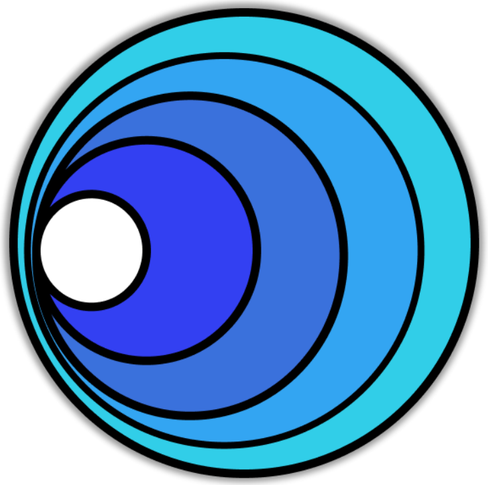
Section - 0

Thinknyx®
You Trust, We Deliver!

K8sGPT Essentials: Unlocking Kubernetes Insights with AI

By – Thinknyx Technologies LLP



AI-powered tool that scans and analyze Kubernetes clusters, diagnose issues in human-readable language and offers expert level troubleshooting insights

Yogesh Raheja

The Ultimate Linux Bootcamp for DevOps SRE & Cloud Engineers

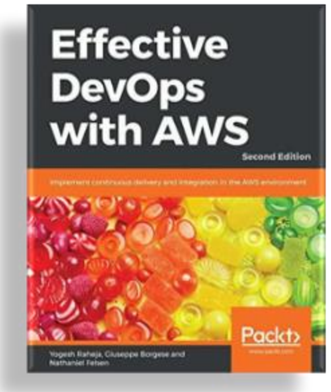
Practical Kubernetes – Beyond CKA and CKAD

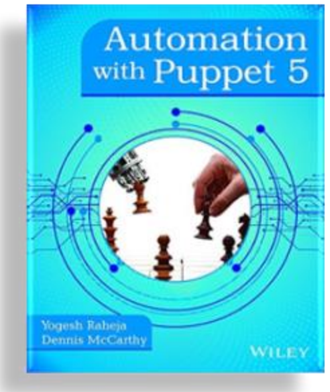
Automation with Ansible - Hands-on DevOps

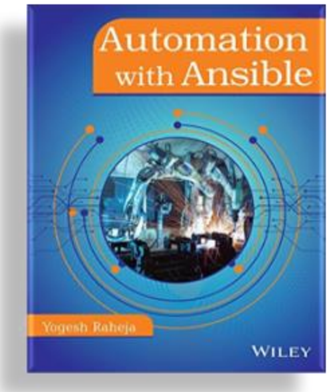
Kubernetes and Cloud Native Associate

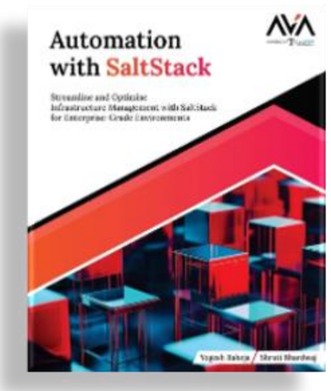
Argo CD for the Absolute Beginners - Hands-On

Mastering Docker Essential - Hands-on

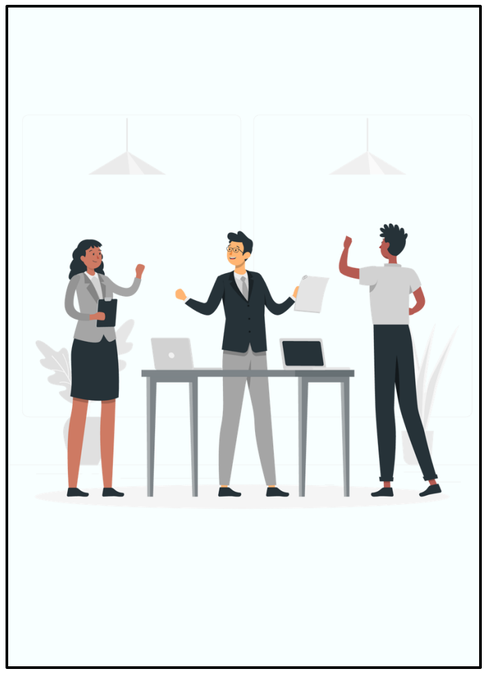








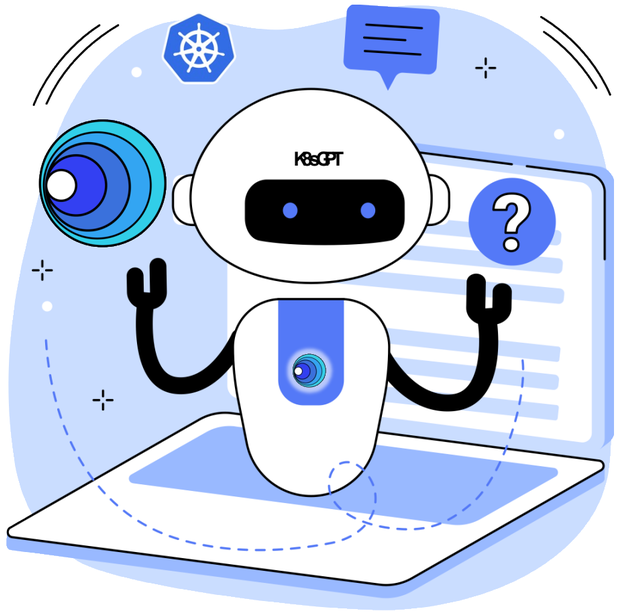
Dheeraj Sain



Thinknyx Team

Madhuri Jha

How Will This Course Work?

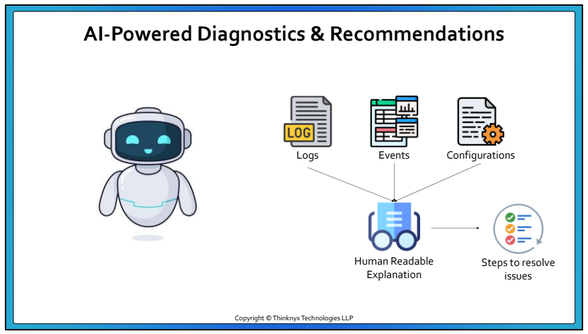


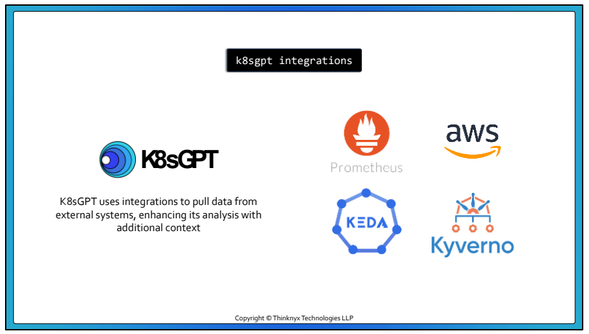
- K8sGPT Fundamentals
- K8sGPT Architecture & Key Concepts
- K8sGPT Setup via CLI & In-cluster Operator
- Integration with Google Gemini & AWS Bedrock
- **`analyze, filter, auth`** & more
- Integration with Prometheus & Claude Desktop
- Implement in-cluster k8sgpt operator in Kubernetess

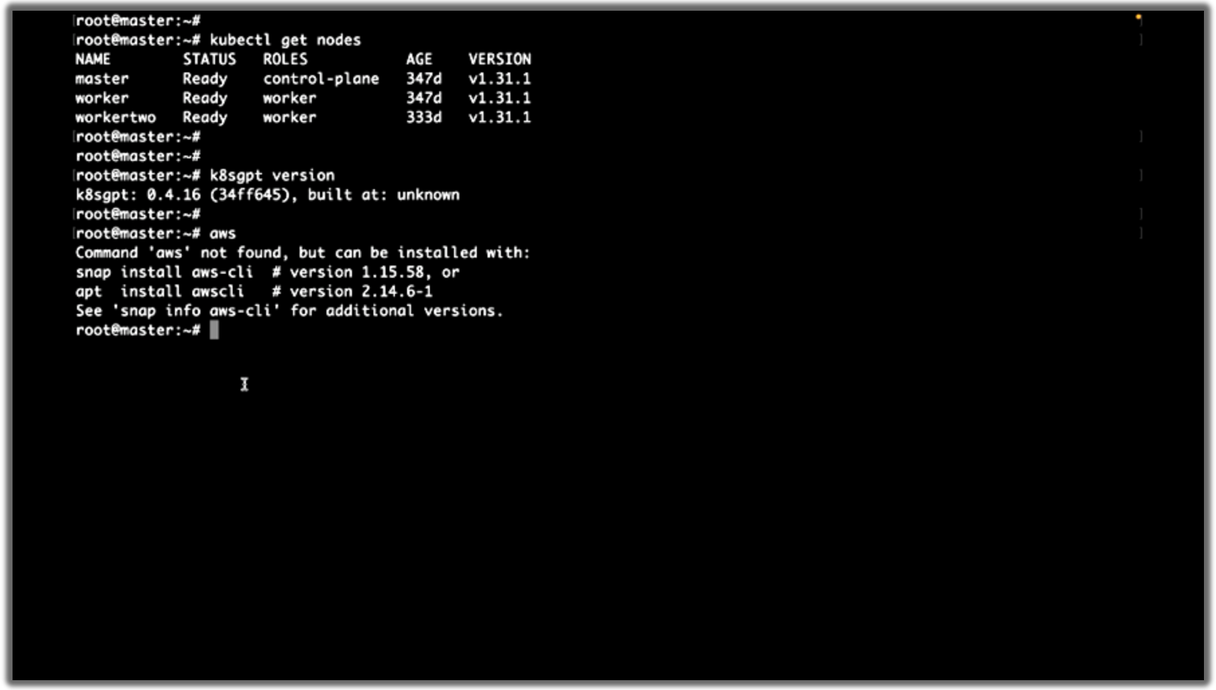
Theory Lectures

Live Demonstrations

Quiz







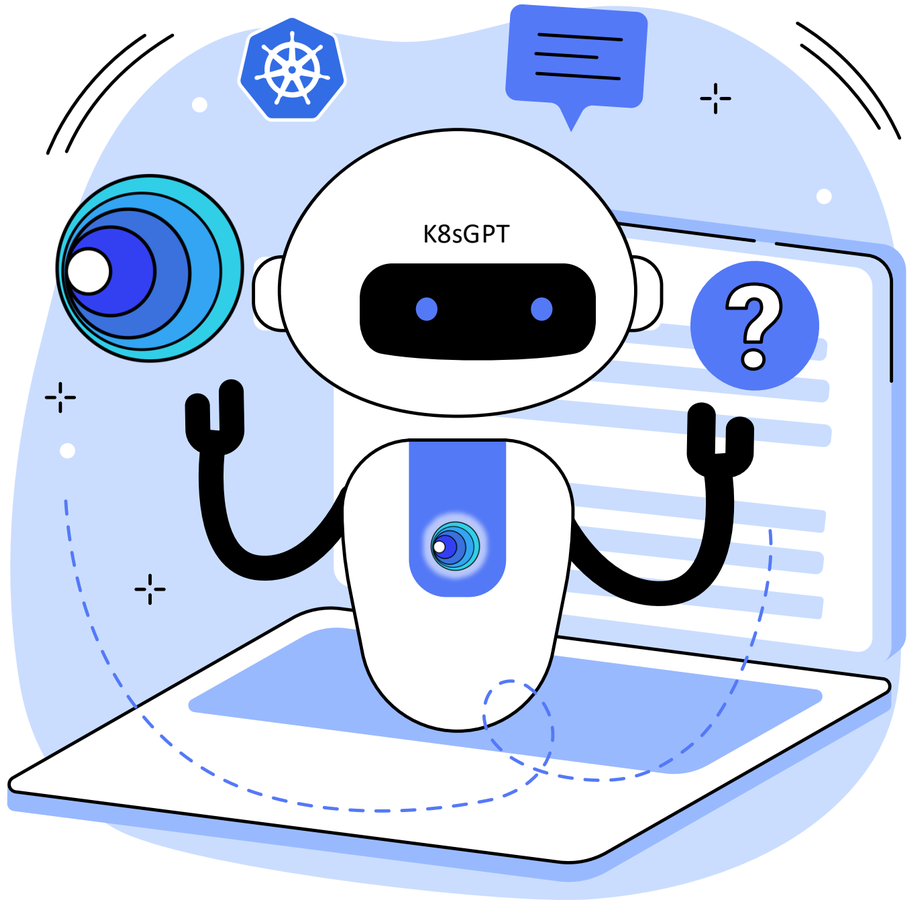
Section - 1

Introduction to K8sGPT

Section Overview

- *What is K8sGPT?*
- *Why Use K8sGPT?*
- *K8sGPT Workflow*
- *K8sGPT Documentation walkthrough*

What is K8sGPT?

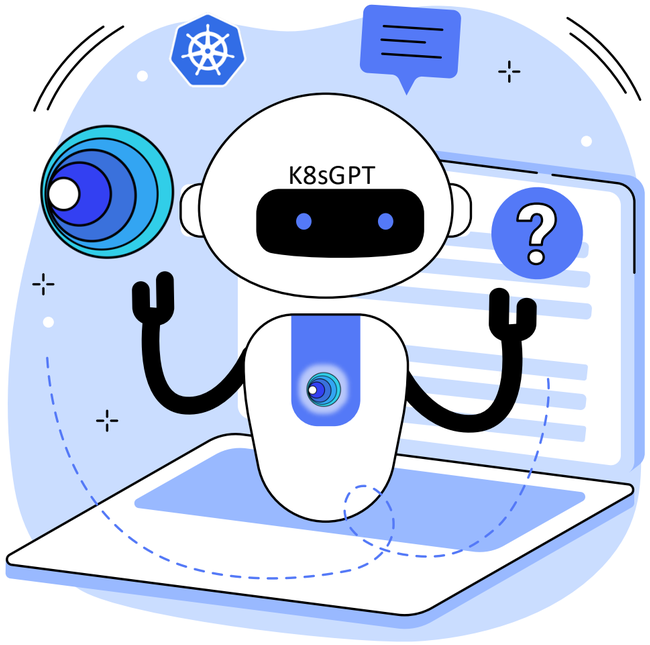


Leading platform for
container orchestration

- ✓ Self-healing
- ✓ Auto-scaling
- ✓ Rolling updates with zero downtime

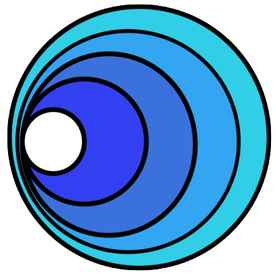
- Cluster misconfigurations
- Inter-component communication failures
- Networking problems
- Storage glitches

Detect Issues



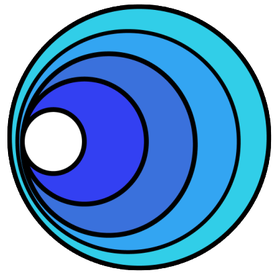
What's going wrong?

How to fix it?



K8sGPT

AI-powered assistant for Kubernetes



K8sGPT

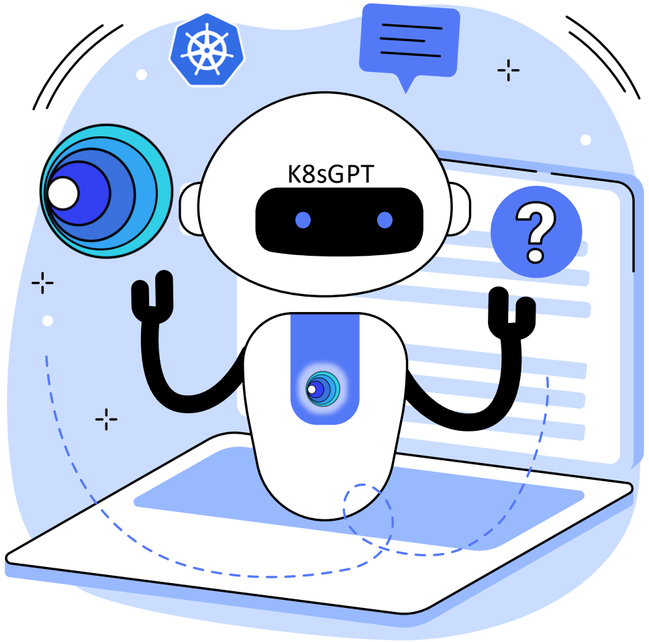
- ✓ Analyzing your cluster
- ✓ Diagnosing problems
- ✓ Providing actionable insights

What is K8sGPT?

