



# Professional Cloud Architect

Partner Certification  
Academy



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## Google confidential & proprietary

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- Do **not** share or otherwise distribute the information in this presentation with anyone **inside** or **outside** of your organization.



Thank you!

# Session logistics



## Questions

In Google Meet, click the raise hand button or add your question to the Q&A section.

Answers may be deferred until the end of the session.



## Recording

The session is **not** recorded.



## Slide availability

These slides are available in the Student Lecture section of your Qwiklabs classroom.

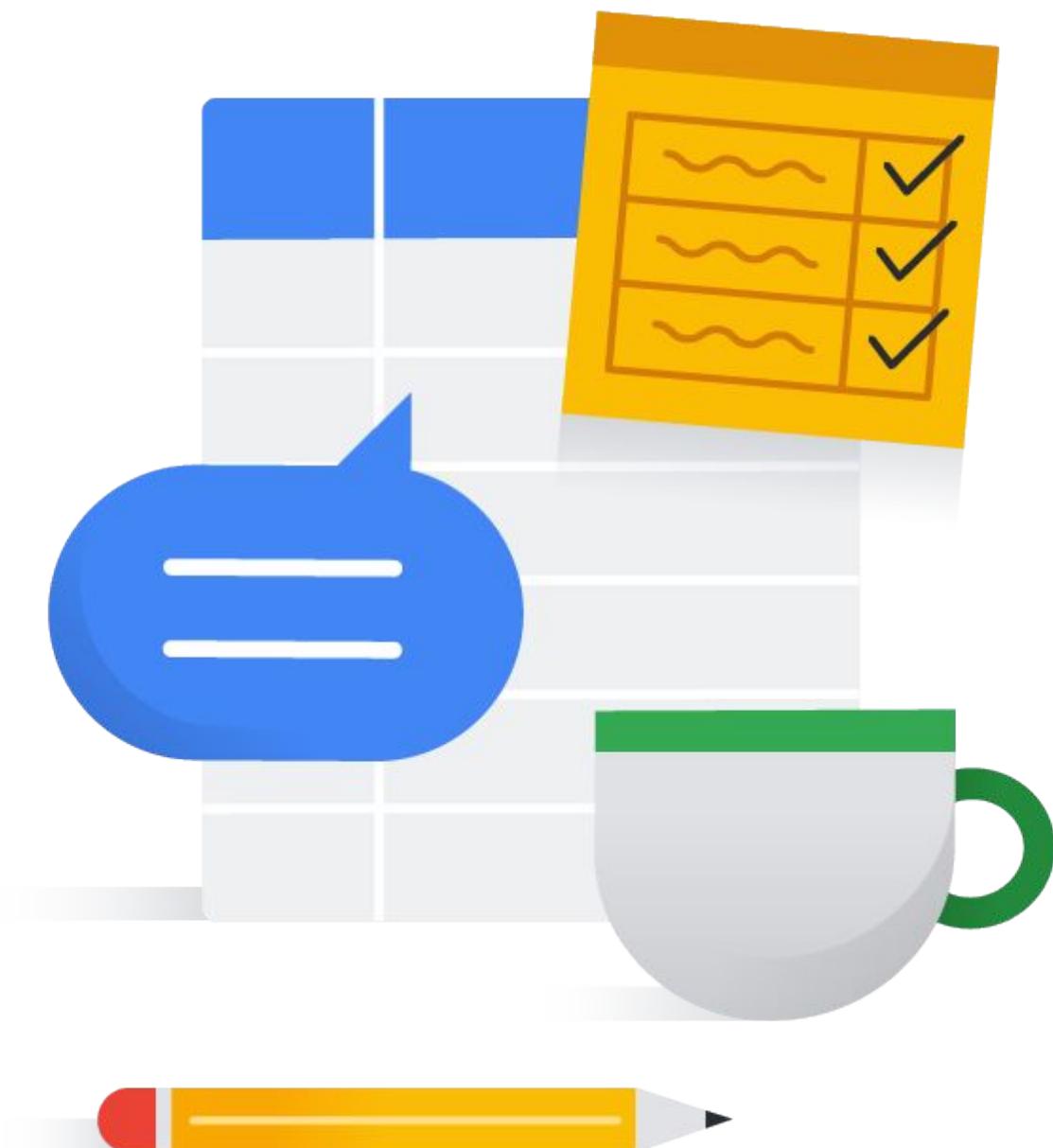


## Chat

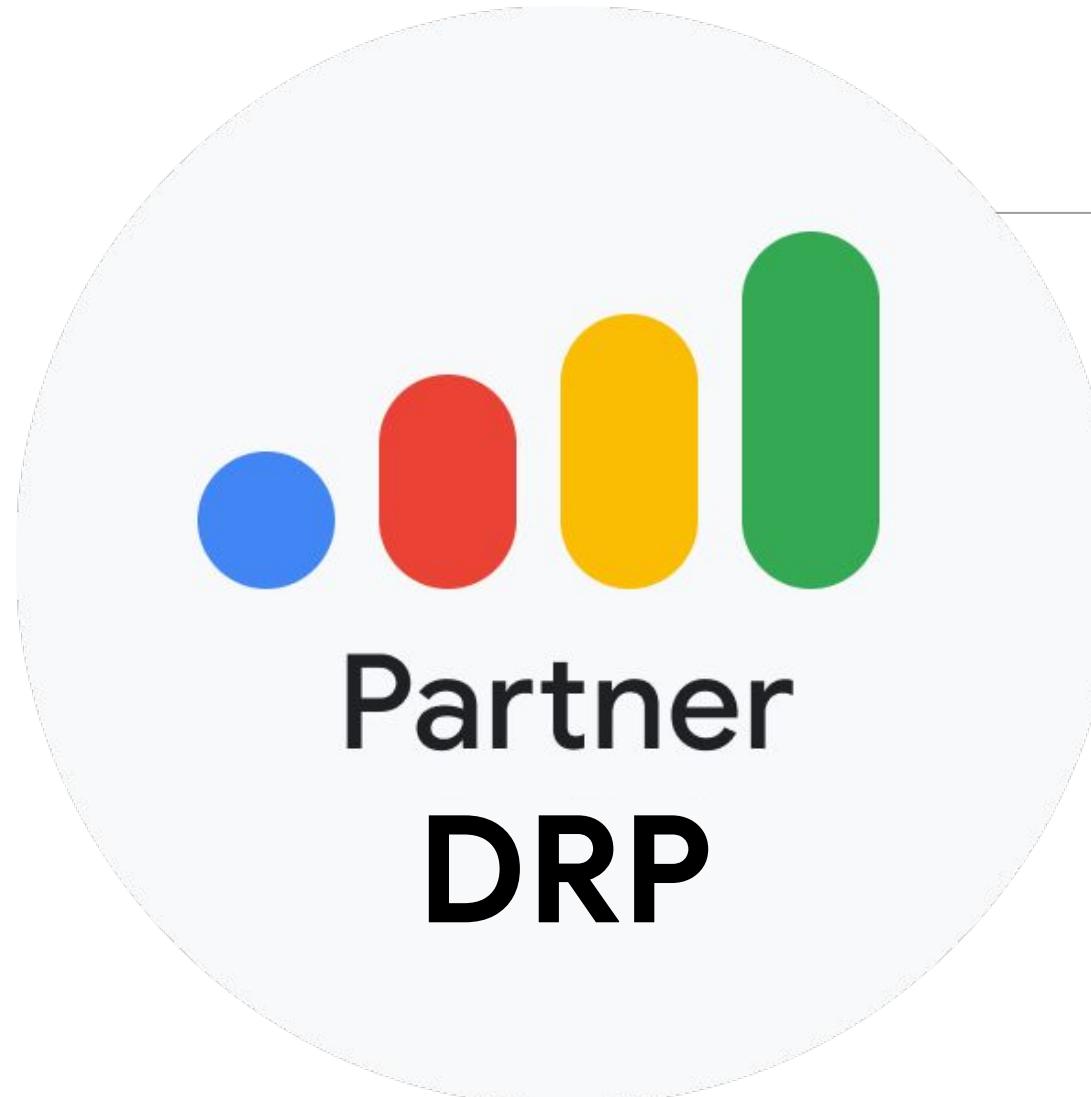
As Google Meet does not have persistent chat, you will lose chat history if you get disconnected. Save URLs as they appear.

# Program issues or concerns?

- Problems with **accessing** Cloud Skills Boost for Partners
  - [partner-training@google.com](mailto:partner-training@google.com)
- Problems with **a lab** (locked out, etc.)
  - [support@qwiklabs.com](mailto:support@qwiklabs.com)
- Problems with accessing Partner Advantage
  - <https://support.google.com/googlecloud/topic/9198654>



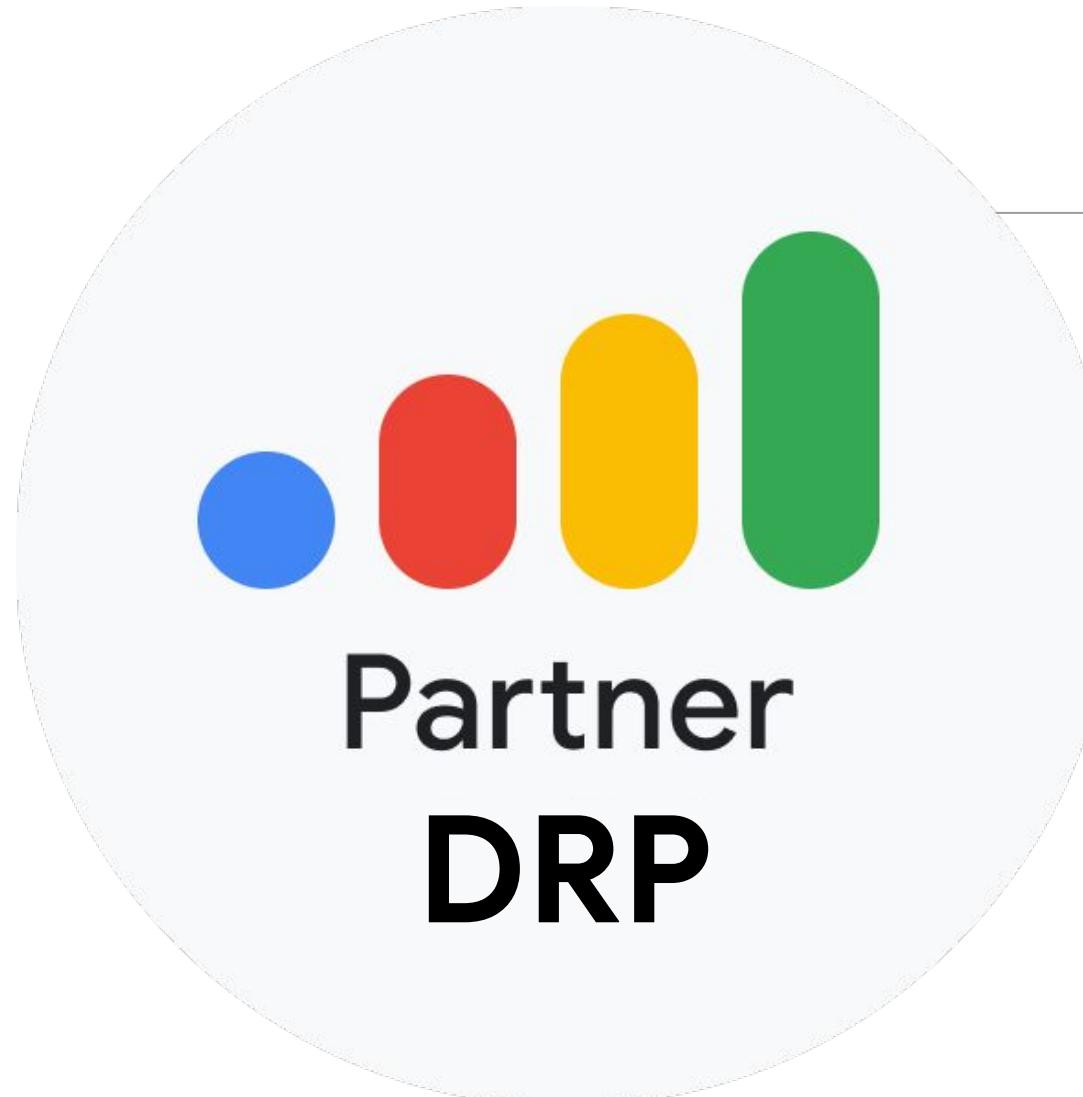
# Benchmark your skills with DRP



## Assess

**Partner proficiency and delivery capability**  
Benchmark partner individuals, and project teams  
and practices Google Cloud capabilities.

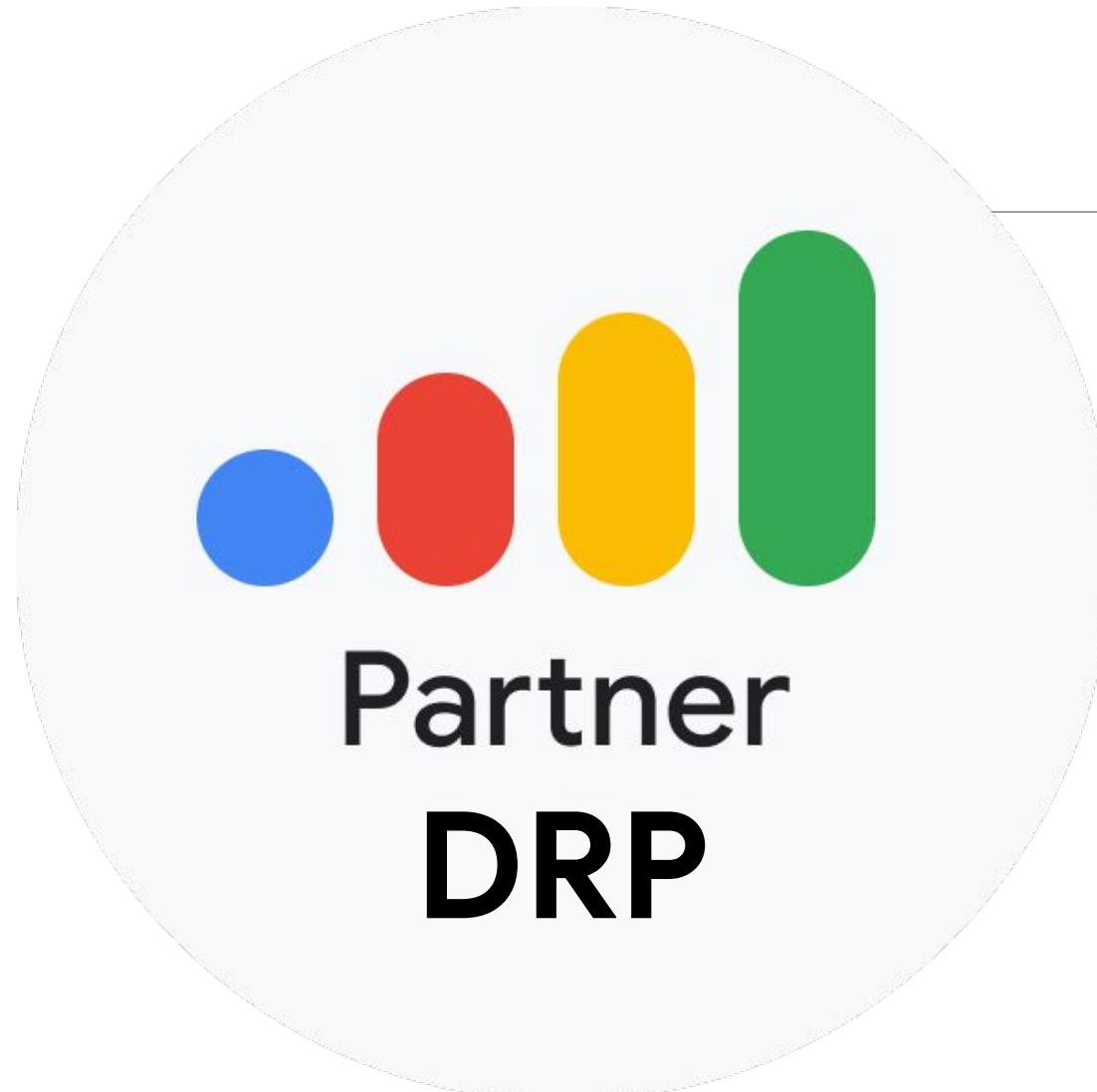
# Benchmark your skills with DRP



## Analyze

**Individual partner consultants' Google Cloud readiness**  
Showcase partner individuals Google Cloud knowledge, skills, and experience.

# Benchmark your skills with DRP

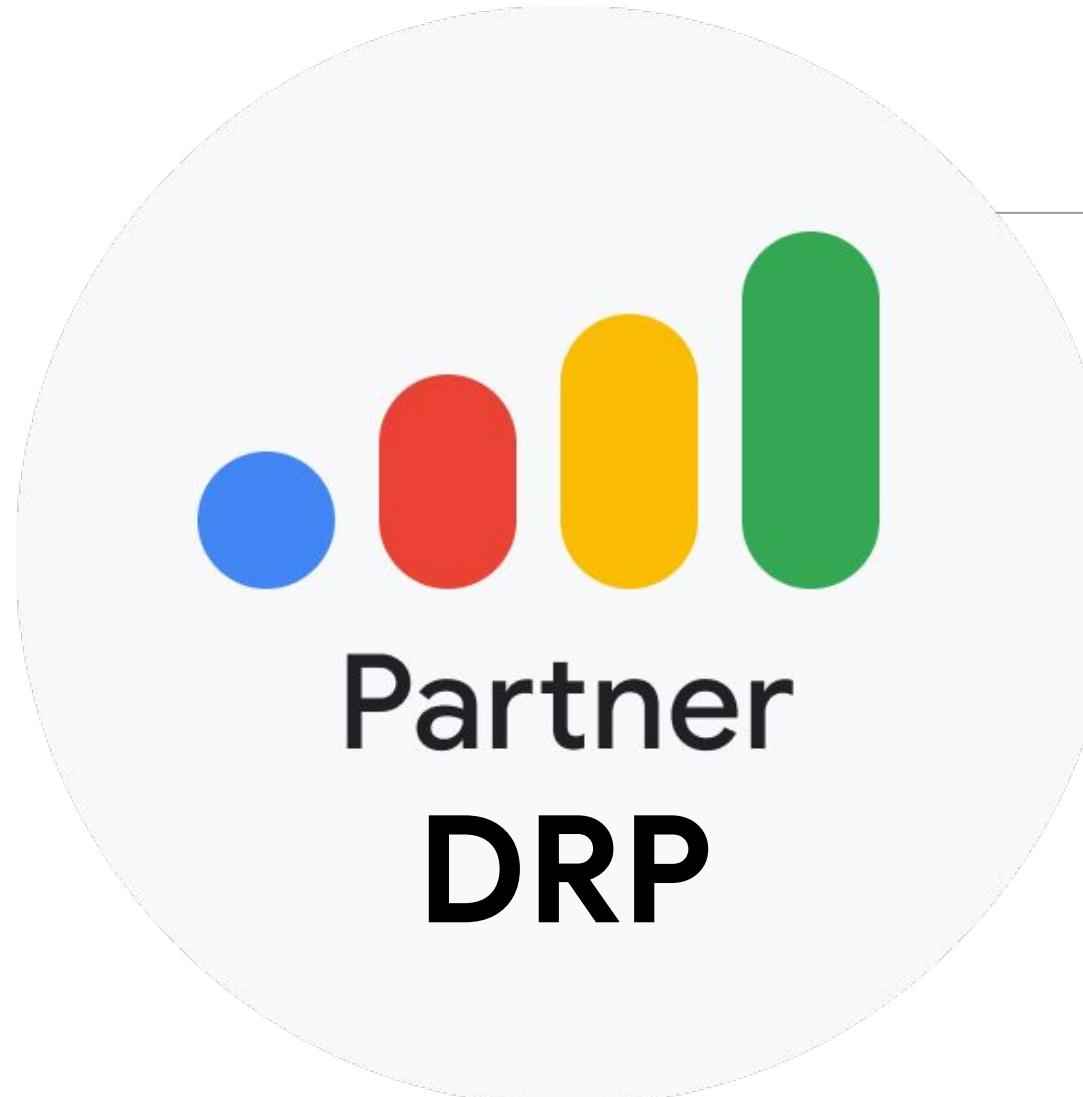


**Partner  
DRP**

**Advise**

**Google assurance for partner delivery**  
Packaged offerings to bridge specific capability gaps.

# Benchmark your skills with DRP



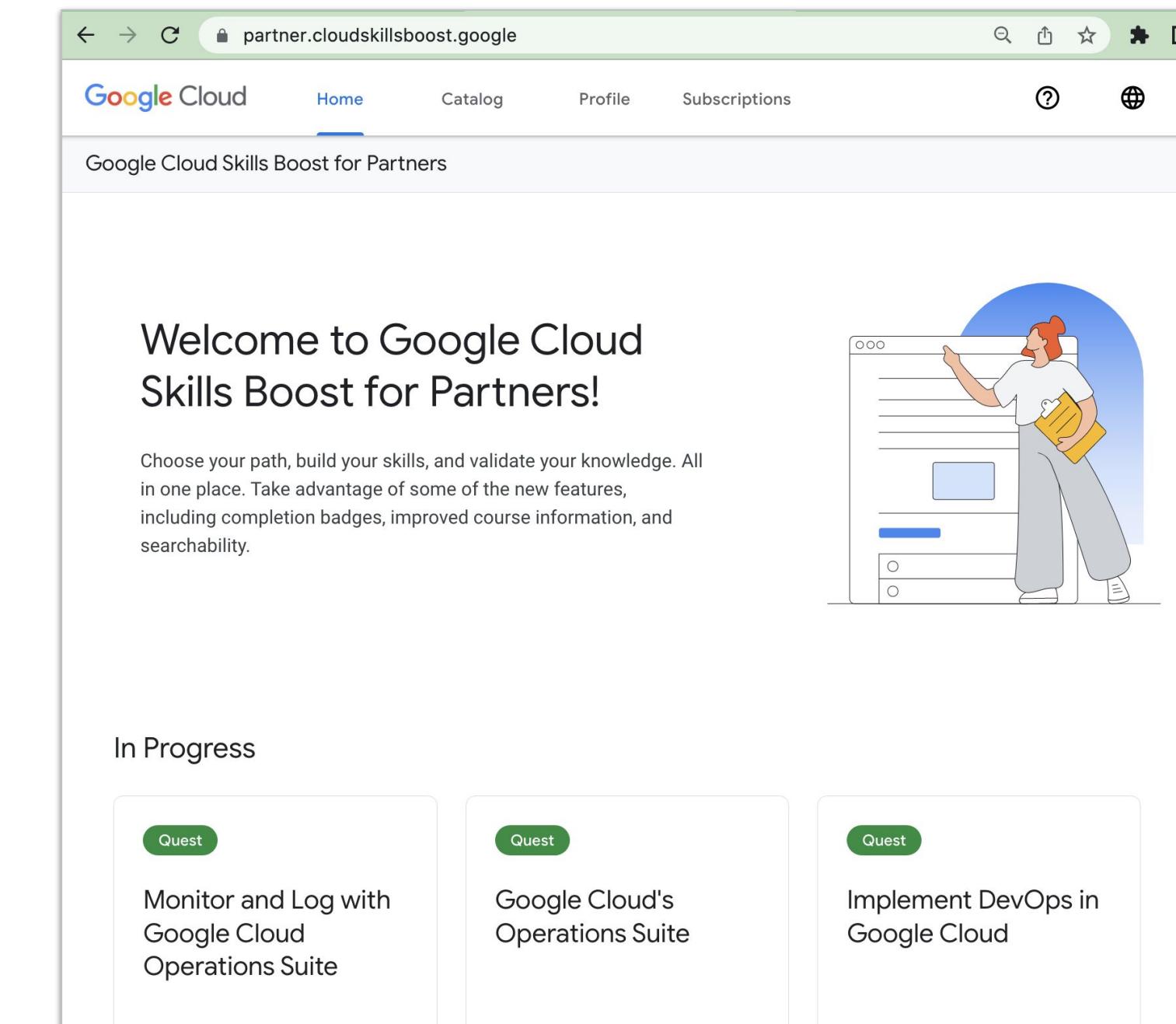
## Action

**Tailored L&D plan for account based enablement**  
Personalized learning & development recommendations  
per individual consultant.

# Google Cloud Skills Boost for Partners

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

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



# Google Cloud Partner Advantage

Welcome to the Partner Advantage portal

[LOGIN](#)

Register as a new partner portal user →

[Register for portal access](#)

To receive access to the new portal and its tools, you can now [register](#) as a user. Reach out to our support teams if you have additional questions about the registration process.

[About Partner Advantage](#)

Partner Advantage—created for and with partners—empowers partners with tools, technology and support so we can put customers first and move our businesses forward, together.

[Expand your opportunities](#)

Learn about our engagement models and select the one that best aligns to your business.

**Create login**

Create a login using your company email. Your organization must verify your request prior to granting you access.

<https://www.partneradvantage.google>

# Google Cloud Partner Advantage - Resources

01

## Google Cloud partner organizations

- Recent announcements
- Solutions/role-based training
- [Webinars](#)

02

## Certification

Complements the certification self-study material presented on Google Cloud Skills Boost for Partners.

03

## Helpful links

- [Getting started](#)
- [Join Partner Advantage](#)
- [Get access help](#)

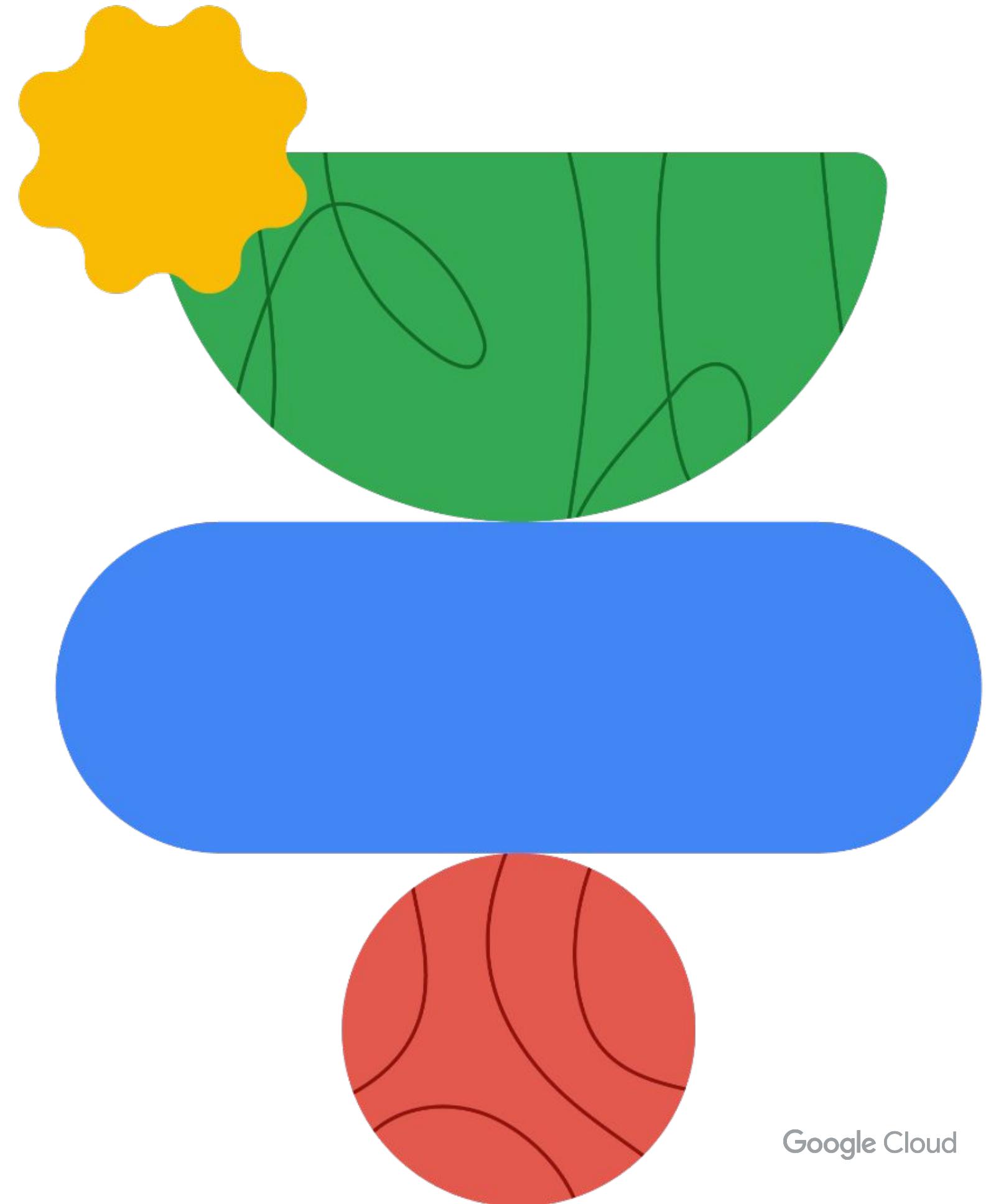


# Today's agenda



- 01 Program Overview
- 02 Accessing Course Content
- 03 Begin module 1 technical content review

# Partner Certification Academy Overview



# Partner Certification Academy

A differentiated learning experience for the busy professional. The goal of this program is to help you prepare for Google Cloud certification exams.

