E-Commerce App Deployment Using Kubernetes

This guide provides step-by-step instructions for setting up a simple e-commerce application using Flask (Python) for the backend and Nginx for the frontend, and deploying it in Kubernetes with Minikube.

1. Setup Directory Structure

First, create a project directory to keep all files organized.

mkdir E-commerce && cd E-commerce

Backend Setup

Create a backend directory and navigate into it.

mkdir backend && cd backend

```
root@Sample:~# mkdir E-commerce
root@Sample:~# cd E-commerce
root@Sample:~/E-commerce# mkdir backend
root@Sample:~/E-commerce# cd backend
root@Sample:~/E-commerce/backend# nano products.csv
root@Sample:~/E-commerce/backend# nano app.py
root@Sample:~/E-commerce/backend# nano app.py
root@Sample:~/E-commerce/backend# nano requirements.txt
root@Sample:~/E-commerce/backend# nano Dockerfile
root@Sample:~/E-commerce/backend# nano requirements.txt
root@Sample:~/E-commerce/backend# nano app.py
root@Sample:~/E-commerce/backend# ^C
root@Sample:~/E-commerce/backend# nano docker-compose.yml
root@Sample:~/E-commerce/backend# docker build -t backend:latest .
```

Create products.csv

This file will store product details in CSV format.

nano products.csv

Paste the following sample data:

```
id,name,price,quantity
1,Smartphone,15000,25
2,Laptop,45000,15
3,Headphones,1500,50
4,Smartwatch,8000,30
5,Tablet,20000,20
6,Wireless Mouse,700,100
7,Bluetooth Speaker,1200,60
8,External Hard Drive,4000,40
9,USB Flash Drive,500,150
```

```
10,Monitor,10000,10
```

Create app.py

This script sets up a Flask server to read the CSV file and return product data as JSON.

```
nano app.py
```

Paste the following Python script:

```
from flask import Flask
import pandas as pd

app = Flask(__name__)

@app.route("/products", methods=['GET'])
def read_data():
    df = pd.read_csv("products.csv")  # Ensure products.csv exists
    json_data = df.to_json()
    return json_data

if __name__ == "__main__":
    app.run(host="0.0.0.0", port=5050)
```

Create requirements.txt

This file lists the dependencies required for the backend.

```
nano requirements.txt
```

Add dependencies:

```
flask
pandas
```

Create Dockerfile

This Dockerfile defines how to package the backend application into a container.

```
nano Dockerfile
```

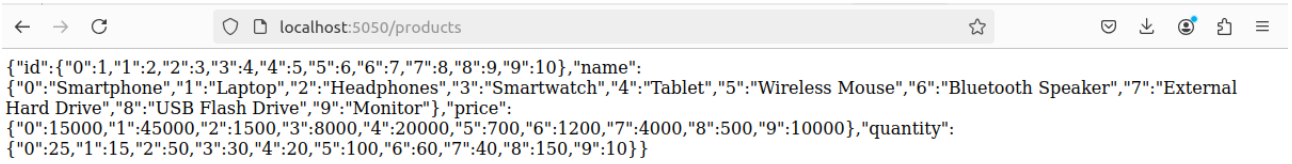
Paste the following:

```
FROM python:3.11
WORKDIR /app
COPY requirements.txt .
RUN pip install --no-cache-dir -r requirements.txt
COPY . .
EXPOSE 5050
CMD ["python", "app.py"]
```

Build & Run Backend Container

Build and run the backend container.

```
docker build -t backend:latest .
docker run -itd -p 5050:5050 backend
docker logs $(docker ps -q --filter "ancestor=backend")
```



Frontend Setup

Create a frontend directory and navigate into it.

```
cd ..
mkdir frontend && cd frontend
```

Create index.html

This HTML file loads the product list from the backend.

```
nano index.html
```

Paste the following:

```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>E-Commerce Store</title>
    <script>
        async function fetchProducts() {
            const response = await fetch("http://localhost:5050/products");
            const products = await response.json();
            let output = "<h2>Product List</h2><ul>";
            for (const id in products.name) {
                output += `<li>${products.name[id]} - $${products.price[id]}</li>`;
            }
```

```
            output += "</ul>";
            document.getElementById("product-list").innerHTML = output;
        }
    </script>
</head>
<body onload="fetchProducts()">
    <h1>Welcome to Our Store</h1>
    <div id="product-list">Loading...</div>
</body>
</html>
```

