



Data Engineering with Databricks



Course Objectives

- Leverage the Databricks Lakehouse Platform to perform core responsibilities for data pipeline development
- Use SQL and Python to write production data pipelines to extract, transform, and load data into tables and views in the lakehouse
- Simplify data ingestion and incremental change propagation using Databricks-native features and syntax
- Orchestrate production pipelines to deliver fresh results for ad-hoc analytics and dashboarding

Course Agenda

- Module 1: Databricks Workspace and Services
- Module 2: Delta Lake
- Module 3: Relational Entities on Databricks
- Module 4: ETL With Spark SQL
- Module 5: OPTIONAL Python for Spark SQL
- Module 6: Incremental Data Processing
- Module 7: Multi-Hop Architecture
- Module 8: Delta Live Tables
- Module 9: Task Orchestration with Jobs
- Module 10: Running a DBSQL Query
- Module 11: Managing Permissions
- Module 12: Productionalizing Dashboards and Queries in DBSQL





The Databricks Lakehouse Platform

Using the Databricks Lakehouse Platform

Learning Objectives

- Describe the components of the Databricks Lakehouse
- Complete basic code development tasks using services of the Databricks Data Science and Engineering Workspace
- Perform common table operations using Delta Lake in the Lakehouse

Using the Databricks Lakehouse Platform

Agenda

- Introduction to the Databricks Lakehouse Platform
- Introduction to the Databricks Workspace and Services
 - Using clusters, files, notebooks, and repos
- Introduction to Delta Lake
 - Manipulating and optimizing data in Delta tables



Lakehouse

One simple platform to unify all of
your data, analytics, and AI workloads

Customers

7000+

across the globe



Original creators of:



Supporting enterprises in every industry

Healthcare & Life Sciences



Manufacturing & Automotive



Media & Entertainment



Financial Services



Public Sector



Retail & CPG



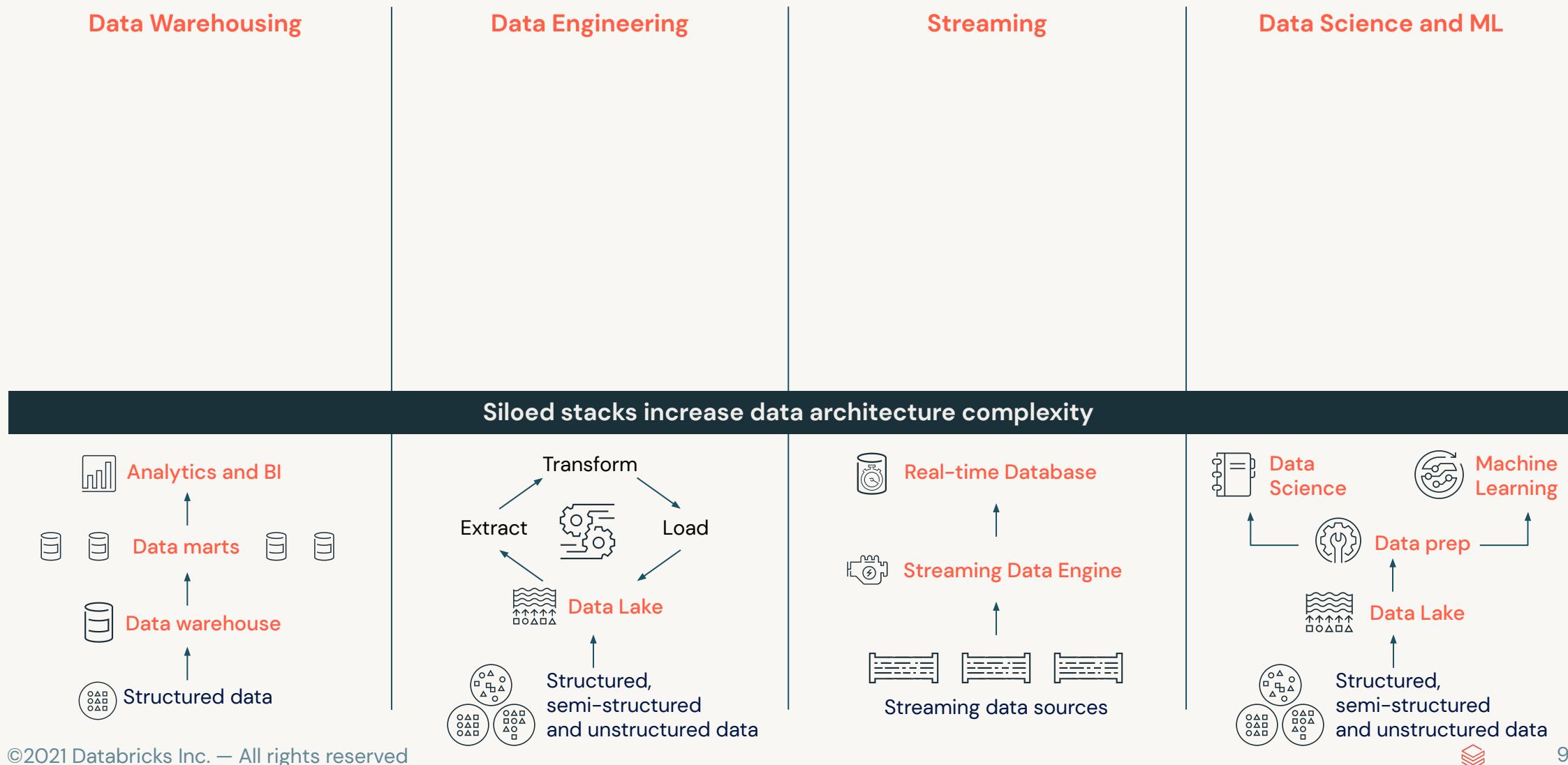
Energy & Utilities



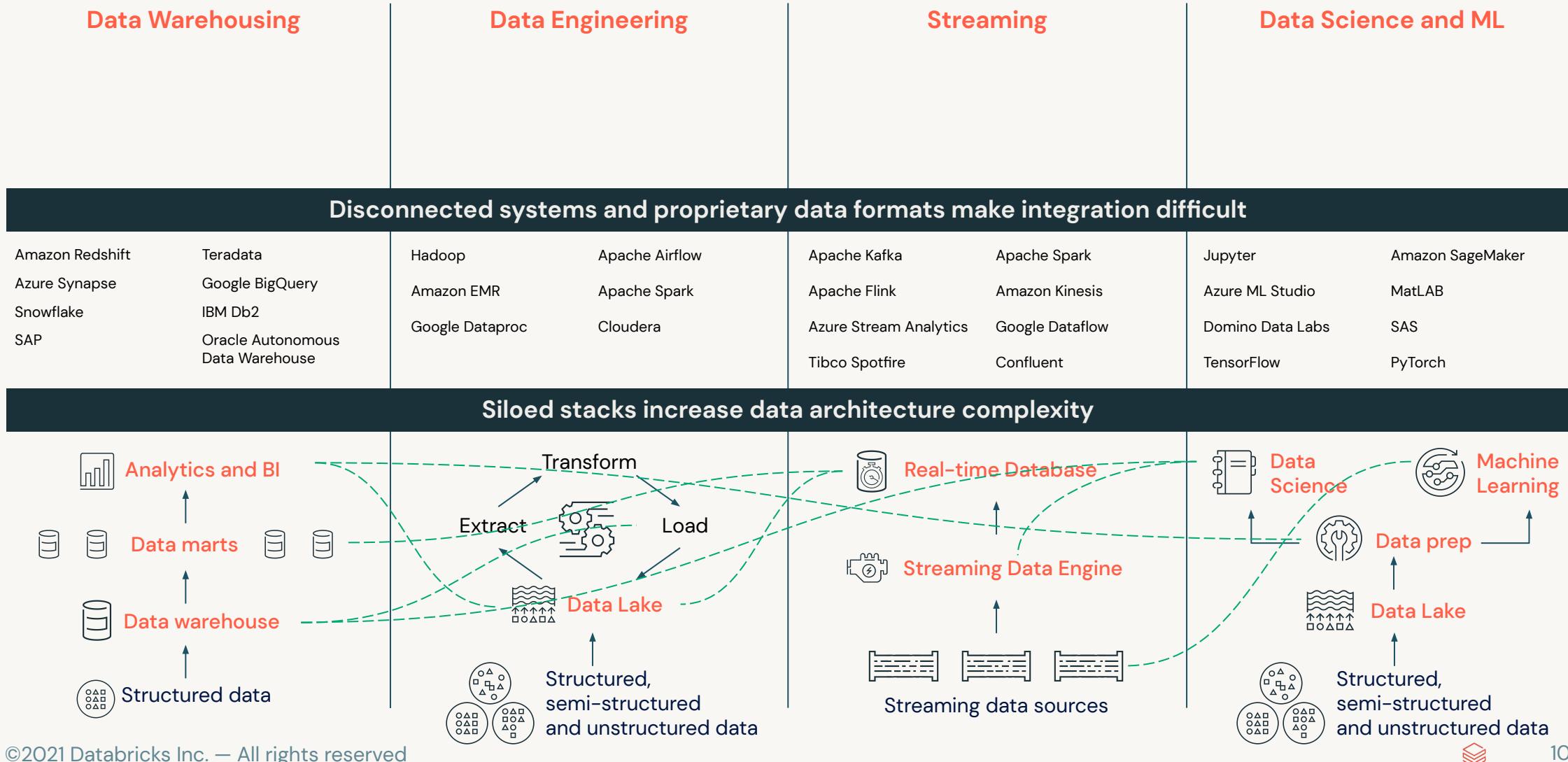
Digital Native



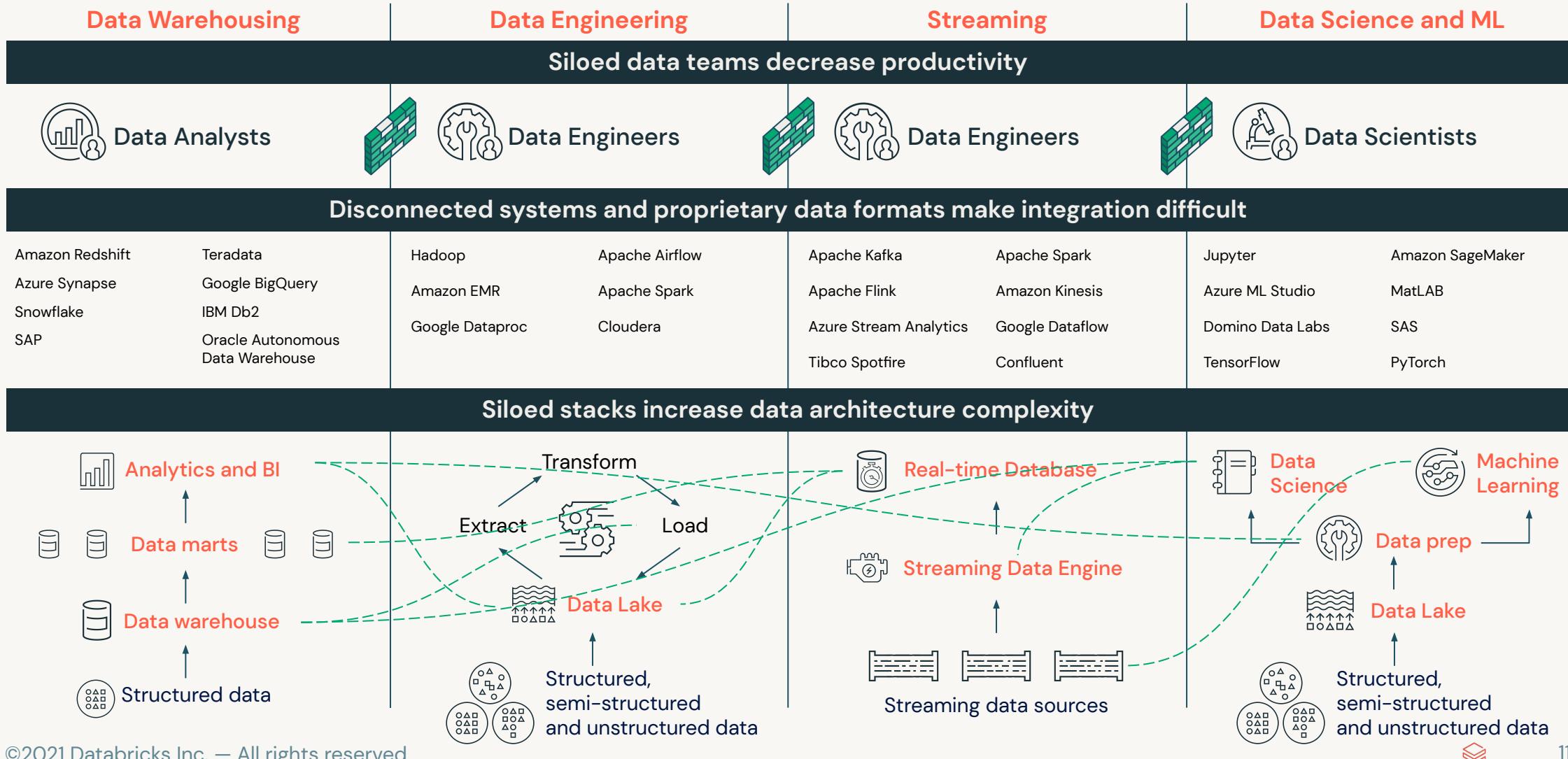
Most enterprises struggle with data



Most enterprises struggle with data



Most enterprises struggle with data





Data
Lake

Lakehouse

One platform to unify all of
your data, analytics, and AI
workloads



Data
Warehouse



Data Lake



DELTA LAKE

An open approach to bringing
data management and
governance to data lakes

Better reliability with transactions

48x faster data processing with indexing

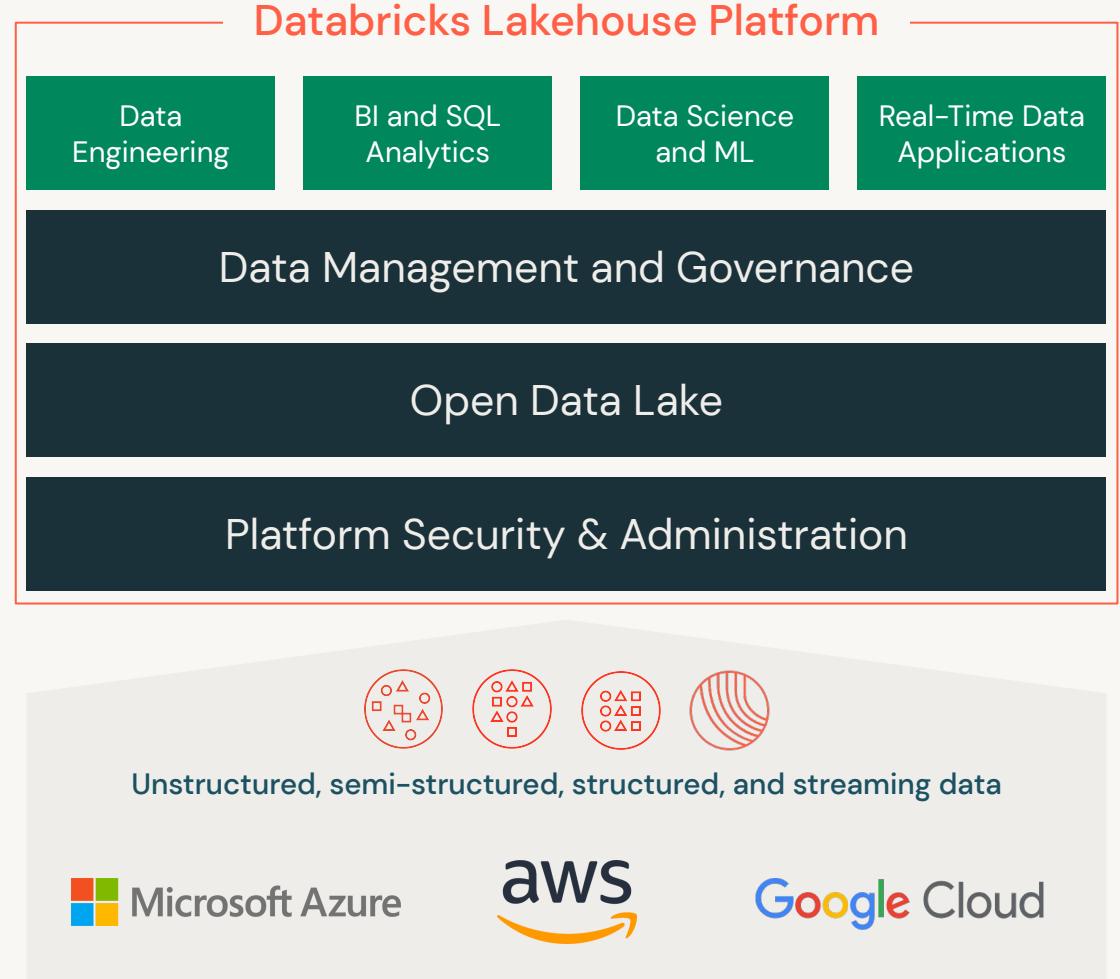
Data governance at scale with
fine-grained access control lists



Data Warehouse

The Databricks Lakehouse Platform

-  Simple
-  Open
-  Collaborative



The Databricks Lakehouse Platform



Simple

Unify your data, analytics, and AI on one common platform for all data use cases

Databricks Lakehouse Platform

Data Engineering

BI and SQL Analytics

Data Science and ML

Real-Time Data Applications

Data Management and Governance

Open Data Lake

Platform Security & Administration



Unstructured, semi-structured, structured, and streaming data

 Microsoft Azure

 aws

 Google Cloud

The Databricks Lakehouse Platform



Open

Unify your data ecosystem with open source standards and formats.

