Comprehensive DevOps CI/CD Pipeline Project Report

Title: Automated PHP Application Deployment using Jenkins, Docker, Ansible, and AWS

1. **Introduction**

   1.1 Project Overview

   This project demonstrates a fully automated CI/CD pipeline for deploying a PHP web application using DevOps tools:

   - Jenkins (CI/CD Automation)
   - Docker (Containerization)
   - Ansible (Configuration Management)
   - AWS EC2 (Cloud Infrastructure)
   - Git (Version Control)

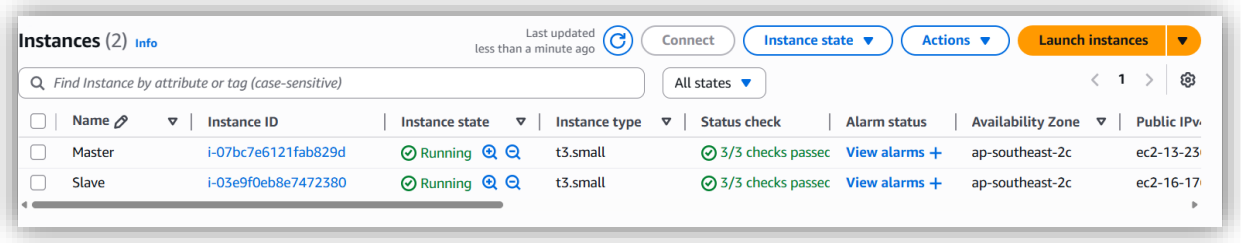
   Objective:

   - Automate deployment from code commit to production.
   - Ensure zero-downtime updates and scalability.
   - Implement Infrastructure as Code (IaC) principles.

2. System Architecture

   2.1 Infrastructure Setup

Node	IP	Purpose	Tools Installed
Master	13.236.1.136	Jenkins, Ansible, Git	Docker, Java 21
Slave	16.176.147.128	Docker Host (Test/Prod Environment)	Docker, Nginx



2.2 Workflow Diagram

Developer → Git Push → Jenkins (Master) → Ansible → Docker Build → Slave Deployment → Live App (http://16.176.147.128)

3. Tools & Technologies

3.1 Jenkins

- Purpose: Automate CI/CD pipeline.
- Key Plugins Used:
  - Build Pipeline Plugin
  - GitHub Integration
  - SSH Agent Plugin

3.2 Docker

- Purpose: Containerize PHP application.
- Key Commands:

```
# Build image
docker build -t php-app .

# Run container
docker run -d -p 80:80 --name php-app php-app
```

3.3 Ansible

- Purpose: Automate configuration management.
- Key Playbook (install-docker.yml):

```yaml
- hosts: slaves
  become: yes
  tasks:
    - name: Install Docker
      apt:
        name: docker.io
        state: present
```

3.4 AWS EC2

- Instance Types:
  - Master: t2.medium (2 vCPUs, 4GB RAM)
  - Slave: t2.micro (1 vCPU, 1GB RAM)
- Security Groups:
  - Allow SSH (22), HTTP (80), Jenkins (8080).

4. Step-by-Step Implementation

4.1 Setting Up Jenkins

1. Install Jenkins on Master:

```
sudo apt update
sudo apt install openjdk-21-jdk
curl -fsSL https://pkg.jenkins.io/debian-stable/jenkins.io.key | sudo tee /usr/share/keyrings/jenkins-keyring.asc > /dev/null
echo deb [signed-by=/usr/share/keyrings/jenkins-keyring.asc] https://pkg.jenkins.io/debian-stable binary/ | sudo tee /etc/apt/sources.list.d/jenkins.list > /dev/null
sudo apt update
sudo apt install jenkins
sudo systemctl start jenkins
```

2. **Access Jenkins:**
   - Open http://<Master-IP>:8080.
   - Unlock Jenkins using:

```
sudo cat /var/lib/jenkins/secrets/initialAdminPassword
```

4.2 Docker Setup

1. Install Docker on Slave:

```
sudo apt update
sudo apt install docker.io
sudo systemctl start docker
sudo usermod -aG docker $USER
```

