



# Overview

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## SUSE OpenStack Cloud Monitoring



## Overview

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# About this Manual

This manual is an introduction to SUSE OpenStack Cloud Monitoring.

The manual is structured as follows:

Chapter	Description
<i>Chapter 1, What is SUSE OpenStack Cloud Monitoring?</i>	Introduces SUSE OpenStack Cloud Monitoring, its key features, components, and users.
<i>Chapter 2, Monitoring</i>	Describes the basic concepts and features of monitoring.
<i>Chapter 3, Log Management</i>	Describes the basic concepts and features of log management.
<i>Appendix A, Glossary</i>	Defines the central terms relevant for SUSE OpenStack Cloud Monitoring.

## 1 Intended Audience

This manual is intended for anyone interested in SUSE OpenStack Cloud Monitoring. It offers an introduction for readers who are not familiar with SUSE OpenStack Cloud Monitoring and for those who have already started using it. The manual does not require any special knowledge.

## 2 Notational Conventions

This manual uses the following notational conventions:

<i>Add</i>	Names of graphical user interface elements.
<u>init</u>	System names, for example command names and text that is entered from the keyboard.
<u>&lt;variable&gt;</u>	Variables for which values must be entered.
<u>[option]</u>	Optional items, for example optional command parameters.
<u>one   two</u>	Alternative entries.

## 3 Abbreviations

This manual uses the following abbreviations:

IaaS. Infrastructure as a Service

ICMP. Internet Control Message Protocol

OS. Operating System

OSS. Open Source Software

PaaS. Platform as a Service

SaaS. Software as a Service

## 4 Available Documentation

The following documentation on SUSE OpenStack Cloud Monitoring is available:

- *Overview*: A manual introducing SUSE OpenStack Cloud Monitoring. It is written for everybody interested in SUSE OpenStack Cloud Monitoring.
- *OpenStack Operator's Guide*: A manual for OpenStack operators describing how to prepare their OpenStack platform for SUSE OpenStack Cloud Monitoring. The manual also describes how the operators use SUSE OpenStack Cloud Monitoring for monitoring their OpenStack services.
- *Monitoring Service Operator's Guide*: A manual for system operators describing how to install, operate, and maintain SUSE OpenStack Cloud Monitoring in single mode. The manual also describes how the operators use SUSE OpenStack Cloud Monitoring for monitoring their environment.

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# 1 What is SUSE OpenStack Cloud Monitoring?

As more and more applications are deployed on cloud systems and cloud systems are growing in complexity, managing the cloud infrastructure is becoming increasingly difficult. SUSE OpenStack Cloud Monitoring helps mastering this challenge by providing a sophisticated Monitoring as a Service solution that is operated on top of OpenStack-based cloud computing platforms.

SUSE OpenStack Cloud Monitoring allows enterprises to manage, track, and optimize their cloud infrastructure and the services they provide to end users. It offers a suite of monitoring and analytics tools aimed at improving the health and performance of cloud systems.

SUSE OpenStack Cloud Monitoring assembles and presents metrics and log data in one convenient access point. It offers an integrated view of cloud resources, based on its seamless integration with OpenStack. While being flexible and scalable to instantly reflect changes in the cloud infrastructure of an enterprise, SUSE OpenStack Cloud Monitoring provides the ways and means required to ensure multi-tenancy and data security. The high availability architecture of SUSE OpenStack Cloud Monitoring ensures an optimum level of operational performance eliminating the risk of component failures and providing for reliable crossover.

## 1.1 Key Features

SUSE OpenStack Cloud Monitoring is an out-of-the-box solution for monitoring OpenStack-based cloud environments. It is provided as a cloud service to users. SUSE OpenStack Cloud Monitoring meets different challenges, ranging from small-scale deployments to high-availability deployments and deployments with high levels of scalability.

The core of SUSE OpenStack Cloud Monitoring is Monasca, an open source Monitoring as a Service solution that integrates with OpenStack. The key features of SUSE OpenStack Cloud Monitoring form an integral part of the Monasca project. SUSE OpenStack Cloud Monitoring extends the source code base of the project through active contributions.

Compared to the Monasca community edition, SUSE OpenStack Cloud Monitoring provides the following added value:

- Packaging as a commercial enterprise solution
- Enterprise-level support

The key features of SUSE OpenStack Cloud Monitoring address public as well as private cloud service providers. They include:

- Monitoring
- Log management
- Integration with OpenStack

## Monitoring

SUSE OpenStack Cloud Monitoring is a highly scalable and fault tolerant monitoring solution for OpenStack-based cloud infrastructures.

