



# Professional Cloud Architect

Preparing for Professional Cloud Architect Journey for AWS Professionals

Plan:

- 2 min: intro
- 13 min: DR game
- 10 min: "Where should I run my stuff?"
- 7 min: FinOps
- ~15 min: [CASE STUDY] Terrramearth
- 10 min: Bonus content + Exam sign-up demo + remote/onsite exam comparison
- 5 min: Survey
- 3 min: Q&A

## Session 8 topics

Ensuring solution and operations excellence

FinOps

Bonus Content

1

2

3

4

5

"Where should I run my stuff?"

KnightMotives

Automotive Case Study

Google Cloud

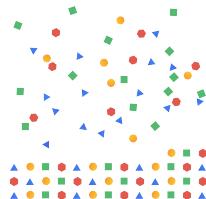
Ensuring solution and  
operations excellence

Google Cloud

# Solution reliability optimization

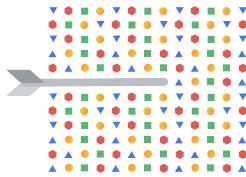
Make sure to go through

## Well-Architected Framework: Reliability pillar



### Chaos Engineering

- Creates a culture of reliability
- Crashes systems intentionally to build resiliency
- Service Mesh can help you here!



### Penetration testing

- Mimics the behavior of hackers to attack your own environment



– first go through

<https://cloud.google.com/architecture/framework/reliability>, explaining why each section is important.

– then, explain Chaos Engineering and Penetration testing:

Google encourages customers to think about introducing some Chaos Engineering practices. The name itself is pretty interesting, and it's mostly about doing something very intrusive, like shutting down some productive resources in one zone and validating if the application is still online when served by the other zone; or testing fault injections and timeouts between your microservices to see how other, connected microservices react to those. I would recommend that you have a look at how Service Mesh can help you with those use cases (see link) Secondly, Penetration Testing is another concept where you, or a company you hire - mimic the behaviour of hackers and try to do some harm to your environment. At the end, you get a summary indicating what your company is resilient against and when it failed the tests. The important thing here is that you don't need to inform or ask Google for any permissions when executing such tests]

- No need to inform GCP about penetration tests.
  - Chaos monitoring = we covered it to some extent when we spoke about Service Mesh last time. But it can be so much more than that: for example, shutting down some part of processing in a single zone and seeing if high availability kicks in and business functionality is still delivered. Or initiating a failover of Cloud SQL:

<https://cloud.google.com/sql/docs/mysql/configure-ha#test>

As a Professional Cloud Architect, your role involves developing procedures to ensure Cymbal Direct's cloud solutions are reliable in production.

While this course is not going to turn into a philosophy class, there is an aspect of philosophy as you consider building procedures to ensure the processes you have identified are reliable. The famous stoic, Marcus Aurelius, advocated taking time to embrace your fears, and not just metaphorically. If you were afraid of being poor, Marcus Aurelius said you should become poor by locking away your worldly possessions and living without money for a few days. His belief was that you would rise to this challenge.

Taking this philosophical approach into the present, if you are afraid your systems will crash, Marcus Aurelius would probably advocate for intentionally crashing them. Today this approach is called chaos engineering and there are applications, such as Chaos Monkey, which will intentionally crash systems by randomly turning them off.

As a Professional Cloud Architect at Cymbal Direct, you consider two types of procedures: chaos engineering and penetration testing. You consider how chaos engineering approaches can help you continuously improve the social media application and to lead to a more robust system design.

You also want to ensure the security of IoT data streaming from Cymbal Direct's Delivery by Drone. You follow Google-recommended practices and draft penetration testing procedures to mimic the behavior of someone trying to hack your system. You want to conduct penetration testing regularly and whenever there are changes to the system, such as when the delivery by drone application is upgraded, when security patches are applied, or when policies addressing customer use are modified.

You believe developing both of these procedures will have immense value for Cymbal Direct and its customers and will make your systems more secure and resilient.