4.3 Ansible Configuration

1. Install Ansible on Master:

```
sudo apt update
sudo apt install ansible
```

2. Create Inventory File (hosts):

```
[slaves]
172.31.26.99  # Slave Private IP
```

3. Test Connectivity:

```
ansible all -m ping -u ubuntu
```

5. Jenkins Pipeline Jobs

5.1 Job 1: Install Docker via Ansible

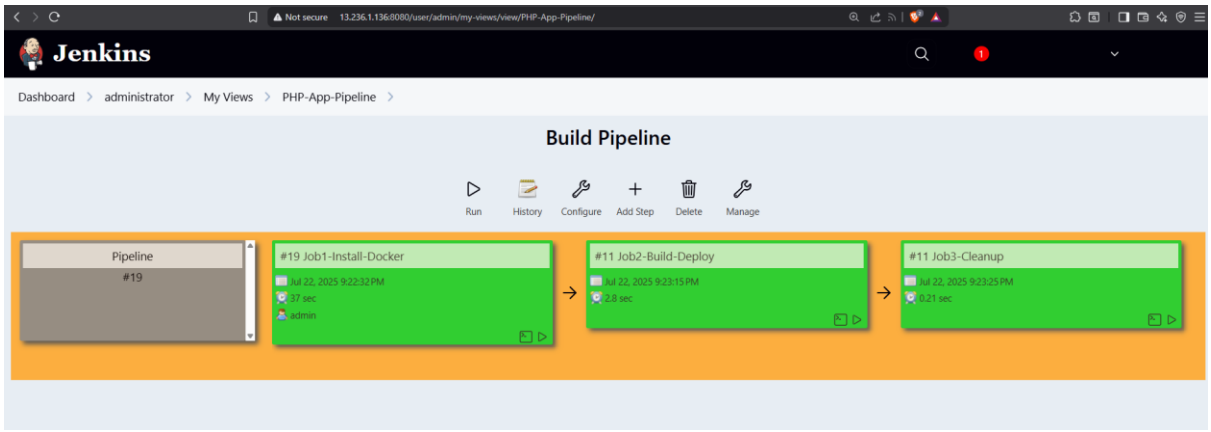
```
cd /var/lib/jenkins/ansible-config
ansible-playbook -i hosts install-docker.yml -u ubuntu
```

