**Rablo DevOps Assignment - Complete Documentation**

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**Project Overview**

This documentation covers the complete implementation of a DevOps assignment that involves containerizing a Node.js application, setting up NGINX as a reverse proxy, implementing AWS Application Load Balancer (ALB), and creating CI/CD pipelines using both GitHub Actions and Jenkins.

**Project Repository**

**GitHub Repository:**[**https://github.com/GaniDynamo/Rablo-Devops-Project**](https://github.com/GaniDynamo/Rablo-Devops-Project)

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**Part 1: Docker Containerization**

**1.1 Application Setup**

I created a simple Node.js application with the following structure:

**1.File: app.js**

const express = require('express');

const app = express();

const PORT = 80;

app.get('/', (req, res) => {

res.send('Hello World');

});

app.listen(PORT, () => {

console.log(`Server running at http://localhost:${PORT}`);

});

app.get('/health', (req, res) => {

res.json({ status: 'healthy', timestamp: new Date().toISOString() });

});

**2.File: package.json**

{

"name": "rablo-devops-assignment",

"version": "1.0.0",

"description": "Simple Node.js app for Rablo.in",

"main": "app.js",

"scripts": {

"start": "node app.js"

},

"dependencies": {

"express": "^4.18.2"

}

}

**3.Dockerfile:**

FROM node:18

WORKDIR /usr/src/app

COPY package\*.json ./

RUN npm install

COPY . .

EXPOSE 80

CMD ["npm", "start"]ckerfile:

**Key Optimizations:**

* Used node:18 for minimal image size
* Copied package files first for better layer caching
* Used --only=production to exclude dev dependencies
* Single EXPOSE instruction for port 80

**Instructions for running the container locally:**

**1.3 Docker Image Build and Push**

Commands executed:

bash

***# Build the Docker image***

docker build -t dynamo28/rablo-assignment:v1.0 .

