Open source monitoring and observability stack on Kubernetes

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kubernetes

Agenda

- Introduction
- Abstract
- What is observability
- Pillars of observability
- Observability vs Monitoring
- Observability Use cases
- Observability solution with Prometheus, Grafana, Loki and Jaeger
- Demo
- Learnings
- Next steps

Introduction

- **Aim** - Open source monitoring and observability stack on kubernetes.
- **Kubernetes** - open-source container orchestration platform.
- Designed to automate the **deployment**, **scaling**, and **management** of containerized applications.
- **Three pillars of observability** - **logs, metrics, and traces**
  When combined, they provide sufficient insights to monitor software at any scale.
- The project covers Monitoring, Alerting/Visualization, Log Aggregation/analytics, and Distributed systems tracing infrastructure which collectively make up observability.

Abstract

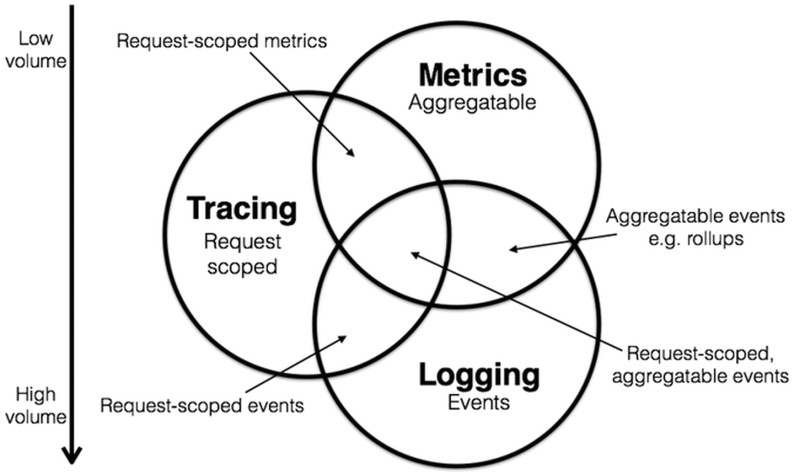
- Physical Server vs Virtual Machine vs Containers.
- Containerization and role of Kubernetes.
- Observability and Monitoring with respect to K8s.
- Setting up kubernetes tools - Micro K8s, Minikube, K3s.
- Using Grafana and Prometheus stack on the cluster to observe metrics of cluster.
- Configuring Alertmanager to receive alerts on slack channel.
- Logging and Tracing using Loki and Jaeger.

What is Observability?

- A way to get insights into the whole infrastructure.
- Can explain any questions about what is happening on the inside of the system just by observing the outside of the system.
- Helps developers understand multi-layered architectures: what's slow, what's broken, and what needs to be done to improve performance.
- Creates an insight through an actionable knowledge of the whole environment by assembling all fragments from logs, monitoring tools and organizing them.

Three Pillars Of Observability

- **Metrics:**
  These are numeric representation of data measured over intervals of time.
- **Logging:**
  They are discrete events and data in a structured textual form.
- **Tracing:**
  Represents consecutive events which reflect an end-to-end request path in a distributed system.



