

Google Cloud Platform Fundamentals



Course Structure

- This course has 12 sections
- Each section focuses on a specific theme
- A section has the following lectures:
 - Learning objectives
 - Overview of the services
 - Discussion on each service
 - Demo of one of the key services of the theme
 - Use cases and scenarios
- Links are provided in the slide as a pointer to external resources
- Each section has a downloadable set of resources

Google Cloud Platform Fundamentals



Key Takeaways

- The big picture of Google Cloud Platform
- Essential building blocks
 - Compute
 - Storage
 - Network
 - Identity Management
- Additional Services
 - Databases
 - Data & Analytics
 - Artificial Intelligence & Machine Learning
 - DevOps
 - Other Services

The Big Picture of Google Cloud Platform

Footprint of Google Cloud Platform



Footprint of Google Cloud Platform

 20

REGIONS

 61

ZONES

 134

NETWORK EDGE LOCATIONS

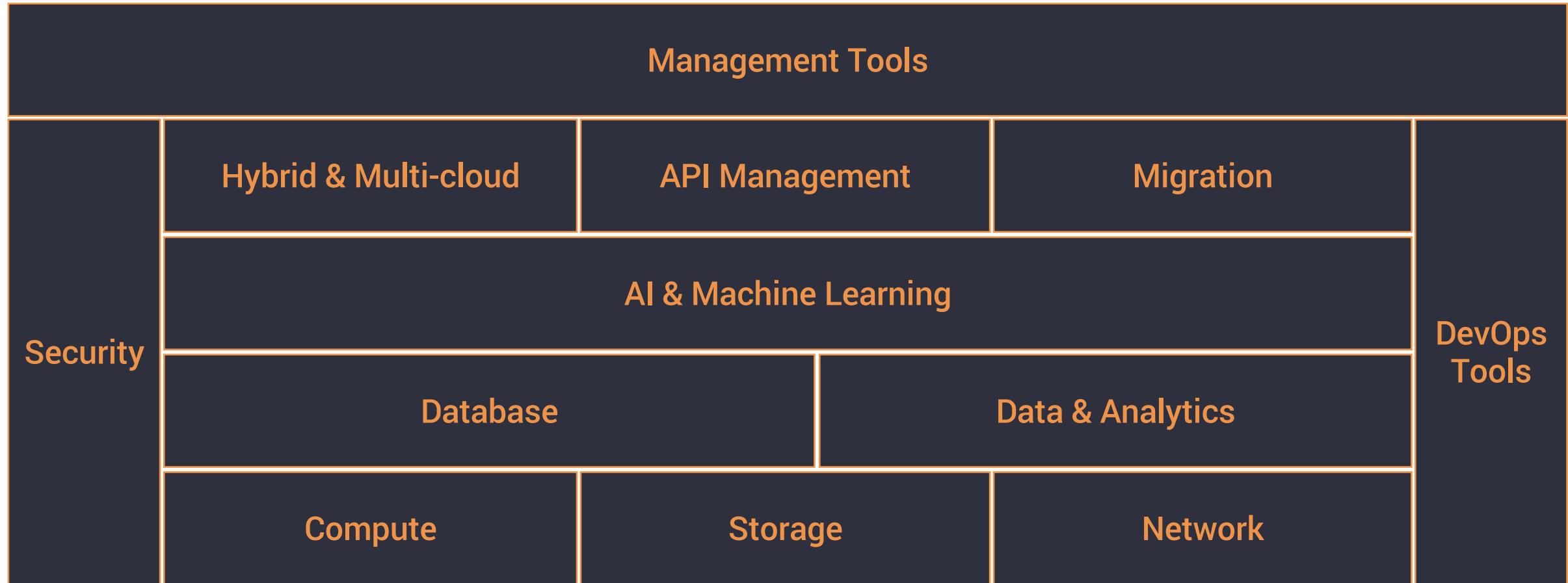
 200+AVAILABLE IN
COUNTRIES AND TERRITORIES

COMING SOON! Google Cloud will continue expanding into the following regions: Seoul (South Korea), Salt Lake City (USA), Las Vegas (USA) and Jakarta (Indonesia).



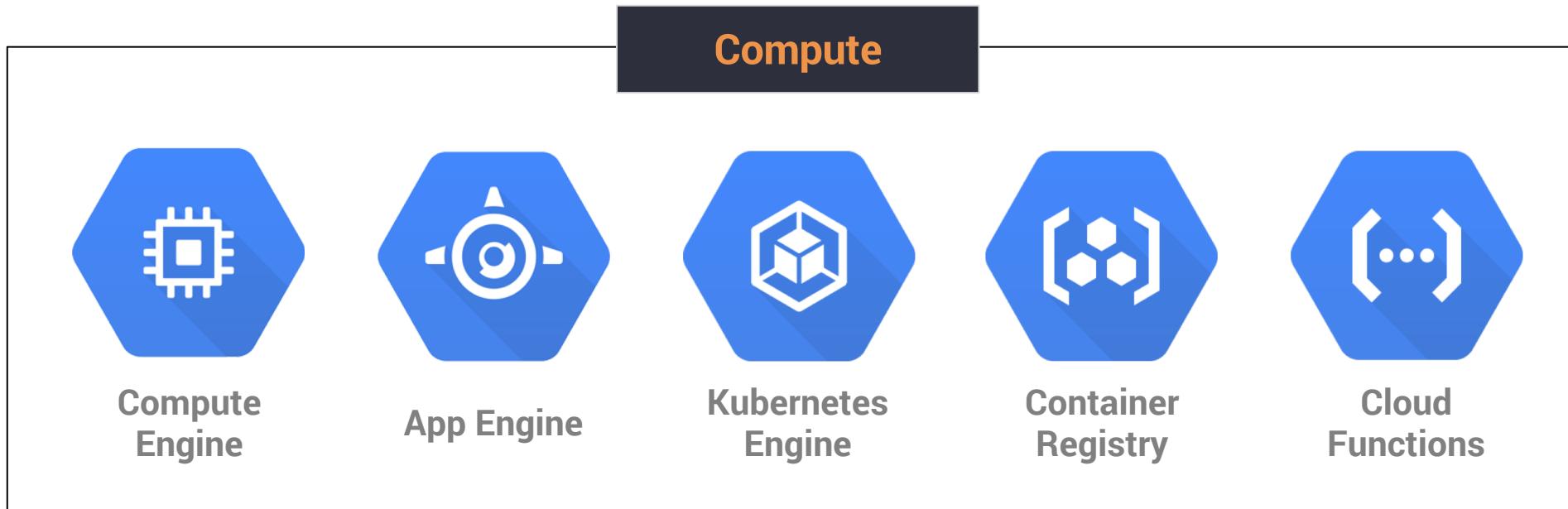
Resource link: <https://cloud.google.com/about/locations/>