## Programs may include:

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

## Workshop sessions:

- Are **NOT** training sessions - that's the purpose of the on-demand content.
- Help you to 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

**Foundational**  
No cloud experience needed



Cloud Digital  
Leader



Associate  
Cloud  
Engineer



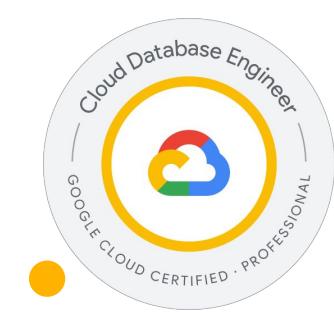
Professional  
Cloud  
Developer



Professional  
Cloud Network  
Engineer



Professional  
Cloud Security  
Engineer



Professional  
Cloud Database  
Engineer

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

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

# Professional Cloud Architect (PCA)

Professional Cloud Architects enable organizations to leverage Google Cloud technologies. With a thorough understanding of cloud architecture and Google Cloud, they design, develop, and manage robust, secure, scalable, highly available, and dynamic solutions to drive business objectives.

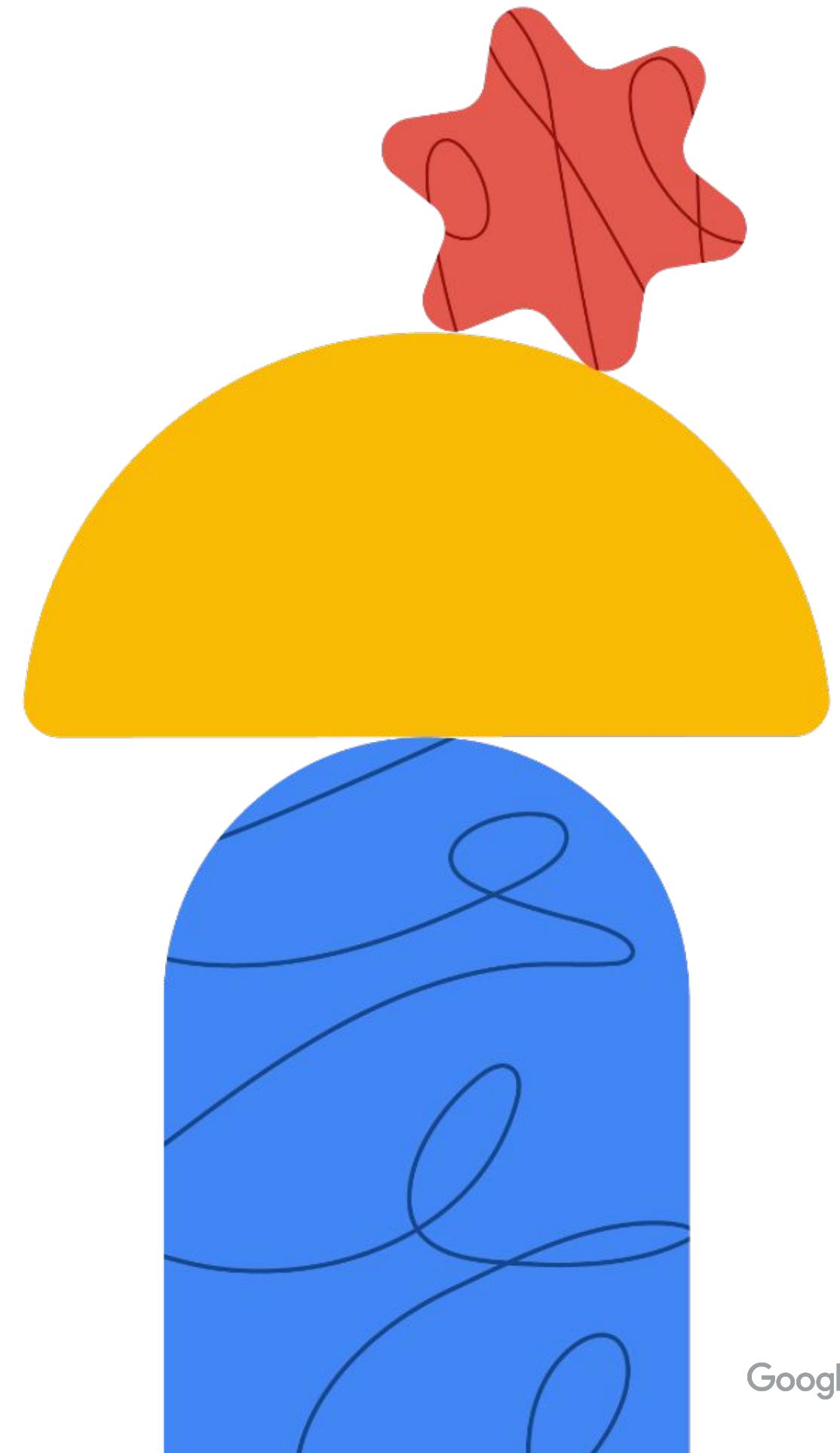
The Professional Cloud Architect certification exam assesses your ability to:

- ✓ Design and plan a cloud solution architecture
- ✓ Manage and provision the cloud solution infrastructure
- ✓ Design for security and compliance
- ✓ Analyze and optimize technical and business processes
- ✓ Manage implementations of cloud architecture
- ✓ Ensure solution and operations reliability



<https://cloud.google.com/certification/cloud-architect>

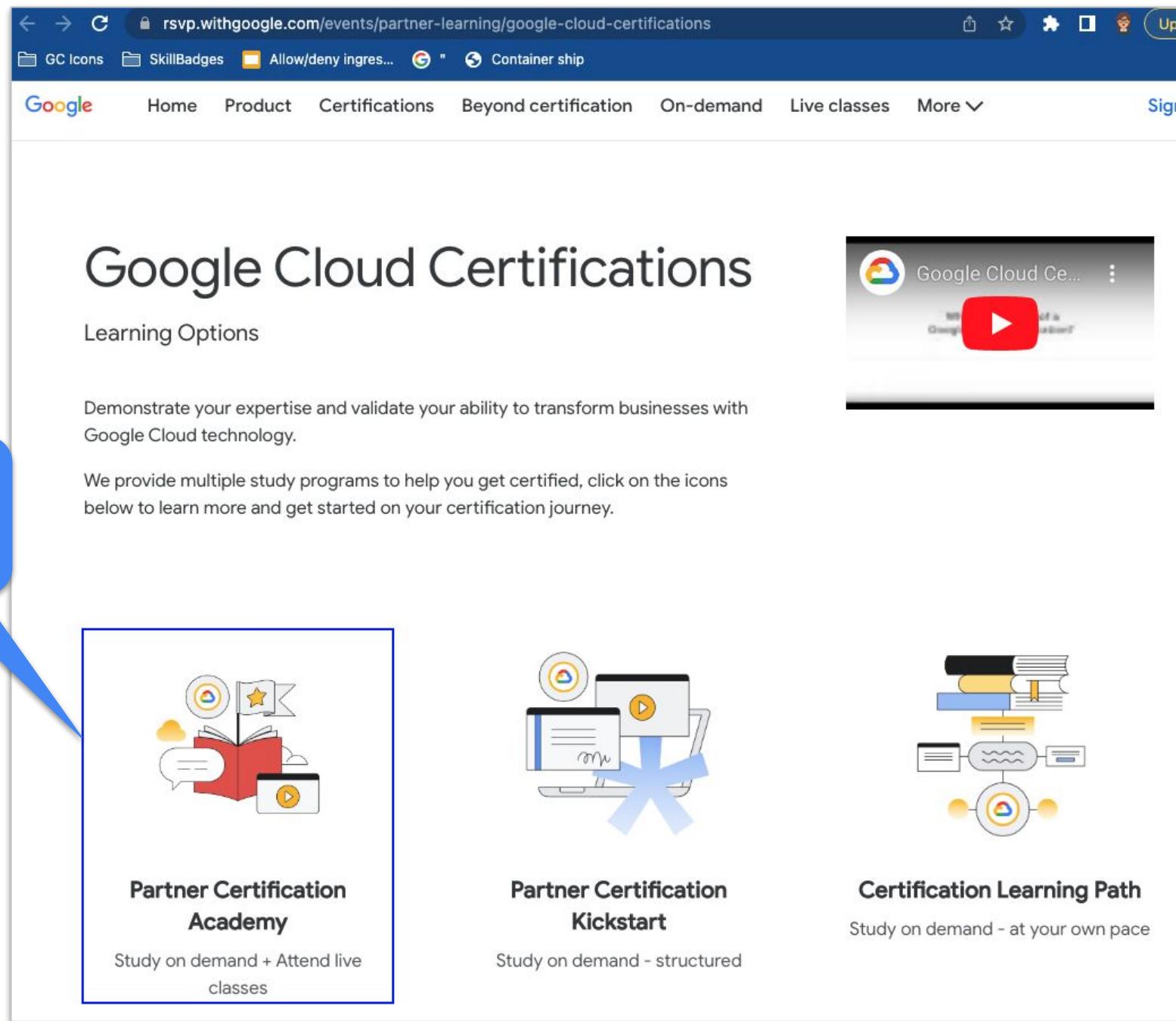
# Accessing Partner Certification Academy Content



Google Cloud

# Learning Path - Partner Certification Academy Website

Go to: <https://rsvp.withgoogle.com/events/partner-learning/google-cloud-certifications>



Google Cloud Certifications

Learning Options

Demonstrate your expertise and validate your ability to transform businesses with Google Cloud technology.

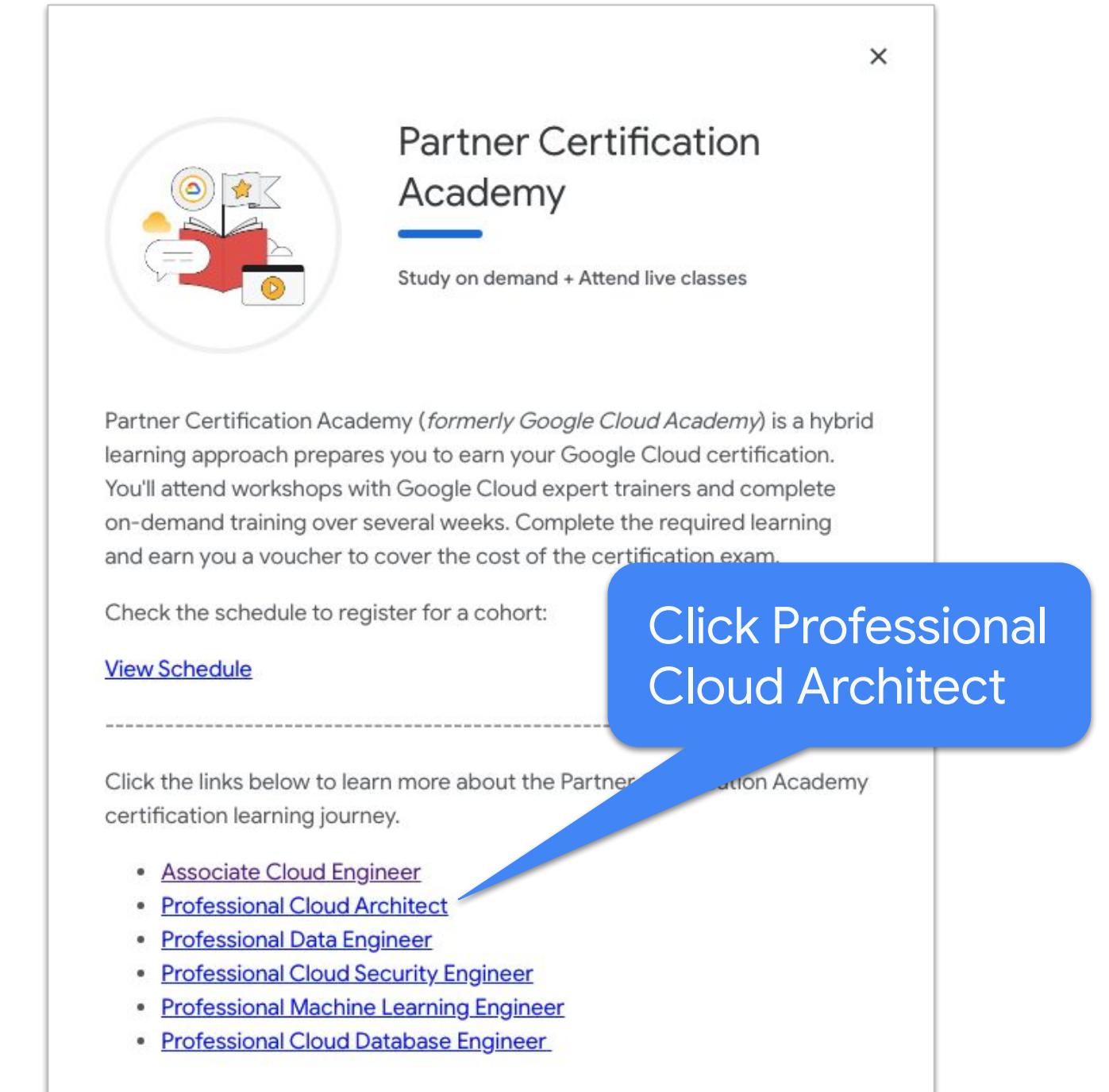
We provide multiple study programs to help you get certified, click on the icons below to learn more and get started on your certification journey.

**Partner Certification Academy**  
Study on demand + Attend live classes

**Partner Certification Kickstart**  
Study on demand - structured

**Certification Learning Path**  
Study on demand - at your own pace

Click here



**Partner Certification Academy**

Study on demand + Attend live classes

Partner Certification Academy (formerly Google Cloud Academy) is a hybrid learning approach prepares you to earn your Google Cloud certification. You'll attend workshops with Google Cloud expert trainers and complete on-demand training over several weeks. Complete the required learning and earn you a voucher to cover the cost of the certification exam.

Check the schedule to register for a cohort:

[View Schedule](#)

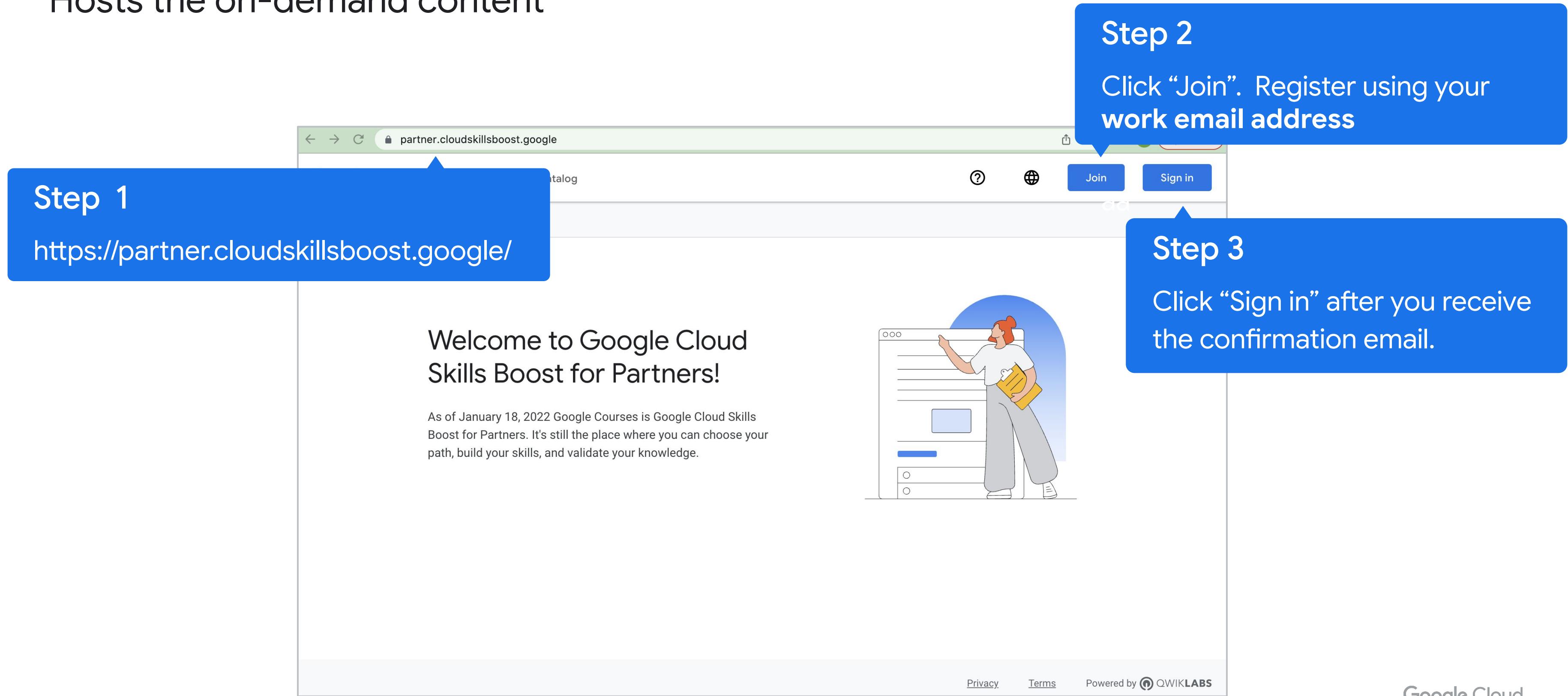
Click the links below to learn more about the Partner Certification Academy certification learning journey.

- [Associate Cloud Engineer](#)
- [Professional Cloud Architect](#)
- [Professional Data Engineer](#)
- [Professional Cloud Security Engineer](#)
- [Professional Machine Learning Engineer](#)
- [Professional Cloud Database Engineer](#)

Click Professional Cloud Architect

# Partner Cloud Skills Boost website

Hosts the on-demand content



**Step 1**  
<https://partner.cloudskillsboost.google/>

Welcome to Google Cloud Skills Boost for Partners!

As of January 18, 2022 Google Courses is Google Cloud Skills Boost for Partners. It's still the place where you can choose your path, build your skills, and validate your knowledge.

**Step 2**  
Click "Join". Register using your **work email address**

**Step 3**  
Click "Sign in" after you receive the confirmation email.

Privacy   Terms   Powered by  QWIKLABS

Google Cloud

# Creating an account

The screenshot shows the 'Create account' page for Google Cloud. At the top is the Google Cloud logo. Below it is a 'Create account' button. A blue speech bubble on the left says 'Important: Enter your work email address' with an arrow pointing to the 'Email' input field. Another blue speech bubble on the right says 'Click “Create account”. Wait a moment and the screen will refresh.' with an arrow pointing to the 'Create account' button at the bottom.

Google Cloud

Create account

G Sign in with Google

or

\* First name \_\_\_\_\_ \* Last name \_\_\_\_\_

\* Email \_\_\_\_\_

\* Company \_\_\_\_\_

\* Password \_\_\_\_\_ \* Password confirmation \_\_\_\_\_

Send me occasional product updates, announcements, and offers.

I'm not a robot reCAPTCHA Privacy - Terms

By joining you agree to Qwiklabs' [Terms of Service](#) and [Privacy Policy](#).

Sign in instead **Create account**

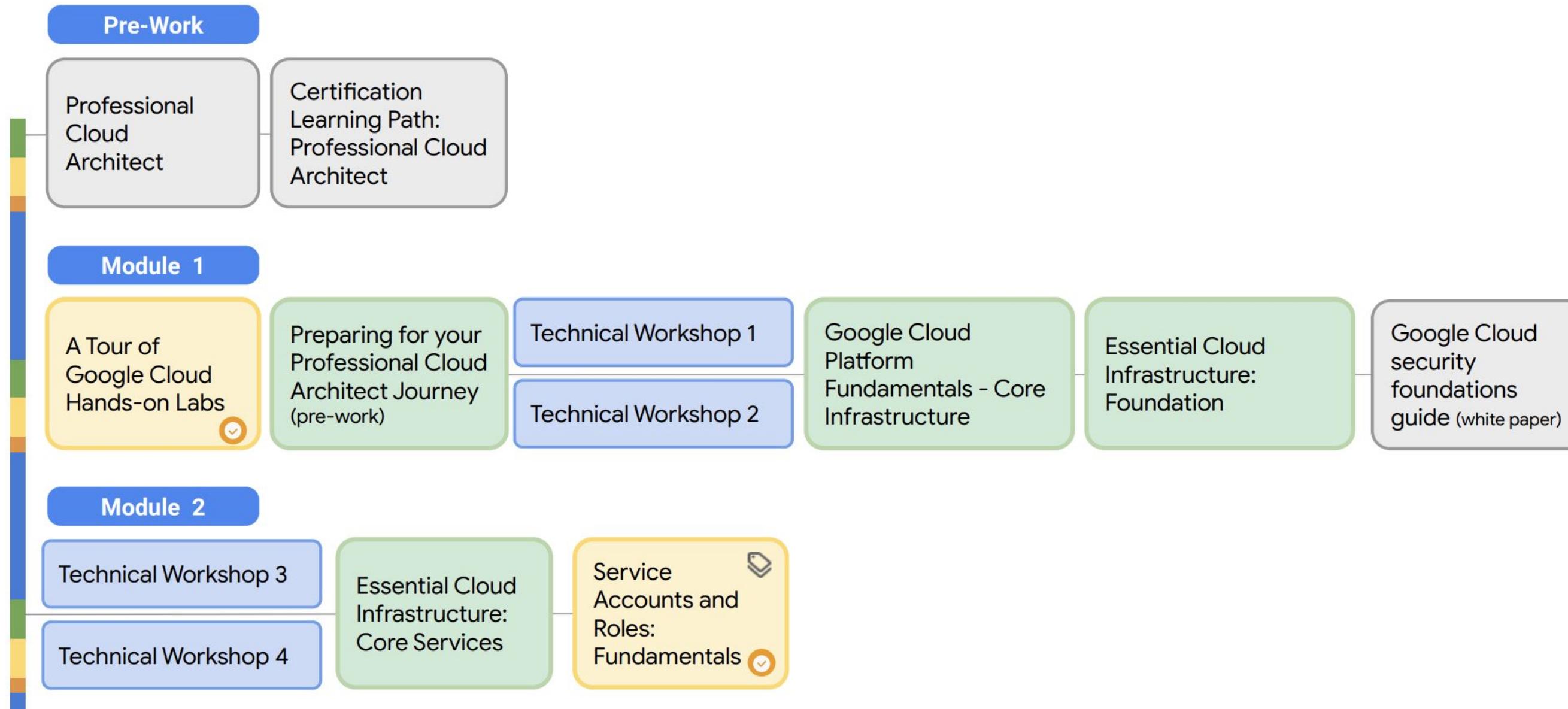


## PARTNER CERTIFICATION ACADEMY

# Professional Cloud Architect

[Click to register](#)

 On-demand Course	 Resource
 Hands-on Skill Badge	 Live Virtual Workshop
 Hands-on Lab	 required to earn exam voucher





## PARTNER CERTIFICATION ACADEMY

# Professional Cloud Architect

- |  |                      |  |                               |
|--|----------------------|--|-------------------------------|
|  | On-demand Course     |  | Resource                      |
|  | Hands-on Skill Badge |  | Live Virtual Workshop         |
|  | Hands-on Lab         |  | required to earn exam voucher |

[Click to register](#)

**Module 3**

Technical Workshop 5

Elastic Google Cloud Infrastructure: Scaling and Automation

HTTP Load Balancer with Cloud Armor

Create an Internal Load Balancer

Network Tiers - Optimizing Network Spend

Perform Foundational Infrastructure Tasks in Google Cloud

Create and Manage Cloud Resources

Technical Workshop 6

Technical Workshop 7

Getting Started with Google Kubernetes Engine

Setting up a Private Kubernetes Cluster

Optimize Costs for Google Kubernetes Engine

Deploy and Manage Cloud Environments with Google Cloud

Technical Workshop 8

Technical Workshop 9

Reliable Google Cloud Infrastructure: Design and Process

Getting Started with Cloud KMS

User Authentication: Identity-Aware Proxy

Securing Virtual Machines using Beyond Corp Enterprise

Set Up and Configure a Cloud Environment in Google Cloud

Automating Infrastructure on Google Cloud with Terraform

Technical Workshop 10

**Module 6**

Logging, Monitoring, and Observability in Google Cloud

Technical Workshop 11

Exam Readiness Workshop

Cloud Architecture: Design, Implement, and Manage

Reporting Application Metrics into Cloud Monitoring

Monitoring Multiple Projects with Cloud Monitoring

Click on a gray, gold or green box to be taken to Partner Cloud Skills Boost

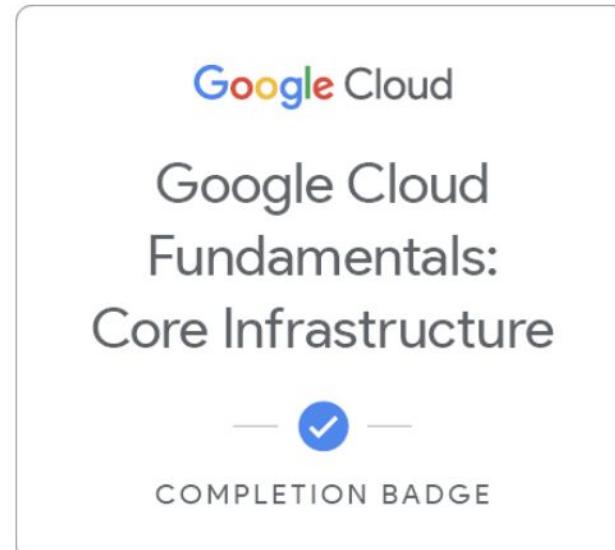
# Enroll in a course, watch the videos and do the labs

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 'Enrol' in this course

# Accessing PDFs in Partner Skills Boost

Instructor slide decks and Associate Cloud Engineer guides

The screenshot shows the Google Cloud Partner Skills Boost interface. At the top, there's a navigation bar with 'Google Cloud' logo, 'Home' (which is selected), 'Catalog', 'Profile', and 'Subscriptions'. Below the navigation is a blue success message: 'Welcome! You have signed up successfully.' On the left, there's a sidebar with the heading 'Jumpstart your cloud career' and a note about temporary credentials. A large blue callout box with white text says 'Click the purple box'. Below it, there's a section for 'In Progress' courses, showing a thumbnail of a sunset over clouds and course details: 'SCHEDULED COURSE [PLS] Certification Academy - PCA', 'Feb 9, 2023 10:00AM EST', and 'USA'. On the right, the main content area is titled '[PLS] Certification Academy - PCA'. It shows two tabs: 'Labs' (selected) and 'Lecture Notes'. A blue callout box points to these tabs with the text 'Shown two tabs: • Labs • Lecture notes'. To the right of the tabs, there's a brief description of the course: 'Session Partner Learning Services help students prepare for the Google Cloud Architect certification.' Below this, there are sections for 'Date' (from 'Thursday, February 9, 2023 9:00AM CST' to 'Thursday, March 23, 2023 9:00AM CDT'), 'Location' ('USA'), 'Instructor' ('Bobbie Townsend, Manjeet Dadyala'), and 'Level' ('Intermediate').

# Downloading the lecture notes

The screenshot shows a web-based interface for a certification academy. At the top, the title is "[PLS] Certification Academy - PCA: Lecture Notes". Below the title, there is a navigation bar with icons for help, globe, and user profile. The main content area displays a list of "Student Guide Books": Student Guide Book 1a, Student Guide Book 1b, Student Guide Book 2, Student Guide Book 3, Student Guide Book 4 (which is highlighted with a gray background), Student Guide Book 5, and Student Guide Book 6. To the right of the list, there is a slide viewer showing the first page of "Student Guide Book 4". The slide has the following text: "Google Cloud Partner Certification Academy", "Cloud Architect", "Google Cloud Certified Professional", "Professional Cloud Architect", and "Google Cloud". The slide number is 1 / 126. Below the slide viewer, there is a toolbar with icons for download (highlighted with a red box and a callout bubble), print, and more options. A blue callout bubble points to the download icon with the text "Click the download icon to download the PDF".

