

Preparing for Your Professional Cloud Architect Journey

Module 1: Designing and Planning a Cloud Solution Architecture

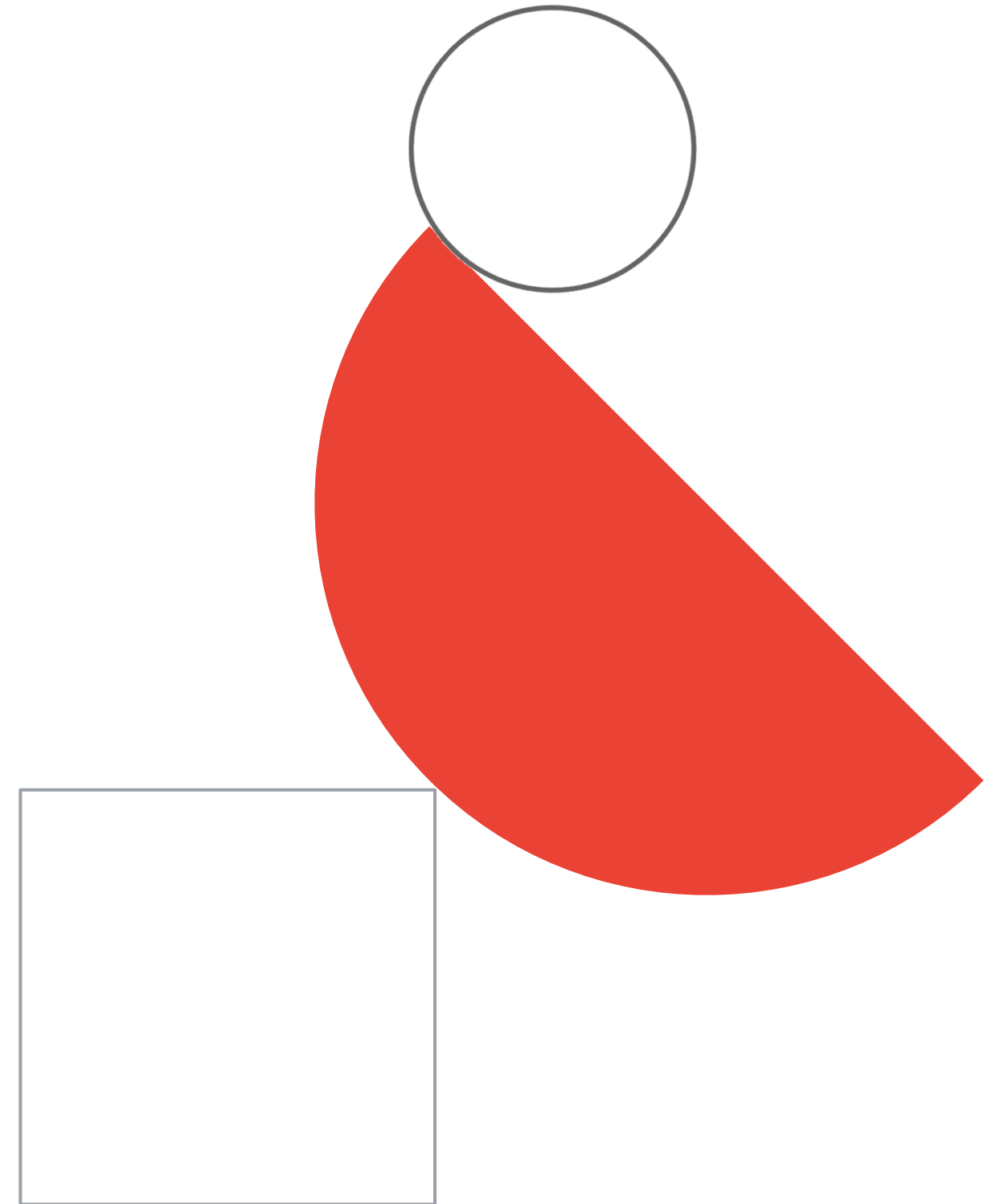


Module agenda

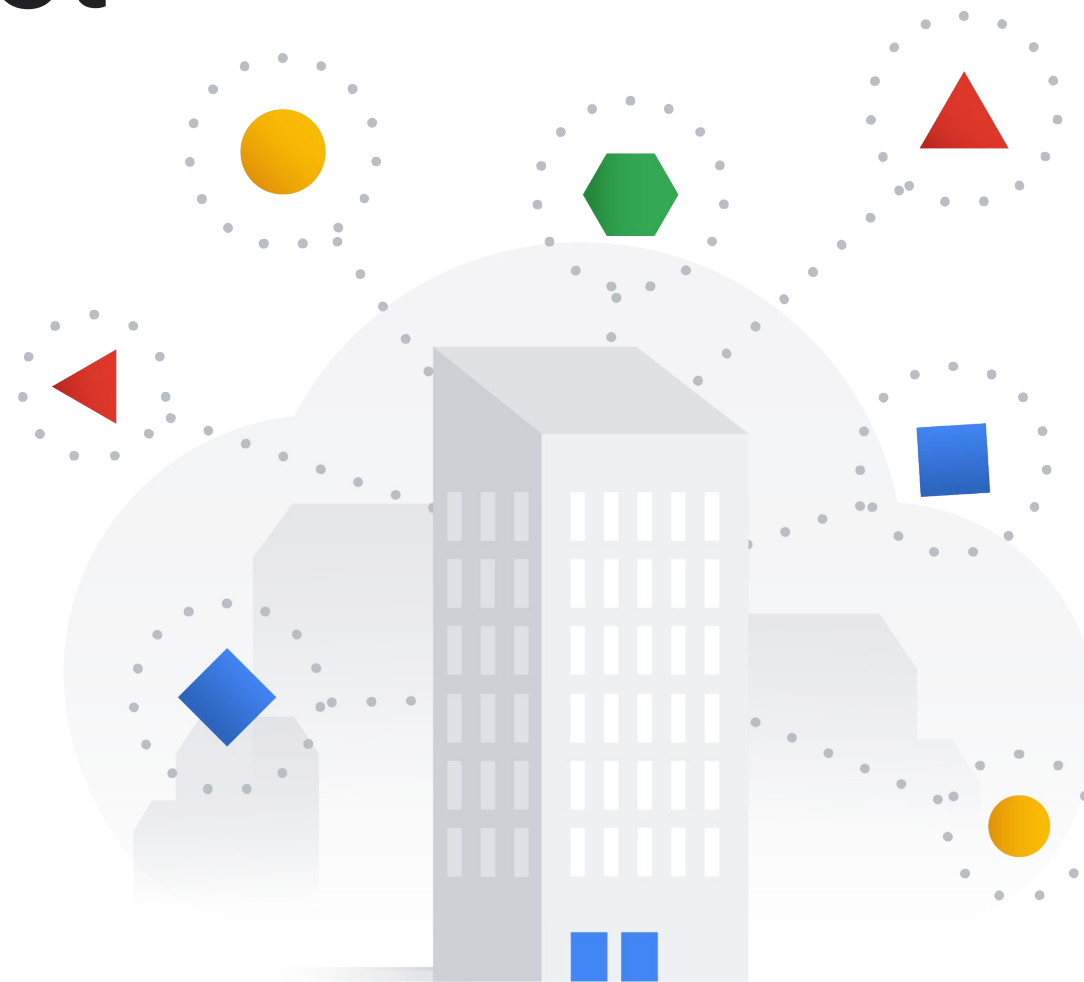
- 01 Designing Cymbal Direct's cloud architecture
- 02 Diagnostic questions
- 03 Review and study planning



Designing Cymbal Direct's cloud architecture



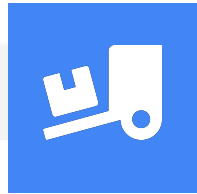
Architecting a solution for Cymbal Direct in Google Cloud



- Designing a solution architecture that meets business requirements.
- Designing a solution infrastructure that meets technical requirements.
- Designing network, storage, and compute resources.
- Creating a migration plan.
- Envisioning future solution improvements.



