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Google Cloud Platform

Introduction - Google Storage Services

May 8, 2020

Agenda - Master Class

S.No.	Topic (Master Class)	Date	Day
1	Introduction to Google Cloud Platform	4-May	Mon
2	Introduction to Google Compute Services - GCE | GAE | GKE	6-May	Wed
3	***Introduction to Google Storage - GCS | Bigtable | Big Query | Datastore***	8-May	Fri
4	Introduction to Google Networking	11-May	Mon
5	Introduction to GCP Monitoring Services	13-May	Wed
6	**DEMO-I (2 Hours)**	15-May	Fri
7	Introduction to GCP Security Services	18-May	Mon
8	Introduction to Google Data & Serverless Services	20-May	Wed
9	Introduction to GCP DevOps Services	22-May	Fri
10	Introduction to Google API Services	26-May	Tue
11	Introduction to Google Anthos	27-May	Wed
12	**DEMO-II (2 Hours)**	29-May	Fri

Google Storage Services

Object

Cloud Storage

Relational

Cloud SQL

Cloud Spanner

Non-Relational

Cloud Datastore

Cloud Bigtable

Block

Persistent Disk

File-based

Cloud Filestore

Warehouse

BigQuery

Google Cloud: Object Store

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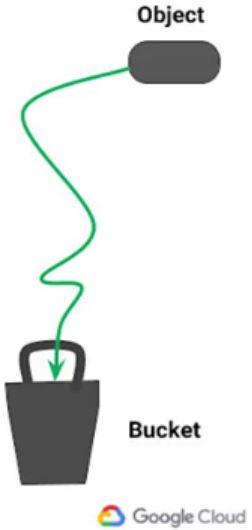
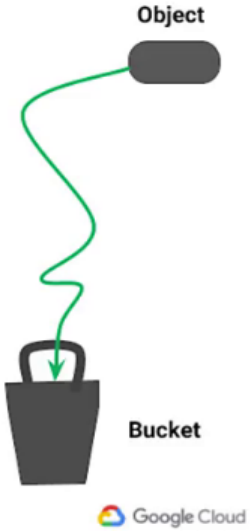
Google Cloud Storage - Object Store

- It is RESTful Online File Storage Web Service
- Stores & Serves Object e.g. BLOB
- Objects are stored in Buckets
- Objects are “immutable by nature” e.g. cannot be overwritten
- Buckets have name, labels, ACL
- Supports advanced security e.g. Pre-defined Roles, KMS
- Sharing capabilities e.g. create time-bound links
- You can use it to serve static web sites

