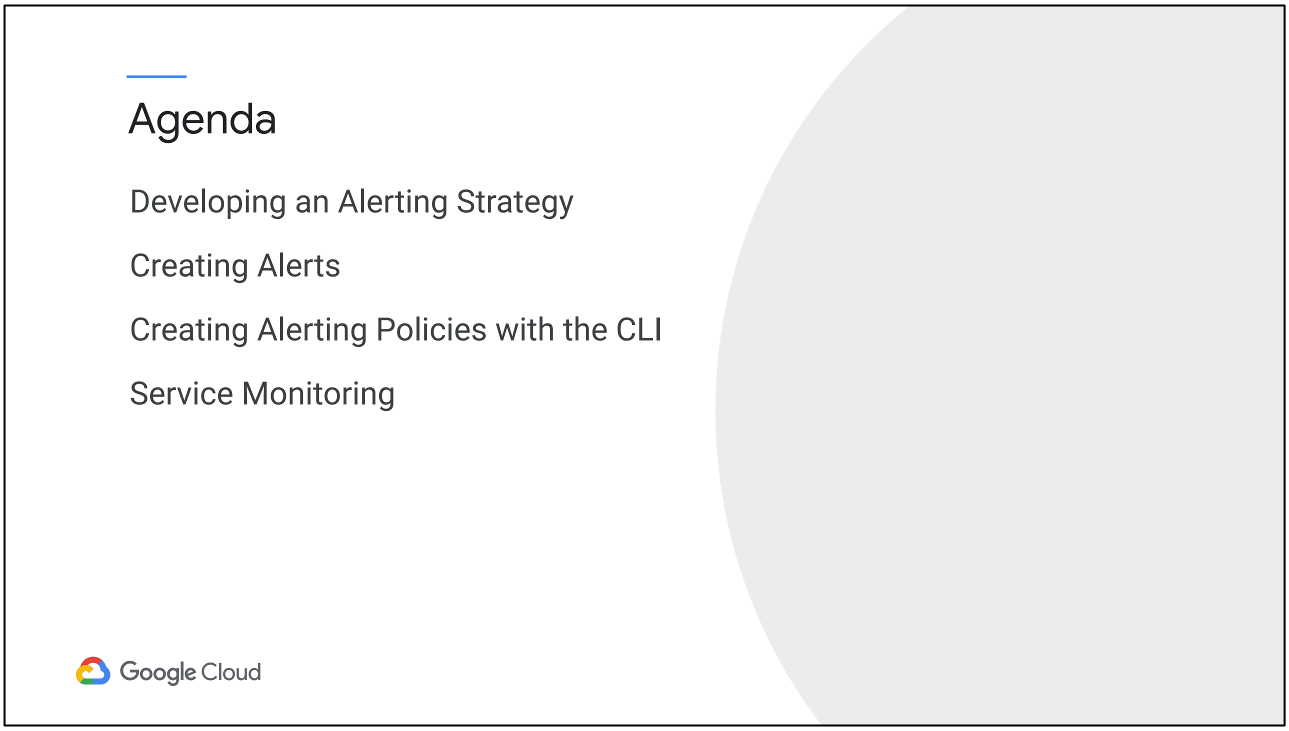
Alerting Policies

Alerting gives timely awareness to problems in your cloud applications so you can resolve the problems quickly.



Agenda

Developing an Alerting Strategy

Creating Alerts

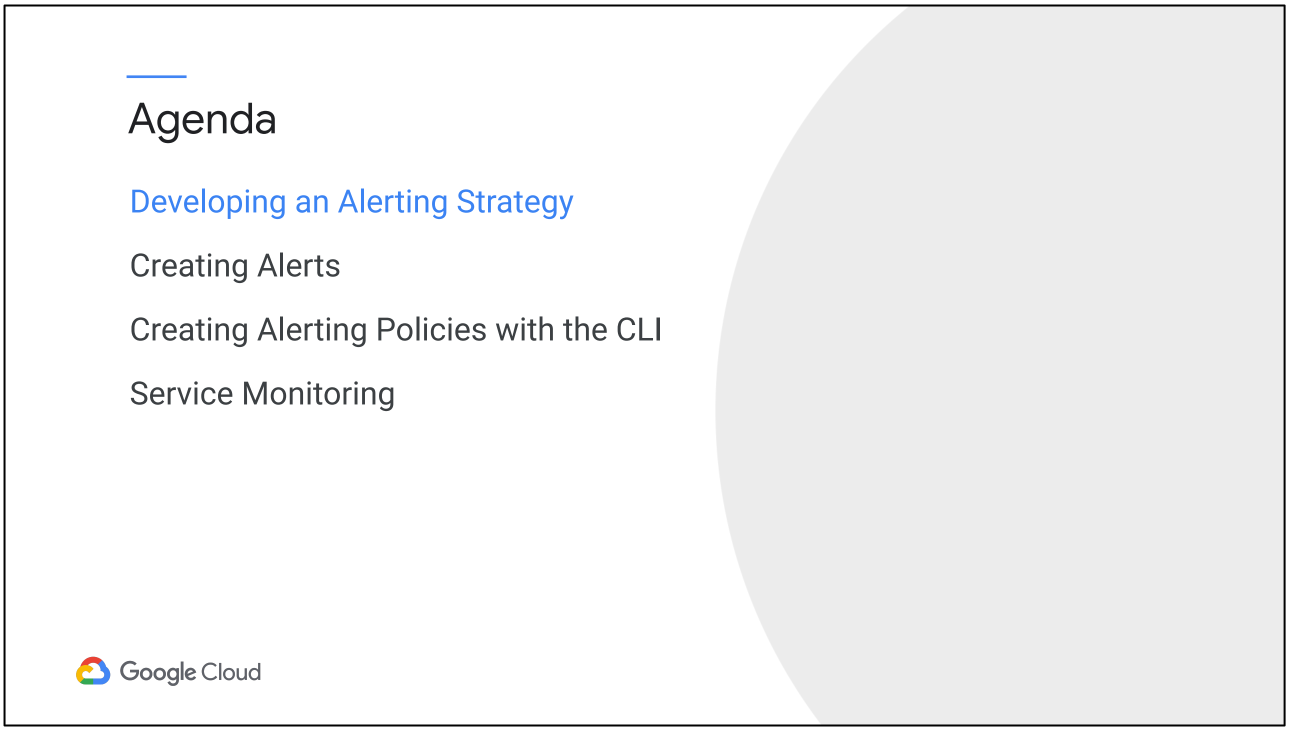
Creating Alerting Policies with the CLI

Service Monitoring

Google Cloud

In this module, you will learn how to:

- Develop alerting strategies
- Define alerting policies
- Add notification channels
- Identify types of alerts and common uses for each
- Construct and alert on resource groups
- And manage alerting policies programmatically



Agenda

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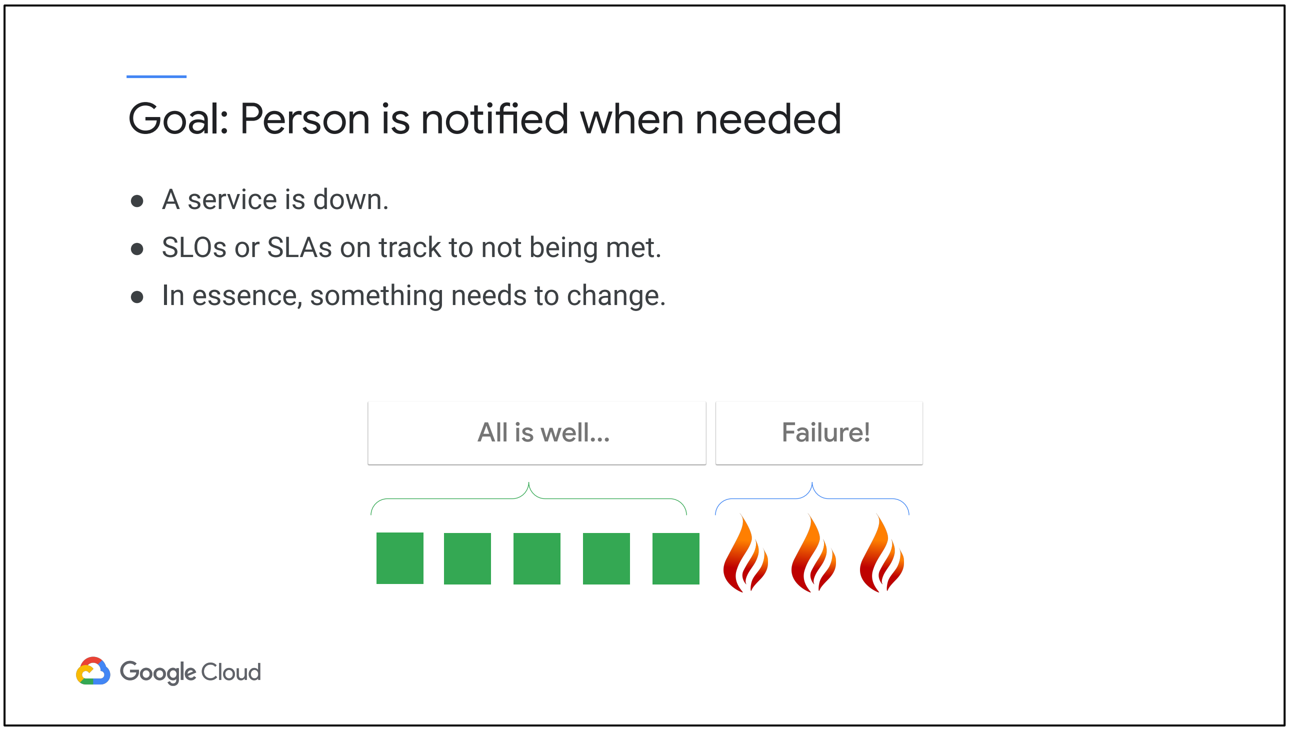
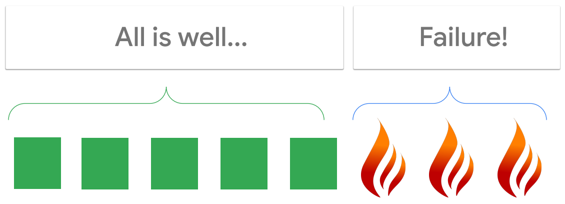
Google Cloud

Let’s start by getting an alerting strategy in place.



Goal: Person is notified when needed

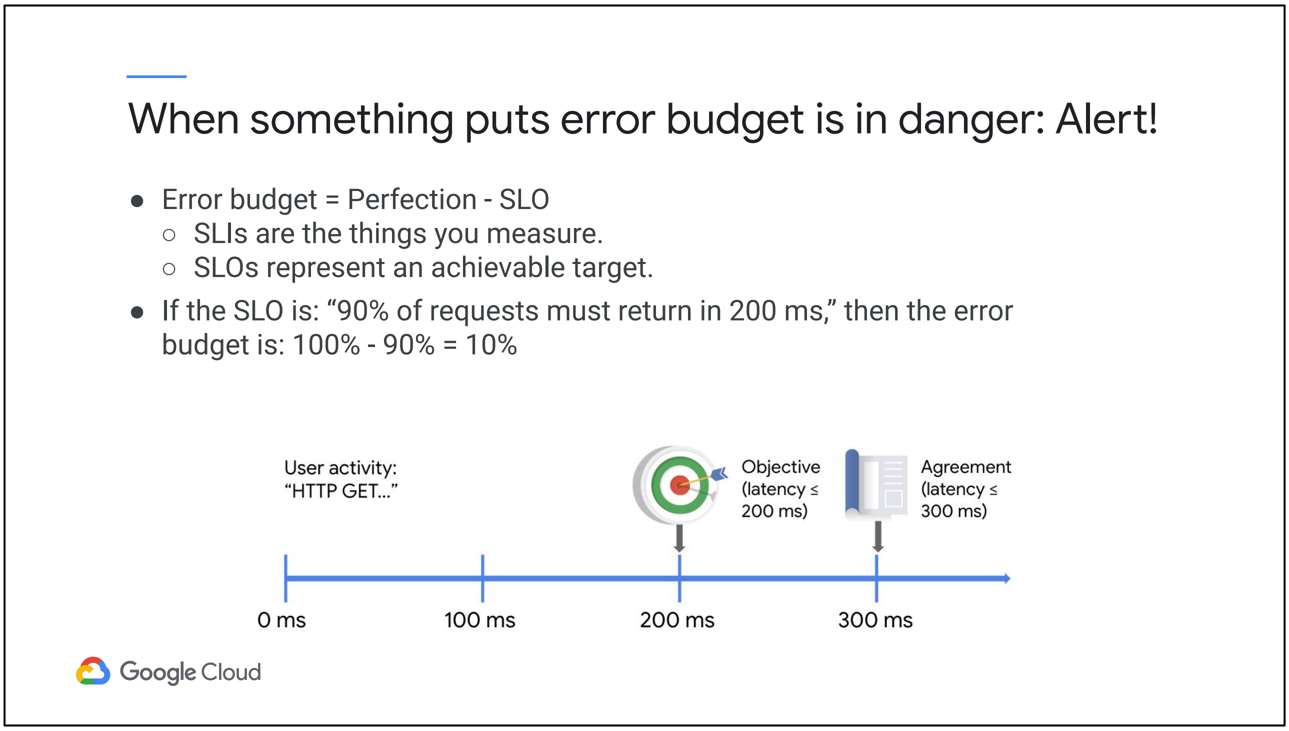
- A service is down.
- SLOs or SLAs on track to not being met.
- In essence, something needs to change.



Google Cloud

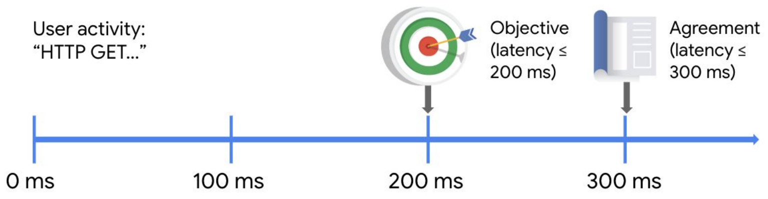
Let's start by defining our term. An alert is an automated notification sent by Google Cloud through some notification channel to an external application, ticketing system, or person.

Why is the alert being sent? Perhaps a service is down, or an SLO isn't being met. Regardless, an alert is generated when something needs to change.



When something puts error budget is in danger: Alert!

- Error budget = Perfection - SLO
  - SLIs are the things you measure.
  - SLOs represent an achievable target.
- If the SLO is: “90% of requests must return in 200 ms,” then the error budget is: 100% - 90% = 10%


User activity: “HTTP GET...”
Objective (latency ≤ 200 ms)
Agreement (latency ≤ 300 ms)
0 ms
100 ms
200 ms
300 ms

Google Cloud

A great time to generate alerts is when a system appears to be on track to spend all of its error budget before the allocated time window.

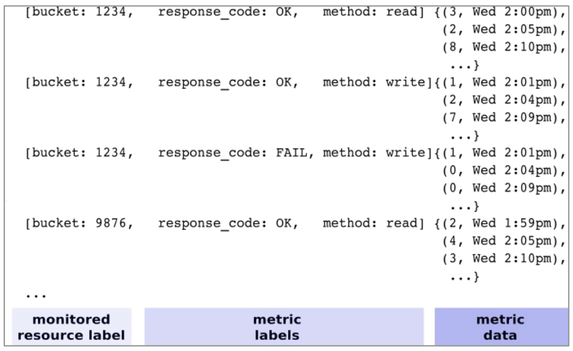
Remember from our SLI/SLO discussion in the last module that an Error budget is Perfection - SLO. SLIs are things that are measured, and SLOs represent achievable targets.

If the SLO target is "90% of requests must return in 200 ms," then the error budget is 100% - 90% = 10%.

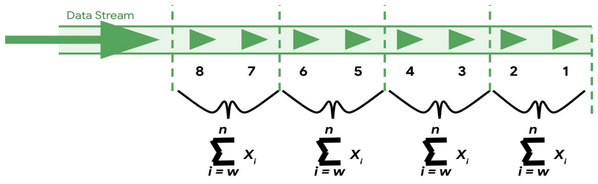
Lecture Notes:
Burn rate 1, means all the error budget will be done at the end of the time window.
If the rate is >1, then notify me

Alerts are based on events in a time series

- Events are continuously occurring:
  - Hundreds/sec? Hundreds/week?
- SLO: Availability requirements?
  - How many 9's?
- Summarize events, calculate error rates, and alert at the right time.



```
[bucket: 1234,   response_code: OK,   method: read] {(3, Wed 2:00pm),
                                                     (2, Wed 2:05pm),
                                                     (8, Wed 2:10pm),
                                                      ...}
[bucket: 1234,   response_code: OK,   method: write]{(1, Wed 2:01pm),
                                                     (2, Wed 2:04pm),
                                                     (7, Wed 2:09pm),
                                                      ...}
[bucket: 1234,   response_code: FAIL, method: write]{(1, Wed 2:01pm),
                                                     (0, Wed 2:04pm),
                                                     (0, Wed 2:09pm),
                                                      ...}
[bucket: 9876,   response_code: OK,   method: read] {(2, Wed 1:59pm),
                                                     (4, Wed 2:05pm),
                                                     (3, Wed 2:10pm),
                                                      ...}
...
```

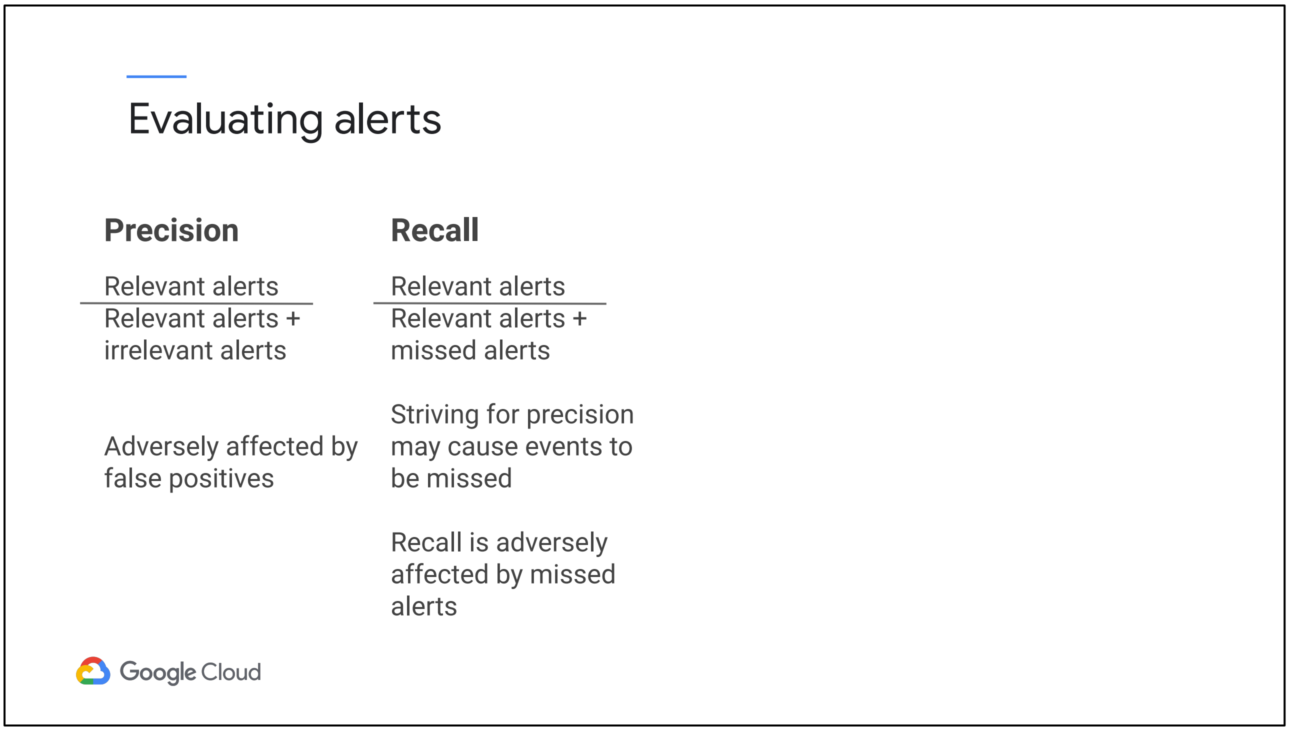


Google Cloud

The events are processed through a time series: a series of event data points broken into successive, equally spaced windows of time. Based on need, each window's duration and the math applied to the member data points inside of each window are both configurable.

Because of the time series, events can be summarized, error rates can be calculated, and alerts can be triggered where appropriate.

