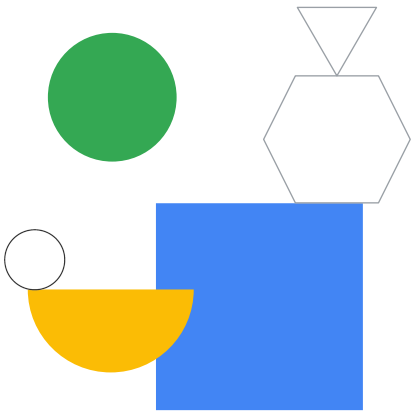
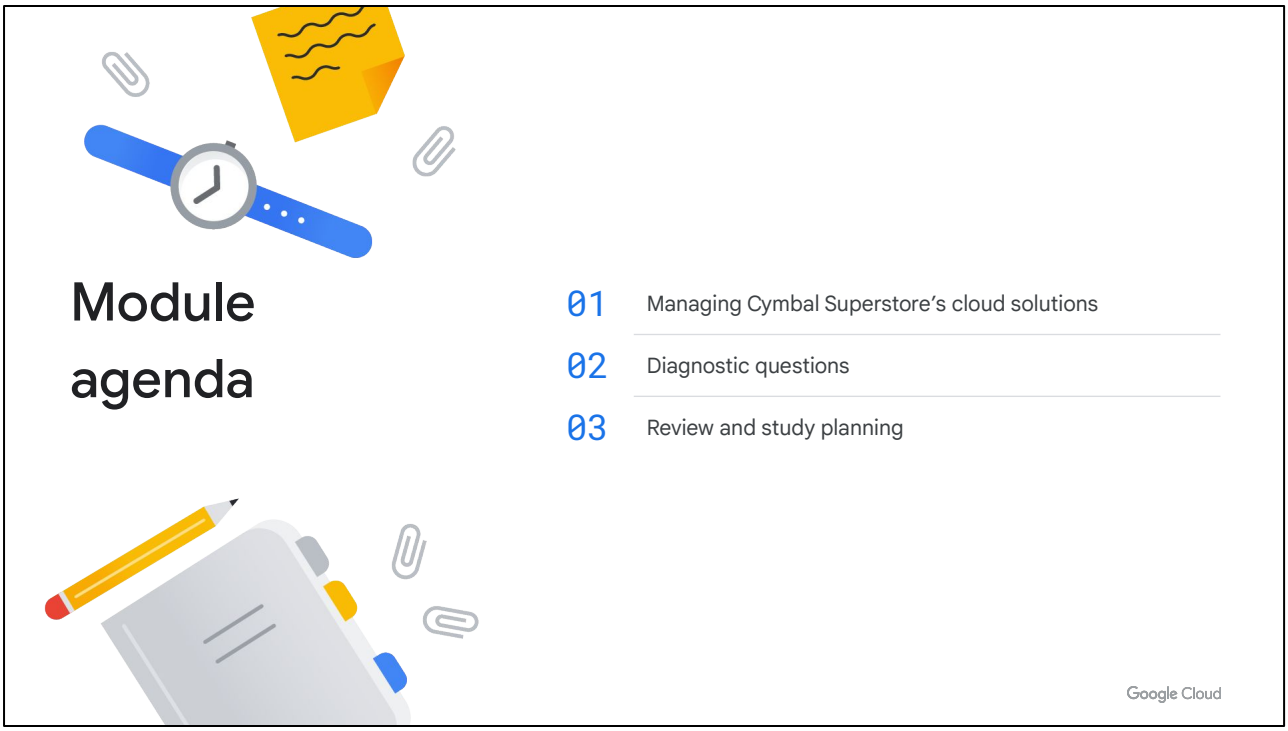
Google Cloud

Preparing for Your Associate Cloud Engineer Journey



Module 4: Ensuring Successful Operation of a Cloud Solution

Welcome to Module 4: Ensuring Successful Operation of a Cloud Solution.

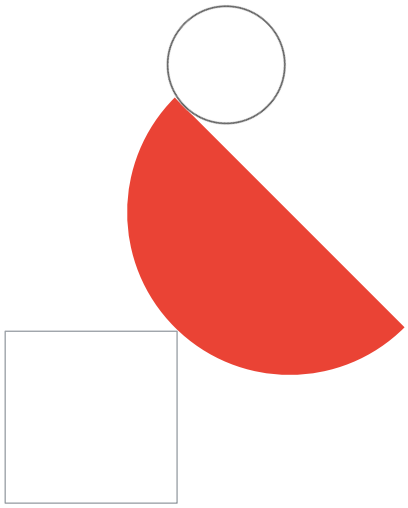


In this module you'll explore the scope of ensuring successful cloud operations. This involves managing the compute, storage, and networking resources as well as monitoring and logging tasks. These areas correspond to the fourth section of the Associate Cloud Engineer Exam Guide.

We'll start by discussing your role as an Associate Cloud Engineer in managing Cymbal Superstore's cloud solutions. Next, you'll assess your skills in this area through 10 diagnostic questions.

When we review the questions, identify the resources you'll want to include in your study plan.

Managing Cymbal Superstore's cloud solutions



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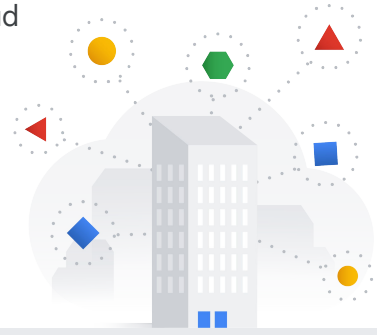
Now that Cymbal Superstore's cloud solutions have been deployed and implemented, your role as an Associate Cloud Engineer shifts focus to maintaining successful operations. Let's explore what that means.

The next step:

managing Cymbal Superstore's cloud solutions



- Managing Compute Engine resources
- Managing GKE resources
- Managing Cloud Run resources
- Managing storage and database solutions
- Managing networking resources
- Monitoring and logging

Cymbal Superstore

In deploying and implementing Cymbal Superstore's cloud architecture, you needed to know how to work with various compute, storage, and networking resources on Google Cloud. To ensure successful operations, an Associate Cloud Engineer needs the knowledge and skills to manage the resources used in an organization's cloud solutions. You also need to be able to use Google Cloud's operations suite for monitoring and logging.

Managing Cymbal Superstore's supply chain app

Upgrading managed instance groups:

```
gcloud compute instance-groups managed
rolling-action start_update cymball_supplychain_ig \
   --version=template=cymball_supplychain_ig_templat
e_<yymmdd> \
   --type=proactive\
   --region=us-central1
```

Google Cloud

Cymbal Superstore's supply chain management app is made of resources implemented close to their HQ in Minneapolis, Mn. It is architected using Compute Engine. Managed instance groups let the application scale automatically and remain available across zonal outages.

Sometimes the instance template that the group is based on might need to be changed.

Some reasons you might want to do this include the following:

- Updating the operating system of your instances.
- Conducting A/B or canary testing of capability upgrades.
- Changing the disk type or attached disks attached to your instances.

Once you do update the template, you need to ensure the change is propagated to all the VM instances in the group.

Managing Cymbal Superstore's ecommerce app

```
apiVersion: networking.k8s.io/v1
kind: Ingress
metadata:
  name: cymbal-ecommerce-ingress
  annotations:
    # If the class annotation is not specified
it defaults to "gce".
    kubernetes.io/ingress.class: "gce"
spec:
  rules:
  - http:
      paths:
      - path: /sales
        pathType: ImplementationSpecific
        backend:
          service:
            name: sales-service
            port:
              number: 60000
```

```
- path: /support
        pathType: ImplementationSpecific
        backend:
          service:
            name: support-service
            port:
              number: 80
```

Here is an example of an ingress object that implements an external layer 7 (http(s)) load balancer

Google Cloud

Cymbal Superstore's ecommerce app is architected using containers deployed to GKE pods. As an Associate Cloud Engineer on the ecommerce team, you might be asked to configure and monitor external connectivity. An external http(s) load balancer is a solution that advertises a single global IP, provides content close to your end user, and forwards content to backends that are available globally.

Managing Cymbal Superstore's transportation management app

Querying external data such as Bigtable data with BigQuery:

1. create a table definition file
2. create a permanent external table in BigQuery

```
bq mk --external_table_definition=cymbal_trans_mngt_bt_def /
  cymbal_data_set.trans_mngt_ext_tbl
```

3. Query the data using the permanent table reference in the from clause of a sql query

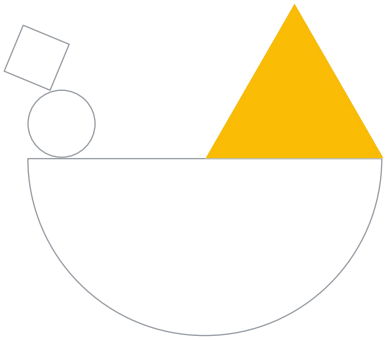
Google Cloud

Cymbal Superstore's transportation management app uses Cloud Functions to monitor incoming sensor data and implements a Cloud Dataflow pipeline that uses a sink to write data to Bigtable. As an Associate Cloud Engineer, it is common to provide information about the sources and sinks required by a pipeline to the data engineer responsible for developing it. You also need to know how to monitor your incoming data stream and manage your Cloud Function instances.

Let's specifically discuss how you might set up the resources required to query that data on a regular basis.

What would this involve? Let's think about Cymbal Superstore's transportation management app. You can use BigQuery sql to query your Bigtable data by defining a permanent external table using the Google Cloud Console or the bq command line tool. You do this by creating a table definition file which includes the uri for the table in Bigtable and information about the column families and columns defined in the table. The entries for the table definition are written in JSON. Next you create an external table reference with a bq mk command. Here is an example of what that might look like for our Cymbal Superstore example. Then you can submit the query using BigQuery sql.

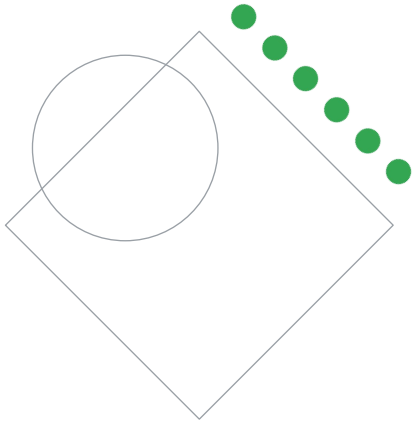
Diagnostic questions



Google Cloud

Now that you have some context for the objectives in this exam section, it’s time to take a self-assessment focused on managing Google Cloud solutions.