The system operator of the cloud infrastructure and the service providers do not have to care for system monitoring software any longer. They use SUSE OpenStack Cloud Monitoring to check whether their services and servers are working appropriately.

SUSE OpenStack Cloud Monitoring provides comprehensive and configurable metrics with reasonable defaults for monitoring the status, capacity, throughput, and latency of cloud systems. SUSE OpenStack Cloud Monitoring users can set their own warnings and critical thresholds and can combine multiple warnings and thresholds to support the processing of complex events. Combined with a notification system, these alerting features enable them to quickly analyze and resolve problems in the cloud infrastructure.

For details, refer to [Chapter 2, Monitoring](#).

## Log Management

With the increasing complexity of cloud infrastructures, it is becoming more and more difficult and time-consuming for the system operator to gather, store, and query the large amounts of log data manually. To cope with these problems, SUSE OpenStack Cloud Monitoring provides centralized log management features.

SUSE OpenStack Cloud Monitoring collects log data from all services and servers the cloud infrastructure is composed of. The log data from a large number of sources can be accessed from a single dashboard. Integrated search, filter, and graphics options enable system operators to isolate problems and narrow down potential root causes. SUSE OpenStack Cloud Monitoring thus provides valuable insights into the log data, even with large amounts of data resulting from highly complex environments.



Based on SUSE OpenStack Cloud Monitoring's alerting features and notification system, users can also configure warnings and critical thresholds for log data. If the number of critical log entries reaches a defined threshold, the users receive a warning and can instantly analyze their logs and start troubleshooting.

For details, refer to [Chapter 3, Log Management](#).

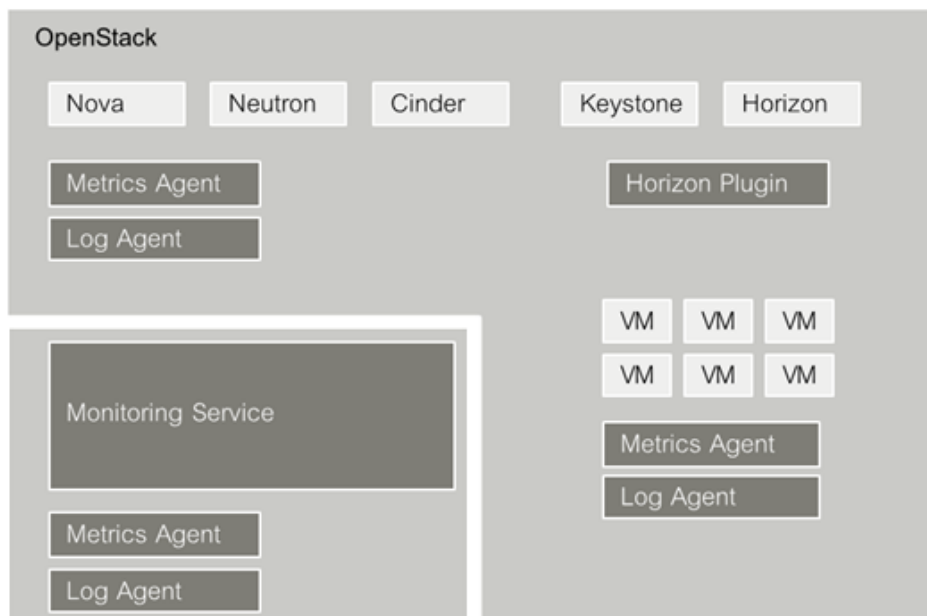
## Integration with OpenStack

SUSE OpenStack Cloud Monitoring is integrated with OpenStack core services. These include:

- OpenStack Horizon dashboard for visualizing monitoring metrics and log data
- OpenStack user management
- OpenStack security and access control

## 1.2 Components

The following illustration provides an overview of the main components of SUSE OpenStack Cloud Monitoring:



## OpenStack

SUSE OpenStack Cloud Monitoring relies on OpenStack as technology for building cloud computing platforms for public and private clouds. OpenStack consists of a series of interrelated projects delivering various components for a cloud infrastructure solution and allowing for the deployment and management of Infrastructure as a Service (IaaS) platforms.

For details on OpenStack, refer to the [OpenStack documentation \(http://docs.openstack.org/\)](http://docs.openstack.org/).

