

Google Cloud

Partner Certification Academy



Professional Cloud Developer

pls-academy-pcd-student-slides-1-2309

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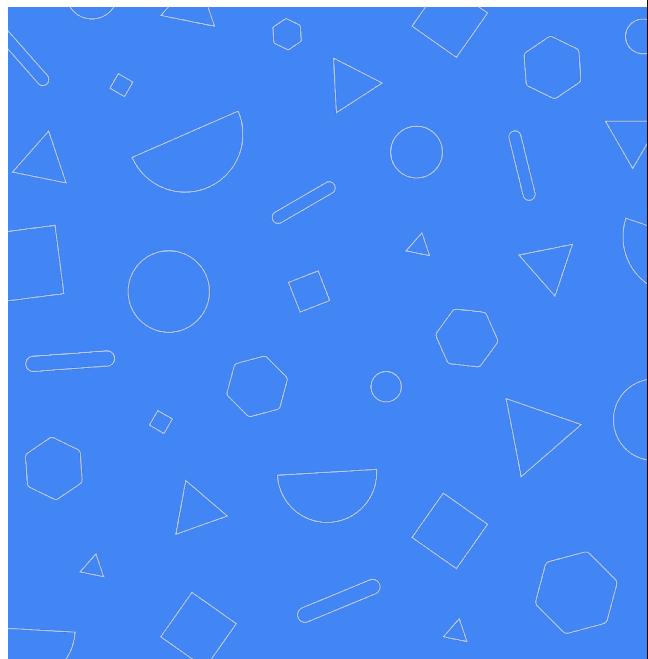
Google Cloud

Source Materials

Some of this program's content has been sourced from the following resources:

- [Google Cloud certification site](#)
- [Google Cloud documentation](#)
- [Google Cloud console](#)
- [Google Cloud courses and workshops](#)
- [Google Cloud white papers](#)
- [Google Cloud Blog](#)
- [Google Cloud YouTube channel](#)
- [Google Cloud samples](#)
- [Google codelabs](#)
- [Google Cloud partner-exclusive resources](#)

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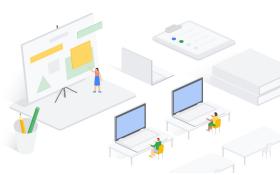
Session logistics

- When you have a question, please:
 - Click the Raise hand button in Google Meet.
 - Or add your question to the Q&A section of Google Meet.
 - Please note that answers may be deferred until the end of the session.
- These slides are available in the Student Lecture section of your Qwiklabs classroom.
- The session is **not recorded**.
- Google Meet does not have persistent chat.
 - If you get disconnected, you will lose the chat history.
 - Please copy any important URLs to a local text file as they appear in the chat.

Path to Service Excellence



Certification



Advanced Solutions Training

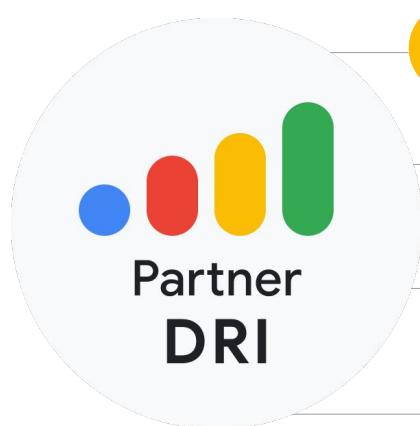


Delivery Readiness Index

Google Cloud

Certification is just one step on your professional journey. Google Cloud also offers our partners access to advanced solutions training, and a new quality-focused program called Delivery Readiness Index (DRI) to help you achieve service excellence with your customers.

Benchmark your skills with DRI



Assess: Partner Proficiency and Delivery Capability

Benchmark Partner individuals, project teams and practices GCP capabilities



Analyze: Individual Partner Consultants' GCP Readiness

Showcase Partner individuals GCP knowledge, skills, and experience



Advise: Google Assurance for Partner Delivery

Packaged offerings to bridge specific capability gaps



Action: Tailored L&D Plan for Account Based Enablement

Personalized learning & development recommendations per individual consultant

Google Cloud

DRI helps to benchmark partner proficiency and capability at any point during the customer journey however should be used primarily as a lead measure to predict and prepare for partner delivery success.

DRI assesses and analyzes Partner Consultant GCP proficiency by creating a DRI Profile inclusive of their GCP knowledge, skills, and experience.

With the DRI insights, we can prescriptively advise the partner project team on the ground and bridge niche capability gaps.

DRI also takes action. For partner consultants, DRI generates a tailored L&D plan that prescribes personalized learning, training, and skill development to build GCP proficiency.

Google Cloud Skills Boost for Partners

<https://partner.cloudskillsboost.google/>

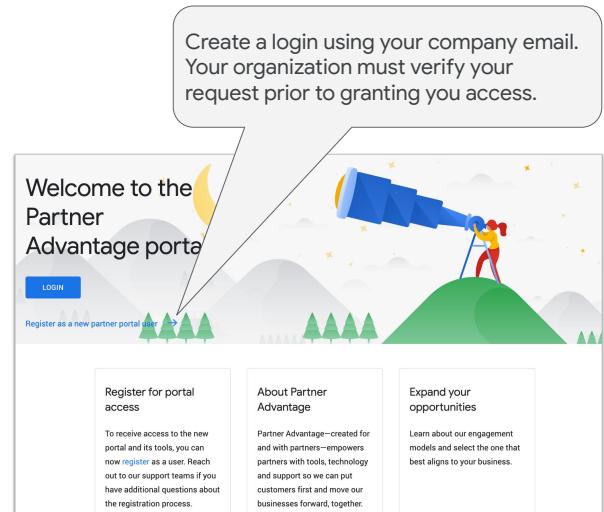
- On-demand course content
- Hands-on labs
- Skill Badges
- **FREE** to Google Cloud Partners!

The screenshot shows the homepage of the Google Cloud Skills Boost for Partners platform. At the top, there's a navigation bar with links for Home, Catalog, Profile, and Subscriptions. Below the navigation is a main header "Google Cloud Skills Boost for Partners". A large, stylized illustration of a person wearing a hard hat and holding a tablet, standing next to a bar chart, is positioned on the right side of the header. The main content area has a heading "Welcome to Google Cloud Skills Boost for Partners!" followed by a brief description: "Choose your path, build your skills, and validate your knowledge. All in one place. Take advantage of some of the new features, including completion badges, improved course information, and searchability." Below this, there's a section titled "In Progress" which lists three courses: "Monitor and Log with Google Cloud Operations Suite", "Google Cloud's Operations Suite", and "Implement DevOps in Google Cloud". Each course item includes a small "Quest" badge icon.

Google Cloud

Google Cloud Partner Advantage

- Resources for Google Cloud partner organizations:
 - Recent announcements
 - Solutions/role-based training
 - Live/pre-recorded webinars on various topics
 - [Partner Advantage Live Webinars](#)
- Complements the certification self-study material presented on Google Cloud Skills Boost for Partners
- Helpful Links:
 - [Getting started on Partner Advantage](#)
 - [Join Partner Advantage](#)
 - [Get help accessing Partner Advantage](#)



<https://www.partneradvantage.google.com>

Google Cloud

The getting started link:

<https://support.google.com/googlecloud/topic/9198654#zippy=%22Getting+Started+%26+User+Guides%22>

Note the top section, “**Getting Started & User Guides**” and two key documents → Direct Partners to this if they need to enroll into Partner Advantage

1. Logging in to the Partner Advantage Portal - Quick Reference Guide
2. Enrolling in the Partner Advantage Program - Quick Reference Guide

Some context on enrolling in PA:

Access to Partner Portal is given in 2 ways

- Partner Admin Led: Partner Administrator at Partner Company can set up users
- User Led: User can go through Self Registration
 - https://www.partneradvantage.google.com/GCPPRM/s/partneradvantageportal/login?language=en_US
 - Or directly to the User Registration Form, https://www.partneradvantage.google.com/GCPPRM/s/partnerselfregistration?language=en_US

Please Note

- After a user self-registers, they receive an email that essentially states:
 - “Hi {Partner Name}, you are one step away from joining the Google Cloud Partner Advantage Community. Please click to continue with the user registration process. See you in the cloud, The Partner Advantage

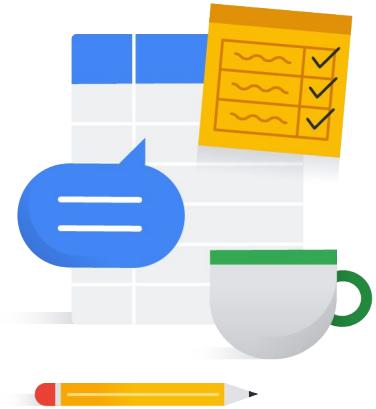
- Team
- Once registered, they can access limited content until their **Partner Administrator approves the user**
- Their Partner Administrator also receive an email notifying them that a member of their organization has registered themselves on their organization's Google Cloud Partner Advantage account.
 - It also states that this user has limited access to the portal
 - They are provided instructions on how to review and provision the appropriate access for the user that has registered
- Once their admin approves the user, they receive an email that states:
 - Hi {User Name}, Your Partner Administrator has updated your access to the Google Cloud Partner Advantage portal. You have been granted edit access to additional account information on the portal on behalf of your organization to help build your business. For additional access needs, please work with your Partner Administrator. See you in the cloud, The Partner Advantage Team

The net takeaway is, on the Support Page (the first link on this slide) [Google Cloud Partner Advantage Support](#), there's a section "**Issue accessing Partner Advantage Portal? Click here for troubleshooting steps**"

- The source of their issue can be related to the different items shown
- Additionally, there's a Partner Administrator / Partner Adminstrator Team at their partner organization that has to approve their access.. Until that step is completed, they will have access issues/limitation. They will need to identify who this person or team is at their organization

Program issues or concerns?

- For questions regarding Cloud Skills Boost access, Qwiklabs issues, voucher queries, etc.
 - cloud-partner-training@google.com
- For questions regarding Partner Advantage access
 - <https://support.google.com/googlecloud/topic/9198654>

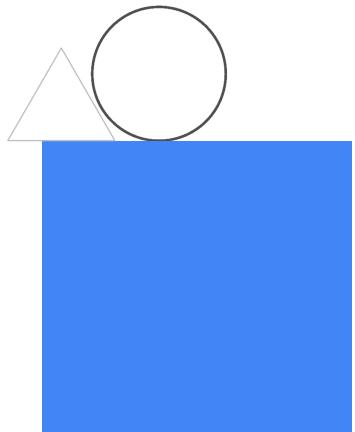


Google Cloud

Module Agenda

- 01** Partner Certification Academy Overview
- 02** Accessing Partner Certification Academy Content
- 03** Introduction to Google Cloud
- 04** Google Cloud Network Overview
- 05** Google Cloud Services Overview
- 06** Identity and Access Management (IAM) Overview
- 07** Next workshop's assigned content

Program Overview



Google Cloud

Partner Certification Academy

A differentiated learning experience for the busy professional



Our goal is to help you prepare for Google Cloud certification exams

These programs may include:

- On-demand learning
- Self-paced labs
- Mentor-led workshops
- A voucher for the exam

The workshop sessions:

- **Are NOT training sessions - that's the purpose of the on-demand content.**
- Help you review key concepts on the exam guide.
- Will NOT discuss actual exam questions.

Google Cloud Certifications



Professional
Cloud DevOps
Engineer



Professional
Google
Workspace
Administrator



Professional
Cloud Architect



Professional
Data Engineer



Professional
Machine Learning
Engineer



Cloud Digital
Leader



Associate
Cloud
Engineer



Professional
Cloud
Developer



Professional
Cloud Network
Engineer



Professional
Cloud Security
Engineer



Foundational
No cloud experience needed

Associate
Recommended 6+ months
hands-on experience
with Google Cloud

Professional
Recommended 3+ years
industry experience & 1 year
hands-on experience with
Google Cloud

Google Cloud

More information:

https://cloud.google.com/certification#certification_paths

Professional Cloud Developer (PCD)

A Professional Cloud Developer builds scalable and highly available applications using Google-recommended tools and best practices. This individual has experience with cloud-native applications, developer tools, managed services, and next-generation databases. A Professional Cloud Developer also has proficiency with at least one general-purpose programming language and instruments their code to produce metrics, logs, and traces.

