04
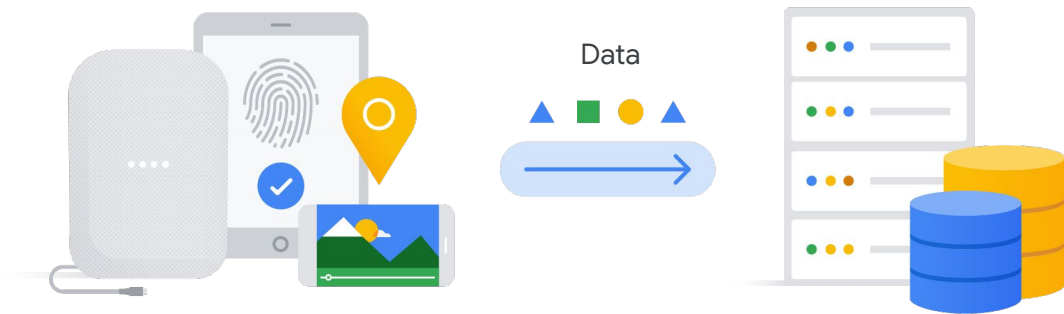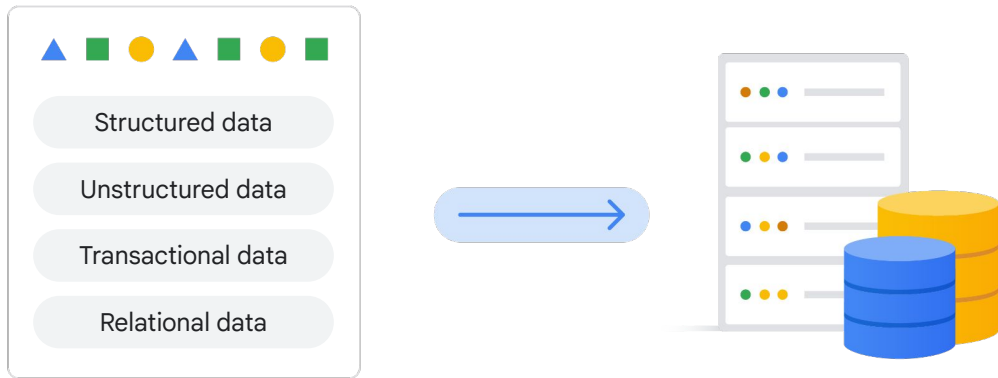
Storage in the Cloud

Applications need to store data

Every application needs to store data - for example, media to be streamed or perhaps even sensor data from devices - and different applications and workloads require different storage database solutions.

Google has many options for storing data

- Structured data
- Unstructured data
- Transactional data
- Relational data

Google Cloud

Google Cloud has storage options for structured, unstructured, transactional, and relational data.

Storage in the Cloud

01	Cloud Storage
02	Cloud SQL
03	Cloud Spanner
04	Firestore
05	Cloud Bigtable
06	Comparing storage options

Google Cloud

In this module, we'll explore Google Cloud's five core storage products: Cloud Storage, Cloud Bigtable, Cloud SQL, Cloud Spanner, and Firestore. Depending on your application, you might use one or several of these services to do the job.
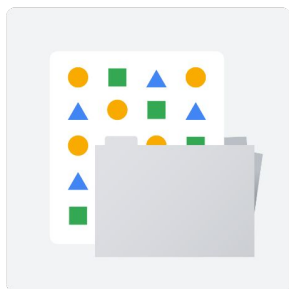
Storage in the Cloud

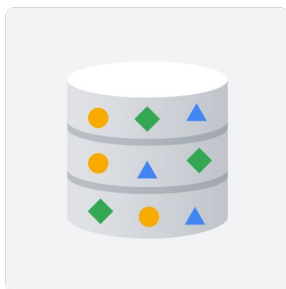|	
01	Cloud Storage
02	Cloud SQL
03	Cloud Spanner
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05	Cloud Bigtable
06	Comparing storage options

Google Cloud

Let's begin with Cloud Storage, which is a service that offers developers and IT organizations durable and highly available **object storage**.
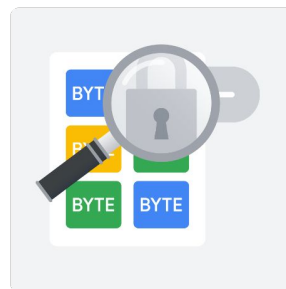
Types of file storage

File storage

Block storage

Object storage

But what is object storage? Object storage is a computer data storage architecture that manages data as "objects" and not as a file and folder hierarchy (file storage), or as chunks of a disk (block storage). These objects are stored in a packaged format which contains the binary form of the actual data itself, as well as relevant associated meta-data (such as date created, author, resource type, permissions, etc), and a globally unique identifier. These unique keys are in the form of URLs, which means object storage interacts well with web technologies. Data commonly stored as objects include video, pictures, and audio recordings.

Cloud Storage is Google's object storage product. It allows customers to store any amount of data, and to retrieve it as often as needed. In this lesson, we'll learn more about Cloud Storage use cases, features, and pricing.

Cloud Storage is a fully managed scalable service

| Website content | Archival & disaster recovery | Direct Download |

Google Cloud

Cloud Storage is a fully managed scalable service that has a wide variety of uses. A few examples include serving website content, storing data for archival and disaster recovery, and distributing large data objects to end users via Direct Download.

Cloud Storage's common object storage use cases

Binary large-object (BLOB) storage

✅ Online content

✅ Backup and archiving

✅ Storage of intermediate results

Google Cloud
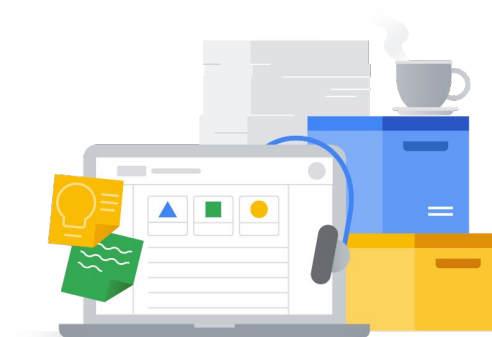
Cloud Storage's primary use is whenever binary large-object storage (also known as a "BLOB") is needed for online content such as videos and photos, for backup and archived data, and for storage of intermediate results in processing workflows.

