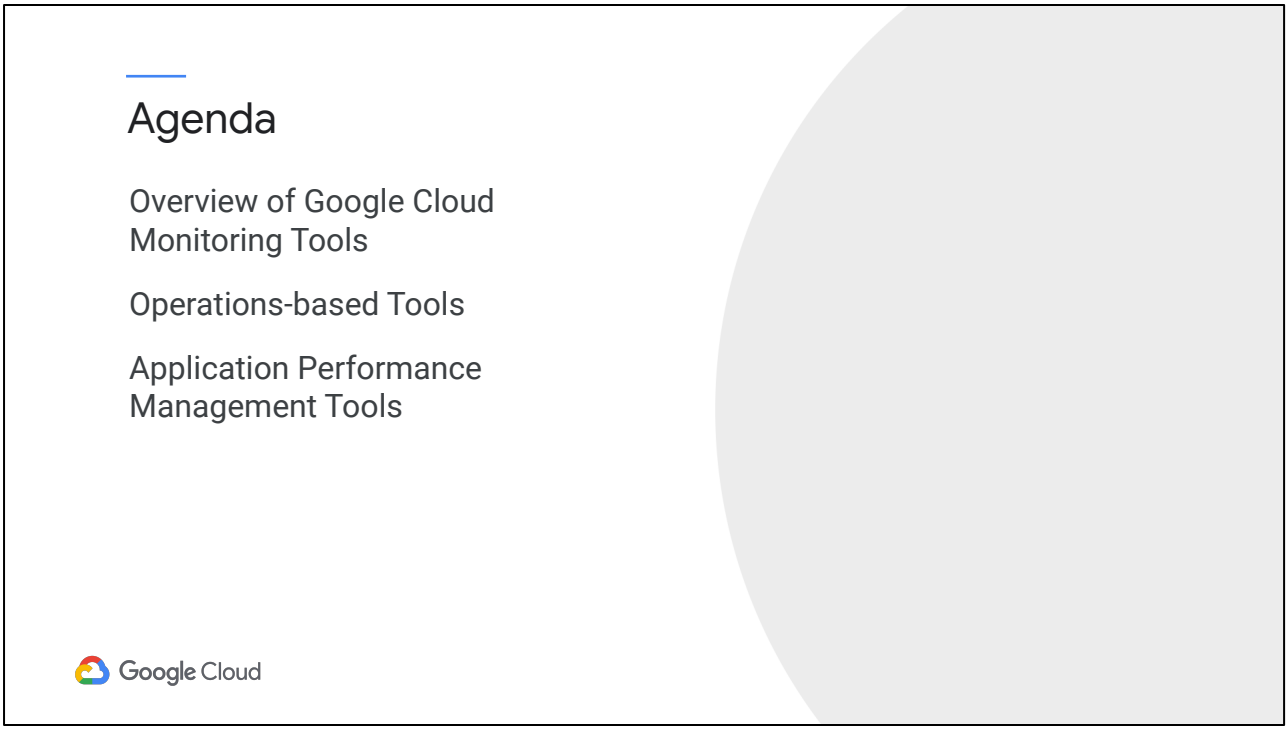

Introduction to Google
Cloud Monitoring Tools



The core operations tools in Google Cloud break down into two major categories:

The operations-focused components—including Logging, Monitoring, Error Reporting, and Service Monitoring—tend to be more for personnel who are primarily interested in infrastructure, and keeping that infrastructure up, running, and error-free.

The application performance management tools—including Debugger, Trace, and Profiler—in contrast, tend to be more for developers who are trying to perfect or troubleshoot applications that are running in one of the Google Cloud compute products.

But it isn't fair to think of these tools as belonging purely to either of these two groups. A developer would, of course, sometimes need access to logs or monitoring metrics, just like an operation team member might need to trace latency.

For reference, the homepage for documentation related to this course can be found at: cloud.google.com/stackdriver/docs.

Agenda

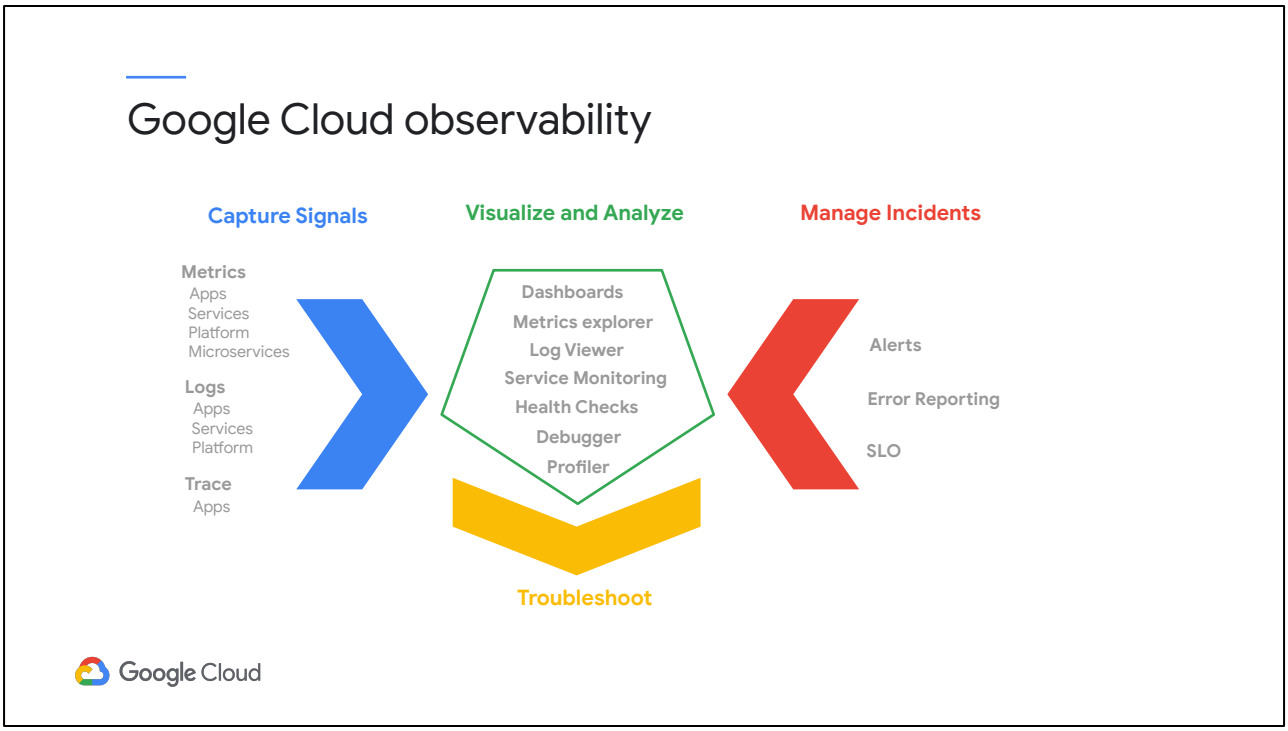
Overview of Google Cloud Monitoring Tools

Operations-based Tools

Application Performance Management Tools

Google Cloud

Let’s start with an overview of why we need these tools, and then we’ll spend a little time getting to know both the operations and the application performance management products.



