



GCP

Google Cloud

Digital Leader

Certification





Google Certified Cloud Digital Leader

Cloud Digital Leader



- Pay attention for 5 minutes, before we dive in.
- Challenging certification, and course is long so have patience.
- Good to have basic IT skill, but I will start from scratch in GCP
- Learn by Doing



GCP certifications



<https://cloud.google.com/certification/cloud-digital-leader>

Cloud Cost for this course



- \$0 – for GCP account
- GCP Free trial
- \$300 for next 3 months <https://cloud.google.com/free>
- Length: Two hours
- Registration fee: \$99 (plus tax where applicable)
- Languages: English
- Exam format: Multiple choice and multiple select,





Create GCP Account

BY ANKIT MISTRY



1. General Cloud Concepts

BY ANKIT MISTRY

c1oud Concepts



- Introduction to Cloud Computing
- Public cloud vs Private cloud
- Computing Service Options
 - Infrastructure as a Service (IaaS)
 - Platform as a Service (PaaS)
 - Software as a Service (SaaS)
- Shared Responsibility Model
- Cost vs responsibility
- Total cost of operations (TCO)
- CapEx & OpEx

Cloud Computing

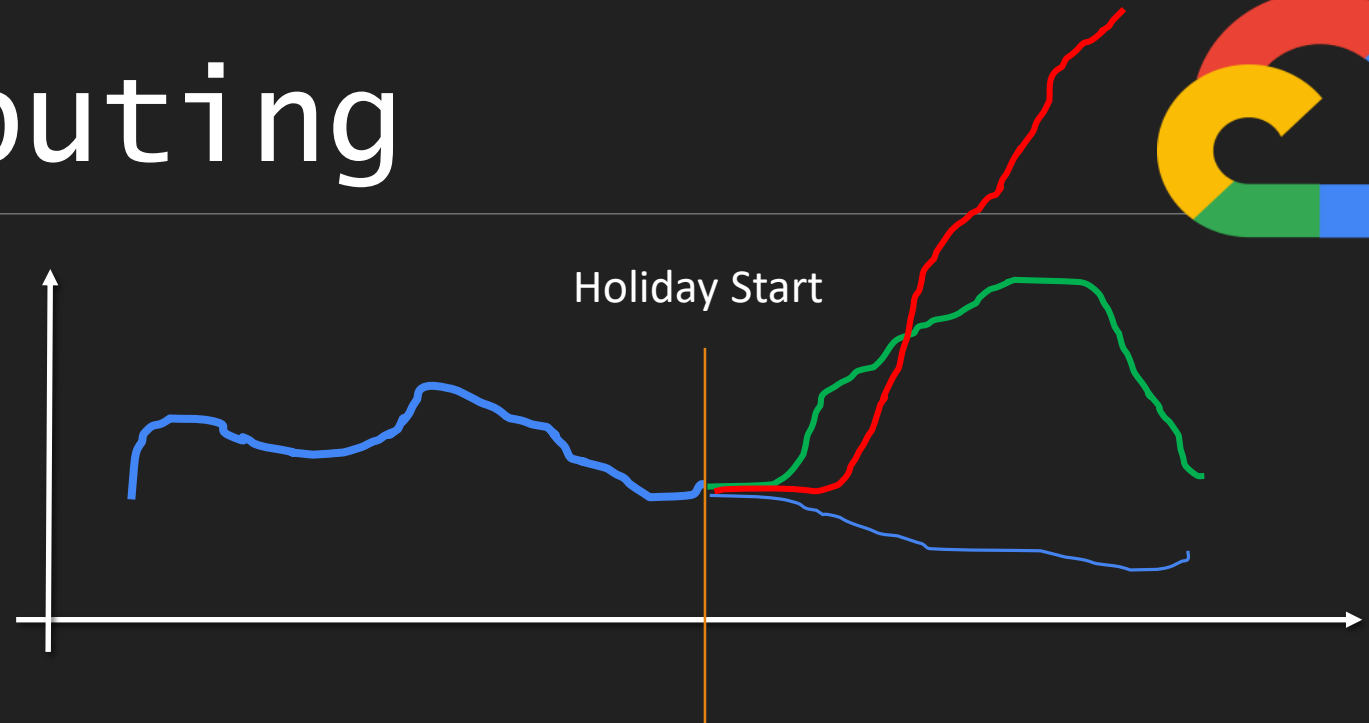
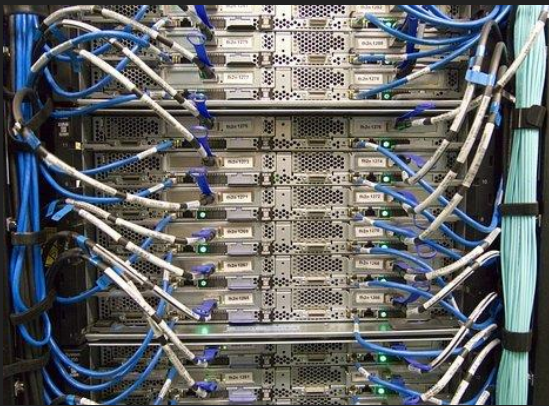
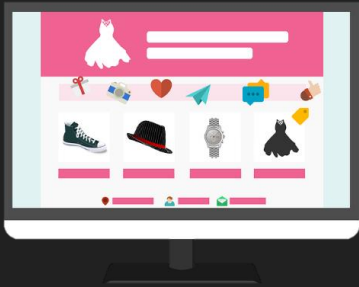


- Something running cloud



- Millions of machine running at some remote locations
 - You can rent those machine
 - Host your application
 - Use for temporary workload processing
 - Destroy whenever you don't need them
 - But Why we need to do that.

cCloud Computing



- Your prediction goes wrong
- But what after holiday over
- All newly provisioned machine will be underutilized.
- Again you never know what is future.
- So, on-premises data center is not elastic.

Image credit : <https://pixabay.com/>

Cloud Computing



- We need something where we can get processing power, storage on-demand
- Cloud is the solution for it.
- Let's say
 - You need 100 VM for next 8 hours
 - Within matter of few minutes you can provision it
 - If you don't need it, delete it.
 - Cool part is : Pay just 8 hours rent for 100 VM
- Distributed system
- Access globally from anywhere

c1oud Computing



- Cloud is where
 - you can rent resources when need them (on-demand)
 - release when you don't need
 - Highly elastic
 - 100 VM to 120 VM (Its just few click away)
 - Stop predicting future
 - Deploy your app at global scale
 - No Data center maintenance cost

Public vs Private cloud



➤ Private Cloud

- your Own Data-center
- Host your application inside data-center
- Highly secure
- Everything under your control
- Hardware, electricity, Renting space is your responsibility
- Many time machine are under utilized
- Lot of maintenance cost for data center

Public vs Private cloud



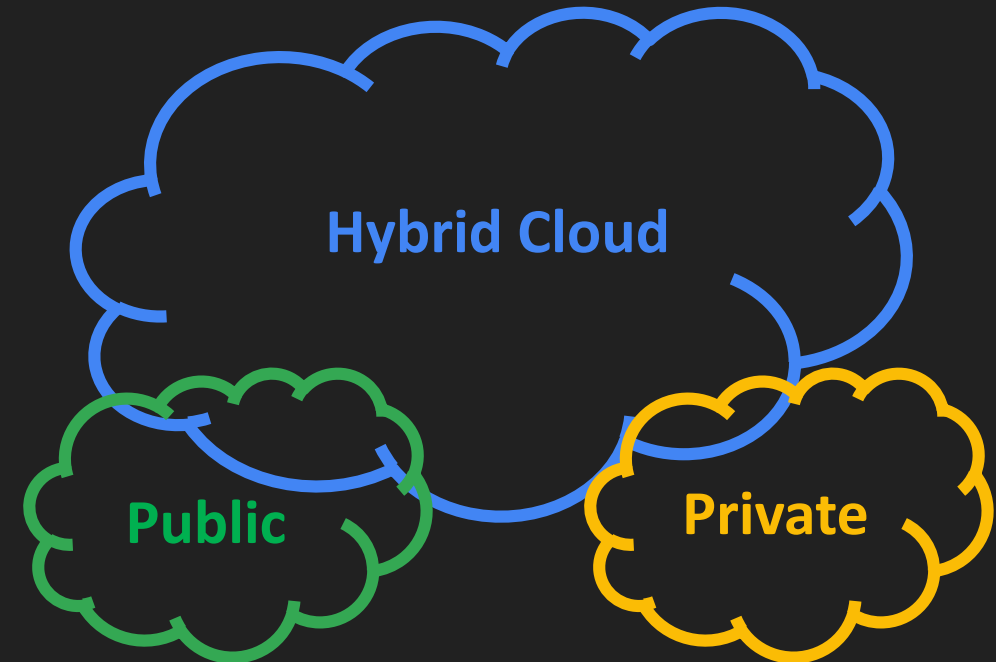
➤ Public Cloud

- Host everything in Publicly rented machine
- we are not responsible for maintaining any data-center
 - No Maintenance overhead like Physical Space, electricity
- All resource inside datacenter owned by Public Cloud Provider
- We are customer renting those resources for limited time.
- Major Public Cloud Provider
 - GCP – Google Cloud
 - AWS by amazon
 - Azure by Microsoft

Hybrid cloud



- Use Both Public Cloud & Private Cloud
- Some organization sensitive data, don't go out from data-center
- Let's say
 - You deploy Application at on-premises
 - Database deploy at GCP- Big table
- Some workload processing you use AWS & then move data to Google cloud storage for long term backup storage



Computing Service Options



- Infrastructure as a Service (IaaS)
- Platform as a Service (PaaS)
- Software as a Service (SaaS)
- Container as a Service (CaaS)

Computing Service Options



On-Premises	IAAS	PAAS	SAAS	
Application	Application	Application	Application	<div>You Manage</div> <div>Cloud Provider</div>
Data	Data	Data	Data	
Runtime	Runtime	Runtime	Runtime	
Middleware	Middleware	Middleware	Middleware	
O/S	O/S	O/S	O/S	
Virtualization	Virtualization	Virtualization	Virtualization	
Servers	Servers	Servers	Servers	
Storage	Storage	Storage	Storage	
Networking	Networking	Networking	Networking	

IaaS, PaaS, SaaS



➤ IAAS

- Only Infrastructure provided by GCP, AWS
- Provisioning Virtual machine
- Full flexibility & complete control over machine
- you need to manage everything yourself.
- Server management, Upgrade OS, Deploy Application

➤ PAAS

- No Server management – GCP will take care
- Auto scaling, Auto Healing feature
- You just Focus on Application

➤ SAAS

- Google drive
- GCP will take care everything
- You are responsible for content you upload on drive & Some feature configuration to access feature
- You are consumer for Drive App

➤ CAAS

- Container as a Service
- Cloud Run, GKE, App engine Flexible

➤ FAAS

- Function as a Service
- Deploy function - PAAS

Shared Responsibility Model



- Google Responsibility to secure cloud, app, data is one aspect
- As a cloud user, also responsible to secure individual resources
- It is shared responsibility between user & GCP
- GCP provide feature like Encryption at rest & transit, KMS, IAM to secure Data



Figure 1: Responsibility chart

<https://cloud.google.com/security/incident-response>

Cost vs responsibility



Towards Lesser Responsibility

Cost will increase

Towards Lesser Responsibility				Cost will increase	
On-Premises	IAAS	PAAS	SAAS		
Application	Application	Application	Application	You Manage	Cloud Provider
Data	Data	Data	Data		
Runtime	Runtime	Runtime	Runtime		
Middleware	Middleware	Middleware	Middleware		
O/S	O/S	O/S	O/S		
Virtualization	Virtualization	Virtualization	Virtualization		
Servers	Servers	Servers	Servers		
Storage	Storage	Storage	Storage		
Networking	Networking	Networking	Networking		