## Diagnostic Question Discussion

You are developing your microservices application on Google Kubernetes Engine. During testing, you want to validate the behavior of your application in case a specific microservice should suddenly crash.

What should you do?

- A. Add a taint to one of the nodes of the Kubernetes cluster. For the specific microservice, configure a pod anti-affinity label that has the name of the tainted node as a value.
- B. Use Istio's fault injection on the particular microservice whose faulty behavior you want to simulate.
- C. Destroy one of the nodes of the Kubernetes cluster to observe the behavior.
- D. Configure Istio's traffic management features to steer the traffic away from a crashing microservice.

Google Cloud

B

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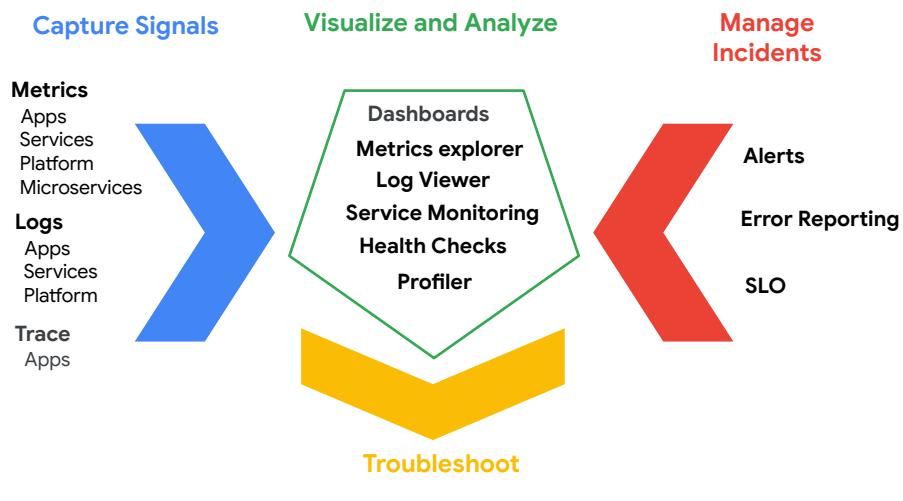
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<https://istiobyexample.dev/fault-injection/>

Google Cloud

B

# Observability in GCP: The big picture



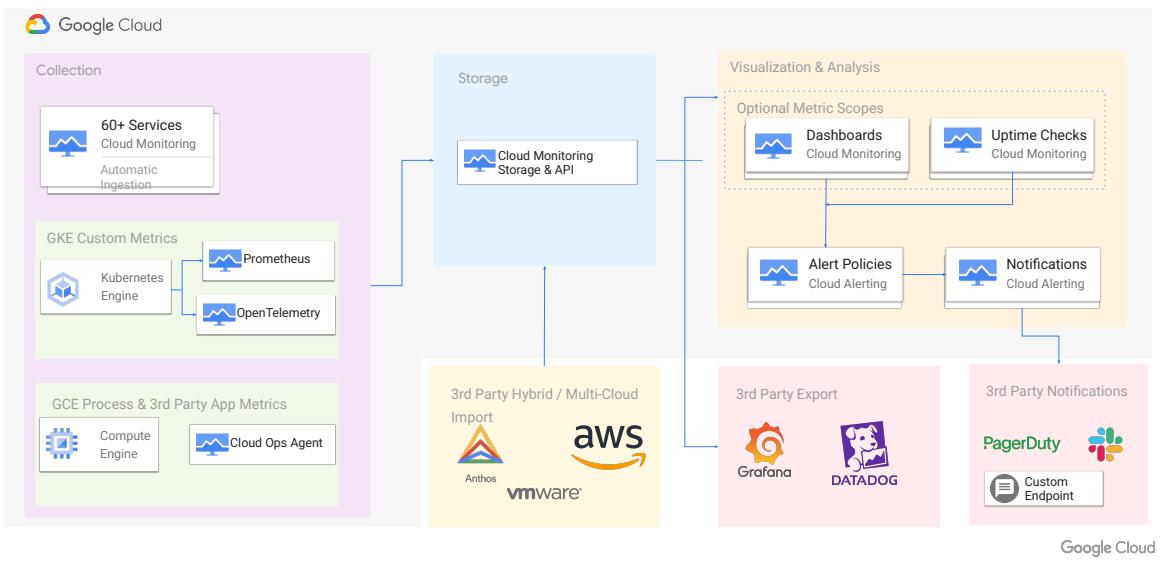
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Observability involves three stages: 1. Capture Signals (Metrics, Logs, Trace from applications and infrastructure); 2. Visualize and Analyze (using Dashboards, Metrics explorer, Log Viewer, Service Monitoring, Health Checks, and Profiler); and 3. Manage Incidents (using Alerts, Error Reporting, and SLOs).

