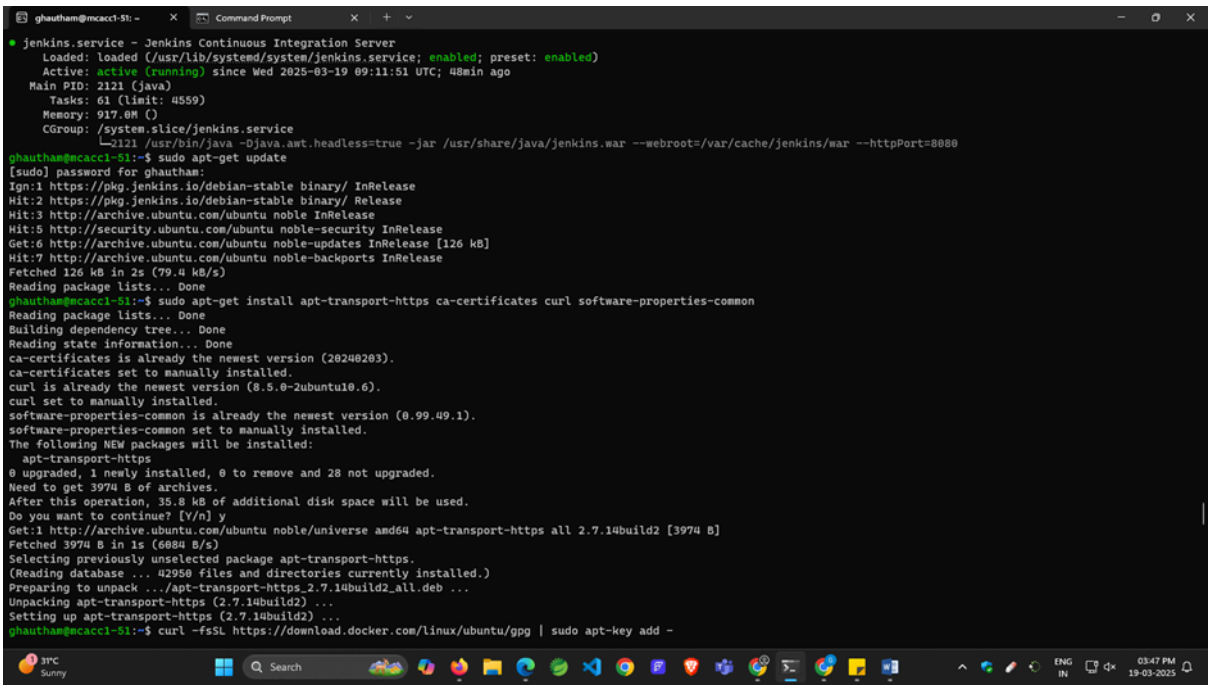
You should see the message: **"Hello, Docker Python App!"**

