**Storage in the cloud**

- (Cloud Storage) Cloud Storage is a service provided by Google that offers durable and highly available object storage. Object storage manages data as discrete "objects" rather than using traditional file and folder hierarchy or disk chunks. These objects include binary data, metadata, and a unique identifier, making them compatible with web technologies.

Objects in Cloud Storage are immutable, creating a new version with each change.

- (Cloud Storage: Storage classes and data transfer) Cloud Storage offers four primary storage classes:

1. Standard Storage: Best for frequently accessed or short-term data storage.
2. Nearline Storage: Suitable for infrequently accessed data, with average access or modification once a month or less.
3. Coldline Storage: A low-cost option for infrequently accessed data, with access or modification occurring at most once every 90 days.
4. Archive Storage: The lowest-cost option for data archiving and disaster recovery, ideal for data accessed less than once a year.

- (Cloud SQL) Key features of Cloud SQL include:

1. Fully Managed: Google takes care of essential tasks, reducing maintenance overhead for users.
2. Scalability: It can scale up to 64 processor cores, 400+ gigabytes of RAM, and 30 terabytes of storage.
3. Automatic Replication: Supports replication scenarios from Cloud SQL primary instances, external primary instances, and external MySQL instances.
4. Managed Backups: Provides secure storage of backed-up data, with the cost of an instance covering seven backups.
5. Data Encryption: Customer data is encrypted on Google's internal networks and when stored in database tables, temporary files, and backups.
6. Network Firewall: Includes a network firewall to control access to each database instance.
7. Integration with Google Cloud Services: Cloud SQL instances are accessible by other Google Cloud services and even external services.
8. Compatibility: Works with App Engine using standard drivers like Connector/J for Java or MySQL DB for Python. Compute Engine instances can also access Cloud SQL instances.

- (Cloud Spanner) Key features of Cloud Spanner include:

1. Scalability: Cloud Spanner can horizontally scale to handle large workloads and high numbers of input and output operations per second, making it suitable for applications with tens of thousands of reads and writes per second or more.
2. SQL Support: Cloud Spanner allows developers to use SQL to interact with the database, including support for joins and secondary indexes, which makes it easier to work with relational data.
3. Built-in High Availability: The service provides built-in high availability, ensuring that applications can access the database without interruptions.
4. Strong Global Consistency: Cloud Spanner offers strong global consistency, ensuring that data is up-to-date and accurate across all regions and replicas.

- (Firestore) Key features of Firestore include:

1. NoSQL Queries: Firestore supports powerful NoSQL queries, allowing developers to retrieve specific documents or all documents in a collection based on query parameters. Queries can include multiple filters and combine filtering and sorting options.
2. Real-time Data Synchronization: Firestore uses data synchronization to update data on connected devices in real-time. It caches active app data, enabling read, write, listen, and query operations even when the device is offline, with synchronization occurring when the device is back online.
3. Google Cloud Infrastructure: Firestore leverages Google Cloud's infrastructure, including automatic multi-region data replication, strong consistency guarantees, atomic batch operations, and real transaction support.

- (Cloud Bigtable) Cloud Bigtable is Google Cloud's NoSQL Big data database service, designed for handling massive workloads with low latency and high throughput. It powers core Google services and is ideal for operational and analytical applications, including IoT, user analytics, and financial data analysis. Customers choose Cloud Bigtable for large-scale, fast-changing, and NoSQL data scenarios, such as time-series data, big data processing, and machine learning. It can interact with other Google Cloud services and third-party clients through APIs and supports data streaming and batch processing for data ingestion and processing. Summarized or calculated data can be written back to Cloud Bigtable or downstream databases.

- (Comparing storage options) Brief comparison of Google Cloud's core storage options based on specific application or workflow requirements:

1. Cloud Storage:

* Suitable for storing immutable blobs larger than 10 megabytes, like large images or movies.
* Offers petabytes of capacity with a maximum unit size of 5 terabytes per object.
* Ideal for serving static website content, backups, and archival storage.

1. Cloud SQL:

* Best for online transaction processing systems that require full SQL support.
* Provides up to 64 terabytes of storage, depending on the machine type.
* Suitable for web frameworks and existing applications, like user credentials and customer orders.

1. Cloud Spanner:

* Recommended if you need horizontal scalability with full SQL support.
* Offers petabytes of capacity, making it suitable for large-scale applications.
* Best for scenarios where strong consistency and scalability are required.

1. Firestore:

* Ideal for massive scaling, real-time query results, and offline query support.
* Provides terabytes of capacity with a maximum unit size of 1 megabyte per entity.
* Great for storing, syncing, and querying data for mobile and web apps.

1. Cloud Bigtable:

* Best for storing a large number of structured objects with heavy read and write events.
* Offers petabytes of capacity, with a maximum unit size of 10 megabytes per cell and 100 megabytes per row.
* Suitable for analytical data, such as AdTech, financial, or IoT data.