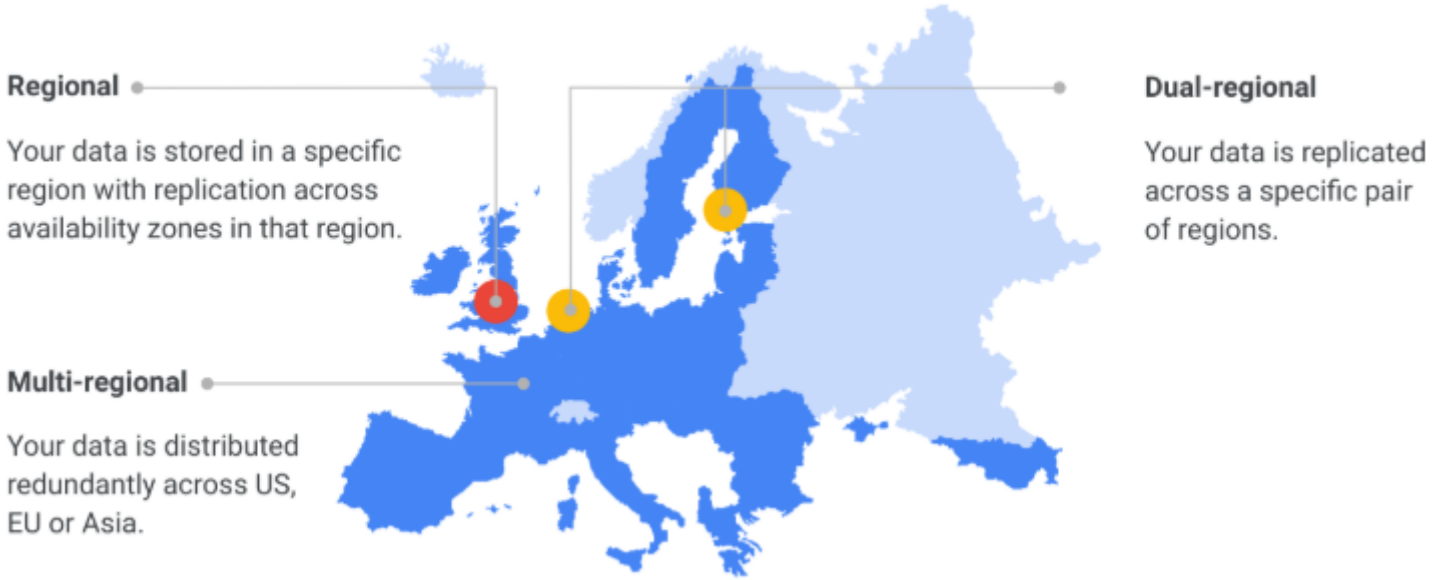


Google Cloud Storage - Features

- Object Lifecycle Management
- Object Versioning
- Retention Policy
- Object Holds
- CMEK / CSEK
- Uniform Bucket-Level-access e.g. disable ACL
- Requester Pays
- Supports Pub/Sub Notification e.g. add, update, delete
- Cloud Audit Logs



Types of Storage Class and Replication Options



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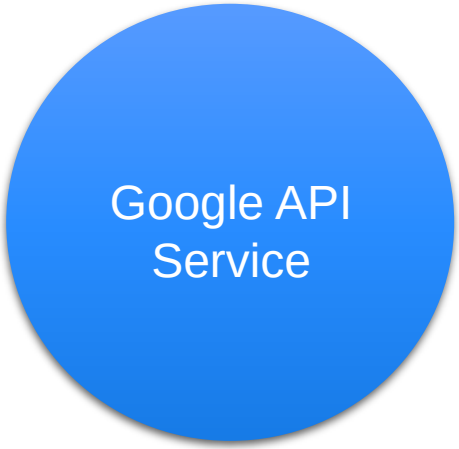
How do you work with Buckets?

gsutil

Web Browser



Programmatic
Access

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Cloud Shell | Shell prompt

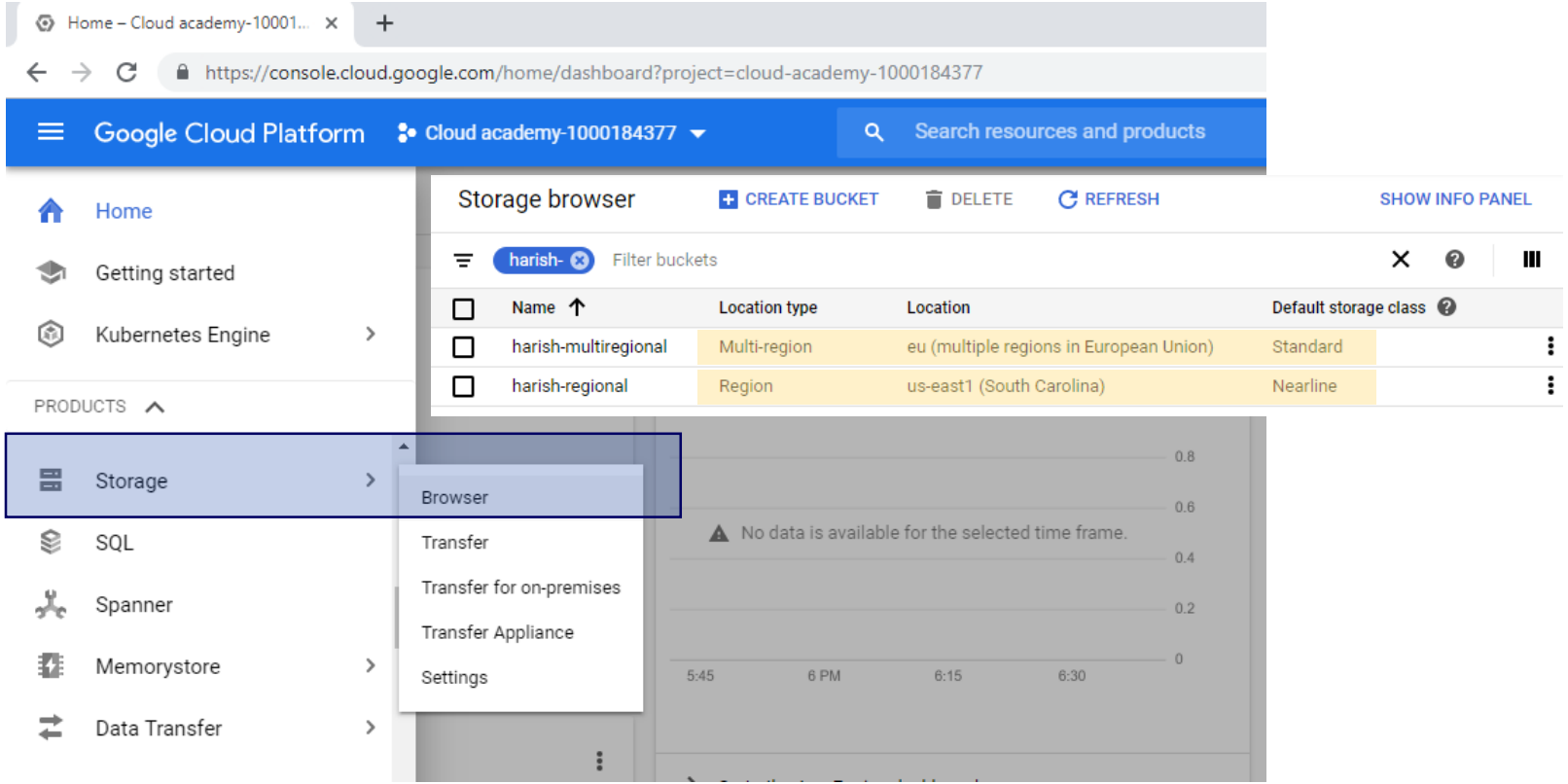
```
$gsutil -p <project_id> -c nearline -l us-east1
```