The Professional Cloud Developer exam assesses your ability to:

- ✓ Design highly scalable, available, reliable cloud-native applications
- ✓ Deploy applications
- ✓ Manage deployed applications
- ✓ Build and test applications
- ✓ Integrate Google Cloud services

<https://cloud.google.com/learn/certification/cloud-developer>



Google Cloud

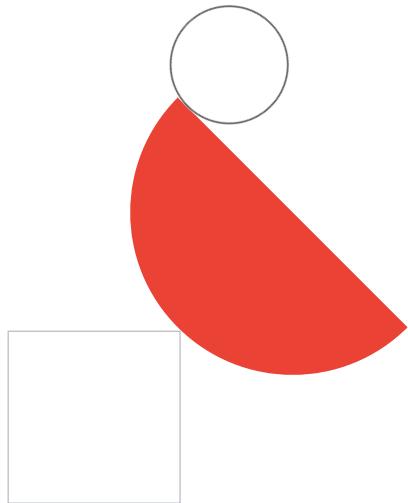
Experience level assumptions

- Per the [certification site](#): “*3+ years of industry experience including 1+ years designing and managing solutions using Google Cloud*”
- Workshops do not cover “programming 101” topics
 - Discussion centers on topics specific to Google Cloud services, e.g.,
 - Authentication and authorization
 - Best practices, etc.
- If you lack experience with Google Cloud
 - Additional content is provided as part of this program which provides a basic overview on Google Cloud compute and storage options



Google Cloud

Accessing Partner Certification Academy Content



Google Cloud

Cloud Developer learning resources

Resource #1

Partner Skills Boost

- Certification Learning Path:
[Professional Cloud Developer](#)
 - On-demand video
 - Hands-on labs

Resource #2

Developer Learning Guides

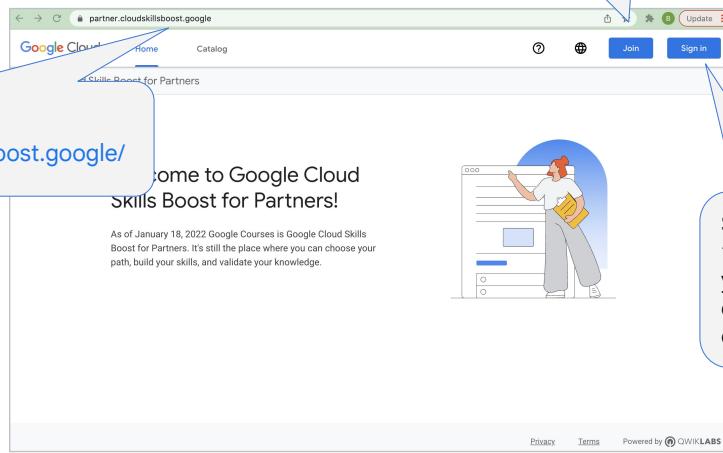
- Covers topics mentioned in the Certificated Cloud Developer [exam guide](#)
 - Youtube videos
 - Documentation links
 - Lab recommendations

Google Cloud

Partner Cloud Skills Boost website hosts the on-demand content

Step 1:

<https://partner.cloudskillsboost.google/>



Accessing the Developer learning path (Resource #1)

Part 1

The screenshot shows the 'Professional Cloud Developer' certification page from the Partner Certification Academy. It features a 'Click to register' button and a detailed description of the role: 'A Professional Cloud Developer builds scalable and highly available applications using Google-recommended tools and best practices. This individual has experience with cloud-native applications, developer tools, managed services, and next-generation databases. A Professional Cloud Developer also has proficiency with at least one general-purpose programming language and instruments their code to produce metrics, logs, and traces.' Below this, a 'Recommended candidate:' section lists '3+ years of industry experience including 1+ years designing and managing solutions using Google Cloud.'

The learning path diagram is organized into three main sections:

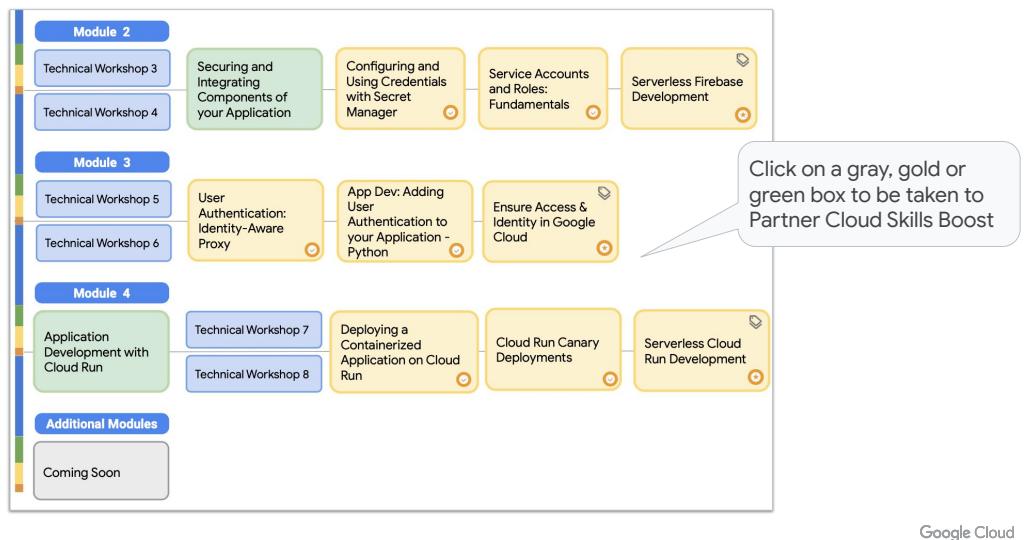
- Pre Work:** Includes 'Professional Cloud Developer' and 'Certification Learning Path: Professional Cloud Developer'.
- Module 1:** Contains 'Technical Workshop 1' (with 'Getting Started with Cloud Shell and gcloud') and 'Technical Workshop 2' (with 'Using gsutil to Perform Operations on Buckets and Objects').
- Hands-on Labs:** Includes 'A Tour of Google Cloud Hands-on Labs', 'Google Cloud Platform Fundamentals - Core Infrastructure', 'Cloud IAM: Qwik Start', and 'Getting Started With Application Development'.

Legend icons indicate the types of resources: On-demand Course (blue square), Resource (grey square), Hands-on Skill Badge (orange circle), Live Virtual Workshop (yellow square), Hands-on Lab (green circle), and required to earn exam voucher (grey square).

Google Cloud

Accessing the Developer learning path (Resource #1)

Part 2



Google Cloud

Enroll in a course, watch the videos and do the labs

Course

Google Cloud Fundamentals: Core Infrastructure

1 day Introductory Free

Google Cloud Fundamentals: Core Infrastructure introduces important concepts and terminology for working with Google Cloud. Through videos and hands-on labs, this course presents and compares many of Google Cloud's computing and storage services, along with important resource and policy management tools.

Google Cloud

Google Cloud Fundamentals: Core Infrastructure

COMPLETION BADGE

When you complete this course, you can earn the badge displayed above! View all the badges you have earned by visiting your profile page. Boost your cloud career by showing the world the skills you have developed!

Enroll in this on-demand course

Click "Enroll in this course"

Google Cloud

Accessing Developer Learning Guides (Resource #2)

Resource #2

Developer Learning Guides

- Covers topics mentioned in the Cloud Developer Certification [exam guide](#)
 - Youtube videos
 - Documentation links
 - Lab recommendations

Introduction to Google Cloud Compute and Storage

Overview of Google Cloud compute services

In this video, you learn about various Google Cloud compute options such as Kubernetes, Serverless, Compute Engine and more

Getting Started with Google Cloud

Learn how to get started with Google Cloud

Identity and Access Management (IAM) Resources and Access in the Cloud

Complete the "Resources and Access in the Cloud" section found in this course's "Cloud Security Basics" module.

This section covers

- Identity and Access Management (IAM)
- Service Accounts
- Cloud IAM

Note: There is no need to do the hands-on lab "Getting Started with Cloud IAM."

Access Control 101

Identify what access is required:

- How to prevent unauthorized access to Google Cloud resources
- The resource hierarchy

Cloud Security Basics Access control 101

Managed Instance Groups

Managed Instance Groups overview

This video provides an overview of the components that make up a managed instance group and discusses

- Auto-scaling
- Regional vs zone instance groups
- Health checks

Compute Engine: Managed Instance Groups

Compute Engine: Managed Instance Groups

Complete the "Load Balancing and AutoScaling" section found in this course's "Basic Google Cloud Infrastructure: Building and

Google Cloud

Accessing PDFs of instructor slide decks and the Developer Guides in Partner Skills Boost

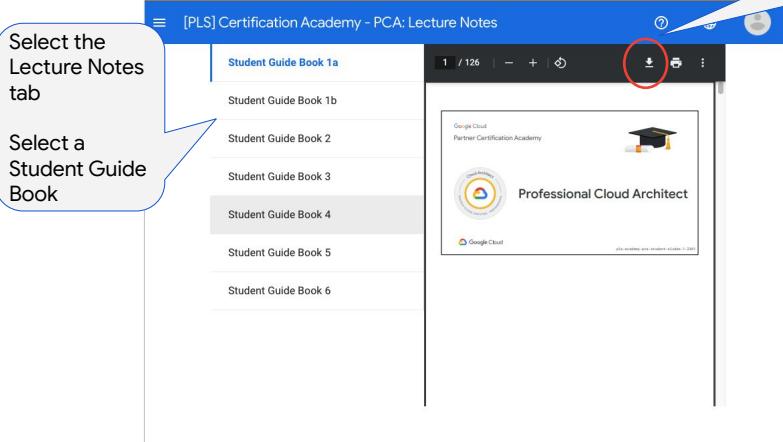
The screenshot shows the Google Cloud Partner Skills Boost interface. On the left, a purple box contains the text "Click the purple box". A blue arrow points from this box to a purple box on the main page. Inside the purple box on the main page, the text "start your cloud career" is visible, along with a "In Progress" status and a thumbnail image of a purple landscape.

On the right, a blue callout box contains the text "Shown two tabs:" followed by a bulleted list: "• Labs" and "• Lecture Notes". An arrow points from this callout to the "Labs" tab in the top navigation bar of the main window.

The main window displays course details for "[PLS] Certification Academy - PCA". It includes sections for "Overview", "Date" (Thursday, February 9, 2023 9:00AM CST – Thursday, March 23, 2023 9:00AM CDT), "Location" (USA), "Instructor" (Bobbie Townsend, Manjeet Dadyal), and "Level" (Intermediate). Below the overview, there is a link to "Take class evaluation: Google Cloud Training Survey".

At the bottom right of the main window, the text "Google Cloud" is visible.

Downloading the lecture notes



Issues? Email: cloud-partner-training@google.com

Google Cloud

What's covered in the workshop sessions?

- Workshops concentrate on the Developer Guide contents
 - Feel free to ask questions about the Skills Boost content as well
- Each workshop covers different Developer Guides
 - The next workshop's Developer Guide assignments will be shown at the end of the current workshop
- **The degree of benefit gained from attending the workshops depends on you**
 - It is assumed that you have reviewed the assigned guide(s) and/or Skills Boost content prior to the workshop
 - **The instructor will show demos, etc. to illustrate some of the key topics in the guides, but not all**
- To be adequately prepared for the exam, you need to
 - Watch all on-demand content and do the hands-on exercises
 - Review all the Developer Guides
 - Watch the videos
 - Review the documentation
 - Answer the quiz questions

Passing the exam requires commitment

- Chances are good that you will **NOT PASS THE EXAM** if your ONLY preparation for the exam is to attend the live sessions
- To increase your chances of passing the exam
 - **Spend time reviewing the on-demand content and the Developer Guides**
 - Complete the hands-on labs
 - Come to the workshops prepared with questions
 - **Do the assignments prior to the workshop**

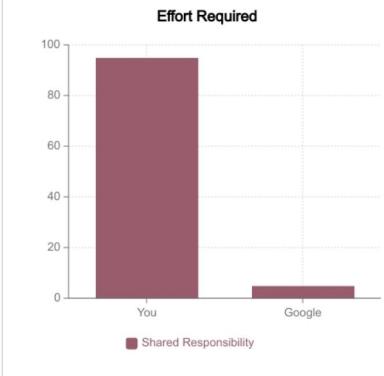
Recommended experience: 3+ years of industry experience including 1+ years designing and managing solutions using Google Cloud.