Built on the innovation of some of the most successful open source data projects in the world

30 Million+
Monthly downloads



The Databricks Lakehouse Platform



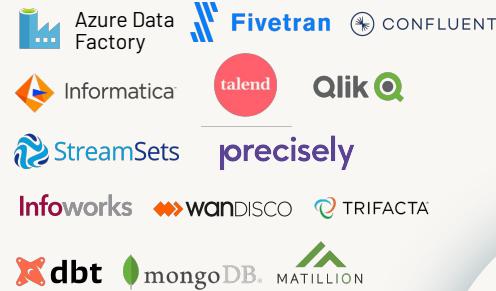
Open

Unify your data ecosystem
with open source standards
and formats.

450+

Partners across the
data landscape

Visual ETL & Data Ingestion



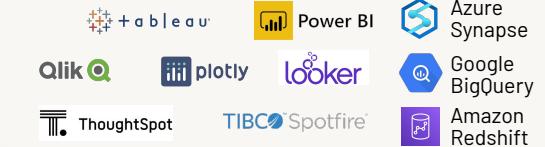
Data Providers



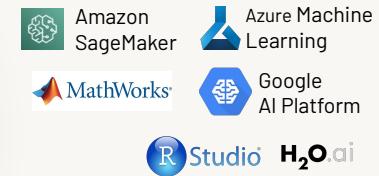
Top Consulting & SI Partners



Business Intelligence



Machine Learning



Centralized Governance

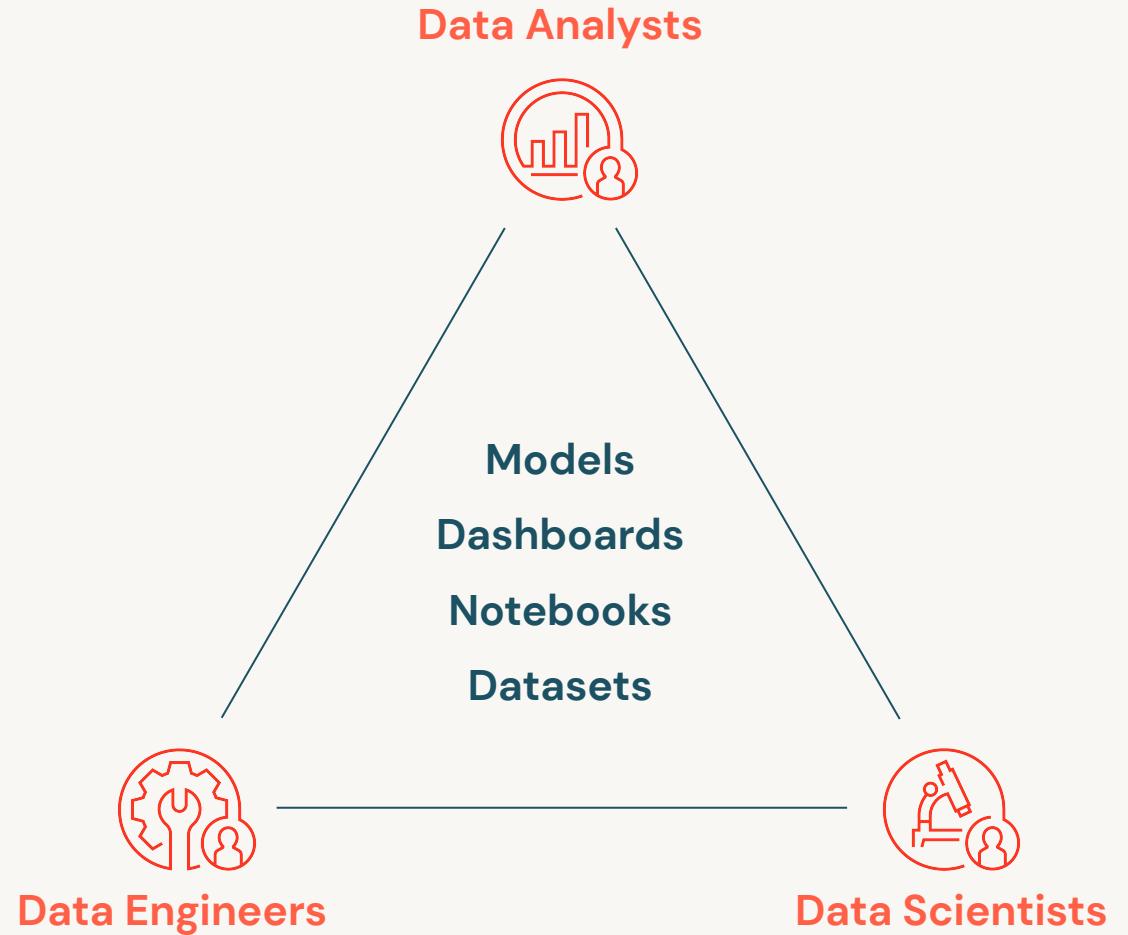


The Databricks Lakehouse Platform



Collaborative

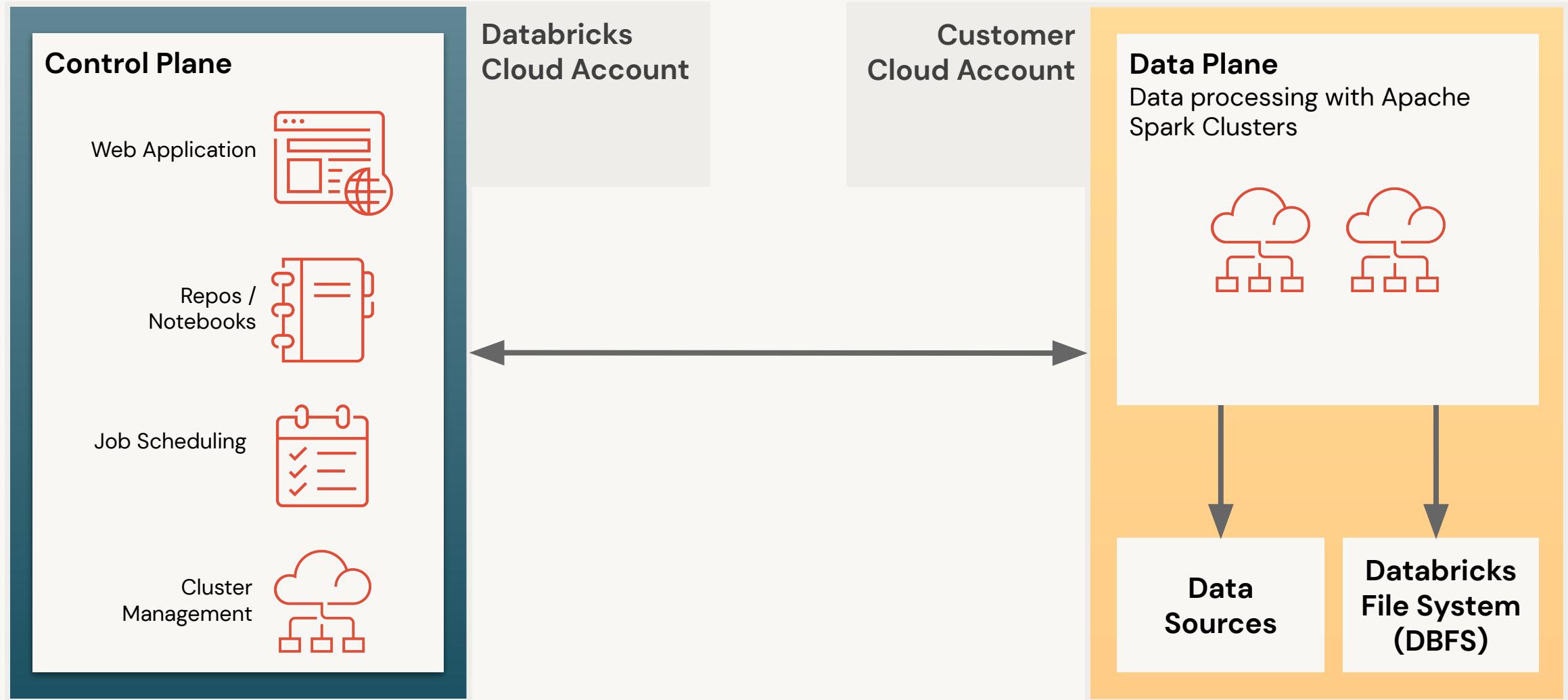
Unify your data teams to collaborate across the entire data and AI workflow