root@cts-client:/home/harish_chauhan - Google Chrome

https://ssh.cloud.google.com/projects/cloud-academy-1000184377/zones/us-central1-a/instances/cts-client?authuser=0&hl=en_US&projectNumber=910525767076

```
[root@cts-client harish_chauhan]# echo "This is File #1" > file1
[root@cts-client harish_chauhan]# echo "This is File #2" > file2
[root@cts-client harish_chauhan]# ls
file1  file2
[root@cts-client harish_chauhan]# gsutil mb -p cloud-academy-1000184377 -c nearline -l us-east1 gs://harish-regional
Creating gs://harish-regional/...
[root@cts-client harish_chauhan]# gsutil mb -p cloud-academy-1000184377 -c standard -l eu gs://harish-multiregional
Creating gs://harish-multiregional/...
[root@cts-client harish_chauhan]# gsutil cp file1 gs://harish-regional
Copying file://file1 [Content-Type=application/octet-stream]...
/ [1 files][   16.0 B/   16.0 B]
Operation completed over 1 objects/16.0 B.
[root@cts-client harish_chauhan]# gsutil cp file2 gs://harish-multiregional
Copying file://file2 [Content-Type=application/octet-stream]...
/ [1 files][   16.0 B/   16.0 B]
Operation completed over 1 objects/16.0 B.
[root@cts-client harish_chauhan]# gsutil ls gs://harish-regional
gs://harish-regional/file1
[root@cts-client harish_chauhan]# gsutil ls gs://harish-multiregional
gs://harish-multiregional/file2
[root@cts-client harish_chauhan]#
```

Google Console



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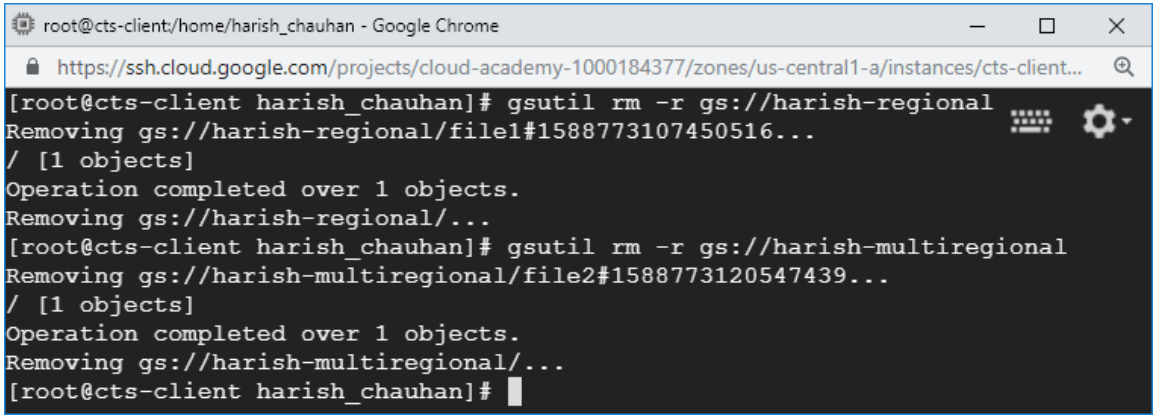
Programmatic Access

```
curl -X PATCH --data-binary @[JSON_FILE_NAME].json \ -H "Authorization: Bearer
[OAUTH2_TOKEN]" \ -H "Content-Type: application/json" \
"https://storage.googleapis.com/storage/v1/b/[BUCKET_NAME]?fields=labels"
```

Removal of the Buckets



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Cloud Storage - Lifecycle Management

Cloud Storage offers the Object Lifecycle Management feature

Condition : Days | CreatedBefore | IsLive | MatchesStorageClass | NumberOfNewerVersions
Action : Delete | SetStorageClass