Lecture Notes:
Alert windows should be shorter than SLO windows so that you can track/identify bad trends soon enough to take corrective action



Evaluating alerts

Precision

$$\frac{\text{Relevant alerts}}{\text{Relevant alerts + irrelevant alerts}}$$

Adversely affected by false positives

Recall

$$\frac{\text{Relevant alerts}}{\text{Relevant alerts + missed alerts}}$$

Striving for precision may cause events to be missed

Recall is adversely affected by missed alerts

Google Cloud

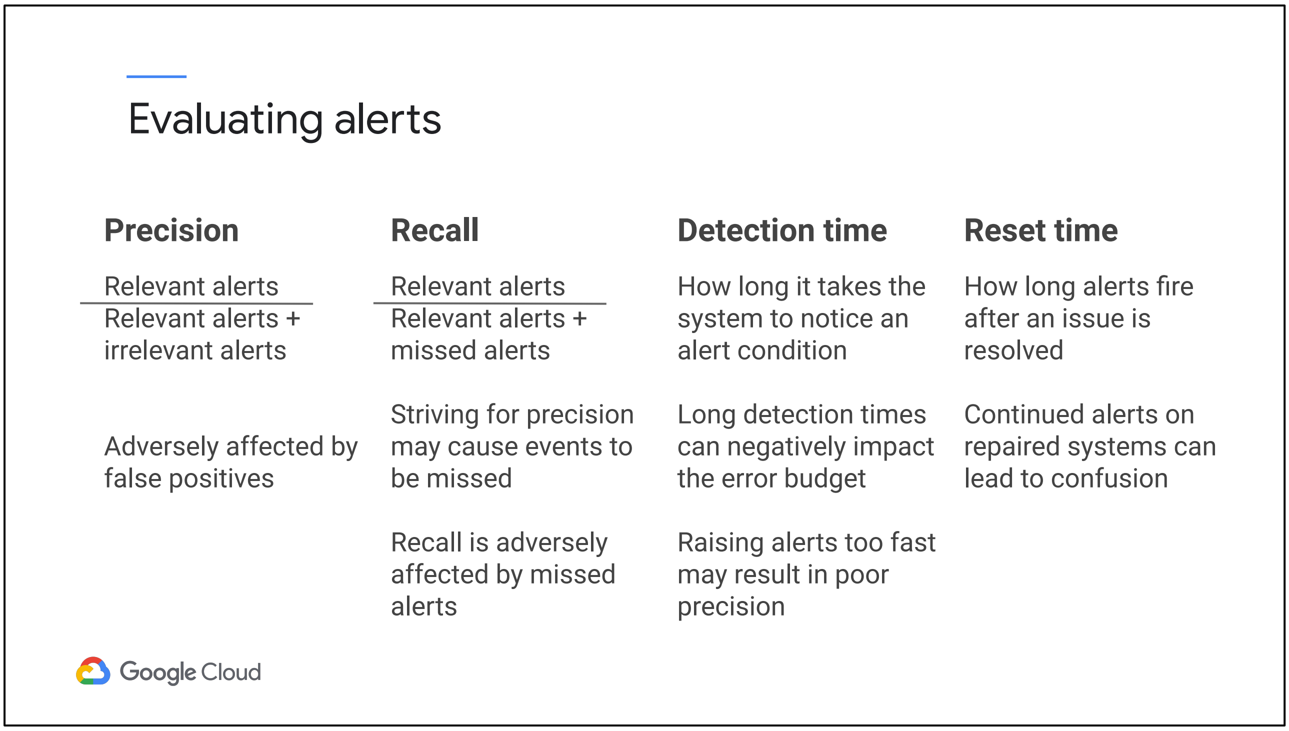
Several attributes should be considered when attempting to measure the accuracy or effectiveness of a particular alerting strategy.

Precision is the proportion of alerts detected that were relevant to the sum of relevant and irrelevant alerts. It is decreased by false alerts.

Recall is the proportion of alerts detected that were relevant to the sum of relevant alerts and missed alerts. It is decreased by missing alerts.

Precision can be seen as a measure of exactness, whereas recall is a measure of completeness.

Lecture Notes:
Irrelevant alerts = false positives
Missed alerts = false negatives



Evaluating alerts

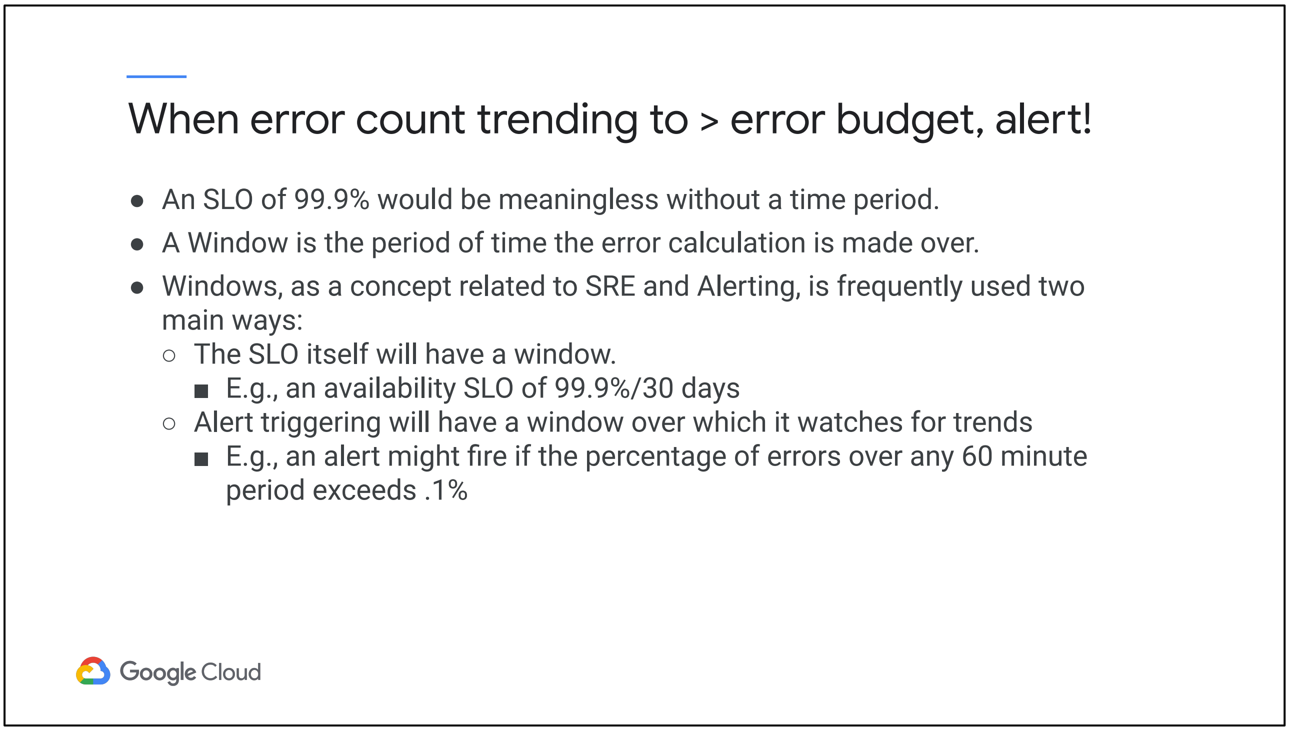
Precision	Recall	Detection time	Reset time
$\frac{\text{Relevant alerts}}{\text{Relevant alerts + irrelevant alerts}}$	$\frac{\text{Relevant alerts}}{\text{Relevant alerts + missed alerts}}$	How long it takes the system to notice an alert condition	How long alerts fire after an issue is resolved
Adversely affected by false positives	Striving for precision may cause events to be missed	Long detection times can negatively impact the error budget	Continued alerts on repaired systems can lead to confusion
	Recall is adversely affected by missed alerts	Raising alerts too fast may result in poor precision	

Google Cloud

Detection time can be defined as how long it takes the system to notice an alert condition. Long detection times can negatively affect the error budget, but alerting too fast may generate false positives.

Reset time measures how long alerts fire after an issue has been resolved. Continued alerts on repaired systems can lead to confusion.

Lecture Notes:
Reset time - is important to consider since it is calculated over a time window. Longer the alert window the longer the reset time. Reset time is also determined by alert precision
It is difficult to determine the reset time manually, but ops team needs to be aware that there is such a thing (and may be different for different alerts)



When error count trending to > error budget, alert!

- An SLO of 99.9% would be meaningless without a time period.
- A Window is the period of time the error calculation is made over.
- Windows, as a concept related to SRE and Alerting, is frequently used two main ways:
    - The SLO itself will have a window.
        - E.g., an availability SLO of 99.9%/30 days
    - Alert triggering will have a window over which it watches for trends
        - E.g., an alert might fire if the percentage of errors over any 60 minute period exceeds .1%

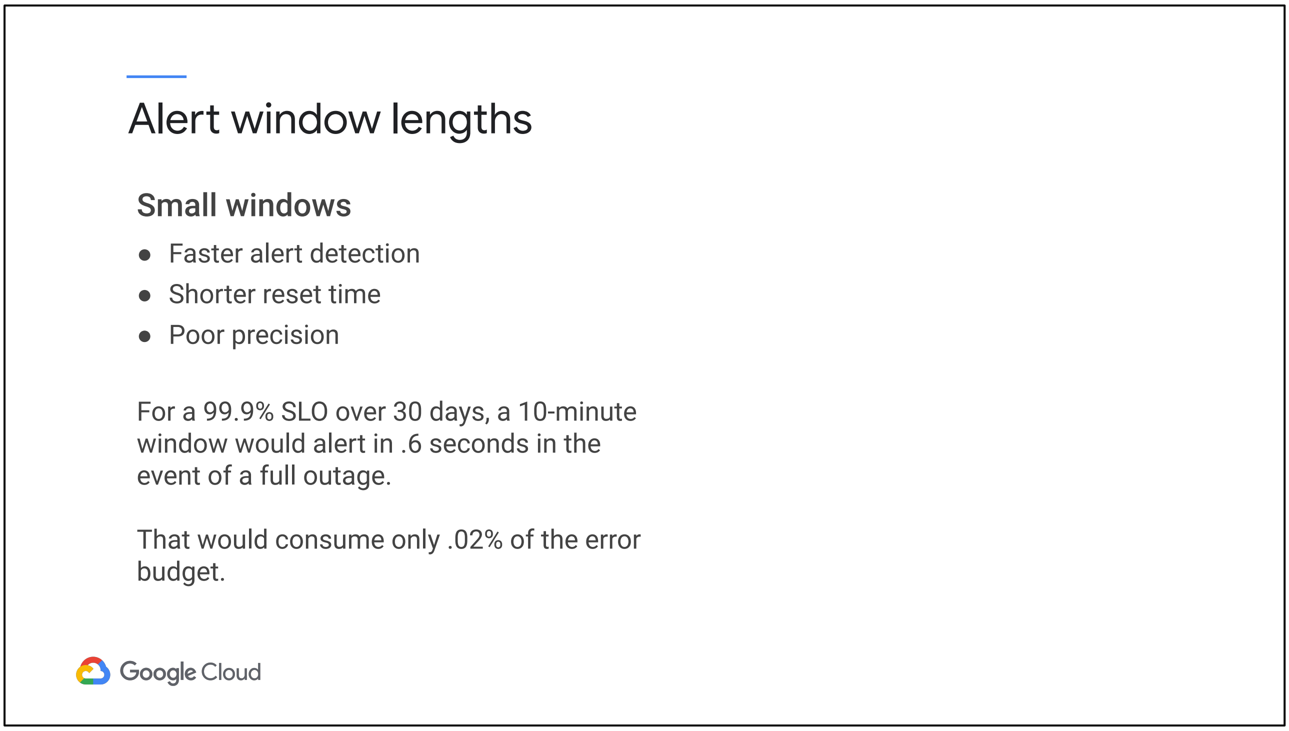
Google Cloud

Error budgeting 101 would state that when the error count, or whatever is being measured, is trending to be greater than the allowed error budget, an alert should be generated.

Both the SLO itself, and the idea of “trending towards” require windows of time over which they are calculated.

In this subject space, there are two key uses of the window term:

- The SLO itself will be measured over a window of time, say an availability SLO of 99.9% over every 30-day period.
- The period of time over which an alert watches for trends, say an alert should be triggered if the percentage of errors over any 60-minute period exceeds .1%.



Alert window lengths

Small windows

- Faster alert detection
- Shorter reset time
- Poor precision

For a 99.9% SLO over 30 days, a 10-minute window would alert in .6 seconds in the event of a full outage.

That would consume only .02% of the error budget.

Google Cloud

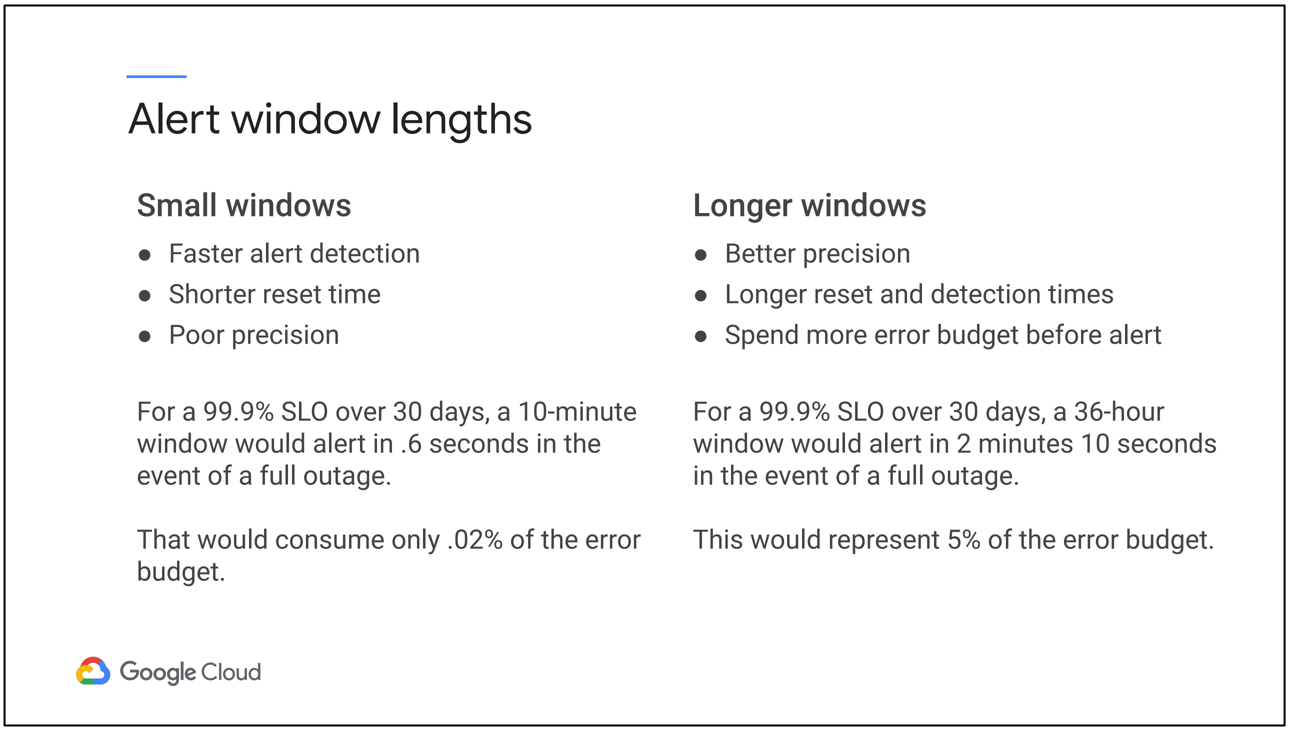
One of the alerting decisions you and your team will have to make is window length. The window is a regular-length subdivision of the SLO's total time.

Imagine you set a Google Cloud spend budget of $1,000 a month. When would you like to receive an alert: When the $1,000 is spent? Or when the predicted spend is trending past the $1,000? Of course, the latter.

Now, the same concept, but this time imagine a 99.9% SLO over 30 days. You don't want to get an alert when your error budget is already gone, because by then it's too late to do anything about the problem.

One option would be small windows. Smaller windows tend to yield faster alert detections and shorter reset times, but they also tend to decrease precision because of their tendency toward false positives.

In our 99.9% SLO over 30 days, a 10-minute window would alert in .6 seconds in the event of a full outage and would consume only .02% of the error budget.



Alert window lengths

Small windows

- Faster alert detection
- Shorter reset time
- Poor precision

For a 99.9% SLO over 30 days, a 10-minute window would alert in .6 seconds in the event of a full outage.

That would consume only .02% of the error budget.

Longer windows

- Better precision
- Longer reset and detection times
- Spend more error budget before alert

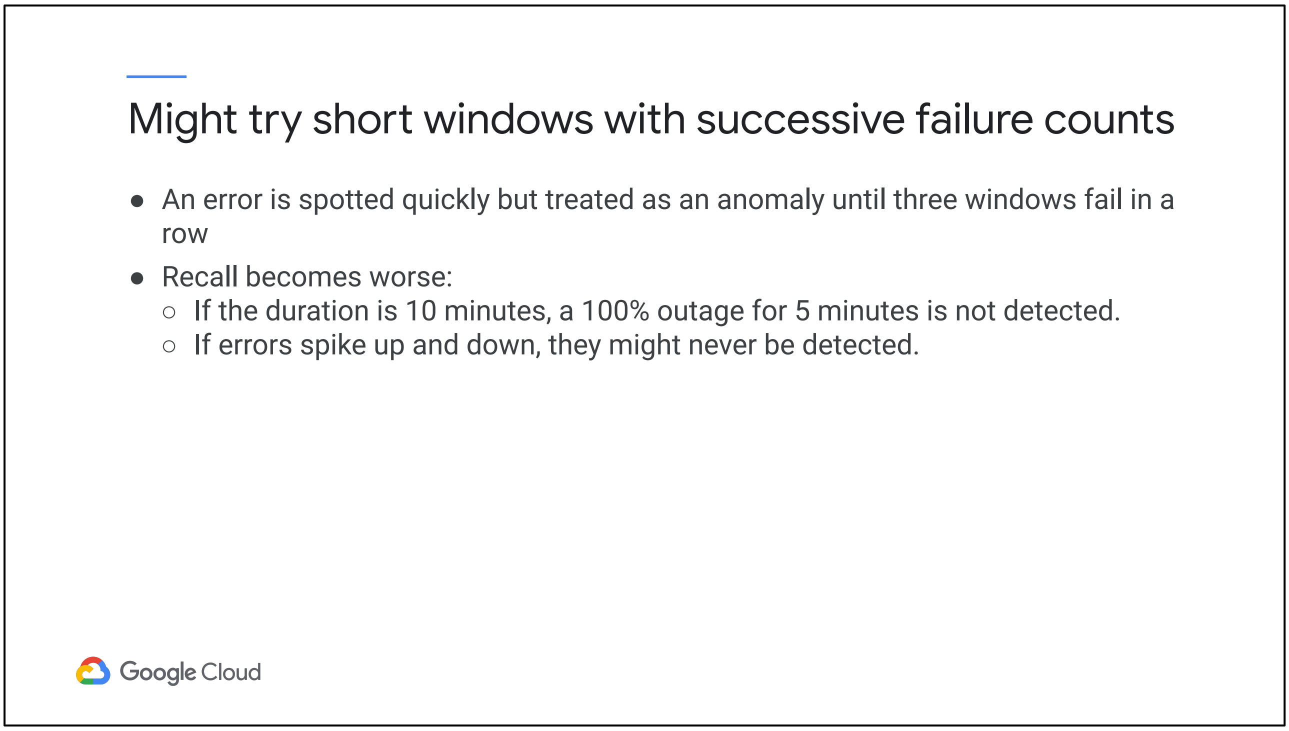
For a 99.9% SLO over 30 days, a 36-hour window would alert in 2 minutes 10 seconds in the event of a full outage.

This would represent 5% of the error budget.

Google Cloud

Longer windows tend to yield better precision, because they have longer to confirm that an error is really occurring, but reset and detection times are also longer. That means you spend more error budget before the alert triggers.

In our same 99.9% SLO over 30 days, a 36-hour window would alert in 2 minutes and 10 seconds in the event of a full outage, but would consume a full 5% of the error budget.