***# Test locally***

docker run -p 80:80 dynamo28/rablo-assignment:v1.0

***# Login to Docker Hub***

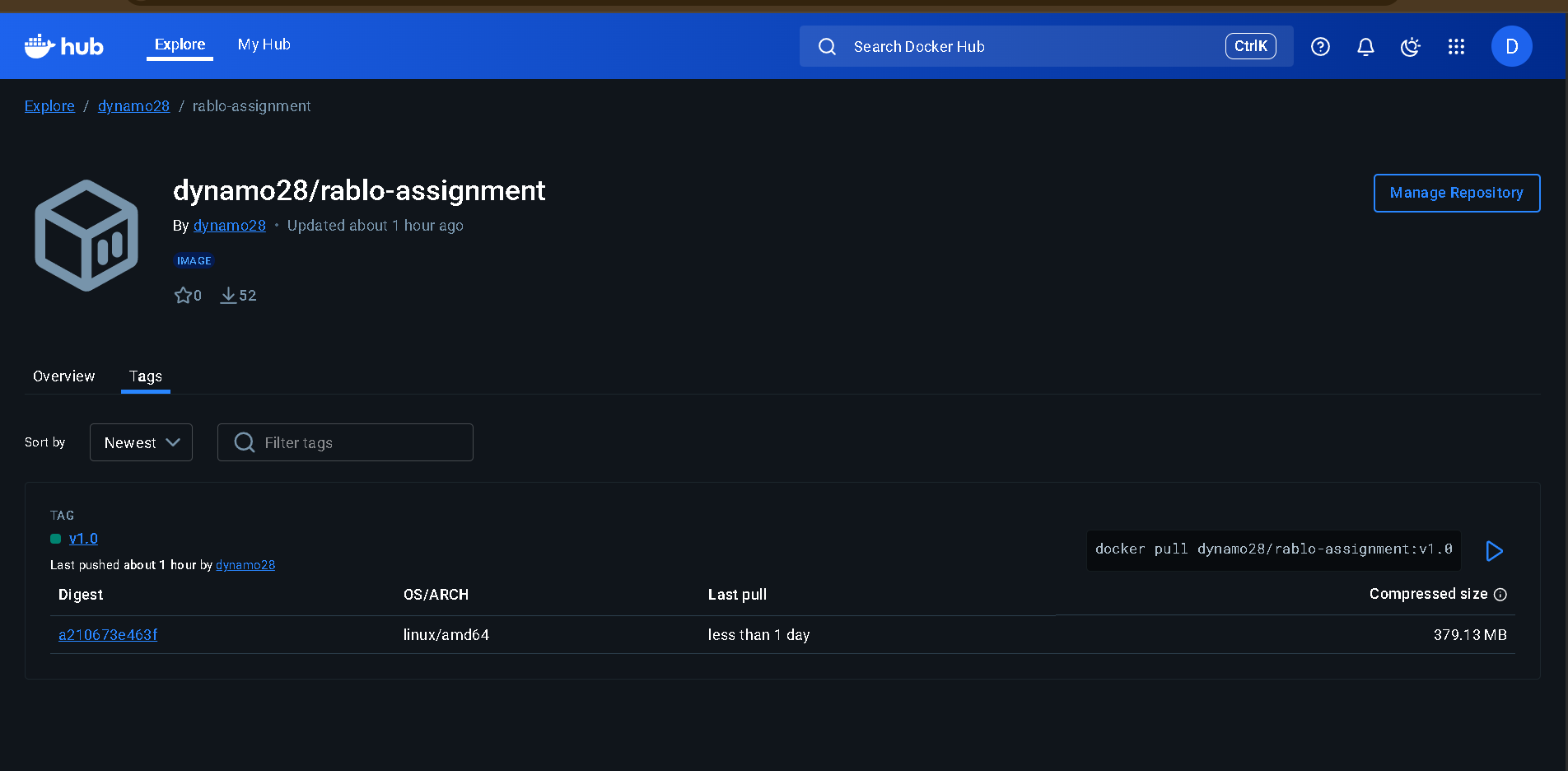
docker login

***# Push to Docker Hub***

docker push dynamo28/rablo-assignment:v1.0

**Docker Hub Link:**

[**https://hub.docker.com/layers/dynamo28/rablo-assignment/v1.0/images/sha256-a210673e463f3d8a2658d74a312db42657a915da5b375609828e7c2fb7beca2f**](https://hub.docker.com/layers/dynamo28/rablo-assignment/v1.0/images/sha256-a210673e463f3d8a2658d74a312db42657a915da5b375609828e7c2fb7beca2f)

****

**Local Testing Results:**

* Application accessible at http://localhost:80
* Health endpoint working at <http://localhost/health>

**Part 2: NGINX as Reverse Proxy**

**2.1 NGINX Configuration**

**File: Nginx.conf**

events {

worker\_connections 1024;

}

http {

upstream app\_servers {

server app1:80;

server app2:80;

}

server {

listen 80;

location / {

proxy\_pass http://app\_servers;

proxy\_http\_version 1.1;

proxy\_set\_header Upgrade $http\_upgrade;

proxy\_set\_header Connection 'upgrade';

proxy\_set\_header Host $host;

proxy\_set\_header X-Real-IP $remote\_addr;

proxy\_set\_header X-Forwarded-For $proxy\_add\_x\_forwarded\_for;

proxy\_set\_header X-Forwarded-Proto $scheme;

proxy\_cache\_bypass $http\_upgrade;

}

# Health check endpoint

location /health {

access\_log off;

return 200 'healthy\n';

add\_header Content-Type text/plain;

}

}

}

**2.2 Docker Compose Setup**

**File: docker-compose.yml**

version: '3.8'

services:

nginx:

image: nginx:alpine

container\_name: nginx-proxy

ports:

- "80:80"

volumes:

- ./nginx.conf:/etc/nginx/nginx.conf:ro

depends\_on:

- app1

- app2

restart: unless-stopped

networks:

- app-network

app1:

image: dynamo28/rablo-assignment:v1.0

container\_name: rablo-app1

expose:

- "80"

restart: unless-stopped

networks:

- app-network

app2:

image: dynamo28/rablo-assignment:v1.0

container\_name: rablo-app2

expose:

- "80"

restart: unless-stopped

networks:

- app-network

networks:

app-network:

driver: bridge

**2.3 Local Testing**

**Commands executed:**

bash

***# Start all services***

docker-compose up -d

***# Verify containers are running***

docker ps -a

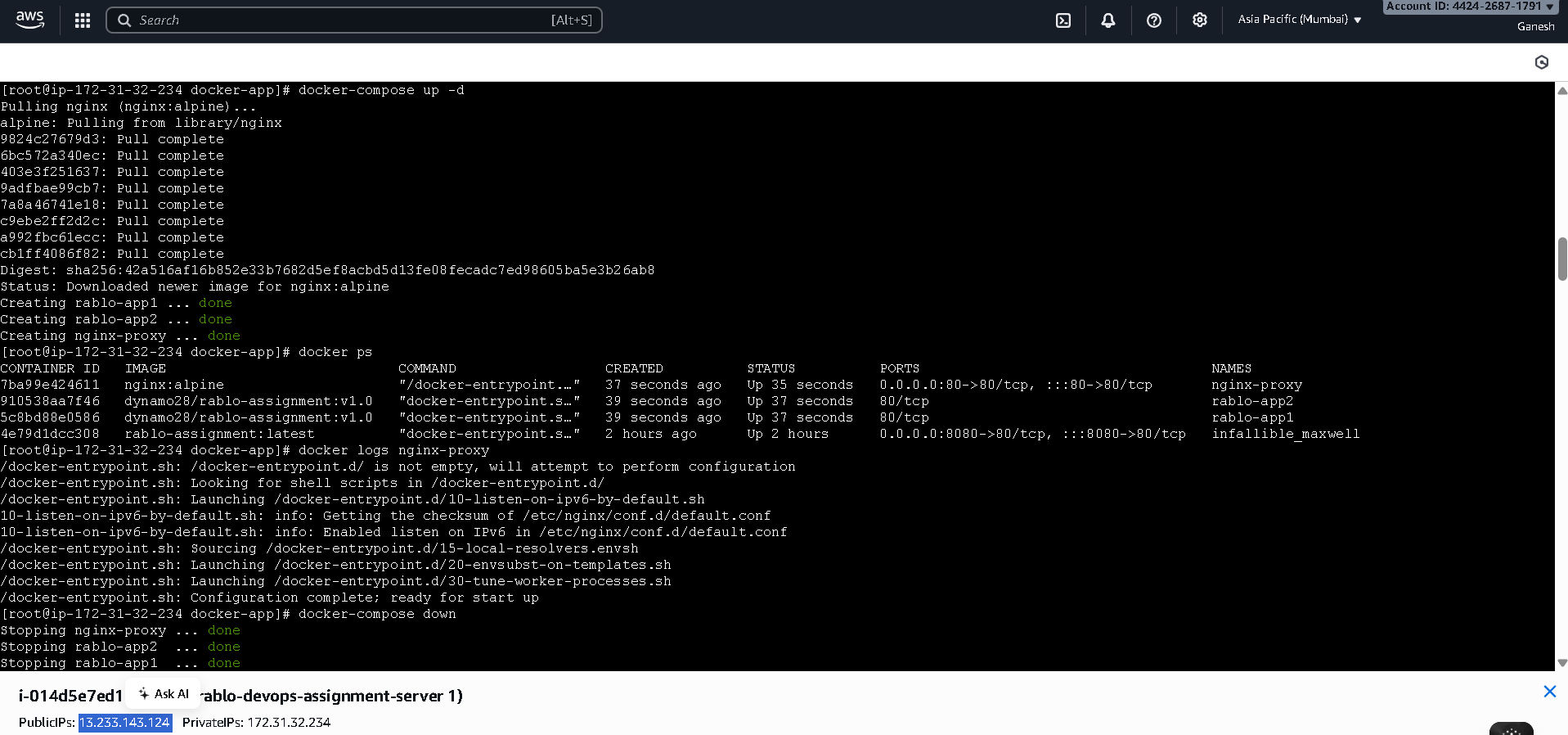
***# Test load balancing***

curl http://localhost/

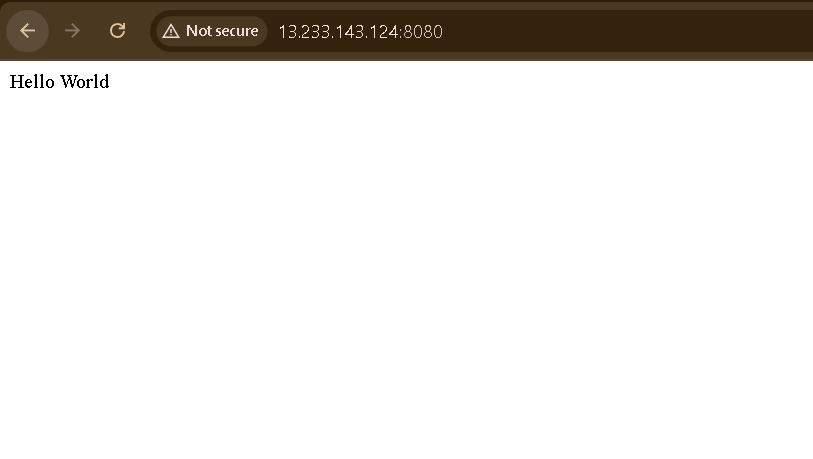
curl http://localhost/health

**Screenshots:**

* Docker Compose output showing successful container startup



* Browser showing application response



**Part 3: AWS Load Balancer Configuration**

**3.1 EC2 Instance Setup**

**Instance Configuration:**

* Instance Type: t2.micro
* AMI: Amazon Linux 2
* Security Group:
  + HTTP (80) from 0.0.0.0/0
  + SSH (22) from your IP
* Key Pair: rablo-key-pair
* Number of Instances: 2

**Instance IDs:**

* EC2 Instance 1: 13.233.143.124
* EC2 Instance 2: 13.232.113.175

**3.2 Docker Installation on EC2**

Commands executed on both instances:

bash

*# Update system*

sudo yum update -y

*# Install Docker*

sudo yum install -y docker

*# Start Docker service*

sudo systemctl start docker

sudo systemctl enable docker

*# Add ec2-user to docker group*

sudo usermod -aG docker ec2-user

*# Logout and login again for group changes to take effect*

logout

*# Verify Docker installation*

docker --version

3.3 Application Deployment on EC2

Commands executed on both instances:

bash

*# Pull the Docker image*

docker pull dynamo28/rablo-assignment:v1.0

*# Run the container*

docker run -d -p 80:80 --name rablo-app --restart unless-stopped dynamo28/rablo-assignment:v1.0

