

IISER RESEARCH PROJECT



DEVOPS PIPELINE

PRESENTED BY -

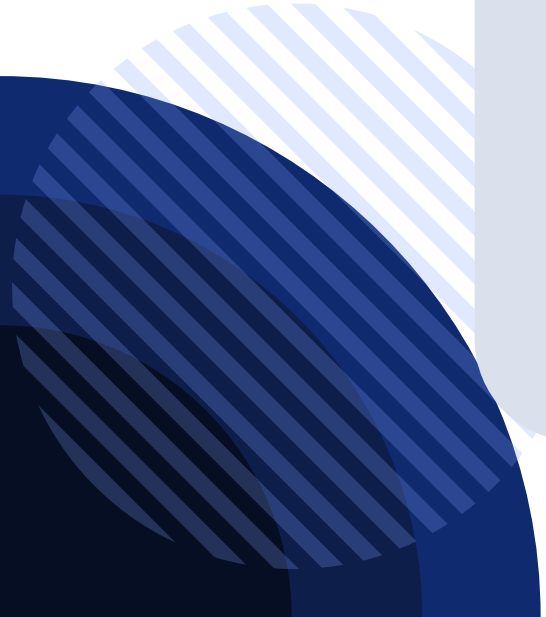
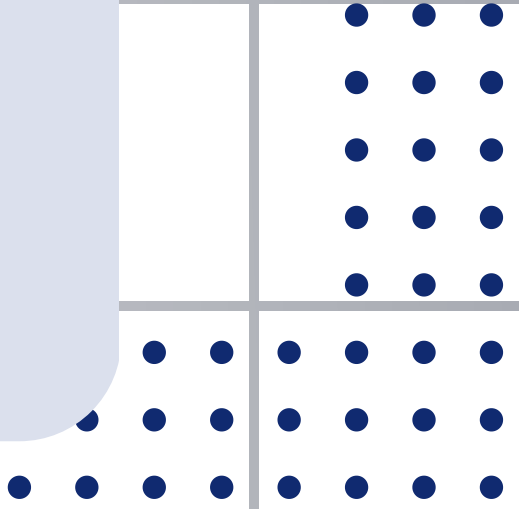
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TE COMP GROUP 2
2025 - 26



LOCAL GOOGLE DRIVE-LIKE FILE STORAGE SYSTEM WITH DEVOPS PIPELINE


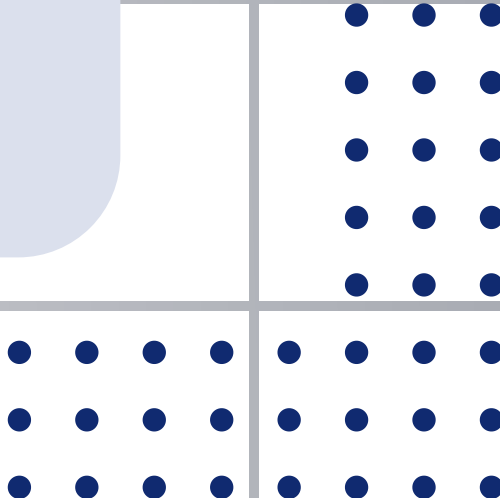


- **Introduction**
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INTRODUCTION



- DevOps enables automation of **code integration, testing, and deployment**.
 - Traditional DevOps pipelines **often ignore security**, leading to **vulnerabilities**.
 - The proposed system integrates **DevSecOps principles** — embedding security into every stage.
 - **Uses open-source tools:** Gitea, Jenkins, SonarQube, Nexus, Flask, PostgreSQL.
 - **Objective:** To create a secure, scalable, and automated CI/CD pipeline.
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MOTIVATION

- **Increasing cyber threats** make **secure automation** essential.
- Many **existing academic projects** rely on **manual deployment**.
- **Motivation:** Integrate open-source tools into a unified DevSecOps pipeline.
- Encourages a **security-first mindset** among developers.
- Provides **hands-on experience** with **real-world automation** workflows.