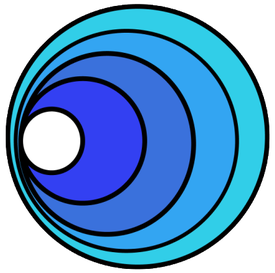
KubernetesGPT

Scan your Kubernetes cluster

Diagnose issues using natural language



Smart troubleshooting assistant, with SRE experience embedded directly into its analyzers



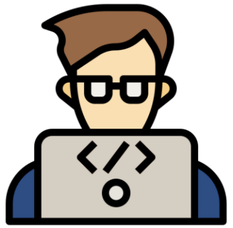
K8sGPT

Simplify Kubernetes cluster management

K8sGPT

DevOps Engineer

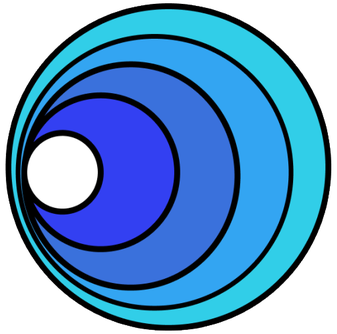
SRE



Developer

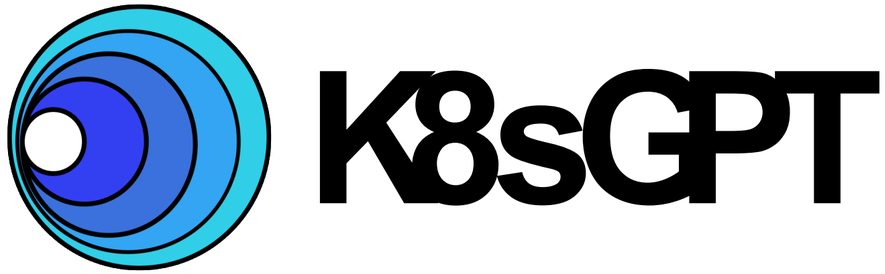
Analyze
cluster health

Significantly reduce Mean Time to Resolution (MTTR)



Diagnose both common and uncommon issues

Provide AI-enriched suggestions to fix problems



The Impact of K8sGPT

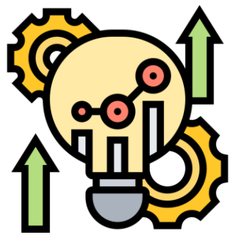
K8sGPT

The Impact of K8sGPT

K8sGPT

Removes the guesswork from cluster troubleshooting

Helps identify root causes faster

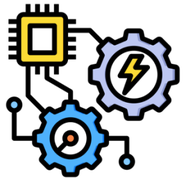


Allows engineers to focus on what truly matters

The Impact of K8sGPT

Ensuring Uptime

Optimizing Deployments



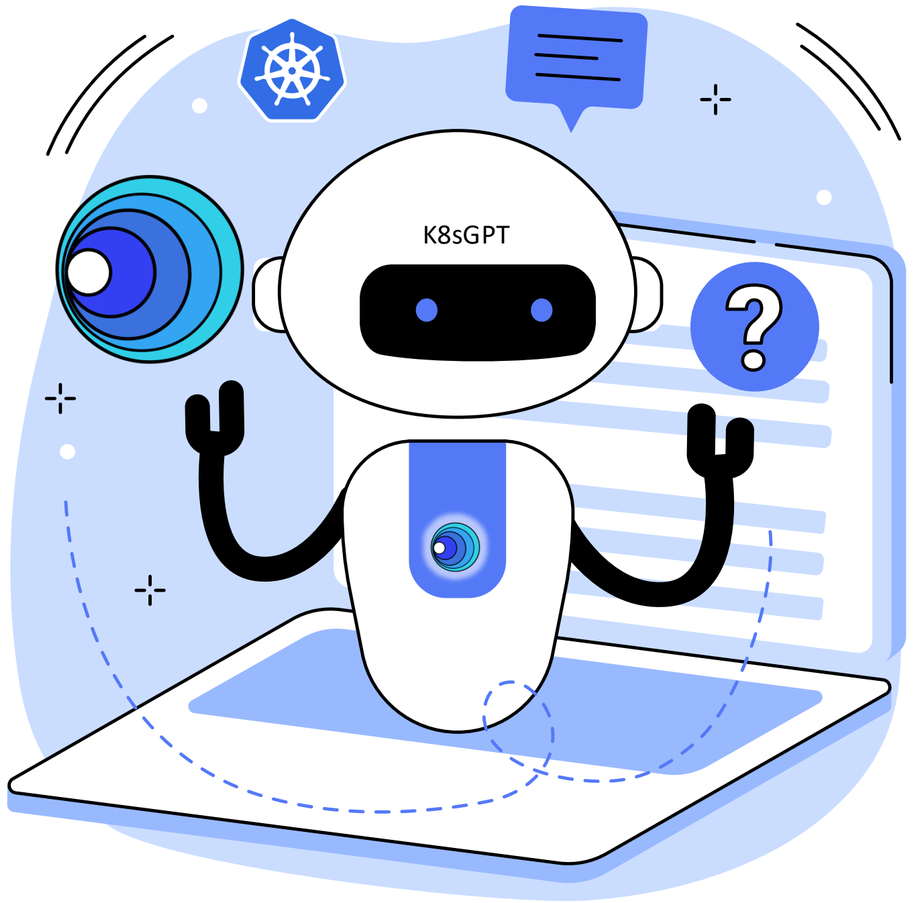
Keeping Systems Healthy

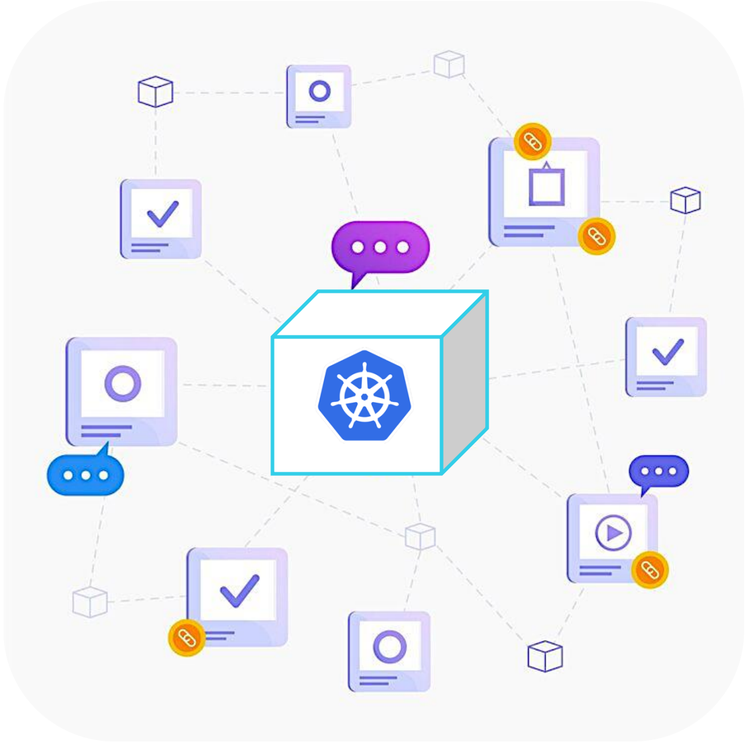
Efficiency

Accuracy

Productivity

Why Use K8sGPT?



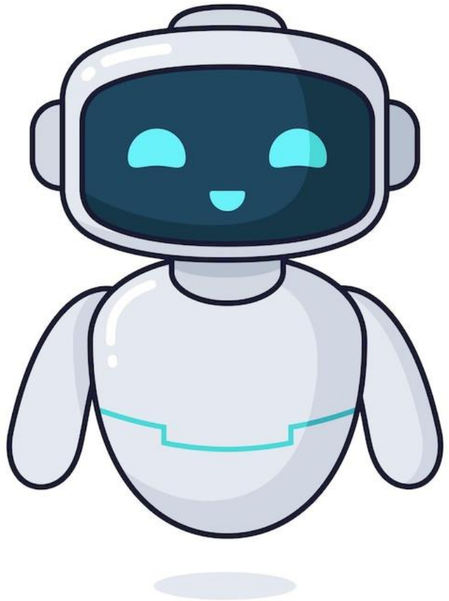


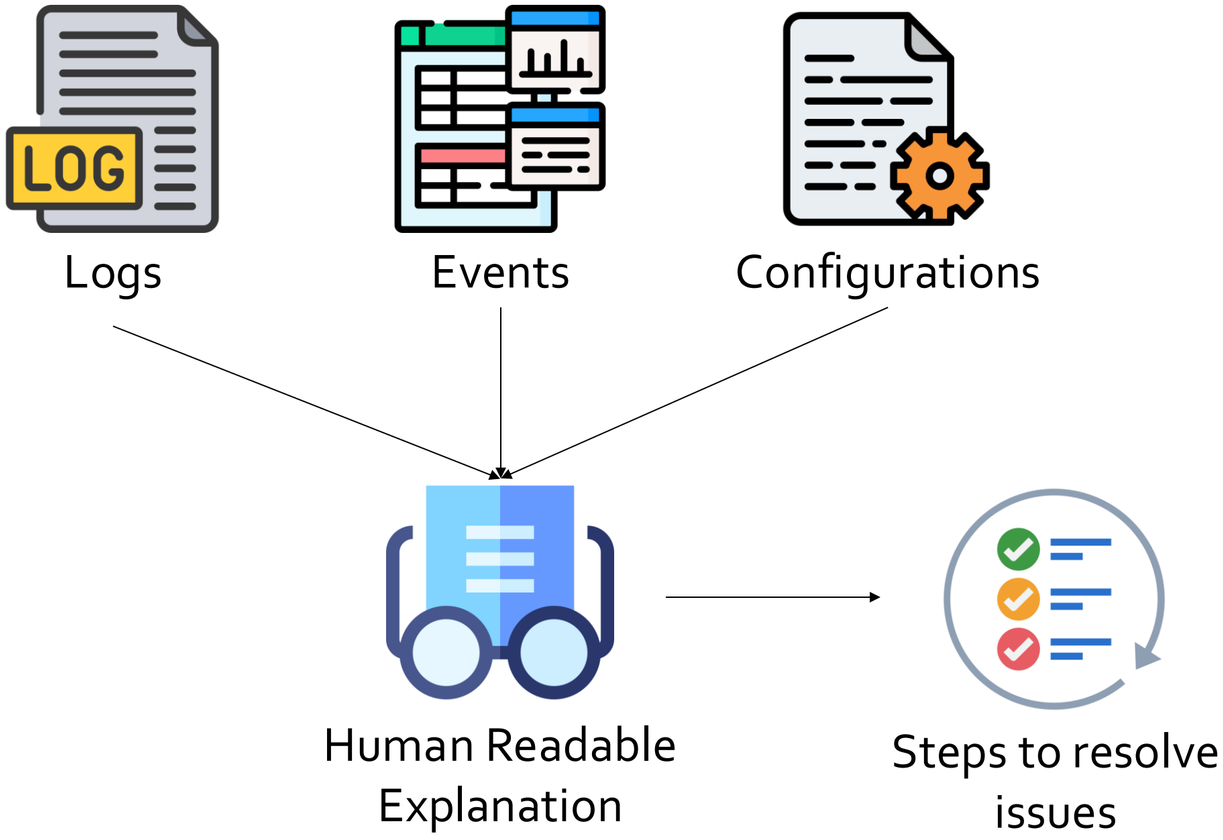
Kubernetes cluster

K8sGPT

- ✓ Easy
- ✓ Fast
- ✓ Efficient

AI-Powered Diagnostics & Recommendations





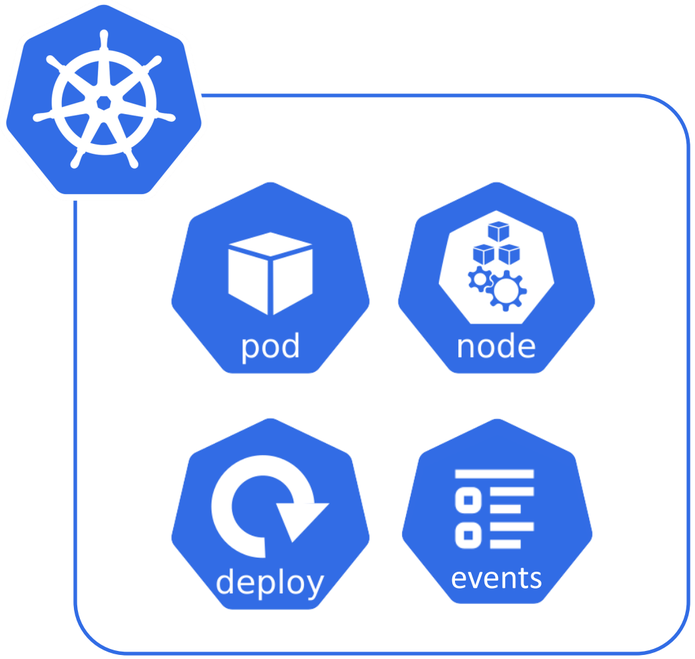
AI-Powered Diagnostics & Recommendations

Simplifying Troubleshooting

Reduces Root Cause Analysis Time

Comprehensive Resource Analysis

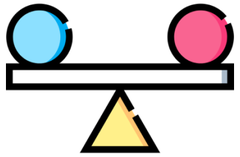
K8sGPT



- ✓ Resource Limits
- ✓ Misconfigurations
- ✓ Bottlenecks

Comprehensive Resource Analysis

Faster Problem Detection



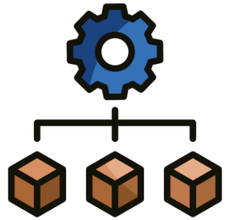
Proactive Resource Management

Proactive Monitoring & Alerts

Identifies problems before they affect your applications by analyzing metrics in real-time

Proactive Monitoring & Alerts

Prevents Downtime



Improves Cluster Stability

Sensitive Data Protection

Ensures your data stays secure by automatically redacting sensitive information

Sensitive Data Protection

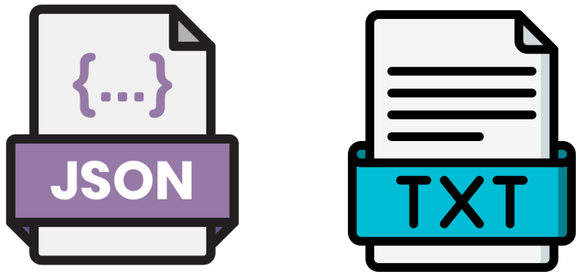
Maintaining Privacy & Security

Customizable Security

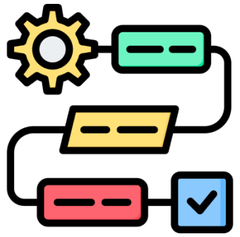
CLI-Based Interface

K8sGPT

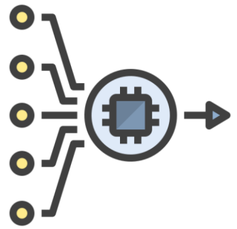
Easy to use through a simple command-line interface



CLI-Based Interface



Efficient
Workflow

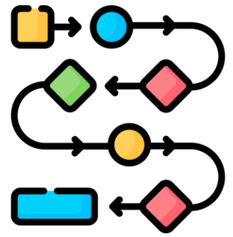


Clear
Outputs

Customizable AI Integrations

Customizable AI Integrations

Flexible Integration



Customizable Workflows

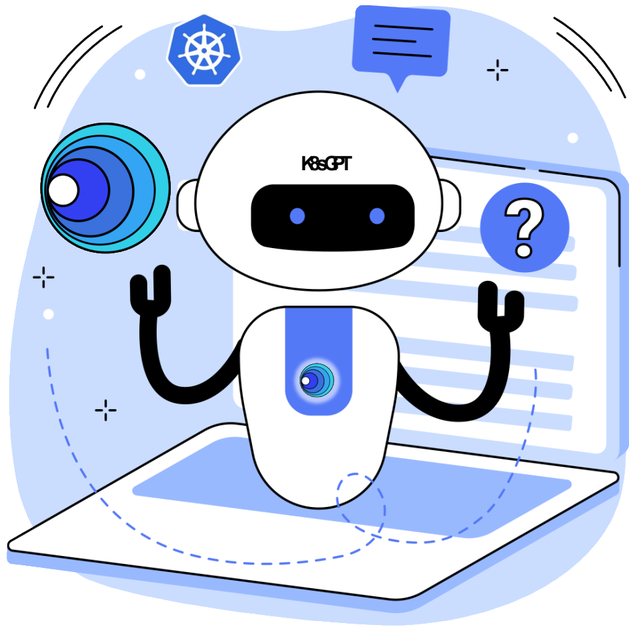
Accessible for Everyone

K8sGPT

Accessible for Everyone

Make K8s Accessible For Beginners

Enhances Productivity For Experts

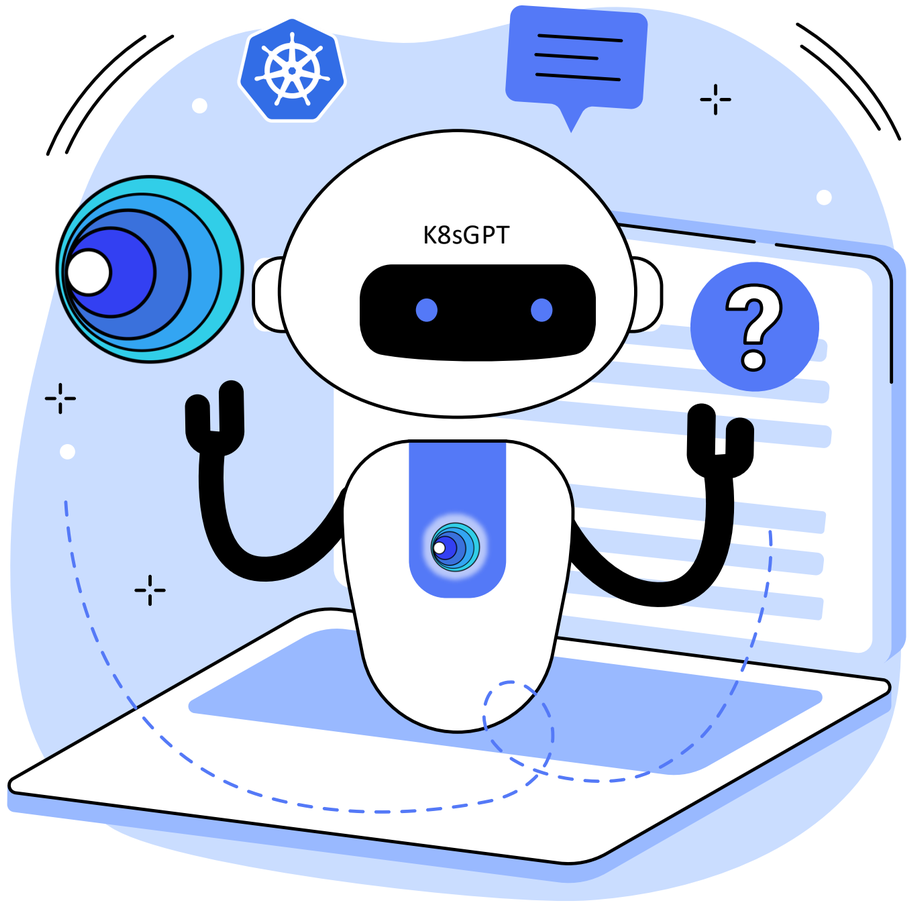


AI-powered Diagnostics

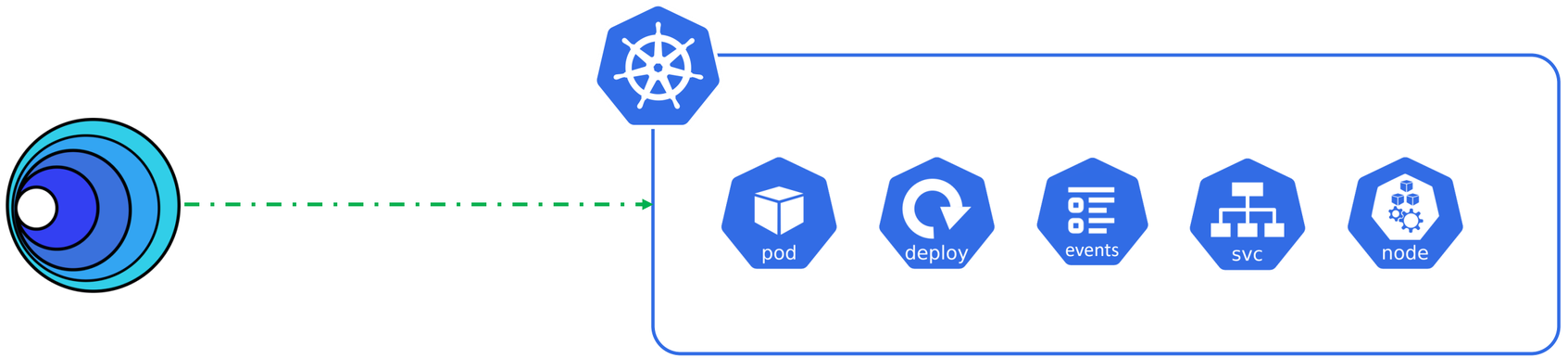
Proactive Monitoring

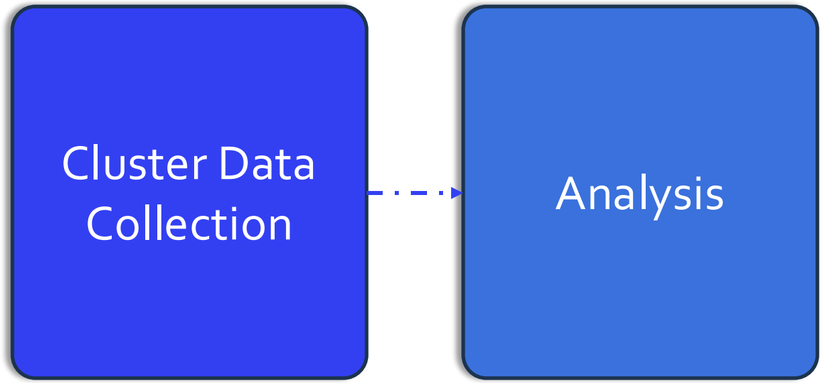
Customizable Insights

K8sGPT Workflow

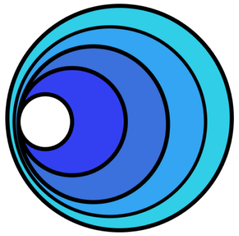


Cluster Data Collection





- Crashed Pods
- Misconfigured Deployments
- Probe Failures
- Network Issues
- Scheduling Errors
- Certificate Issues