Review and study planning

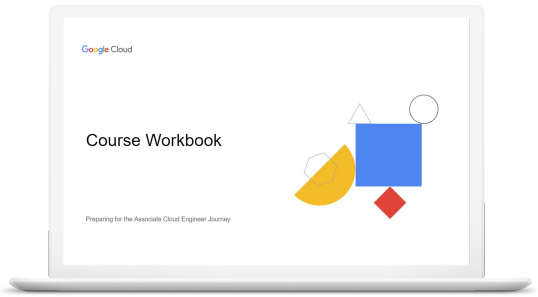


Google Cloud

What areas do you need to develop your skills in order to manage the different aspects of a Google Cloud solution? This is another important area for an Associate Cloud Engineer, and where you'll likely spend much of your time on the job. Let's review the diagnostic questions to help you target your study time to focus on the areas where you need to develop your skills.

Your study plan:

Ensuring successful operation of a cloud solution



4.1	Managing Compute Engine resources
4.2	Managing Google Kubernetes Engine resources
4.3	Managing Cloud Run resources
4.4	Managing storage and database solutions
4.5	Managing networking resources
4.6	Monitoring and logging

Google Cloud

We'll approach this review by looking at the objectives of this exam section and the questions you just answered about each one. We'll introduce an objective, briefly review the answers to the related questions, then talk about where you can find out more in the learning resources and/or in Google Cloud documentation. As we go through each section objective, use the page in your workbook to mark the specific documentation, courses (and modules!), and quests you'll want to emphasize in your study plan.

Just like with the previous section, there are multiple objectives in this section that have many related tasks - so you will probably need to plan for more study time.

4.1 Managing Compute Engine resources

Tasks include:

- Managing a single VM instance (e.g., start, stop, edit configuration, or delete an instance)
- Remotely connecting to the instance
- Attaching a GPU to a new instance and installing necessary dependencies
- Viewing current running VM inventory (instance IDs, details)
- Working with snapshots (e.g., create a snapshot from a VM, view snapshots, delete a snapshot)
- Working with images (e.g., create an image from a VM or a snapshot, view images, delete an image)
- Working with instance groups (e.g., set autoscaling parameters, assign instance template, create an instance template, remove instance group)
- Working with management interfaces (e.g., Cloud Console, Cloud Shell, Cloud SDK)

Google Cloud

As we've discussed before, Cymbal Superstore's supply chain app is built on Compute Engine resources. As an Associate Cloud Engineer you might be put in charge of implementing and updating instance groups, which give you healing and autoscaling capabilities. It also lets you load balance data if needed, as we'll discuss in the networking section. Common actions can be scripted with command line tools or client SDKs.

These are the diagnostic questions you answered that relate to this area:
Question 1: Identify commands required to list and describe Compute Engine disk snapshots
Question 2: Describe the incremental nature of Compute Engine disk snapshots
Question 3: Implement an Instance Group based on an instance template

4.1 Diagnostic Question 01 Discussion

You want to view a description of your available snapshots using the command line interface (CLI). What gcloud command should you use?

A. gcloud compute snapshots list
B. gcloud snapshots list
C. gcloud compute snapshots get
D. gcloud compute list snapshots

Google Cloud

Question:
You want to view a description of your available snapshots using the command line interface (CLI). What gcloud command should you use?

4.1 Diagnostic Question 01 Discussion

You want to view a description of your available snapshots using the command line interface (CLI). What gcloud command should you use?

A. gcloud compute snapshots list
B. gcloud snapshots list
C. gcloud compute snapshots get
D. gcloud compute list snapshots

Google Cloud

Feedback:
*A. **gcloud compute snapshots list**
Feedback: Correct! gcloud commands are built with groups and subgroups, followed by a command, which is a verb. In this example, Compute is the Group, snapshots is the subgroup, and list is the command.

B. **gcloud snapshots list**
Feedback: Incorrect. Snapshots is not a main group defined in gcloud.

C. **gcloud compute snapshots get**
Feedback: Incorrect. Available commands for snapshots are list, describe, and delete.

D. **gcloud compute list snapshots**
Feedback: Incorrect. Snapshots is a compute command subgroup. It needs to come before the list command.

Where to look:
https://cloud.google.com/compute/docs/disks/create-snapshots#listing-snapshots
https://cloud.google.com/compute/docs/disks/create-snapshots#viewing-snapshot

Content mapping:
- Google Cloud Fundamentals: Core Infrastructure (ILT and On-demand)
  - M3 Virtual Machines and Networks in the Cloud

- Architecting with Google Compute Engine (ILT)
    - M3 Virtual Machines

- Essential Google Cloud Infrastructure: Foundation (On-demand)
    - M3 Virtual Machines

Summary:
Explanation/summary on the following slide.

Getting information about snapshots

To list Compute Engine disk snapshots:

```
gcloud compute snapshots list --project PROJECT_ID
```

To describe snapshots:

```
gcloud compute snapshots describe SNAPSHOT_NAME
```

Google Cloud

To list snapshots run the following command:

```
gcloud compute snapshots list --project PROJECT_ID
Flags available
      --limit maximum number of results you want back
      --regexp a filter for results you want returned
      --sort-by field to sort by
      --uri only print URI's of the resources returned
```

To describe snapshots, which returns creation time, size, and source disk, run the following command:

```
gcloud compute snapshots describe SNAPSHOT_NAME
Flags available
      --format what kind of format you want printed out
      --project project to be used for command
      --quiet disables interactive prompts
```

4.1 Diagnostic Question 02 Discussion

You have a scheduled snapshot you are trying to delete, but the operation returns an error.

What should you do to resolve this problem?

A. Delete the downstream incremental snapshots before deleting the main reference.

B. Delete the object the snapshot was created from.

C. Detach the snapshot schedule before deleting it.

D. Restore the snapshot to a persistent disk before deleting it.

Google Cloud

Question:
You have a scheduled snapshot you are trying to delete, but the operation returns an error. What should you do to resolve this problem?

4.1 Diagnostic Question 02 Discussion

You have a scheduled snapshot you are trying to delete, but the operation returns an error.

What should you do to resolve this problem?

A. Delete the downstream incremental snapshots before deleting the main reference.

B. Delete the object the snapshot was created from.

C. **Detach the snapshot schedule before deleting it.**

D. Restore the snapshot to a persistent disk before deleting it.

Google Cloud

Feedback:
A. Delete the downstream incremental snapshots before deleting the main reference.
Feedback: Incorrect. This is not required to delete a scheduled snapshot and would be a lot of manual work.

B. Delete the object the snapshot was created from.
Feedback: Incorrect. This is not required to delete a scheduled snapshot and is destructive.

*C. Detach the snapshot schedule before deleting it.
Feedback: Correct! You can't delete a snapshot schedule that is still attached to a persistent disk.

D. Restore the snapshot to a persistent disk before deleting it.
Feedback: Incorrect. This does not allow you to delete a scheduled snapshot.

Where to look:
https://cloud.google.com/compute/docs/disks/snapshots#incremental-snapshots

Content mapping:

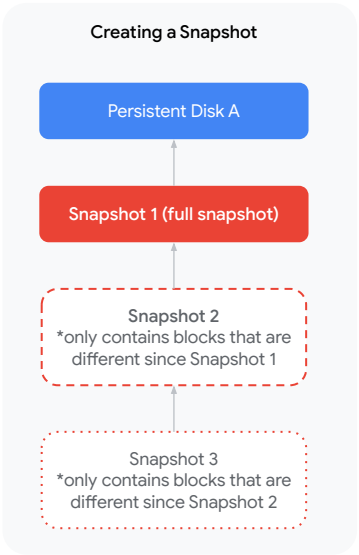
- Google Cloud Fundamentals: Core Infrastructure (ILT and On-demand)
  - M3 Virtual Machines and Networks in the Cloud
- Architecting with Google Compute Engine (ILT)

    - M3 Virtual Machines

- Essential Google Cloud Infrastructure: Foundation (On-demand)
    - M3 Virtual Machines

Summary:
Explanation/summary on the following slide.

Snapshots are incremental



Google Cloud

Reference from snapshot concepts page:
https://cloud.google.com/compute/docs/disks/snapshots

Snapshots are incremental in nature and less expensive than creating full images of a disk. You can only create them for persistent disks. They are stored in a Cloud Storage bucket managed by the snapshot service and are automatically compressed. You can choose regional or multi-regional storage, which will affect cost. Snapshots are stored across multiple locations with automatic checksums. You schedule them using the gcloud command line and cron. You can also set up a snapshot schedule in the Google cloud console or command line. A Snapshot schedule and its source persistent disk have to be in the same region. You can restore them to a new persistent disk. The new disk can be in a different zone or region, so you can use snapshots to move VMs. You can create them while they are running. Snapshots of a disk have to be at least 10 minutes apart.

Here's how the incremental nature of snapshots works:

- The first snapshot is full and contains all data on the persistent disk it was run on.
- Each subsequent snapshot only contains new or modified data since the first snapshot.
- However, sometimes to clean up resources and cost, a new snapshot might be a full backup.

Deleting a snapshot copies its data to downstream incremental snapshots that are dependent on it, increasing the downstream snapshot's size. You can't delete a snapshot that has a schedule associated with it.

4.1 Diagnostic Question 03 Discussion

Which of the following tasks are part of the process when configuring a managed instance group? (Pick two.)

A. Defining Health checks.
B. Providing Number of instances.
C. Specifying Persistent disks.
D. Choosing instance Machine type.
E. Configuring the operating system.

Google Cloud

Question:
Which of the following tasks are part of the process when configuring a managed instance group? (Pick two.)

4.1 Diagnostic Question 03 Discussion

Which of the following tasks are part of the process when configuring a managed instance group? (Pick two.)

A. Defining Health checks.
B. Providing Number of instances.
C. Specifying Persistent disks.
D. Choosing instance Machine type.
E. Configuring the operating system.