*# Verify container is running*

docker ps -a

*# Test application*

curl http://localhost/

**3.4 Application Load Balancer Setup**

**ALB Configuration:**

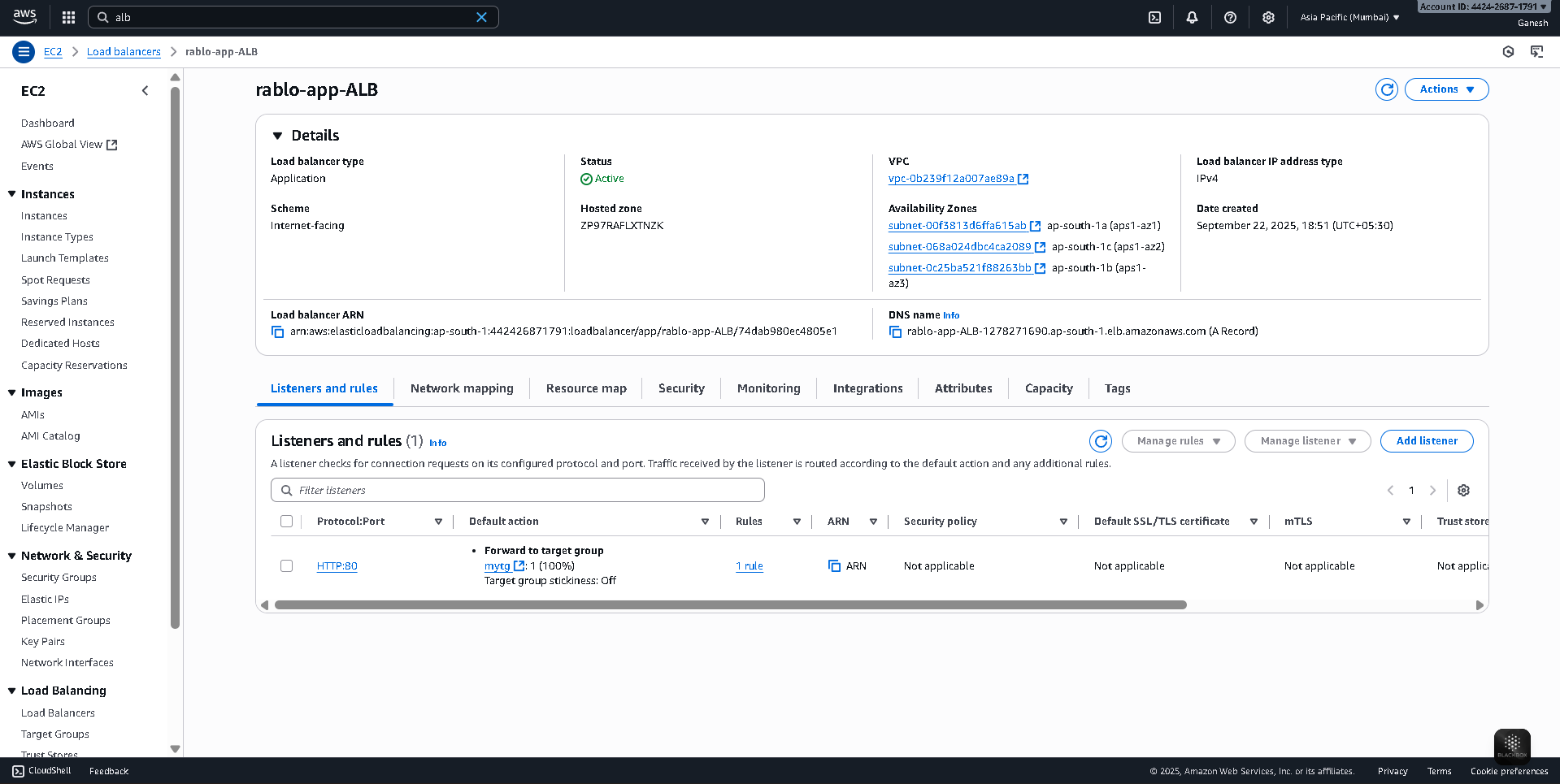
* Name: rablo-app-alb
* Scheme: Internet-facing
* IP Address Type: IPv4
* Listeners: HTTP:80
* Availability Zones: At least 2 AZs
* Security Group: Allow HTTP (80) from 0.0.0.0/0

Target Group Configuration:

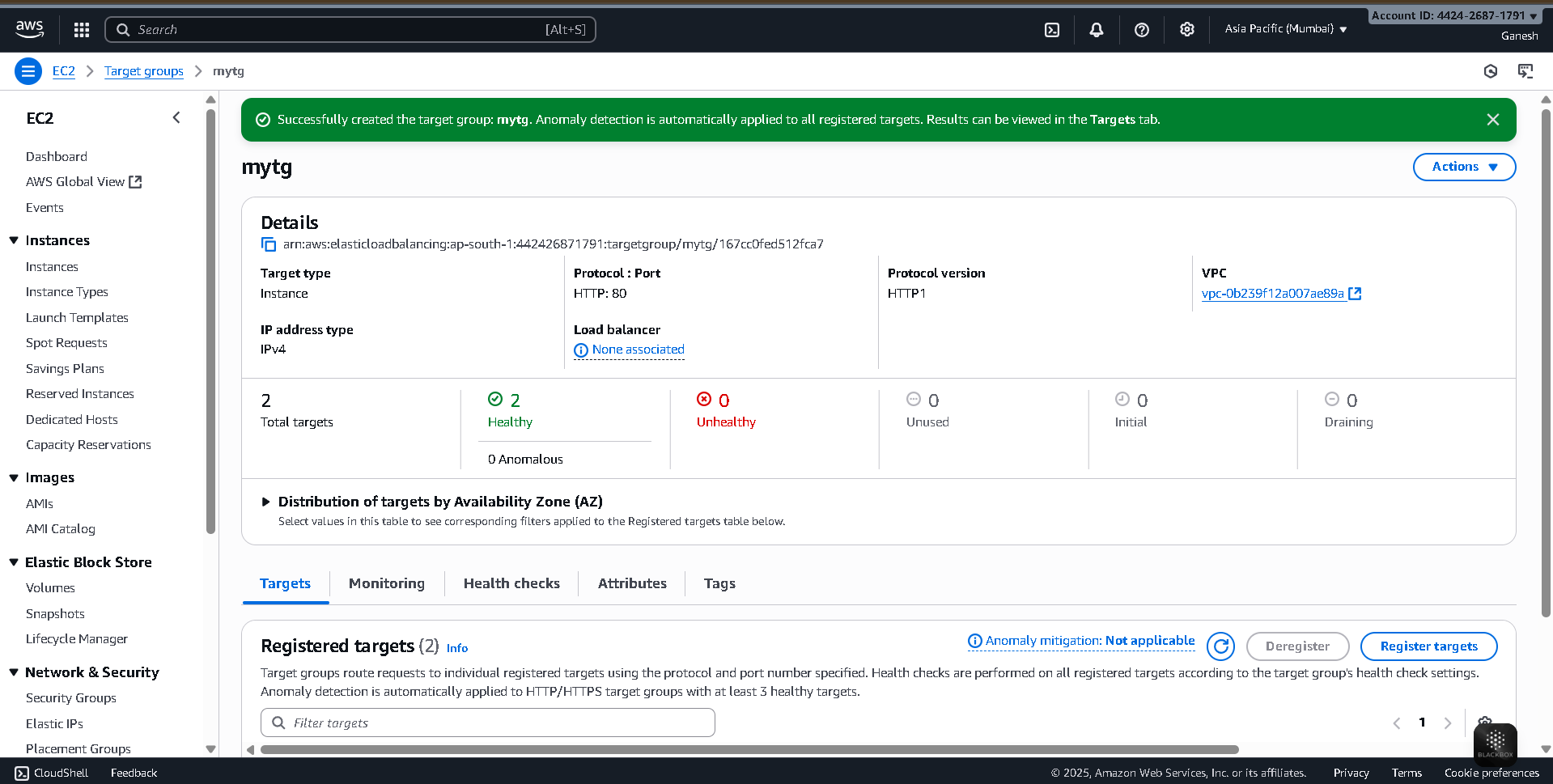
* Name: rablo-app-targets
* Target Type: Instances
* Protocol: HTTP
* Port: 80
* Health Check Path: /health
* Health Check Port: 80
* Health Check Protocol: HTTP