Sample Policy File

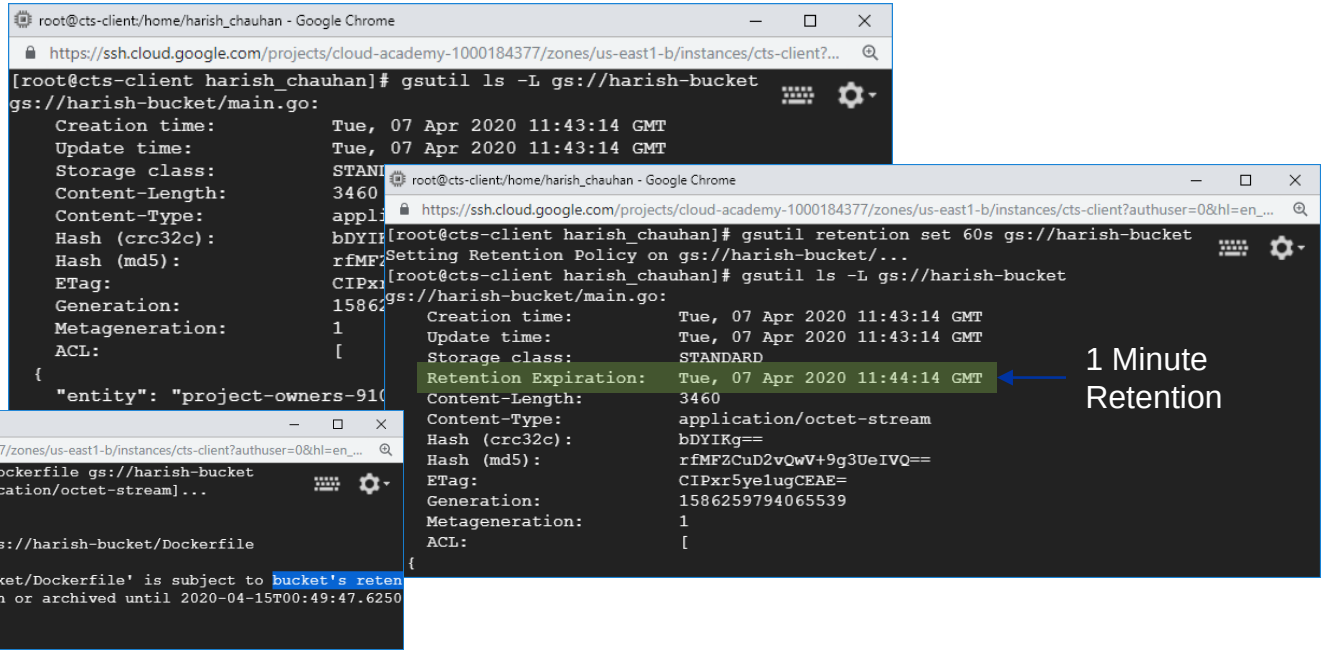
```
{
  "lifecycle": {
    "rule":
    [
      {
        "action": {"type": "Delete"},
        "condition": {"age": 365}
      }
    ]
  }
}
```

Source: Google

Cloud Storage - Retention Policy & Bucket Lock

Bucket Lock feature allows you to configure a data retention policy for a Cloud Storage bucket that governs how long objects in the bucket must be retained

- Retention Policy
- Lock Policy
- Temporary Hold
- Event-based



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What's the difference between SQL/NoSQL

Cloud Spanner

Cloud SQL

SQL	NOSQL
Relational Database management system	Distributed Database management system
Vertically Scalable	Horizontally Scalable
Fixed or predifined Schema	Dynamic Schema
Not suitable for hierarchical data storage	Best suitable for hierarchical data storage
Can be used for complex queries	Not good for complex queries

Source

Cloud Bigtable

Cloud Firestore

Cloud Datastore

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Google Cloud: Relational Database

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Google Database Options - SQL Compliant

Cloud SQL

Google Cloud SQL is a fully-managed relational database service

- Supports **Open Source** and **Commercial Database**
- **Automates database provisioning**, storage capacity mgmt. & other time-consuming tasks
- Ensures **reliability & security** with built-in automation for HA, Backups, Security updates & 24/7 SRE team
- Easy integration with your workstation, as well as App Engine, Compute Engine, Kubernetes, and BigQuery
- Pay-Per-Use & Fully Managed