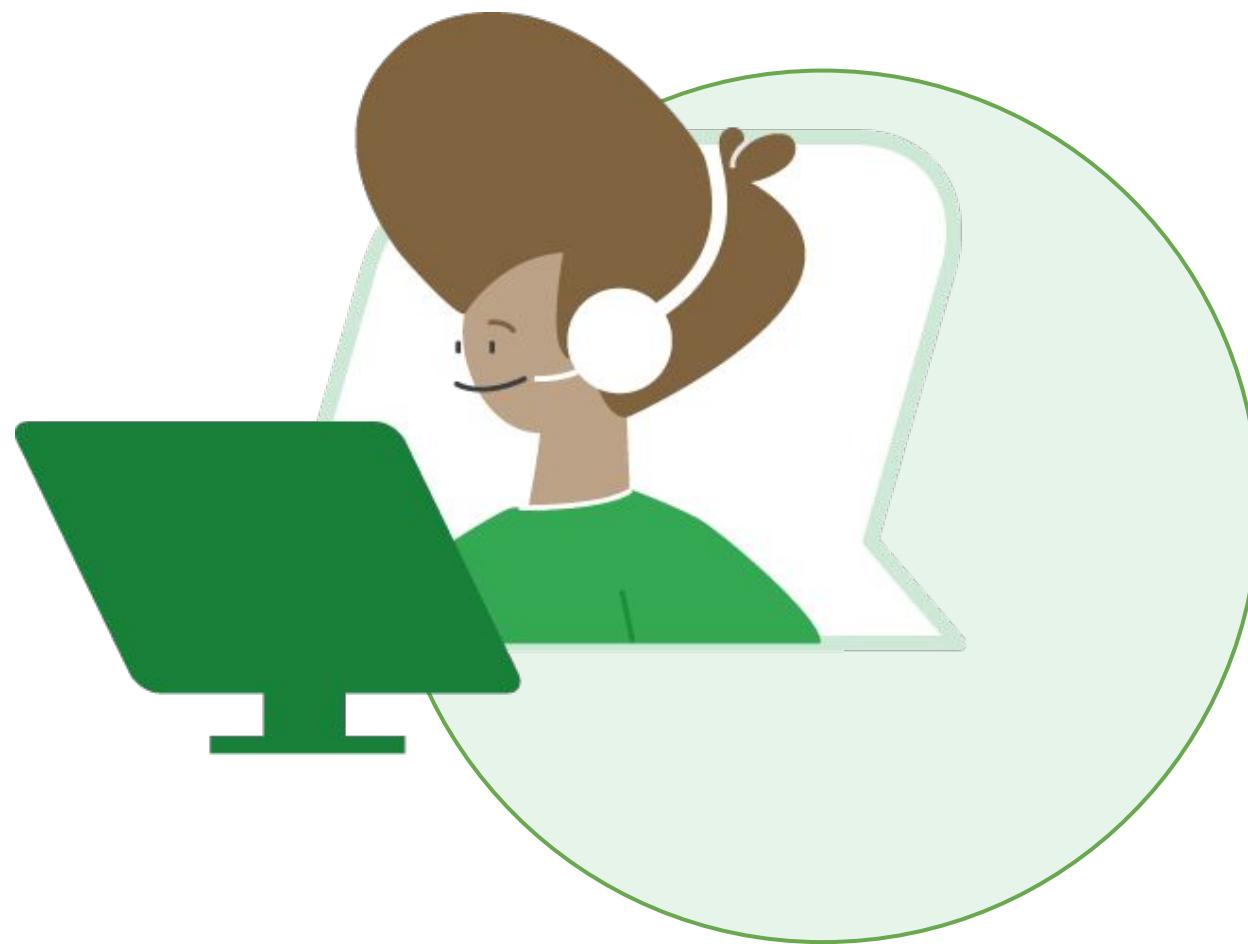
**Select:**

1. The Lecture Notes tab
2. A Student Guide Book

Click the download icon to download the PDF

# Downloading the lecture notes

**For any queries/issues email:**  
[cloud-partner-training@google.com](mailto:cloud-partner-training@google.com)



# What's covered in the workshop sessions?

## Cloud Architect Guide Content

- Workshops concentrate on the Cloud Architect Guide content

**Feel free to ask questions about the Skills Boost content as well**

## Different Cloud Architect Guides

- Each workshop covers different Cloud Architect Guides

**At the conclusion of the current workshop, the Cloud Architect Guide assignments for the following workshop will be displayed.**

# Benefits for you



## Benefits



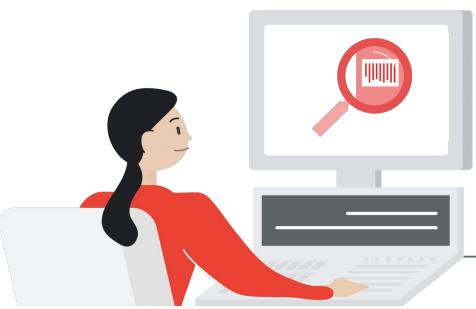
-  **The amount you gain from the workshops is directly proportional to the effort you invest.**
-  **To make the most of the workshop, it is recommended that you review the guide(s) and/or Skills Boost content beforehand.**
-  **The instructor will show demos, etc. to illustrate some of the key topics in the guides, but not all**

## Watch/listen/do



- Watch or listen to all on-demand content
- Do the hands-on exercises

## Review



- Review all the Cloud Architect Guides by watching the videos, reviewing the documentation, and answering the quiz questions

# Passing the exam

## **Consistent attendance**

With consistent attendance at live sessions and additional study efforts, you have an excellent opportunity to succeed in the exam.

## **Recommended experience**

Recommended 3+ years industry experience, and 1 year hands-on experience with Google Cloud.

## **For more information about the exam visit:**

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

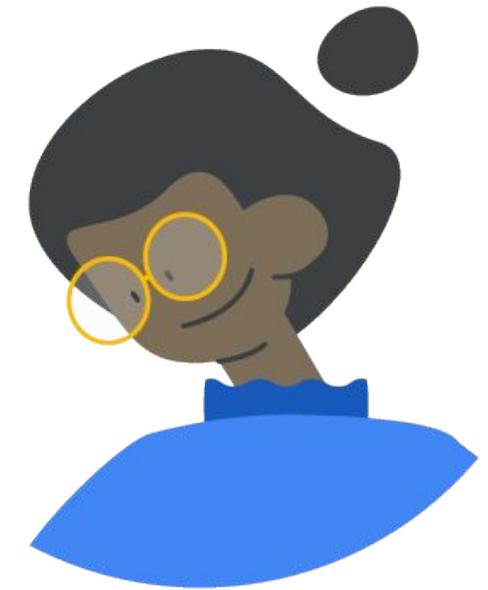


# Increase your chances of passing the exam

**Spend time reviewing the on-demand content  
and the Cloud Architect Guides**

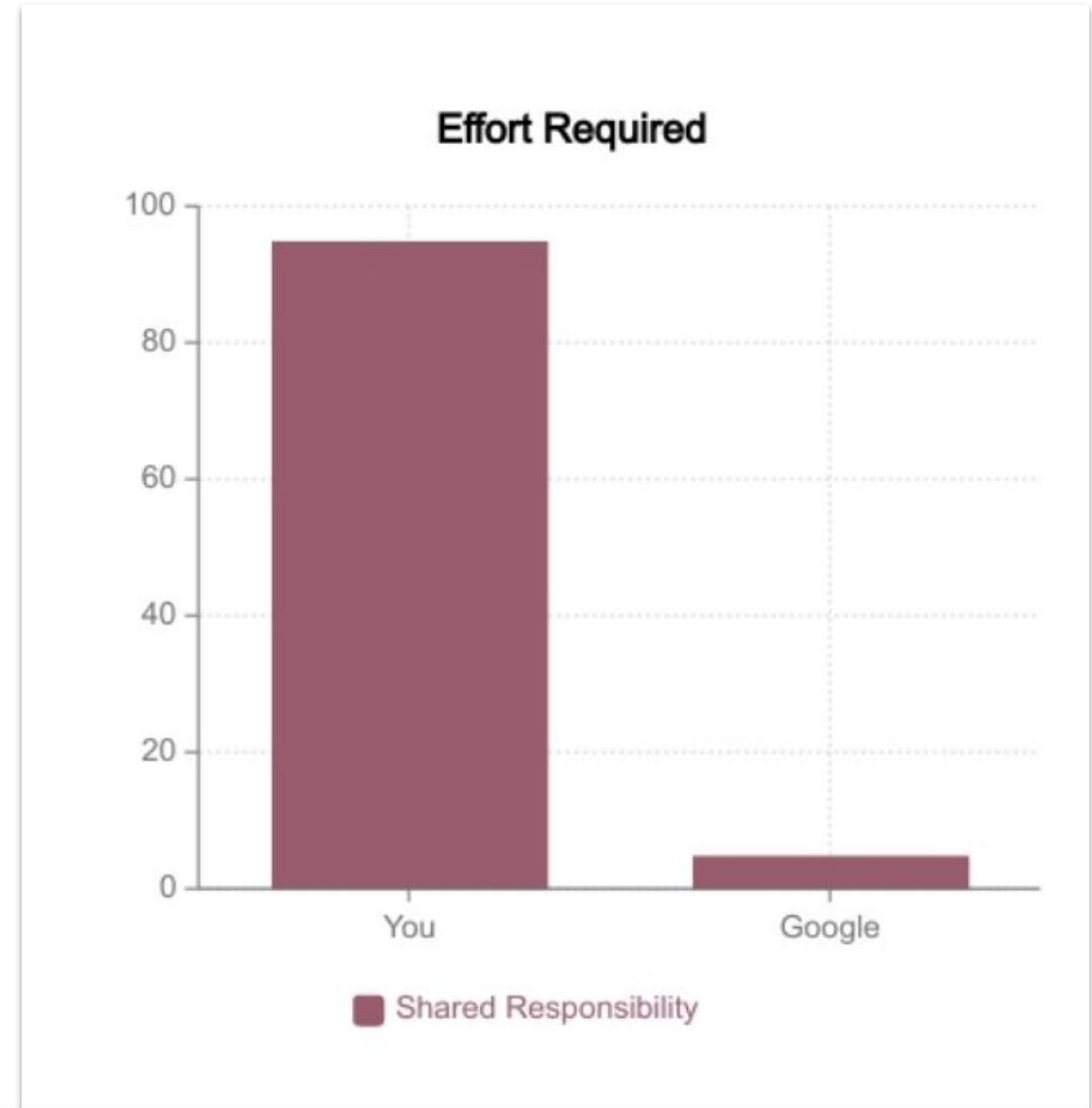
- Complete the hands-on labs
- Come to the workshops prepared with questions

**Do the assignments prior to the workshop**



# 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.

# Your responsibilities

With dedication and hard work, you can achieve success in passing the exam.

## Attend workshops

Meet for the cohort's workshops when they are conducted. This is optional.

## Review material

Review material covered during the workshops, complete any course(s) as needed, perform hands-on labs, and review additional suggested material.

## Reach out

Reach out to your mentor for questions and guidance.

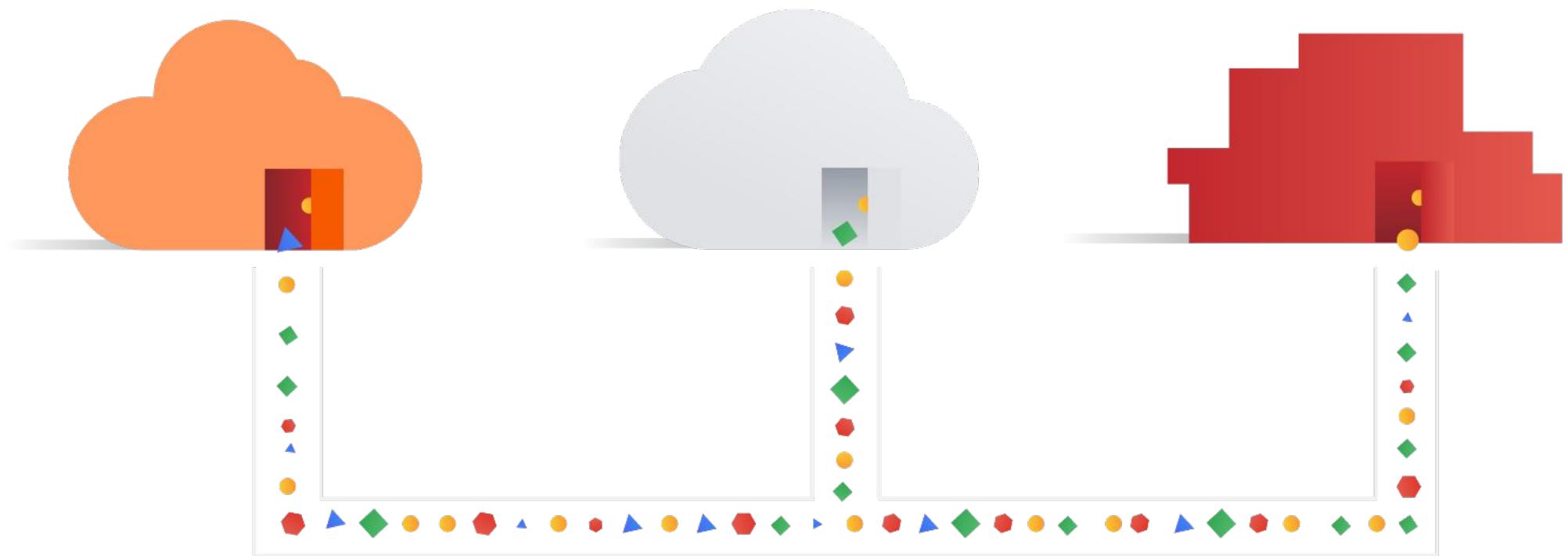
## Allocate time

Allocate time between sessions to study and familiarize yourself with any prerequisite knowledge that will be covered during the workshops.

# Experienced with AWS or Azure?

Speed your learning journey with:

- [Compare AWS and Azure services to Google Cloud](#)



# Additional learning resources

- The Cloud Girl
  - <https://github.com/priyankavergadia/GCPSketchnote>
- Cloud Engineer Cheat Sheet
  - <https://googlecloudcheatsheet.withgoogle.com/>
- Google Cloud product list
  - <https://cloud.google.com/terms/services>

# Achieved ACE certification recently?

- PCA course content is similar to ACE content but differs by:
  - Two additional on-demand courses
  - Additional Skills Badges are needed for a voucher
- If desired, do the on-demand content and acquire the additional Skills Badges
  - If vouchers do not arrive via email automatically contact  
[cloud-partner-training@google.com](mailto:cloud-partner-training@google.com)



# Module 1

# Topics in this module

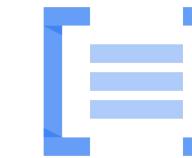
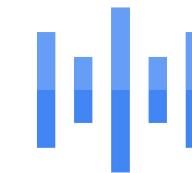
- Machine Learning APIs
- VPC Network
  - Subnets
  - Firewall rules
- Compute Engine
  - Machine types
  - Pricing
  - Images
  - Storage options
  - Snapshots
  - Migration



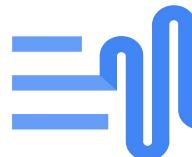
Vertex AI



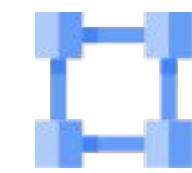
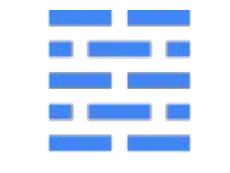
AutoML

Cloud Natural  
Language APICloud Translation  
APICloud Vision  
API

Speech-to-Text



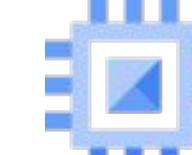
Text-to-Speech

Video Intelligence  
APIVirtual Private  
CloudCloud Firewall  
Rules

Cloud Routes



Cloud NAT



Compute Engine



Filestore

Persistent  
DiskPersistent  
Disk SnapshotMigrate for  
Compute EngineMigrate to  
Containers

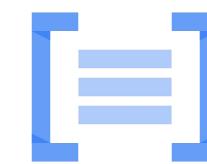
# Machine learning APIs...



Vertex AI



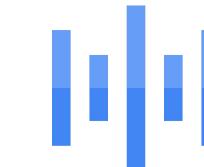
AutoML



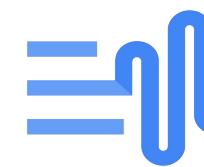
Cloud Natural  
Language API



Cloud Translation  
API



Speech-to-Text



Text-to-Speech



Video Intelligence  
API



Cloud Vision  
API

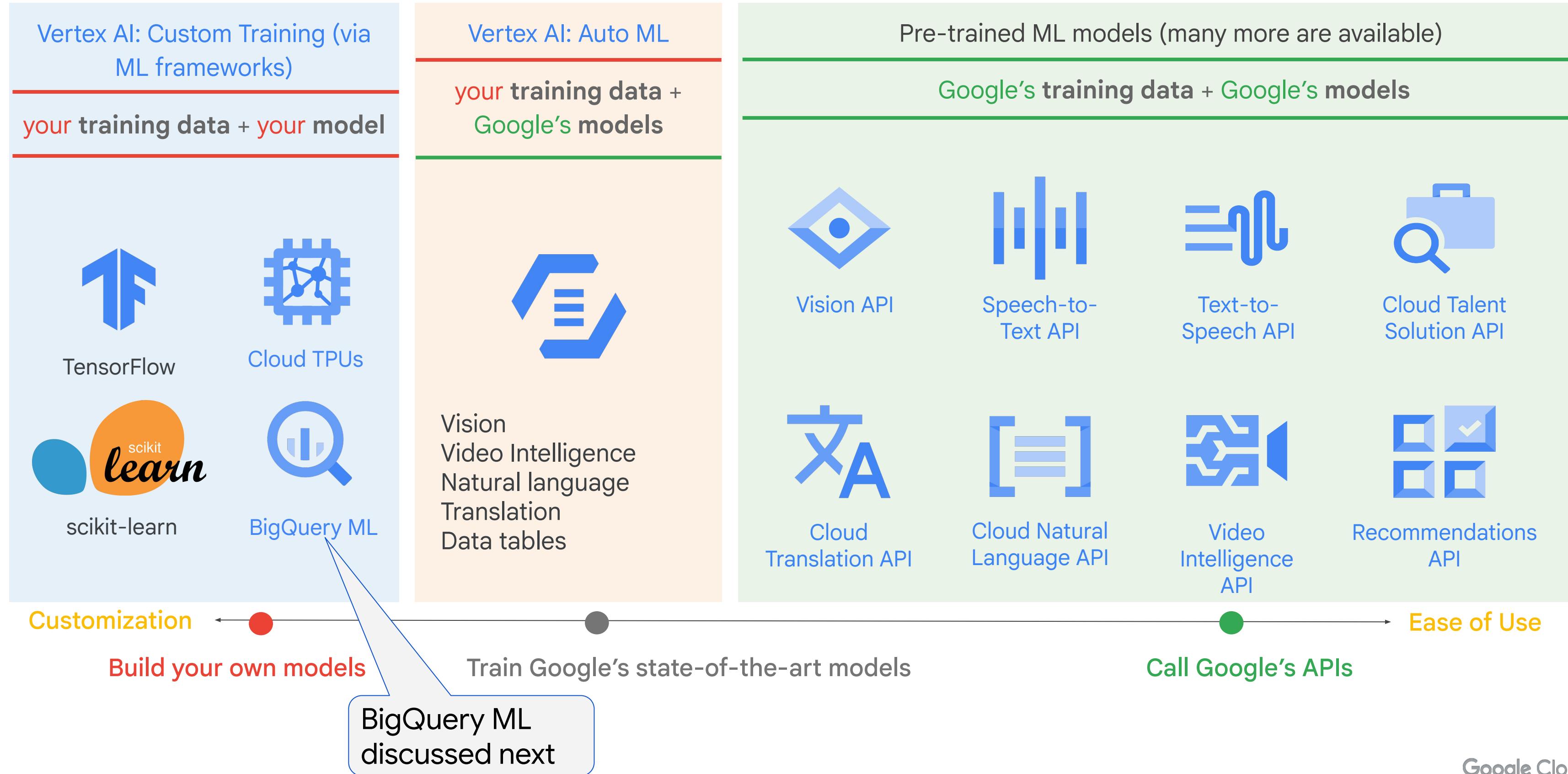
# Vertex AI is Google's comprehensive AI platform

- Contains ML tools needed to create, train, manage and deploy machine learning models
- Includes tools for data scientists such as
  - Managed JupyterLab notebooks
  - Integration with widely used open source frameworks such as TensorFlow, PyTorch, and scikit-learn
- Also includes tools for non-data scientists
  - Contains pre-trained APIs for vision, video, natural language, and more
  - Customer can add their own data to the models for further customization



Vertex AI  
<https://cloud.google.com/vertex-ai>

# Google Cloud machine learning spectrum



# BigQuery ML makes AI super easy

## BigQuery ML in 2 steps

**Train and deploy** ML models in SQL

**Execute** ML workflows without moving data from [BigQuery](#)

**Automate** common ML tasks

**Built-in** infrastructure management, security & compliance

<https://cloud.google.com/bigquery-ml/docs/introduction>

Google Cloud

# BigQuery ML makes AI super easy

## Step 1: Model creation

```
1 CREATE MODEL numbikes.model
2 OPTIONS
3 (model_type='linear_reg', labels=['num_trips']) AS
4 WITH bike_data AS
5 (
6 SELECT
7 COUNT(*) as num_trips,
```

Run Query

**Train and deploy** ML models in SQL

**Execute** ML workflows without moving data from [BigQuery](#)

**Automate** common ML tasks

**Built-in** infrastructure management, security & compliance

# BigQuery ML makes AI super easy

## Step 2: **Prediction**

```
1 SELECT
2   predicted_num_trips, num_trips, trip_date
3 FROM
4   ml.PREDICT(MODEL `numbikes.model`, (WITH bike_data AS
5   (
6     SELECT
7       COUNT(*) as num_trips,
```

Run Query

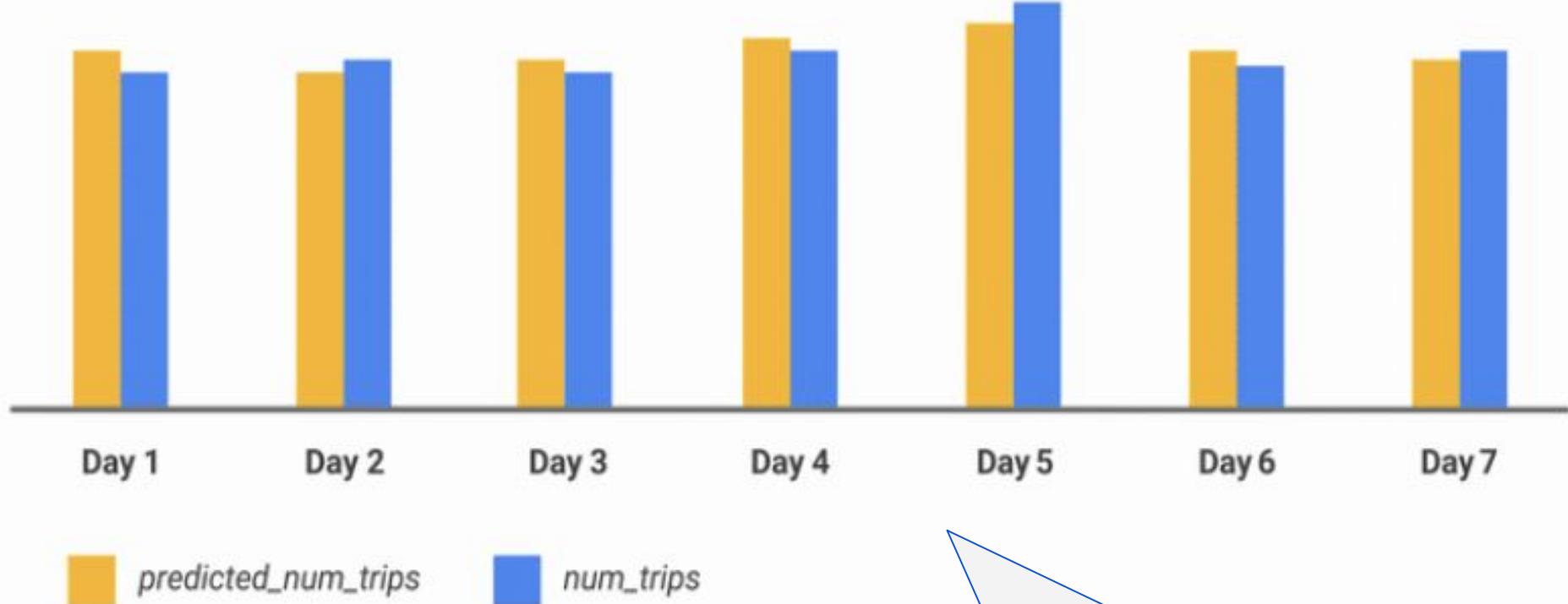
**Train and deploy ML models in SQL**

**Execute** ML workflows without moving data from [BigQuery](#)

**Automate** common ML tasks

**Built-in** infrastructure management, security & compliance

# BigQuery ML makes AI super easy



[Looker BI Platform](#)

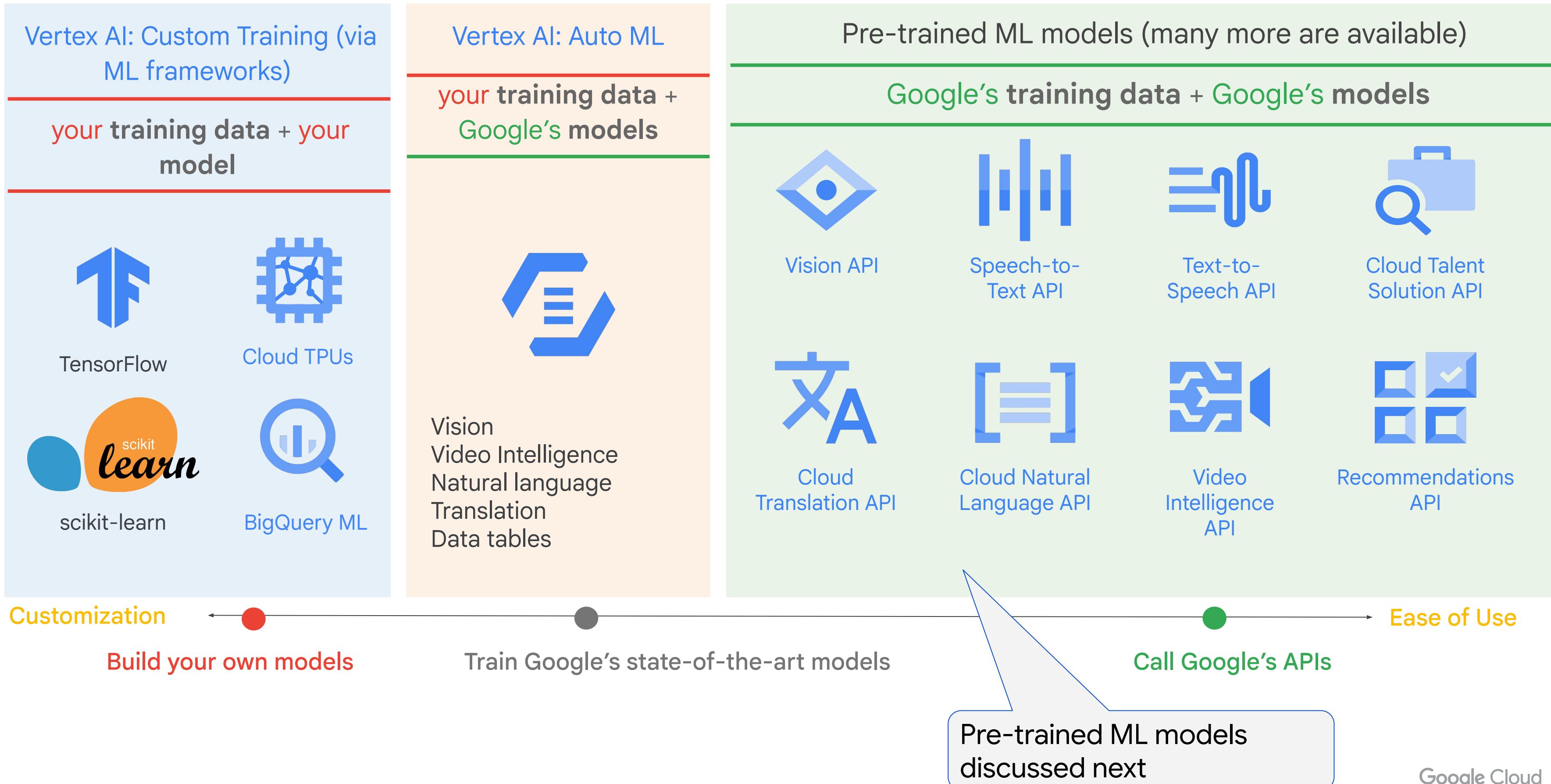
**Train and deploy ML models in SQL**

**Execute** ML workflows without moving data from [BigQuery](#)

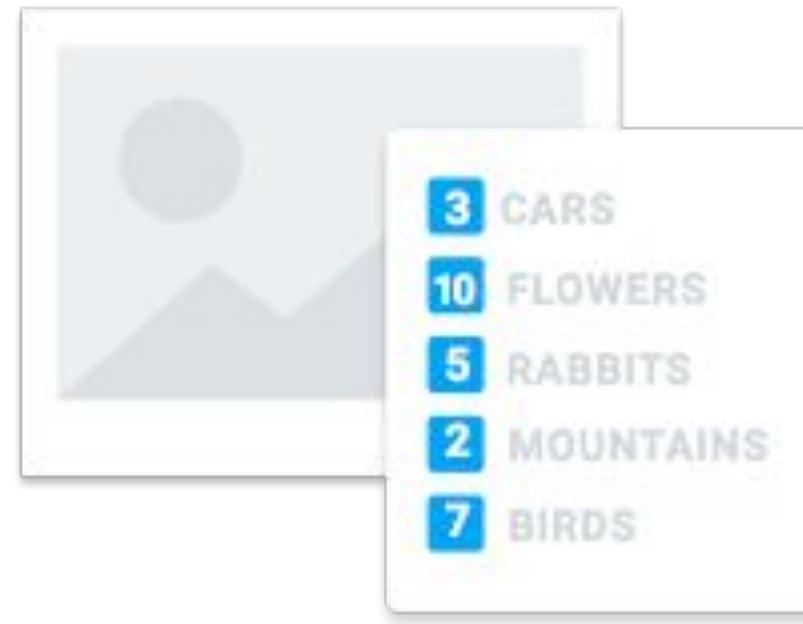
**Automate** common ML tasks

**Built-in** infrastructure management, security & compliance

# Google Cloud machine learning spectrum



# Use the Vision API to understand image content



Detect and label



Extract text



Identify entities

# Cloud Natural Language API

## Derive insights from unstructured text

The powerful pre-trained models of the Natural Language API let developers work with natural language understanding features including sentiment analysis, entity analysis, entity sentiment analysis, content classification, and syntax analysis.

RESET

See supported languages

Entities Sentiment Syntax Categories

Dependency  Parse label  Part of speech  Lemma  Morphology

The powerful pre-trained models of the Natural Language API

det amod amod nsubj prep det nn nn pobj  
The powerful pre-trained models of the Natural Language API

DET ADJ ADJ NOUN ADP DET NOUN NOUN NOUN  
tense=PAST number=PLURAL number=SINGULAR proper=PROPER number=SINGULAR proper=PROPER proper=PROPER mood=tense



## Cloud Natural Language API

# Cloud Translation API

Dynamically translate between languages

Source Language  
French (fr) ▾

Target Language  
English (en) ▾

Sample text. Enter your own text to translate.

