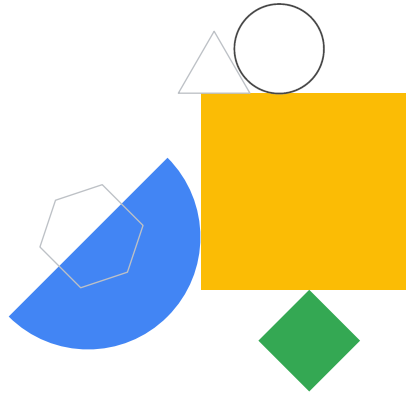


Configuring Google Cloud Services for Observability



In the next part of our operations suite discussion, let's take some time to examine the art of configuring Google Cloud services for observability.

Objectives

- 01 Use Ops Agent with Compute Engine.
- 02 Explain the benefits of using Google Cloud Managed Service for Prometheus.
- 03 Explain the usage of Prometheus Query Language (or PromQL) to query Cloud Monitoring metrics.
- 04 Explain custom metrics.



In this module, we're going to spend a little time learning how to use Ops Agent with Compute Engine. We will also explain the benefits of using Google Cloud Managed Service for Prometheus and usage of Prometheus Query Language (or PromQL) to query Cloud Monitoring metrics. We will then finally cover custom metrics.

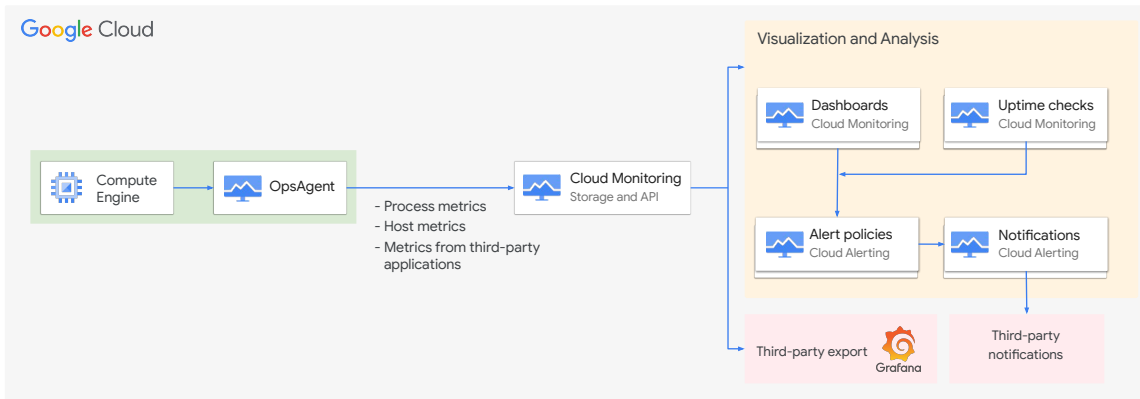
In this section, you explore



- ✓ [Introduction to Ops Agent](#)
- ✓ Non-VM resources
- ✓ Cloud operations for GKE
- ✓ Google Cloud Managed Service for Prometheus
- ✓ Exposing user-defined metrics

The first section of this module focuses on how to collect metrics from applications deployed on a Google Cloud Compute Engine.

What is Ops Agent?



Monitoring data can originate from a number of different sources. With Google Compute Engine instances, because the VMs are running on Google hardware, Cloud Monitoring can access some instance metrics without the agent, including CPU utilization, some disk traffic metrics, network traffic, and uptime information, but that information can be augmented by installing agents into the VM operating system.

Many mission critical services use compute infrastructure directly and run on Google Compute Engine instances. How can we improve observability for those workloads?

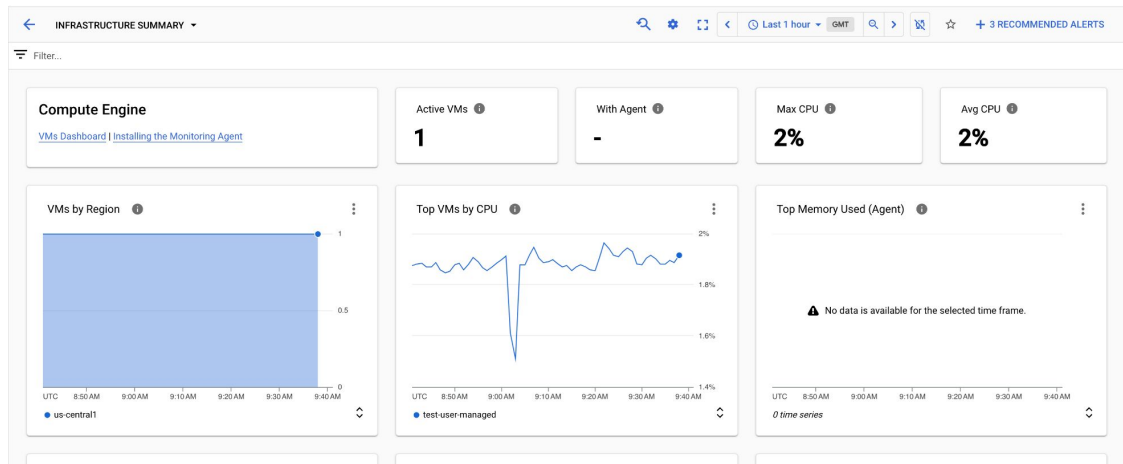
The Ops Agent is the primary agent for collecting telemetry data from your Compute Engine instances. Combining logging and metrics into a single agent, the Ops Agent uses Fluent Bit for logs, which supports high-throughput logging, and the Open Telemetry Collector for metrics.

These agents are required for security reasons, the hypervisor cannot access some of the internal metrics inside a VM, for example, memory usage.

You can configure the Ops agent to monitor many third-party applications such as Apache, MySQL, Oracle database, SAP HANA, and NGINX. The Ops Agent collects metrics inside the VM, not at the hypervisor level. For a detailed list, refer to the [documentation](#).

The Ops Agent supports most major operating systems such as CentOS, Ubuntu and Windows.

Why Ops Agent?



We learned what Ops Agent is, let us next understand why we need Ops Agent. Here is an example of an infrastructure summary dashboard for a project with a few Compute Engine VMs in it.

Notice that we're not getting any data about how our instances are using memory. That's because the VM hypervisor only knows how much memory is allocated to each VM, not how much of the allocated memory the VM is actually using.