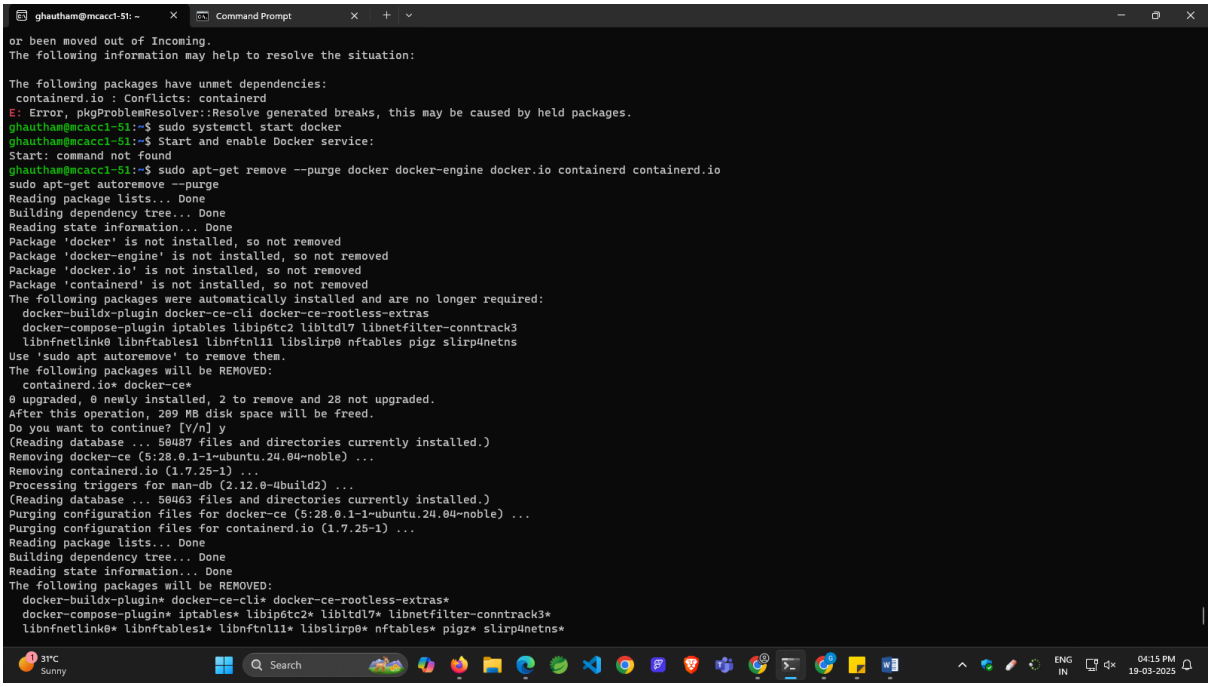
Summary of Commands

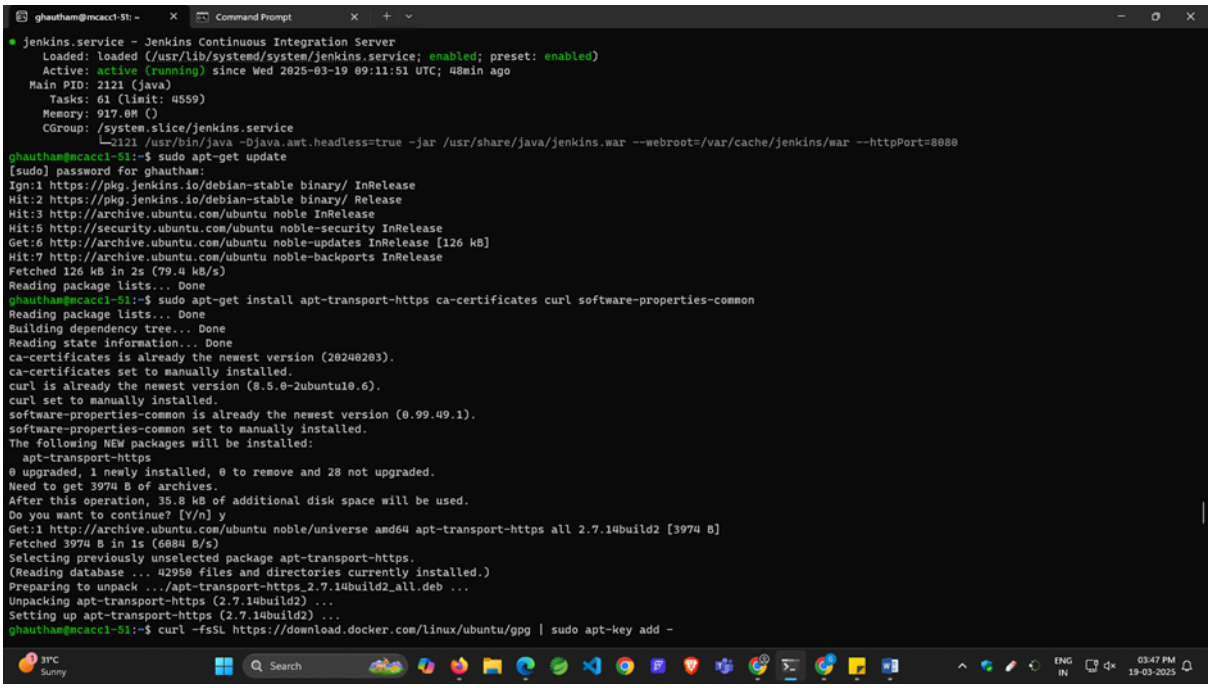
1. Install Docker:
2. sudo apt install -y docker.io
3. Start and enable Docker service:
4. sudo systemctl start docker
5. sudo systemctl enable docker
6. Install Docker Compose:
7. sudo curl -L "https://github.com/docker/compose/releases/latest/download/docker-compose-$(uname -s)-$(uname -m)" -o /usr/local/bin/docker-compose
8. sudo chmod +x /usr/local/bin/docker-compose
9. Create project directory:
10. mkdir ~/docker-python-app
11. cd ~/docker-python-app