Google Cloud

Feedback:
*A. Defining Health checks
Feedback: Correct! Health checks are part of your managed instance group configuration.

*B. Providing Number of instances
Feedback: Correct! Number of instances is part of your managed instance group configuration.

C. Specifying Persistent disks
Feedback: Incorrect. This is part of your instance template definition.

D. Choosing instance Machine type
Feedback: Incorrect. This is part of your instance template definition.

E. Configuring the operating system
Feedback: Incorrect. This is part of your instance template definition.

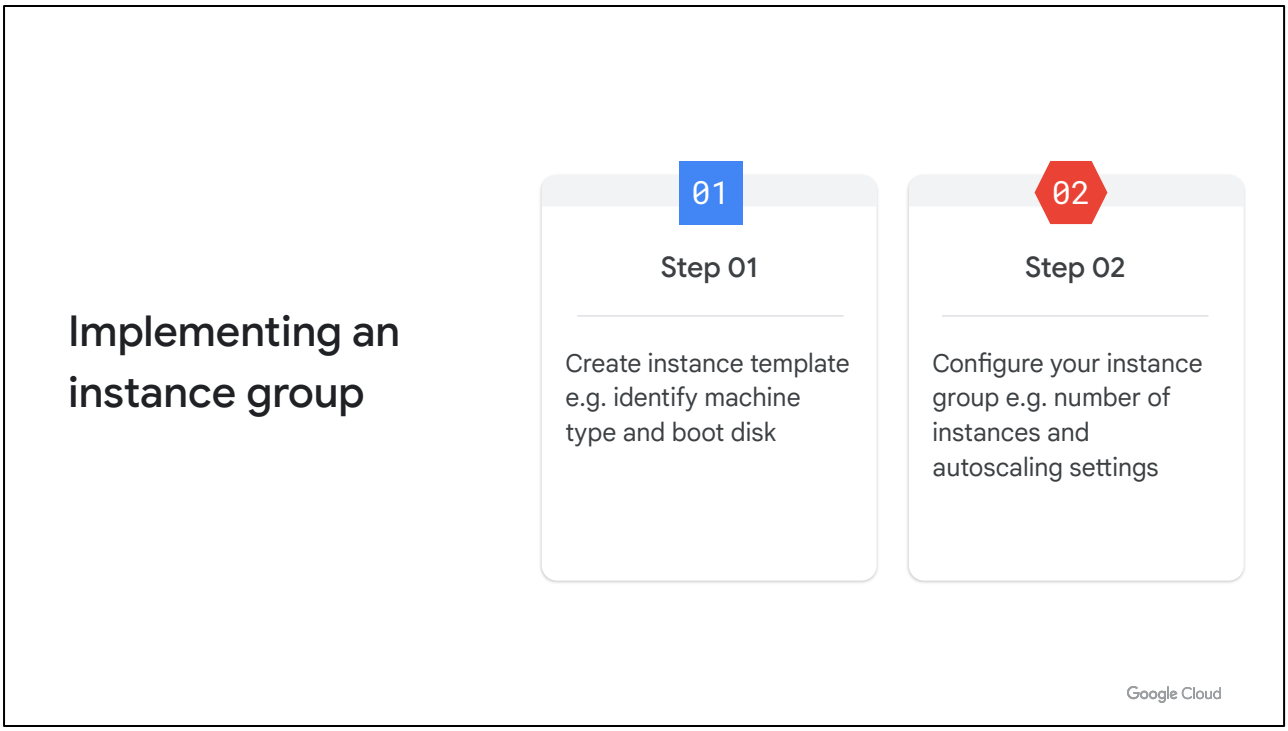
Where to look:
https://cloud.google.com/compute/docs/instance-templates
https://cloud.google.com/compute/docs/instance-groups

Content mapping:

- Architecting with Google Compute Engine (ILT)
    - M9 Load Balancing and Autoscaling

- Elastic Google Cloud Infrastructure: Scaling and Automation (On-demand)
    - M2 Load Balancing and Autoscaling

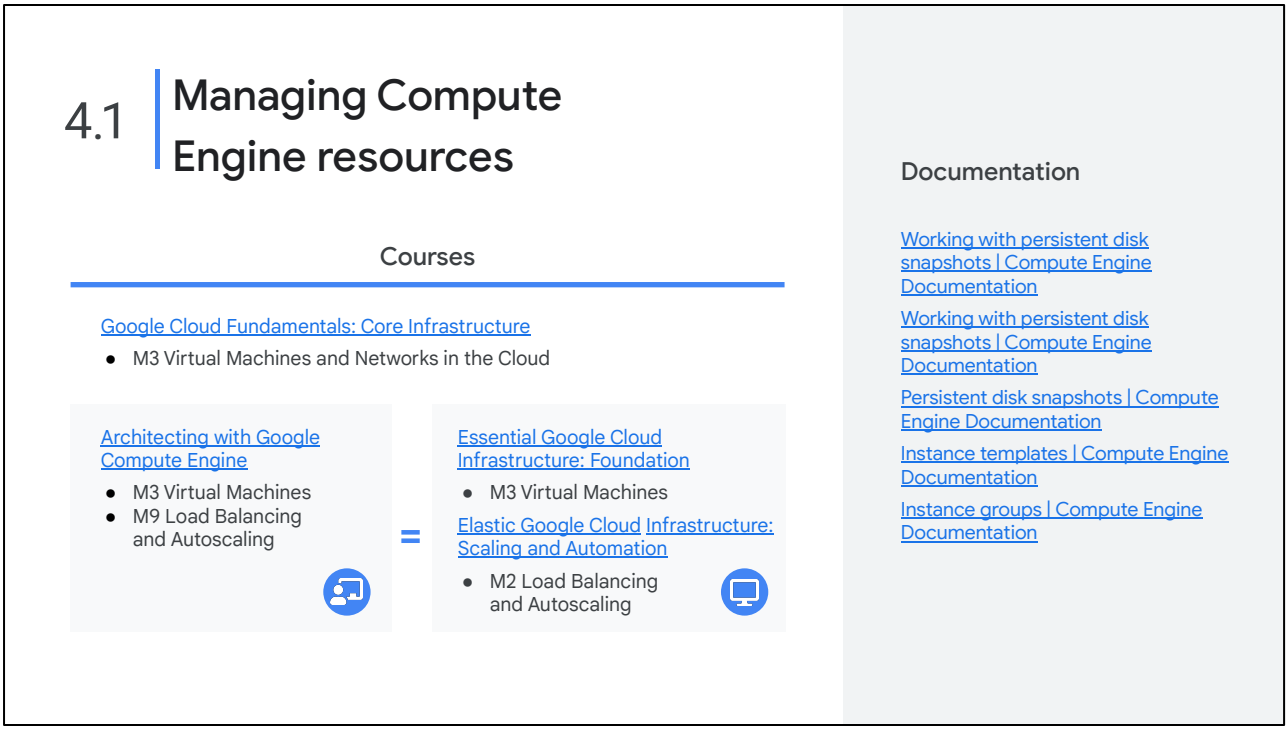
Summary:
Explanation/summary on the following slide.



Managed instance groups help you create and manage groups of identical VM instances. They are based on an instance template that defines how new VMs added to the instance group should be configured. You can specify the size of an instance group and change it at any time. The managed instance group will make sure the number of instances matches what you request, and monitors instances via health checks. If an instance goes down, the managed instance group will start another instance to replace it. Managed instance groups can be zonal or regional. Regional instance groups create instances across multiple zones in a region so your application can still run in case of a zonal outage.

The first step to creating a managed instance group is to create an instance template. An instance template contains information about how to create instances in the group by specifying machine type, boot disk, connectivity, disks, and other details pertinent to your needs. This information is similar to what you would provide if you were configuring an individual instance.

After you create an instance template you need to configure your managed instance group. Here is where you specify location settings, describe port mappings, and reference the instance template. You also specify the number of instances in your group, configure autoscaling, and create health checks for your instances to determine which instances should receive traffic.



Let's take a moment to consider resources that can help you build your knowledge and skills in this area.

The concepts in the diagnostic questions we just reviewed are covered in these modules and in this documentation. You'll find this list in your workbook so you can take a note of what you want to include later when you build your study plan. Based on your experience with the diagnostic questions, you may want to include some or all of these.

Google Cloud Fundamentals: Core Infrastructure (On-demand)
Architecting with Google Compute Engine (ILT)
Essential Google Cloud Infrastructure: Foundation (On-demand)
Elastic Google Cloud Infrastructure: Scaling and Automation (On-demand)

https://cloud.google.com/compute/docs/disks/create-snapshots#listing-snapshots
https://cloud.google.com/compute/docs/disks/create-snapshots#viewing-snapshot
https://cloud.google.com/compute/docs/disks/snapshots#incremental-snapshots
https://cloud.google.com/compute/docs/instance-templates
https://cloud.google.com/compute/docs/instance-groups

4.2 Managing Google Kubernetes Engine resources

Tasks include:

- Viewing current running cluster inventory (nodes, pods, services)
- Browsing Docker images and viewing their details in the Artifact Registry
- Working with node pools (e.g., add, edit, or remove a node pool)
- Working with pods (e.g., add, edit, or remove pods)
- Working with services (e.g., add, edit, or remove a service)
- Working with stateful applications (e.g. persistent volumes, stateful sets)
- Managing Horizontal and Vertical autoscaling configurations.
- Working with management interfaces (e.g., Cloud Console, Cloud Shell, Cloud SDK, kubectl)

Google Cloud

GKE is a managed service that provides production-level orchestration for your container-based applications. Cymbal Superstore's e-commerce app is implemented through services being exposed by GKE. As an Associate Cloud Engineer on the ecommerce app team, certain tasks might require you to interact with a GKE cluster and its nodes. You will also have to know about GKE's workload objects, such as pods, deployments, and services. Containers in GKE are based on images which are shared via the Google Container registry. You need to be familiar with how to create images and deploy them to the registry.

These diagnostic questions addressed managing GKE resources:
Question 4: Contrast the differences between an internal and external load balancer in Google Kubernetes Engine
Question 5: Describe the relationship between Kubernetes pods, services, and deployments
Question 6: Apply kubectl commands to manage pods, deployments, and services

4.2 Diagnostic Question 04 Discussion

Cymbal Superstore's GKE cluster requires an internal http(s) load balancer. You are creating the configuration files required for this resource.