## Monitoring Service

The Monitoring Service is the central SUSE OpenStack Cloud Monitoring component. It is responsible for receiving, persisting, and processing metrics and log data, as well as providing the data to the users.

The Monitoring Service relies on Monasca. It uses Monasca for high-speed metrics querying and integrates the streaming alarm engine and the notification engine of Monasca. For details, refer to the [Monasca Wiki \(https://wiki.openstack.org/wiki/Monasca\)](https://wiki.openstack.org/wiki/Monasca).

## Horizon Plugin

SUSE OpenStack Cloud Monitoring comes with a plugin for the OpenStack Horizon dashboard. The Horizon plugin extends the main dashboard in OpenStack with a view for monitoring. This enables SUSE OpenStack Cloud Monitoring users to access the monitoring and log management functions from a central Web-based graphical user interface. Metrics and log data are visualized on a comfortable and easy-to-use dashboard.

For details, refer to the [OpenStack Horizon documentation \(http://docs.openstack.org/developer/horizon/\)](http://docs.openstack.org/developer/horizon/).

## Metrics Agent

A Metrics Agent is required for retrieving metrics data from the host on which it runs and sending the metrics data to the Monitoring Service. The agent supports metrics from a variety of sources as well as a number of built-in system and service checks.

A Metrics Agent can be installed on each virtual or physical server to be monitored.

The agent functionality is fully integrated into the source code base of the Monasca project. For details, refer to the [Monasca Wiki \(https://wiki.openstack.org/wiki/Monasca\)](https://wiki.openstack.org/wiki/Monasca).

## Log Agent

A Log Agent is needed for collecting log data from the host on which it runs and forwarding the log data to the Monitoring Service for further processing. It can be installed on each virtual or physical server from which log data is to be retrieved.

The agent functionality is fully integrated into the source code base of the Monasca project. For details, refer to the [Monasca Wiki \(https://wiki.openstack.org/wiki/Monasca\)](https://wiki.openstack.org/wiki/Monasca).

## 1.3 Users and Roles

SUSE OpenStack Cloud Monitoring users can be grouped by their role. The following user roles are distinguished:

- An **application operator** acts as a service provider in the OpenStack environment. He books virtual machines in OpenStack to provide services to end users or to host services that he needs for his own development activities. SUSE OpenStack Cloud Monitoring helps application operators to ensure the quality of their services in the cloud.
- The **OpenStack operator** is a special application operator. He is responsible for administrating and maintaining the underlying OpenStack platform and ensures the availability and quality of the OpenStack services (e.g. Heat, Nova, Cinder, Swift, Glance, or Keystone). For details on the tasks of the OpenStack operator, refer to the *OpenStack Operator's Guide*.
- The **Monitoring Service operator** is responsible for administrating and maintaining SUSE OpenStack Cloud Monitoring. He provides the cloud monitoring services to the other users and ensures the quality of the Monitoring Service. For details on the tasks of the Monitoring Service operator, refer to the *Monitoring Service Operator's Guide*.

The tasks of the Monitoring Service operator and the OpenStack Operator can jointly be performed by one system operator. In this case, refer to the *Monitoring Service Operator's Guide* and the *OpenStack Operator's Guide*.

## User Management

SUSE OpenStack Cloud Monitoring is fully integrated with Keystone, the identity service which serves as the common authentication and authorization system in OpenStack.

The SUSE OpenStack Cloud Monitoring integration with Keystone requires any SUSE OpenStack Cloud Monitoring user to be registered as an OpenStack user. All authentication and authorization in SUSE OpenStack Cloud Monitoring is done through Keystone. If a user requests monitoring data, for example, SUSE OpenStack Cloud Monitoring verifies that the user is a valid user in OpenStack and allowed to access the requested metrics.

SUSE OpenStack Cloud Monitoring users are created and administrated in OpenStack:

- Each user assumes a role in OpenStack to perform a specific set of operations. The OpenStack role specifies a set of rights and privileges.
- Each user is assigned to at least one project in OpenStack. A project is an organizational unit that defines a set of resources which can be accessed by the assigned users. Application operators in SUSE OpenStack Cloud Monitoring can monitor the set of resources that is defined for the projects to which they are assigned.

For details on user management, refer to the [OpenStack documentation \(http://docs.openstack.org/\)](http://docs.openstack.org/).