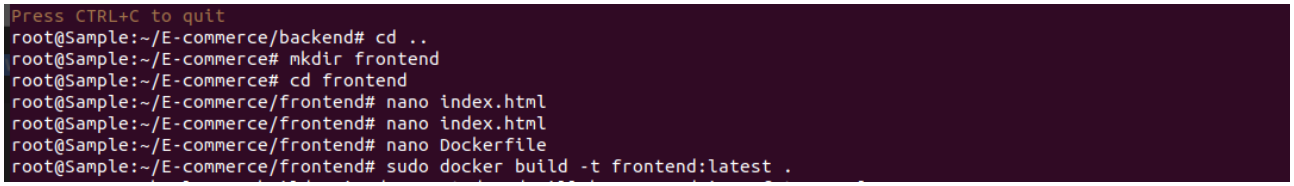
Create Dockerfile

This Dockerfile packages the frontend as an Nginx container.

nano Dockerfile

Paste:

```
FROM nginx:alpine
COPY index.html /usr/share/nginx/html/index.html
```



Build & Run Frontend Container

docker build -t frontend:latest .

2. Kubernetes Deployment

Create a k8s directory for Kubernetes configuration files.

```
cd ..
mkdir k8s && cd k8s
```

Backend Deployment (backend-deployment.yaml)

Defines a backend pod in Kubernetes.

nano backend-deployment.yaml

Paste:

```
apiVersion: apps/v1
kind: Deployment
metadata:
  name: backend
spec:
  replicas: 1
```

```
  selector:
    matchLabels:
      app: backend
  template:
    metadata:
      labels:
        app: backend
    spec:
      containers:
      - name: backend
        image: backend:latest
        ports:
        - containerPort: 5050
```

Frontend Deployment (**frontend-deployment.yaml**)

Defines a frontend pod in Kubernetes.

nano frontend-deployment.yaml

Paste:

```
apiVersion: apps/v1
kind: Deployment
metadata:
  name: frontend
spec:
  replicas: 1
  selector:
    matchLabels:
      app: frontend
  template:
    metadata:
      labels:
        app: frontend
    spec:
      containers:
      - name: frontend
        image: frontend:latest
        ports:
        - containerPort: 3000
```

Connecting Frontend & Backend (**service.yaml**)

Defines services for communication between frontend and backend.

nano service.yaml

Paste:

```
apiVersion: v1
kind: Service
metadata:
  name: backend-service
spec:
  selector:
    app: backend
```

```
  ports:
    - protocol: TCP
      port: 5050
      targetPort: 5050
  type: ClusterIP
---
apiVersion: v1
kind: Service
metadata:
  name: frontend-service
spec:
  selector:
    app: frontend
  ports:
    - protocol: TCP
      port: 3000
      targetPort: 3000
  type: NodePort
```

ConfigMap (**configmap.yaml**)

Stores backend configuration values.

```
nano configmap.yaml
```

Paste:

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: backend-config
data:
  DATABASE_FILE: "/backend/products.csv"
```

3. Installing Kubernetes

Instructions to install Minikube and kubectl.

Step 1: Install Docker

```
sudo apt update
sudo apt install -y docker.io
```

Step 2: Verify Docker Installation

```
docker --version
```

You should see output similar to: Docker version 20.10.12, build e91ed57

Step 3: Enable and Start Docker

