Report BCDV 4032
Building Scalable Blockchain Applications
Demo: Group 19
Minio & Datadog

https://github.com/saki-osive/ScalableBlockchainApps-4032/tree/master/demo

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Minio on Kubernetes

Introduction to Minio

- MinIO is high-performance Kubernetes-native object storage that is compatible with the S3 API
- It is software-defined, runs on industry standard hardware and is 100% open source with the dominant license being GNU AGPL v3
- MinIO is different in that it was designed from its inception to be the standard in private/hybrid cloud object storage.
- It is built for large scale AI/ML, data lake and database workloads. It is software-defined and runs on any cloud or on-premises infrastructure. MinIO is dual-licensed under open source GNU AGPL v3 and a commercial enterprise license.
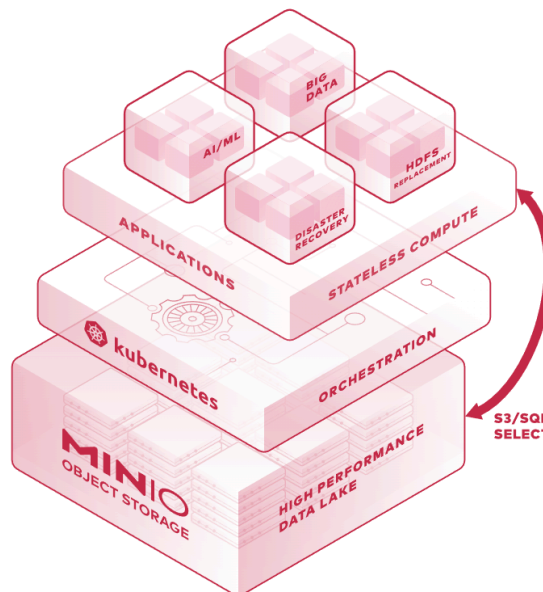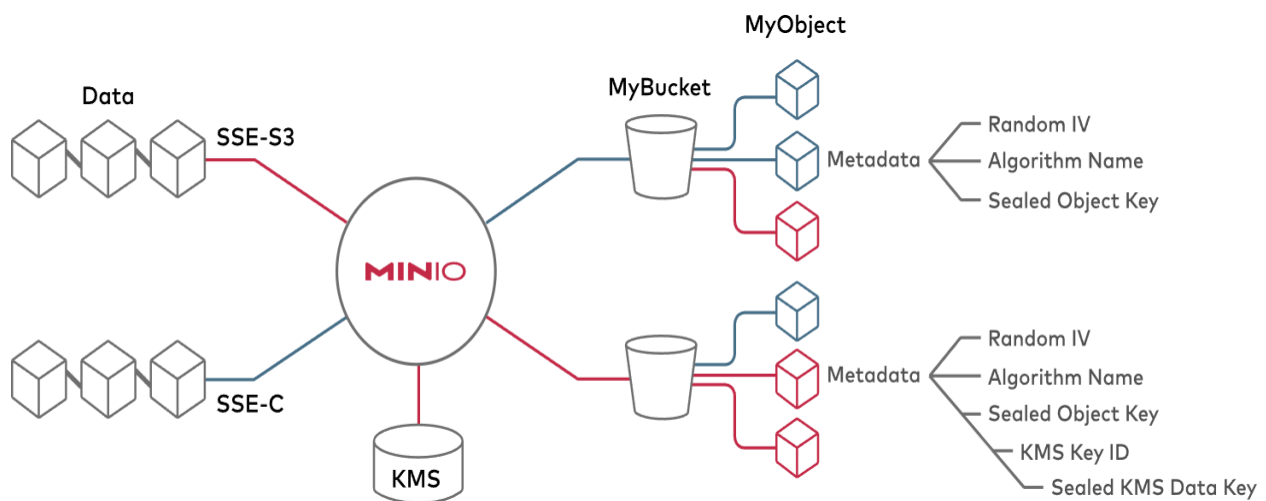

WHY MINIO FOR OBJECT STORE ?

Bucket & Object Immutability

➢ Protecting data from deletion (accidental or intentional) is a key compliance component that touches every industry. MinIO supports a complete range of functionality including **object locking, retention, legal holds, governance, and compliance.** MinIO's bucket

and object immutability is Veeam certified and validated by Cohasset Partners for use under SEC Rule 17a-4(f), FINRA Rule 4511, and CFTC Regulation 1.31.