<https://cloud.google.com/learn/certification/cloud-developer>

Google Cloud

Your Responsibilities

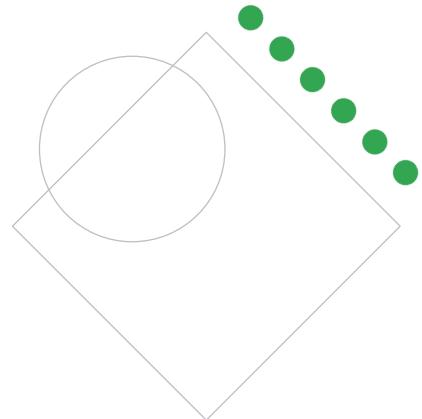
- **Workshop Day:** Meet for the cohort's weekly workshops (optional)
- **During the week:** Review material covered in the week's workshop, complete any course(s) as needed, perform hands-on labs, review additional suggested material.
- **Any time:** Reach out to your Mentor with questions



Important: You must allocate time between each weekly session to study and familiarize yourself with any prerequisite knowledge that will be covered in the workshops. You will not pass the exam if you don't put in the work.

Google Cloud

Interacting with Google Cloud



Google Cloud

Guide: Google Cloud Console, Cloud Shell, Cloud SDK, Cloud Code and Emulators Overview

Topics covered

- Overview of different methods used to communicate with Google Cloud
- How to install the Google Cloud SDK and the `gcloud` command line interface (CLI)
- How to create a free Google Cloud account (highly recommended)
- Link to Cloud Client Libraries and other developer specific resources
- List of emulators available for various Google Cloud services

Google Cloud Console, Cloud Shell, Cloud SDK, Cloud Code and Emulators Overview

Getting Started with Google Cloud

- Learn how to get started with Google Cloud



<https://www.youtube.com/watch?v=NgGEH1FzANTA>

- Websites mentioned in the video
 - Documentation: cloud.google.com/docs
 - Code samples: cloud.google.com/docs/samples
 - Codelabs: codelabs.cloud (need a personal Google Cloud account to do these)

- Highly recommended: Create a free Google Cloud Account

Google Cloud Console, Cloud Shell and SDK Overview

Google Cloud

Quiz Questions*

- Most Developer Guides have associated quiz questions
- Covers topics related to the guide content
 - Provides links to sites that discuss the correct answer
- **These are for practice only and are not actual exam questions**

Quiz questions

Google Cloud Console, Cloud Shell, SDK and Cloud Code Overview

Question: Which of the following IDEs does Cloud Code support?

- A. Eclipse
- B. Atom
- C. Sublime Text
- D. Visual Studio Code and JetBrains IDEs

Question: What is the Google Cloud SDK?

- A. A set of tools for managing resources and applications hosted on Google Cloud.
- B. A library for interacting with Google Cloud services.
- C. A command-line interface for Google Cloud services.
- D. All of the above.

Question: What is the Google Cloud Shell?

- A. A command-line interface for managing Google Cloud resources and applications.
- B. A web-based shell for executing commands directly within the Google Cloud Console.
- C. A tool for deploying applications on Google Cloud.
- D. A and B

*Doing well on the quiz questions is not a guarantee of passing the exam

Google Cloud

There are multiple ways to interact with Google Cloud

Cloud Console



Web user interface

Cloud Shell and Cloud SDK



Command-line interface

REST-based APIs
and Client Libraries



For custom applications

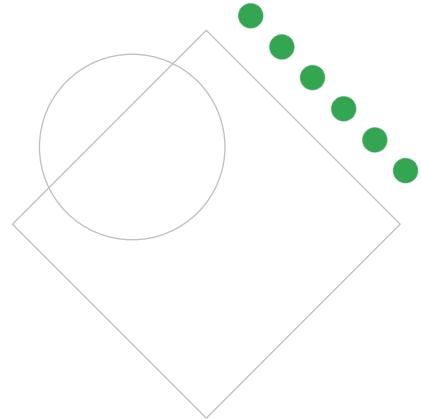
Cloud Mobile App



For iOS and Android

Interacting with Google Cloud

- **Cloud Console**
- Cloud Shell
- Cloud SDK
- Client Libraries
- REST based APIs
- Cloud Console Mobile App



Google Cloud

Cloud Console provides web-based interaction

-  Simple web-based graphical user interface
-  Easily find resources, check their health, have full management control over them, and set budgets
-  Provides a search facility to quickly find resources and connect to instances via SSH in the browser

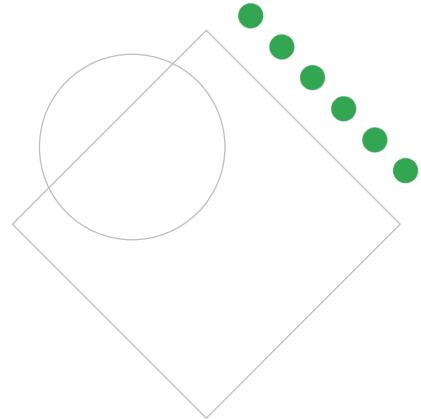
<input type="checkbox"/>	Name ^	Zone	Internal IP	External IP	Connect
<input type="checkbox"/>	nginxstack-1	us-central1-f	10.128.0.3 (nic0)	35.238.84.245	SSH <input type="button" value="⋮"/>
<input type="checkbox"/>	nginxstack-2	us-central1-f	10.128.0.4 (nic0)	35.225.177.18	SSH <input type="button" value="⋮"/>
<input type="checkbox"/>	nginxstack-3	us-central1-f	10.128.0.2 (nic0)	35.239.250.238	SSH <input type="button" value="⋮"/>

Google Cloud

First is the Google **Cloud Console**, which is Google Cloud's Graphical User Interface (GUI) which helps you deploy, scale, and diagnose production issues in a simple web-based interface. With the Cloud Console, you can easily find your resources, check their health, have full management control over them, and set budgets to control how much you spend on them. The Cloud Console also provides a search facility to quickly find resources and connect to instances via SSH in the browser.

Interacting with Google Cloud

- Cloud Console
- **Cloud Shell**
- Cloud SDK
- Client Libraries
- REST based APIs
- Cloud Console Mobile App



Google Cloud

Cloud Shell provides command line access to resources



Provides command-line access to cloud resources directly from a browser



Linux-based virtual machine with a persistent 5-GB home directory



The **Cloud SDK gcloud command and other utilities are always installed**, available, up to date, and fully authenticated

```
$ gcloud compute instances list
```

NAME	ZONE	INTERNAL_IP	EXTERNAL_IP
nginxstack-1	us-central1-f	10.128.0.3	35.238.84.245
nginxstack-2	us-central1-f	10.128.0.4	35.225.177.18
nginxstack-3	us-central1-f	10.128.0.2	35.239.250.238

Google Cloud

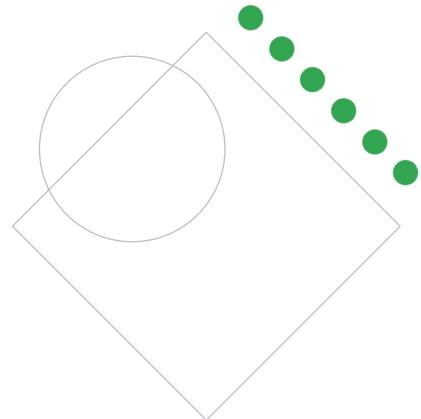
How Cloud Shell works:

<https://cloud.google.com/shell/docs/how-cloud-shell-works>

Cloud Shell provides command-line access to cloud resources directly from a browser. Cloud Shell is a Debian-based virtual machine with a persistent 5-GB home directory, which makes it easy to manage Google Cloud projects and resources. With Cloud Shell, the Cloud SDK gcloud command and other utilities are always installed, available, up to date, and fully authenticated.

Interacting with Google Cloud

- Cloud Console
- Cloud Shell
- **Cloud SDK**
- Client Libraries
- REST based APIs
- Cloud Console Mobile App



Google Cloud

Cloud SDK is a collection of tools

Google Cloud CLI



- A set of command line tools used to access and manage Google Cloud from the command line



Client Libraries

- Provides high level API abstractions reducing the amount of code you have to write



Cloud SDK



Cloud Code

- Integrated development extension available for VS Code and IntelliJ

Google Cloud

Cloud CLI is a set of command line tools



<https://cloud.google.com/sdk/docs/>



Set of tools to manage resources and applications hosted on Google Cloud from the command line

Includes:



`gcloud` - Provides the main command-line interface for Google Cloud products and services



`gsutil` - Provides access to Cloud Storage from the command line



`bq` - A command-line tool for BigQuery



Others can be added as needed, for example:



`kubectl` - Kubernetes command line tool



`cbt` - Bigtable command line tool

Google Cloud

Cloud SDK: <https://cloud.google.com/sdk/docs/>

The **Cloud SDK** is a set of tools that you can use to manage resources and applications hosted on Google Cloud. These include the [gcloud tool](#), which provides the main command-line interface for Google Cloud products and services, as well as [gsutil](#), which lets you access Cloud Storage from the command line, and [bq](#), a command-line tool for BigQuery. When installed, all of the tools within the Cloud SDK are located under the bin directory.

`gcloud components list` shows what is currently installed

The gcloud command lets you do most common tasks on Google Cloud

```
$ gcloud compute instances list

NAME          ZONE      MACHINE_TYPE  INTERNAL_IP  EXTERNAL_IP  STATUS
example-instance  asia-east1-b  n1-standard-1  10.240.95.199  107.167.182.44  RUNNING
example-instance2 us-central1-a  n1-standard-1  10.240.173.254  23.251.148.121  RUNNING
test-instance    us-central1-a  n1-standard-1  10.240.118.207  23.251.153.172  RUNNING
```

Google Cloud

The gcloud CLI tool lets you perform most common tasks on Google Cloud, including creating and managing resources for many services.

This example command, gcloud compute instances list, shows all the Compute Engine virtual machine instances for your project.

gcloud CLI overview: <https://cloud.google.com/sdk/gcloud>

gcloud CLI cheat sheet: <https://cloud.google.com/sdk/docs/cheatsheet>

Use gsutil to manage Cloud Storage*

- Create and delete buckets
- Upload, download, and delete objects
- List buckets and objects
- Move, copy, and rename objects
- Add/remove IAM roles on a bucket

```
$ gsutil cp Desktop/cloud-storage-logo.png gs://my-awesome-bucket

Copying file://Desktop/cloud-storage-logo.png [Content-Type=image/png]...
Uploading   gs://my-awesome-bucket/cloud-storage-logo.png:          0 B/2.58 KiB
Uploading   gs://my-awesome-bucket/cloud-storage-logo.png:          2.58 KiB/2.58 KiB
```

*Note: gcloud can also manage Cloud Storage as of mid-2022

Google Cloud

gsutil is a command-line tool used to manage Cloud Storage. Google's Cloud Storage provides reliable, secure, and highly performant object storage. You can use gsutil to create and manage storage buckets and upload, download, and delete objects. You can also move, copy, and rename objects and manage access to stored objects.

This gsutil example copies a file from your local machine into a Cloud Storage bucket.

gsutil tool: <https://cloud.google.com/storage/docs/gsutil>

bq is a command-line tool for BigQuery

- Manages datasets, tables, and other BigQuery entities.
- Runs queries.

```
$ bq query "SELECT word, SUM(word_count) as count FROM publicdata:samples.shakespeare WHERE word CONTAINS 'raisin' GROUP BY word"
```

```
Waiting on job_dcda37c0bbcd4c669b04dfd567859b90 ... (0s) Current status: DONE
+-----+-----+
|   word    | count |
+-----+-----+
| Praising   |  4   |
| raising    |  5   |
| raisins    |  1   |
| praising   |  8   |
| dispraising |  2   |
| dispraisingly |  1   |
+-----+-----+
```

Google Cloud

bq is a command-line tool for BigQuery, Google Cloud's serverless, highly scalable, and cost-effective data warehouse. bq can be used to manage datasets, tables, and other BigQuery entities, but its primary purpose is running queries.