PROBLEM STATEMENT

1. Most academic or small-scale projects **face challenges** due to the **absence of structured DevOps pipelines**.
2. Manual deployment and testing often **cause delays, inconsistencies, and quality issues**.
3. Additionally, **integrating multiple tools for version control, build automation, and quality analysis is complex and time-consuming**.
4. To address these limitations, this project proposes a unified and **automated DevSecOps system** that **streamlines code management, testing, deployment, and monitoring** within a single secure environment.
5. This ensures **faster feedback, better collaboration, and improved code reliability**.

METHODOLOGY

**DEVELOPER COMMITS
CODE TO GITEA**



**JENKINS AUTOMATICALLY
TRIGGERS THE BUILD.**



**SONARQUBE SCANS FOR BUGS
AND VULNERABILITIES**



**NEXUS STORES APPROVED
BUILD ARTIFACTS.**



**FLASK + POSTGRESQL BACKEND
IS DEPLOYED.**

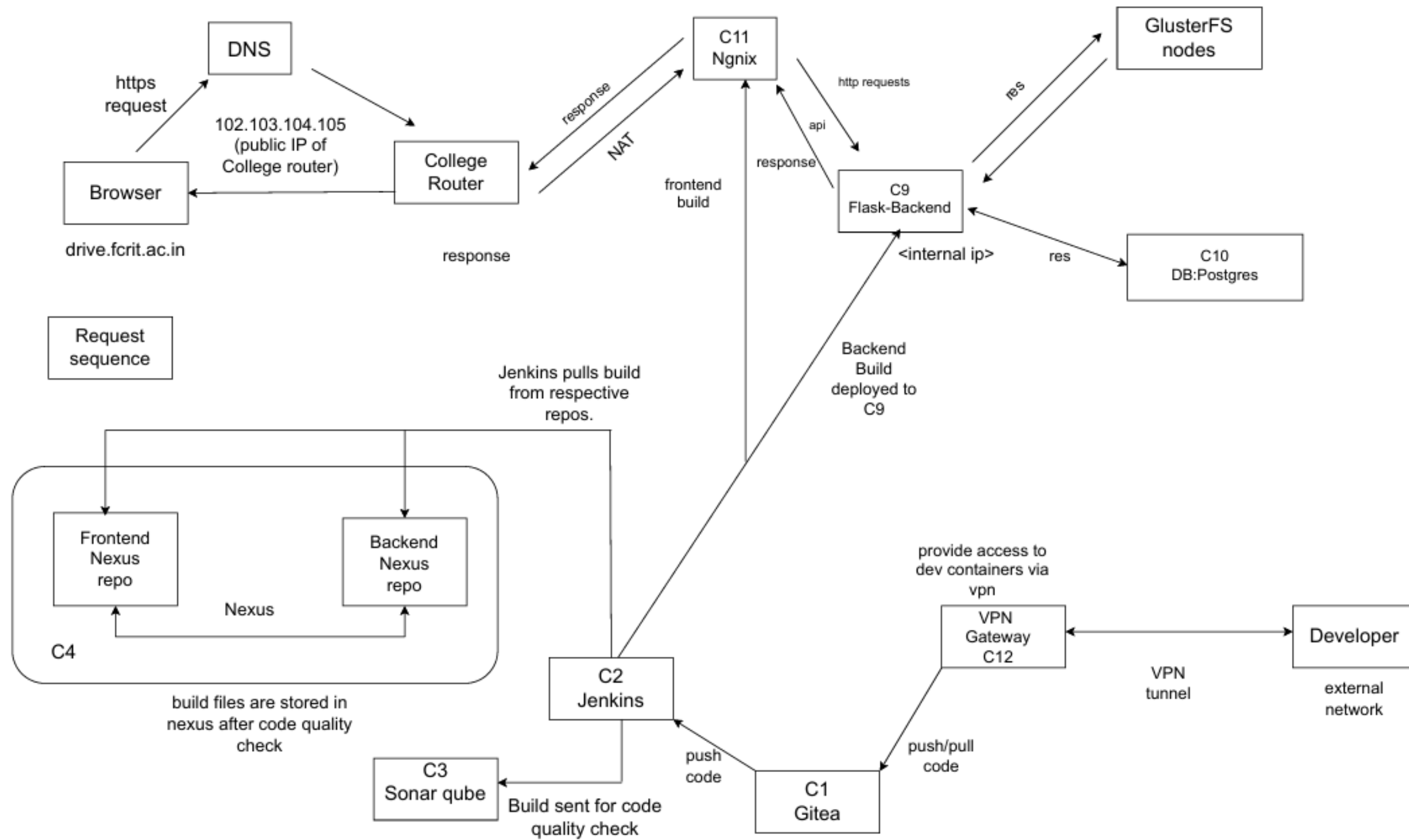


**NGINX SERVES FRONTEND
TO USERS.**



**VPN GATEWAY ENSURES
SECURE DEVELOPER ACCESS**

SYSTEM ARCHITECTURE



Steps in Progress & steps to be done

PC 1		PC 2	
Container 1	✓	Container 1	✓
1. Jenkins: Working Testing	✓	1. GITEA: Working Testing	✓
PC 3		PC 4	
Container 1	✓	Container 1	✓
1. Nginx: Working Testing	✓	1. PostgreSQL Working Testing	✓
Container 2	✓	Container 2	✓
1. Sonarqube: Working Testing	✓		
Flask API Working Testing	✓		

TOOLS/TECHSTACK

HARDWARE COMPONENTS

1. Server Nodes (4 PCs):

- Processor: Intel i5/i7 or Ryzen 5/7
- RAM: 8–32 GB
- Storage: 512 GB–1 TB SSD
- Network: Gigabit Ethernet
- Power: UPS backup

2. Client Systems:

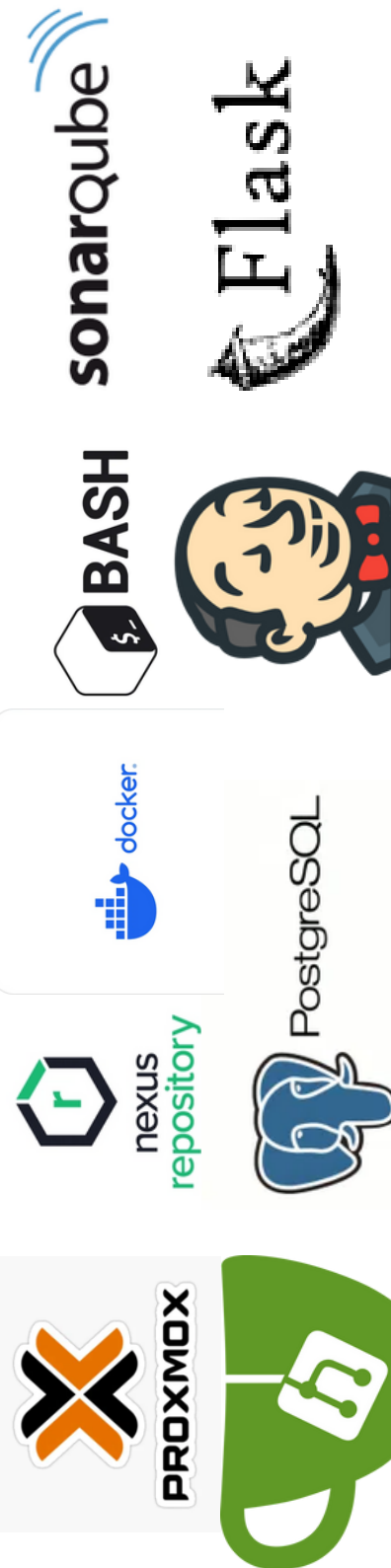
- Processor: i3/i5
- RAM: 4–8 GB
- Stable LAN or Wi-Fi

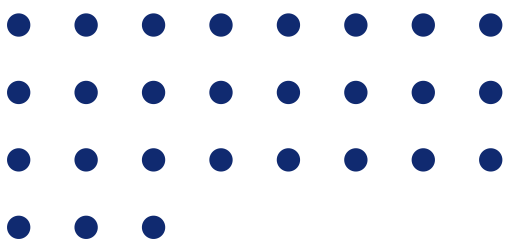
3. Networking:

- Gigabit switch, Cat6 cables, Router

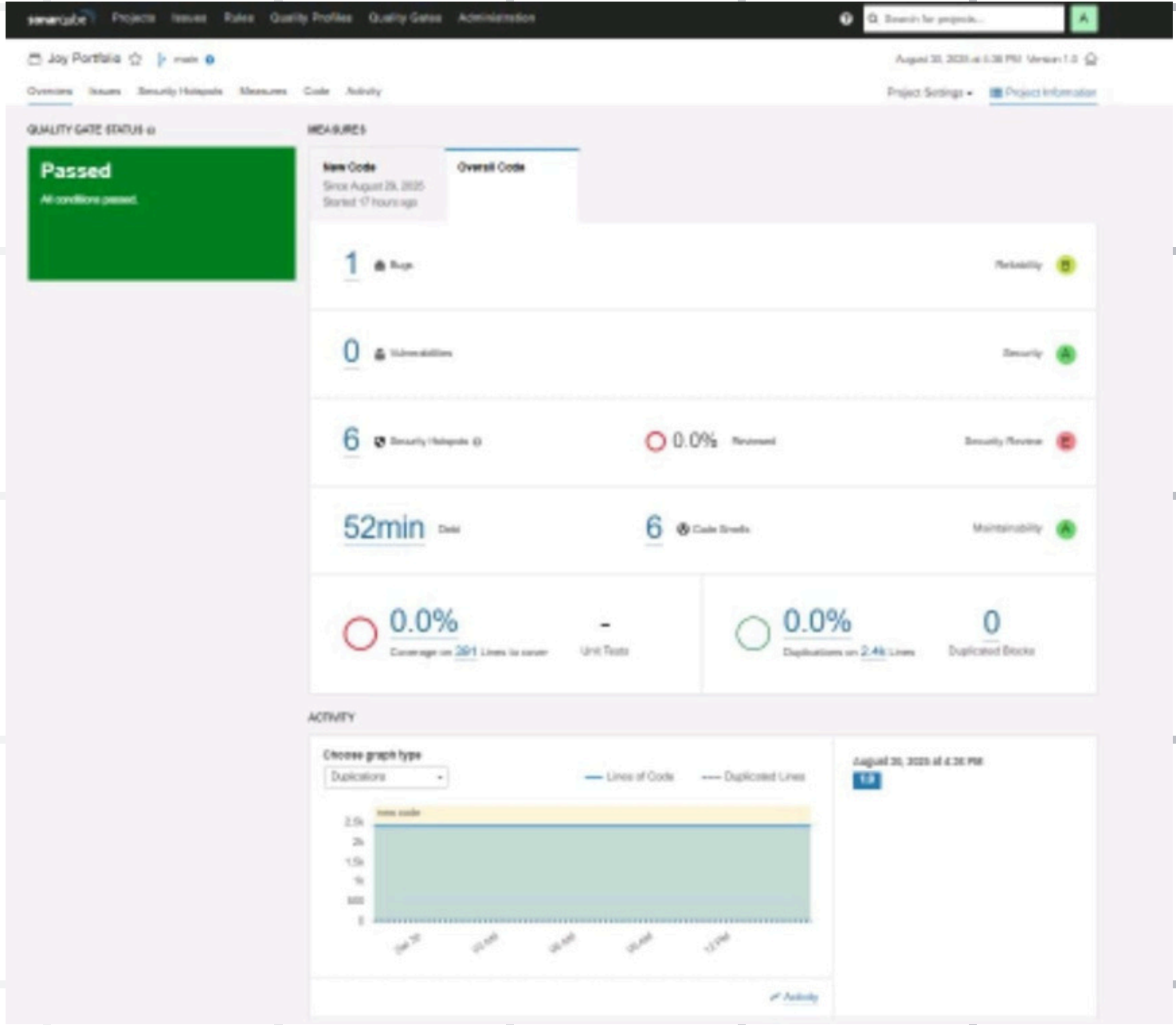
