databricks

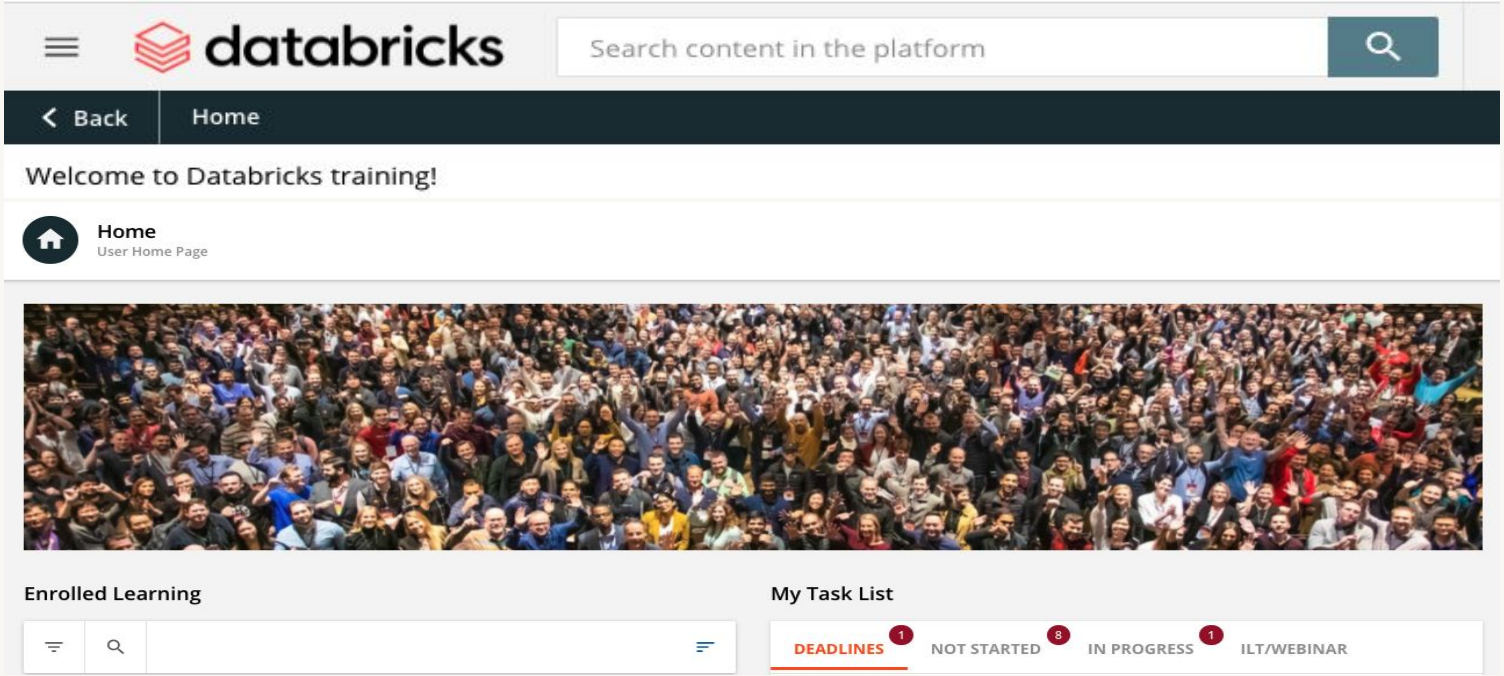
Introduction to Databricks

Bring reliability, performance, and security to your data lake

October 2022

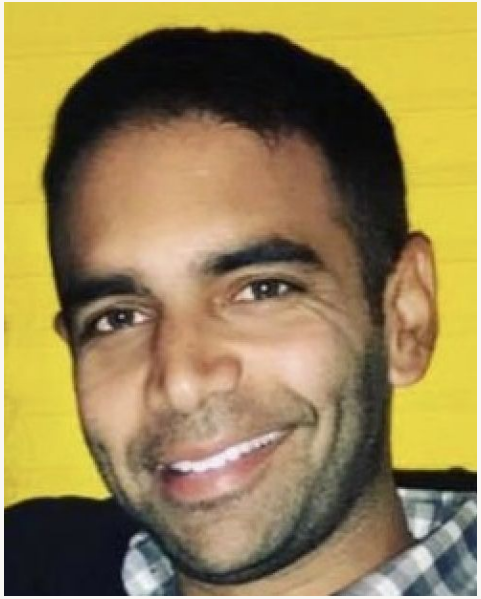
Continue learning on Databricks Academy

New link: Databricks Academy and check our full list of courses



About Me

Jai Karve, Solutions Architect, Databricks



- Native Houstonian
- Shellfish enthusiast
- Likes to experiment with facial hair
- New Dad