Cloud Spanner

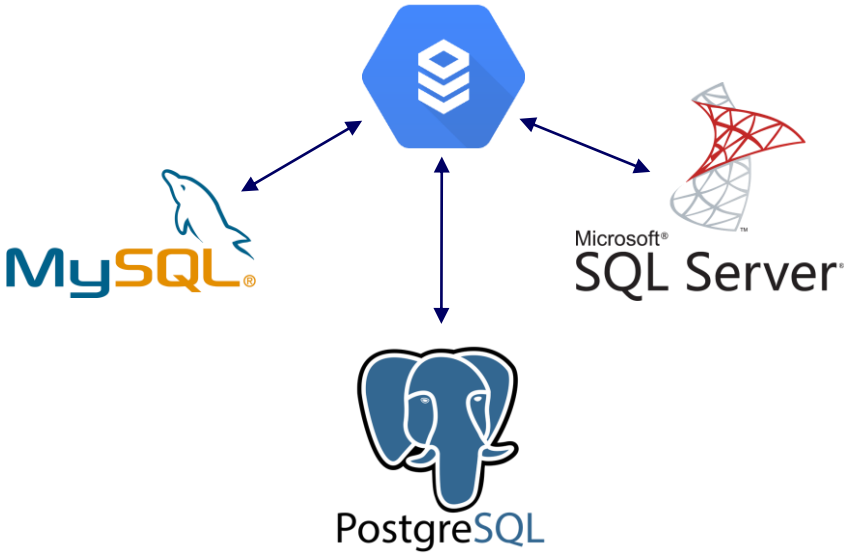
Cloud Spanner is a fully-managed, scalable & globally available relational database service

- **Global Scale** e.g. one to thousands of nodes
- Relational Semantics e.g. SQL (ANSI 2011))
- Offers SLA of **99.999%**
- **Multi-Language Support** e.g. C#, Go, Java, Node.js, PHP, Python and Ruby
- **Transactional Consistency** with Enterprise Grade Security
- **Highly Available** & **Fully Managed**

AWS : Amazon RDS | Aurora
Azure : Azure SQL Database

Cloud SQL Service

- Secure Access & Connectivity
- Built-in HA
- Scalable
- Automatic Storage Increase
- High Performance
- Easy Integration
- Automatic Backup
- Point-in-Time Recovery
- External Migration
- Compatibility
- Standard APIs



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Cloud Spanner - Feature Comparison & Pricing

Comparison - Best of both Relational and Non-Relational databases

	Cloud Spanner	Traditional Relational	Traditional Non-Relational
Schema	✓ **Yes**	✓ Yes	✗ No
SQL	✓ **Yes**	✓ Yes	✗ No
Consistency	✓ **Strong**	✓ Strong	✗ Eventual
Availability	✓ **High**	✗ Failover	✓ High
Scalability	✓ **Horizontal**	✗ Vertical	✓ Horizontal
Replication	✓ **Automatic**	↻ Configurable	↻ Configurable

Pricing

Feature	REGIONAL PRICE (USD)	MULTI-REGION PRICE (USD)
Nodes	From $0.90 per node per hr	From $3.00 per node per hr
Storage	From $0.30 per GB per month	From $0.50 per GB per month
Network Ingress	FREE	
Network Egress	Cross-region and internet egress rates apply	

Quota & Limits

Google Cloud: Non-Relational Database

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Google Database Options - NoSQL Compliant

Bigtable

Cloud Bigtable is Google's NoSQL Big Data Service

- **Columnar Database**
- Data is encrypted both in-transit and at-rest
- Designed to handle massive workloads at consistent **low-latency and high-throughput**
- Automatically scales to handle **PB of data** and millions of operations per second
- Easy to integrate with Cloud Dataproc & Cloud Dataflow services
- HBase Compatible. i.e. HBAse API
- Fully Managed Service

AWS : Amazon DynamoDB
Azure : Cosmos DB

Datastore

Cloud Firestore

Cloud Datastore is a highly-scalable NoSQL database for your applications

- **NoSQL** & **Fully Managed** database for Mobile, Web & IoT apps
- Support **Atomic** transactions
- **Connect directly** to Cloud Firestore from your Mobile or Web clients for a truly server-less solution
- **Sync data** across devices, on or offline
- **High Availability | Massive Scalability | High Performance**
- Balance of strong and **eventual consistence**
- **Encryption at-rest**

AWS : Amazon SimpleDB
Azure : Azure DocumentDB

Google Cloud: Block Storage

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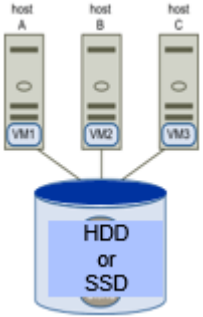
Google Cloud Storage - Persistent Storage

Durable

Persistent Disk is designed for high durability. It stores data redundantly to ensure data integrity.



Independent volumes

Your storage is located independently from your virtual machine instances, so you can detach or move your disks to keep your data even after you delete your instances.

Volume size

Each persistent disk can be up to 64 TB in size, so there is no need to manage arrays of disks to create large logical volumes.

Auto Encryption

Online resize

Online growth allows volumes to grow on-demand without the need to restart virtual machines or reattach volumes.