This is just one example of data that can only be gathered by a process running in the guest VM, such as an agent.

Why Ops Agent?

Monitors your VM instances without the need for any additional configuration after the installation.

Monitors third-party applications and supports both Windows and Linux guest OS.

Exposes many additional process metrics beyond memory and gives you better visibility to CPU, disk, and network performance.

Unifies gathering of metrics and logs into a single agent.

Ingests user-defined metrics in Prometheus format.

There are other benefits of running the Ops Agent inside the VM:

- It **monitors your VM instances** without the need for any additional configuration after the installation.
- It helps monitor 3rd party applications and also supports both Windows and Linux guest OS.
- It **exposes many additional process metrics** beyond memory, and gives you better visibility to CPU, disk, and network performance. It exposes metrics beyond the [80+ metrics](#) that Cloud Monitoring already supports for Compute Engine.
- The Ops Agent unifies gathering of metrics and logs into a single agent.
- And also ingests any user defined (Custom) metrics in Prometheus format.

Three ways to install Ops Agent

Using CLI

Install agent on a single VM by using command line.

Using agent policies

Install agents on a fleet of VMs by using agent policies.

Using automation tools

Install agents on a fleet of VMs by using automation tools.

You can install Ops Agent by using three different methods:

- Use the Google Cloud CLI or the Google Cloud console to install the agent on individual VMs.
- Use an Agent Policy that installs and manages agents on your fleet of VMs.
- Use automation tools, like Ansible, Chef, Puppet, and Terraform, to install and manage agents on your fleet of VMs.

We will cover the first two methods. For the automation process, refer to the [documentation](#).

Installing the Ops Agent by using the agent policy



Step 1

Install the beta component of the gcloud CLI.

Step 2

Enable the APIs.

Step 3

Create a policy.

Installing the Ops Agent is [well documented](#) on the Google site. In this slide we will cover the process using the agent policy.

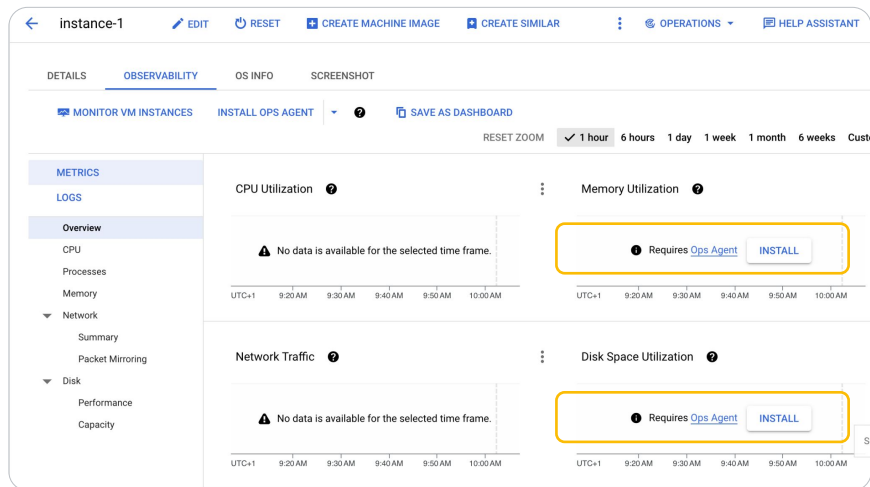
The first step is to install the beta component. Then enable the APIs and finally create a policy.

Installing the Ops Agent by using the agent policy

```
gcloud beta compute instances ops-agents policies create ops-agents-test-policy
--agent-rules="type=ops,enable-autoupgrade=false;type=metrics,enable-autoupgrade=
false" --description="A test policy." --os-types=short-name=centos,version=7
--instances=zones/us-central1-a/instances/test-instance
```

Here, you see an example to create a policy named ops-agents-test-policy. The policy targets a single CentOS 7 VM instance named test-instance. It also installs both Logging and Monitoring agents on that VM instance.

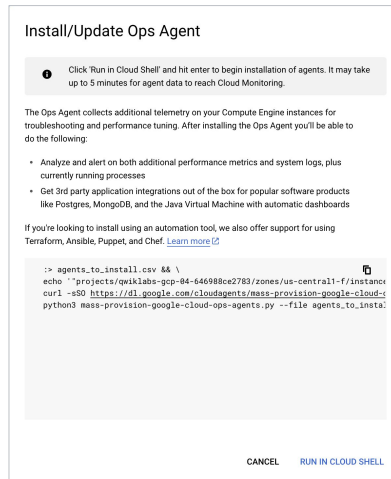
Installing the Ops Agent on individual VMs (1/2)



On this slide, we will cover the process for installing the Ops Agent on individual VMs.

1. Go to the VM instances page in the Google Cloud console.
2. Click the name of the VM that you want to install the agent on. The Details page opens.
3. Click the Observability tab. The Observability page opens. Click Install.

Installing the Ops Agent on individual VMs (2 of 2)



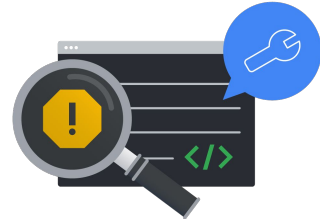
A new window opens. Click Run in Cloud Shell. Cloud Shell opens and pastes the installation command.

1. Press Enter on your keyboard to run the command.
2. Click Authorize to allow Cloud Shell to install the agent.

You can install a specific version of the agent and the steps also vary based on the operating system. For details refer to the [documentation](#).

Troubleshooting: Agent is not sending metrics to Cloud Monitoring

- ✓ Check the metrics module in syslog.
- ✓ If there are no logs, then the agent service is not running.
- ✓ If you see `permission_denied` errors when writing to the Monitoring API, enable the [Monitoring API](#) and the [Monitoring Metric Writer](#) role.



Normally, you won't have to perform this step, but if the agent is not sending logs to Cloud Logging:

1. First, check the metrics module in syslog
2. If there are no logs, then agent service is not running.
3. If you see a 403 permission errors when writing to the Monitoring API, enable the Logging API and Logs Writer role

Make sure to check the [Google documentation](#) if you have questions.

Integrations page

Monitoring | Integrations

Get started with Integrations
Integrations brings together metrics, logs, dashboards, and alerts to give you quick access to rich data for your application stack. Built on an open-source foundation, you can customize the data to fit your need.

