

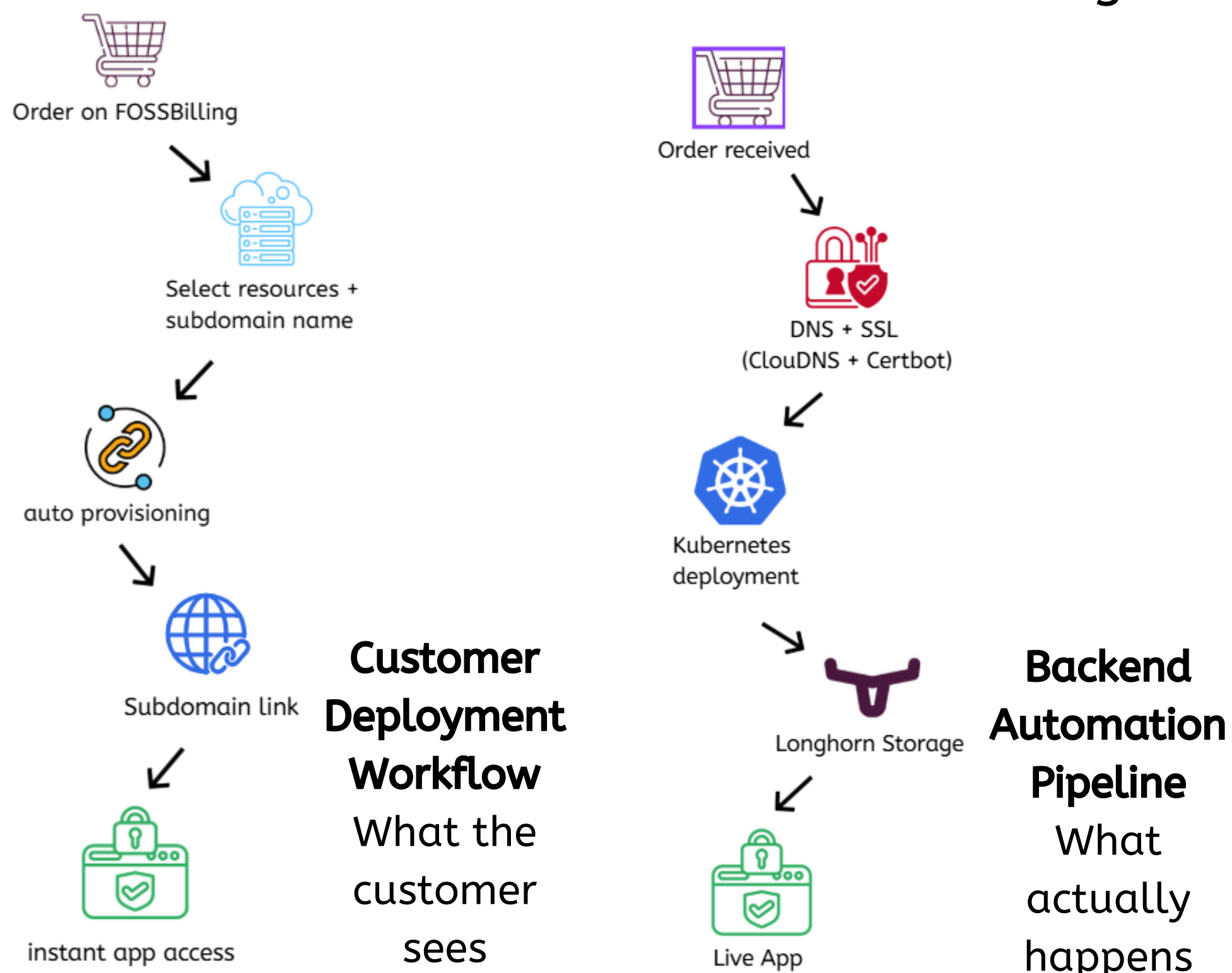
Problem Definition

- Our client currently offers web and email hosting and wants to expand into fully managed application hosting like Nextcloud.
- Current deployment process requires:
 - Server setup
 - Domain registration
 - SSL certificate configuration
- Application deployment is often complex, time-consuming, and difficult for users without technical expertise.