And how do these components play together?

- a. it all starts with capturing signals: telemetry, logging, tracing data, all capture from a hardware level and up
- b. Once captured, those signals are ingested into Cloud Operations Suite where they can be visualized in Dashboards and/or the metrics explorer; automated and custom logs can be analyzed using the Logs Viewer; services can be monitored for compliance with SLOs; you can run health checks to check latency and uptime for external facing services and you can also debug and profile running applications, all this using Cloud Operations tools
- c. If any incident happens, there are various ways to intervene: we can have automated alerts to inform personnel; Error reporting can help dev and ops teams to spot and analyze crashes, and you can use the visualization and analysis tools to troubleshoot what is happening in your cloud environment

# Cloud monitoring architecture and integration



– explain.

– talk about difference between “3rd party import”, where it’s mostly about using GCP Monitoring for applications deployed on GCP and outside of GCP (eg. on-premises) vs “3rd Party Export”:

- “import”: go to “Monitoring Integrations”, choose Elasticsearch and navigate to the configuration documentation
- “export”: google for “gcp monitoring datadog export guide” -> show documentation for exporting telemetry from GCP to Datadog

Cloud Ops agent on AWS?

Alerts and notifications

To be notified when the value of a performance metric meets criteria that you define, create an alerting policy. The alerting policy includes the list of people or groups who are to receive notifications. Monitoring supports common notification channels, including email, Cloud Mobile App, and services such as PagerDuty or Slack.

Proactive monitoring and validation

To test the availability, consistency, and performance of your services, applications, web pages, and APIs, create synthetic monitors. For example, you can probe HTTP,

HTTPS, and TCP endpoints for responsiveness with uptime checks, and then get notified when an endpoint fails to respond. You can also create a broken-link checker to crawl a web page and then notify you when broken links are detected.

#### Custom and Prometheus metrics

Your application can report a custom metric to Monitoring. You can configure Kubernetes to respond to these metrics and scale your workload automatically. For example, you can scale your application based on metrics such as queries per second, writes per second, network performance, latency when communicating with a different application, or other metrics that make sense for your workload. For more information, see [Optimize Pod autoscaling based on metrics](#).

#### External metrics

If you need to scale your workload based on the performance of an application or service outside of Kubernetes, you can configure an external metric. For example, you might need to increase the capacity of your application to ingest messages from Pub/Sub if the number of undelivered messages is trending upward. The external application needs to export the metric to a Monitoring instance that the cluster can access. The trend of each metric over time causes Horizontal Pod Autoscaler to change the number of replicas in the workload automatically. For more information, see [Optimize Pod autoscaling based on metrics](#).

With BindPlane from Google's partner observIQ, you can import monitoring and logging data from both on-premises VMs and other cloud providers, such as Amazon Web Services (AWS), Microsoft Azure, Alibaba Cloud, and IBM Cloud into Google Cloud.