## 2 Monitoring

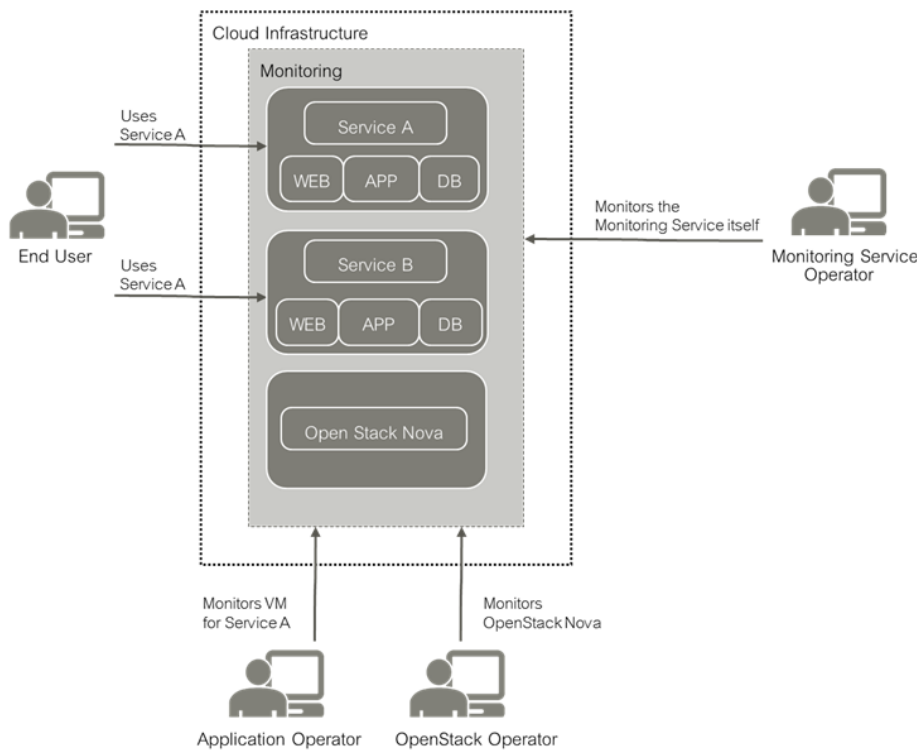
The monitoring solution of SUSE OpenStack Cloud Monitoring addresses the requirements of large-scale public and private clouds where high numbers of physical and virtual servers need to be monitored and huge amounts of monitoring data need to be managed. SUSE OpenStack Cloud Monitoring consolidates metrics, alarms, and notifications, as well as health and status information from multiple systems, thus reducing the complexity and allowing for a higher level analysis of the monitoring data.

SUSE OpenStack Cloud Monitoring covers all aspects of a Monitoring as a Service solution:

- Storage of monitoring data in a resilient way.
- Multi-tenancy architecture for submitting and streaming metrics. The architecture ensures the secure isolation of metrics data.
- Horizontal and vertical scalability to support constantly evolving cloud infrastructures. When physical and virtual servers are scaled up or down to varying loads, the monitoring solution can be adapted accordingly.

## Basic Usage Scenario

The basic usage scenario of setting up and using the monitoring features of SUSE OpenStack Cloud Monitoring looks as follows:



The **Monitoring Service operator** is responsible for providing the monitoring features to the application operators and the OpenStack operator. This enables the application operators and the OpenStack operator to focus on operation and ensure the quality of their services without having to carry out the tedious tasks implied by setting up and administrating their own system monitoring software. The Monitoring Service operator uses the features himself for monitoring the operation of SUSE OpenStack Cloud Monitoring.

**Application operators** monitor the virtual machines on which they provide services to **end users** or services they need for their development activities. They ensure that the physical and virtual servers on which their services are provided are up and running as required.

The **OpenStack operator** monitors physical and virtual servers, hypervisors, and services of the underlying platform. In addition, he is responsible for the middleware components, for example, the database services.

## Metrics

A Metrics Agent can be installed and configured on each physical and virtual server where cloud resources are to be monitored. The agent is responsible for querying metrics and sending the data to the Monitoring Service for further processing.

Metrics are self-describing data structures that are uniquely identified by a name and a set of dimensions. Each dimension consists of a key/value pair that allows for a flexible and concise description of the data to be monitored, for example, region, availability zone, service tier, or resource ID.