Cymbal Direct's existing environment



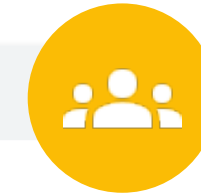
Delivery by Drone

- Their website frontend, pilot, and truck management systems run on **Kubernetes**.
- Positional data for drone and truck location is kept in a **MongoDB** database clusters
- Drones stream video to virtual machines via stateful connection



Purchase & Product APIs

- APIs are simply built into **monolithic apps**, and were not designed for partner integration.
- APIs are running on **Ubuntu linux VMs**



Social Media Highlighting

- Single SuSE linux VM
- MySQL DB
- Redis
- Python

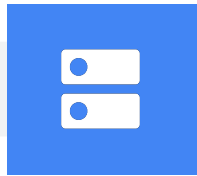



Cymbal Direct's business requirements

- Scale to handle additional demand when expanding into test markets
- Streamline development
- Spend developer time on core business functionality as much as possible
- Let partners order directly via API
- Deploy the social media highlighting service and ensure appropriate content

Cymbal Direct's technical requirements

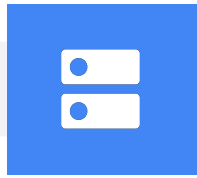
- Managed services
- Container-based workloads
- Highly scalable environment
- Standardization where possible
- Existing virtualization infrastructure refactored over time
- Secure partner integration
- Streaming IoT data

Putting it together: Existing environment

			
<div>Existing environment</div> <div>Website frontend, pilot, and truck management systems run on Kubernetes</div>	<div>Technical requirements</div>	<div>Business requirements</div>	<div>Proposed product/ solution</div>

* One row of a much larger spreadsheet

Putting it together: Technical requirements



Existing environment

Website frontend, pilot, and truck management systems run on Kubernetes



Technical requirements (does it...?)

- Move to managed services wherever possible
- Ensure that developers can deploy container based workloads to testing and production environments in a highly scalable environment.
- Standardize on containers where possible



Business requirements



Proposed product/ solution

* One row of a much larger spreadsheet

Putting it together



Existing environment

Website frontend, pilot, and truck management systems run on Kubernetes



Technical requirements (does it...?)

- Move to managed services wherever possible
- Ensure that developers can deploy container based workloads to testing and production environments in a highly scalable environment.
- Standardize on containers where possible



Business requirements (does it...?)

- Easily scale to handle additional demand when needed?
- Streamline development?



Proposed product/ solution

?

* One row of a much larger spreadsheet

Potential solutions



Existing environment

Website frontend, pilot, and truck management systems run on Kubernetes



Technical requirements (does it...?)

- Move to managed services wherever possible
- Ensure that developers can deploy container based workloads to testing and production environments in a highly scalable environment.
- Standardize on containers where possible



Business requirements (does it...?)

- Easily scale to handle additional demand when needed?
- Streamline development?