Screenshots :

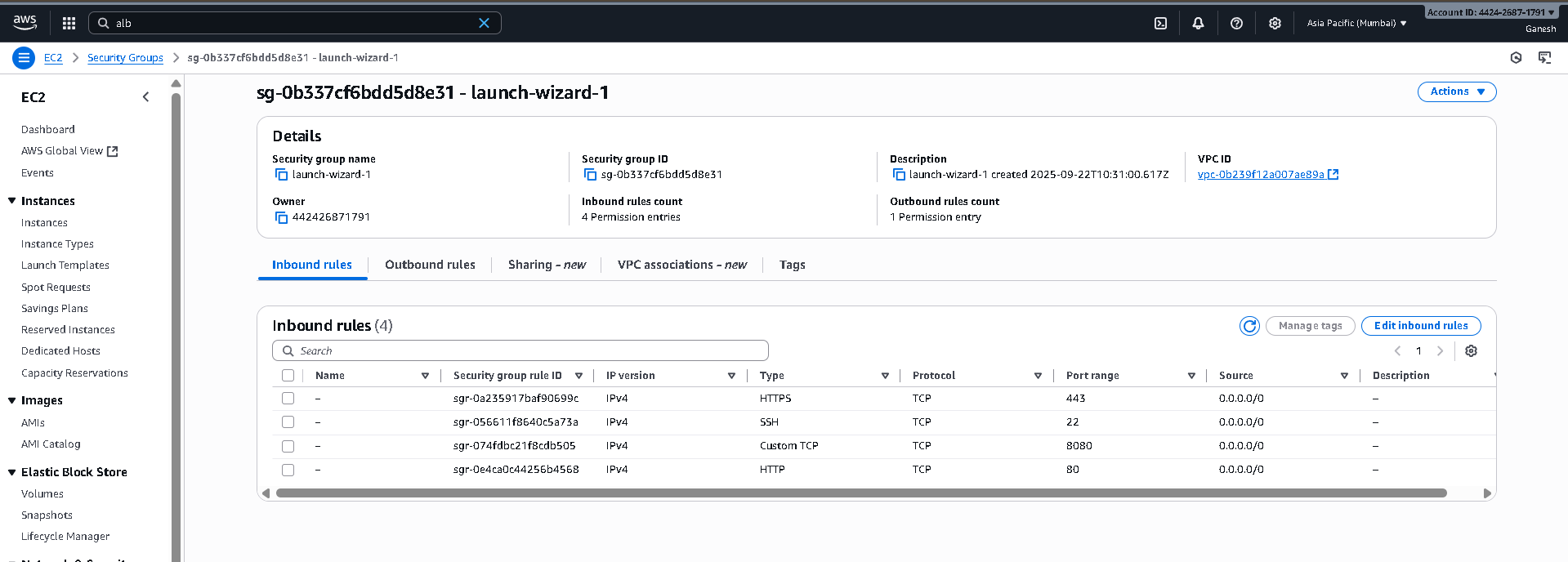
* AWS ALB configuration page



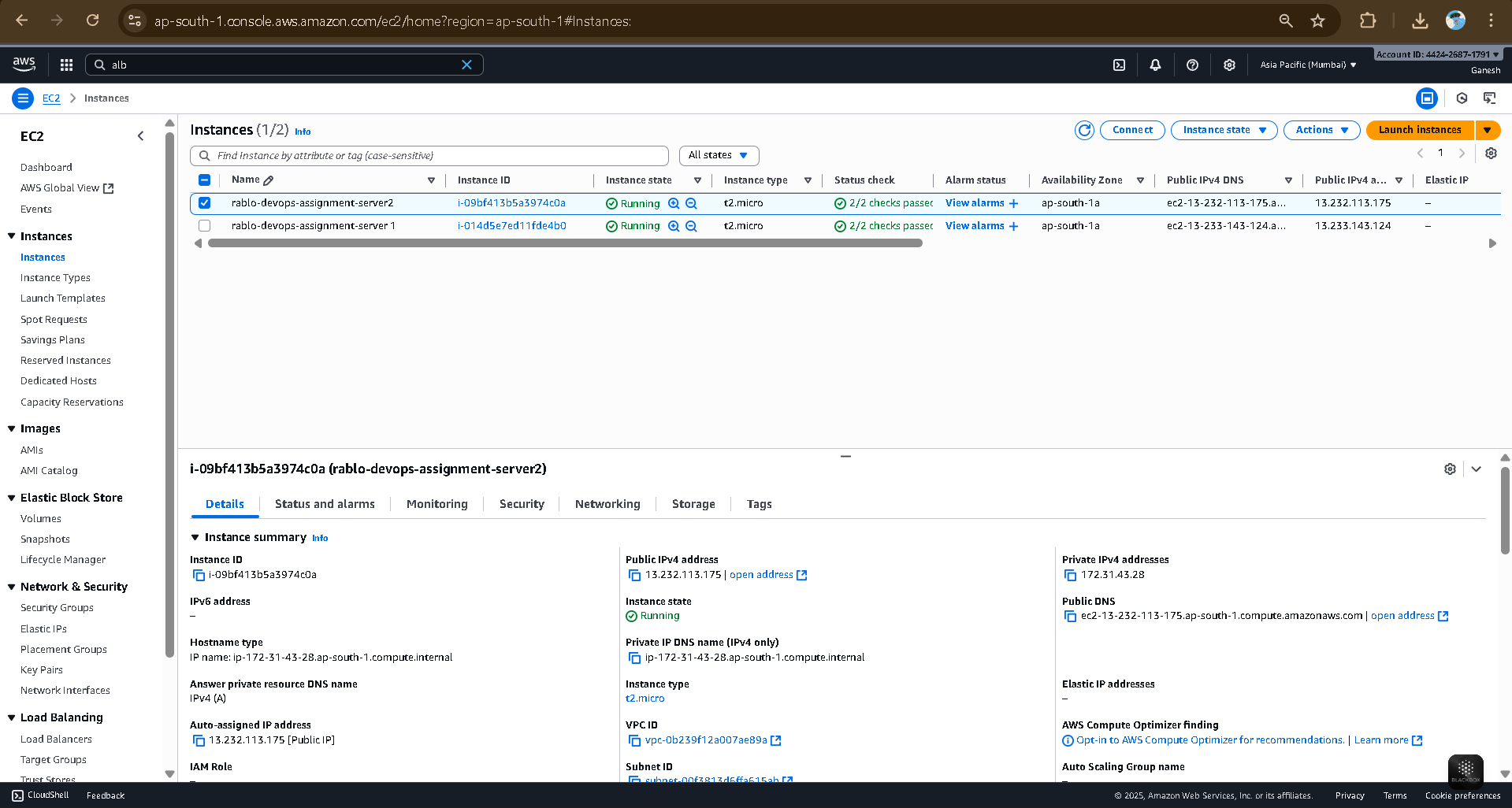
* Target Group showing healthy targets



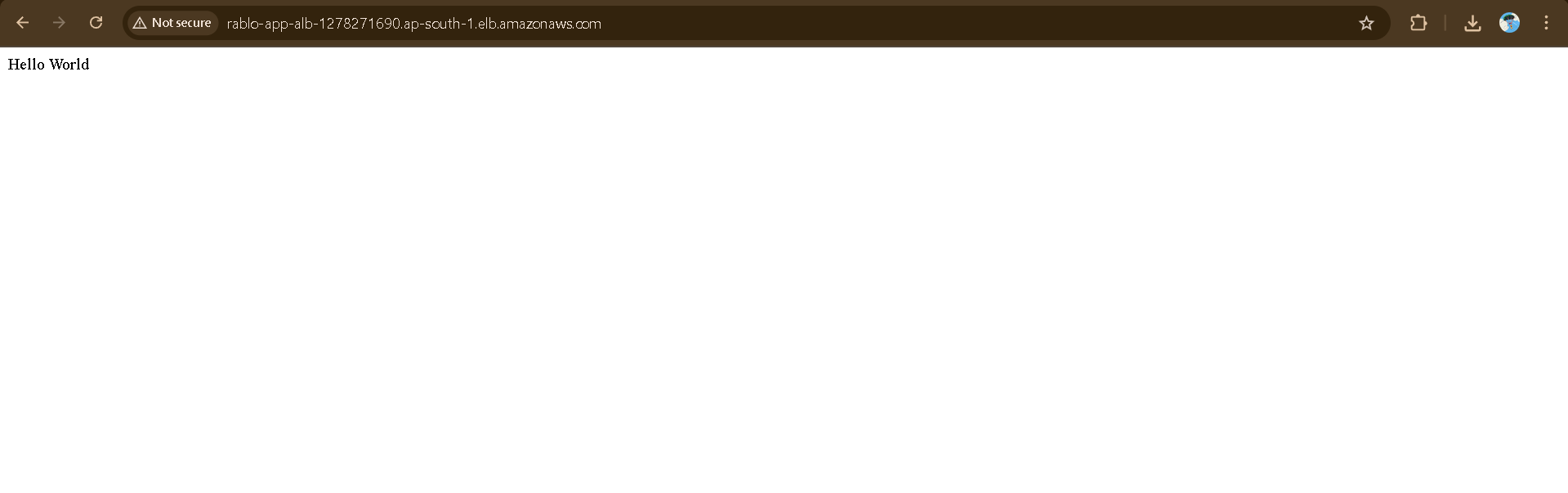
* Security Group rules



* EC2 instances list



* Application response through ALB



**Part 4: CI/CD Pipeline Implementation**

**4.1 GitHub Actions Pipeline**

File: .github/workflows/ci-cd.yml

name: CI/CD Pipeline

on:

push:

branches:

- main

env:

DOCKER\_IMAGE: dynamo28/rablo-assignment:v1.0

EC2\_HOST\_1: 13.233.143.124

EC2\_HOST\_2: 13.232.113.175

jobs:

build:

runs-on: ubuntu-latest

steps:

- uses: actions/checkout@v4

- name: Set up Docker Buildx

uses: docker/setup-buildx-action@v3

- name: Login to Docker Hub

uses: docker/login-action@v3

with:

username: ${{ secrets.DOCKERHUB\_USERNAME }}

password: ${{ secrets.DOCKERHUB\_TOKEN }}

- name: Build and push Docker image

uses: docker/build-push-action@v5

with:

context: ./rablo-devops-assignment/docker-app

push: true

tags: |

${{ env.DOCKER\_IMAGE }}

deploy:

needs: build

runs-on: ubuntu-latest

steps:

- name: Deploy to EC2 instance 1

uses: appleboy/ssh-action@v0.1.7

with:

host: ${{ env.EC2\_HOST\_1 }}

username: ec2-user

key: ${{ secrets.EC2\_SSH\_KEY }}