```
sudo systemctl enable docker
sudo systemctl start docker
```

Check Docker status:

sudo systemctl status docker

Kubectl is the command-line tool used to interact with a Kubernetes cluster.

Step 1: Download Kubectl

curl -LO "https://dl.k8s.io/release/$(curl -L -s https://dl.k8s.io/release/stable.txt)/bin/linux/amd64/kubectl"

Step 2: Install Kubectl

sudo install -o root -g root -m 0755 kubectl /usr/local/bin/kubectl

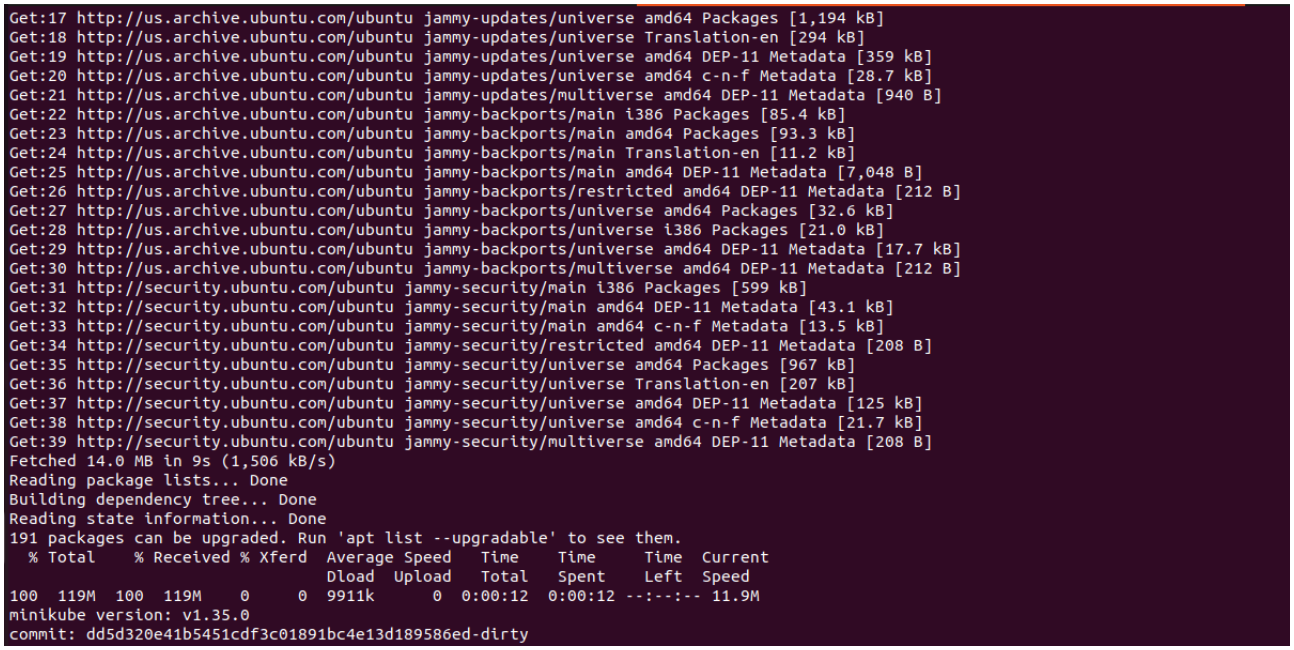
Step 3: Verify Installation

kubectl version --client

If the installation is successful, it will display the version information.

4. Installing Minikube

Minikube provides a local Kubernetes cluster, making it ideal for development and testing.



Step 1: Download Minikube

curl -LO https://storage.googleapis.com/minikube/releases/latest/minikube-linux-amd64

Step 2: Install Minikube

```
sudo install minikube-linux-amd64 /usr/local/bin/minikube
```

Step 3: Verify Minikube Installation

```
minikube version
```

This should return the installed Minikube version.

5. Starting Minikube

Once Minikube is installed, you can start it using the Docker driver.

```
minikube start --driver=docker
```

This command will:

- Download the necessary Kubernetes images.
- Start a single-node Kubernetes cluster.
- Configure kubectl to interact with the cluster.

Check the status of the Minikube cluster:

```
minikube status
```

Verify that Kubernetes is running:

```
kubectl get nodes
```

Expected output:

```
NAME       STATUS   ROLES                AGE     VERSION
minikube   Ready    control-plane,master   3m24s   v1.32.0
```

6. Enabling the Kubernetes Dashboard (Optional)

Minikube includes a web-based Kubernetes dashboard. To enable it, run:

```
minikube dashboard
```

This will open a web browser with the Kubernetes dashboard.

7. Managing Minikube

Stopping Minikube

To stop the Minikube cluster without deleting it:

```
minikube stop
```

Deleting Minikube Cluster

To remove Minikube completely:

```
minikube delete
```

Checking Running Services

To list all Kubernetes services:

```
kubectl get services
```

8. Troubleshooting Tips

1. If Minikube Fails to Start

Try deleting and restarting Minikube:

```
minikube delete
minikube start --driver=docker
```

2. If Kubectl Cannot Connect to Minikube

Check if Minikube is running:

```
minikube status
```

If it’s stopped, restart it:

```
minikube start
```

3. If Kubernetes Services Are Not Accessible

Use port forwarding to access a service:

```
kubectl port-forward svc/<service-name> <local-port>:<service-port>
```

Example:

```
kubectl port-forward svc/backend-service 5000:5000
```

Then access the service at:

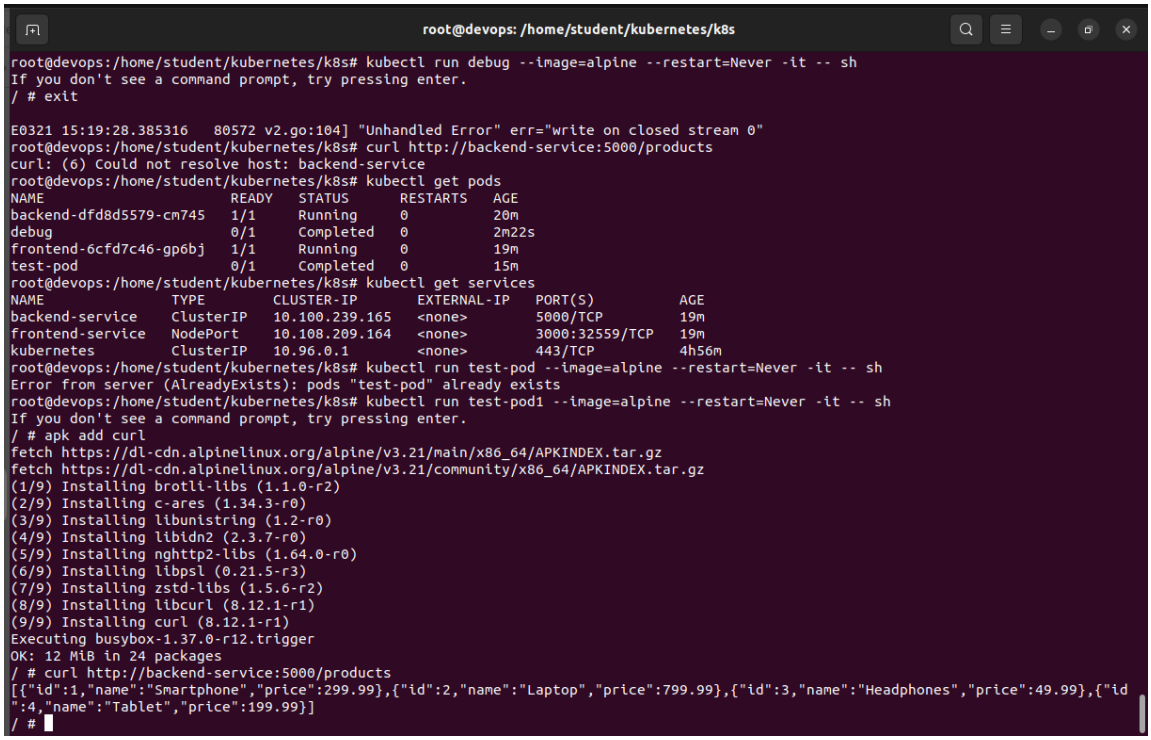
http://localhost:5000

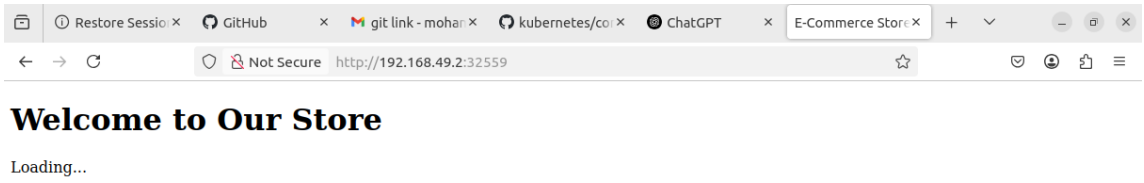
9. Deploying in Minikube

Deploying the application using Kubernetes and Minikube.

minikube start
eval $(minikube docker-env)
kubectl apply -f k8s/
kubectl get pods
kubectl get services
minikube service frontend-service --url

Open the displayed URL in a browser to view the application.





Configuring Jenkins Pipeline

Step 1: Create a Jenkinsfile

nano Jenkinsfile

Step 2: Add Jenkins Pipeline Code

Paste the following content into the file:

```
pipeline {
    agent any


    environment {
        BACKEND_IMAGE = "sujisuki/backend-app:latest"
        FRONTEND_IMAGE = "sujisuki/frontend-app:latest"
        BACKEND_CONTAINER = "backend-running-app"
        FRONTEND_CONTAINER = "frontend-running-app"
        REGISTRY_CREDENTIALS = "docker_suji"
    }
```

```
    stages {

        stage('Checkout Code') {

            steps {

                withCredentials([usernamePassword(credentialsId: 'github_suji', usernameVariable: 'GIT_USER',
passwordVariable: 'GIT_TOKEN')]) {

                    git url: "https://$GIT_USER:$GIT_TOKEN@github.com/SujithaKC/Jenkins_E-commerce.git",
branch: 'main'

                }

            }

        }



        stage('Build Docker Images') {

            parallel {

                stage('Build Backend Image') {

                    steps {

                        dir('backend') {

                            sh 'docker build -t $BACKEND_IMAGE .'