Cloud Storage files are organized into buckets

Unique name

Geographic location

Google Cloud
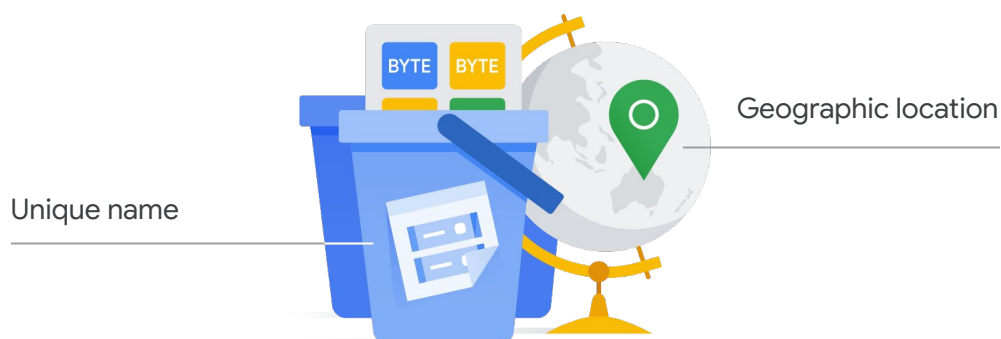
Cloud Storage files are organized into buckets. A bucket needs a globally-unique name and a specific geographic location for where it should be stored, and an ideal location for a bucket is where latency is minimized. For example, if most of your users are in Europe, you probably want to pick a European location so either a specific Google Cloud region in Europe, or else the EU multi-region.

Cloud Storage objects are immutable

Version 01   Version 02

Cannot directly edit   Create new version

Google Cloud
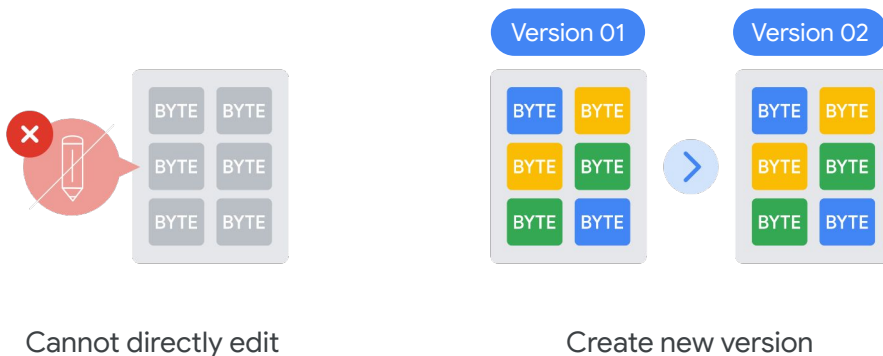
The storage objects offered by Cloud Storage are "immutable," which means that you do not edit them, but instead a new version is created with every change made.

Object versioning keeps a record of modifications

Object versioning

History	V1	V2	V3
Object 01	✓		
Object 02	✓	✓	✓
Object 03	✓	✓	

Google Cloud
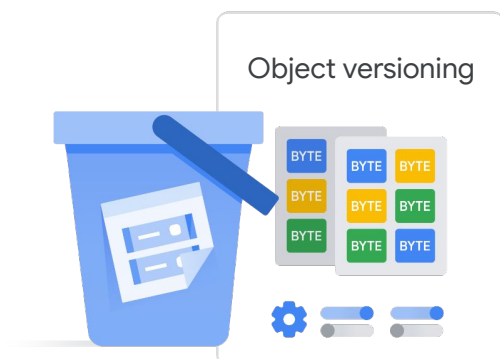
Administrators have the option to either allow each new version to completely overwrite the older one, or to keep track of each change made to a particular object by enabling "versioning" within a bucket. If you choose to use versioning, Cloud Storage will keep a detailed history of modifications -- that is, overwrites or deletes -- of all objects contained in that bucket.

Object versioning allows reversion to an older state

History	V1	V2	V3
Object 01	✓		
Object 02	✓	✓	✓
Object 03	✗	✓	

Google Cloud
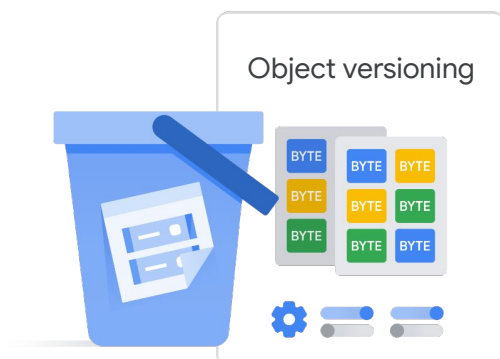
If you don't turn on object versioning, by default new versions will always overwrite older versions.

With object versioning enabled, you can list the archived versions of an object, restore an object to an older state, or permanently delete a version of an object, as needed.

Cloud Storage also offers lifecycle management policies for your objects. For example, you could tell Cloud Storage to delete objects older than 365 days, or to delete objects created before January 1, 2013, or to keep only the 3 most recent versions of each object in a bucket that has versioning enabled. We'll look more closely at object lifecycle management in just a few minutes.

Control access to data objects with IAM roles and ACLs

|		
01 For most purposes, IAM is sufficient	———	Inherited from project to bucket to object
02 If you need finer control, you can create access control lists (ACLs)	———	Scope **+** Permission

In many cases, personally identifiable information may be contained in data objects, so controlling access to stored data is essential to ensuring security and privacy are maintained. Using IAM roles and, where needed, access control lists (ACLs), companies can conform to security best practices, which require each user have access and permissions to **only what they need to do their jobs**, but no more than that.

There are a couple of options to control user access to objects and buckets.

1. For most purposes, IAM is sufficient. Roles are inherited from project to bucket to object.
2. If you need finer control, you can create access control lists. Each access control list consists of two pieces of information. The first is a scope, which defines who can access and perform an action. This can be a specific user or group of users. The second is a permission, which defines what actions can be performed, like read or write.

Cloud Storage can also be used like a file system

Third-party tools can "mount" the
bucket and allow it to be used as
if it were a Linux or MacOS directory.