Il ne faut avoir aucun regret pour le passé, aucun remords pour le présent, et une confiance inébranlable pour

There must be no regrets for the past, no remorse for the present, and unshakable confidence for the future.



Cloud Translation API

# Video Intelligence API

Make your media more discoverable

Labels      Shots      Explicit Content      API

---



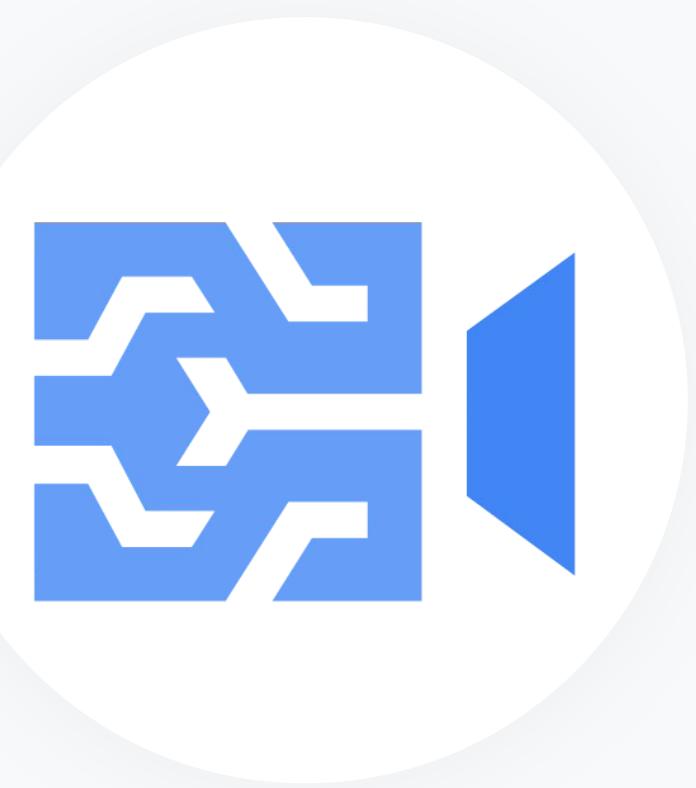
▶ 00:00:30 / 00:00:42    🔍    🔊

### Video Labels

Detect and label entities, such as dogs, flowers, and people, throughout the entire video.

dinosaur	80%
vehicle	79%
tree	40%
plant	
bicycle	36%
vehicle	
land vehicle	36%
vehicle	

**Note:** shot-level label annotations are present on the shots tab.



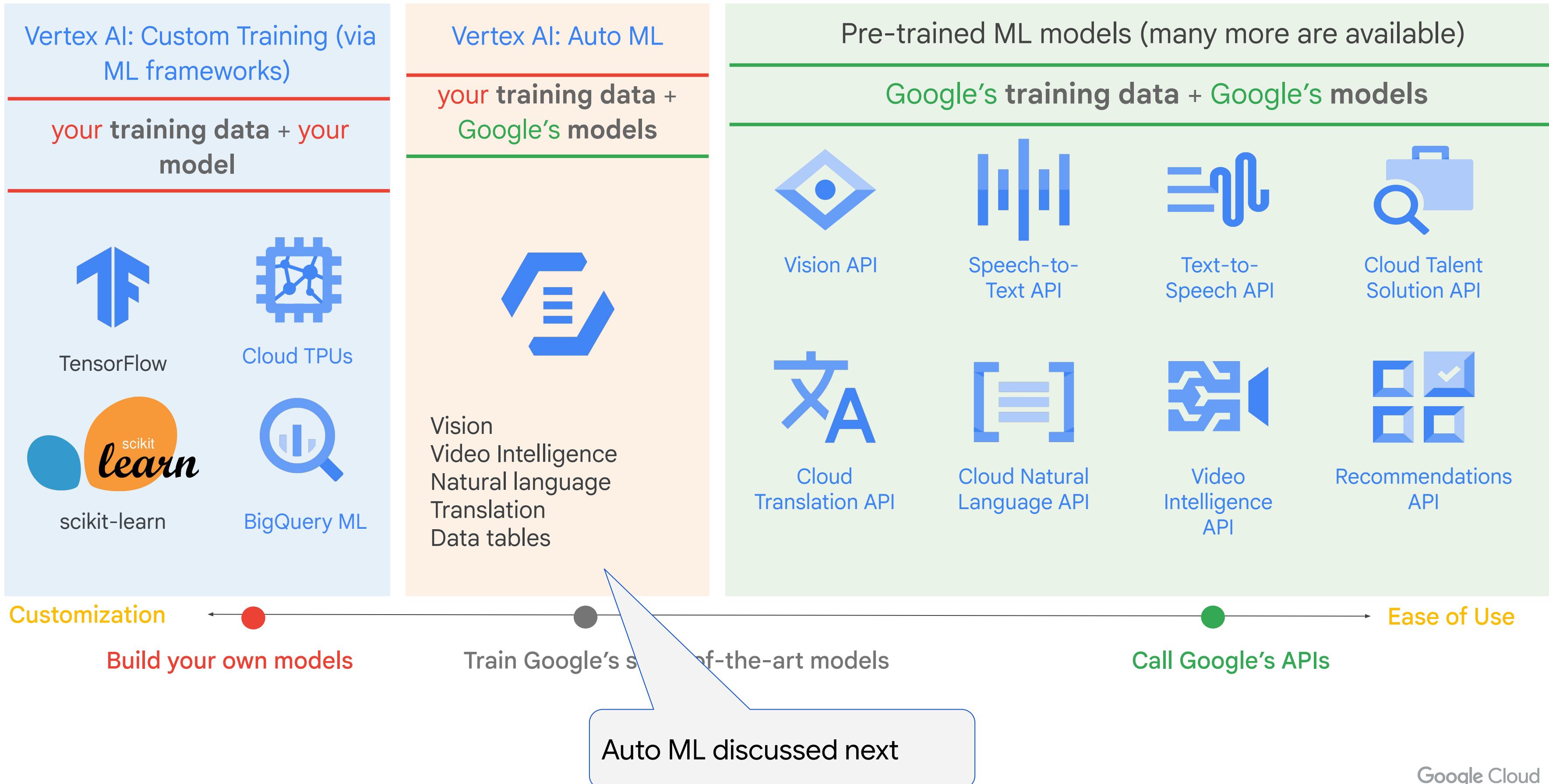
Video Intelligence API

# Speech-to-Text /Text-to-Speech APIs

Convert speech to text and vice versa



# Google Cloud machine learning spectrum



# Use AutoML to enhance Google's pre-trained models

## AutoML Natural Language

Reveal the structure and meaning of text through machine learning.



## AutoML Translation

Dynamically translate between languages.



## AutoML Video Intelligence

Enable powerful content discovery and engaging video experiences.



## AutoML Vision

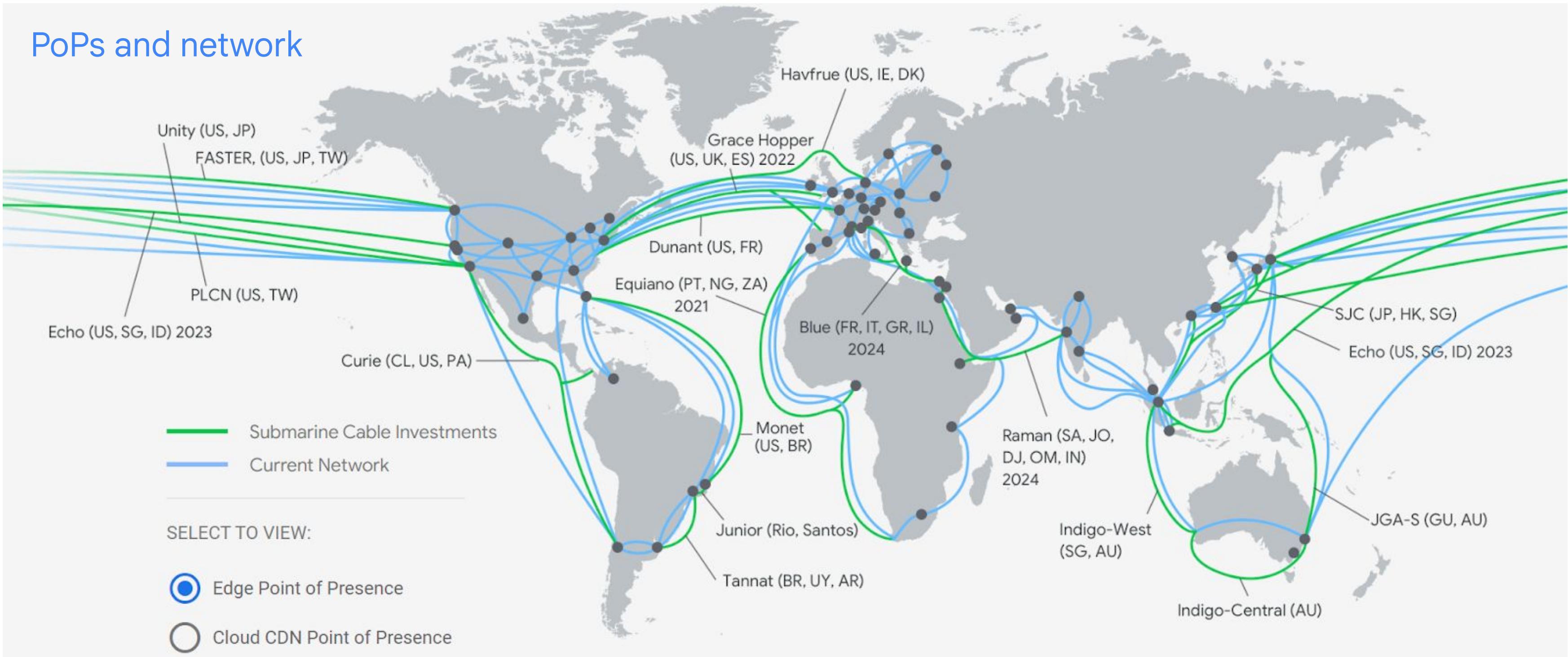
Derive insights from images in the cloud or at the edge.



# VPC Network



# Google Cloud Network

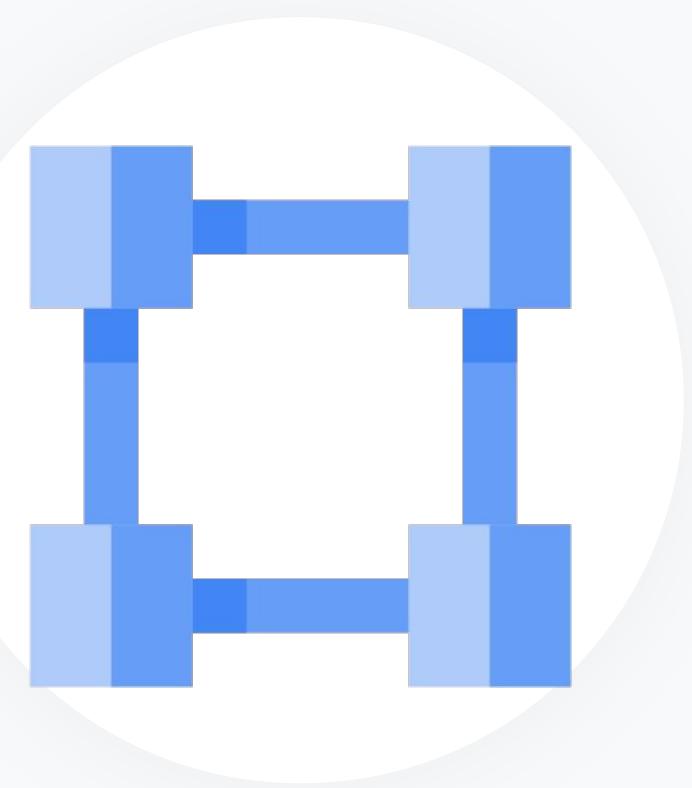


[VPC Overview](#)

Google Cloud

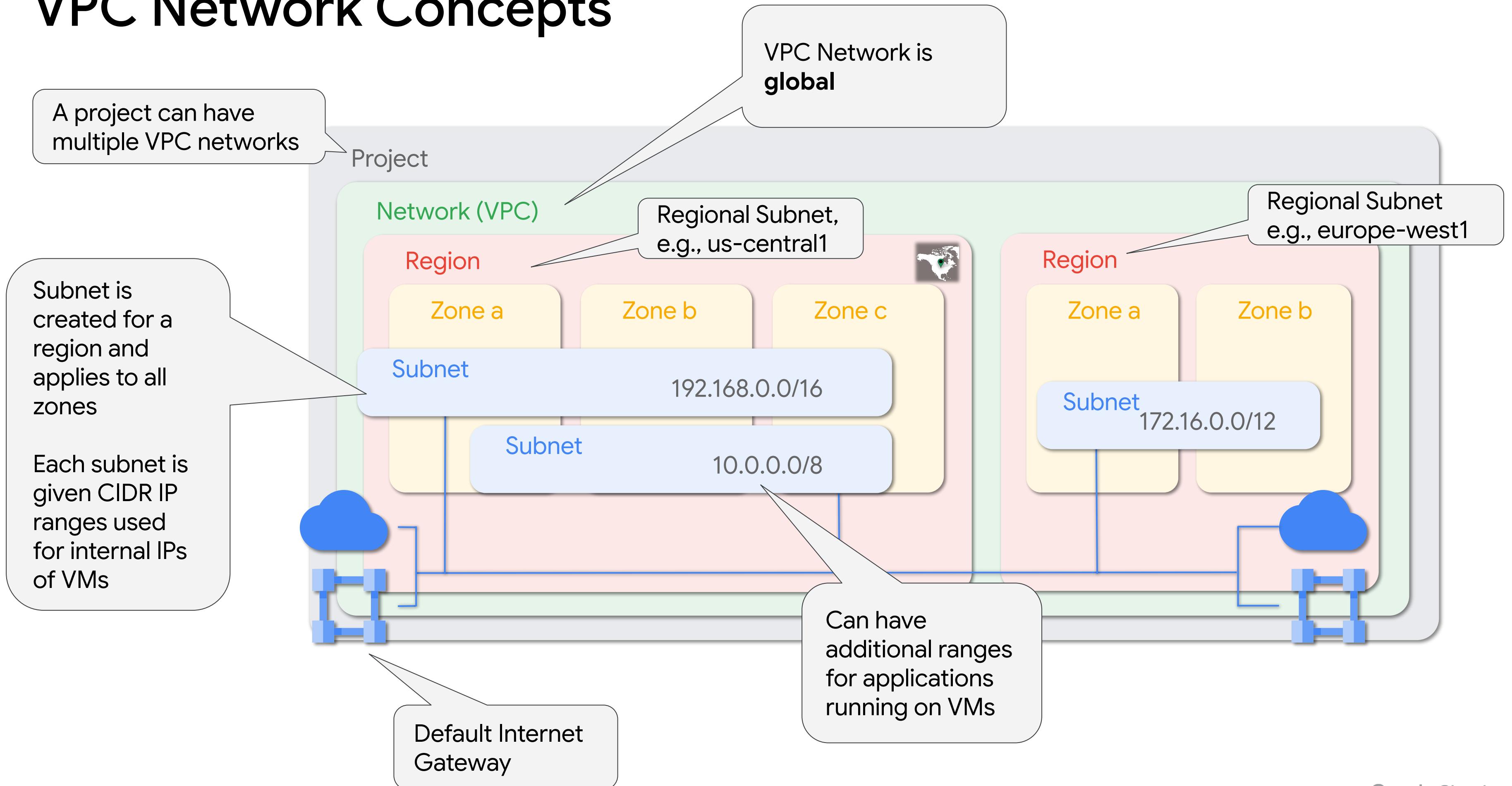
# VPC objects

- Projects
- Networks
  - Default, auto mode, custom mode
- Subnetworks
- Regions
- Zones
- IP addresses
  - Internal, external, range
- Virtual machines (VMs)
- Routes
- Firewall rules



Virtual Private Cloud

# VPC Network Concepts



# Subnet creation modes

## Default

- One subnet per region
- Default firewall rules
- Experimentation
- Not good for production
- Org policy to skip

## Auto Mode

- Default network
- Default /20 subnet per region
- Expandable up to /16
- Default firewall rules
- Isolated use cases (testing, PoCs)

## Custom Mode

- Full control of subnets and IP ranges
- No default firewall rules
- Expandable
- Good for production
- Best Practice

# VMs must have internal IP and can have external IP addresses



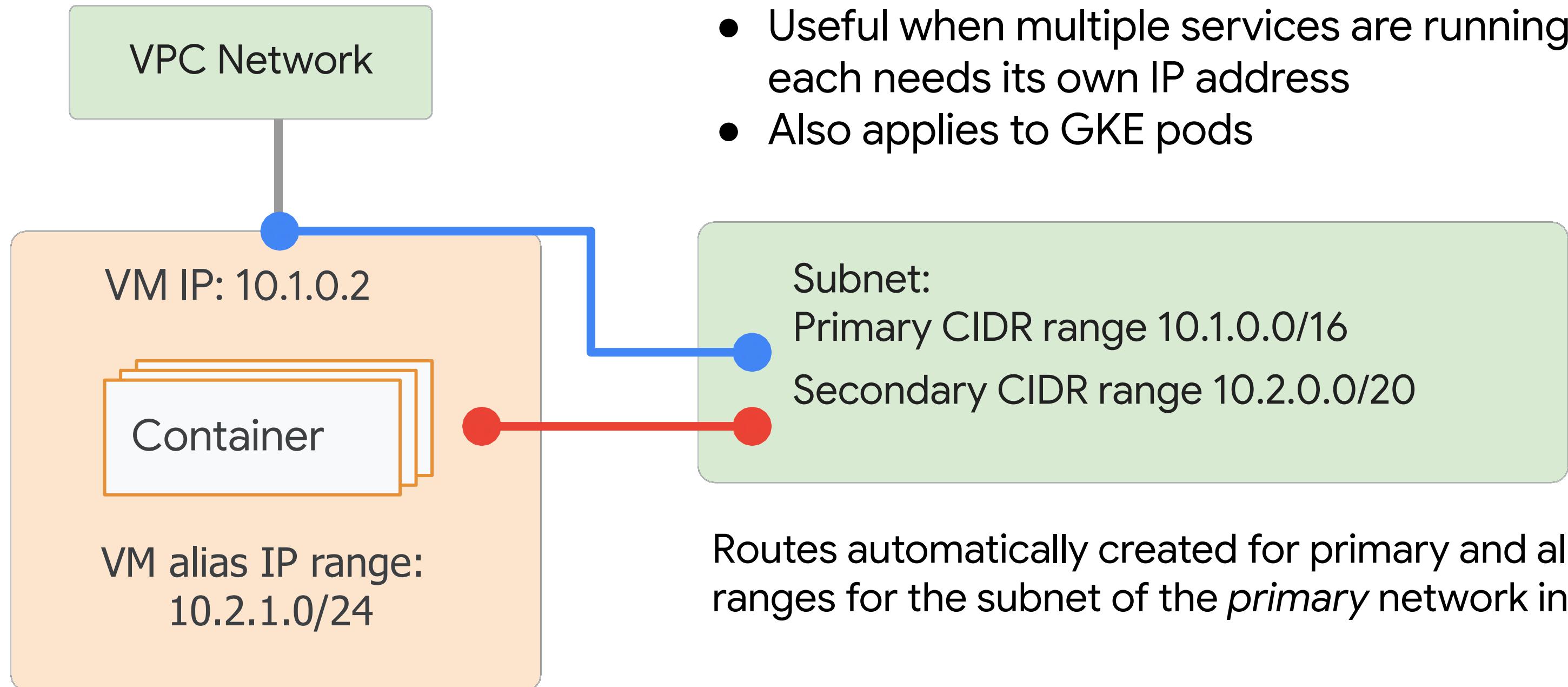
## Internal IP

- Allocated from subnet range to VMs by DHCP
- Alternatively, can reserve (static) internal IP address

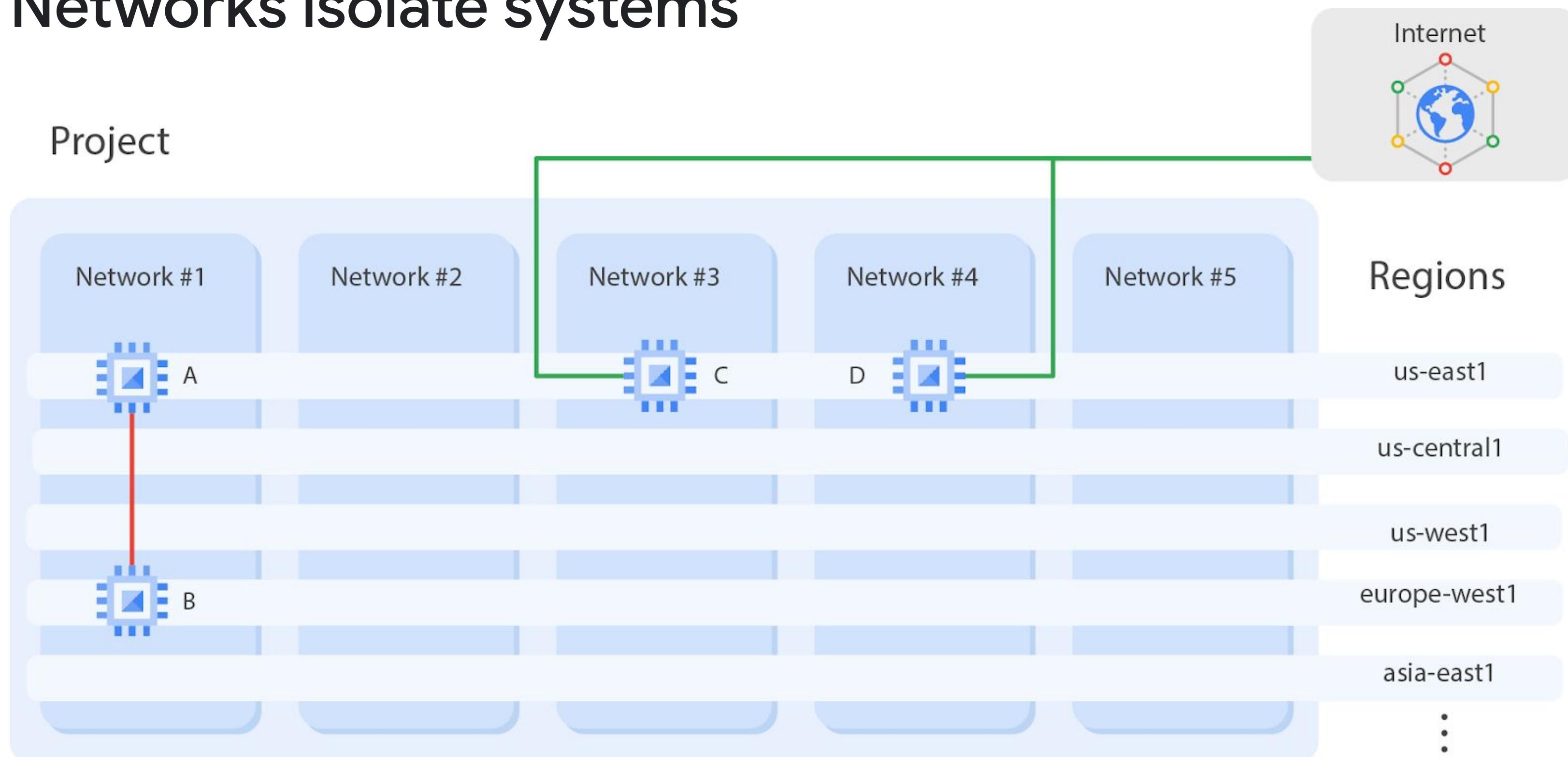
## External IP

- Assigned from pool (ephemeral)
- Alternatively, can reserve (static) external IP address
- Bring Your Own IP address (BYOIP)

# A subnet can contain a secondary range of internal IP addresses



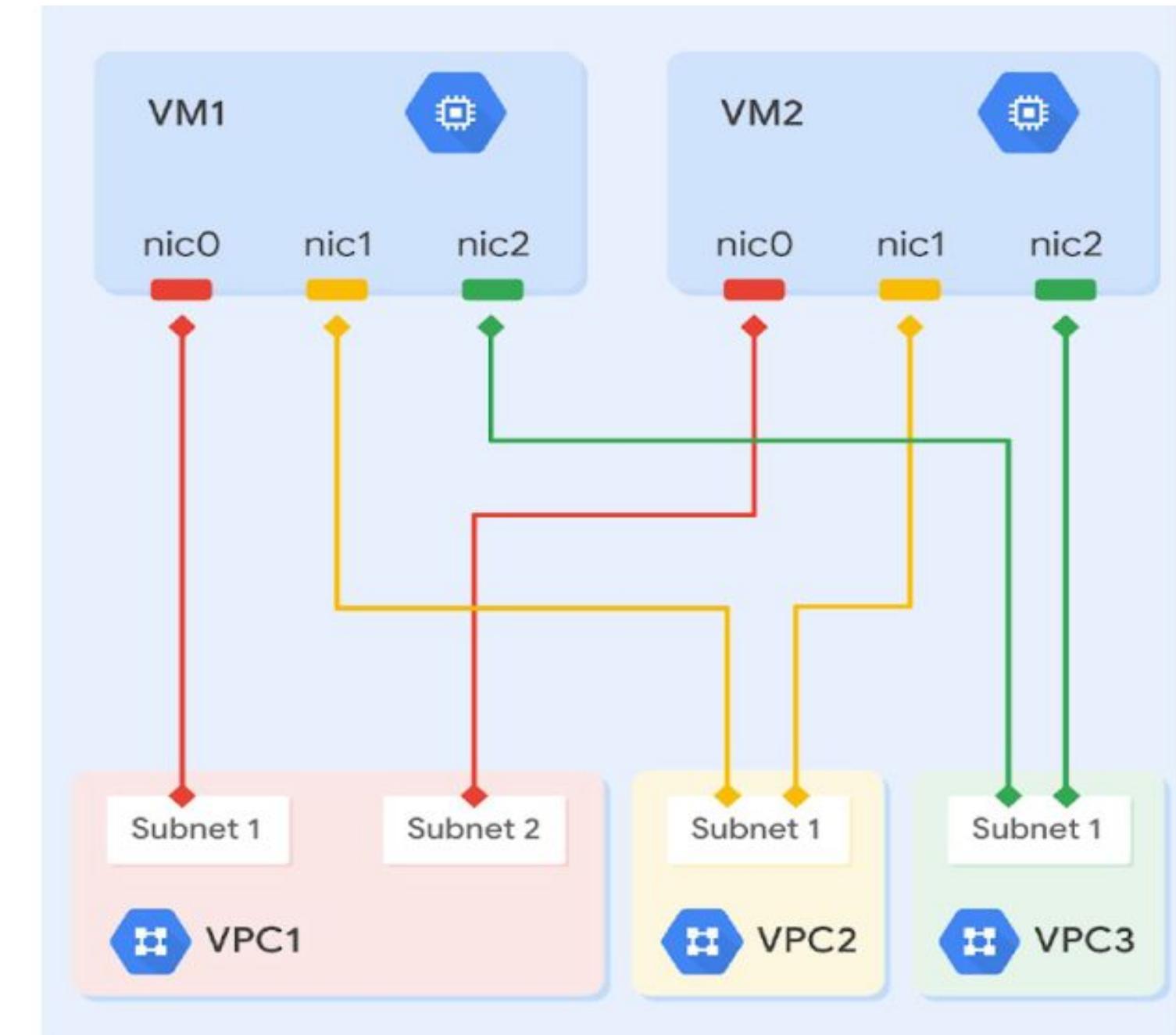
# Networks isolate systems



- **A** and **B** can communicate over internal IPs even though they are in different regions.
- **C** and **D** must communicate over external IPs even though they are in the same region.