                        }

                    }

                }



                stage('Build Frontend Image') {

                    steps {

                        dir('frontend') {

                            sh 'docker build -t $FRONTEND_IMAGE .'

                        }

                    }

                }
```

```
        }
    }

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

    stage('Push Images to Docker Hub') {
        parallel {
            stage('Push Backend Image') {
                steps {
                    sh 'docker push $BACKEND_IMAGE'
                }
            }

            stage('Push Frontend Image') {
                steps {
                    sh 'docker push $FRONTEND_IMAGE'
                }
            }
        }
    }
```

```
    stage('Stop & Remove Existing Containers') {
        steps {
            script {
                sh '''
                docker stop $BACKEND_CONTAINER $FRONTEND_CONTAINER || true
                docker rm $BACKEND_CONTAINER $FRONTEND_CONTAINER || true
                '''
            }
        }
    }

    stage('Run Containers') {
        parallel {
            stage('Run Backend Container') {
                steps {
                    sh 'docker run -d -p 5000:5000 --name $BACKEND_CONTAINER $BACKEND_IMAGE'
                }
            }

            stage('Run Frontend Container') {
                steps {
                    sh 'docker run -d -p 3000:3000 --name $FRONTEND_CONTAINER $FRONTEND_IMAGE'
                }
            }
        }
    }
}
```