Might try short windows with successive failure counts

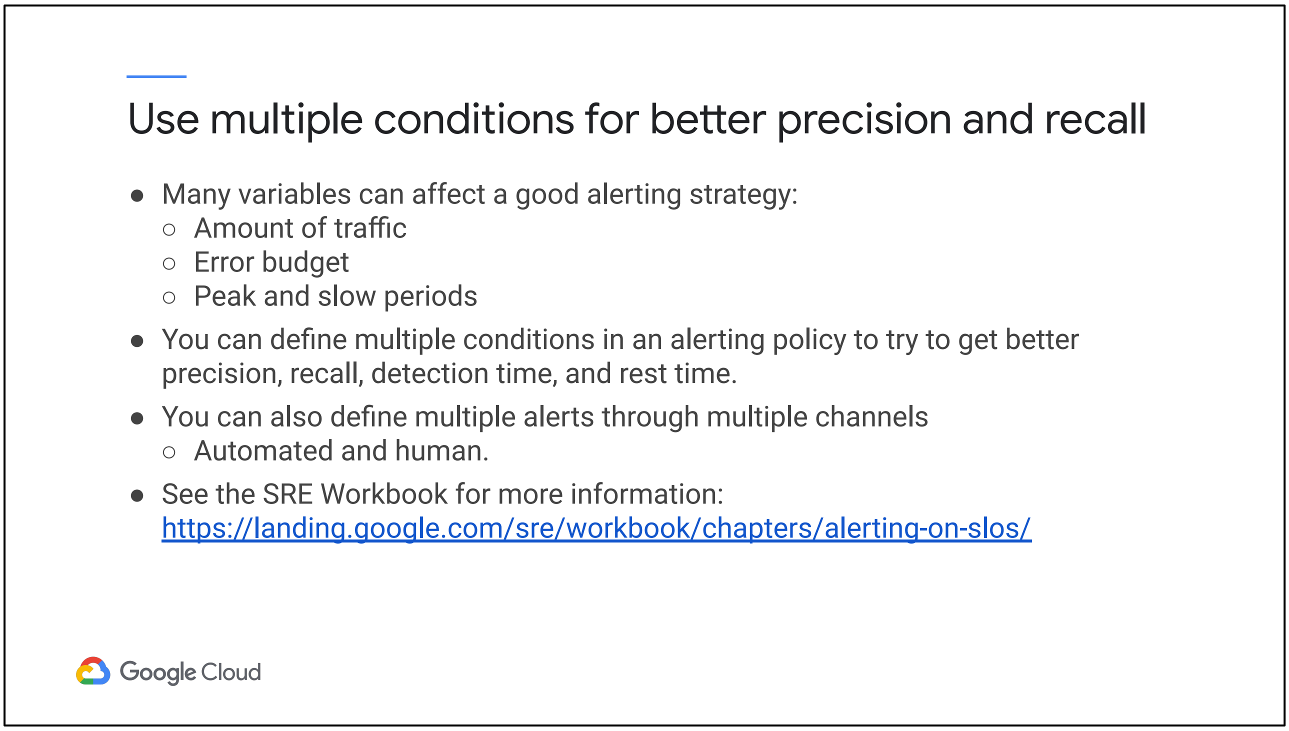
- An error is spotted quickly but treated as an anomaly until three windows fail in a row
- Recall becomes worse:
  - If the duration is 10 minutes, a 100% outage for 5 minutes is not detected.
  - If errors spike up and down, they might never be detected.

Google Cloud

One trick might be to use short windows, but add a successive failure count. One window failing won't trigger the alert, but when three fail in a row the error is triggered. This way, the error is spotted quickly but treated as an anomaly until the duration or error count is reached. This is what you do when your car starts making a sound. You don't immediately freak out, but you pay attention and try to determine whether it's a real issue or a fluke.

The downside is that precision typically has an inverse relationship to recall. As the precision goes up, as you avoid false positives, you let the problem continue to happen.

If the "pay attention but don't alert yet" duration is 10 minutes, a 100% outage for 5 minutes would not be detected. As a result, if errors spike up and down, they may never be detected.



Use multiple conditions for better precision and recall

- Many variables can affect a good alerting strategy:
  - Amount of traffic
  - Error budget
  - Peak and slow periods
- You can define multiple conditions in an alerting policy to try to get better precision, recall, detection time, and rest time.
- You can also define multiple alerts through multiple channels
  - Automated and human.
- See the SRE Workbook for more information: https://landing.google.com/sre/workbook/chapters/alerting-on-slos/

Google Cloud

So how do we get good precision and good recall? Multiple conditions.

There are many variables that affect a good alerting strategy, including the amount of traffic, the error budget, peak and slow periods, to name a few.

The fallacy is believing that you have to choose a single option. Define multiple conditions in an alerting policy to get better precision, recall, detection time, and rest time.

You can also define multiple alerts through multiple channels. Perhaps a short window condition generates an alert, but it takes the form of a Pub/Sub message to a Google Cloud Run container, which then uses complex logic to check multiple other conditions before deciding if a human gets a notification.

Prioritize alerts based on customer impact and SLA

- Involve humans only for critical alerts.
- Send a message to your team’s Slack channel or out through SMS for high-priority alerts.
    - PagerDuty?
- Log low-priority alerts for later analysis.
    - Ticket? Email?

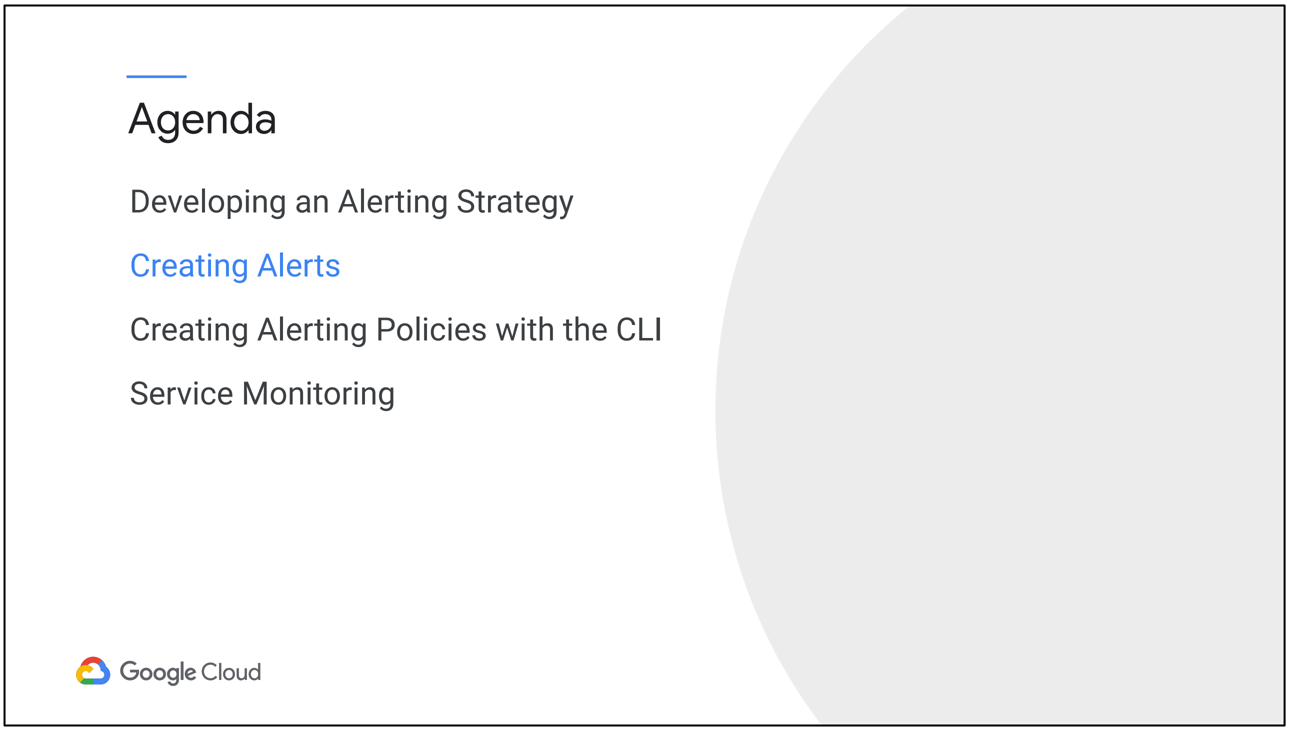
Google Cloud

And alerts should always be prioritized based on customer impact and SLA.

Don't involve the humans unless the alert meets some threshold for criticality.

High-priority alerts might go to Slack, SMS, or maybe even a third-party solution like PagerDuty.

Low-priority alerts might be logged, sent through email, or inserted into a support ticket management system.



Agenda

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Creating Alerting Policies with the CLI

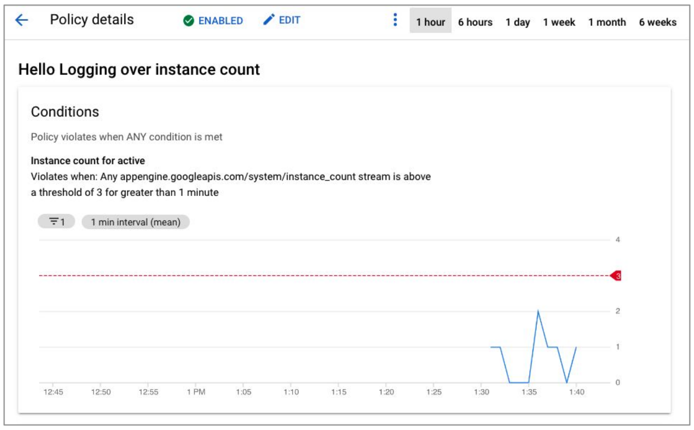
Service Monitoring

Google Cloud

Okay, we've discussed some of the alerting concepts and strategies. Now, let's run through the Google Cloud mechanics of creating alerts.

Use alerting policies to define alerts

- An alerting policy has:
  - A name
  - One or more conditions
  - Notifications
  - Documentation



Hello Logging over instance count

Conditions

Policy violates when ANY condition is met

Instance count for active

Violates when: Any appengine.googleapis.com/system/instance_count stream is above a threshold of 3 for greater than 1 minute

Google Cloud

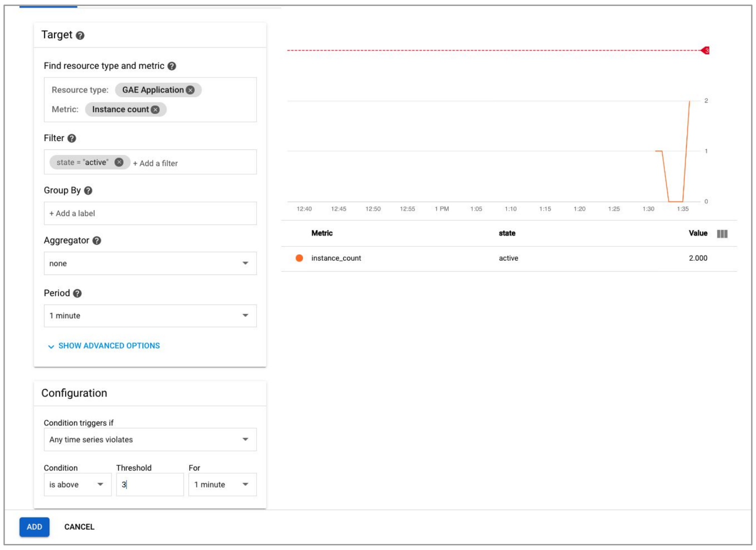
Google Cloud defines alerts using alerting policies.

An alerting policy has:

- A name
- One or more alert conditions
- Notifications
- And documentation

For the name, use something descriptive so you can recognize alerts after the fact. Organizational naming conventions can be a great help.

Conditions: What's watched and when to alert



Target

Find resource type and metric

Resource type: GAE Application

Metric: Instance count

Filter: state = "active" + Add a filter

Group By: + Add a label

Aggregator: none

Period: 1 minute

SHOW ADVANCED OPTIONS

Configuration

Condition triggers if: Any time series violates

Condition: is above

Threshold: 3

For: 1 minute

Metric	state	Value
● instance_count	active	2.000

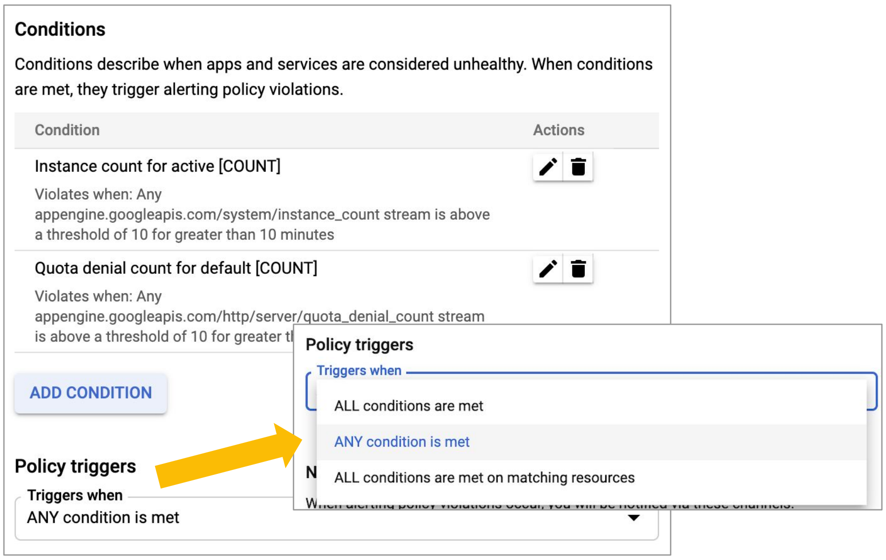
Google Cloud

The alert condition is where you'll be spending the most alerting policy time and making the most decisions. This is where you decide what's being monitored and under what condition an alert should be generated. Notice how the UI combines the heart of the Metrics Explorer with a configuration condition.

You start with a target resource and metric you want the alert to monitor. You can filter, group by, and aggregate to the exact measure you require.

Then the yes-no decision logic for triggering the alert notification is configured. It includes the trigger condition, threshold, and duration.

Use multiple conditions


Conditions

Conditions describe when apps and services are considered unhealthy. When conditions are met, they trigger alerting policy violations.

Condition	Actions
Instance count for active [COUNT] Violates when: Any appengine.googleapis.com/system/instance_count stream is above a threshold of 10 for greater than 10 minutes	
Quota denial count for default [COUNT] Violates when: Any appengine.googleapis.com/http/server/quota_denial_count stream is above a threshold of 10 for greater th	

Policy triggers

Triggers when: ANY condition is met

Policy triggers

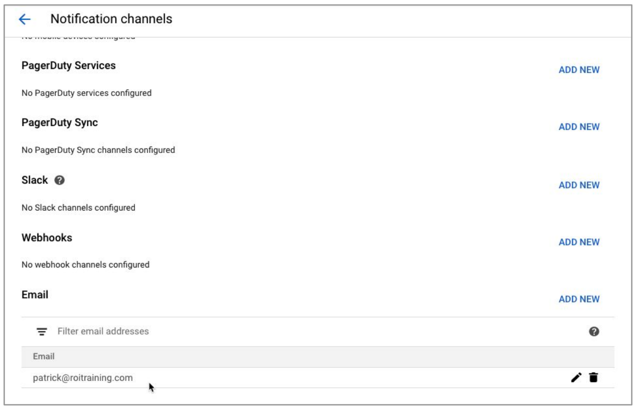
Triggers when
- ALL conditions are met
- ANY condition is met
- ALL conditions are met on matching resources

To try to maximize both precision and recall within a single alert; you can create multiple conditions. The policy trigger is used to determine how more than one trigger will relate to one another and to the alert triggering itself.

Select notification channels

Supported notification channels include:

- Email
- SMS
- Slack
- Google Cloud Mobile app
- PagerDuty
- Webhooks
- Pub/Sub


Notification channels

PagerDuty Services — ADD NEW

No PagerDuty services configured

PagerDuty Sync — ADD NEW

No PagerDuty Sync channels configured

Slack — ADD NEW

No Slack channels configured

Webhooks — ADD NEW

No webhook channels configured

Email — ADD NEW

Filter email addresses

Email
patrick@roitraining.com

Google Cloud

The notification channel, or channels, decides how the alert is sent to the recipient.

Email alerts are easy and informative, but they can become notification spam if you aren't careful.

SMS is a great option for fast notifications, but choose the recipient carefully.

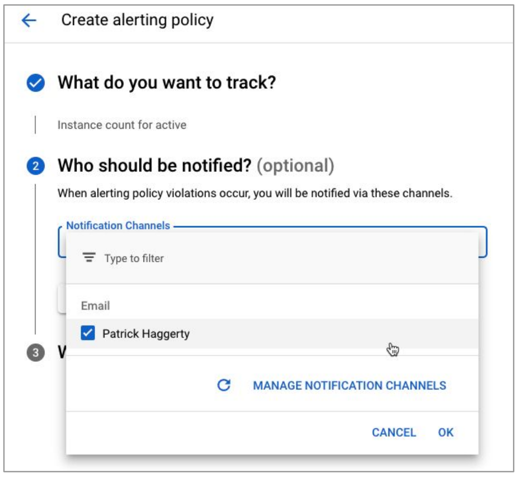
Slack is very popular in support circles.

Google Cloud's mobile app is a valid option.

PagerDuty is a third party on-call management and incident response service.

Webhooks and Pub/Sub are excellent options when alerting to external systems or code.

Zero to many notification channels


Create alerting policy

What do you want to track?

Instance count for active

Who should be notified? (optional)

When alerting policy violations occur, you will be notified via these channels.

Notification Channels

Type to filter

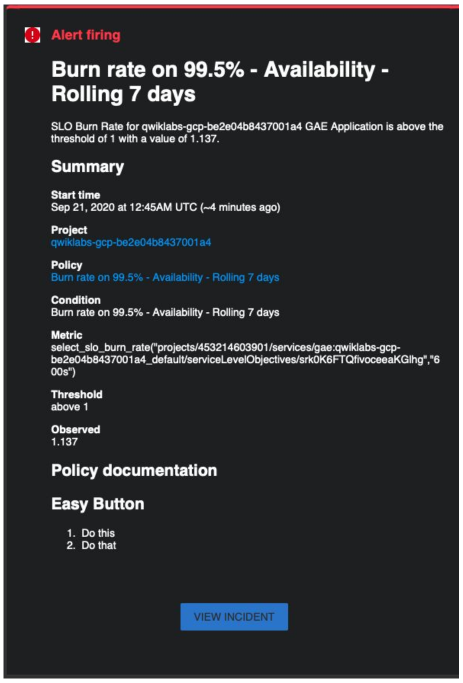
Email

✓ Patrick Haggerty

Google Cloud

An alert may have zero to many notification options selected, and they each can be of a different type.

Email alert example


Alert firing

Burn rate on 99.5% - Availability - Rolling 7 days

SLO Burn Rate for qwiklabs-gcp-be2e04b8437001a4 GAE Application is above the threshold of 1 with a value of 1.137.

Summary

Start time
Sep 21, 2020 at 12:45AM UTC (~4 minutes ago)

Project
qwiklabs-gcp-be2e04b8437001a4

Policy
Burn rate on 99.5% - Availability - Rolling 7 days

Condition
Burn rate on 99.5% - Availability - Rolling 7 days

Metric
select_slo_burn_rate("projects/453214603901/services/gae:qwiklabs-gcp-be2e04b8437001a4_default/serviceLevelObjectives/srk0K6FTQfivoceeaKGlhg","600s")

Threshold
above 1

Observed
1.137

Policy documentation

Easy Button

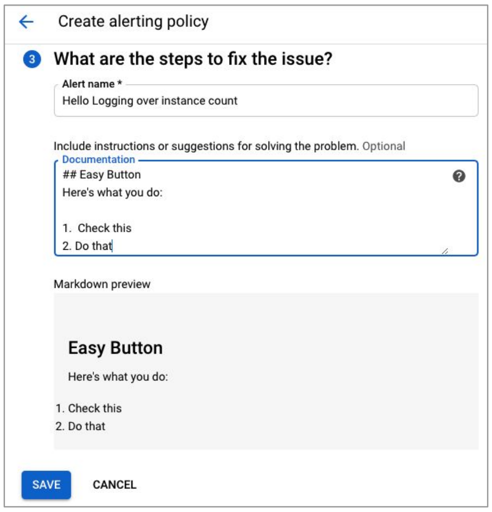
1. Do this
2. Do that

Google Cloud

Here, you see an alert notification sent out through an email. Notice how a lot of the details about exactly what went wrong are automatically included in the email body. The bottom documentation section can also be used to augment the provided information.

Include documentation for added clarity

- Make it easy for the team to understand what is wrong.
- Use markdown to format messages.
- This should be the easy button for the fix, if there is one.


Create alerting policy

What are the steps to fix the issue?