Summary:
VMs with Ops Agent: 1
0 w/o Ops Agent. [View VMs](#)
Clusters with Managed Prometheus: 0
0 w/o Managed Prometheus. [View Clusters](#)

Integrations

Quick filters: All 49 | Filter: Filter integrations

- Deployment Platform**
 - Kubernetes Engine 31
 - Compute Engine 31
- Status**
 - Available 47
 - Detected 2
- Type**
 - 3rd party services 42
 - Google services 7

Active Directory Domain Services (AD DS)
Active Directory Domain Services stores information about objects on the network so that administrators and users can easily access this information. [VIEW DETAILS](#)

Aerospike
The Aerospike integration collects key namespace and system metrics, such as disk and memory usage, scans, and connections. The integration collects these metrics using the official client API provided by Aerospike. [VIEW DETAILS](#)

Anthos
Anthos is a modern application management platform that provides a consistent development and operations experience for cloud and on-premises environments. Use Anthos to modernize existing apps, and build new apps rapidly in hybrid and multi-cloud environments, while enabling consistency between on-premises and cloud environments. [VIEW DETAILS](#)

Apache ActiveMQ
The Apache ActiveMQ integration collects storage usage and message metrics. Storage metrics include memory and disk usage. Message metrics include number of waiting messages, average wait time, and expired messages. [VIEW DETAILS](#)

We learned how to install the Ops agent. Let us next look at how the data collected can be previewed as Dashboards. You can preview the dashboards and charts for telemetry data collected from the third-party applications such as Apache Web Server, MySQL, and Redis for deployments that run on Compute Engine and Google Kubernetes Engine. To view the logs, metrics and dashboards for data collected through Ops agent, navigate to **Monitoring**, and select the **Integrations** page.

Integrations brings together metrics, logs, dashboards, and alerts to give you quick access to rich data for your application stack. Built on an open-source foundation, you can customize the data to fit your needs.

In this section, you explore

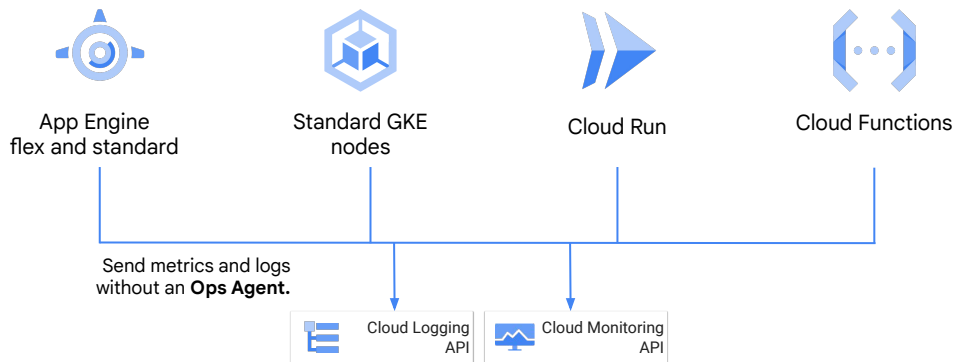


- ✓ Introduction to Ops Agent
- ✓ [Non-VM resources](#)
- ✓ Cloud operations for GKE
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- ✓ Exposing user-defined metrics

In addition to Google Cloud virtual machines, there are a lot of [Google Cloud resources that support some type of monitoring](#).

Let's look at a few of these.

Services with built-in logging and monitoring support



When monitoring any of the following non-virtual machine systems in Google Cloud, the Ops Agent is not required, and should not be installed:

- App Engine standard environment has monitoring built-in.
- App Engine flexible environment is built on top of GKE and has the Monitoring agent pre-installed and configured.
- With Standard Google Kubernetes Engine nodes (VMs), Cloud Monitoring and Cloud Logging is an option which is enabled by default.
- Cloud Run and Cloud Function provides integrated monitoring support.

App Engine



App Engine

Standard and flexible environments support Cloud Monitoring.

Standard and flexible environments support Cloud Logging.

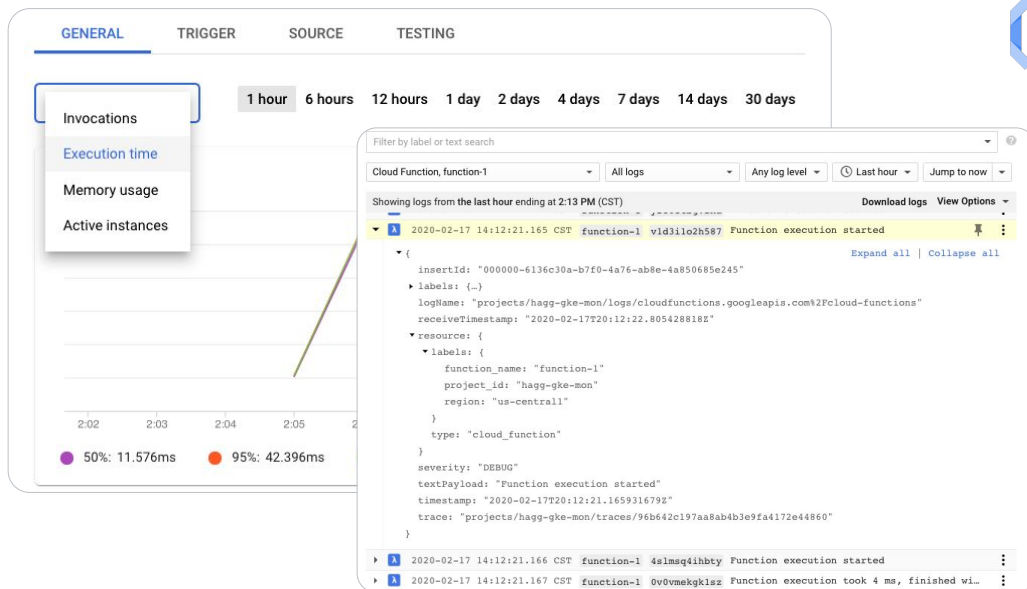
- Support writing to [stdout](#) or [stderr](#) from code.
- Support language-specific logging APIs (like Winston on Node.js).
- Let you view logs under GAE Application resource.