Google Cloud
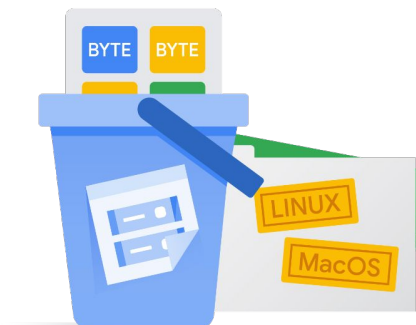
Although Cloud Storage is not a file system, it can be accessed as one via third-party
tools that can "mount" the bucket and allow it to be used as if it were a typical Linux
or MacOS directory.
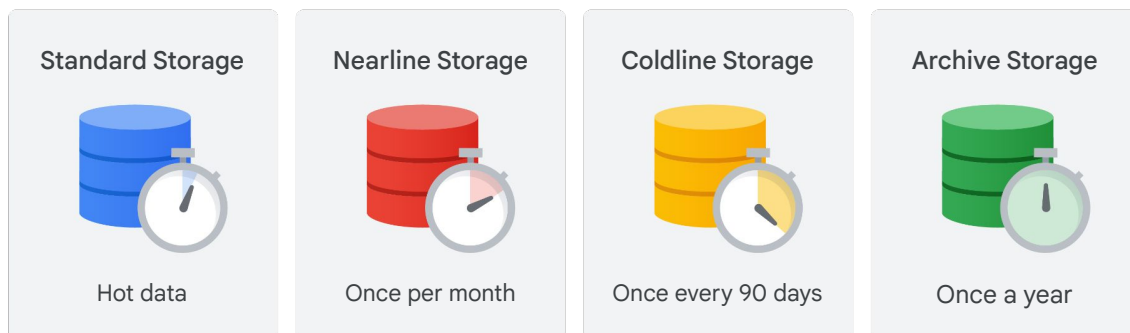
Lifecycle management policies save money

Lifecycle policies
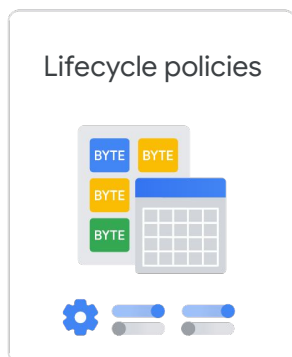
Examples

✓ Delete objects older than 365 days

✓ Delete objects created before MM/DD/YY

✓ Keep only the 3 most recent versions

Google Cloud

Because storing and retrieving large amounts of object data can quickly become expensive, Cloud Storage also offers lifecycle management policies. For example, you could tell Cloud Storage to delete objects older than 365 days, or to delete objects created before January 1, 2013; or to keep only the 3 most recent versions of each object in a bucket that has versioning enabled. Having this control ensures that you are not paying for more than you actually need.
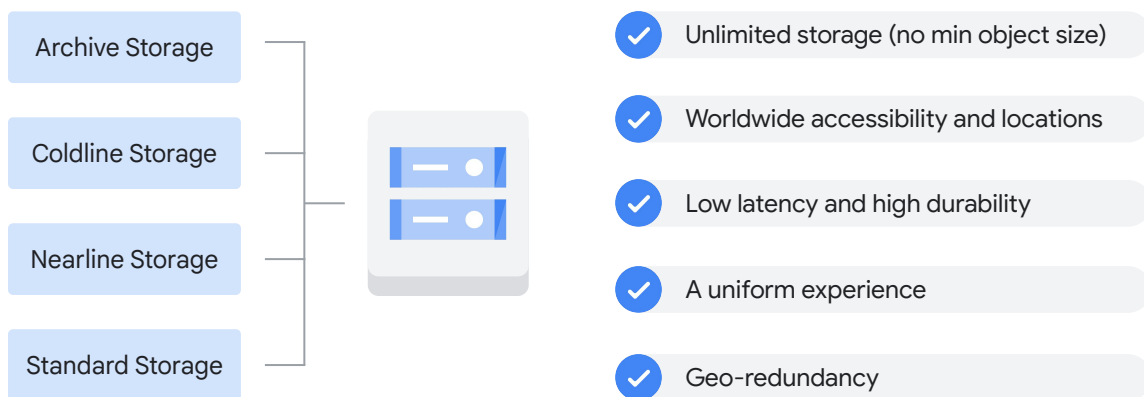
There are four basic Cloud Storage classes

Standard Storage	Nearline Storage	Coldline Storage	Archive Storage
Hot data	Once per month	Once every 90 days	Once a year

There are four primary storage classes in Cloud Storage and stored data is managed and billed according to which "class" it belongs.

1. The first is **Standard Storage**. Standard Storage is considered best for frequently accessed, or "hot," data. It's also great for data that is stored for only brief periods of time.

2. The second storage class is **Nearline Storage.** This is best for storing infrequently accessed data, like reading or modifying data once per month or less, on average. Examples might include data backups, long-tail multimedia content, or data archiving.

3. The third storage class is **Coldline Storage**. This is also a low-cost option for storing infrequently accessed data. However, as compared to Nearline Storage, Coldline Storage is meant for reading or modifying data, at most, once every 90 days.

4. The fourth storage class is **Archive Storage**. This is the lowest-cost option, used ideally for data archiving, online backup, and disaster recovery. It's the best choice for data that you plan to access less than once a year, because it has higher costs for data access and operations and a 365-day minimum storage duration.

Each storage class has some common features

Archive Storage	✓ Unlimited storage (no min object size)
Coldline Storage	✓ Worldwide accessibility and locations
Nearline Storage	✓ Low latency and high durability
Standard Storage	✓ A uniform experience
	✓ Geo-redundancy

Although each of these four classes has differences, it's worth noting that several characteristics apply across all these storage classes.

These include:
- Unlimited storage with no minimum object size requirement,
- Worldwide accessibility and locations,
- Low latency and high durability,
- A uniform experience, which extends to security, tools, and APIs, and
- Geo-redundancy if data is stored in a multi-region or dual-region. So this means placing physical servers in geographically diverse data centers to protect against catastrophic events and natural disasters, and load-balancing traffic for optimal performance.

Autoclass automatically transitions objects to appropriate storage classes

Autoclass

✓ Moves data that is not accessed to colder storage classes to reduce storage cost

✓ Moves data that is accessed to Standard storage to optimize future accesses
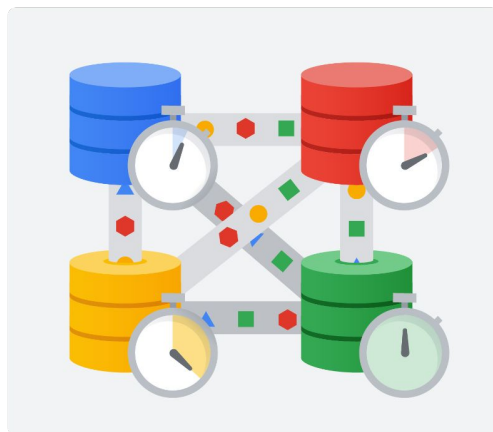
Google Cloud

Cloud Storage also provides a feature called **Autoclass**, which automatically transitions objects to appropriate storage classes based on each object's access pattern.