Total cost of operations (TCO)



- $TCO = \text{Purchase Cost of Asset} + \text{Cost of operation}$
- When moving to Cloud from on Premises
 - Cost need to consider
 - In GCP, No purchase of asset
 - Provision Resources with no minimum commitment (Expect few service feature)
 - Cost include (Pay as you go model)
 - Operation Cost

CapEx & OpEx



➤ CapEx

- Capital Expenditure
- How much money required to buy infrastructure
- In case of On-premises : building complete data center
- In case of GCP : No capital investment, but service like Compute engine there is committed use discounts

➤ OpEx

- Operational Expenditure
- How much money required to operate resources
- In GCP, mostly pay per use model for almost all services
- Operational Cost for VM - Provision for Compute engine
- Machine provision in background for app engine
- In case of Cloud Function : Total number of request served



2. Google Cloud Concepts

BY ANKIT MISTRY

Google Cloud Concepts

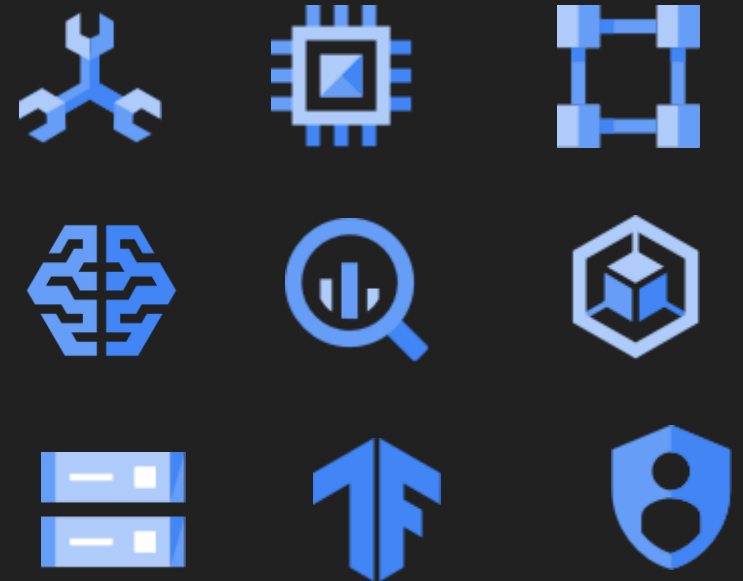


- What is Google Cloud
- Regions & Zones
 - Regional, Zonal, Multiregional resources
- Organization, folders, projects, and resources
- Different GCP Services
- Consumption based vs Fixed pricing model
- Flat-rate, committed use discounts [CUD], sustained use discounts [SUD]
- Google Service Pricing
- Billing support & technical support
- Service Level Agreement (SLA)
- Google Cloud - Compliance

Google Cloud (GCP)



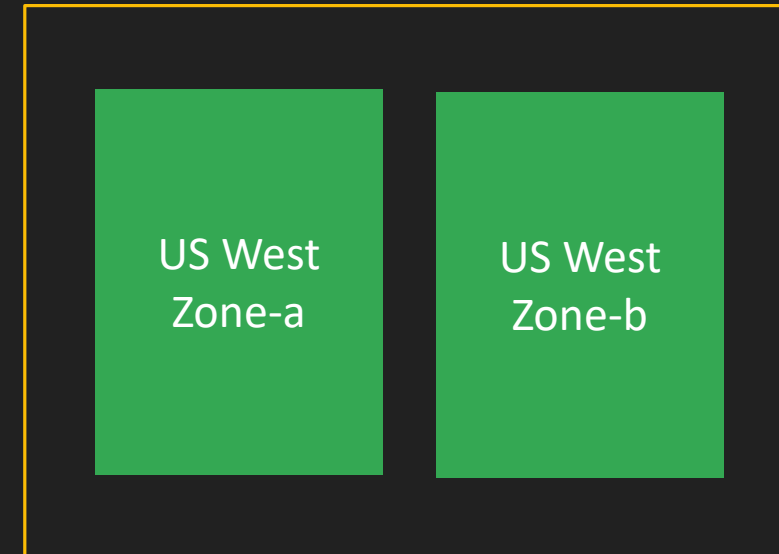
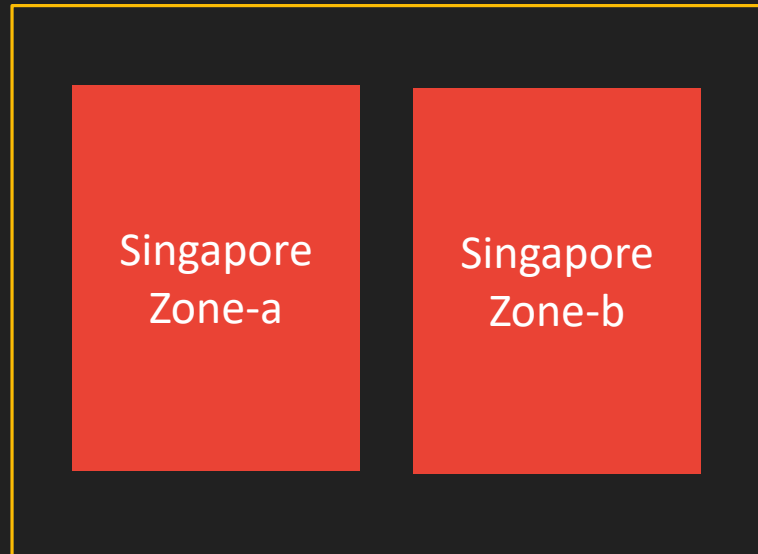
- Public Cloud – Build by Google
- Suite of 200+ Cloud computing services offered by Google
- Fastest growing public cloud
- Growing by 50% every year
- <https://www.statista.com/chart/18819/worldwide-market-share-of-leading-cloud-infrastructure-service-providers/>
- 7+ Google app having billion plus user deployed in same cloud infrastructure
- Google Cloud is carbon neutral today & goal is to be free from carbon.



Zones & Regions



- Low latency
- Follow Government rules
- High availability
- Disaster recovery



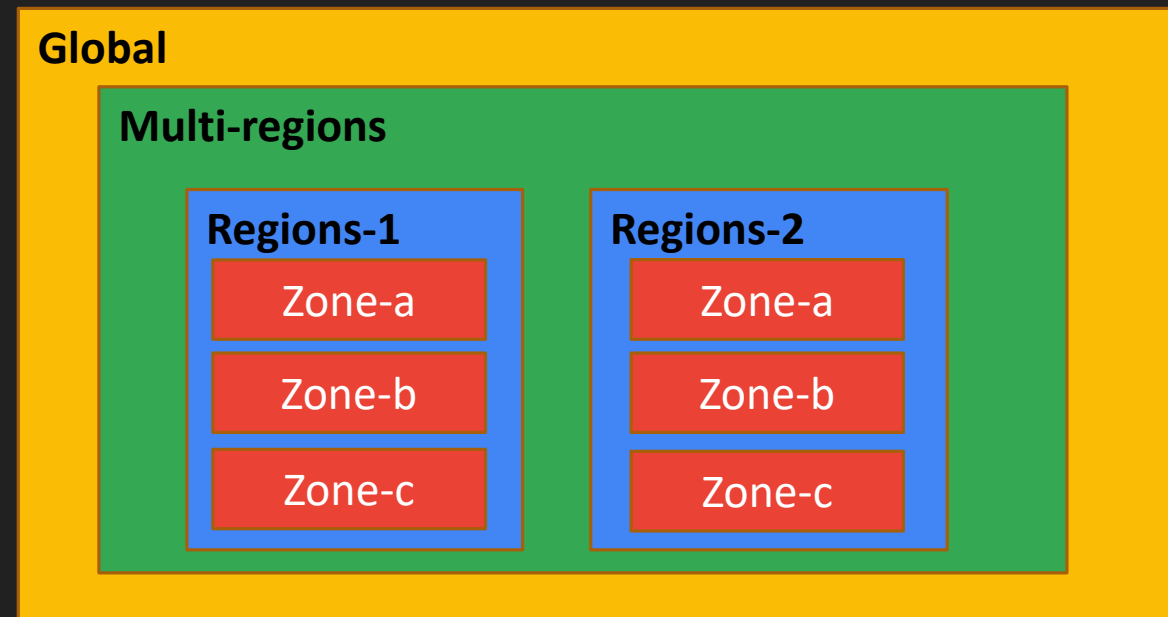
GCP (Zones & Region)



[Fascinating Number: Google Is Now 40% Of The Internet \(forbes.com\)](https://www.forbes.com/sites/kevinduggan/2019/04/04/google-is-now-40-of-the-internet/)

- Zones – Independent data Center
- Region – Geographical area
- Multi-region : Collection of Geographical
- Global - Anywhere

[Global Locations - Regions & Zones | Google Cloud](#)



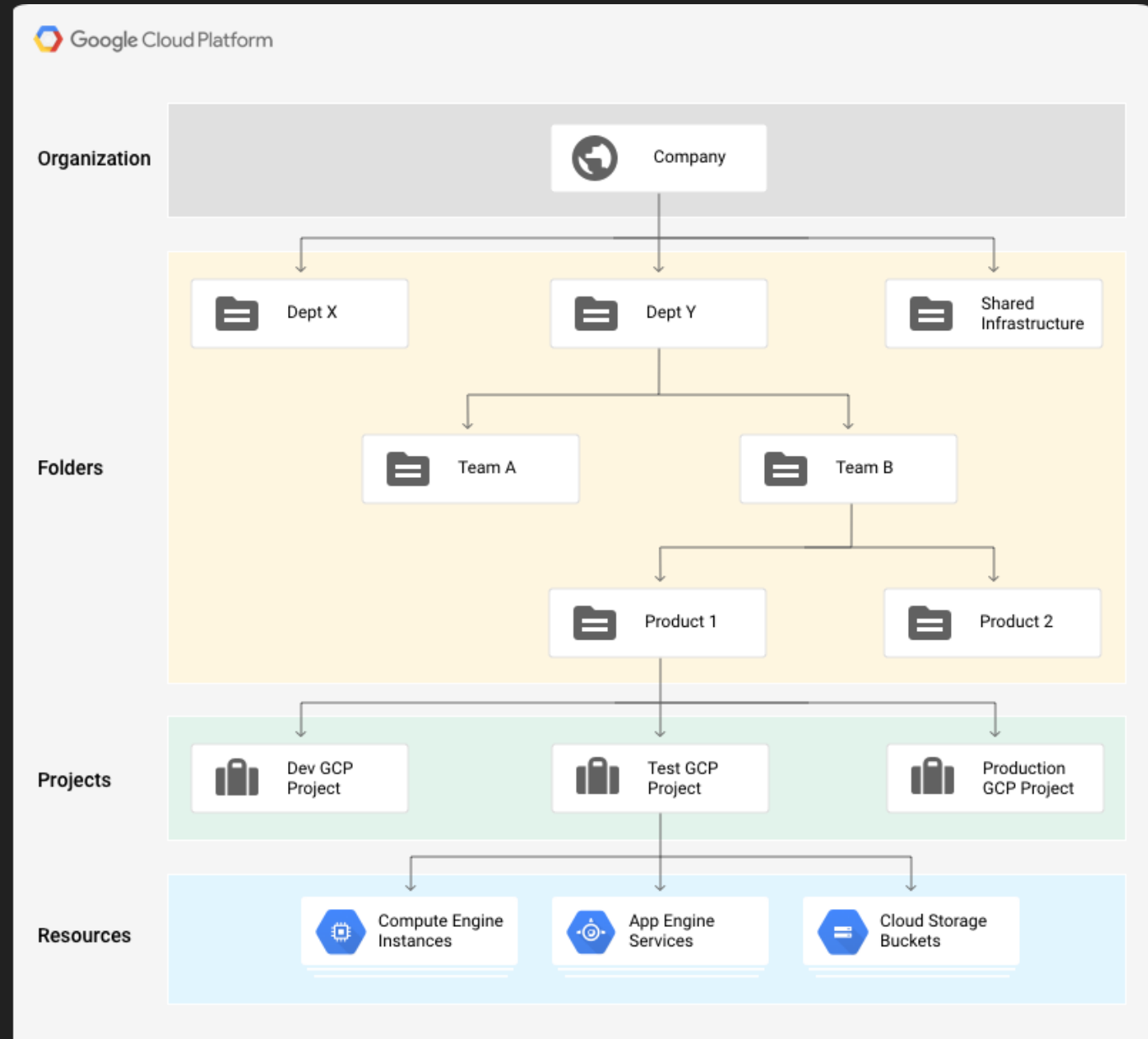
Regional, Zonal, Multiregional resources