Google's App Engine standard and flexible environments both support monitoring. Make sure to check Google's documentation for the metric details.

They also both support logging by writing to standard out or standard error. For refined logging capabilities, review the language-specific logging APIs, such as Winston for Node.js.

Also, the logs are viewable under the GAE Application resources.

Monitoring and logging in Cloud Functions

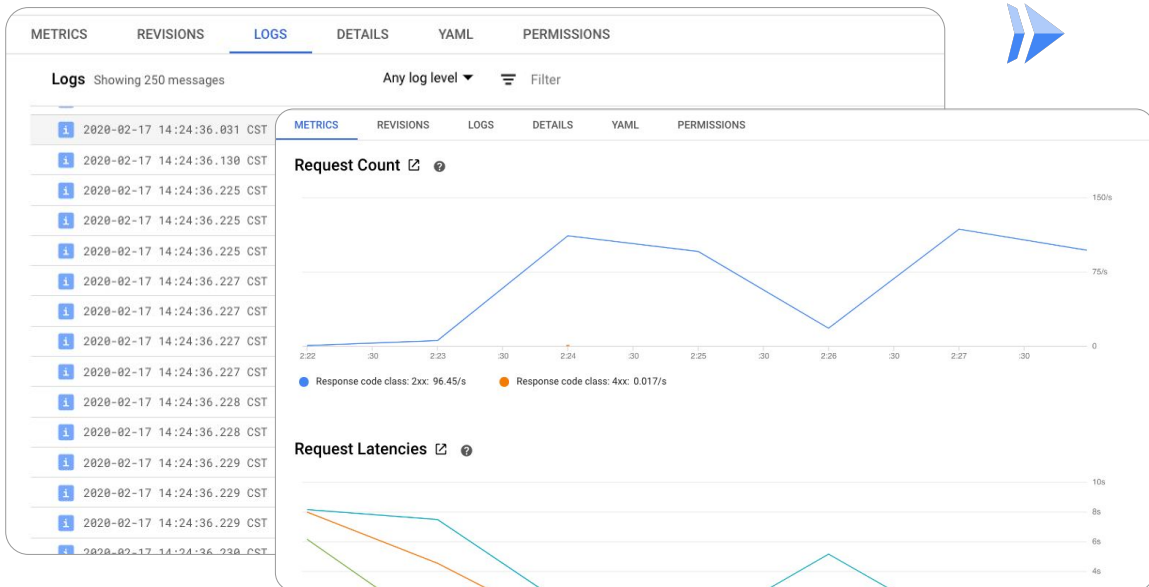


Cloud Functions offers lightweight, purpose-built functions, typically invoked in response to an event. For example, you might upload a PDF file to a Cloud Storage bucket, the new file triggers an event that invokes a Cloud Functions instance, which translates the PDF from English to Spanish.

Cloud Functions monitoring is automatic and can provide you with access to invocations, execution times, memory usage, and active instances in the Google Cloud console. These metrics are also available in Cloud Monitoring, where you can set up custom alerting and dashboards for these metrics.

Cloud Functions also support simple logging by default. Logs written to standard out or standard error will appear automatically in the Google Cloud console. The logging API can also be used by extending log support.

Monitoring and logging in Cloud Run



Cloud Run is Google's managed container service. It can run in a fully managed version, in which it acts as a sort of App Engine for containers, and it can also run on GKE, in which case it's a managed version of the open-source KNative. Cloud Run is automatically integrated with Cloud Monitoring **with no setup or configuration required**. This means that metrics of your Cloud Run services are captured automatically when they are running.

You can view metrics either in Cloud Monitoring or on the Cloud Run page in the console. Cloud Monitoring provides more charting and filtering options.

The resource type differs for fully managed Cloud Run and Cloud Run for Anthos:

- For fully managed Cloud Run, the monitoring resource name is "Cloud Run Revision" (*cloud_run_revision*).
- For Cloud Run for Anthos, the monitoring resource name is "Cloud Run on GKE Revision" (*knative_revision*).

Cloud Run has two types of logs which is automatically sent to Cloud Logging, request logs and container logs.

- Request logs are logs of requests sent to Cloud Run services.
- And Container logs are logs emitted from the container instances from your own code, written to standard out or standard error streams, or using the logging API.

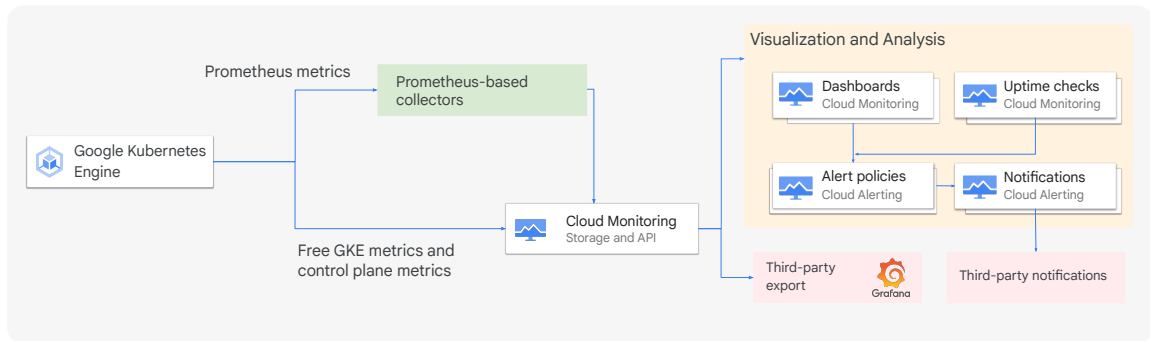
In this section, you explore



- ✓ Introduction to Ops Agent
- ✓ Non-VM resources
- ✓ [Cloud operations for GKE](#)
- ✓ Google Cloud Managed Service for Prometheus
- ✓ Exposing user-defined metrics

We looked at monitoring for Compute Engine and other compute options. Now lets look at monitoring options explicitly available for GKE.