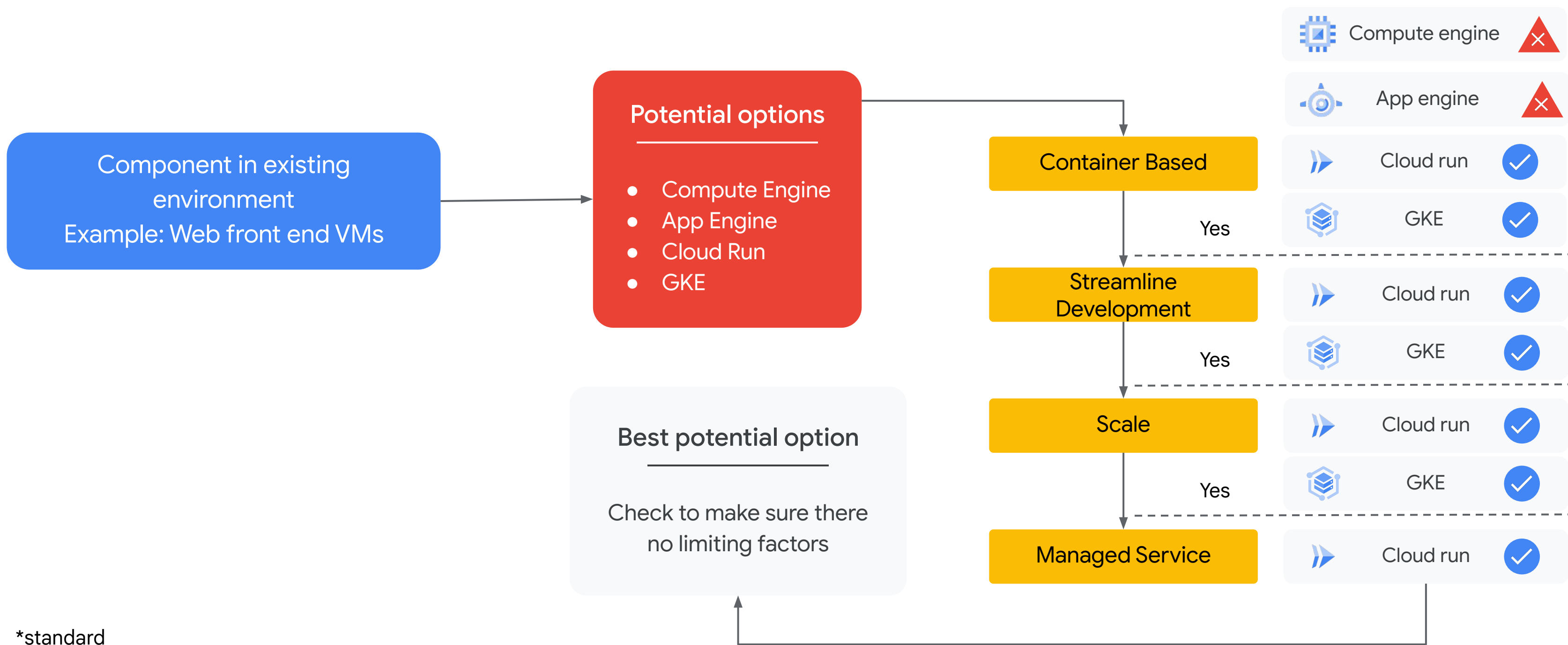


Proposed product/ solution

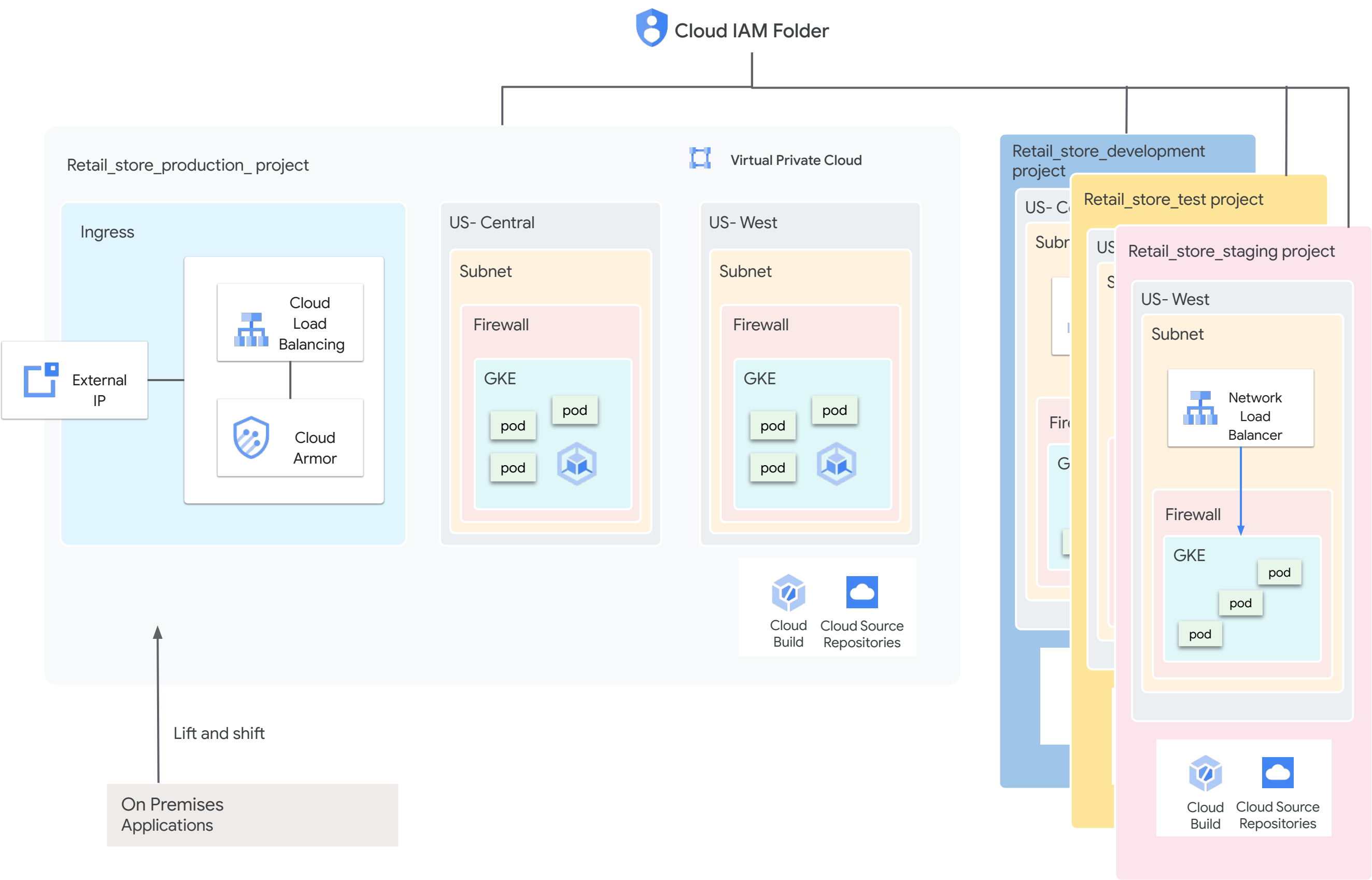
- Global HTTP(s) Load Balancer
- GKE
- Separate projects
- Migration type: lift and shift
- Replace GKE with Cloud Run for website (future)

* One row of a much larger spreadsheet

Decision flow diagram



Simplified project structure for Cymbal Retail



Planning your solution

Google Cloud

Why GoogleSolutionsProductsPricingGetting Started

🔍

DocsSupport

🌐 Language ▾

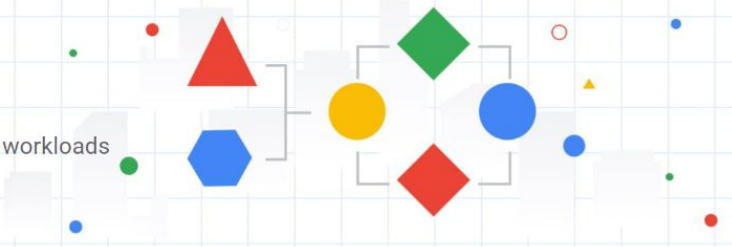
Sign in

Cloud Architecture Center

Contact UsGet started for free

Cloud Architecture Center

Discover reference architectures, diagrams, design patterns, guidance, and best practices for building or migrating your workloads on Google Cloud.



FILTER BY

Choose a topic

Select all

☐ Application development

☐ Big data and analytics

☐ Compute

☐ Containers

☐ Databases

☐ DevOps

☐ Health care and life sciences

☐ High performance computing (HPC)

Filter results

Internet of Things (IoT) ✕

Concept ✕

Reference architecture ✕

Building scalable applications with Firestore

This document describes when to use Firestore to build large applications. This document provides solutions for infrastructure administrators who...

Firestore

Remote monitoring and alerting for IoT

This article reviews how tools and practices used for monitoring cloud-native services apply to solutions that use IoT devices. The article is intended...