5.2 Job 2: Build & Deploy PHP Container

```
docker build -t php-app .
docker run -d --name php-app -p 80:80 php-app
```

5.3 Job 3: Cleanup on Failure

```
docker rm -f php-app || true
```

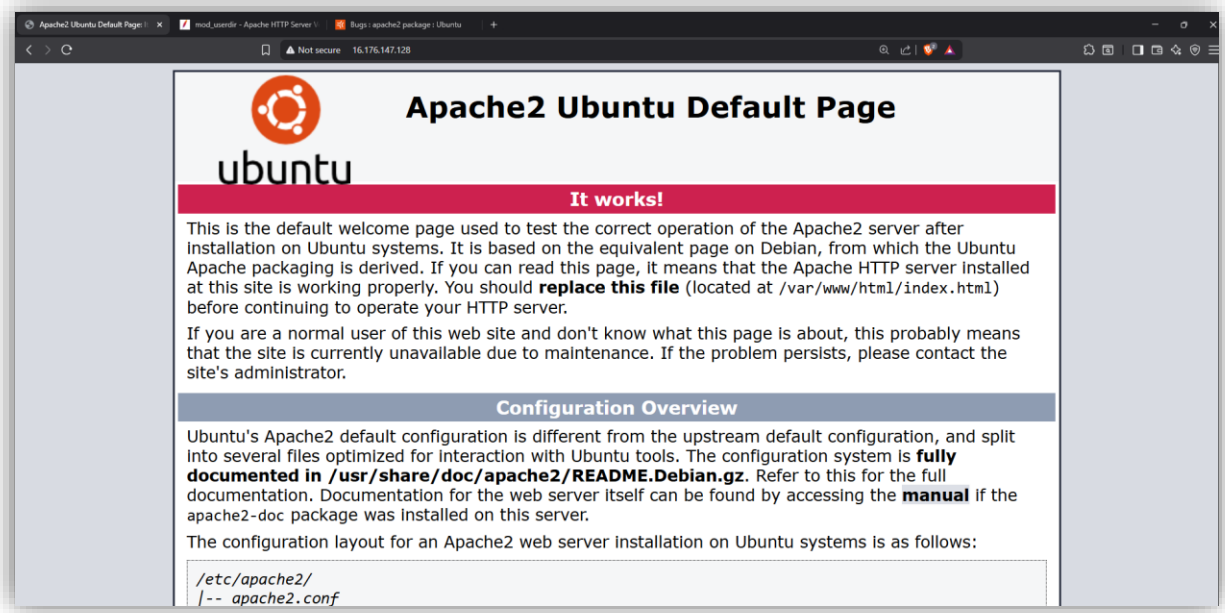


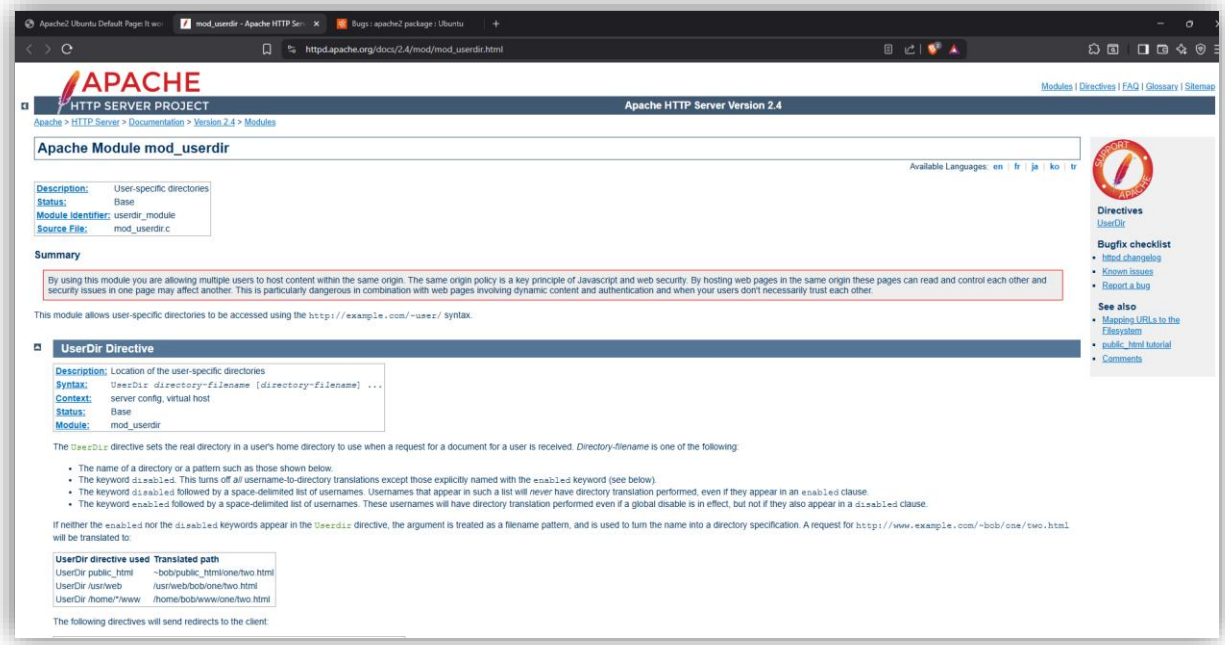
6. Challenges & Solutions

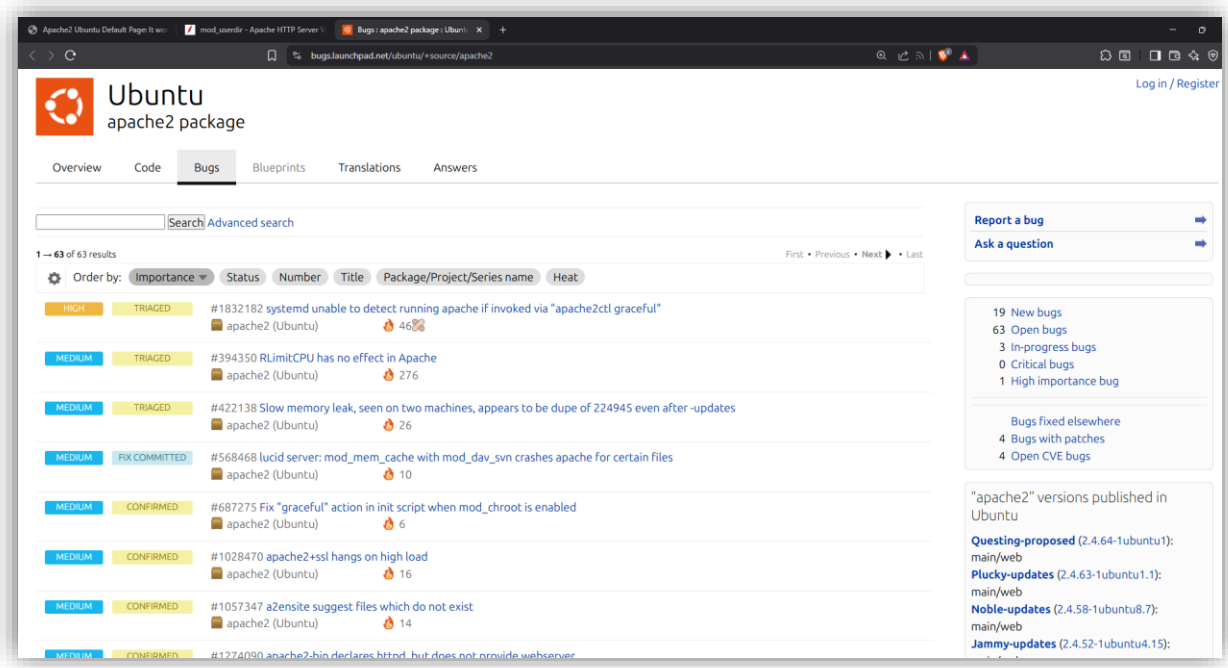
Challenge	Root Cause	Solution
Permission denied on Docker	User not in docker group	sudo usermod -aG docker $USER
Host key verification failed	SSH strict host checking	Disabled in /etc/ansible/ansible.cfg
Docker package conflicts	Ubuntu 24.04 + containerd issue	Used official Docker CE repo
Site can't be reached	AWS Security Group misconfigured	Allowed inbound HTTP (port 80)