The Big Picture of GCP

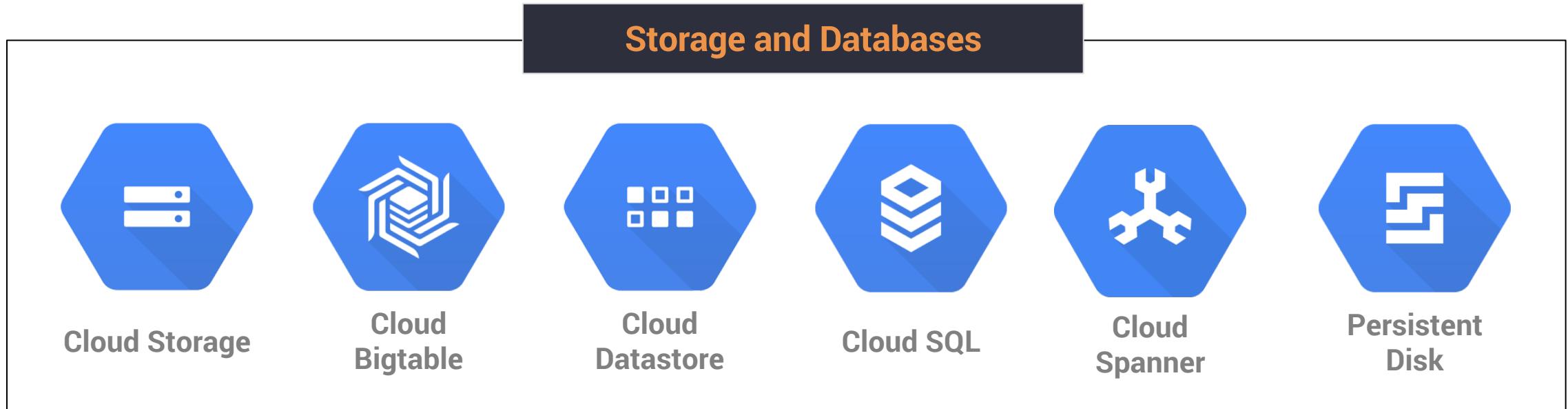


Key GCP Services

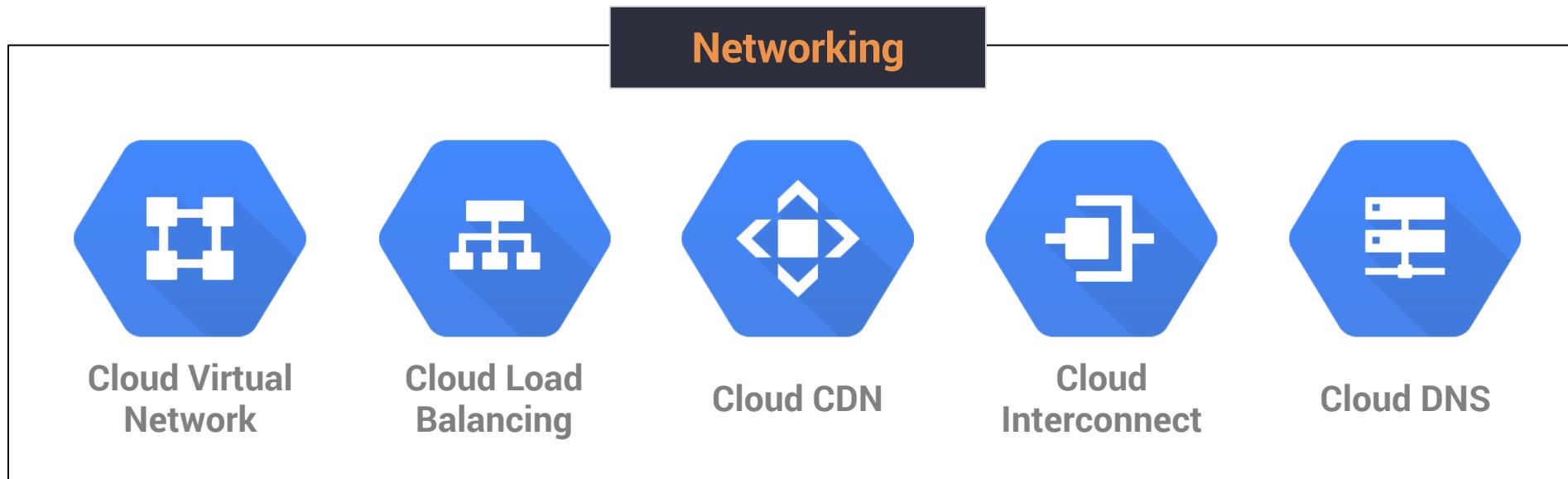
Key Compute Services



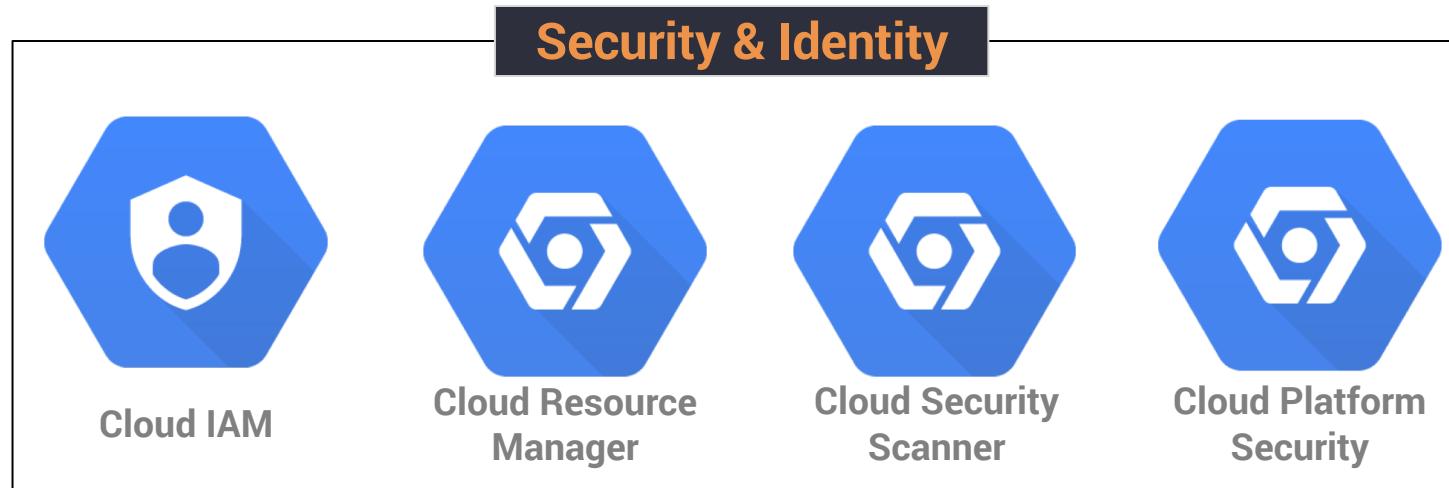
Key Storage & Database Services



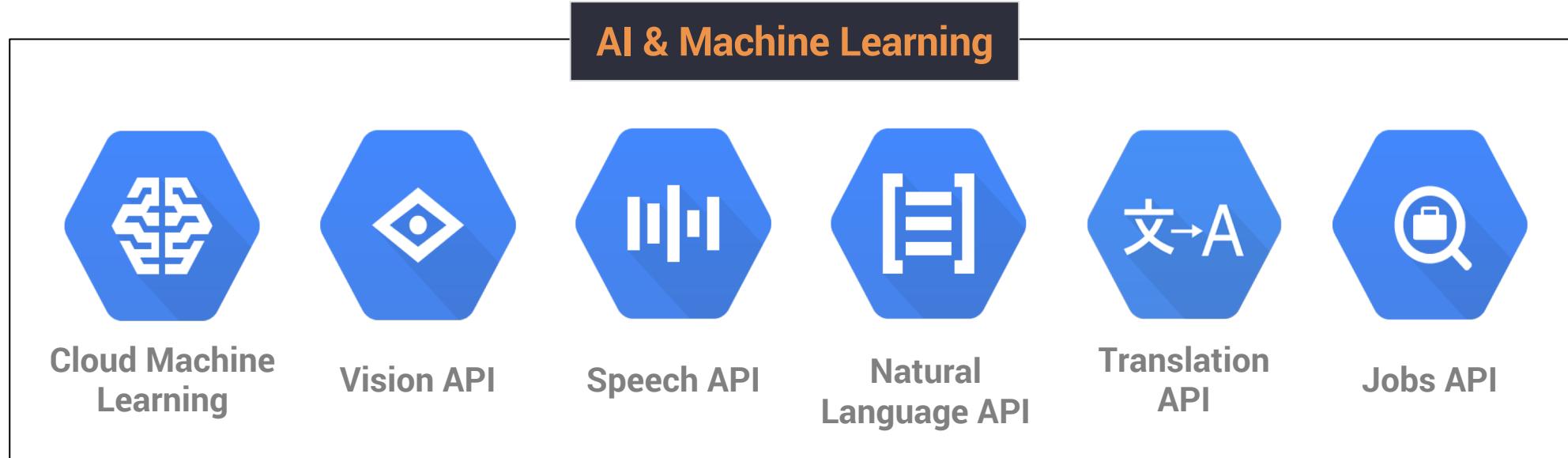
Key Network Services



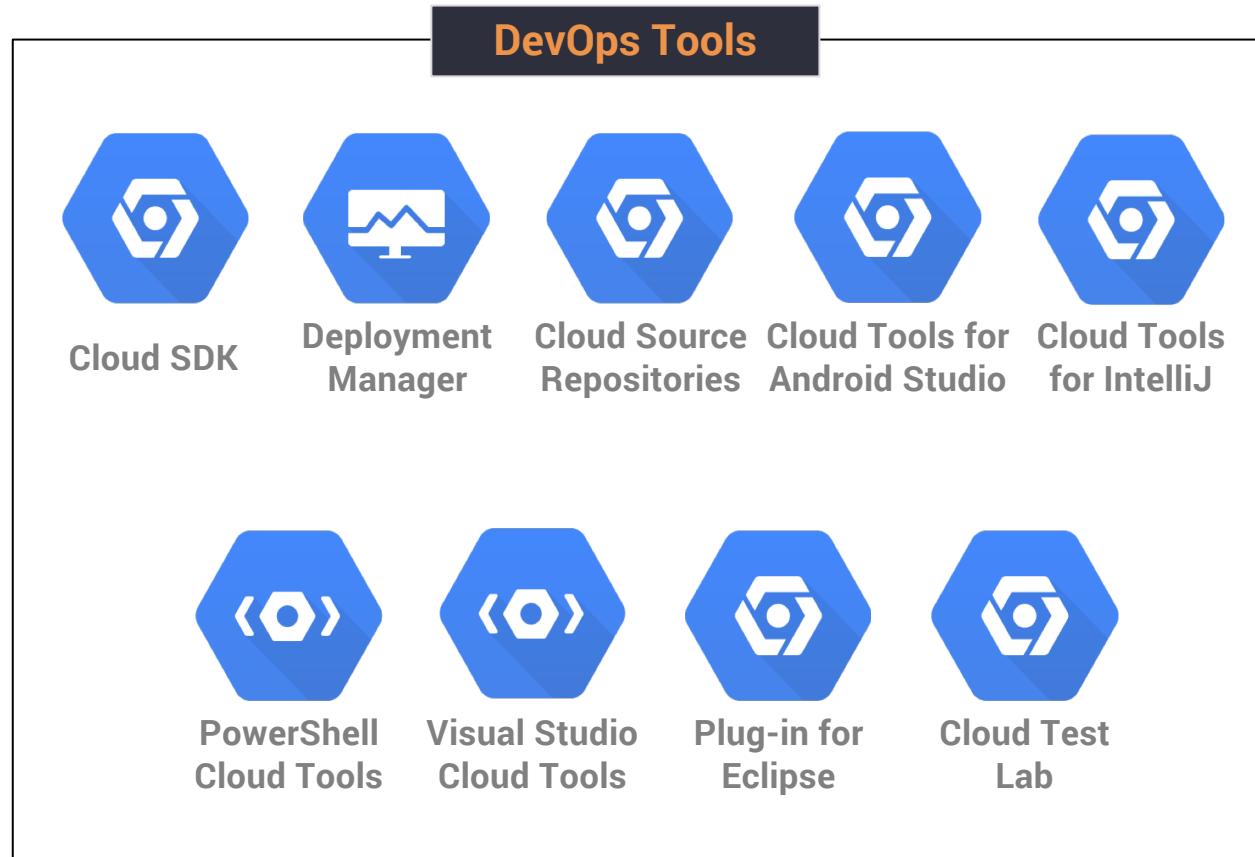
Key Security & Identity Services



Key AI & Machine Learning Services



Key DevOps Tools



Key Management Tools

Management Tools



Stackdriver



Monitoring



Logging



Error Reporting



Trace



Debugger



Deployment Manager



Cloud Endpoints



Cloud Console



Cloud
Shell



Cloud Mobile
App



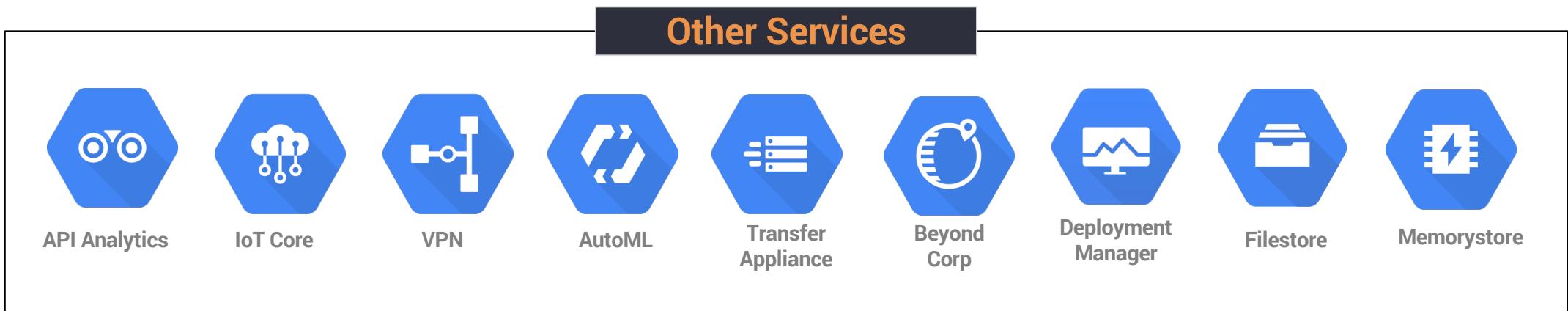
Billing
App



Cloud
APIs

GCP Services

GCP Services



Overview of Google Cloud Platform

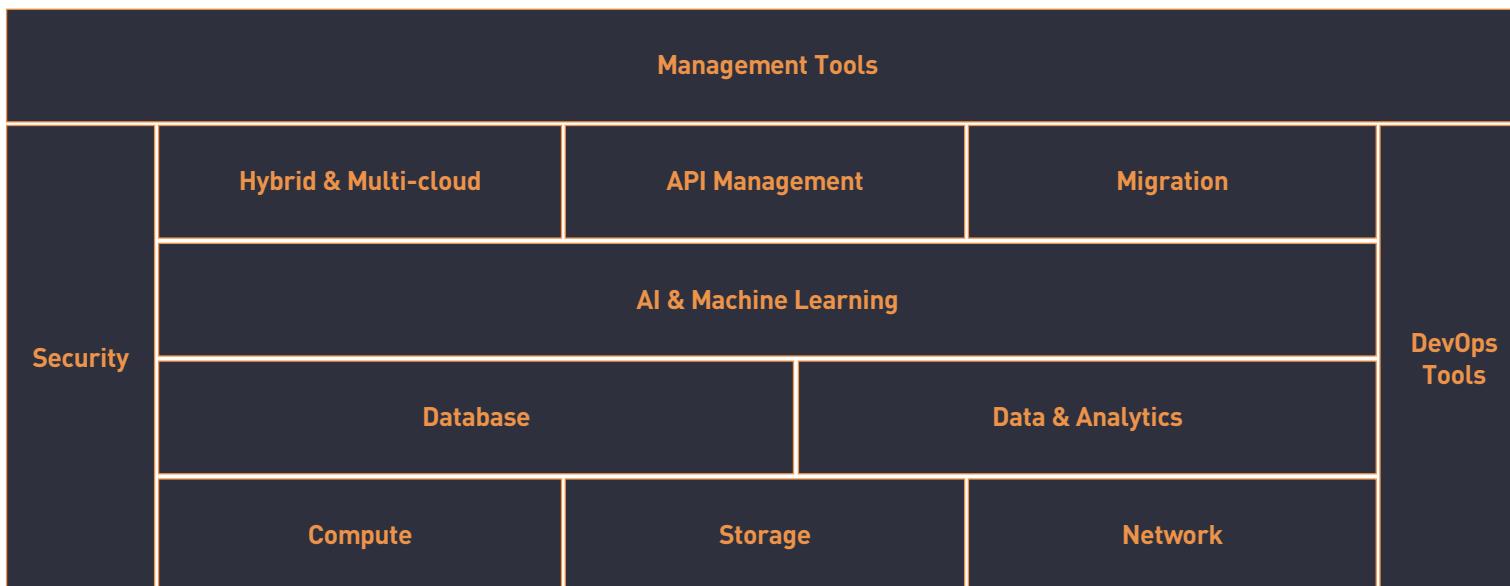


Learning Objectives

- The big picture of Google Cloud Platform
- Key building blocks of Google Cloud Platform
- Other services of Google Cloud Platform

Summary

- GCP has a global footprint spanning all the continents
- GCP includes core infrastructure, databases, analytics, AI and more
- The platform has over 100 services spanning IaaS, PaaS, and SaaS



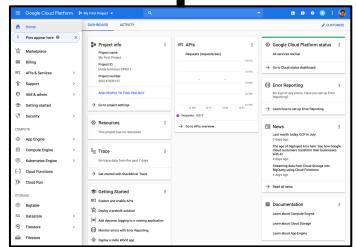
Resource link: <https://cloud.google.com/products/>

Interacting with Google Cloud Platform

Interacting with GCP



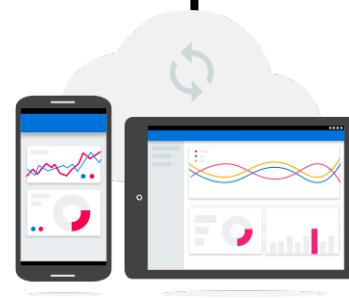
Google Cloud



Web Console

```
$ gcloud compute regions list
NAME        ZONE        CPU(S)_GB  ADDRESSES  RESERVED_ADDRESSES  STATUS
us-central1  us-central1  0/72      0/69       0/21          UP
us-east1    us-east1    0/72      0/4096     0/8           UP
us-east2    us-east2    0/72      0/4096     0/8           UP
us-northwest1 us-northwest1 0/72      0/4096     0/21          UP
us-northwest2 us-northwest2 0/72      0/4096     0/8           UP
us-south1   us-south1   0/72      0/4096     0/8           UP
us-south2   us-south2   0/72      0/4096     0/8           UP
us-southeast1 us-southeast1 0/72      0/4096     0/21          UP
us-southeast2 us-southeast2 0/72      0/4096     0/8           UP
europe-north1 europe-north1 0/72      0/4096     0/8           UP
europe-north2 europe-north2 0/72      0/4096     0/8           UP
europe-west1  europe-west1  0/72      0/4096     0/21          UP
europe-west2  europe-west2  0/72      0/4096     0/8           UP
europe-west3  europe-west3  0/72      0/4096     0/8           UP
europe-west4  europe-west4  0/72      0/4096     0/21          UP
europe-west5  europe-west5  0/72      0/4096     0/8           UP
europe-west6  europe-west6  0/72      0/4096     0/8           UP
europe-northeast1 europe-northeast1 0/72      0/4096     0/8           UP
europe-south1  europe-south1 0/72      0/4096     0/8           UP
southamerica-north1 southamerica-north1 0/72      0/4096     0/8           UP
southamerica-north2 southamerica-north2 0/72      0/4096     0/8           UP
us-central2   us-central2  0/72      0/4096     0/21          UP
us-east4     us-east4    0/72      0/4096     0/21          UP
us-west1     us-west1    0/72      0/4096     0/21          UP
us-west2     us-west2    0/72      0/4096     0/8           UP
```