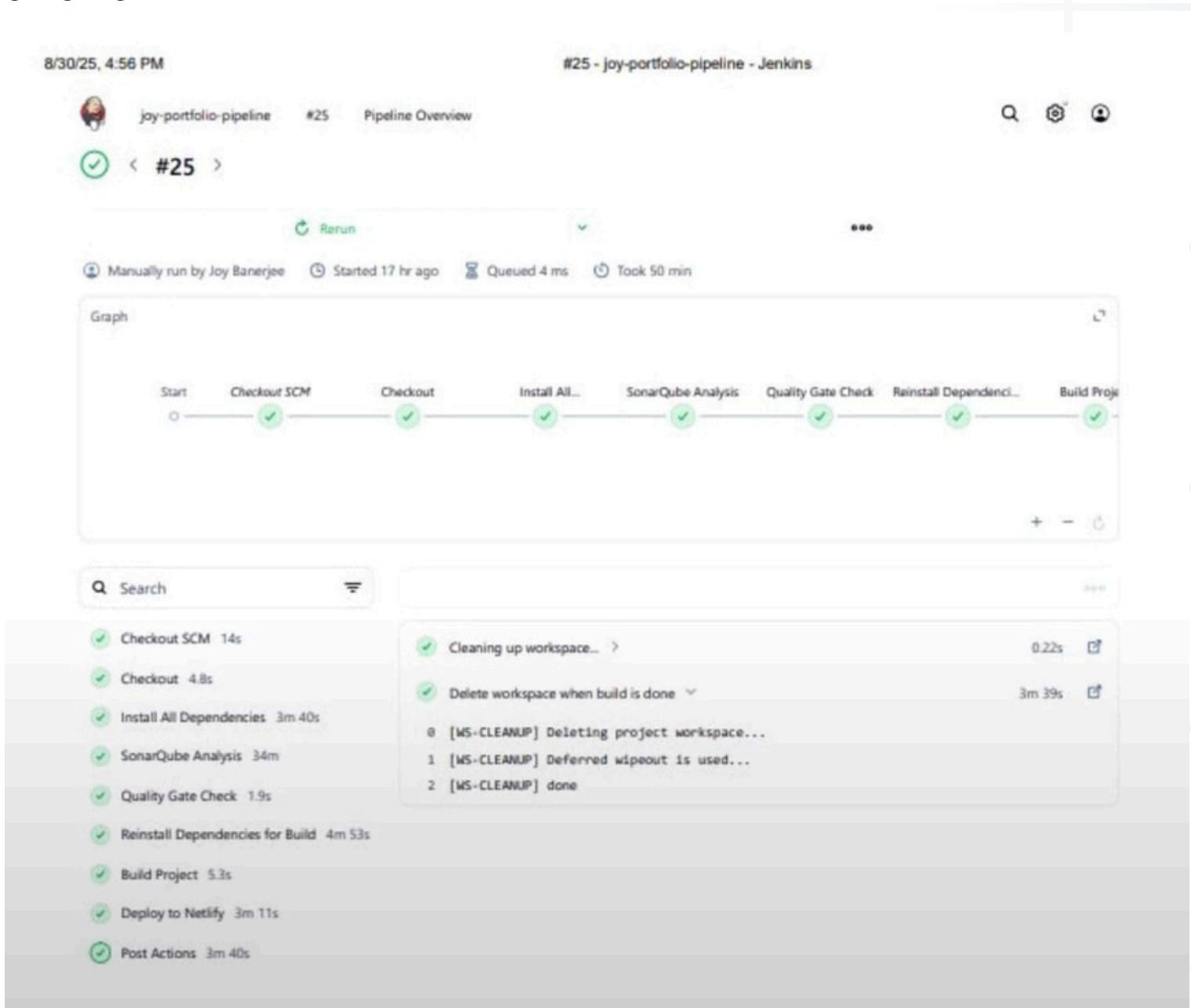
SOFTWARE COMPONENTS