OpenAI

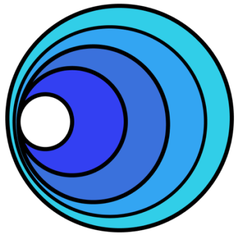
Azure OpenAI

Hugging Face

Ollama

Translate errors into understandable summaries and action-oriented suggestions

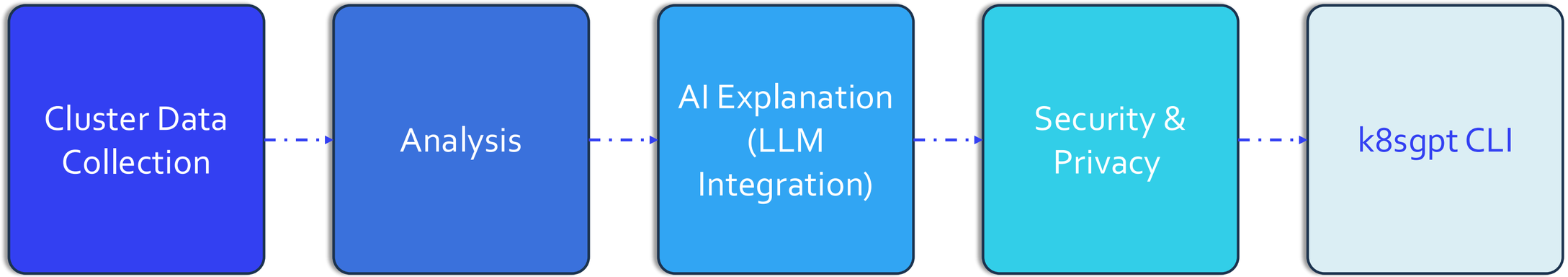
Cluster Data Collection → Analysis → AI Explanation (LLM Integration) → Security & Privacy

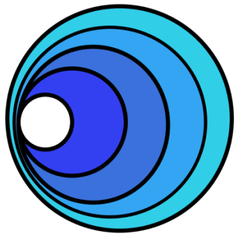


Redaction of Sensitive Data

Secret: *********

Name: *********



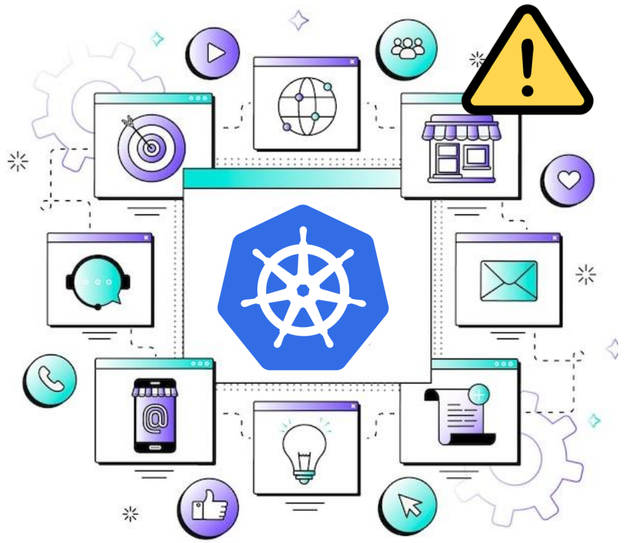


```
k8sgpt analyze --explain                    -o json
```

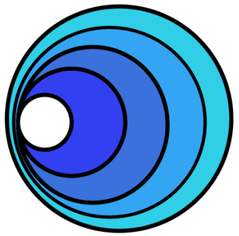
Logs

Metrics

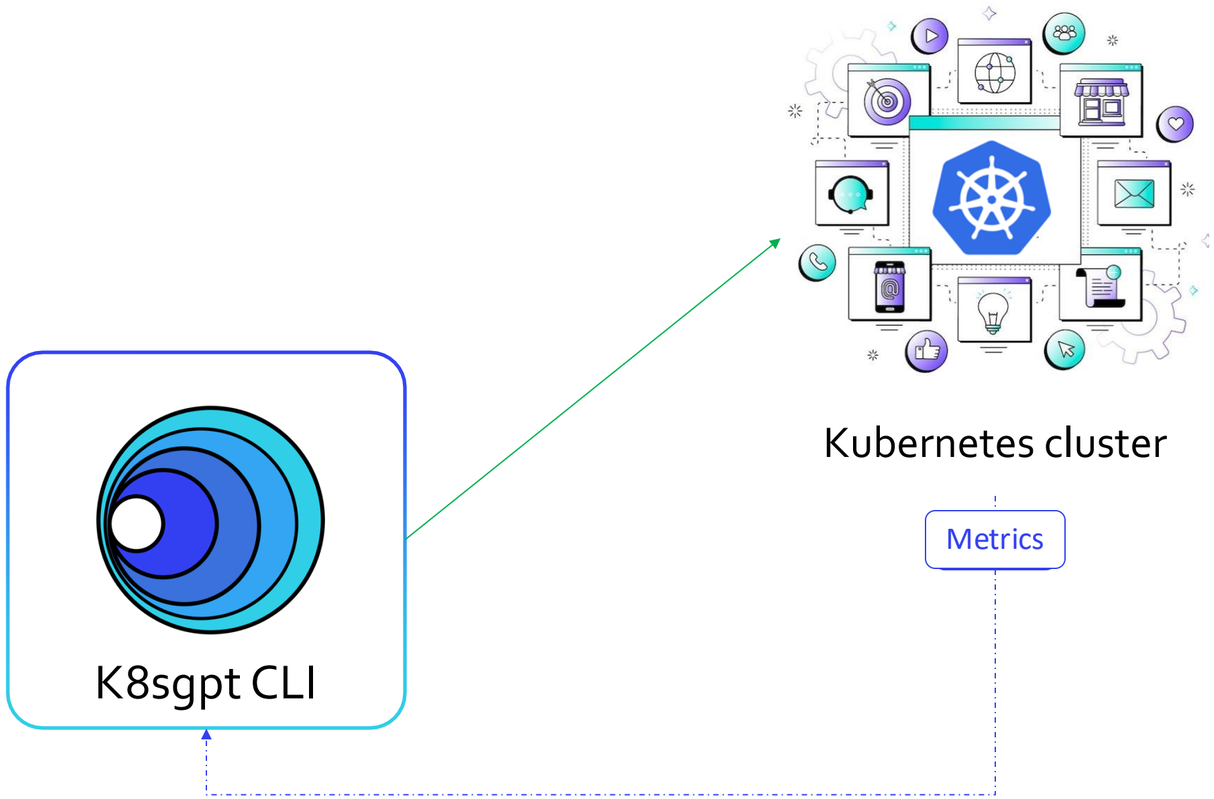
YAML

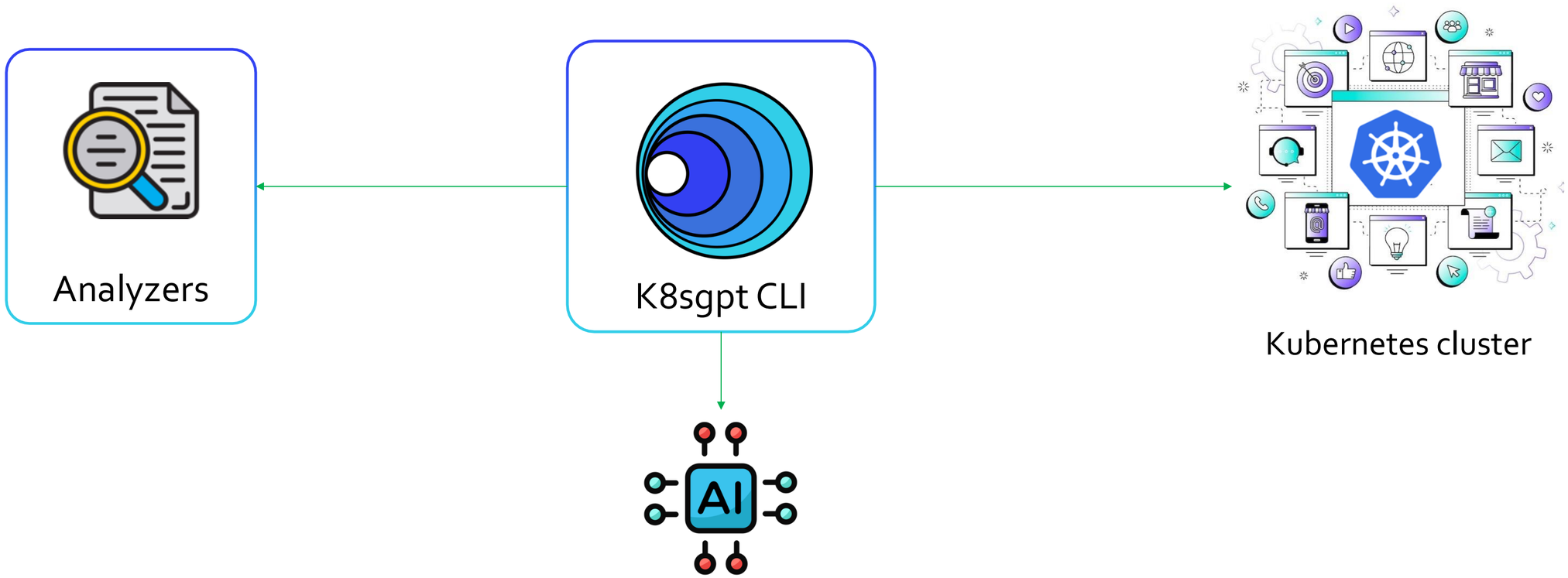


Kubernetes cluster



- Pod Failures
- Networking Issues
- Misconfigured Autoscaling

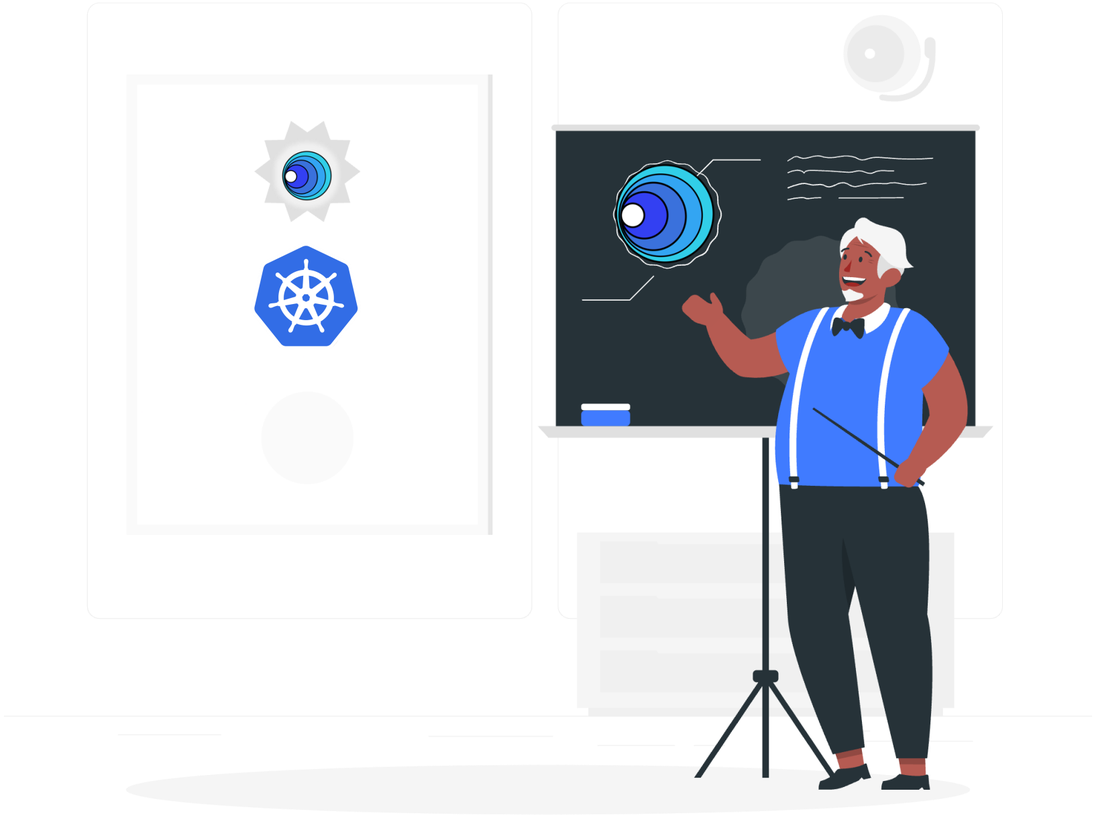




- ✓ Increase memory and CPU limits for backend pods
- ✓ Enable HPA if not set
- ✓ Distribute backend pods across nodes for load balance

Demo

K8sGPT Documentation



Introduction to K8sGPT

Section Summary

- ✓ *What K8sGPT is*
- ✓ *How K8sGPT uses AI to simplify Kubernetes troubleshooting*
- ✓ *Why it's a valuable tool for SREs, DevOps engineers, and developers*
- ✓ *How its workflow enables real-time diagnostics and intelligent recommendations*
- ✓ *K8sGPT documentation*

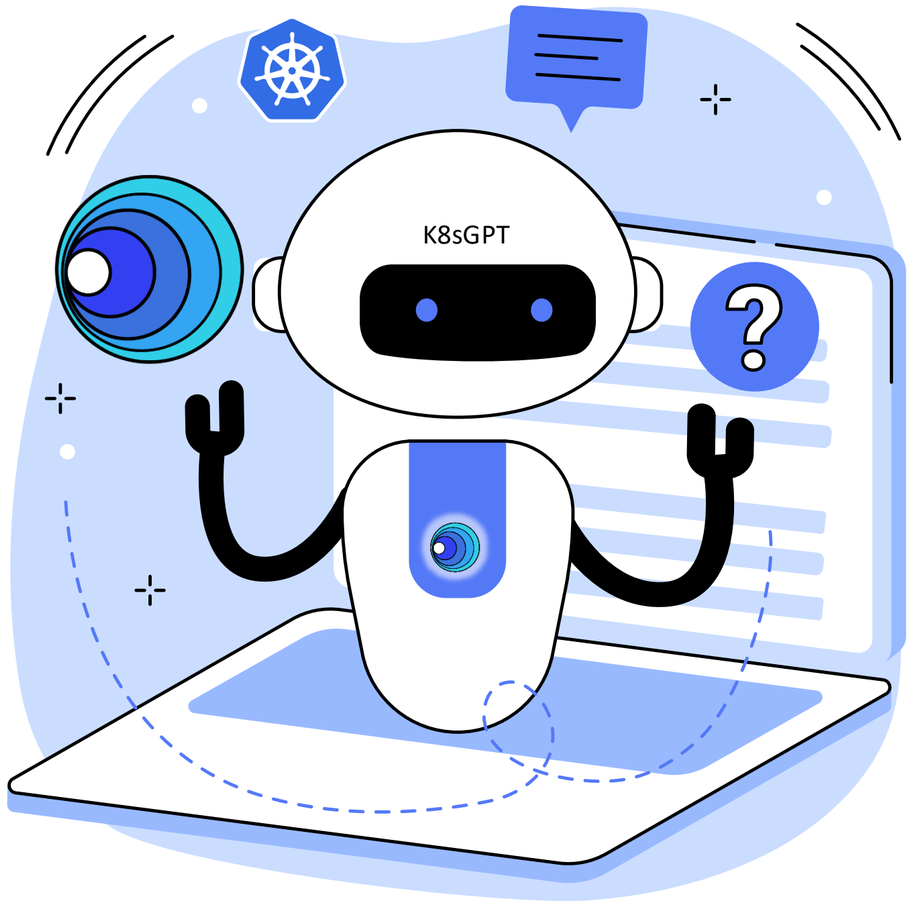
Section - 2

Environment Setup

Section Overview

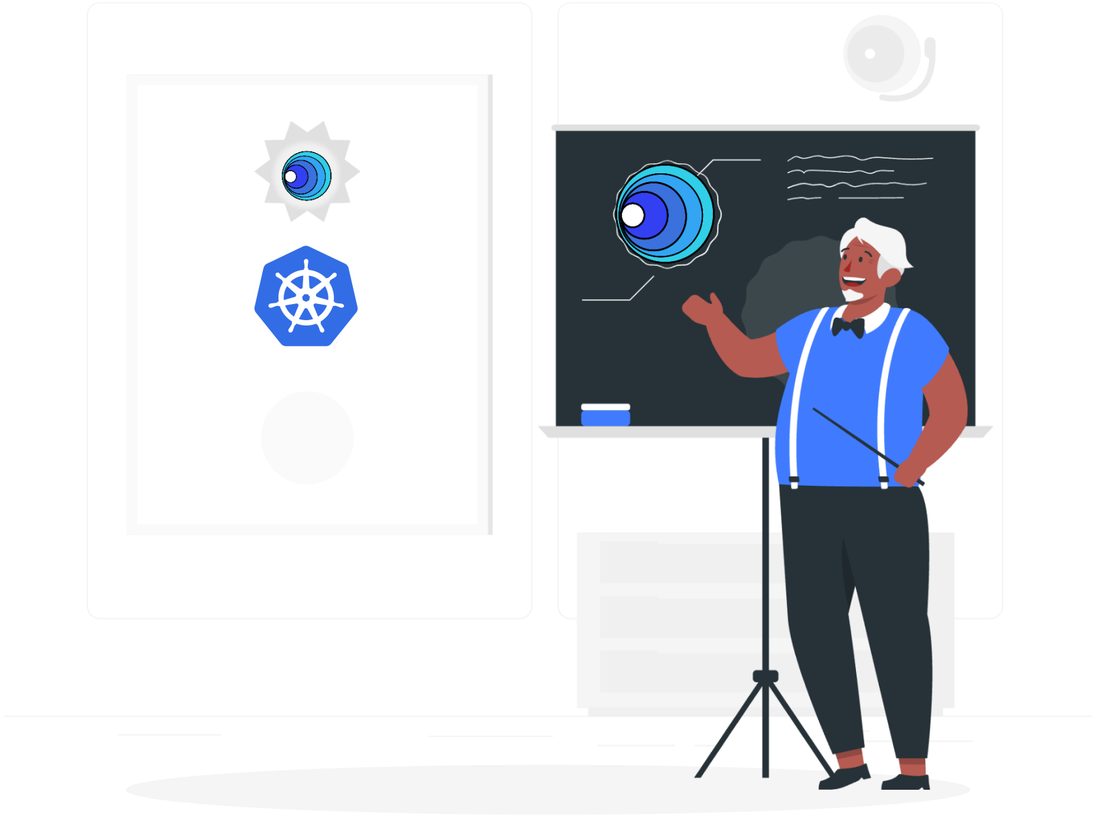
- *Prerequisites for setting up Kubernetes cluster*
- Steps to get your cluster up and running
- *K8sGPT Installation:*
  - *CLI on macOS*
  - *in-cluster operator inside K8s environment*
- *Getting started with K8sGPT CLI*
- *Troubleshoot Kubernetes workloads using AI*