Cloud Shell
Cloud SDK



Mobile App



REST API

Accessing GCP Shell

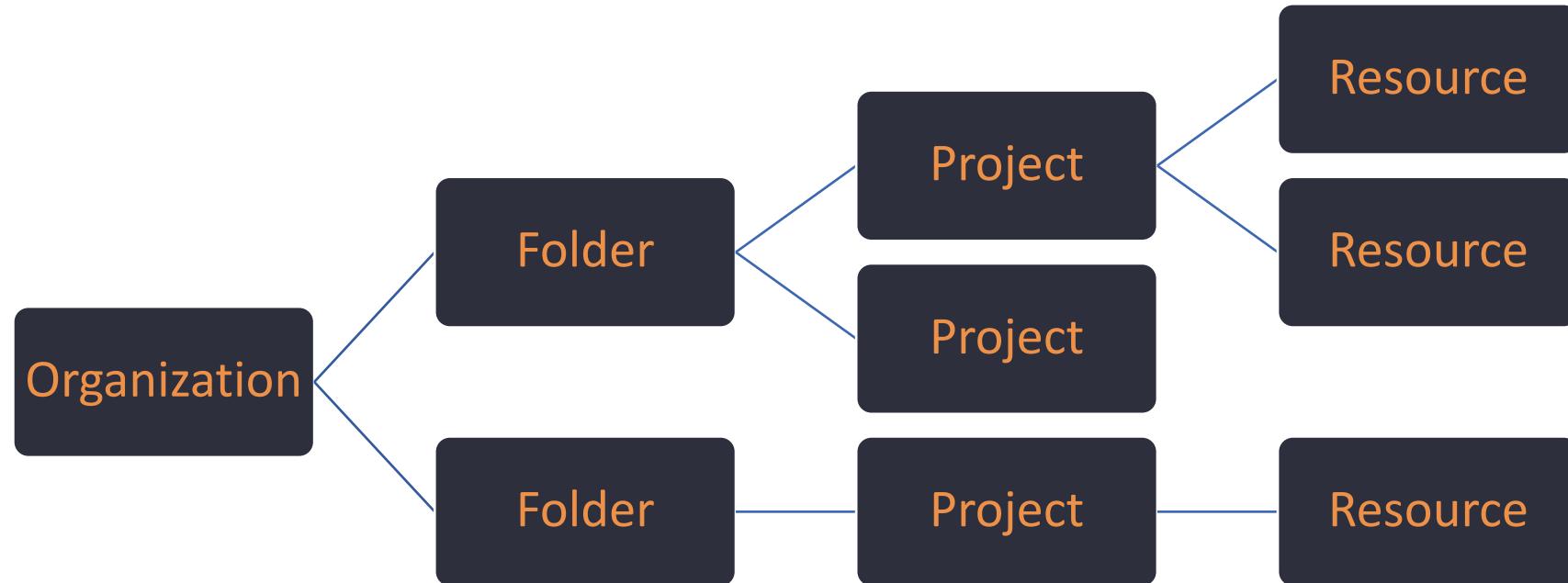
- An interactive shell environment for GCP
- Accessible from any web browser
- Comes preloaded with an IDE, gcloud SDK and other tools
- Based on a GCE VM
- Provides 5GB of persistence disk storage
- In-built web preview functionality

Understanding Google Cloud Platform Resources

Understanding GCP Resources

- Resources are the fundamental components of GCP
 - GCE VMs
 - GAE instances
 - Cloud Pub/Sub topics
 - Cloud Storage buckets
 -
- Resources belong to a project
- Projects may be organized into a folders
- Project represents a billable unit
- Folders provide logical grouping of projects
- Folders belong to one and only one organization
- An organization is the top level entity in GCP hierarchy

Understanding GCP Resources



Understanding GCP Resources

Google Cloud Platform ≡ ▼

Manage resources CREATE PROJECT CREATE FOLDER MOVE DELETE

JANAKIRAM.COM ▾ Filter tree

<input type="checkbox"/>	Name	ID	Status	Requests	Errors	Charges	Labels	Actions
<input type="checkbox"/>	janakiram.com	54233245210						⋮
<input type="checkbox"/>	Development	380948972221						⋮
<input type="checkbox"/>	My First Project	black-terminus-249511						⋮
<input type="checkbox"/>	Production	731472846684						⋮
<input type="checkbox"/>	Test	971811353053						⋮

Getting Started with Google Cloud Platform

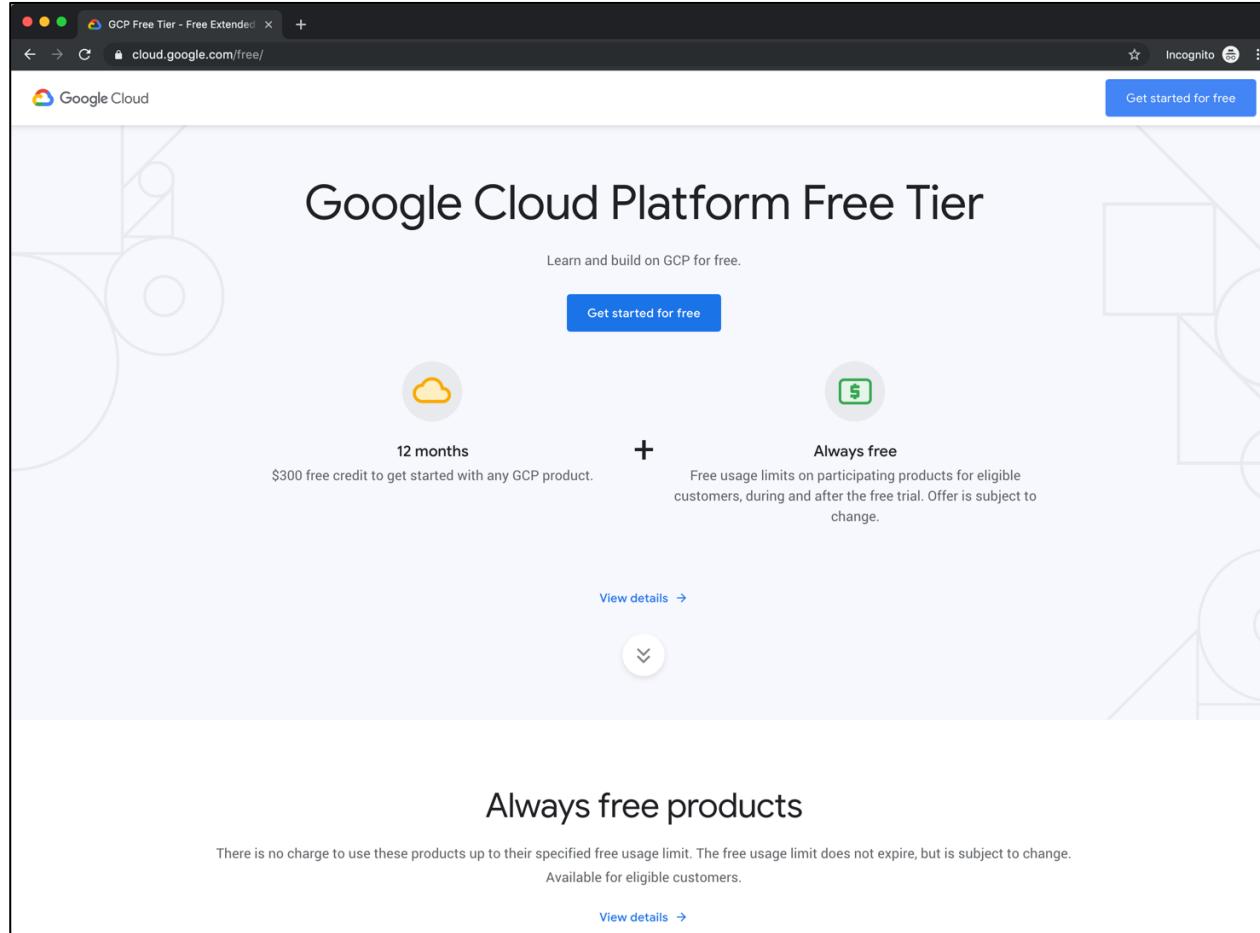


Learning Objectives

- Signing up with GCP
- Resource hierarchy
- Interacting with GCP Resources

Signing up with Google Cloud Platform

GCP Free Tier



Resource link: <https://cloud.google.com/free>

Signing up with GCP

The screenshot shows a web browser window for a Google Cloud Platform free trial sign-up. The URL in the address bar is `console.cloud.google.com/freetrial/signup/tos?_ga=2.22729467.-1119269977.1565523323&login=true`. The page is titled "Free Trial - Google Cloud Platform".

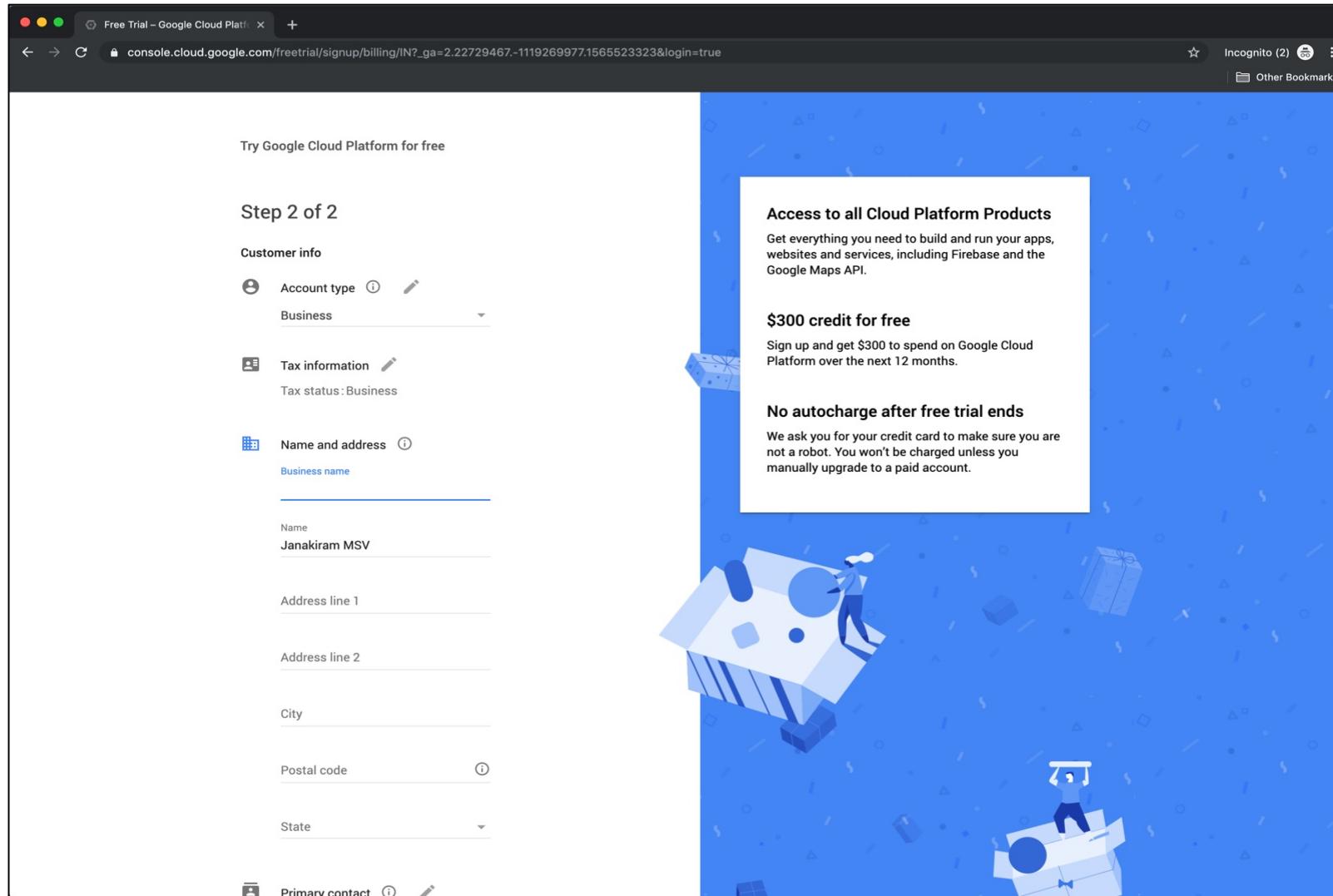
The main content area is titled "Step 1 of 2" and asks for "Country". A dropdown menu shows "India" selected. Below it, there's a "Terms of Service" section with a checkbox for accepting the [Google Cloud Platform Free Trial Terms of Service](#), which is marked as required to continue.

A prominent blue sidebar on the right side of the page highlights three benefits:

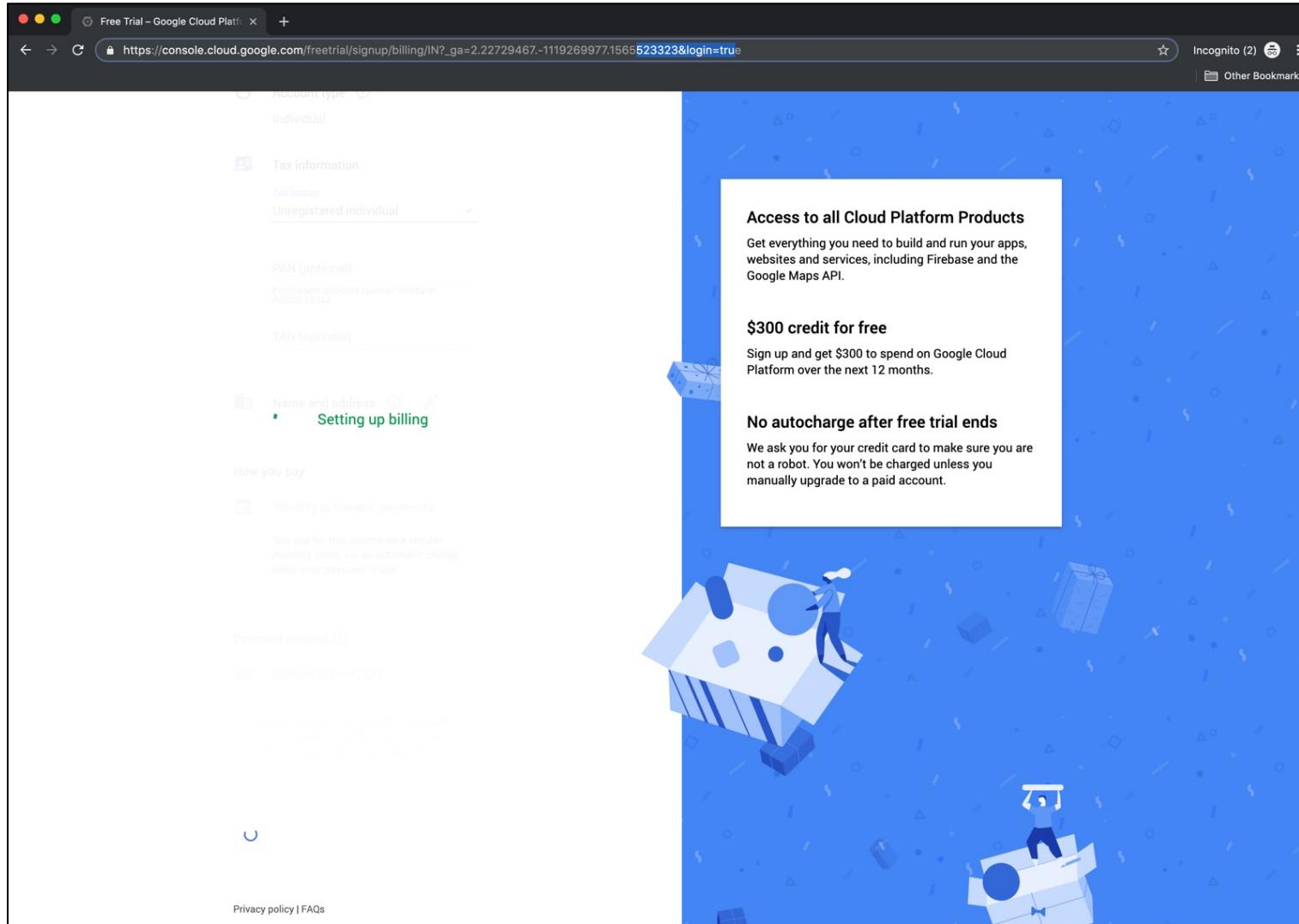
- Access to all Cloud Platform Products**: Get everything you need to build and run your apps, websites and services, including Firebase and the Google Maps API.
- \$300 credit for free**: Sign up and get \$300 to spend on Google Cloud Platform over the next 12 months.
- No autocharge after free trial ends**: We ask you for your credit card to make sure you are not a robot. You won't be charged unless you manually upgrade to a paid account.

At the bottom left of the main form, there is a "AGREE AND CONTINUE" button. At the very bottom of the page, there are links for "Privacy policy | FAQs".

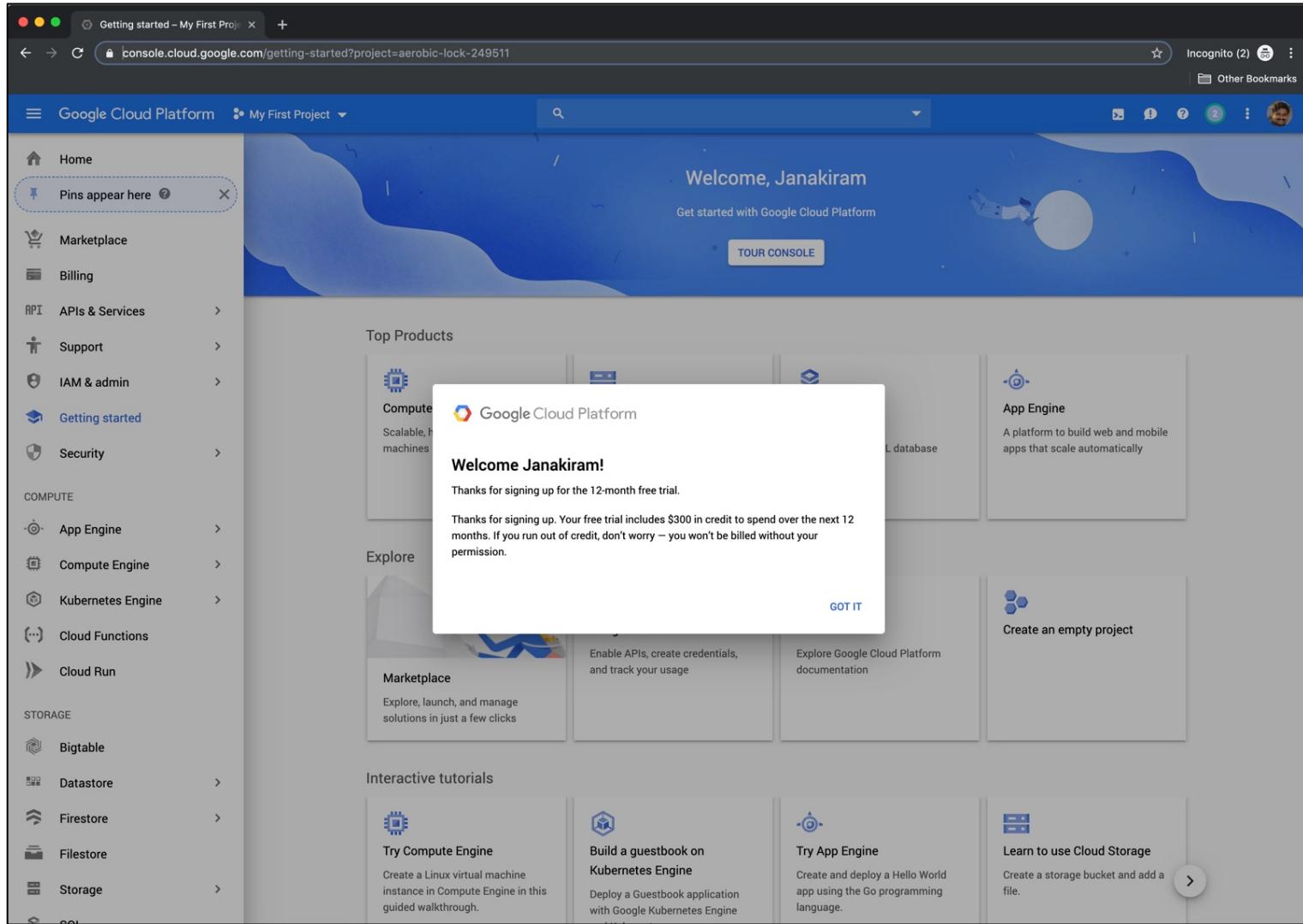
Signing up with GCP



Signing up with GCP



Signing up with GCP



Summary

- GCP offers a \$300 credit along with a free tier
- Organization, folders, projects, resources are a part of GCP hierarchy
- GCP is accessed through console, Cloud Shell, SDK, and a mobile app
- GCP Cloud Shell is a powerful environment available within the browser

Overview of Google App Engine

Google App Engine

- One of the first compute services from Google (PaaS)
- Fully managed platform for deploying web apps at scale
- Supports multiple languages, frameworks, and libraries
- App Engine is available in two environments
 - Standard
 - Flexible
- Applications deployed in standard environment run in a sandbox
- Flexible environment uses Docker containers to deploy and scale apps



Resource link: <https://cloud.google.com/appengine/docs/the-appengine-environments>

Overview of Google Compute Engine

Google Compute Engine

- GCE enables Linux and Windows VMs to run on Google's global infrastructure
- VMs are based on machine types with varied CPU and RAM configuration
- Persistence is available through standard and SSD disks
- VMs are charged a minimum of 1 minute and in 1 second increments after that
- Sustained use discounts are offered for running VMs for a significant portion of the billing month
- Committed use discounts are offered for purchases based on 1 year or 3 year contracts

Overview of Google Cloud Functions

Google Cloud Functions

- Cloud Functions is a serverless execution environment for building and connecting cloud services
- Serverless compute environments execute code in response to an event
- Cloud Functions supports JavaScript, Python 3, and Go
- GCP events fire a Cloud Function through a trigger
- An example event includes adding an object to a storage bucket
- Trigger connects the event to the function

Overview of Google Kubernetes Engine

Google Kubernetes Engine

- GKE is a managed environment for deploying containerized applications managed by Kubernetes
- Kubernetes has a control plane and worker node
- GKE provisions worker nodes as GCE VMs
- Node pools enable mixing and matching different VM configurations
- The service is tightly integrated with GCP resources such as networking, storage, and monitoring
- Auto scaling, automatic upgrades, and node auto-repair are some of the unique features of GKE

Google Cloud Platform Compute Services



Learning Objectives

- Overview of GCP Compute Services
 - App Engine
 - Compute Engine
 - Kubernetes Engine
 - Cloud Functions
- Demo: Launching a VM in GCE**
- Use Cases of Compute Services

Overview of GCP Compute Services

Overview of GCP Compute Services

- Compute services are a critical component of the cloud
- Code is deployed and executed in one of the compute services
- GCP offers a wide range of compute choices
 - App Engine
 - Compute Engine
 - Kubernetes Engine
 - Cloud Functions

GCP Compute – Use Cases

The Choice of Compute on GCP



Google Compute
Engine (GCE)



Google Kubernetes
Engine (GKE)



Google App
Engine (GAE)



Google Cloud
Functions



Use Cases

Product	Delivery Model	Key Feature	Use Case
Google Compute Engine	IaaS	Virtual Machines	Highly customized workloads
Google Kubernetes Engine	CaaS	Containers & Microservices	Containerized workloads
Google App Engine	PaaS	Managed Runtime	Line-of-business applications
Google Cloud Functions	FaaS	Functions	Event-driven applications

Google Cloud Filestore

Google Cloud Filestore

- Managed file storage service for applications
- Delivers NAS-like filesystem interface and a shared filesystem
- Centralized, highly-available filesystem for GCE and GKE
- Exposed as a NFS fileshare with fixed export settings and default Unix permissions
- Filestore file shares are available as mount points in GCE VMs
- On-prem applications using NAS take advantage of Filestore
- Filestore has built-in zonal storage redundancy for data availability
- Data is always encrypted while in transit

Google Cloud Storage

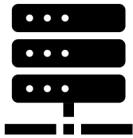
Google Cloud Storage

- Unified object storage for a variety of applications
- Applications can store and retrieve objects through single API
- GCS can scale to exabytes of data
- GCS is designed for 99.99999999% durability
- GCS can be used to store high-frequency and low-frequency access of data
- Data can be stored within a single region, dual-region, or multi-region

Google Cloud Storage – Storage Classes

High-performance object storage

High Frequency Access



Standard

- Most common storage class used by developers
- Optimized **for reduced latency**

Backup & archival storage

Low Frequency Access



Nearline

- Meant for data accessed less frequently
- Chosen for data accessed less than **once a month**

Lowest Frequency Access



Coldline

- Meant for data accessed least frequently
- Chosen for data accessed less than **once a year**

Google Cloud Storage – Location Type

Regional

Your data is stored in a specific region with replication across availability zones in that region. Good for colocating compute and storage for high performance.

Dual-region

Your data is replicated across a specific pair of regions. Good for when you need colocated compute and storage and automatic failover.

Multi-region

Your data is distributed redundantly across US, EU, or Asia. Good for serving content to end users and when you want automatic failover.



Google Cloud Platform Storage Services



Learning Objectives

- Overview of GCP Storage Services
- Cloud Storage
- Persistent Disks
- Cloud Filestore

Demo: Storing data in Cloud Storage

- Use Cases of Storage Services

Overview of GCP Storage Services

Overview of GCP Storage Services

- Storage services add persistence and durability to applications
- Storage services are classified into three types:
 - Object storage
 - Block storage
 - File system
- GCP storage services can be used to store:
 - Unstructured data
 - Folders and Files

Persistent Disks

Persistent Disks

- PD provides reliable block storage for GCE VMs
- Disks are independent of Compute Engine VMs
- Each disk can be up to 64TB in size
- PDs can have one writer and multiple readers
- Supports both SSD and HDD storage options
- SSD offers best throughput for I/O intensive applications
- PD is available in three storage types:
 - Zonal
 - Regional
 - Local

Google Cloud Storage Services – Use Cases

GCP Storage Services - Use Cases

Product	Storage Type	Key Feature	Use Case
Google Cloud Storage	Object storage	Scalable, durable and long-term storage	Centralized storage for frequently and infrequently accessed files
Persistent Disks	Block storage	Attached to GCE VMs	Dedicated attached storage for apps running in VMs based on HDDs and SSDs
Cloud Filestore	File system	NFS fileshare for GCE VMs	NAS-like shared file storage with standard UNIX permissions

GCP Hybrid Connectivity

Hybrid Connectivity

- Hybrid connectivity extends local data center to GCP
- Three GCP services enable hybrid connectivity:
 - Cloud Interconnect
 - Cloud VPN
 - Peering
- Cloud Interconnect extends on-premises network to GCP via Dedicated or Partner Interconnect
- Cloud VPN connects on-premises environment to GCP securely over the internet through IPSec VPN
- Peering enables direct access to Google Cloud resources with reduced Internet egress fee



