Monitoring SUSE AI with OpenTelemetry and SUSE Observability

WHAT?

This document focuses on techniques for gathering telemetry data from all SUSE AI components, including metrics, logs and traces.

WHY?

To observe, analyze and maintain the behavior, performance and health of your SUSE AI environment, and to troubleshoot issues effectively.

EFFORT

Setting up the recommended monitoring configurations with SUSE Observability is straightforward. Advanced setups for more granular control may require additional time for specialized analysis and fine-tuning.

GOAL

To visualize the complete topology of your services and operations, providing deep insights and clarity into your SUSE AI environment.

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Contents

1 Introduction

This document focuses on techniques for gathering telemetry data from all SUSE AI components.

For most of the components, it presents two distinct paths:

Recommended settings
: Straightforward configurations designed to utilize the SUSE Observability Extension, providing a quick solution for your environment.

Advanced configuration
: For users who require deeper and more granular control. Advanced options unlock additional observability signals that are relevant for specialized analysis and fine-tuning.

Several setups are specific to the product, while others—particularly for scraping metrics—are configured directly within the OpenTelemetry Collector. By implementing the recommended settings, you can visualize the complete topology of your services and operations, bringing clarity to your SUSE AI environment.

1.1 What is SUSE AI monitoring?

Monitoring SUSE AI involves observing and analyzing the behavior, performance and health of its components. In a complex, distributed system like SUSE AI, this is achieved by collecting and interpreting telemetry data. This data is typically categorized into the three pillars of observability:

Metrics
: Numerical data representing system performance, such as CPU usage, memory consumption or request latency.

Logs
: Time-stamped text records of events that occurred within the system, useful for debugging and auditing.

Traces
: A representation of the path of a request as it travels through all the different services in the system. Traces are essential for understanding performance bottlenecks and errors in the system architecture.

1.2 How monitoring works

SUSE AI uses OpenTelemetry, an open-source observability framework, for instrumenting applications. Instrumentation is the process of adding code to an application to generate telemetry data. By using OpenTelemetry, SUSE AI ensures a standardized, vendor-neutral approach to data collection.

The collected data is then sent to SUSE Observability, which provides a comprehensive platform for visualizing, analyzing and alerting on the telemetry data. This allows administrators and developers to gain deep insights into the system, maintain optimal performance, and troubleshoot issues effectively.

2 Monitoring GPU usage

To effectively monitor the performance and utilization of your GPUs, configure the OpenTelemetry Collector to scrape metrics from the NVIDIA DCGM Exporter, which is deployed as part of the NVIDIA GPU Operator.

PROCEDURE 1: COLLECT GPU METRICS (RECOMMENDED)

1. **Grant permissions (RBAC).** The OpenTelemetry Collector requires specific permissions to discover the GPU metrics endpoint within the cluster.
   Create a file named `otel-rbac.yaml` with the following content. It defines a `Role` with permissions to get services and endpoints, and a `RoleBinding` to grant these permissions to the OpenTelemetry Collector's service account.

```
---
apiVersion: rbac.authorization.k8s.io/v1
kind: Role
metadata:
  name: suse-observability-otel-scraper
rules:
  - apiGroups:
      - ""
    resources:
      - services
      - endpoints
    verbs:
      - list
      - watch
```

```
---
apiVersion: rbac.authorization.k8s.io/v1
kind: RoleBinding
metadata:
  name: suse-observability-otel-scraper
roleRef:
  apiGroup: rbac.authorization.k8s.io
  kind: Role
  name: suse-observability-otel-scraper
subjects:
  - kind: ServiceAccount
    name: OPENTELEMETRY-COLLECTOR
    namespace: OBSERVABILITY
---
```

Important

Verify that the `ServiceAccount` name and namespace in the `RoleBinding` match your OpenTelemetry Collector's deployment.

2. Apply this configuration to the `gpu-operator` namespace.

```
> kubectl apply -n gpu-operator -f otel-rbac.yaml
```

3. **Configure the OpenTelemetry Collector.** Add the following Prometheus receiver configuration to your OpenTelemetry Collector's values file. This tells the collector to scrape metrics from any endpoint in the `gpu-operator` namespace every 10 seconds.

```
config:
  receivers:
    prometheus:
      config:
        scrape_configs:
          - job_name: 'gpu-metrics'
            scrape_interval: 10s
            scheme: http
            kubernetes_sd_configs:
              - role: endpoints
                namespaces:
                  names:
                    - gpu-operator
```

3 Monitoring Open WebUI

The preferred way of retrieving relevant telemetry data from Open WebUI is to use the SUSE AI Filter (https://github.com/SUSE/suse-ai-observability-extension/blob/main/integrations/oi-filter/suse_ai_filter.py) ↗. It requires enabling and configuring Open WebUI Pipelines.