This example query searches for all occurrences of a word in a sample public dataset that contains the complete word index of Shakespeare's works.

Using the bq command-line tool:

<https://cloud.google.com/bigquery/bq-command-line-tool>

Cloud Code

- Integrated development plugins for VS Code, Cloud Shell Editor and [JetBrains IDEs](#)
 - Provides an integrated Kubernetes and Cloud Run development and debugging environment;
 - Container tools such as [minikube](#), [Skaffold](#), [Buildpacks](#) and [Jib](#) are integrated under the hood to provide local emulators and continuous feedback for faster local development
 - Contains an integrated API explorer to make it easy to incorporate Google APIs into your application



[Cloud Code](#)

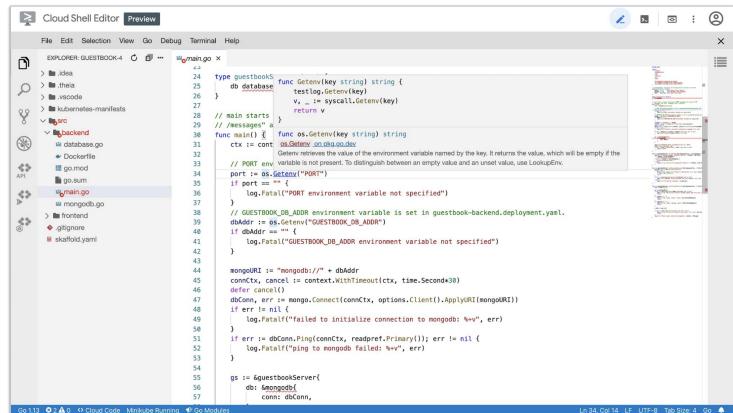
 IntelliJ IDEA 2023.1.3 The Leading Java and Kotlin IDE	 WebStorm 2023.1.3 The smartest JavaScript IDE	 PyCharm 2023.1.3 Python IDE for professional developers	 GoLand 2023.1.3 Capable and Ergonomic Go IDE	 Visual Studio Code	 Cloud Shell
--	---	---	--	--	---

Google Cloud

Cloud Code with Cloud Shell editor

Fully functional development tool

- Requires no local setup
- Accessible via Cloud Shell in the Cloud Console or directly from a [browser](#)



```

func guestbook() string {
    db := database()
    testLog("getenv", "v")
    v := syscall.Getenv("key")
    return v
}

func main() {
    ctx := context.Background()
    log.Println("main starts")
    log.Println("args:", os.Args)
    port := os.Getenv("PORT")
    if port == "" {
        log.Fatal("PORT environment variable not specified")
    }
    // GUESTBOOK_DB_ADDR environment variable is set in guestbook-backend.deployment.yaml
    dbAddr := os.Getenv("GUESTBOOK_DB_ADDR")
    if dbAddr == "" {
        log.Fatal("GUESTBOOK_DB_ADDR environment variable not specified")
    }
    mongoURI := "mongodb://" + dbAddr
    connCtx, cancel := context.WithTimeout(ctx, time.Second*10)
    defer cancel()
    dbConn, err := mongo.Connect(connCtx, options.Client().ApplyURI(mongoURI))
    if err != nil {
        log.Fatalf("Failed to initialize connection to mongodb: %v", err)
    }
    if err := dbConn.Ping(connCtx, readpref.Primary()); err != nil {
        log.Fatal("ping to mongodb failed: %v", err)
    }
    gs := &guestbookServer{
        db: dbConn,
    }
}

```

[Get your first cloud-native app running in minutes](#)

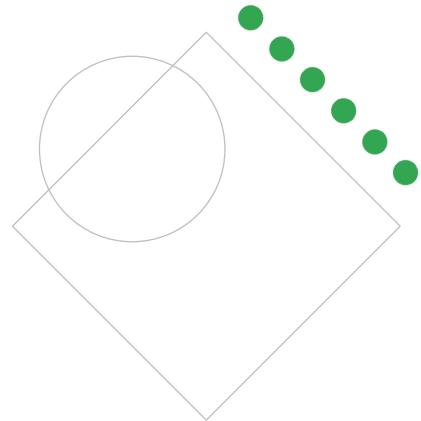
Google Cloud

Youtube video showing how to use the local Cloud Run emulator with Cloud Code

<https://www.youtube.com/watch?v=4Mo6pdLqlBE>

Interacting with Google Cloud

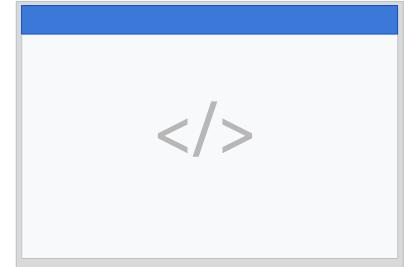
- Cloud Console
- Cloud Shell
- Cloud SDK
- Client Libraries**
- REST based APIs
- Cloud Console Mobile App



Google Cloud

Google provides Cloud Client and Google API Client libraries

- Cloud Client Libraries
 - **Recommended option** for accessing Cloud APIs programmatically
 - Multiple languages supported
 - Provides “wrappers” around API calls
 - Easier than calling the API directly
 - The response returned is a json object with key/value pairs
- Google API Client Libraries
 - Programmatic access to Google Maps, Google Drive, YouTube, and many other Google products



[Client libraries explained](#)

Getting started with the Cloud Client Libraries

GitHub repos:

- Provided for each supported language and individual services
- Contain installation instructions and Client Library code
- Provides reference libraries
 - Link to documentation
 - Provide code examples

Google Cloud Client Library	Installation & Reference
Go	<ul style="list-style-type: none"> • GitHub Repo • Library Reference • Supported Go Versions
Java	<ul style="list-style-type: none"> • GitHub Repo • Library Reference • Supported Java Versions
Node.js	<ul style="list-style-type: none"> • GitHub Repo • Library Reference
Python	<ul style="list-style-type: none"> • GitHub Repo • Library Reference
Ruby	<ul style="list-style-type: none"> • GitHub Repo • Library Reference
PHP	<ul style="list-style-type: none"> • GitHub Repo • Library Reference
C#	<ul style="list-style-type: none"> • GitHub Repo • Library Reference
C++	<ul style="list-style-type: none"> • GitHub Repo • Library Reference

Google Cloud

You can pull the repo for the Cloud Client Libraries for each of the supported programming languages. The GitHub Repo page lists the services/APIs supported by each language's Cloud Client library and provides installation instructions. You can also download Cloud Client Libraries for individual Google Cloud services. Reference libraries contain links to documentation and relevant StackOverflow posts and provide code examples. The reference libraries are your one-stop shop for information on a language-specific Cloud Client Library.

For direct links to GitHub Repos and Reference Libraries, see
<https://cloud.google.com/apis/docs/cloud-client-libraries>.

Example: Using the Node.js client library to list VM instances

gcloud command which makes the same API call

gcloud compute instances list

```
/**  
 * TODO(developer): Uncomment and replace these variables before running the sample.  
 */  
// const projectId = 'YOUR_PROJECT_ID';  
// const zone = 'europe-central2-b'  
  
const compute = require('@google-cloud/compute');  
  
// List all instances in the given zone in the specified project.  
async function listInstances() {  
  const instancesClient = new compute.InstancesClient();  
  
  const [instanceList] = await instancesClient.list({  
    project: projectId,  
    zone,  
  });  
  
  console.log(`Instances found in zone ${zone}:`);  
  
  for (const instance of instanceList) {  
    console.log(` - ${instance.name} (${instance.machineType})`);  
  }  
  
  listInstances();  
}
```

Retrieving the list of instances

Sending the instance names and machine types to the log

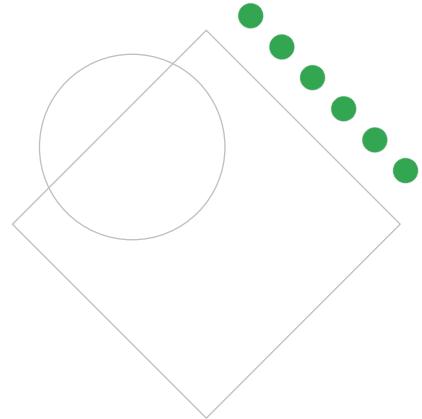
Google Cloud

From

<https://cloud.google.com/compute/docs/api/libraries>

Interacting with Google Cloud

- Cloud Console
- Cloud Shell
- Cloud SDK
- Client Libraries
- **REST based APIs**
- Cloud Console Mobile App



Google Cloud

APIs allow code to control your Cloud resources



- ✓ Google Cloud services offer APIs that allow code to be written to control them
- ✓ The **Google APIs Explorer** shows what APIs are available, and in what versions
- ✓ Developers have **Cloud Client** and **Google API Client libraries** for application development

Google Cloud

The services that make up Google Cloud offer **APIs**, so that code you write can control them. The Cloud Console includes a tool called the Google APIs Explorer that shows what APIs are available, and in what versions. You can try these APIs interactively, even those that require user authentication.

Suppose you've explored an API, and you're ready to build an application that uses it. Do you have to start coding from scratch? No. Google provides Cloud Client and Google API Client libraries in many popular languages to take a lot of the drudgery out of the task of calling Google Cloud from your code. Languages currently represented in these libraries are: Java, Python, PHP, C#, Go, Node.js, Ruby and C++.

API Explorer provides documentation on Google APIs

Interactive tool to try APIs in a browser

- Find methods for each API and what parameters they support
- Execute requests and see real-time response
- API calls can be authenticated

The screenshot shows the Google APIs Explorer interface. At the top, there's a search bar and a language selection dropdown set to English. Below the header, a blue navigation bar has links for 'Directory', 'Documentation', and 'Support'. The main content area is titled 'Google APIs Explorer' and has a sub-section title 'cloud'. A table lists several APIs with their titles and descriptions:

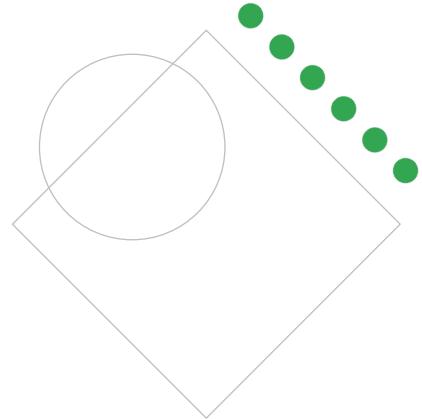
Title	Description
Assured Workloads API	Secure your government workloads and accelerate your path to running compliant workloads on Google Cloud with Assured Workloads for Government.
Bare Metal Solution API	Bare Metal Solution provides hardware to run specialized workloads with low latency on Google Cloud.
Binary Authorization API	The management interface for Binary Authorization, a service that provides policy-based deployment validation and control for images deployed to Google Kubernetes Engine (GKE), Anthos Service Mesh, Anthos Clusters, and Cloud Run.
Certificate Manager API	Certificate Manager lets you acquire and manage TLS (SSL) certificates for use with Cloud Load Balancing.
Cloud Asset API v1	The cloud asset API manages the history and inventory of cloud resources.
Cloud Asset API v1p1beta1	The cloud asset API manages the history and inventory of cloud resources.
Cloud Asset API v1p5beta1	The cloud asset API manages the history and inventory of cloud resources.