Alert name *
Hello Logging over instance count

Include instructions or suggestions for solving the problem. Optional

Documentation
```
## Easy Button
Here's what you do:

1.  Check this
2. Do that
```

Markdown preview

Easy Button

Here's what you do:

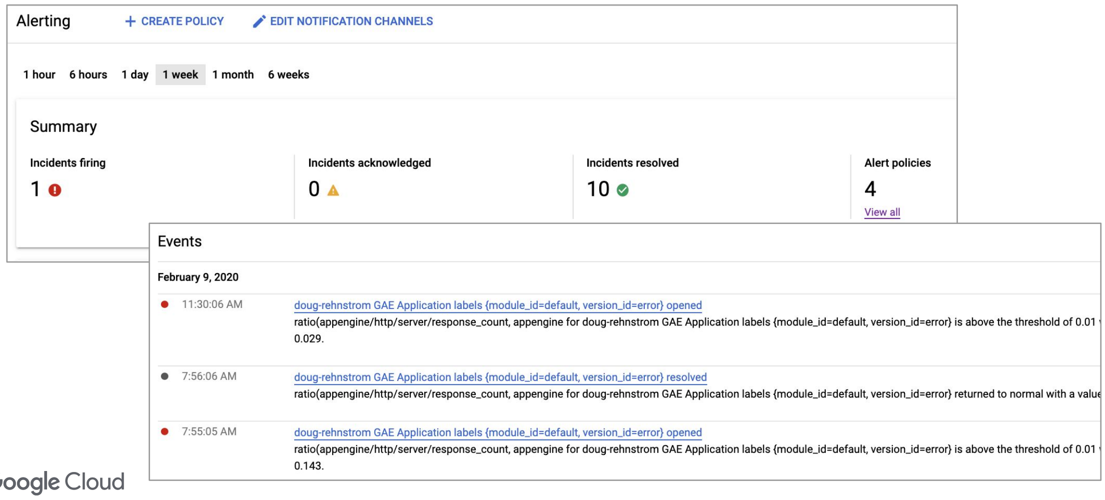
1. Check this
2. Do that

Google Cloud

The documentation option is designed to give the alert recipient additional information they might find helpful. The default alert content will already contain information about which alert is failing and why, so think of this more like an easy button. If there's a standard solution to this particular alert, adding a reference to it here might be a good example of proper documentation inclusion.

Then again, if it was that easy, automate it!

Alerting UI summarizes incidents and events



Alerting + CREATE POLICY EDIT NOTIFICATION CHANNELS

1 hour 6 hours 1 day 1 week 1 month 6 weeks

Summary

Incidents firing	Incidents acknowledged	Incidents resolved	Alert policies
1 ●	0 ▲	10 ✓	4 View all

Events

February 9, 2020

● 11:30:06 AM doug-rehnstrom GAE Application labels {module_id=default, version_id=error} opened
ratio(appengine/http/server/response_count, appengine for doug-rehnstrom GAE Application labels {module_id=default, version_id=error} is above the threshold of 0.01
0.029.

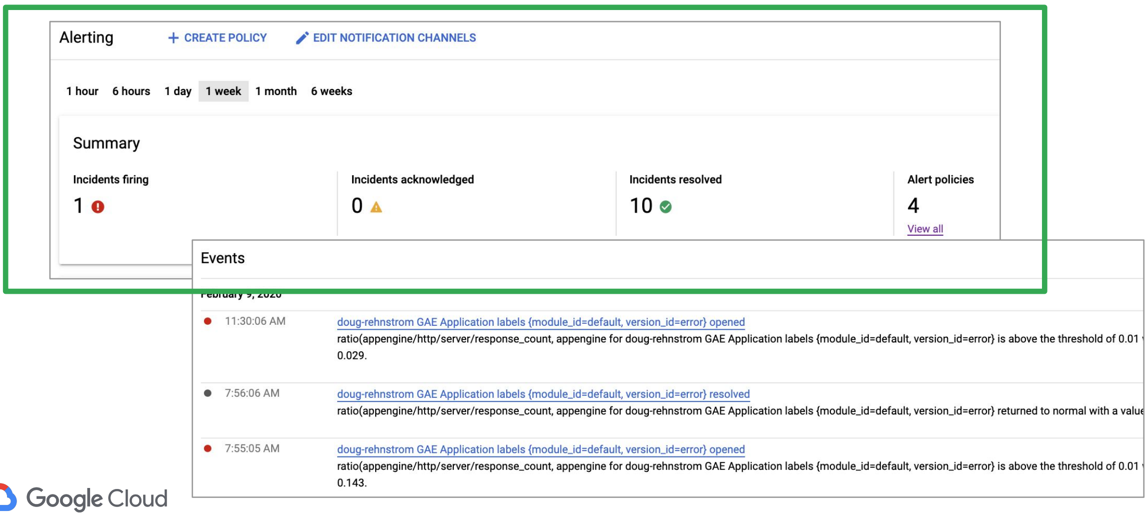
● 7:56:06 AM doug-rehnstrom GAE Application labels {module_id=default, version_id=error} resolved
ratio(appengine/http/server/response_count, appengine for doug-rehnstrom GAE Application labels {module_id=default, version_id=error} returned to normal with a value

● 7:55:05 AM doug-rehnstrom GAE Application labels {module_id=default, version_id=error} opened
ratio(appengine/http/server/response_count, appengine for doug-rehnstrom GAE Application labels {module_id=default, version_id=error} is above the threshold of 0.01
0.143.

Google Cloud

When one or more alert policies have been created, the Alerting UI provides a summary of incidents and alerting events. An event occurs when the conditions for an alerting policy are met. When an event occurs, Cloud Monitoring opens an incident.

Alerting UI summarizes incidents and events



Alerting + CREATE POLICY EDIT NOTIFICATION CHANNELS

1 hour 6 hours 1 day 1 week 1 month 6 weeks

Summary

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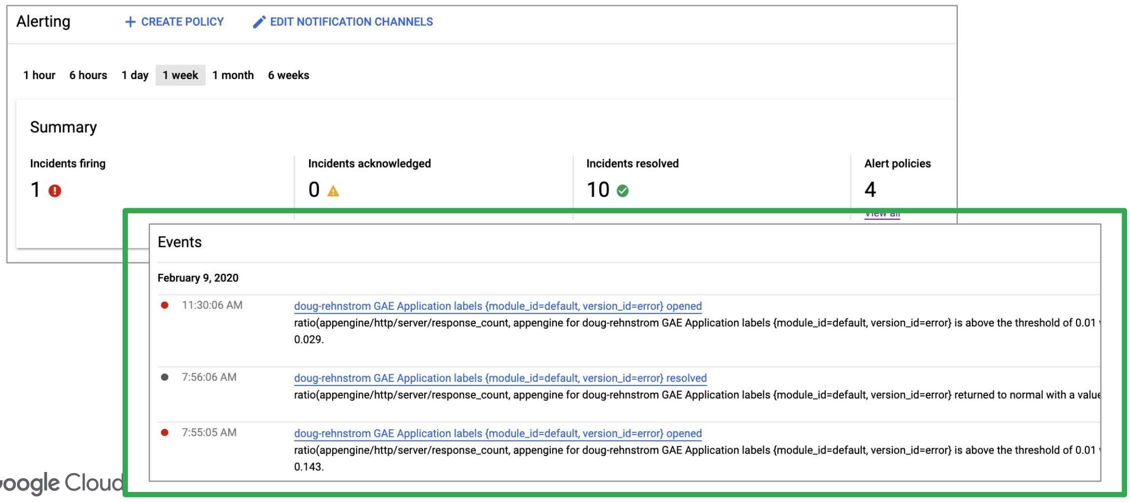
0.143.

Google Cloud

In the **Alerting** window, the **Summary** pane lists the number of incidents, and the **Incidents** pane displays the 10 most recent incidents. Each incident is in one of three states:

- Open incidents. If an incident is open, the alerting policy's set of conditions is currently being met, or there is no data to indicate that the condition is no longer met. This usually indicates a new or unhandled alert.
- Acknowledged incidents. A tech spots a new open alert, but before they start to investigate, they mark it as acknowledged as a signal to others that someone is dealing with the issue.
- Closed incidents. If an incident is closed, the alert policy conditions are no longer being met. An incident is listed as closed if there is no data to indicate whether the condition still exists and the incident has expired.

Alerting UI summarizes incidents and events



Summary

Incidents firing	Incidents acknowledged	Incidents resolved	Alert policies
1	0	10	4

Events

February 9, 2020

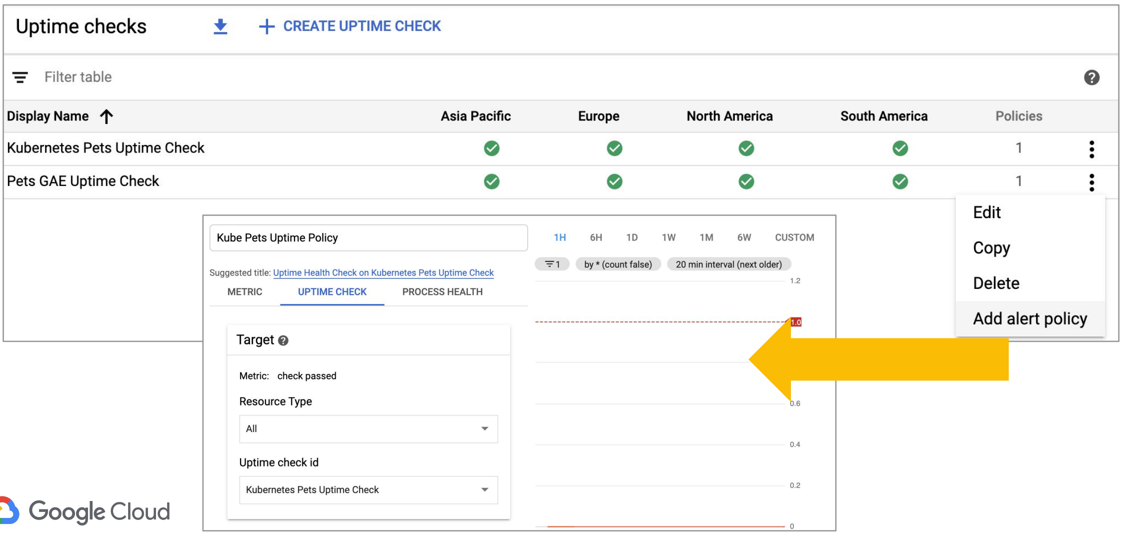
● 11:30:06 AM doug-rehnstrom GAE Application labels {module_id=default, version_id=error} opened
ratio(appengine/http/server/response_count, appengine for doug-rehnstrom GAE Application labels {module_id=default, version_id=error} is above the threshold of 0.01
0.029.

● 7:56:06 AM doug-rehnstrom GAE Application labels {module_id=default, version_id=error} resolved
ratio(appengine/http/server/response_count, appengine for doug-rehnstrom GAE Application labels {module_id=default, version_id=error} returned to normal with a value

● 7:55:05 AM doug-rehnstrom GAE Application labels {module_id=default, version_id=error} opened
ratio(appengine/http/server/response_count, appengine for doug-rehnstrom GAE Application labels {module_id=default, version_id=error} is above the threshold of 0.01
0.143.

The **Events** pane of the **Alerting** dashboard displays the most recent events and includes a graphical indicator of the alert status, a link to event details, a quick description, and a timestamp.

Attach alerts to uptime checks



Uptime checks | CREATE UPTIME CHECK

Filter table

Display Name	Asia Pacific	Europe	North America	South America	Policies
Kubernetes Pets Uptime Check	✓	✓	✓	✓	1
Pets GAE Uptime Check	✓	✓	✓	✓	1

Kube Pets Uptime Policy

Suggested title: Uptime Health Check on Kubernetes Pets Uptime Check

Target

Metric: check passed

Resource Type: All

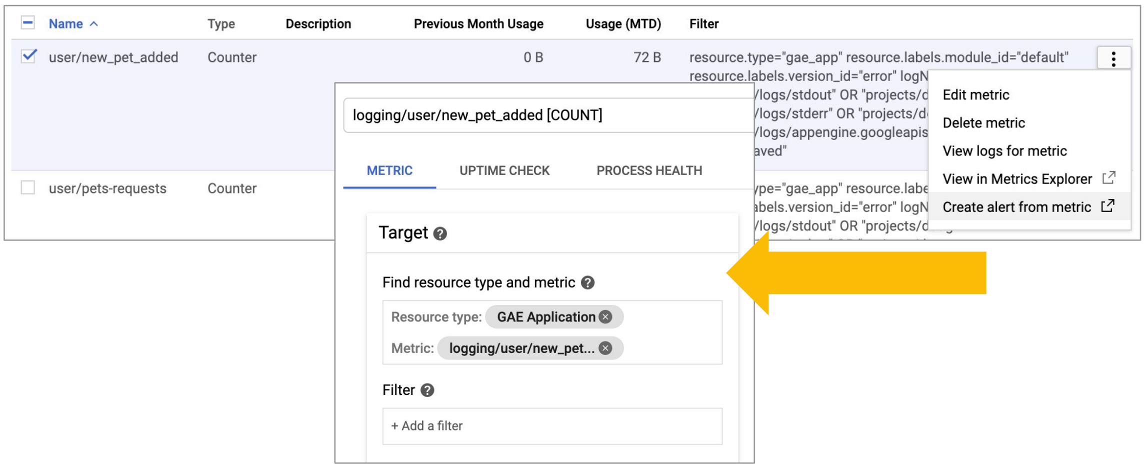
Uptime check id: Kubernetes Pets Uptime Check

Google Cloud

An uptime check is a request sent to an externally accessible site or service to see if it responds, or is up. You can use uptime checks to determine the availability and latency of a VM instance, an App Engine service, a URL, or an AWS load balancer.

You can monitor the availability of a resource by creating an alerting policy that creates an incident if the uptime check fails. You also have the option to observe the results of uptime checks in the Monitoring uptime-check dashboards.

Attach alerts to logs-based metrics



Name	Type	Description	Previous Month Usage	Usage (MTD)	Filter
✓ user/new_pet_added	Counter		0 B	72 B	resource.type="gae_app" resource.labels.module_id="default" resource.labels.version_id="error" logN /logs/stdout" OR "projects/d /logs/stderr" OR "projects/d /logs/appengine.googleapis aved"
user/pets-requests	Counter				ype="gae_app" resource.labe abels.version_id="error" logN /logs/stdout" OR "projects/d

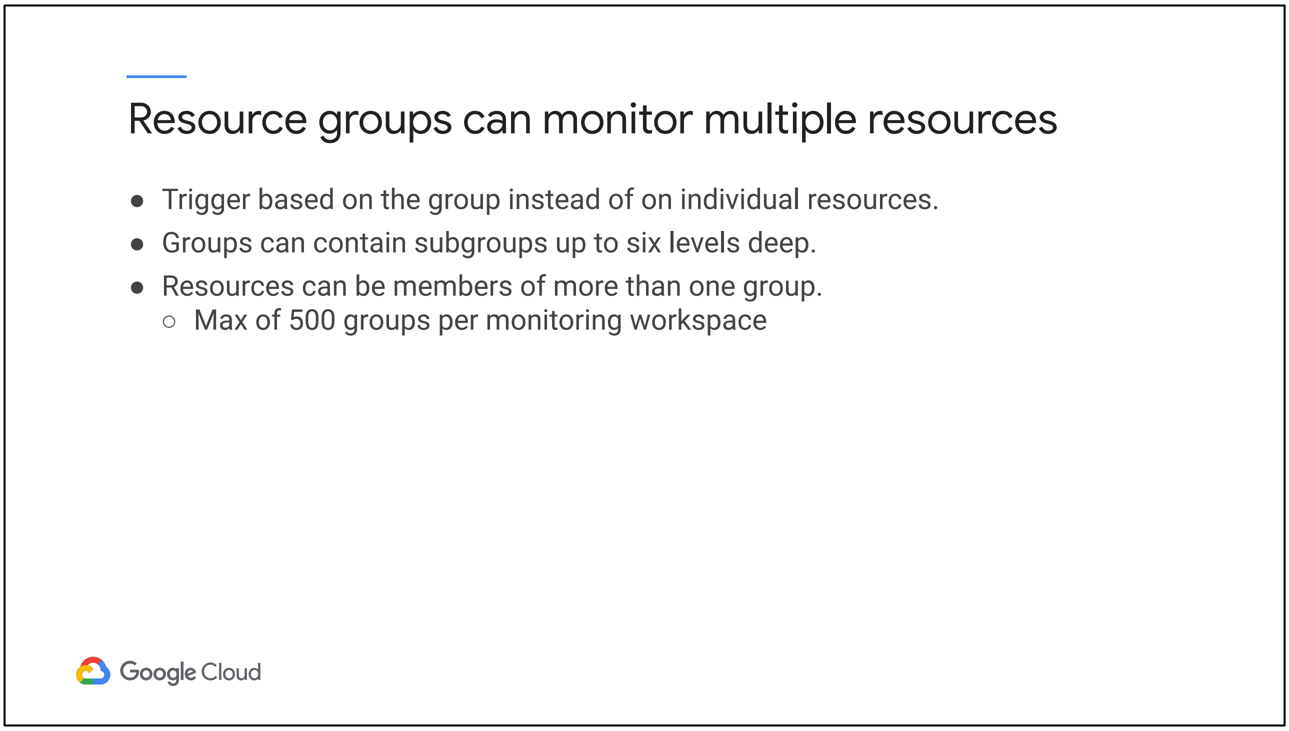
logging/user/new_pet_added [COUNT]

Resource type: GAE Application

Metric: logging/user/new_pet...

Logs-based metrics are Cloud Monitoring metrics based on the content of log entries. For example, the metrics can record the number of log entries containing particular messages, or they can extract latency information reported in log entries. You can use logs-based metrics in Cloud Monitoring charts and alerting policies.

As we covered earlier in this module, an alerting policy describes a set of conditions that you want to monitor. When you create an alerting policy, you must also specify its conditions: what is monitored and when to trigger an alert. The logs-based metric serves as the basis for an alerting condition.



Resource groups can monitor multiple resources

- Trigger based on the group instead of on individual resources.
- Groups can contain subgroups up to six levels deep.
- Resources can be members of more than one group.
  - Max of 500 groups per monitoring workspace

Google Cloud

Groups provide a mechanism for alerting on the behavior of a set of resources, rather than on individual resources. For example, you can create an alerting policy that is triggered if some number of resources in the group violates a particular condition (for example, CPU load), rather than having each resource inform you of violations individually.

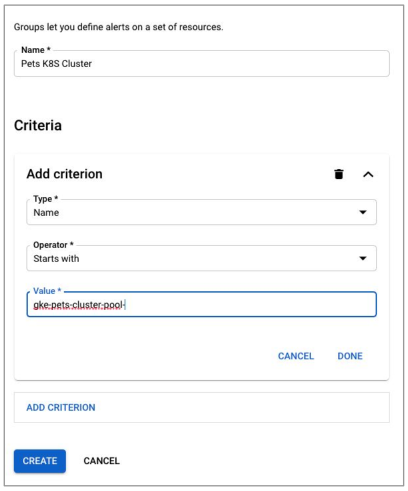
Groups can contain subgroups, up to six levels deep. One application for groups and subgroups is the management of physical or logical topologies. For example, with groups, you can separate your monitoring of production resources from your monitoring of test or development resources. You can also create subgroups to monitor your production resources by zone.

Resources can belong to multiple groups, and a given monitoring workspace can have up to 500 groups.

Use multiple criteria to create resource groups

Criteria can include:

- Resource name
- Resource type
- Tags and labels
- Security groups
- Regions
- App Engine apps and services


Groups let you define alerts on a set of resources.

Name *: Pets K8S Cluster

Criteria

Add criterion

Type *: Name

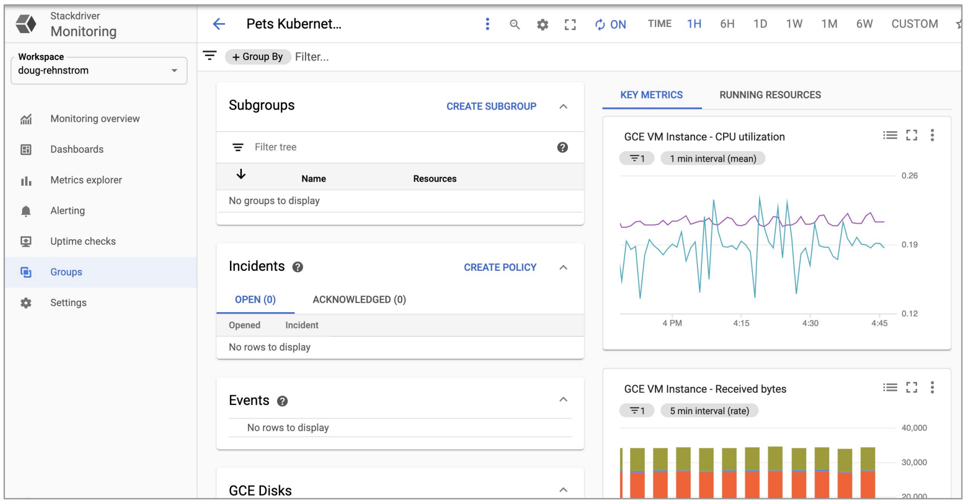
Operator *: Starts with

Value *: gke-pets-cluster-pool-

Google Cloud

You define the one-to-many membership criteria for your groups. A resource belongs to a group if the resource meets the membership criteria of the group. Membership criteria can be based on resource name or type, network tag, resource label, security group, region, or App Engine app or service. Resources can belong to multiple groups.