The Metrics Agent supports various types of metrics including the following:

- System metrics, for example, CPU usage, consumed disk space, or network traffic.
- Host alive checks. The agent can perform active checks on a host to determine whether it is alive using ping (ICMP) or SSH.
- Process checks. The agent can check and monitor a process, for example, the number of instances, memory size, or number of threads.
- HTTP endpoint checks. The agent can perform up/down checks on HTTP endpoints by sending an HTTP request and reporting success or failure to the Monitoring Service.
- Service checks. The agent can check middleware services, for example, MySQL, Kafka, or RabbitMQ.
- OpenStack services. The agent can perform specific checks on each process that is part of an OpenStack service.
- Log metrics. The agent can check and monitor the number of critical log entries in the log data retrieved from the cloud resources.

## Data Visualization and Analysis

All SUSE OpenStack Cloud Monitoring user groups work with a graphical user interface that is seamlessly integrated into their cloud infrastructure. Based on OpenStack Horizon, the user interface enables access to all monitoring functionality and the resulting large-scale monitoring data.

A comfortable dashboard visualizes the health and status of the cloud resources. It allows SUSE OpenStack Cloud Monitoring users to experiment with many ways of analyzing the performance of their cloud resources in real-time. They cannot only view but also share and explore visualizations of their monitoring data.

## Alarms and Notifications

SUSE OpenStack Cloud Monitoring supports GUI-based alarm and notification management. Template-based alarm definitions allow for monitoring a dynamically changing set of resources without the need for reconfiguration. While the number of underlying virtual machines is changing, for example, this ensures the efficient monitoring of scalable cloud services. Alarm definitions allow you to specify expressions that are evaluated based on the metrics data that is received. Alarm definitions can be combined to form compound alarms. Compound alarms allow you to track and process even more complex events. Notifications can be configured in order to inform SUSE OpenStack Cloud Monitoring users when an alarm is triggered.



## 3 Log Management

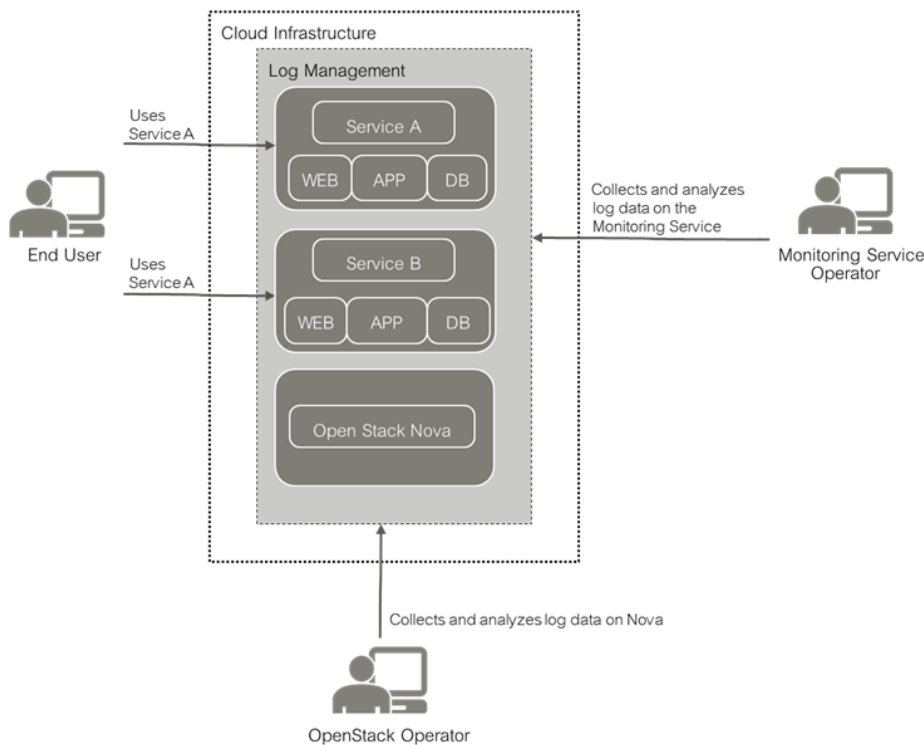
Services and servers in a cloud infrastructure generate huge amounts of log data, from simply announcing that everything is healthy to detailed information on events or processes. The logs are distributed over many physical and virtual servers. SUSE OpenStack Cloud Monitoring collects, stores, and queries these logs and makes them accessible to SUSE OpenStack Cloud Monitoring users in one central place.