# VMs can connect to multiple VPCs

- VMs have Multi-NIC support (8 max)
  - Each NIC must connect to a different VPC network
  - Allows communication between VPCs using private IPs
- Are other ways to accomplish private IP communication between VPCs, such as
  - VPC Peering
  - VPN
  - These will be discussed later



# Routes map traffic to destination networks

- Managed at the VPC level
- Applies to traffic egressing a VM
- Enables VMs on same network (VPC) to communicate via private IP
  - Only if it is allowed by a firewall rule
- Automatically created when a subnet is created
- Can manually create static/custom routes
  - Next hop can be: Instance IP or name, Cloud VPN, Internal TCP/UDP load balancer, default internet gateway
- Routes can be selectively applied to
  - All instances, instances with specific network tags, instances with specific service accounts
- Internet access is enabled by a **default route** (priority=1000)
  - Applies to VMs with external IPs
  - No gateway or public component needed

# VPC Firewall rules

Protect your VM instances from unapproved connections

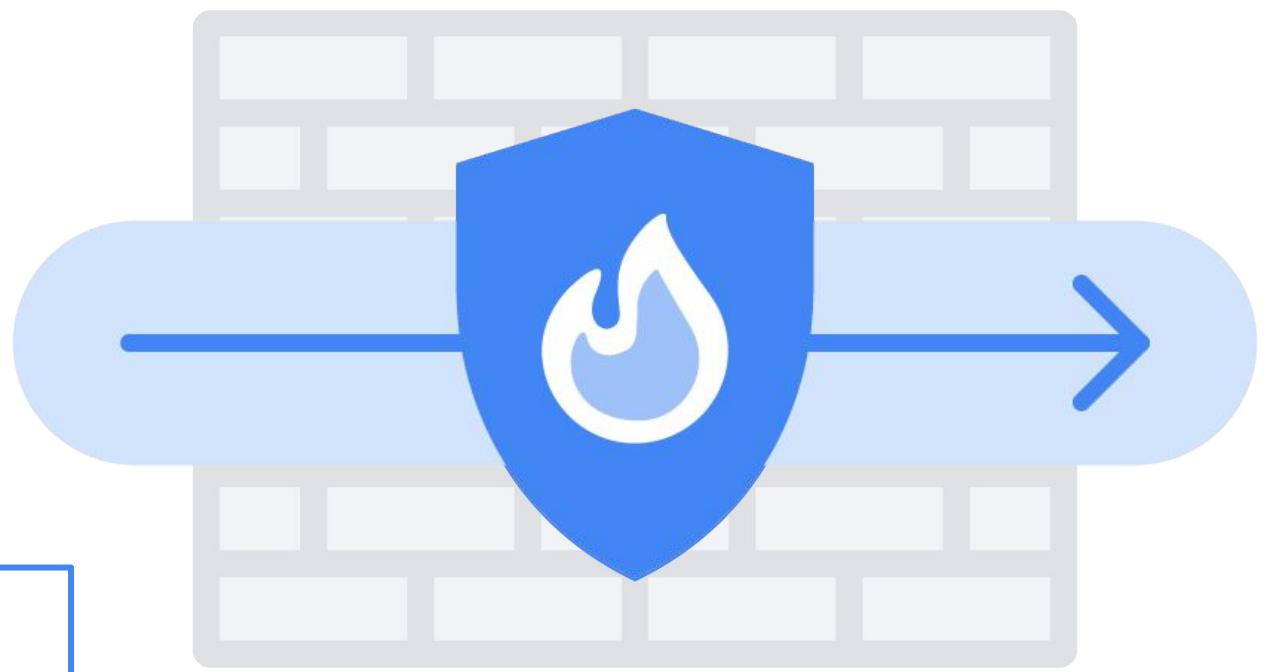
- VPC network functions as a distributed firewall.
- Firewall rules are applied to the network as a whole
- Connections are allowed or denied at the instance level
- Firewall rules are stateful

Consist of:

- Direction (ingress/egress)
- Action (allow/deny)
- Source OR destination
- ports/protocol, priority

Implied rules:

- deny all ingress
- allow all egress
- Have lowest priority



# Creating Firewall Rules

When creating rules, specify

- Source
  - Could be the internet (0.0.0.0/0 IP range)
  - Individual or ranges of IPv4 or IPv6 addresses
  - Could be VMs with specific network tags or service accounts
- Target - Defines which VMs the rule applies to
  - All instances in the network
  - VMs with specific network tags
  - VM's with service accounts

Will revisit the last 2 after the service account discussion

Network \* default

Priority \* 1000 [CHECK PRIORITY OF OTHER FIREWALL RULES](#)

Direction of traffic [?](#)  
 Ingress  
 Egress

Action on match [?](#)  
 Allow  
 Deny

Targets All instances in the network

Source filter IPv4 ranges

Source IPv4 ranges \* 0.0.0.0/0 [x](#) for example, 0.0.0.0/0, 192.168.2.0/24

Second source filter None

Protocols and ports [?](#)  
 Allow all  
 Specified protocols and ports

tcp : 22

udp : all

Other protocols

# All VPCs have implied firewall rules

Implied IPv4/IPv6 firewall rules are present in all VPC networks

- Implied allow egress rule
  - Lets any instance send traffic to any destination
- Implied deny ingress rule
  - Protects all instances by blocking incoming connections to them
- Override them with your own firewall rules (if desired)



# Default VPCs have additional allow rules

Rule	Description
default-allow-internal	Allows ingress connections for all protocols and ports among instances within the VPC network
default-allow-ssh	Allows port 22 - secure shell (ssh) access
default-allow-rdp	Allows port 3389 - remote desktop protocol (RDP) access
default-allow-icmp	Allows ICMP traffic

# Hierarchical firewall policies

Hierarchical firewall policies

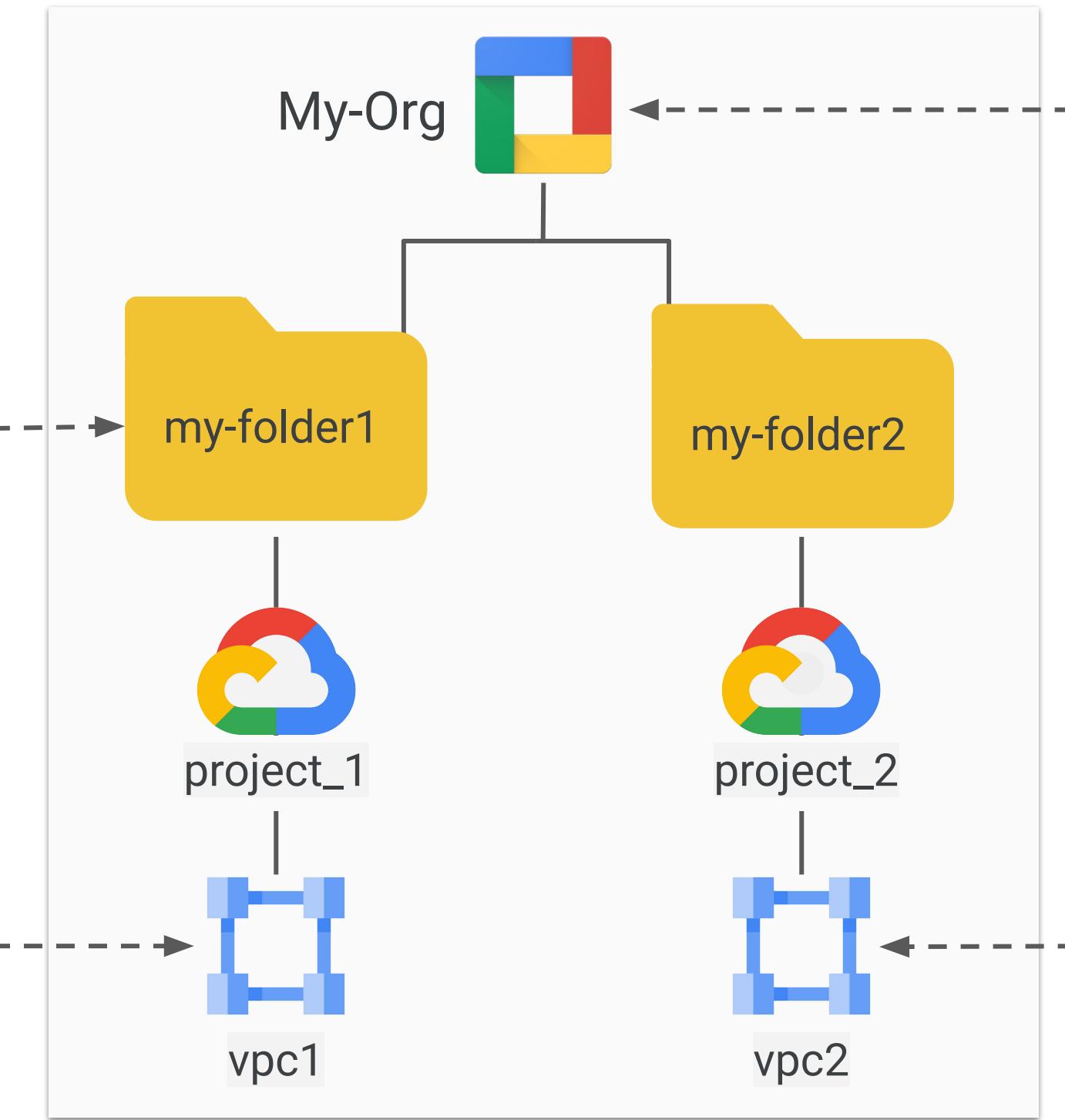
VPC firewall rules

Ingress tcp:80,443 priority 1  
allow

Ingress any:any priority 2  
deny

Default ingress deny all

Default egress allow all



Ingress from 1.1.1.10/24 priority 1 go to\_next

Ingress any:any priority 2 deny

Ingress tcp:80,443,22 priority 1000  
allow

Default ingress deny all

Default egress allow all

# Bring your own IP (BYOIP)

Bring your own IP (BYOIP) lets you provision and use your own public IPv4 addresses for Google Cloud resources.

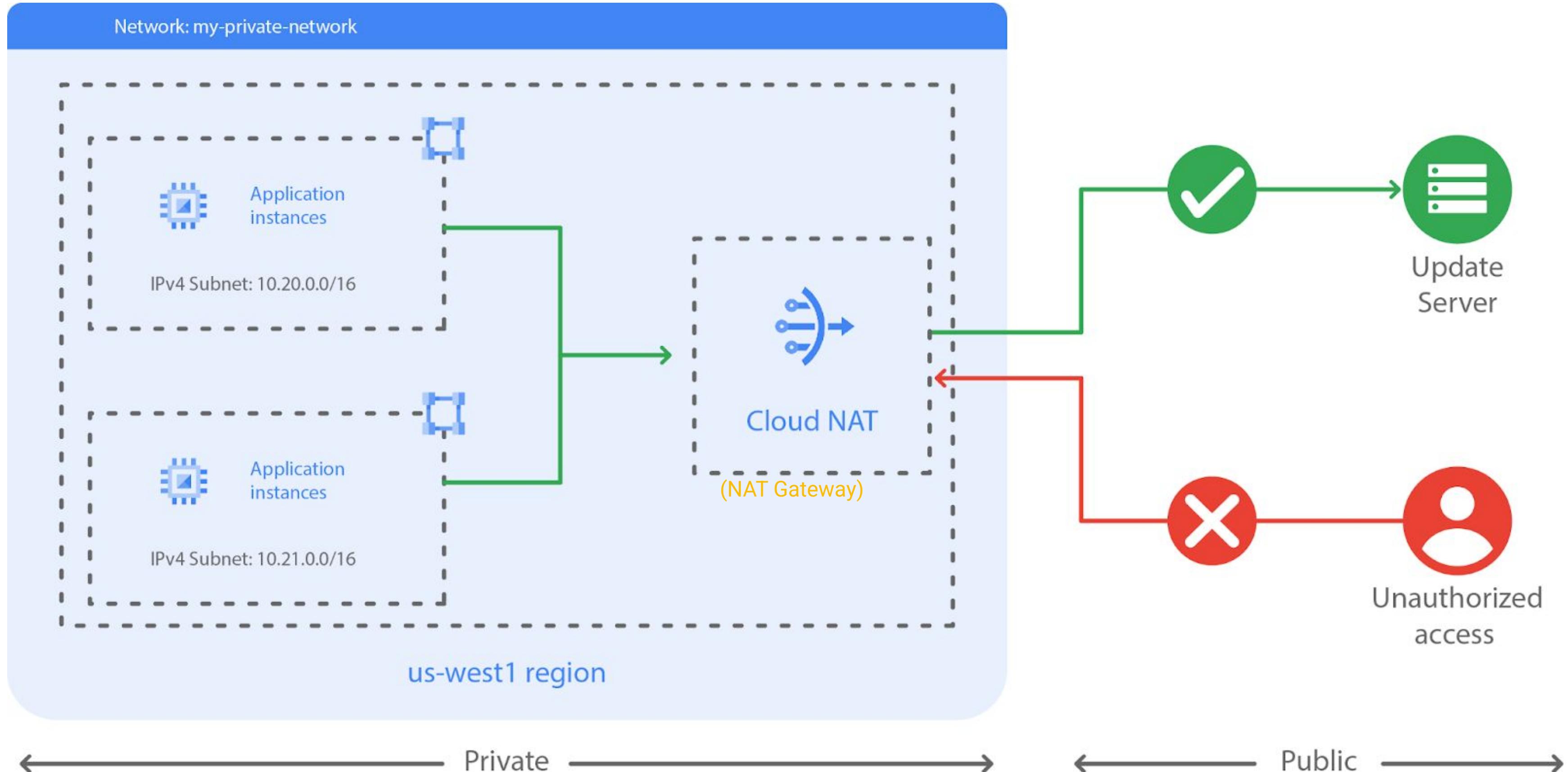
After the IP addresses are imported, Google Cloud manages them in the same way as Google-provided IP addresses, with these exceptions:

- The IP addresses are available only to the customer who imported them
- There are no charges for idle or in-use IP addresses.

# Summary - VPC Networks

- One VPC Network must exist prior to creating a VM
  - When VMs are created, they must be assigned to a network
- A default network is created when the Compute Engine API is enabled
  - Contains a subnet for every region of Google Cloud
- Upon creation a VM is assigned an internal IP from the CIDR range assigned to the subnet in which the VM was created
  - Can optionally be given a external IP address (ephemeral or static)
- VMs on same network communicate via internal IPs
- VMs in different networks **must** communicate via external IPs
  - Unless
    - VPC Peering is enabled (discussed later)
    - VMs have multiple NICs
- To prevent access to a machine from outside its network don't give it an external IP

# Cloud NAT provides internet access to private instances



# Suggested lab: Multiple VPC Networks (if time allows)

**Start Lab**    00:45:00

# Configuring Networks via gcloud

45 minutes    No cost    

**GSP630**

 Google Cloud Self-Paced Labs

- GSP630
- Overview
- Setup and requirements
- Task 1. Create network
- Task 2. Create a subnetwork
- Task 3. Viewing networks
- Task 4. List subnets
- Task 5. Creating firewall rules
- Task 6. Viewing firewall rules details
- Task 7. Create another network
- Task 8. Create VM instances
- Task 9. Explore the connectivity
- Congratulations!

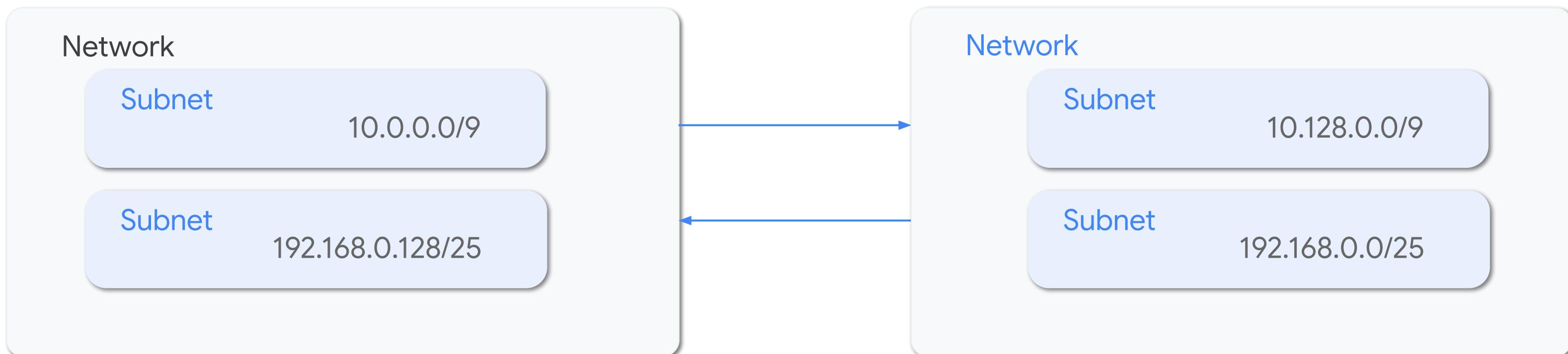
Creates custom network, firewall rules, VM instances w/multiple network interfaces (NIC)

[https://partner.cloudskillsboost.google/catalog\\_lab/2047](https://partner.cloudskillsboost.google/catalog_lab/2047)

Google Cloud

# VPC peering

- VMs in different VPC networks cannot communicate over private IPs by default
- VPC Peering connects two VPC Networks
  - As long as there are no overlapping subnet IP ranges
  - Networks can be in the same project, different projects or different organizations
- Traffic latency within a peering group is the same as if they were the same VPC network



# VPC peering benefits

- **Reduce latency**
  - Connecting via private IPs will have lower latency than public IPs
- **Reduce costs**
  - Google Cloud charges egress bandwidth when using public IPs to communicate
  - Peering communication is via private IPs
- **Improve Security**
  - VMs may no longer require public access

# Suggested Lab (if time allows)

The screenshot shows a web interface for a lab catalog. At the top left is a back arrow and the text "VPC Network Peering". To the right are icons for sharing, favoriting, help, and a user profile with a green "B". Below this is a green button labeled "Start Lab" and a timer showing "01:00:00". The main title "VPC Network Peering" is displayed prominently. To the right of the title is a sidebar with the identifier "GSP193" and a yellow box showing "-/100". The sidebar also lists several steps: "Overview", "Setup", "VPC Network Peering setup", "Setting up a VPC Network Peering session", "Connectivity Test", and "Congratulations!". At the bottom left of the main area is the identifier "GSP193".

[https://partner.cloudskillsboost.google/catalog\\_lab/935](https://partner.cloudskillsboost.google/catalog_lab/935)

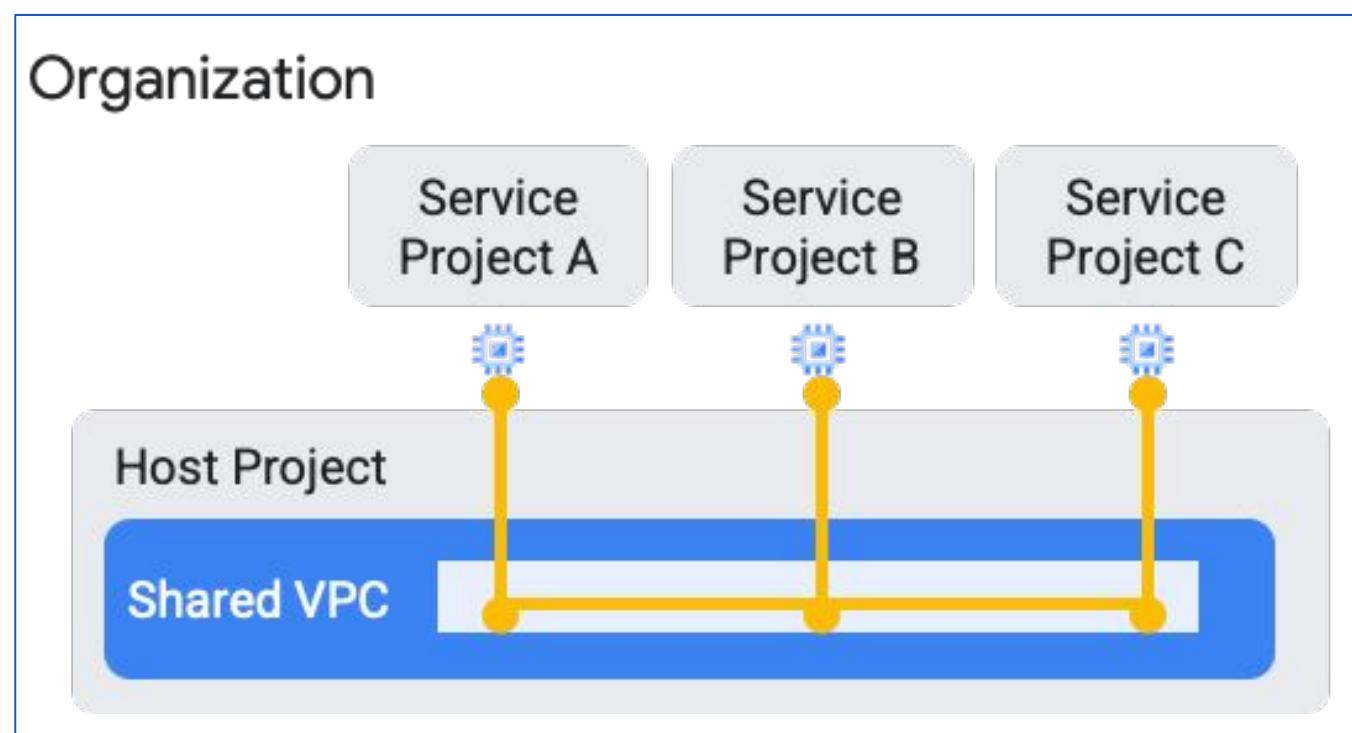
# Creating one VPC network for use by multiple projects



# A Shared VPC is created in one project, but can be shared and used by other projects

Networking specialists

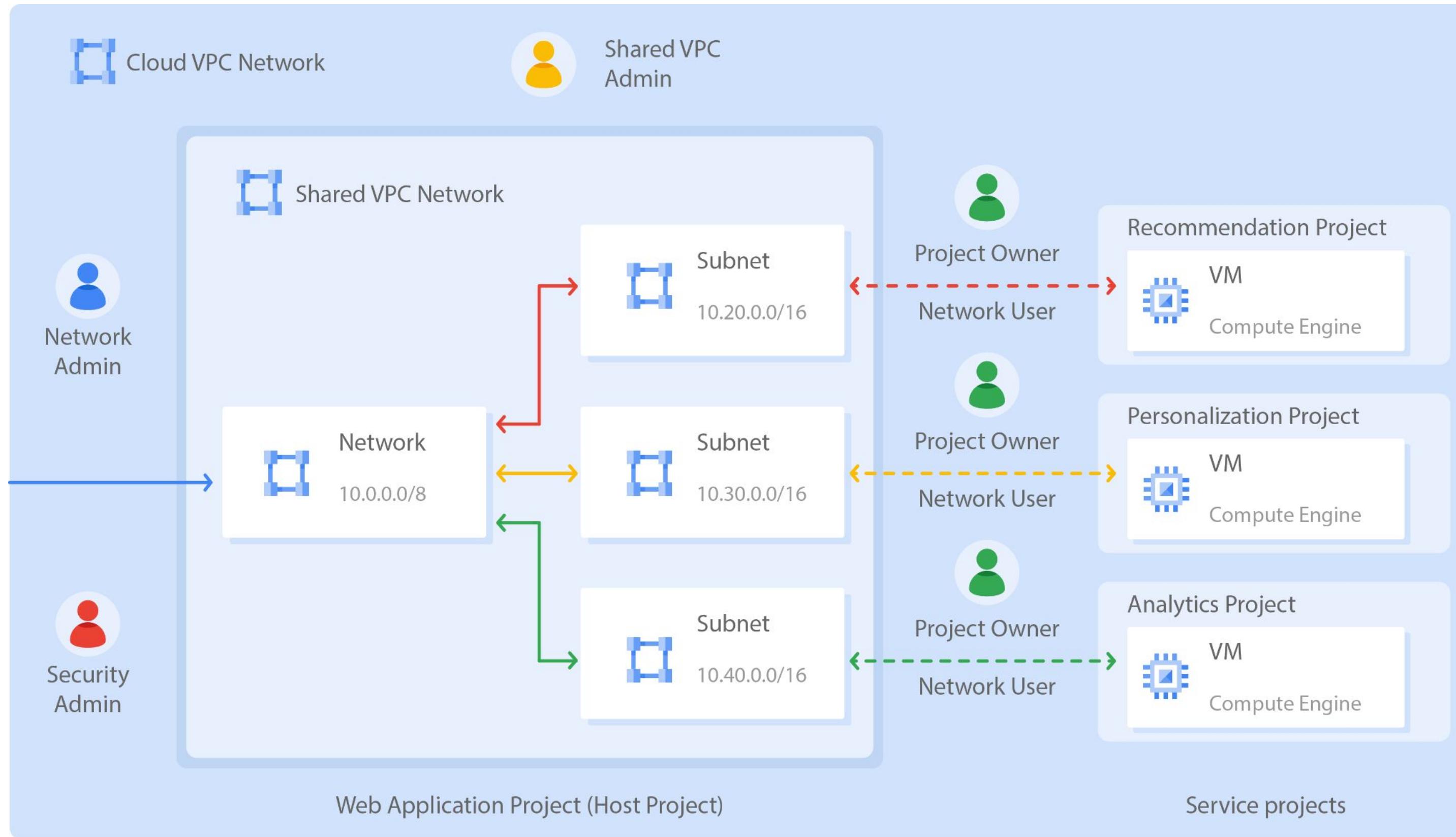
- Create the VPC in the **host** project.
- Shares the VPC with other **service** projects.



Allows centralized control over network configuration

- Network admins configure subnets, firewall rules, routes, etc.
- Remove network admin rights from developers.
- Developers focus on machine creation and configuration in the shared network.
- Disable the creation of the default network using an organizational policy.

# Shared VPC



# Shared VPC vs. VPC peering

Consideration	Shared VPC	VPC Network Peering
Across Organizations	No	Yes
Within Project	No	Yes
Network Administration	Centralized	Decentralized

# Google Cloud VPC - Youtube Videos

Covers many of the same topics mentioned here today

**Networking End to End**  
Google Cloud Tech - 1 / 16

1 Migrating to GCP? First Things First: VPCs 7:26

2 Hybrid Networking: Google Cloud Interconnect 8:25

3 Protect Your Google Cloud Instances with Firewall... 6:44

4 Enable VM Communication with IP Addresses 6:22

**Migrating to GCP? First things first: VPCs**

Google Cloud

<https://bit.ly/34uBApk>

# Practice Question

What are the three types of networks offered in the Google Cloud?

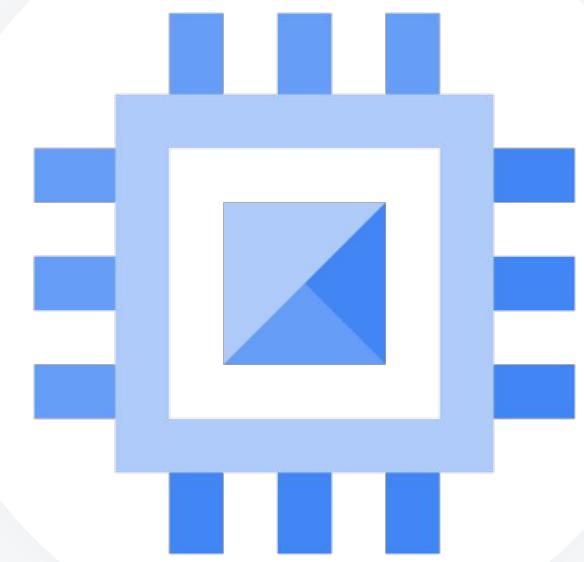
- A. Zonal, regional, and global
- B. Gigabit network, 10-gigabit network, and 100-gigabit network
- C. Default network, auto-mode network, and custom-mode network
- D. IPv4 unicast network, IPv4 multicast network, IPv6 network

# Practice Question

What are the three types of networks offered in the Google Cloud?

- A. Zonal, regional, and global
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- C. Default network, auto-mode network, and custom-mode network
- D. IPv4 unicast network, IPv4 multicast network, IPv6 network

# Compute Engine



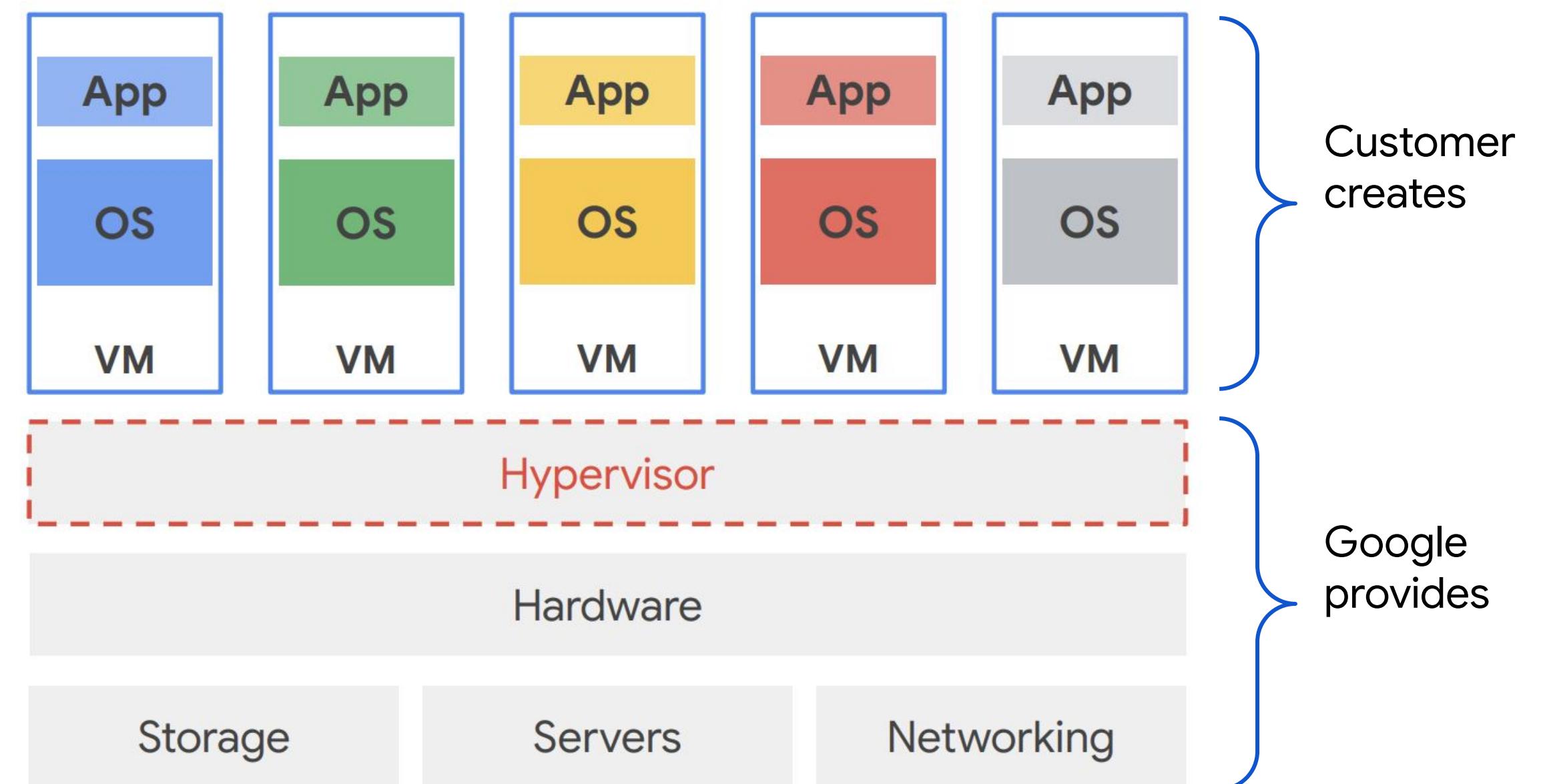
# Compute Engine

## Virtual machines on Google's infrastructure

- **Predefined machine types:** Pre-built and ready-to-go configurations
- **Custom machine types:** Create VMs with optimal amounts of vCPU (cores) and memory (RAM), while balancing cost
- **Spot machines and preemptible virtual machines:** Reduce computing costs
- **Confidential computing:** Encrypt your most sensitive data while it's being processed
- **Rightsizing recommendations:** Optimize resource utilization with automatic recommendations
- **Per second billing**

# Virtual Machines:

Typical use case:  
“Lift and shift” of on-premise  
VMs and applications



# Compute Engine Machine Types



Tip: More detail and use cases found here: <https://cloud.google.com/compute#section-6>

# Tau VMs - Scale-out Optimized Machine Types

- Best price / performance and full x86 compatibility**



**Tau**, a new family of virtual machines, delivers **42% better price-performance among leading cloud providers** for scale-out apps



First instances under the Tau VM family are based on 3rd gen AMD EPYC processors, **preserving full x86 compatibility**.



