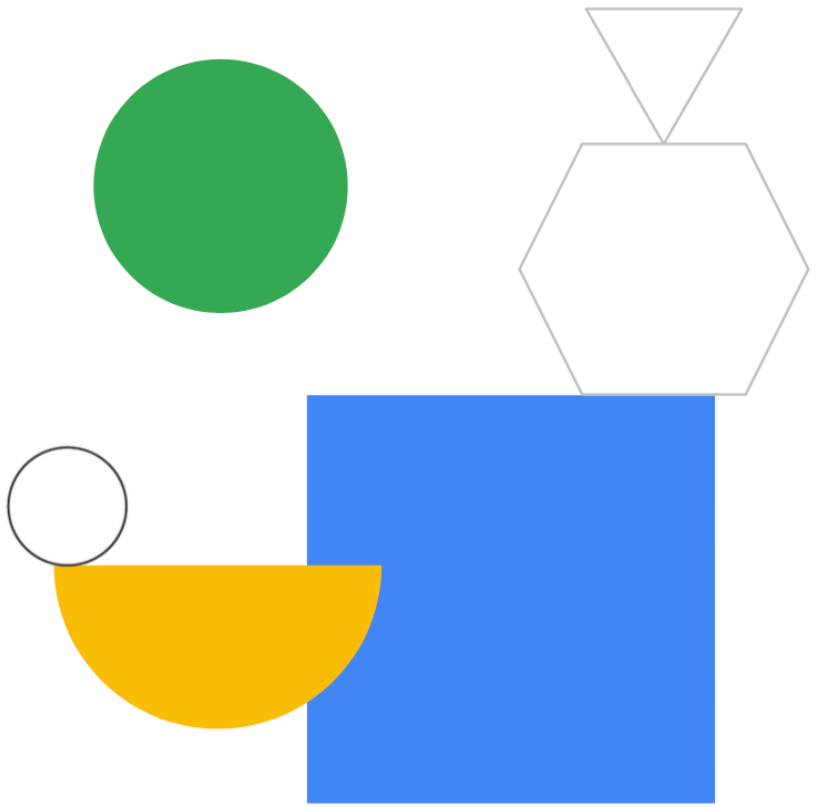
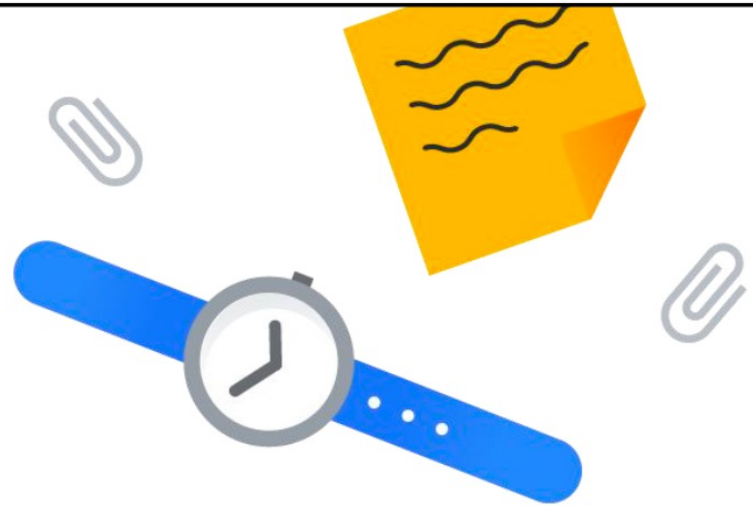
Google Cloud

Building a Data Lake





Module agenda

01 Introduction to Data Lakes

02 Data Storage and ETL Options on Google Cloud

03 Build a Data Lake Using Cloud Storage

04 Secure Cloud Storage

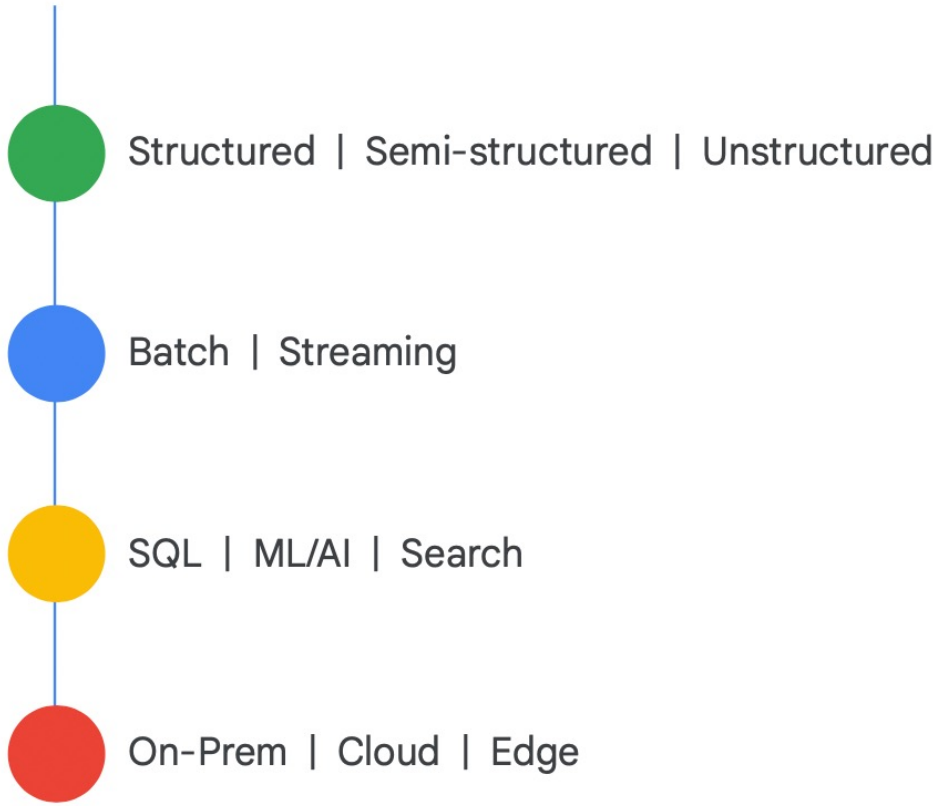
05 Store All Sorts of Data Types

06 Cloud SQL as a Relational Data Lake

Introduction to Data Lakes

What is a data lake?

A scalable and secure data platform that allows enterprises to ingest, store, process, and analyze any type or volume of information.



Components of a Data Engineering ecosystem

- Data sources
- Data sinks
  - Central data lake repository
  - Data warehouse
- Data pipelines (batch and streaming)
- High-level orchestration workflows

Our focus in this module

Our focus in the next module

Our focus in other courses

Data Engineering is like Civil Engineering

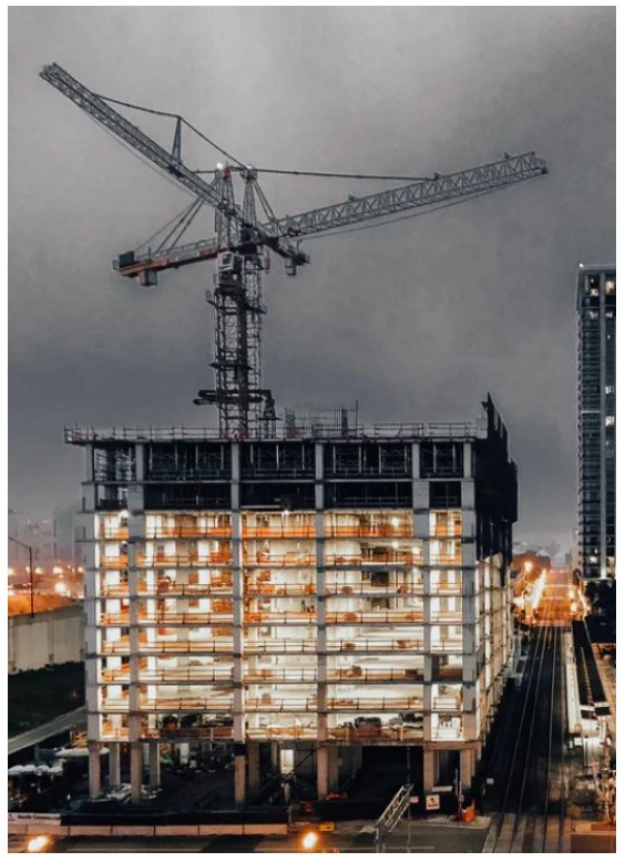
1. Raw Materials need to be brought to the job site (into the Data Lake).

Transform raw materials into a useful form

1. Raw Materials need to be brought to the job site (into the Data Lake).

2. Materials need to be cut and transformed for purpose and stored (pipelines to data sinks).

The new building is the new insight, ML model, etc.



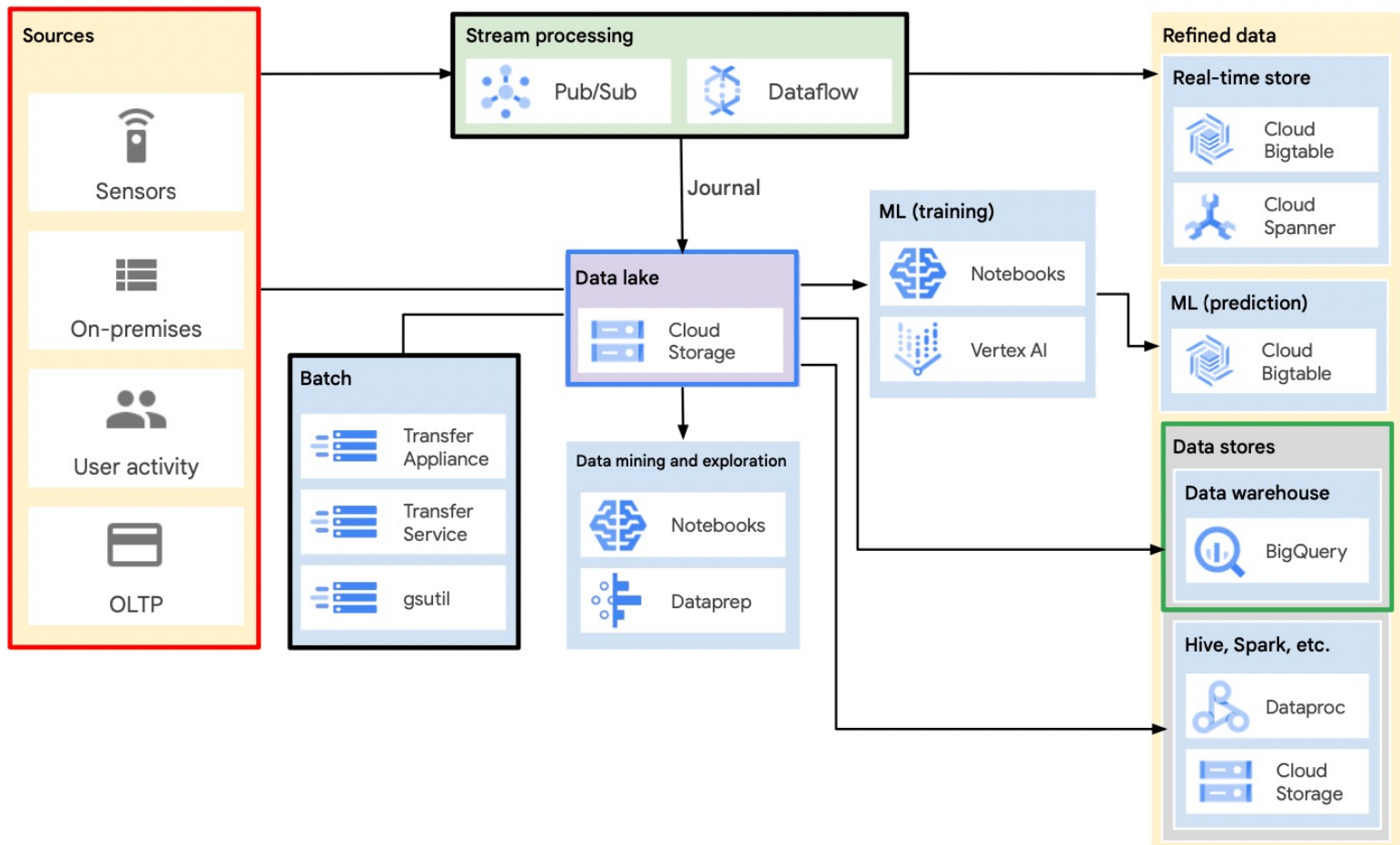
1. Raw Materials need to be brought to the job site (into the Data Lake).
2. Materials need to be cut and transformed for purpose and stored (pipelines to data sinks).
3. The actual building is the new insight or ML model etc.