Databricks Architecture and Services

Databricks Architecture



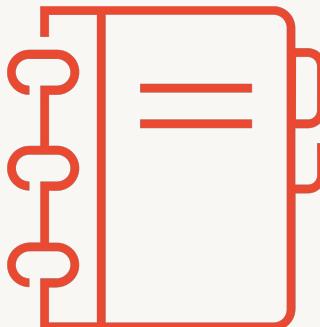
Databricks Services

Control Plane in Databricks

Manage customer accounts, datasets, and clusters



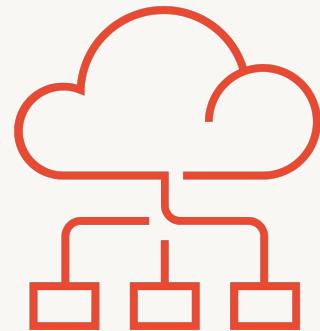
Databricks Web
Application



Repos /
Notebooks

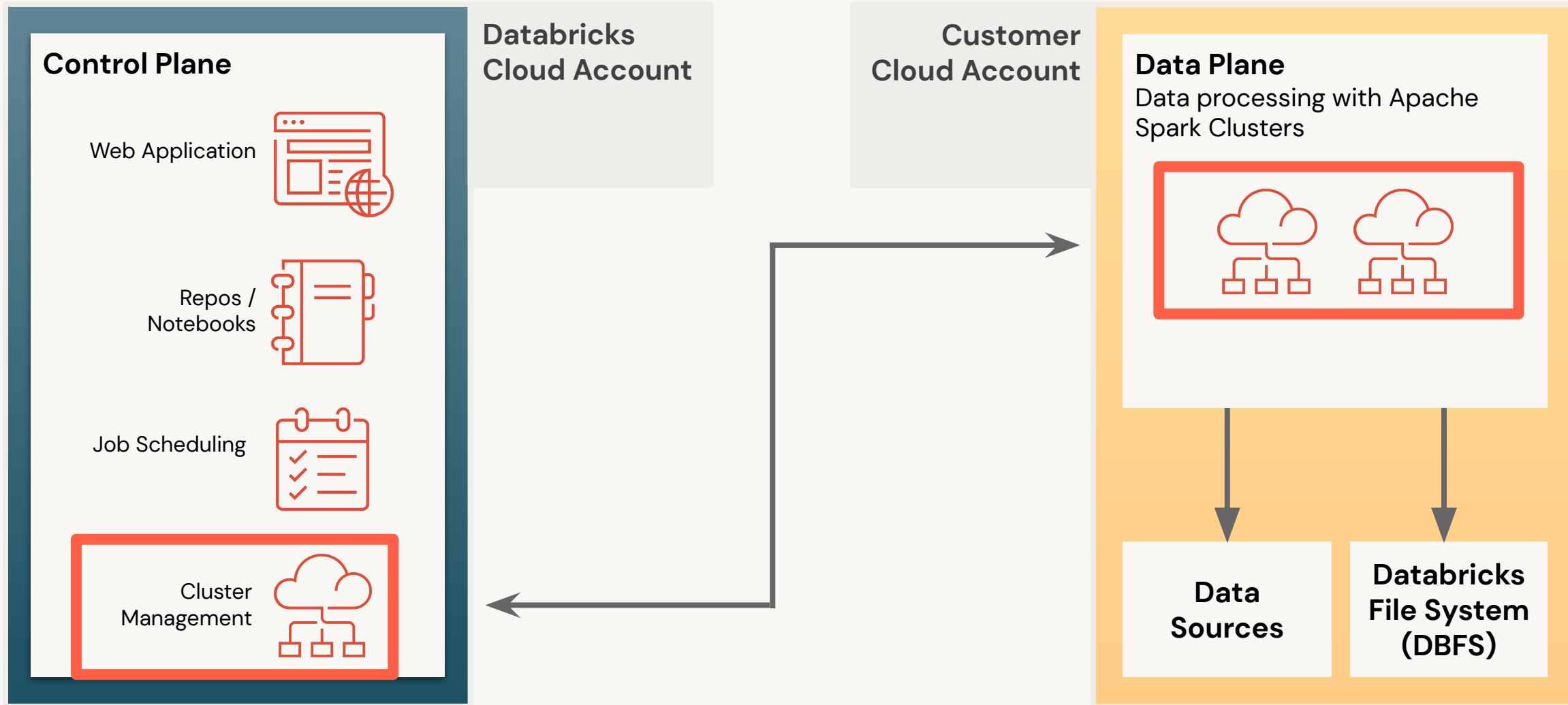


Jobs



Cluster
Management

Clusters



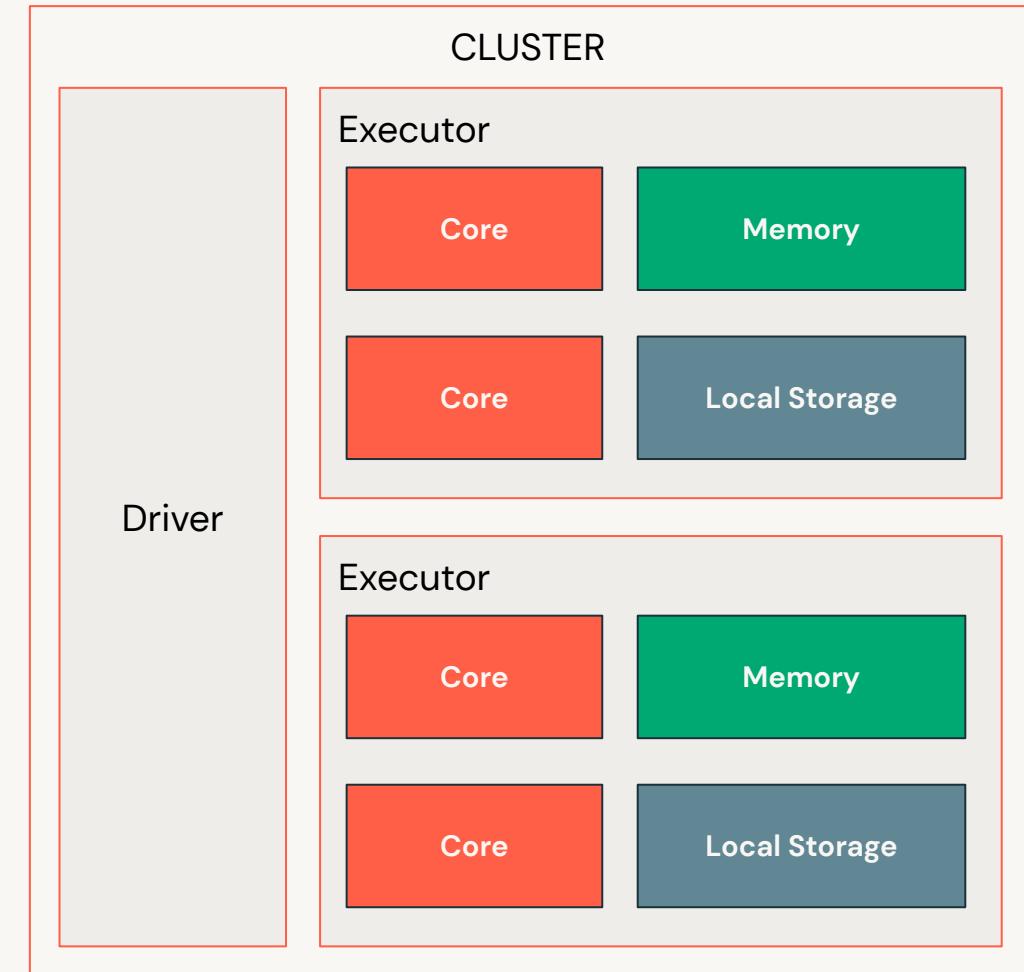
Clusters

Overview

Clusters are made up of one or more virtual machine (VM) instances

Driver coordinates activities of executors

Executors run tasks composing a Spark job



Clusters

Types

All-purpose Clusters

Analyze data collaboratively using interactive notebooks

Create clusters from the Workspace or API

Retains up to 70 clusters for up to 30 days.

Job Clusters

Run automated jobs

The Databricks job scheduler creates job clusters when running jobs.

Retains up to 30 clusters.