Need: A system where users can purchase a service and automatically receive a fully deployed, secure application via a subdomain without manual setup.

Objective

- Design and implement a **managed application hosting platform** and **dashboards** for control and monitoring.



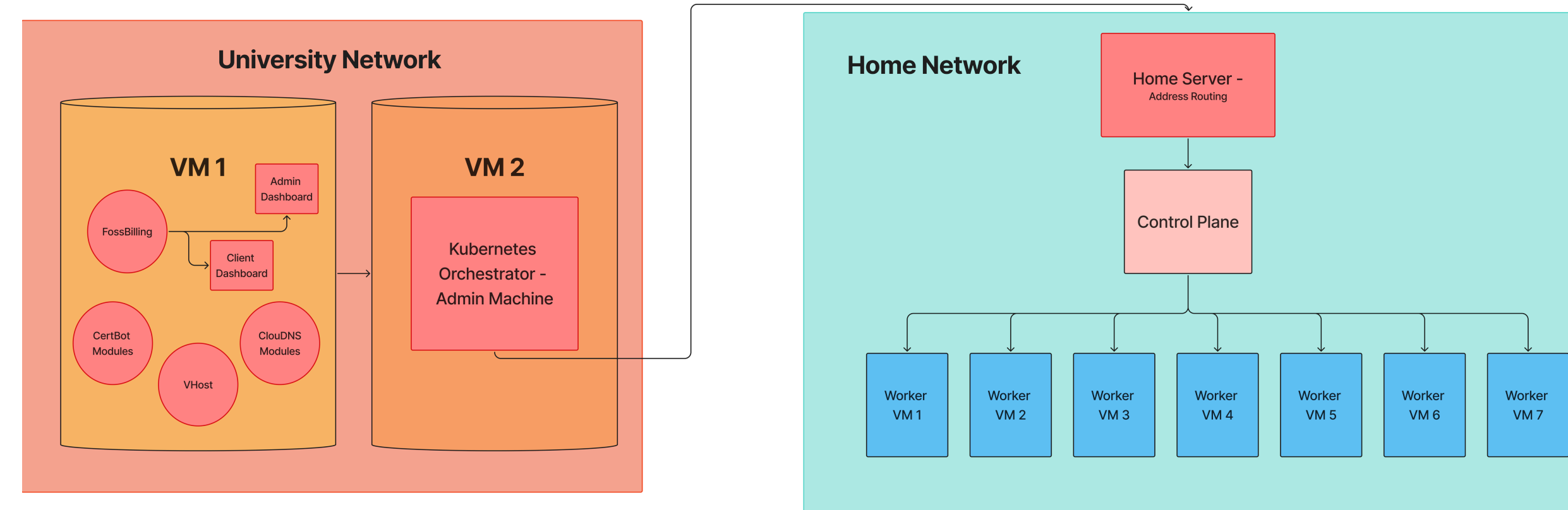
Design

Frontend Control Layer (University Network – VM 1)

- Runs FOSSBilling for user order management, handles:
 - User/Admin dashboards
 - DNS management (CloudDNS)
 - HTTPS automation (Certbot)
 - Virtual host configuration
- Sends deployment requests to backend after user order.