<https://developers.google.com/apis-explorer>

Google Cloud

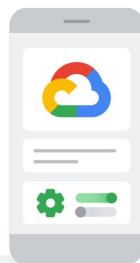
Interacting with Google Cloud

- Cloud Console
- Cloud Shell
- Cloud SDK
- Client Libraries
- REST based APIs
- **Cloud Console Mobile App**



Google Cloud

Cloud Console Mobile App provides resource management



cloud.google.com/console-app



- Start, stop, and use SSH to connect into Compute Engine instances, and see logs
- Stop and start Cloud SQL instances
- Up-to-date billing information for projects and alerts for those going over budget
- Customizable graphs showing key metrics
- Alerts and incident management

Google Cloud

Google Cloud app

<https://cloud.google.com/app>

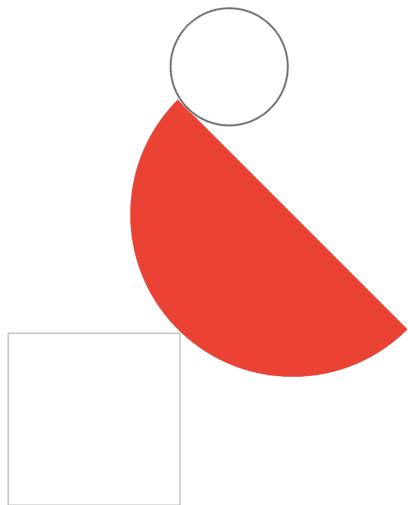
The **Cloud Console Mobile App** can be used to start, stop, and use ssh to connect to Compute Engine instances, and to see logs from each instance. It also lets you stop and start Cloud SQL instances. Additionally, you can administer applications deployed on App Engine, by viewing errors, rolling back deployments, and changing traffic splitting.

The Cloud Console Mobile App provides up-to-date billing information for your projects, and billing alerts for projects that are going over budget.

You can set up customizable graphs showing key metrics such as CPU usage, network usage, requests per second, and server errors.

The mobile app also offers alerts and incident management.

Google Cloud emulators for local development



Google Cloud

Multiple emulators are available for use in local development

- Use `gcloud beta emulators` to install and manage emulators
- Switch from using a local emulator to the Google Cloud service without changing application code
- Develop your applications without consuming Google Cloud resources



[Cloud Bigtable](#)



[Datastore](#)



[Firestore](#)



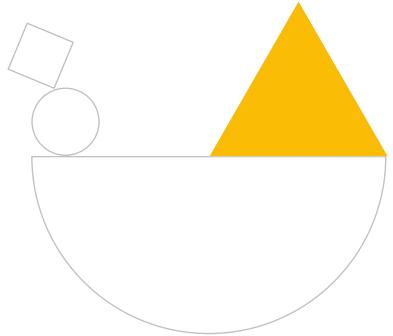
[Pub/Sub](#)



[Cloud Spanner](#)

Google Cloud

Google Cloud Network Overview



Google Cloud

Google Cloud Global Network

 36

REGIONS

 109

ZONES

 176

NETWORK EDGE LOCATIONS

 200+

COUNTRIES AND TERRITORIES

AVAILABLE IN

COMING SOON! Google Cloud will continue expanding into the following regions: Doha (Qatar), Berlin (Germany), Dammam (Kingdom of Saudi Arabia), Querétaro (Mexico), Malaysia, Thailand, New Zealand, Greece, Norway, South Africa, Austria and Sweden.

<https://cloud.google.com/about/locations/>

Google Cloud

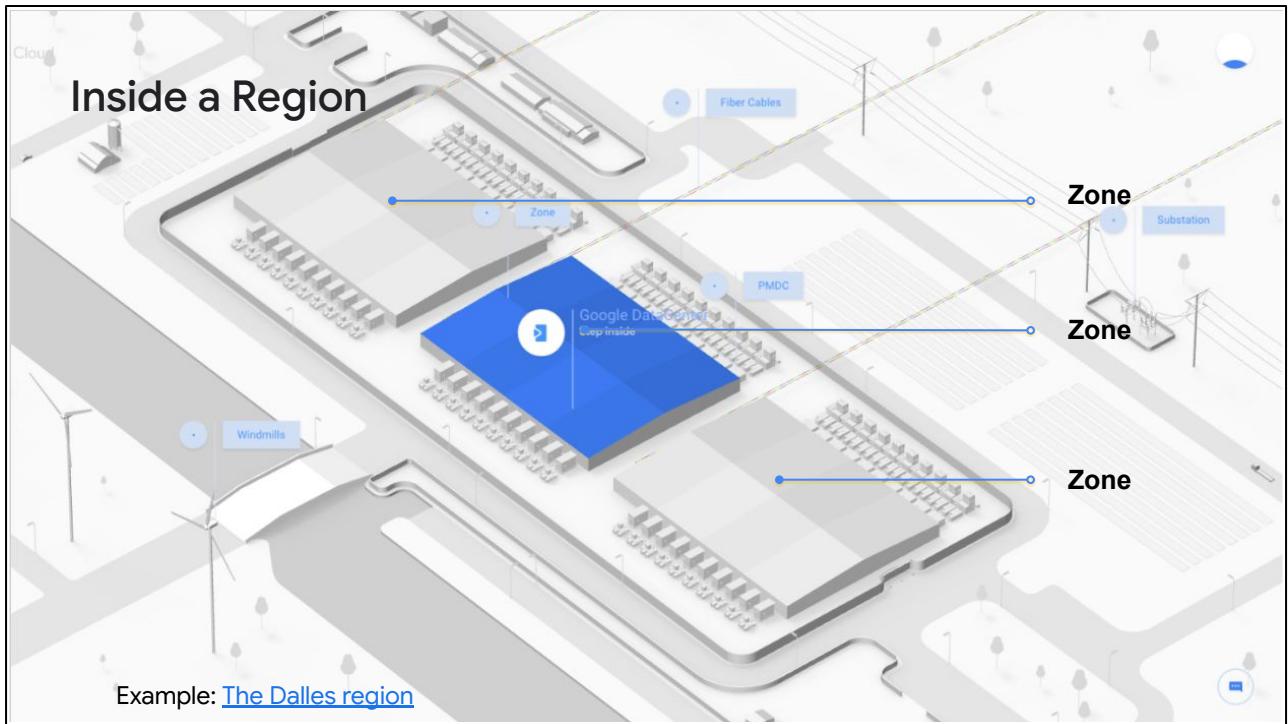
Google Cloud Regions*



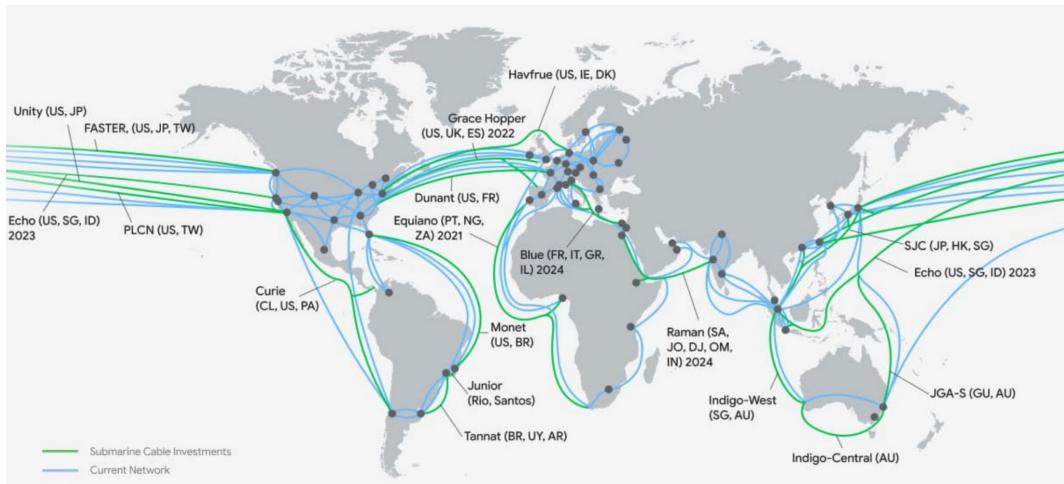
*New regions are added on an ongoing basis. Check [here](#) for the latest updates.

Google Cloud

Inside a Region



Google network fibre connectivity and underseas cables

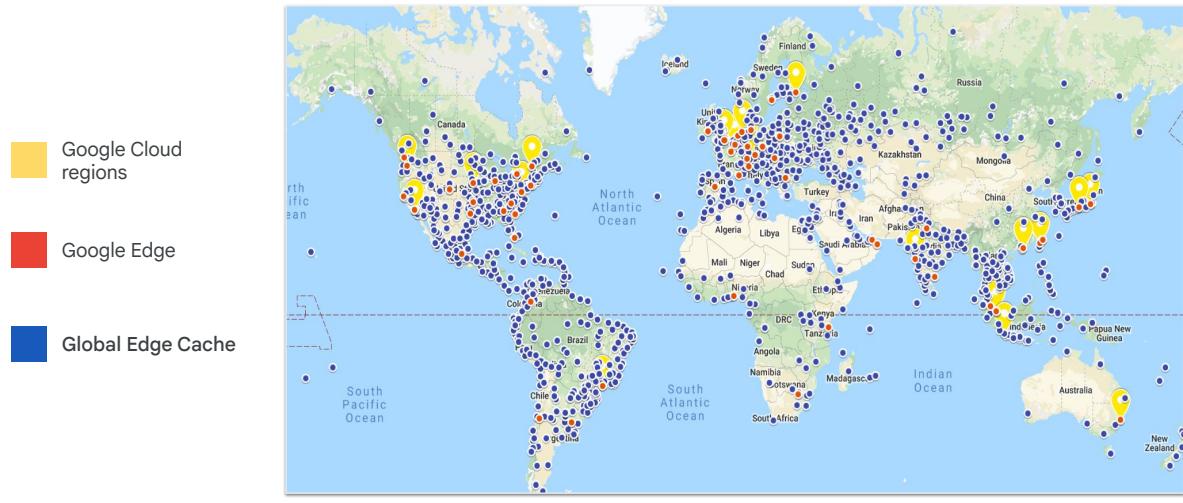


Google Cloud

List of Google's Subsea Cable Investments (**this is out of date**, but illustrates the major investments Google makes to ensure fast, reliable internet connectivity)

<https://www.submarinenetworks.com/en/insights/complete-list-of-google-s-sub-sea-cable-investments>

Google network with Google Edge locations



Google Cloud

Google's Edge Network is where Google connects to ISPs to get traffic to and from users. Google's edge nodes (also known as Google Global Cache, GGC) allow host network operators to optimise their traffic exchange with Google and enhance the quality of experience for users.

Why does this matter to a developer?

- You have a choice of deployment locations*
 - All compute products can be deployed to regions of your choice
 - Some of the storage products are regional; others are multi regional
 - In general
 - Deploy resources to closest to where they will be used
 - Single region, e.g.,
 - Compliance
 - Storage of data for compute located in that same region
 - Multiple regions, e.g.,
 - Redundancy
 - Application serving data to users in multiple locations within that region
 - Use [Cloud CDN](#) to cache static assets at the edge locations
 - Use [Cloud Media CDN](#) to cache video content

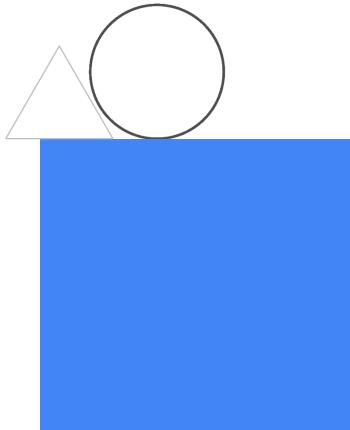
*Your organization may limit the locations you are allowed to use

Google Cloud

Google Cloud

Services Overview

- Compute options
- Database options
- BLOB/Object storage



Guide: Introduction to Google Cloud Compute and Storage

Topics covered

- Overview of Compute options
- Overview of Storage options
- Quiz questions

Introduction to Google Cloud Compute and Storage

Overview of Google Cloud compute services

- In this video, you learn about various Google Cloud compute options such as Kubernetes, Serverless, Compute Engine and more



<https://www.youtube.com/watch?v=vJpHSVStb9Y>

- Google Blog:
 - [Where should I run my stuff? Choosing a Google Cloud compute option](#)