What is the proper setting for this scenario?

A. Annotate your ingress object with an ingress.class of "gce."
B. Configure your service object with a type: LoadBalancer.
C. Annotate your service object with a neg reference.
D. Implement custom static routes in your VPC.

Google Cloud

Question:
Cymbal Superstore's GKE cluster requires an internal http(s) load balancer. You are creating the configuration files required for this resource. What is the proper setting for this scenario?

4.2 Diagnostic Question 04 Discussion

Cymbal Superstore's GKE cluster requires an internal http(s) load balancer. You are creating the configuration files required for this resource.

What is the proper setting for this scenario?

A. Annotate your ingress object with an ingress.class of "gce."
B. Configure your service object with a type: LoadBalancer.
C. Annotate your service object with a neg reference.
D. Implement custom static routes in your VPC.

Google Cloud

Feedback:
Cymbal Superstore's GKE cluster requires an internal http(s) load balancer. You are creating the configuration files required for this resource. What is the proper setting for this scenario?

A. Annotate your ingress object with an ingress.class of "gce."
Feedback: Incorrect. To implement an internal load balancer, the ingress class needs to be "gce-internal."

B. Configure your service object with a type: LoadBalancer.
Feedback: incorrect. Using Load Balancer at the service level implements a Layer 4 network load balancer, not an http(s) load balancer.

*C. Annotate your service object with a neg reference.
Feedback: Correct! This is correct because an internal http(s) load balancer can only use NEGs.

D. Implement custom static routes in your VPC.
Feedback: Incorrect. This describes a routes-based cluster. In order to support internal load balancing, your cluster needs to use VPC-native mode, where your cluster provides IP addresses to your pods from an alias IP range.

Where to look:
https://cloud.google.com/kubernetes-engine/docs/concepts/ingress-ilb

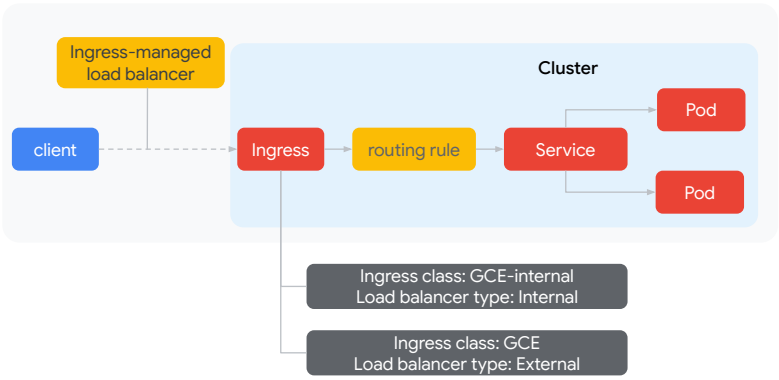
https://cloud.google.com/kubernetes-engine/docs/concepts/ingress-xlb
https://cloud.google.com/kubernetes-engine/docs/how-to/load-balance-ingress
https://cloud.google.com/kubernetes-engine/docs/how-to/internal-load-balance-ingress

Content mapping:

- Google Cloud Fundamentals: Core Infrastructure (ILT and On-demand)
  - M5 Containers in the Cloud
- Getting Started with Google Kubernetes Engine (ILT and On-demand)
  - M4 Introduction to Kubernetes Workloads

Summary:
Explanation/summary on the following slide.

Internal vs External load balancing in Kubernetes



Google Cloud

To implement network load balancing you create a service object with these settings:

- `type: LoadBalancer.`
- Set External Traffic Policy to cluster or local

Cluster - traffic will be load balanced to any healthy GKE node and then kube-proxy will send it to a node with the pod.

Local - nodes without the pod will be reported as unhealthy. Traffic will only be sent to nodes with the pod. Traffic will be sent directly to pod with source ip header info included.

To implement external http(s) load balancing create an ingress object with the following settings:

- Routing depends on URL path, session affinity, and the balancing mode of backend Network endpoint groups (NEGS)
- The object type is ingress.
- Using `ingress.class: “gce”` annotation in the metadata deploys an external load balancer.
- External load balancer is deployed at Google Points of presence.
- Static IP for ingress lasts as long as the object.

To implement an internal http(s) load balancer create an ingress object with the following settings:

- Routing depends on URL path, session affinity, and balancing mode of the backend NEGS.
- The object kind is ingress.
- Metadata requires an `Ingress.class: “gce-internal”` to spawn an internal load balancer.
- Proxies are deployed in a proxy only subnet in a specific region in your VPC.
- Only NEGs are supported. Use the following annotation in your service metadata:
  - `cloud.google.com/neg: '{"ingress": true}'`
- Forwarding rule is assigned from the GKE node address range.

4.2 Diagnostic Question 05 Discussion

What Kubernetes object provides access to logic running in your cluster via endpoints that you define?

A. Pod templates
B. Pods
C. Services
D. Deployments

Google Cloud

Question:
What Kubernetes object provides access to logic running in your cluster via endpoints that you define?

4.2 Diagnostic Question 05 Discussion

What Kubernetes object provides access to logic running in your cluster via endpoints that you define?

A. Pod templates
B. Pods
C. Services ✓
D. Deployments

Google Cloud

Feedback:
A. Pod templates
Feedback: Incorrect. Pod templates define how pods will be configured as part of a deployment.

B. Pods
Feedback: Incorrect. Pods provide the executable resources your containers run in.

*C. Services
Feedback: Correct! Service endpoints are defined by pods with labels that match those specified in the service configuration file. Services then specify how those pods are exposed.

D. Deployments
Feedback: Incorrect. Deployments help you with availability and the health of a set of pod replicas. They do not help you configure external access.

Where to look:
https://cloud.google.com/kubernetes-engine/docs/concepts/kubernetes-engine-overview
https://cloud.google.com/kubernetes-engine/docs/concepts/pod
https://cloud.google.com/kubernetes-engine/docs/concepts/deployment
https://cloud.google.com/kubernetes-engine/docs/concepts/service

Content mapping:

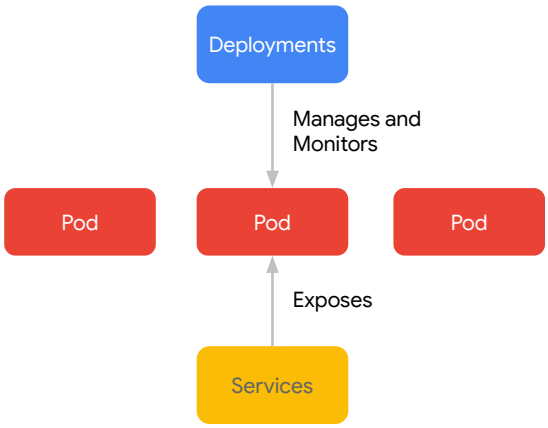
- Google Cloud Fundamentals: Core Infrastructure (ILT and On-demand)
  - M5 Containers in the Cloud

- Getting Started with Google Kubernetes Engine (ILT and On-demand)
  - M3 Kubernetes Architecture

- Quest: Set Up and Configure a Cloud Environment in Google Cloud (https://www.qwiklabs.com/quests/119)

Summary:
Explanation/summary on the following slide.

Kubernetes objects



Google Cloud

What is a pod? A pod Is the smallest deployable object in Kubernetes. It is a single instance of a running process that contains one or more docker containers. Pods provide networking and storage to containers, and contain dependencies the container needs to run and communicate.

What is a deployment? A deployment manages a set of multiple identical pods. It uses a replica set to define the number of pods. A deployment monitors pods in a replica set and replaces unhealthy instances to ensure your application remains available. A deployment uses a pod template, which provides a spec of what each deployed pod should look like. When you update the pod template in a deployment, it starts a rolling upgrade of the pods in the deployment.

What is a service? A service is a group of pod endpoints that you can configure access for. You use selectors to define which pods are included in a service.
A service gives you a stable IP that belongs to the service. Pods have internal IP addresses but they can change as pods get restarted and replaced.
A service can be configured to implement load balancing.

4.2 Diagnostic Question 06 Discussion

What is the declarative way to initialize and update Kubernetes objects?

A. kubectl apply
B. kubectl create
C. kubectl replace
D. kubectl run

Google Cloud

Question:
What is the declarative way to initialize and update Kubernetes objects?

4.2 Diagnostic Question 06 Discussion

What is the declarative way to initialize and update Kubernetes objects?

A. kubectl apply
B. kubectl create
C. kubectl replace
D. kubectl run

Google Cloud

Feedback:
*A. **kubectl apply**
Feedback: Correct! **kubectl apply** creates and updates Kubernetes objects in a declarative way from manifest files.

B. **kubectl create**
Feedback: Incorrect. **kubectl create** creates objects in an imperative way. You can build an object from a manifest but you can't change it after the fact. You will get an error.

C. **kubectl replace**
Feedback: Incorrect. **kubectl replace** downloads the current copy of the spec and lets you change it. The command replaces the object with a new one based on the spec you provide.

D. **kubectl run**
Feedback: Incorrect. **kubectl run** creates a Kubernetes object in an imperative way using arguments you specify on the command line.

Where to look:
https://cloud.google.com/kubernetes-engine/docs/how-to/deploying-workloads-overview#imperative_commands
https://kubernetes.io/docs/concepts/overview/working-with-objects/object-management/

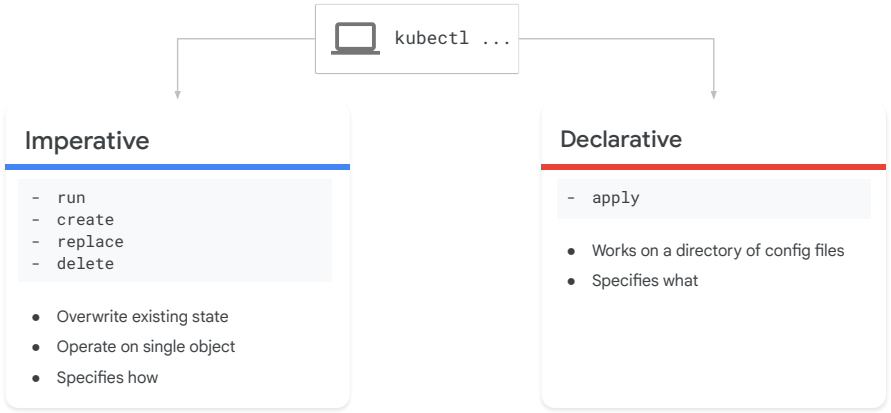
Content mapping:

- Getting Started with Google Kubernetes Engine (ILT and On-demand)
  - M4 Introduction to Kubernetes Workloads

- Quest: Set Up and Configure a Cloud Environment in Google Cloud (https://www.qwiklabs.com/quests/119)

Summary:
Explanation/summary on the following slide.

