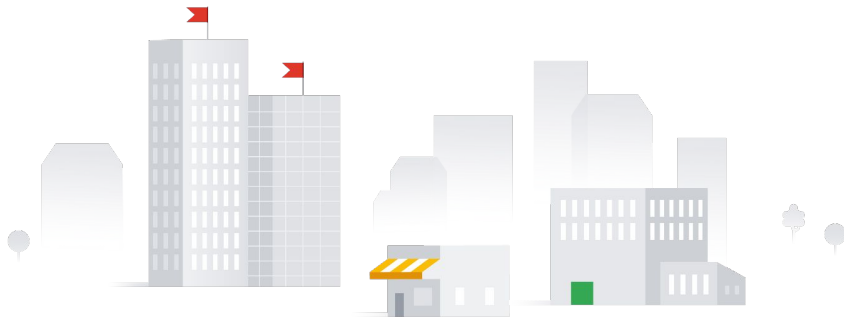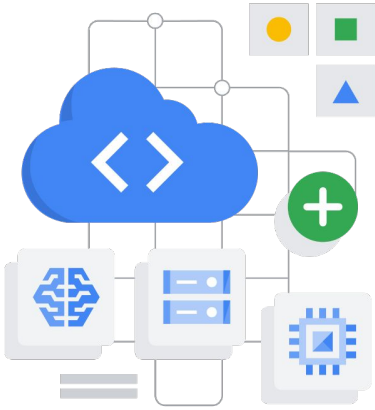# 09

Course Summary

Google Cloud

And this brings us close to the end of this course. Thank you for your time and attention today!

Before you go, let's take a few minutes to review what's been covered.

Module 01

01	Google Cloud and cloud computing
02	Managed infrastructure and services with IaaS and PaaS
03	The Google Cloud network
04	Environmental impact
05	Security throughout the infrastructure
06	Google Cloud's pricing structure and billing tools

Module 1 recap

In module 1, Google Cloud and cloud computing was introduced.

You saw how as cloud computing has evolved, the momentum has shifted toward managed infrastructure and managed services. **IaaS, or Infrastructure as a Service,** and **PaaS, or Platform as a service,** offerings allow companies to concentrate more on their business goals and spend less time and money creating and maintaining their technical infrastructure.

You learned about the effectiveness of the **Google Cloud network**, including how being organized across a number of regions and zones can improve latency, availability, and durability for end users. You also saw how Google Cloud is reducing its **environmental impact** by achieving 100% renewable energy, and aiming to operate entirely carbon free by 2030.

You saw how, with our layered approach, design for **security** is prevalent throughout the infrastructure that Google Cloud and Google services run on, from the hardware infrastructure layer, right up to the operational security layer.

You also saw how Google publishes key elements of technology using **open source** licenses to create ecosystems that provide customers with options other than Google. Google believes that by providing choice and flexibility to customers gives them agility to move faster and drive transformation.

Finally in module 1, you explored Google Cloud's **pricing** structure and **billing** tools. This included a look at per-second billing on Compute Engine, sustained-use discounts for organizations that run a virtual machine instance for a significant portion of the billing month, and tools to ensure that you don't accidentally run up a big Google Cloud bill.

Module 02
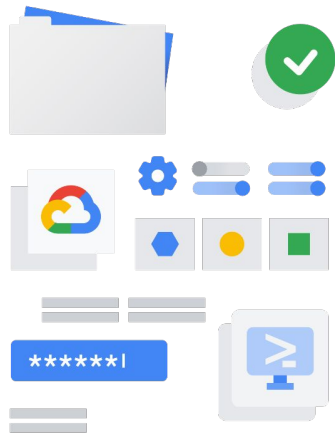
01 Google Cloud Resource Hierarchy:
- Resources
- Projects
- Folders
- Organization node

02 Policies

03 Identity and Access Management (IAM)

04 Roles: basic, predefined, and custom

05 Ways to access and interact with Google Cloud:
- Google Cloud console
- Cloud SDK and Cloud Shell
- APIs
- Cloud Mobile App

Module 2 recap

Module 2 began with the Google Cloud Resource Hierarchy. This hierarchy is made up of four levels: **resources**, **projects**, **folders**, and an **organization node**.