Orchestration Layer (University Network – VM 2)

- Acts as Kubernetes control node, responsible for:
 - Provision and deploy containerized applications
 - Manage scaling and overall cluster operations



End-to-End Automated Application Deployment Architecture

Routing & Execution Layer (Home Network)

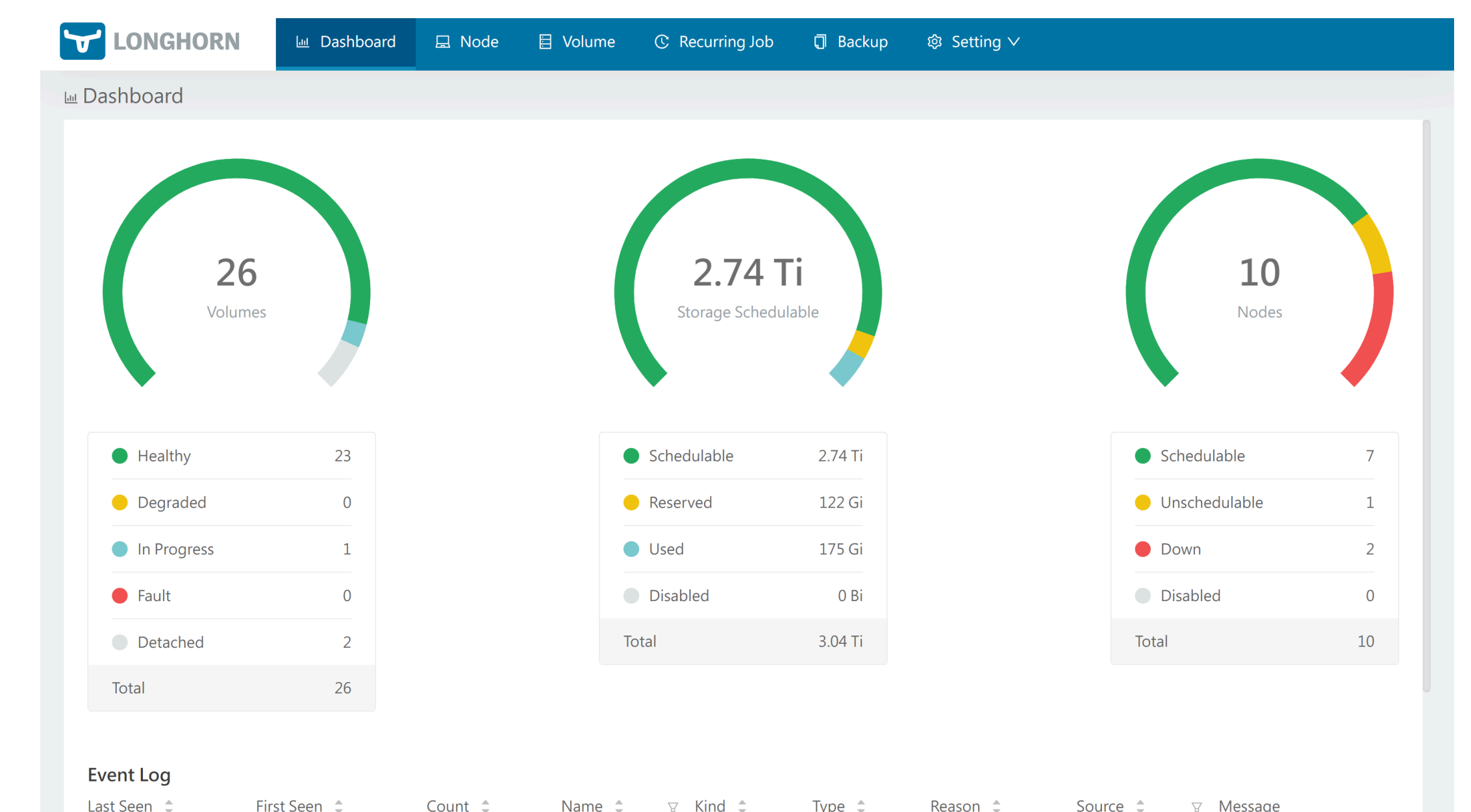
- Home server manages:
 - Secure connection to Kubernetes cluster
- Kubernetes cluster:
 - Control plane handles scheduling & state
 - Worker nodes run application containers