The feature moves data that is not accessed to colder storage classes to reduce storage cost and moves data that is accessed to Standard storage to optimize future accesses.

Autoclass simplifies and automates cost saving for your Cloud Storage data.

Additional Cloud Storage features include encryption

✓ Pay only for what you use

✓ No prior provisioning of capacity

✓ Encrypts data on the server side

✓ Use HTTPS/TLS (Transport Layer Security)

Google Cloud
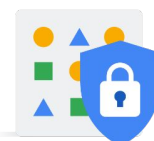
Cloud Storage has no minimum fee because you pay only for what you use, and prior provisioning of capacity isn't necessary.

And from a security perspective, Cloud Storage always encrypts data on the server side, before it's written to disk, at no additional charge. Data traveling between a customer's device and Google is encrypted by default using HTTPS/TLS (Transport Layer Security).
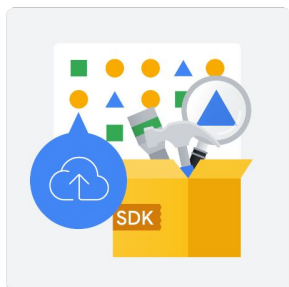
Bringing data into Cloud Storage
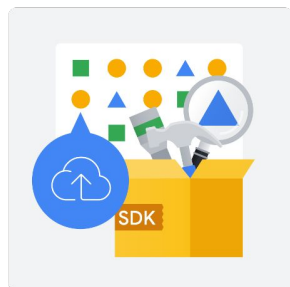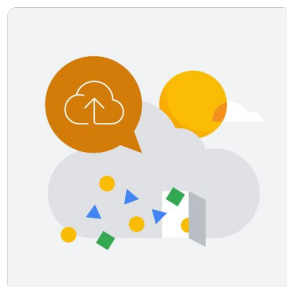

Online transfer

Regardless of which storage class you choose, there are several ways to bring your data into Cloud Storage.

Many customers simply carry out their own **online transfer** using gcloud storage, which is the Cloud Storage command from the Cloud SDK. Data can also be moved in by using a drag and drop option in the Google Cloud console, if accessed through the Google Chrome web browser.

Bringing data into Cloud Storage

Online transfer
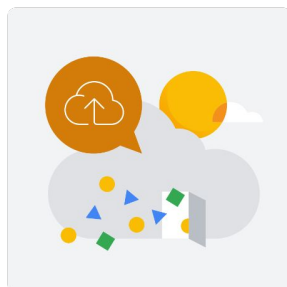

Storage Transfer Service

Google Cloud

But what if you have to upload terabytes or even petabytes of data? **Storage Transfer Service** enables you to import large amounts of online data into Cloud Storage quickly and cost-effectively. The Storage Transfer Service lets you schedule and manage batch transfers to Cloud Storage from another cloud provider, from a different Cloud Storage region, or from an HTTP(S) endpoint.
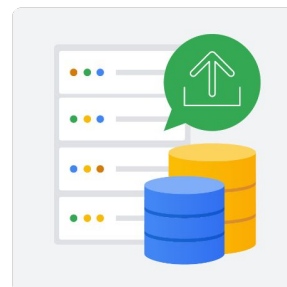
Bringing data into Cloud Storage
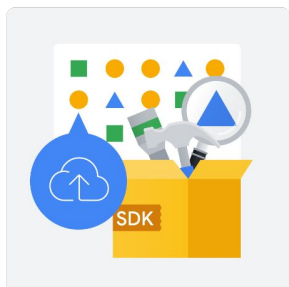
Online transfer   Storage Transfer Service   Transfer Appliance

Google Cloud

And then there is the **Transfer Appliance**, which is a rackable, high-capacity storage server that you lease from Google Cloud. You connect it to your network, load it with data, and then ship it to an upload facility where the data is uploaded to Cloud Storage. You can transfer up to a petabyte of data on a single appliance.

Integration with other Google Cloud products
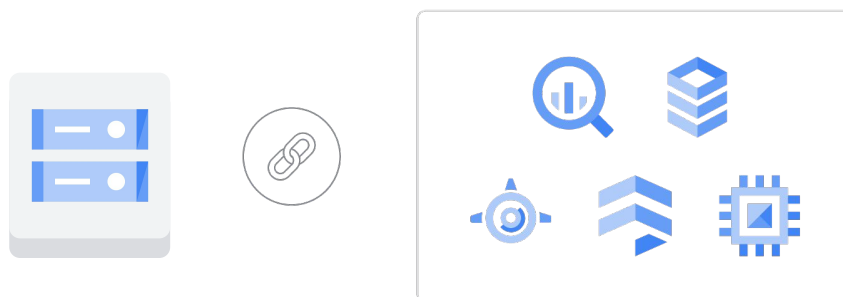
Cloud Storage's tight integration with other Google Cloud products and services means that there are many additional ways to move data into the service. For example, you can import and export tables to and from both BigQuery and Cloud SQL. You can also store App Engine logs, Firestore backups, and objects used by App Engine applications like images. Cloud Storage can also store instance startup scripts, Compute Engine images, and objects used by Compute Engine applications.

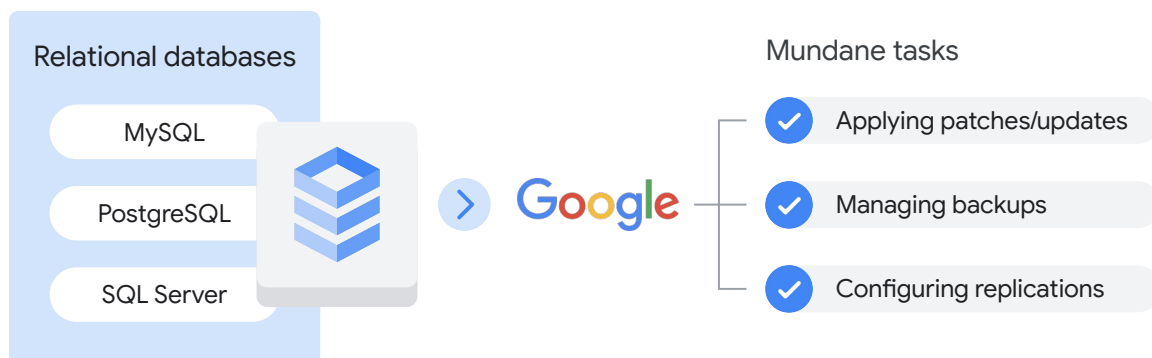# Storage in the Cloud

01	Cloud Storage
02	Cloud SQL
03	Cloud Spanner
04	Firestore
05	Cloud Bigtable
06	Comparing storage options

The second core storage option is Cloud SQL.