- Virtual Machine
- Google Cloud Storage
- We need to answer : Above resource are zonal, Regional or Multiregional
- Virtual Machine - Zonal
- GCS – Google Cloud Storage : Regional, Multi-region
- It is recommended when you learn any GCP product or services, Focus service deployed at which level

Resource Hierarchy in GCP

Organization, Folders, Projects





Organization Policy

BY ANKIT MISTRY

Different GCP Services



- <https://cloud.google.com/products>
- My Recommendation :
 - Don't try to learn everything
 - Start with
 - Compute engine
 - App Engine
 - Basic Networking VPC,
 - Cloud Storage
 - Move towards specific category of product

In This Course



- Google compute machine
- container-based compute
 - container registry
 - Google Kubernetes Engine
- Serverless
 - App Engine, Google Cloud Functions, and Cloud Run
- relational and non-relational database offerings
 - Cloud SQL, Cloud Spanner, Cloud Bigtable, BigQuery
- Google Cloud's data pipeline offerings
 - Pub/Sub, Dataflow, Cloud Data Fusion, BigQuery, Looker
- ML/AI offerings
 - Vision API, AI Platform, TPUs
 - Identify when to train your own model, use a Google Cloud pre-trained model, or build on an existing model
- Identify data migration options
- Hybrid Connectivity
 - Determine the best connectivity option based on networking and security requirements
 - Private Google Access
- Cloud Identity, Google Cloud Directory Sync, and Identity Access Management (IAM)

Consumption based vs Fixed pricing model



➤ Consumption based Model

- Pay for what you use
- BigQuery : On-demand Pricing
 - you are charged for the number of bytes processed by each query.
- Cloud Function
 - Billed for number of request served.

➤ Fixed Pricing based Model

- Pay for resources weather you use it or not
- BigQuery : Flat-rate Pricing
 - Buying dedicated vcpu. You need to pay for that resources independent of weather you use it or not.
- Compute Engine
 - Weather you host app or not. You need to pay for resources.



Flat-rate, committed use discounts[CUD], sustained use discounts[SUD]

BY ANKIT MISTRY

We will learn about in Compute Engine Section

Google Service Pricing



- There is not constant pricing
- It varies from product to product
- Unless you learn about that service pricing doesn't make any sense.
- For each service pricing depends on number of different factors.
- For your cost estimation Visit : [Google Pricing Calculator](#).

Billing support



➤ Billing Support

- All Google Cloud accounts get free billing and payments support.
- <https://cloud.google.com/support/billing>
- you must be a billing administrator to contact & get support
- If you are not billing administrator, Follow Support Contact Troubleshooter

GCP Support offering



- Basic
 - By Default – Free of cost
- Standard
- Enhanced
- Premium
- Let's visit Cloud Console

Role-based support, and enterprise support



➤ There is

Service Level Agreement (SLA)



- Formal agreement between service provider & customer
- It indicated for how much amount of time service will be up & running
- SLA – 99.99% : four 9's
- <https://uptime.is>
- If GCP Doesn't meet SLA, you will get discount.
 - varies by service to service
 - but mostly it's same

SLA – BigQuery



Covered Service	Monthly Uptime Percentage
BigQuery	$\geq 99.99\%$

Monthly Uptime Percentage	Percentage of monthly bill for the respective Covered Service that does not meet SLO that will be credited to future monthly bills of Customer
99.0% – $< 99.99\%$	10%
95.0% – $< 99.0\%$	25%
$< 95.0\%$	50%

<https://cloud.google.com/terms/sla>

How to increase SLA



➤ For different service strategy will be different.

Compute Engine

Covered Service	Monthly Uptime Percentage
Instances in Multiple Zones	$\geq 99.99\%$
A Single Instance	$\geq 99.5\%$
Load balancing	$\geq 99.99\%$

Google Cloud Storage

Covered Service	Monthly Uptime Percentage
Standard storage class in a multi-region or dual-region location of Cloud Storage	$\geq 99.95\%$
Standard storage class in a regional location of Cloud Storage; Nearline, Coldline, or Archive storage class in a multi-region or dual-region location of Cloud Storage	$\geq 99.9\%$
Nearline, Coldline, or Archive storage class in a regional location of Cloud Storage; Durable Reduced Availability storage class in any location of Cloud Storage	$\geq 99.0\%$

Google Cloud – Compliance



- Google products undergo independent verification of their
 - security, privacy, and compliance controls, achieving certifications, attestations, and audit reports to demonstrate compliance
- GCP is compliant with several regulations/standards
- visit : <https://cloud.google.com/security/compliance>
 - To know about with which standard GCP follow
- It is equally apply to GCP customer to verify their app follow standard
- Google provides multiple region to deploy app
 - Some standard needs app to deploy in certain region only



3. Google Cloud Products and Services

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Cloud Identity & IAM

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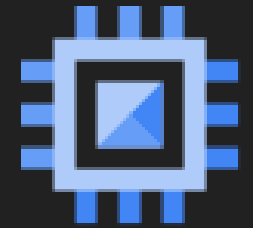
Compute Engine

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Compute Engine



- It is Basic Building block of any other services in GCP
- You can rent virtual machine inside GCP
- Host your app inside virtual machine
- Factors needs to consider while provisioning VM
 - Zone (Region)
 - Machine family
 - Predefined Machine Size
 - Custom Size
 - Networking
 - Storage Disk
- Let's create first virtual machine



Host App on VM



- Either install Simple Apache Webserver or nginx
- First SSH into it.
- `sudo apt update`
- `sudo apt -y install nginx`
- or
- `sudo apt -y install apache2`



Flat-rate,
committed use discounts [CUD],
sustained use discounts [SUD]

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Flat Rate

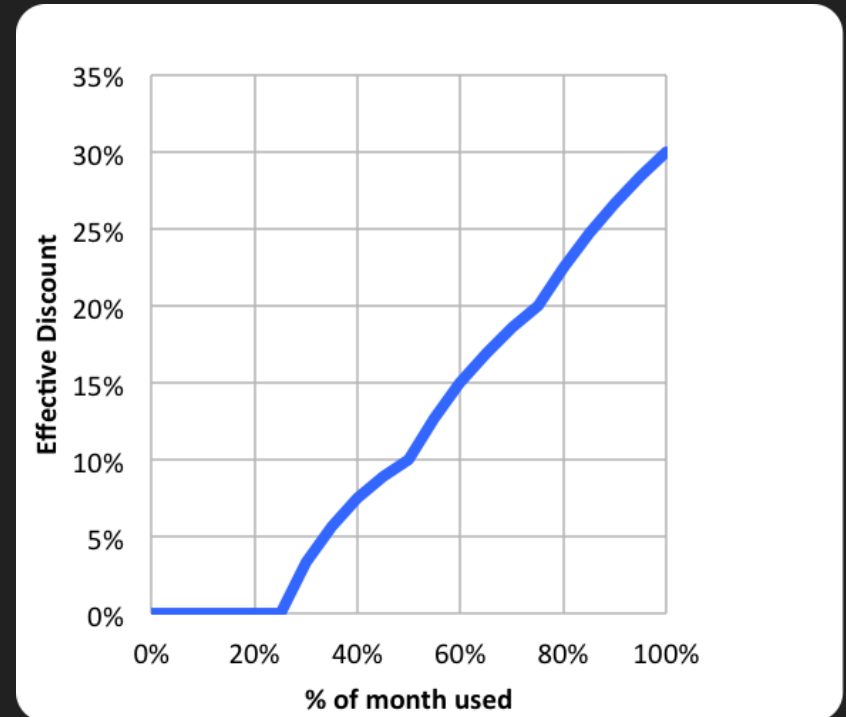


- Pay for what you use
- No Special Discount
- In Compute Engine :
 - E2 and A2 category of Machine

Sustained use discounts [CUD]



- Sustained use discounts are automatic discounts for running specific Compute Engine resources a significant portion of the billing month
- Applies to N1, N2 machine types
 - Not applicable to other machine type
- If you use at least 25% of month
- Only on GKE & VM Instances
- Let's see in action



Committed use discounts[CUD]



- Let's say your workload is predictable
- you can commit for 1 year or 3 year
- Get up to 70% of discount.
- Only on GKE & VM Instances
- Can not cancel commitments
- Let's see in action

Preemptible VM



- Just like Other virtual machine
- Short lived cheaper virtual machine
- Provision Pre-emptible VM When
 - Workload is fault tolerant
 - Not require 100% high availability
 - Cost is critical
- up to 80% discount
- max life is 24 hours
- Not always available
- Google give you 30 sec warning before auto shutdown
 - Regular VM has higher priority than Preemptible VM
- Let's see how to configure it

Instance Group



- Collection of VM instances
- Manage all instance group as single entity
- GCP offers 2 kinds of instance group.
 - Managed instance group - MIG
 - Unmanaged instance group

Managed Instance Group



- All instance identical in nature
- Autoscaling, auto-healing, regional deployment, and auto updating
- Workload highly available and scalable
- VM instance can be created from instance template
- Can not change configuration of one VM
- Good for stateless workload like,
 - Frontend of website
 - Some image related operations

Unmanaged Instance Group



- You need to manage instance yourself.
- Multiple heterogeneous VM instances.
- You can add, remove instance from group
- No Auto scaling, No auto-healing, regional deployment, and auto updating

Instance template



- VM Creation has lot of parameter. Some mandatory, some GCP will assume default.
- It's cumbersome task to provide all parameter everytime.
- Why can't we put all parameter info in one single file & tell GCP to create VM from this file.
- An instance template is a resource that you can use to create virtual machine (VM) instances and managed instance groups (MIGs).
- Create VM from existing configuration.
- Compare like oops
 - Instance template – class
 - VM – Object
- No option to update
- Let's create instance template



Creating VM from instance template

BY ANKIT MISTRY



Creating an Managed instance group

BY ANKIT MISTRY



Deploy Load balancer

BY ANKIT MISTRY

sole-tenant Nodes



- Sole-tenant
 - Single host machine dedicated to one customer (tenant)
- Shared machine
 - Single host machine has multiple tenant
- When you have
 - Specific Compliance requirement
 - You need high performing CPU

Google Cloud VMware Engine



- VMware is virtualization technology
- Many organization deployed their workload on VMWare (Datacenter)
- With VMware Engine on GCP
 - You can lift & Shift VMWare to GCP Environment
 - Run on dedicated sole tenant High performance machine
 - Lift & shift means no change required for migration
 - use other google resource after shifting to GCP (Like Network & Other services)

Bare metal in GCP



- Regular Virtual machine
 - Inside GCP hypervisor create multiple VM
 - Hypervisor introduce extra burden
- You want to run specialized workload like : Oracle, SAP
 - Going at bare metal is good solution
 - here there is no hypervisor
 - OS directly running on hardware
 - You have low level access to server