1. At the first level are resources. These represent virtual machines, Cloud Storage buckets, tables in BigQuery, or anything else in Google Cloud.
2. Resources get organized into projects, which sit on the second level.
3. Projects can be organized into folders, or even subfolders. These sit at the third level and each Google Cloud project has three identifying attributes: a project ID, a project name, and a project number.
4. And then at the top level is an organization node, which encompasses all the projects, folders, and resources in your organization.

Policies can be defined at the project, folder, and organization node levels and are also inherited downward.

You saw that when an organization node contains lots of folders, projects, and resources, administrators can use **Identity and Access Management**, or IAM. With IAM, administrators can apply policies that define who can do what on which resources.

This is achieved through user **roles**. There are three kinds of roles in IAM: **basic**, **predefined**, and **custom**.

In this module, you also explore the four ways to access and interact with Google Cloud. Options include through the **Google Cloud console**, the **Cloud SDK** and **Cloud Shell**, **APIs**, and the **Cloud Mobile App**.

Module 03
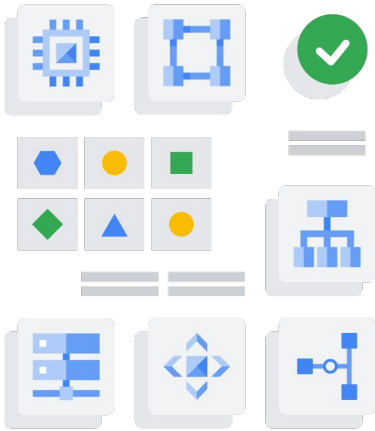
01	Google Compute Engine
02	Virtual private cloud (VPC)
03	Virtual machines
04	Compute Engine's Autoscaling feature
05	Google Virtual Private Cloud compatibility features: routing tables, firewalls, VPC peering, shared VPC
06	Cloud Load Balancing
07	VPN, peering, dedicated interconnect, partner interconnect

Module 3 recap

In module 3, you explored how Google Compute Engine works, with a focus on virtual networking.

You were introduced to the VPC, or **virtual private cloud**. From there, you learned that with **Compute Engine**, users can create and run **virtual machines** (VMs) on Google infrastructure. There are no upfront investments, and thousands of virtual CPUs can run on a system that is designed to be fast and offer consistent performance.

You saw how VMs can be added to or subtracted from an application based on load metrics through Compute Engine's **Autoscaling** feature.

You explored some of the most important Google Virtual Private Cloud compatibility features, like **routing tables**, **firewalls**, **VPC peering** and **shared VPC**, all of which result in the need for less network management.

You learned about **Cloud Load Balancing**, a fully distributed, software-defined, managed service for all your traffic.

Finally, you compared the ways that on-premises or other-cloud networks can be **interconnected** with a Google VPC, like through a VPN, peering, a dedicated interconnect, or a partner interconnect.
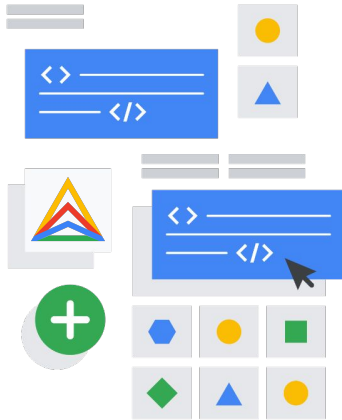
Module 4 recap
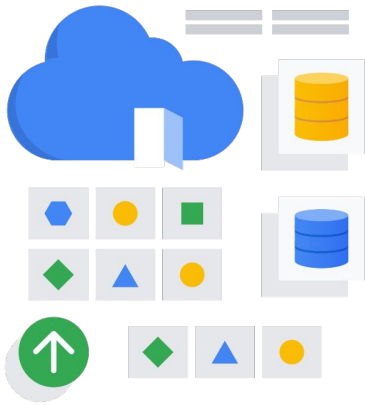
In module 4, you explored Google Cloud's five core storage options: Cloud Storage, Cloud Bigtable, Cloud SQL, Cloud Spanner, Firestore.

- **Cloud Storage** is best if you need to store immutable binary objects.
- **Cloud Bigtable** is best if you need to store a large amount of single-keyed data, especially structured objects.
- **Cloud SQL** or **Cloud Spanner** are for full SQL support for an online transaction processing system. Cloud SQL provides terabytes of capacity, while Cloud Spanner provides petabytes and horizontal scalability.
- And **Firestore** is best if you need to store, sync, and query data for mobile and web applications, and server development.