PROCEDURE 2: CONFIGURING PIPELINE FILTER DURING OPEN WEBUI INSTALLATION (RECOMMENDED)

1. Verify that the Open WebUI installation override file `owui_custom_overrides.yaml` includes the following content.

```
pipelines:
  enabled: true
  persistence:
    storageClass: longhorn ❶
  extraEnvVars: ❷
    - name: PIPELINES_URLS ❸
      value: "https://raw.githubusercontent.com/SUSE/suse-ai-observability-
extension/refs/heads/main/integrations/oi-filter/suse_ai_filter.py"
    - name: OTEL_SERVICE_NAME ❹
      value: "Open WebUI"
    - name: OTEL_EXPORTER_HTTP_OTLP_ENDPOpen WebUINT ❺
      value: "http://opentelemetry-collector.suse-
observability.svc.cluster.local:4318"
    - name: PRICING_JSON ❻
      value: "https://raw.githubusercontent.com/SUSE/suse-ai-observability-
extension/refs/heads/main/integrations/oi-filter/pricing.json"
extraEnvVars:
- name: OPENAI_API_KEY ❼
  value: "0p3n-w3bu!"
```

Note

In the above example, there are two `extraEnvVars` blocks: one at the root level and another inside the `pipelines` configuration. The root-level `extraEnvVars` is fed into Open WebUI to configure the communication between Open WebUI and Open WebUI Pipelines. The `extraEnvVars` inside the configuration are injected into the container that acts as a runtime for the `pipelines`.

❶ `longhorn` or `local-path`.

2. The environment variables that you are making available for the pipeline's runtime container.

3. A list of pipeline URLs to be downloaded and installed by default. Individual URLs are separated by a semicolon `;`.

4. The service name that appears in traces and topological representations in SUSE Observability.

5. The endpoint for the OpenTelemetry collector. Make sure to use the HTTP port of your collector.

6. A file for the model multipliers in cost estimation. You can customize it to match your actual infrastructure experimentally.

7. The value for the API key between Open WebUI and Open WebUI Pipelines. The default value is “0p3n-w3bu!”.

2. After you fill the override file with correct values, install or update Open WebUI.

```
> helm upgrade \
  --install open-webui oci://dp.apps.rancher.io/charts/open-webui \
  -n suse-private-ai \
  --create-namespace \
  --version 7.2.0 \
  -f owui_custom_overrides.yaml
```

Tip

Make sure to set the version, namespace and other options to the proper values.

After the installation is successful, you can access tracing data in SUSE Observability for each chat.

Tip

You can verify that a new connection was created with correct credentials in *Admin Panel* › *Settings* › *Connections*.

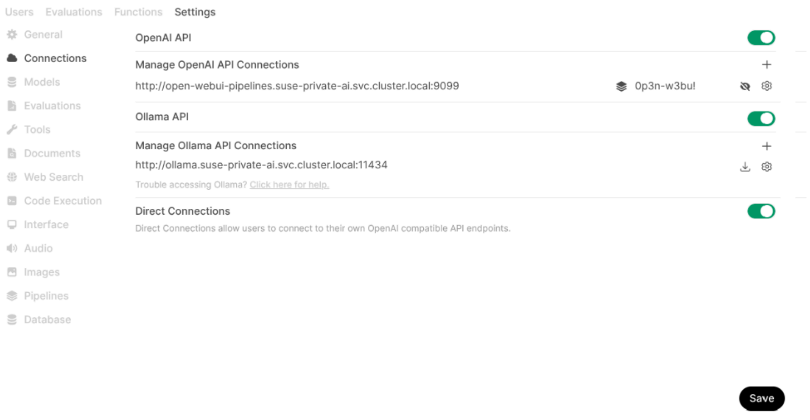

FIGURE 1: NEW CONNECTION ADDED FOR THE PIPELINE

PROCEDURE 3: CONFIGURING A PIPELINE FILTER IN OPEN WEBUI (RECOMMENDED)

If you already have a running instance of Open WebUI with the pipelines enabled and configured, you can set up the SUSE AI Filter in its Web user interface.