Compute Engine Migration





Attaching Disk to VM

BY ANKIT MISTRY



Containers & Kubernetes Engine

BY ANKIT MISTRY

In this video

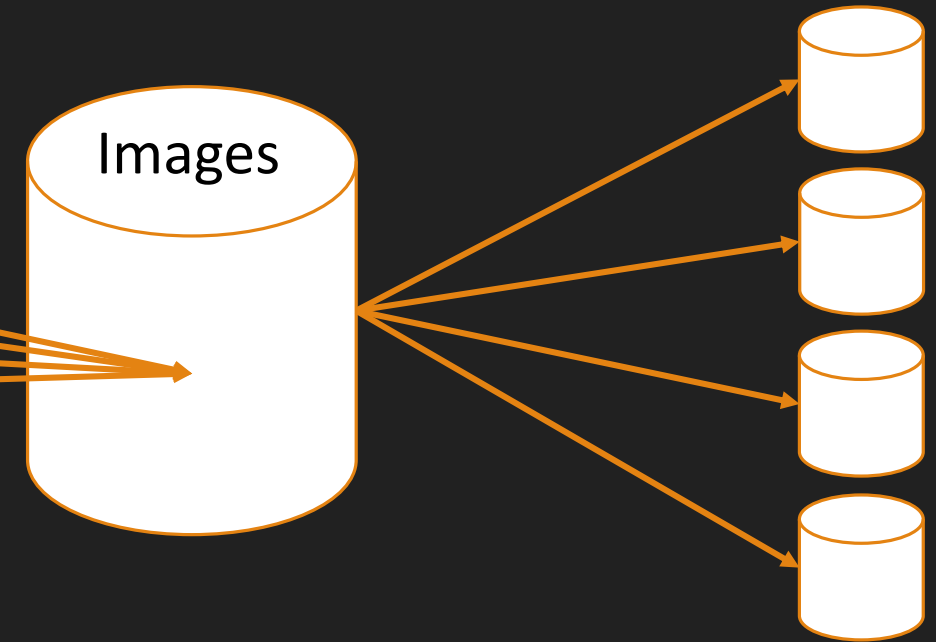


- What is Container
- How Container are different from VM (Virtual machine)
- Docker Introduction

Container



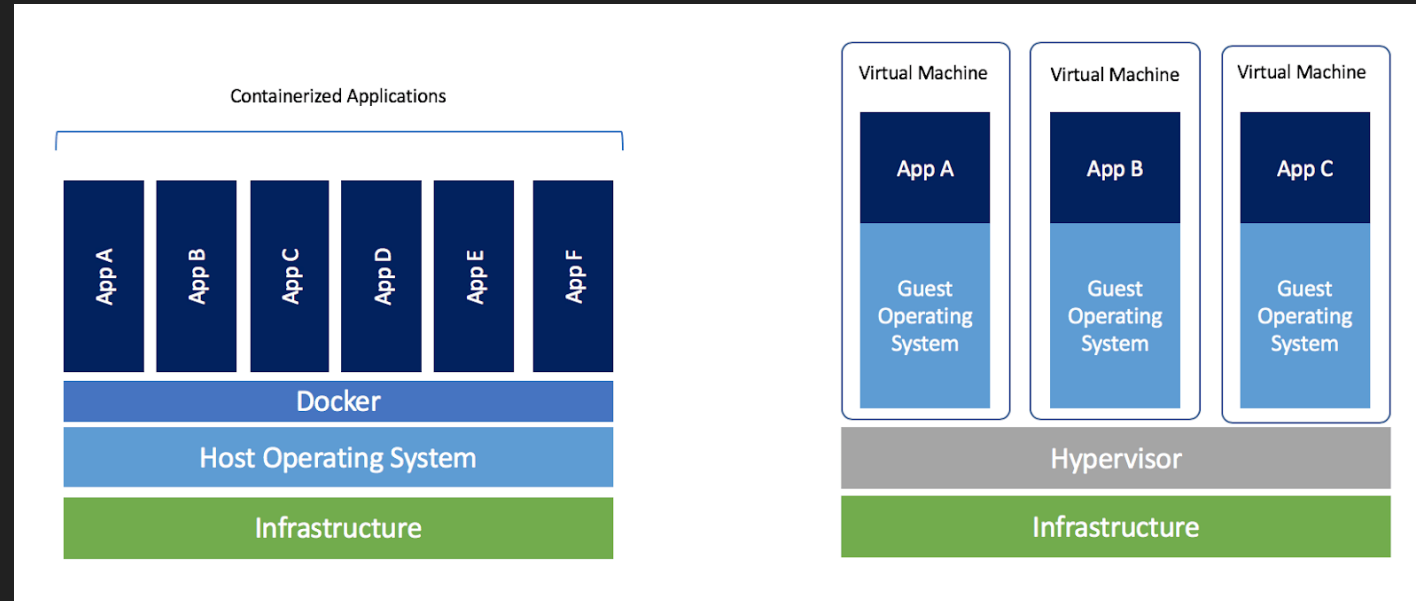
- Software shipping technology
- Let's say building JAVA APP
 - java runtime (JRE)
 - All library dependency
 - Network configuration
 - Runtime DLL
- Combine all this thing into one single bucket & ship
- Compare with oops
 - Images like class (Blueprint)
 - Container like objects



VM vs Containers



- Container are lightweight
- Easily portable to any public cloud, VM, bare metal
- For Micro service deployment, lightweight containers are preferred
- Fast CI/CD cycle
- All major public cloud providers has services to deploy container
- In GCP
 - VM
 - Cloud Run
 - GKE



<https://www.docker.com/blog/containers-replacing-virtual-machines/>

what is Docker



- Container are abstract concept.
- Docker is implementation of Container concept.
- Create Docker Images, from Images can create multiple containers

Container Registry



- Online storage space for Docker images
- Docker Hub inside Google Cloud
- You can store Docker images, pull images & push images, tag images
- GCP recently introduce next level registry –
 - Artifact registry
 - It can store not just Docker image but many more thing like NPM, maven
- Naming convention :
 - HostName/ProjectID/imagename:Tag - gcr.io/[ProjectID]/nginx:1.0
- Binary authorization can be used to detect vulnerabilities & enforce deployment policies.

Create First Docker images



- Node Application
 - server.js
 - Dockerfile
- node server.js
- `gcloud builds submit -t gcr.io/project_id/my-first-image:v1.0`

GKE – kubernetes Engine



- Let's say
 - you want to create 100's of container to scale your app
 - need some automate approach which fully manage all container lifecycle
- Kubernetes is the solution for it
- Opensource
- Google create cloud version – GKE : Google Kubernetes Engine
- Let's Deploy image to GKE
 1. Create Cluster
 2. Deploy Workload (Container image)
 3. Expose Outside World



Serverless Products

BY ANKIT MISTRY

serverless



- No server
 - Not really
- No server management from customer
- GCP internally take care server start stop and management
- Idea behind Serverless is
 - Don't worry about infrastructure, no server management, no resource provision
 - Focus on code
 - Deploy App
 - Start Accessing your application
- Billed based to number of request invocation , not with servers (VM)
- Auto Scaling if traffic shoot up
- GCP Serverless Product :
 - App Engine, Cloud Run, Cloud Function



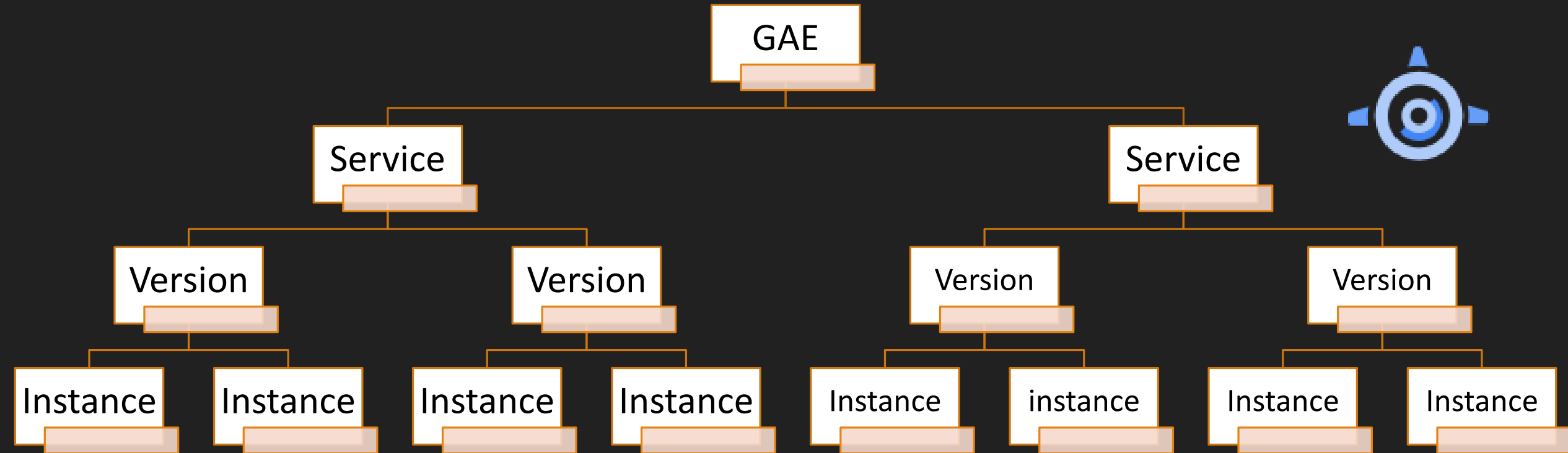
Google App Engine



- PAAS solution
- Fully managed service
- Deploy web app at high scale
- Server less
- Deploy http based web application
- Runtime Supported - Go, Java, .NET, Node.js, PHP, Python
- Two Flavors :
 - Standard – Specific Runtime
 - Flexible – Docker container
 - Support any runtime



Google App Engine



Google App Engine feature



- Auto scaling
- Load balancing
- Versioning
- Traffic splitting





Deploy App to GAE

BY ANKIT MISTRY

Google Cloud Run



- Serverless – fully managed
- Containerized App
- Best of App Engine Standard + Container
- App versioning – canary deployment (Traffic splitting)





Deploy App to Cloud Run

BY ANKIT MISTRY

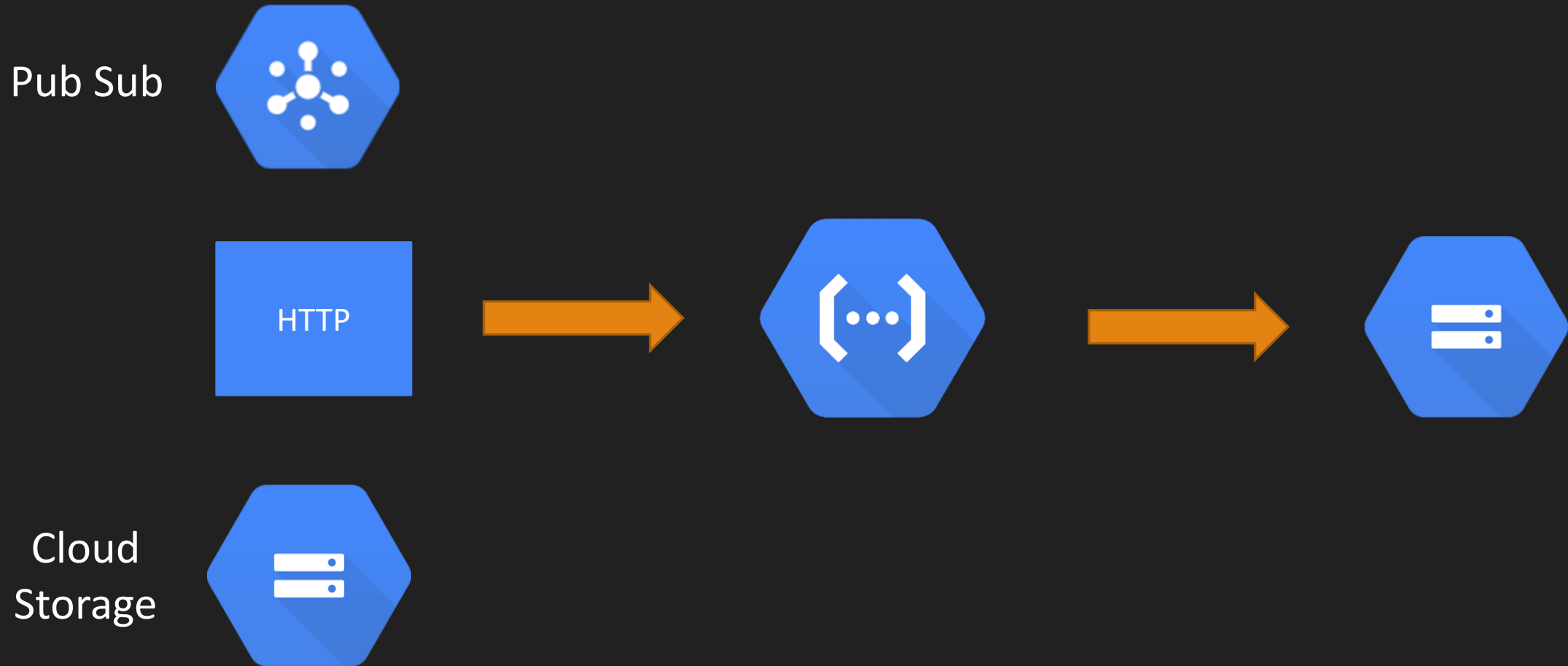
Google Cloud Function



- Single purpose micro services
- Event based trigger
 - Http
 - Pub sub
 - object upload in Cloud storage
- Deploy code as function