12. Create app.py with Flask code.
13. Create requirements.txt with flask.
14. Install pip (if needed):
15. sudo apt update
16. sudo apt install python3-pip
17. Create Dockerfile with the configuration.
18. Create docker-compose.yml with service definition.
19. Add your user to the Docker group (if necessary):
20. sudo usermod -aG docker $USER
21. newgrp docker
22. Build and run the app:
23. docker-compose up --build

Now your "Hello, Docker!" Flask app should be running inside a Docker container, accessible at http://localhost:5000.




ghautham@mcacc1-51: ~
Command Prompt
or been moved out of Incoming.
The following information may help to resolve the situation:
The following packages have unmet dependencies:
containerd.io : Conflicts: containerd
E: Error, pkgProblemResolver::Resolve generated breaks, this may be caused by held packages.
ghautham@mcacc1-51:~$ sudo systemctl start docker
ghautham@mcacc1-51:~$ Start and enable Docker service:
Start: command not found
ghautham@mcacc1-51:~$ sudo apt-get remove --purge docker docker-engine docker.io containerd containerd.io
sudo apt-get autoremove --purge
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
Package 'docker' is not installed, so not removed
Package 'docker-engine' is not installed, so not removed
Package 'docker.io' is not installed, so not removed
Package 'containerd' is not installed, so not removed
The following packages were automatically installed and are no longer required:
docker-buildx-plugin docker-ce-cli docker-ce-rootless-extras
docker-compose-plugin iptables libip6tc2 libltdl7 libnetfilter-conntrack3
libnfnetlink0 libnftables1 libnftnl11 libslirp0 nftables pigz slirp4netns
Use 'sudo apt autoremove' to remove them.
The following packages will be REMOVED:
containerd.io* docker-ce*
0 upgraded, 0 newly installed, 2 to remove and 28 not upgraded.
After this operation, 209 MB disk space will be freed.
Do you want to continue? [Y/n] y
(Reading database ... 50487 files and directories currently installed.)
Removing docker-ce (5:28.0.1-1~ubuntu.24.04~noble) ...
Removing containerd.io (1.7.25-1) ...
Processing triggers for man-db (2.12.0-4build2) ...
(Reading database ... 50463 files and directories currently installed.)
Purging configuration files for docker-ce (5:28.0.1-1~ubuntu.24.04~noble) ...
Purging configuration files for containerd.io (1.7.25-1) ...
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following packages will be REMOVED:
docker-buildx-plugin* docker-ce-cli* docker-ce-rootless-extras*
docker-compose-plugin* iptables* libip6tc2* libltdl7* libnetfilter-conntrack3*
libnfnetlink0* libnftables1* libnftnl11* libslirp0* nftables* pigz* slirp4netns*
31°C
Sunny
Search
ENG
IN
04:15 PM
19-03-2025