Monitor all resources in a group together

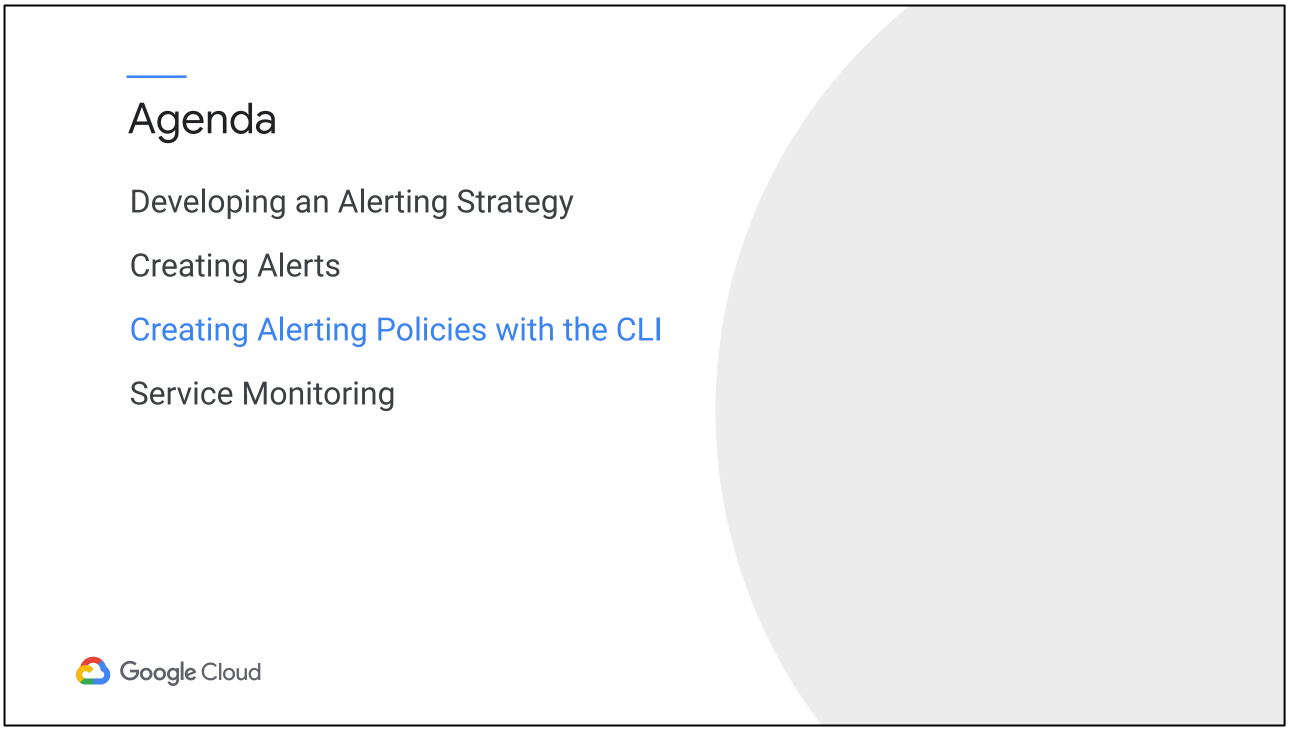


No groups to display

No rows to display

No rows to display

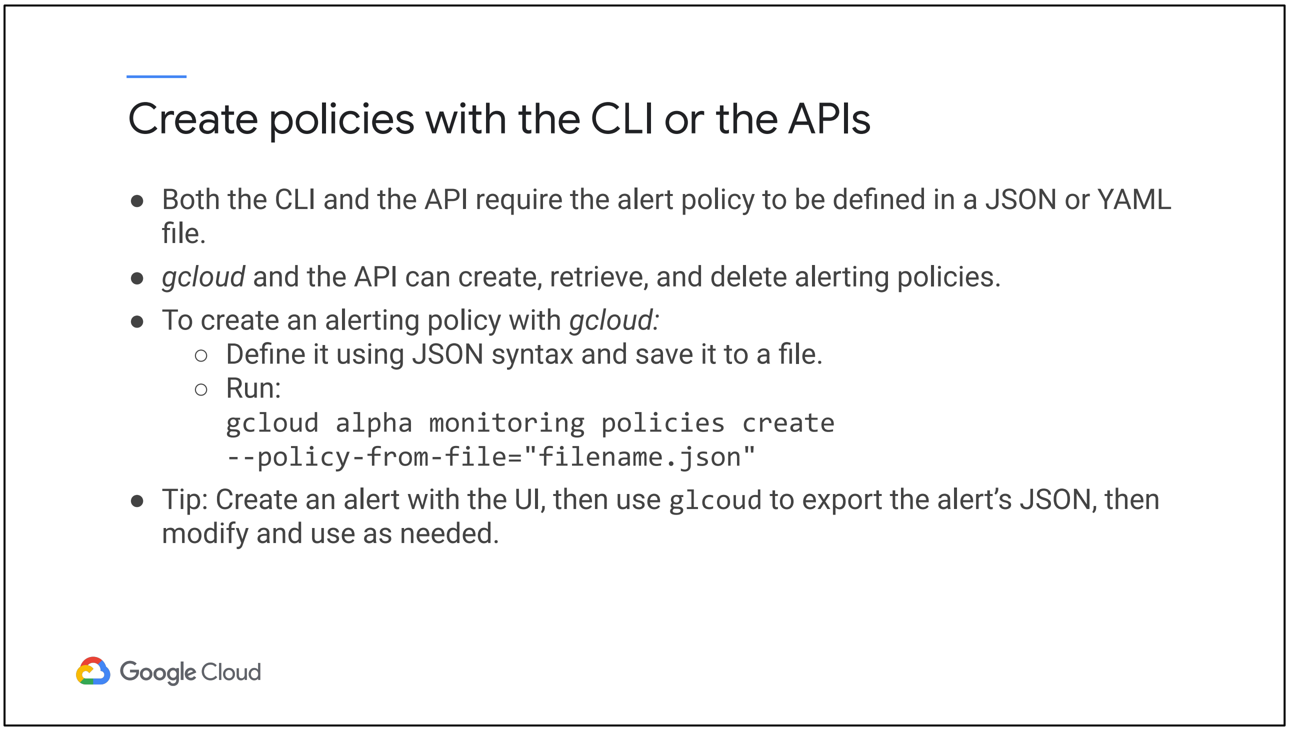
After the group is created, all the resources in the group can be monitored together as a unit.



Agenda

Google Cloud

Alerting policies can be created both in the Google Cloud Console and by using the CLI or API.



Create policies with the CLI or the APIs

- Both the CLI and the API require the alert policy to be defined in a JSON or YAML file.
- *gcloud* and the API can create, retrieve, and delete alerting policies.
- To create an alerting policy with *gcloud:*
  - Define it using JSON syntax and save it to a file.
  - Run:
    ```
    gcloud alpha monitoring policies create
    --policy-from-file="filename.json"
    ```
- Tip: Create an alert with the UI, then use `glcoud` to export the alert's JSON, then modify and use as needed.

Google Cloud

https://cloud.google.com/sdk/gcloud/reference/alpha/monitoring/channels/create

Creating alerts from the CLI or the API starts with an alert policy definition in either a JSON or YAML format. One neat learning trick when learning the correct file format is to create an alert using the Google Cloud Console, then use the *gcloud monitoring policies list* and the *describe* commands to see the corresponding definition file.

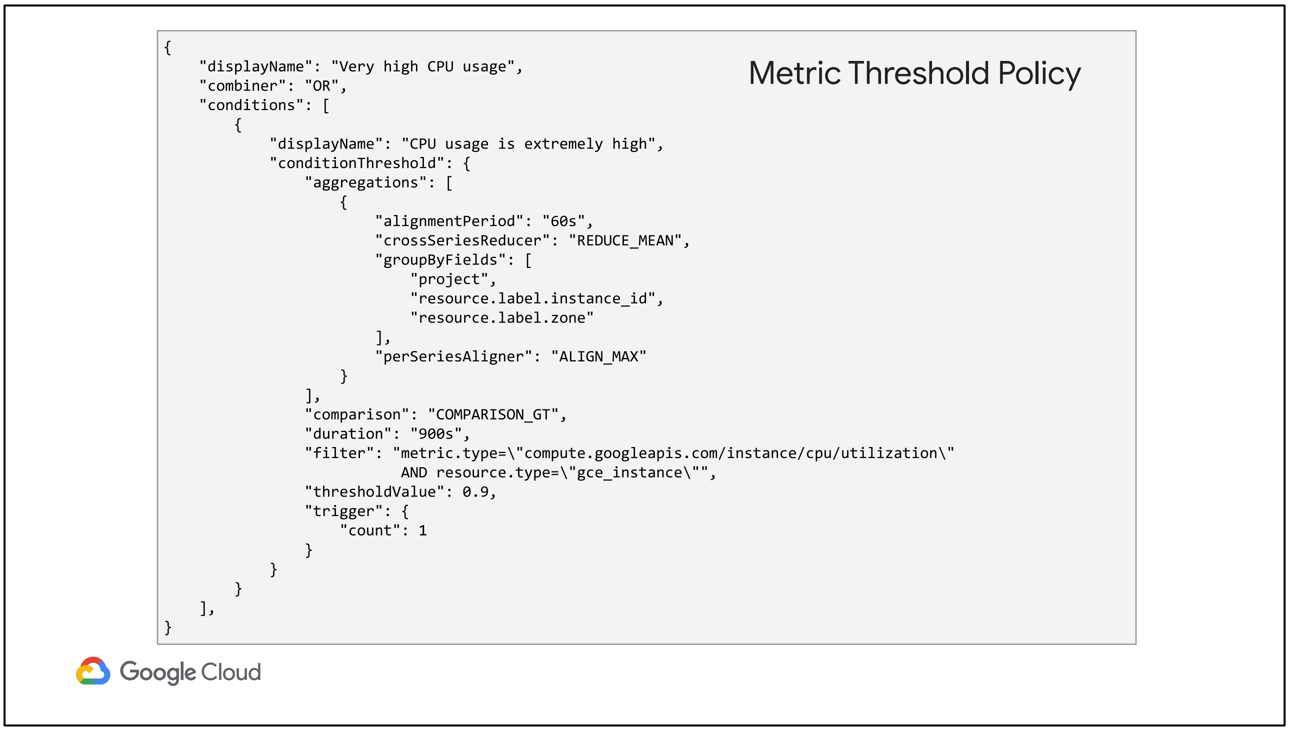
The alerting API and *gcloud* can create, retrieve, and delete alerting policies.

As an example, to create an alerting policy with *gcloud*:

- Define it using JSON syntax and save to a file.
- Then run:
  gcloud alpha monitoring policies create --policy-from-file="filename.json"

You can list all alerts by running:
gcloud alpha monitoring policies list

Find the one that's close to what you need, get its name, then do a describe on it. Like:
*gcloud alpha monitoring policies describe projects/qwiklabs-gcp-***/alertPolicies/17163449757014751989 --format json > example.json*

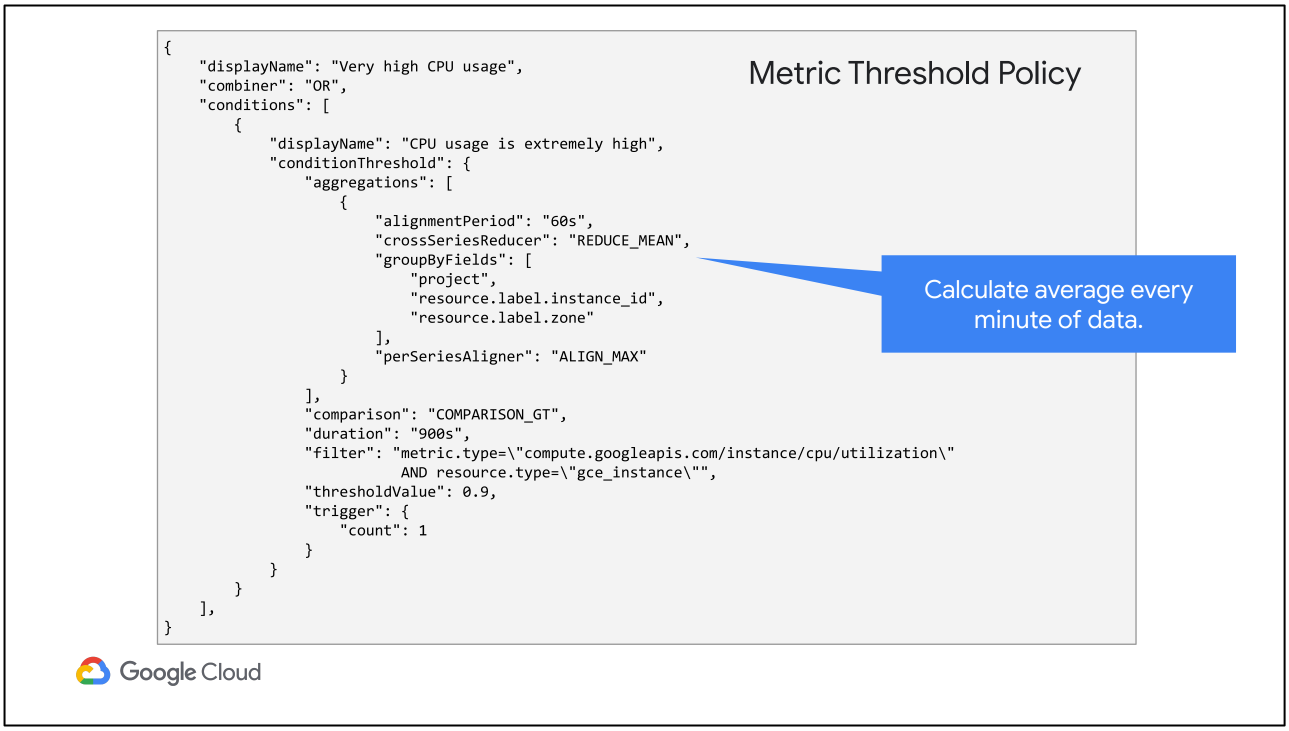

Metric Threshold Policy

```
{
    "displayName": "Very high CPU usage",
    "combiner": "OR",
    "conditions": [
        {
            "displayName": "CPU usage is extremely high",
            "conditionThreshold": {
                "aggregations": [
                    {
                        "alignmentPeriod": "60s",
                        "crossSeriesReducer": "REDUCE_MEAN",
                        "groupByFields": [
                            "project",
                            "resource.label.instance_id",
                            "resource.label.zone"
                        ],
                        "perSeriesAligner": "ALIGN_MAX"
                    }
                ],
                "comparison": "COMPARISON_GT",
                "duration": "900s",
                "filter": "metric.type=\"compute.googleapis.com/instance/cpu/utilization\"
                          AND resource.type=\"gce_instance\"",
                "thresholdValue": 0.9,
                "trigger": {
                    "count": 1
                }
            }
        }
    ],
}
```

Google Cloud

Now let's examine some policy file examples. Our first example is a metric threshold policy.

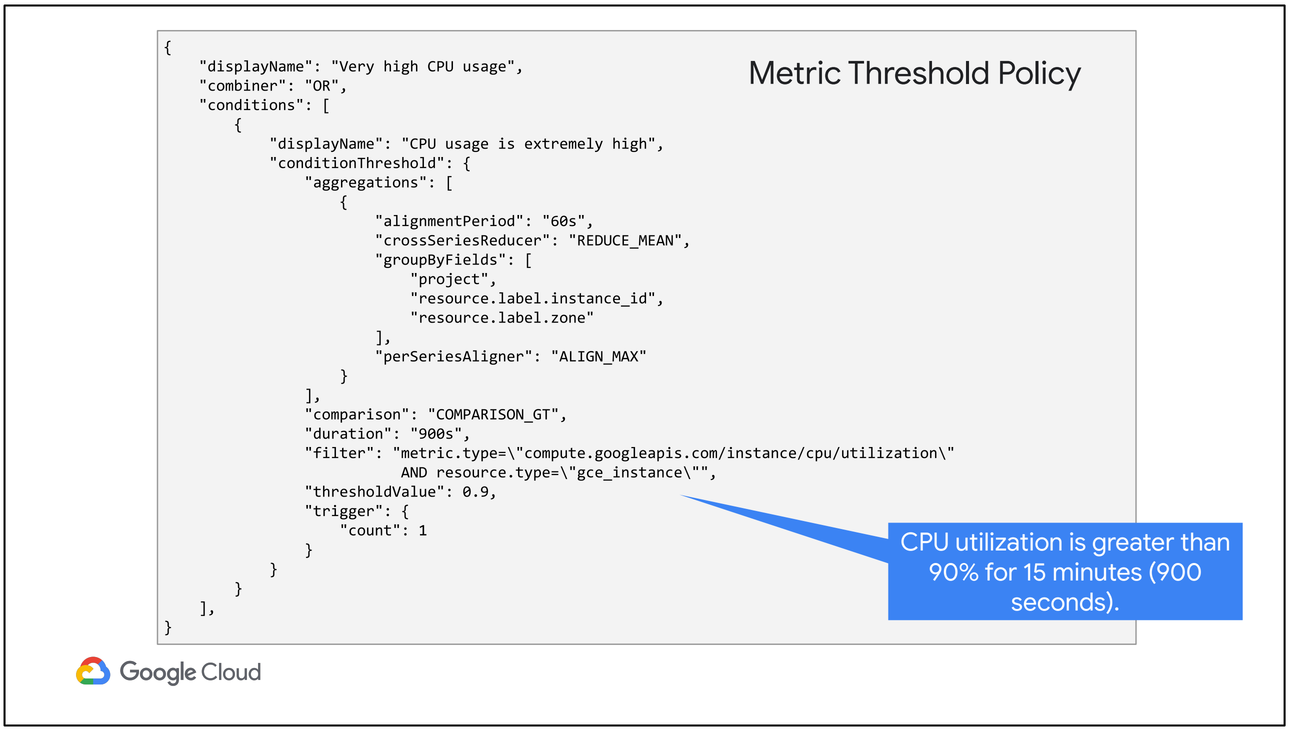
A metric threshold policy detects when some value crosses a specified boundary. Threshold policies let you know that something is approaching an important point, so you can take some action. For example, when available disk space falls below 10 percent of total disk space, your system may soon run out of disk space.



Metric Threshold Policy

```
{
    "displayName": "Very high CPU usage",
    "combiner": "OR",
    "conditions": [
        {
            "displayName": "CPU usage is extremely high",
            "conditionThreshold": {
                "aggregations": [
                    {
                        "alignmentPeriod": "60s",
                        "crossSeriesReducer": "REDUCE_MEAN",
                        "groupByFields": [
                            "project",
                            "resource.label.instance_id",
                            "resource.label.zone"
                        ],
                        "perSeriesAligner": "ALIGN_MAX"
                    }
                ],
                "comparison": "COMPARISON_GT",
                "duration": "900s",
                "filter": "metric.type=\"compute.googleapis.com/instance/cpu/utilization\"
                           AND resource.type=\"gce_instance\"",
                "thresholdValue": 0.9,
                "trigger": {
                    "count": 1
                }
            }
        }
    ],
}
```

This sample policy uses average CPU usage as an indicator of the health of a group of VMs. It averages by instance ID per zone,

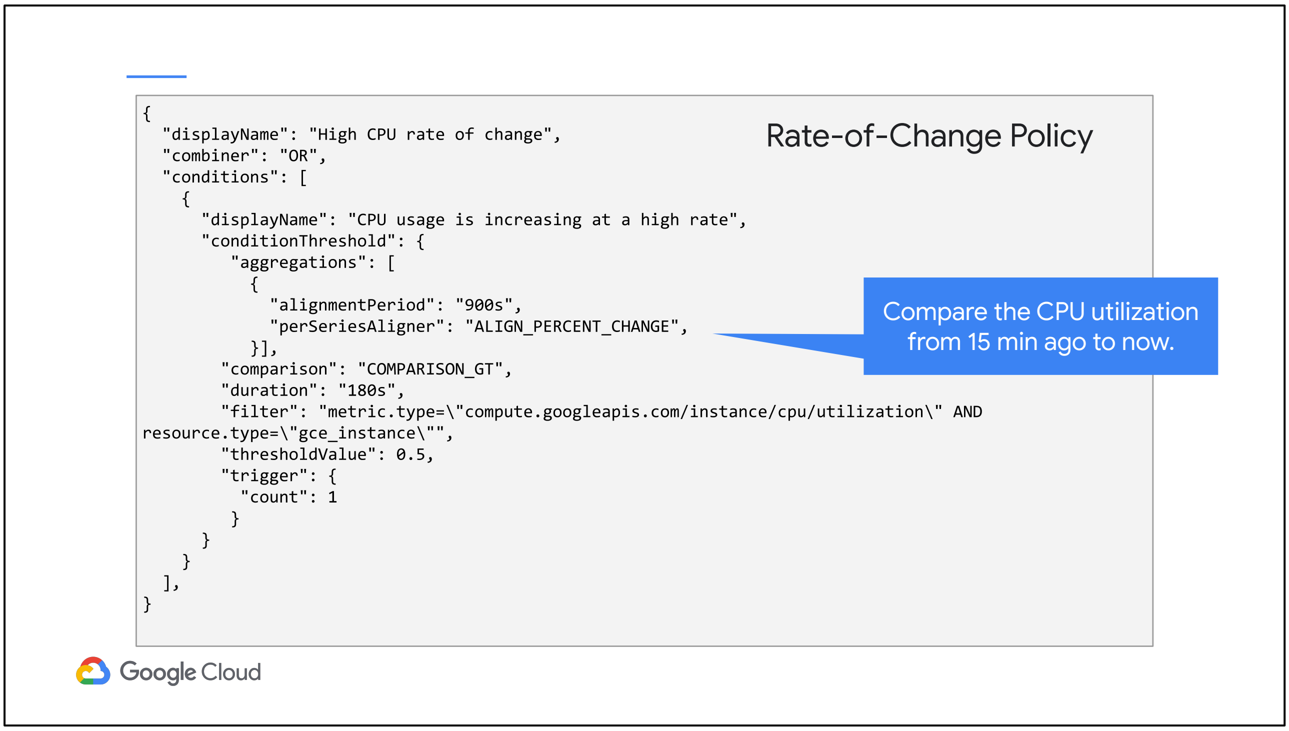


Metric Threshold Policy

```
{
    "displayName": "Very high CPU usage",
    "combiner": "OR",
    "conditions": [
        {
            "displayName": "CPU usage is extremely high",
            "conditionThreshold": {
                "aggregations": [
                    {
                        "alignmentPeriod": "60s",
                        "crossSeriesReducer": "REDUCE_MEAN",
                        "groupByFields": [
                            "project",
                            "resource.label.instance_id",
                            "resource.label.zone"
                        ],
                        "perSeriesAligner": "ALIGN_MAX"
                    }
                ],
                "comparison": "COMPARISON_GT",
                "duration": "900s",
                "filter": "metric.type=\"compute.googleapis.com/instance/cpu/utilization\"
                           AND resource.type=\"gce_instance\"",
                "thresholdValue": 0.9,
                "trigger": {
                    "count": 1
                }
            }
        }
    ],
}
```

CPU utilization is greater than 90% for 15 minutes (900 seconds).
Google Cloud

then it grabs value with the highest CPU usage and compares it to the 90% threshold. If it's over 90% for more than 15 minutes, an alert is triggered.