Git Versioning with Databricks Repos

Databricks Repos

Overview

Git Versioning

Native integration with Github, Gitlab, Bitbucket and Azure Devops

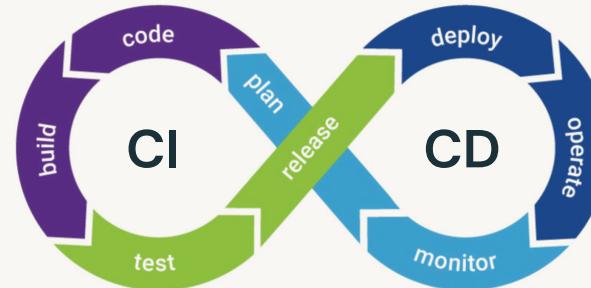
UI-based workflows



CI/CD Integration

API surface to integrate with automation

Simplifies the dev/staging/prod multi-workspace story



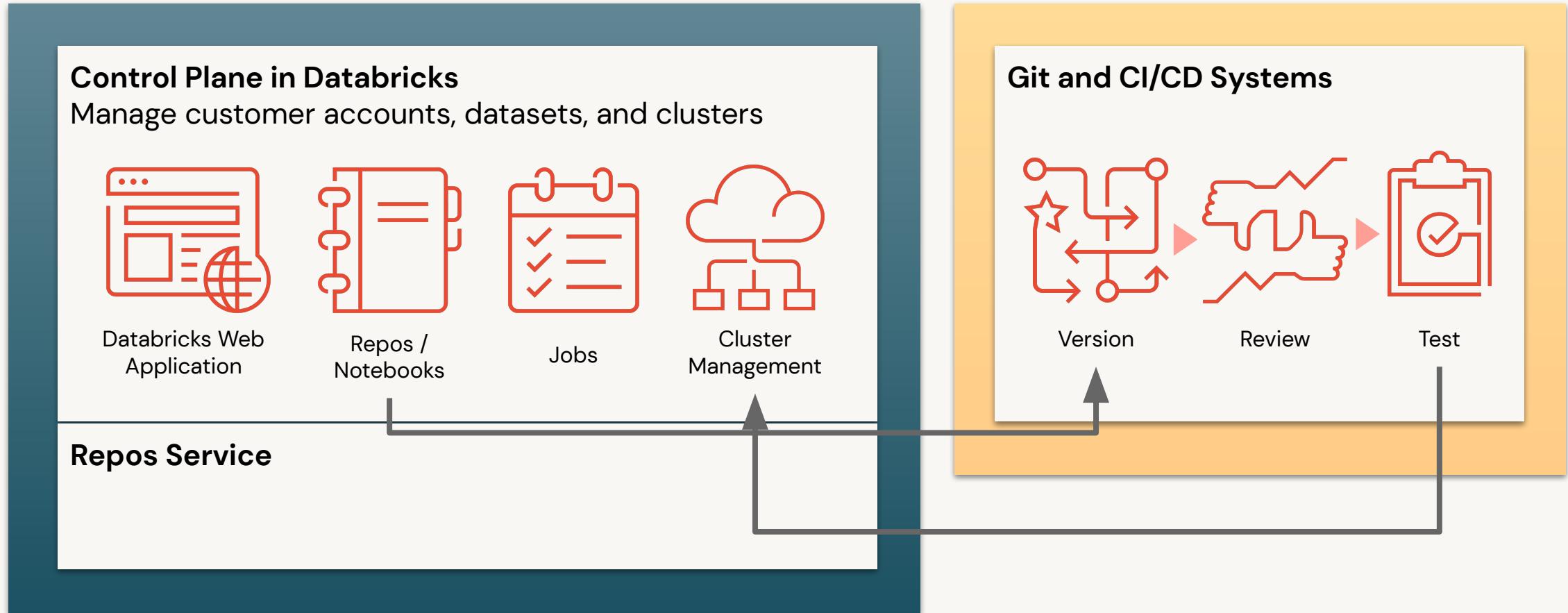
Enterprise ready

Allow lists to avoid exfiltration

Secret detection to avoid leaking keys

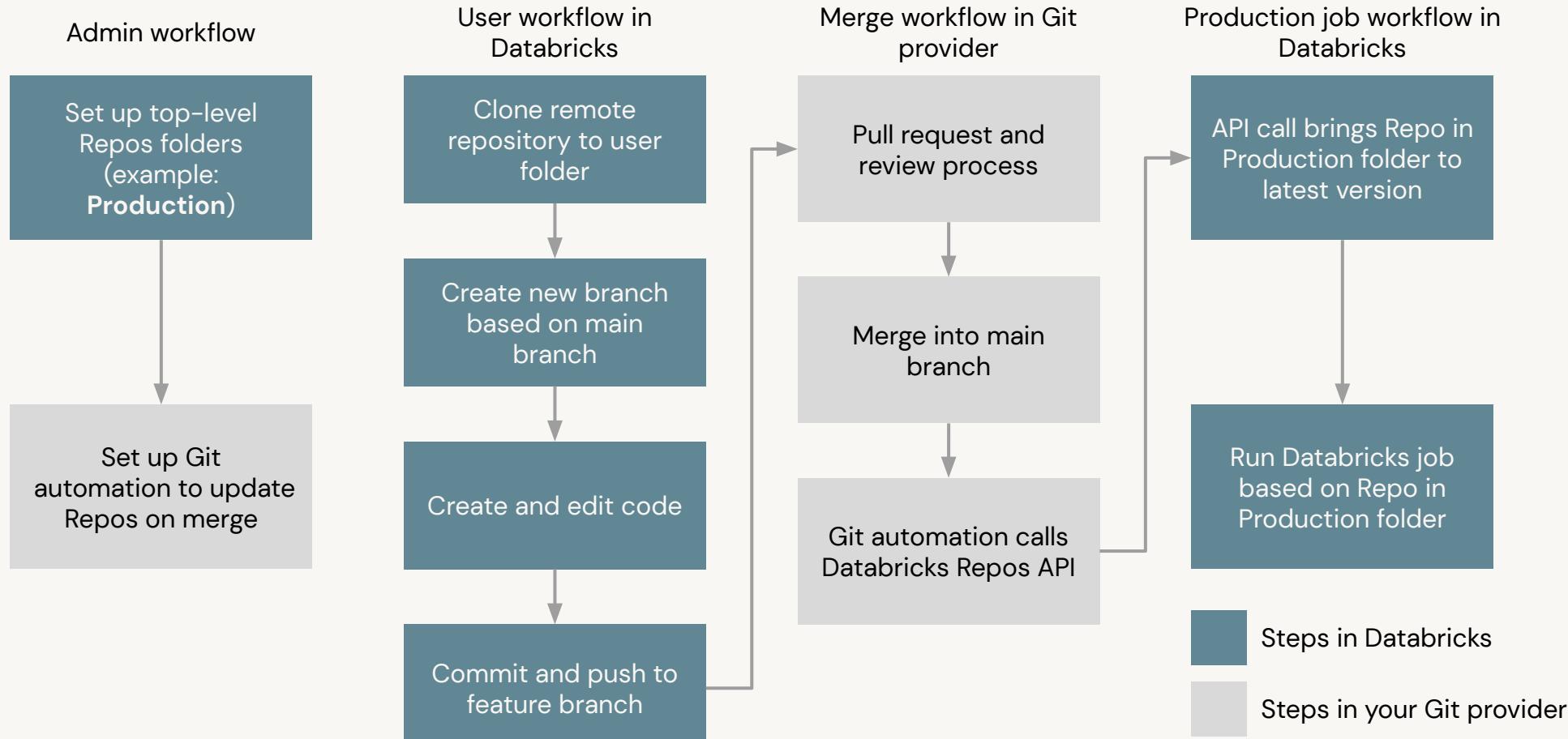
Databricks Repos

CI/CD Integration



Databricks Repos

Best practices for CI/CD workflows



What is
Delta Lake?



**Delta Lake is an open-source
project that enables building a
data lakehouse on top of
existing storage systems**

Delta Lake Is Not...

- Proprietary technology
- Storage format
- Storage medium
- Database service or data warehouse

Delta Lake Is...

- Open source
- Builds upon standard data formats
- Optimized for cloud object storage
- Built for scalable metadata handling

Delta Lake brings ACID to object storage

- Atomicity
- Consistency
- Isolation
- Durability



Problems solved by ACID

1. Hard to append data
2. Modification of existing data difficult
3. Jobs failing mid way
4. Real-time operations hard
5. Costly to keep historical data versions



**Delta Lake is the default for all
tables created in Databricks**



ETL with Spark SQL and Python



ETL With Spark SQL and Python

Learning Objectives

- Leverage Spark SQL DDL to create and manipulate relational entities on Databricks
- Use Spark SQL to extract, transform, and load data to support production workloads and analytics in the Lakehouse
- Leverage Python for advanced code functionality needed in production applications

ETL With Spark SQL and Python

Agenda

- Working with Relational Entities on Databricks
 - Managing databases, tables, and views
- ETL with Spark SQL
 - Extracting data from external sources, loading and updating data in the lakehouse, and common transformations
- Just Enough Python for Spark SQL
 - Building extensible functions with Python-wrapped SQL



Incremental Data and Delta Live Tables



Incremental Data and Delta Live Tables

Learning Objectives

- Incrementally process data to power analytic insights with Spark Structured Streaming and Auto Loader
- Propagate new data through multiple tables in the data lakehouse
- Leverage Delta Live Tables to simplify productionalizing SQL data pipelines with Databricks