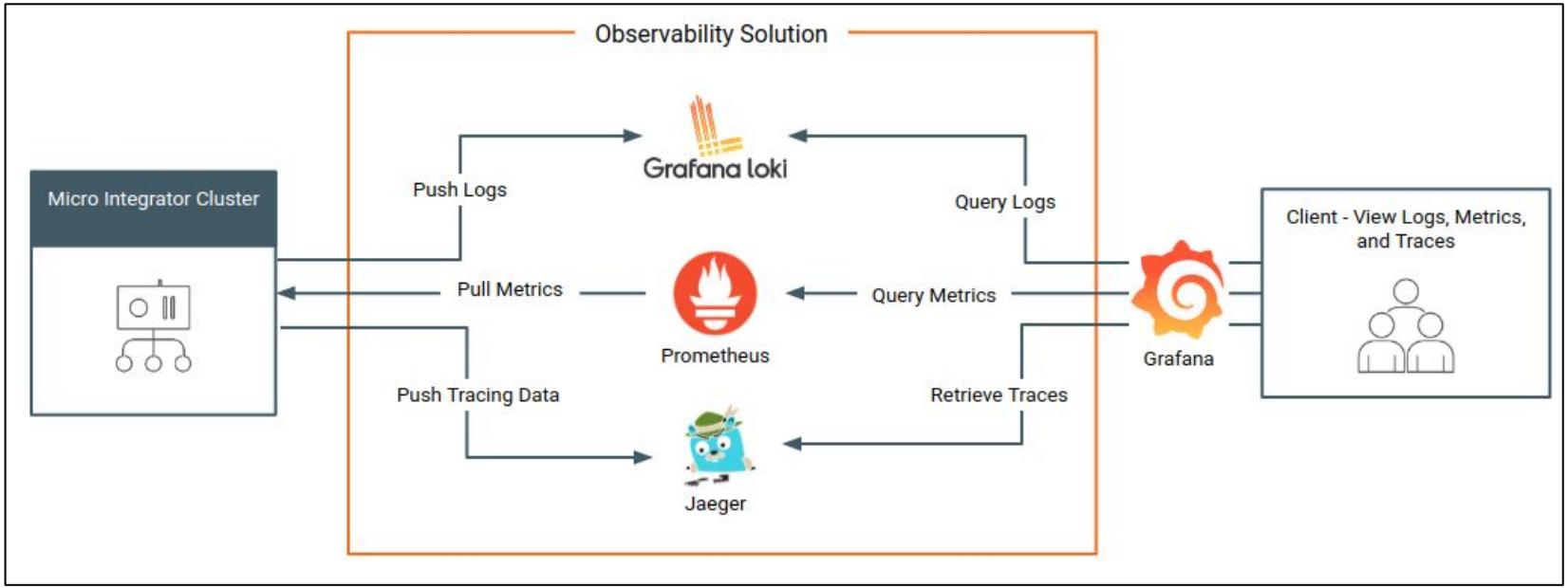
Observability vs Monitoring

Observability	Monitoring
What is the system doing?	Is the system working?
Tells us **why** something goes wrong	Tells us **when** something went wrong
Proactive in nature	**Reactive** in nature
Reduces the duration and impact of incidents	Enables **quick response** when an incident occurs
Gain understanding **actively**	Consume information **passively**
Build to tame dynamic environments with changing complexity	Built to maintain static environments with little variation
Preferred by developers of systems with variability and **unknown permutations**	Used by developers of systems with little change and **known permutation**

Observability Use cases

- As an Infrastructure Admin, I would like the "Platform" services are monitored constantly for application runtime errors, re-curing operational / API / UI failures and generate alerts so that assigned / scheduled Support team gets notified immediately and is able to troubleshoot the error through Operations Console.
- As an Infrastructure Admin, I would like to configure Monitoring in the "Platform" to send Monitoring alerts to Operations console for any persistent failures in the System for timely response from the Operations team.
- As an SRE, I would like to monitor a gradual but consistent degradation of the Platform services performance / response times so that I can rectify any hardware resource related or scaling issues with the application and prevent missing any SLA(s).
- As an IT Operator, I would like to monitor cluster kube state and node metrics of Platform.
- As an IT Operator, I would like to monitor all the namespaces of the Platform.