Cluster Prerequisites



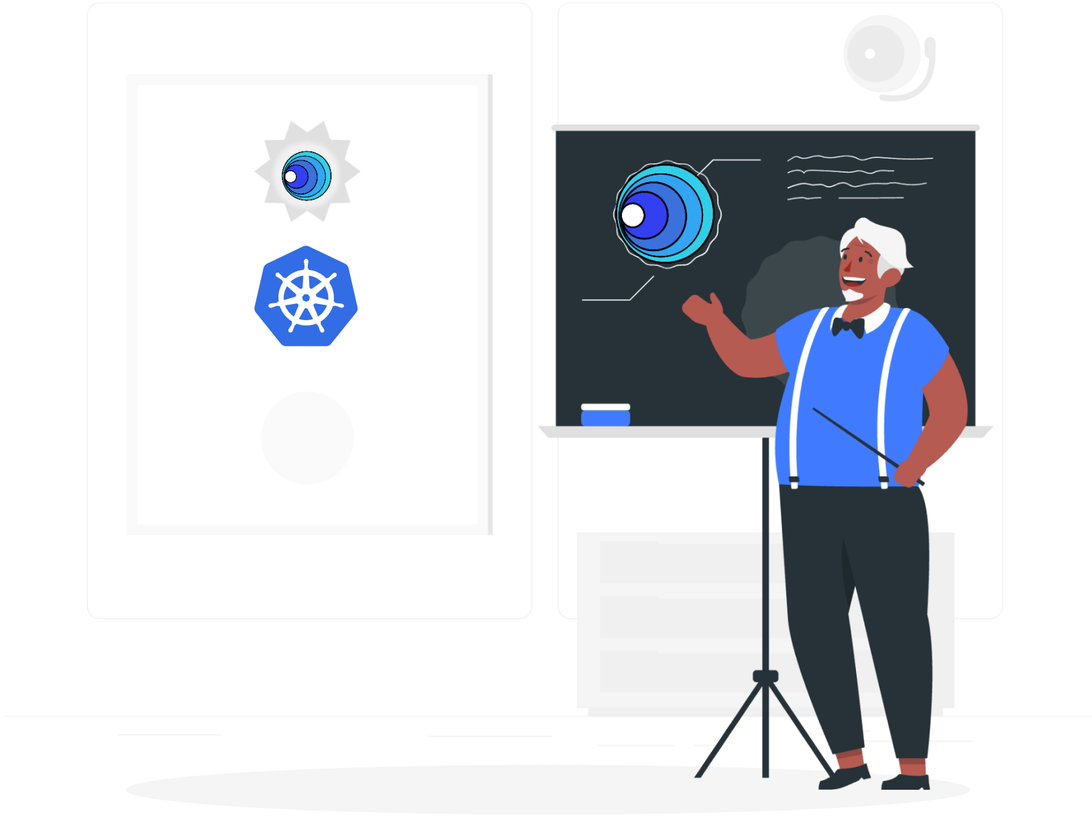
Demo

Setting up Kubernetes



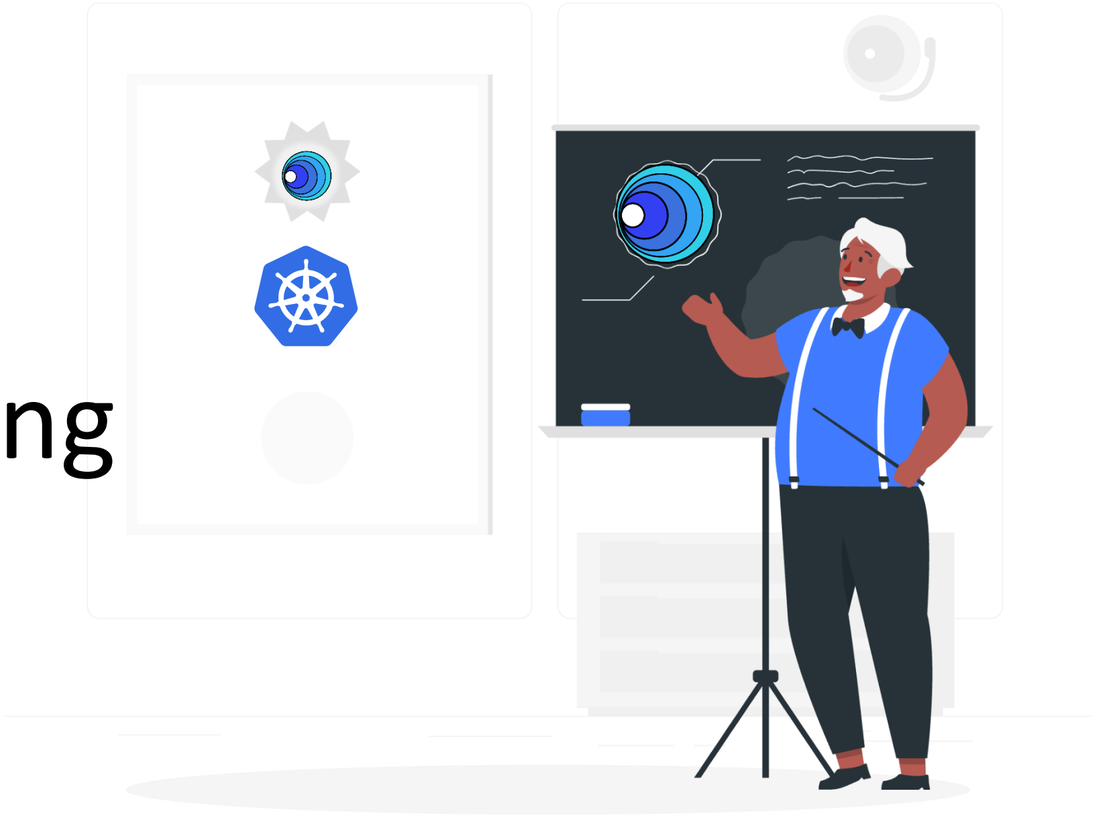
Demo

Installing K8sGPT via CLI on macOS

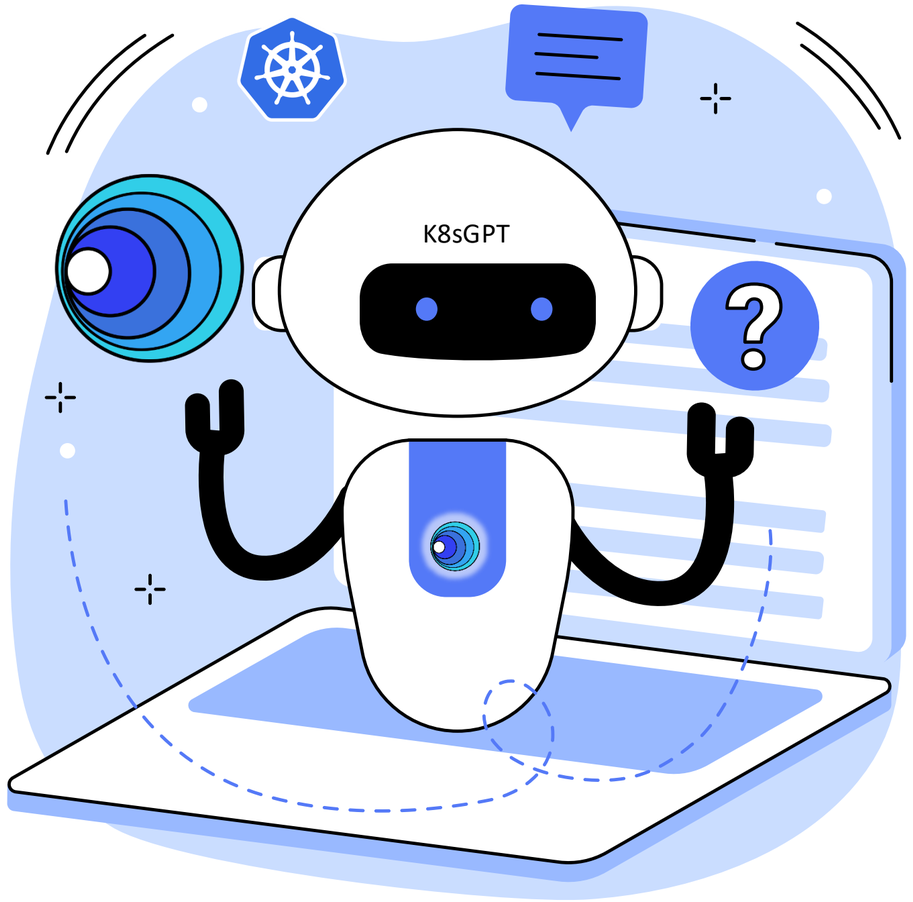


Demo

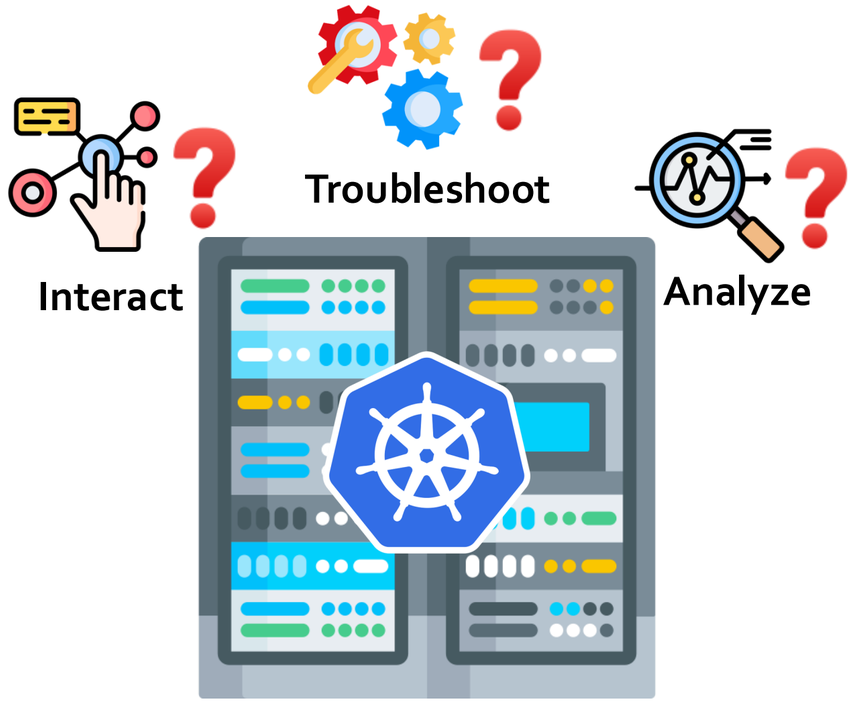
Installing K8sGPT using In-Cluster Operator

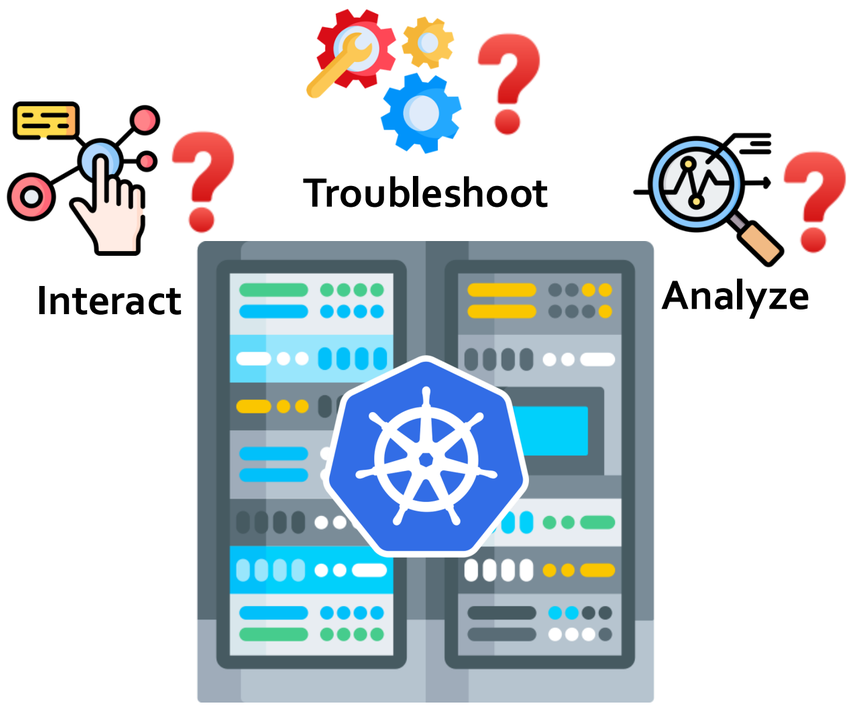


Getting started with k8sgpt CLI



K8sGPT





k8sgpt [command] [flags]

- ✓ Main CLI that runs the engine using various command options

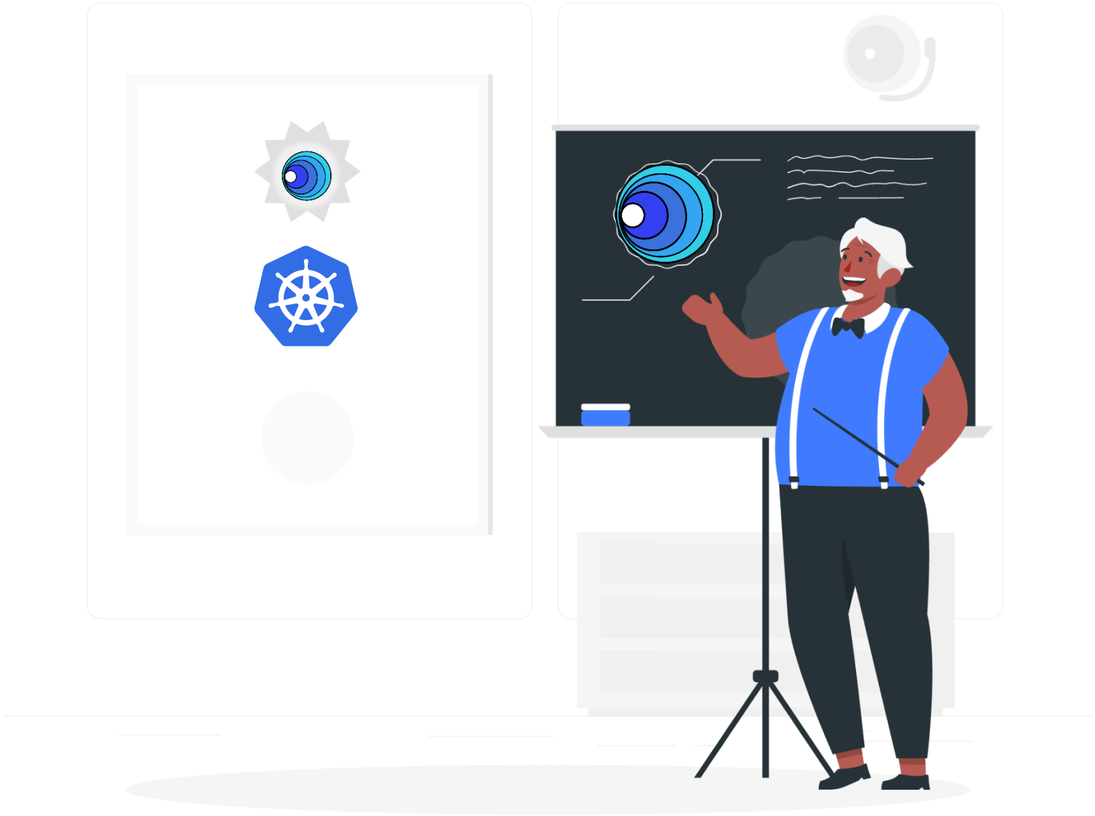
- ✓ Primary actions for K8s interaction, analysis, and integration
  - ❑ analyze
  - ❑ auth
  - ❑ filters
  - ❑ integrations
  - ❑ version
- ✓ Allows to:
  - ❑ Find problems
  - ❑ Authenticate Choosen Backend
  - ❑ Manage Filters
  - ❑ Integrate with tools

- ✓ Sub-options or parameters passed to a specific command
- ✓ Vary depending on the command being executed
- ✓ For example –
  k8sgpt auth remove --backend google

removes the google backend

Demo

k8sgpt cli



Environment Setup

Section Summary

- ✓ *Environment for K8sGPT*
- ✓ *Prerequisites for setting up Kubernetes cluster*
- ✓ *Installed K8sGPT via CLI on macOS and as an in-cluster operator*
- ✓ *Configured namespaces and used Helm for installation*
- ✓ *Installed K8sGPT CLI on Linux machine*

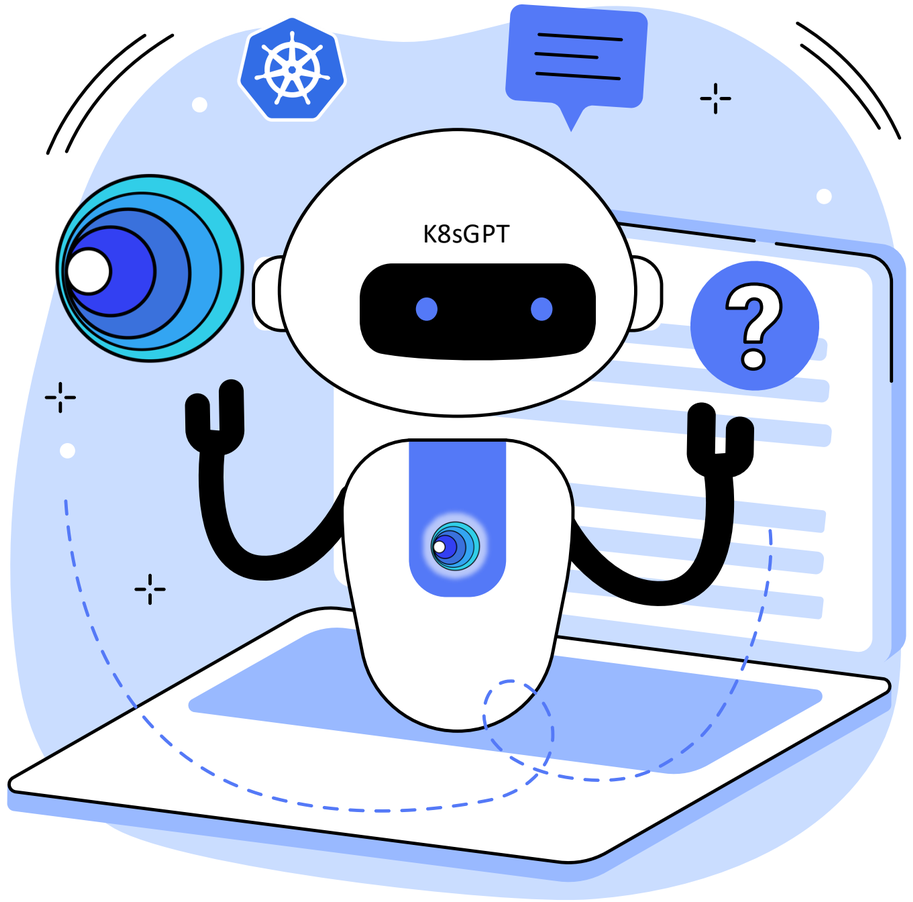
Section - 3

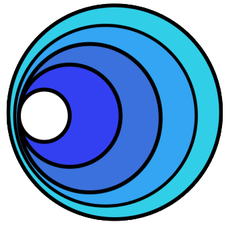
Core Components of K8sGPT

Section Overview

- *K8sGPT Terminologies*
  - *Analyzers*
  - *Filters*
  - *AI-powered Insights*
- *K8sGPT Process Flow*