script: |

sudo docker pull ${{ env.DOCKER\_IMAGE }}

sudo docker stop rablo-app || true

sudo docker rm rablo-app || true

sudo docker run -d -p 80:80 --name rablo-app --restart unless-stopped ${{ env.DOCKER\_IMAGE }}

- name: Deploy to EC2 instance 2

uses: appleboy/ssh-action@v0.1.7

with:

host: ${{ env.EC2\_HOST\_2 }}

username: ec2-user

key: ${{ secrets.EC2\_SSH\_KEY }}

script: |

sudo docker pull ${{ env.DOCKER\_IMAGE }}

sudo docker stop rablo-app || true

sudo docker rm rablo-app || true

sudo docker run -d -p 80:80 --name rablo-app --restart unless-stopped ${{ env.DOCKER\_IMAGE }}4.2 GitHub Secrets Configuration

Required Secrets:

* DOCKERHUB\_USERNAME: Docker Hub username
* DOCKERHUB\_TOKEN: Docker Hub access token
* EC2\_SSH\_KEY: Private SSH key content for EC2 access

**Setup Process:**

1. Navigate to GitHub Repository → Settings → Secrets and variables → Actions
2. Add new repository secrets with the above names
3. For EC2\_SSH\_KEY, copy the entire content of your .pem file

**4.3 Jenkins Pipeline**

File: Jenkinsfile

pipeline {

agent any

environment {

DOCKER\_IMAGE = 'dynamo28/rablo-assignment:v1.0'

EC2\_HOST\_1 = '13.233.143.124'

EC2\_HOST\_2 = '13.232.113.175'

SSH\_CREDENTIALS\_ID = 'your-ssh-credentials-id'