Cloud SQL lets you focus on building great applications

Relational databases

MySQL

PostgreSQL

SQL Server

> Google

Mundane tasks

✓ Applying patches/updates

✓ Managing backups

✓ Configuring replications

Google Cloud

Cloud SQL offers fully managed relational databases, including MySQL, PostgreSQL, and SQL Server as a service. It's designed to hand off mundane, but necessary and often time-consuming, tasks to Google—like applying patches and updates, managing backups, and configuring replications—so your focus can be on building great applications.

There are many reasons to use Cloud SQL

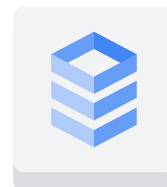Doesn't require any software installation or maintenance

Currently can scale up to 128 processor cores, 864 GB of RAM, and 64 TB of storage

Supports automatic replication scenarios

Supports managed backups – The cost of an instance covers 7 backups

Encrypts customer data when on Google's internal networks and when stored in database tables, temporary files, and backups

Includes a network firewall

Google Cloud

Cloud SQL:

- Doesn't require any software installation or maintenance.
- Currently can scale up to 128 processor cores, 864 GB of RAM, and 64 TB of storage.
- Supports *automatic replication* scenarios, such as from a Cloud SQL primary instance, an external primary instance, and external MySQL instances.
- Supports *managed backups*, so backed-up data is securely stored and accessible if a restore is required. The cost of an instance covers seven backups.
- Encrypts customer data when on Google's internal networks and when stored in database tables, temporary files, and backups.
- Includes a network firewall, which controls network access to each database instance.

Cloud SQL instances are accessible by other Google Cloud and external services.

A benefit of Cloud SQL instances is that they are accessible by other Google Cloud services, and even external services. Cloud SQL can be used with App Engine using standard drivers like Connector/J for Java or MySQLdb for Python.

Compute Engine accesses Cloud SQL instances and tools

			Workbench	Other external applications that use standard MySQL drivers
			Toad	
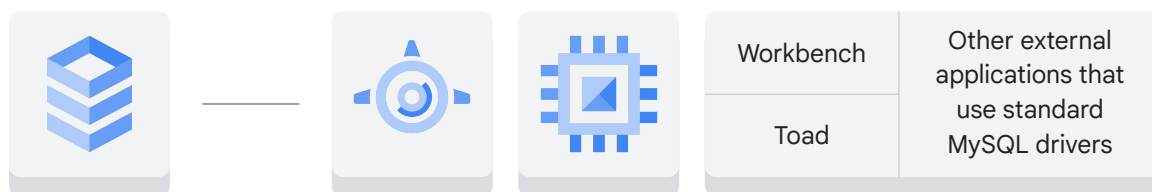
Compute Engine instances can be authorized to access Cloud SQL instances and configure the Cloud SQL instance to be in the same zone as your virtual machine.

Cloud SQL also supports other applications and tools that you might use, like SQL Workbench, Toad, and other external applications using standard MySQL drivers.
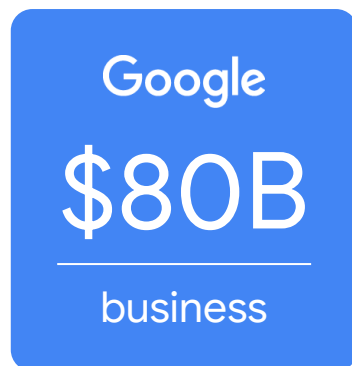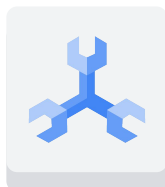
Storage in the Cloud

01	Cloud Storage
02	Cloud SQL
03	Cloud Spanner
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Google Cloud

The third core storage option is Cloud Spanner.

Cloud Spanner is a fully managed relational database

✓ Scales horizontally

✓ Strongly consistent

✓ Speaks SQL

Google

$80B

business

Google Cloud

Cloud Spanner is a fully managed relational database service that scales horizontally, is strongly consistent, and speaks SQL. Battle tested by Google's own mission-critical applications and services, Spanner is the service that powers Google's $80 billion business.

Applications that Cloud Spanner is especially suited for

Applications that require:

SQL relational database management system with joins and secondary indexes

Built-in high availability

Strong global consistency

And high numbers of input/output operations per second. We're talking tens of thousands of reads/writes per second or more

Cloud Spanner is especially suited for applications that require:
- An SQL relational database management system with joins and secondary indexes.
- Built-in high availability.
- Strong global consistency.
- And high numbers of input/output operations per second. We're talking tens of thousands of reads/writes per second or more.

Storage in the Cloud

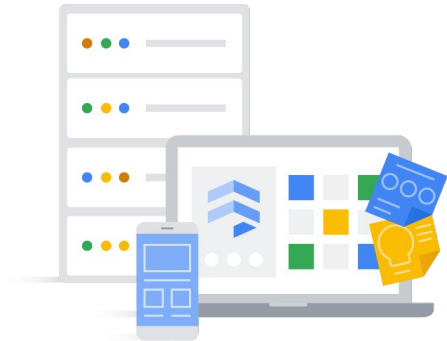| 01	Cloud Storage
02	Cloud SQL
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The fourth core storage option is Firestore.
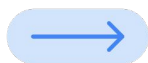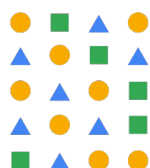
Firestore is ideal for mobile and web development

- ✓ Flexible
- ✓ Scales horizontally
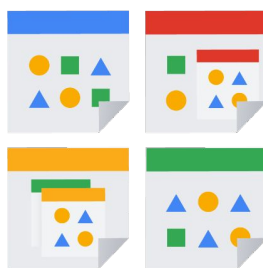- ✓ NoSQL cloud database

Google Cloud

Firestore is a flexible, horizontally scalable, NoSQL cloud database for mobile, web, and server development.

Firestore stores data as "documents"

Incoming data   Documents   Collection
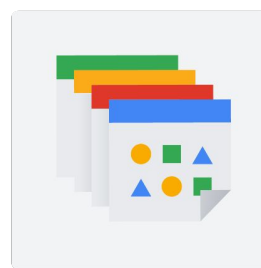
With Firestore, incoming data is stored in a document structure and these documents are then organized into collections. Documents can contain complex nested objects in addition to subcollections.