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What can you achieve using a Persistent Disk?

- Take a Snapshot as a “Backup”
- Re-build an instance from a Snapshot in case of a failure
- Helps in creating an instance copy across a different region (e.g. Snapshot is Global Resource)
- Snapshot to Image - Instance provisioning across a different Project

High IOPS

HDD (per 10GB)	7.5 (R)	15 (W)
SSD (per 10GB)	300 (R)*	300 (W)*

Throughput

HDD (MB/s for 10GB)	1.2 (R)	1.2 (W)
SSD (MB/s for 10GB)	4.8 (R)*	4.8 (W)*

*Shows up in range for higher capacity. Read More

Persistent Storage Options

Features	Zonal Standard	Regional Standard	Zonal SSD	Regional SSD	Local SSD
Storage Type	Efficient & reliable block storage	Efficient & reliable with synchronized replication across two zones in a region	Fast and reliable block storage	Fast & Reliable with Synchronized replication across two zones in a region	High Performance local block storage
Max Capacity (Per Disk)	64 TB	64 TB	64 TB	64 TB	375 GB
Capacity Increment	1 GB	1 GB	1 GB	1 GB	375 GB
Max Capacity (Per Instance)	257 TB	257 TB	257 TB	257 TB	3 TB (9 TB IN BETA)
Scope of Access	ZONE	ZONE	ZONE	ZONE	INSTANCE
Encryption (At-Rest)	YES	YES	YES	YES	YES
Supported Machine Types	All Machine Types	All Machine Types	Most Machine Types	Most Machines Types	Most Machine Types

Google Cloud: File Storage

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Cloud Filestore

Cloud Filestore is a managed file storage service for applications that require a file system interface and a shared file system for data. It provides users a simple, native experience for standing up managed Network Attached Storage (NAS) with their GCE/GKE instances

Features:

- Fast - Choose an option based on your need
- Simple - Fully managed service
- Consistent - Predictable price for the predictable performance
- Scalable - Add file storage elastically

	Standard	Premium
Max read throughput	100 MB/s (1 TB), 180 MB/s (10+ TB)	1.2 GB/s
Max write throughput	100 MB/s (1 TB), 120 MB/s (10+ TB)	350 MB/s
Max IOPS	5,000	60,000
Max capacity per share	63.9 TB	63.9 TB
Typical customer availability	99.9%	99.9%
Protocol	NFSv3	NFSv3

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Google Cloud: Warehouse

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Cloud BigQuery

It is an enterprise grade data warehouse that enables super-fast SQL queries using the processing power of Google's infrastructure.

Features:

- Fully-managed data warehouse on RESTful web service
- Scalable, cost-effective and fast analysis of big data
- Leveraged as Serverless and Software as a Service (SaaS)
- Has built-in Machine Learning capabilities

- ✓ BigQuery ML enables data scientists and data analysts to build and operationalize ML models
- ✓ BigQuery BI Engine is a blazing-fast in-memory analysis service for BQ that allows users to analyze large and complex datasets
- ✓ BigQuery GIS uniquely combines the server-less architecture of BQ with native support for Geo-Spatial analysis
- ✓ BigQuery transparently & automatically provides highly durable, replicated storage in multiple locations and high availability with no extra charge and no additional setup

Google Storage Options - Workload Suitability

Relational	Non-Relational			Object	Block	Warehouse
 Cloud SQL	 Cloud Spanner	 Cloud Datastore	 Cloud Bigtable	 Cloud Storage	 Persistent Disk	 BigQuery
Good for: Web frameworks **Such as:** CMS, eCommerce	**Good for:** RDBMS+scale, HA, HTAP **Such as:** User metadata, Ad/Fin/MarTech	**Good for:** Hierarchical, mobile, web **Such as:** User profiles, Game State	**Good for:** Heavy read + write, events, **Such as:** AdTech, Financial, IoT	**Good for:** Binary or object data **Such as:** Images, Media serving, backups	**Good for:** Local VM storage in file systems **Such as:** App binaries, logs, database files, etc.	**Good for:** Enterprise Data Warehouse **Such as:** Analytics, Dashboards

File-based			
 Cloud Filestore	**Good for:** File Share, Large File Sizes, App Migration	**Such as:** Rendering, Media Processing, Shared Contents	