Types of kubectl commands



Google Cloud

You execute kubectl commands to manage objects such as pods, deployments, and services.

Imperative commands such as run, create, replace, delete act on a live object or single config file and overwrite any state changes that have occurred on an existing object.

Declarative commands use a config stored in a directory to deploy and apply changes to your app objects.

- uses `kubectl -apply` on a directory
- You don't specify create, replace or delete commands.

Example commands:

`kubectl -run` #generates a new object in a cluster, by default of deployment
`Kubectl -create` #generates a new object from a config file
`Kubectl -get` #display requested resources
`kubectl -expose` #creates a new service that distributes traffic to labelled pods

Pods are not created by themselves but are based on template made available in deployments.

You can use the name of an existing object or defined config file. The object you create service for can be one of the following: deployment, service, replica set, replication controller or pod.

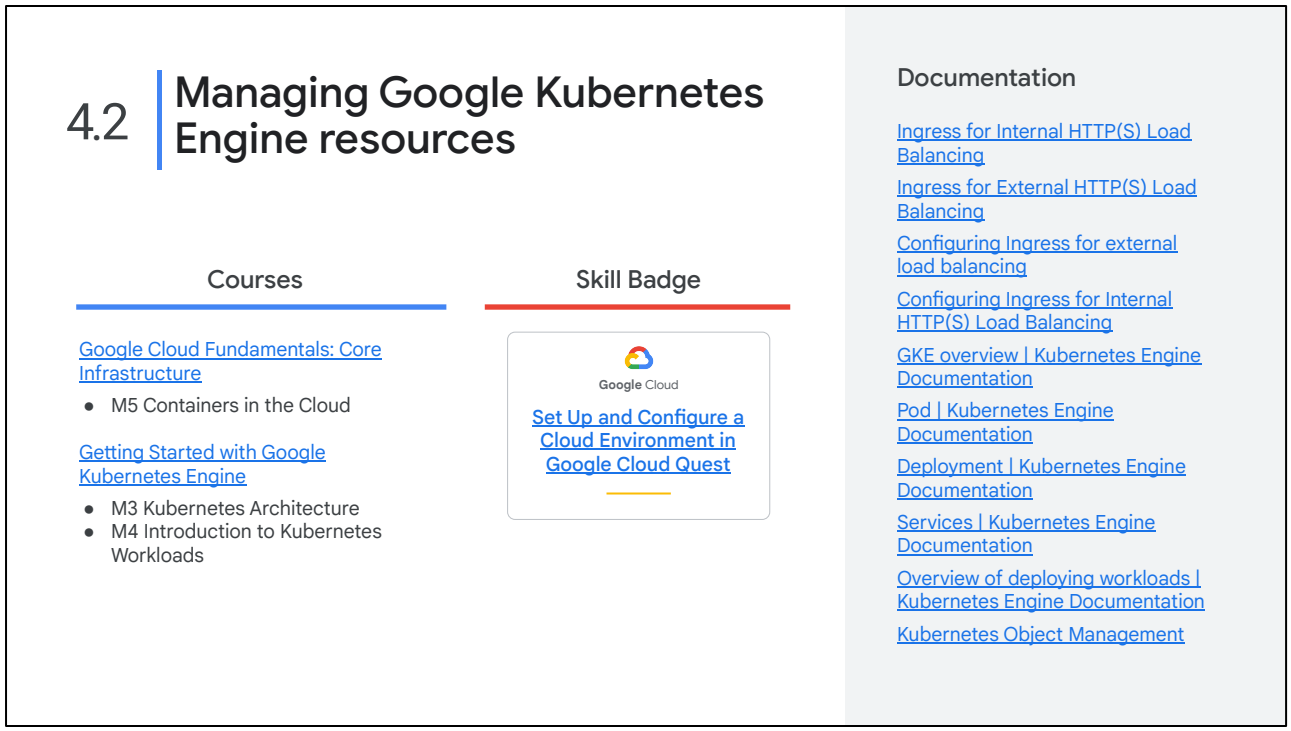
Important specs in a deployment manifest:

- kind:Deployment
- Replicas:3
- Spec:template specifies labels, container name, and image it is based on.

If you need to change a deployment you change the config file and do a `kubectl -apply`

Important specs in a service manifest:

Kind: service
Spec:selector - labels of pods included in service - have to match them all
Port: incoming port
targetPort: port the pod is listening on



Let's take a moment to consider resources that can help you build your knowledge and skills in this area.

The concepts in the diagnostic questions we just reviewed are covered in these modules, skill badges, and documentation. You'll find this list in your workbook so you can take a note of what you want to include later when you build your study plan. Based on your experience with the diagnostic questions, you may want to include some or all of these.

Google Cloud Fundamentals: Core Infrastructure (On-demand)
Getting Started with Google Kubernetes Engine (On-demand)

Set Up and Configure a Cloud Environment in Google Cloud Quest

https://cloud.google.com/kubernetes-engine/docs/concepts/ingress-ilb
https://cloud.google.com/kubernetes-engine/docs/concepts/ingress-xlb
https://cloud.google.com/kubernetes-engine/docs/how-to/load-balance-ingress
https://cloud.google.com/kubernetes-engine/docs/how-to/internal-load-balance-ingress
https://cloud.google.com/kubernetes-engine/docs/concepts/kubernetes-engine-overview
https://cloud.google.com/kubernetes-engine/docs/concepts/pod
https://cloud.google.com/kubernetes-engine/docs/concepts/deployment

https://cloud.google.com/kubernetes-engine/docs/concepts/service
https://cloud.google.com/kubernetes-engine/docs/how-to/deploying-workloads-overview#imperative_commands
https://kubernetes.io/docs/concepts/overview/working-with-objects/object-management/

4.3 Managing Cloud Run resources

Tasks include:

- Adjusting application traffic splitting parameters
- Setting scaling parameters for autoscaling instances
- Determining whether to run Cloud Run (fully managed) or Cloud Run for Anthos

Google Cloud

Cloud Run and Cloud Functions are Google's serverless approach to handling containers and functional code. In both of these technologies, you pay for resources based on how many requests are coming in. One big difference between the two of them is that Cloud Run is optimized for multiple concurrent connections to each instance, while Cloud Functions only lets you have only one connection per function instance.

For Cymbal Superstore, Cloud Run could be used to quickly test updates to containers. As an Associate Cloud Engineer, you could be tasked to implement traffic splitting to test changes or rollback updates that didn't work well. There are also settings you need to know for autoscaling, such as min and max instances, that will let you make tradeoffs of relative latency versus cost. You also have the choice of using a fully managed version in Google Cloud or a hybrid version available as part of Anthos. The hybrid version runs on abstracted GKE resources allocated by your Anthos cluster.

These types of tasks were covered in this question:
Question 7: Express the differences between manual, basic, and automatic scaling in serverless: App Engine or Cloud Run

4.3 Diagnostic Question 07 Discussion

You have a Cloud Run service with a database backend. You want to limit the number of connections to your database.

What should you do?

A. Set Min instances.
B. Set Max instances.
C. Set CPU Utilization.
D. Set Concurrency settings.

Google Cloud

Question:
You have a Cloud Run service with a database backend. You want to limit the number of connections to your database. What should you do?

4.3 Diagnostic Question 07 Discussion

You have a Cloud Run service with a database backend. You want to limit the number of connections to your database.

What should you do?

A. Set Min instances.
B. Set Max instances.
C. Set CPU Utilization.
D. Set Concurrency settings.

Google Cloud

Feedback:
A. Set Min instances.
Feedback: Incorrect. Min instances reduce latency when you start getting requests after a period of no activity. It keeps you from scaling down to zero.

*B. Set Max instances.
Feedback: Correct! Max instances control costs, keeping you from starting too many instances by limiting your number of connections to a backing service.

C. Set CPU Utilization.
Feedback: Incorrect. Default CPU utilization is 60%. It doesn't affect the number of connections to your backing service.

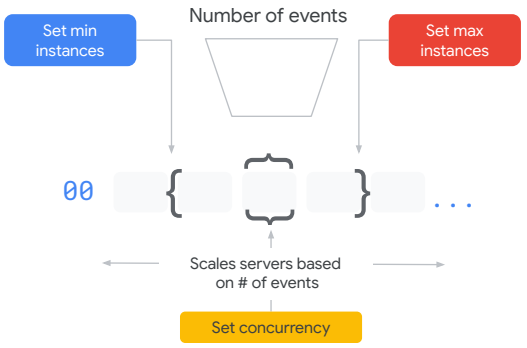
D. Set Concurrency settings.
Feedback: Incorrect. Concurrency is how many users can connect to a particular instance. It does not directly affect connections to backend services.

Where to look:
https://cloud.google.com/run/docs/about-instance-autoscaling

Content mapping:
- Google Cloud Fundamentals: Core Infrastructure (ILT and On-demand)
  - M6 Applications in the Cloud

Summary:
Explanation/summary on the following slide.

Cloud Run autoscaling



Google Cloud

How does autoscaling work in Cloud Run?

Cloud Run automatically scales the number of container instances required for each deployed revision. When no traffic is received, the deployment automatically scales to zero.

Other ways you can affect Cloud Run autoscaling:

- CPU utilization, with a default 60% utilization.
- Concurrency settings, with a default of 80 concurrent requests. You can increase it to 1000. You can also lower it if you need to.
- Max number of instances limits total number of instances. It can help you control costs and limit connections to a backing service. Defaults to 1000. Quota increase required if you want more.
- Min number of instances keeps a certain number of instances up. You will incur cost even when no instances are handling requests.