Cloud Monitoring for Google Kubernetes Engine



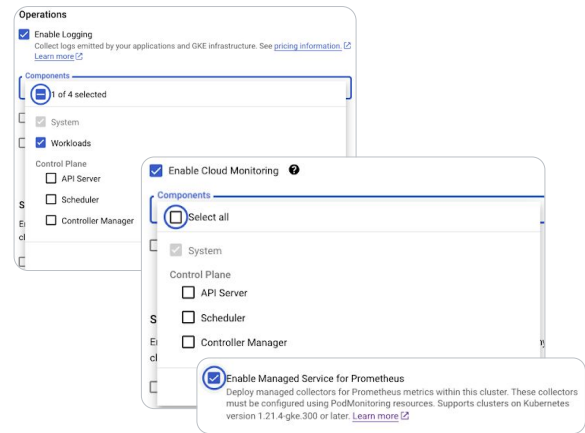
Google Kubernetes Engine (GKE) includes integration with Cloud Logging and Cloud Monitoring and Google Cloud Managed Service for Prometheus. When you create a GKE cluster that runs on Google Cloud, Cloud Logging and Cloud Monitoring are enabled by default and provide observability specifically tailored for Kubernetes.

You also enable Google Cloud Managed service for Prometheus to collect Prometheus metrics and monitor workloads running on GKE and non-GKE compute workloads. We will explore this in detail in the next section.

Configuring Cloud Operations for GKE clusters

For new cluster

- 1 Cloud Monitoring and Cloud Logging is enabled by default.
- 2 Under **Components**, select the components from which you want to collect logs and metrics.
- 3 Optionally, you can enable Managed Service for Prometheus.



You can configure Cloud Logging and Cloud Monitoring for GKE clusters either during creation or after creation.

During cluster creation, navigate to Standard mode under Operations.

- For new cluster, Cloud Logging and Cloud Monitoring are enabled by default.
- You can change the components for which the metrics and logs are collected under the Components section.
- Enable managed collection by selecting Managed Service for Prometheus.

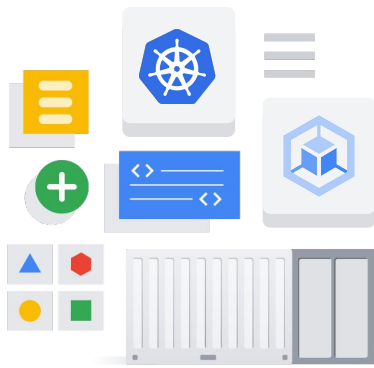
In this section, you explore



- ✓ Introduction to Ops Agent
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- ✓ [Google Cloud Managed Service for Prometheus](#)
- ✓ Exposing user-defined metrics

Next, let's look at what Google Cloud Managed Service for Prometheus is all about and how it helps collect metrics.

Google Cloud Managed Service for Prometheus



Collects, stores, and analyzes Prometheus metrics.

Collects metrics from both GKE and Compute Engine environments.

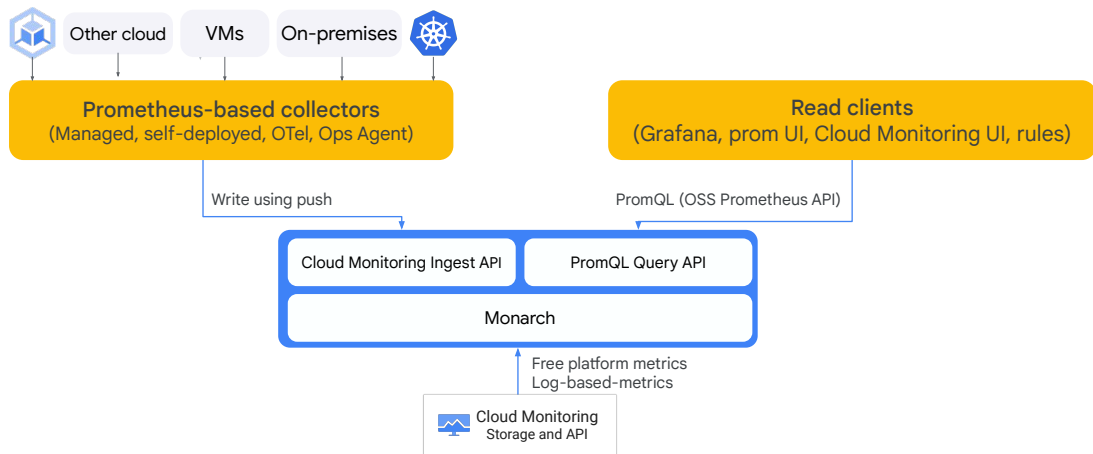
Helps make GKE easier to use with maintained metric collectors.

Google Cloud Managed Service for Prometheus is a fully managed service that makes it easy to collect, store, and analyze Prometheus metrics.

Managed Service for Prometheus lets users collect metrics from both Kubernetes and VM environments at incredible scale without operational overhead by leveraging Monarch, Google's own globally available and scalable time series database.

For those getting started with Prometheus for the first time, Managed Service for Prometheus helps make Google Kubernetes Engine even easier to use with maintained metric collectors.

The Managed Service for Prometheus ecosystem



It's built on top of Monarch, the same globally-scalable data store as Cloud Monitoring.

Monarch is an end-to-end monitoring system with high-level data modeling, data collection, querying, alerting and data management features. You can replace your existing Prometheus deployment to collect cluster and workload metrics and then query the data across multiple clusters by using PromQL.

Managed Service for Prometheus splits responsibilities for data collection, query evaluation, rule and alert evaluation, and data storage into multiple components.

- Monarch handles the query evaluation and data storage. Monarch can execute queries and union results across all Google Cloud regions. It also supports two years of metric retention by default at no additional cost.
- When it comes to data collection, there are multiple choices available for data collection, which includes self-deployed, Ops Agent, OpenTelemetry, and managed collection. These collectors are responsible for scraping local exporters and forwarding that data to Monarch.
- Rule evaluation on the other hand is handled by locally run and configured rule evaluators. Refer to the documentation for latest information on the storage granularity and retention timeline. Another important Query Validator activity of Prometheus monitoring is making queries.

Any UI that can call the Prometheus query API is also supported in the managed

service for Prometheus. That includes Grafana and Cloud Monitoring. Your existing dashboards in Grafana continue to work just as before and you can keep using any PromQL found in popular open source repositories and forums.