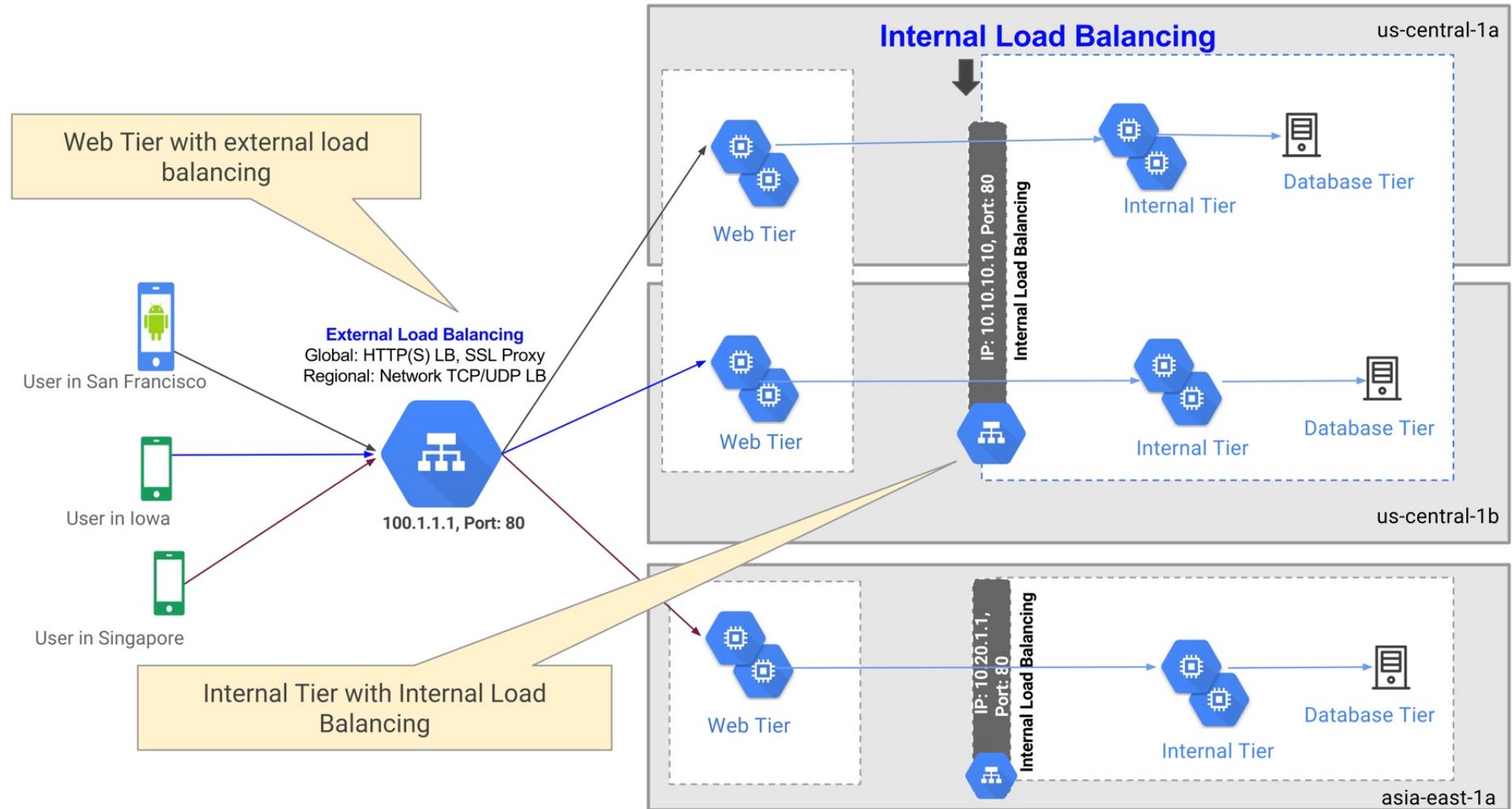
Resource link: <https://cloud.google.com/hybrid-connectivity/>

Google Cloud Load Balancers

Google Cloud Load Balancing

- Load balancer distributes traffic across multiple GCE VMs in a single or multiple regions
- There are two types of GCP load balancers:
 - HTTP(S) load balancer
 - Network load balancer
- HTTP(S) load balancer provides global load balancing
- Network load balancer balances regional TCP and UDP traffic
- Both types can be configured as internal or external load balancers

Google Cloud Load Balancing



GCP Network Service Tiers

GCP Network Service Tiers

- Network service tiers provide a choice of traffic optimization
- There are two service tiers:
 - Premium Tier
 - Standard Tier
- Premium Tier delivers traffic via Google's premium backbone
- Standard Tier uses regular connectivity based on ISP networks
- GCP uses premium tier as the default option



Resource link: <https://cloud.google.com/network-tiers/docs/overview>

Google Cloud Platform Network Services



Learning Objectives

- Overview of GCP Network Services
- Network Tiers
- Cloud Load Balancing
- VPC
- Hybrid Connectivity

Demo: Configuring Load Balancing

- Use Cases of Network Services

GCP Network Services

Overview of GCP Network Services

- Network services are one of the key building blocks of cloud
- GCP leverages Google's global network for connectivity
- Customers can choose between standard and premium tiers
- Load balancers route the traffic evenly to multiple endpoints
- Virtual Private Cloud (VPC) offers private and hybrid networking
- Customers can extend their data center to GCP through hybrid connectivity

GCP Network Services – Use Cases

Use Cases of GCP Network Services

Product	Key Feature	Use Case
HTTP(S) Load Balancing	Global load balancing of HTTP(S) endpoints	CMS deployed in multiple regions
TCP Load Balancing	Regional load balancing of TCP/UDP endpoints	Distribute traffic evenly across gaming backend service
VPC	Private networking within GCP	Deploy GCE VMs that are not exposed to the public internet
Cloud Interconnect	Dedicated network to extend local data center	Access cloud resources from local applications with low latency
Cloud VPN	Secure access to GCP resources through public internet	Cheaper option to extend local data center to cloud
Peering	Directly access cloud resources with reduced egress fee	Secure access to GCP and G Suite resources via direct or carrier peering

Virtual Private Cloud

Virtual Private Cloud

- VPC is a software defined network providing private networking for VMs
- VPC network is a global resource with regional subnets
- Each VPC is logically isolated from each other
- Firewall rules allow or restrict traffic within subnets
- Resources within a VPC communicate via IPV4 addresses
- VPC networks can be connected to other VPC networks through VPC peering
- VPC networks are securely connected in hybrid environments using Cloud VPN or Cloud Interconnect

Cloud IAM – Key Elements

Key Elements of Cloud IAM

- **Resource** – Any GCP resource
 - *Projects*
 - *Cloud Storage Buckets*
 - *Compute Engine Instances*
- **Permissions** - Determines operations allowed on a resource
 - *<service>.<resource>.<verb>*
 - *pubsub.subscriptions.consume*
 - *compute.instances.insert*
- **Roles** – A collection of permissions
 - *Compute.instanceAdmin*
 - *compute.instances.start*
 - *compute.instances.stop*
 - *compute.instances.delete*
 - *....*
- **Users** – Represents an identity
 - *Google Account*
 - *Google Group*
 - *G Suite Domain*
 - *...*

Cloud IAM Identity

Cloud IAM Users/Members

- Google account
- Service account
- Google group
- G Suite domain
- Cloud Identity domain
- *allAuthenticatedUsers*
- *allUsers*

Google Cloud Platform Identity and Access Management



Learning Objectives

- Overview of identity and access management
- Key components of IAM
- Members
- Permissions
- Roles

Demo: Exploring Members, Roles, and Permissions

- Service Accounts

Demo: Exploring Service Accounts

- Where do you use IAM?

Overview of Cloud IAM

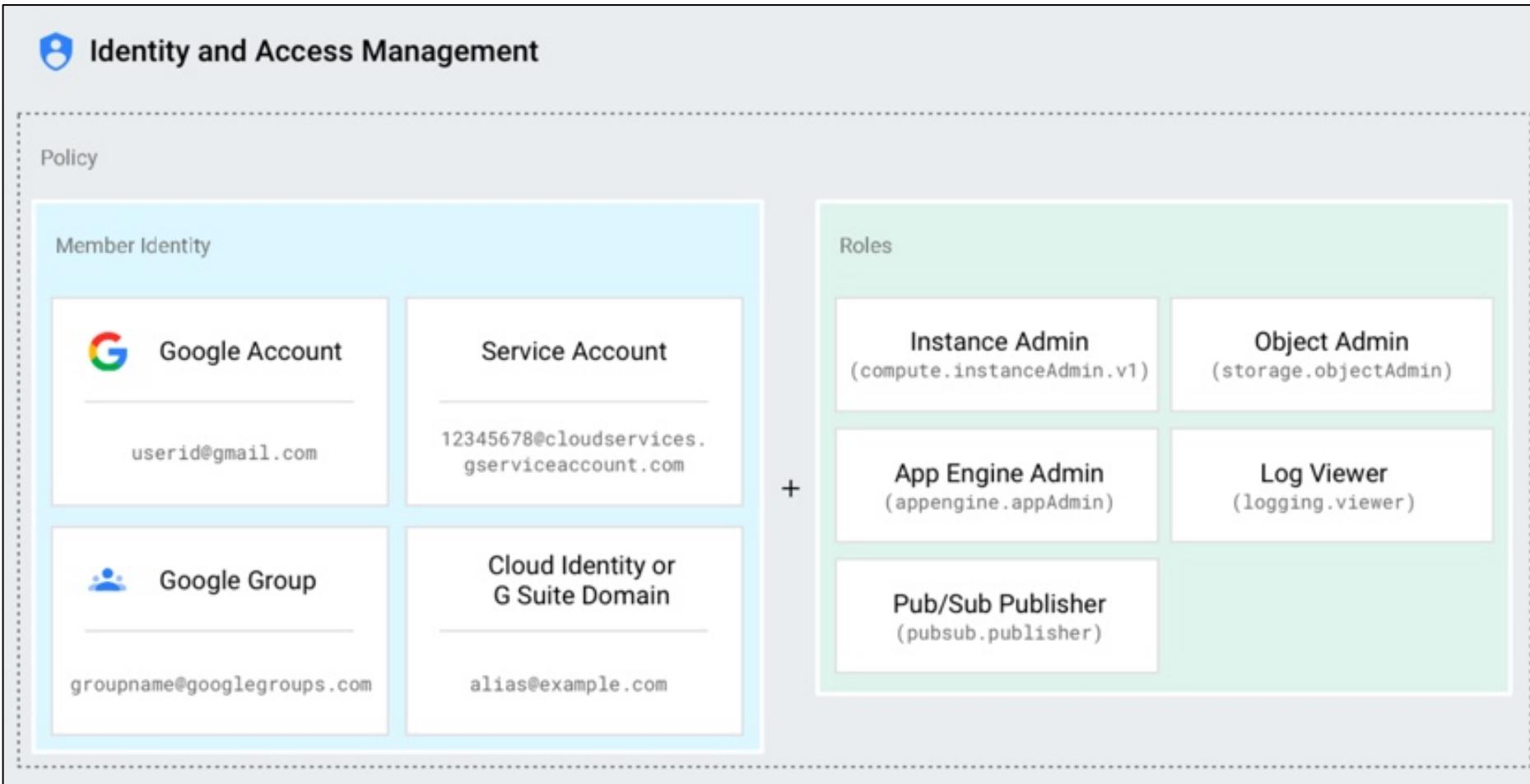
Overview of Cloud IAM

- IAM controls access by defining **who** (identity) has **what** access (role) for **which** resource



- Cloud IAM is based on the principle of least privilege
- An IAM policy binds identity to roles which contains permissions

Google Cloud IAM



Cloud IAM Permissions

Cloud IAM Permissions

- Permissions determine the operations performed on a resource
- Correspond 1:1 with REST methods of GCP resources
- Each GCP resource exposes REST APIs to perform operations
- Permissions are directly mapped to each REST API
 - *Publisher.Publish() -> pubsub.topics.publish*
- Permissions cannot be assigned directly to members/users
- One or more permissions are assigned to an IAM Role

Cloud IAM Roles

Cloud IAM Roles

- **Primitive roles**
 - Owner
 - Editor
 - Viewer
- **Predefined roles**
 - *roles/pubsub.publisher*
 - *roles/compute.admin*
 - *roles/storage.objectAdmin*
- **Custom roles**
 - Collection of assorted set of permissions
 - Fine-grained access to resources

Google Cloud IAM Service Accounts

Cloud IAM Service Accounts

- A special Google account that belongs to an application or VM
- Service account is identified by its unique email address
- Service accounts are associated with key-pairs used for authentication
- Two types of service accounts
 - User managed
 - Google managed
- Each service account is associated with one or more roles

When to use Cloud IAM?

Where do you use IAM?

- To share GCP resources with fine-grained control
- Selectively allow/deny permissions to individual resources
- Define custom roles that are specific to a team/organization
- Enable authentication of applications through service accounts

Google Cloud Bigtable

Cloud Bigtable

- Petabyte-scale, managed NoSQL database service
- Sparsely populated table that can scale to billions of rows and thousands of columns
- Storage engine for large-scale, low-latency applications
- Ideal for throughput-intensive data processing and analytics
- An alternative to running Apache HBase column-oriented database in VMs
- Acts as a storage engine for MapReduce operations, stream processing, and machine-learning applications

Google Cloud Memorystore

Cloud Memorystore

- A fully-managed in-memory data store service for Redis
- Ideal for application caches that provides sub-millisecond data access
- Cloud Memorystore can support instances up to 300 GB and network throughput of 12 Gbps
- Fully compatible with Redis protocol
- Promises 99.9% availability with automatic failover
- Integrated with Stackdriver for monitoring

Google Cloud Platform Database Services



Learning Objectives

- Overview of GCP Database Services
- Cloud SQL
- Cloud Bigtable
- Cloud Spanner
- Cloud Memorystore

Demo: Provisioning Managed MySQL Database Instance

- Use Cases of Database Services

GCP Database Services

Overview of GCP Database Services

- GCP has managed relational and NoSQL database services
- Traditional web and line-of-business apps may use RDBMS
- Modern applications rely on NoSQL databases
- Web-scale, distributed applications need multi-region databases
- In-memory database is used for accelerating the performance of apps

Google Cloud Spanner

Cloud Spanner

- Managed, scalable, relational database service for regional and global application data
- Scales horizontally across rows, regions, and continents
- Brings best of relational and NoSQL databases
- Supports ACID transactions and ANSI SQL queries
- Data is replicated synchronously with globally strong consistency
- Cloud Spanner instances run in one of the three region types:
 - Read-write
 - Read-only
 - Witness

Google Cloud SQL

Google Cloud SQL

- Fully managed RDBMS service that simplifies set up, maintain, manage, and administer database instances
- Cloud SQL supports three types of RDBMS
 - MySQL
 - PostgreSQL
 - Microsoft SQL Server (Preview)
- A managed alternative to running RDBMS in VMs
- Cloud SQL delivers scalability, availability, security, and reliability of database instances
- Cloud SQL instances may be launched within VPC for additional security