Source: Google

Google Storage Options - Comparison

Products	Interface	R/W Latency	3rd Party Integration	Typical Size	Data/ Query Model	Transactions	Good for OLTP	Good for OLAP
Cloud Spanner	SQL, (Relational)	Great (ms)	Great	PB	SQL (ANSI 2011)	Yes	Yes	Yes
Cloud SQL	SQL, (Relational)	Great (ms)	Great	< 30TB*	SQL	Yes	Yes	No
BigTable	NoSQL, (wide-column)	Great (ms)	Great	2TB-10PB	Simple	No	Yes	Yes
Datastore	NoSQL, (document)	Good (10s of ms)	Good	< 200TB	Rich	Some (Supports ACID)	Yes	No
Cloud Storage	BLOB, (object store)	Slow (100s of ms)	Great	Any	Very Simple	No	No	Yes
BigQuery	SQL / REST (columnar)	Slow (s)	Good	Any	Rich	No	No	Yes

*Quota & Limits

References

Google Cloud SQL	- https://cloud.google.com/sql - https://cloud.google.com/sql/docs/concepts - https://cloud.google.com/sql/docs/mysql/roles-and-permissions - https://cloud.google.com/sql/docs/postgres/roles-and-permissions
Google Cloud Spanner	- https://cloud.google.com/spanner/docs/resources - https://cloud.google.com/spanner/docs/instances - https://cloud.google.com/spanner/docs/iam
Google Cloud Storage	- https://cloud.google.com/storage/docs/concepts - https://cloud.google.com/storage/docs/access-control/iam
Google Cloud DataStore	- https://cloud.google.com/datastore/docs/concepts
Google Cloud Bigtable	- https://cloud.google.com/bigtable/docs/concepts
Google BiqQuery	- https://cloud.google.com/bigquery/docs - https://cloud.google.com/persistent-disk

Thank You

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SLA's for different Storage Classes

Storage Class	Name for APIs and gsutil	Minimum storage duration	Typical monthly availability[1]
Standard Storage	STANDARD	None	• >99.99% in multi-regions and dual-regions • 99.99% in regions
Nearline Storage	NEARLINE	30 days	• 99.95% in multi-regions and dual-regions • 99.9% in regions
Coldline Storage	COLDLINE	90 days	• 99.95% in multi-regions and dual-regions • 99.9% in regions
Archive Storage	ARCHIVE	365 days	• 99.95% in multi-regions and dual-regions • 99.9% in regions

Durability: 99.999999999 (Eleven 9's)

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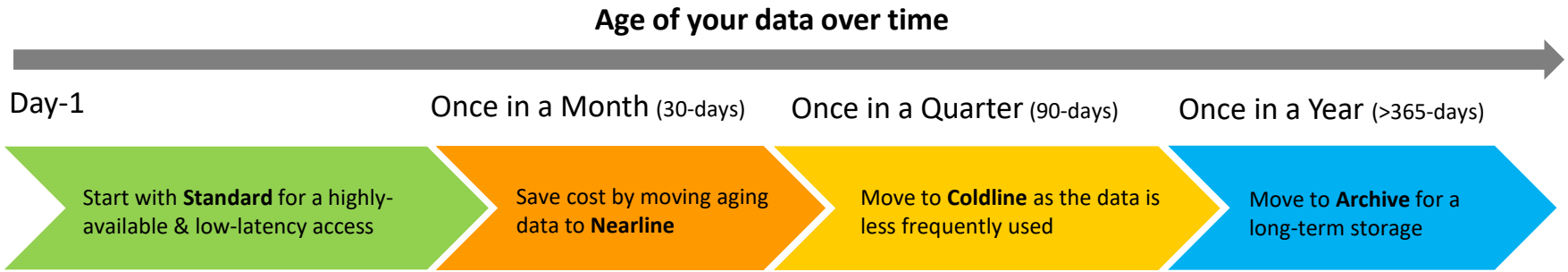
Cloud Storage - Policy based Data Migration