K8sGPT Terminologies





K8sGPT

Analyzers

- Filters
- AI Backend
- k8sgpt CLI
- ML Models & NLP

K8sGPT

Analyzers

Filters

AI Backend

k8sgpt CLI

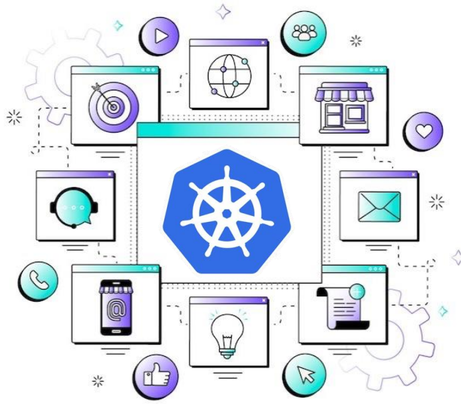
ML Models & NLP

Simplify Kubernetes management & optimization

Actionable Insights

Recommendations

Analyze & diagnose issues in the Kubernetes cluster



Kubernetes cluster

Analyzers

- ✓ Pods
- ✓ Deployments
- ✓ Services
- ✓ Ingresses
- ✓ Events
- ✓ Other cluster resources

Enabled by default

- podAnalyzer
- pvcAnalyzer
- serviceAnalyzer
- nodeAnalyzer
- eventAnalyzer
- ingressAnalyzer
- statefulSetAnalyzer
- deploymentAnalyzer
- cronJobAnalyzer
- rsAnalyzer
- mutatingWebhookAnalyzer
- validatingWebhookAnalyzer

Analyzers

Optional

- hpaAnalyzer
- pdbAnalyzer
- logAnalyzer
- networkPolicyAnalyzer
- gatewayClass
- gateway
- httproute
- storageAnalyzer
- securityAnalyzer

Enabled by default

- podAnalyzer
- pvcAnalyzer
- serviceAnalyzer
- nodeAnalyzer
- eventAnalyzer
- ingressAnalyzer
- statefulSetAnalyzer
- deploymentAnalyzer
- cronJobAnalyzer
- rsAnalyzer
- mutatingWebhookAnalyzer
- validatingWebhookAnalyzer

Analyzers

- Pod stuck in pending state
- Node is unreachable
- Endpoints are empty

Optional

- hpaAnalyzer
- pdbAnalyzer
- logAnalyzer
- networkPolicyAnalyzer
- gatewayClass
- gateway
- httproute
- storageAnalyzer
- securityAnalyzer

Filters

```
k8sgpt filter [subcommand]
```

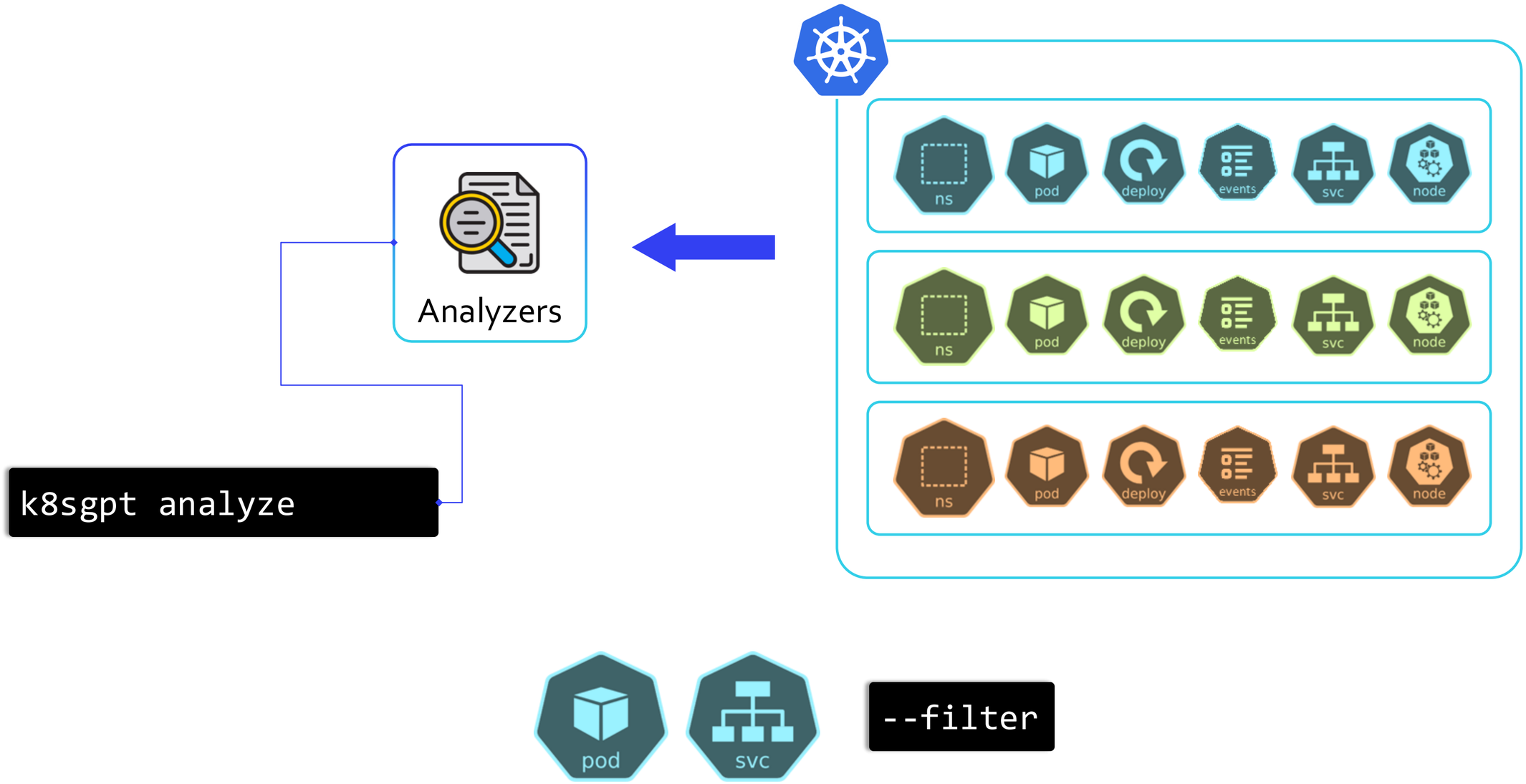
Command

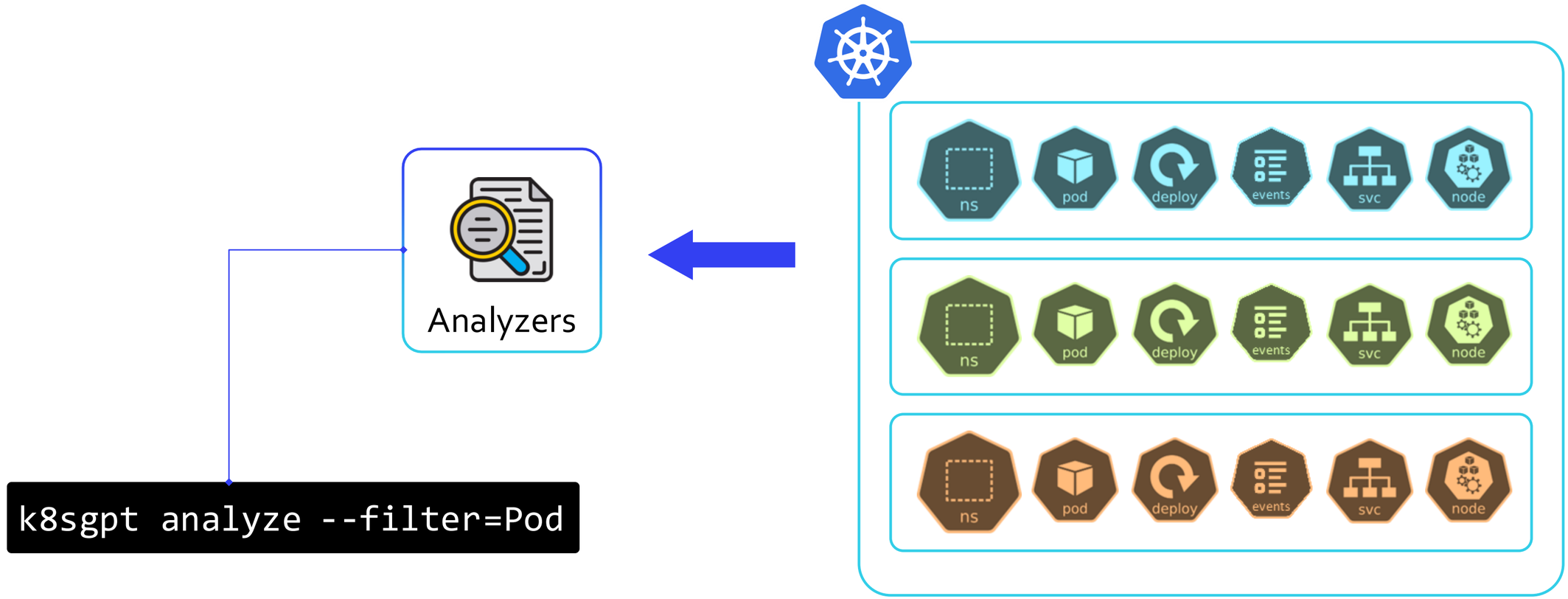
Manage filter groups for analyzing Kubernetes resources

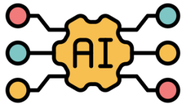
- ✓ Pods
- ✓ Deployments
- ✓ Services
- ✓ StatefulSets
- ✓ And more

```
k8sgpt filter list
```

List of available filters







AI-powered Backends

OpenAI

Azure OpenAI

Gemini

Ollama

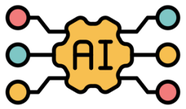
vertex.ai

Amazon Bedrock

watsonx

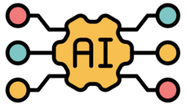
Hugging Face

K8sGPT



AI-powered
Backends

Provide contextual & actionable insights from the data
processed by analyzers & filters



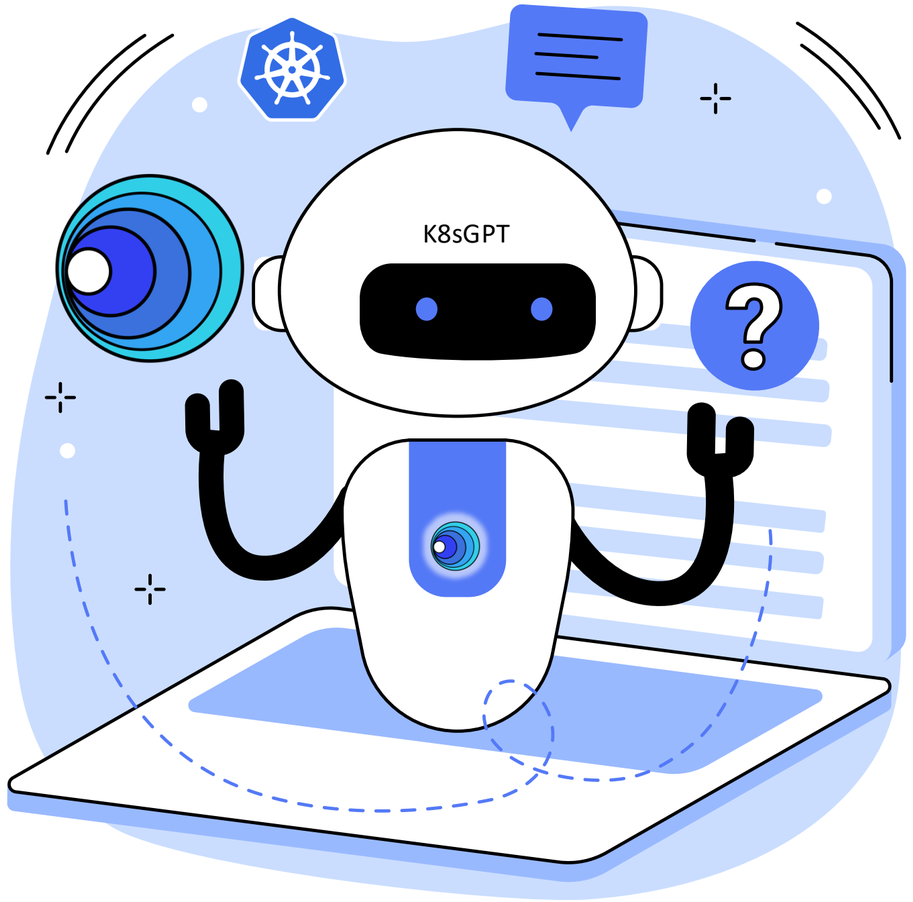
AI-powered Backends

Identifies Patterns & Correlations

Root Cause Analysis & Recommendations

Learns From Past Incidents

K8sGPT Process Flow



Core Components of K8sGPT

Section Summary

- ✓ *K8sGPT Terminologies*
  - *Analyzers - detect issues in your cluster*
  - *Filters - helps in narrow down the scope*
  - *AI-powered Insights - brings human-like reasoning to the output*
- ✓ *K8sGPT Process Flow*
  - *Step-by-step look at how the tool collects data*
  - *Runs analysis*
  - *Generates insights using AI providers*

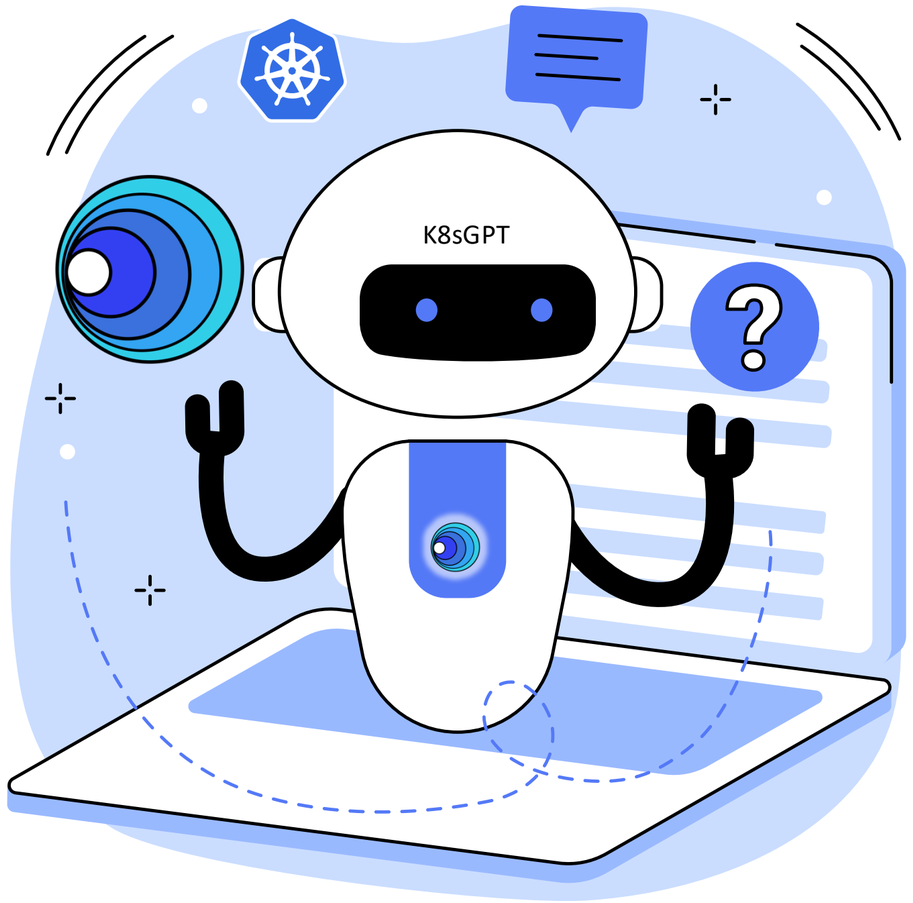
Section - 4

K8sGPT Commands and Usage

Section Overview

- *K8sGPT CLI*
  - *analyze*
  - *filter*
- *Integrate K8sGPT with Backend*
  - *Google Gemini*
  - *Amazon Bedrock*
- *Additional features*
  - *JSON Output*
  - *Data Anonymization*
  - *Interactive Terminal*
  - *Debug*

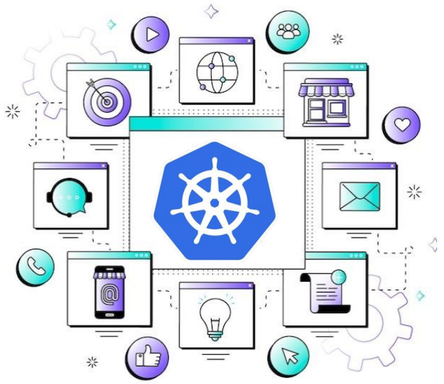
K8sGPT CLI
Part I



analyze

filter

k8sgpt analyze



Kubernetes cluster

```
thinknyxdheeraj@Dheerajs-MacBook-Air ~ % k8sgpt analyze
AI Provider: AI not used; --explain not set

0: Deployment default/mydep2()
- Error: Deployment default/mydep2 has 1 replicas but 0 are available with status running

1: StatefulSet default/my-statefulset()
- Error: StatefulSet uses the service default/my-service which does not exist.

2: StatefulSet demo-namespace/my-statefulset()
- Error: StatefulSet uses the service demo-namespace/stateful-service which does not exist.

3: Ingress default/example-ingress()
- Error: Ingress default/example-ingress does not specify an Ingress class.
- Error: Ingress uses the service default/foo-service which does not exist.

4: Ingress demo-namespace/my-ingress()
- Error: Ingress demo-namespace/my-ingress does not specify an Ingress class.

5: Pod default/mydep2-6d8f69b548-ktrq2(Deployment/mydep2)
- Error: Back-off pulling image "deptest:v7"

6: Pod demo-namespace/failed-pod-1()
- Error: the last termination reason is Error container=busybox pod=failed-pod-1
```

```
k8sgpt analyze [flag]
```

```
k8sgpt analyze --help
```

Flag	Shorthand	Command	Description
--namespace	-n	`k8sgpt analyze --namepspace <nsName>`	Namespace to analyze
--selector	-L	`k8sgpt analyze --selector key1=value1`	Label selector (label query) to filter on
--output	-o	`k8sgpt analyze --output json`	Output format (text, json)
--with-doc	-d	`k8sgpt analyze --with-doc`	Official documentation of the involved field
--with-stat	-s	`k8sgpt analyze --with-stat`	Print analysis stat
--filter	-f	`k8sgpt analyze --filter=<filterName>`	Filter for these analyzers (e.g. Pod, Service)

```
k8sgpt filter
```