Google Function





Deploy Cloud Function

BY ANKIT MISTRY



Networking

BY ANKIT MISTRY

Networking



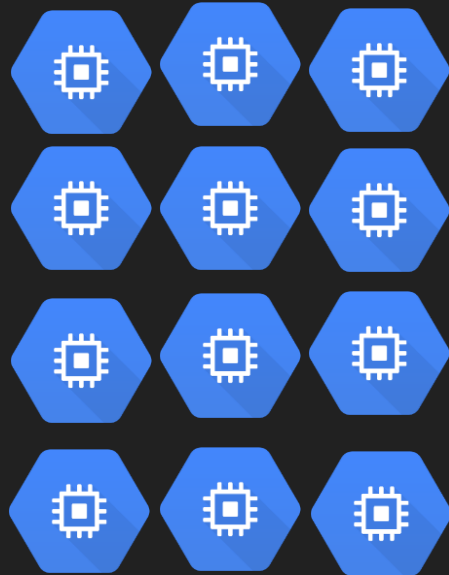
- CIDR notation
- Virtual Private Network & subnets
- Create Custom VPC
- Firewall
 - default firewall rules
 - create own firewall rule
- IP address
- Private Google Access
- GCP Hybrid Connectivity Options

CIDR notation



Classless Inter-Domain Routing

123.52.36.47



123.52.36.0

123.52.36.1

123.52.36.2

123.52.36.3

123.52.36.4

123.52.36.5

123.52.36.6

123.52.36.7

123.52.36.8

123.52.36.9

123.52.36.10

123.52.36.11



123.52.36.0

24

123.52.36.0/24

CIDR notation



123.52.36.0/24



123 . 52 . 36 . 0 / 24

0 1 1 1 1 0 1 1 0 0 1 1 0 1 0 0 0 0 1 0 0 1 0 0 0 0 0 0 0 0 0 0

123.52.36.0

123.52.36.1

123.52.36.2

123.52.36.3

123.52.36.4

||

||

||

||

||

123.52.36.254

123.52.36.255

CIDR Notation



123.52.36.0/28

28 bits are fixed

4 bits are variable

Total IP address – $2^4 = 16$

123.52.36.0/31

31 bits are fixed

1 bit is variable

Total IP address – $2^1 = 2$

0.0.0.0/32

32 bits are fixed

0 bits are variable

Total IP address – $2^0 = 1$

0.0.0.0/0

0 bits are fixed

32 bits are variable

Total IP address – 2^{32}
= 4,294,967,296

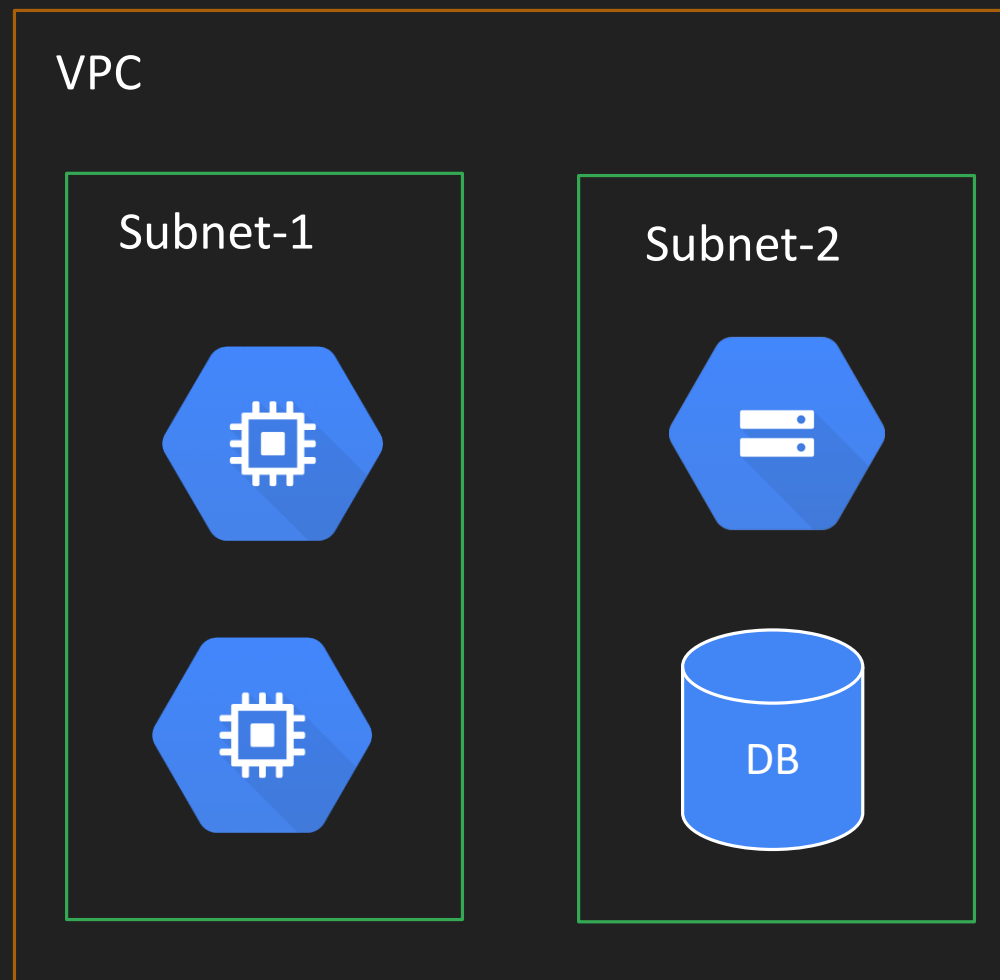
VPC – Subnetworks



- No Network -> No Cloud
- Virtual version of a physical network
- Networks are part of projects
- It's Global resources
- Placeholder to keep all your resources
- Max 5 networks per project
- No IP Assigned
- Network contain subnets
- Subnets are used for segregate resources
- Subnets has IP ranges
 - Expressed as CIDR notation
- VPC must have minimum one subnet
- Subnet belongs to one single region in GCP



VPC – Subnetworks



Types of VPC



Default

- Created when compute engine API enabled
- Every project has default VPC
- There is one subnet per regions

Auto

- With Auto mode, Default VPC can be created
- Fixed subnetwork ranges per region
- Can expand from /20 to /16
- Default firewall can be added easily.

Custom

- No Subnet automatically created
- Subnet creation manual
- Custom IP range allocation
- No necessary to create subnet in each region



Create VPC

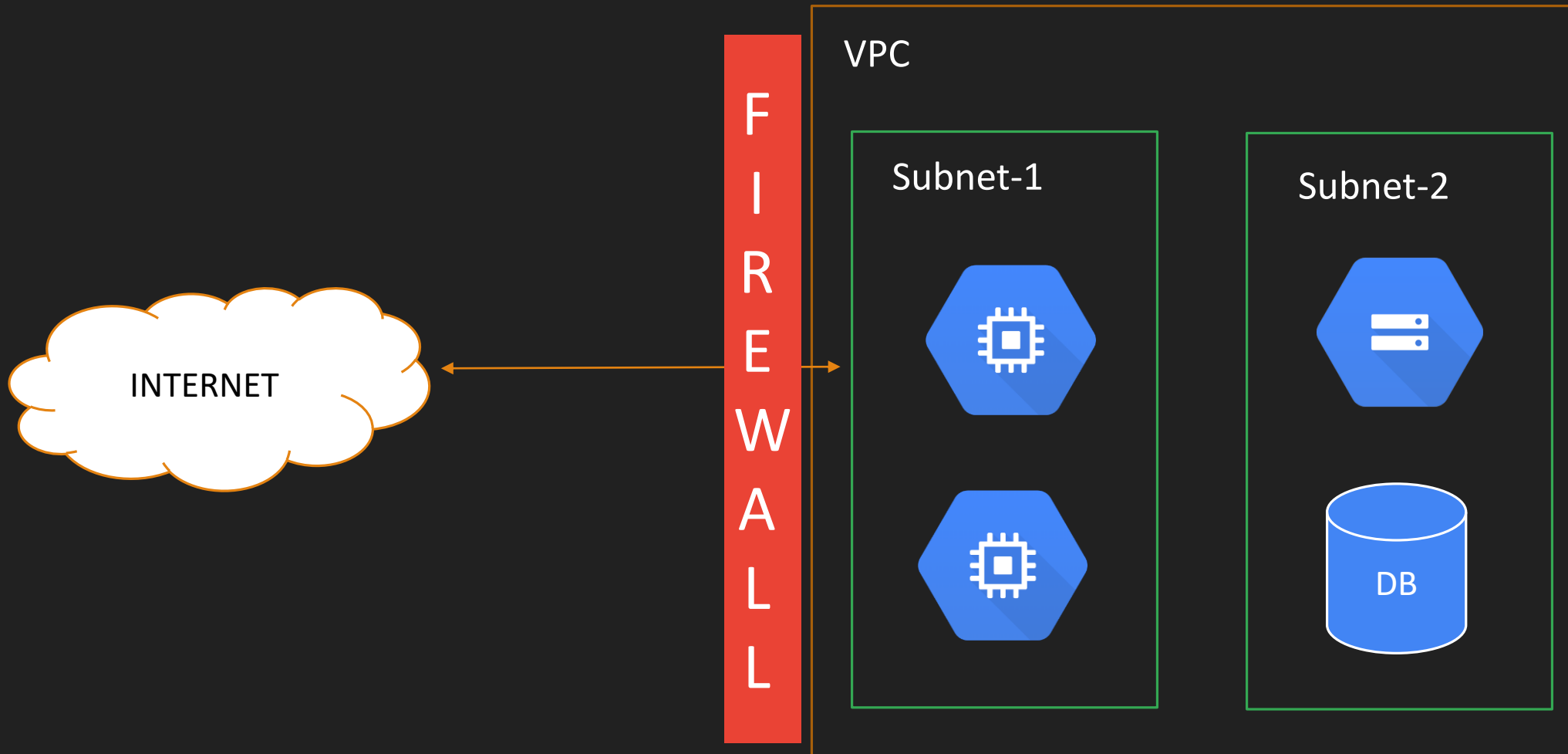
BY ANKIT MISTRY



virtual machine with vpc

BY ANKIT MISTRY

Firewall



Firewall rules



- Trust nothing by default
- Some default rule :
 - Allow all outgoing traffic - egress
 - Deny all incoming traffic - ingress
- Rule has priority number : (0-65535)
 - Lower the number higher priority
- Common port/protocol
 - 22 – SSH, 3389 - RDP
 - ICMP – ping
 - 80 - HTTP/HTTPS



IP Address

BY ANKIT MISTRY

Google API Private Access



- Private access allow different subnetwork to use GCP services privately
- No external IP Address require
- Call Google APIs & Services with internal IP address
 - YouTube API, Cloud Storage etc...