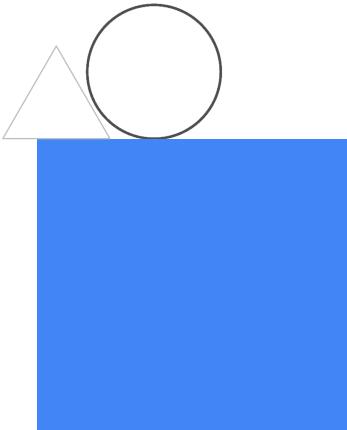
Introduction to Google Cloud Compute and Storage

Google Cloud

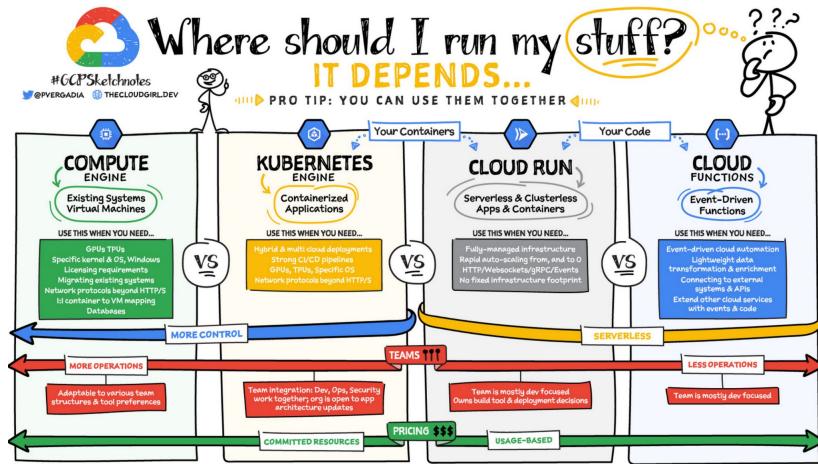
Google Cloud

Services Overview

- [Compute options](#)
- Database options
- Object/BLOB storage



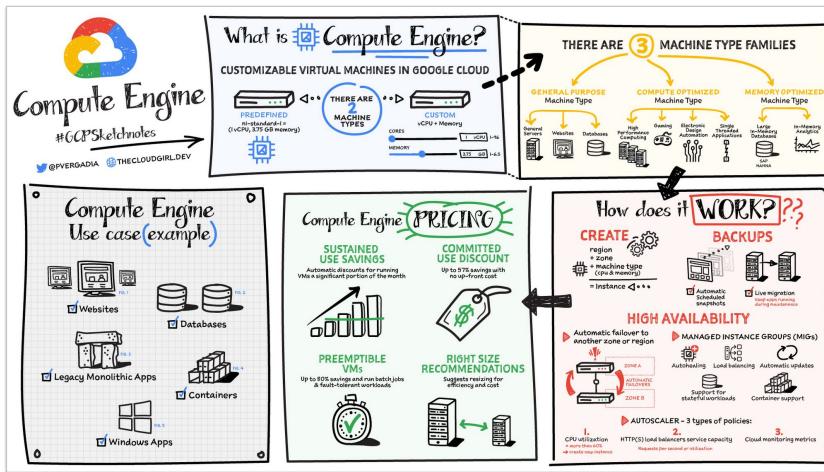
Choosing a Google Cloud compute option



[Where should I run my stuff? Choosing a Google Cloud compute option](#)

Google Cloud

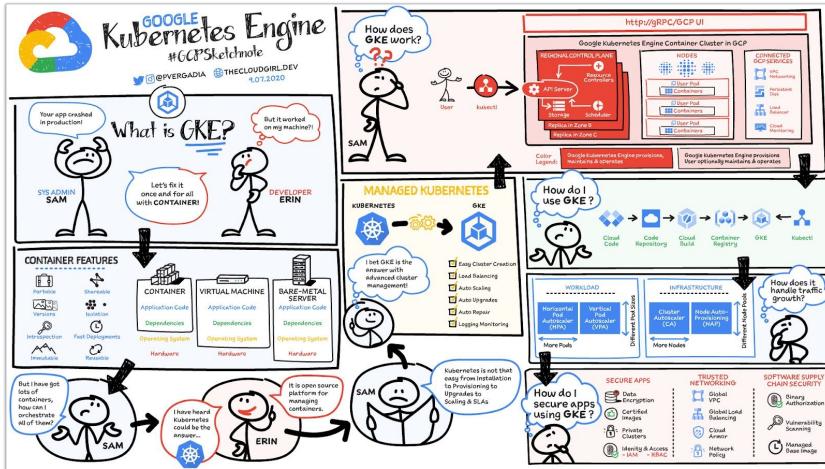
Compute Engine



[What is Compute Engine? Use cases, security, pricing and more](#)

Google Cloud

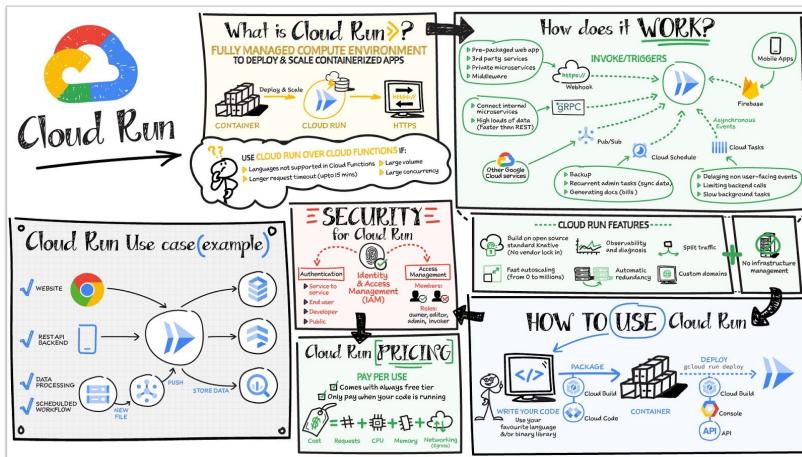
Kubernetes Engine



A container story - Google Kubernetes Engine

Google Cloud

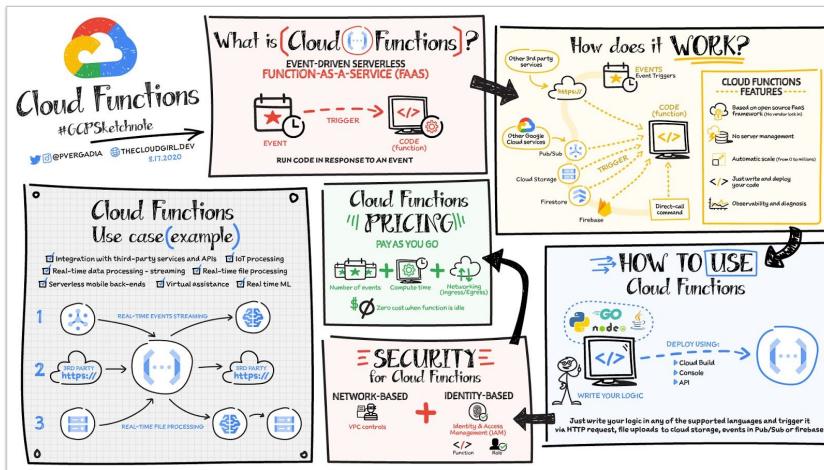
Cloud Run



[Cloud Run: What no one tells you about Serverless \(and how it's done\)](#)

Google Cloud

Cloud Functions



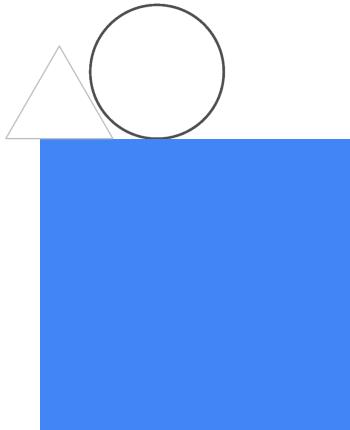
[Learn Cloud Functions in a snap!](#)

Google Cloud

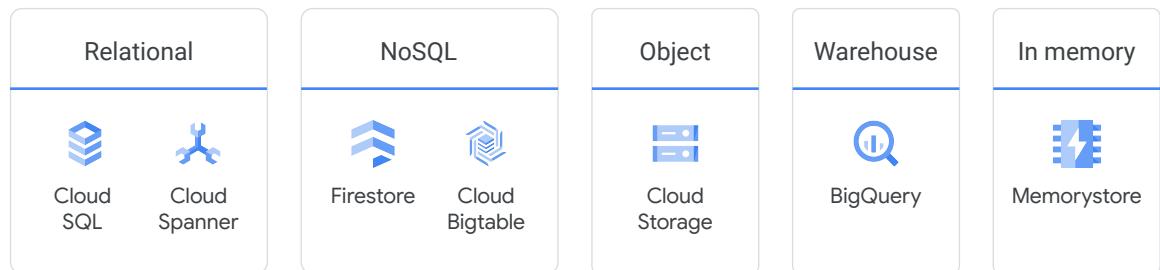
Google Cloud

Services Overview

- Compute options
- **Database options**
- Object/BLOB storage



Google Cloud-managed storage and database portfolio

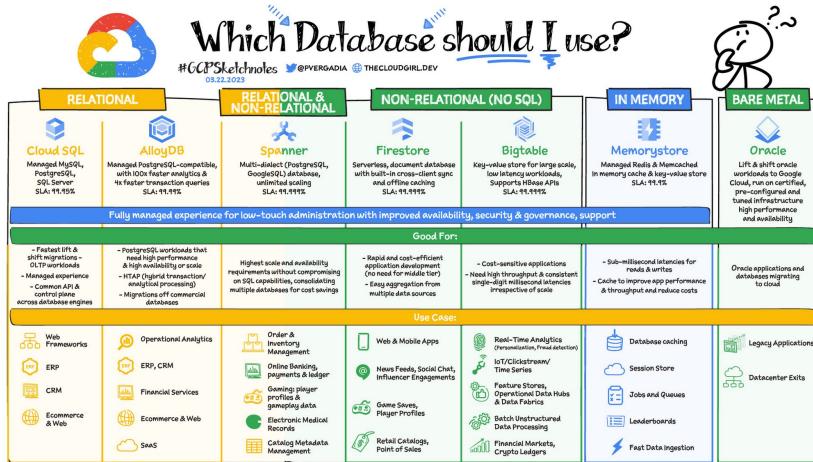


Google Cloud

Google Cloud has a wide range of managed storage and database options. Knowing the characteristics of each and being able to select a suitable solution is vital as an architect. From a high level, the services range from in-memory and relational through to data warehouse options. These services are fully managed, scalable, and backed by industry-leading SLAs.

Making a decision on which storage solution is right for your requirements is a balance of a number of characteristics, including: type of data, scale, durability, availability, and location requirements. We discuss ways in which you can make the best decision based on your requirements.