Encryption

➢ In the world of object storage, **strong encryption is required just to get a seat at the table**. MinIO delivers more with the highest level of encryption alongside extensive optimizations that all but eliminate the overhead typically associated with storage encryption operations.

Active-Active Replication for Object Storage

● Active Active, Multi-Site Replication for Object Storage is a **key requirement for mission-critical production environments**. **MinIO is the only vendor that offers it today**.
● MinIO offers bucket-level granularity and **supports both synchronous and near-synchronous replication** depending on the architectural choices and rate of change with the data.
● Reference Video Link: ▶ MinIO Feature Overview: Active-Active Replication .

Automated Data Management Interfaces

- Data is the enterprise's most critical asset and must therefore be made easily and securely available throughout the entire organization in order to maximize its value to everyone. As a result, **enterprises must adopt a range of data interface approaches based on the needs** of the audience. MinIO **offers a suite of options** to cover every persona in a data-driven enterprise, such as graphical user interfaces **(GUI)**, command line interfaces **(CLI)** and application programming interfaces **(API)**. MinIO's data management interfaces function interchangeably to deliver granular, performant and scalable object storage management.

Object Storage Built for S3

S3 compatibility is a hard requirement for cloud-native applications. MinIO is unyielding in its adherence to the API and with tens of thousands of users - both commercial and community - **MinIO's S3 implementation is the most widely tested and implemented alternative to AWS S3 in the world.**

One of the earliest adopters of the S3 API (both V2 and V4) and one of the only storage companies to focus exclusively on S3, MinIO's massive community ensures that no other AWS alternative is more compatible. MinIO is also one of the few companies to support S3 Select.
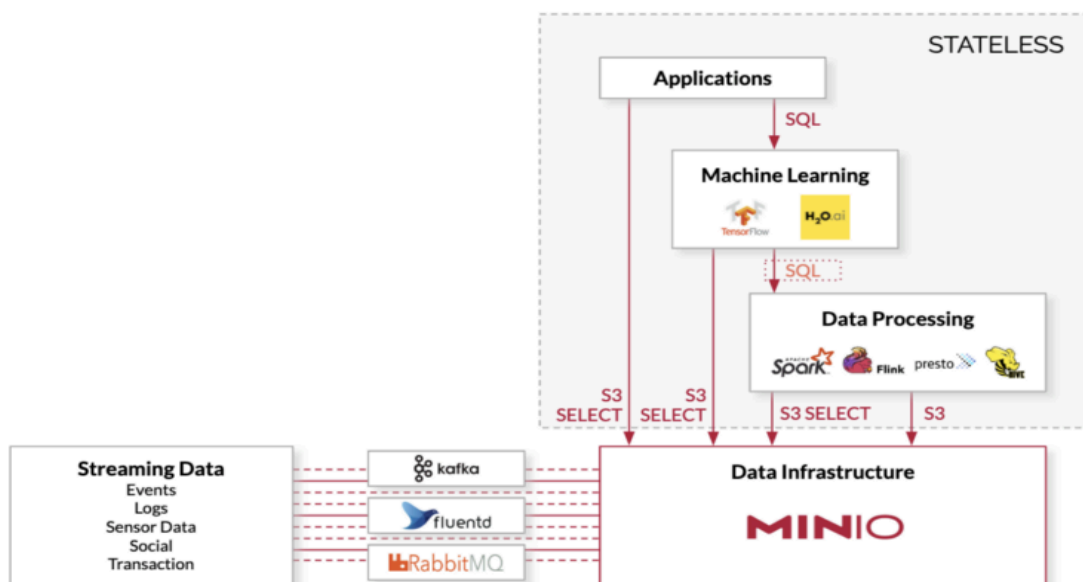
Multi-Cloud Gateway

