CASE STUDY
DEPLOYING A 3-NODE KUBERNETES CLUSTER ONUBUNTU FOR SCALABLE MICROSERVICES ARCHITECTURE

From Zero to Scalable: Deploying Kubernetes on Ubuntu for Modern Architectures

Client Overview :

A modern, cloud-based point-of-sale system built for restaurants, bars, and retail businesses. Designed by industry experts, it supports Android, Windows, and Apple devices with full remote setup, real-time monitoring, and unlimited terminals. With 24/7 global support and weekly feature updates, it offers an intuitive, powerful, and scalable POS experience tailored to modern business needs.

The system enables seamless menu management, multi-location control, and kitchen integration. It's easy to use, quick to deploy, and flexible enough for startups or large enterprises, ensuring smooth operations and customer satisfaction.

Problem Statement :

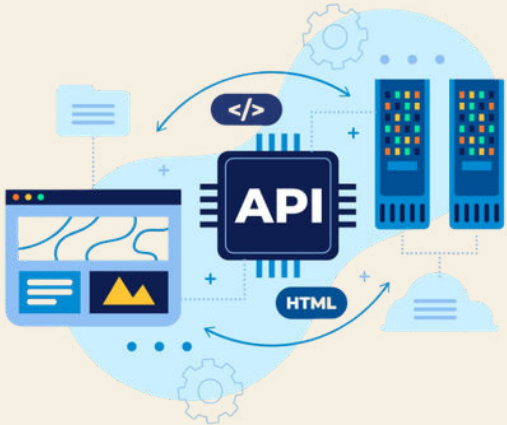
The client was operating with a monolithic architecture hosted on a single cloud VM, leading to:

- **Limited scalability during peak usage.**
- **High deployment downtime and dependency on manual CI/CD workflows.**
- **Inefficient resource utilization due to over-provisioning.**
- **Need for high availability (HA), auto-scaling, and faster rollback strategies for microservices.**

The client required a production-grade, highly available Kubernetes cluster to support containerized microservices, CI/CD pipelines, and scaling with minimal downtime.

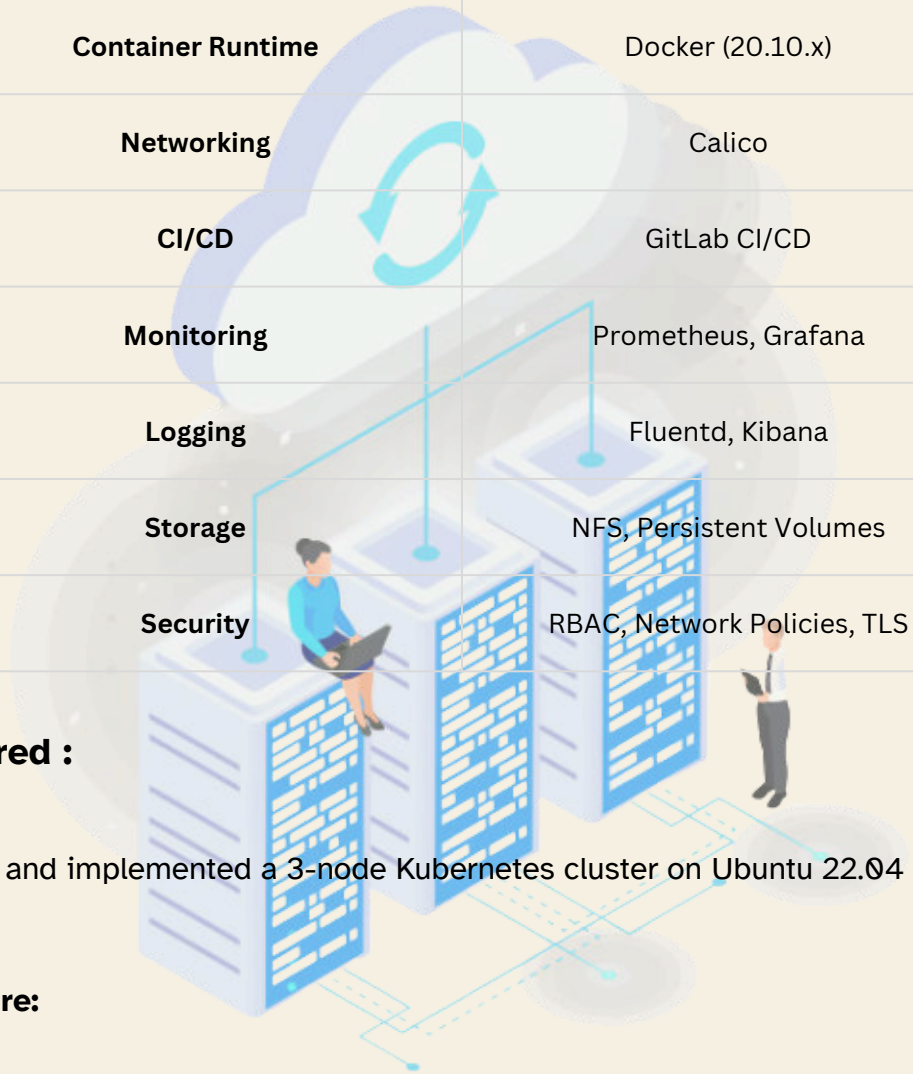
Business Outcomes :

- 99.95% Uptime achieved through container orchestration and HA design.
- 70% faster deployments using GitLab CI/CD pipelines integrated with Kubernetes.
- 40% improved resource utilization by moving from VM-based workloads to pods.
- Reduced downtime from ~20 minutes to <2 minutes during app updates.
- Enhanced developer velocity with isolated namespaces for testing and production.