GCP Database Services – Use Cases

Use Cases

Product	DB Type	Key Feature	Use Case
Google Cloud SQL	Relational	Supports MySQL, PostgreSQL, and MS SQL Server	Traditional web applications and business applications
Google Cloud Bigtable	NoSQL	Column-oriented NoSQL database	Big data and machine learning workloads
Google Cloud Spanner	RDBMS + NoSQL	Globally distributed database with strong consistency	Geographically deployed scalable applications with distributed database backend
Google Cloud Memorystore	In-memory	Low latency Redis cache	Accelerate retrieval of frequently accessed data

Google BigQuery

BigQuery

- Serverless, scalable cloud data warehouse
- Has an in-memory BI Engine and machine learning built in
- Supports standard ANSI:2011 SQL dialect for querying
- Federated queries can process external data sources
 - Cloud Storage
 - Cloud Bigtable
 - Spreadsheets (Google Drive)
- Automatically replicates data to keep a seven-day history of changes
- Supports data integration tools like Informatica and Talend

Google Cloud Dataflow

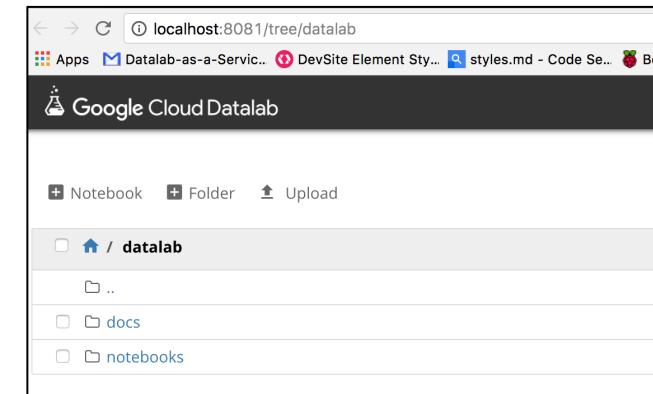
Google Cloud Dataflow

- Managed service for transforming and enhancing data in stream and batch modes
- Based on Apache Beam open source project
- Serverless approach automates provisioning and management
- Inbound data can be queried, processed, and extracted for target environment
- Tightly integrated with Cloud Pub/Sub, BigQuery, and Cloud Machine Learning
- Cloud Dataflow connector for Kafka makes it easy to integrate Apache Kafka

Google Cloud Datalab

Google Cloud Datalab

- Interactive tool for data exploration, analysis, visualization, and machine learning
- Runs on Compute Engine and may connect to multiple cloud services
- Built on open source Jupyter Notebooks platform
- Enables analysis data on BigQuery, Cloud ML Engine, and Cloud Storage
- Supports Python, SQL, and JavaScript languages



Google Cloud Dataproc

Google Cloud Dataproc

- Managed Apache Hadoop and Apache Spark cluster environments
- Automated cluster management
- Clusters can be quickly created and resized from three to hundreds of node
- Move existing Big Data projects to GCP without redevelopment
- Frequent updates to Spark, Hadoop, Pig, and Hive
- Integrates with other GCP services like Cloud Dataflow and BigQuery

Google Cloud Platform Data Analytics Services



Learning Objectives

- Overview of GCP Data Analytics Services
- Cloud Pub/Sub
- Cloud Dataflow
- Cloud Dataproc
- Cloud Datalab
- BigQuery

Demo: Analyzing data with BigQuery

- Use Cases of Data and Analytics Services

GCP Data & Analytics Services

Overview of GCP Data Analytics Services

- Data analytics include ingestion, collection, processing, analyzing, visualizing data
- GCP has a comprehensive set of analytics services
- Cloud Pub/Sub is used for ingesting data at scale
- Cloud Dataflow can process data in real-time or batch mode
- Cloud Dataproc is a Big Data service for running Hadoop and Spark jobs
- BigQuery is the data warehouse in the cloud
- Cloud Datalab is used for analyzing and visualizing data

Google Cloud Pub/Sub

Google Cloud Pub/Sub

- Managed service to ingest data at scale
- Based on the publishing/subscription pattern
- Global entry point to GCP-based analytics services
- Acts as a simple and reliable staging location for data
- Tightly integrated with services such as Cloud Storage and Cloud Dataflow
- Supports at-least-once delivery with synchronous, cross-zone message replication
- Comes with end-to-end encryption, IAM, and audit logging

GCP Data & Analytics Service – Use Cases

Use Cases

Product	Service Type	Key Feature	Use Case
Google Cloud Pub/Sub	Ingestion	High-speed ingestion of data	Sensor data, telemetry, and logs
Google Cloud Dataflow	Stream and batch processing	Process data coming from Pub/Sub and data in GCS	ETL for business intelligence and machine learning
Google Cloud Dataproc	MapReduce jobs	Big Data processing based on Apache Hadoop and Spark	MapReduce jobs
Google Cloud Datalab	Visualization	Jupyter Notebooks for interactive analysis	Data exploration and visualization
BigQuery	Data warehouse	Query large datasets in ANSI SQL	Business intelligence

GCP AI Building Blocks

GCP AI Building Blocks

SIGHT



Vision

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



Video

Enable powerful content discovery and engaging video experiences.

CONVERSATION



Dialogflow

Build virtual agents and other conversational experiences.



Cloud Text-to-Speech API

Convert text to human-like speech using WaveNet voices.



Cloud Speech-to-Text API

Convert speech to text automatically with outstanding accuracy.

LANGUAGE



Translation

Dynamically detect and translate between languages.



Natural Language

Reveal the structure and meaning of text through machine learning.

STRUCTURED DATA



AutoML Tables

Automatically build and deploy state-of-the-art machine learning models on structured data.



Recommendations AI

Deliver highly personalized product recommendations at scale.



Cloud Inference API

Quickly run large-scale correlations over typed time-series datasets.

Google AI Hub

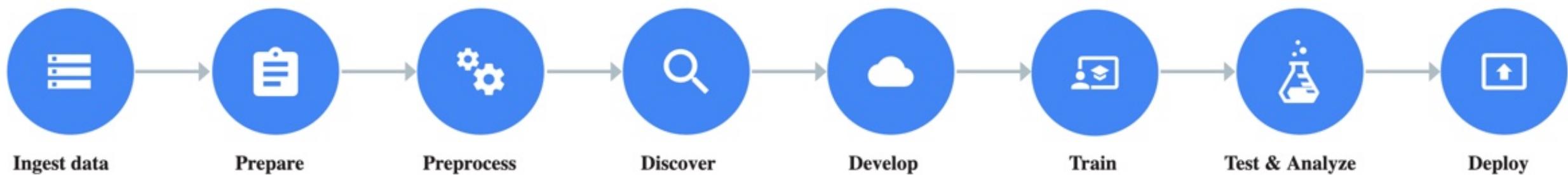
Google Cloud AI Hub

- Hosted repository of plug-and-play AI components
- Makes it easy for data scientists and teams to collaborate
- Contains private and public content
- AI Hub includes
 - Kubeflow Pipeline components
 - Jupyter Notebooks
 - TensorFlow modules
 - VM Images
 - Trained models
 - ...

Google AI Platform

Google AI Platform

- Covers the entire spectrum of machine learning pipelines
- Built on Kubeflow, an open source ML project based on Kubernetes
- Includes tools for data preparation, training, and inference



Google Cloud AutoML

Google Cloud AutoML

- Cloud AutoML enables training high-quality models specific to a business problem
- Custom machine learning models without writing code
- Based on Google's state-of-the-art machine learning algorithms
- AutoML Services
 - **Sight**
 - Vision
 - Video Intelligence
 - **Language**
 - Natural Language
 - Translation
 - **Structure Data**
 - Tabular data

Google Cloud Platform AI & ML Services



Learning Objectives

- Overview of Machine Learning & Artificial Intelligence Services
- Cloud AI Building Blocks
- Cloud AutoML
- AI Platform
- AI Hub

Demo: Image Recognition with Cloud Vision API

- Use Cases of ML & AI Services

GCP AI & ML Services

Overview of GCP AI & ML Services

- AI Building Blocks provide AI through simple REST calls
- Cloud AutoML enables training models on custom datasets
- AI Platform provides end-to-end ML pipelines on-premises and cloud
- AI Hub is a Google hosted repository to discover, share, and deploy ML models
- Google Cloud Platform offers comprehensive set of ML & AI services for beginners and advanced AI engineers

GCP ML & AI Services – Use Cases

Use Cases of GCP ML & AI Services

Product	Service Type	Key Feature	Use Case
Cloud Building Blocks	REST API Endpoint	Simple API for vision, language, and data	Infuse AI into apps with one API call
Cloud AutoML	Models based on custom data	No-code approach to training high-quality models	Train and deploy models custom datasets
AI Platform	ML Pipelines	Open and portable framework for ML	Train ML models on-prem and deploy it in the cloud
AI Hub	ML Artifact repository	Sharable directory of various ML components	Reuse existing TensorFlow models shared by other users

Google Cloud Build

Google Cloud Build

- Managed service for source code build management
- The CI/CD tool running with Google Cloud Platform
- Supports building software written in any language
- Custom workflow to deploy across multiple target environments
- Tight integration with Cloud Source Repo, GitHub, and Bitbucket
- Supports native Docker integration with automated deployment to Kubernetes and GKE
- Identifies vulnerabilities through efficient OS package scanning

GCP Dev Tools Integration

Integration with Developer Tools

- IDE plugins for popular development tools
 - IntelliJ
 - Visual Studio
 - Eclipse
- Tight integration between IDEs and managed SCM, build services
- Automates generating configuration files and deployment scripts
- Makes GCP libraries and SDKs available within the IDEs
- Enhances developer productivity

Google Cloud Platform DevOps Services



Learning Objectives

- Overview of Developer Tools and DevOps Services
- Cloud Source Repositories
- Cloud Build
- Container Registry
- IDE Integration

Demo: Storing Docker Images in Container Registry

- Use Cases of Developer Tools and DevOps Services

GCP DevOps Services

Overview of GCP DevOps Services

- DevOps Services provide tools and frameworks for automation
- Cloud Source Repositories store and track source code
- Cloud Build automates continuous integration and deployment
- Container Registry acts as the central repository for storing, securing, and managing Docker container images
- IDE and tools integration enables developer productivity

Google Container Registry

Container Registry

- Single location to manage container images and repositories
- Store images close to GCE, GKE, and Kubernetes clusters
- Secure, private, scalable Docker registry within GCP
- Supports RBAC to access, view, and download images
- Detects vulnerabilities in early stages of the software deployment
- Supports automatic lock-down of vulnerable container images
- Automated container build process based on code or tag changes

Google Cloud Source Repositories

Google Cloud Source Repositories

- Acts as a scalable, private Git repository
- Extends standard Git workflow to Cloud Build, Cloud Pub/Sub and Compute services
- Unlimited private Git repositories that can mirror code from Github and Bitbucket repos
- Triggers to automatically build, test, and deploy code
- Integrated regular expression-based code search
- Single source of code for deployments across GCE, GAE, GKE, and Functions

GCP DevOps Services – Use Cases

Use Cases

Product	Service Type	Key Feature	Use Case
Google Cloud Source Repositories	Source Control Management (SCM)	Private source code repo	Store code securely in the cloud
Google Cloud Build	CI/CD	Integrated workflow to build and deploy code	Pipelines to deploy code automatically from SCM
Google Container Registry	Private Container Registry	Private image registry close to compute services	Store images in the same region as GKE clusters
IDE Integration	Developer Tools	Developer productivity	Manage and deploy apps from the IDE