Acknowledgement

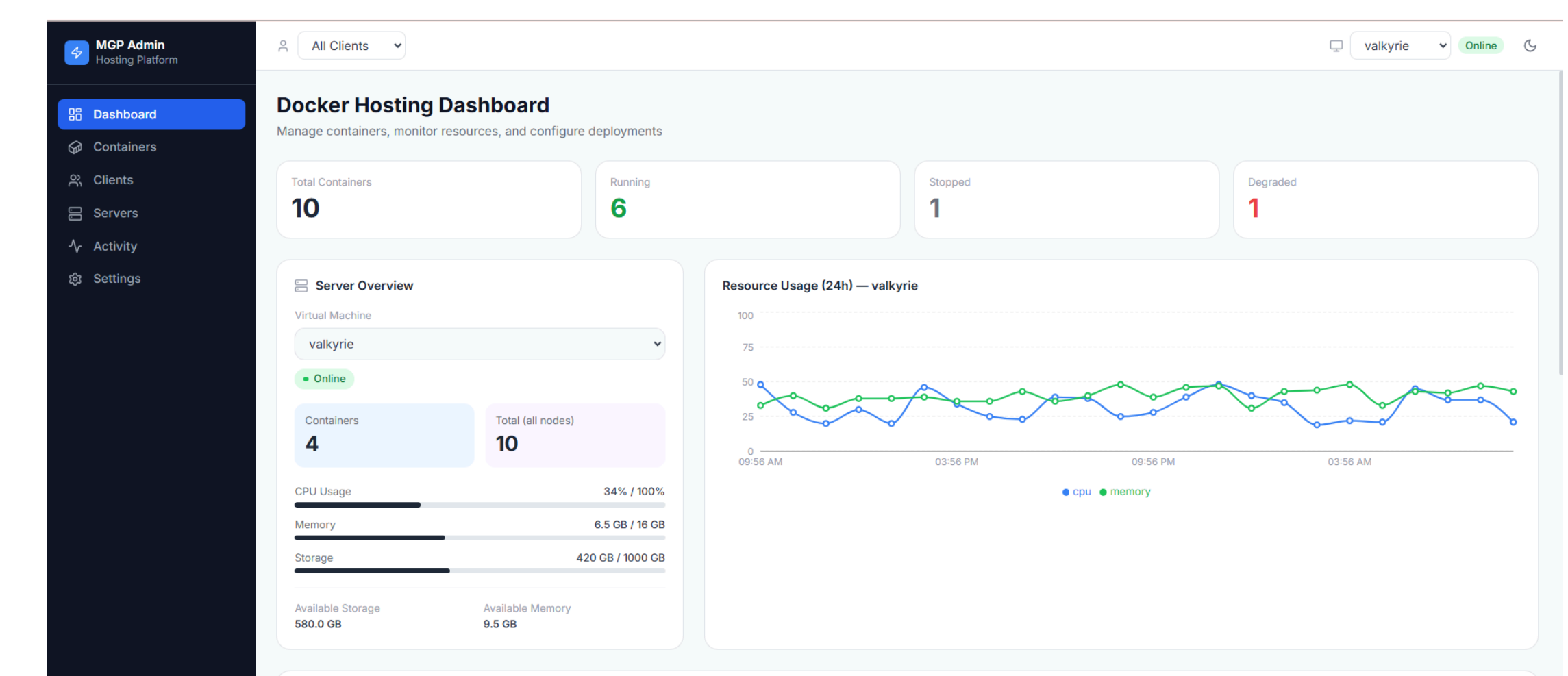
This project was developed as part of CMSC435: Software Engineering at the University of Maryland, College Park. We would like to thank our instructor, Dr. James Purtilo and our client, Christian Johnson, for their guidance and support.