Observability solution with Prometheus, Grafana, Loki and Jaeger



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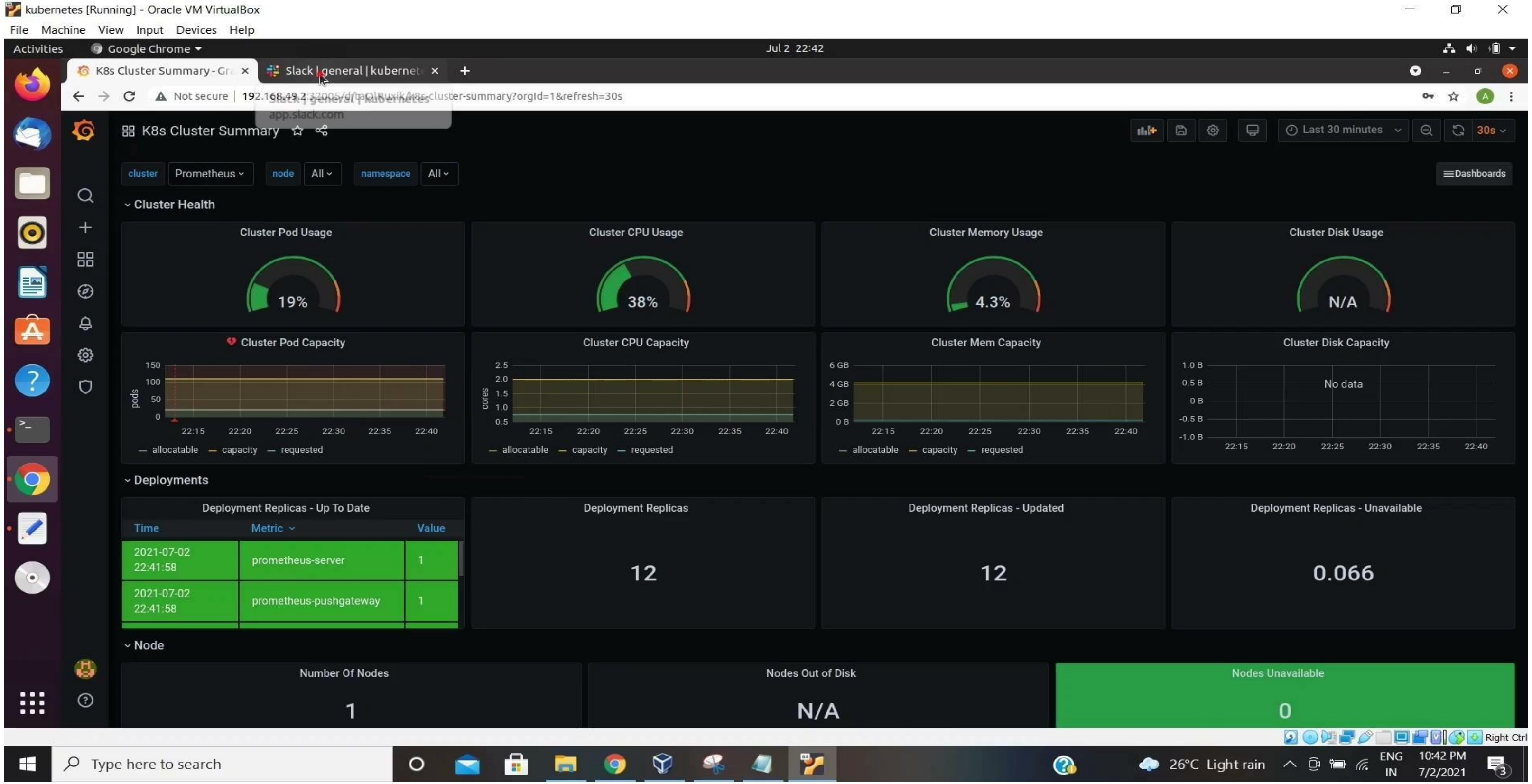