SUSE OpenStack Cloud Monitoring covers all aspects of an enterprise-class log management solution:

- Central management of log data from medium and large-size OpenStack deployments.
- Buffered exchange of log data to provide high data throughput.
- Logical isolation of log data through multi-tenancy.
- Scalable architecture capable of mastering the data load from a large number of nodes in OpenStack environments. The log management solution can be horizontally and vertically adapted to constantly changing data loads.

## Basic Usage Scenario

The basic usage scenario of setting up and using the log management features of SUSE OpenStack Cloud Monitoring looks as follows:



The **Monitoring Service operator** is responsible for providing the log management features to the OpenStack operator. He uses the features himself for retrieving log data on SUSE OpenStack Cloud Monitoring.

The **OpenStack operator** uses the log management features for retrieving log data on the OpenStack services and the middleware components that make up the underlying OpenStack platform.

## Data Collection

A Log Agent can be installed and configured on each physical and virtual server where log data is to be retrieved. The agent is responsible for collecting the log data from the cloud resources and sending it to the Monitoring Service for further processing.

SUSE OpenStack Cloud Monitoring stores the log data in a central database. The central database forms the basis for visualizing the log data for the SUSE OpenStack Cloud Monitoring users.

## Data Visualization and Analysis

SUSE OpenStack Cloud Monitoring supports advanced data visualization and analysis of the log data in a variety of charts, tables, or maps. Visualizations can easily be combined in dynamic dashboards that display changes to search queries in real time.

Based on OpenStack Horizon, the customizable dashboards are seamlessly integrated into the cloud infrastructure. They enable user access to all log management functionality.

## Alarms and Notifications

GUI-based alarm and notification management is also supported for log data. SUSE OpenStack Cloud Monitoring supports a template mechanism for alarms on log data that is not limited to a single cloud resource but can analyze a scalable set of resources.

Alarms and notifications can be configured to inform system operators when the number of critical log entries exceeds a defined threshold. Compound alarms can be used to analyze more complex log events. This automation of log handling guarantees that system operators identify problems in their infrastructure early and find the root cause of these problems quickly.

# A Glossary

## Application Operator

A person with limited access to cloud resources in OpenStack. An application operator provides services to end users or hosts services for his own development activities.

## Dimension

A key/value pair that allows for a flexible and concise description of the data to be monitored, for example, region, availability zone, service tier, or resource ID. Each dimension describes a specific characteristic of the metrics to be monitored.

In SUSE OpenStack Cloud Monitoring, metrics are uniquely identified by a name and a set of dimensions. Dimensions can serve as a filter for the monitoring data.

## Elasticsearch

An open source application that provides a highly scalable full-text search and analytics engine. SUSE OpenStack Cloud Monitoring uses Elasticsearch as the underlying technology for storing, searching, and analyzing large volumes of log data.

## Grafana

An open source application for visualizing large-scale measurement data. SUSE OpenStack Cloud Monitoring integrates with Grafana for visualizing the monitoring data.

## Infrastructure as a Service (IaaS)

The delivery of computer infrastructure (typically a platform virtualization environment) as a service.

## InfluxDB

An open source time-series database that supports high write loads and large data set storage. SUSE OpenStack Cloud Monitoring uses InfluxDB as the underlying technology for storing metrics and the alarm history.

## Kibana

An open source analytics and visualization platform designed to work with Elasticsearch. SUSE OpenStack Cloud Monitoring integrates with Kibana for visualizing the log data.

## Logstash

An open source application that provides a data collection engine with pipelining capabilities. SUSE OpenStack Cloud Monitoring integrates with Logstash for collecting, processing, and outputting logs.

## MariaDB

An open source relational database that provides an SQL-compliant interface for accessing data. SUSE OpenStack Cloud Monitoring uses MariaDB as the underlying technology for storing configuration information, alarm definitions, and notification methods.

## Metrics

Self-describing data structures that allow for a flexible and concise description of the data to be monitored. Metrics values represent the actual monitoring data that is collected and presented in SUSE OpenStack Cloud Monitoring.

## Monasca

An open source Monitoring as a Service solution that integrates with OpenStack. It forms the core of SUSE OpenStack Cloud Monitoring.

## Monitoring Service Operator

A person responsible for maintaining and administrating SUSE OpenStack Cloud Monitoring.

## OpenStack Operator

A person responsible for maintaining and administrating OpenStack, the underlying platform technology of SUSE OpenStack Cloud Monitoring.

## Platform as a Service (PaaS)

The delivery of a computing platform and solution stack as a service.

## Software as a Service (SaaS)

A model of software deployment where a provider licenses an application to customers for use as a service on demand.