If you've ever worked with on-premises environments, you know that you, or someone in your organization, can actually lay hands on any of your servers. If an application becomes unresponsive, someone can walk in and physically check as to why.

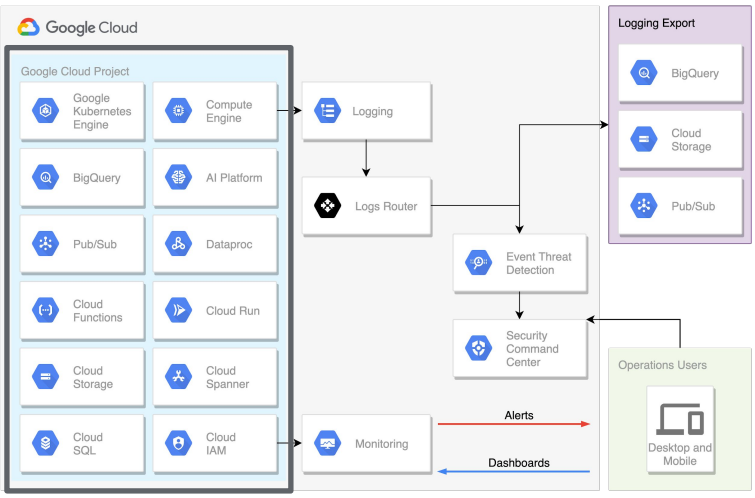
In the cloud though, the servers aren't yours, they're Google's, and you aren't going to be able to inspect them physically. So the question becomes, how do you know what's happening with your server, or database, or application? The answer is the tools discussed in this course.

It all starts with signals. Metric, logging, and trace data capturing is integrated into Google products from the hardware layer up. From those products, the signal data flows into the Google Cloud operation's tools where it can be visualized in Dashboards and through the Metrics Explorer. Automated and custom logs can be dissected and analyzed in the Log Viewer. Services can be monitored for compliance with Service Level Objectives (SLOs), and error budgets can be tracked. Health Checks can be used to check uptime and latency for external-facing sites and services. And running applications can be debugged and profiled.

When Incidents occur, signal data can generate automated Alerts to code or, through various information channels, to key personnel. Error Reporting can help operations and developer teams spot, count, and analyze crashes in cloud-based services. The visualization and analysis tools can then help troubleshoot what's happening in Google Cloud.

Ultimately, you won't miss that easy server access, because Google is going to allow you more precise insights into your Cloud install than you ever had on-premises.

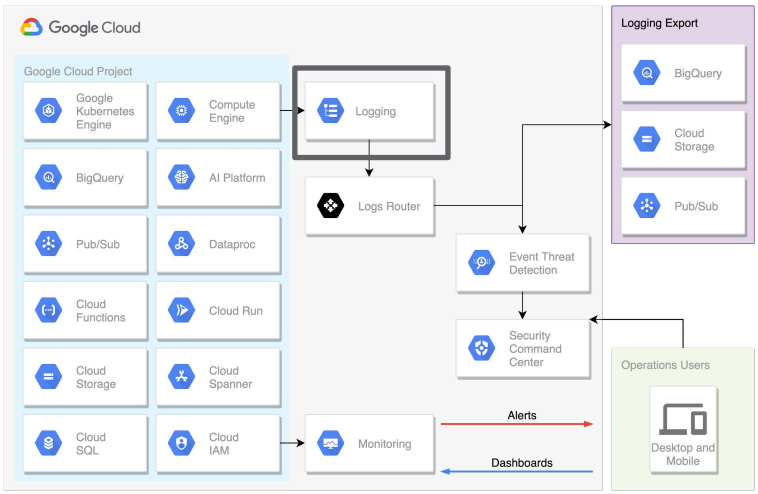
Application and infrastructure observability



Google Cloud

Google Cloud has many products, from Kubernetes, to BigQuery, to Spanner, and they all stream metrics and logs into Google's Cloud Logging and Cloud Monitoring components.

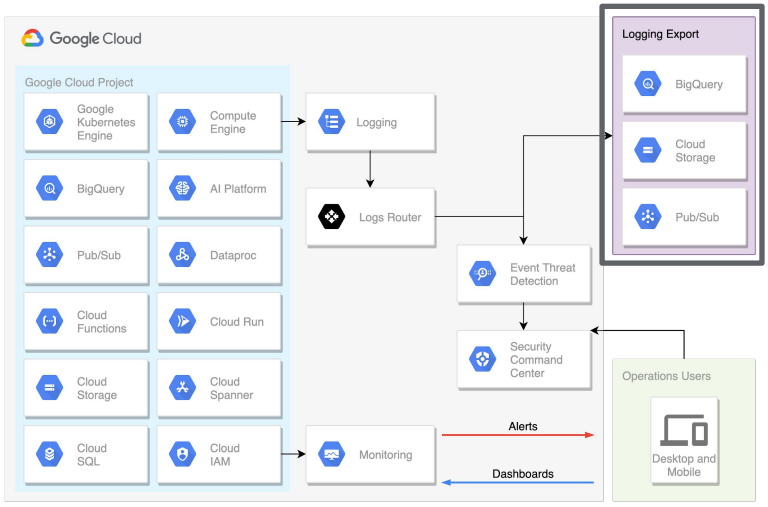
Application and infrastructure observability



Google Cloud

The Logs Router determines where the data goes and can be used to exclude some types of entries.