Rate-of-Change Policy

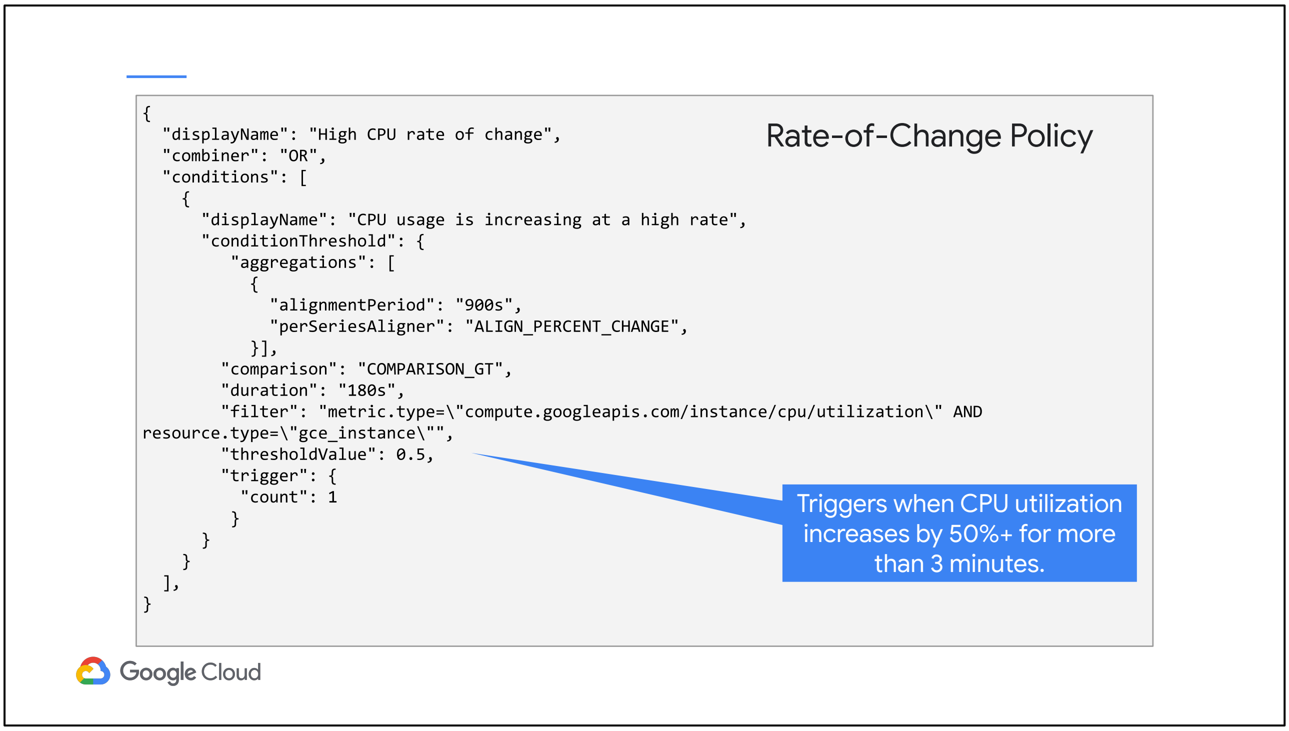
```
{
  "displayName": "High CPU rate of change",
  "combiner": "OR",
  "conditions": [
    {
      "displayName": "CPU usage is increasing at a high rate",
      "conditionThreshold": {
         "aggregations": [
           {
             "alignmentPeriod": "900s",
             "perSeriesAligner": "ALIGN_PERCENT_CHANGE",
           }],
        "comparison": "COMPARISON_GT",
        "duration": "180s",
        "filter": "metric.type=\"compute.googleapis.com/instance/cpu/utilization\" AND
resource.type=\"gce_instance\"",
        "thresholdValue": 0.5,
        "trigger": {
          "count": 1
         }
      }
    }
  ],
}
```

Compare the CPU utilization from 15 min ago to now.

Google Cloud

In our next example, let's look at a rate of change policy. In this example, we want to trigger an alert if the rate of CPU use is increasing rapidly.

This time, we filter for the Compute Engine instance CPU utilization metric. The align percent change aligner averages CPU utilization over a 10-minute window. Here, we take the window average from 15 minutes (900 seconds) ago, and we compare it against the window for now, calculating a percent change.



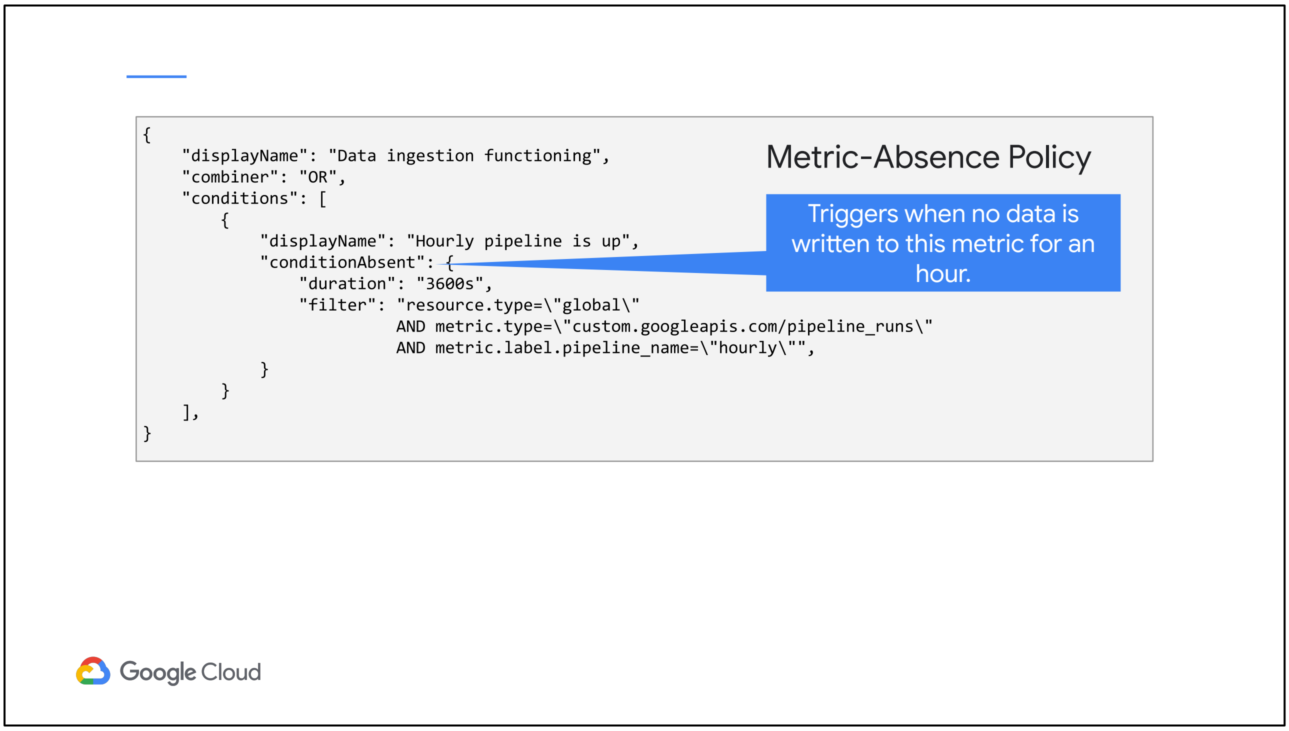
Rate-of-Change Policy

```
{
  "displayName": "High CPU rate of change",
  "combiner": "OR",
  "conditions": [
    {
      "displayName": "CPU usage is increasing at a high rate",
      "conditionThreshold": {
         "aggregations": [
           {
             "alignmentPeriod": "900s",
             "perSeriesAligner": "ALIGN_PERCENT_CHANGE",
           }],
        "comparison": "COMPARISON_GT",
        "duration": "180s",
        "filter": "metric.type=\"compute.googleapis.com/instance/cpu/utilization\" AND
resource.type=\"gce_instance\"",
        "thresholdValue": 0.5,
        "trigger": {
          "count": 1
         }
      }
    }
  ],
}
```

Triggers when CPU utilization increases by 50%+ for more than 3 minutes.

Google Cloud

If that percent change is over 50% for 3 minutes (180 seconds) or more, trigger an alert.



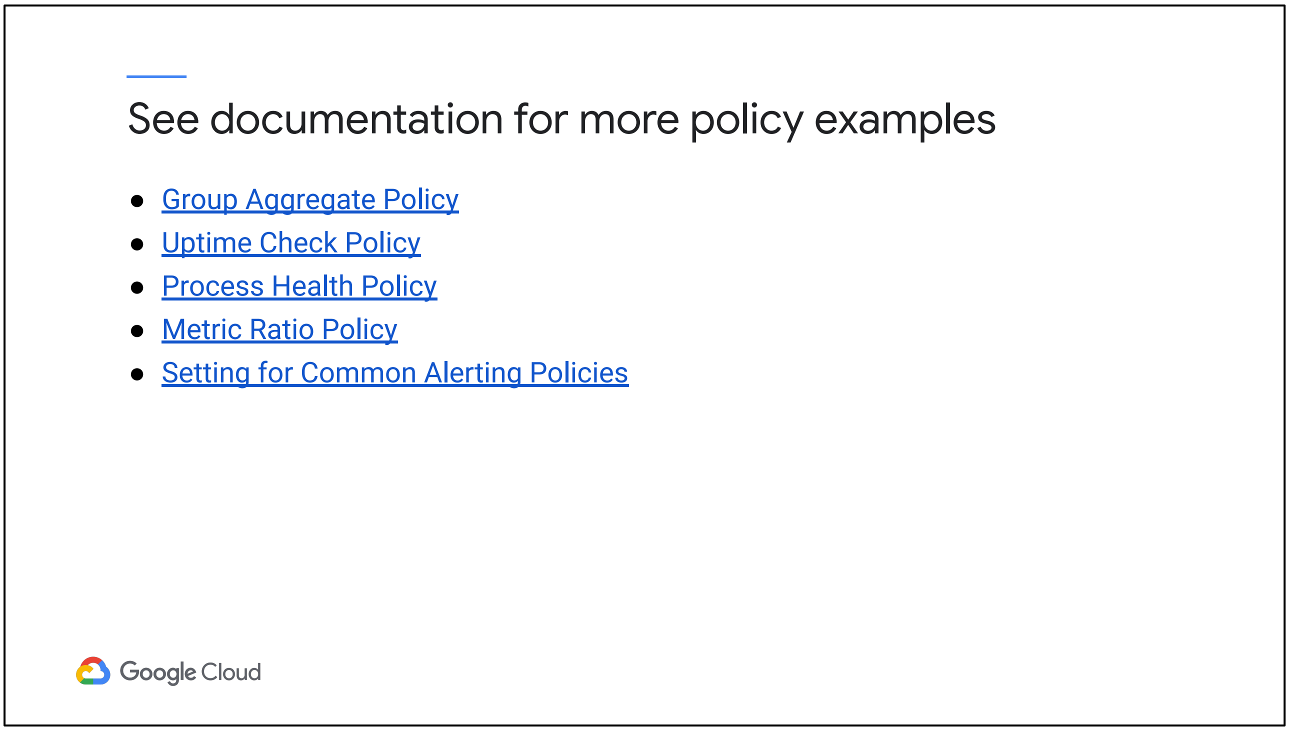
Metric-Absence Policy

```
{
    "displayName": "Data ingestion functioning",
    "combiner": "OR",
    "conditions": [
        {
            "displayName": "Hourly pipeline is up",
            "conditionAbsent": {
                "duration": "3600s",
                "filter": "resource.type=\"global\"
                          AND metric.type=\"custom.googleapis.com/pipeline_runs\"
                          AND metric.label.pipeline_name=\"hourly\"",
            }
        }
    ],
}
```

Triggers when no data is written to this metric for an hour.

Google Cloud

Here we see a metric-absence policy. It will trigger if no data is written to the pipeline_runs custom metric for a period of an hour: in other words, your hourly pipeline has failed to run. Note that the condition used here is `conditionAbsent`.



See documentation for more policy examples

- Group Aggregate Policy
- Uptime Check Policy
- Process Health Policy
- Metric Ratio Policy
- Setting for Common Alerting Policies

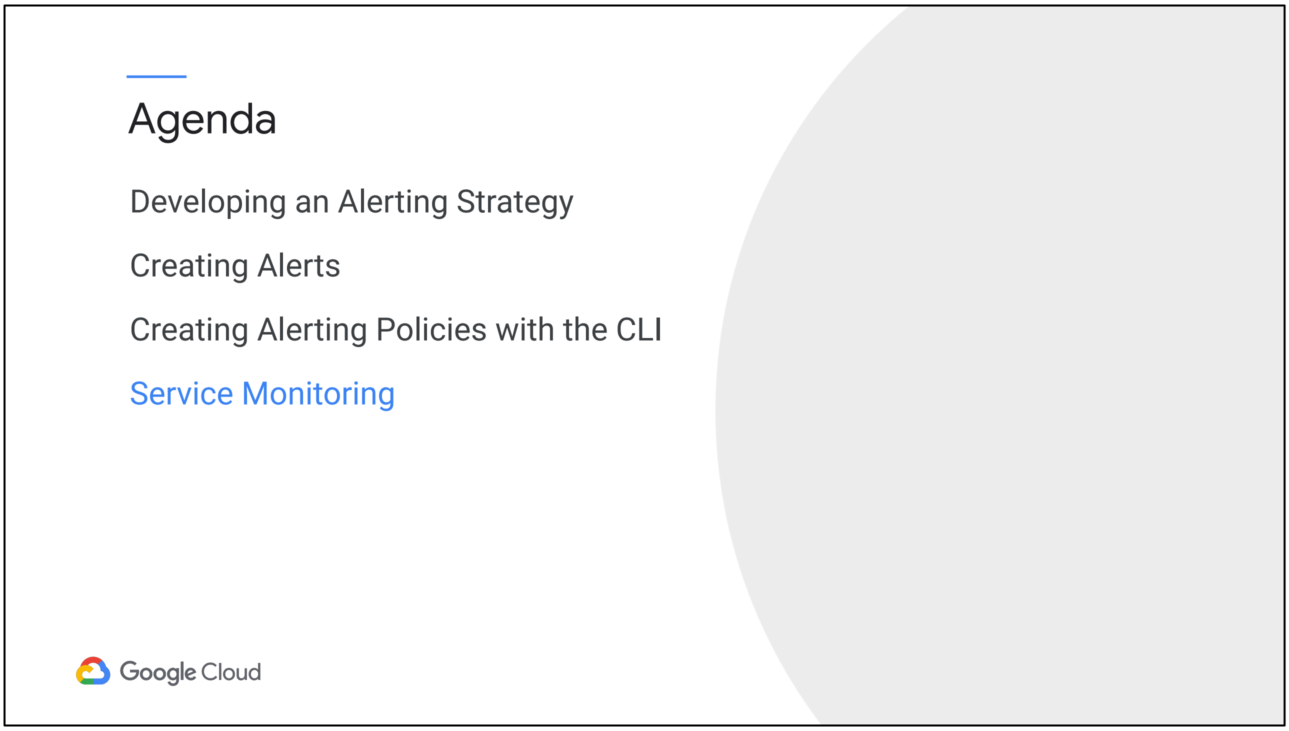
Google Cloud

For some more policy examples, visit the links listed on this slide.

Lab Intro

Alerting in Google Cloud

In this lab, you deploy an application to Google Cloud and then create alerting policies that notify you if the application is not up or is generating errors.



Agenda

Developing an Alerting Strategy

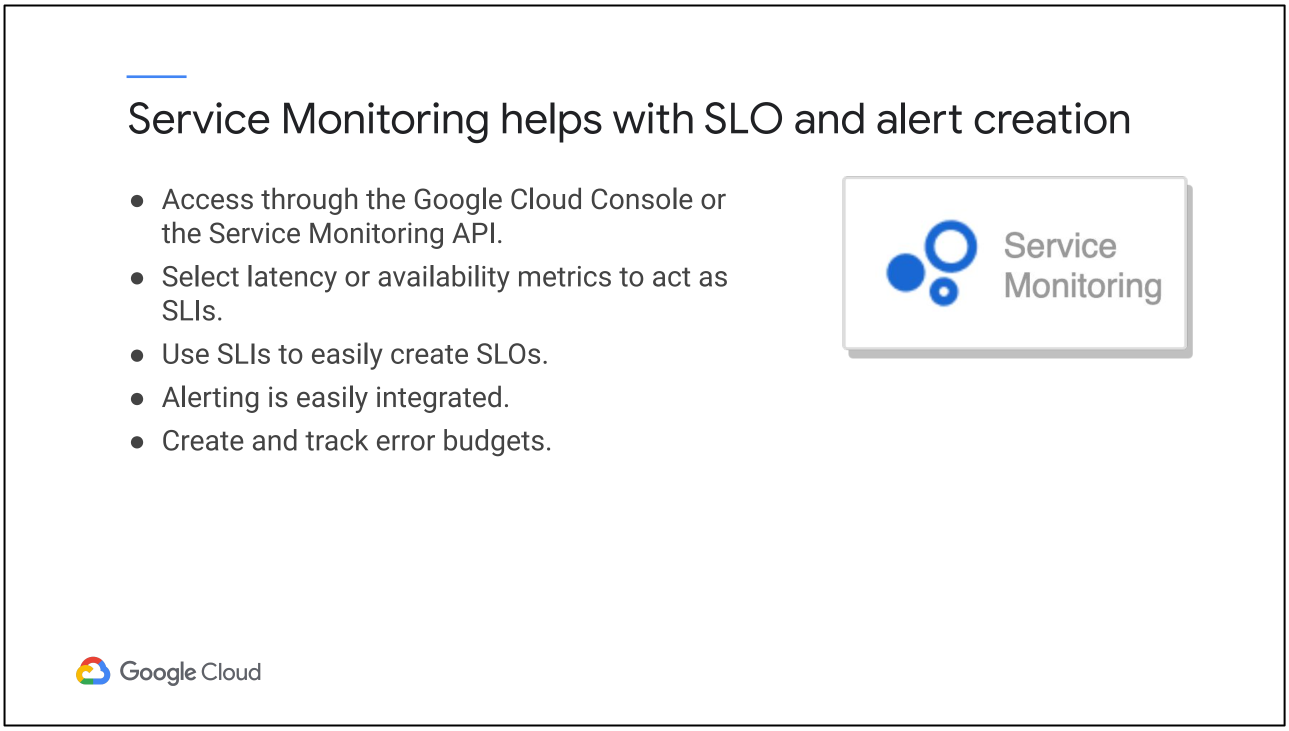
Creating Alerts

Creating Alerting Policies with the CLI

Service Monitoring

Google Cloud

Now that we’ve examined alerts, their use, and their creation, let’s see how Google’s new Service Monitoring console and API can help.