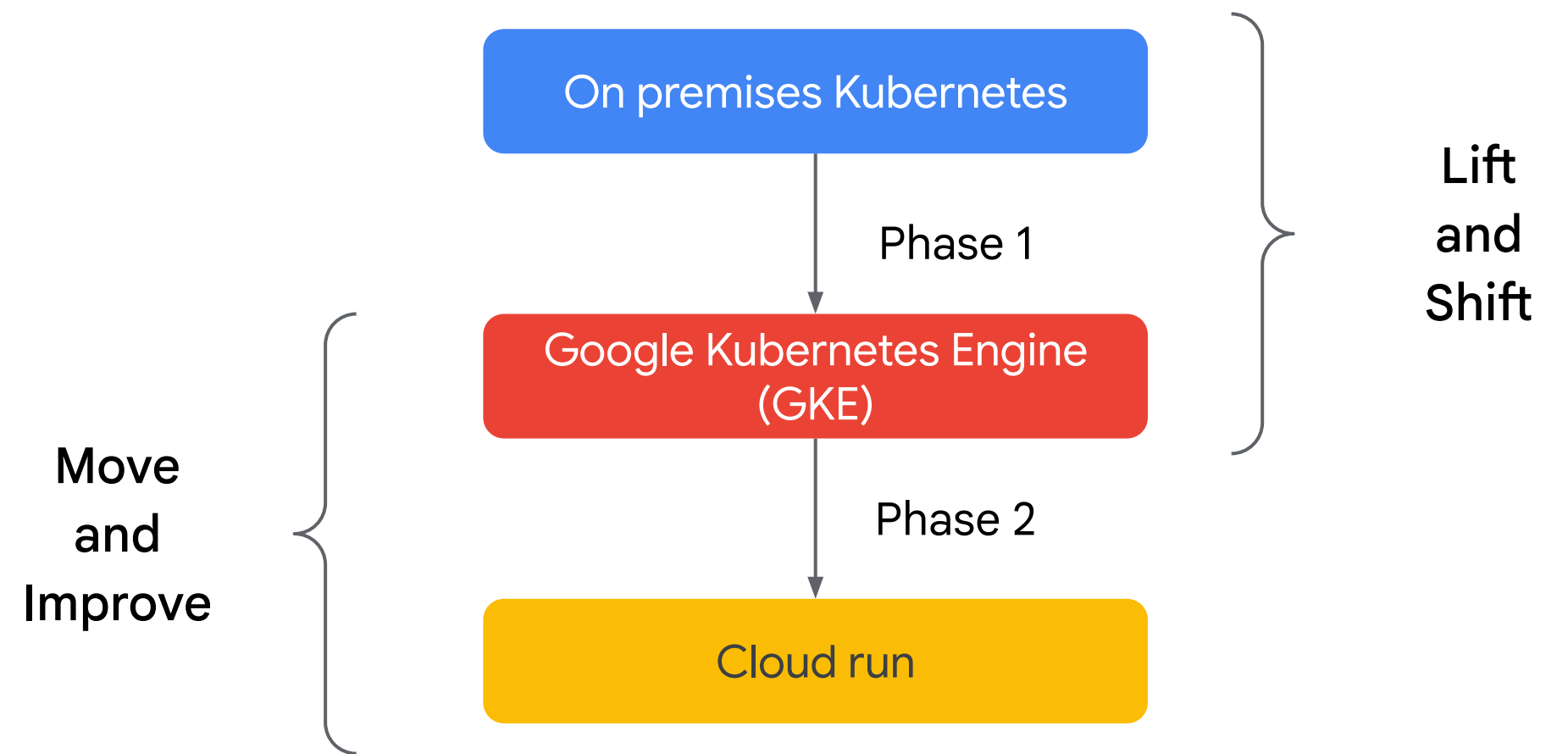
IoT CoreCloud Pub/Sub

Designing a Connected Vehicle Platform on Cloud IoT Core

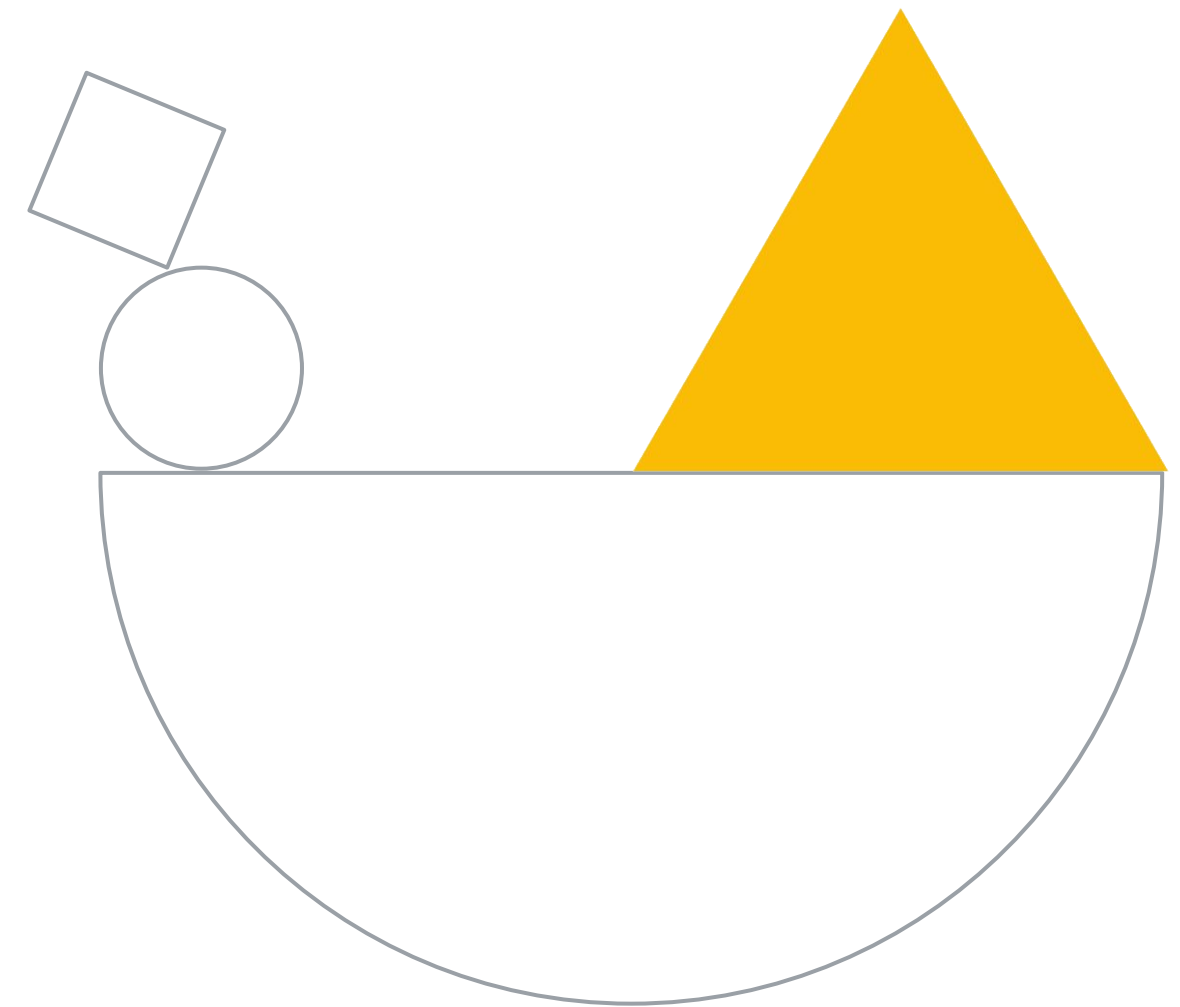
This solution examines managing connected vehicles with usage-based insurance using Cloud IoT Core on Google Cloud. Vehicles are transformin...