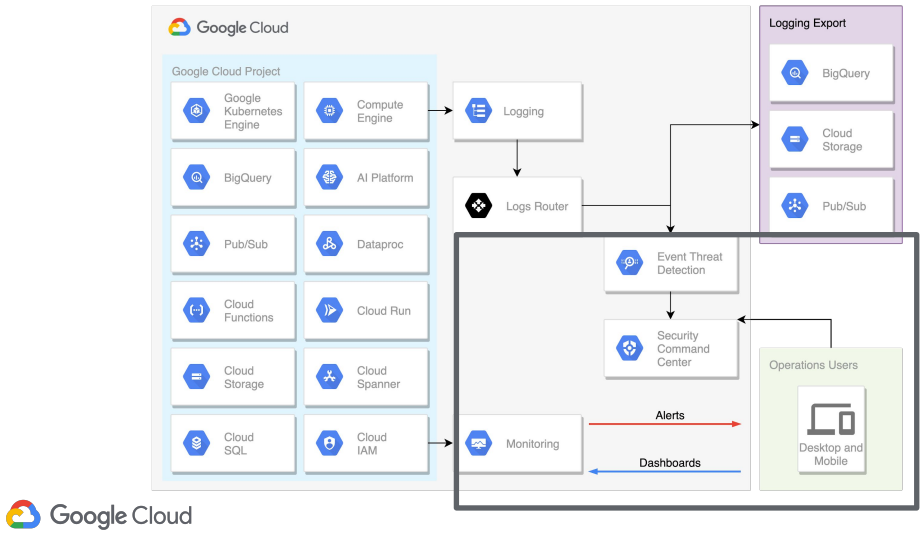
Application and infrastructure observability



Google Cloud

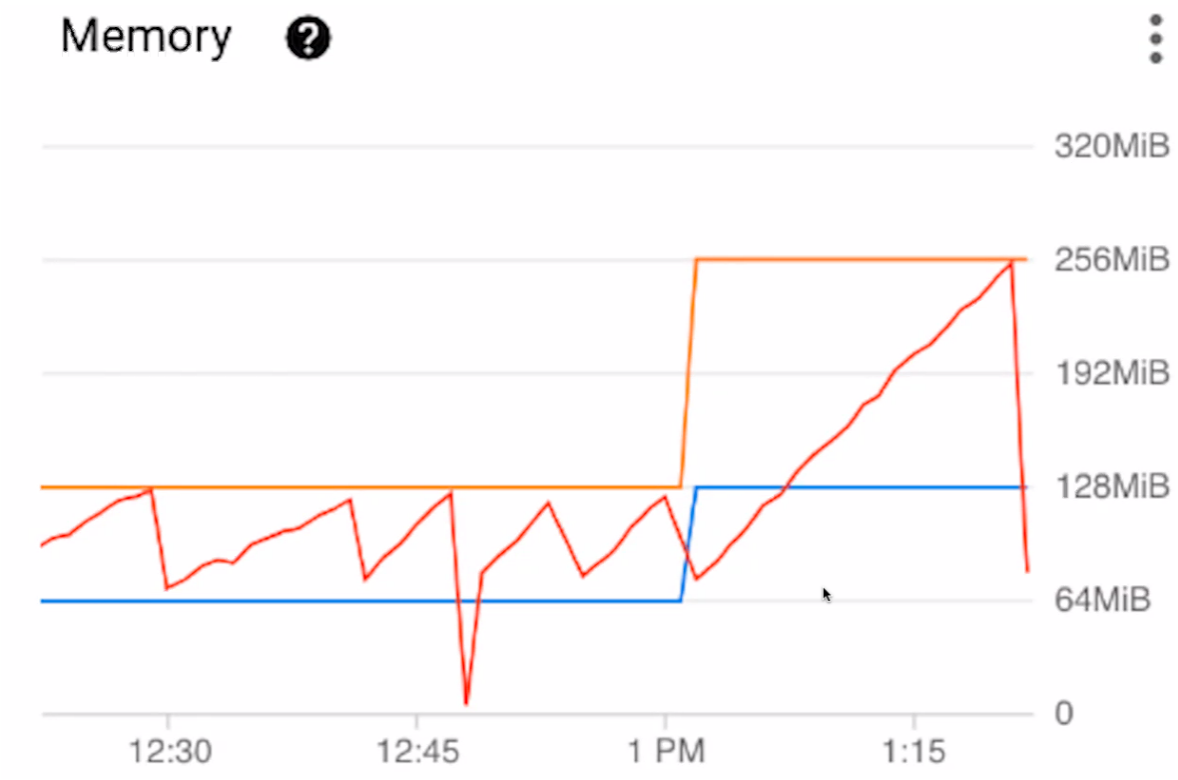
Or to route logs to external locations like Pub/Sub or BigQuery, perhaps for automated handling and/or long-term storage and analysis.

Application and infrastructure observability

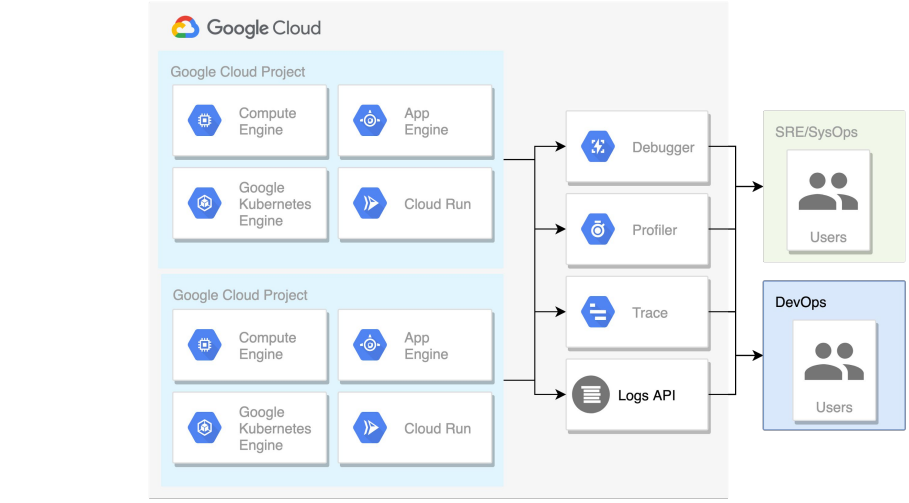


Google Cloud

An auditor might inspect the Logs Viewer to see when a given Spanner instance was created and by whom. Security personnel could use Threat Detection or the Security Command Center to spot and analyze intrusion attempts. A network engineer might run SQL queries in BigQuery to better understand network flow. Below is an example of monitoring showing a memory leak



Application performance management tools



Google Cloud

In addition to raw monitoring and logging, Google Cloud also helps SysOps/SRE and DevOps personnel analyze and improve application performance. Take, as an example, a containerized HTTP based service running inside the fully managed version of Cloud Run.