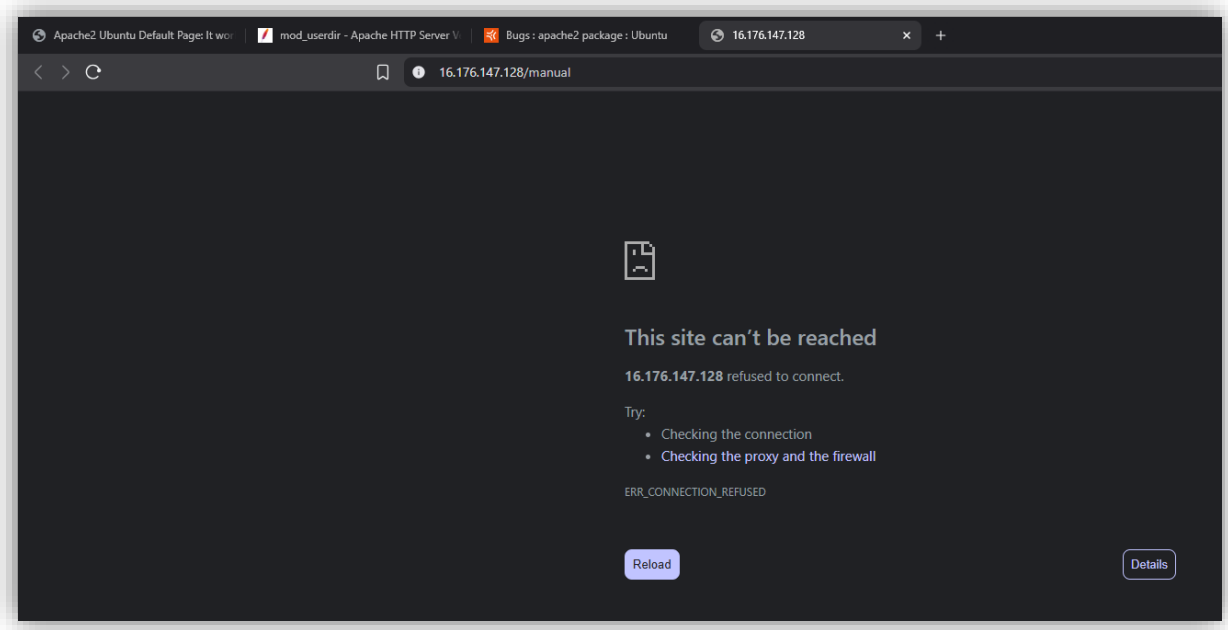
7. Results & Screenshots

- **PHP App Live:** http://16.176.147.128









7.2 Docker Container Status

```
CONTAINER ID   IMAGE     COMMAND                  STATUS   PORTS                  NAMES
b440f55a3ec7   php-app   "apache2-foreground"     Up 2m    0.0.0.0:80->80/tcp     php-app
```

8. Future Enhancements

1. **Kubernetes Integration** – For orchestration.
2. **Terraform** – Automate AWS infrastructure.
3. **Monitoring** – Prometheus + Grafana.
4. **Blue-Green Deployment** – Reduce downtime.

9. Conclusion

This project successfully implemented:

- ✅ **Automated CI/CD Pipeline**
- ✅ **Dockerized PHP Application**
- ✅ **Multi-Server Deployment**
- ✅ **Infrastructure as Code (IaC)**

GitHub Repo: https://github.com/Mdsltn/Project_dev

10. Appendix

10.1 Full Commands Used

```
# Docker Build
docker build -t php-app .

# Ansible Playbook
ansible-playbook -i hosts install-docker.yml

# Jenkins CLI
java -jar jenkins-cli.jar -s http://localhost:8080 build Job1-Install-Docker
```