1. **Operating System:** Ubuntu Server LTS
2. **Version Control:** Gitea
3. **Automation:** Jenkins
4. **Code Analysis:** SonarQube
5. **Artifact Repository:** Nexus
6. **Backend:** Flask (Python)
7. **Database:** PostgreSQL
8. **Storage:** GlusterFS
9. **Virtualization:** Proxmox VE
10. **Additional Tools:** Docker, Git, SSH, Shell scripts





STEPS IN PROGRESS



LITERATURE SURVEY

Title	Authors / Year	Key Focus	Relevance to Our Work
High Availability Cluster Design Using Proxmox VE	Sharma et al. (2021)	VM clustering and redundancy with Proxmox	Used to understand HA design with Proxmox
Virtualization in Education Infrastructure Using Open Source Tools	Ahmed & Patel (2020)	Proxmox and virtualization in academia	Validates feasibility of virtual infra in colleges
Containerization vs Virtualization Performance Comparison	Liu et al. (2022)	Benchmarking VMs vs containers	Supports choice of containers for modularity
KVM vs. LXC: Comparing Performance and Isolation of Hardware-assisted Virtual Routers	Rathore, Hidell & Sjödin (2013)	This study evaluates how LXC containers and KVM VMs perform, especially under hardware virtualization enhancements like SR-IOV and Intel VT-d. Although focused on virtual routers, its findings are broadly relevant to service hosting in virtualization environments	LXC containers offer superior performance and reduced resource overhead. Unless strict isolation or multi-OS support is needed, KVM VMs don't offer significant advantage for your current setup.

EXISTING SYSTEMS

System	Description	Key Features	Limitations
GitHub	Cloud-based platform for version control and collaborative development using Git.	<ul style="list-style-type: none">- Repository hosting with pull requests and issue tracking.- Integrates with CI/CD tools like Jenkins and GitHub Actions.- Supports open-source collaboration.	<ul style="list-style-type: none">- Limited customization in free tier.- Requires internet access.- Advanced features available only in paid plans.
GitLab	Complete DevOps platform offering integrated CI/CD, monitoring, and code management.	<ul style="list-style-type: none">- Built-in pipelines for automation.- Integration with Kubernetes and container registries.- Provides project and user access management.	<ul style="list-style-type: none">- High resource usage when self-hosted.- Complex setup for enterprise use.- Some advanced options are paid.
Travis CI	Cloud-based CI/CD tool that automates code building and testing after every commit.	<ul style="list-style-type: none">- Easy YAML-based configuration.- Supports multiple languages and frameworks.- Simple GitHub integration.	<ul style="list-style-type: none">- Slow builds in free tier.- Limited environment control.- Less active community support.
CircleCI	Modern CI/CD platform supporting cloud and on-prem automation.	<ul style="list-style-type: none">- Docker-based builds with parallel execution.- Fast and scalable pipelines.- Integration with GitHub and Bitbucket.	<ul style="list-style-type: none">- Limited free-tier build minutes.- Complex for multi-container workflows.- Weak offline/on-premise support.



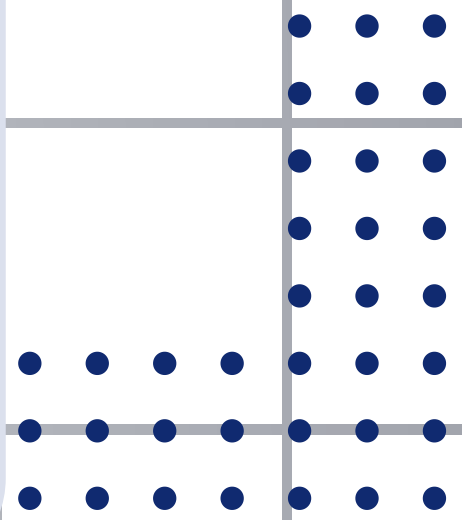
CONCLUSIONS AND FUTURE SCOPE

Conclusion:

- Achieving a secure, automated CI/CD pipeline using 3-tier architecture.
- Reduced manual work, improved quality and speed of deployment.
- Demonstrated scalable and fault-tolerant DevOps infrastructure.

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Future Scope:

- Integration with Docker & Kubernetes.
 - Monitoring using Prometheus + Grafana.
 - Cloud deployment on AWS or GCP.
 - Add role-based access and centralized logging.
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THANK YOU



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