Debugger would allow the inspection of the service's code state without stopping or degrading its performance. It helps answer the question, "What was happening in the code when this particular line executed." Similarly, Profiler can be used to examine CPU and memory utilization to help spot bottlenecks and to improve algorithmic performance. Trace is all about analyzing latency in a multi-layer, microservice application. And the Logs API can be used by developers to write directly to Google Cloud logs.

Agenda

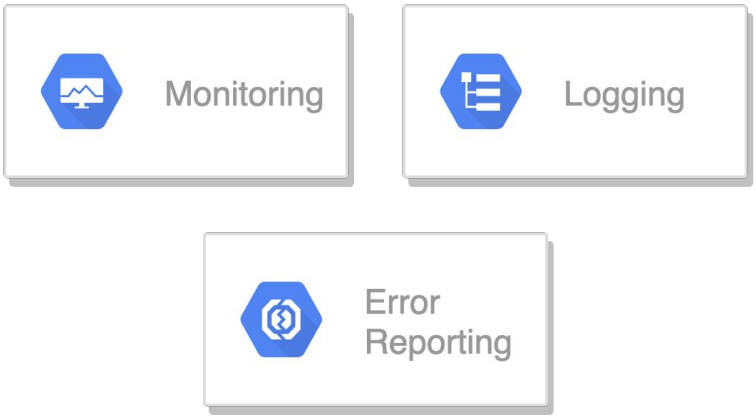
Overview of Google Cloud Monitoring Tools

Operations-based Tools

Application Performance Management Tools

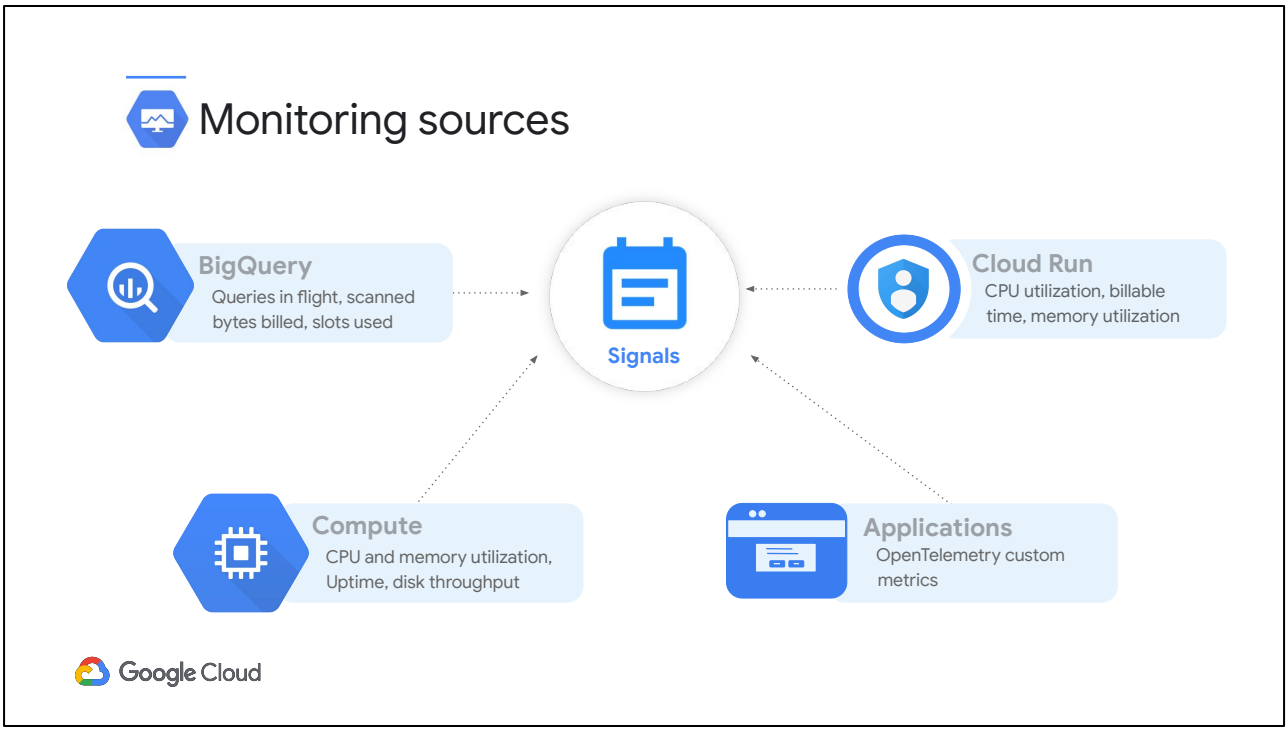
Now that we've introduced the products in Google Cloud's logging and monitoring tool suite, let's take a closer look.

Operations-based tools



Google Cloud

Let's start with the products that tend to be of interest for the operations folk: Monitoring, Logging, and Error Reporting.



When DevOps personnel think about tracking exactly what's happening inside Google Cloud projects, a lot of times, the first thing to come to mind is Monitoring. It's mentioned first on the documentation homepage, just like the first product in the operations section of the Google Cloud navigation menu.

As we stated previously, monitoring starts with signal data. Metrics take measurements, and use math to align those measurements over time. Think taking raw CPU usage measurement values and averaging them to produce a single value per minute.