All enterprises are adopting a multi-cloud strategy. This also includes private clouds. As a result, your bare-metal virtualization containers and public cloud services (including non-S3 providers like Google, Microsoft and Alibaba) have to look identical. While the modern application is highly portable, the data that powers those applications is not.
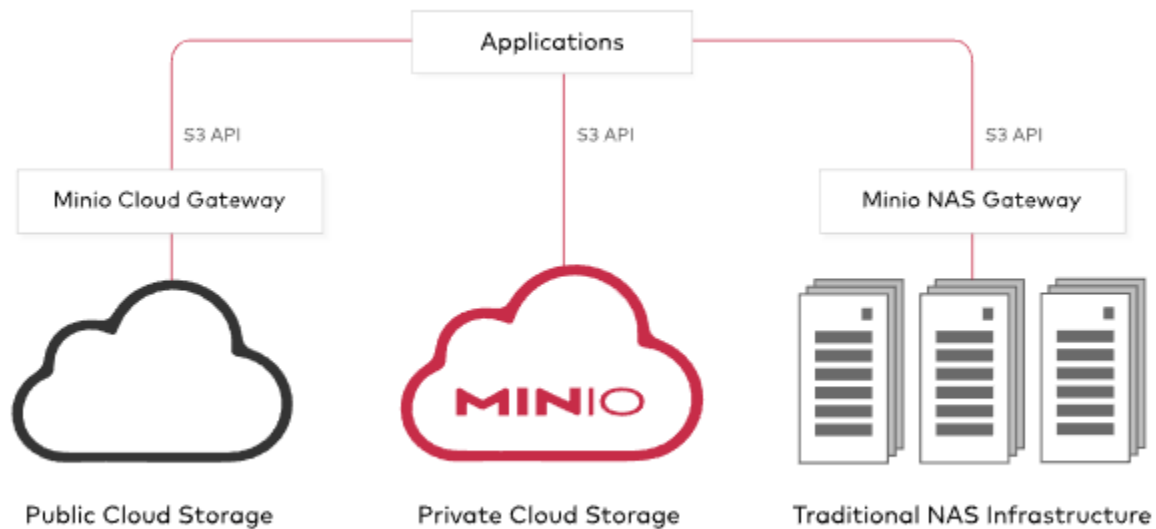
Making that data available, wherever it may reside, is the primary challenge that MinIO addresses. MinIO runs on bare metal, network attached storage and every public cloud. More importantly, MinIO ensures your view of that data looks exactly the same from an application and management perspective via the Amazon S3 API.
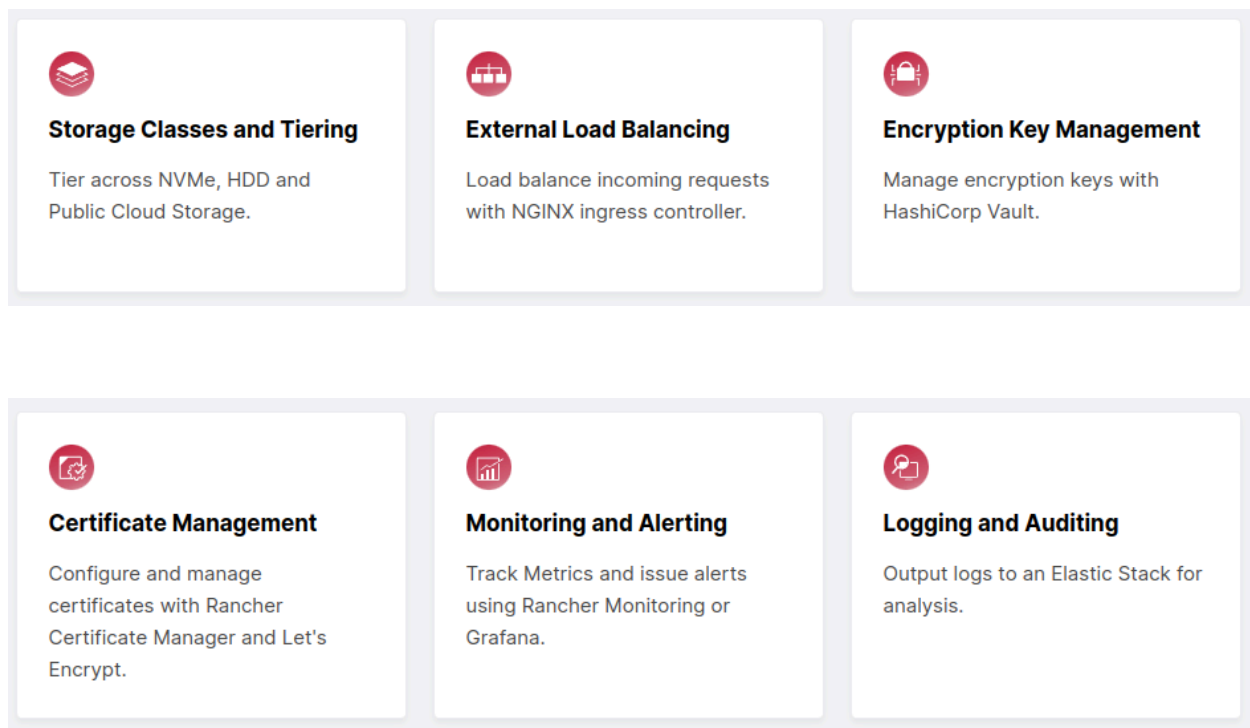
Scalable Object Storage