Results

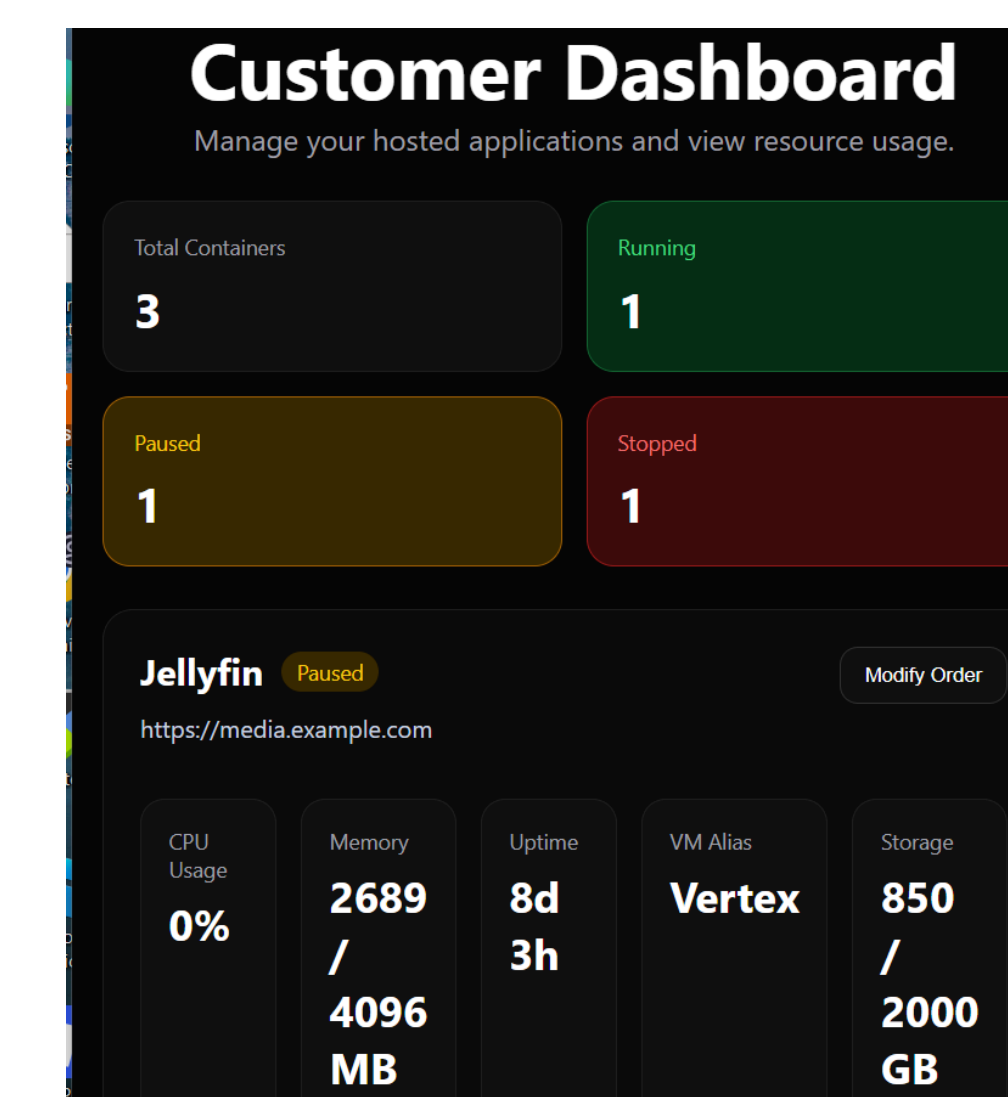
- Implemented automated application deployment.
- Core system fully integrated (FOSSBilling, Kubernetes orchestration, APIs).
- Built interactive dashboards for monitoring and controlling container resources and system activity.



Longhorn Distributed Storage Dashboard in Kubernetes Cluster



Admin Dashboard for Monitoring Containers and System Resources



Customer Monitoring Dashboard

- Built container control interface (start, stop, reset) with real-time resource metrics.
- Validated feasibility of an automated, scalable hosting platform.