DataflowIoT CoreCloud Pub/Sub

Planning for migration and the future



Diagnostic questions

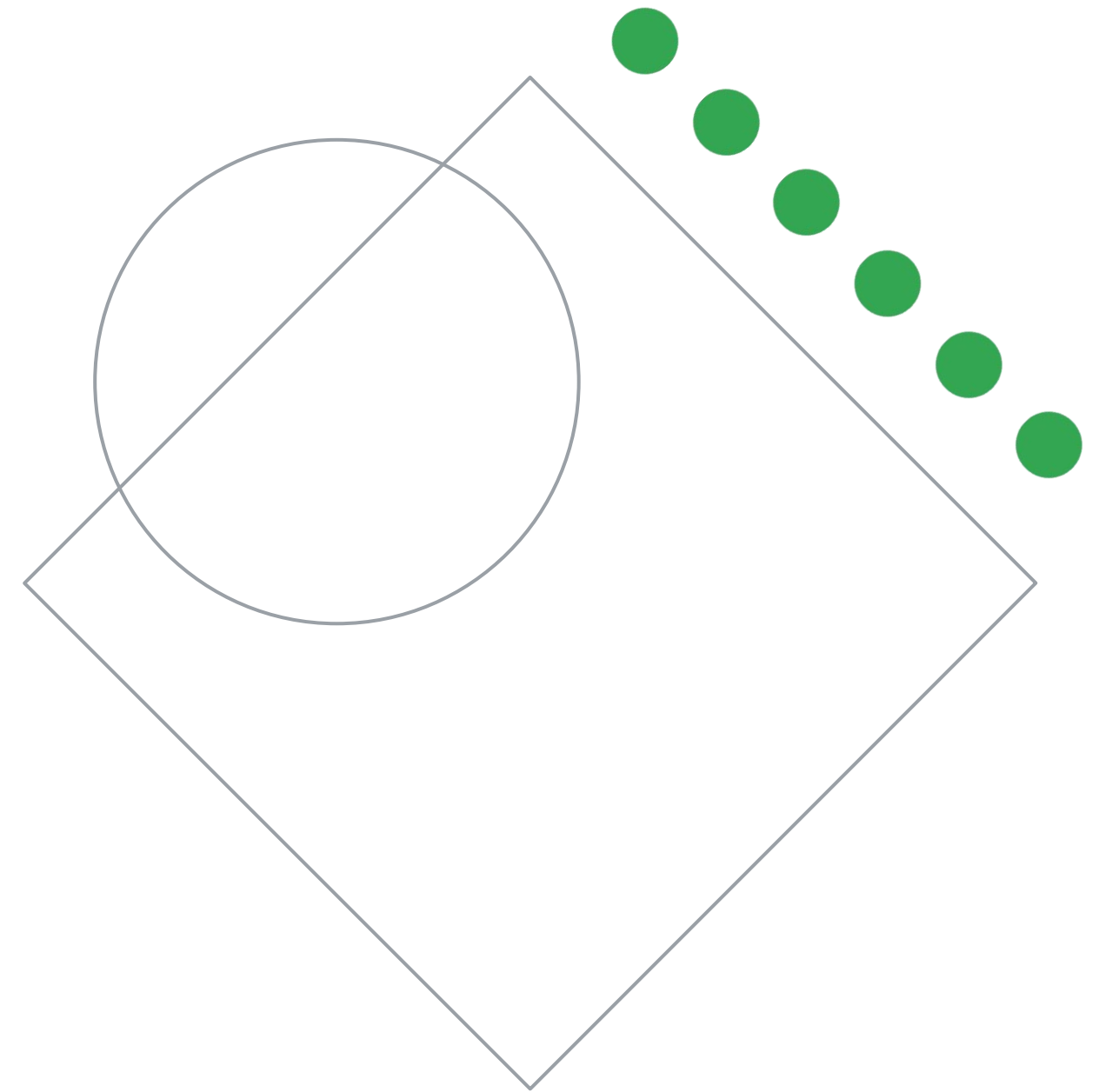


Please complete the diagnostic questions now

- Forms are provided for you to answer the diagnostic questions
- The instructor will provide you a link to the forms
- The diagnostic questions are also available in the workbook

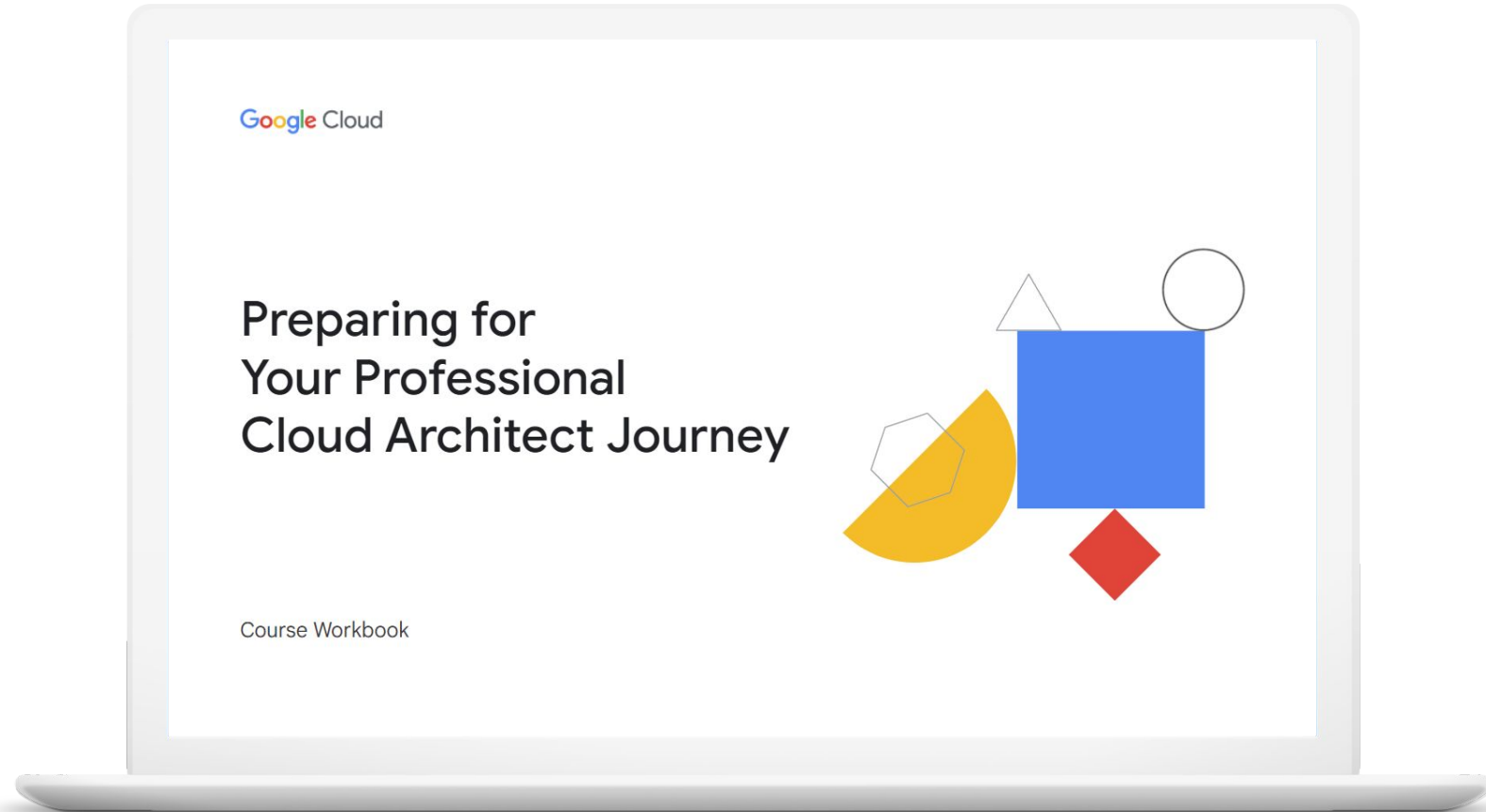


Review and study planning



Your study plan:

Designing and planning a cloud solution architecture



1.1

Designing a solution infrastructure that meets business requirements

1.2

Designing a solution infrastructure that meets technical requirements

1.3

Designing network, storage, and compute resources

1.4

Creating a migration plan

1.5

Envisioning future solution improvements

1.1 | Designing a solution infrastructure that meets business requirements

Considerations include:

- Business use cases and product strategy
- Cost optimization
- Supporting the application design
- Integration with external systems
- Movement of data
- Design decision trade-offs
- Build, buy, modify, or deprecate
- Success measurements (e.g., key performance indicators [KPI], return on investment [ROI], metrics)
- Compliance and observability

1.1 | Diagnostic Question 02 Discussion



Customers need to have a **good experience** when accessing your web application so they will continue to use your service. You want to **define key performance indicators (KPIs)** to establish a service level objective (SLO).

Which KPI could you use?

- A. Eighty-five percent of customers are **satisfied users**
- B. Eighty-five percent of **requests succeed when aggregated over 1 minute**
- C. **Low latency** for > 85% of requests when aggregated over 1 minute
- D. Eighty-five percent of **requests are successful**

1.1 | Diagnostic Question 02 Discussion



Customers need to have a **good experience** when accessing your web application so they will continue to use your service. You want to **define key performance indicators (KPIs)** to establish a service level objective (SLO).

Which KPI could you use?