An orchestrator governs all aspects of the workflow

1. Raw Materials need to be brought to the job site (into the Data Lake).
2. Materials need to be cut and transformed for purpose and stored (pipelines to data sinks).
3. The actual building is the new insight or ML model etc.
4. The supervisor directs all aspects and teams on the project (workflow orchestration).

Example architecture

1. **Data sources**
2. **Data lake**
3. **Data pipelines**
4. **Data warehouse**
5. Used for ML and analytics workloads



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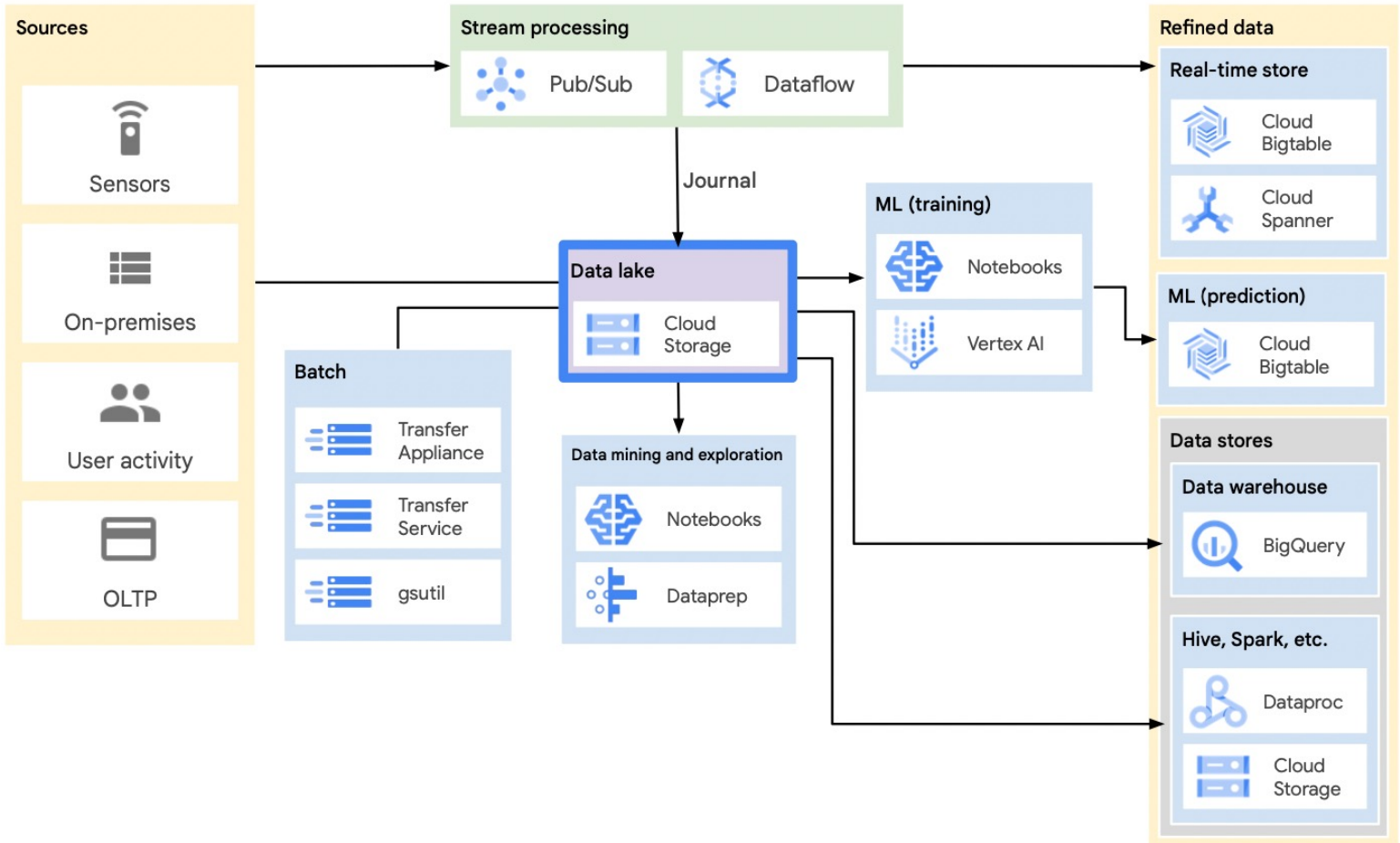

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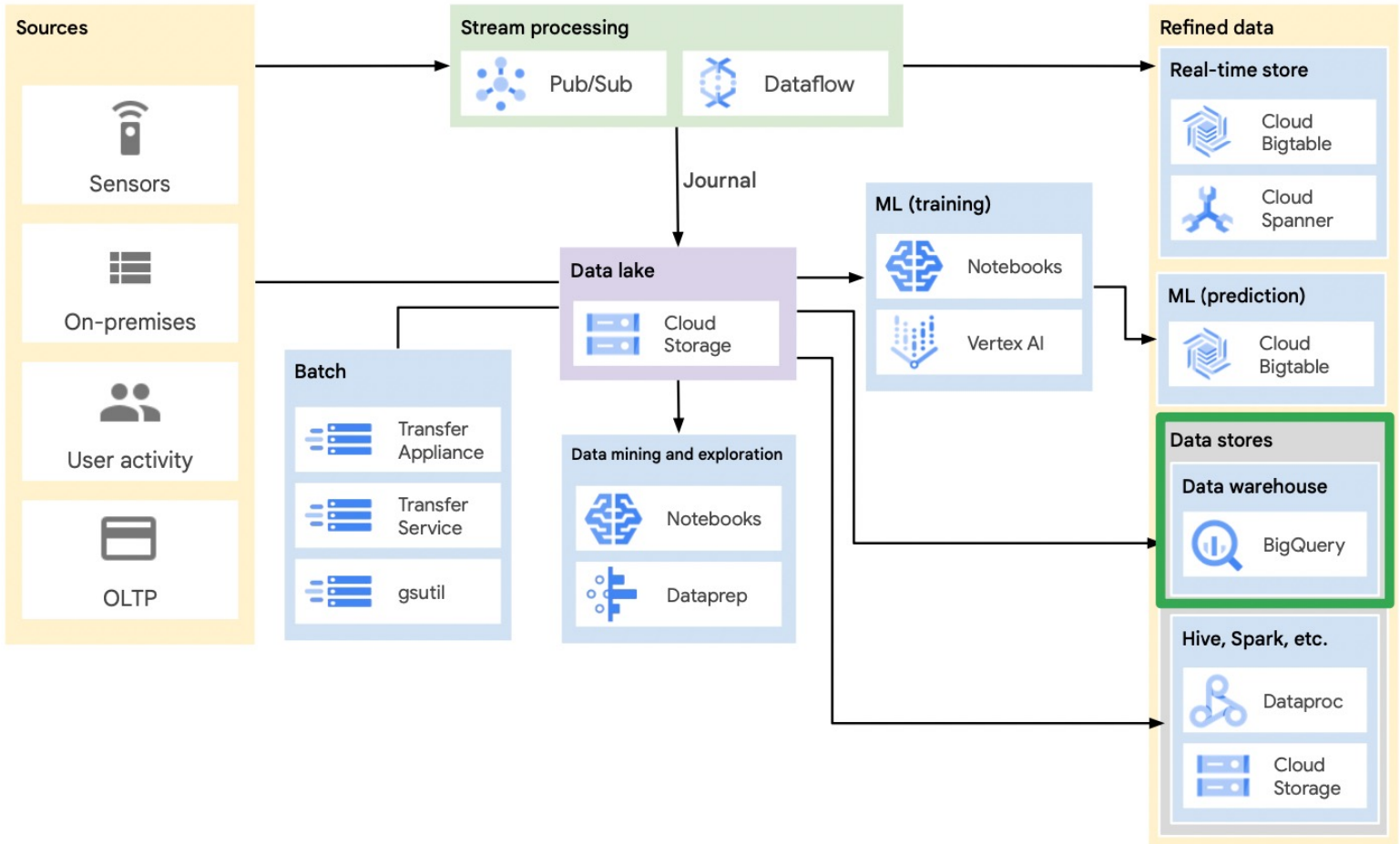