}

stages {

stage('Checkout') {

steps {

git 'https://github.com/GaniDynamo/Rablo-Devops-Project.git'

}

}

stage('Build Docker Image') {

steps {

sh "docker build -t $DOCKER\_IMAGE:latest docker-app"

}

}

stage('Push Docker Image') {

steps {

withCredentials([usernamePassword(credentialsId: 'dockerhub', usernameVariable: 'USER', passwordVariable: 'PASS')]) {

sh "echo $PASS | docker login -u $USER --password-stdin"

sh "docker push $DOCKER\_IMAGE:latest"

}

}

}

stage('Deploy to EC2') {

steps {

sshagent(['your-ssh-credentials-id']) {

sh """

ssh -o StrictHostKeyChecking=no ec2-user@$EC2\_HOST\_1 << EOF

docker pull $DOCKER\_IMAGE:latest

docker stop rablo-app || true

docker rm rablo-app || true

docker run -d -p 80:80 --name rablo-app --restart unless-stopped $DOCKER\_IMAGE:latest

EOF

ssh -o StrictHostKeyChecking=no ec2-user@$EC2\_HOST\_2 << EOF

docker pull $DOCKER\_IMAGE:latest

docker stop rablo-app || true

docker rm rablo-app || true

docker run -d -p 80:80 --name rablo-app --restart unless-stopped $DOCKER\_IMAGE:latest

EOF

"""

}

}

}

stage('Clean Up') {

steps {

sh "docker logout"

}

}

}

post {

success {

echo "Deployment Successful!"

}

failure {

echo "Deployment Failed!"