- A. Eighty-five percent of customers are **satisfied users**
- B. Eighty-five percent of **requests succeed when aggregated over 1 minute**
- C. **Low latency** for > 85% of requests when aggregated over 1 minute
- D. Eighty-five percent of **requests are successful**

1.1

Designing a solution infrastructure that meets business requirements

Resources to start your journey

[Google Cloud Architecture Framework: System design](#)

[SRE Books](#)



1.2 | Designing a solution infrastructure that meets technical requirements

Considerations include:

- High availability and failover design
- Elasticity of cloud resources with respect to quotas and limits
- Scalability to meet growth requirements
- Performance and latency

1.2 | Diagnostic Question 03 Discussion



Cymbal Direct developers have written a new application. Based on initial usage estimates, you decide to run the application on **Compute Engine instances with 15 Gb of RAM and 4 CPUs**. These instances **store persistent data locally**. After the application runs for several months, historical data indicates that the **application requires 30 Gb of RAM**.

Cymbal Direct management wants you to make adjustments that will **minimize costs**.

What should you do?

- A. Stop the instance, and then use the command `gcloud compute instances set-machine-type VM_NAME --machine-type e2-standard-8`. Start the instance again.
- B. Stop the instance, and then use the command `gcloud compute instances set-machine-type VM_NAME --machine-type e2-standard-8`. Set the instance's metadata to: **preemptible: true**. Start the instance again.
- C. Stop the instance, and then use the command `gcloud compute instances set-machine-type VM_NAME --machine-type 2-custom-4-30720`. Start the instance again.
- D. Stop the instance, and then use the command `gcloud compute instances set-machine-type VM_NAME --machine-type 2-custom-4-30720`. Set the instance's metadata to: **preemptible: true**. Start the instance again.

1.2 | Diagnostic Question 03 Discussion



Cymbal Direct developers have written a new application. Based on initial usage estimates, you decide to run the application on **Compute Engine instances with 15 Gb of RAM and 4 CPUs**. These instances **store persistent data locally**. After the application runs for several months, historical data indicates that the **application requires 30 Gb of RAM**.

Cymbal Direct management wants you to make adjustments that will **minimize costs**.

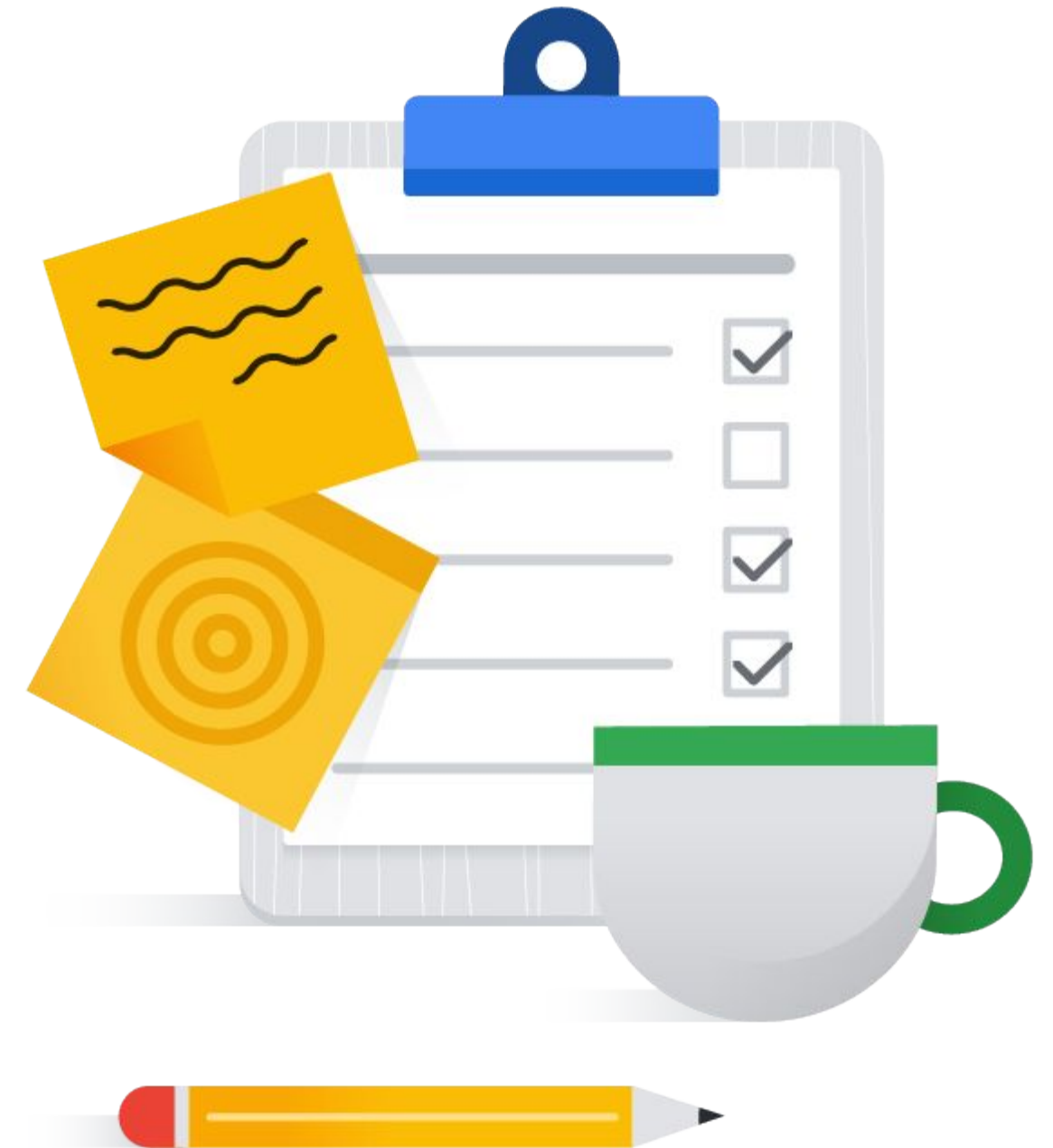
What should you do?

- A. Stop the instance, and then use the command `gcloud compute instances set-machine-type VM_NAME --machine-type e2-standard-8`. Start the instance again.
- B. Stop the instance, and then use the command `gcloud compute instances set-machine-type VM_NAME --machine-type e2-standard-8`. Set the instance's metadata to: **preemptible: true**. Start the instance again.
- C. Stop the instance, and then use the command `gcloud compute instances set-machine-type VM_NAME --machine-type 2-custom-4-30720`. Start the instance again.
- D. Stop the instance, and then use the command `gcloud compute instances set-machine-type VM_NAME --machine-type 2-custom-4-30720`. Set the instance's metadata to: **preemptible: true**. Start the instance again.

1.2 | Designing a solution infrastructure that meets technical requirements

Resources to start your journey

[Google Cloud Architecture Framework: System design](#)



1.3 | Designing network, storage, and compute resources

Considerations include:

- Integration with on-premises/multicloud environments
- Cloud-native networking (VPC, peering, firewalls, container networking)
- Choosing data processing technologies
- Choosing appropriate storage types (e.g., object, file, databases)
- Choosing compute resources (e.g., preemptible, custom machine type, specialized workload)
- Mapping compute needs to platform products

1.3 | Diagnostic Question 04 Discussion



You are creating a new project. You plan to set up a Dedicated interconnect between two of your data centers in the near future and want to ensure that your resources are only deployed to the **same regions** where your data centers are located. You need to make sure that you **don't have any overlapping IP addresses** that could cause conflicts when you set up the interconnect. You want to use **RFC 1918 class B address space**.