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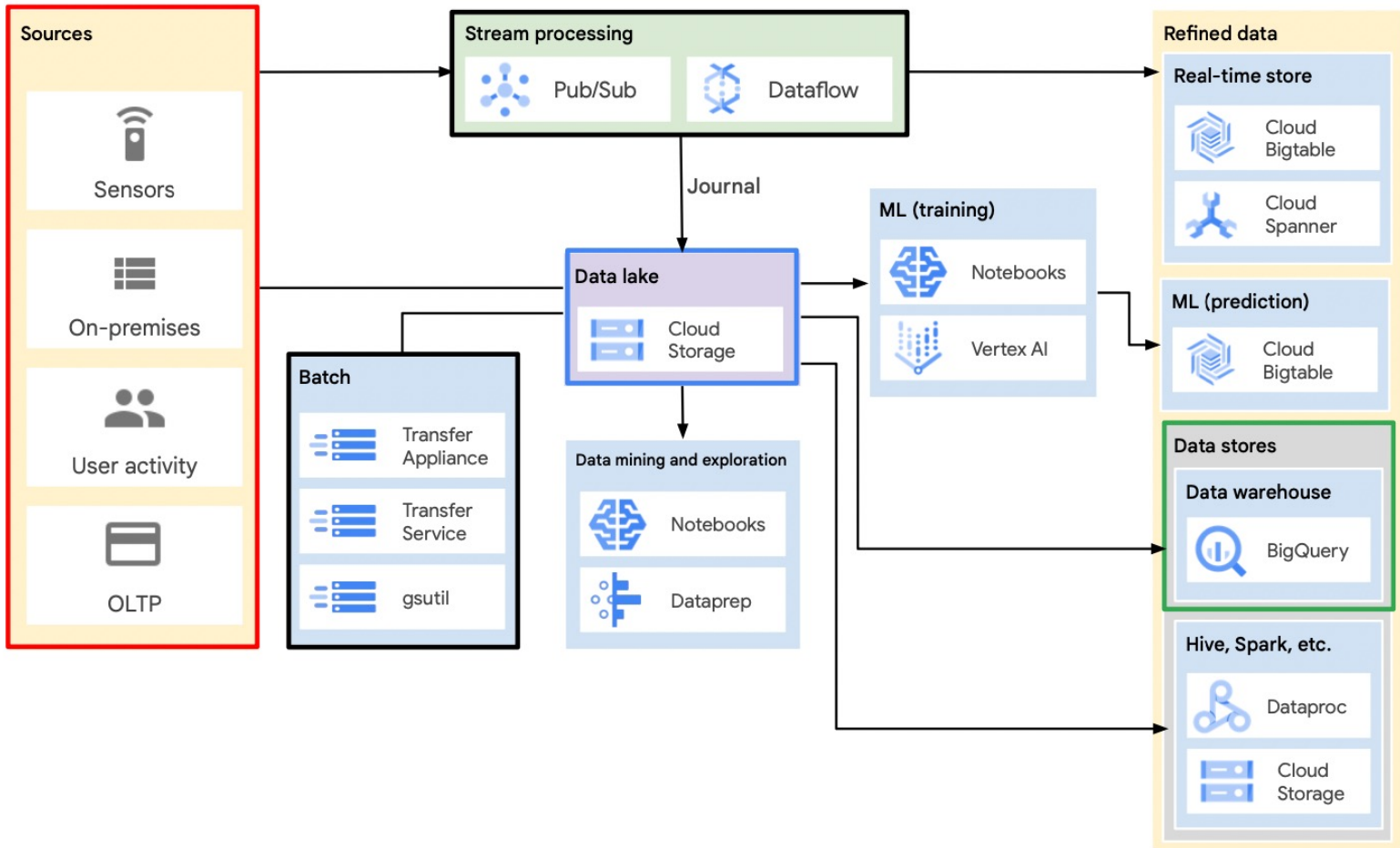
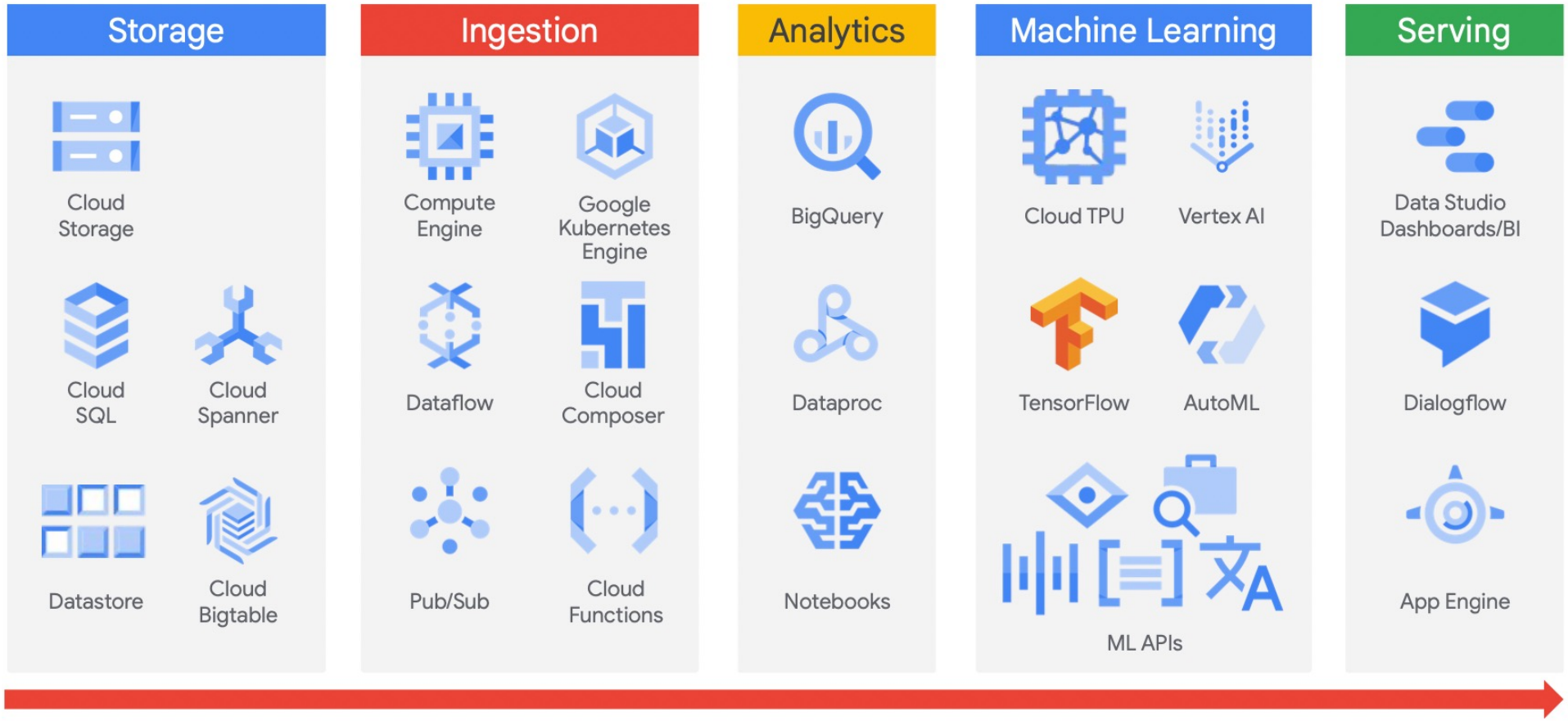
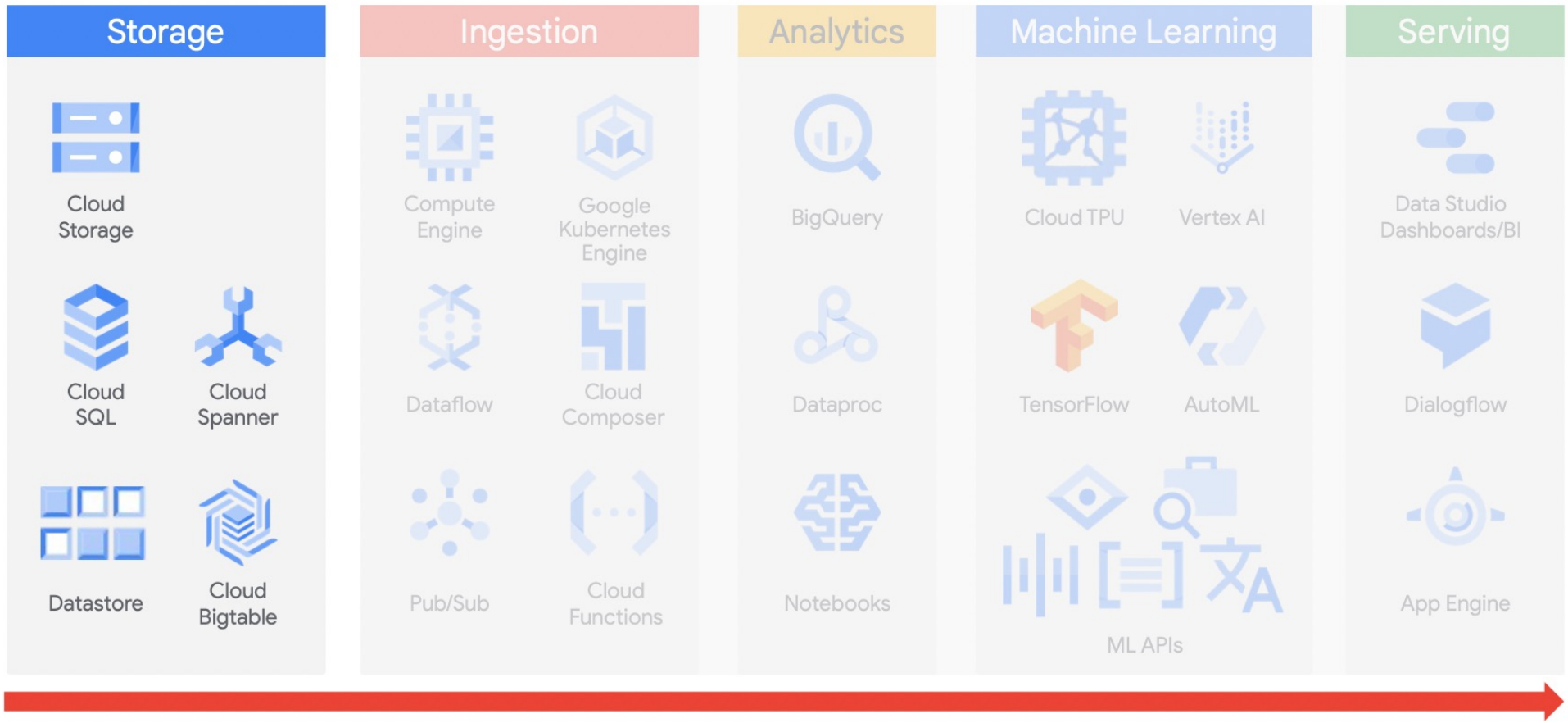


The suite of big data products on Google Cloud



You will build scalable, durable, Data Lakes with Google Cloud storage solutions



Data lake versus data warehouse

A **data lake** is a capture of every aspect of your business operation.
The data is stored in its natural/raw format, usually as object blobs or files.

- Retain all data in its native format
- Support all data types and all users
- Adapt to changes easily

Data lake versus data warehouse

A **data lake** is a capture of every aspect of your business operation.
The data is stored in its natural/raw format, usually as object blobs or files.