## Business Continuity = Planning for failure

A well-designed system can answer the question: "What happens when a **zone or region** has a 1, 5, 10, or 30 minute outage?" This should be considered at many layers, including:

- What will my customers experience during an outage?
- How will I detect that an outage is happening?
- What happens to my application during an outage?
- What happens to my data during an outage?
- What happens to my other applications due to an outage (due to cross-dependencies)?
- What do I need to do in order to recover after an outage is resolved? Who does it?
- Who do I need to notify about an outage, within what time period?

Resource	Examples	Availability design goal	Implied downtime
Zonal	Compute Engine, Persistent Disk	99.9%	8.75 hours / year
Regional	Regional Cloud Storage, Replicated Persistent Disk, Regional Google Kubernetes Engine	99.99%	52 minutes / year

## High Availability for...

- Compute Engine ⇒ ?
- GKE ⇒ ?
- Cloud Run ⇒ ?
- Cloud SQL ⇒ ?
- Cloud Spanner ⇒ ?
- Cloud Storage => ?

Google Cloud

HA: Usually up to and including a zonal outage

## High Availability for...

- Compute Engine ⇒ regional MIGs, Load Balancers
- GKE ⇒ ?
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- Cloud Storage => ?

Google Cloud

Not only about multi-zone setup, but also autoscaling and autohealing!

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Google Cloud

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Google Cloud

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Google Cloud

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Google Cloud

## High Availability for...

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- GKE ⇒ Regional clusters, Load Balancers
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- Cloud Spanner ⇒ Multi-instance deployment with automatic failover
- Cloud Storage => regional / dual/ multi-region bucket, optional replication

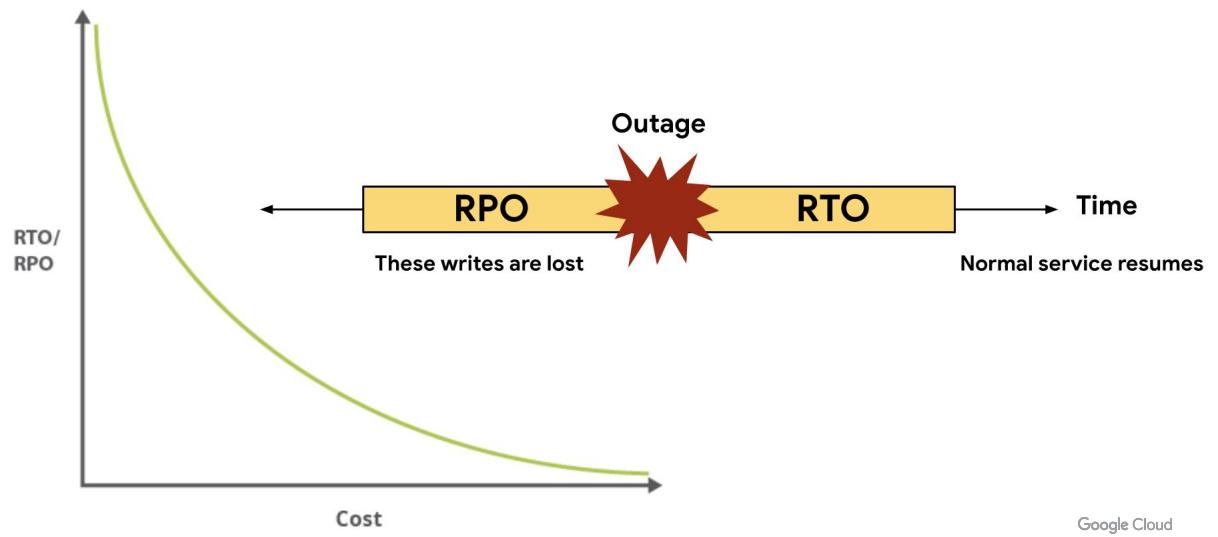
[Product Reference for Business Continuity](#)

**TIP**

The more managed a service is, the easier it is to ensure at least 99,99% SLA

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## Disaster Recovery architecture is driven by RPO and RTO