PromQL can be used to query:

- 1,500 free metrics in Cloud Monitoring
- Free Kubernetes metrics, custom metrics, and log-based metrics

Data collection options

Managed data collection	Self-deployed collection	The Ops Agent	OpenTelemetry
<ul style="list-style-type: none">Managed data collection in Kubernetes environments	<ul style="list-style-type: none">Prometheus installation managed by the user	<ul style="list-style-type: none">Prometheus metrics scraped and sent by the Ops Agent	<ul style="list-style-type: none">Deployed in any compute or Kubernetes environment

For collecting the data Prometheus will monitor, you can use the service in one of four ways:

- Managed data collection
- Self-deployed data collection
- Using Ops Agent
- OpenTelemetry collection

Managed Service for Prometheus offers an operator for managed data collection in Kubernetes environments. We recommend that you use managed collection; because it eliminates the complexity of deploying, scaling, sharding, configuring, and maintaining Prometheus servers. Managed collection is supported for both GKE and non-GKE Kubernetes environments.

With self-deployed data collection, you manage your Prometheus installation as you always have. The only difference from upstream Prometheus is that you run the Managed Service for Prometheus drop-in replacement binary instead of the upstream Prometheus binary.

You can configure the Ops Agent on any Compute Engine instance to scrape and send Prometheus metrics to the global data store. Using an agent simplifies VM discovery and eliminates the need to install, deploy, or configure Prometheus in VM environments.

OpenTelemetry Collector uses a single collector to collect metrics from any environment and then sends them to any compatible backend. It is deployed either manually or by using Terraform in any compute or Kubernetes environment.

Data collection options

Managed data collection	Self-deployed collection	The Ops Agent	OpenTelemetry
<ul style="list-style-type: none">• Managed data collection in Kubernetes environments• Recommended approach for all Kubernetes environments	<ul style="list-style-type: none">• Prometheus installation managed by the user• Suitable for quick integrations into complex environment	<ul style="list-style-type: none">• Prometheus metrics scraped and sent by the Ops Agent• Recommended for sending Prometheus metric data	<ul style="list-style-type: none">• Deployed in any compute or Kubernetes environment• Recommended for cross-signal workflows such as exemplars

When you choose between collection options, consider the following aspects:

- Managed collection is a recommended approach for all Kubernetes environments and is especially suitable for more hands-off fully managed experience.
- Self-deployed collection is suitable for quick integration into more complex environment.
- Using the Ops Agent is the easiest way and is recommended to collect and send Prometheus metric data originating from Compute Engine environments, including both Linux and Windows distros.
- The OpenTelemetry Collector is best to support cross-signal workflows such as exemplars.

Rule and alert evaluation

Managed Service for Prometheus provides a standalone rule evaluator for evaluating, recording, and alerting rules.

There's no need to co-locate the data.

Migration to Managed Service for Prometheus is made easier.

Managed Service for Prometheus provides a standalone rule evaluator for evaluating, recording, and alerting rules against all Monarch data accessible in a metrics scope.

- No need to co-locate the data in a single Prometheus server or on a single Google Cloud project.
- The rule evaluator uses the standard Prometheus rule files format, which makes migration to Managed Service for Prometheus easier.

Setting up managed collection for GKE clusters

Click **ENABLE SELECTED.**

Select category

- All
- Managed Collection
- Self-Deployed
- Not Detected

Filter Enter property name or value

<input type="checkbox"/>	Name ↑	Managed Prometheus Status	Ingestion Rate	Location	Mode
<input type="checkbox"/>	alisa-testing	Not Detected	-	us-central1-c	Standard
<input type="checkbox"/>	gcloud-with-exporters	Managed Collection	459.57 samples/s	us-central1-c	Standard
<input type="checkbox"/>	gke-gmp-system	Not Detected	-	us-central1	Autopilot
<input type="checkbox"/>	hpa-test-2	Managed Collection	1.55 samples/s	us-central1-c	Standard
<input type="checkbox"/>	hpa-test-3	Managed Collection	-	us-central1-c	Standard
<input type="checkbox"/>	intentionally-broken-cluster	Self-Deployed	11.18 samples/s	us-central1-c	Standard
<input type="checkbox"/>	kube-prom-no-gmp	Not Detected	-	us-central1-c	Standard
<input type="checkbox"/>	lees-gmp-cluster	Self-Deployed	11.32 samples/s	us-central1-c	Standard
<input type="checkbox"/>	managed-prom-gcloud	Managed Collection	-	us-central1-c	Standard
<input type="checkbox"/>	masterclass-gmp	Self-Deployed	12.48 samples/s	us-east1-b	Standard
<input type="checkbox"/>	self-deployed-gmp	Self-Deployed	1,564.63 samples/s	us-central1-c	Standard
<input type="checkbox"/>	thd-test	Not Detected	-	us-central1-c	Standard

Rows per page: 200 1 - 12 of 12

Select the GKE cluster you need.

You can enable a managed collection for your resource by selecting the GKE cluster you need and clicking **ENABLE SELECTED.**

Deploy a PodMonitoring resource to scrape metrics

```
apiVersion: monitoring.googleapis.com/v1
kind: PodMonitoring //PodMonitoring resource
metadata:
  name: prom-example
spec:
  selector:
    matchLabels:
      app: prom-example //find pods that matches the label and value
  endpoints:
    - port: metrics
      interval: 30s //scrape on a port every 30 seconds
```

```
kubectl -n NAMESPACE_NAME apply -f <pod-monitoring.yaml>
```

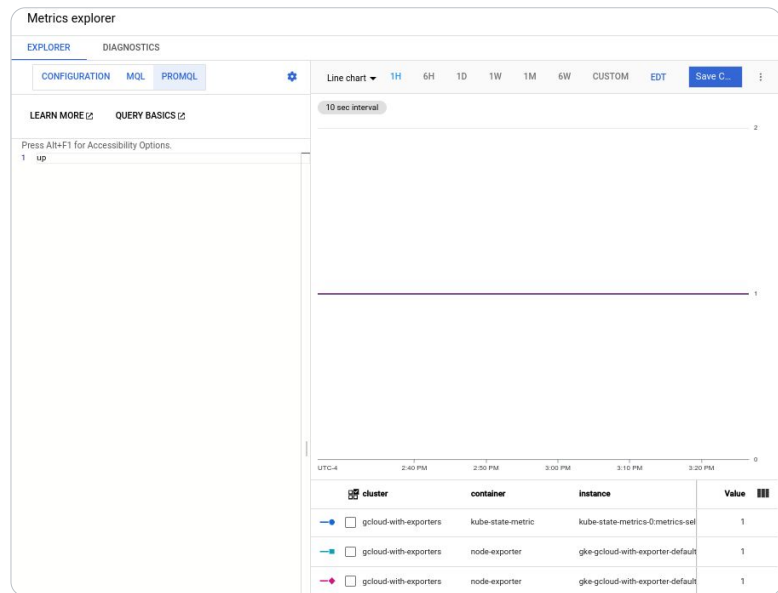
After enabling managed collection, the in-cluster components are running, but no metrics are generated yet. You must deploy a PodMonitoring resource that scrapes a metrics endpoint to see any data in the Query UI.