- Retain all data in its native format
- Support all data types and all users
- Adapt to changes easily
- **Tends to be application-specific**

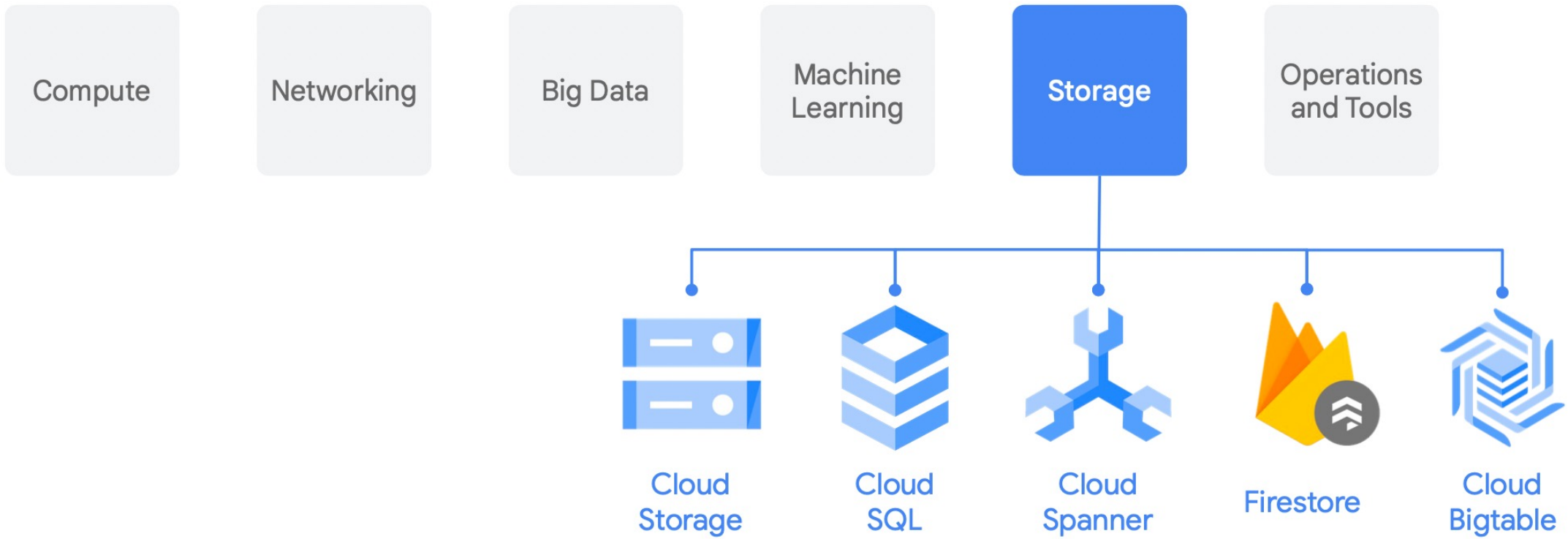
Data lake versus data warehouse

In contrast, a **data warehouse** typically has the following characteristics:

- Typically loaded only after a use case is defined.
- Processed/organized/transformed.
- Provide faster insights.
- Current/historical data for reporting.
- Tends to have consistent schema shared across applications.

Data Storage and ETL Options on Google Cloud

Storage options for your data on Google Cloud



The path your data takes to get to the cloud depends on

- Where your data is now
- How big your data is
- Where it has to go
- How much transformation is needed

The method you use to load data depends on how much transformation is needed

EL

Extract and Load

ELT

Extract, Load, and Transform

ETL

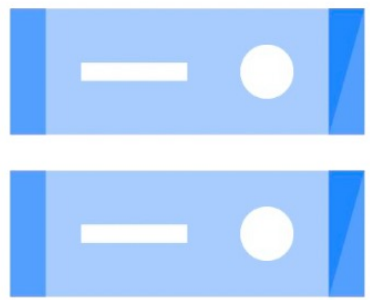
Extract, Transform, and Load

Build a Data Lake Using Cloud Storage

Cloud Storage

Qualities that Cloud Storage contributes to data engineering solutions:

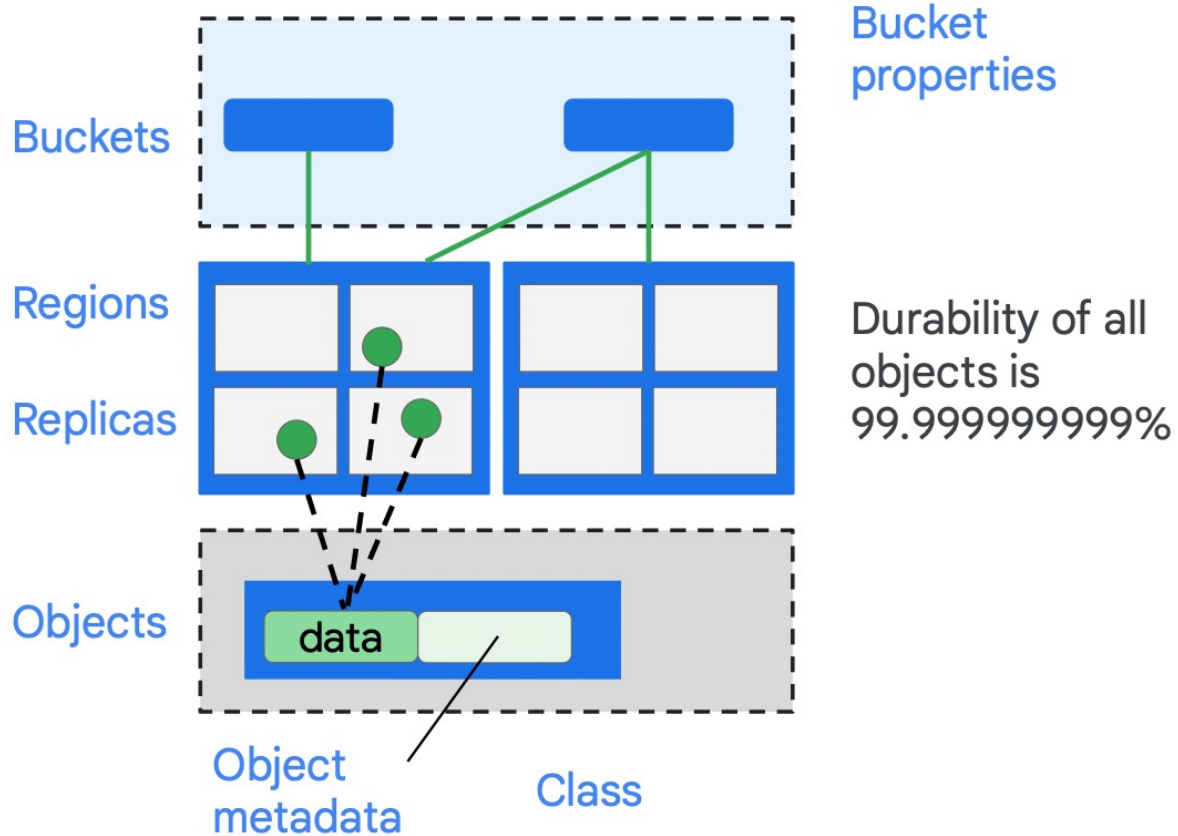
- Persistence
- Durability
- Strong consistency
- Availability
- High throughput



Cloud Storage

How does Cloud Storage work?

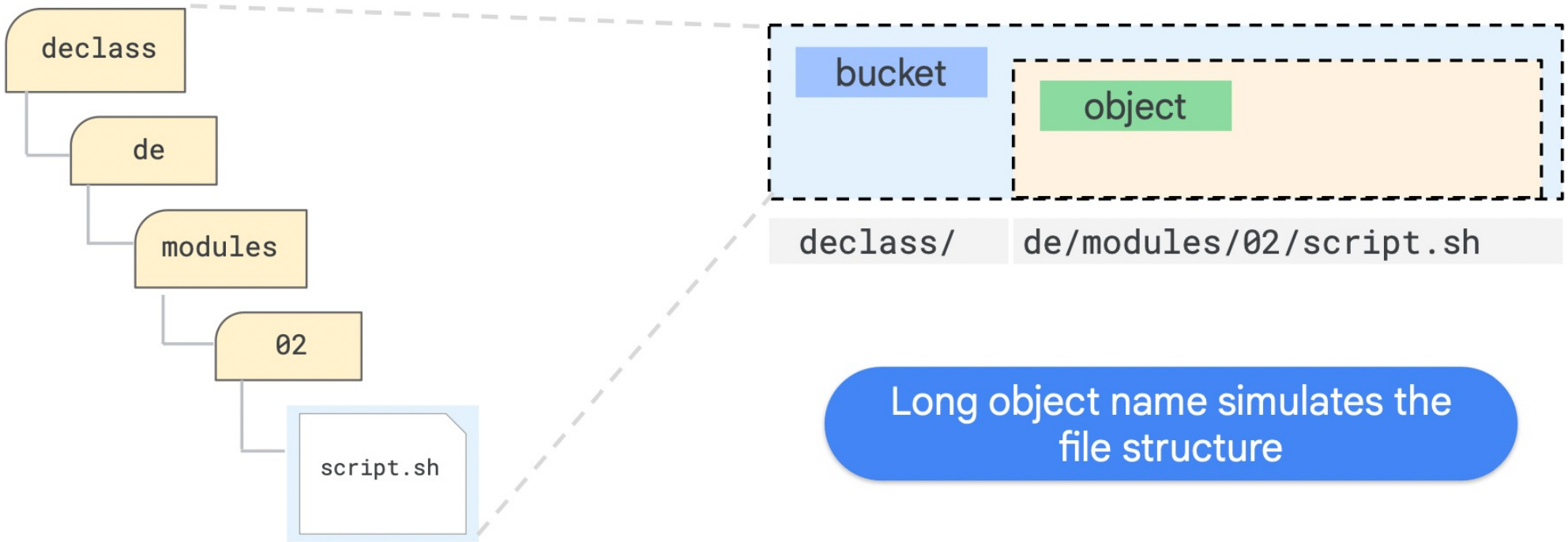
- Single global namespace simplifies locating buckets and objects
- Location to control latency
- Durability and availability
- Long object names simulate structure



Overview of storage classes

Storage Class	Minimum duration	Availability SLA	Typical monthly availability	Use cases	Name for APIs and gsutil
Standard Storage	None	Multi-region 99.95% Dual-region 99.95% Region 99.9%	>99.99% availability in multi-regions and dual-regions; 99.99% in regions	Access data frequently ("hot" data) and/or store for brief periods • Serve website content • Stream videos • Interactive workloads • Mobile and gaming apps	STANDARD
Nearline Storage	30 days	Multi-region 99.9% Dual-region 99.9% Region 99.0%	99.95% availability in multi-regions and dual-regions; 99.9% in regions	Read/modify data ≤ once per month • Data backup • Serve long-tail multimedia content	NEARLINE
Coldline Storage	90 days	Multi-region 99.9% Dual-region 99.9% Region 99.0%	99.95% availability in multi-regions and dual-regions; 99.9% in regions	Read/modify data no more than once a quarter	COLDLINE
Archive Storage	365 days	None	99.95% availability in multi-regions and dual-regions; 99.9% in regions	Read/modify data < once a year • Cold data storage • Disaster recovery	ARCHIVE

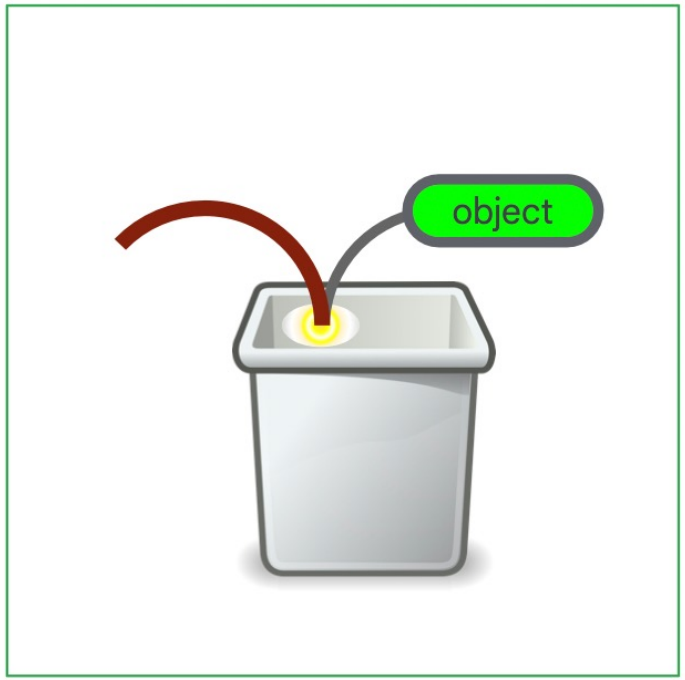
Cloud Storage simulates a file system



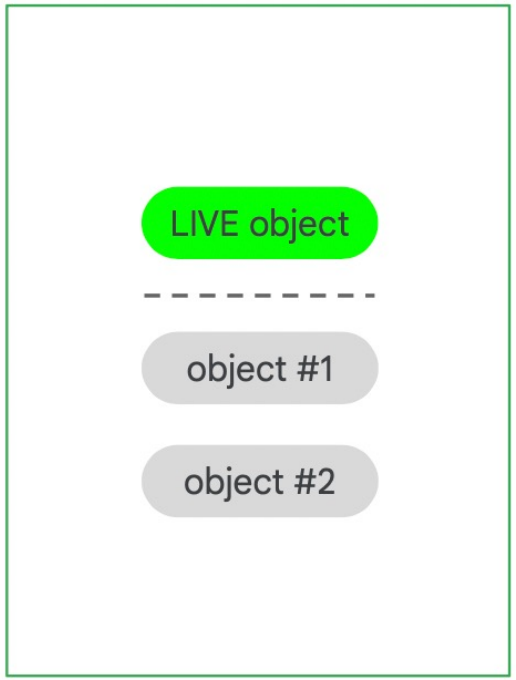
File access `gs://declass/de/modules/02/script.sh`