While we looked in some depth at each of those options, it's worth also reminding ourselves of the four storage classes that comprise Cloud Storage. **Standard Storage**, which is used for *hot data*, **Nearline Storage and Coldline Storage**, which are used to less-frequently accessed *cool data*, and **Archive Storage**.
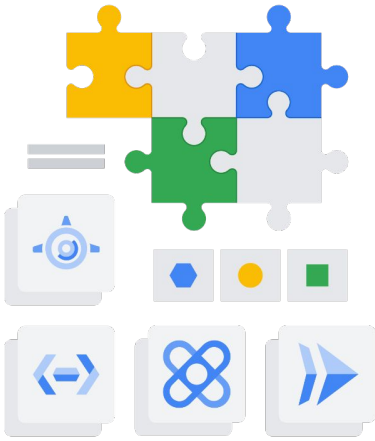
Module 05

Module 5 recap

In module 5, you learned about **containers**, which is an invisible box around your code and its dependencies, with limited access to its own partition of the file system and hardware. It scales like PaaS, but gives you nearly the same flexibility as IaaS.

You learned about **Kubernetes**, an open-source platform for managing containerized workloads and services.

You also learned about **Google Kubernetes Engine** (GKE), a Google-hosted managed Kubernetes service in the cloud.

Finally in module 5, you were introduced to **Anthos**, Google's answer to modern hybrid and multi-cloud distributed systems and services management.

Module 06

01 Developing applications in the cloud

02 Google App Engine:
    ● Standard environment
    ● Flexible environment

03 API management tools:
    ● Cloud Endpoints
    ● API Gateway
    ● Apigee API Management

04 Cloud Run

Module 6 recap

In module 6, your attention was turned to developing applications in the cloud.

You first looked at **Google App Engine**, a fully managed, serverless platform for developing and hosting web applications at scale. You'll recall that we learned about two types of App Engine environments: **standard** and **flexible**:
- The App Engine **standard environment** is based on container instances running on Google's infrastructure.
- The App Engine **flexible environment** lets you specify the container your web application will run in.

You also learned about three API management tools provided by Google Cloud: **Cloud Endpoints, API Gateway,** and **Apigee API Management.**

The final application platform you explored in this module was **Cloud Run**, a managed compute platform that lets you run stateless containers via web requests or Pub/Sub events.
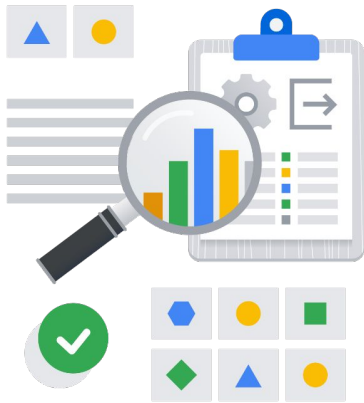
Module 07

Module 7 recap
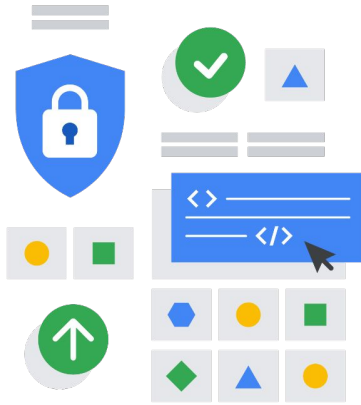
The focus for module 7 was developing and deploying in the cloud.

For development in the cloud, we learned about **Cloud Source Repositories**. These provide full-featured Git repositories hosted on Google Cloud that support the collaborative development of any application or service, including those that run on App Engine and Compute Engine.

You also learned about **Cloud Functions**, a lightweight, event-based, asynchronous compute solution that allows you to create small, single-purpose functions that respond to cloud events without the need to manage a server or a runtime environment.

For deployment in the cloud, you learned about **Terraform**. Terraform lets you use a template to write the specifications for your application environment in the same way you'd write a configuration file, but your template can then be deployed in a scaled environment to quickly create as many identical application environments as needed.

Module 08

01	Logging and monitoring on Google Cloud
02	Four golden signals: • Latency • Traffic • Saturation • Errors
03	Service Level Indicators, Service Level Objectives, and Service Level Agreements
04	Google's integrated observability tools

Module 8 recap

In the final module of today's course, you focused on logging and monitoring on Google Cloud. You learned about the "Four Golden Signals" that measure a system's performance and reliability: **latency**, **traffic**, **saturation**, and **errors**.