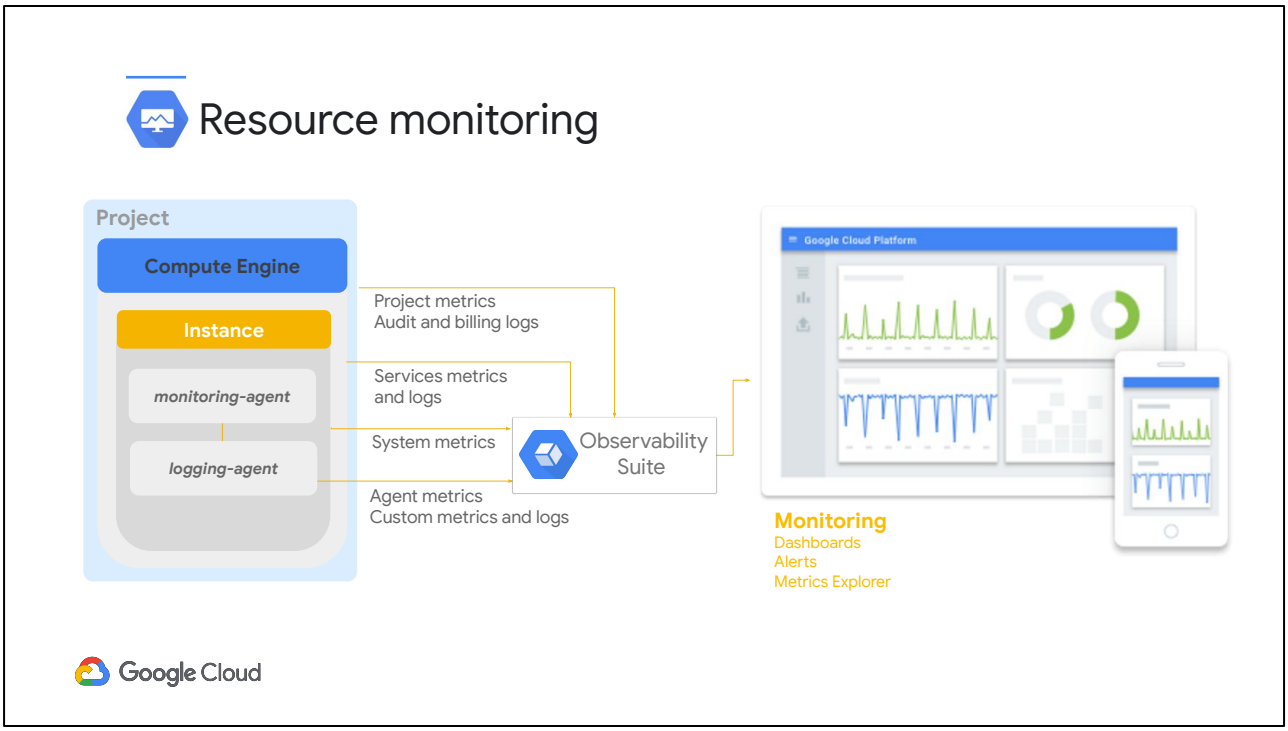
When the data scientists are running massively scalable queries in BigQuery, knowing how many queries are currently in flight, how many bytes have been scanned and added to the bill, and data slot usage patterns, all will be important.

It could also be critical to DevOps teams running containerized applications in Cloud Run to know CPU and memory utilization, and app bill time.

And if those same DevOps teams want to augment the signal metrics coming out of their custom application wherever it's running, they could use the open-source OpenTelementry and create their own metrics.

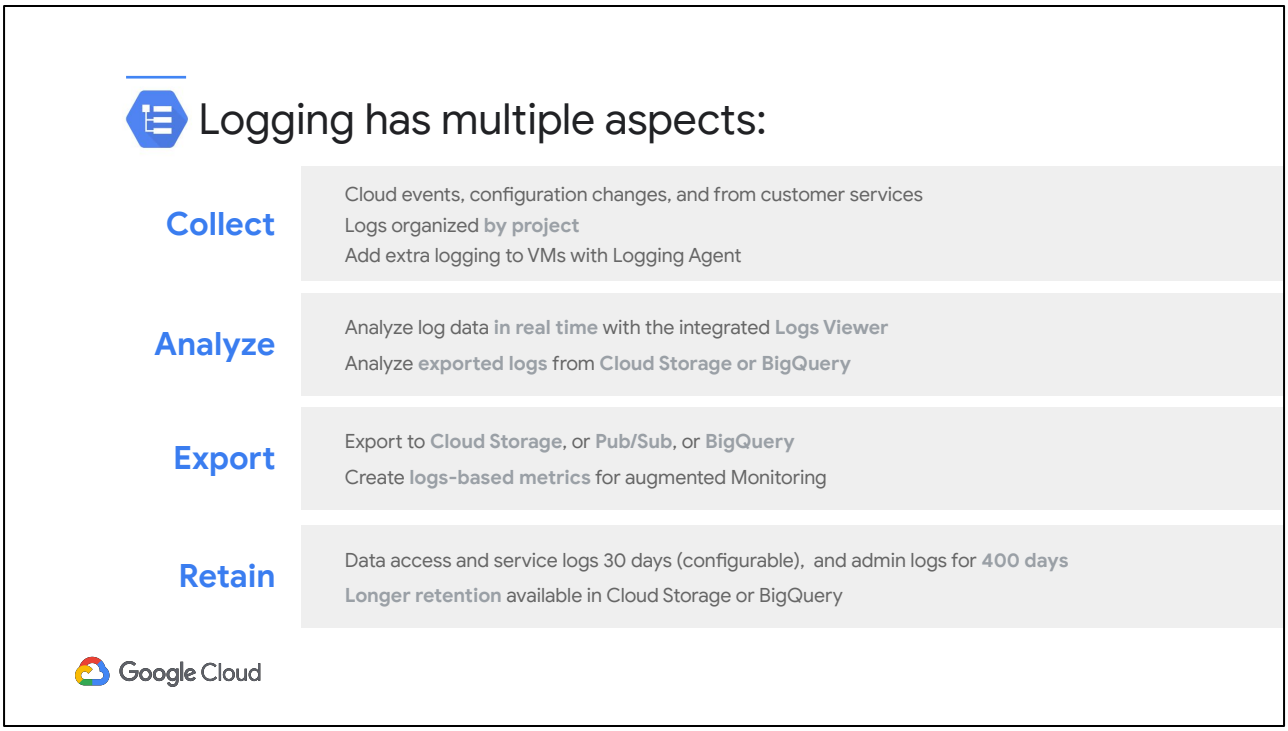
Workloads on Compute Engine will benefit from CPU and memory utilization data, along with uptime, disk throughput, and scores of others.

Google Cloud, by default, collects more than a thousand different streams of metric data, which can be incorporated into dashboards, alerts, and a number of other key tools.



Here, we see a project running a Compute Engine VM instance with the logging and monitoring agents installed.