Web access `https://storage.cloud.google.com/declass/de/modules/02/script.sh`

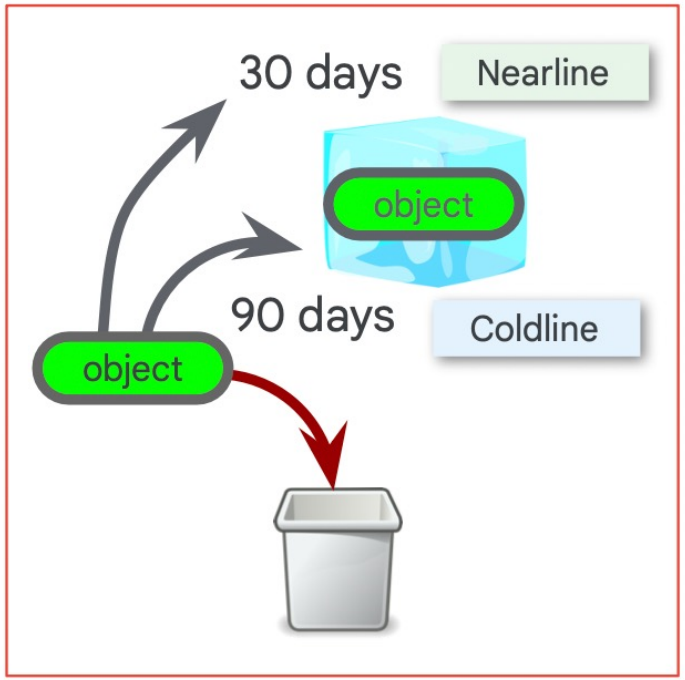
Cloud Storage has many object management features



Retention policy



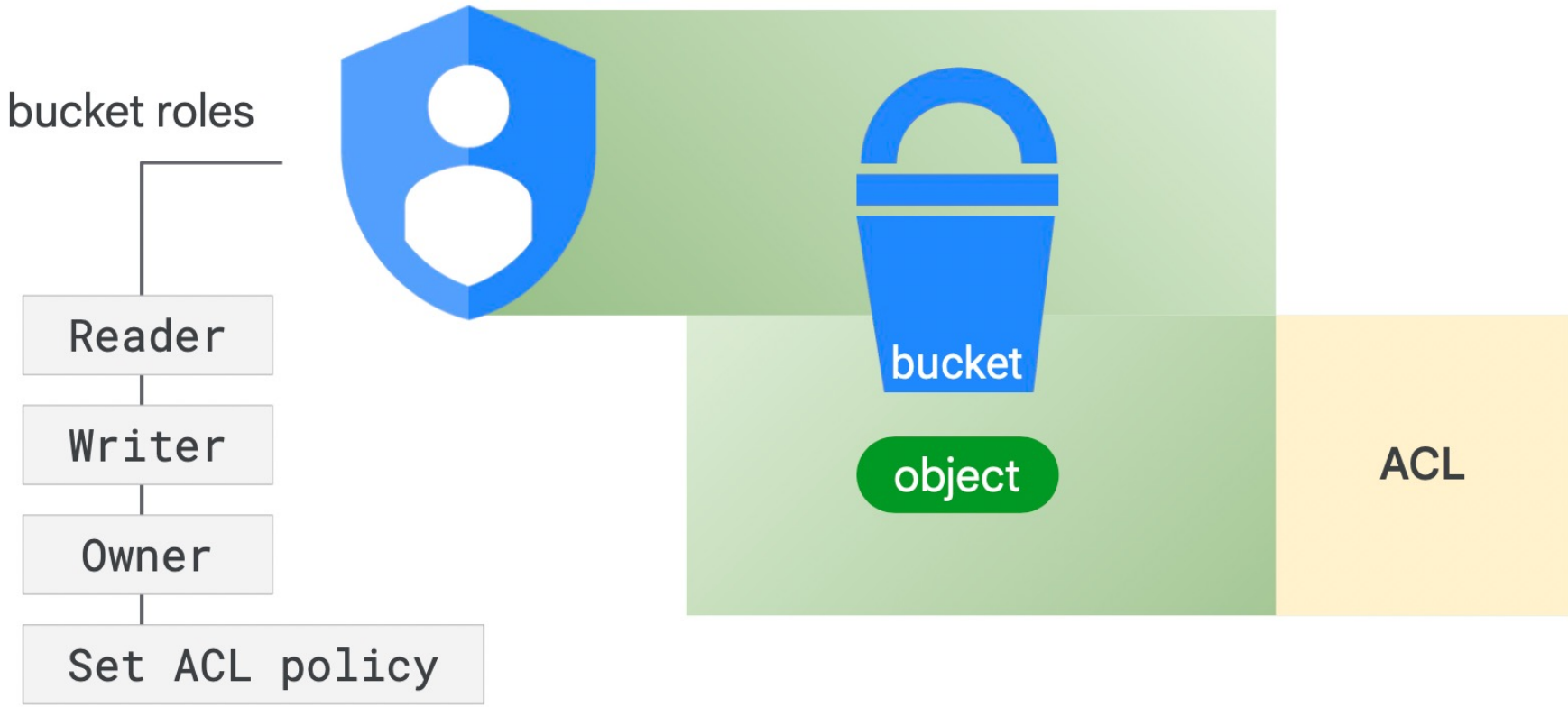
Versioning



Lifecycle management

Secure Cloud Storage

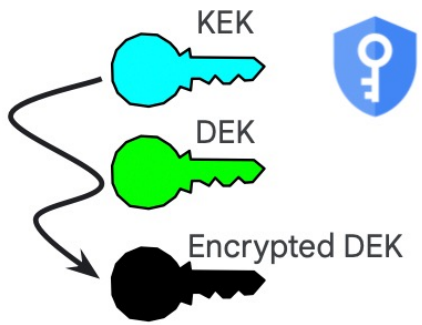
Controlling access with IAM and access lists



Data encryption options for many requirements

GMEK

Google-managed encryption keys



Cloud KMS Key Management Service Encryption is automatic

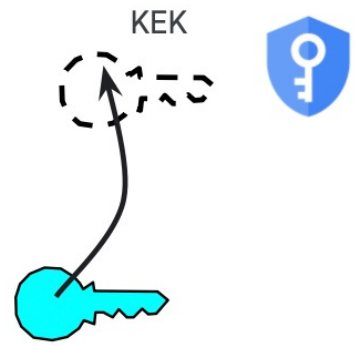
CMEK

Customer-managed encryption keys

You control the creation and existence of the KEK key in Cloud KMS

CSEK

Customer-supplied encryption keys



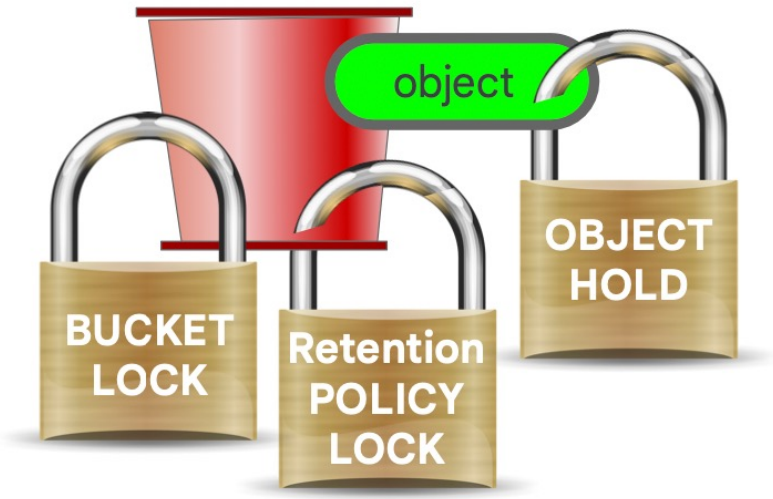
You provide the KEK key

Cloud Storage supports many special use cases

Client-side encryption

Client-side encryption

Data locking for audits



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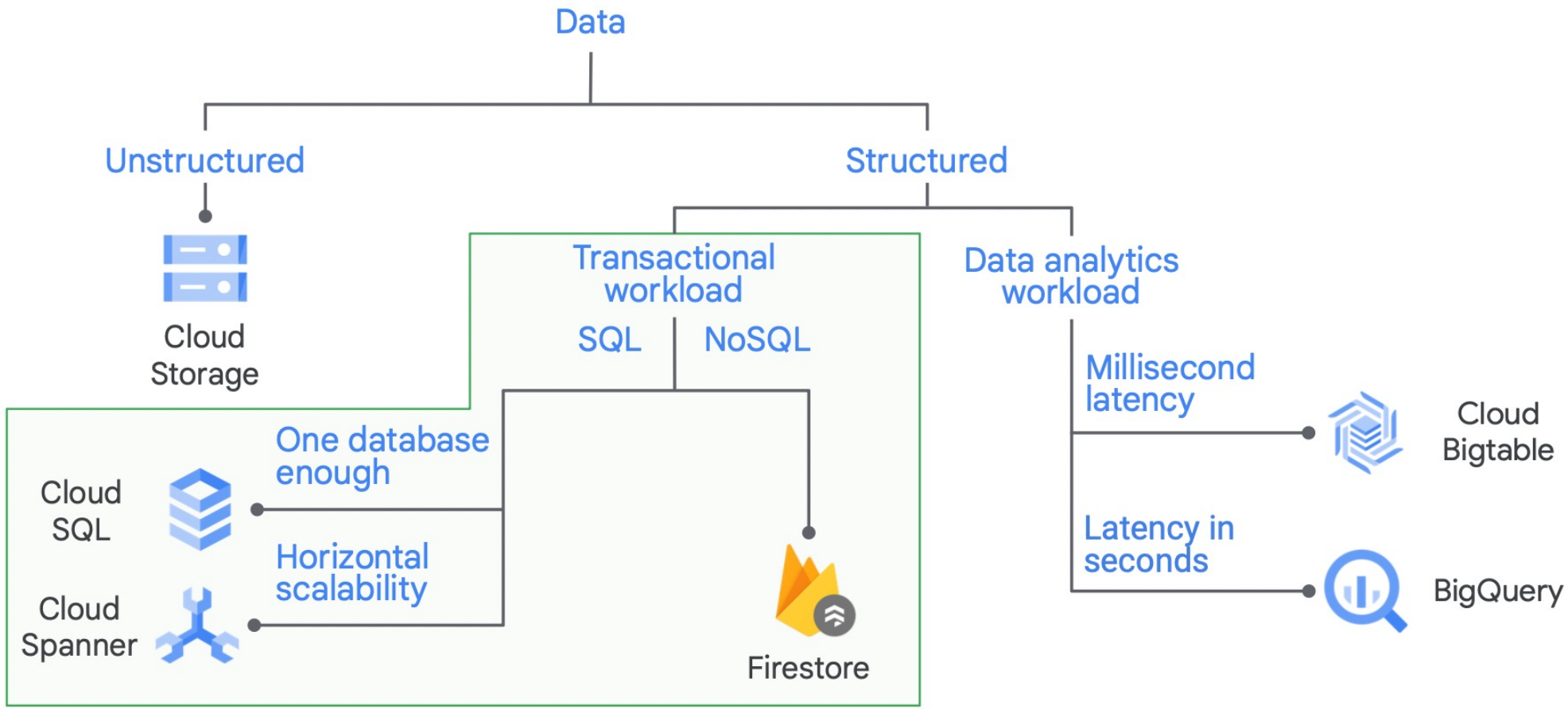
- Decompressive coding
- Requester pays
- Signed URLs for anonymous sharing
- Period expirations
- Composite objects
- ...