A screenshot of the Google Cloud console's 'Subnet details' page for a subnet named 'subnet-sg'. The page shows configuration details for the VPC Network (my-vpc), Region (asia-southeast1), and IP address range (10.1.0.0/24). The 'Private Google access' option is highlighted with a red circle and is currently set to 'On'. Other options like 'Secondary IP ranges', 'Gateway', 'Flow logs', and buttons for 'SAVE' and 'CANCEL' are also visible.

Subnet details EDIT DELETE

subnet-sg

VPC Network
my-vpc

Region
asia-southeast1

IP address range

10.1.0.0/24

Secondary IP ranges ?
+ ADD IP RANGE

Gateway
10.1.0.1

Private Google access

☒ On
☐ Off

Flow logs

☐ On
☒ Off

SAVE CANCEL

Private Access – Demo

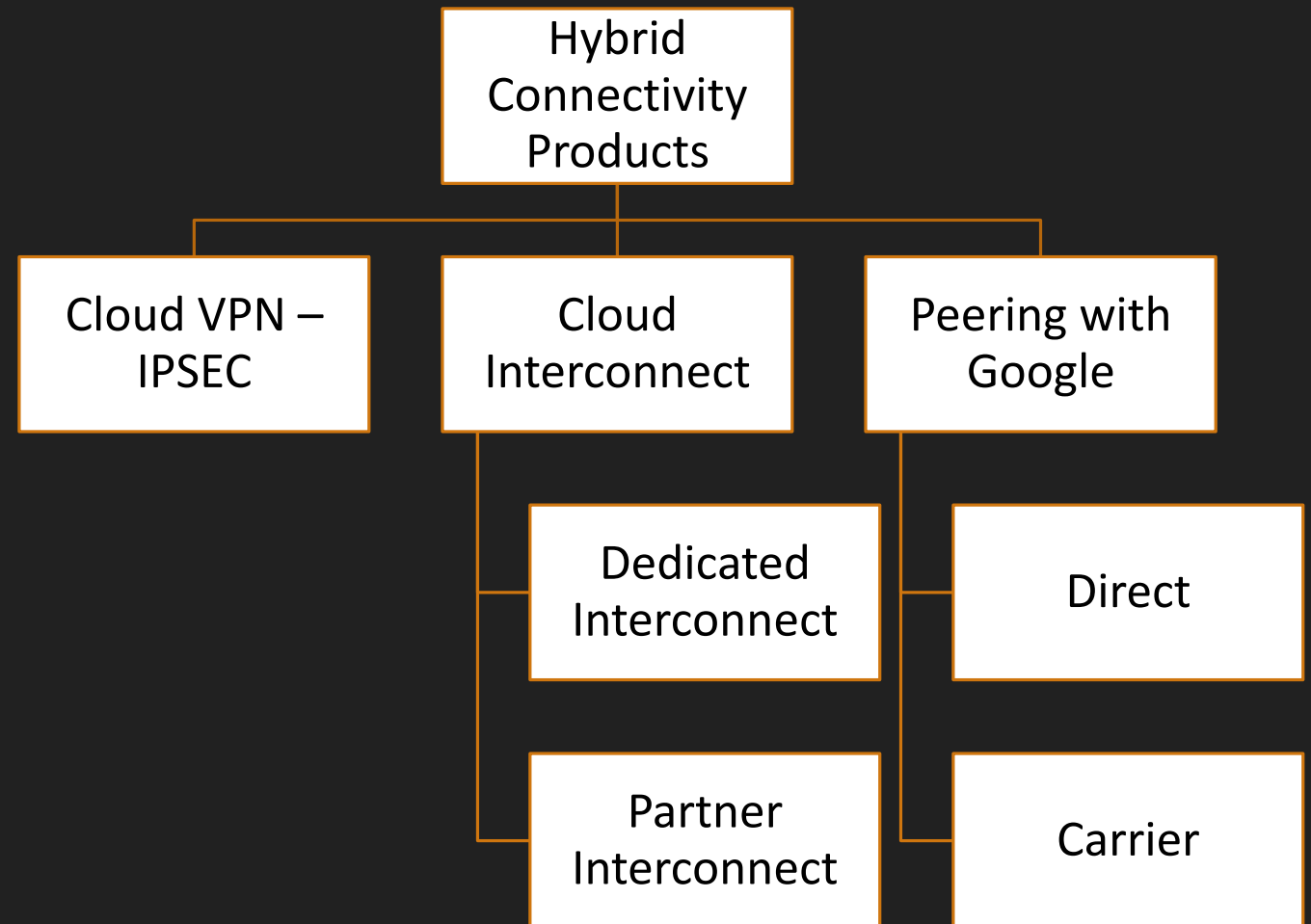


1. Create VM with Default
2. Test connectivity with different APIs
3. Remove external IP
4. Step - 2
5. Make Private Google Access – On
6. Step - 2

GCP Hybrid Connectivity



- Connect your datacenter network with GCP network



Cloud VPN

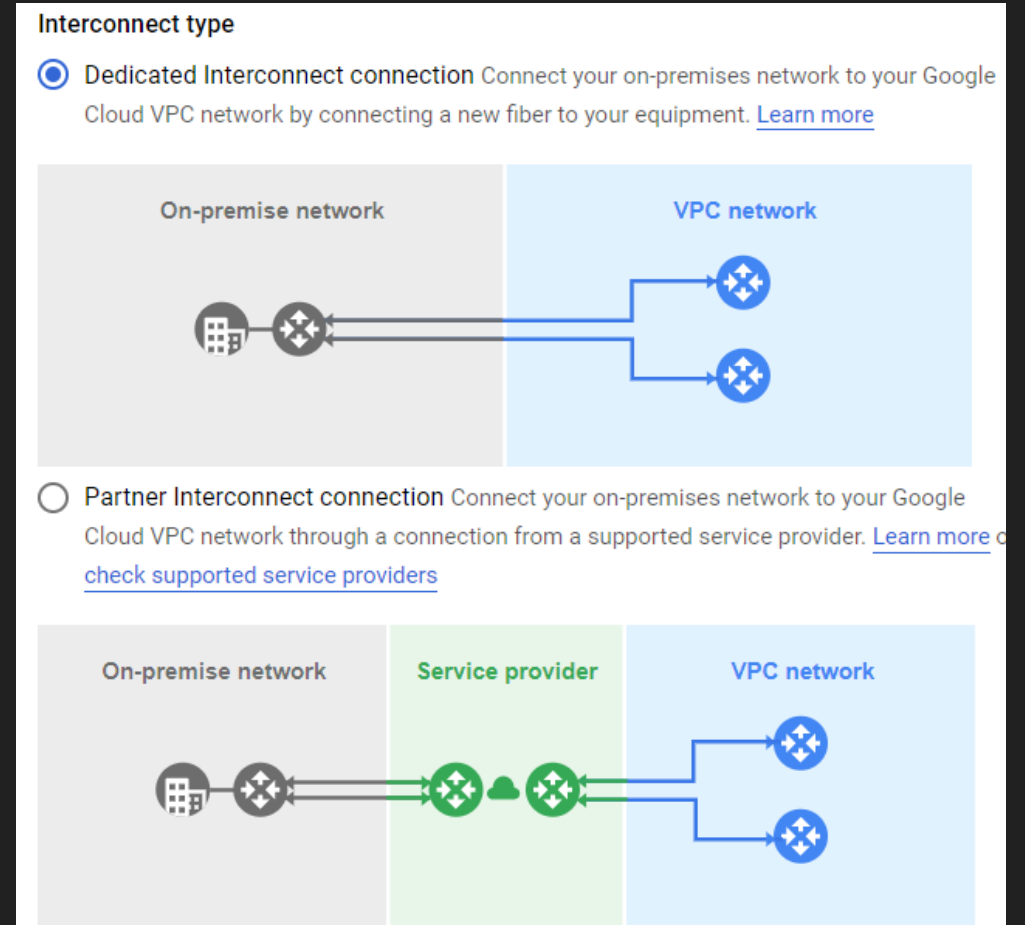


- A virtual private network lets you securely connect your Google Compute Engine resources to your own private network.
- Cloud VPN securely connects your peer network to your Virtual Private Cloud (VPC) network through an IPsec VPN
- It works between
 - Google cloud & datacenter
 - Google cloud & other public cloud (AWS)
- If you want to quickly setup connectivity, Cloud VPN is good choice.
- Traffic is encrypted by one VPN gateway and then decrypted by the other VPN gateway.
- Traffic travelled over public internet
- Cloud VPN tunnel can support up to 3 Gbps

Cloud Interconnect



- Extend your on premises VPC to GCP network
- highly available, low latency connection
- Access resource with Internal IP address only
- Require time for initial setup
- Once setup, it works with very low latency & with Internal IP address
- No encryption while traffic travelled



Storage & Database



➤ Storage

- Block Storage
- File Storage
- Object Storage

➤ Database

- Cloud SQL
- Cloud Spanner
- Bigtable
- BigQuery
- Datastore/firestore
- memystore



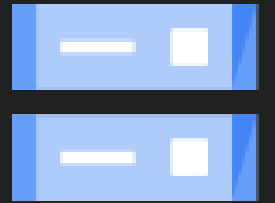
Google Cloud Storage

BY ANKIT MISTRY

Google Cloud Storage



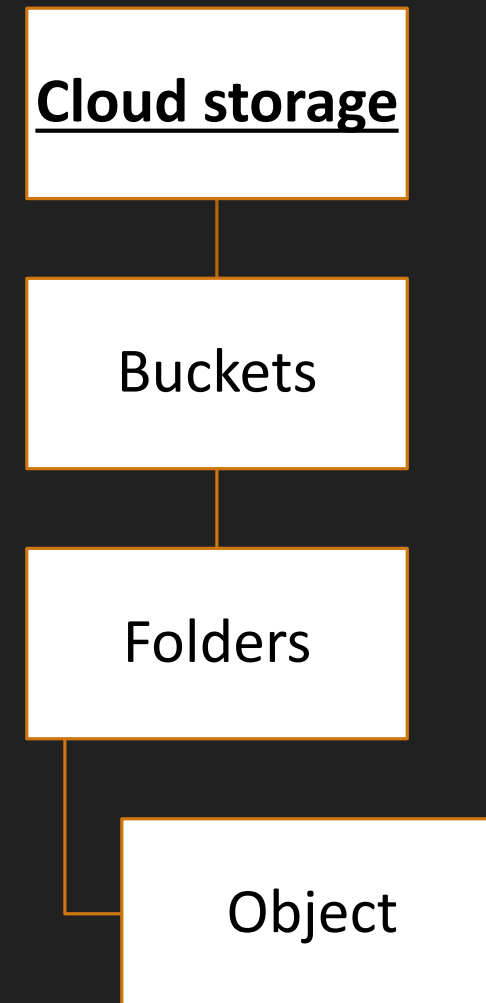
- Object storage solution in GCP
- Unstructured Data storage
 - Image
 - Video
 - Binary File, etc...
- Cloud storage can be used for long term archival storage
- Can be access object over http
- No capacity planning required
- Unlimited data can be stored
- By Default Data is encrypted at rest
- In transit also by default encryption.