Service Monitoring helps with SLO and alert creation

- Access through the Google Cloud Console or the Service Monitoring API.
- Select latency or availability metrics to act as SLIs.
- Use SLIs to easily create SLOs.
- Alerting is easily integrated.
- Create and track error budgets.

Service Monitoring

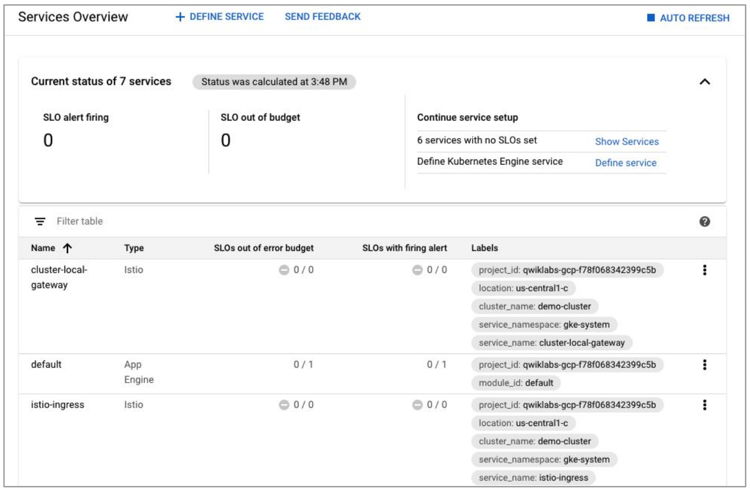
Google Cloud

Modern applications are composed of multiple services, and when something fails, it often seems like many things fail at once. To help manage this complexity, Service Monitoring helps with SLO and Alert creation.

Accessible through the Google Cloud Console and via an API, Service Monitoring supports latency- and availability-based SLI metrics. SLO performance goals can be specified and, when combined with compliance periods, automated alerting is easily configurable.

Service Monitoring also calculates and reports error budgets to help with change planning.

Consolidated services overview



Services Overview   + DEFINE SERVICE   SEND FEEDBACK   AUTO REFRESH

Current status of 7 services   Status was calculated at 3:48 PM

SLO alert firing
0

SLO out of budget
0

Continue service setup

6 services with no SLOs set	Show Services
Define Kubernetes Engine service	Define service

Filter table

Name ↑	Type	SLOs out of error budget	SLOs with firing alert	Labels
cluster-local-gateway	Istio	0 / 0	0 / 0	project_id: qwiklabs-gcp-f78f068342399c5b location: us-central1-c cluster_name: demo-cluster service_namespace: gke-system service_name: cluster-local-gateway
default	App Engine	0 / 1	0 / 1	project_id: qwiklabs-gcp-f78f068342399c5b module_id: default
istio-ingress	Istio	0 / 0	0 / 0	project_id: qwiklabs-gcp-f78f068342399c5b location: us-central1-c cluster_name: demo-cluster service_namespace: gke-system service_name: istio-ingress

Google Cloud

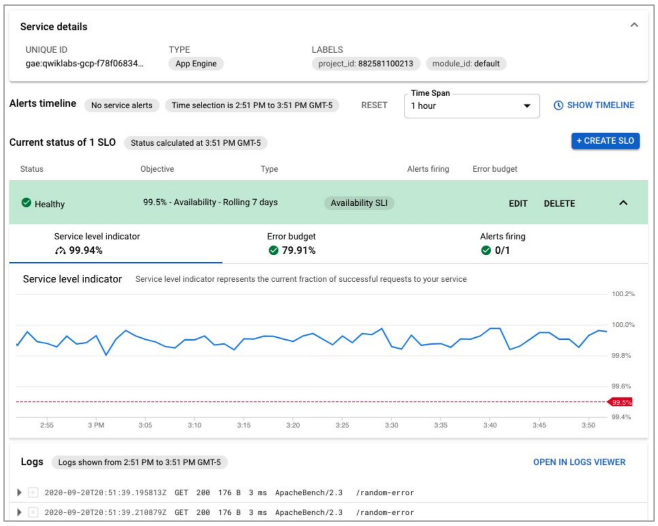
The Service Monitoring consolidated services overview page is your point of entry. Near the top of the page, a summary of your alerts and SLOs is displayed.

Below that is a summary view of the health of your various services. Here, you can see the service name, type, SLO status, and whether any SLO-related alerts are firing.

To monitor or view details for a specific service, click the service name.

You can also filter by entering a value in the **Filter table** in the upper-left corner of the table to apply additional conditions.

SLO details, compliance, and alerting in central UI



Service details

UNIQUE ID	TYPE	LABELS
gae:qwiklabs-gcp-f78f06834...	App Engine	project_id: 882581100213 · module_id: default

Alerts timeline · No service alerts · Time selection is 2:51 PM to 3:51 PM GMT-5 · RESET · Time Span: 1 hour · SHOW TIMELINE

Current status of 1 SLO · Status calculated at 3:51 PM GMT-5 · + CREATE SLO

Status	Objective	Type	Alerts firing	Error budget
✓ Healthy	99.5% - Availability - Rolling 7 days	Availability SLI		

Service level indicator	Error budget	Alerts firing
99.94%	✓ 79.91%	✓ 0/1

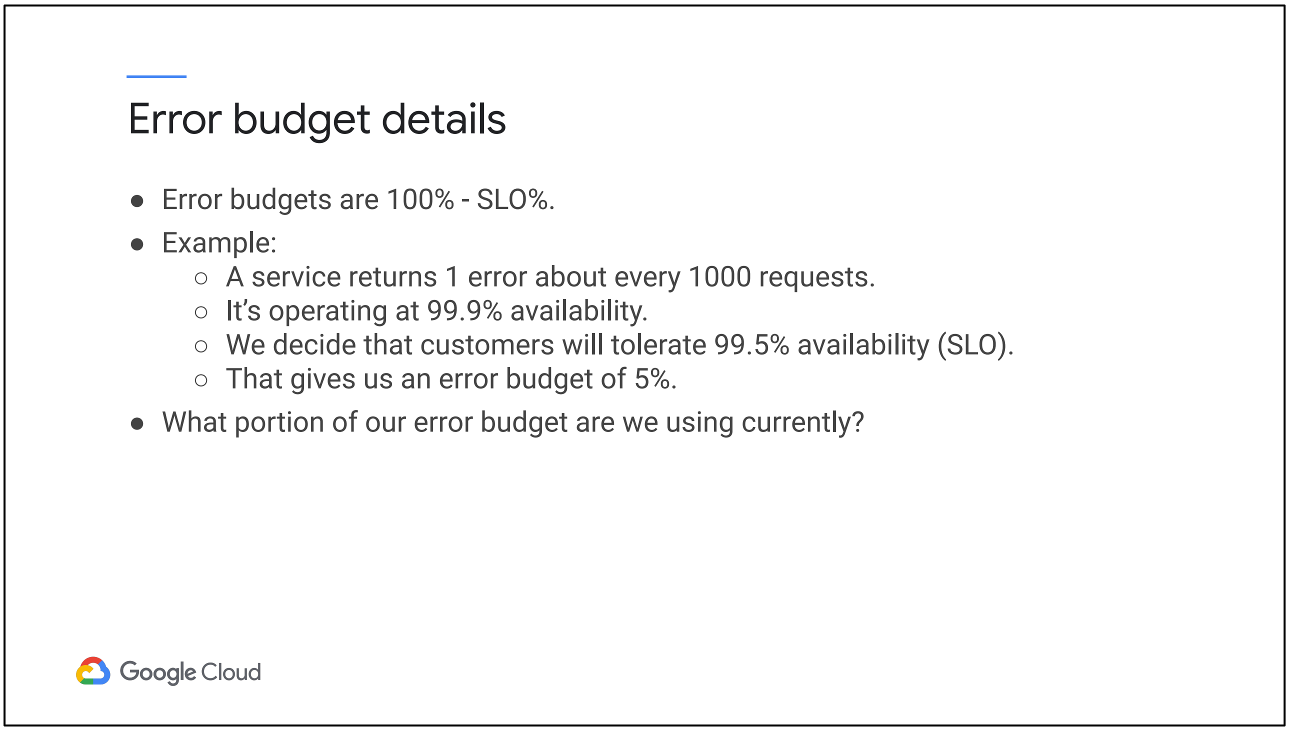
Service level indicator Service level indicator represents the current fraction of successful requests to your service

Logs · Logs shown from 2:51 PM to 3:51 PM GMT-5 · OPEN IN LOGS VIEWER

```
2020-09-20T20:51:39.195813Z  GET  200  176 B  3 ms  ApacheBench/2.3   /random-error
2020-09-20T20:51:39.210879Z  GET  200  176 B  3 ms  ApacheBench/2.3   /random-error
```

Google Cloud

Click an individual service on the Services Overview page to view its details. There, you can see existing SLOs and, by expanding them, their details. The SLI's current status, the error budget remaining, and the current level of SLO compliance are all displayed. If alerts have been set, their status is also displayed.



Error budget details

- Error budgets are 100% - SLO%.
- Example:
  - A service returns 1 error about every 1000 requests.
  - It’s operating at 99.9% availability.
  - We decide that customers will tolerate 99.5% availability (SLO).
  - That gives us an error budget of 5%.
- What portion of our error budget are we using currently?

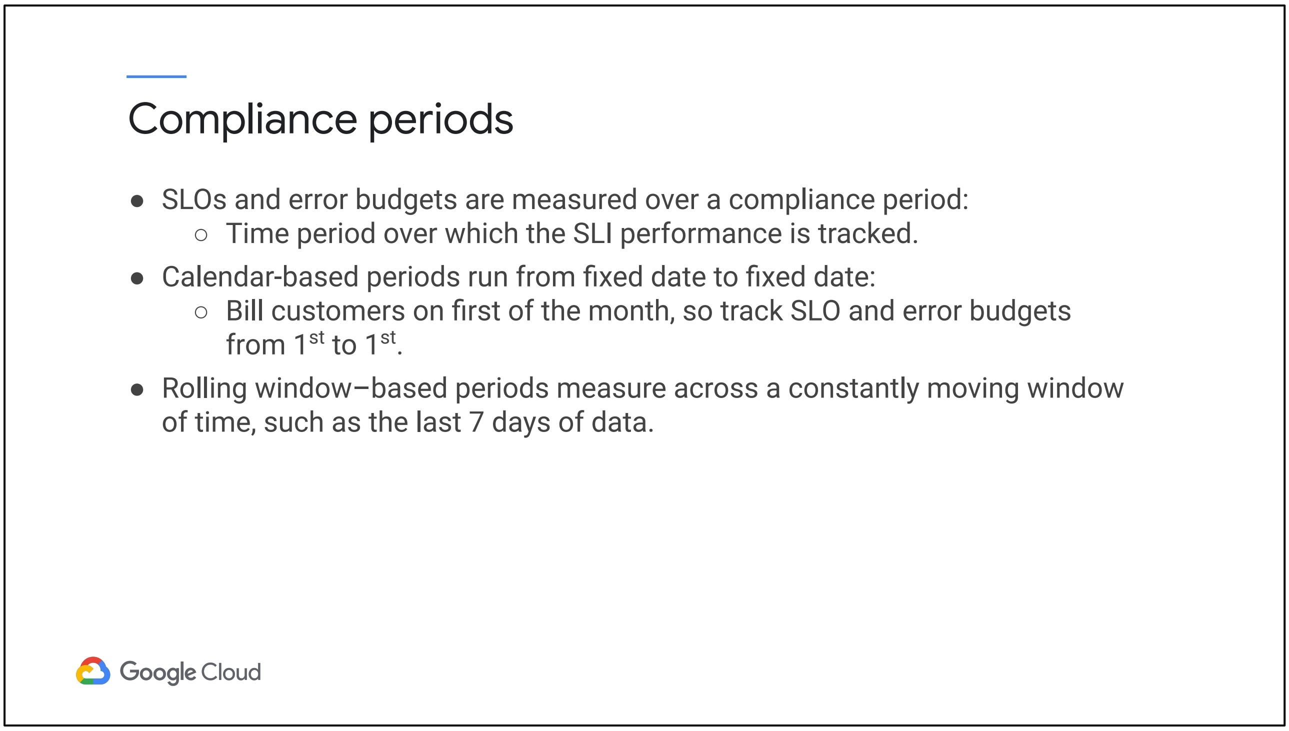
Google Cloud

As we discussed earlier in the module, error budgets are 100% - SLO%.

For example, if a service returns 1 error about every 1000 requests, then it's operating at 99.9% availability. If we determine that customers will tolerate 99.5% availability, and that's where we've set our SLO, that gives us an error budget of 5%.

In this example, what portion of our error budget are we using currently?

20%. The error budget is 5%. We are currently getting errors about 1% of the time. That means we've used 1 out of 5, or 20% of our error budget.



Compliance periods

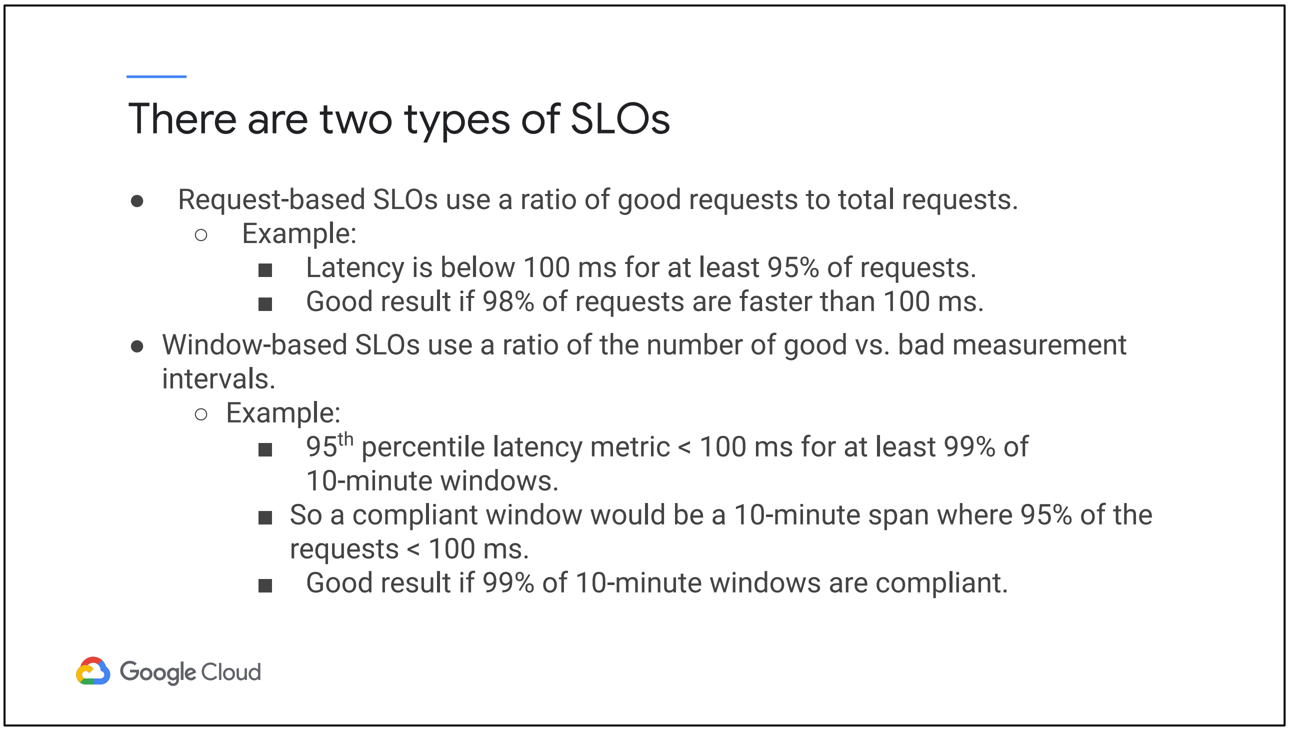
- SLOs and error budgets are measured over a compliance period:
  - Time period over which the SLI performance is tracked.
- Calendar-based periods run from fixed date to fixed date:
  - Bill customers on first of the month, so track SLO and error budgets from 1st to 1st.
- Rolling window–based periods measure across a constantly moving window of time, such as the last 7 days of data.

Google Cloud

SLOs and error budgets are measured over a period of compliance; that is, a period over which the SLI performance is tracked.

There are two fundamental types of compliance periods:

- Calendar-based periods run *from* a fixed date *to* a fixed date. Perhaps you bill customers on the first of the month, so you track SLOs and error budgets from the 1st of the month to the 1st of the next month.
- Rolling window–based periods measure across a constantly moving window of time. Perhaps we always want to be in compliance over a rolling window containing the last seven days of data.



There are two types of SLOs

- Request-based SLOs use a ratio of good requests to total requests.
    - Example:
        - Latency is below 100 ms for at least 95% of requests.
        - Good result if 98% of requests are faster than 100 ms.
- Window-based SLOs use a ratio of the number of good vs. bad measurement intervals.
    - Example:
        - 95th percentile latency metric < 100 ms for at least 99% of 10-minute windows.
        - So a compliant window would be a 10-minute span where 95% of the requests < 100 ms.
        - Good result if 99% of 10-minute windows are compliant.

Google Cloud

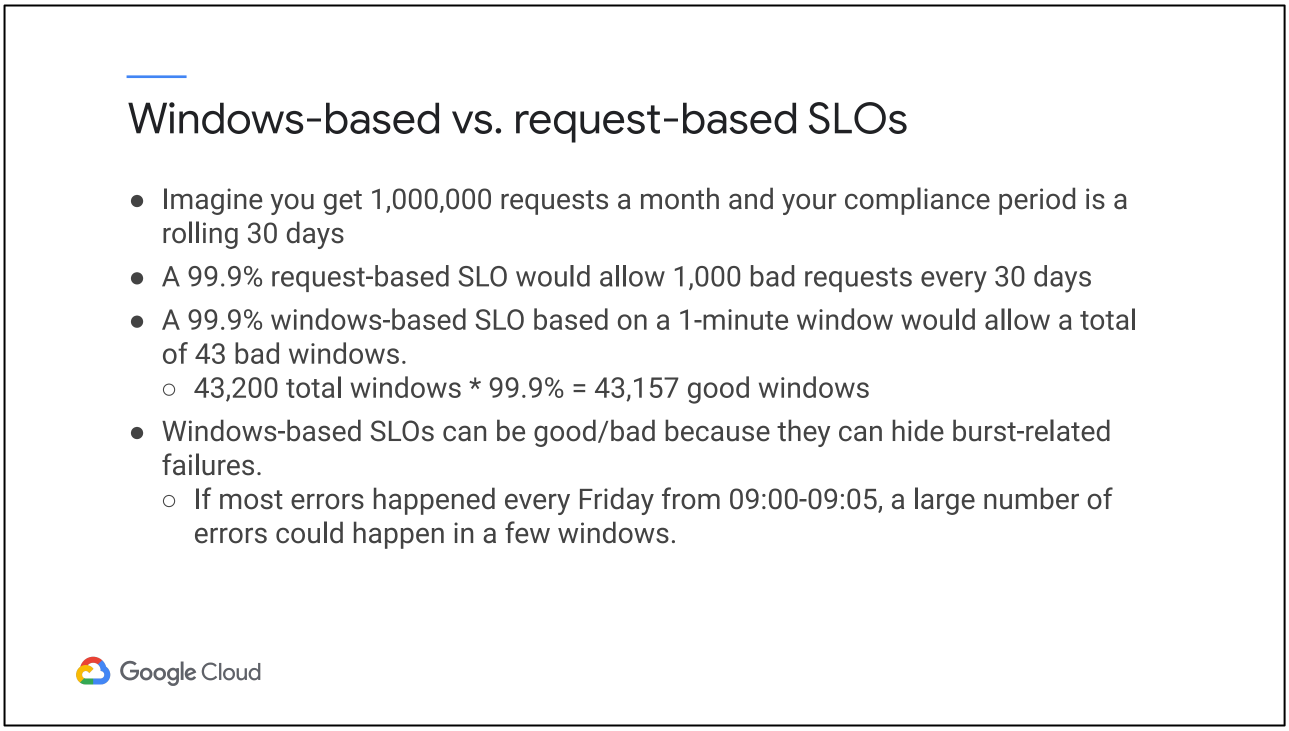
There are two fundamental ways Service Monitoring can approach SLO compliance calculations.

Request-based SLOs use a ratio of good requests to total requests.

For example, we want a request-based SLO with a latency below 100 ms for at least 95% of requests. So we'd be happy if 98% of requests were faster than 100 ms.

Window-based SLOs use a ratio of the number of good vs. bad measurement intervals, or windows. So each window represents a data point, rather than all the data points that comprise the window.