Store All Sorts of Data Types

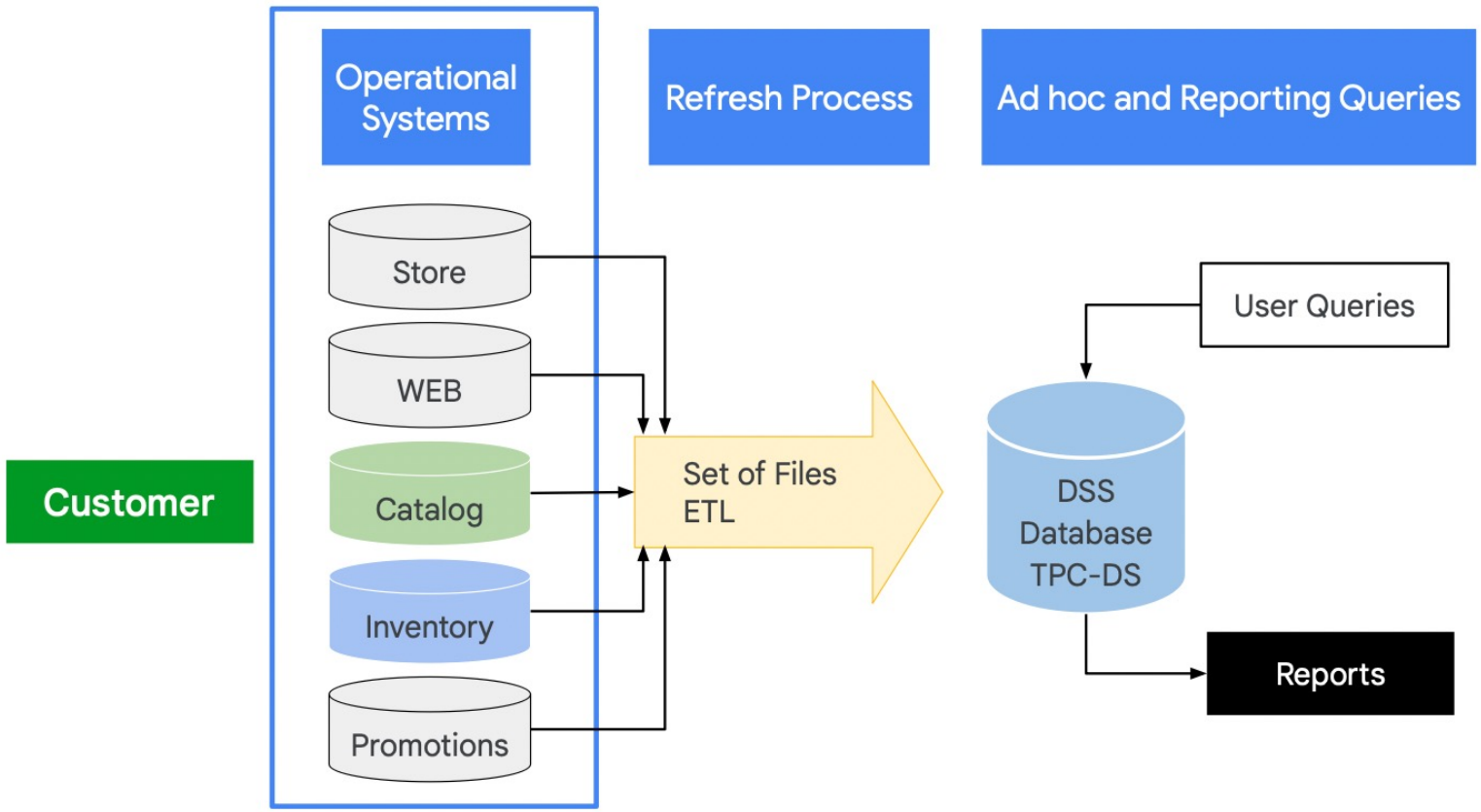
Different considerations for transactional workloads



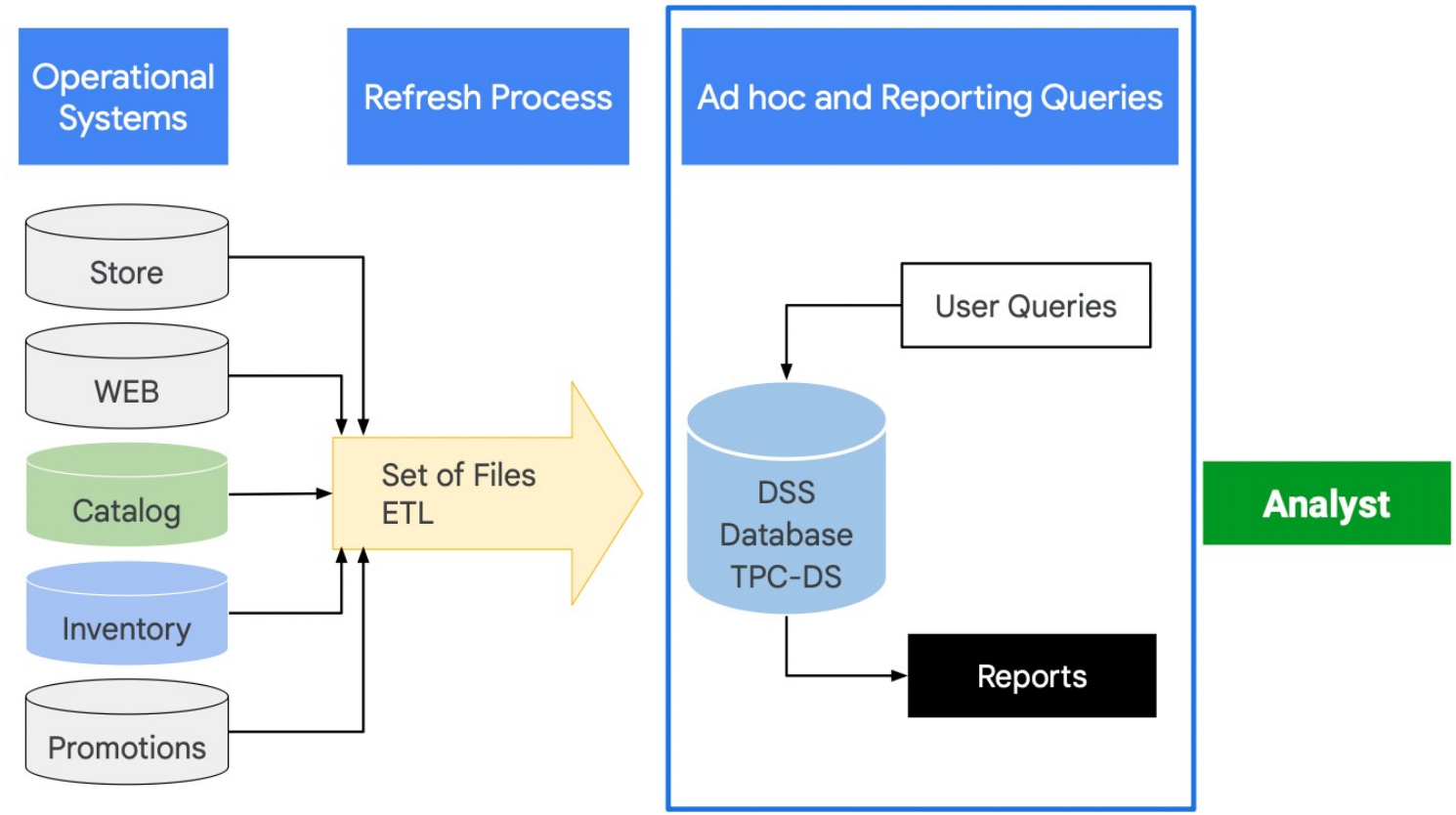
Transactional versus analytical

	Transactional	Analytical
Source of data	Operational data; OLTPs are the original source of the data	Consolidation data; OLAP data comes from the various OLTP databases
Purpose of data	Control and run fundamental business tasks	Help with planning, problem solving, and decision support
What the data shows	Reveals snapshot of ongoing business processes	Multi-dimensional views of various kinds of business activities
Inserts and updates	Short and fast inserts and updates initiated by end users	Periodic long-running batch jobs refresh the data
Queries	Relatively standardized and simple queries returning relatively few records	Often complex queries involving aggregations
Processing speed	Typically very fast	Depends on amount of data involved; improve query speed with indexes
Space requirements	Can be relatively small if historical data is archived	Larger, more indexes than OLTP