Enables control over which resources are included
or excluded during analysis

View | Add | Remove

Helpful when working in large clusters with many components, allows you to
analyze a subset of the Kubernetes environment

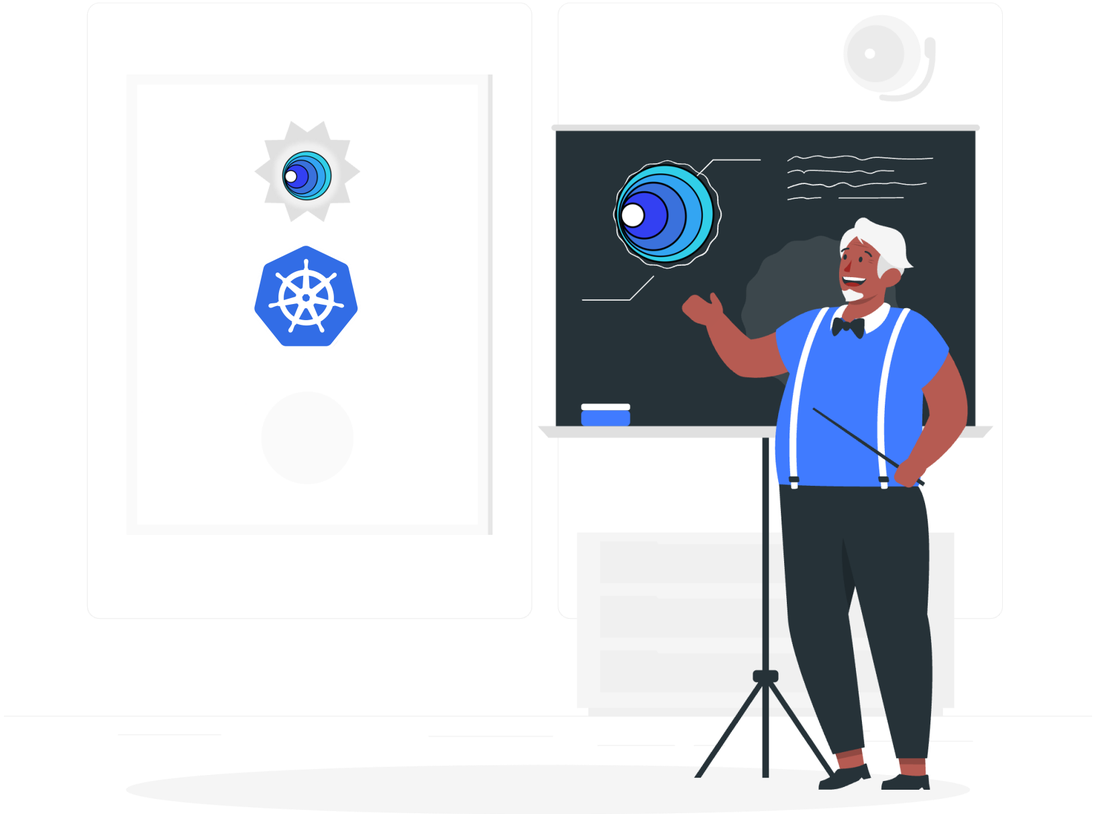
```
k8sgpt filter [subcommand]
```

```
k8sgpt filter --help
```

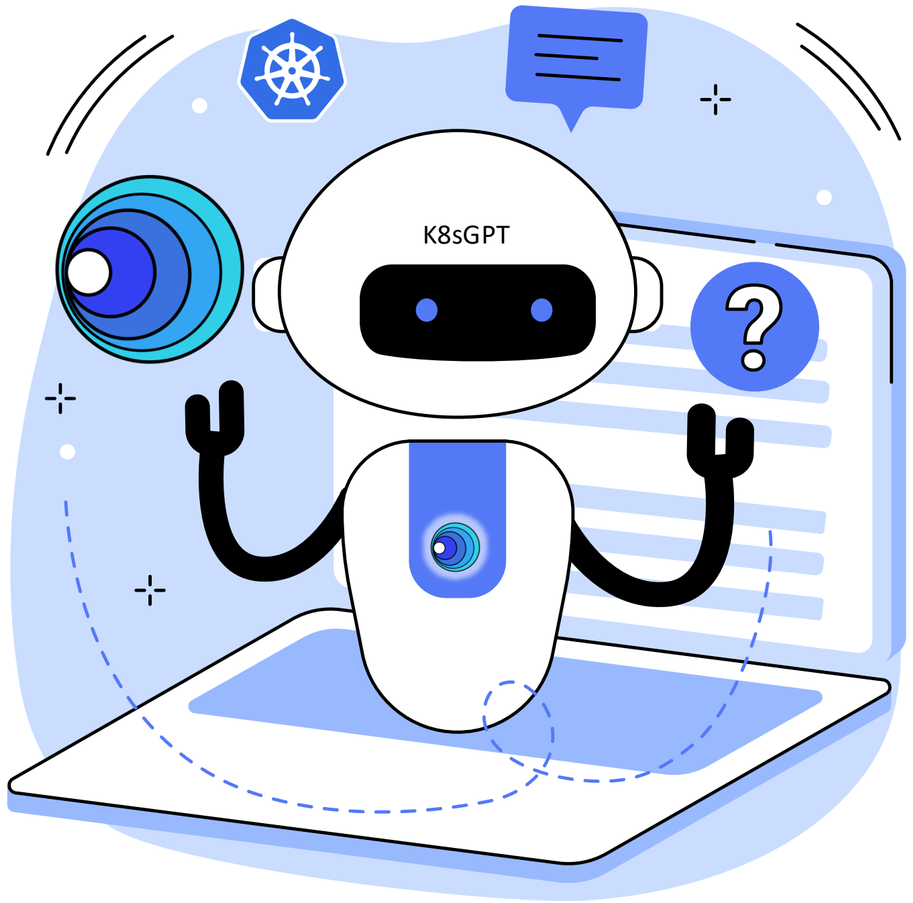
Subcommand	Command	Description
list	`k8sgpt filter list`	List available filters
add	`k8sgpt filter add <filterName>`	Adds one or more new filters
remove	`k8sgpt filter remove <filterName>`	Remove one or more filters

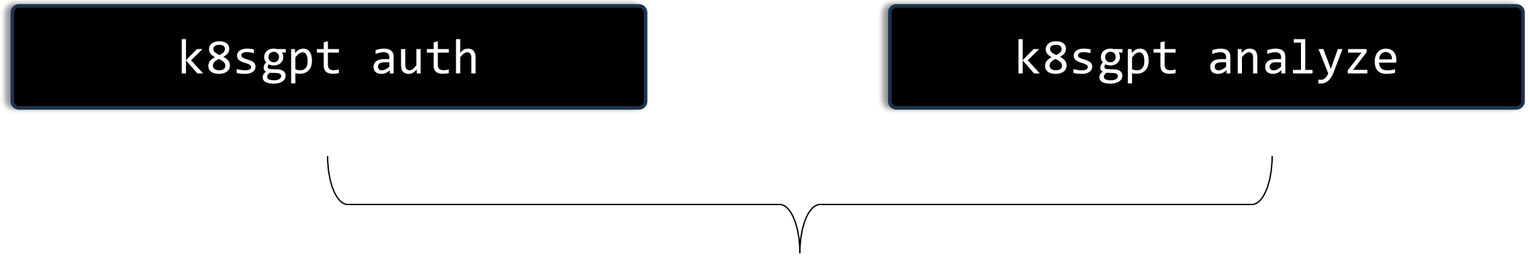
Demo

k8sgpt analyze &
k8sgpt filter
commands



K8sGPT CLI
Part II





- ✓ Configure AI backends
- ✓ Enable multilingual support
- ✓ More insightful explanations

```
k8sgpt auth
```

Manage the AI provider credentials that K8sGPT relies on
for generating analysis results

```
k8sgpt auth [subcommand] [flags]
```

```
k8sgpt auth [subcommand] --help
```

Subcommand	Command	Description
list	`k8sgpt auth list`	Lists all configured AI providers, showing active, unused, and default ones
add	`k8sgpt auth add --backend <name> --model <model_name>`	Adds a new AI provider and model, if not specified, OpenAI with GPT-4o is used by default
default	`k8sgpt auth default <provider>`	Sets the default provider (e.g., OpenAI or Google) used for analysis
remove	`k8sgpt auth remove -b <backend>`	Removes a previously added AI provider using the --backend or -b flag
update	`k8sgpt auth update --backend <name> --model <model_name>`	Updates the model or credentials (e.g., API key) for an existing backend configuration

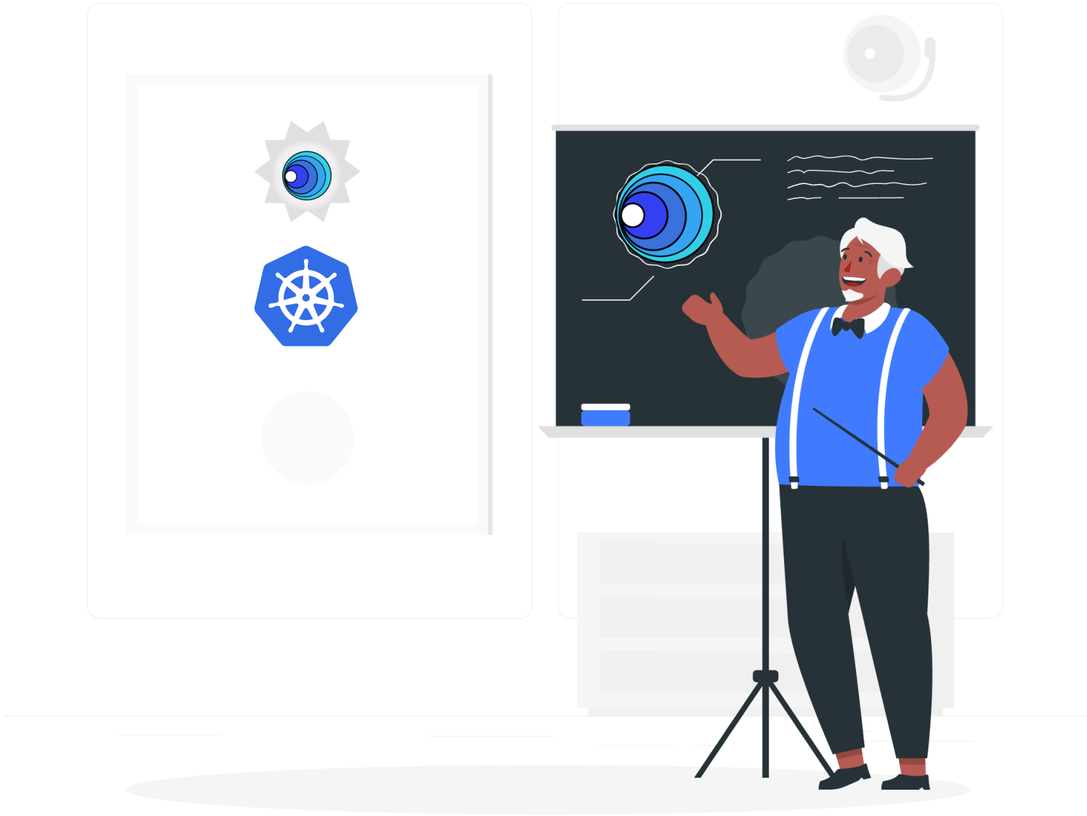
```
k8sgpt analyze
```

Enhance the output by providing deeper insights, localizing results, and narrowing the focus to specific parts of your Kubernetes cluster

Flag	Shorthand	Command	Description
--explain	-e	`k8sgpt analyze --explain`	Provides detailed AI-generated explanations for identified issues
--language	-l	`K8sgpt analyze –explain --language <language>`	Runs analysis in the selected language (e.g., Spanish, French)

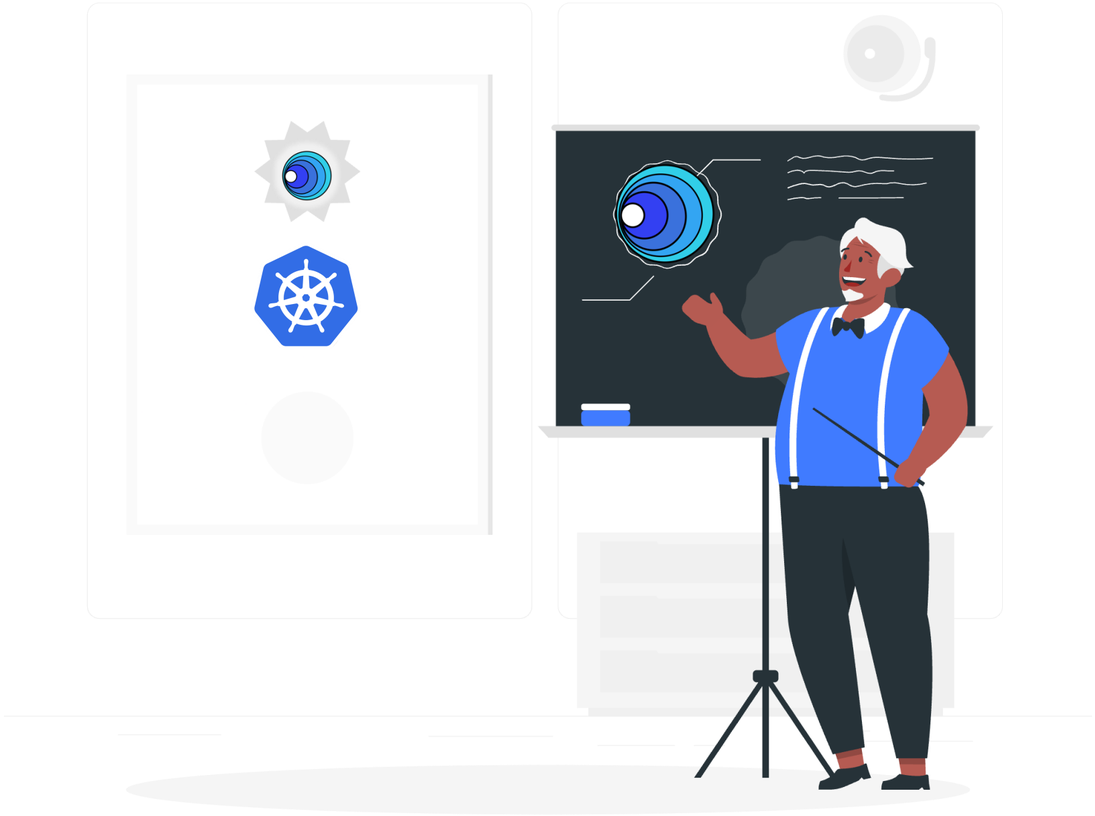
Demo

Integrating K8sGPT with Backend (Google Gemini)

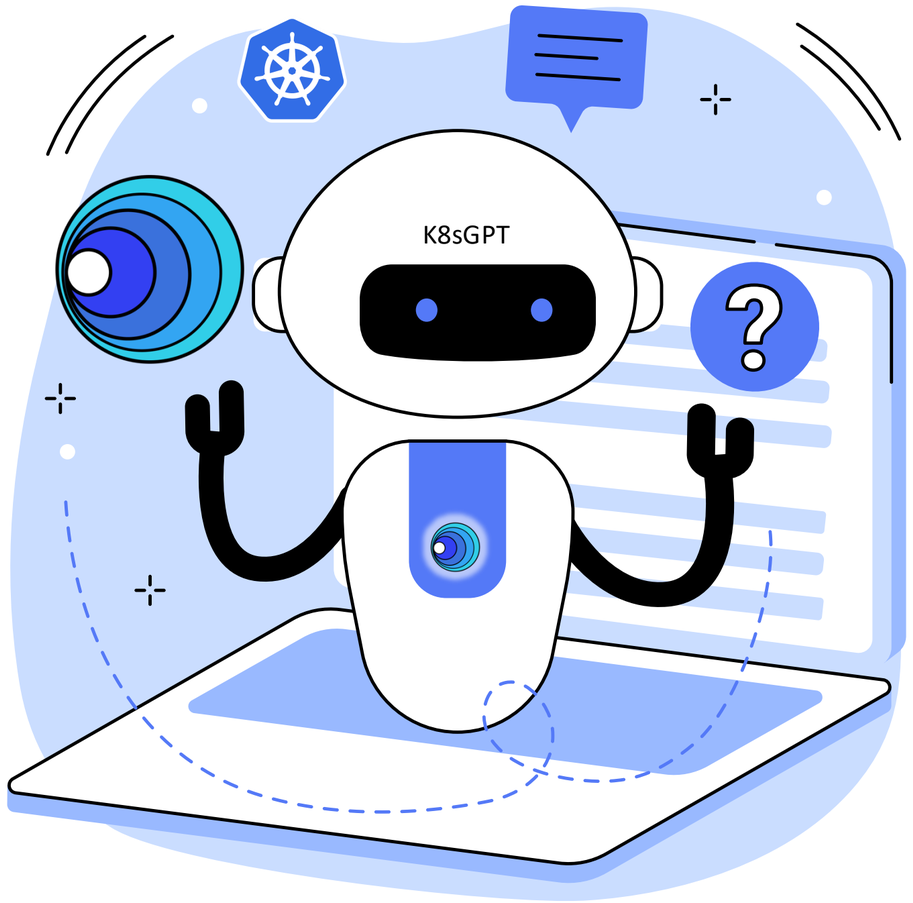


Demo

Integrating K8sGPT with Backend (Amazon Bedrock)



More Concepts: JSON Output, Data Anonymization, Interactive Terminal & Debug



Advanced flags
& features

- JSON Output
- Data Anonymization
- Interactive Terminal
- Debugging Mode

k8sgpt analyze

```
thinknyxdheeraj@Dheerajs-MacBook-Air ~ % k8sgpt analyze
AI Provider: AI not used; --explain not set

0: Deployment default/mydep2()
- Error: Deployment default/mydep2 has 1 replicas but 0 are available with status running

1: StatefulSet default/my-statefulset()
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2: StatefulSet demo-namespace/my-statefulset()
- Error: StatefulSet uses the service demo-namespace/stateful-service which does not exist.

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5: Pod default/mydep2-6d8f69b548-ktrq2(Deployment/mydep2)
- Error: Back-off pulling image "deptest:v7"

6: Pod demo-namespace/failed-pod-1()
- Error: the last termination reason is Error container=busybox pod=failed-pod-1
```
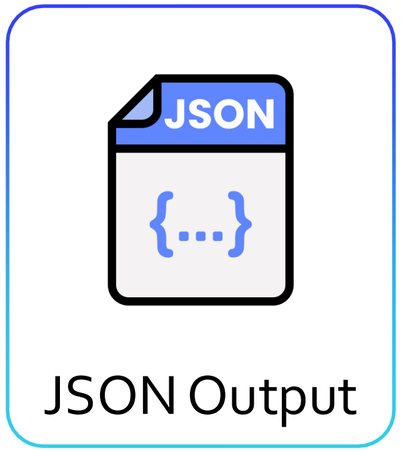
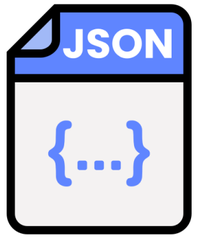