You then explored **Service Level Indicators (SLIs)**, **Service Level Objectives** (**SLOs),** and **Service Level Agreements** (**SLAs)**, which are all types of targets set for a system's Four Golden Signal metrics.

The module finished with an exploration of Google's integrated **observability tools,** which include Cloud Monitoring, Cloud Logging, Error Reporting, Cloud Trace, and Cloud Profiler.

Congratulations on completing today's course. We realize that we've imparted a ton of information to you, but hopefully now you have a thorough understanding of Google Cloud's technology, products, and services, that you can take back with you to your organizations.

So, what's next? How can you continue your learning journey with Google Cloud?

Well, we offer learning paths for different cloud roles…

If you're a **Cloud Engineer** who does or will deploy applications, monitor operations, and manage enterprise solutions, you should take the Cloud Engineer Learning Path and continue next with the course: Architecting with Google Compute Engine.

What's next for Cloud Architect?

Cloud Architect

If you're a Cloud Architect who does or will design, develop, and manage robust and scalable cloud architecture solutions.

1	Core Infrastructure
2	**Cloud Architect Learning Path**
3	Architecting with Google Compute Engine

Google Cloud

If you're a **Cloud Architect** who does or will design, develop, and manage robust and scalable cloud architecture solutions, you should take the Cloud Architect Learning Path and also continue next with the course: Architecting with Google Compute Engine.

What's next for Cloud Developer?

Cloud Developer

For Cloud Developer who does or will build scalable and highly available cloud applications using Google Cloud and tools that leverage fully managed services.

1 Core Infrastructure

2 Cloud Developer Learning Path

3 Developing Applications with Google Cloud

Google Cloud

If you're a **Cloud Developer** who does or will build scalable and highly available cloud applications using Google Cloud and tools that leverage fully managed services, you should take the Cloud Developer Learning Path and then continue next with the course: Developing Applications with Google Cloud.

What's next for Cloud DevOps Engineer?

Cloud DevOps Engineer

If you're a Cloud DevOps Engineer who does or will maintain the efficient operations of the full software delivery pipeline.

1 Core Infrastructure

2 Cloud Developer Learning Path

3 Architecting with Google Cloud: Design and Process

Google Cloud

If you're a **Cloud DevOps Engineer** who does or will maintain the efficient operations of the full software delivery pipeline, you should take the Cloud Developer Learning Path and then continue next with the course: Architecting with Google Cloud: Design and Process.

By becoming Google Cloud Certified, you can show the world that you can design, develop, manage, and administer application infrastructure and data solutions on Google Cloud technology. The Google Cloud Certified designation means you've demonstrated the necessary skills to leverage Google Cloud technology in a way that transforms businesses and meaningfully impacts the people and customers they serve.

Helpful links

VMs and Networks

Compute Engine
cloud.google.com/compute/docs

Virtual Private Cloud
cloud.google.com/compute/docs/vpc

Google Cloud operations suite
cloud.google.com/stackdriver/docs

gcloud tool guide
cloud.google.com/source-repositories/docs

Storage

Overview of Cloud Storage
cloud.google.com/storage

Getting started with Cloud SQL
cloud.google.com/sql/docs/quickstart

Cloud Bigtable
cloud.google.com/stackdriver/docs

Cloud Spanner
cloud.google.com/spanner/docs

Firestore
firebase.google.com/docs/firestore

Google Cloud

So that you can find out a little more about some of the topics we've discussed today, we've put together a list of helpful links that you can access in your own time. You'll have access to a copy of this deck where you'll find these slides.

Thank you for attending this training!

We love your feedback! Please take a minute to complete the survey and help us improve our courses.

Google Cloud
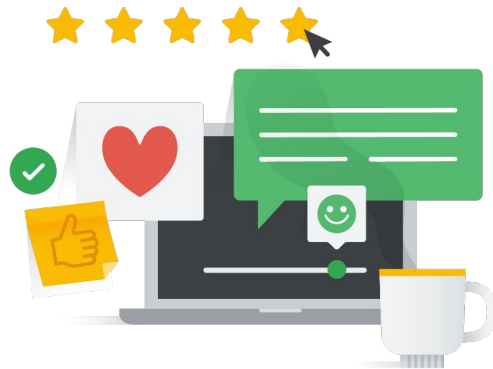
Feedback

We hope you've enjoyed today's course. It would be great for us if you could take a couple of minutes to give us feedback to ensure that we can continue to improve our training offering in the future.

Thank you

Thank you!