The manifest shown on slide defines a PodMonitoring resource, **prom-example**, in the namespace. The resource uses a Kubernetes label selector to find all the pods in the namespace that have the label `app` with the value **prom-example**. The matching pods are scraped on a port named `metrics`, every 30 seconds, on the `/metrics` HTTP path.

To apply this resource, run the command on screen.

To configure a horizontal collection that applies to a range of pods across all namespaces, use the ClusterPodMonitoring resource. The ClusterPodMonitoring resource provides the same interface as the PodMonitoring resource but does not limit discovered pods to a given namespace.

Using PromQL



When working with metric data, including data from Managed Service for Prometheus, in Cloud Monitoring, you can use the following query tools provided by Cloud Monitoring:

- PromQL
- Monitoring Query Language (MQL)
- Monitoring filters

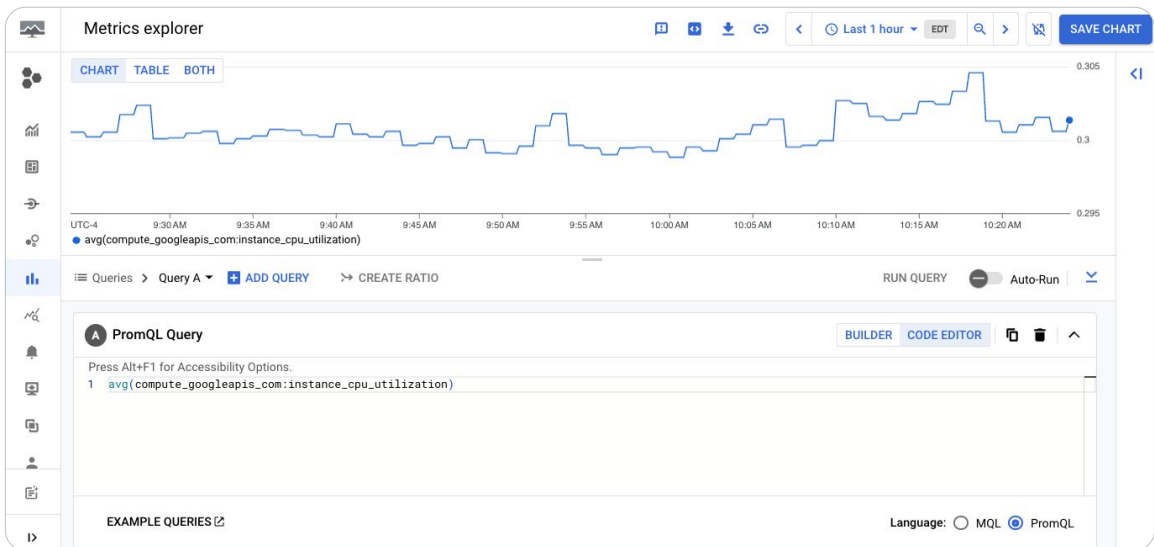
The simplest way to verify that your Prometheus data is being exported is to use the Cloud Monitoring Metrics Explorer page in the Google Cloud console:

In the Google Cloud console, Go to Monitoring.

1. In the Monitoring navigation pane, click Metrics Explorer.
2. Select the PromQL tab.
3. Enter the query. Here we are running a simple up query.
4. And simply click Run Query.

For MQL and filter options, refer to the documentation.

PromQL example



Here is another example of using PromQL. This PromQL query shows the average CPU utilization of the compute instances in your Google Cloud environment. The chart shows the visual representation of the utilization within a span of 1 hour.

In this section, you explore



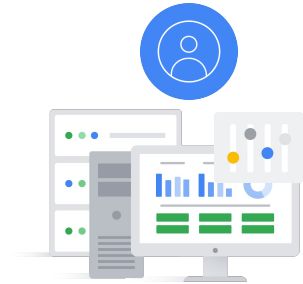
- ✓ Introduction to Ops Agent
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- ✓ Google Cloud Managed Service for Prometheus
- ✓ [Exposing user-defined metrics](#)

In addition to the more than 1,000 metrics that Google automatically collects, you can use code to create your own.

User-defined metrics

Any metrics not defined by Google Cloud are user-defined metrics.

They are used to extract metrics that are not captured by the built-in metrics.



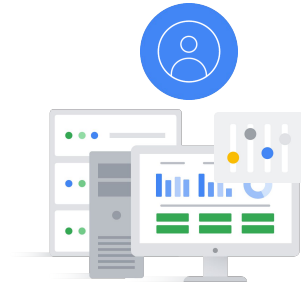
Application-specific metrics, also known as user or custom metrics, are metrics that you define and collect to capture information that the built-in Cloud Monitoring metrics cannot. You capture such metrics by using an API provided by a library to instrument your code, and then you send the metrics to Cloud Monitoring.

Custom metrics can be used in the same way as built-in metrics. That is, you can create charts and alerts for your custom metric data.

User-defined metrics

Two approaches:

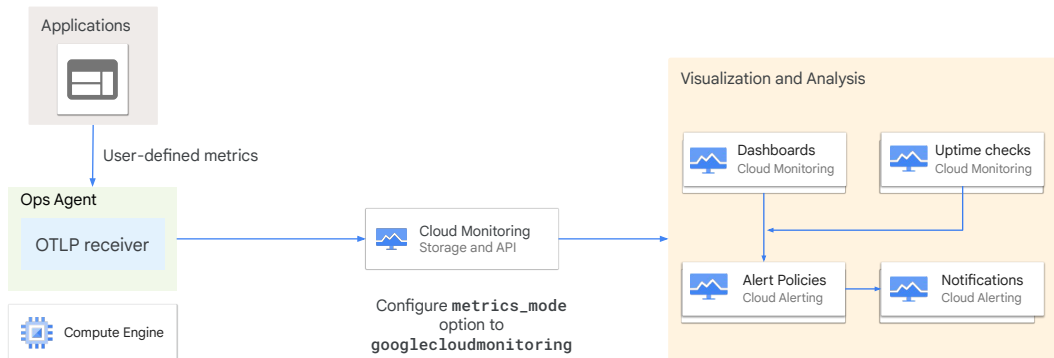
- 1 Use OpenTelemetry Protocol (recommended).
- 2 Use the Cloud Monitoring API.