ghautham@mcacc1-51: ~
Command Prompt
jenkins.service - Jenkins Continuous Integration Server
Loaded: loaded (/usr/lib/systemd/system/jenkins.service; enabled; preset: enabled)
Active: active (running) since Wed 2025-03-19 09:11:51 UTC; 48min ago
Main PID: 2121 (java)
Tasks: 61 (limit: 4559)
Memory: 917.0M ()
CGroup: /system.slice/jenkins.service
└─2121 /usr/bin/java -Djava.awt.headless=true -jar /usr/share/java/jenkins.war --webroot=/var/cache/jenkins/war --httpPort=8080
ghautham@mcacc1-51:~$ sudo apt-get update
[sudo] password for ghautham:
Ign:1 https://pkg.jenkins.io/debian-stable binary/ InRelease
Hit:2 https://pkg.jenkins.io/debian-stable binary/ Release
Hit:3 http://archive.ubuntu.com/ubuntu noble InRelease
Hit:5 http://security.ubuntu.com/ubuntu noble-security InRelease
Get:6 http://archive.ubuntu.com/ubuntu noble-updates InRelease [126 kB]
Hit:7 http://archive.ubuntu.com/ubuntu noble-backports InRelease
Fetched 126 kB in 2s (79.4 kB/s)
Reading package lists... Done
ghautham@mcacc1-51:~$ sudo apt-get install apt-transport-https ca-certificates curl software-properties-common
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
ca-certificates is already the newest version (20240203).
ca-certificates set to manually installed.
curl is already the newest version (8.5.0-2ubuntu10.6).
curl set to manually installed.
software-properties-common is already the newest version (0.99.49.1).
software-properties-common set to manually installed.
The following NEW packages will be installed:
apt-transport-https
0 upgraded, 1 newly installed, 0 to remove and 28 not upgraded.
Need to get 3974 B of archives.
After this operation, 35.8 kB of additional disk space will be used.
Do you want to continue? [Y/n] y
Get:1 http://archive.ubuntu.com/ubuntu noble/universe amd64 apt-transport-https all 2.7.14build2 [3974 B]
Fetched 3974 B in 1s (6084 B/s)
Selecting previously unselected package apt-transport-https.
(Reading database ... 42950 files and directories currently installed.)
Preparing to unpack .../apt-transport-https_2.7.14build2_all.deb ...
Unpacking apt-transport-https (2.7.14build2) ...
Setting up apt-transport-https (2.7.14build2) ...
ghautham@mcacc1-51:~$ curl -fsSL https://download.docker.com/linux/ubuntu/gpg | sudo apt-key add -
31°C
Sunny
Search
ENG
IN
03:47 PM
19-03-2025

Jenkins Pipeline Through Git Token - Setup Procedure

Step 1: Generate a Git Personal Access Token

Before configuring the Jenkins pipeline, you need to generate a **Personal Access Token (PAT)** from your Git service.

GitHub (Example)

1. **Log in to GitHub** and navigate to your profile.
2. Go to **Settings** > **Developer Settings** > **Personal Access Tokens**.
3. Click **Generate New Token**.
4. Select the necessary permissions for the token. For example, to clone repositories, select:
    - repo (full control of private repositories)
    - read:org (for organization repository access)
5. Generate the token and **copy it**. This token will act as the password when Jenkins connects to GitHub.

GitLab (Example)

1. **Log in to GitLab** and go to **Profile Settings** > **Access Tokens**.
2. Generate a new token with appropriate scopes (e.g., read_repository).
3. **Save the token** to use in Jenkins.

Bitbucket (Example)

1. **Log in to Bitbucket** and go to **Personal Settings** > **App Passwords**.
2. Create an app password with necessary permissions (like repository read).
3. **Save the password** to use in Jenkins.

Step 2: Store Git Token in Jenkins Credentials

Once you've generated the Git token, the next step is to store it securely in Jenkins.

1. **Log in to Jenkins** and navigate to the Jenkins dashboard.
2. In the left menu, click on **Manage Jenkins**.

3. Click on **Manage Credentials**.
4. Select the appropriate **scope** (e.g., (Global)).
5. Click on **Add Credentials**.
6. In the **Kind** dropdown, select **Username with password**.
7. In the **Username** field, enter your Git username (e.g., your-username for GitHub).
8. In the **Password** field, paste the **Git token** you generated.
9. Optionally, give it an ID (e.g., git-token-jenkins).
10. Click **OK** to save the credentials.

Step 3: Configure Jenkins Pipeline

Now that the Git token is securely stored in Jenkins, you can configure a Jenkins pipeline to use it for Git interactions.

Example Pipeline Script (Declarative Pipeline)

You'll now set up a pipeline that uses Git for the source code. Here's an example using a declarative pipeline.

1. **Create a New Pipeline Job**:
    - Go to Jenkins Dashboard.
    - Click **New Item**, select **Pipeline**, and name your pipeline (e.g., Git-Pipeline).
    - Click **OK**.
2. **Configure the Pipeline**:
    - In the pipeline configuration, scroll to the **Pipeline** section.
    - Choose **Pipeline script from SCM**.
    - Set the **SCM** dropdown to **Git**.
    - In the **Repository URL** field, enter your repository URL (e.g., https://github.com/yourusername/your-repository.git).
    - Select **Credentials**. Choose the credentials you created earlier (e.g., git-token-jenkins).