For example, take a 95th percentile latency SLO that needs to be less than 100 ms for at least 99% of 10-minute windows. Here, a compliant window would be a 10-minute period, over which 95% of the requests were less than 100 ms. We'd be happy if 99% of 10-minute windows were compliant.



Windows-based vs. request-based SLOs

- Imagine you get 1,000,000 requests a month and your compliance period is a rolling 30 days
- A 99.9% request-based SLO would allow 1,000 bad requests every 30 days
- A 99.9% windows-based SLO based on a 1-minute window would allow a total of 43 bad windows.
    - 43,200 total windows * 99.9% = 43,157 good windows
- Windows-based SLOs can be good/bad because they can hide burst-related failures.
    - If most errors happened every Friday from 09:00-09:05, a large number of errors could happen in a few windows.

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Let's look at another pair of window-based vs. request-based SLO examples.

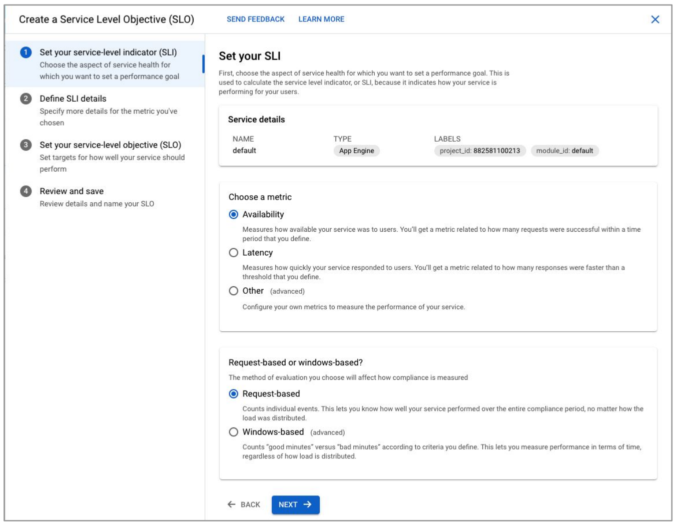
Imagine you get 1,000,000 requests a month, and your compliance period is a rolling 30 days.

If you were looking for a 99.9% request-based SLO, that would translate to 1,000 total bad requests every 30 days.

On the other hand, a 99.9% windows-based SLO, averaged across 1-minute windows, would allow a total of 43 bad windows, or
43,200 total windows * 99.9% = 43,157 good windows.

Windows-based SLOs are good and bad because they can hide burst-related failures. If the system returns nothing but errors, but only every Friday morning from 9:00-9:05, then you'd never violate your SLO, but no one would want to use the system the first thing Friday mornings :-)

Service Monitoring makes SLO creation easy



1. Set your service-level indicator (SLI)
   Choose the aspect of service health for which you want to set a performance goal
2. Define SLI details
   Specify more details for the metric you've chosen
3. Set your service-level objective (SLO)
   Set targets for how well your service should perform
4. Review and save
   Review details and name your SLO

Set your SLI

First, choose the aspect of service health for which you want to set a performance goal. This is used to calculate the service level indicator, or SLI, because it indicates how your service is performing for your users.

Service details

NAME	TYPE	LABELS
default	App Engine	project_id: 882581100213 module_id: default

Choose a metric

[✓ Availability]
Measures how available your service was to users. You'll get a metric related to how many requests were successful within a time period that you define.

Latency
Measures how quickly your service responded to users. You'll get a metric related to how many responses were faster than a threshold that you define.

Other (advanced)
Configure your own metrics to measure the performance of your service.

Request-based or windows-based?

The method of evaluation you choose will affect how compliance is measured

[✓ Request-based]
Counts individual events. This lets you know how well your service performed over the entire compliance period, no matter how the load was distributed.

Windows-based (advanced)
Counts "good minutes" versus "bad minutes" according to criteria you define. This lets you measure performance in terms of time, regardless of how load is distributed.

Google Cloud

Service Monitoring makes SLO creation easy. On the **Services** overview page, select one of the listed services. If a service is built on a Google Cloud compute technology that supports Service Monitoring, it will automatically be listed.

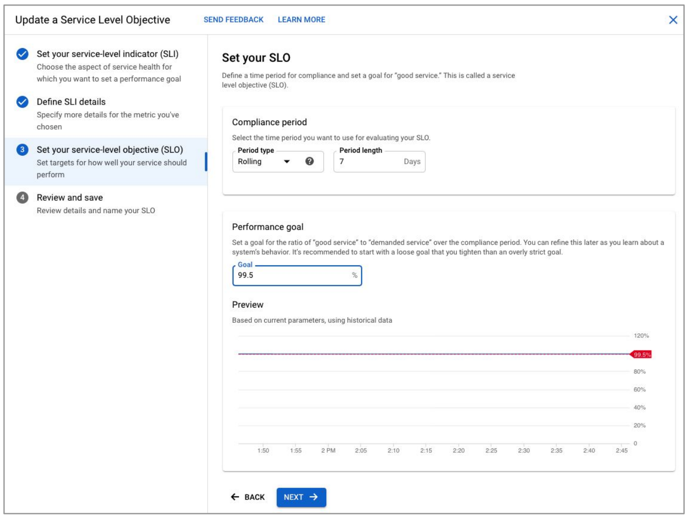
Next, click **Create an SLO**.

Select an option from the SLI metric. Out-of-the-box options include:

- **Availability** is a ratio of the number of successful responses to the number of all responses.
- **Latency** is the ratio of the number of calls that are below the specified **Latency Threshold** to the number of all calls.
- **Other** will give you the Metrics Explorer window and will allow you to create your own SLI from scratch.

As previously discussed, this is also where you can select request-based or windows-based SLOs.

Set compliance period and goal



Update a Service Level Objective SEND FEEDBACK LEARN MORE

1. Set your service-level indicator (SLI) — Choose the aspect of service health for which you want to set a performance goal
2. Define SLI details — Specify more details for the metric you've chosen
3. Set your service-level objective (SLO) — Set targets for how well your service should perform
4. Review and save — Review details and name your SLO

Set your SLO

Define a time period for compliance and set a goal for "good service." This is called a service level objective (SLO).

Compliance period

Select the time period you want to use for evaluating your SLO.

Period type: Rolling

Period length: 7 Days

Performance goal

Set a goal for the ratio of "good service" to "demanded service" over the compliance period. You can refine this later as you learn about a system's behavior. It's recommended to start with a loose goal that you tighten than an overly strict goal.

Goal: 99.5 %

Preview

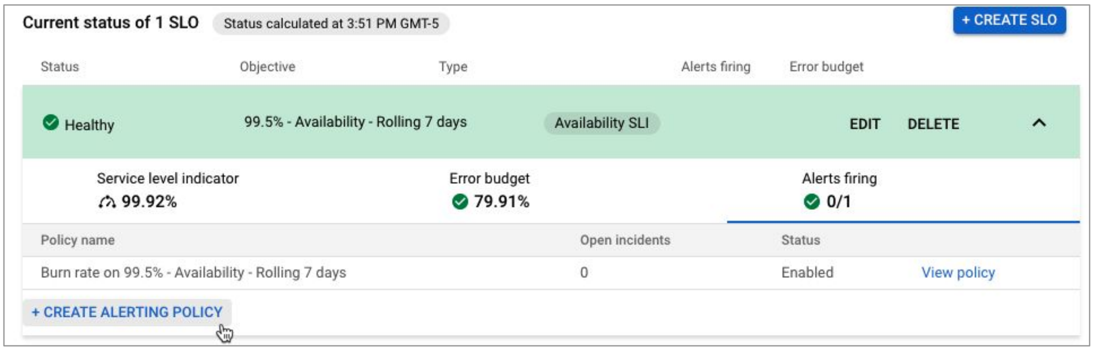
Based on current parameters, using historical data

Google Cloud

In the **Compliance Period** section, select the **Period Type** and the **Period Length**. You will recall from earlier that the two compliance period types are calendar-based and rolling.

In the **SLO Goal** section, enter a percentage in the **Compliance Target** field to set the performance target for the SLI. Service Monitoring uses this value to calculate the error budget you have for this SLO.

SLO linked alerts are easy to create


Current status of 1 SLO — Status calculated at 3:51 PM GMT-5

Status	Objective	Type	Alerts firing	Error budget
Healthy	99.5% - Availability - Rolling 7 days	Availability SLI		

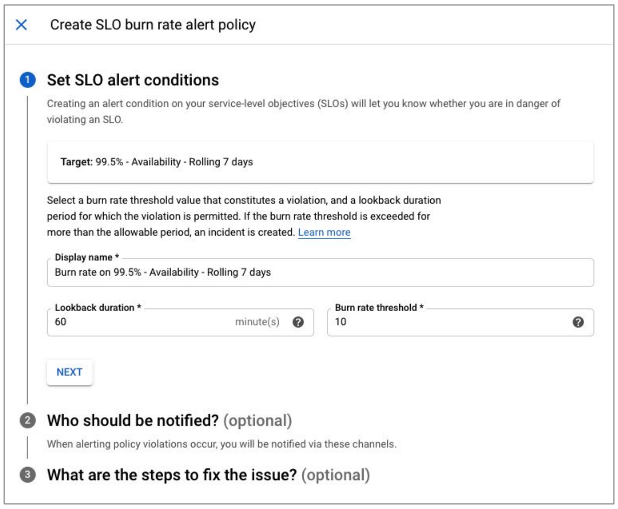
Service level indicator: 99.92%
Error budget: 79.91%
Alerts firing: 0/1

Policy name	Open incidents	Status	
Burn rate on 99.5% - Availability - Rolling 7 days	0	Enabled	View policy

Google Cloud

Creating an alert is as easy as clicking **Create Alerting Policy**.

Alert if the burn rate is too high


Create SLO burn rate alert policy

1. Set SLO alert conditions

Creating an alert condition on your service-level objectives (SLOs) will let you know whether you are in danger of violating an SLO.

Target: 99.5% - Availability - Rolling 7 days

Select a burn rate threshold value that constitutes a violation, and a lookback duration period for which the violation is permitted. If the burn rate threshold is exceeded for more than the allowable period, an incident is created. Learn more

Display name *: Burn rate on 99.5% - Availability - Rolling 7 days

Lookback duration *: 60 minute(s)

Burn rate threshold *: 10

2. Who should be notified? (optional)

When alerting policy violations occur, you will be notified via these channels.

3. What are the steps to fix the issue? (optional)

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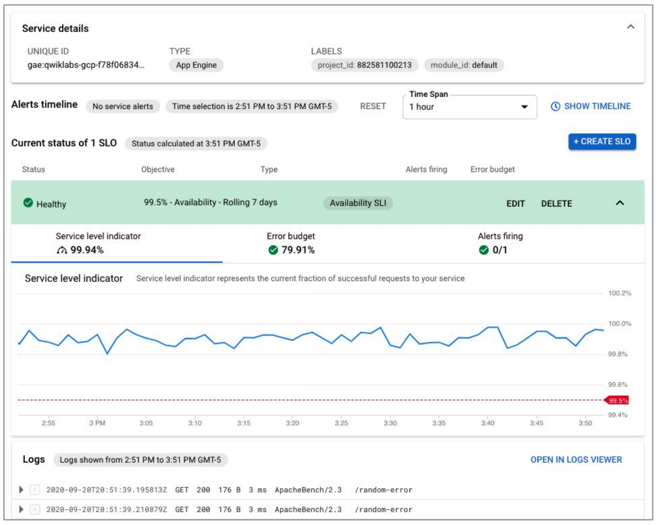
Service Monitoring can trigger an alert when a service is on track to violate an SLO. The alerting policy will use a lookback window to examine a period of time for trends. The burn rate threshold is then used to determine if an alert should be raised. In this example, we are using a 60-minute window. A burn rate threshold of 1 would use 100% of the error budget by the end of the 7-day period. In this case, if we see a trend that if continued, would burn through our total error budget in 1/10th of those 7 days or faster, then we should raise an alert.

SLO status is easy to monitor



Service details

UNIQUE ID	TYPE	LABELS
gae:qwiklabs-gcp-f78f06834...	App Engine	project_id: 882581100213 · module_id: default

Alerts timeline · No service alerts · Time selection is 2:51 PM to 3:51 PM GMT-5 · RESET · Time Span: 1 hour · SHOW TIMELINE

Current status of 1 SLO · Status calculated at 3:51 PM GMT-5 · + CREATE SLO

Status	Objective	Type	Alerts firing	Error budget
✓ Healthy	99.5% - Availability - Rolling 7 days	Availability SLI		

Service level indicator	Error budget	Alerts firing
99.94%	✓ 79.91%	✓ 0/1

Service level indicator — Service level indicator represents the current fraction of successful requests to your service

Logs · Logs shown from 2:51 PM to 3:51 PM GMT-5 · OPEN IN LOGS VIEWER

```
2020-09-20T20:51:39.195813Z  GET  200  176 B  3 ms  ApacheBench/2.3   /random-error
2020-09-20T20:51:39.210879Z  GET  200  176 B  3 ms  ApacheBench/2.3   /random-error
```

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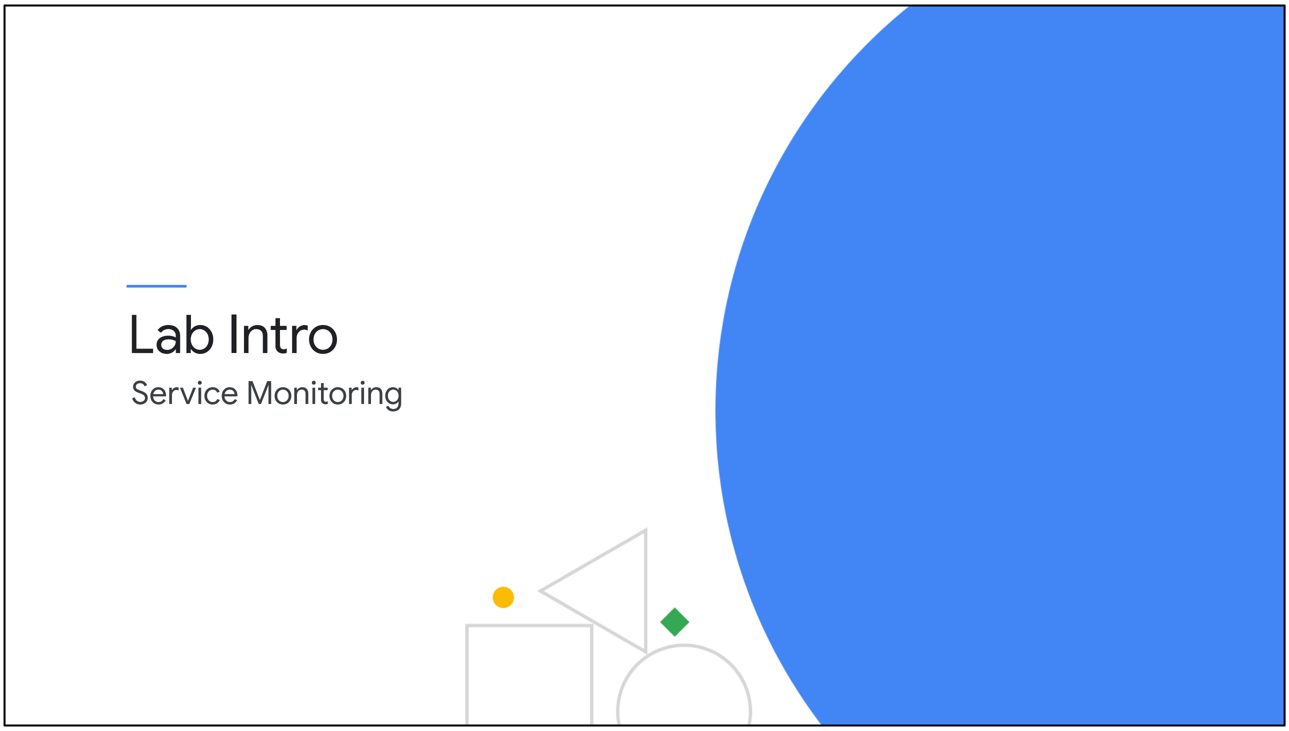
After the SLO has been created, it’s easy to monitor the SLI current status, error budget, compliance, and alert status. In this case, I’ve selected to view the **Service level indicator**, so it’s displaying the current SLI values. You could also examine the **Error budget** or **Alerts firing** tabs for more detail on those.



Lab Intro

Service Monitoring

Google Cloud Service Monitoring streamlines the creation of Service Level Objectives based on latency- and availability-based Service Level Indicators. In this lab, you use Service Monitoring to create a 99.5% availability SLO and corresponding alert.

Quiz

In evaluating your alerting policies, which below best describes precision?

A. The proportion of events detected that were significant
B. The proportion of significant events detected
C. How long it takes to send notifications in various conditions
D. How long alerts fire after an issue is resolved

Google Cloud

Quiz

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Quiz

In evaluating your alerting policies, which below best describes recall?

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Quiz

In evaluating your alerting policies, which below best describes recall?

A. The proportion of events detected that were significant
B. The proportion of significant events detected
C. How long it takes to send notifications in various conditions
D. How long alerts fire after an issue is resolved

Quiz

In Google Cloud alerting, which below is a valid notification channel?

A. SMS and Email
B. Webhooks
C. Slack
D. All of the above

Quiz

In Google Cloud alerting, which below is a valid notification channel?

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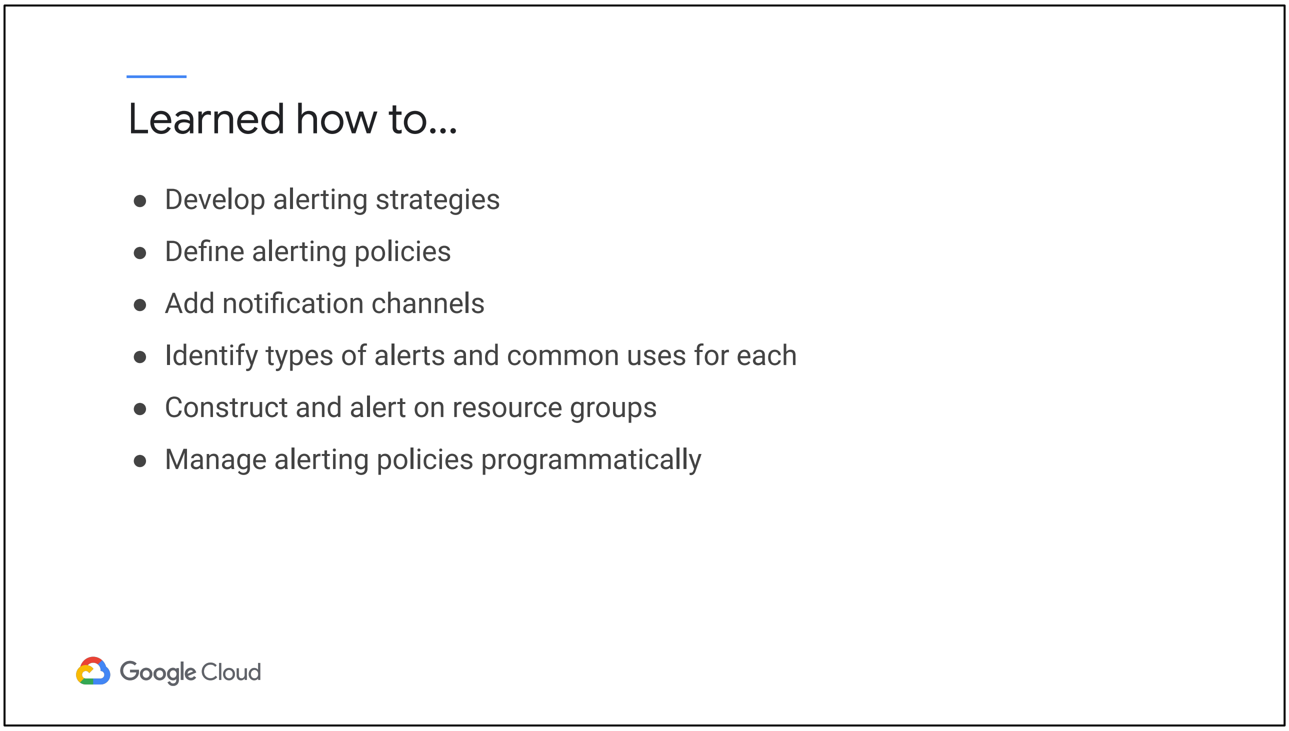
Google Cloud



Learned how to...

- Develop alerting strategies
- Define alerting policies
- Add notification channels
- Identify types of alerts and common uses for each
- Construct and alert on resource groups
- Manage alerting policies programmatically

Google Cloud

Fantastic job. In this module, you have learned how to:

- Develop alerting strategies
- Define alerting policies
- Add notification channels
- Identify types of alerts and common uses for each
- Construct and alert on resource groups
- And manage alerting policies programmatically

Great work.

Google Cloud

Google Cloud