Also supported in **GKE** (Google Kubernetes Engine), just add T2D to your GKE node pools

**No application porting required !**

Ideal for scale-out workloads:

- Web servers
- Containerized microservices
- Data-logging processing
- Media transcoding
- Large-scale Java applications



# Compute Optimized Machine Types

**Performance sensitive for CPU workloads.**  
**Or, licensed applications that may benefit from more powerful cores.**

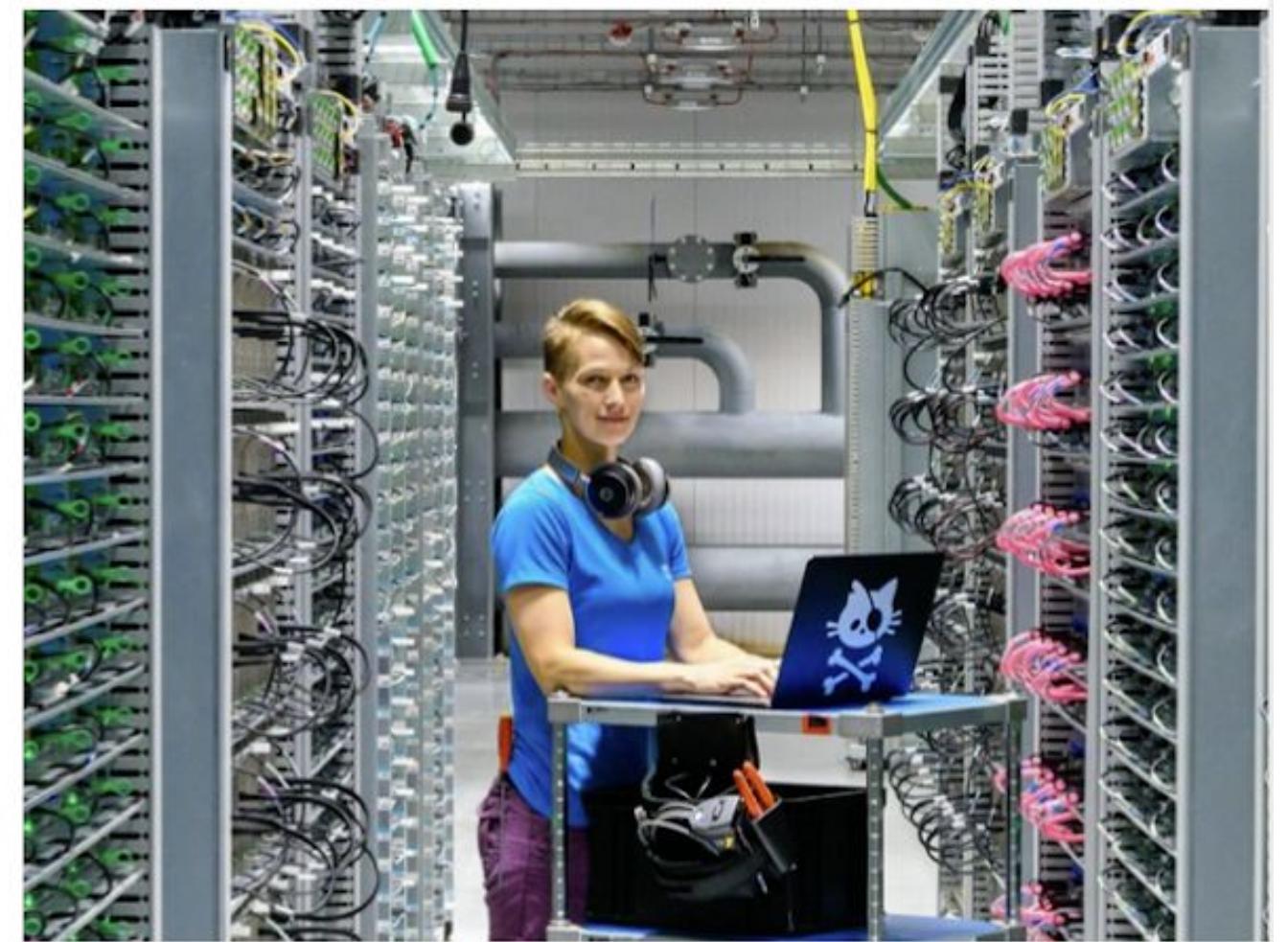
- **High-performance Web Servers**
- **Gaming (AAA Game Servers)**
- **High Performance Computing (HPC)**
  - Simulations (Finite Element Analysis, Oil & Gas, CFD, Monte Carlo, Product Simulation, Weather, Physics, Chemistry)
  - Financial Services (Financial analysis & simulation workloads)
  - Genomic Analysis
- **Media Transcoding**
- **Electronic Design Automation**



# Memory Optimized Machine Types

Designed for high-end business critical applications Optimized for SAP

- ✓ In-memory databases  
SAP HANA
- ✓ In-memory Analytics
- ✓ In memory persistent cache



# Accelerator Optimized Machine Types

**A2 VM Family: Newest NVIDIA GPUs, Optimized for ML, HPC and other parallelized CUDA Compute Workloads**

## Optimized Hardware

- Newest, Highest Performance NVIDIA A100 GPUs with 40 GB Memory
- Up to 96 Cascade Lake vCPUs and 1.3T memory
- *a2-highgpu* fixed VM shapes w/ 1,2,4 or 8 GPUs for scale-out workloads
- *a2-megagpu* VM shape w/**16 GPUs** for scale-up workloads
- NVLINK, optional Local SSD and optimized 100 Gbps Networking

## Optimized Virtualization

- New transparent Numa topology, enabling maximum system throughput
- Memory speed improvements via 1G pages

## Giant boost for all GPU accelerated Workloads

- ML Training - Create NexGen AI and maximize data scientist productivity
- ML Inference - Performance and versatility for running AI at Scale
- HPC - Faster & larger scale simulation to unlock new discoveries
- Data Analytics - Faster analytics with larger data set



# Custom Machine Types

- Specify number of vCPU cores and memory
- Optimize resources
- Manage costs

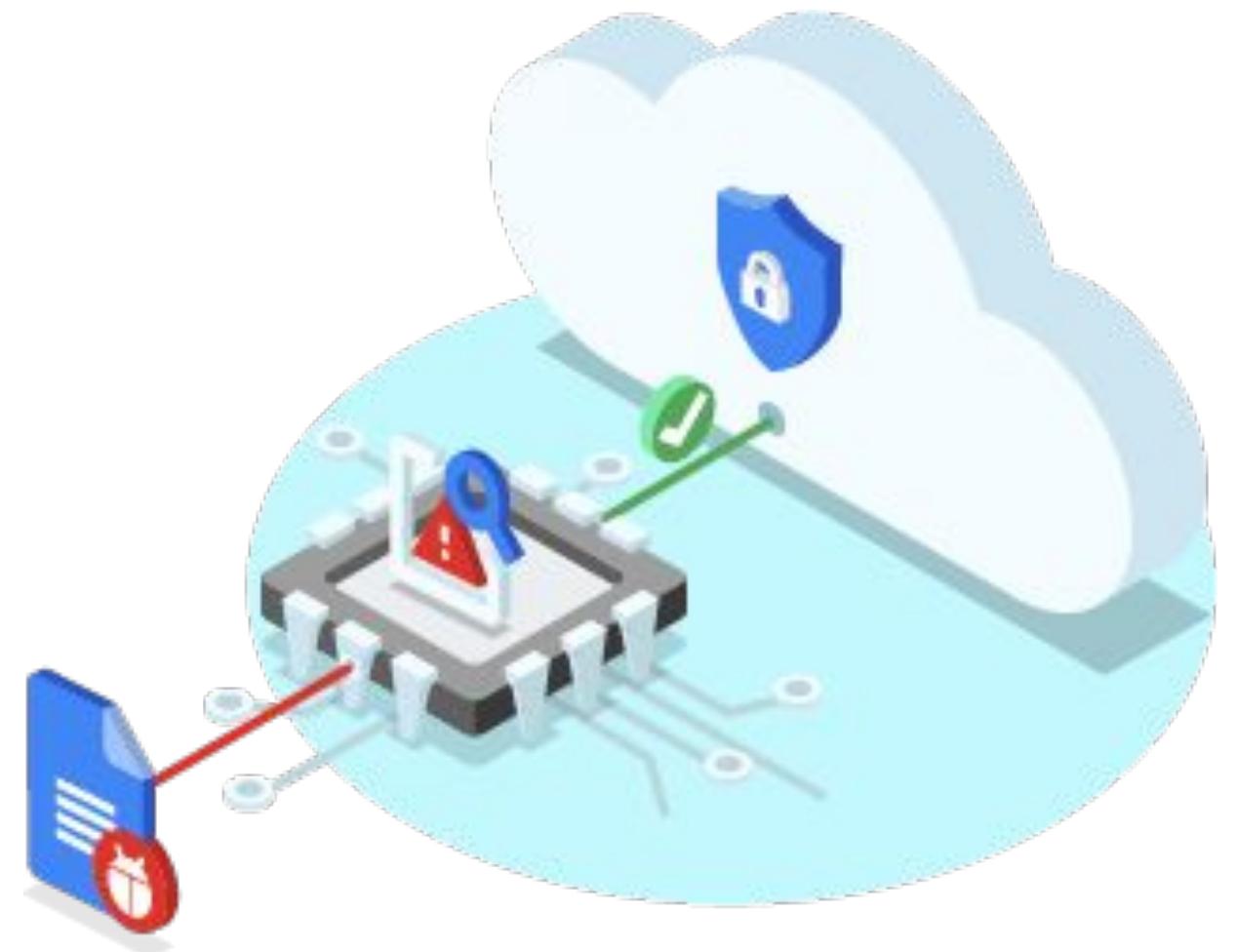


# Shielded VMs offer verifiable integrity

VMs include a set of security controls that ensures your instances haven't been compromised by boot- or kernel-level malware or rootkits.

## Helps Protect Against:

- Remote Attacks
- Privilege escalation
- Malicious insiders

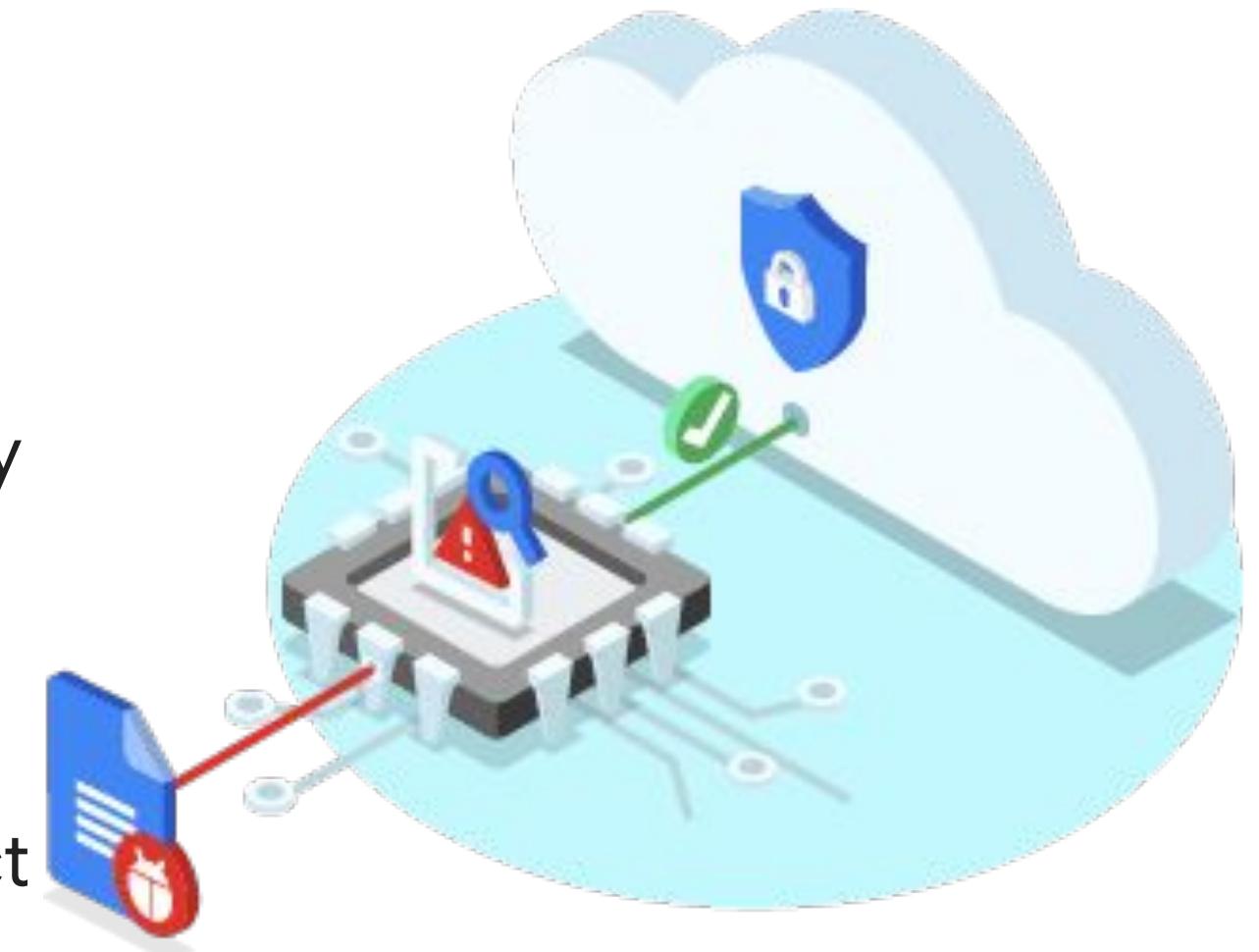


# Shielded VMs offer verifiable integrity

VMs include a set of security controls that ensures your instances haven't been compromised by boot- or kernel-level malware or rootkits.

## Includes:

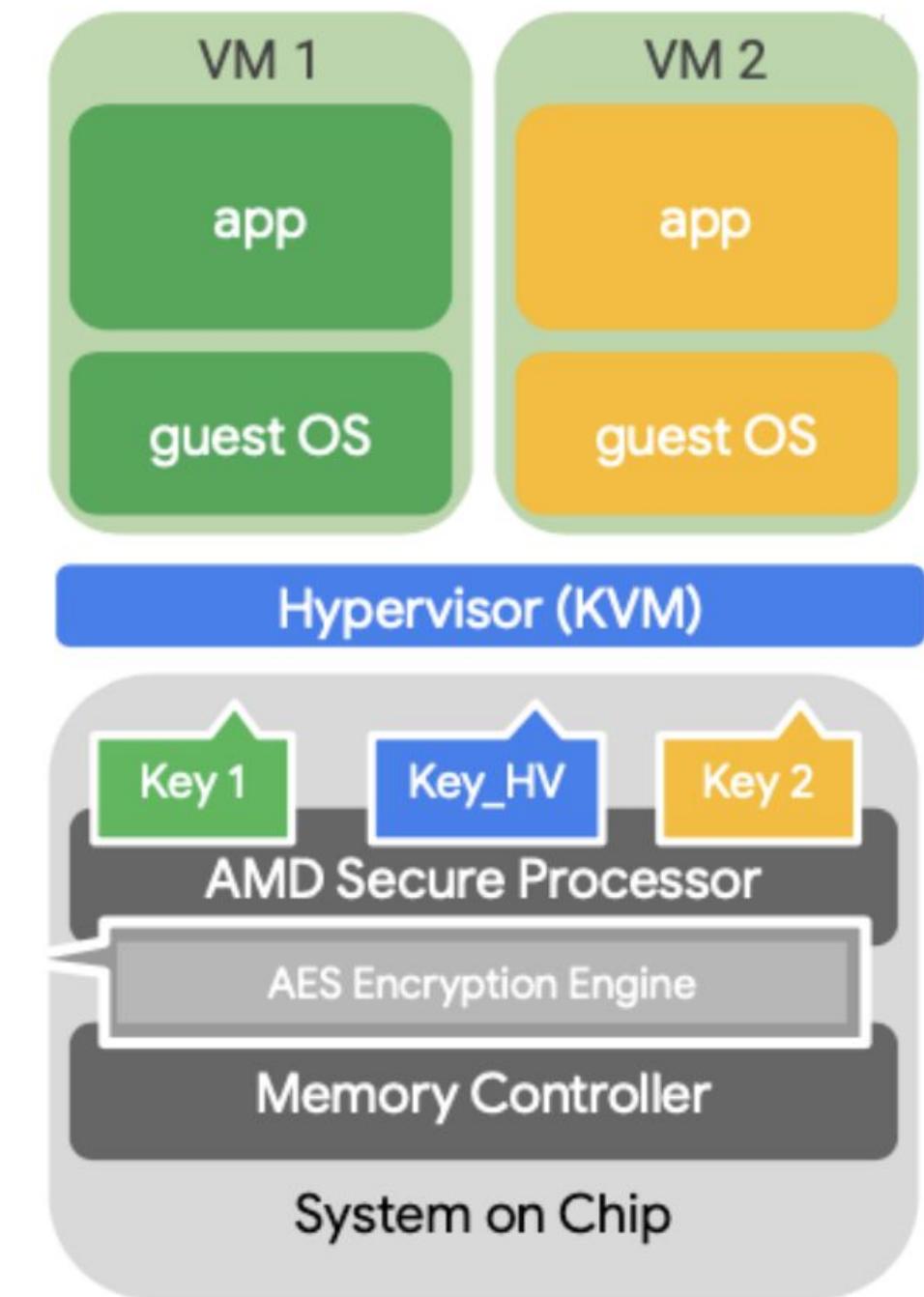
- Secure Boot – prevents boot- or kernel-level rootkits by only allowing components signed by Google
- Integrity Monitoring – discover and act on changes in boot and kernel components across restarts
- vTPM – exposed to host OS for applications to use to project secrets, but also a requirement for Integrity Monitoring



## Shielded VMs

# Confidential Computing w/Confidential VMs

- A breakthrough technology that **encrypts sensitive data** while it's being processed
  - Data is encrypted/decrypted only on CPU chp
- No code changes needed to applications
  - Any existing workload can run as a Confidential VM.
- Uses a Shielded VM to perform computations
- Leverages AMD SEV powered by 2nd Gen ADM EPYC processors



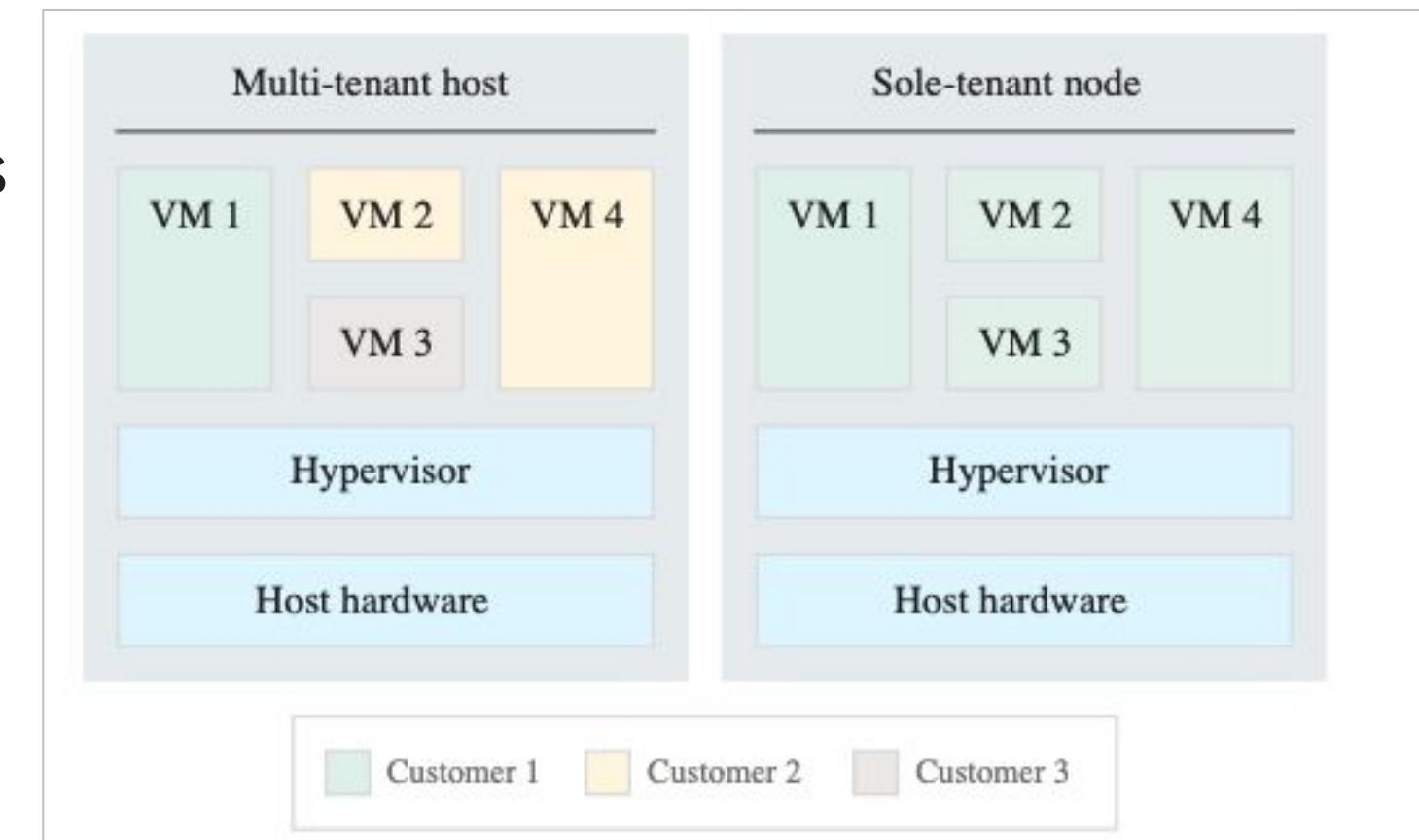
Confidential Computing

# Sole Tenant Nodes

A physical Compute Engine server that is dedicated to hosting only your project's VMs

## Use cases:

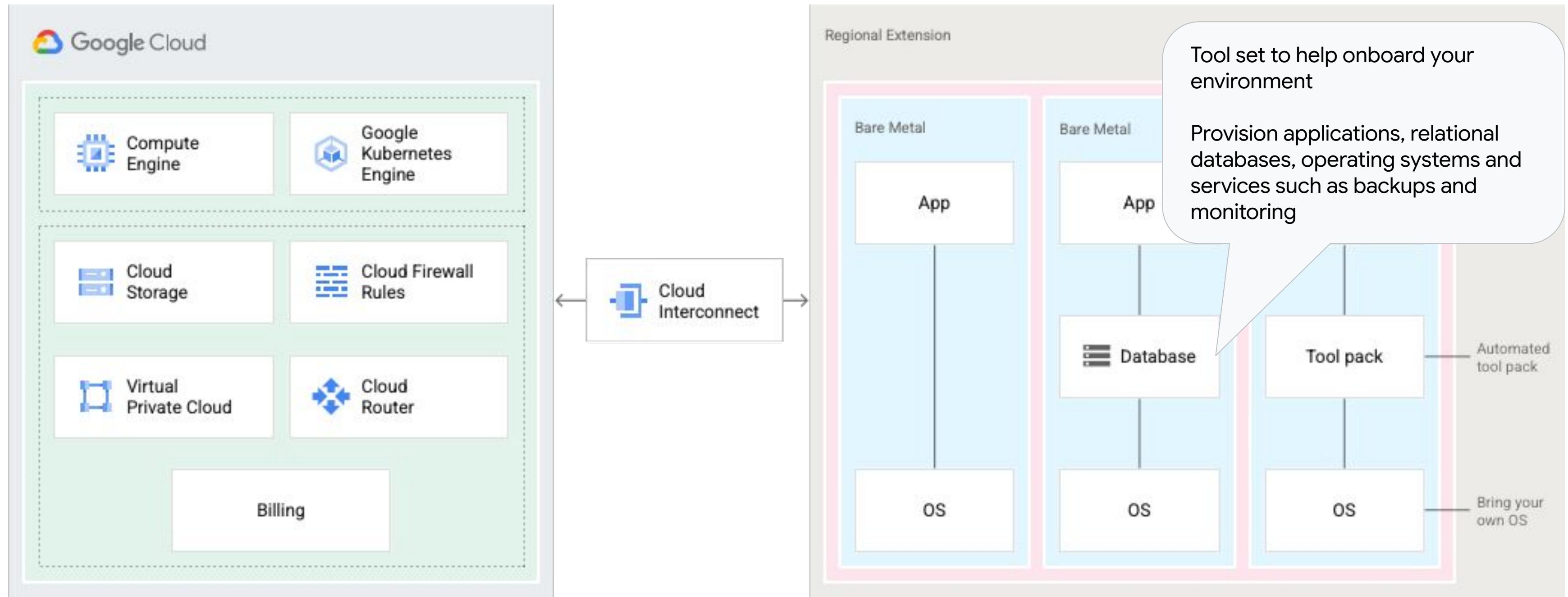
- Meet security or compliance requirements with workloads that require physical isolation from other workloads or VMs
- Meet dedicated hardware requirements for bring your own license (BYOL) scenarios that require per-core or per-processor licenses



## Sole Tenant Nodes

# Bare Metal Solution for Specialized Workloads

Provides hardware to run specialized workloads with low latency



Bare Metal

Google Cloud

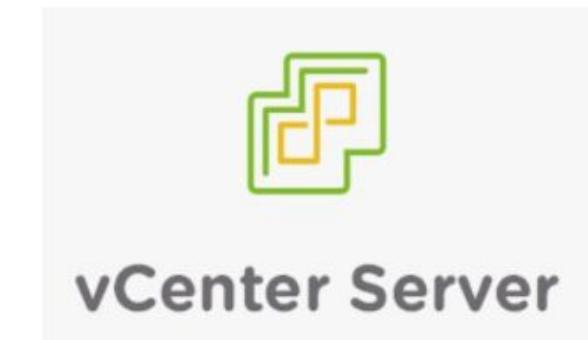
# VMware Engine: VMware-as-a-Service

## What's included?

Google Cloud VMware Engine delivers a fully managed **VMware Cloud Foundation** stack:

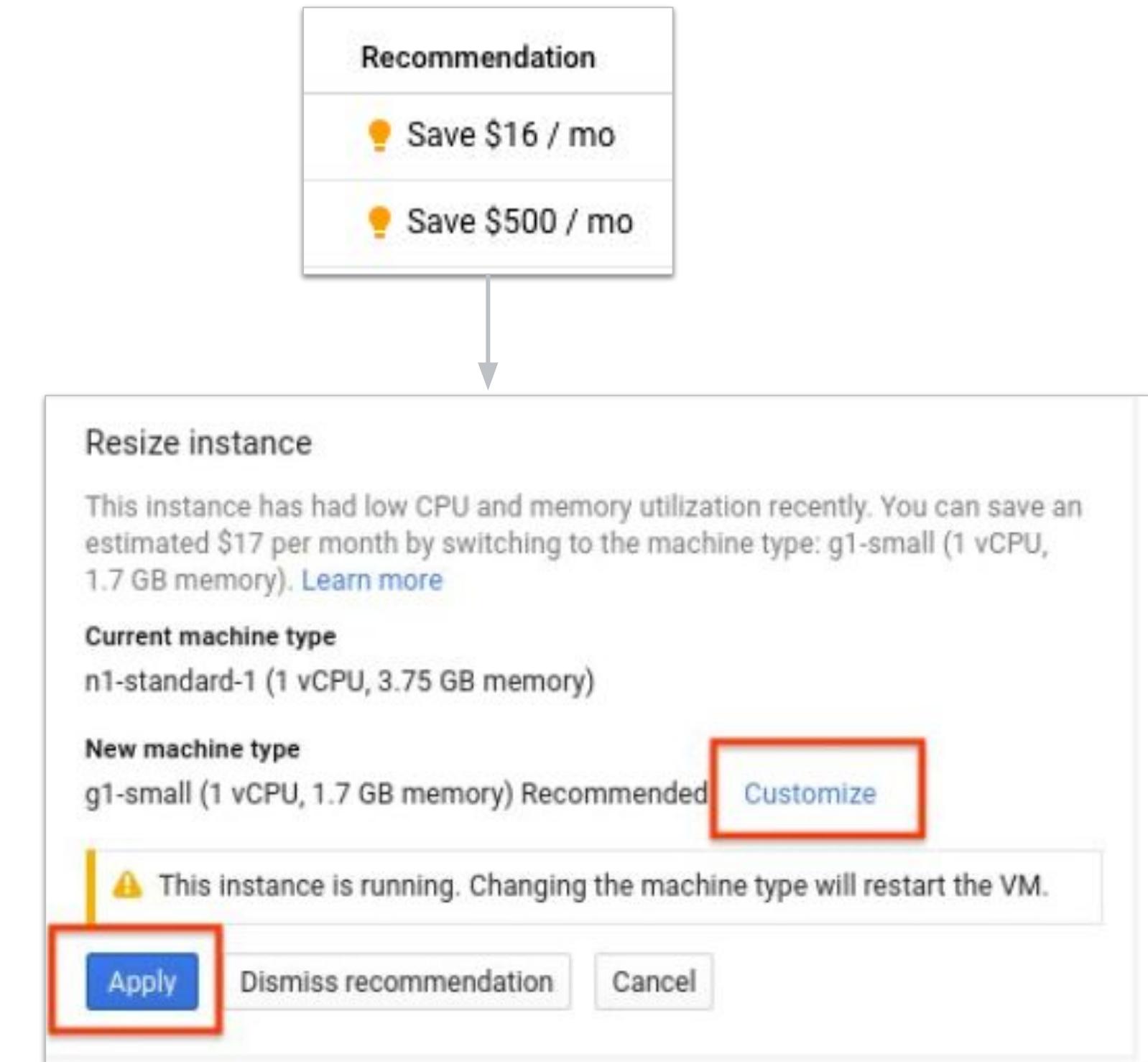
- VMware vSphere 7.0u2
- vCenter 7.0u2
- vSAN 7.0u2
- NSX-T 3.1.2
- HCX 3.5.3 Enterprise

All in a dedicated environment within Google Cloud



# Rightsizing recommendations

- Help optimize the resource utilization of VMs
- Generated automatically based on system metrics gathered by the Cloud Monitoring service over the previous 8 days.
- Suggests resizing instance's machine type to more efficiently use the instance's resources.
  - Avoid paying for idle and oversized resources
- Recommendations are free of charge.