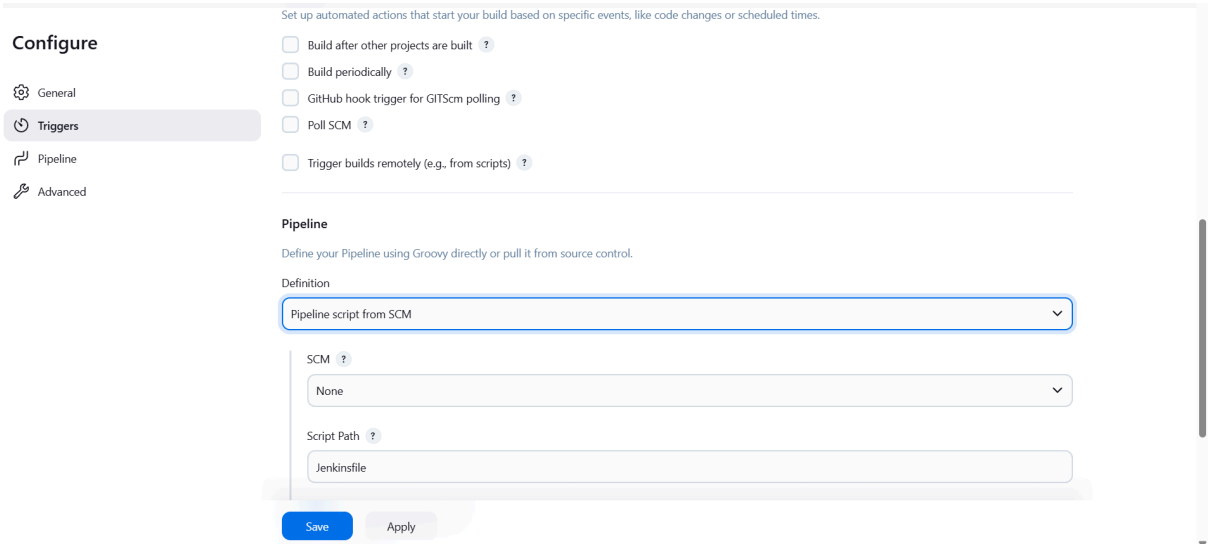
Step 4: Run the Jenkins Pipeline

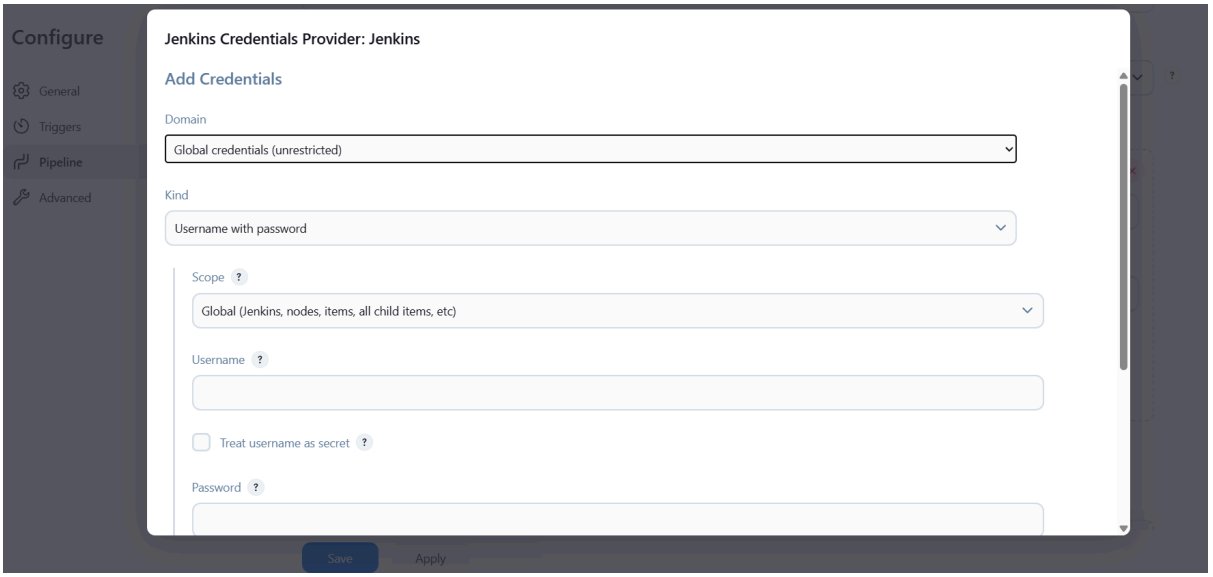
- After configuring the pipeline, click **Save** and then **Build Now** to run the pipeline.
- Jenkins will use the credentials you provided to authenticate with Git, clone the repository, and run the pipeline steps.