Scaling is a dimensional concept but it has one truth: simplicity scales.

MinIO scales horizontally (scale out) through a concept called Server Pools. Server pools are an approach that combines multiple technology components. Each server pool is an independent set of nodes with their own compute, network and storage resources.

WHY USE MINIO ON KUBERNETES ?

- Deploy, manage, and secure S3-like infrastructure.
- Freedom to innovate without public cloud lock-in or disruption.
- Control over the software stack with flexibility.

MInio Operator integrates natively with Kubernetes to provide::

Storage Classes and Tiering

Tier across NVMe, HDD and Public Cloud Storage.

External Load Balancing

Load balance incoming requests with NGINX ingress controller.

Encryption Key Management

Manage encryption keys with HashiCorp Vault.

Certificate Management

Configure and manage certificates with Rancher Certificate Manager and Let's Encrypt.

Monitoring and Alerting

Track Metrics and issue alerts using Rancher Monitoring or Grafana.

Logging and Auditing

Output logs to an Elastic Stack for analysis.

Comparison of Minio with other object storage tools:

- **Scalability**: AWS S3 is a managed service provided by Amazon Web Services (AWS), which means it can scale automatically to handle large amounts of data and high traffic loads. On the other hand, MinIO is a self-hosted object storage server that requires manual configuration for scalability[1].

- **Cost**: AWS S3 offers a pay-as-you-go pricing model, where customers only pay for the storage they use and the data transfer costs. In contrast, MinIO is an open-source software that can be

run on commodity hardware, making it a more cost-effective option for organizations looking for an on-premises or self-hosted solution[1].

- **Security**: Both AWS S3 and MinIO offer robust features such as encryption in transit and at rest, access control policies, and user authentication. However, AWS S3 provides additional security features like AWS Identity and Access Management (IAM) integration, which allows for fine-grained access control and permissions management[1].

- **Integration**: AWS S3 integrates seamlessly with other AWS services like AWS Lambda, Amazon Redshift, and Amazon EMR, making it a preferred choice for organizations already utilizing the AWS ecosystem. On the other hand, MinIO, being an open-source solution, provides APIs that can be integrated with a wide range of applications[1].

- **Compliance**: AWS S3 is compliant with various industry standards and regulations, such as GDPR, HIPAA, and ISO 27001, making it suitable for organizations with strict compliance requirements. MinIO, being a self-hosted solution, requires organizations to ensure compliance on their own[1].

- **Performance**: MinIO running in local Kubernetes outperforms AWS S3, often by a significant margin[3].

In summary, AWS S3 is a highly scalable and fully managed cloud storage solution provided by AWS, which offers extensive integrations, compliance, and a wide range of security features. MinIO, on the other hand, is a self-hosted open-source object storage server that provides cost-efficiency, flexibility, and control over data storage[1].

Datadog on Kubernetes

Introduction to Datadog

Datadog is a **powerful, full-featured and scalable monitoring service** that provides teams with a unified view of all their systems, apps, and services. It's a cloud-based platform that is vendor-neutral and can collect metrics, traces, and logs from across your entire stack, providing full observability into your environment.

Datadog is particularly useful in a Kubernetes environment as it provides comprehensive visibility into your cluster.

It collects all your telemetry data in one place and tracks it over time, giving you insights into how your containers are behaving.
This allows you to
- **monitor** the performance of your applications,
- troubleshoot issues quickly,
- and optimize resource usage.

With its robust integration capabilities, Datadog can **automatically monitor the nodes of your Kubernetes clusters** and the technologies you are deploying, providing transaction-level insight into applications running in your Kubernetes clusters. This makes Datadog an essential tool for teams running complex, dynamic environments.