There are two fundamental approaches to creating custom metrics for Cloud Monitoring:

- You can use the classic Cloud Monitoring API.
- Or you can use the OpenTelemetry protocol and Ops Agent.

Collect user-defined metrics by using OTLP receiver



The OpenTelemetry Protocol (OTLP) receiver is a plugin installed on the Ops Agent that helps collect the **user-defined metrics from the application** and send those metrics to Cloud Monitoring for analysis and visualization. These metrics can then be used to create dashboards, uptime checks, and alerting policies.

The ingestion and authorization is not required as it is handled at the agent level. To configure OTLP, you must install an Ops Agent and modify the user configuration file to include the OTLP file.

By default, the receiver uses the Prometheus API; the default value for the `metrics_mode` option is `googlemanagedprometheus`.

To receive the custom metrics from the OTLP receiver, set the OTLP receiver `metrics_mode` to `googlecloudmonitoring`.

Create user-defined metrics by using the API

```
//Custom metric descriptor example in Python
from google.cloud import monitoring_v3

client = monitoring_v3.MetricServiceClient()
project_name = client.project_path(project_id)

descriptor = monitoring_v3.types.MetricDescriptor()
descriptor.type = ('custom.googleapis.com/my_metric')
descriptor.metric_kind = (monitoring_v3.enums.MetricDescriptor.MetricKind.GAUGE)

descriptor.value_type = (monitoring_v3.enums.MetricDescriptor.ValueType.DOUBLE)

descriptor.description = 'Custom metric example.'

client.create_metric_descriptor(project_name, descriptor)
```

The steps used to create a custom metric using the API are [well documented](#).

1. To begin, the data you collect for a custom metric must be associated with a descriptor for a custom metric type. In this example, we create a gauge double metric named `my_metric`. It's a gauge metric of type double, with the description "Custom metric example."
2. Once you collect the information you need for creating your custom metric type, call the create method, passing into a `MetricDescriptor` object. You write data points by passing a list of `TimeSeries` objects to `create_time_series`.

Writing user-defined metrics

```
client = monitoring_v3.MetricServiceClient()
project_name = client.project_path(project_id)

//my_metric is linked to the specified Compute Engine instance
series = monitoring_v3.types.TimeSeries()
series.metric.type = ('custom.googleapis.com/my_metric')
series.resource.type = 'gce_instance'
series.resource.labels['instance_id'] = '1267890123456789'
series.resource.labels['zone'] = 'us-east4-c'

//Create point by adding to the series
point = series.points.add()
point.value.double_value = 3.14
now = time.time()
point.interval.end_time.seconds = int(now)

//Passing a list of timeseries objects to create_time_series
client.create_time_series(project_name, [series])
```

You write data points by passing a list of TimeSeries objects to the function `create_time_series`. Each time series is identified by the metric and resource fields of the TimeSeries object.

These fields represent the metric type and the monitored resource from which the data was collected.

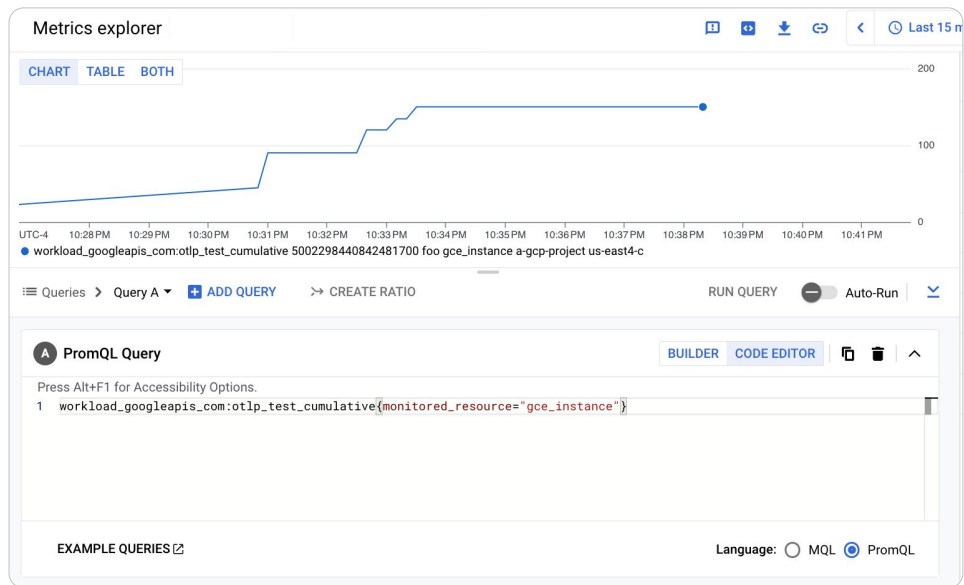
In this example, we use the `my_metric` described on the last slide to link our metric to the specified Compute Engine instance.

Next, we create the point by adding it to the series and adding the details.

Each TimeSeries object must contain a single Point object.

Finally, we report our metric.

Query custom metrics



After you configure the `metrics_mode` to Prometheus API or the Cloud Monitoring API in the OTLP receiver, you can then query the metrics by using Metrics Explorer, dashboards or even alternate interface.

Here we see an example from the Metrics explorer, where you query the user defined metrics ingested by the monitoring API.

Recap

- 01 Use Ops Agent with Compute Engine.
- 02 Explain the benefits of using Google Cloud Managed Service for Prometheus.
- 03 Explain the usage of Prometheus Query Language (or PromQL) to query Cloud Monitoring metrics.
- 04 Explain custom metrics.



In this module, you learned how to:

- Use Ops Agent with Compute Engine.
- Explain the benefits of using Google Cloud Managed Service for Prometheus.
- Explain the usage of PromQL to query Cloud Monitoring metrics.
- Explain custom metrics.