Each document contains a set of key-value pairs. For example, a document to represent a user has the keys for the firstname and lastname with the associated values.

More information about Firestore data model can be found at
https://cloud.google.com/firestore/docs/data-model

Firestore NoSQL queries connect apps with data

- ✓ Retrieve individual documents

- ✓ Retrieve all the documents in a collection

- ✓ Can include multiple, chained filters

- ✓ Can combine filtering and sorting options

- ✓ Indexed by default

Google Cloud
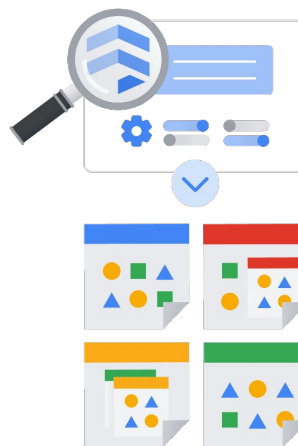
Firestore's NoSQL queries can then be used to retrieve individual, specific documents or to retrieve all the documents in a collection that match your query parameters. Queries can include multiple, chained filters and combine filtering and sorting options. They're also indexed by default, so query performance is proportional to the size of the result set, not the dataset.

Firestore uses online and offline data synchronization

On/Offline

Write
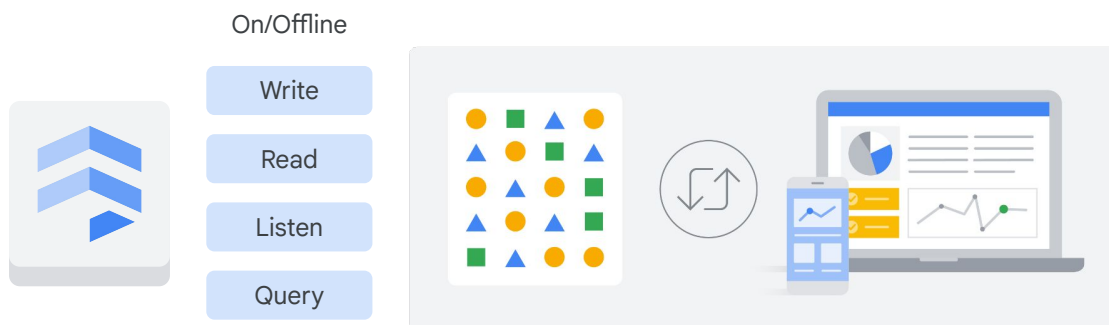
Read

Listen

Query

Firestore uses data synchronization to update data on any connected device. However, it's also designed to make simple, one-time fetch queries efficiently. It caches data that an app is actively using, so the app can write, read, listen to, and query data even if the device is offline. When the device comes back online, Firestore synchronizes any local changes back to Firestore.

Firestore leverages Google Cloud's infrastructure

Google Cloud

- ✓ Automatic multi-region data replication
- ✓ Strong consistency guarantees
- ✓ Atomic batch operations
- ✓ Real transaction support

Google Cloud
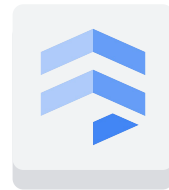
Firestore leverages Google Cloud's powerful infrastructure: automatic multi-region data replication, strong consistency guarantees, atomic batch operations, and real transaction support.

Storage in the Cloud

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Google Cloud

And the final core storage option we're going to explore is Cloud Bigtable.

Cloud Bigtable

Cloud Bigtable
Google's NoSQL big data database service

- ✓ Handle massive workloads
- ✓ Consistent low latency
- ✓ High throughput
- ⌄ Great choice for:
- ✓ Operational applications
- ✓ Analytical applications

Google Cloud

Cloud Bigtable is Google's NoSQL big data database service. It's the same database that powers many core Google services, including Search, Analytics, Maps, and Gmail.

Bigtable is designed to handle massive workloads at consistent low latency and high throughput, so it's a great choice for both operational and analytical applications, including Internet of Things, user analytics, and financial data analysis.

Why customers often choose Cloud Bigtable

Work with more than 1TB of semi-structured or structured data

Data is fast with high throughput, or it's rapidly changing

Work with NoSQL data

Data is a time-series or has natural semantic ordering

Work with big data, running asynchronous batch or synchronous real-time processing on the data

Run machine learning algorithms on the data

Google Cloud

When deciding which storage option is best, customers often choose Bigtable if:

- They're working with more than 1TB of semi-structured or structured data.
- Data is fast with high throughput, or it's rapidly changing.
- They're working with NoSQL data. This usually means transactions where strong relational semantics are not required.
- Data is a time-series or has natural semantic ordering.
- They're working with big data, running asynchronous batch or synchronous real-time processing on the data.
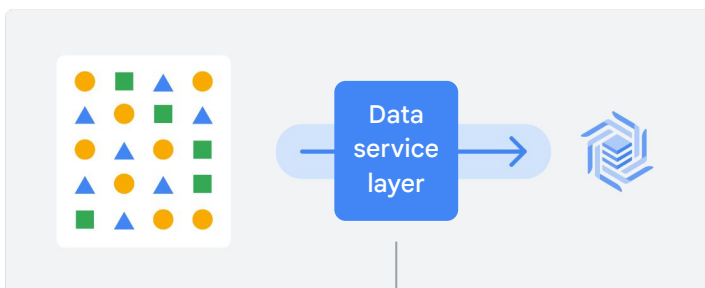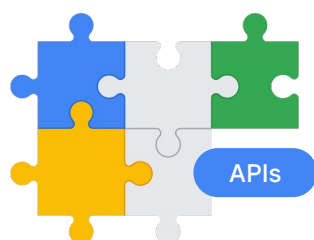- Or they're running machine learning algorithms on the data.

Using APIs to read and write data

Examples:

| Managed VMs | HBase REST Server | Java Server |

Cloud Bigtable can interact with other Google Cloud services and third-party clients.

Using **APIs**, data can be read from and written to Cloud Bigtable through a data service layer like Managed VMs, the HBase REST Server, or a Java Server using the HBase client. Typically this is used to serve data to applications, dashboards, and data services.