Google Cloud API Management

API Management



**Apigee API
Platform**



API Analytics



Cloud Endpoints

Google Cloud Hybrid & Multi-Cloud Services

Hybrid & Multi-Cloud



Traffic Director



Stackdriver



GKE On-Prem

Google Cloud IoT

Google Cloud IoT



Cloud IoT Core



Edge TPU

Google Cloud Migration Tools

Migration



Transfer Appliance



**Migrate for
Compute Engine**



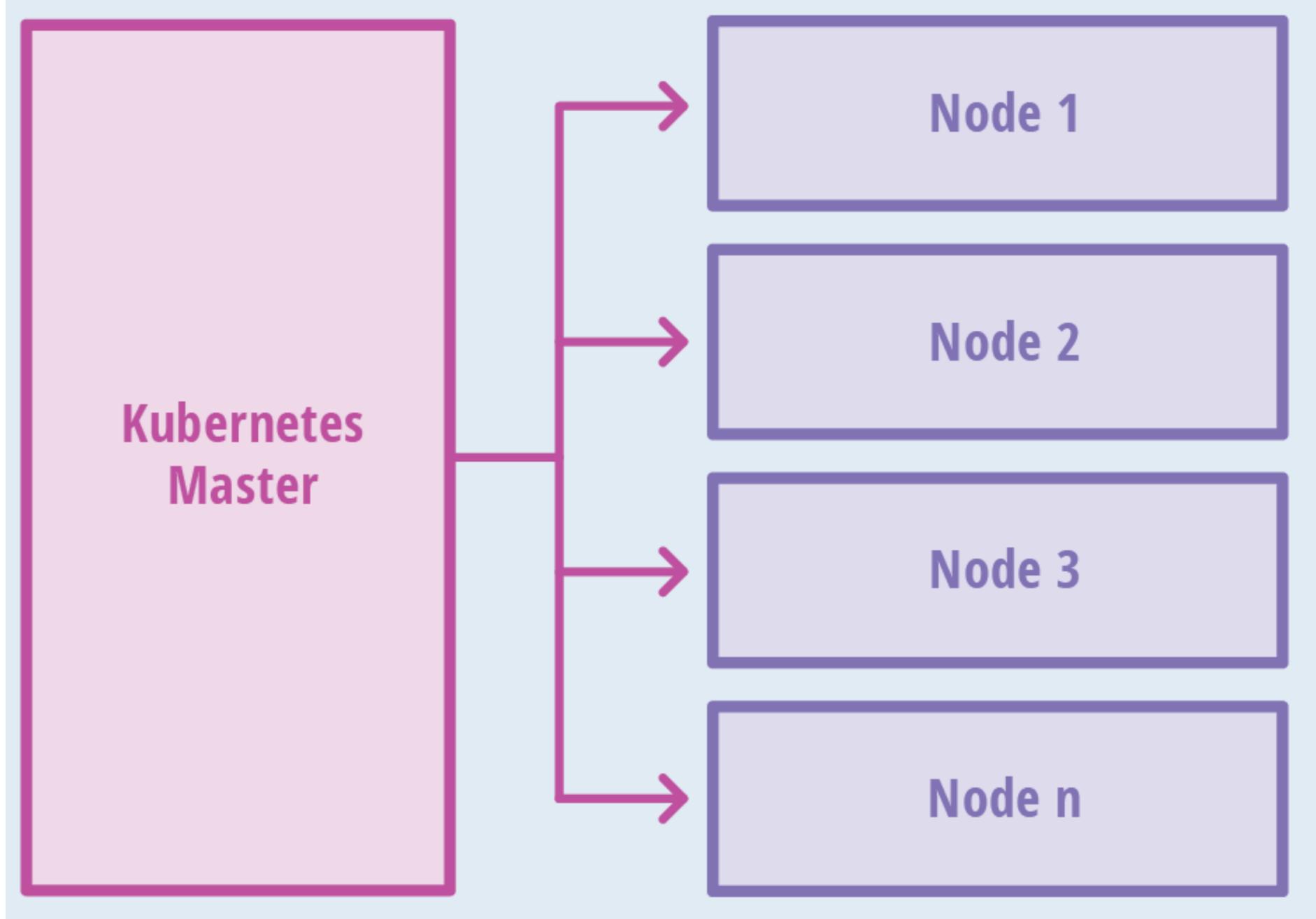
**BigQuery Data
Transfer Service**

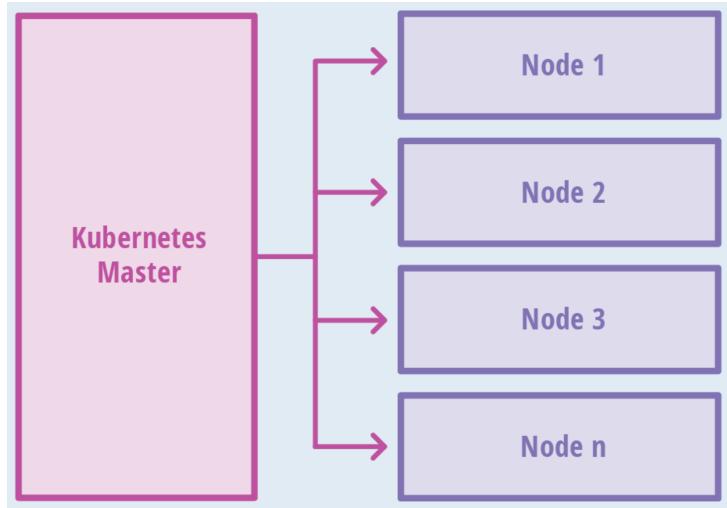
Google Cloud Products & Services



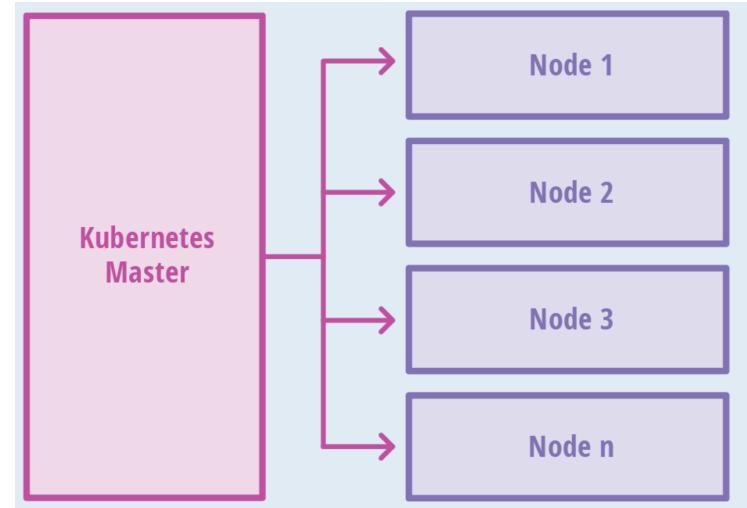
<https://cloud.google.com/products>

Anthos

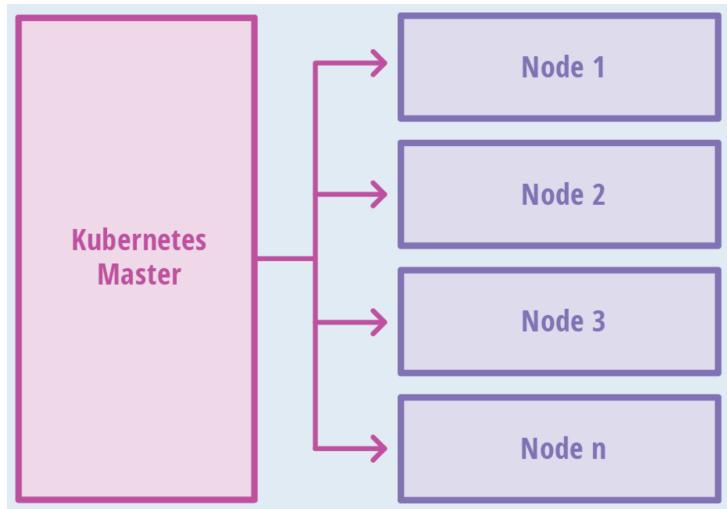




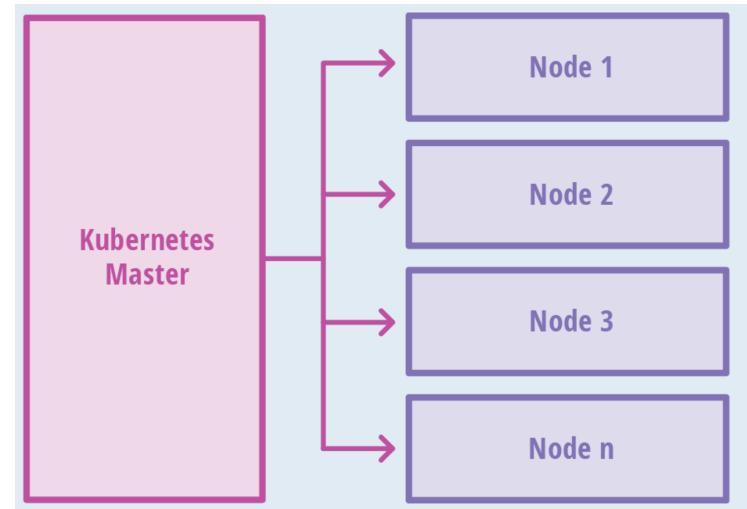
Dev/Test - Datacenter



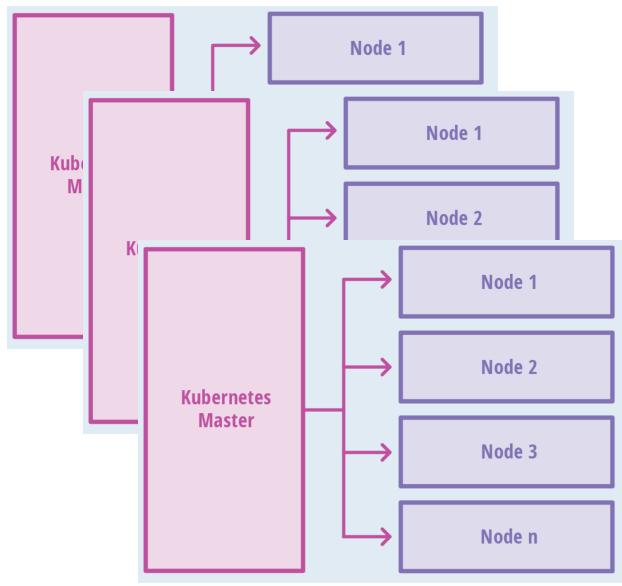
Staging - AWS



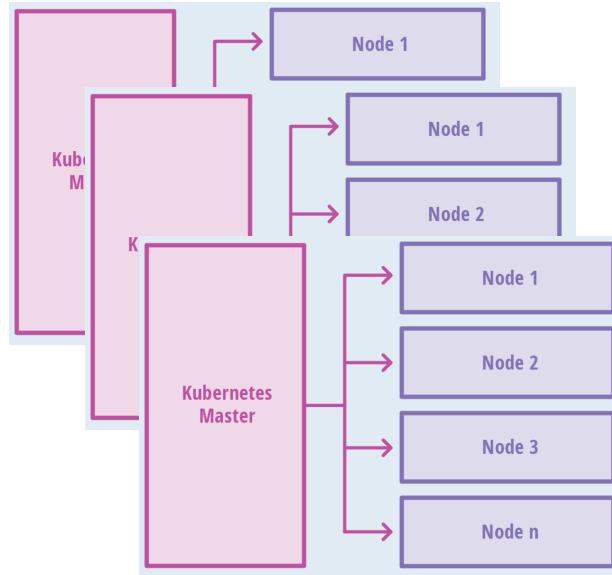
UAT - Azure



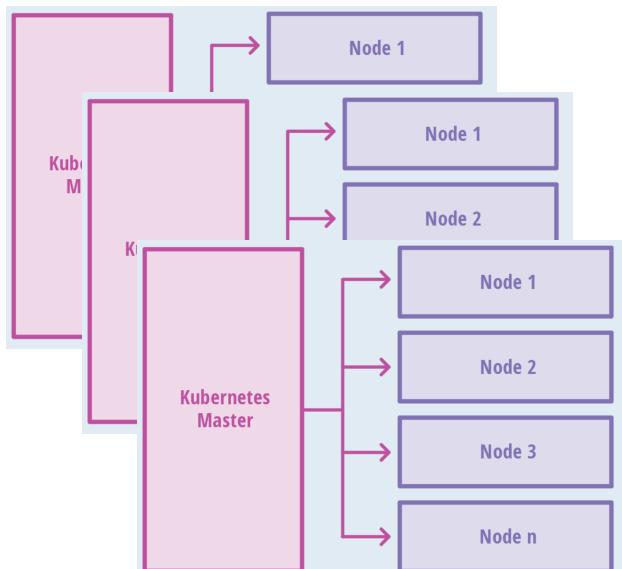
Prod - GCP



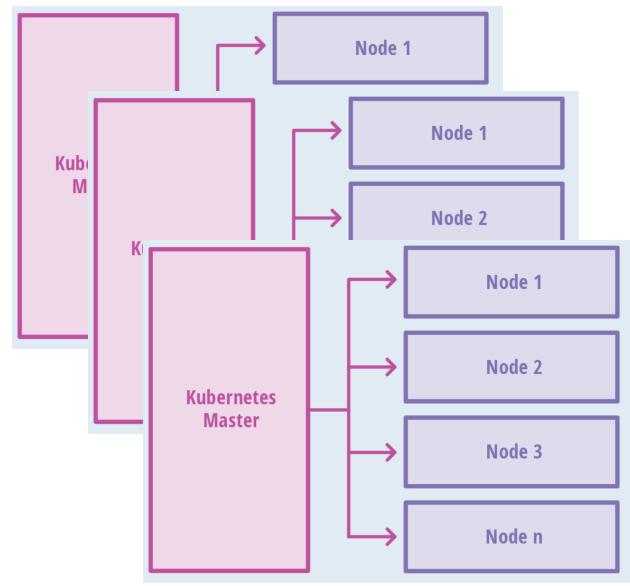
Finance: On-prem



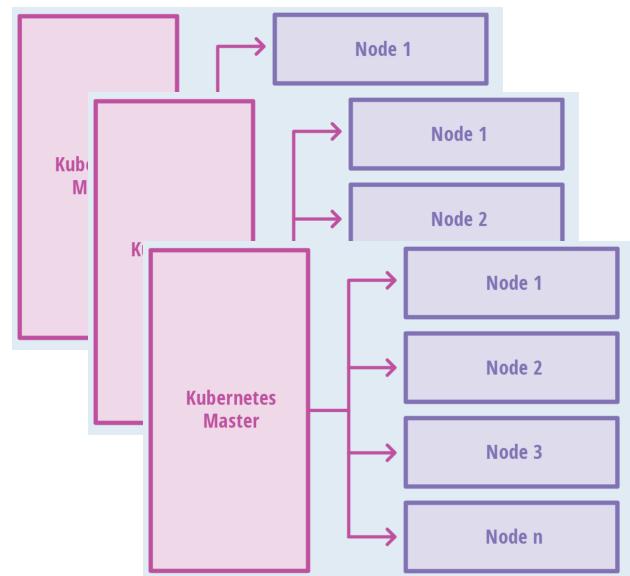
Legal: On-prem



HR: On-prem



Operations: On-prem + AWS

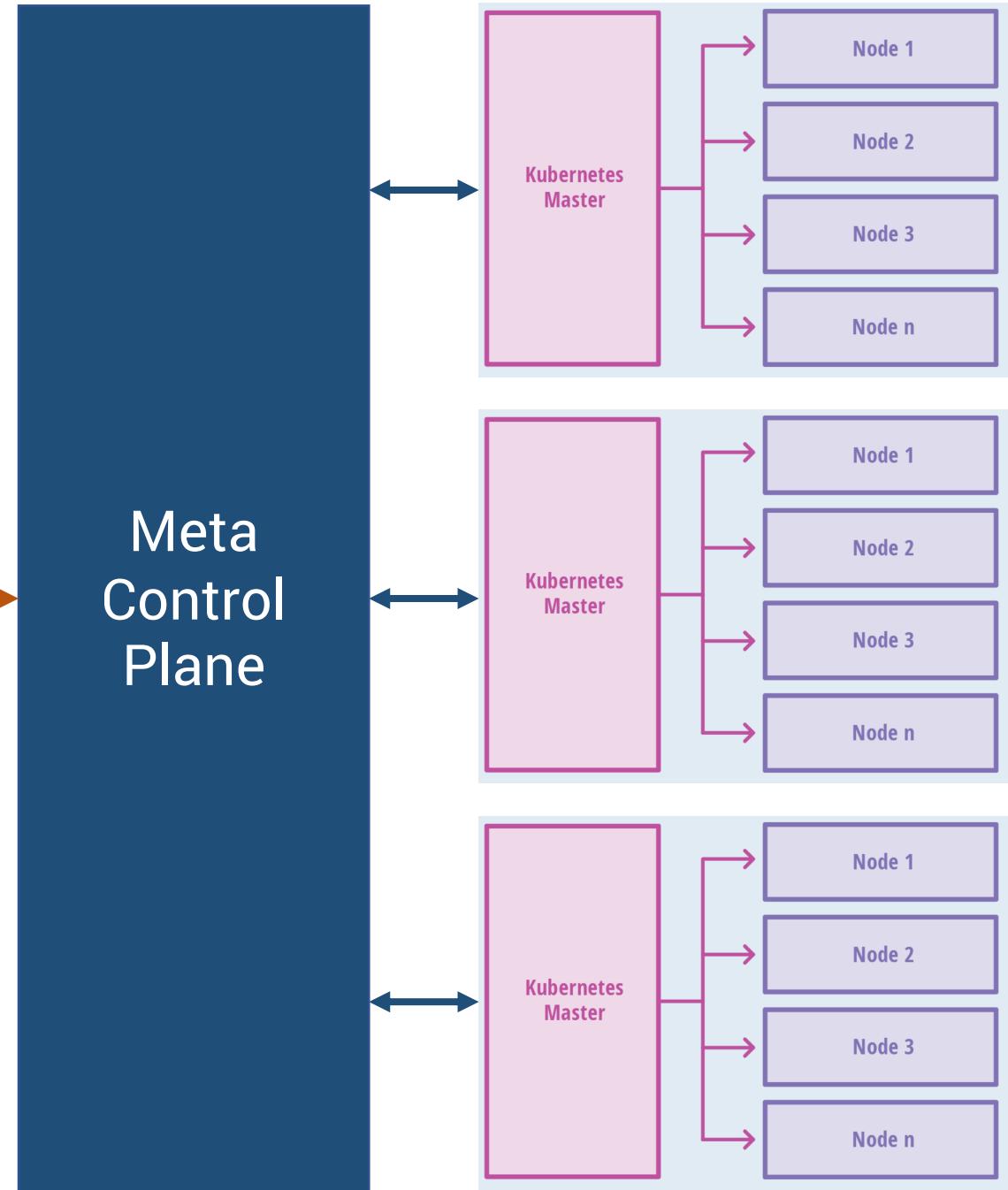


IT: On-prem + GKE



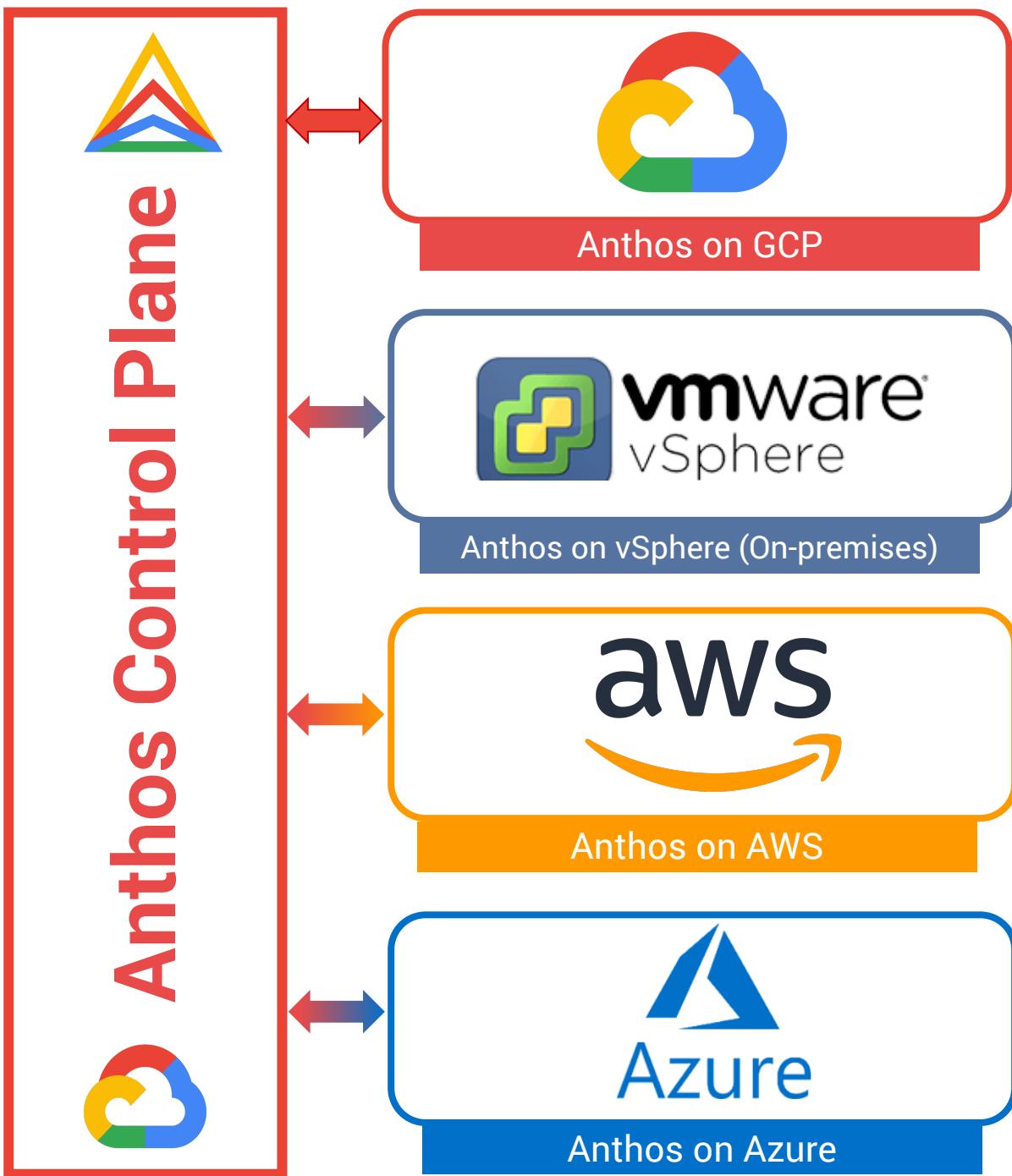
- Cluster Lifecycle
- Deployments