Incremental Data and Delta Live Tables

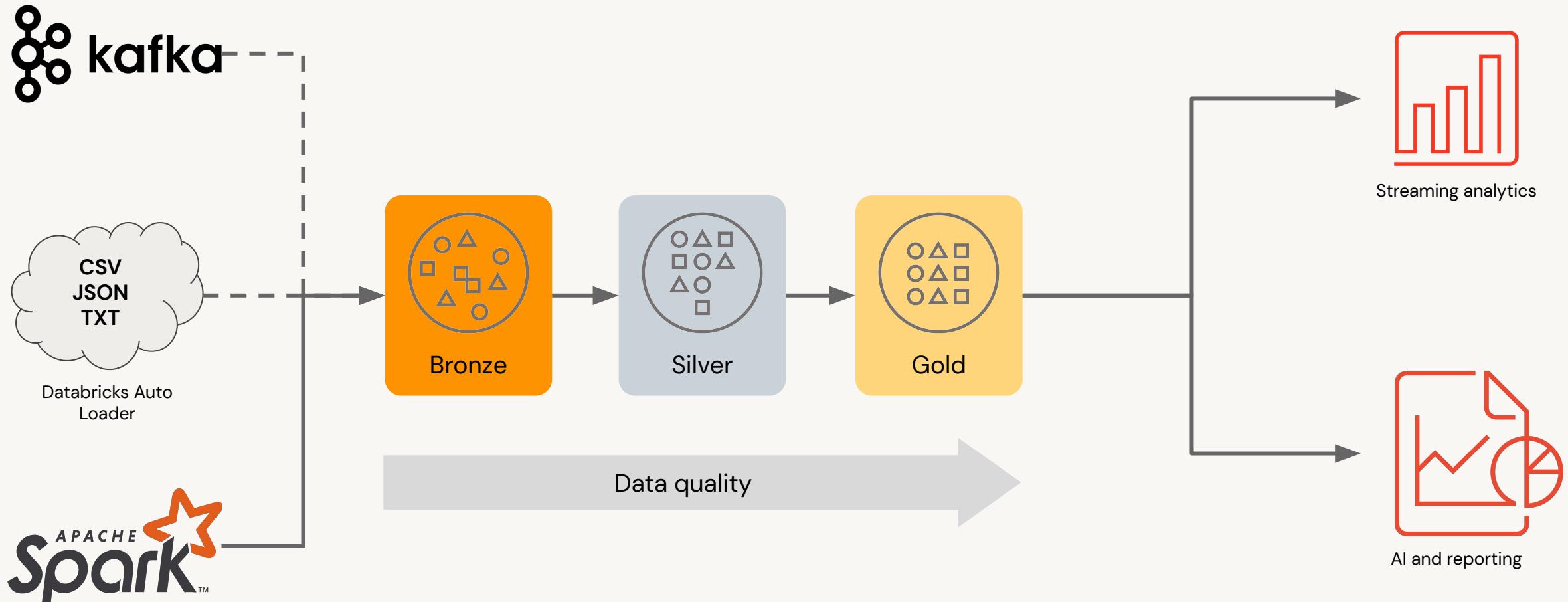
Agenda

- Incremental Data Processing with Structured Streaming and Auto Loader
 - Processing and aggregating data incrementally in near real time
- Multi-hop in the Lakehouse
 - Propagating changes through a series of tables to drive production systems
- Using Delta Live Tables
 - Simplifying deployment of production pipelines and infrastructure using SQL



Multi-hop Architecture

Multi-Hop in the Lakehouse



Multi-Hop in the Lakehouse

Bronze Layer

Typically just a raw copy of ingested data

Replaces traditional data lake

Provides efficient storage and querying of full, unprocessed history of data



Multi-Hop in the Lakehouse

Silver Layer

Reduces data storage complexity, latency, and redundancy

Optimizes ETL throughput and analytic query performance

Preserves grain of original data (without aggregations)

Eliminates duplicate records

Production schema enforced

Data quality checks, corrupt data quarantined



Multi-Hop in the Lakehouse

Gold Layer

Powers ML applications, reporting, dashboards, ad hoc analytics

Refined views of data, typically with aggregations

Reduces strain on production systems

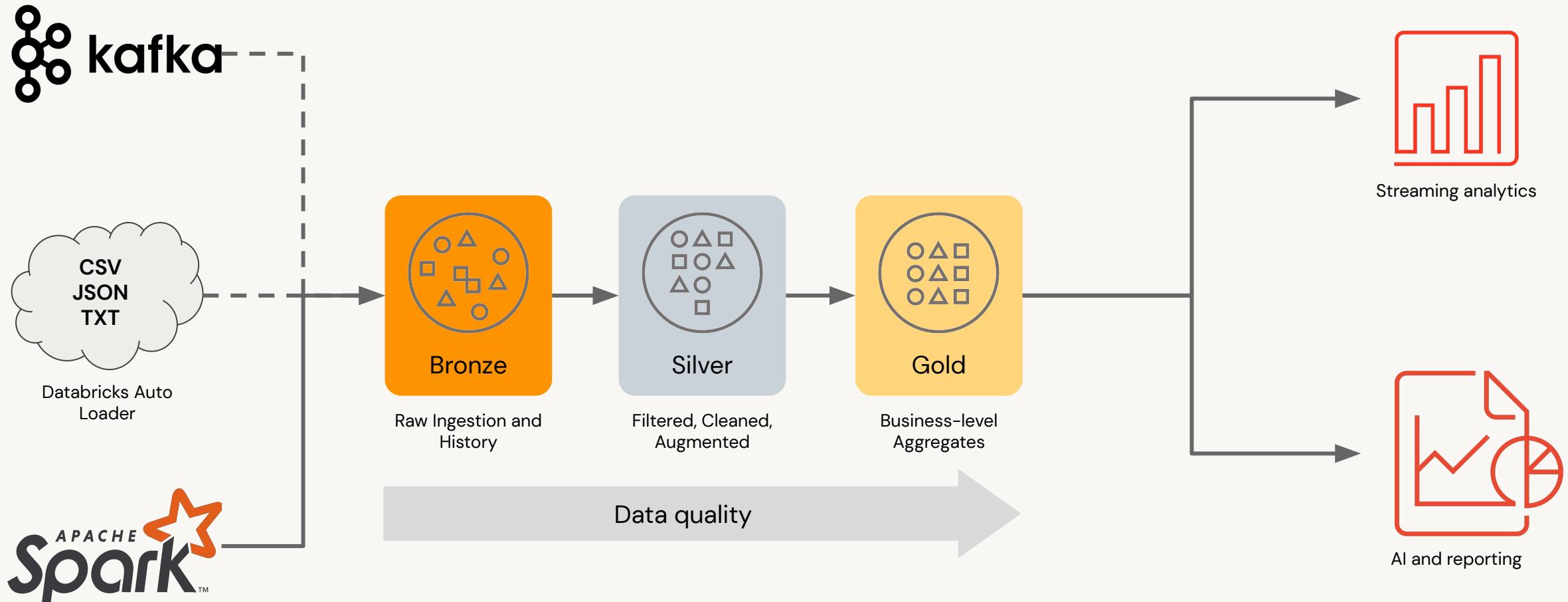
Optimizes query performance for business-critical data