Google Cloud

## Disaster Recovery architecture is driven by RPO and RTO



Application criticality	% of Apps	Example apps	Zone outage	Region outage
Tier 1 (most important)	5%	Typically global or external customer-facing applications such as real-time payments and eCommerce storefronts.	RTO Zero RPO Zero	RTO Zero RPO Zero
Tier 2	35%	Typically regional applications or important internal applications such as CRM or ERP.	RTO 15mins RPO 15mins	RTO 1hr RPO 1hr
Tier 3 (least important)	60%	Typically team or departmental applications, such as back office, leave booking, internal travel, accounting, and HR.	RTO 1hr RPO 1hr	RTO 12hrs RPO 12hrs

Disaster = natural / man-made disaster which is less frequent and more wide scale than failure of single components or even a zone.

How you deal with a flat tire depends on how prepared you are:

- Cold: You have no spare tire, so you must call someone to come to you with a new tire and replace it. Your trip stops until help arrives to make the repair.
- Warm: You have a spare tire and a replacement kit, so you can get back on the road using what you have in your car. However, you must stop your journey to repair the problem.
- Hot: You have run-flat tires. You might need to slow down a little, but there is no immediate impact on your journey. Your tires run well enough that you can continue (although you must eventually address the issue).

## EXAMPLE: Disaster Recovery for Cloud SQL instance...

- **Cold:**
- **Warm:**
- **Hot:**

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## EXAMPLE: Disaster Recovery for Cloud SQL instance...

- **Cold:** backups offloaded to another region
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- **Cold**: backups offloaded to another region
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- **Hot**:

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## EXAMPLE: Disaster Recovery for Cloud SQL instance...

- **Cold**: backups offloaded to another region
- **Warm**: read-only replicas in a different region with asynchronous replication
- **Hot**: ... none available out of the box. Alternatives:
  - Migrate to Cloud Spanner ?
  - MySQL on 2 GCE VMs (NOT Cloud SQL) with DRBD, load balancer in front and automatic failover. Details [here](#).
  - Other Do-It-Yourself options

Google Cloud

# Diagnostic Question Discussion

You are designing a multi-region disaster recovery solution for a critical web application deployed on Google Cloud. The application requires high availability and minimal downtime in the event of a regional outage. You need to ensure that the application remains accessible to users in a different region if one region

What should you do?

- A. Deploy the application to a single region using Compute Engine virtual machine (VM) instances and configure cross-region backups to a different region.
- B. Deploy the application to a single region using Cloud Functions and configure a Cloud Storage bucket in a different region for static content.
- C. Deploy the application to multiple regions using Google Kubernetes Engine (GKE) with regional clusters and configure a global load balancer to distribute traffic across the regions.
- D. Deploy the application to multiple zones within a single region using Compute Engine VM instances and configure a regional load balancer to distribute traffic across the zones.

Google Cloud

\* **Option C is CORRECT** because deploying the application to multiple regions using GKE with regional clusters and a global load balancer provides high availability and failover capabilities. If one region experiences an outage, the global load balancer will direct traffic to the healthy region, ensuring application accessibility.

\* **Option A is INCORRECT** because while cross-region backups are essential for disaster recovery, they do not provide automatic failover for a live application. Restoring from backups would introduce significant downtime.

\* **Option B is INCORRECT** because Cloud Functions are suitable for event-driven applications, not for hosting an entire web application that requires high availability.

\* **Option D is INCORRECT** because deploying to multiple zones within a single region does not provide disaster recovery in the event of a regional outage. All zones within a region share the same underlying infrastructure.