Cloud Monitoring provides visibility into the performance, uptime, and overall health of cloud-powered applications. It collects metrics, events, and metadata from projects, logs, services, systems, agents, custom code, and various common application components, including Cassandra, Nginx, Apache Web Server, Elasticsearch, and many others. Monitoring ingests that data and generates insights via dashboards, Metrics Explorer charts, and automated alerts.

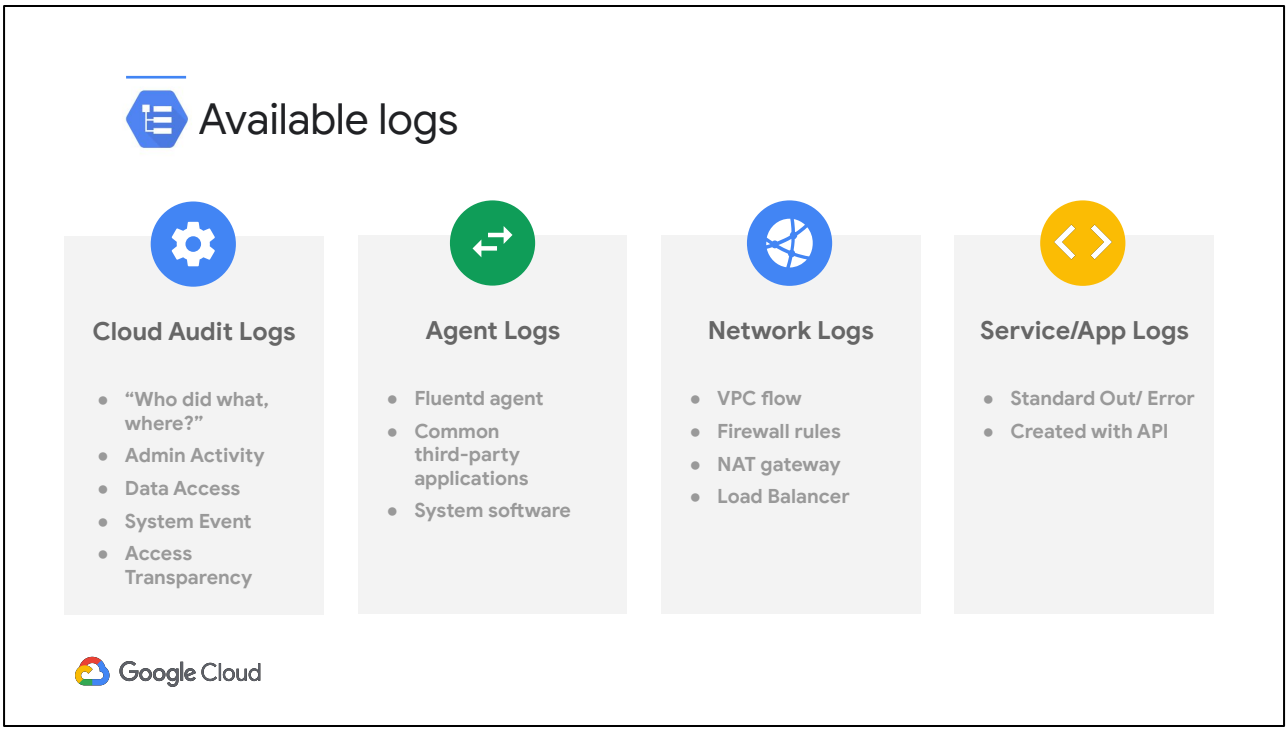


Google's Cloud Logging allows users to collect, store, search, analyze, monitor, and alert on log entries and events. Automated logging is integrated into Google Cloud products like App Engine, Cloud Run, Compute Engine VMs running the logging agent, and GKE.

Most log analysis is going to start with Google Cloud's integrated Logs Viewer. Logging entries can also be exported to several destinations for alternative or further analysis. Pub/Sub messages can be analyzed in near-real time using custom code or stream processing technologies like Dataflow. BigQuery allows analysts to examine logging data through SQL queries. And archived log files in Cloud Storage can be analyzed with several tools and techniques.

Export log data as files to Google Cloud Storage, as messages through Pub/Sub, or into BigQuery tables. Logs-based metrics may be created and integrated into Cloud Monitoring dashboards, alerts, and service SLOs.

Default log retention in Cloud Logging depends on the log type. Data access logs are retained by default for 30 days, but this is configurable up to a max of 3650 days. Admin logs are stored by default for 400 days. Export logs to Google Cloud Storage or BigQuery to extend retention.



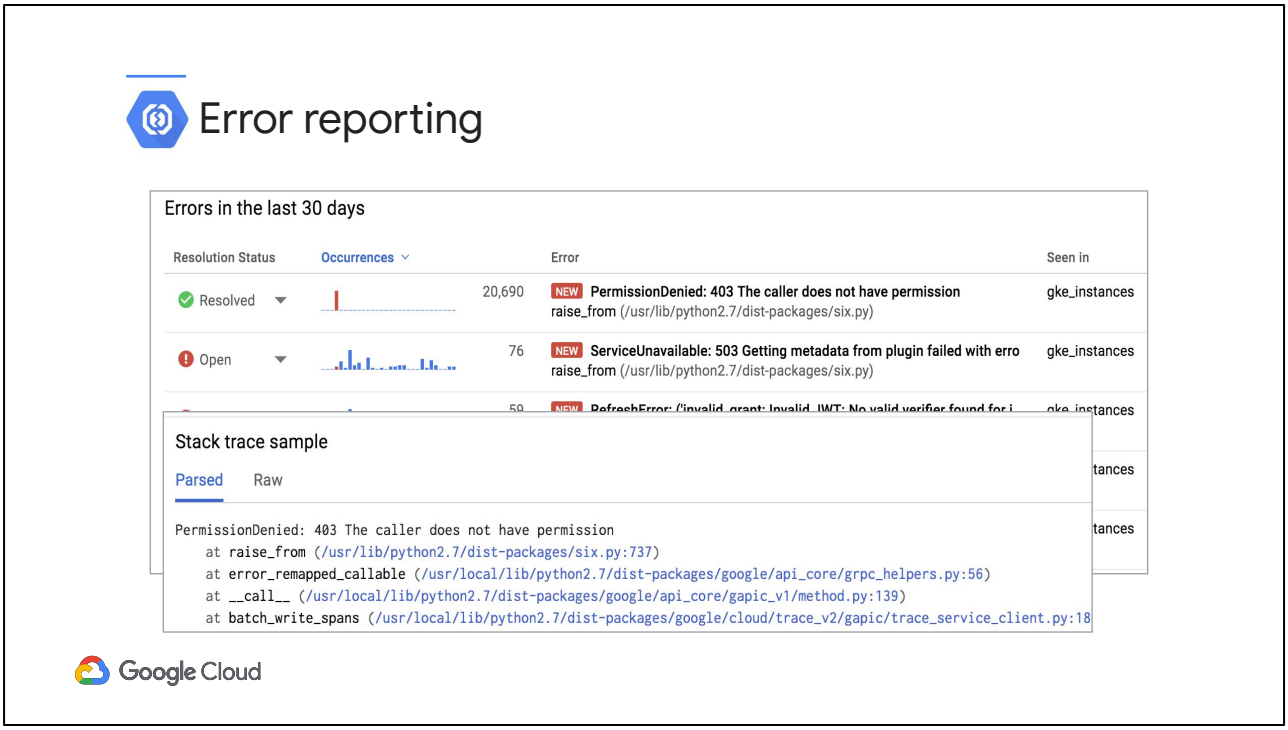
The Google Cloud platform logs visible to you in Cloud Logging vary, depending on which Google Cloud resources you're using in your Google Cloud project or organization. Four key log categories are audit logs, agent logs, network logs, and service logs.