Streaming data into Cloud Bigtable

Examples:

Dataflow   Spark Streaming   Storm
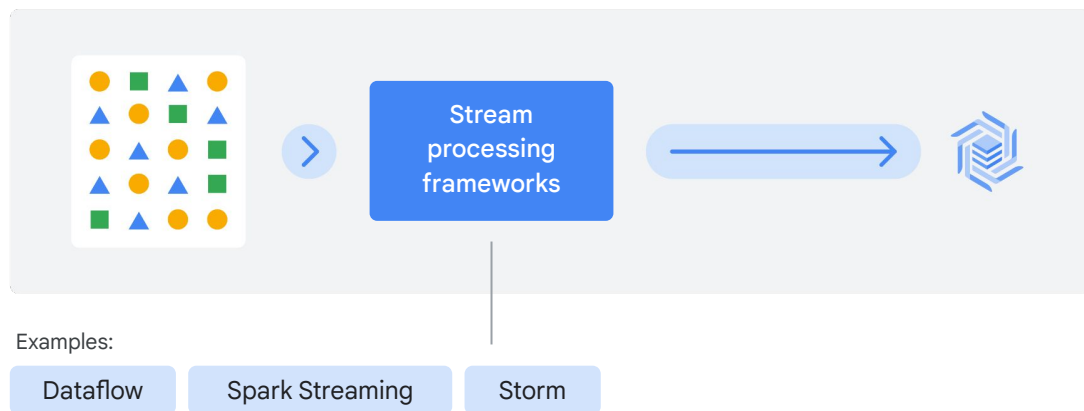
Data can also be **streamed** in through a variety of popular stream processing frameworks like Dataflow Streaming, Spark Streaming, and Storm.

Using batch processes to read and write data

Examples:

| Hadoop MapReduce | Dataflow | Spark |
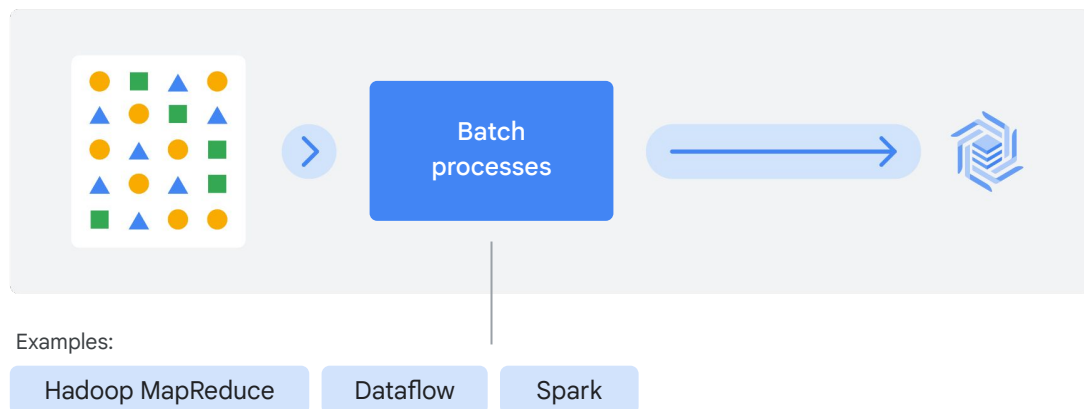
And if streaming is not an option, data can also be read from and written to Cloud Bigtable through batch processes like Hadoop MapReduce, Dataflow, or Spark. Often, summarized or newly calculated data is written back to Cloud Bigtable or to a downstream database.

BigQuery and Bigtable are different products with different uses
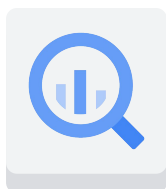
BigQuery

On the edge between data storage and data processing
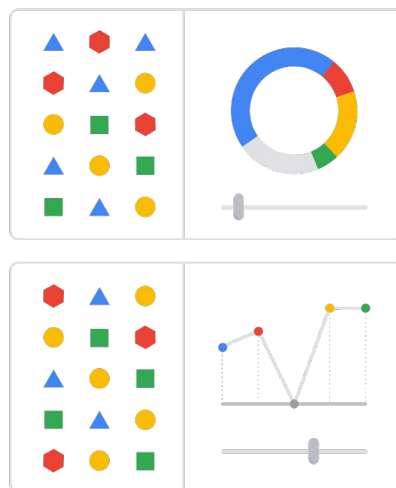
BigQuery is not mentioned in this module, because it sits on the edge between data storage and data processing, and is covered in more depth in other courses. The usual reason to store data in BigQuery is so you can use its big data analysis and interactive querying capabilities. It is not purely a data storage product.

Storage in the Cloud

01	Cloud Storage
02	Cloud SQL
03	Cloud Spanner
04	Firestore
05	Cloud Bigtable
06	Comparing storage options

Google Cloud

Comparing storage options

| Cloud Storage | Cloud Bigtable | Cloud SQL | Cloud Spanner | Firestore |

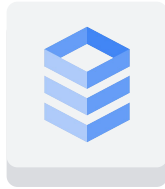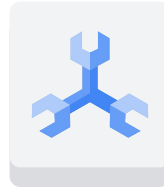Now that we've covered Google Cloud's core storage options, let's do a comparison to help highlight the most suitable service for a specific application or workflow.

Option	Best for	Capacity
Cloud Storage	Storing immutable blobs larger than 10 MB	Petabytes Max unit size: 5 TB per object
Cloud SQL	• Full SQL support for an online transaction processing system • Web frameworks and existing applications	Up to 64 TB
Spanner	• Full SQL support for an online transaction processing system • Horizontal scalability	Petabytes
Firestore	Massive scaling and predictability together with real time query results and offline query support	Terabytes. Max unit size: 1 MB per entity
Cloud Bigtable	• Storing large amount of structured objects • Does not support SQL queries and multi-row transactions • Analytical data with heavy read and write events	Petabytes. Max unit size: 10 MB p/cell, 100 MB p/row

Google Cloud

Consider using Cloud Storage if you need to store immutable blobs larger than 10 MB, such as large images or movies. This storage service provides petabytes of capacity with a maximum unit size of 5 TB per object.

Option	Best for	Capacity
Cloud Storage	Storing immutable blobs larger than 10 MB	Petabytes Max unit size: 5 TB per object
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Cloud Bigtable	• Storing large amount of structured objects • Does not support SQL queries and multi-row transactions • Analytical data with heavy read and write events	Petabytes. Max unit size: 10 MB p/cell, 100 MB p/row

Google Cloud

Consider using Cloud SQL or Cloud Spanner if you need full SQL support for an online transaction processing system. Cloud SQL provides up to 64 TB, depending on machine type, and Cloud Spanner provides petabytes. Cloud SQL is best for web frameworks and existing applications, like storing user credentials and customer orders.

Option	Best for	Capacity
Cloud Storage	Storing immutable blobs larger than 10 MB	Petabytes Max unit size: 5 TB per object
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Google Cloud

If Cloud SQL does not fit your requirements because you need horizontal scalability, not just through read replicas, consider using Cloud Spanner.