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Google Cloud

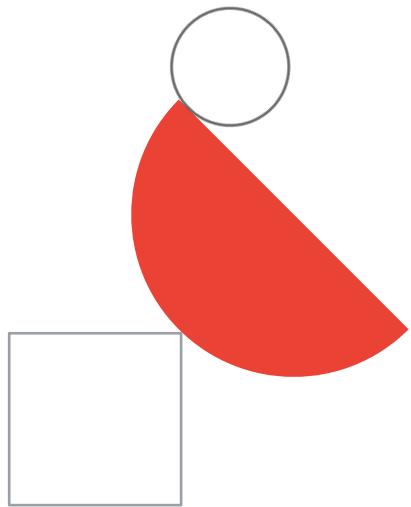
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“Where should I run my  
stuff?” game



Google Cloud

## Where should I run my stuff?

- Containers =>

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- Containers => GKE, Cloud Run

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- Containers => GKE, Cloud Run
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- Event-based processing =>

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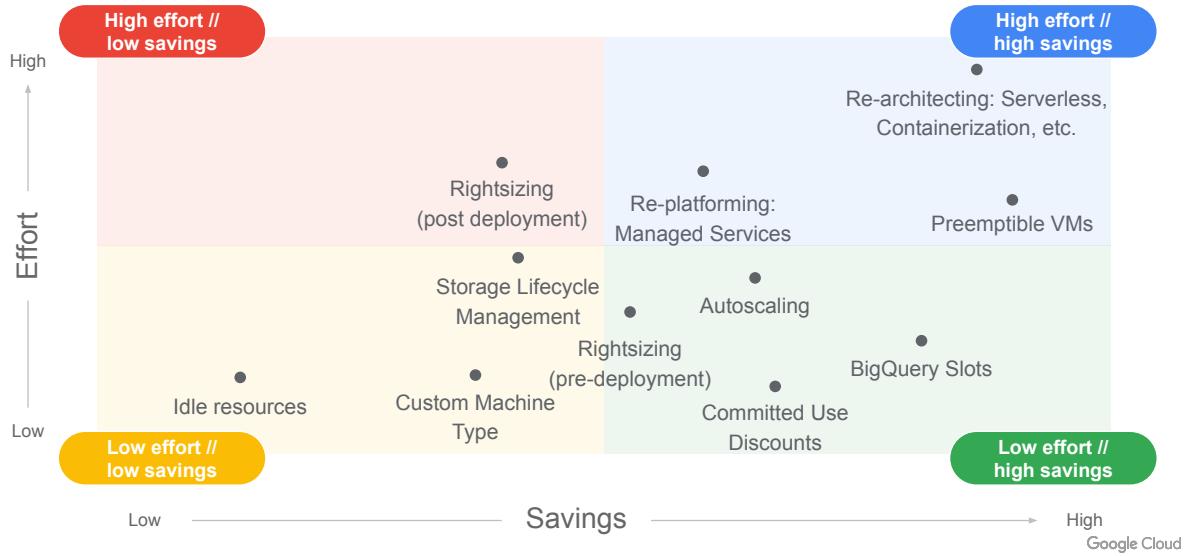
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- Billing based on resources => GCE, GKE

# FinOps

# Cost Optimization Matrix



[Another area you might contribute to is so-called FinOps, where you might give some insights into optimizing cloud spend. As you can see, there are different ways to do it, and it's more a continuous, iterative process than a one-step task you would perform]

## Diagnostic Question Discussion

You are analyzing and defining business processes to support your startup's trial usage of GCP, and you don't yet know what consumer demand for your product will be. Your manager requires you to minimize GCP service costs and adhere to Google best practices.

What should you do?

- A. Utilize free tier and sustained use discounts. Provision a staff position for service cost management.
- B. Utilize free tier and sustained use discounts. Provide training to the team about service cost management.
- C. Utilize free tier and committed use discounts. Provision a staff position for service cost management.
- D. Utilize free tier and committed use discounts. Provide training to the team about service cost management.

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B. Easy?

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Google Cloud

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# KnightMotives

## Automotive

### case study



[https://services.google.com/fh/files/misc/v6.1\\_pca\\_knightmotives\\_automotive\\_case\\_study\\_english.pdf](https://services.google.com/fh/files/misc/v6.1_pca_knightmotives_automotive_case_study_english.pdf)

This case study outlines the challenges and modernization strategy for KnightMotives, a car manufacturer specializing in autonomous, self-driving vehicles, including Battery Electric Vehicles (BEVs), hybrids, and traditional internal combustion engine (ICE) vehicles.