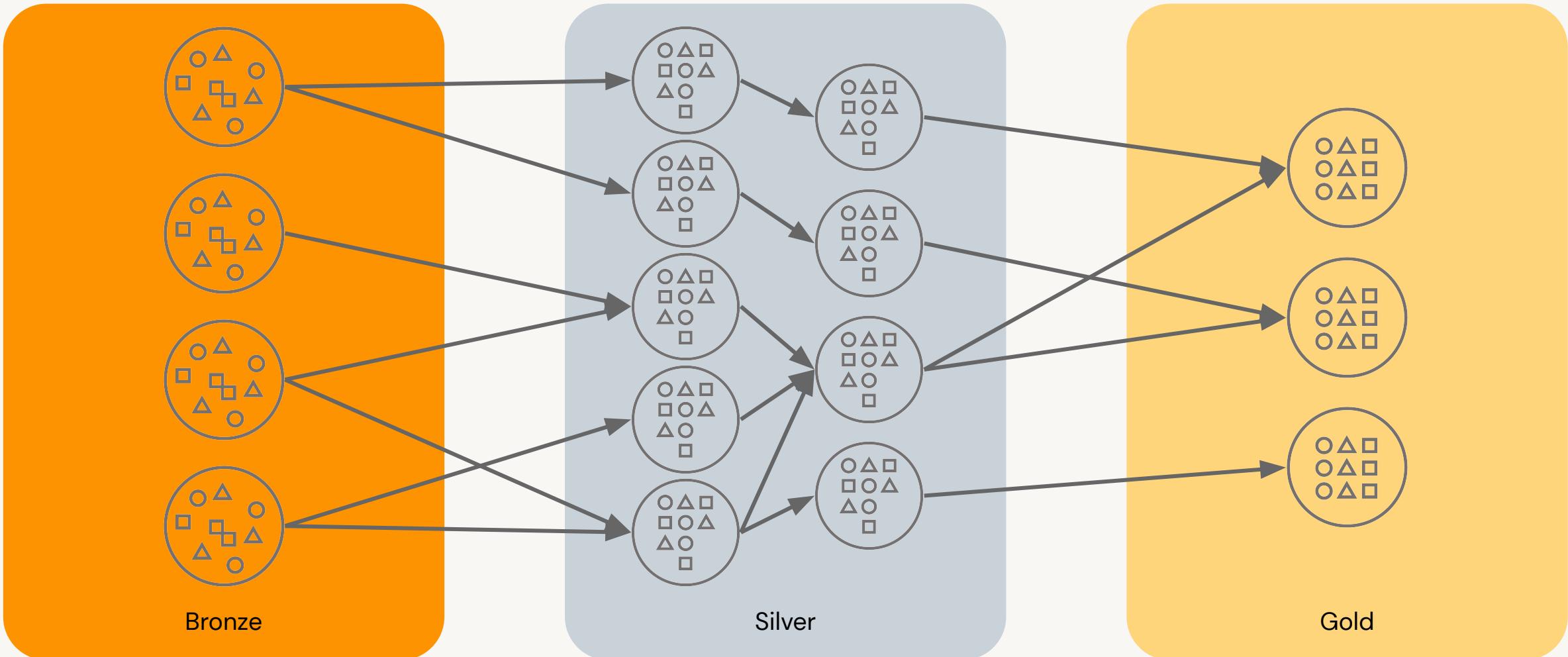


Introducing Delta Live Tables

Multi-Hop in the Lakehouse



The Reality is Not so Simple



Large scale ETL is complex and brittle

Complex pipeline development

Hard to build and maintain table dependencies

Difficult to switch between **batch** and **stream** processing

Data quality and governance

Difficult to monitor and enforce **data quality**

Impossible to trace data **lineage**

Difficult pipeline operations

Poor **observability** at granular, data level

Error handling and **recovery** is laborious

Introducing Delta Live Tables

Make reliable ETL easy on Delta Lake

Operate with agility

Declarative tools to build batch and streaming data pipelines



Trust your data

DLT has built-in declarative quality controls

Declare quality expectations and actions to take



Scale with reliability

Easily scale infrastructure alongside your data





Managing Data Access and Production Pipelines



Managing Data Access and Production Pipelines

Learning Objectives

- Orchestrate tasks with Databricks Jobs
- Use Databricks SQL for on-demand queries
- Configure Databricks Access Control Lists to provide groups with secure access to production and development databases
- Configure and schedule dashboards and alerts to reflect updates to production data pipelines

Managing Data Access and Production Pipelines

Agenda

- Task Orchestration with Databricks Jobs
 - Scheduling notebooks and DLT pipelines with dependencies
- Running Your First Databricks SQL Query
 - Navigating, configuring, and executing queries in Databricks SQL
- Managing Permissions in the Lakehouse
 - Configuring permissions for databases, tables, and views in the data lakehouse
- Productionalizing Dashboards and Queries in DBSQL
 - Scheduling queries, dashboards, and alerts for end-to-end analytic pipelines



Introducing Unity Catalog

Data Governance Overview

Four key functional areas

Data Access Control

Control who has access to which data

Data Access Audit

Capture and record all access to data

Data Lineage

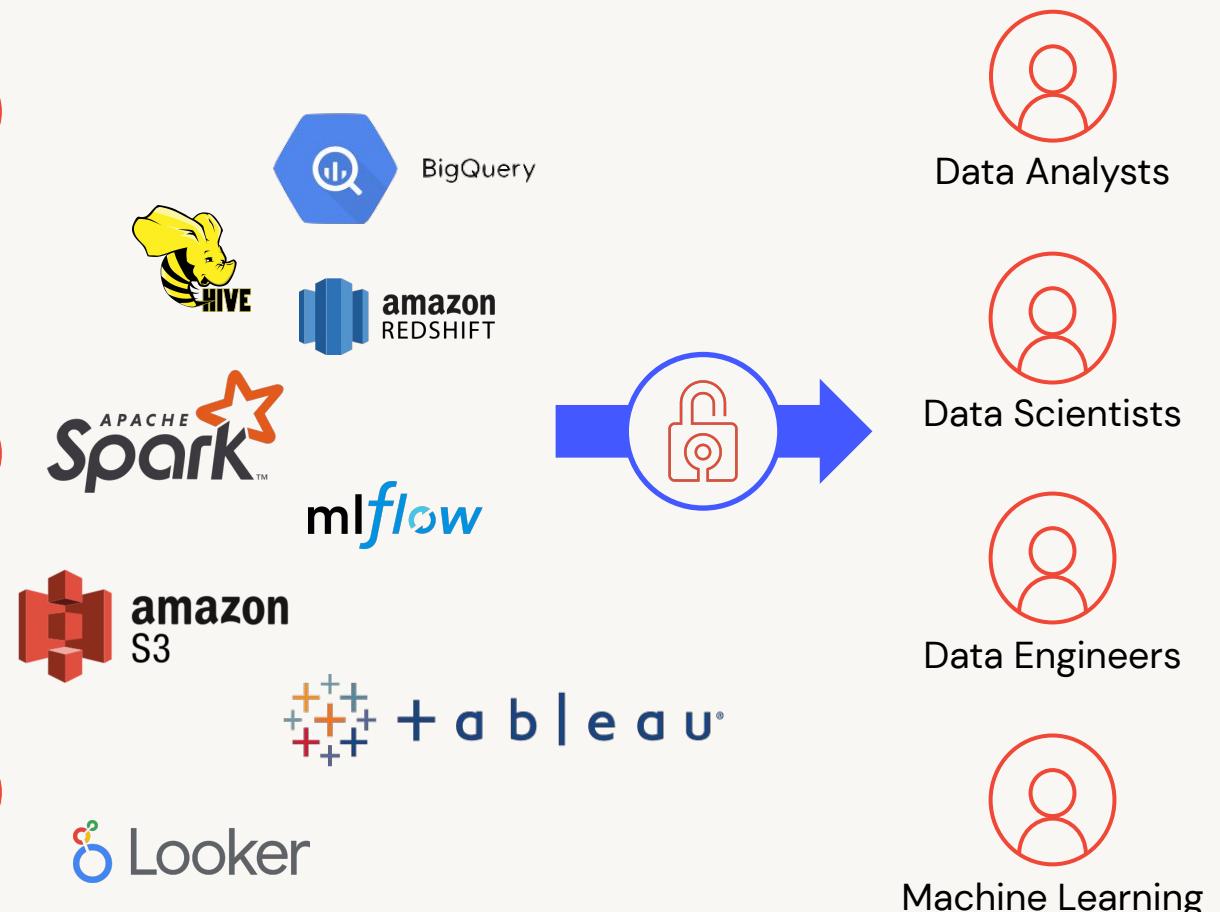
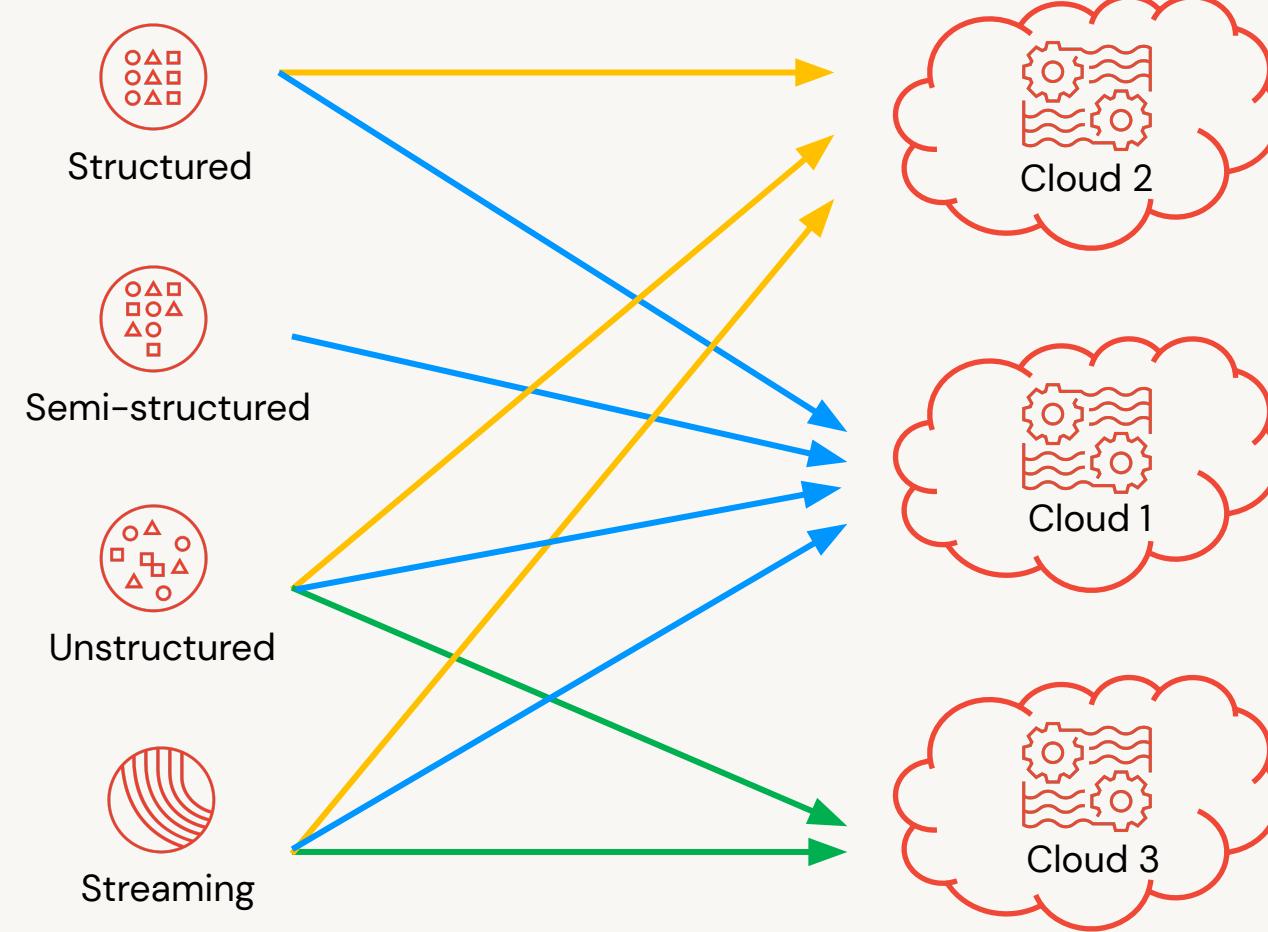
Capture upstream sources and downstream consumers

Data Discovery

Ability to search for and discover authorized assets

Data Governance Overview

Challenges



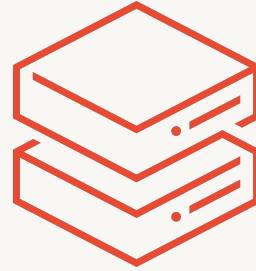
Databricks Unity Catalog

Overview



Unify governance across clouds

Fine-grained governance for data lakes across clouds – based on open standard ANSI SQL.