Database Options



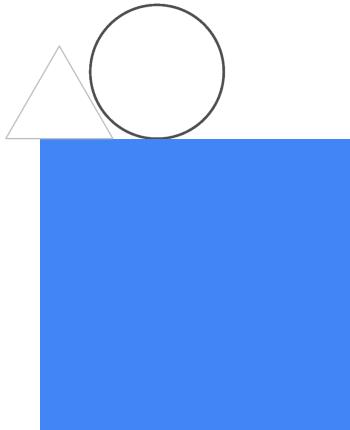
[Your Google Cloud database options, explained](#)

Google Cloud

Google Cloud

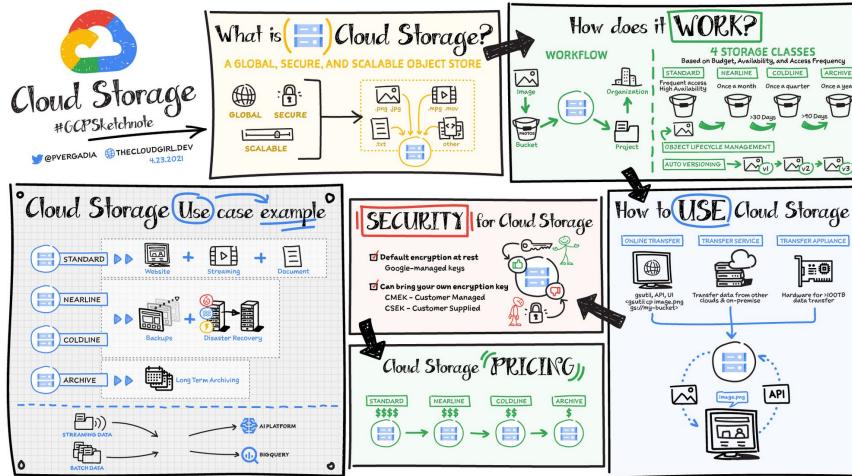
Services Overview

- Compute options
- Database options
- **Object/BLOB storage**



Google Cloud

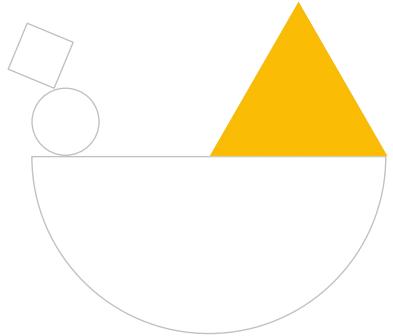
Cloud Storage - Object/BLOB storage



[All you need to know about Cloud Storage](#)

Google Cloud

Identity and Access Management (IAM) Overview



Google Cloud

Guide: Identity and Access Management

Topics covered

- Google Cloud Resource Hierarchy
- Identity and Access Management (IAM)
- Service Accounts

Identity and Access Management (IAM)

Resources and Access in the Cloud

- Complete the "Resources and Access in the Cloud" section found in this course: [Google Cloud Fundamentals: Core Infrastructure](#)
 - This section covers
 - Google Cloud Resource Hierarchy
 - Identity and Access Management (IAM)
 - Service Accounts
 - Cloud Identity
 - Note: There is NO need to do the hands-on lab "Getting Started with Cloud Marketplace"

Access Control 101

- In this video, you learn about :
 - How to prevent unauthorized access to Google Cloud resources
 - The resource hierarchy

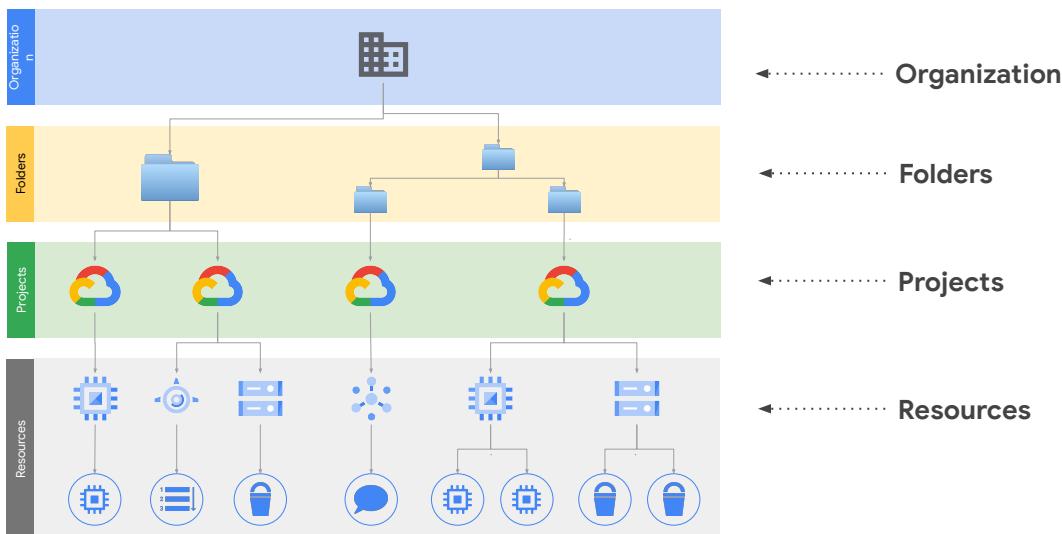


Identity and Access Management
(IAM)

Google Cloud

Google Cloud Resource Hierarchy

Proprietary + Confidential



Google Cloud

Resource Manager

<https://cloud.google.com/resource-manager>

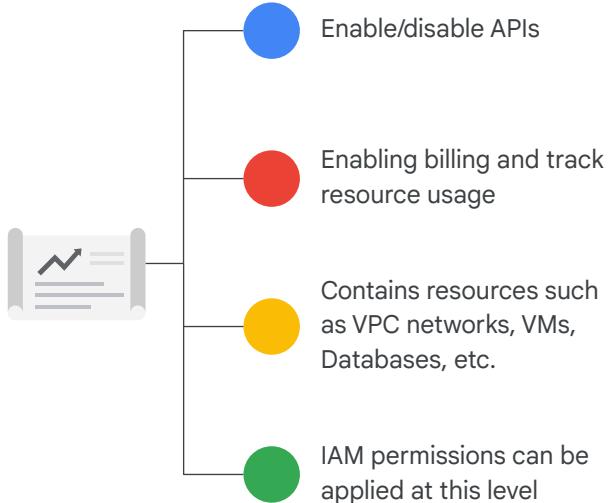
Resource hierarchy

<https://cloud.google.com/resource-manager/docs/cloud-platform-resource-hierarchy>

Resource hierarchy and billing:

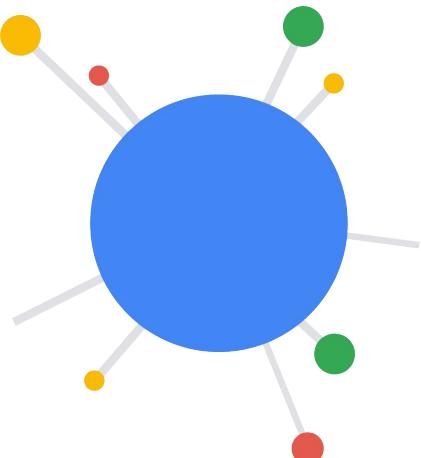
<https://cloud.google.com/billing/docs/concepts>

All products & services are associated with a project



Resources

- Resources are anything created when using services
- All resources are associated with a project
- Examples of resources are:
 - Virtual machines
 - Persistent disk
 - Cloud Storage buckets
 - BigQuery datasets and tables
 - Spanner databases
 - Kubernetes Engine clusters
- Must enable service-specific APIs before creating resources within a project



Google Cloud

All resources must be associated with a project, so proper billing can be implemented.

Examples of resources include:

- Virtual machines
- Disks
- Cloud Storage buckets
- BigQuery datasets and tables
- Spanner databases
- Kubernetes Engine clusters

These are just a small sample.

Enabling APIs - Console & Command Line

gcloud services enable pubsub.googleapis.com

Google Cloud

API Explorer:

<https://developers.google.com/apis-explorer>

Getting started:

<https://cloud.google.com/apis/docs/getting-started>

Client Libraries

<https://cloud.google.com/apis/docs/client-libraries-explained>

<https://cloud.google.com/apis/docs/cloud-client-libraries>

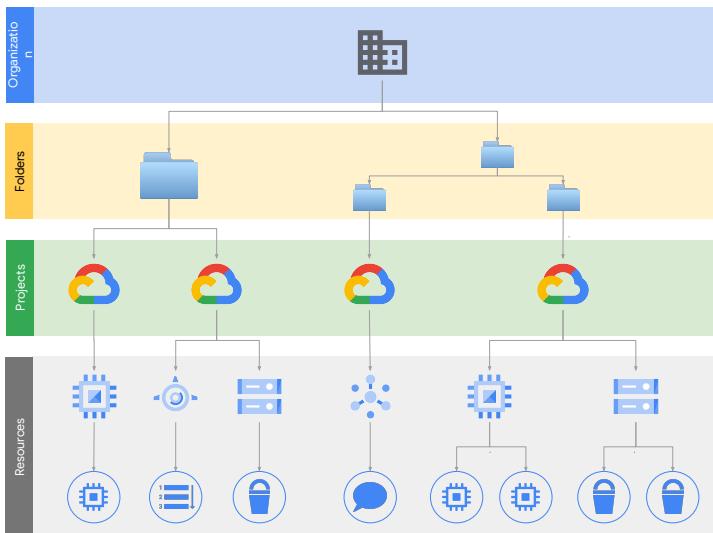
Enabling and Disabling Services:

<https://cloud.google.com/service-management/enable-disable>

Lists the services that are enabled or available to be enabled by a project:

<https://cloud.google.com/sdk/gcloud/reference/services/list>

Hierarchy inheritance



Next discussion:
Identity and
Access
Management

IAM grants access to principals

Accounts that exist externally to Google Cloud can be added as principals in Google Cloud

- Those accounts are limited to
 - Google Account - e.g., gmail
 - Google group - named collection of Google Accounts
 - Google Workspace account
 - Collection of users from organizations that use Google Workspace
 - Cloud Identity domain
 - Collection of users who are associated with an organization's internet domain name, such as example.com

Principals

 Google Account userid@gmail.com	 Service Account 12345678@cloudservices. gserviceaccount.com
 Google Group groupname@googlegroups .com	 Cloud Identity or Google Workspace Domain alias@example.com

Also [allUsers](#) and [allAuthenticatedUsers](#)

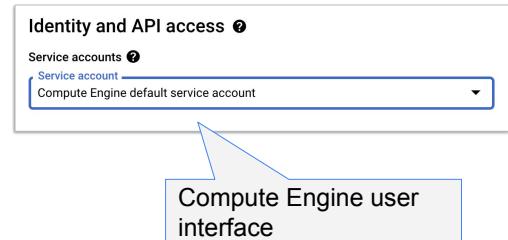
Service Accounts are the only accounts created within Google Cloud

- Created specifically to provide IAM for application or compute workloads

Google Cloud

Service accounts are identities for Google Cloud services*

- Special type of account intended to represent a non-human user that needs to authenticate and be authorized to access data
 - Are created *within* Google Cloud, unlike other principals
- Attached to VMs or other services
 - Applications can perform only those actions allowed by the roles given to the service account
- Also used by external applications to authenticate to Google Cloud to access Google Cloud resources



[Understanding Service Accounts](#)

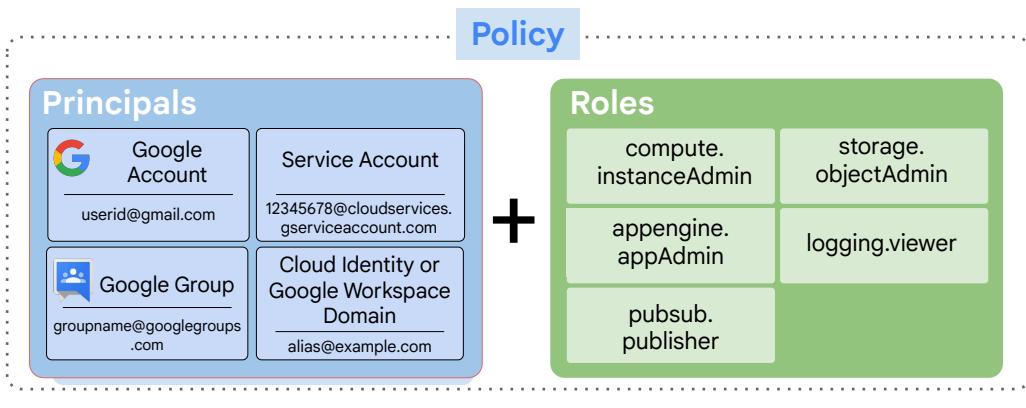
*Service accounts are covered in more detail in Module 2

Google Cloud

Understanding service accounts:

<https://cloud.google.com/iam/docs/service-accounts>

To grant access, add principals and assign them one or more roles



Google Cloud

Google Cloud uses roles as a method to distribute permissions.

Principals are assigned one or more roles. The roles a principal is assigned will determine the permissions of a member.