REQUIREMENTS

- You must have Open WebUI administrator privileges to access configuration screens or settings mentioned in this section.

1. In the bottom left of the Open WebUI window, click your avatar icon to open the user menu and select *Admin Panel*.
2. Click the *Settings* tab and select *Pipelines* from the left menu.
3. In the *Install from Github URL* section, enter `https://raw.githubusercontent.com/SUSE/suse-ai-observability-extension/refs/heads/main/integrations/oi-filter/suse_ai_filter.py` and click the upload button on the right to upload the pipeline from the URL.
4. After the upload is finished, you can review the configuration of the pipeline. Confirm with *Save*.

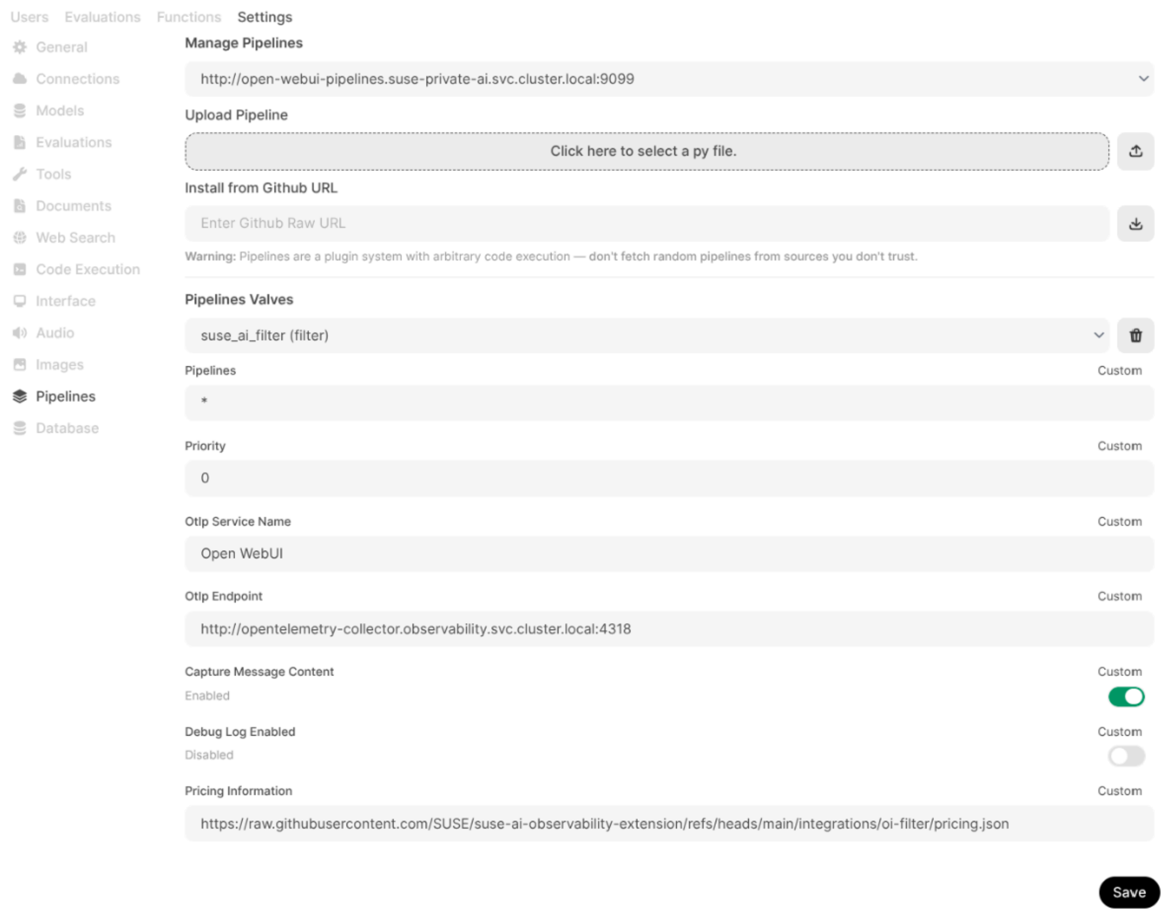

FIGURE 2: ADDING SUSE AI FILTER PIPELINE

PROCEDURE 4: CONFIGURING DEFAULT OPEN WEBUI METRICS AND TRACES (ADVANCED)

Open WebUI also offers certain built-in OpenTelemetry integration for traces and metrics. These signals are related to the API consumption but do not provide details about the GenAI monitoring. That is why we need to configure the SUSE AI filter as described in *Procedure 2, “Configuring pipeline filter during Open WebUI installation (recommended)”*.