Instances that are started might remain idle for up to 15 minutes to reduce latency associated with cold starts. You don't get charged for these idle instances. You set a min and max on the container tab in the advanced settings dialog.

4.3 Managing Cloud Run resources

Courses

Google Cloud Fundamentals: Core Infrastructure

- M6 Applications in the Cloud

Documentation

About container instance autoscaling | Cloud Run Documentation

Let's take a moment to consider resources that can help you build your knowledge and skills in this area.

The concepts in the diagnostic question we just reviewed are covered in this modules and in this documentation. You'll find this list in your workbook so you can take a note of what you want to include later when you build your study plan. Based on your experience with the diagnostic questions, you may want to include some or all of these.

Google Cloud Fundamentals: Core Infrastructure (On-demand)

https://cloud.google.com/run/docs/about-instance-autoscaling

4.4 Managing storage and database solutions

Tasks include:

- Managing and securing objects in and between Cloud Storage buckets
- Setting object life cycle management policies for Cloud Storage buckets
- Executing queries to retrieve data from data instances (e.g., Cloud SQL, BigQuery, Cloud Spanner, Cloud Datastore, Cloud Bigtable)
- Estimating costs of data storage resources
- Backing up and restoring database instances (e.g., Cloud SQL, Cloud Datastore)
- Reviewing job status in Cloud Dataproc, Cloud Dataflow, or BigQuery

Google Cloud

We discussed earlier about how to define an external table definition in BigQuery. Cymbal Superstore's transportation management app required you to do this so that you could query the location of Cymbal Superstore's delivery vehicles from Big Table.That is just one example of the type of storage management tasks you will have to do as an Associate Cloud Engineer

Consider this example. You store static images of products for Cymbal Superstore's ecommerce app in Cloud Storage. As an Associate Cloud Engineer, you would be expected to know how to secure access to these images from the application through IAM roles assigned to a service account. When you upgrade product images you would like to keep the previous images, but move them to a different storage type based on object versioning. You could do this using the object lifecycle management feature of Cloud Storage.

You explored these types of tasks in this question:
Question 8: Implement different types of Google Cloud Storage Lifecycle Actions (delete, set storage class) using lifecycle conditions

4.4 Diagnostic Question 08 Discussion

You want to implement a lifecycle rule that changes your storage type from Standard to Nearline after a specific date.

What conditions should you use? (Pick two.)

A. Age
B. CreatedBefore
C. MatchesStorageClass
D. IsLive
E. NumberofNewerVersions

Google Cloud

Question:
You want to implement a lifecycle rule that changes your storage type from Standard to Nearline after a specific date. What conditions should you use? (Pick two.)

4.4 Diagnostic Question 08 Discussion

You want to implement a lifecycle rule that changes your storage type from Standard to Nearline after a specific date.

What conditions should you use? (Pick two.)

A. Age
B. CreatedBefore
C. MatchesStorageClass
D. IsLive
E. NumberofNewerVersions

Google Cloud

Feedback:
A. Age
Feedback: Incorrect. Age is specified by number of days, not a specific date.

*B. CreatedBefore
Feedback: Correct! CreatedBefore lets you specify a date.

*C. MatchesStorageClass
Feedback: Correct! MatchesStorageClass is required to look for objects with a Standard storage type.

D. IsLive
Feedback: Incorrect. IsLive has to do with whether or not the object you are looking at is the latest version. It is not date-based.

E. NumberofNewerVersions
Feedback: Incorrect. NumberofNewerVersions is based on object versioning and you don't specify a date.

Where to look:
https://cloud.google.com/storage/docs/lifecycle

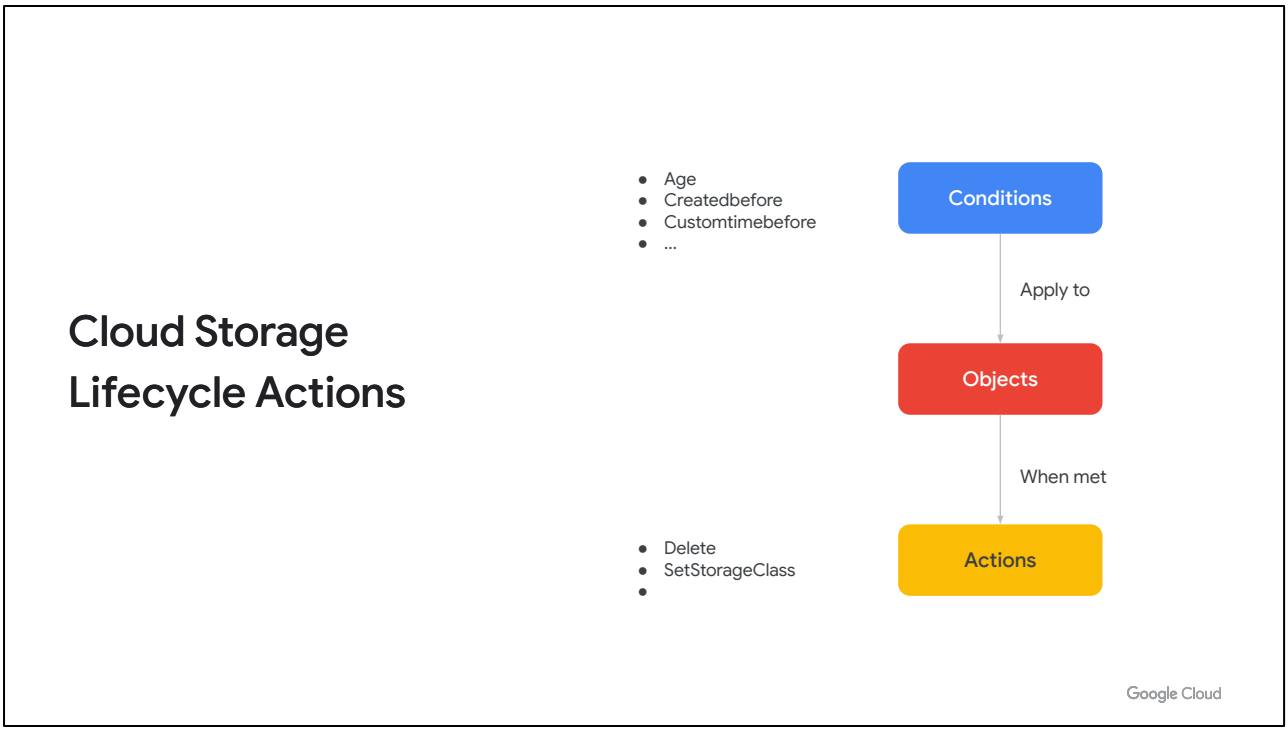
Content mapping:

- Google Cloud Fundamentals: Core Infrastructure (ILT and On-demand)
    - M4 Storage in the Cloud

- Architecting with Google Compute Engine (ILT)
    - M5 Storage and Database Services

- Essential Google Cloud Infrastructure: Core Services (On-demand)
    - M2 Storage and Database Services

Summary:
Explanation/summary on the following slide.



Lifecycle management configurations apply to current and future objects in a Cloud Storage bucket. When object metadata meets the criteria of any of the rules, Cloud Storage performs a specified action.

Examples:

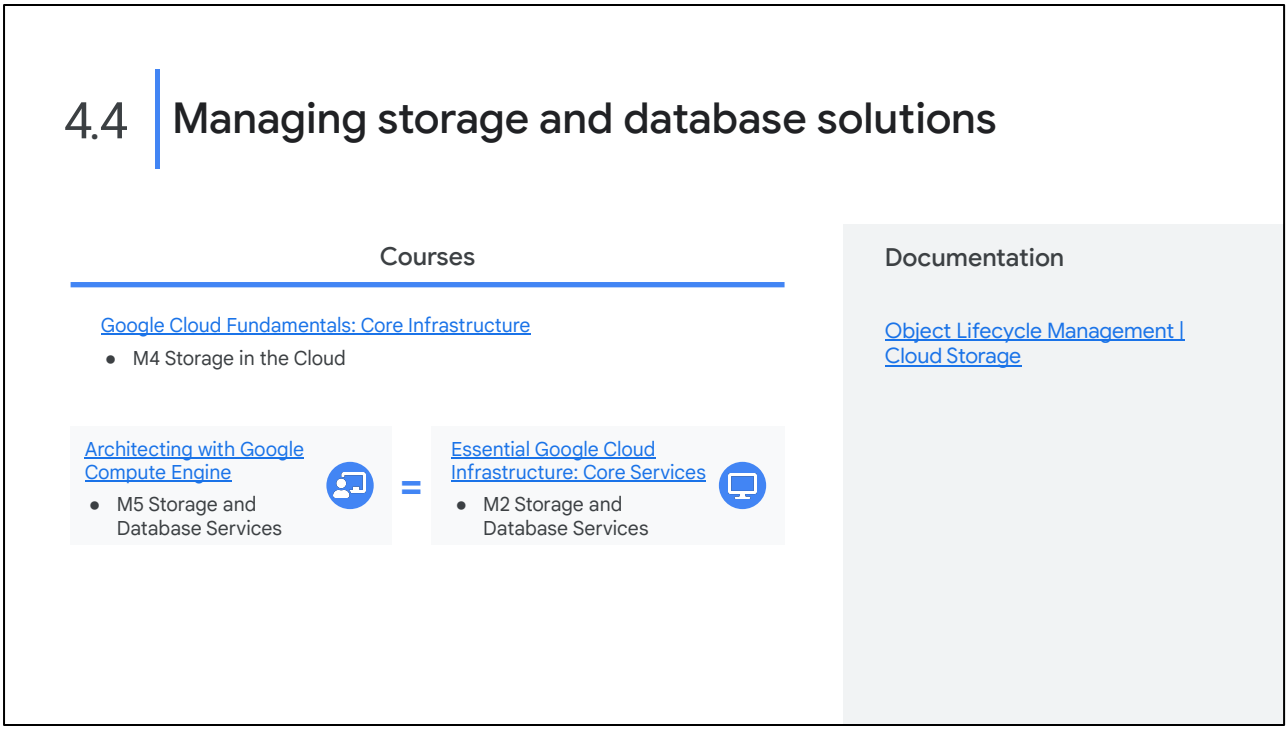
- Downgrade the storage class of objects older than 365 days to coldline storage.
- Delete an object that existed before a certain date.
- Keep the 3 most recent versions of each object in a bucket with versioning enabled.