Unify data and AI assets

Centrally share, audit, secure and manage all data types with one simple interface.



Unify existing catalogs

Works in concert with existing data, storage, and catalogs – no hard migration required.

Databricks Unity Catalog

Three-layer namespace

Traditional two-layer namespace



```
SELECT * FROM schema.table
```

Three-layer namespace with Unity Catalog

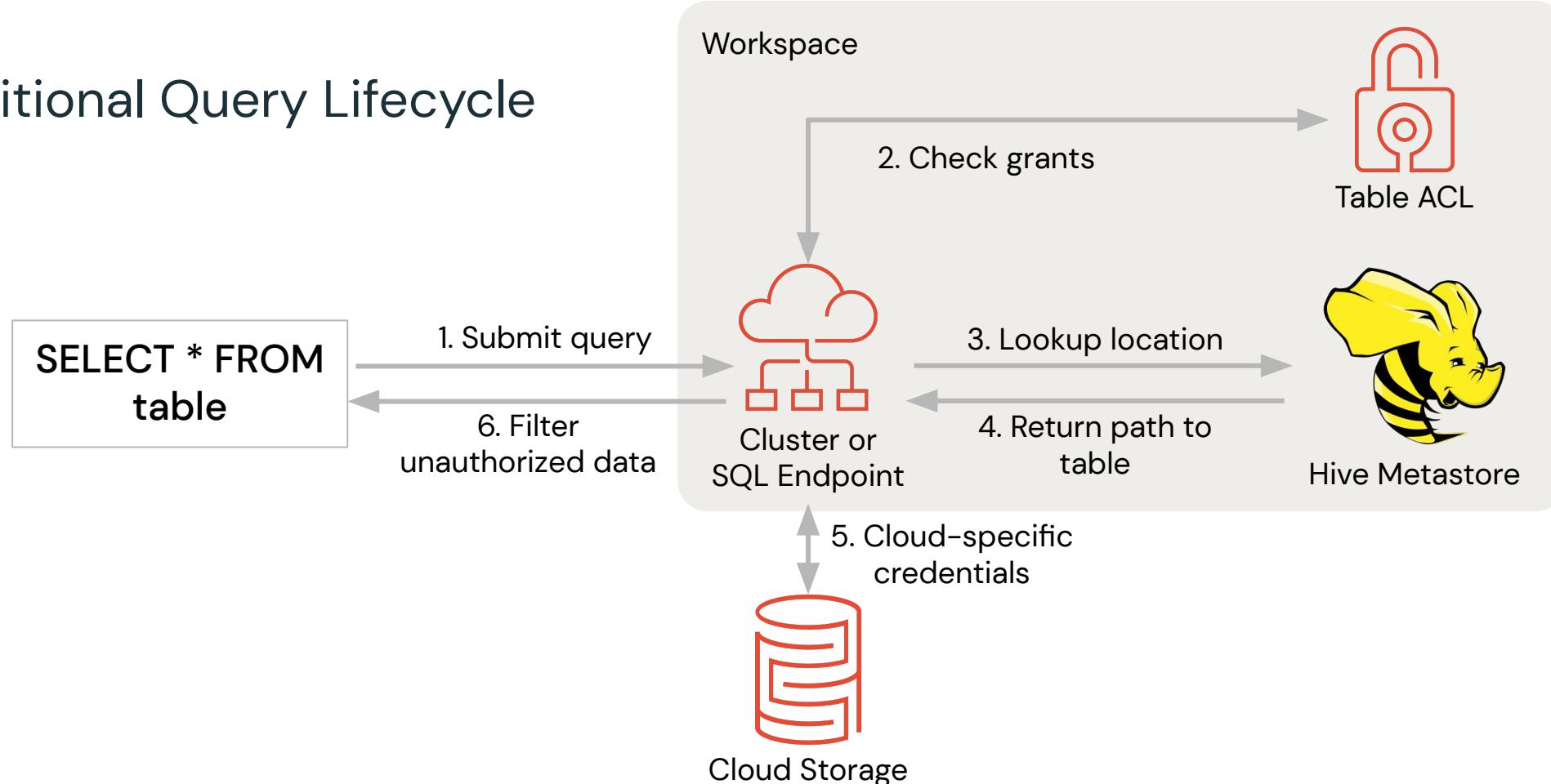


```
SELECT * FROM catalog.schema.table
```

Databricks Unity Catalog

Security Model

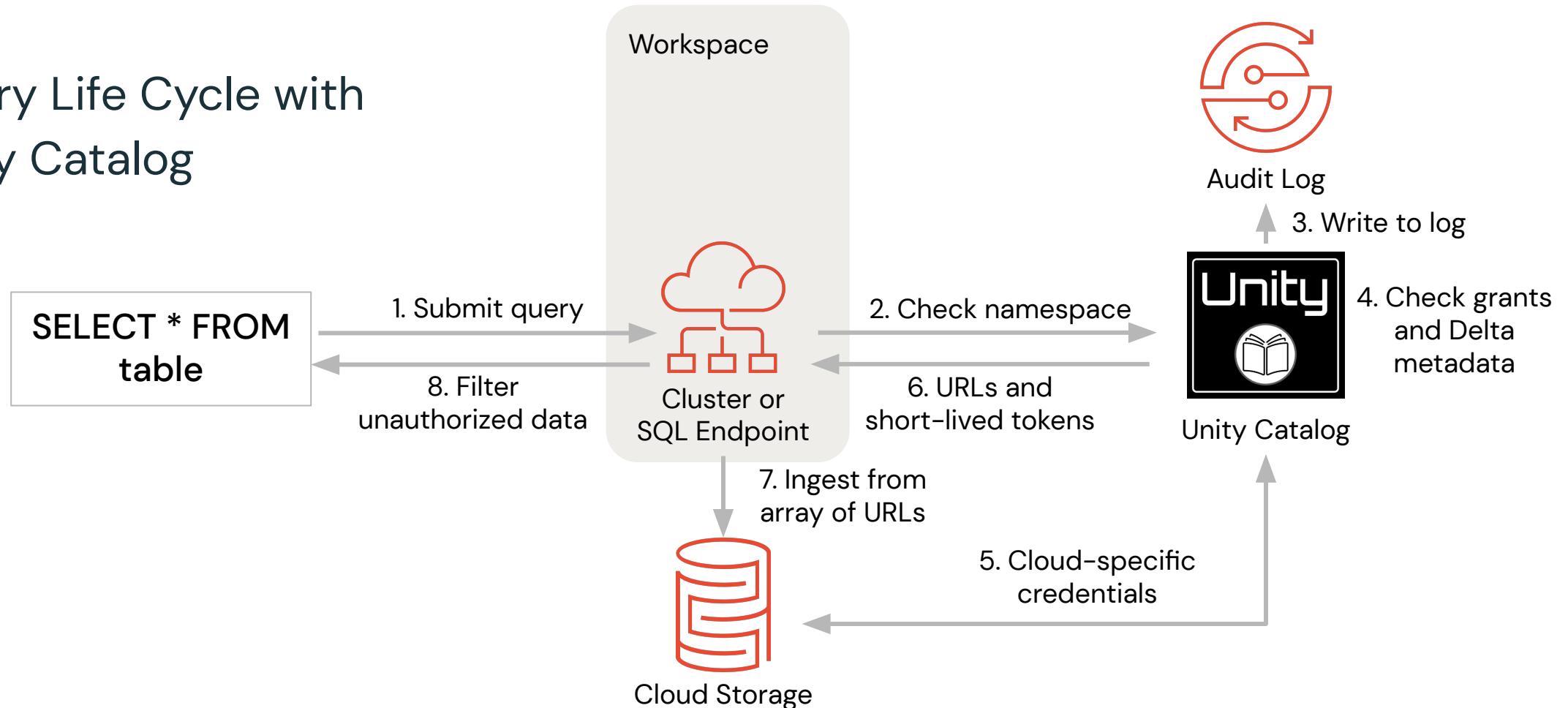
Traditional Query Lifecycle



Databricks Unity Catalog

Security Model

Query Life Cycle with Unity Catalog





Course Recap

Course Objectives

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