1. Append the following environment variables to your `extraEnvVars` section in the `owui_custom_overrides.yaml` file mentioned in *Procedure 2, “Configuring pipeline filter during Open WebUI installation (recommended)”*.

```
[...]
extraEnvVars:
- name: OPENAI_API_KEY
  value: "0p3n-w3bu!"
- name: ENABLE_OTEL
  value: "true"
```

```
- name: ENABLE_OTEL_METRICS
  value: "true"
- name: OTEL_EXPORTER_OTLP_INSECURE
  value: "false" ❶
- name: OTEL_EXPORTER_OTLP_ENDPOINT
  value: CUSTOM_OTEL_ENDPOINT ❷
- name: OTEL_SERVICE_NAME
  value: CUSTOM_OTEL_IDENTIFYER ❸
```

❶ Set to `"true"` for testing or controlled environments, and `"false"` for production deployments with TLS communication.

❷ Enter your custom OpenTelemetry collector endpoint URL, such as `"http://opentelemetry-collector.suse-observability.svc.cluster.local:4318"`.

❸ Specify a custom identifier for the OpenTelemetry service, such as `"OI Core""`.

2. Save the enhanced override file and update Open WebUI:

```
> helm upgrade \
  --install open-webui oci://dp.apps.rancher.io/charts/open-webui \
  -n suse-private-ai \
  --create-namespace \
  --version 7.2.0 \
  -f owui_custom_overrides.yaml
```

4 Monitoring Milvus

Milvus is monitored by scraping its Prometheus-compatible metrics endpoint. The SUSE Observability Extension uses these metrics to visualize Milvus's status and activity.

4.1 Scraping the metrics (recommended)

Add the following job to the `scrape_configs` section of your OpenTelemetry Collector's configuration. It instructs the collector to scrape the `/metrics` endpoint of the Milvus service every 15 seconds.

```
config:
  receivers:
```

```
    prometheus:
      config:
        scrape_configs:
          - job_name: 'milvus'
            scrape_interval: 15s
            metrics_path: '/metrics'

            static_configs:
            - targets: ['milvus.suse-private-ai.svc.cluster.local:9091'] (1)
```

(1) Your Milvus service metrics endpoint. The example `milvus.suse-private-ai.svc.cluster.local:9091` is a common default, but you should verify that it matches your installation service name and namespace.

4.2 Tracing (advanced)

Milvus can also export detailed tracing data.

Important: High data volume

Enabling tracing in Milvus can generate a large amount of data. We recommend configuring sampling at the collector level to avoid performance issues and high storage costs.

To enable tracing, configure the following settings in your Milvus Helm chart values:

```
extraConfigFiles:
  user.yaml: |+
    trace:
      exporter: jaeger
      sampleFraction: 1
      jaeger: url: "http://opentelemetry-collector.observability.svc.cluster.local:14268/
api/traces" (1)
```

(1) The URL of the OpenTelemetry Collector installed by the user.

5 Monitoring user-managed applications

To monitor other applications, you can utilize OpenTelemetry SDKs or any other instrumentation provider compatible with OpenTelemetry's semantics, for example, OpenLIT SDK. For more details, refer to *Appendix B, Instrument applications with OpenLIT SDK*.

OpenTelemetry offers several instrumentation techniques for different deployment scenarios and applications. You can instrument applications either manually, with more detailed control, or automatically for an easier starting point.

> **Tip**
>
> One of the most straightforward ways of getting started with OpenTelemetry is using the OpenTelemetry Operator for Kubernetes, which is available in the SUSE Application Collection. Find more information in this extensive guide (https://docs.apps.rancher.io/reference-guides/opentelemetry-operator/) on how to use this operator for instrumenting your applications.

5.1 Ensuring that the telemetry data is properly captured by the SUSE Observability Extension

For the SUSE Observability Extension to acknowledge an application as a GenAI application, it needs to have a meter configured. It must provide at least the `RequestsTotal` metric with the following attributes:

- `TelemetrySDKLanguage`
- `ServiceName`
- `ServiceInstanceId`
- `ServiceNamespace`
- `GenAIEnvironment`
- `GenAiApplicationName`
- `GenAiSystem`

- `GenAiOperationName`
- `GenAiRequestModel`

Both the meter and the tracer must contain the following resource attributes:

service.name
: The logical name of the service. Defaults to `"My App"`.

service.version
: The version of the service. Defaults to `"1.0"`.

deployment.environment
: The name of the deployment environment, such as `"production"` or `"staging"`. Defaults to `"default""`.

telemetry.sdk.name
: The value must be `"openlit"`.