Cloud Audit Logs help answer the question, "Who did what, where, and when?" Admin activity tracks configuration changes. Data access tracks calls that read the configuration or metadata of resources, as well as user-driven calls that create, modify, or read user-provided resource data. System events are non-human Google Cloud administrative actions that change the configuration of resources. Access Transparency provides you with logs that capture the actions Google personnel take when accessing your content.

Agent logs use a Google-customized and packaged Fluentd agent that can be installed on any AWS or Google Cloud VM to ingest log data from Google Cloud instances (for example, Compute Engine, Managed VMs, or Containers), as well as AWS EC2 instances.

Network logs provide both network and security operations with in-depth network service telemetry. VPC Flow Logs record samples of VPC network flow and can be used for network monitoring, forensics, real-time security analysis, and expense optimization. *Firewall Rules Logging* allows you to audit, verify, and analyze the effects of your firewall rules. NAT Gateway logs capture information on NAT network connections and errors.

Service logs provide access to logs created by developers deploying code to Google Cloud. For example, if they build a container using NodeJS and deploy it to Cloud Run, any logging to Standard Out or Standard Error will automatically be sent to Cloud Logging for easy, centralized viewing.



Error Reporting counts, analyzes, and aggregates the crashes in your running cloud services. Crashes in most modern languages are Exception which are not caught and handled by the code itself. Its management interface displays the results with sorting and filtering capabilities. A dedicated view shows the error details: time chart, occurrences, affected user count, first- and last-seen dates, and a cleaned exception stack trace. You can also create alerts to receive notifications on new errors.

Mostly uncaught exceptions.

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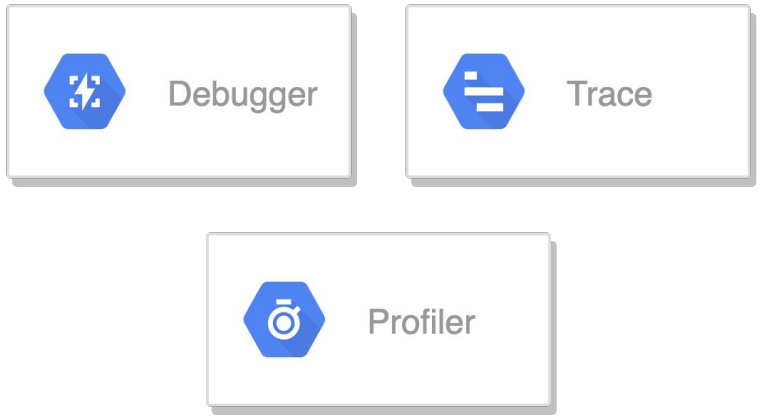
Google Cloud

Now that we've explored the operations-based tools, let's spend a little time on the tools designed to help with application performance management, namely...

Application performance management tools



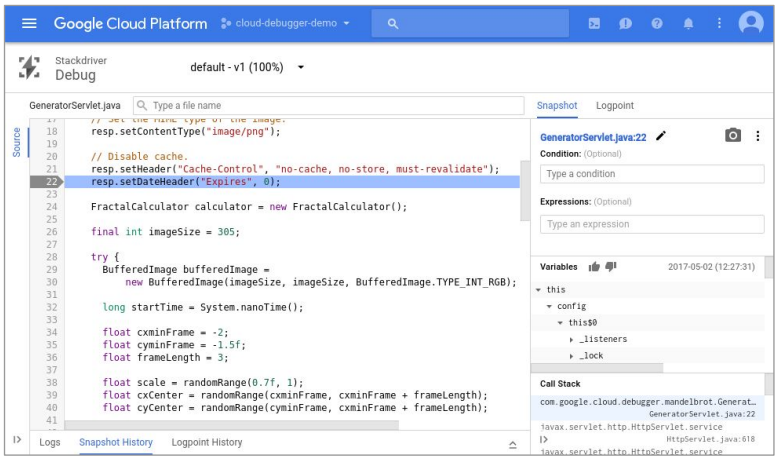
Google Cloud

Debugger, Trace, and Profiler.

Debugger

Debugger

- Real-time app debugging
- Increased collaboration by sharing debug sessions
- Debug snapshots and logpoints
- Integrations with popular IDEs
- Multiple version control sources (GitHub, Google Cloud Source Repositories, Bitbucket, GitLab)



Google Cloud

Google Cloud's Debugger lets you debug your applications while running in production, without stopping them or slowing them down, so you can examine your code's function and performance under actual production conditions.

Easily collaborate with other team members by sharing your debug session. Sharing a debug session is as easy as sending the Console URL.