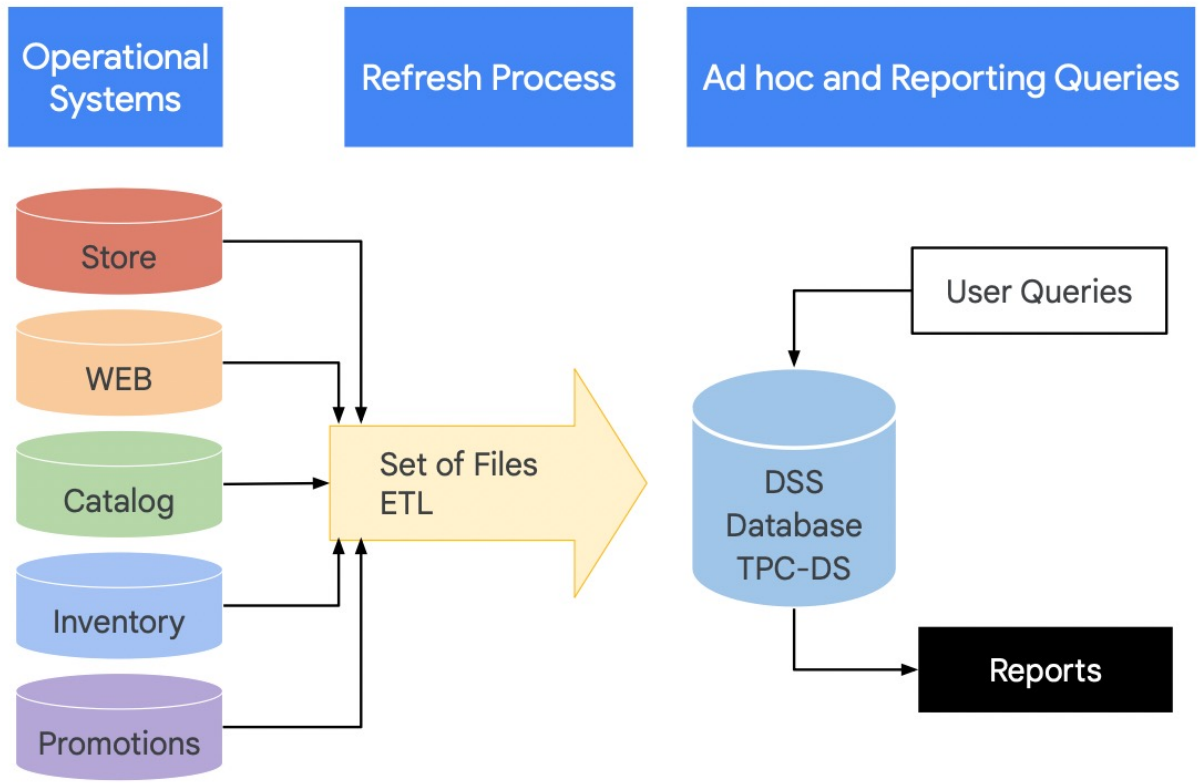
Transactional systems are 80% writes and 20% reads



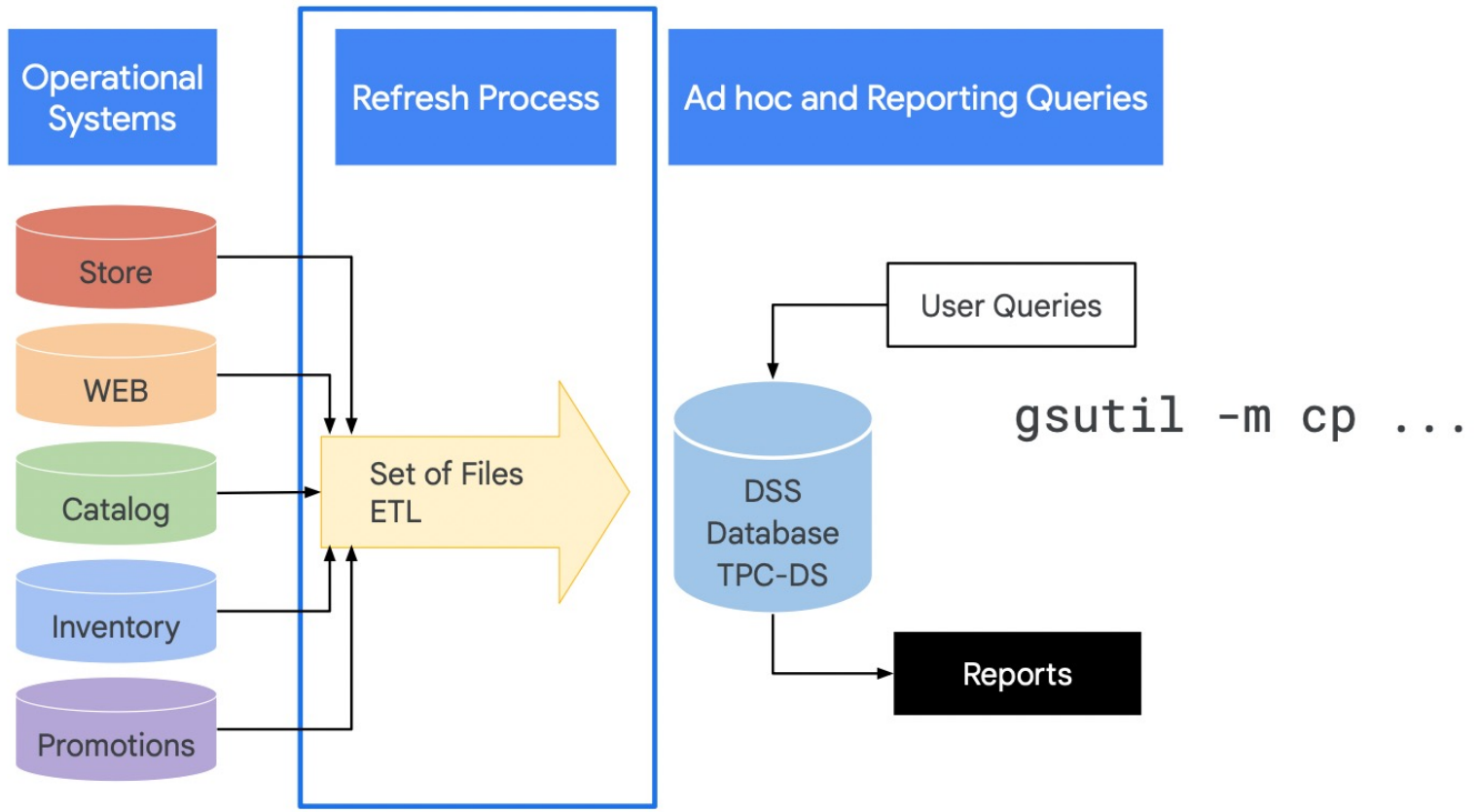
Analytical systems are 20% writes and 80% reads



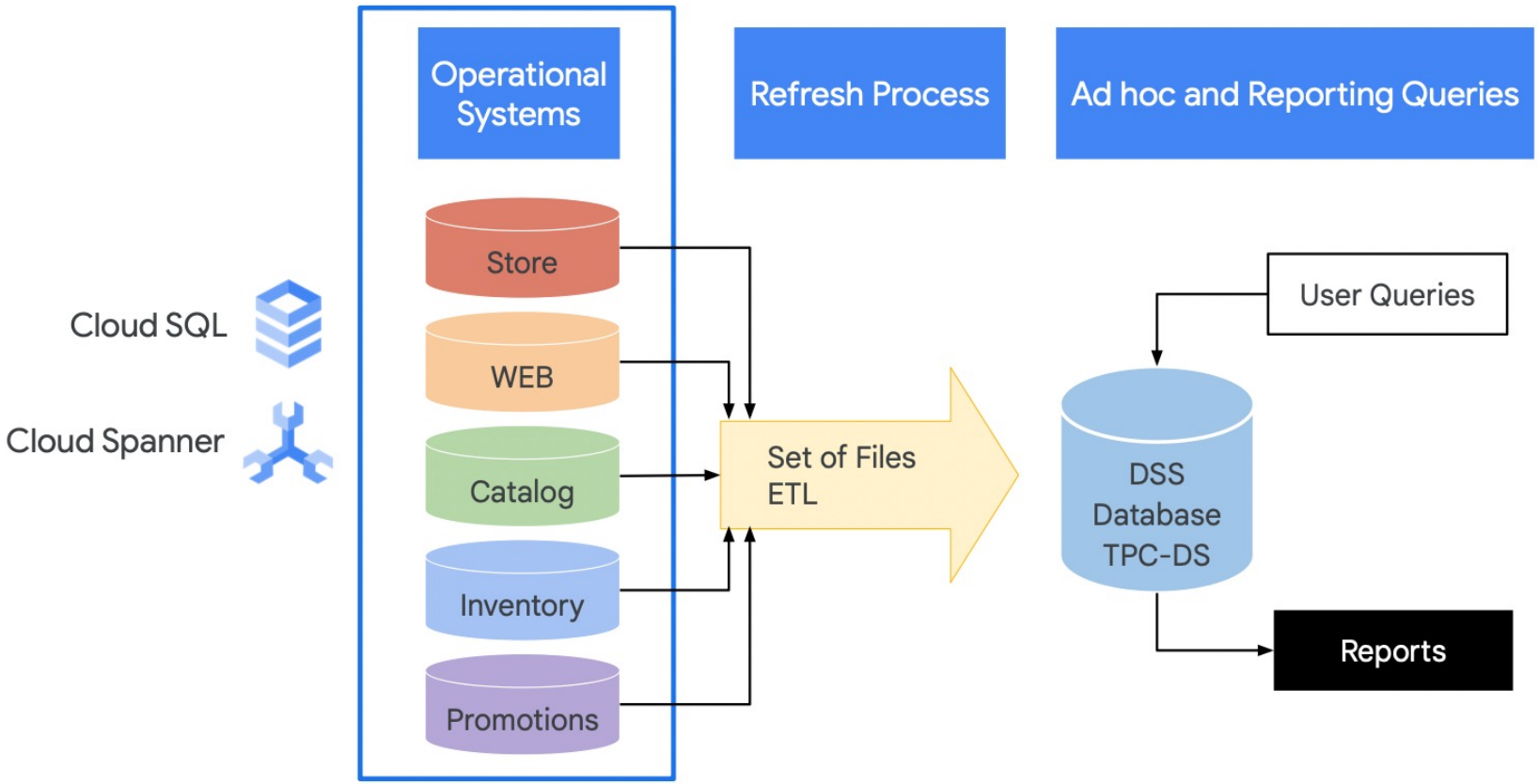
Data engineers build the pipelines between the systems