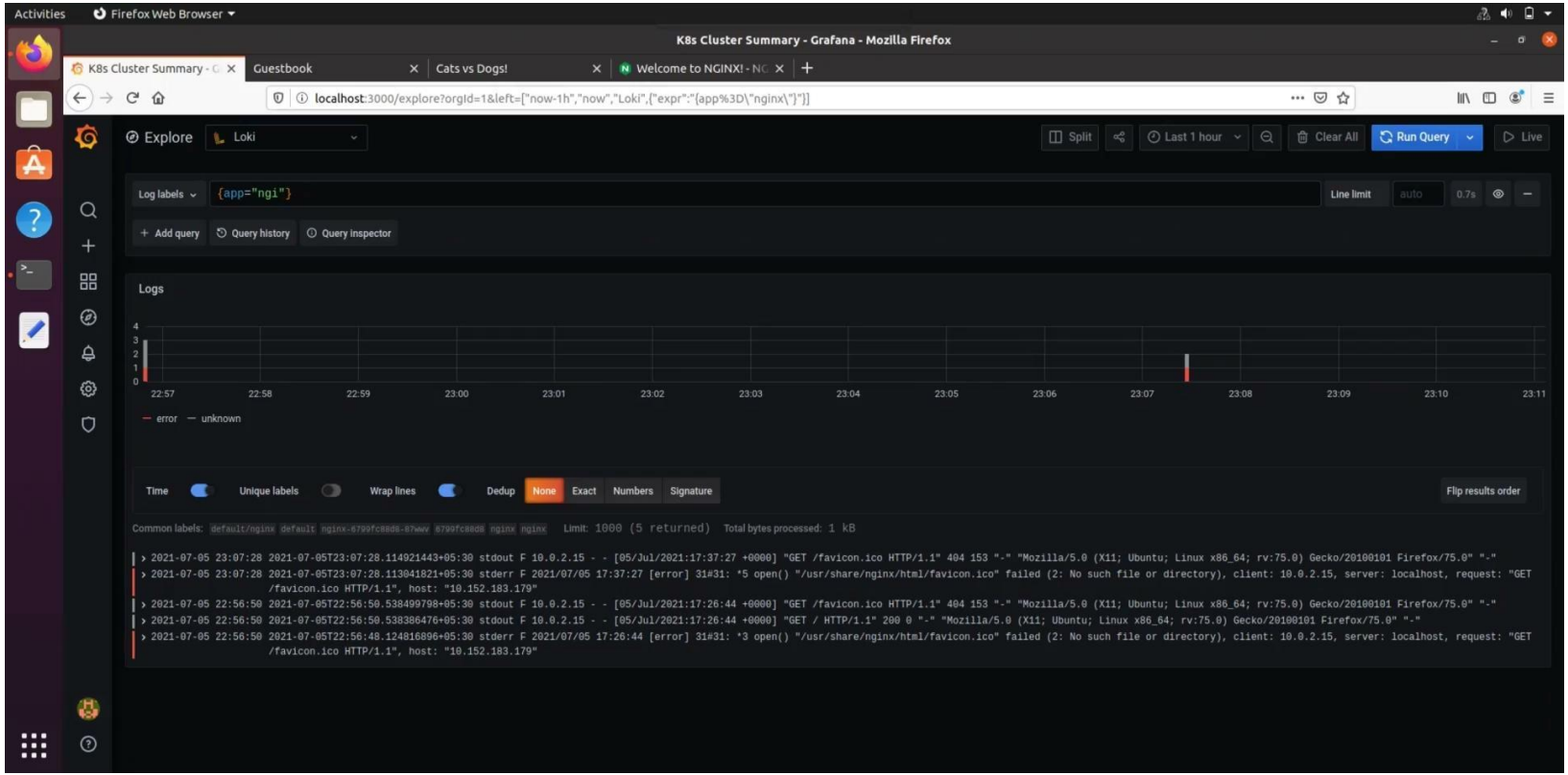
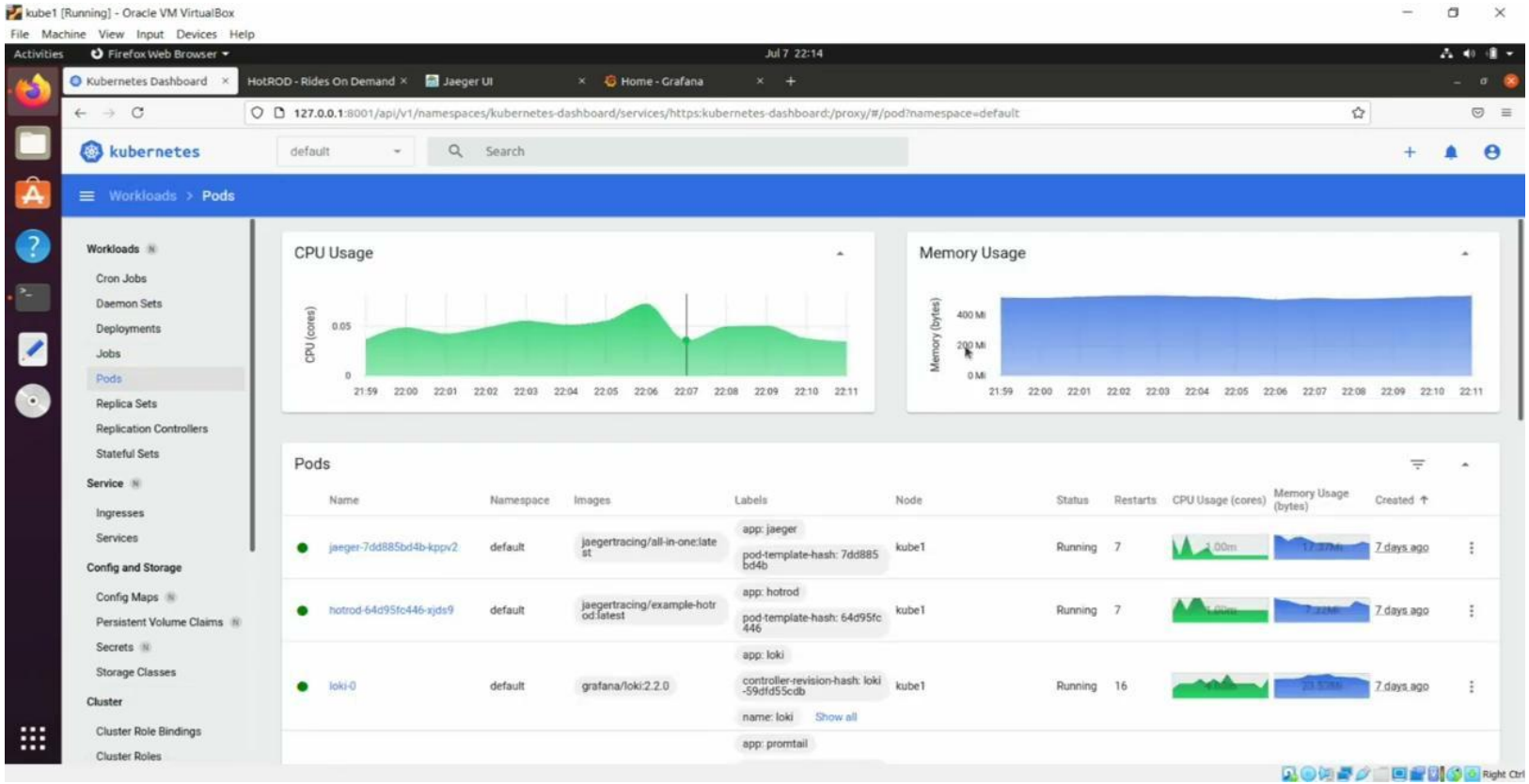
Demo