# Preemptible and Spot VMs

- A highly discounted VM compared to the price of standard VMs
  - Discount of 60-91% discount
- Availability depends on having excess compute capacity in a zone
  - May or may not have availability in a given zone at a given time
    - Try another zone or wait for the resource to be available
- Compute Engine might stop preemptible/spot instances at any time due to system events
  - Preemptible VMs - always stopped after they run for 24 hours.
    - May be stopped before the 24 hour time period
    - When restarted, the 24 hour clock resets
  - Spot VMs - stopped/deleted when Google needs the resource elsewhere
    - Spot VMs are the latest version of preemptible VMs
    - Can specify termination or deletion when creating the VM

# Preemptible/Spot VMs - additional details

- Offer the same machine types, options, and performance as regular compute instances
- Use cases
  - Stateless workloads that can be stopped and checkpointed in less than 30 seconds
- Provides no live migration or automatic restart during maintenance events
- Not covered by Service Level Agreement
- No free tier

Tip: Look through all the links in [Top 5 use cases for Google Cloud Spot VMs explained + best practices](#)

# Compute Engine Pricing

- Based on per-second usage of:
  - Machine types
  - Persistent disks
  - Other resources you select for your VMs
- Estimate cost with with [Google Cloud Pricing Calculator](#)
- Manage Costs with:
  - [Sustained use discounts](#)
  - [Committed Use Discounts \(CUDs\)](#)
  - [Preemptible VMs](#)
  - [Spot VMs](#)

# Compute Engine Images



# Compute Engine Images

- Public base images\*
  - Google, third-party vendors, and community; Premium images (p)
  - Linux
    - CentOS, CoreOS, Debian, RHEL(p), SUSE(p), Ubuntu, openSUSE, and FreeBSD
  - Windows
    - Windows Server 2022(p), 2019(p), 2016(p), 2012-r2(p) and more
    - SQL Server pre-installed on Windows(p)
- Custom images
  - Create new image from VM: pre-configured and installed SW
  - Import from on-prem, workstation, or another cloud
  - Management features: image sharing, image family, deprecation

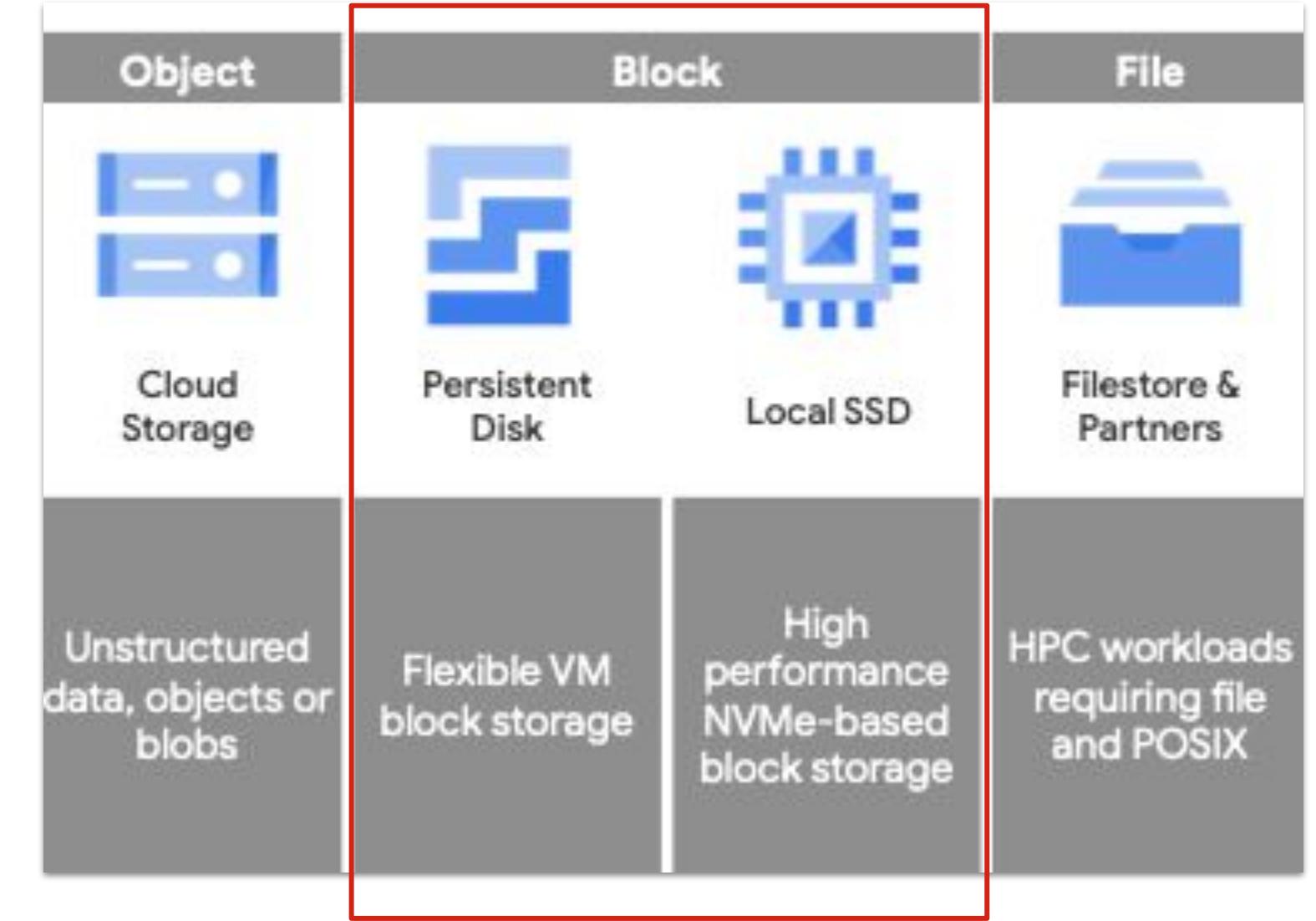
\*Check the [website](#) for an updated list of public images

# Compute Engine Storage Options



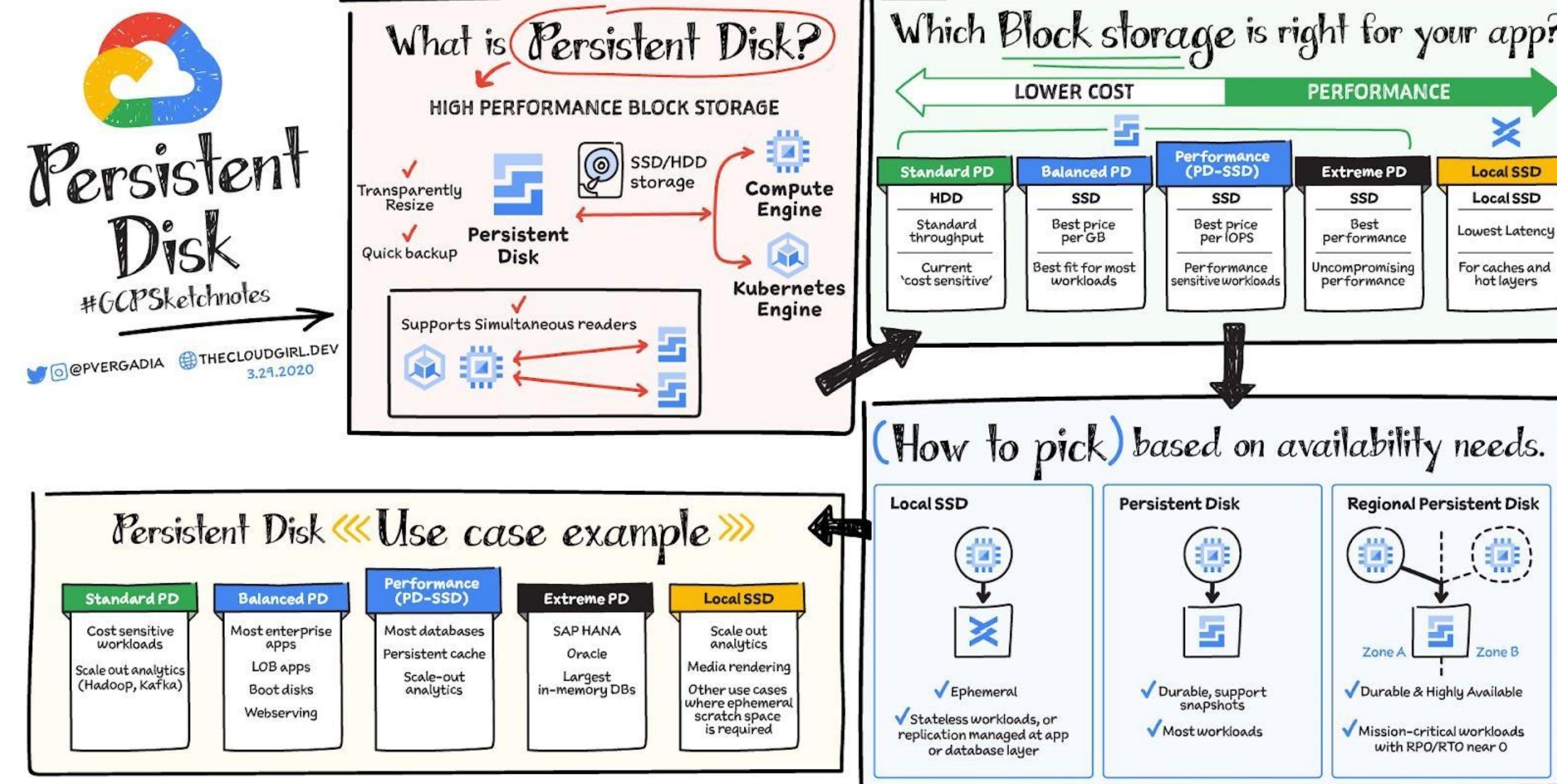
# Compute Engine Data Storage

- Each VM has a boot persistent disk (PD) that contains the operating system
  - Not best practice to place non-system data on the boot disk
- When apps require additional storage space add one or more additional storage options
  - **Cloud Storage buckets:** Affordable object storage
  - **Additional persistent disk(s):** Efficient, reliable block storage.
  - **Local SSD:** High performance, transient, local block storage.
  - **Filestore:** High performance file storage for Google Cloud users.



Next  
discussion

# Persistent Disk



A Google Cloud block storage options cheat sheet

# Persistent Disk Types

- **Standard persistent disks** (pd-standard)
  - Standard hard disk drives (HDD)
- **SSD persistent disks** (pd-ssd)
  - Backed by solid-state drives
- **Balanced persistent disks** (pd-balanced)
  - Solid-state drives (SSD) that balance performance and cost
    - Faster than Standard, less expensive than SSD
- **Extreme persistent disks** (pd-extreme)
  - Solid-state drives designed for high-end database workloads
  - Provides high performance for both random access workloads and bulk throughput
  - Available for high performance machine types
- **Local SSD (ephemeral storage)**
  - Always-encrypted local solid-state drive (SSD)
  - Multiple disks can be attached to a VM for a total of 9TB

Data written to Local SSDs is not guaranteed to persist between VM restarts

# Adding additional disks with the Console

**Additional disks**

+ ADD NEW DISK    + ATTACH EXISTING DISK

**Backup plan**

Secure your backups against deletion through backup vault storage and enable centralized backup management across projects. Managed by Backup and DR Service, a separate service from Compute Engine with independent certifications and accreditation. [Learn more](#)

**Info** To switch to a different backup plan, you must remove the current plan, save changes, and then return to this page and apply a new plan.

**Backup plan**    SELECT A PLAN ?

**Local disks**

None

Add new disk

Name \* disk-1

Name is permanent

Description

Location

Single zone

Regional  
Create a failover replica in the same region. [Learn more](#)

Region us-central1 (Iowa)

Source

Create a blank disk, apply a bootable disk image, or attach an existing disk to this project.

Disk source type \* Blank disk

Encryption

Data is encrypted automatically. Select an encryption key.

Google-managed encryption key  
Keys owned by Google

Cloud KMS key  
Keys owned by customers

Disk settings

Disk type \* Balanced persistent disk

Attachment settings

Mode

Disk attachment mode

Read/write

Read-only

Deletion rule

When deleting instance

Keep disk

Delete disk

Device name ?

Used to reference the device for mounting or resizing.

Use a custom device name

Device name disk-1

Based on disk name (default)

You can now automate creation of this disk type.

**DISMISS**    **LEARN MORE**

Size \* 100

Provision between 10 and 65,536 GB

Customer-supplied encryption key (Customer-managed)

Manage outside of Google Cloud

# Regional disks provide high availability

- Synchronously replicate of data between two zones in a region
- In the event of a zonal outage where VM instance becomes unavailable
  - Spin up a VM in the secondary zone and force attach the disk
    - Time to recover = time to create VM (several minutes) + time to force attach disk (~1 minute)

```
gcloud compute instances attach-disk myvm2 \
--disk data-disk --disk-scope=regional \
--force-attach
```

# Summary: Persistent Disk Options

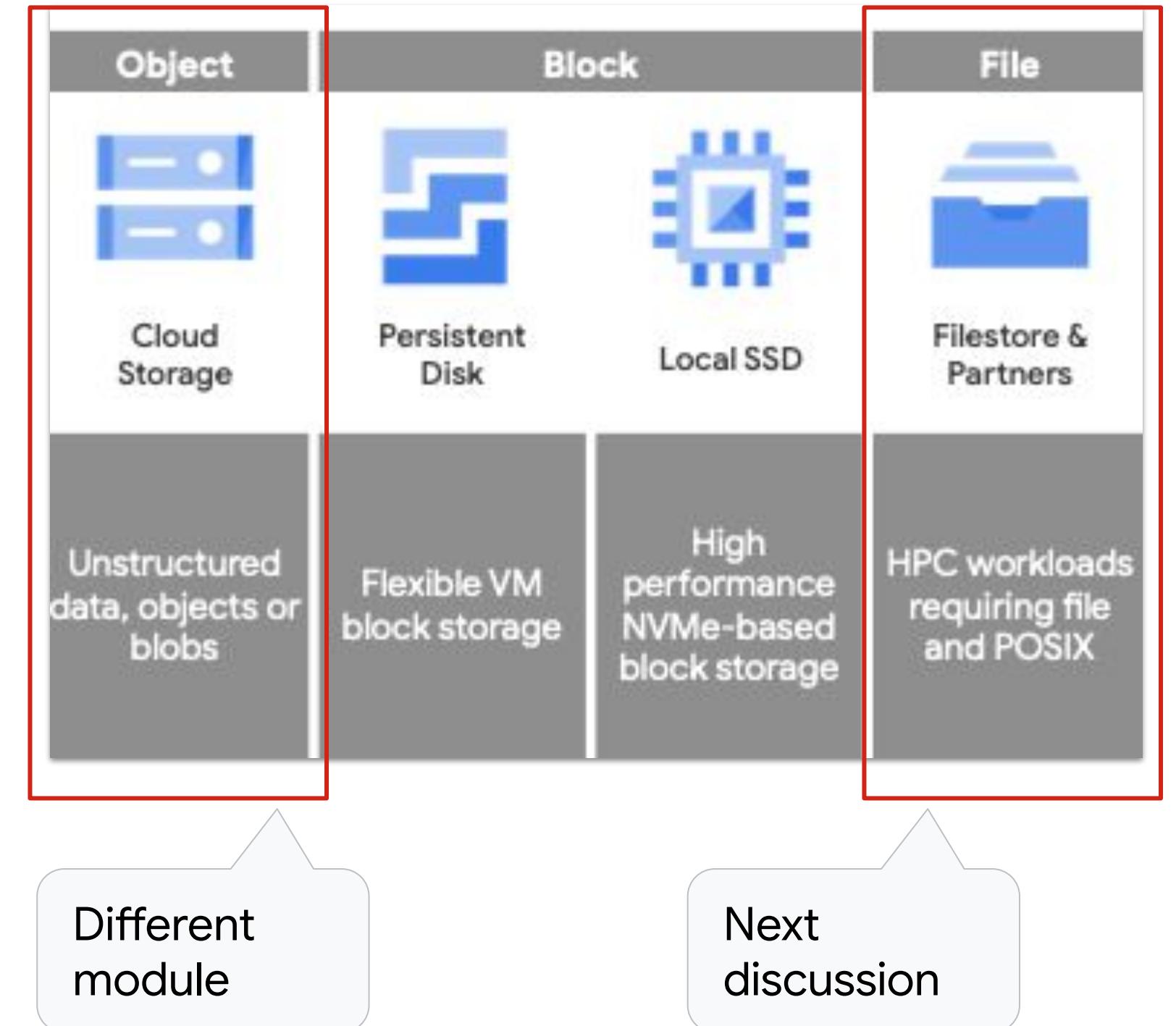
Network storage appearing as a block device:

- Attached to a VM through the network interface
- Durable storage: can survive VM terminate
- Bootable: you can attach to a VM and boot from it
- Snapshots: incremental backups
- Performance: Scales with size

- Disk resizing: even running and attached!
- Can be attached in read-only mode to multiple VMs
- Local SSD available for fast caching
- Zonal or Regional
- Encrypted by Google by default
  - Customers can do their own encryption using
    - Customer managed encryption keys
    - Customer supplied encryption keys

# Compute Engine Data Storage

- Each VM has a boot persistent disk (PD) that contains the operating system
  - Not best practice to place non-system data on the boot disk
- When apps require additional storage space add one or more additional storage options
  - **Cloud Storage buckets:** Affordable object storage
  - **Additional persistent disk(s):** Efficient, reliable block storage.
  - **Local SSD:** High performance, transient, local block storage.
  - **Filestore:** High performance file storage for Google Cloud users.



# What is Filestore?

- Cloud-based managed file storage service for the Unix file system (POSIX)
- Provides native experience for standing up Network Attached Storage (NAS) for Compute Engine and Kubernetes Engine
- High-performance, fully managed network attached storage
  - Mount as file shares on Compute Engine instances
  - Used to store and serve files such as documents, images, videos, audio files, and other data
- Pay for what you use
- Capacity scales automatically scale based on demand
- Use cases:
  - Enterprise application migrations (SAP)
  - Media rendering where file shares are needed
  - Web content management



[YouTube video](#)

# Filestore use cases

## Rendering

Mount Filestore volumes on Compute Engine instances, enabling visual effects artists to collaborate on the same file share. Burst compute to meet rendering demands.

## Application Migrations

Filestore can support a broad range of enterprise applications that need a shared filesystem interface to data. Ex. SAP

## Web Content Management

Web developers creating websites and blogs that serve file content to their audience will find it easy to integrate Filestore with web software like Wordpress.

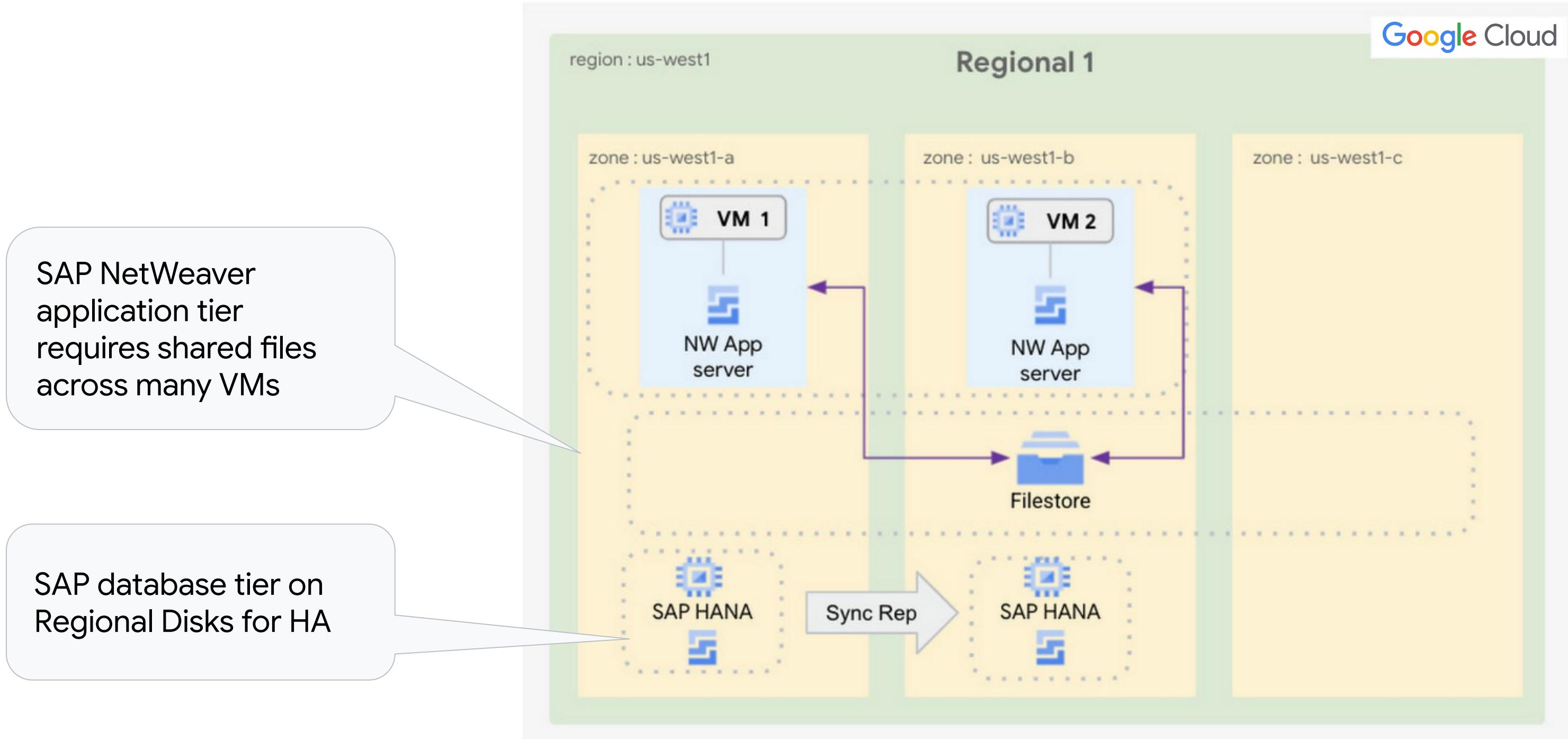
## Media Processing

Graphic design, video and image editing and other media workflows use files as an input and files as the output. Filestore helps creators access shared storage to manipulate and produce large files.

## Home Directories

Users across your organization probably need to access and share common data sets. You can host file content in datastore and enable shared access to that data.

# Filestore example - SAP NetWeaver



Announcing Filestore Enterprise, for your most demanding apps (2021)

# Practice Question

Your client needs to create several Compute Engine VMs which will house various MySQL instances currently being used on-prem. Your customer will be making database backups nightly and will use these to restore if a failure occurs. They want to do the move for the lowest possible cost. You know you need to add a data disk to each VM. What else do you need to do?

- A. Look at the size of the disks being used on-prem and make it 1.5 times bigger in order to store the backups on the VM. Use regional disks for redundancy.
- B. Look at the size of the databases being used on-prem and create a disk of the appropriate size. Use regional disks for redundancy. Copy database backups to a Cloud Storage bucket.
- C. Look at the size of the disks being used on-prem and create a zonal disk of the same size. Copy database backups to a Cloud Storage bucket.
- D. Look at the size of the databases being used on-prem and create a zonal disk of the appropriate size. Copy database backups to a Cloud Storage bucket.

# Practice Question

Your client needs to create several Compute Engine VMs which will house various MySQL instances currently being used on-prem. Your customer will be making database backups nightly and will use these to restore if a failure occurs. They want to do the move for the lowest possible cost. You know you need to add a data disk to each VM. What else do you need to do?