The overall objective of KnightMotives is to shift from manufacturing cars to creating a complete and compelling "automotive experience"

## Proposed Technical Solutions



- Hybrid cloud strategy -> GKE + [Anthos](#) / [Cloud Service Mesh](#)
- ERP: migrate to GCP (using GCE), or modernize by choosing 3rd party, cloud-based solution
- Network:
  - [NCC](#) for connectivity between plants and headquarters.
  - [IoT platform](#) for vehicle connectivity + [Google AI Edge](#) & small models (Gemma? Nano?) deployed directly to vehicles
- In-vehicle experience:
  - release [Android Automotive OS](#) for a consistent experience across the board.
  - Build IoT pipeline (Pub/Sub -> Dataflow -> BigQuery) with a custom AI model (complete lifecycle via Vertex AI) for predictive maintenance, personalized driver settings, and advanced driver-assistance systems
- Delightful experience for dealers and customers:
  - Rebuild the online ordering system as a cloud-native application on Google Kubernetes Engine (GKE) / Cloud Run for scalability and reliability. Use Firestore or Cloud SQL as the backend database.
  - Develop web-based apps for inventory management, sales analytics dashboards (using Looker), and a streamlined service process.
  - Improve customer experience with Vertex AI Conversation chatbots for customer support
- Focus on security and risk management: variety of options depending on the system (compute / storage / AI / ...) like [SCC](#), [Model Armor](#), [VPC-SC SDP](#) and more.
- Data monetization and insights:
  - Break down data silos by consolidating all corporate data into BigQuery.
  - Expose APIs via [Apigee for monetization](#)

Google Cloud

## [KnightMotives Automotive] Diagnostic Question #1



KnightMotives wants to create a consistent in-vehicle user experience across all its models, including BEV, hybrid, and ICE vehicles. The platform needs to support AI-powered features and be easily updatable.

- A. A custom Linux-based OS
- B. Android Automotive OS
- C. A proprietary real-time operating system (RTOS)
- D. A web-based application running on an in-vehicle browser

Which technology should they adopt as the foundation for their new in-vehicle system?

Google Cloud

**Answer:** B. Android Automotive OS

**Explanation:** Android Automotive OS is a full-stack, open-source platform that powers the in-vehicle infotainment (IVI) system. It provides a familiar, consistent UX that can be customized by KnightMotives. It has a robust ecosystem, supports modern applications, and can be updated over-the-air, meeting all the stated requirements. Building a custom OS (A, C) would be expensive and time-consuming. A web-based app (D) would lack the deep integration needed for a compelling in-vehicle experience.

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## [KnightMotives Automotive] Diagnostic Question #2



KnightMotives has experienced past data breaches and must adhere to strict EU data protection regulations. They need a centralized tool to manage security policies and detect potential vulnerabilities across their GCP environment.

- A. Cloud Armor
- B. Cloud Identity and Access Management (IAM)
- C. Security Command Center
- D. Cloud Key Management Service (KMS)

Which GCP service should they use?

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**Answer:** C. Security Command Center

**Explanation:** Security Command Center provides a centralized security and risk management platform for Google Cloud. It helps discover assets, detect threats and vulnerabilities, and maintain compliance. While Cloud Armor (A) protects against web attacks, IAM (B) manages permissions, and KMS (D) manages encryption keys, Security Command Center is the comprehensive tool for overall security posture management.

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## [KnightMotives Automotive] Diagnostic Question #3



KnightMotives plans to develop a chatbot to improve the customer service experience. This chatbot should be able to handle natural language queries related to sales, service, and vehicle features.

Which GCP service should be used to build this solution?