Object metadata has to match all rules for the action to fire. If an object state matches more than one rule set, delete takes precedence, followed by storage class with lowest price.

Here are the available conditions:

- Age
- Createdbefore
- Customtimebefore
- Dayssincecustomtime
- Dayssincenoncurrent
- Islive
- Matchesstorageclass
- Noncurrenttimebefore

- numberofnewerversions



Let's take a moment to consider resources that can help you build your knowledge and skills in this area.

The concepts in the diagnostic question we just reviewed are covered in this module and in this documentation. You'll find this list in your workbook so you can take a note of what you want to include later when you build your study plan. Based on your experience with the diagnostic questions, you may want to include some or all of these.

Google Cloud Fundamentals: Core Infrastructure (On-demand)
Architecting with Google Compute Engine (ILT)
Essential Google Cloud Infrastructure: Core Services (On-demand)

https://cloud.google.com/storage/docs/lifecycle

4.5 Managing networking resources

Tasks include:

- Adding a subnet to an existing VPC
- Expanding a subnet to have more IP addresses
- Reserving static external or internal IP addresses
- Working with CloudDNS, CloudNAT, Load Balancers and firewall rules

Google Cloud

As an Associate Cloud Engineer, any app you deploy is going to have connectivity requirements. Google's software defined networking stack is based on the idea of a Virtual Private Cloud. VPCs group regional resources into internal IP address ranges called subnets. As you manage network resources, you might have to add subnets or expand a subnet to let it support more devices. IP addresses assigned to both internal and external virtual machines are ephemeral, meaning as resources come and go your IP addresses might change. To get around this problem you can set and attach static IPs that persist across different individual resources.

How do these tasks apply to Cymbal Superstore? The ecommerce app requires global external connectivity for users to access it. You can manage this through an ingress object in GKE. The ecommerce application middleware is going to need private, regional, internal access to a Spanner backend that stores order data. Cymbal's supply chain app is going to need external regional connectivity with regional internal connectivity as well, only implemented with Google Cloud load balancers instead of GKE ingress objects.

You explored these types of tasks in the following questions:
Question 9: Describe how to expand the IPs available to a subnet (e.g. shrinking the subnet mask)

4.5 Diagnostic Question 09 Discussion

Cymbal Superstore has a subnetwork called mysubnet with an IP range of 10.1.2.0/24. You need to expand this subnet to include enough IP addresses for at most 2000 users or devices.

What should you do?

A. gcloud compute networks subnets expand-ip-range mysubnet --region us-central1 --prefix-length 20

B. gcloud networks subnets expand-ip-range mysubnet --region us-central1 --prefix-length 21

C. gcloud compute networks subnets expand-ip-range mysubnet --region us-central1 --prefix-length 21

D. gcloud compute networks subnets expand-ip-range mysubnet --region us-cetnral1 --prefix-length 22

Question:
Cymbal Superstore has a subnetwork called mysubnet with an IP range of 10.1.2.0/24. You need to expand this subnet to include enough IP addresses for at most 2000 new users or devices. What should you do?

4.5 Diagnostic Question 09 Discussion

Cymbal Superstore has a subnetwork called mysubnet with an IP range of 10.1.2.0/24. You need to expand this subnet to include enough IP addresses for at most 2000 users or devices.

What should you do?

A. gcloud compute networks subnets expand-ip-range mysubnet --region us-central1 --prefix-length 20

B. gcloud networks subnets expand-ip-range mysubnet --region us-central1 --prefix-length 21

C. **gcloud compute networks subnets expand-ip-range mysubnet --region us-central1 --prefix-length 21**

D. gcloud compute networks subnets expand-ip-range mysubnet --region us-cetnral1 --prefix-length 22

Google Cloud

Feedback:

A. **gcloud compute networks subnets expand-ip-range mysubnet --region us-central1 --prefix-length 20**
Feedback: Incorrect. A prefix length of 20 would expand the IP range to 4094, which is far too many for the scenario.

B. **gcloud networks subnets expand-ip-range mysubnet --region us-central1 --prefix-length 21**
Feedback: Incorrect. This command is missing the compute command-set.

*C. **gcloud compute networks subnets expand-ip-range mysubnet --region us-central1 --prefix-length 21**
Feedback: Correct! This command gives a total of 2046 addresses available and meets the requirement.

D. **gcloud compute networks subnets expand-ip-range mysubnet --region us-cetnral1 --prefix-length 22**
Feedback: Incorrect. This command doesn't give you enough IP addresses (only 1,000).

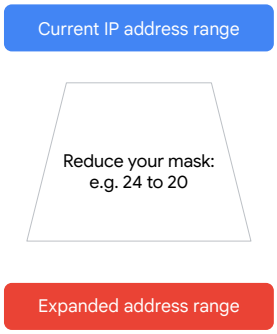
Where to look:
https://cloud.google.com/sdk/gcloud/reference/compute/networks/subnets/expand-ip-range
https://cloud.google.com/vpc/docs/using-vpc#expand-subnet

Content mapping:

- Architecting with Google Compute Engine (ILT)
  - M2 Virtual Networks
- Essential Google Cloud Infrastructure: Foundation (On-demand)
  - M2 Virtual Networks

Summary:
Explanation/summary on the following slide.

Expand IP addresses in a subnet

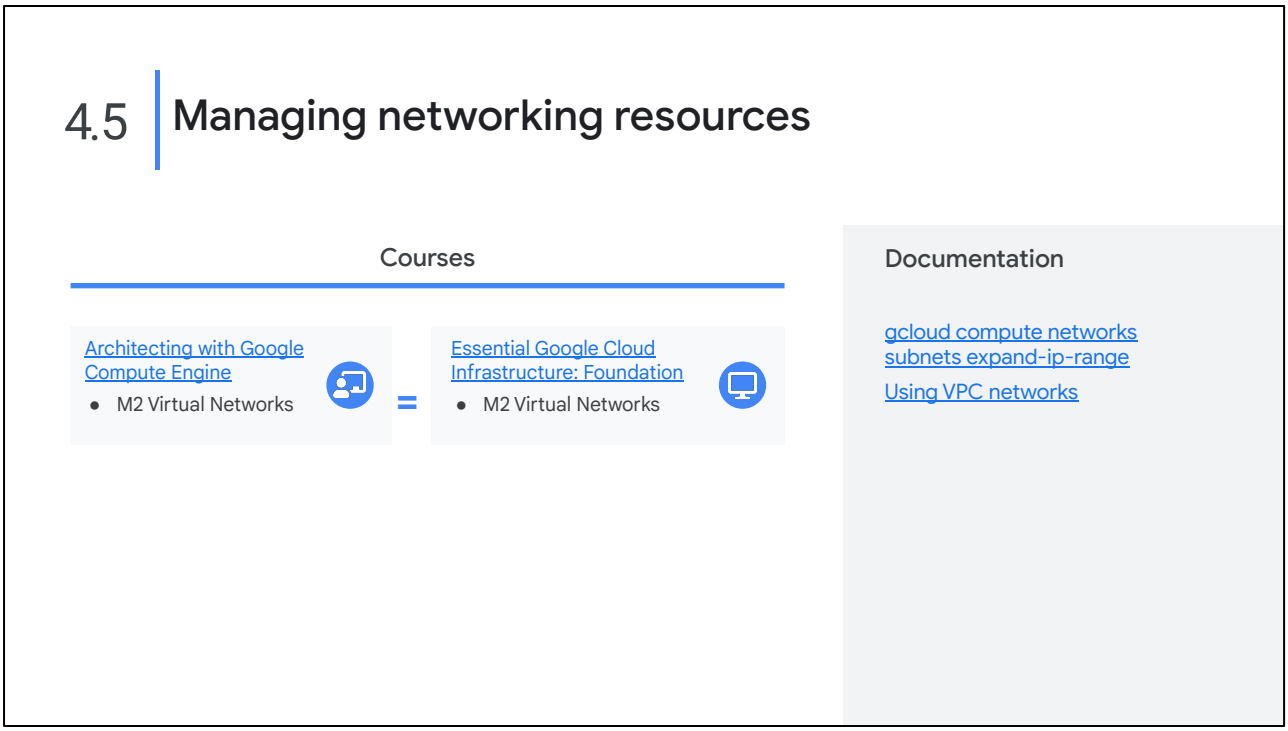


Google Cloud

Command syntax:

```
gcloud compute networks subnets expand-ip-range SUBNET
--prefix-length = PREFIX_LENGTH
```

If 10.0.128.0/24 you can supply 20 to reduce your mask, which increases your number of available ip addresses.



Let's take a moment to consider resources that can help you build your knowledge and skills in this area.

The concepts in the diagnostic question we just reviewed are covered in this module and in this documentation. You'll find this list in your workbook so you can take a note of what you want to include later when you build your study plan. Based on your experience with the diagnostic questions, you may want to include some or all of these.

Architecting with Google Compute Engine (ILT)
Essential Google Cloud Infrastructure: Foundation (On-demand)

https://cloud.google.com/sdk/gcloud/reference/compute/networks/subnets/expand-ip-range
https://cloud.google.com/vpc/docs/using-vpc#expand-subnet

4.6 Monitoring and logging

Tasks include:

- Creating Cloud Monitoring alerts based on resource metrics
- Creating and ingesting Cloud Monitoring custom metrics (e.g., from applications or logs)
- Configuring log sinks to export logs to external systems (e.g., on-premises or BigQuery)
- Configuring logs routers
- Viewing and filtering logs in Cloud Logging
- Viewing specific log message details in Cloud Logging
- Using cloud diagnostics to research an application issue (e.g., viewing Cloud Trace data, using Cloud Debug to view an application point-in-time)
- Viewing Google Cloud Platform status

Google Cloud

Performance monitoring is another important aspect of managing the day-to-day operations of your cloud solutions. The majority of the products we review in this topic come from the Cloud Operations Suite.