What should you do?

- A. Create a new project, **leave the default network in place**, and then use the default 10.x.x.x network range to create subnets in your desired regions.
- B. Create a new project, delete the default VPC network, **set up an auto mode VPC network**, and then use the default 10.x.x.x network range to create subnets in your desired regions.
- C. Create a new project, delete the default VPC network, **set up a custom mode VPC network**, and then use IP addresses in the **172.16.x.x address range** to create subnets in your desired regions.
- D. Create a new project, delete the default VPC network, **set up the network in custom mode**, and then use IP addresses in the **192.168.x.x address range** to create subnets in your desired zones. **Use VPC Network Peering** to connect the zones in the same region to create regional networks.

1.3 | Diagnostic Question 04 Discussion



You are creating a new project. You plan to set up a Dedicated interconnect between two of your data centers in the near future and want to ensure that your resources are only deployed to the **same regions** where your data centers are located. You need to make sure that you **don't have any overlapping IP addresses** that could cause conflicts when you set up the interconnect. You want to use **RFC 1918 class B address space**.

What should you do?

- A. Create a new project, **leave the default network in place**, and then use the default 10.x.x.x network range to create subnets in your desired regions.
- B. Create a new project, delete the default VPC network, **set up an auto mode VPC network**, and then use the default 10.x.x.x network range to create subnets in your desired regions.
- C. Create a new project, delete the default VPC network, **set up a custom mode VPC network**, and then use IP addresses in the **172.16.x.x address range** to create subnets in your desired regions.
- D. Create a new project, delete the default VPC network, **set up the network in custom mode**, and then use IP addresses in the **192.168.x.x address range** to create subnets in your desired zones. **Use VPC Network Peering** to connect the zones in the same region to create regional networks.

1.3 | Diagnostic Question 07 Discussion



Cymbal Direct is evaluating database options to store the **analytics data** from its experimental drone deliveries. You're currently using a small cluster of MongoDB NoSQL database servers. You want to move to a **managed NoSQL database service with consistent low latency that can scale throughput seamlessly and can handle the petabytes of data** you expect after expanding to additional markets.

What should you do?

- A. Extract the data from MongoDB. Insert the data into **Firestore** using Datastore mode.
- B. Create a **Bigtable** instance, extract the data from MongoDB, and insert the data into Bigtable.
- C. Extract the data from MongoDB. Insert the data into **Firestore** using Native mode.
- D. Extract the data from MongoDB, and insert the data into **BigQuery**.

1.3 | Diagnostic Question 07 Discussion



Cymbal Direct is evaluating database options to store the **analytics data** from its experimental drone deliveries. You're currently using a small cluster of MongoDB NoSQL database servers. You want to move to a **managed NoSQL database service with consistent low latency that can scale throughput seamlessly and can handle the petabytes of data** you expect after expanding to additional markets.

What should you do?

- A. Extract the data from MongoDB. Insert the data into **Firestore** using Datastore mode.
- B. Create a **Bigtable** instance, extract the data from MongoDB, and insert the data into Bigtable.
- C. Extract the data from MongoDB. Insert the data into **Firestore** using Native mode.
- D. Extract the data from MongoDB, and insert the data into **BigQuery**.

1.3

Designing network, storage, and compute resources

Resources to start your journey

[Choose and manage compute | Architecture Framework | Google Cloud](#)

[Design your network infrastructure | Architecture Framework | Google Cloud](#)

[Select and implement a storage strategy | Architecture Framework | Google Cloud](#)

[Google Cloud documentation](#)



1.4 | Creating a migration plan

Considerations include:

- Integrating solutions with existing systems
- Migrating systems and data to support the solution
- Software license mapping
- Network planning
- Testing and proofs of concept
- Dependency management planning

1.4 | Diagnostic Question 09 Discussion



You are working in a mixed environment of VMs and Kubernetes. **Some of your resources are on-premises, and some are in Google Cloud.** Using containers as a part of your CI/CD pipeline has sped up releases significantly. You want to start **migrating some of those VMs to containers** so you can get similar benefits. You want to **automate the migration process** where possible.

- A. **Manually create a GKE cluster**, and then use **Migrate to Containers (Migrate for Anthos)** to set up the cluster, import VMs, and convert them to containers.
- B. Use **Migrate to Containers (Migrate for Anthos)** to automate the creation of **Compute Engine instances** to import VMs and convert them to containers.
- C. **Manually create a GKE cluster.** Use **Cloud Build** to import VMs and convert them to containers.
- D. Use **Migrate for Compute Engine** to import VMs and convert them to containers.

What should you do?

1.4 | Diagnostic Question 09 Discussion



You are working in a mixed environment of VMs and Kubernetes. **Some of your resources are on-premises, and some are in Google Cloud.** Using containers as a part of your CI/CD pipeline has sped up releases significantly. You want to start **migrating some of those VMs to containers** so you can get similar benefits. You want to **automate the migration process** where possible.

What should you do?

- A. **Manually create a GKE cluster**, and then use **Migrate to Containers (Migrate for Anthos)** to set up the cluster, import VMs, and convert them to containers.
- B. Use **Migrate to Containers (Migrate for Anthos)** to automate the creation of **Compute Engine instances** to import VMs and convert them to containers.
- C. **Manually create a GKE cluster.** Use **Cloud Build** to import VMs and convert them to containers.
- D. Use **Migrate for Compute Engine** to import VMs and convert them to containers.

1.4 | Creating a migration plan

Resources to start your journey

[Migrate to Containers | Google Cloud](#)

[Migration to Google Cloud: Choosing your migration path](#)

[Migrating to the cloud: a guide and checklist](#)

[Cloud Migration Products & Services](#)

[Application Migration | Google Cloud](#)



1.5 | Envisioning future solution improvements

Considerations include:

- Cloud and technology improvements
- Evolution of business needs
- Evangelism and advocacy

1.5 | Diagnostic Question 10 Discussion



Cymbal Direct has created a proof of concept for a social integration service that highlights images of its products from social media. **The proof of concept is a monolithic application** running on a single SuSE Linux virtual machine (VM). **The current version requires increasing the VM's CPU and RAM in order to scale.** You would like to **refactor the VM so that you can scale out instead of scaling up.**

What should you do?

- A. **Move the existing codebase and VM provisioning scripts to git,** and attach external persistent volumes to the VMs.
- B. Make sure that the application declares any **dependent requirements** in a requirements.txt or equivalent statement so that they can be referenced in a startup script. Specify the startup script in a **managed instance group** template, and use an autoscaling policy.
- C. Make sure that the application declares any **dependent requirements** in a requirements.txt or equivalent statement so that they can be referenced in a startup script, and **attach external persistent volumes to the VMs.**
- D. **Use containers instead of VMs,** and use a **GKE autoscaling deployment.**

1.5 | Diagnostic Question 10 Discussion



Cymbal Direct has created a proof of concept for a social integration service that highlights images of its products from social media. **The proof of concept is a monolithic application** running on a single SuSE Linux virtual machine (VM). **The current version requires increasing the VM's CPU and RAM in order to scale.** You would like to **refactor the VM so that you can scale out instead of scaling up.**

What should you do?