- Configuration
- Policies
- Observability
- Maintenance

Meta Control Plane



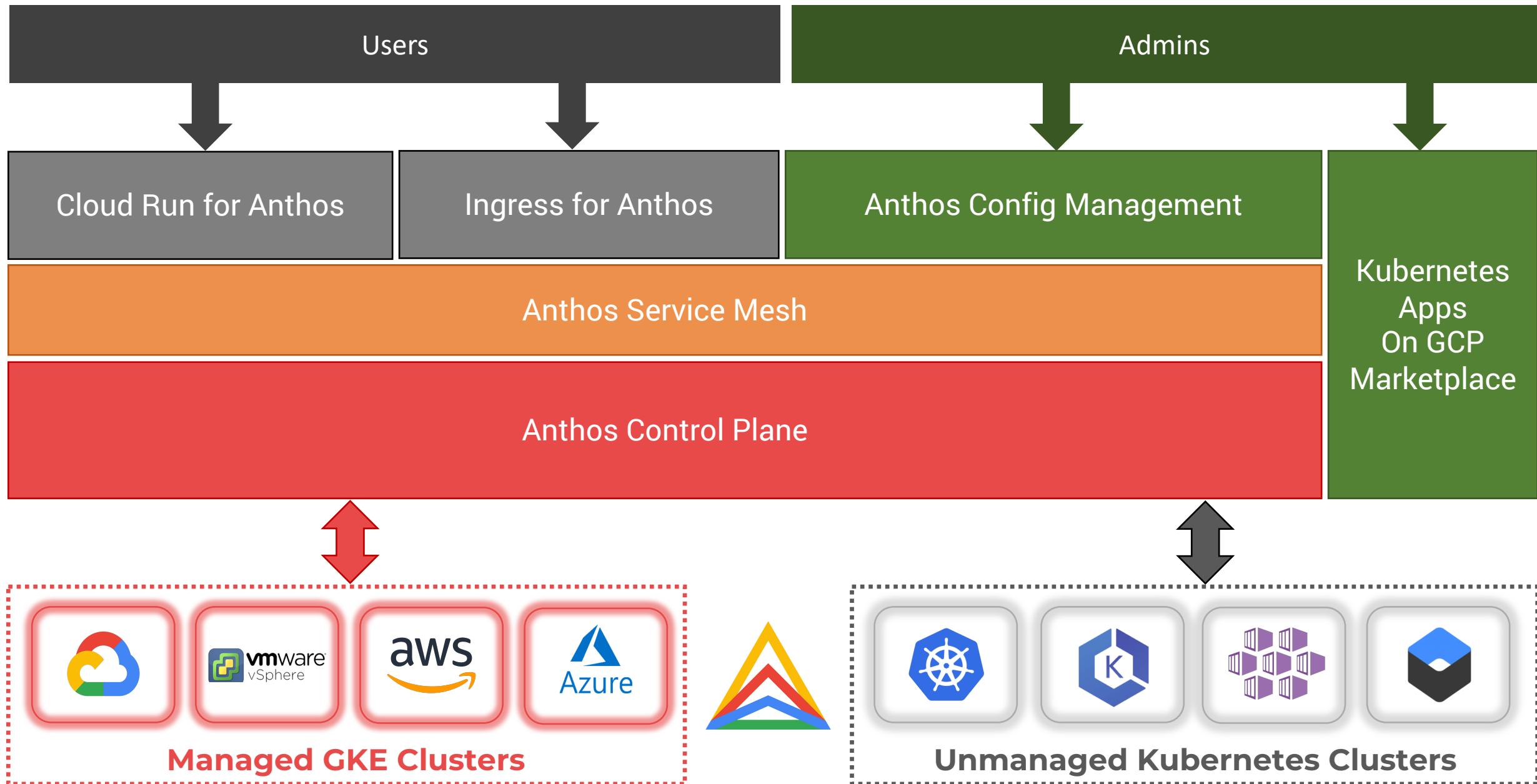
What is Anthos?

- Google's multi-cloud and hybrid cloud platform based on Kubernetes
- Enables customers to run managed Kubernetes service (GKE) in a variety of environments
- Anthos can be deployed in
 - Google Cloud
 - vSphere (on-premises)
 - Amazon Web Services
 - Microsoft Azure
- Non-GKE Kubernetes clusters can be attached to Anthos
- Delivers centralized management and operations for Kubernetes clusters running diverse environments



Anthos Managed Clusters

Anthos Big Picture



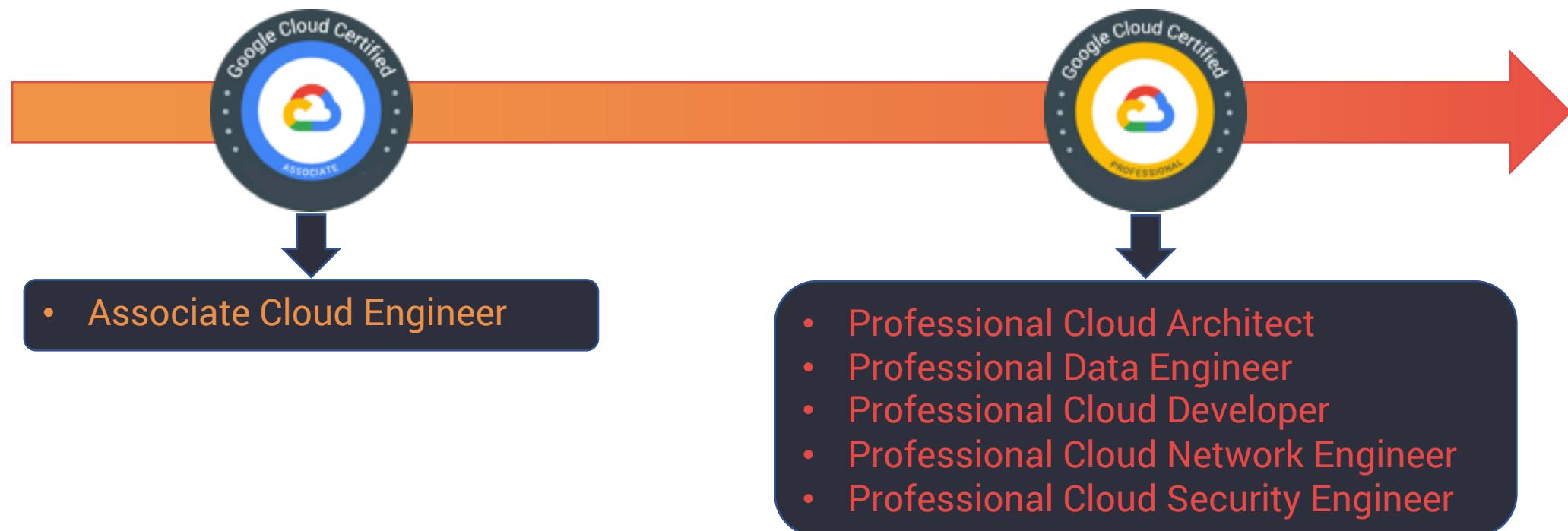
Google Cloud Platform Enterprise Services



Learning Objectives

- Google Cloud IoT
- API Management
- Hybrid and Multi-cloud
- Migration

Next Steps – Google Cloud Certification



Resource link: <https://cloud.google.com/certification/>

Google Cloud Platform Fundamentals



Quick Recap

- The big picture of Google Cloud Platform
- Essential building blocks
 - Compute
 - Storage
 - Network
 - Identity Management
- Additional Services
 - Databases
 - Data & Analytics
 - Artificial Intelligence & Machine Learning
 - DevOps
 - Other Services