kubernetes [Running] - Oracle VM VirtualBox
File
Machine
View
Input
Devices
Help
Activities
Google Chrome
Jul 2 22:42
K8s Cluster Summary
cluster
Prometheus
node
All
namespace
All
Last 30 minutes
30s
Dashboards
Cluster Health
Cluster Pod Usage
19%
Cluster CPU Usage
38%
Cluster Memory Usage
4.3%
Cluster Disk Usage
N/A
Cluster Pod Capacity
Cluster CPU Capacity
Cluster Mem Capacity
Cluster Disk Capacity
No data
allocatable
capacity
requested
Deployments
Deployment Replicas - Up To Date
Time
Metric
Value
2021-07-02 22:41:58
prometheus-server
1
2021-07-02 22:41:58
prometheus-pushgateway
1
Deployment Replicas
12
Deployment Replicas - Updated
12
Deployment Replicas - Unavailable
0.066
Node
Number Of Nodes
1
Nodes Out of Disk
N/A
Nodes Unavailable
0
Type here to search
26°C Light rain
10:42 PM
7/2/2021

Demo


Activities
Firefox Web Browser
K8s Cluster Summary - Grafana - Mozilla Firefox
K8s Cluster Summary
Guestbook
Cats vs Dogs!
Welcome to NGINX!
localhost:3000/explore?orgId=1&left=["now-1h","now","Loki",{"expr":"{app%3D\"nginx\"}"}]
Explore
Loki
Split
Last 1 hour
Clear All
Run Query
Live
Log labels
{app="ngi"}
Line limit
auto
0.7s
Add query
Query history
Query inspector
Logs
22:57
22:58
22:59
23:00
23:01
23:02
23:03
23:04
23:05
23:06
23:07
23:08
23:09
23:10
23:11
error
unknown
Time
Unique labels
Wrap lines
Dedup
None
Exact
Numbers
Signature
Flip results order
Common labels:
Limit: 1000 (5 returned)
Total bytes processed: 1 kB
2021-07-05 23:07:28 2021-07-05T23:07:28.114921443+05:30 stdout F 10.0.2.15 - - [05/Jul/2021:17:37:27 +0000] "GET /favicon.ico HTTP/1.1" 404 153 "-" "Mozilla/5.0 (X11; Ubuntu; Linux x86_64; rv:75.0) Gecko/20100101 Firefox/75.0" "-"
2021-07-05 23:07:28 2021-07-05T23:07:28.113041821+05:30 stderr F 2021/07/05 17:37:27 [error] 31#31: *5 open() "/usr/share/nginx/html/favicon.ico" failed (2: No such file or directory), client: 10.0.2.15, server: localhost, request: "GET /favicon.ico HTTP/1.1", host: "10.152.183.179"
2021-07-05 22:56:50 2021-07-05T22:56:50.538499798+05:30 stdout F 10.0.2.15 - - [05/Jul/2021:17:26:44 +0000] "GET /favicon.ico HTTP/1.1" 404 153 "-" "Mozilla/5.0 (X11; Ubuntu; Linux x86_64; rv:75.0) Gecko/20100101 Firefox/75.0" "-"
2021-07-05 22:56:50 2021-07-05T22:56:50.538386476+05:30 stdout F 10.0.2.15 - - [05/Jul/2021:17:26:44 +0000] "GET / HTTP/1.1" 200 0 "-" "Mozilla/5.0 (X11; Ubuntu; Linux x86_64; rv:75.0) Gecko/20100101 Firefox/75.0" "-"
2021-07-05 22:56:50 2021-07-05T22:56:48.124816896+05:30 stderr F 2021/07/05 17:26:44 [error] 31#31: *3 open() "/usr/share/nginx/html/favicon.ico" failed (2: No such file or directory), client: 10.0.2.15, server: localhost, request: "GET /favicon.ico HTTP/1.1", host: "10.152.183.179"

Demo


kube1 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities
Firefox Web Browser
Jul 7 22:14
Kubernetes Dashboard
HotROD - Rides On Demand
Jaeger UI
Home - Grafana
127.0.0.1:8001/api/v1/namespaces/kubernetes-dashboard/services/https:kubernetes-dashboard:/proxy/#/pod?namespace=default
kubernetes
default
Search
Workloads > Pods
Workloads
Cron Jobs
Daemon Sets
Deployments
Jobs
Pods
Replica Sets
Replication Controllers
Stateful Sets
Service
Ingresses
Services
Config and Storage
Config Maps
Persistent Volume Claims
Secrets
Storage Classes
Cluster
Cluster Role Bindings
Cluster Roles
CPU Usage
CPU (cores)
0.05
0
21:59 22:00 22:01 22:02 22:03 22:04 22:05 22:06 22:07 22:08 22:09 22:10 22:11
Memory Usage
Memory (bytes)
400 Mi
200 Mi
0 Mi
21:59 22:00 22:01 22:02 22:03 22:04 22:05 22:06 22:07 22:08 22:09 22:10 22:11
Pods
Name
Namespace
Images
Labels
Node
Status
Restarts
CPU Usage (cores)
Memory Usage (bytes)
Created
jaeger-7dd885bd4b-kppv2
default
jaegertracing/all-in-one:latest
app: jaeger
pod-template-hash: 7dd885bd4b
kube1
Running
7
7 days ago
hotrod-64d95fc446-xjds9
default
jaegertracing/example-hotrod:latest
app: hotrod
pod-template-hash: 64d95fc446
kube1
Running
7
7 days ago
loki-0
default
grafana/loki:2.2.0
app: loki
controller-revision-hash: loki-59dfd55cdb
name: loki
Show all
kube1
Running
16
7 days ago
app: promtail
Right Ctrl

Learnings

- Importance of containerization and container orchestration.
- Importance of using Kubernetes.
- Using different tools to set up kubernetes clusters.
- Importance of observability and monitoring.
- Exploring different tools for observability and monitoring.
- Deploying multiple applications on a kubernetes cluster.
- Practical implementation of three pillars of observability i.e metrics, logging and tracing.
- Exploring multi-cluster observability.

Next steps

- Creating a central dashboard for visualizing metrics of multiple clusters.
- Using Spark to process Big Data on Kubernetes.
- Implementation of load balancers using traefik.
- Monitoring and observability using EFK Stack.
- Observability using Open Telemetry.
- Setting up a High availability cluster using K3d.
- AI/ML stack on Kubernetes.

CHALLENGES FACED

- Working remotely
- Insufficient hardware
- Ramp up time in working with various tools

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Any Questions?

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Thank You!

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