- A. **Move the existing codebase and VM provisioning scripts to git,** and attach external persistent volumes to the VMs.
- B. Make sure that the application declares any **dependent requirements** in a requirements.txt or equivalent statement so that they can be referenced in a startup script. Specify the startup script in a **managed instance group** template, and use an autoscaling policy.
- C. Make sure that the application declares any **dependent requirements** in a requirements.txt or equivalent statement so that they can be referenced in a startup script, and **attach external persistent volumes to the VMs.**
- D. **Use containers instead of VMs,** and use a **GKE autoscaling deployment.**

1.5 | Envisioning future solution improvements

Resources to start your journey

[Twelve-factor app development on Google Cloud | Cloud Architecture Center](#)



Knowledge Check 1

What could Cymbal Direct use to estimate costs for their Google Cloud environment?

- A. Average Compute Instance CPU utilization
- B. Cloud Pricing Calculator
- C. KPIs
- D. ROI



Knowledge Check 1

What could Cymbal Direct use to estimate costs for their Google Cloud environment?

A. Average Compute Instance CPU utilization

B. Cloud Pricing Calculator

C. KPIs

D. ROI



Knowledge Check 2

If you have a business requirement to minimize costs, what are two things you could do?

- A. Follow Google's rightsizing recommendations
- B. Cap costs by creating a budget in Google Cloud
- C. Do not run instances when they are not being used
- D. Migrate to Kubernetes from VMs
- E. Use a managed service



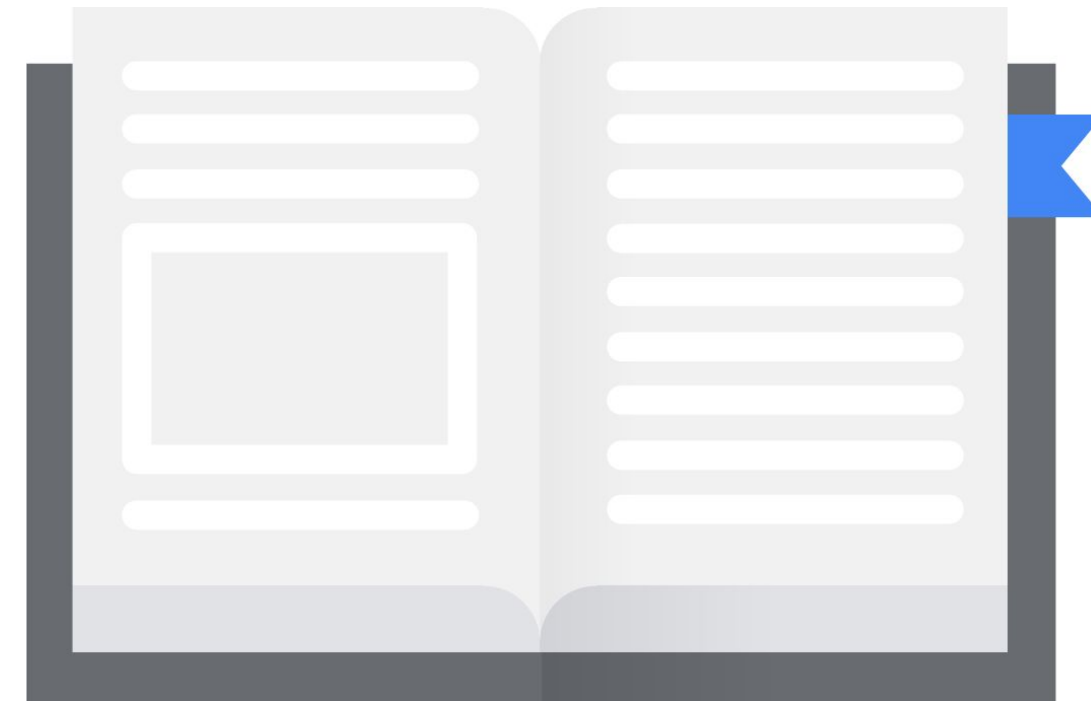
Knowledge Check 2

If you have a business requirement to minimize costs, what are two things you could do?

- A. Follow Google's rightsizing recommendations
- B. Cap costs by creating a budget in Google Cloud
- C. Do not run instances when they are not being used
- D. Migrate to Kubernetes from VMs
- E. Use a managed service



Appendix



1.1 | Diagnostic Question 01 Discussion



Cymbal Direct drones continuously send data during deliveries. You need to process and analyze the incoming telemetry data. **After processing, the data should be retained, but it will only be accessed once every month or two.** Your CIO has issued a directive to incorporate managed services wherever possible. You want a **cost-effective solution to process the incoming streams of data.**

What should you do?

- A. Ingest data with IoT Core, process it with **Dataprep**, and store it in a **Coldline Cloud Storage bucket**.
- B. Ingest data with IoT Core, and then publish to Pub/Sub. Use **Dataflow** to process the data, and store it in a **Nearline Cloud Storage bucket**.
- C. Ingest data with IoT Core, and then publish to Pub/Sub. Use **BigQuery** to process the data, and store it in a **Standard Cloud Storage bucket**.
- D. Ingest data with IoT Core, and then store it in **BigQuery**.

1.3 | Diagnostic Question 05 Discussion

Cymbal Direct is working with Cymbal Retail, a separate, autonomous division of Cymbal with different staff, networking teams, and data center. Cymbal Direct and Cymbal Retail are **not in the same Google Cloud organization**. Cymbal Retail needs access to Cymbal Direct's web application for making bulk orders, but the **application will not be available on the public internet**. You want to ensure that **Cymbal Retail has access to your application with low latency**. You also want to avoid **egress network charges** if possible.

- A. Verify that the subnet range Cymbal Retail is using **doesn't overlap** with Cymbal Direct's subnet range, and then **enable VPC Network Peering for the project**.
- B. If Cymbal Retail does not have access to a Google Cloud data center, **use Carrier Peering** to connect the two networks.
- C. Specify Cymbal Direct's project as the **Shared VPC** host project, and then configure Cymbal Retail's project as a service project.
- D. Verify that the subnet Cymbal Retail is using has the **same** IP address range with Cymbal Direct's subnet range, and then **enable VPC Network Peering for the project**.

What should you do?



1.3 | Diagnostic Question 06 Discussion



Cymbal Direct's employees will use **Google Workspace**. Your current on-premises network **cannot meet the requirements to connect** to Google's public infrastructure.

What should you do?

- A. Order a **Dedicated Interconnect** from a Google Cloud partner, and ensure that proper routes are configured.
- B. Connect the network to a Google point of presence, and enable **Direct Peering**.
- C. Order a **Partner Interconnect** from a Google Cloud partner, and ensure that proper routes are configured.
- D. Connect the on-premises network to Google's public infrastructure via a partner that supports **Carrier Peering**.

1.3 | Diagnostic Question 08 Discussion



You are working with a client who is using **Google Kubernetes Engine (GKE)** to migrate applications from a virtual machine-based environment to a microservices-based architecture. Your client has a **complex legacy application that stores a significant amount of data on the file system of its VM**. You do not want to re-write the application to use an external service to store the file system data.

What should you do?

- A. In Cloud Shell, create a YAML file defining your **Deployment** called deployment.yaml. Create a Deployment in GKE by running the command `kubectl apply -f deployment.yaml`
- B. In Cloud Shell, create a YAML file defining your **Container** called build.yaml. Create a Container in GKE by running the command `gcloud builds submit -config build.yaml`.
- C. In Cloud Shell, create a YAML file defining your **StatefulSet** called statefulset.yaml. Create a StatefulSet in GKE by running the command `kubectl apply -f statefulset.yaml`
- D. In Cloud Shell, create a YAML file defining your **Pod** called pod.yaml. Create a Pod in GKE by running the command `kubectl apply -f pod.yaml`