}

}

}

**Testing and Verification**

**5.1 Local Testing**

Docker Container Testing:

bash

*# Test single container*

docker run -p 80:80 dynamo28/rablo-assignment:v1.0

curl http://localhost/

*# Test with Docker Compose*

docker-compose up -d

curl http://localhost/

**5.2 AWS Testing**

ALB Testing:

bash

*# Test through ALB DNS*

curl http:// rablo-app-ALB-1278271690.ap-south-1.elb.amazonaws.com/

curl http:// rablo-app-ALB-1278271690.ap-south-1.elb.amazonaws.com/health

*# Test direct EC2 access*

curl http://13.233.143.124/

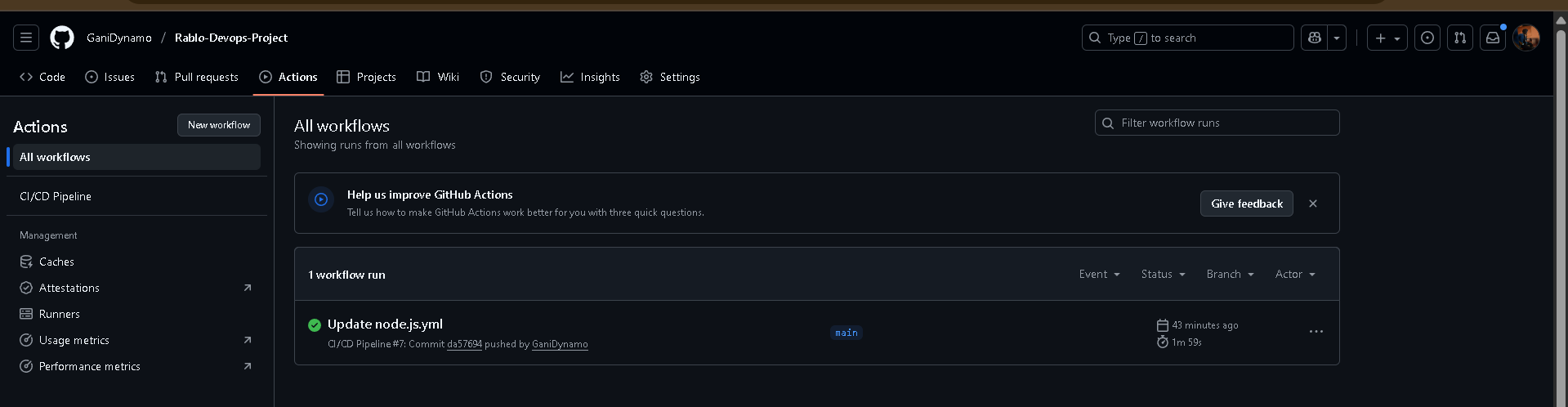
curl http://13.232.113.175/

**5.3 CI/CD Testing**

GitHub Actions:

* Push changes to main branch
* Monitor workflow execution in Actions tab
* Verify successful build and deployment

**Result:**

****

Jenkins:

* Trigger manual build
* Monitor console output
* Verify deployment success

**Challenges and Solutions**

**6.1 Docker Permission Issues**

Challenge: Permission denied while trying to connect to Docker daemon socket

**Solution:**

* Added sudo prefix to all Docker commands in deployment scripts
* Added ec2-user to docker group: sudo usermod -aG docker ec2-user

**6.2 GitHub Actions Build Context Error**

**Challenge:** Unable to prepare context: path "./docker-app" not found

**Solution:**

* Updated context path to correct folder structure: ./rablo-devops-assignment/docker-app

**6.3 SSH Key Configuration**

Challenge: SSH authentication failures in CI/CD pipelines

**Solution:**

* Correctly configured SSH private key in GitHub Secrets
* Used proper SSH action version compatible with our setup

**6.4 ALB Health Check Failures**

**Challenge:** Target instances showing unhealthy status

**Solution:**

* Implemented /health endpoint in the application
* Configured proper security group rules for ALB to EC2 communication

**Key Deliverables**

Completed Deliverables:

1. Docker Containerization:
   * ✅ Optimized Dockerfile
   * ✅ Docker image pushed to Docker Hub
   * ✅ Local testing instructions
2. NGINX Reverse Proxy:
   * ✅ nginx.conf with load balancing
   * ✅ Docker Compose configuration
   * ✅ Local testing setup
3. AWS Load Balancer:
   * ✅ ALB configuration
   * ✅ EC2 instances setup
   * ✅ Health check implementation
4. CI/CD Pipeline:
   * ✅ GitHub Actions workflow
   * ✅ Jenkins pipeline
   * ✅ Automated deployment to EC2
5. Documentation:
   * ✅ Complete step-by-step documentation
   * ✅ Code snippets and configurations
   * ✅ Troubleshooting guide

**Screenshots Included**

**Required Screenshots:**

1. Docker Hub showing pushed image
2. Local application running (browser/curl output)
3. Docker Compose services running
4. AWS EC2 instances list
5. ALB configuration page
6. Target Group with healthy targets
7. GitHub Actions workflow success
8. Jenkins pipeline execution
9. Application response through ALB

**Conclusion**

This project successfully demonstrates the complete DevOps workflow from containerization to production deployment with automated CI/CD pipelines. The implementation covers all aspects of modern DevOps practices including containerization, reverse proxy configuration, cloud load balancing, and automated deployment pipelines.

The solution is production-ready and follows best practices for security, scalability, and maintainability.