The following metrics are utilized in the graphs of the SUSE Observability Extension:

gen_ai.client.token.usage
: Measures the number of used input and output tokens.
Type: histogram
Unit: token

gen_ai.total.requests
: Number of requests.
Type: counter
Unit: integer

gen_ai.usage.cost
: The distribution of GenAI request costs.
Type: histogram
Unit: USD

gen_ai.usage.input_tokens
: Number of prompt tokens processed.
Type: counter
Unit: integer

gen_ai.usage.output_tokens

Number of completion tokens processed.

Type: counter

Unit: integer

gen_ai.client.token.usage

Number of tokens processed.

Type: counter

Unit: integer

5.2 Troubleshooting

1. *No metrics received from any components.*
   - Verify the OpenTelemetry Collector deployment.
   - Check if the exporter is properly set to the SUSE Observability collector and with the correct API key and endpoint specified.
2. *No metrics received from the GPU.*
   - Verify if the RBAC rules were applied.
   - Verify if the metrics receiver scraper is configured.
   - Check the NVIDIA DCGM Exporter for errors.
3. *No metrics received from Milvus.*
   - Verify if Milvus chart configuration is exposing the metrics endpoint.
   - Verify if the metrics receiver scraper is configured.
   - For usage metrics, confirm that requests were actually made to Milvus.
4. *No tracing data received from any components.*
   - Verify the OpenTelemetry Collector deployment.
   - Check if the exporter is properly set to the SUSE Observability collector, with the right API key and endpoint set.
5. *No tracing data received from Open WebUI.*
   - Verify if the SUSE AI Observability Filter was installed and configured properly.
   - Verify if chat requests actually happened.

6. *Cost estimation is far from real values.*

   Recalculate the multipliers for the `PRICING_JSON` in the SUSE AI Observability Filter.

7. *There is high demand for storage volume.*

   Verify if sampling is being applied in the OpenTelemetry Collector.

Glossary

AI, artificial intelligence

Refers to the simulation of human intelligence in machines that are designed to learn and solve problems like humans. Enables computers to understand language, make decisions and improve from experience.

Air gap

A security measure where a computer network is physically isolated from unsecured networks, including the public Internet.

Batch size

The number of samples processed simultaneously during model inference, affecting processing speed and resource utilization.

BYOC, bring your own certificate

A practice allowing users to provide their own SSL/TLS certificates for securing communications instead of using default or auto-generated ones.

CA, certification authority

An entity that issues digital certificates to verify the identity of certificate holders and ensure secure communications.

Chain-of-thought (CoT) prompting

A prompting technique that guides AI models to break down complex problems into step-by-step reasoning processes, improving response accuracy and transparency.

Chat template

A structured format for organizing conversations between users and AI models, defining how system prompts, user inputs, and AI responses are formatted and processed.

Context window

The maximum amount of text (tokens) that an AI model can process at once, including both the input prompt and generated response.

CRD, custom resource definitions

Extensions of the Kubernetes API that allow users to define custom resources and their controllers in a Kubernetes cluster.

CUDA, Compute Unified Device Architecture

NVIDIA's parallel computing platform and programming model used to accelerate AI workloads on GPU hardware.

Data leakage

The unintended exposure of sensitive information through AI model responses, potentially compromising data security and privacy.

Embeddings

Numerical representations of data (text, images, etc.) in a high-dimensional space that capture semantic relationships and enable AI models to process information effectively.

Fine-tuning

The process of further training a pre-trained AI model on specific data to adapt it for particular tasks or domains, improving its performance for targeted applications.

GenAI, generative AI

A type of artificial intelligence that can create new content such as text, images or music.

GPU, graphics processing unit

Specialized hardware designed for parallel processing. In AI applications, GPUs accelerate model training and inference tasks.

Hallucination

An AI behavior where the model generates false or unsupported information that appears plausible but has no basis in provided context or real facts.

Helm

A package manager for Kubernetes that helps install and manage applications. Helm uses charts to define, install and upgrade complex Kubernetes applications.

Helm chart

A package format for Kubernetes applications that contains all resource definitions needed to deploy and configure application workloads.

IaC, infrastructure as code

The practice of managing and provisioning infrastructure through machine-readable definition files rather than manual processes.