Object Organization



- Global unique name for bucket
- Example access URL :
 - [https://storage.cloud.google.com/\[bucket\]/\[objectname\]](https://storage.cloud.google.com/[bucket]/[objectname])
- Bucket name appear in URL
- So, be careful while naming bucket
- Does not store anything like file system



Storage Location



Region

- Lowest latency within a single region
- Replicated data across multiple zone in single region

Dual-region

- High availability and low latency across 2 regions (Paired region)
- Auto-failover

Multi-region

- Highest availability across continent area – US, EU, Asia
- Auto-failover

Storage class



- How frequently access data
- How much amount of data

Standard

- High frequency access
- Storage Costliest
- Access cost is very low
- Low latency

Near line

- Low Frequency access
- Once in a 30 days
- Cheaper than standard
- Back up

Cold line

- Very low frequency to access
- Once in 90 days
- Cheaper than Near line

Archive

- Offline data
- backup
- Storage Cheapest
- Access cost very high



[Hands-on] Cloud Object Storage

BY ANKIT MISTRY



Google Block Storage

Google Block Storage



- Block storage – hard Disk storage
 - Direct attached Storage
 - Network attached Storage

Direct attached – Local SSD



- Local SSD
- Physically attached to VM
- Very High Performance – 10x to 100x of Persistence Disk
- Costlier than Persistence Disk
- You can not re attach to other VM
- Once VM destroy, Local SSD will be deleted
- Lower Availability
- Temporary/Ephemeral Storage
- No Snapshot
- Let's see in action.

Network attached storage



- Network attached hard disk
- Persistent Disks
- Zonal, Regional
- Not attached directly to any VM
- Can be re-attached with other VM
- Very Flexible – resize easily
- Permanent storage
- Snapshot supported
- Cheaper than Local SSD



Google Filestore

Google Filestore



- Fully managed, High performance Filestore
- Network attached storage (NAS) for Compute Engine and GKE instances
- Minimum 1 TB, can scale to 64 TB
- support for both HDD & SSD
- Enterprise level – easy fileshare
- Costly compared to cloud storage
- Let's see in action

Database inside GCP



- Cloud SQL
- Cloud Spanner
- Datastore/firestore
- BigTable
- BigQuery



Databases

Database



➤ Structured Data

- Tabular structure
- fixed number of rows & columns
- RDBMS system

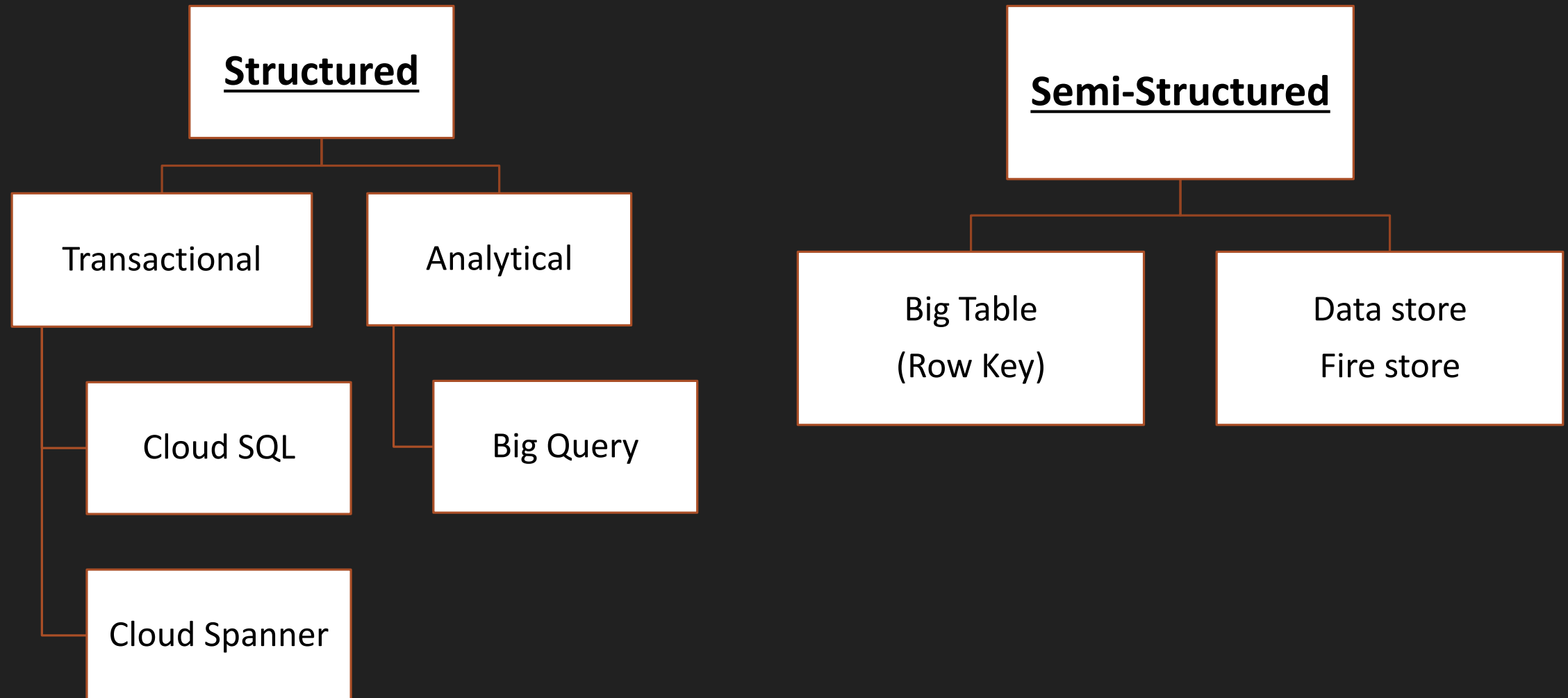
studentID	name	rank
100	John	12
101	Alice	7

➤ Semi- Structured data

- Variable number of properties
- JSON Like structure
- NoSQL system

```
{  
  "studentID" : 100,  
  "name" : "john",  
  "score" : 78,  
  "country" : "US"  
},  
{  
  "studentID" : 101,  
  "name" : "Alice",  
  "rank" : 7,  
}
```

Database inside GCP



Google Cloud SQL



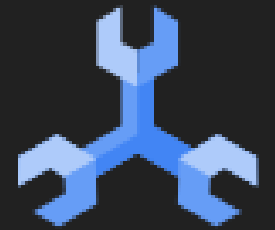
- Fully managed Relational database services for MySQL, PostgreSQL & SQL Server
- Lift & shift above database
- Regional Database with 99.95% SLA
- Storage up to 30 TB
- Scale up to 96 core & 416 GB Memory
- No Horizontal Scaling but Scale with Read replicas
- Data is encrypted with Google managed key or CMEK
- Cloud SQL can be accessed from anywhere like – App Engine, Compute Engine...
- Used for storing Transactional database
- Ecommerce, CRM kind application backend.





[Hands-on] Cloud SQL

Google Cloud Spanner



- Distributed & scalable solution for RDBMS in GCP
- Fully managed, Mission critical application
- Horizontal Scalability
- Costlier than Cloud SQL
- Cloud SQL has just Read replicas,
 - where as in cloud spanner horizontal read/write across region
- Highly scalable, Petabyte scale
- Data is strongly typed.
 - Must define schema for database
 - Datatype for each column of each table must be defined.
- 99.999% availability



[Hands-on] Cloud Spanner

c1oud Datastore



- Highly scalable NoSQL database
- Document database like Mongo DB – flexible schema
- Automatic scaling
- Upto few TBs of data
- Tightly coupled with App Engine
- export data from gcloud utility only
- Support for transaction, SQL like query

cloud firestore



- Next generation Datastore
- You can use in either datastore or firestore (native) mode
- Multi device access – ios, web, Android

Comparison with relational DB



Concept	Relational database	Datastore	Firestore
Category of object	Table	Kind	Collection group
One object	Row	Entity	Document
Individual data for an object	Column	Property	Field
Unique ID for an object	Primary key	Key	Document ID

Cloud BigTable



- Wide column NoSQL database
- Use when data is > 10 TB
- Petabyte Scale
- Not Serverless
- Scale Horizontally
- Millions of transaction per seconds – Milliseconds latency
- HBase compatible
- No Multi row transactions
- export possible with java app/Hbase command only

Cloud BigTable



- Data stored as key/value map
- Only one key per table – Row Key
- Important design consideration :
 - Design row key based on which is frequent query
- Columns are grouped into Column family
- High performance in read/write at low latency
- Use for
 - IOT data
 - Financial Data

Row ID	Column Family 1			Column Family 2		
	col1	col2	col3	col1	col2	col3
1						
2						
3						

Column Family 2:col1

Cloud BigQuery



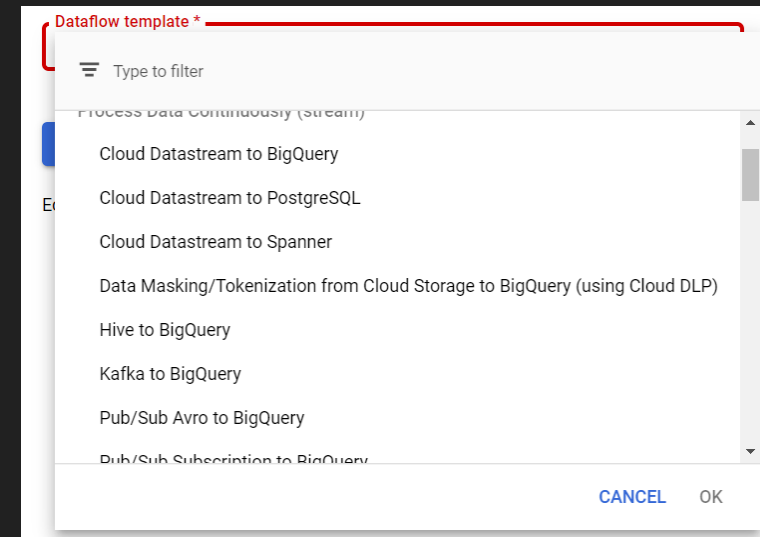
- Data warehouse solution in GCP
- Like Relational database – SQL schema
- Exabyte scale
- Query using
 - Standard SQL
 - legacy SQL
- Big Query can query from external data source.
 - Cloud storage, SQL, Big Table
- Biquery can load data from various sources.
 - CSV, JSON, Avro, SQL and many more
- Query is very expensive
- \$5 approx. for 1 TB of data scanned
- Before query execution do dry run.