For example, Cymbal Superstore's supply chain app might require you to monitor CPU utilization for all the instances in your managed instance group.

Cloud Monitoring allows you to build charts based on metrics you specify. You can also look at logs associated with resources from the dashboard. You could use this to monitor messages being posted to your pubsub topic for the transportation management app.

Custom metrics allow you to define metrics descriptors for things you want to keep track of that aren't included in standard metrics. For example, in Cymbal Superstore's ecommerce app you want to track the number of requests going to sales and the number going to support.

Cloud Logging allows you to log any timestamped data in logs you define and manage. There are a myriad of options for where you can save your logs and how to route them. There is also an interface provided to query your logs.

Cloud Ops has several tools that will help you with debugging app performance issues. Cloud Trace, Cloud Debugger, and Cloud Profiler all help you figure out what might be causing latency and performance issues in your apps.

You explored these types of tasks in this question:
Question 10: Configure a Google Cloud Operations custom alert: specify conditions, send optional notifications, and reference documentation.

4.6 Diagnostic Question 10 Discussion

Cymbal Superstore's supply chain management system has been deployed and is working well. You are tasked with monitoring the system's resources so you can react quickly to any problems. You want to ensure the CPU usage of each of your Compute Engine instances in us-central1 remains below 60%. You want an incident created if it exceeds this value for 5 minutes. You need to configure the proper alerting policy for this scenario.

What should you do?

A. Choose resource type of VM instance and metric of CPU load, condition trigger if any time series violates, condition is below, threshold is .60, for 5 minutes.

B. Choose resource type of VM instance and metric of CPU utilization, condition trigger all time series violates, condition is above, threshold is .60 for 5 minutes.

C. Choose resource type of VM instance, and metric of CPU utilization, condition trigger if any time series violates, condition is below, threshold is .60 for 5 minutes.

D. Choose resource type of VM instance and metric of CPU utilization, condition trigger if any time series violates, condition is above, threshold is .60 for 5 minutes.

Google Cloud

Question:
Cymbal Superstore's supply chain management system has been deployed and is working well. You are tasked with monitoring the system's resources so you can react quickly to any problems. You want to ensure the CPU usage of each of your Compute Engine instances in us-central1 remains below 60%. You want an incident created if it exceeds this value for 5 minutes. You need to configure the proper alerting policy for this scenario. What should you do?

4.6 Diagnostic Question 10 Discussion

Cymbal Superstore's supply chain management system has been deployed and is working well. You are tasked with monitoring the system's resources so you can react quickly to any problems. You want to ensure the CPU usage of each of your Compute Engine instances in us-central1 remains below 60%. You want an incident created if it exceeds this value for 5 minutes. You need to configure the proper alerting policy for this scenario.

What should you do?

A. Choose resource type of VM instance and metric of CPU load, condition trigger if any time series violates, condition is below, threshold is .60, for 5 minutes.

B. Choose resource type of VM instance and metric of CPU utilization, condition trigger all time series violates, condition is above, threshold is .60 for 5 minutes.

C. Choose resource type of VM instance, and metric of CPU utilization, condition trigger if any time series violates, condition is below, threshold is .60 for 5 minutes.

D. Choose resource type of VM instance and metric of CPU utilization, condition trigger if any time series violates, condition is above, threshold is .60 for 5 minutes.

Google Cloud

Feedback:
A. Choose resource type of VM instance and metric of CPU load, condition trigger if any time series violates, condition is below, threshold is .60, for 5 minutes.
Feedback: Incorrect. CPU load is not a percentage, it is a number of processes.

B. Choose resource type of VM instance and metric of CPU utilization, condition trigger all time series violates, condition is above, threshold is .60 for 5 minutes.
Feedback: Incorrect. The trigger should be "each of your instances", not "all of your instances."

C. Choose resource type of VM instance, and metric of CPU utilization, condition trigger if any time series violates, condition is below, threshold is .60 for 5 minutes.
Feedback: Incorrect. The alert policy should record an incident when the CPU utilization exceeds a certain amount. The condition for this statement is below that, so it is wrong.

* D. Choose resource type of VM instance and metric of CPU utilization, condition trigger if any time series violates, condition is above, threshold is .60 for 5 minutes.
Feedback: Correct! All the values of this statement match the scenario.

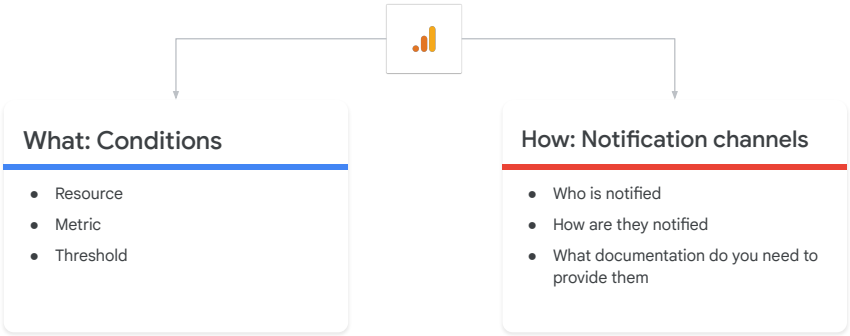
Where to look:
https://cloud.google.com/monitoring/alerts/using-alerting-ui
https://cloud.google.com/monitoring/alerts

Content mapping:

- Architecting with Google Compute Engine (ILT)
  - M7 Resource Monitoring
- Essential Google Cloud Infrastructure: Core Services (On-demand)
  - M4 Resource Monitoring
- Quests
  - Perform Foundational Infrastructure Tasks in Google Cloud (https://www.qwiklabs.com/quests/118)
  - Set Up and Configure a Cloud Environment in Google Cloud (https://www.qwiklabs.com/quests/119)

Summary:
Explanation/summary on the following slide.

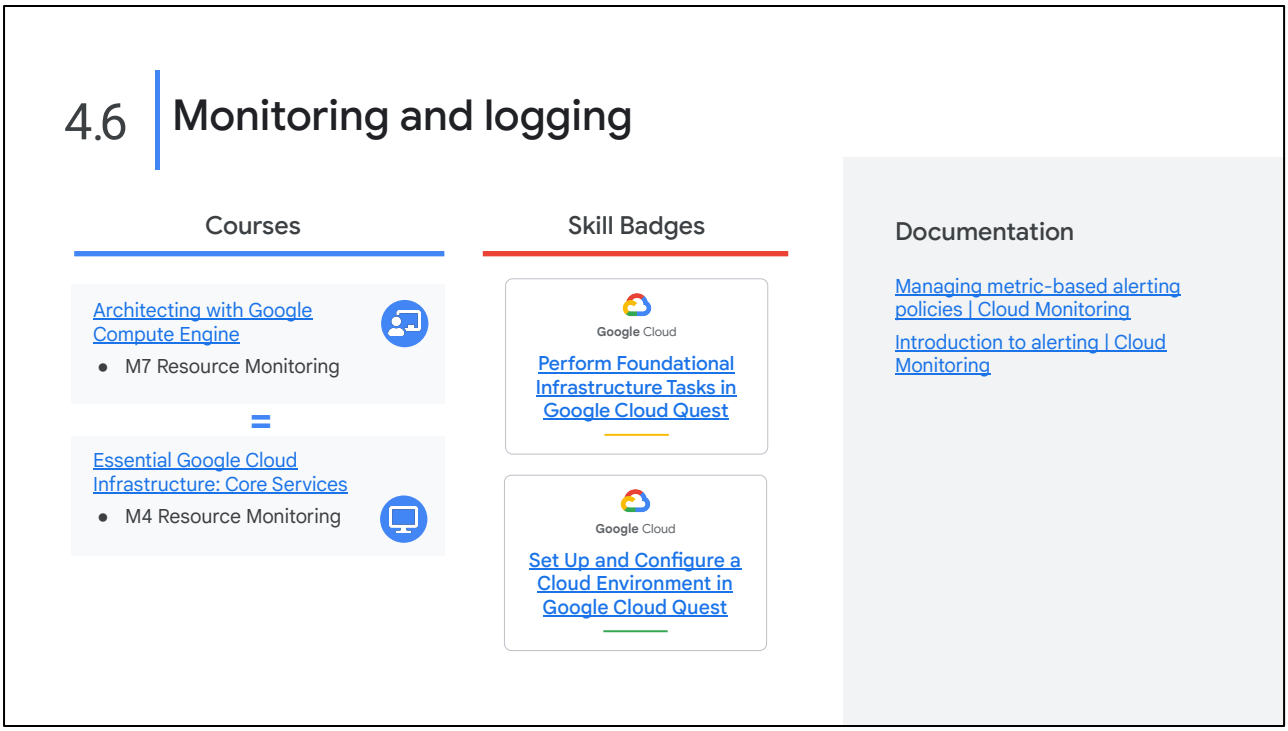
Cloud operations custom alerts



Google Cloud

In Cloud Monitoring you implement alerts by defining alert policies. An alerting policy specifies what you want to be alerted on and how you want to be notified. The “what” is made of conditions that describe the state of a resource, or groups of resources, that cause you to take action. The “how” is provided by notification channels, where you specify who is notified when the condition of the alerting policy is met. Each notification channel configures a different type of output, such as email, slack channel, or posting a message to pub/sub topic. You can also specify documentation you want included in your notification.

Conditions are made of a monitored resource, a metric for that resource, and the threshold where the condition is met. An alerting policy can have up to 6 conditions. In an alerting policy with 1 condition, when that condition is met, an incident is created. For an alerting policy, you specify how those conditions are combined.



Let's take a moment to consider resources that can help you build your knowledge and skills in this area.

The concepts in the diagnostic question we just reviewed are covered in this module and in this documentation. You'll find this list in your workbook so you can take a note of what you want to include later when you build your study plan. Based on your experience with the diagnostic questions, you may want to include some or all of these.

Architecting with Google Compute Engine (ILT)
Essential Google Cloud Infrastructure: Core Services (On-demand)

Perform Foundational Infrastructure Tasks in Google Cloud Quest
Set Up and Configure a Cloud Environment in Google Cloud Quest

https://cloud.google.com/monitoring/alerts/using-alerting-ui
https://cloud.google.com/monitoring/alerts