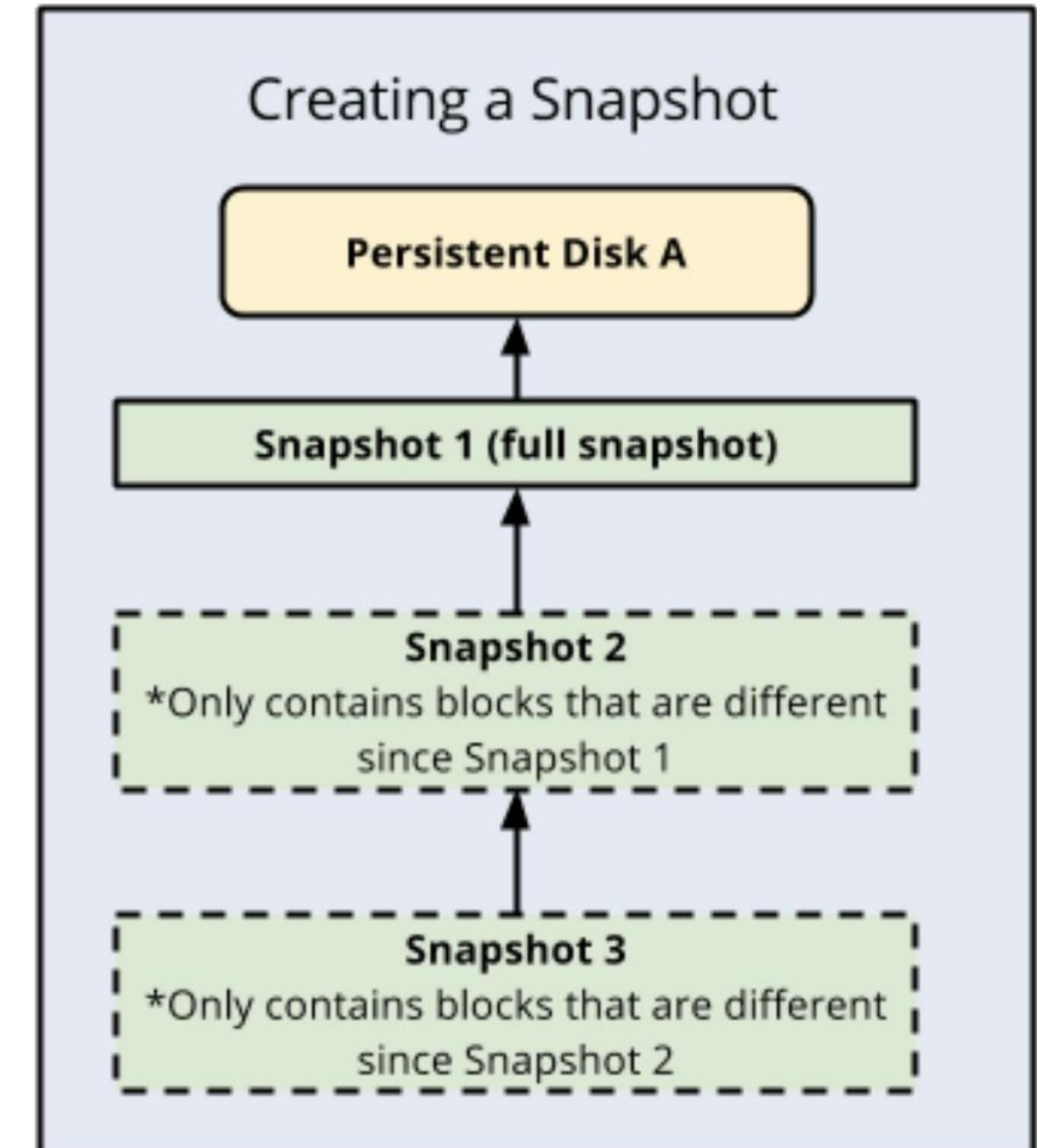
- A. Look at the size of the disks being used on-prem and make it 1.5 times bigger in order to store the backups on the VM. Use regional disks for redundancy.
- B. Look at the size of the databases being used on-prem and create a disk of the appropriate size. Use regional disks for redundancy. Copy database backups to a Cloud Storage bucket.
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# Compute Engine Disk Snapshots



# Snapshots

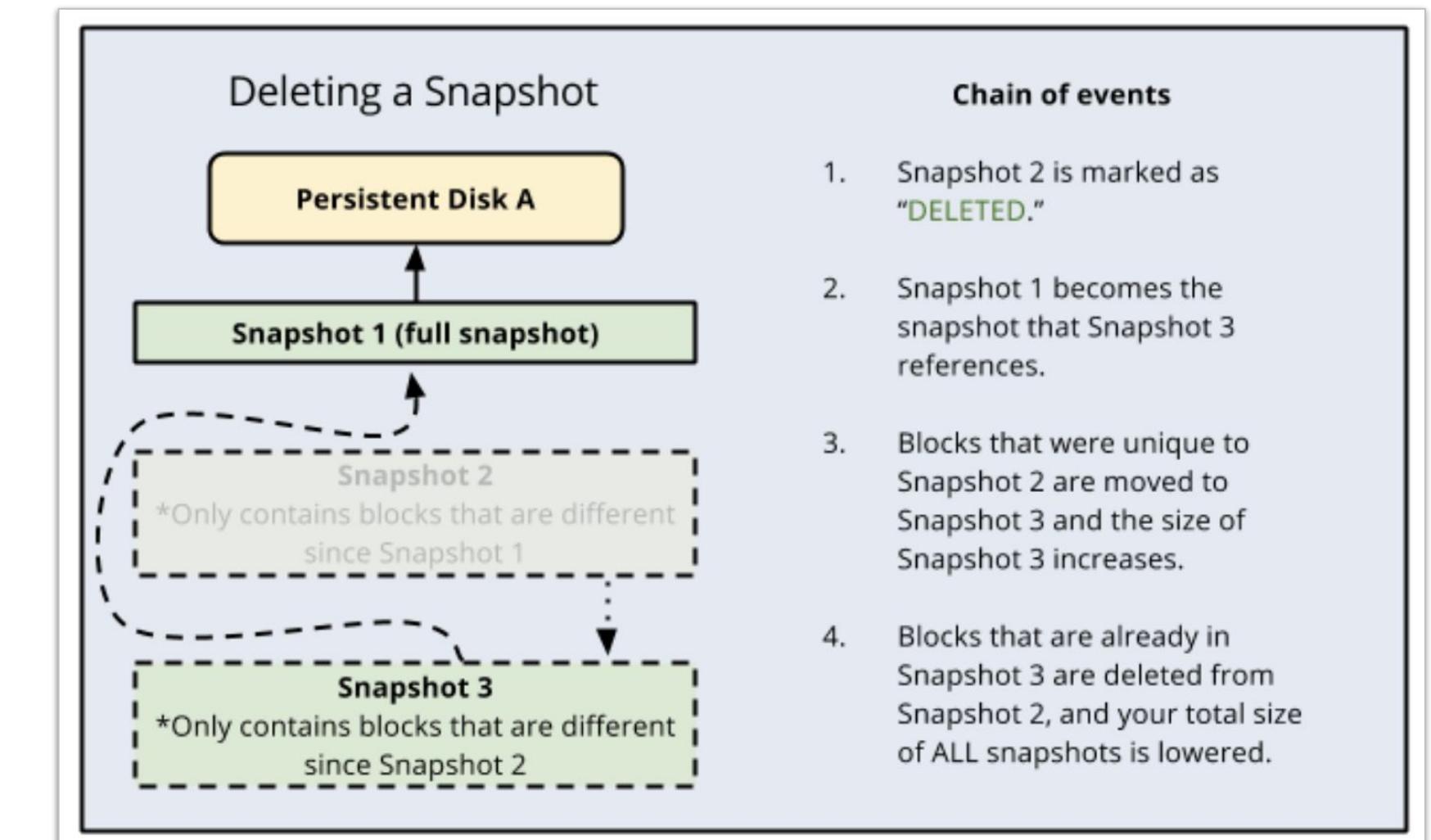
- Are incremental backups of data from persistent disks
  - No need to stop VM to take a snapshot
- Multiple copies are stored across multiple locations automatically
  - Snapshots can be shared across projects
- Create snapshot schedules to make backups of disks on a predetermined schedule



<https://cloud.google.com/compute/docs/disks/snapshots>

# Deleting Snapshots

- A deleted snapshot is immediately marked as **DELETED** in the system.
  - Is deleted outright if no dependent snapshots
- If dependant snapshots exist
  - Data required for restoring other snapshots is moved into the next snapshot
  - Data not required for restoring is deleted
  - The next snapshot no longer references the snapshot marked for deletion, and instead references the snapshot before it



# Create a Snapshot

Compute Engine / Snapshots

- Virtual machines
- Storage
  - Disks
  - Storage Pools
- Snapshots**
- Images
- Async Replication
- Instance groups
- VM Manager
- Bare Metal Solution

```
gcloud compute snapshots create webserver
--source-disk ws-disk
--source-disk-region=us-central1
```

[← Create a snapshot](#)

Snapshots are backups of persistent disks. They're commonly used to recover, transfer, or make data accessible to other resources in your project. [Learn more](#)

Name \*  Name is permanent

Description

Select source disk

Snapshot source type \*

Source disk \*  ?

Location ?

Select location

Type \*
 Snapshot Standard backup
 Multi-regional
 Regional

Instant snapshot Rapid restoration
 Archive snapshot Long-term storage disk

Labels ? [+ ADD LABEL](#)

[COMPARE SNAPS](#)

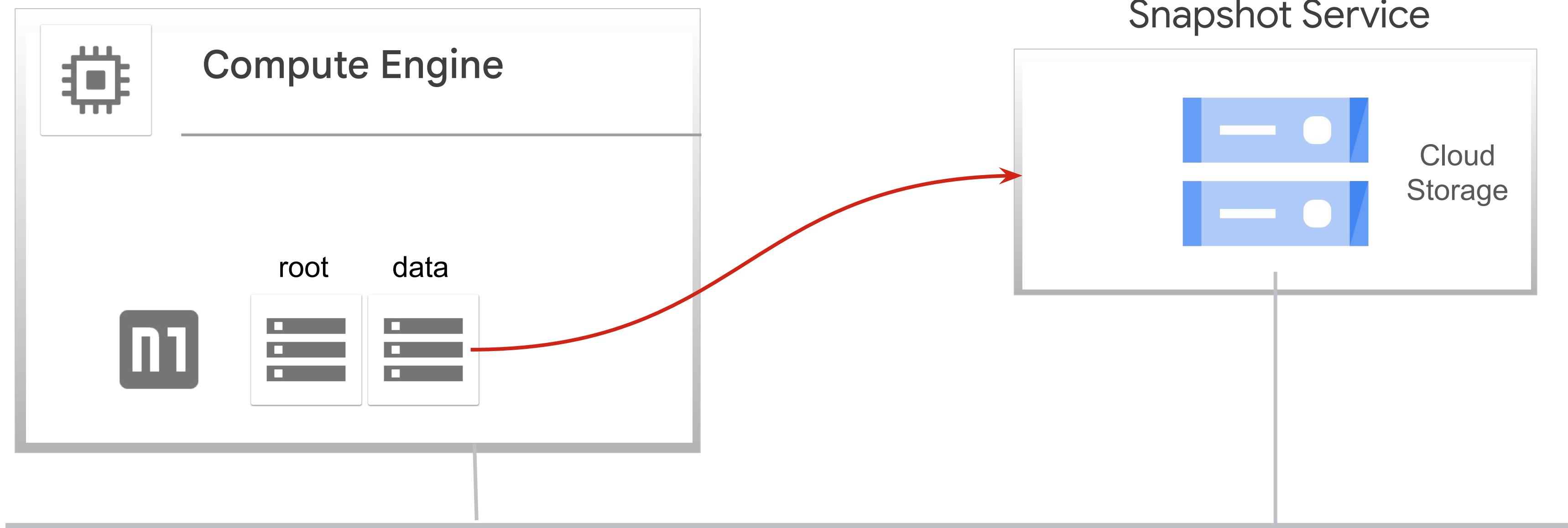
# Snapshot storage

- Stored in Cloud Storage and have a choice of
  - Multi-regional location, such as Asia
    - Provides higher availability (99.95% SLA vs 99.9% for regional)
    - Potentially slower snapshot restoration performance
  - Regional location, such as asia-south1
    - Use for compliance, e.g., GDPR
    - Use when all resources created from the snapshot will be in the same region - provides fastest restoration performance
- Network costs may be incurred when creating a disk from a snapshot
  - Multi-regional location storage
    - No network costs as long as the new persistent disk is created in one of the regions of the multi-regional group
  - Regional storage
    - Will incur network costs if the new disk is created in another region

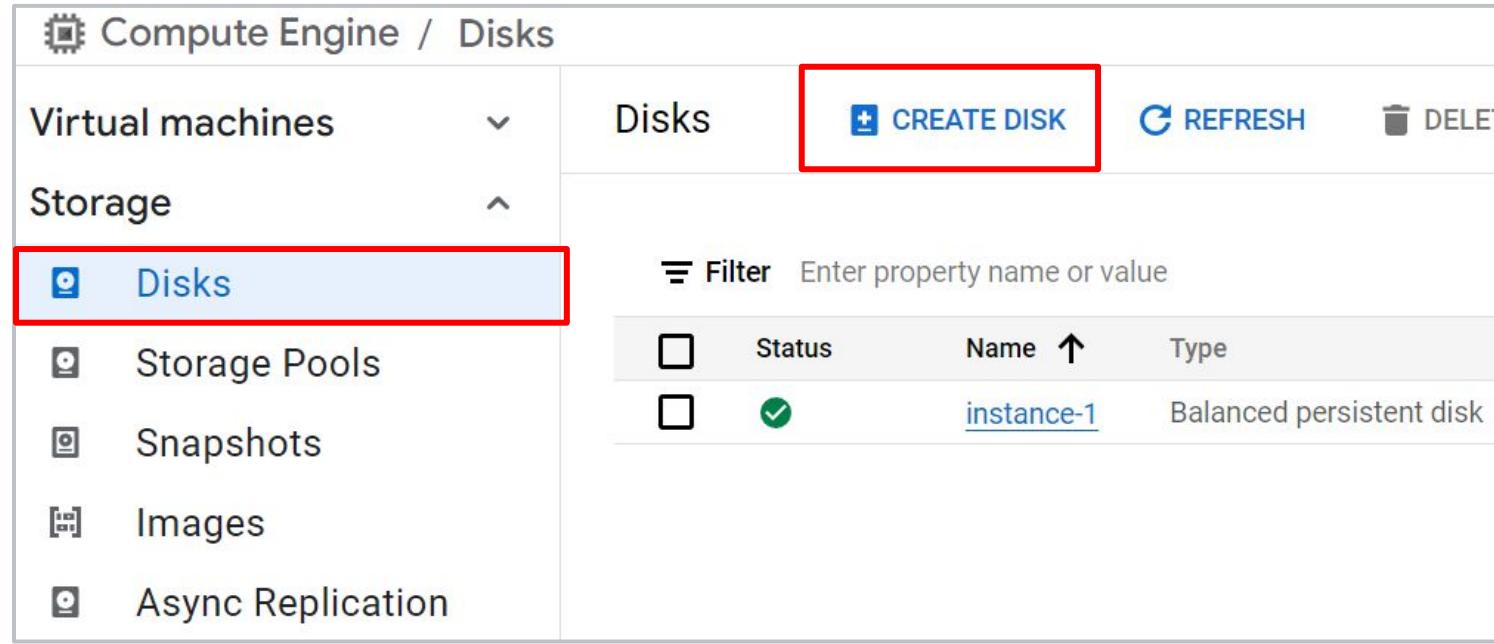
# Snapshot use cases

- Snapshots have many use cases
  - Can be used as source for a new disk
  - Can play a part in a disaster recovery plan
  - Can backup data
  - Can be used to move a VM to another zone/region
  - Can be used to migrate data from one disk type to another
- Examples are shown on the following slides

# Example - using a snapshot to backup data



# Example - create disk from snapshot



**Create a disk**

Name \*  ?  
Name is permanent

Description

**Location**

Single zone  
 Regional  
Create a failover replica in the same region for high availability. Storage and data replication is provided between both zones. [Learn more](#)

Region \*  Zone \*

**Source**  
Create a blank disk, apply a bootable disk project.

Disk source type \*

**Disk settings**

Disk type \*

**Snapshot name**

Size \*   
Provision between 10 and 65,536 GB

**Storage pool**

Enable storage pool

**Snapshot schedule (Recommended)**  
Use snapshot schedules to automate disk backups. [Learn more](#)

Enable snapshot schedule

Select or create a snapshot schedule \*   
Every day, starts between 7:00 AM and 8:00 AM, Storage location: us (United States)  
[More details](#)

**Consistency group**  
Ensure that the asynchronous replication of data is aligned across multiple disks in the same region. [Learn more](#)

Select or create a consistency group

**Encryption**  
Data is encrypted automatically. Select an encryption key management solution.

Google-managed encryption key  
Keys owned by Google

Cloud KMS key  
Keys owned by customers

Customer-supplied encryption key (CSEK)  
Manage outside of Google Cloud

**Labels** [+ ADD LABEL](#)

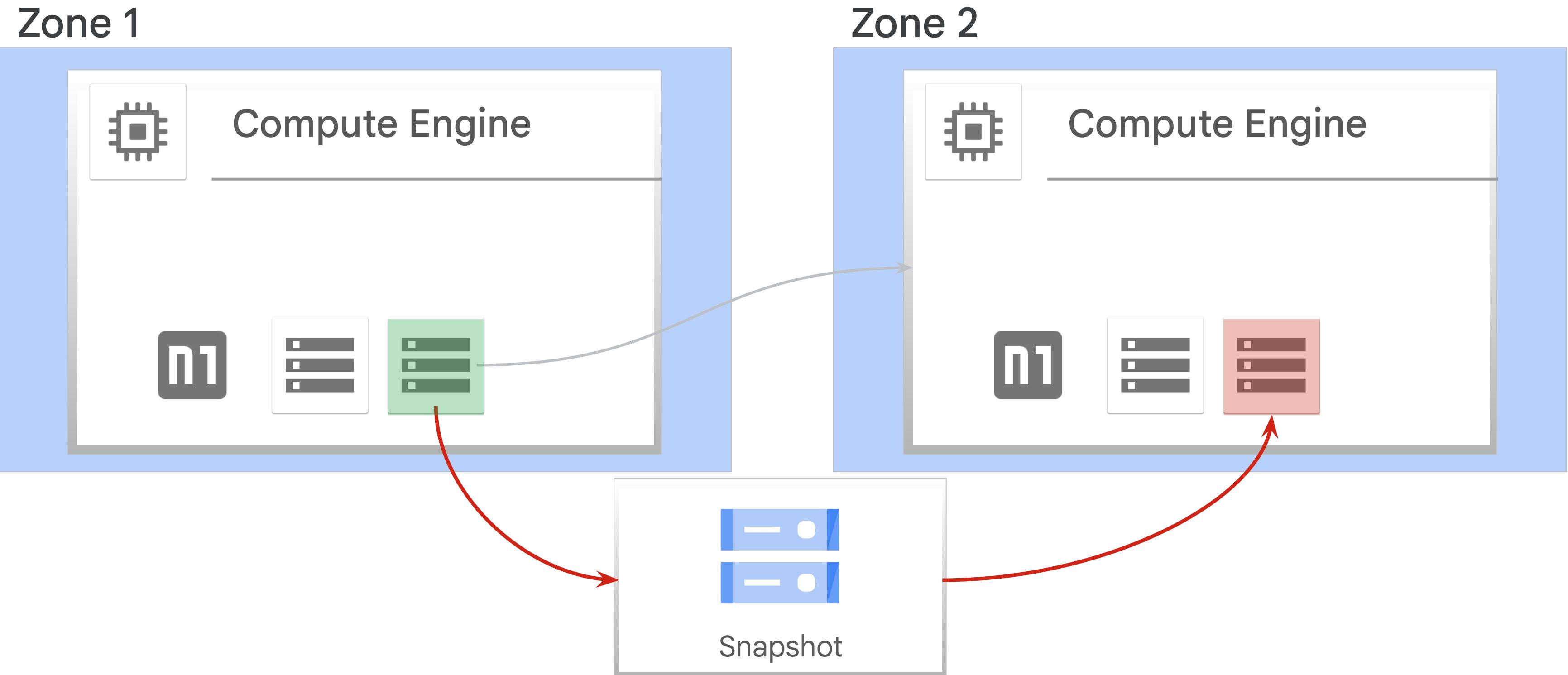
**Tags** [+ ADD TAGS](#)

You're creating an unformatted disk. Format the disk after you attach it to your VM instance. [Formatting and mounting a zonal persistent disk](#)

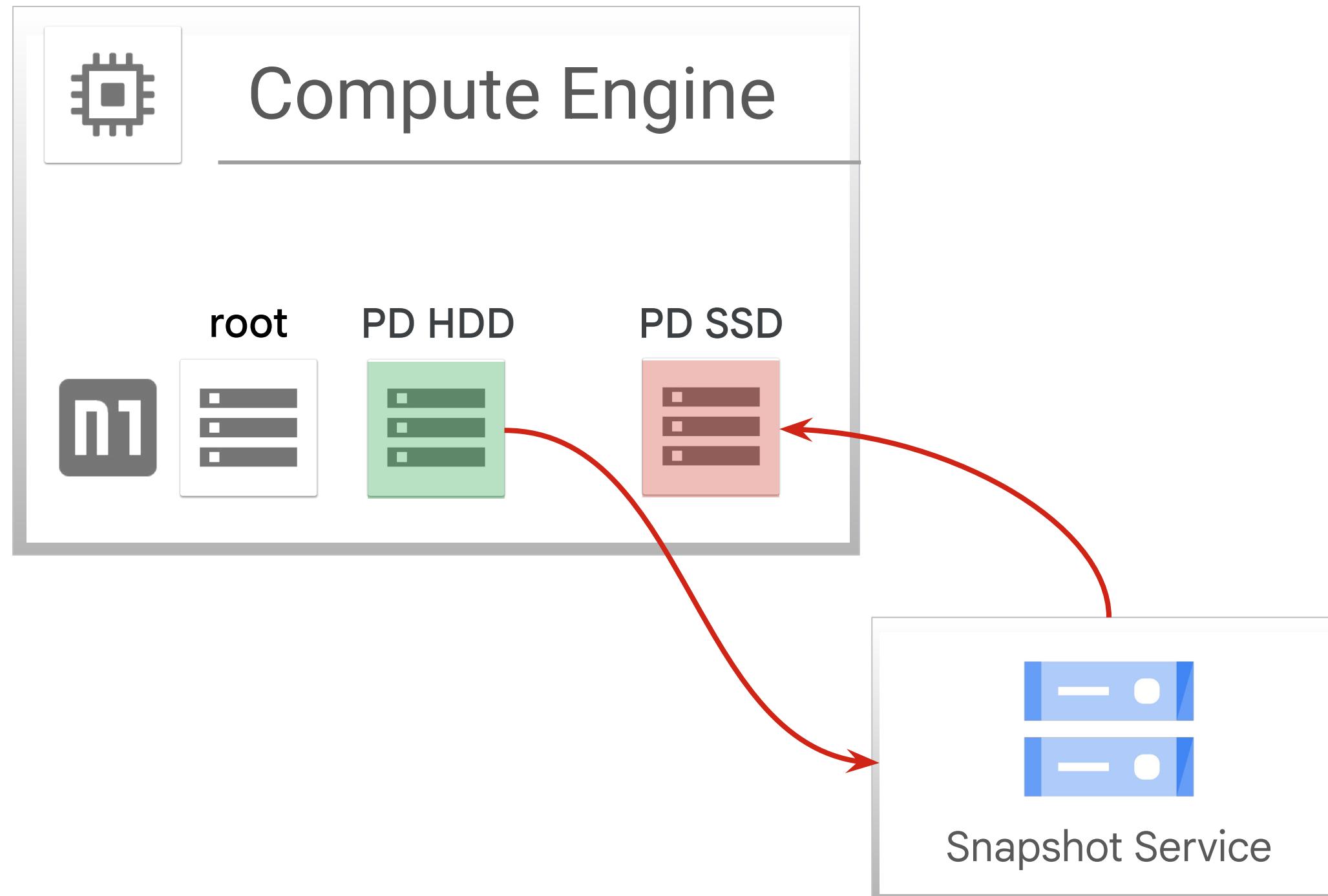
Options are: Blank disk, Image, Snapshot, Instant snapshot, Archive snapshot

Snapshot name

# Example - using a snapshot migrate data between zones



# Example - Transferring data to SSD to improve performance



# Snapshots vs Images

Both can be used as the basis for a new VM

- Takes longer to spin up a VM from a snapshot (data needs to be restored) versus an image (which is already in the state to be booted)

## Snapshots

- Best for disk backups
- Can be scheduled
- Good for the use cases mentioned on the prior slides
- Lower storage cost than images
- Can be created while VM is running

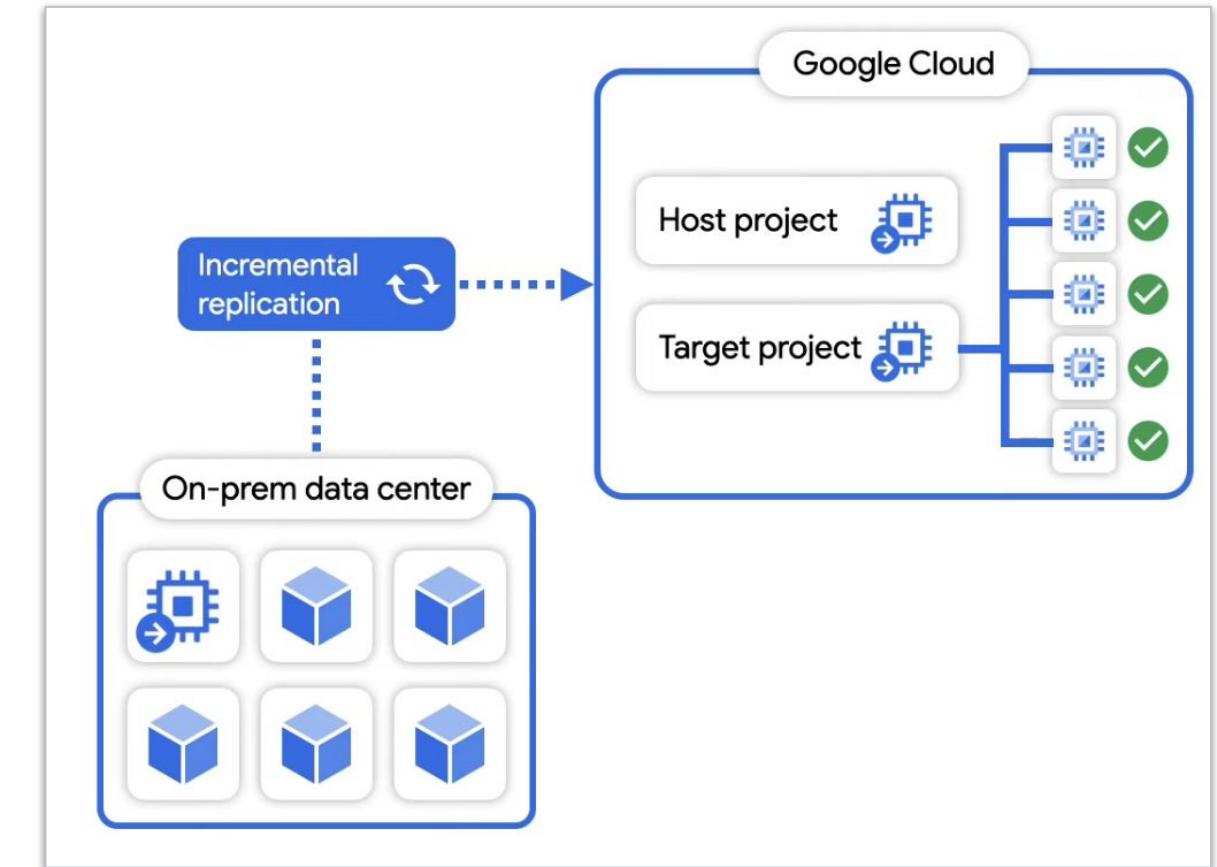
## Images

- Best for infrastructure re-use
  - Boot disk/data disk images for new VMs
  - Managed Instance Group templates require images (not snapshots)
- Can be versioned and deprecated

# Migrating applications running on-premise to Google Cloud

# Migrate to Compute Engine Virtual Machines

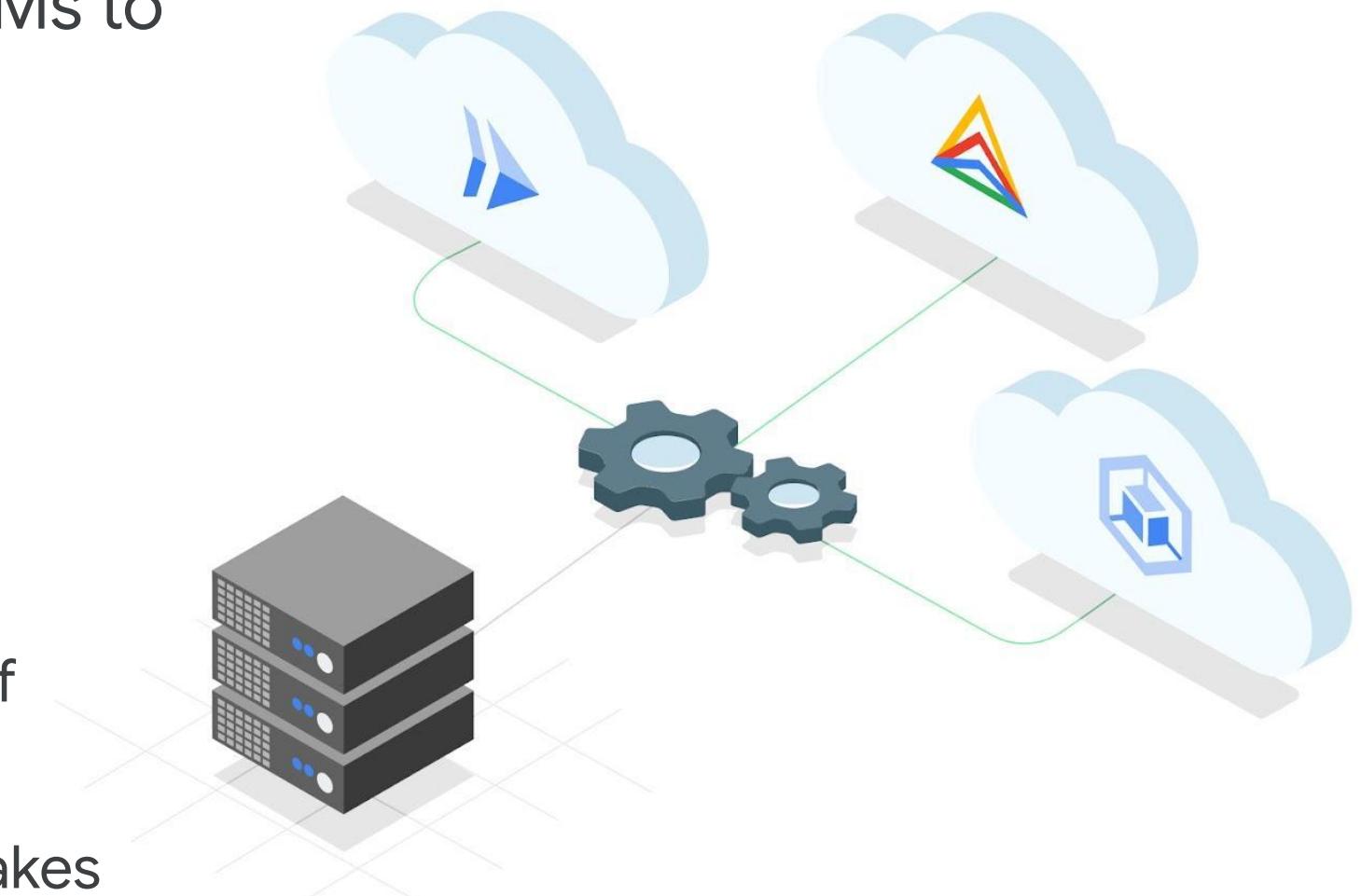
- Migrate VMs to Google Cloud Compute Engine directly from on-premise including support for customizations to networking, disks, and more
  - Includes VMs running Microsoft Windows applications such as SQL Server
- Some of the benefits include
  - Built-in testing makes it fast and easy to validate before migration
  - Can replicate data from the source workload to the destination without manual steps or interruptions to the running workload
  - Provides usage-driven analytics to help you rightsize destination instances and avoid cloud over-provisioning



<https://cloud.google.com/migrate/virtual-machines>

# Migrate to Containers

- Automated approach to migrate *applications* running in VMs to
  - Google Kubernetes Engine
  - Cloud Run
  - Anthos clusters
- Just some of the benefits
  - Higher utilization and density of nodes, leveraging automatic bin-packing and auto-scaling capabilities of GKE
  - Reduced downtime by leveraging Kubernetes features like self healing and dynamic scaling
  - Environment parity with improved visibility and monitoring, makes finding and fixing problems less toilsome



<https://cloud.google.com/migrate/containers>

Google Cloud