- A. Conversational AI
- B. Cloud Natural Language API
- C. Cloud Translation API
- D. AutoML Tables

Google Cloud

**Answer:** A. Conversational AI

**Explanation:** <https://cloud.google.com/conversational-ai?hl=en> is a development suite for creating conversational interfaces like chatbots and voice bots. It provides the tools to design, build, and deploy a sophisticated chatbot that can understand natural language and integrate with backend systems, perfectly matching the requirement.

## [KnightMotives Automotive] Diagnostic Question #3



KnightMotives plans to develop a chatbot to improve the customer service experience. This chatbot should be able to handle natural language queries related to sales, service, and vehicle features.

Which GCP service should be used to build this solution?

A. Conversational AI

B. Cloud Natural Language API

C. Cloud Translation API

D. AutoML Tables

Google Cloud

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## [KnightMotives Automotive] Diagnostic Question #4



KnightMotives's dealers have no budget for new equipment , but they need modern tools to be successful. The solution for new dealer tools must be accessible without requiring any local hardware installation or upgrades.

How should KnightMotives deploy these new tools?

- A. As a desktop application that dealers must install.
- B. As a mobile app for iOS and Android.
- C. As a web application hosted on Cloud Run.
- D. As a thick client application running on-premises at the dealerships.

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Answer: C. As a web application hosted on Cloud Run.

Explanation: web-based application that can be accessed through a browser on any device (desktop, tablet, phone) without installation. Hosting it on GCP (e.g., using Cloud Run or App Engine) ensures it is always up-to-date and requires no new hardware from the dealers, directly addressing the "no budget for new equipment" constraint. While a mobile app (B) is also a good option, a PWA offers broader accessibility across all devices.

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## BONUS CONTENT

Google Cloud

# Bonus quiz

[Pre-exam quiz 1](#)

[Pre-exam quiz 2](#)

~30 exam-like questions which should help you evaluate your exam-readiness.

Google Cloud

# How to register for the exam?

The screenshot shows a web browser window with the URL [cp.certmetrics.com/google/en/schedule/sso/kryterion](https://cp.certmetrics.com/google/en/schedule/sso/kryterion). The page has a blue header bar with the text "Access Webassessor" and the user's name "MACIEJ ZACHARIAZ" and ID "GGLE00240666". On the left, there is a sidebar with a "Google" logo and several menu items: HOME, PROFILE, ACCESS WEBASSESSOR, Schedule an Exam (which is highlighted in green), EXAM HISTORY, CERTIFICATION TRANSCRIPT, BENEFITS, and DIGITAL CREDENTIALS. The main content area contains a heading "Access Webassessor for the following:" followed by a bulleted list: "Schedule an Exam", "Launch an Exam", "Reschedule or Cancel a Scheduled Exam", and "View Receipts". Below this is a link "[RETURN TO DASHBOARD](#)". A note at the bottom states: "[If you receive an error message when trying to SSO, please check that your profile information is complete: State and Zip are required and your phone number must not contain any special characters. (Ex. "+") We are working to resolve this issue and apologize for the inconvenience.]". At the bottom right of the content area is a "ACCESS WEBASSESSOR" button.

Start by [creating an account on Certmetrics](#) - new Google Cloud Certification platform

Google Cloud

# Taking the test: options comparison

## Online

### Pros

- Take it from home. No need to plan commute.
- Flexible Hours
- Can be rescheduled if needed

### Cons

- Can be overwhelming during inspection
- Need extra 15 mins if you are taking a GCP test for the first time.
- Windows / MacOS / Chromebooks supported.  
**Linux and virtual machines NOT supported!**
- Personal computer strongly recommended

## In-Person

### Pros

- No hassle. Just walk in and start your test
- Can be rescheduled if needed
- Distractions free

### Cons

- Slots fill up fast. Sign up as quickly as possible
- Plan a commute.

Click [here](#) for online testing requirements.



Make sure to...

Enjoy the journey as much  
as the destination!



Google Cloud

Now that you know about the overall setup of this course and how to use the workbook, let's get started by exploring section 1 of the exam guide.