Slack

Monitoring System

Analysis

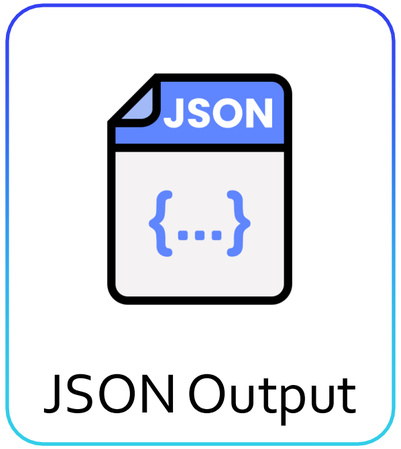



```
{
  "issue": "PodCrashLoopBackOff",
  "namespace": "default",
  "pod": "nginx-deployment-7c77b68cff-abcde",
  "explanation": "The pod is repeatedly crashing due to
misconfigured image or missing                    dependency."
}
```



JSON Output

Simplifies integration with tools and automation, making it ideal for CI/CD pipelines and scripts that handle analysis results

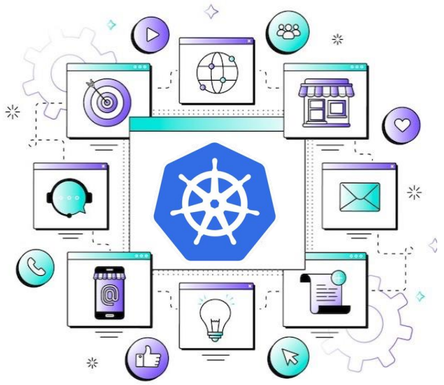



```
k8sgpt analyze --output json
```

```
k8sgpt analyze --output json > output.json
```

Data Anonymization

K8sGPT

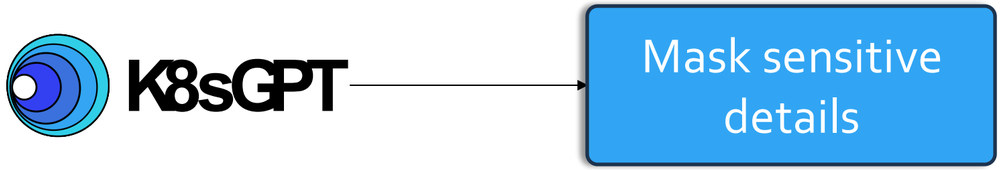


Kubernetes cluster

- Pod Names
- Service Names
- Namespaces
- Error Messages

- Project Names
- Customer Identifiers
- Environment-specific Labels

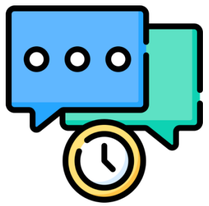

```
--anonymize
```



Data Anonymization

```
k8sgpt analyze --explain --anonymize
```

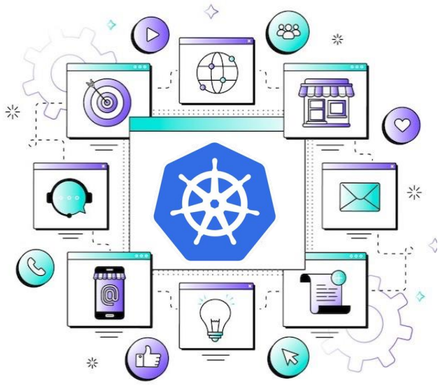
Perform cluster scan and anonymize sensitive fields while preserving the data structure and analytical insights



Interactive Terminal

K8sGPT

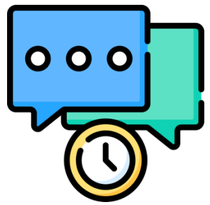
Pod Failures or Misconfigurations



Kubernetes cluster

Ask Follow-up Questions

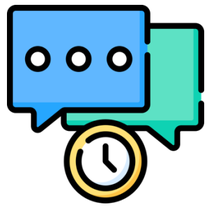
Explore Specific Areas



Interactive Terminal

This feature lets you talk to K8sGPT in real time to ask questions, improve your searches, and better understand problems step by step

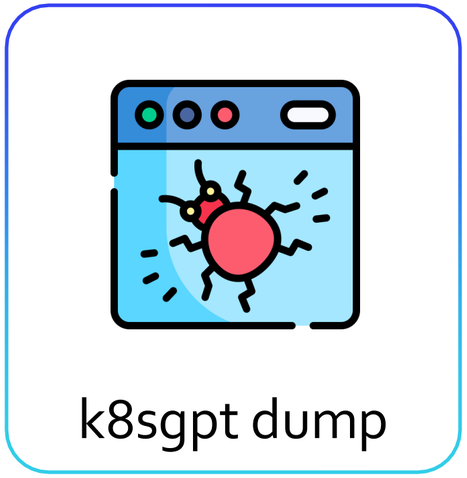
```
k8sgpt analyze --explain --interactive
```



Interactive Terminal

```
k8sgpt analyze --explain --interactive
```

- This feature requires a properly configured AI backend
- To exit the session, simply type **`exit`**



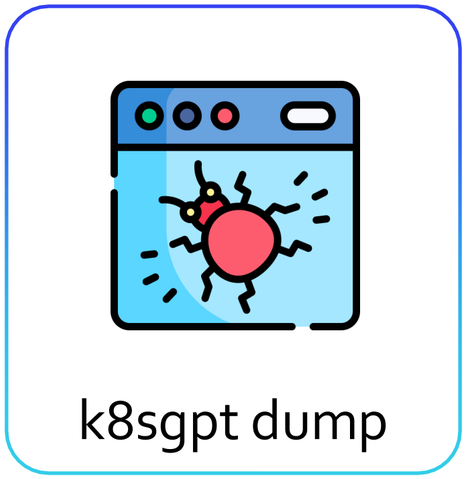
K8sGPT

dump

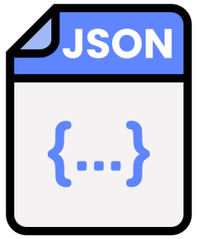
JSON

dump.*.json

Non-sensitive
Configuration Data

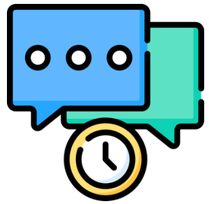


https://github.com/k8sgpt-ai/k8sgpt/issues

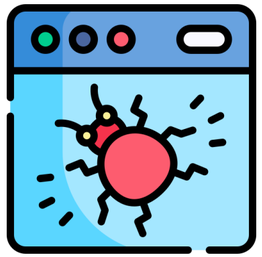


JSON Output

Data Anonymization



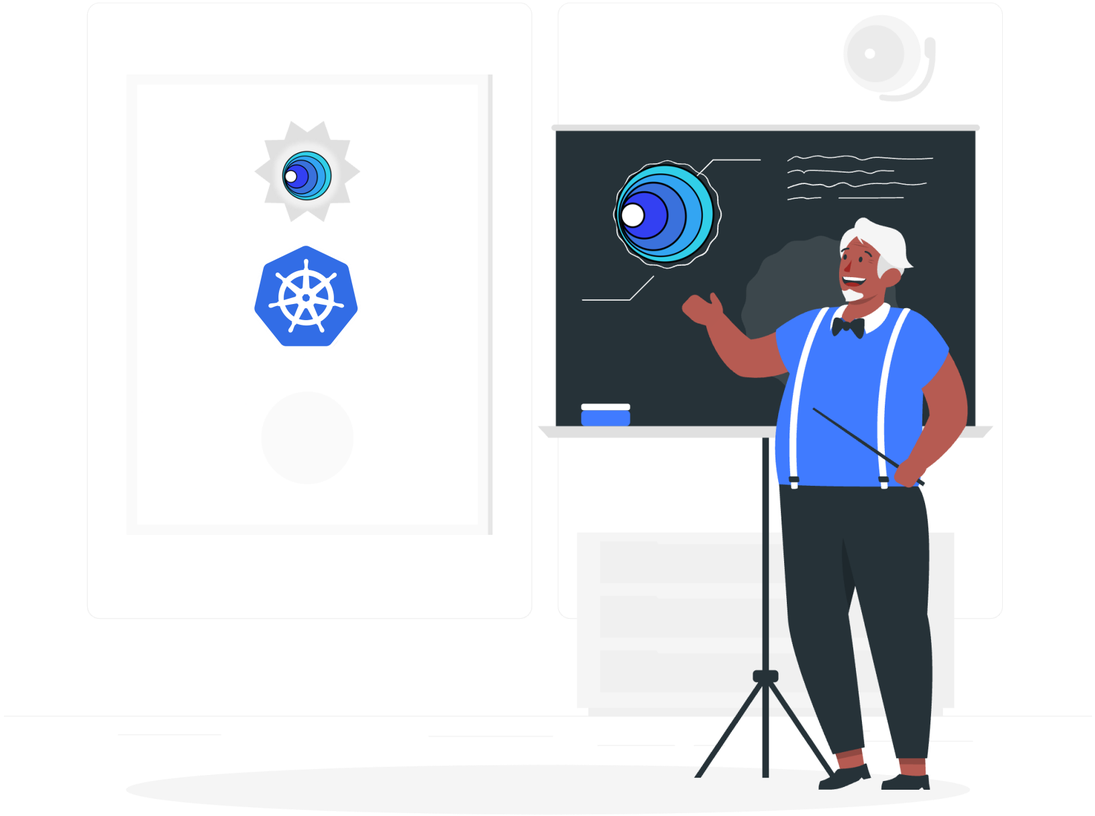
Interactive Terminal



k8sgpt dump

Demo

More Concepts:
JSON Output,
Data Anonymization,
Interactive Terminal
& Debug



K8sGPT Commands and Usage

Section Summary

- ✓ *analyze and filter commands*
- ✓ *Integrated K8sGPT with Google Gemini & Amazon Bedrock*
- ✓ *Options*
  - *JSON Output*
  - *Data Anonymization*
  - *Interactive Terminal*
  - *Debug*

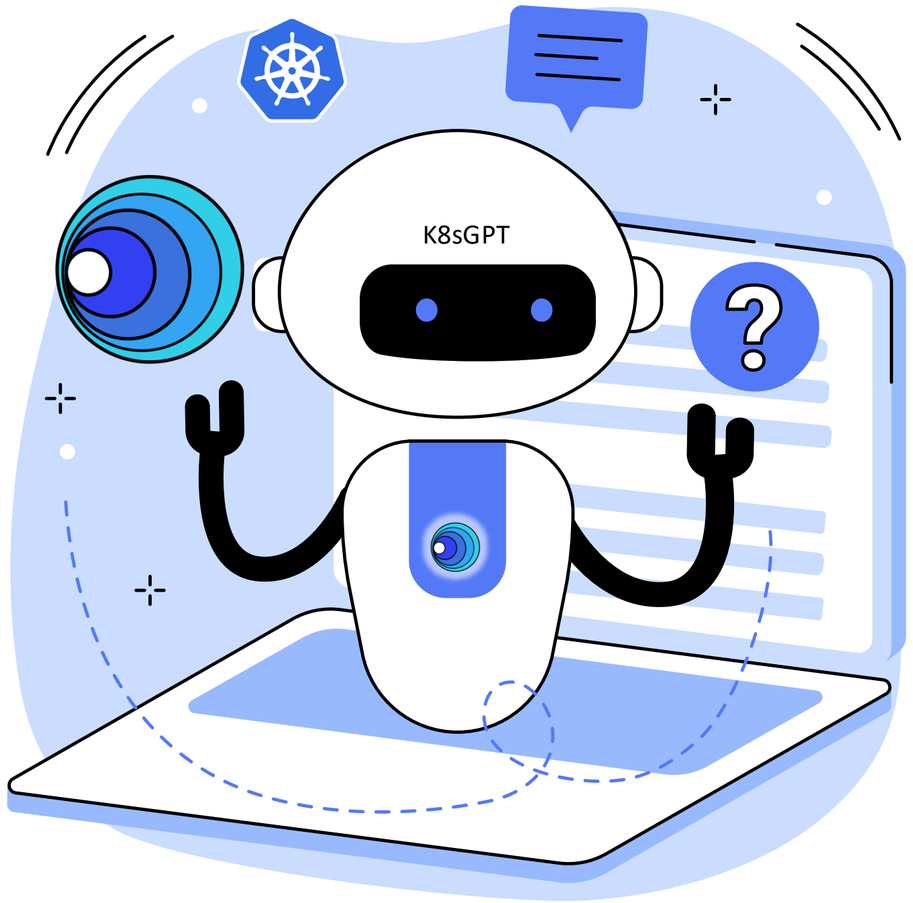
Section – 5

K8sGPT Integrations

Section Overview

- *Getting Started with Integrations in K8sGPT*
- *The Role of Integrations in Enhancing Analysis*
- *CLI Commands for Managing Integrations - list & activate*
- *Demo on Prometheus Integration*

Getting started with Integrations in K8sGPT



k8sgpt integrations

k8sgpt integrations

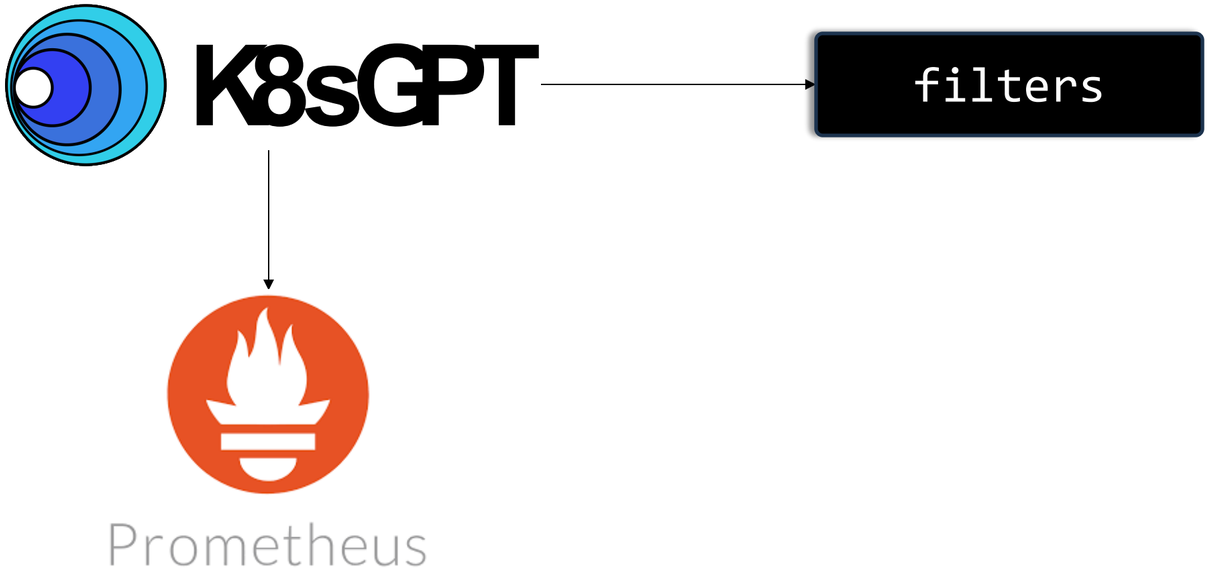
K8sGPT uses integrations to pull data from external systems, enhancing its analysis with additional context

```
k8sgpt filters
```

```
k8sgpt integrations
```

Integrations let K8sGPT use external data sources as filters, giving you greater control over what gets analyzed and how

Most tools in the cloud-native ecosystem are valuable because they integrate seamlessly with other tools



```
k8sgpt integrations --help
```

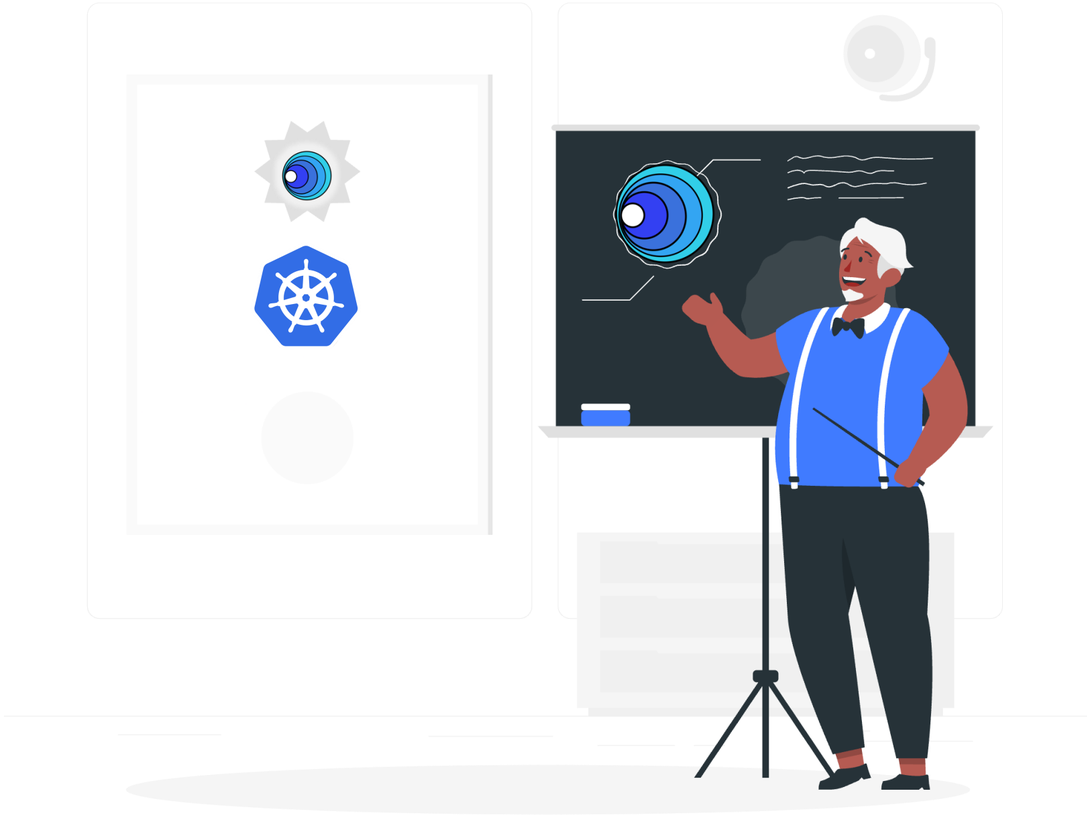
```
k8sgpt integrations list
```

```
k8sgpt integrations activate [integration name] [flags]
```

Prometheus

Demo

Prometheus Integration with K8sGPT



K8sGPT Integrations

Section Summary

- ✓ *What are Integrations?*
- ✓ *How Integrations Work with Filters - filter mechanism used in pulling data from external sources*
- ✓ *Useful CLI Commands - list & activate*
- ✓ *Prometheus Integration Demo - insights using Prometheus data*