Step 5: Monitor and Troubleshoot

- If the pipeline fails, check the Jenkins job's **Console Output** for debugging information. Common issues can be due to incorrect credentials, Git URL, or permission issues.

-





Jenkins Pipeline for Dockerized Application Deployment

This document provides a step-by-step guide on how the Jenkins pipeline automates the process of fetching the code from GitHub, building a Docker image, pushing it to a container registry, and deploying the application in a running Docker container.

Pipeline Overview

The pipeline follows these key steps:

1. **Checkout Code** - Fetch the latest code from the GitHub repository.
2. **Build Docker Image** - Create a Docker image for the application.
3. **Login to Docker Registry** - Authenticate to the container registry.
4. **Push to Container Registry** - Upload the built image to a Docker registry.
5. **Stop & Remove Existing Container** - Stop and remove any existing container with the same name.
6. **Run Docker Container** - Deploy a new container with the updated image.
7. **Post Actions** - Handle success or failure messages.

Step-by-Step Execution

1. Checkout Code

- Uses Jenkins credentials to authenticate and fetch the latest code from GitHub.
- Ensures secure access using stored credentials instead of exposing raw tokens.

Implementation:

```
stage('Checkout Code') {
   steps {
      withCredentials([usernamePassword(credentialsId: 'github-nisanthg1010', usernameVariable: 'GIT_USER', passwordVariable: 'GIT_TOKEN')]) {
         git url: "https://$GIT_USER:$GIT_TOKEN@github.com/nisanthg1010/Devops_Nisanth.git", branch: 'main'
      }
   }
}
```

2. Build Docker Image

- Builds the Docker image using the Dockerfile present in the repository.
- Tags the image with the latest version.

Implementation:

```
stage('Build Docker Image') {
   steps {
      sh 'docker build -t $DOCKER_IMAGE .'
   }
```

}

3. Login to Docker Registry

- Uses stored Jenkins credentials to log in securely to the Docker registry.
- Prevents exposing login credentials in the script.

Implementation:

```
stage('Login to Docker Registry') {
   steps {
      withCredentials([usernamePassword(credentialsId: 'docker_nisanth', usernameVariable: 'DOCKER_USER', passwordVariable: 'DOCKER_PASS')]) {
         sh 'echo $DOCKER_PASS | docker login -u $DOCKER_USER --password-stdin'
      }
   }
}
```

4. Push to Container Registry

- Pushes the newly built Docker image to the specified container registry.
- Ensures the latest version of the application is stored and accessible.

Implementation:

```
stage('Push to Container Registry') {
   steps {
      sh 'docker push $DOCKER_IMAGE'
   }
}
```

5. Stop & Remove Existing Container

- Stops and removes the running container if it exists.
- Prevents conflicts when deploying the new version.

Implementation:

```
stage('Stop & Remove Existing Container') {
   steps {
      script {
         sh '''
         if [ "$(docker ps -aq -f name=$CONTAINER_NAME)" ]; then
```

```
            docker stop $CONTAINER_NAME || true
            docker rm $CONTAINER_NAME || true
        fi
        '''
    }
  }
}
```

6. Run Docker Container

- Starts a new Docker container with the updated image.
- Maps the internal application port 5000 to 5001 on the host machine.

Implementation:

```
stage('Run Docker Container') {
  steps {
    sh 'docker run -d -p 5001:5000 --name $CONTAINER_NAME $DOCKER_IMAGE'
  }
}
```

7. Post Actions

- If successful, displays a success message.
- If failed, displays an error message.

Implementation:

```
post {
  success {
    echo "Build, push, and container execution successful!"
  }
  failure {
    echo "Build or container execution failed."
  }
}
```

Conclusion

This Jenkins pipeline automates the entire process of fetching the code, building a Docker image, pushing it to a registry, and deploying the container. It ensures a seamless CI/CD workflow, making application updates smooth and efficient. 🚀