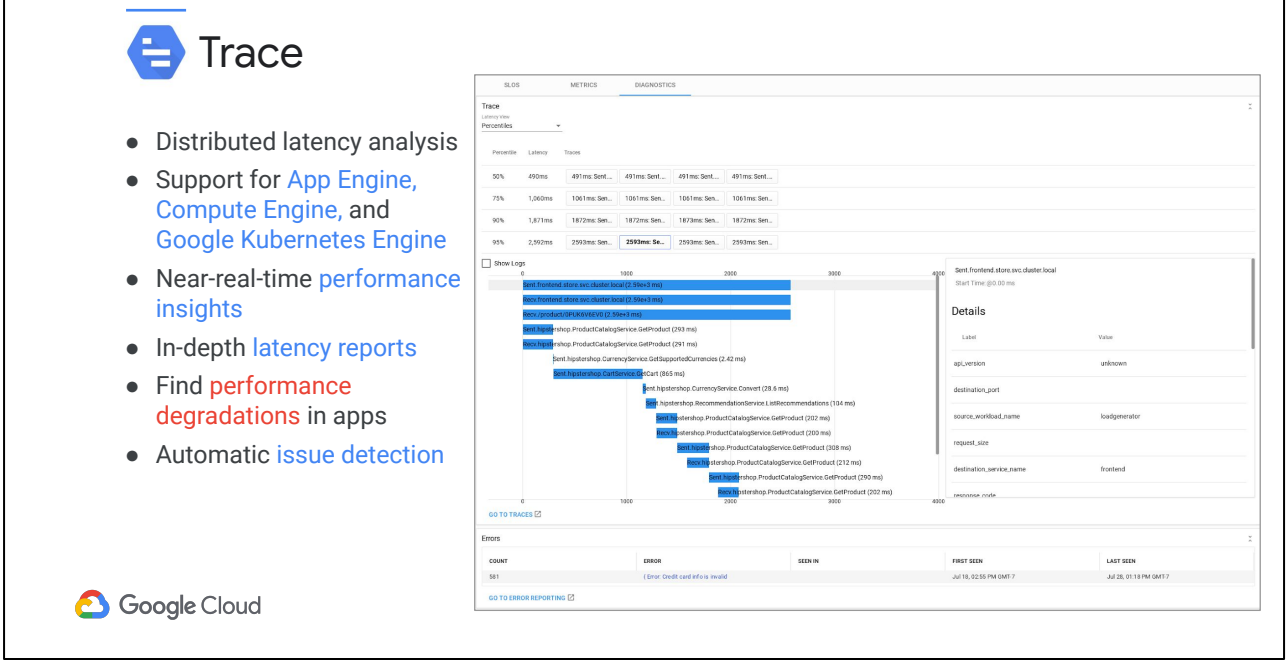
Capture the state of your application in production at a specific line location with snapshots. Use logpoints to inject a new logging statement on demand at a specific line location. Capture a snapshot or write a logpoint message only when you need it, using a simple conditional expression written in your application's language.

Cloud Debugger is easily integrated into existing developer workflows. Launch Debugger and take snapshots directly from Cloud Logging, error reporting, dashboards, IDEs, and the gcloud command-line interface.

And Debugger knows how to display the correct version of the source code because it easily integrates with version control systems, such as Cloud Source Repositories, GitHub, Bitbucket, or GitLab.

Note from classroom: Don't use debugger if you don't have to. It can be very complicated. Use it only to debug if you are not able to replicate in local environment.

Logpoint: Allows you to add special logs while in debug mode



Based on the tools Google uses on its production services, Cloud Trace is a tracing system that collects latency data from your distributed applications and displays it in the Google Cloud Console.

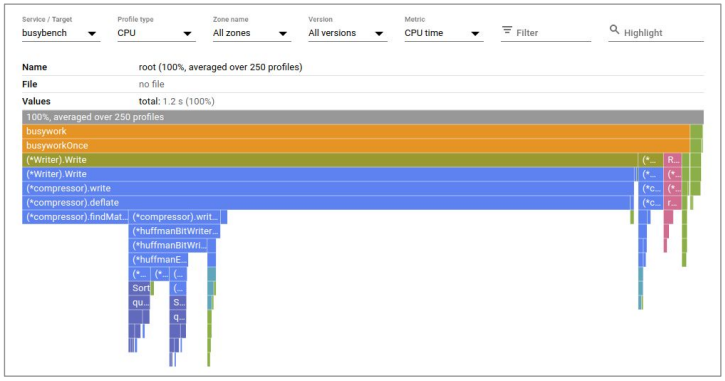
Trace can capture traces from applications deployed on App Engine, Compute Engine VMs, and Kubernetes Engine containers.

Performance insights are provided near-real time, and Trace automatically analyzes all of your application's traces to generate in-depth latency reports to surface performance degradations.

Trace continuously gathers and analyzes trace data to automatically identify recent changes to your application's performance.

Profiler

- Improve performance and reduce costs
- Low-impact production CPU and heap profiling
- Broad platform support (VMs, App Engine, Compute Engine, GKE)
- Support for Java, Go, Python, NodeJS
- Understand your applications' call patterns



Google Cloud

Poorly performing code increases the latency and cost of applications and web services every day, without anyone knowing or doing anything about it.

Cloud Profiler changes this by using statistical techniques and extremely low-impact instrumentation that runs across all production application instances to provide a complete CPU and heap picture of an application without slowing it down.

With broad platform support that includes Compute Engine VMs, App Engine, and Kubernetes, it allows developers to analyze applications running anywhere, including Google Cloud, other cloud platforms, or on-premises, with support for Java, Go, Python, and Node.js.

Cloud Profiler presents the call hierarchy and resource consumption of the relevant function in an interactive flame graph that helps developers understand which paths consume the most resources and the different ways in which their code is actually called.

Classroom notes: Again, try doing it in your local environment first. Use profiler on Google only if absolutely necessary. Tools available for local profiling is more flexible and more matured.

Lab Intro

Product Knowledge

Google Cloud

Quiz

You want a simple way to see the latency of requests for a web application you deployed to App Engine. What Google Cloud tool should you use?

A. Trace

B. Profiler

C. Debugger

D. Logging

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Learned how to...

Explain the purpose and capabilities of:

- Google Cloud operations-focused components:
  Logging, Monitoring, Error Reporting, and Incident Response and Management (IRM)
- Google Cloud application performance management focused components:
  Debugger, Trace, Profiler, and Service Monitoring

Google Cloud

In this module, we've explored the core operation tools in Google Cloud, including Logging, Monitoring, Error Reporting, and Service Monitoring, and the application performance management tools, including Debugger, Trace, and Profiler.

Now that we have a foundation, let's move on to cover the various tools in greater detail.

Google Cloud