```
    post {
        success {
            echo "✅ Deployment successful! Backend and Frontend are running."
        }
        failure {
            echo "❌ Deployment failed! Check logs for errors."
        }
    }
}
```

Pushing the Project to GitHub

Step 1: Clone the Repository

git clone https://github.com/ SujithaKC/Jenkins_E-commerce.git

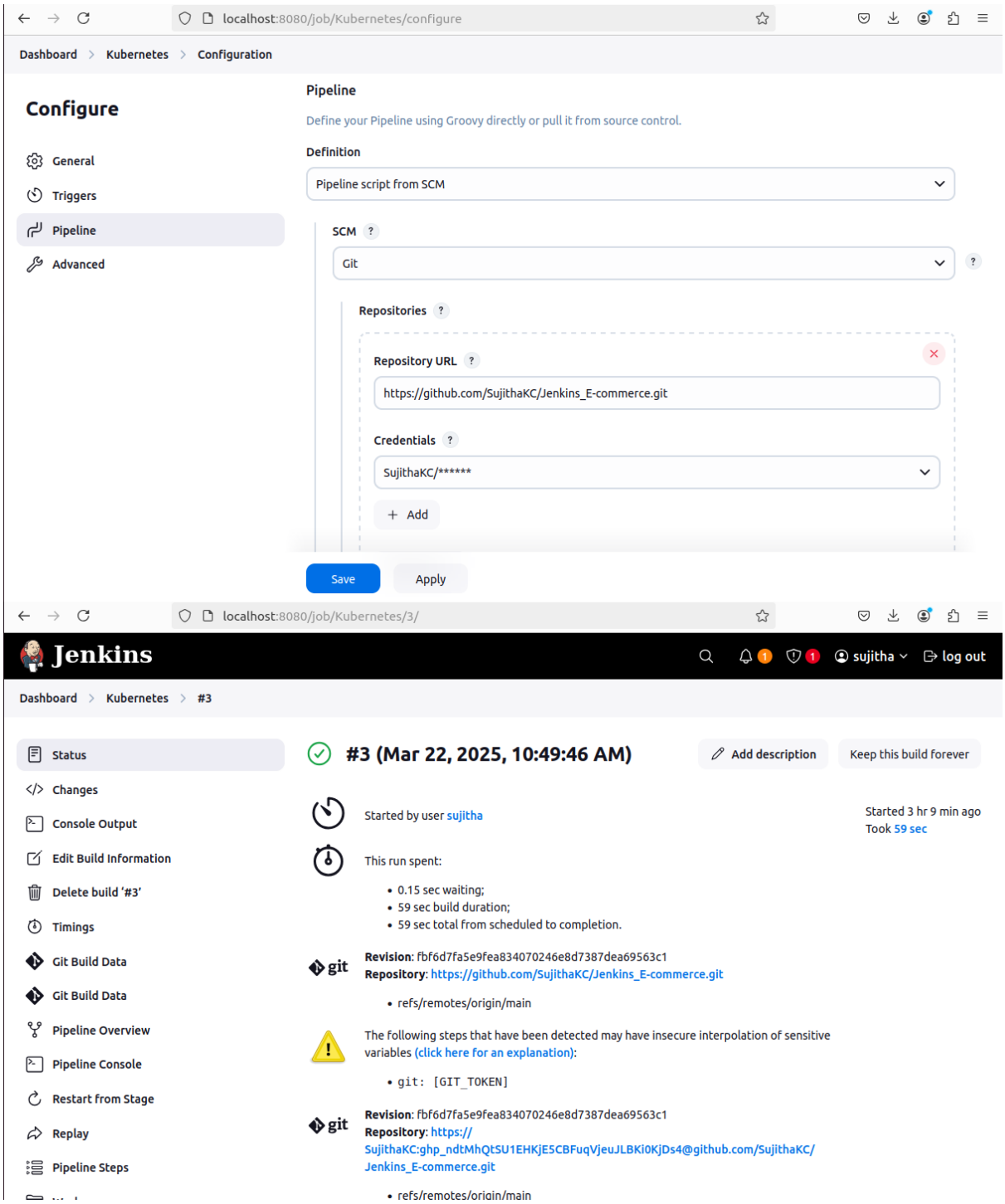
Step 2: Add and Commit the Changes

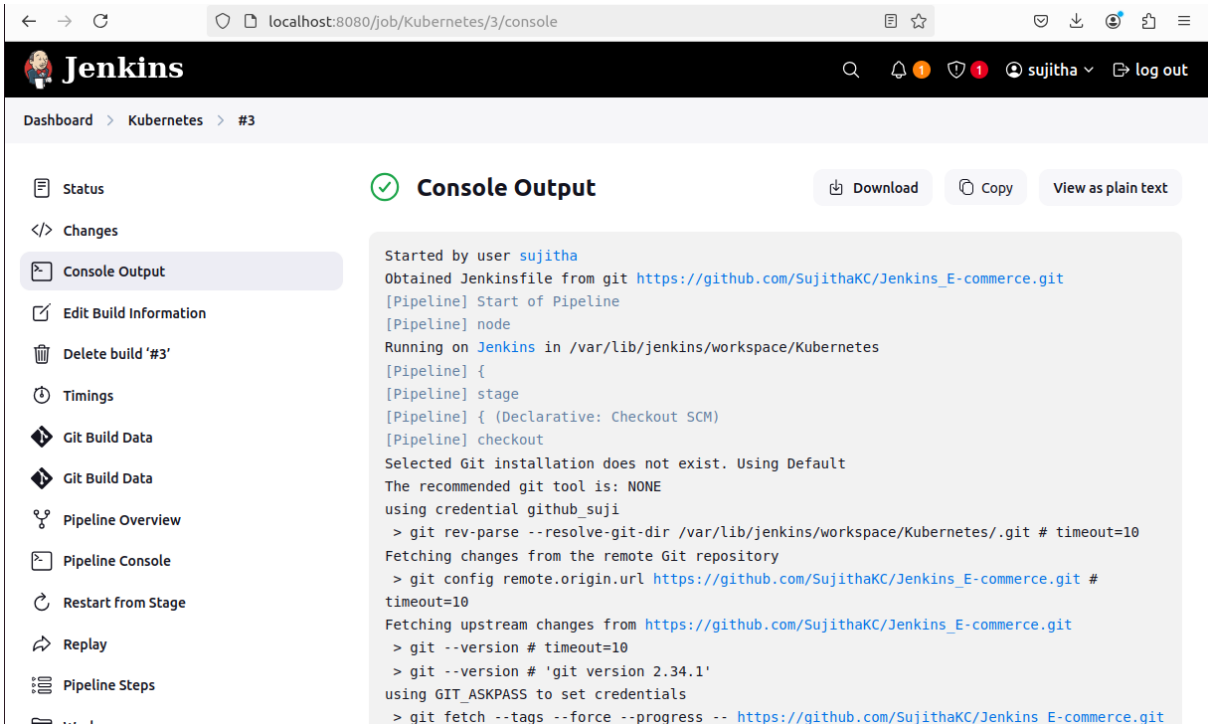
git add --all
git commit -m "Kubernetes"

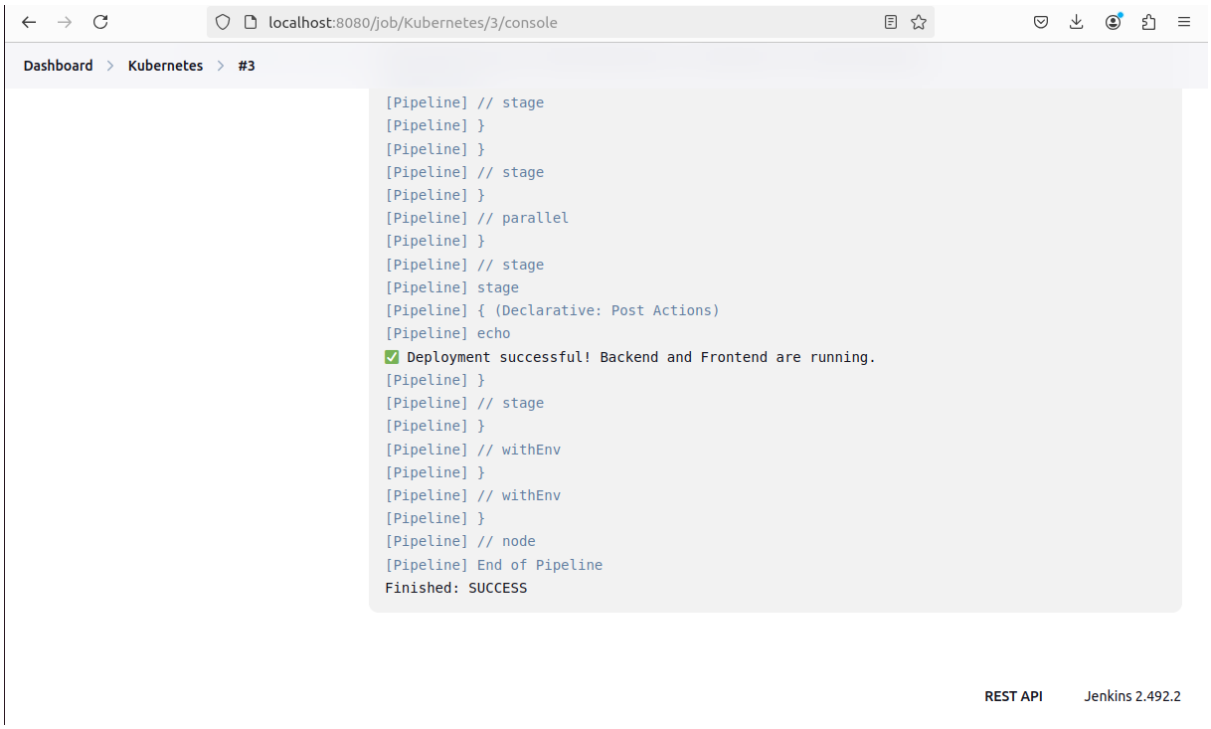
Step 3: Push to GitHub

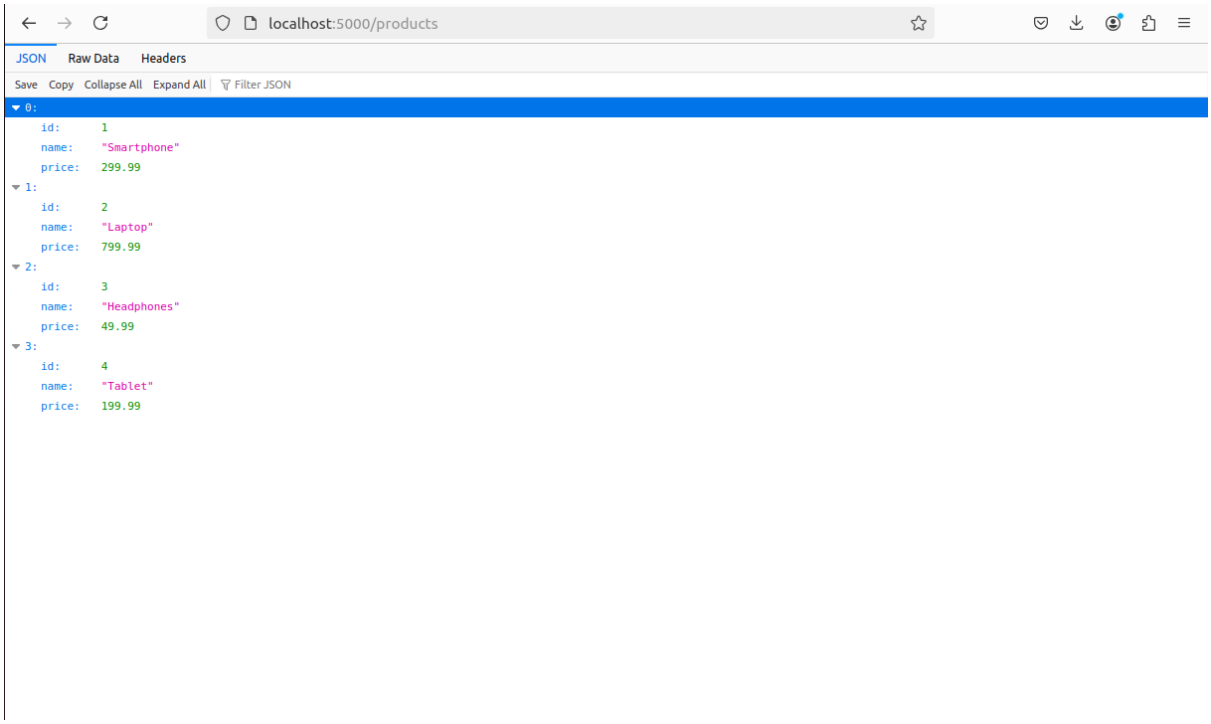
git push origin main

Running Jenkins Build




localhost:8080/job/Kubernetes/3/console
Jenkins
sujitha
log out
Dashboard
Kubernetes
#3
Status
Changes
Console Output
Edit Build Information
Delete build '#3'
Timings
Git Build Data
Git Build Data
Pipeline Overview
Pipeline Console