Inference

The process of using a trained AI model to make predictions or generate outputs based on new input data.

Kubernetes pods

The smallest deployable units in Kubernetes that can host one or more containers, sharing networking and storage resources.

LLM, large language model

An advanced AI model trained on amounts of text data to understand and generate human-like text. Can perform tasks like translation, summarization and answering questions.

Model weights

The learned parameters of an AI model that determine how it processes inputs and generates outputs. These weights are adjusted during training to optimize model performance.

NLG, natural language generation

A process of automatically generating human-like text from structured data or other forms of input. Designed to convert raw data into coherent and meaningful language easily understood by humans.

NLU, natural language understanding

A process AI uses to analyze and understand the meaning of the input query.

NVIDIA GPU driver

Software that enables communication between the operating system and NVIDIA graphics hardware, essential for GPU-accelerated AI workloads.

NVIDIA GPU Operator

A Kubernetes operator that automates the management of NVIDIA GPUs in container environments, handling driver deployment, runtime configuration, and monitoring.

Ollama

An open source framework for running and serving AI models locally. Ollama simplifies the process of downloading, running and managing large language models.

OpenGL

A cross-platform API for rendering 2D and 3D graphics, commonly used in visualization applications and GPU-accelerated computing.

Prompt Engineering

The practice of crafting effective input queries to AI models to obtain desired and accurate outputs. Good prompt engineering helps prevent hallucinations and improves response quality.

Prompt injection

A security vulnerability where malicious inputs attempt to override or bypass an AI model's system prompt or safety constraints.

Quantization

A technique to reduce AI model size and computational requirements by converting model parameters to lower precision formats while maintaining acceptable performance.

RAG, retrieval-augmented generation

A technique that enhances AI responses by retrieving relevant information from a knowledge base before generating answers, improving accuracy and reducing hallucinations.

RBAC, role-based access control

A security model that restricts system access based on roles assigned to users, managing permissions and authorization in Kubernetes clusters.

Semantic search

A search method using AI to understand the meaning and context of queries rather than just matching keywords, enabling more relevant results.

System prompt

Initial instructions given to an AI model that define its behavior, role and response parameters. System prompts help maintain consistent and appropriate AI responses.

Temperature

A parameter controlling the randomness in AI model outputs. Lower values produce more focused and deterministic responses, while higher values increase creativity and variability.

Token

The basic unit of text processing in AI models, representing parts of words, characters or symbols. Models process text by breaking it into tokens for analysis and generation.

Top-K

A parameter that limits token selection during text generation to the K most likely next tokens, helping control output quality and relevance.

Top-P

Also known as nucleus sampling, a parameter that selects from the smallest set of tokens whose cumulative probability exceeds P, providing dynamic control over text generation diversity.

Vector database

A specialized database designed to store and efficiently query high-dimensional vectors that represent data in AI applications, enabling similarity searches and semantic operations.

Vector store

A specialized storage system optimized for managing and querying vector embeddings, essential for semantic search and RAG implementations in AI applications.

A Cost estimation

The cost estimation is calculated for every chat interaction between the Open WebUI user and the AI model with the following formula:

```
cost = (prompt_tokens / 1000) * model_prompt_multiplier + (completion_tokens / 1000) *
 model_completion_multiplier
```

Each multiplier comes from the `pricing.json` file, which is structured in a way that each model has a multiplier for the prompt tokens and completion tokens.

If the cost estimation deviates from the actual costs of your environment, you can calculate new multipliers and update your `pricing.json`.

B Instrument applications with OpenLIT SDK

Tip

For the full list of configuration options for OpenLIT SDKs, check the upstream documentation (https://docs.openlit.io/latest/sdk-configuration).

PROCEDURE B1: INSTRUMENTING USING PYTHON OPENLIT SDK

1. Open terminal and add a OpenLIT dependency.

```
> pip install openlit
```

2. Import OpenLIT and initialize it in your code, usually in the main entrypoint. Remember to adjust the OpenTelemetry Protocol (OTLP) endpoint.

```
import openlit

openlit.init(otlp_endpoint="http://otel-
collector.observability.svc.cluster.local:4318")
```

3. With this code in place, you will start receiving telemetry data from the libraries currently supported by OpenLIT. You can test it with Ollama by following this example:

```
import ollama
import openlit

openlit.init()

response = ollama.chat(model='gemma:2b', messages=[
  {
    'role': 'user',
    'content': 'Why is the sky blue?',
  },
])
```

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