Cloud Dataflow



- Fully managed data processing service
- Serverless
- Apache beam inside GCP (Unified programming language for ETL)
- Batch + Stream processing
- Number of pre-built template are available
- If not use custom template
 - Use Python, Java, SQL



Cloud Dataflow (Hands-on)



PubSub



Dataflow



BigQuery



c1oud DataProc



- Managed Hadoop & Spark inside GCP
- You can submit Spark, Hadoop job.
- Lift and shift existing spark, Hadoop code & leverage Google infrastructure
- DataProc cluster uses compute engine VMs
- DataProc – Demo
 - Create DataProc cluster
 - Submit Spark job to calculate Value of PI



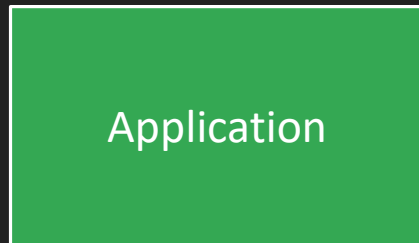
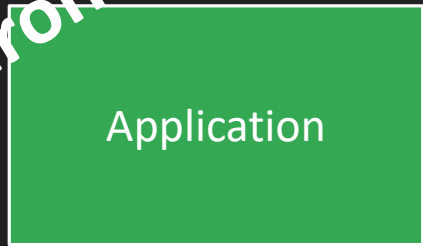


Asynchronous Communication

Cloud PubSub



Synchronous



Asynchronous

Cloud PubSub



- Fully-managed asynchronous messaging service
- Scale to billions of message per day
- Push & Pull way to access messages



Machine Learning – GCP



- Concept behind Machine Learning
- Types of ML System
- Pre trained Model
- Custom Model
- TPU – tensor processing unit

Machine Learning

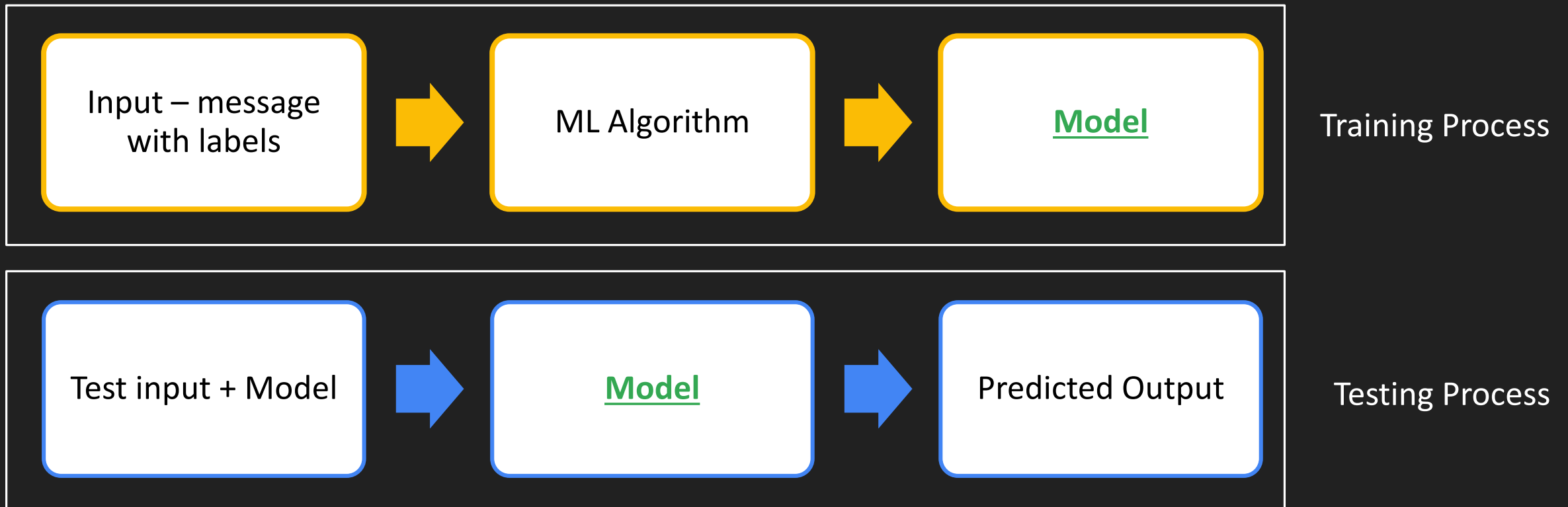


- Design Spam email classification system
- How to design?
- What rules you will code inside system
 - If message coming from some specified list of senders, spam it
 - If message contain word like lottery, promotion, spam it
- But how many such rule you will define inside system.
- It is very difficult & cumbersome task to design such way.
- If spammer start sending spam which is not part of rule book.
- So, need some intelligent approach,
- Machine Learning is the solution behind it.

Machine Learning



- Rather than define such rule,
- In machine learning, system learn from data
- Training + Testing kind of system



Types of ML System



- ML Types
 - Supervised learning
 - Label has been given
 - Regression
 - Classification
 - Unsupervised learning
 - No labels
 - Find Structure within data

Regression




- Output prediction is continuous in nature
- Example
 - House Price prediction
- Regression ML Algorithm :
 - Linear Regression
 - SVR
 - Decision Tree Regressor

Area	No of Bedroom	Price
5434	5	3536
2342	5	3564
243	1	4564
987	4	7675

Classification



- Output prediction is discrete in nature
- Example
 - Sentiment analysis of review : +ve/-ve
 - This product is very much helpful. +ve
 - Is it Orange? 
 - Yes/No
- Classification Algorithm :
 - Logistic Regression
 - SVM
 - KNN
 - Decision Tree Classification

Unsupervised Learning



- No label Given
- Find Structure within data
- Clustering is type of Unsupervised Learning
- Some clustering Algorithm :
 - K-Means
 - hierarchical

Pre-Trained Model



- Google has huge amount of data
- Google has already trained ML/AI algorithm to build model
- For generic use case like
 - Object recognition/detection – Vision API
 - OCR
 - Speech to Text
 - Language Translation
 - NLP API – to get insight from natural language
- You can take advantage of pre-built model.
- No Training required from customer
- Use already built Rest API for above use cases

Pre-built API Demo



- <https://cloud.google.com/vision#section-2>
- <https://cloud.google.com/speech-to-text#section-2>
- <https://cloud.google.com/natural-language#natural-language-api-demo>
- <https://cloud.google.com/text-to-speech>

Custom model



- Your use case is not generic
- You have some custom requirement
- Detect Dogs breed from thousands of images of dog
- Two ways train custom Model
 - Auto ML
 - State-of art Transfer learning technology
 - Throw your data & Google AI will create model
 - For Data scientist
 - Create notebook instance
 - Write complete code with different AI/ML framework
 - Tensorflow
 - PyTorch
 - Scikit-learn
- Let's see in Cloud Console

TPU



- TPU – Tensor Processing Unit
- Machine Learning Training is one of the most time consuming process
- It may take hours to days to sometime week
- Training time depend upon ML Algorithm + Amount of dataset
- Google introduce Tensorflow framework to do Machine Learning which powers their own ML Product
- Tensor are basic building block of this framework.
- So, To do training faster Google created ASIC based in-house dedicated computing for Tensor Processing
- Speed up training by 20x to 30x
- Work with VM, GKE, AI Platform
- Quickly experiment with number of ML Models creation

Migration services



- Database Migration Service
- Data Transfer Service
 - Transfer Service for cloud data
 - Transfer Service for on-premises data
 - Transfer Appliance
- Migrate for Compute Engine
- Migrate for Anthos
- Big Query Data Transfer Service

Database Migration Service



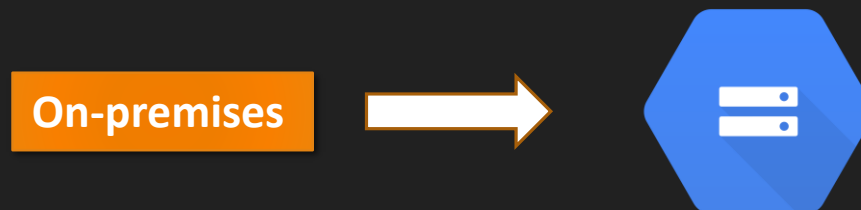
- Database Migration Service – DMS
- Sync RDBMS or One time transfer to Google Cloud SQL
- Source database supported
 - MySQL
 - Cloud SQL for MySQL
 - Amazon RDS for MySQL
 - PostgreSQL
 - Amazon RDS for PostgreSQL
 - Cloud SQL for PostgreSQL
- Destination can be
 - Cloud SQL for MySQL
 - Cloud SQL for PostgreSQL



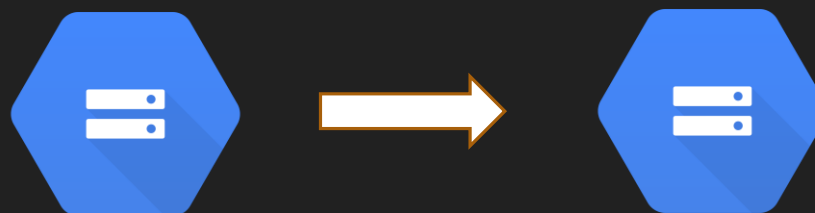
Data Transfer Service



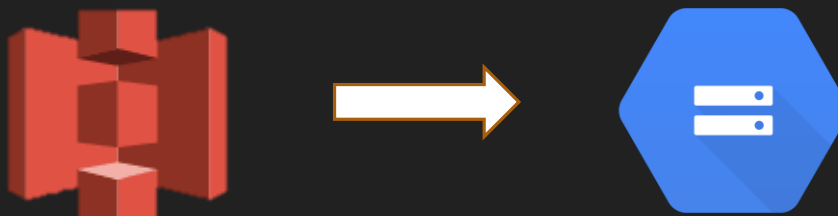
- From On-premises to Google Cloud Storage (GCS)



- From One bucket to another bucket inside same GCP



- From Other public cloud Amazon S3, Azure Container to GCS



On-premises to (GCS)



➤ gsutil – command line utility

- Online mode of transfer
- install locally Google Cloud SDK
- `gsutil -m cp large_number_of_small_files` (-m for parallel upload)
- Should we go for it or not?
 - Follow chart in next slide

➤ Transfer Service for on-premises data

- This will quickly and securely move your data from private data centers into Google Cloud Storage
- Two step process
 - installing an agent
 - create a transfer job

➤ Transfer Appliance

- Physical device which securely transfer large amounts of data to Google Cloud Platform
- When data that exceeds 20 TB or would take more than a week to upload.

Online vs offline transfer

Close



Data Size

100 PB	124 days	3 years	34 years	340 years	3,404 years	34,048 years
10 PB	12 days	124 days	3 years	34 years	340 years	3,404 years
1 PB	30 hours	12 days	124 days	3 years	34 years	340 years
100 TB	3 hours	30 hours	12 days	124 days	3 years	34 years
10 TB	18 minutes	3 hours	30 hours	12 days	124 days	3 years
1 TB	2 minutes	18 minutes	3 hours	30 hours	12 days	124 days
100 GB	11 seconds	2 minutes	18 minutes	3 hours	30 hours	12 days
10 GB	1 second	11 seconds	2 minutes	18 minutes	3 hours	30 hours
1 GB	0.1 seconds	1 second	11 seconds	2 minutes	18 minutes	3 hours
	100 Gbps	10 Gbps	1 Gbps	100 Mbps	10 Mbps	1 Mbps

Network Bandwidth

Transfer Service | cloud data

- This will quickly and securely transfer data into Google Cloud Storage
- From various sources
 - Amazon S3
 - Azure Blob Storage
 - Move data between Cloud Storage buckets
- Create Transfer Job
- Onetime run or recurring

Migrate for Compute Engine



- With Migrate for Compute Engine,
 - you can migrate your virtual machines (VMs) to Compute Engine from source platforms such as VMware, Microsoft Azure, and Amazon EC2.
- Migrate thousands of application
- So fast which reduce downtime
- Orchestrate migration – no manual job
- Monitor migrations and logging
- Let's see in action

Migrate for Anthos & GKE



- Do you want to migrate App from VM to Container
- Migrate for Anthos automatically transforms VMs
 - From on-premises VMware
 - Compute Engine
 - other clouds directly to containers running on GKE
- Anthos makes it easy to modernize traditional applications away from virtual machines and into native containers.
- Significantly reduces the cost and labor for a manual application modernization project
- With container – no burden of OS
- If VM is outside of GCP
 - First migrate to GCE with Migrate for Compute Engine
 - Then Migrate GCE to Container with Migrate for Anthos & GKE

Big Query Data Transfer



- BigQuery Data Transfer Service automates data movement into BigQuery on a scheduled, managed basis
- Schedule queries or transfer external data from SaaS applications to Google BigQuery on a regular basis.
- Following ways we can access this service
 - Cloud Console
 - bq command-line tool
 - BigQuery Data Transfer Service API
- Follow : <https://cloud.google.com/bigquery-transfer/docs/introduction>
 - To know full list of supported data sources

THANK YOU