Business Outcomes :

Component	Technology
Operating System	Ubuntu 22.04 LTS
Orchestration	Kubernetes (v1.29)
Container Runtime	Docker (20.10.x)
Networking	Calico
CI/CD	GitLab CI/CD
Monitoring	Prometheus, Grafana
Logging	Fluentd, Kibana
Storage	NFS, Persistent Volumes
Security	RBAC, Network Policies, TLS



Solution Delivered :

Our team designed and implemented a 3-node Kubernetes cluster on Ubuntu 22.04 LTS using Kubeadm.

Cluster Architecture:

- 1 Master Node: Controls the cluster, runs control plane components.
- 2 Worker Nodes: Hosts workloads and services.
- Ubuntu 22.04 used on all nodes for its LTS support and minimal OS overhead.

Key Steps Executed:

Environment Setup:

- Provisioned 3 Ubuntu VMs on the client's private cloud (2 vCPU, 4GB RAM each).
- Installed Docker as the container runtime.
- Set up static IPs and configured hostnames for internal resolution.

Network Configuration:

- Deployed Calico for network policies and pod networking.
- Verified inter-pod communication and cluster DNS resolution.

Storage Integration:

- Integrated NFS persistent storage for stateful apps.
- Configured dynamic volume provisioning via StorageClasses.

CI/CD Integration:

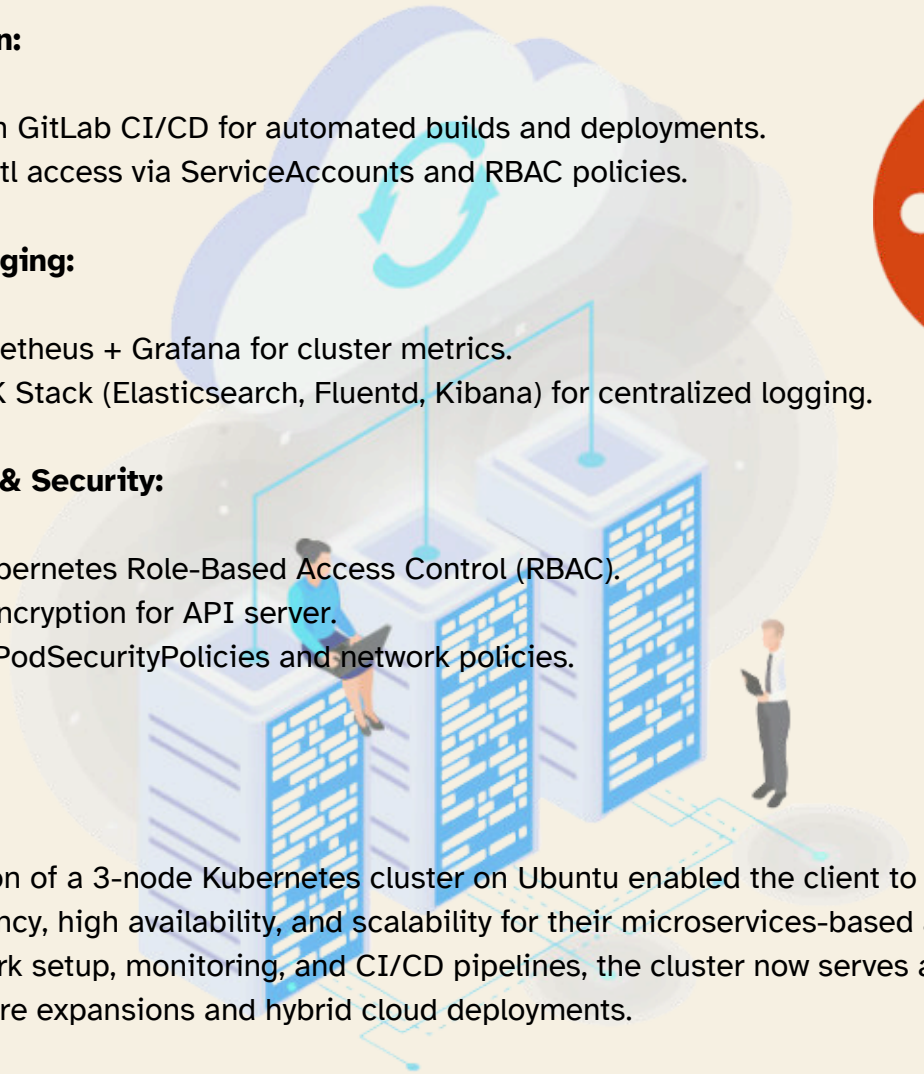
- Integrated with GitLab CI/CD for automated builds and deployments.
- Enabled kubectl access via ServiceAccounts and RBAC policies.

Monitoring & Logging:

- Installed Prometheus + Grafana for cluster metrics.
- Integrated EFK Stack (Elasticsearch, Fluentd, Kibana) for centralized logging.

High Availability & Security:

- Configured Kubernetes Role-Based Access Control (RBAC).
- Enabled TLS encryption for API server.
- Implemented PodSecurityPolicies and network policies.



Conclusion :

The implementation of a 3-node Kubernetes cluster on Ubuntu enabled the client to achieve operational efficiency, high availability, and scalability for their microservices-based application. With proper network setup, monitoring, and CI/CD pipelines, the cluster now serves as a robust foundation for future expansions and hybrid cloud deployments.

This architecture now supports their current operations and is scalable enough to include multi-zone clusters or managed services in the future (like EKS or GKE) without architectural overhauls.