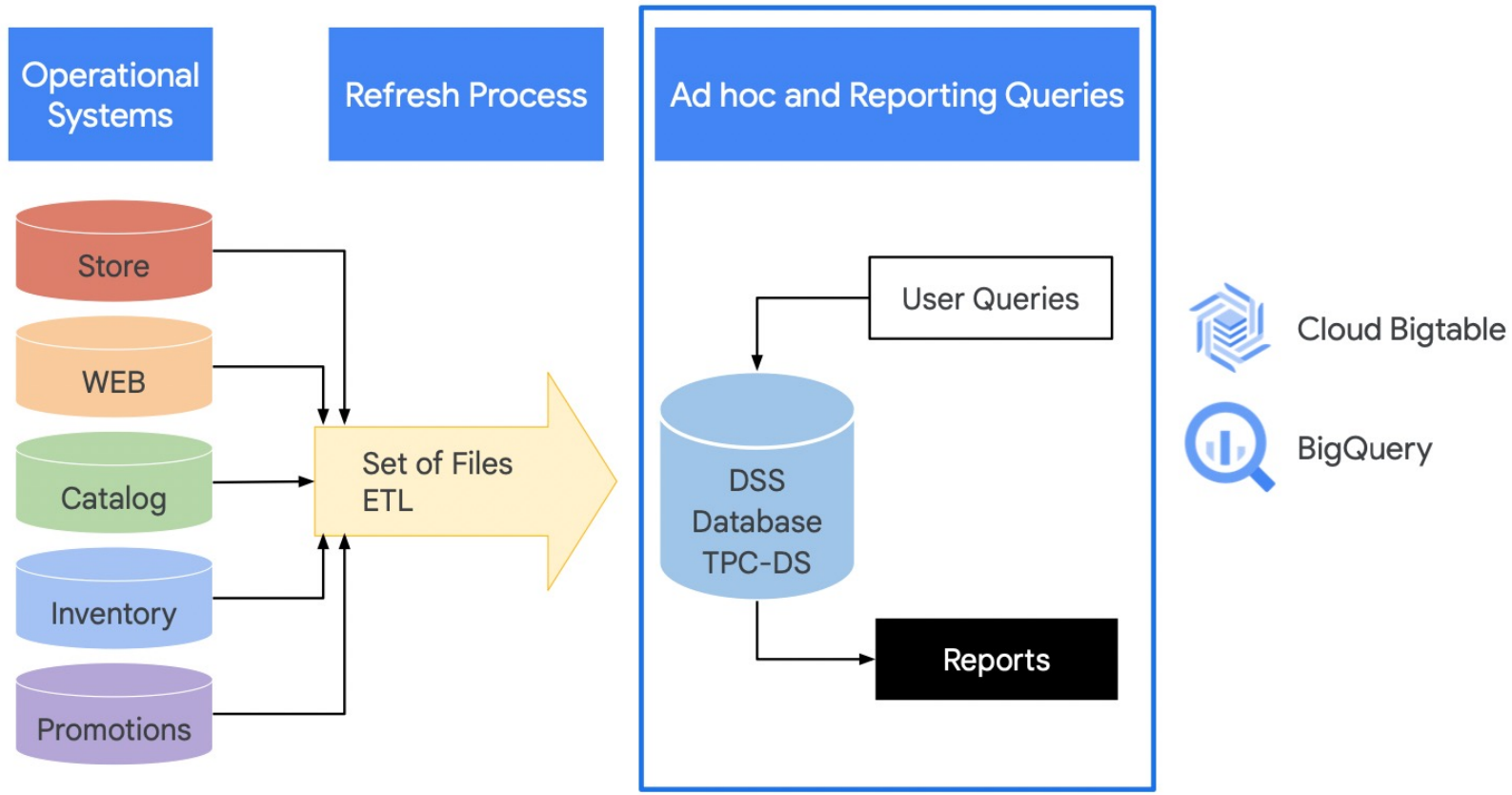
Use Cloud Storage for scalable staging of raw data



Choose from cloud relational databases for transactional workloads



Choose from cloud data warehouses for analytic workloads



Cloud SQL as a Relational Data Lake

Cloud SQL is a fully managed database service that makes it easy to set up and administer your relational databases in the cloud

Cloud SQL can be used with other Google Cloud services

Cloud SQL can be used with App Engine using standard drivers.

You can configure a Cloud SQL instance to follow an App Engine application.

Compute Engine instances can be authorized to access Cloud SQL instances using an external IP address.

Cloud SQL instances can be configured with a preferred zone.

Cloud SQL can be used with external applications and clients.

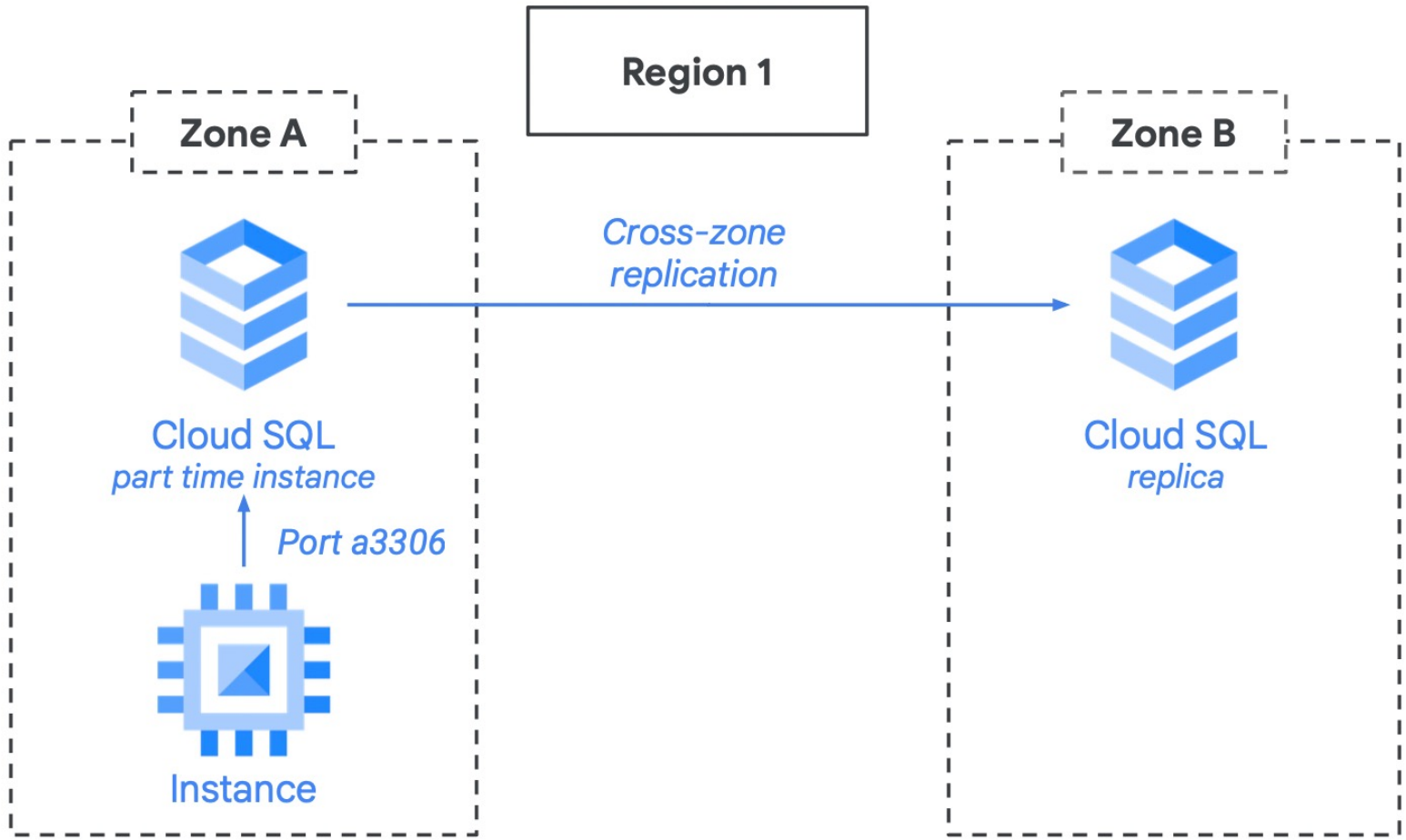
Standard tools can be used to administer databases.

External read replicas can be configured.

Backup, recovery, scaling, and security is managed for you

- Google security
- Managed backups
- Vertical scaling (read and write)
- Horizontal scaling (read)
- Automatic replication

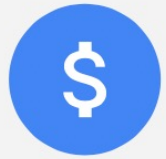
Cloud SQL replication



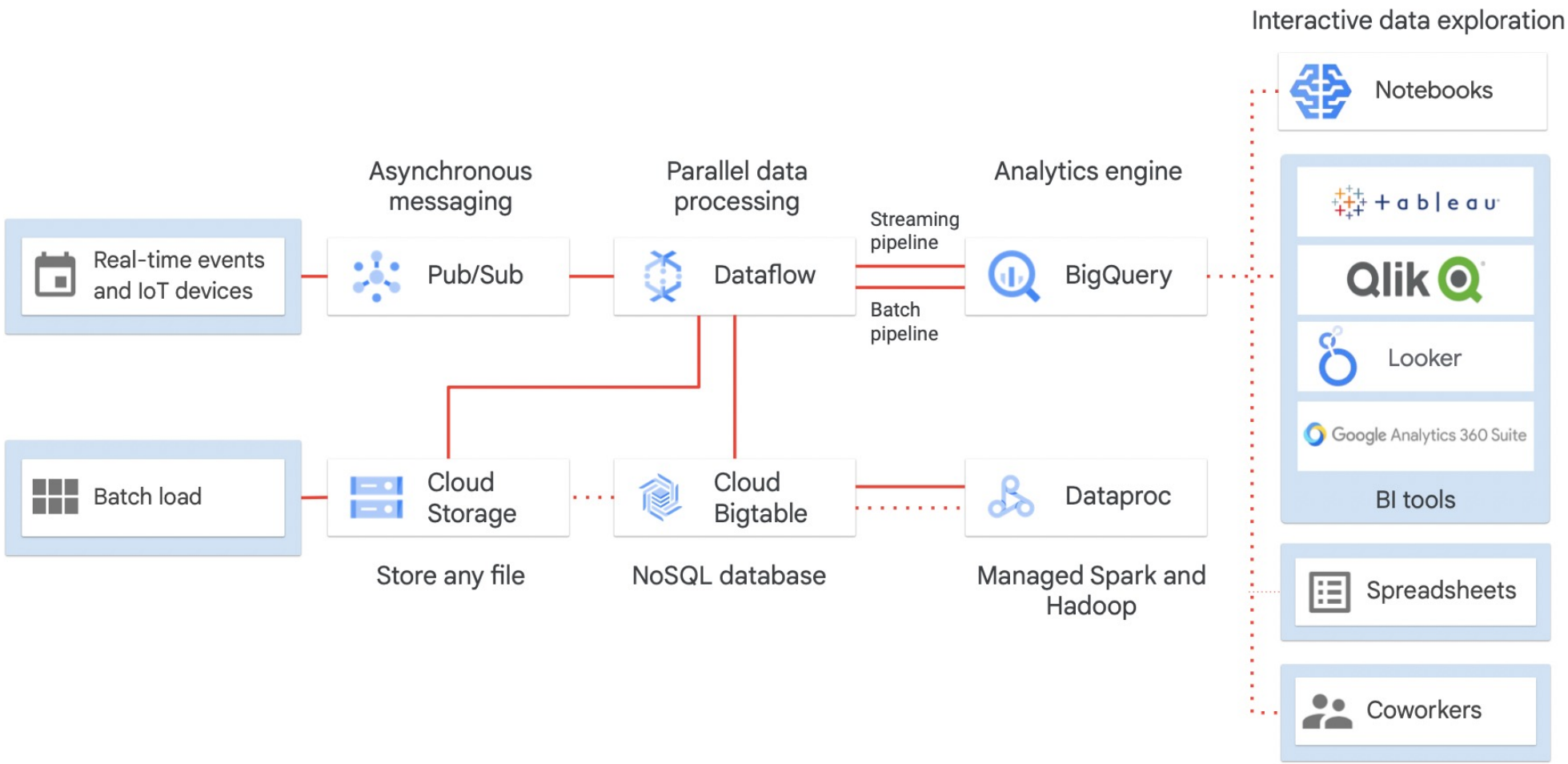
Cloud SQL replication caveats

- The failover replica is charged as a separate instance
- Existing connections to the instance are closed
- The replica becomes the primary

Fully managed versus serverless

Fully managed	 No setup	 Automated backups, updates, etc.	 Replicated, highly available
Serverless	 No server management	 Fully managed security	 Pay only for usage

Modern serverless data management architecture



Lab Intro

Loading Taxi Data into Cloud SQL