Datadog is a critical tool for maintaining the health and performance of your systems, making it easier to understand and troubleshoot any issues that arise. It's a must-have for any team looking to ensure the reliability and efficiency of their Kubernetes deployments.

WHAT IT OFFERS, WHY CHOOSE IT ?

Agent
Install and configure the Datadog Agent to collect and send data

Integrations
Gather data about your applications, services, and systems

OpenTelemetry
Pipe your OpenTelemetry metrics, logs, and traces into Datadog

Dashboards
Visualize, analyze, and generate insights about your data

Infrastructure
Track your hosts, containers, processes, and serverless functions

Events
Track notable changes and alerts in your applications and infrastructure

Metrics
Explore, search, and create distributions for your metrics

Alerting
Create, edit, and manage your monitors and notifications

APM
Explore out-of-the-box performance dashboards and distributed traces

Continuous Profiler
Compare performance snapshots and investigate bottlenecks

Log Management
Process, monitor, and archive your ingested logs

Security
Detect threats, vulnerabilities, and misconfigurations

Synthetic Monitoring
Ensure uptime, flag regional issues, and test application performance

Mobile Application Testing
Monitor user journeys and business transactions in mobile applications

Continuous Testing
Perform codeless integration and end-to-end testing with CI/CD providers

Real User Monitoring
Capture, observe, and analyze the user experience of your applications

Network Monitoring
Use tagged objects to collect and graph data about your network traffic

Serverless
Detect and resolve performance issues in your serverless applications

Mobile Application
View Datadog alerts, incidents, and more on your mobile device

Incident Management
Identify, analyze, and mitigate disruptive incidents in your organization

Datadog Watchdog
Detect and surface application and infrastructure anomalies

CI Visibility
See test metrics, build results, and pipeline executions for your CI pipeline

CD Visibility
See deployment metrics, results, and insights for your CD provider

Cloud Cost Management
Take control of your cloud spend with unified observability and cost data

Database Monitoring
Explore enriched dashboards, query metrics, and query samples

Data Streams Monitoring
Track and improve performance of your data streaming pipelines

Observability Pipelines
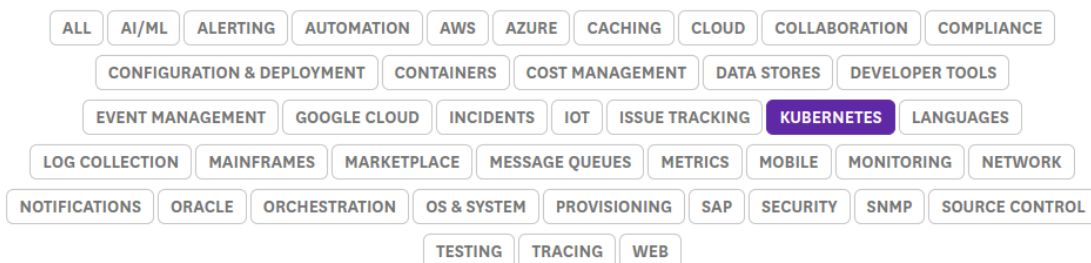Manage and monitor your telemetry pipelines

Universal Service Monitoring
Discover, map, and monitor services without changing code

Workflow Automation
Automate and orchestrate processes across your tech stack

More than 700 built-in integrations

See across all your systems, apps, and services

ALL | AI/ML | ALERTING | AUTOMATION | AWS | AZURE | CACHING | CLOUD | COLLABORATION | COMPLIANCE | CONFIGURATION & DEPLOYMENT | CONTAINERS | COST MANAGEMENT | DATA STORES | DEVELOPER TOOLS | EVENT MANAGEMENT | GOOGLE CLOUD | INCIDENTS | IOT | ISSUE TRACKING | KUBERNETES | LANGUAGES | LOG COLLECTION | MAINFRAMES | MARKETPLACE | MESSAGE QUEUES | METRICS | MOBILE | MONITORING | NETWORK | NOTIFICATIONS | ORACLE | ORCHESTRATION | OS & SYSTEM | PROVISIONING | SAP | SECURITY | SNMP | SOURCE CONTROL | TESTING | TRACING | WEB