Restart from Stage
Replay
Pipeline Steps
Console Output
Download
Copy
View as plain text
Started by user sujitha
Obtained Jenkinsfile from git https://github.com/SujithaKC/Jenkins_E-commerce.git
[Pipeline] Start of Pipeline
[Pipeline] node
Running on Jenkins in /var/lib/jenkins/workspace/Kubernetes
[Pipeline] {
[Pipeline] stage
[Pipeline] { (Declarative: Checkout SCM)
[Pipeline] checkout
Selected Git installation does not exist. Using Default
The recommended git tool is: NONE
using credential github_suji
> git rev-parse --resolve-git-dir /var/lib/jenkins/workspace/Kubernetes/.git # timeout=10
Fetching changes from the remote Git repository
> git config remote.origin.url https://github.com/SujithaKC/Jenkins_E-commerce.git #
timeout=10
Fetching upstream changes from https://github.com/SujithaKC/Jenkins_E-commerce.git
> git --version # timeout=10
> git --version # 'git version 2.34.1'
using GIT_ASKPASS to set credentials
> git fetch --tags --force --progress -- https://github.com/SujithaKC/Jenkins_E-commerce.git


localhost:8080/job/Kubernetes/3/console
Dashboard
Kubernetes
#3
[Pipeline] // stage
[Pipeline] }
[Pipeline] }
[Pipeline] // stage
[Pipeline] }
[Pipeline] // parallel
[Pipeline] }
[Pipeline] // stage
[Pipeline] stage
[Pipeline] { (Declarative: Post Actions)
[Pipeline] echo
✅ Deployment successful! Backend and Frontend are running.
[Pipeline] }
[Pipeline] // stage
[Pipeline] }
[Pipeline] // withEnv
[Pipeline] }
[Pipeline] // withEnv
[Pipeline] }
[Pipeline] // node
[Pipeline] End of Pipeline
Finished: SUCCESS
REST API
Jenkins 2.492.2


localhost:5000/products
JSON
Raw Data
Headers
Save
Copy
Collapse All
Expand All
Filter JSON
0:
id: 1
name: "Smartphone"
price: 299.99
1:
id: 2
name: "Laptop"
price: 799.99
2:
id: 3
name: "Headphones"
price: 49.99
3:
id: 4
name: "Tablet"
price: 199.99