Option	Best for	Capacity
Cloud Storage	Storing immutable blobs larger than 10 MB	Petabytes Max unit size: 5 TB per object
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Cloud Bigtable	• Storing large amount of structured objects • Does not support SQL queries and multi-row transactions • Analytical data with heavy read and write events	Petabytes. Max unit size: 10 MB p/cell, 100 MB p/row

Consider Firestore if you need massive scaling and predictability together with real time query results and offline query support. This storage service provides terabytes of capacity with a maximum unit size of 1 MB per entity. Firestore is best for storing, syncing, and querying data for mobile and web apps.

Option	Best for	Capacity
Cloud Storage	Storing immutable blobs larger than 10 MB	Petabytes Max unit size: 5 TB per object
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Cloud Bigtable	• Storing large amount of structured objects • Does not support SQL queries and multi-row transactions • Analytical data with heavy read and write events	Petabytes. Max unit size: 10 MB p/cell, 100 MB p/row

Consider using Cloud Bigtable if you need to store a large number of structured objects. Cloud Bigtable does not support SQL queries, nor does it support multi-row transactions. This storage service provides petabytes of capacity with a maximum unit size of 10 MB per cell and 100 MB per row. Bigtable is best for analytical data with heavy read and write events, like AdTech, financial, or IoT data.

Option	Best for	Capacity
Cloud Storage	Storing immutable blobs larger than 10 MB	Petabytes Max unit size: 5 TB per object
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Google Cloud

Depending on your application, it's possible that you might use one, or several, of these services to do the job.

Module Quiz
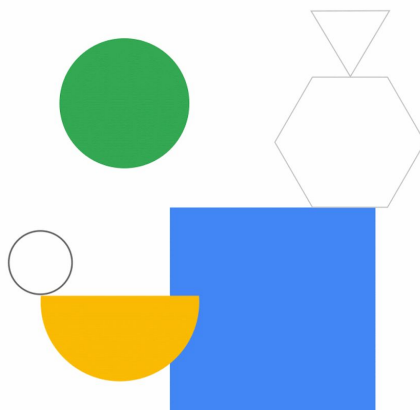
Quiz | Question 1

Question

What is the correct use case for Cloud Storage?

A. Cloud Storage is well suited to providing the root file system of a Linux virtual machine.

B. Cloud Storage is well suited to providing durable and highly available object storage.

C. Cloud Storage is well suited to providing data warehousing services.

D. Cloud Storage is well suited to providing RDBMS services.

Google Cloud

Quiz | Question 1

Answer

What is the correct use case for Cloud Storage?

A. Cloud Storage is well suited to providing the root file system of a Linux virtual machine.

B. Cloud Storage is well suited to providing durable and highly available object storage. ✅

C. Cloud Storage is well suited to providing data warehousing services.

D. Cloud Storage is well suited to providing RDBMS services.

What is the correct use case for Cloud Storage?

A:Cloud Storage is well suited to providing the root file system of a Linux virtual machine.
Feedback: Sorry, the statement is false. Cloud Storage is object storage rather than file storage. Compute Engine virtual machines use Persistent Disk storage to contain their file systems.

B: Cloud Storage is well suited to providing durable and highly available object storage
Feedback: That's correct! Cloud Storage is object storage rather than file storage.

C: Cloud Storage is well suited to providing data warehousing services
Feedback: Sorry, the statement is false. Cloud Storage is object storage rather than data warehousing. Big Query is Google Clouds data warehousing service.

D:Cloud Storage is well suited to providing RDBMS services.
Feedback: Sorry, the statement is false. Cloud Storage is object storage rather than Database storage. Cloud SQL or Cloud Spanner are Google Cloud's RDBMS offerings.

Quiz | Question 2

Question

Which SQL database service can be scaled to petabyte database sizes?

A. Cloud Spanner

B. Cloud SQL

C. Cloud Bigtable

D. Firestore

Quiz | Question 2

Answer

Which SQL database service can be scaled to petabyte database sizes?

A. Cloud Spanner ✅

B. Cloud SQL

C. Cloud Bigtable

D. Firestore

Which database service can scale to higher database sizes?

A: Cloud Spanner.
Feedback: Correct! Cloud Spanner can scale to petabyte database sizes, while Cloud SQL is limited by the size of the database instances you choose. At the time this quiz was created, the maximum was 10,230 GB.

B: Cloud SQL.
Feedback: Sorry, that's not correct. Cloud Spanner can scale to petabyte database sizes, while Cloud SQL is limited by the size of the database instances you choose. At the time this quiz was created, the maximum was 30720 GB.

C: Cloud Bigtable
Feedback: Sorry, that's not correct. Cloud Bigtable is Google's NoSQL, big data database service.

D: Firestore
Feedback: Sorry, that's not correct. Firestore is Google's flexible, horizontally scalable NoSQL cloud database to store and sync data

Quiz | Question 3

Question

Why would a customer consider the Coldline storage class?

A.   To save money on storing infrequently accessed data.

B.   To save money on storing frequently accessed data.

C.   To improve security.

D.   To use the Coldline Storage API.

Quiz | Question 3

Answer

Why would a customer consider the Coldline storage class?

A.   To save money on storing infrequently accessed data. ✅

B.   To save money on storing frequently accessed data.

C.   To improve security.

D.   To use the Coldline Storage API.

Google Cloud

Why would a customer consider the Coldline storage class?

A: To save money on storing infrequently accessed data.
Feedback: That's correct! Data stored in Coldline is billed at a low monthly storage rate, although a fee is assessed on retrievals.

B: To save money on storing frequently accessed data.
Feedback: Sorry, that's not correct. Data stored in Coldline is billed at a low monthly storage rate, although a fee is assessed on retrievals. Therefore, storing frequently accessed data in Coldline might actually be the most expensive option.

C: To improve security.
Feedback: Sorry, that's not correct. You use the same tools and techniques to manage the security of data in Coldline as you do for data in other storage classes.

D: To use the Coldline Storage API.
Feedback: Sorry, that's not correct. You use the same API to access data in Coldline as you do for data in other storage classes.

Lab Intro

Google Cloud Fundamentals: Getting Started with Cloud Storage and Cloud SQL

In this lab, you create a Cloud Storage bucket and place an image in it. You'll also configure an application running in Compute Engine to use a database managed by Cloud SQL. For this lab, you will configure a web server with PHP, a web development environment that is the basis for popular blogging software.

Google Cloud