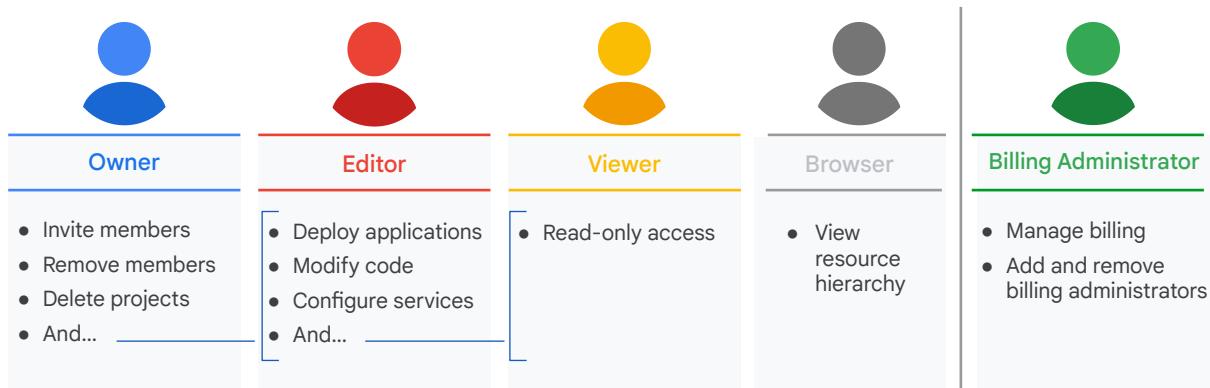
A role is a list of permissions organized by a service.

This list of permissions correlate with Google Cloud API calls and are aligned based on job functions.

Overview of role types

- Basic
 - Provide very broad permissions
 - In general, not best practice to use them
- Pre-defined
 - Provides fine-grained permissions for the various Google Cloud services
- Custom
 - Create custom, fine-grained roles
 - Use only when necessary

Basic roles offer fixed, coarse-grained levels of access that are broad in scope



Google Cloud

IAM basic and predefined roles reference

<https://cloud.google.com/iam/docs/understanding-roles>

IAM basic roles offer fixed, coarse-grained levels of access.

The basic roles are the Owner, Editor, Viewer, Browser and Billing Administrator roles.

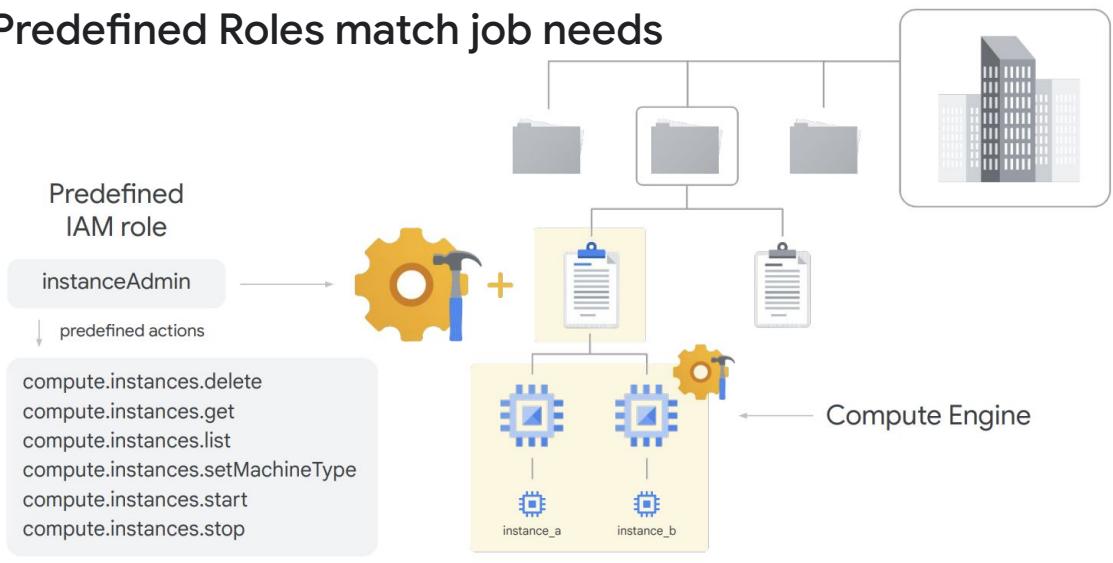
- The owner has full administrative access. This includes the ability to add and remove members and delete projects.
- The editor role has modify and delete access. This allows a developer to deploy applications and modify or configure its resources.
- The viewer role has read-only access
- The browser role can view only the resource hierarchy

The Owner role includes the permissions of the Editor role, and the Editor role includes the permissions of the Viewer role.

There is also a billing administrator role to manage billing and add or remove administrators without the right to change the resources in the project.

Each project can have multiple owners, editors, viewers, and billing administrators.

Predefined Roles match job needs



Google Cloud

Choosing the correct predefined role:

<https://cloud.google.com/iam/docs/choose-predefined-roles>

A role is a list of permissions organized by a service.

This list of permissions correlate with Google Cloud API calls and are aligned based on job functions.

The example shown are some of the permissions for Compute Engine Instance Admin

Custom Roles

- Roles that you create
 - Fine-grained control over permissions
- Can be based on predefined roles
 - Add /remove permissions as needed
- Custom roles add operational overhead
 - You must maintain the permissions
- Applied at the project or organization level

3 assigned permissions		
	Permission ↑	Status
<input checked="" type="checkbox"/>	compute.instances.create	Supported
<input checked="" type="checkbox"/>	compute.instances.delete	Supported
<input checked="" type="checkbox"/>	compute.instances.list	Supported

Google Cloud

Understanding custom roles:

<https://cloud.google.com/iam/docs/understanding-custom-roles>

Custom roles are an option when there is not a predefined role available that provides the permissions you would like to group.

Custom roles give you fine-grained control over permissions by allowing you to add any permission you like to a role you create.

You can create custom roles by copying and modifying a predefined role or you can create one from scratch.

Custom roles add operational overhead, as you are responsible for maintaining the permissions of a custom role.

Custom roles can only be applied either to project level or organization level. They can't be applied to the folder level.

Assigning roles

- **Best practice:** Avoid the basic roles and use predefined roles
- Predefined roles exist for each Google Cloud service
 - Makes it easy to follow the “principle of least privilege”
 - E.g., Don’t give someone **Storage Admin** if they need only **Storage Viewer**
- Predefined roles are maintained by Google
 - Roles are updated when new capabilities are added to a service

Add members, roles to "Dave's Cloud Project" project

Enter one or more members below. Then select a role for these members to access to your resources. Multiple roles allowed. [Learn more](#)

New members
steve@lochnetsystems.com 

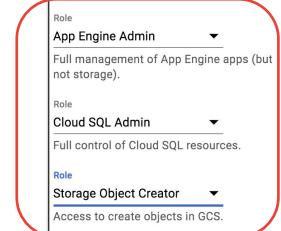
Role
App Engine Admin 
Full management of App Engine apps (but not storage).

Role
Cloud SQL Admin 
Full control of Cloud SQL resources.

Role
Storage Object Creator 
Access to create objects in GCS.

[+ ADD ANOTHER ROLE](#)

SAVE **CANCEL**



Google Cloud

Granting roles using client libraries

Most of things you can do with the Cloud Console or the CLI can also be done via client libraries

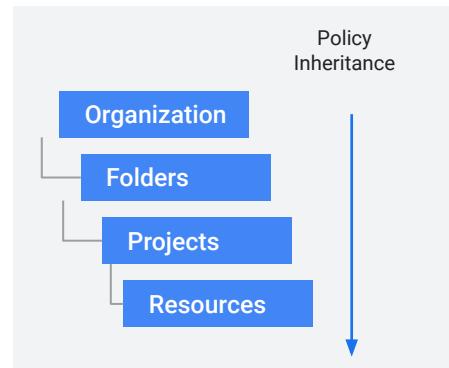
[Grant roles using client libraries](#)

```
public class Quickstart {  
  
    public static void main(String[] args) {  
        // TODO: Replace with your project ID in the form "projects/your-project-id".  
        String projectId = "your-project";  
        // TODO: Replace with the ID of your member in the form "user:member@example.com"  
        String member = "your-member";  
        // The role to be granted.  
        String role = "roles/logging.logWriter";  
  
        // Initializes the Cloud Resource Manager service.  
        CloudResourceManager crmService = null;  
        try {  
            crmService = initializeService();  
        } catch (IOException | GeneralSecurityException e) {  
            System.out.println("Unable to initialize service: " + e.getMessage() + e.getStackTrace());  
        }  
  
        // Grants your member the "Log writer" role for your project.  
        addBinding(crmService, projectId, member, role);  
  
        // Get the project's policy and print all members with the "Log Writer" role  
        Policy policy = getPolicy(crmService, projectId);  
        Binding binding = null;  
        List<Binding> bindings = policy.getBindings();  
        for (Binding b : bindings) {  
            if (b.getRole().equals(role)) {  
                binding = b;  
                break;  
            }  
        }
```

Google Cloud

Other IAM best practices

- Grant roles to groups rather than individuals
 - For example
 - Project-Managers group may need “Viewer” at a folder level
 - Developers-group may need “Compute Instance Admin” at a project level
 - One person could be both a project manager and a developer and be a member of both groups
 - Could view all resources in the projects within the folder
 - Could create VMs only in one project
- Consider hierarchy inheritance when assigning roles



Google Cloud

You can set Identity and Access Management (IAM) policies at different levels of the resource hierarchy. Resources inherit the policies of the parent resource. The effective policy for a resource is the union of the policy set at that resource and the policy inherited from its parent. Some of the best practices for applying IAM are listed below:

It is best to select policies at the organization and project level. As new resources are added, they will automatically inherit the policies of their parent. This makes maintenance of policies easier and helps keep consistency. If adding a policy on a child resource, make sure you are aware of the access granted by the parent and the effect of inheritance.

The principle of least privilege should always be applied, giving the minimal amount of access to roles and making sure to minimize the use of owner and editor roles.

The predefined roles have been designed to cover all use cases for resources. The need for custom roles should therefore be an exception.

For more details, see

<https://cloud.google.com/iam/docs/resource-hierarchy-access-control>

Developer authentication and authorization

- Developers need personal credentials added to Google Cloud in order to
 - Access projects
 - Create/manage resources
- Developer credentials are usually managed by a Google Cloud admin
 - Roles given to developers depends on the specific needs, for example
 - Cloud Storage Admin: Add/delete storage buckets and files
 - Cloud Storage Viewer: View only access to files in one or more buckets
 - Compute Instance Admin: Add/delete Compute Instances instances
 - Cloud Run Admin: Fully manage all Cloud Run services
 - Or others



Cloud IAM

Important concept #1: Principle of least privilege

- Users should only be able to do the tasks that are required by their jobs
- This also applies to Google Cloud compute and applications accessing Google Cloud resources
- Use IAM to enforce this principle.
- Assign IAM roles to users, groups and service accounts to restrict what they can do.

Google Cloud

Least privilege is a practice of granting a user only the minimal set of permissions required to perform a duty. IAM roles and permissions are fine-grained and support the practice of least privilege. The predefined IAM roles are designed to fit the needs of the most common roles. It is highly likely that there is a predefined role for the significant majority of requirements. In those cases where there is not, it is possible to create a custom role and assign that role the privileges required.

Important concept #2: Separation of duties

Examples

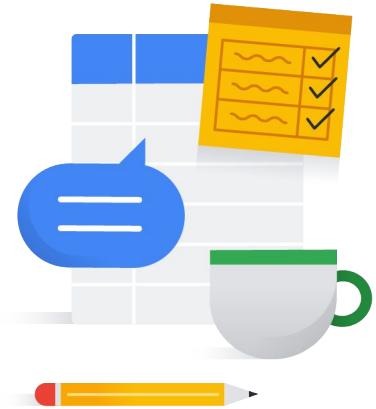
- No one person can change or delete data without being detected
- No one person is in charge of designing, implementing, and reporting on sensitive systems
- The people who write the code shouldn't deploy the code; those who deploy the code shouldn't be able to change it

Implementation Suggestions

- Use multiple projects to separate duties
- Give different people/groups different rights in different projects
- Use folders to help organize projects

Program issues or concerns?

- For questions regarding Cloud Skills Boost access, Qwiklabs issues, voucher queries, etc.
 - cloud-partner-training@google.com
- For questions regarding Partner Advantage access
 - <https://support.google.com/googlecloud/topic/9198654>



Google Cloud