Section – 6

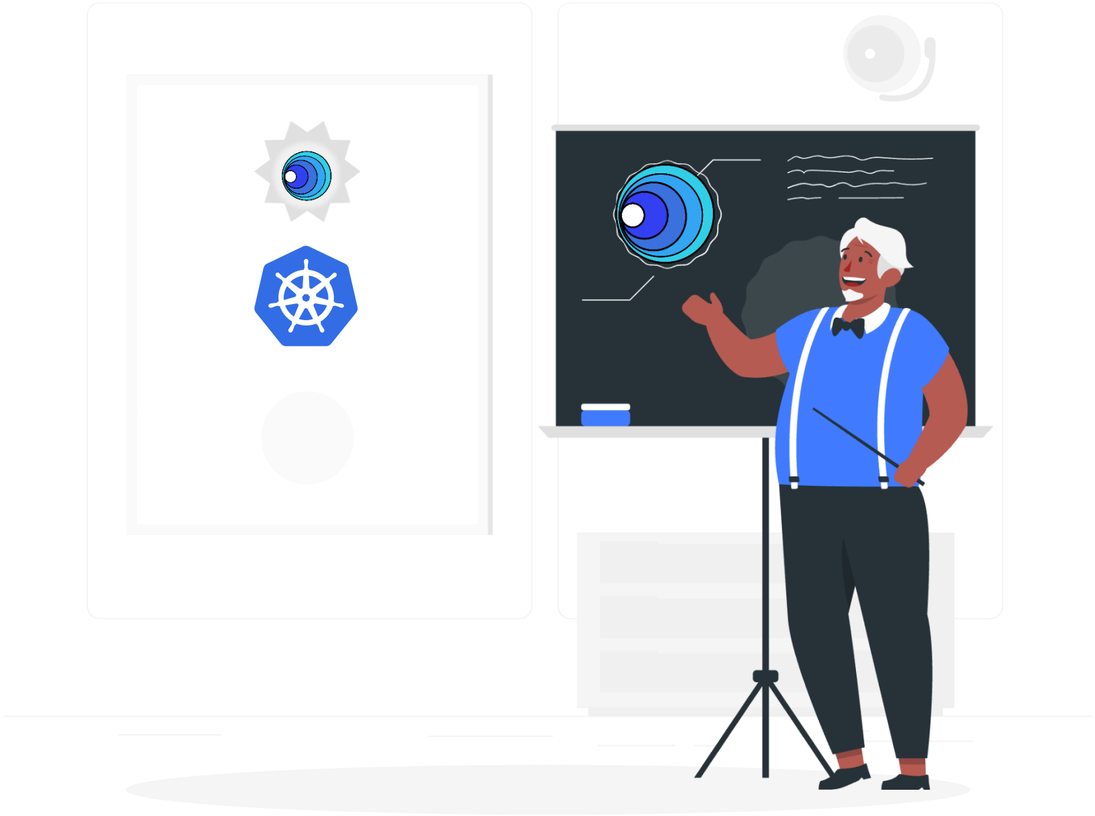
Analyzing Real-Time Issues

Section Overview

- *Case Study - How K8sGPT and KubeBuddy work together*
- *Demonstration*
  - *KubeBuddy dashboard for real-time visibility into Kubernetes components*
  - *How K8sGPT detects issues to give AI-powered recommendations*

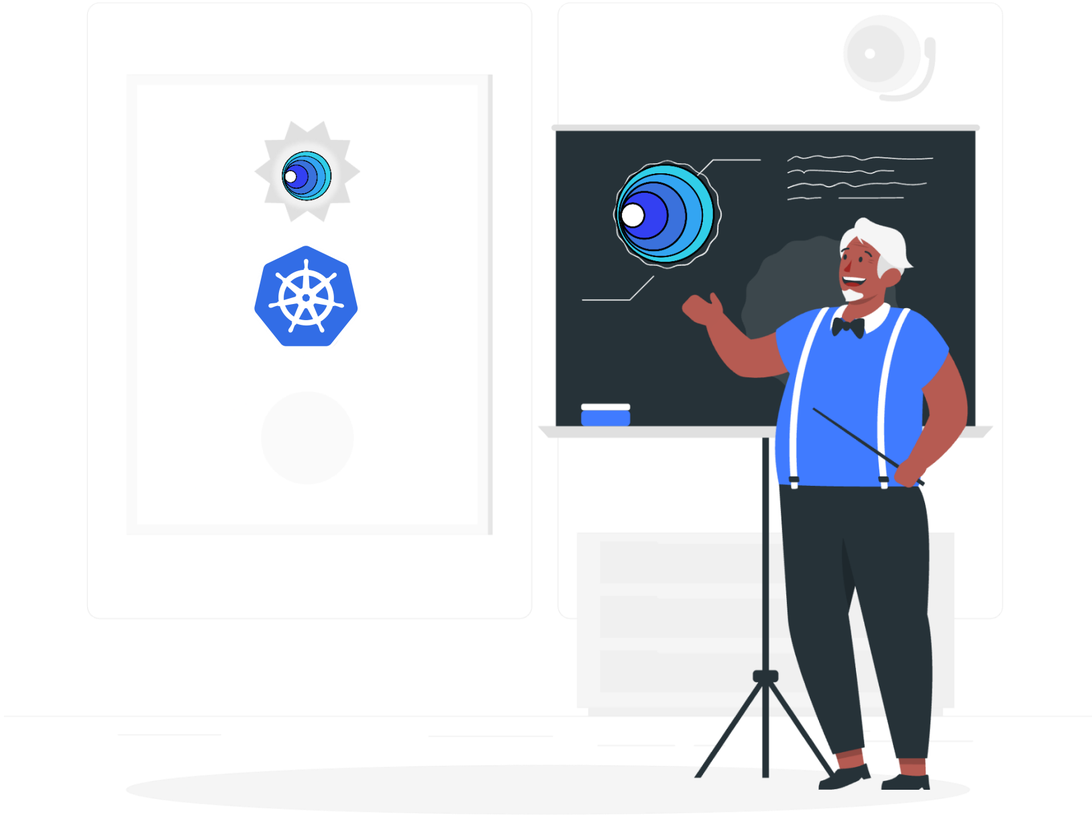
Case Study

K8s Dashboards & Recommendations



Demo

KubeBuddy - An AI Powered Dashboard With K8sGPT



Environment Setup

Section Summary

- ✓ *Explored practical ways to analyze and troubleshoot a Kubernetes cluster*
- ✓ *Case Study on how KubeBuddy simplify Kubernetes Dashboarding*
- ✓ *K8sGPT for issue detection and AI recommendations*

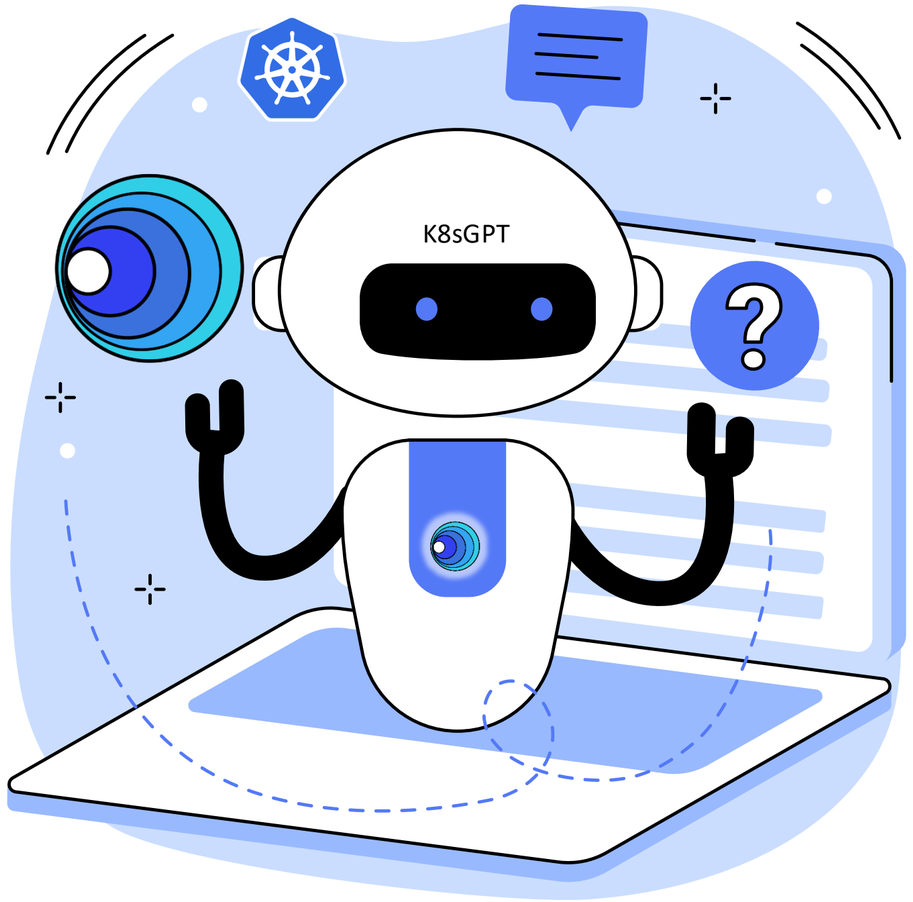
Section – 7

K8sGPT using In-Cluster Operator for K8s Clusters

Section Overview

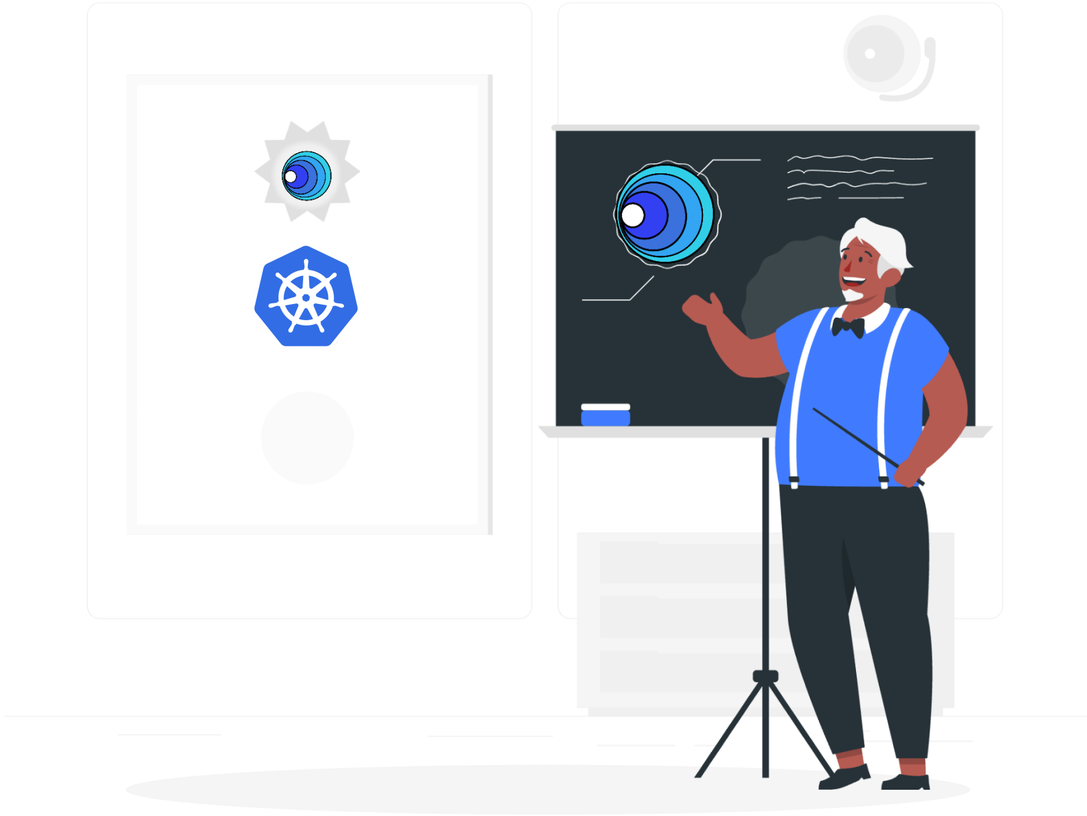
- *Understanding In-cluster Operator Workflow*
- *Demonstration:*
  - *Adding K8sGPT Cluster Resource via Manifest File*
  - *Prometheus & Grafana Integration with K8sGPT Kubernetes Operator*

Understanding In-cluster Operator Workflow



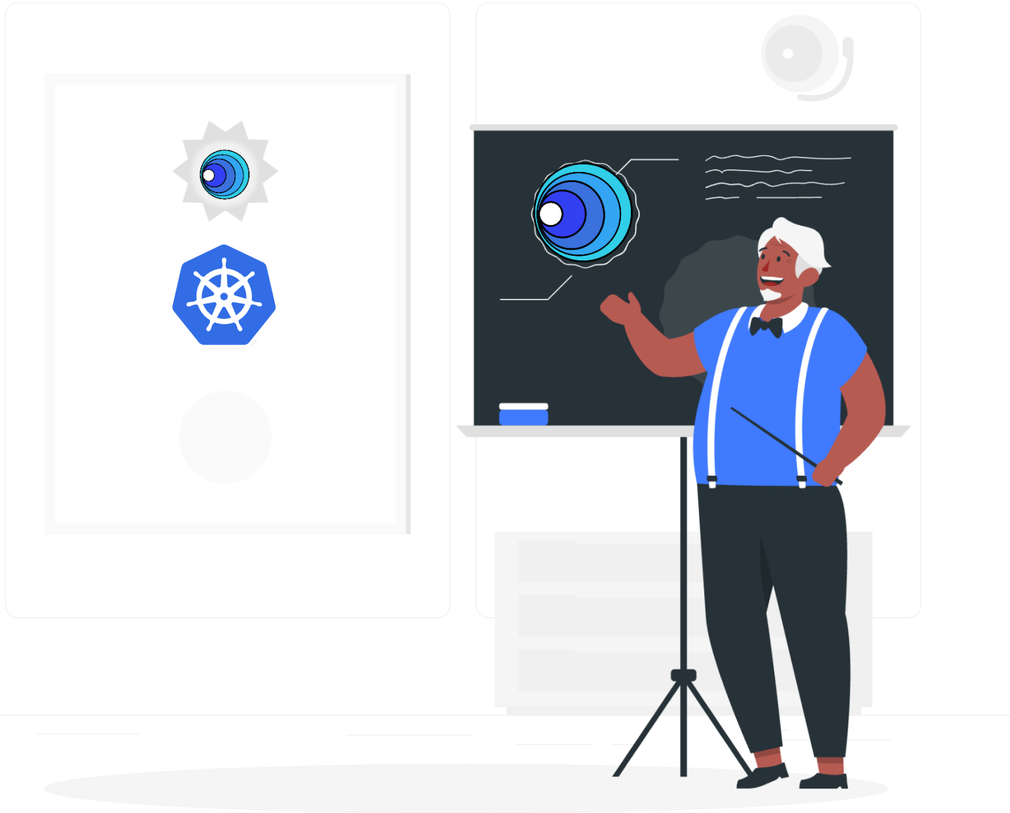
Demo

Adding K8sGPT Cluster Resource via Manifest File



Demo

Prometheus & Grafana Integration with K8sGPT Kubernetes Operator



K8sGPT using In-Cluster Operator for K8s Clusters

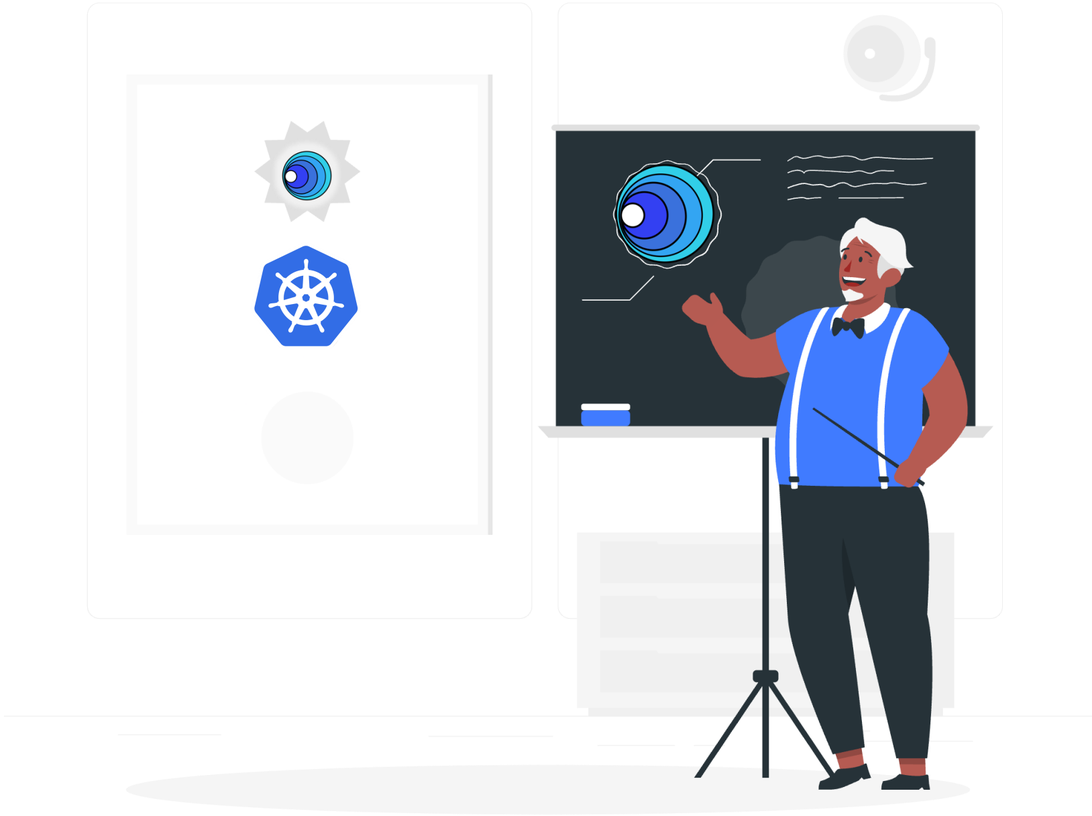
Section Summary

- ✓ *In-cluster operator setup of K8sGPT*
- ✓ *How in-cluster operator leverages CRDs and custom manifests*
- ✓ *How results are stored as native Kubernetes objects*
- ✓ *K8sGPT integration with Prometheus and Grafana for enhanced visibility*

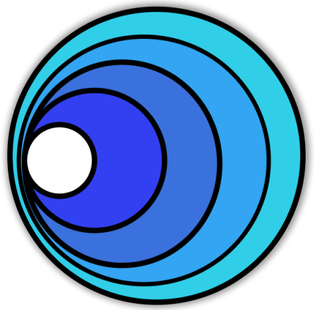
Section – 8

Demo

Claude Desktop Integration with K8sGPT



Section – 9



K8sGPT Essentials: Unlocking Kubernetes Insights with AI

By – Thinknyx Technologies LLP

Course Conclusion

- ✓ *Mastered K8sGPT architecture and setup workflows*
- ✓ *Connected K8sGPT with Gemini and Bedrock*
- ✓ *Worked with K8sGPT CLI commands & deployed in-cluster operator for real-time monitoring*
- ✓ *Integrated tools like Prometheus, Claud Desktop and KubeBuddy Dashboard*
- ✓ *Developed skills needed to analyze Kubernetes clusters intelligently and efficiently using AI-powered insights*
- ✓ *Ready to implement K8sGPT in production*

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