Akeyless Gateway

Amazon EKS

Ambassador API Gateway

CloudNatix

MARKETPLACE

CloudNatix

Container

Containerd

CoreDNS

CoreWeave

MARKETPLACE

Sysdig

CRI

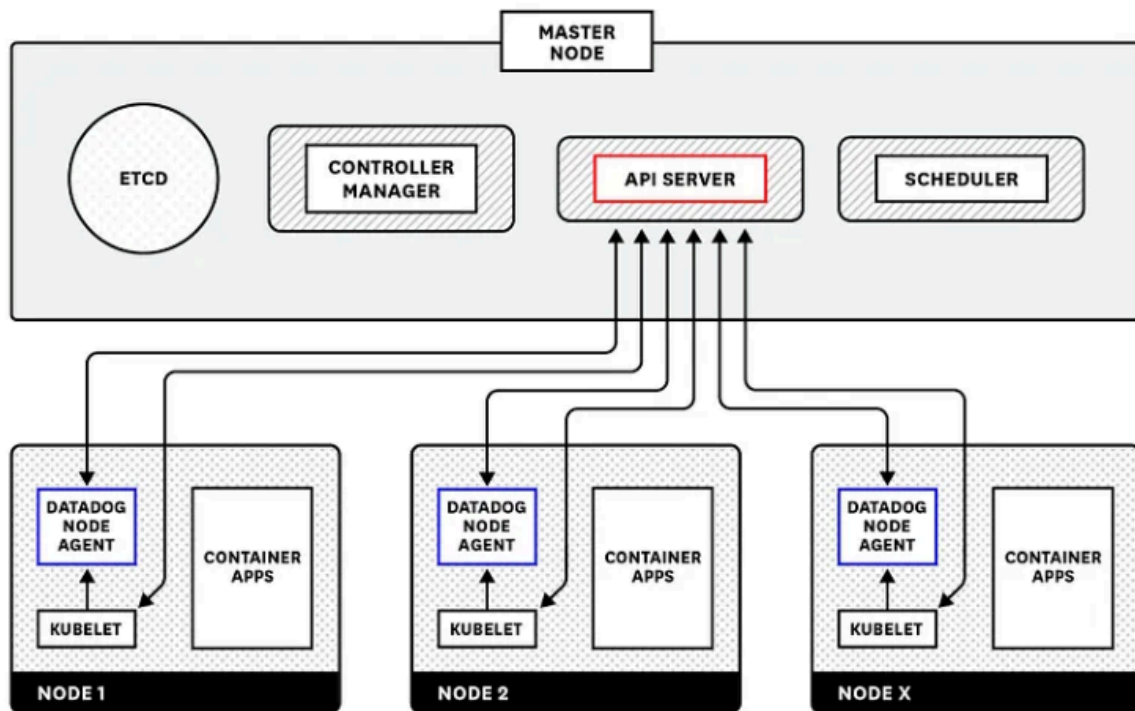**Amazon EKS Anywhere**

HOW DATADOG WORKS ON KUBERNETES ?

Depoying Datadog DaemonSet through Kubernetes:

- kubectl create namespace datadog
- kubectl create secret generic datadog-secret --from-literal api-key=YOUR_API_KEY -n datadog
- kubectl apply -f datadog-agent.yaml

How does DataDog differ from Kubernetes Web View?

Datadog:
- **Type**: Datadog is a comprehensive cloud-scale monitoring and analytics platform.
- **Features:**
  - ➢ Datadog provides end-to-end observability by collecting and analyzing metrics, traces, and logs from various sources.
  - ➢ It supports monitoring of not only Kubernetes but also other cloud services, applications, infrastructure, and more.
  - ➢ Offers alerting, dashboards, and visualization tools to help users understand the performance and health of their entire system.
  - ➢ Integrates with various tools and platforms to provide a unified monitoring solution.

Kubernetes Web View (KubeView):
- **Type**: KubeView is specifically designed for visualizing Kubernetes clusters.
- **Features:**
  - ➢ KubeView focuses on providing a visual representation of the Kubernetes cluster and its components.
  - ➢ It offers an interactive and graphical UI that displays the relationships between different Kubernetes objects, such as nodes, pods, services, etc.
  - ➢ Helps users understand the overall structure and status of their Kubernetes deployment in a more intuitive way.
  - ➢ May not provide extensive monitoring and alerting features compared to dedicated monitoring solutions like Datadog.