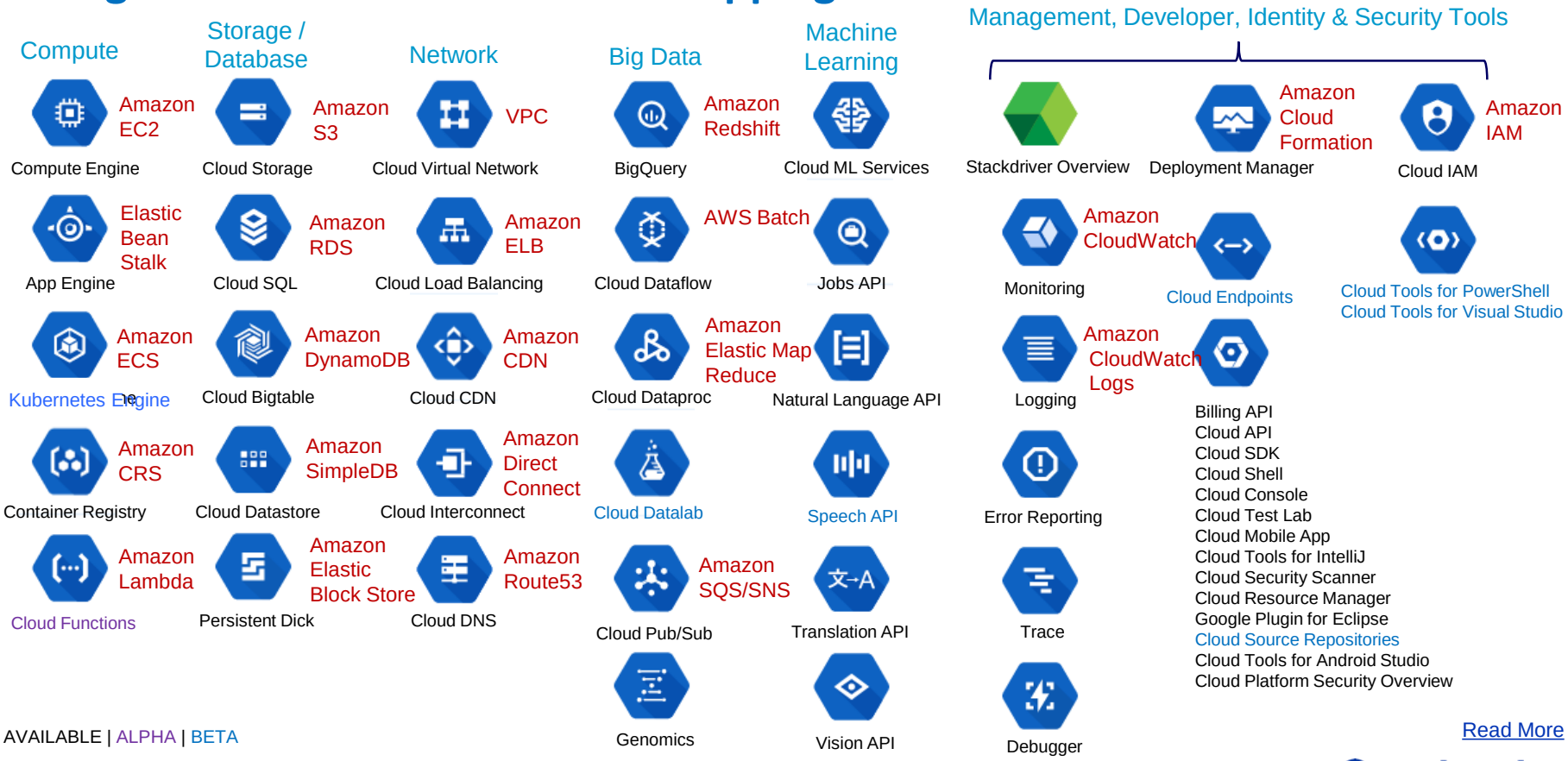
Configure Google Cloud Storage Lifecycle Management rules/policies to automate the movement of data to different storage classes



A highly available, affordable solution for backup, archiving and disaster recovery.

Source: Google

Google Cloud Platform Services mapping with Amazon Web Services



AVAILABLE | ALPHA | BETA

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Google Cloud Platform Services mapping with Microsoft Azure Services

Compute

Azure Virtual Machine

Compute Engine

Azure Cloud Services & App Service

App Engine

Azure Kubernetes Service, Azure Service Fabric

Kubernetes Engine

Container Registry

Azure functions

Cloud Functions

Storage / Database

Azure Block Blobs

Cloud Storage

Azure SQL Database

Cloud SQL

Azure Cosmos DB

Cloud Bigtable

Azure DocumentDB

Cloud Datastore

Disk Storage

Persistent Dick

Network

Cloud Virtual Network

Azure Load Balancer

Cloud Load Balancing

Cloud CDN

Azure Express Route

Cloud Interconnect

Azure DNS

Cloud DNS

Big Data

BigQuery

Azure HD Insight

Cloud Dataflow

Azure HD Insight

Cloud Dataproc

Cloud Datalab

Azure Event Hubs & Azure Service Bus

Cloud Pub/Sub

Genomics

Machine Learning

Azure SQL DW & Azure Data Lake Analytics

Cloud ML Services

Jobs API

Natural Language API

Speech API

Translation API

Vision API

Management, Developer, Identity & Security Tools

Stackdriver Overview

Azure Resource Manager

Deployment Manager

Cloud IAM

Monitoring

Azure Application & Operational Insights

Cloud Endpoints

Cloud Tools for PowerShell
Cloud Tools for Visual Studio

Logging

Billing API
Cloud API
Cloud SDK
Cloud Shell
Cloud Console
Cloud Test Lab
Cloud Mobile App
Cloud Tools for IntelliJ
Cloud Security Scanner
Cloud Resource Manager
Google Plugin for Eclipse
Cloud Source Repositories
Cloud Tools for Android Studio
Cloud Platform Security Overview

Error Reporting

Trace

Debugger

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