Presentation Overview

What we'll cover

- Introduction to the Lakehouse
- Integration with BI Tools
- Delta Live Tables
- Performance Optimizations
- How Oxy Currently Uses Databricks

Hands on Overview

What we'll do

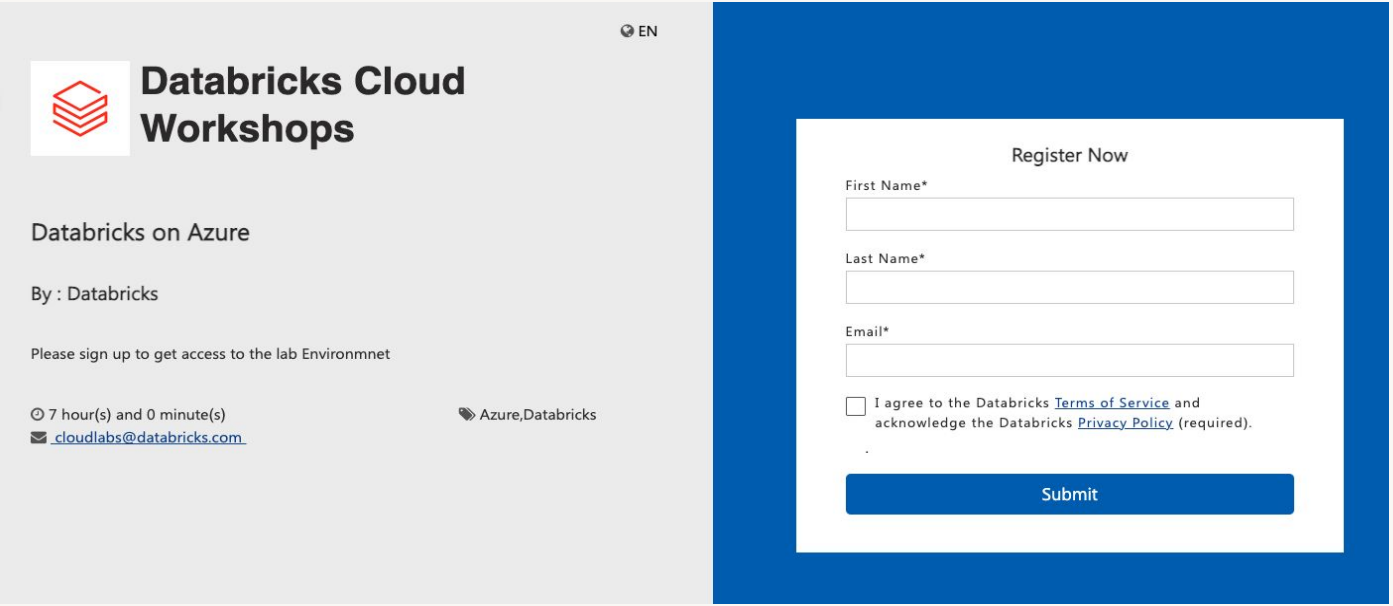
- Dataframes
- Data Persistence
- Data Ingestion
- Schema Enforcement/Evolution
- Performance Optimizations

Let’s get you set up

Step 1: Workspace Registration

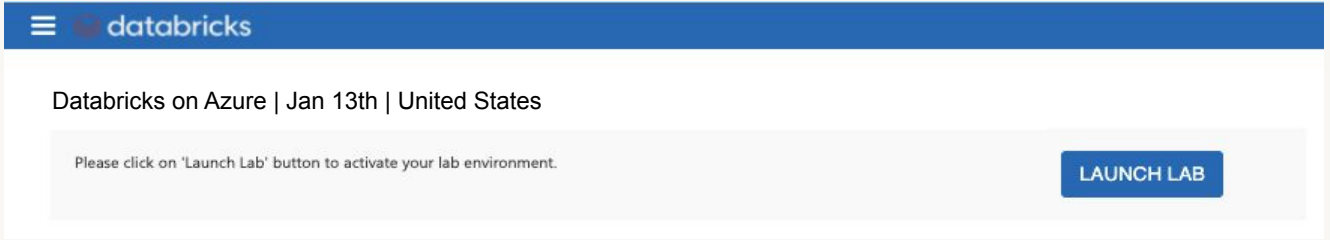
The temporary workspace you'll be using in today's workshop is administered by a third party vendor.

Complete this short registration form for the hands-on portion of the workshop.



Step 2: Launching the workspace

Click “Launch Lab” and allow 5-10 minutes for the environment to load.



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Delta Lake: The foundation of your lakehouse

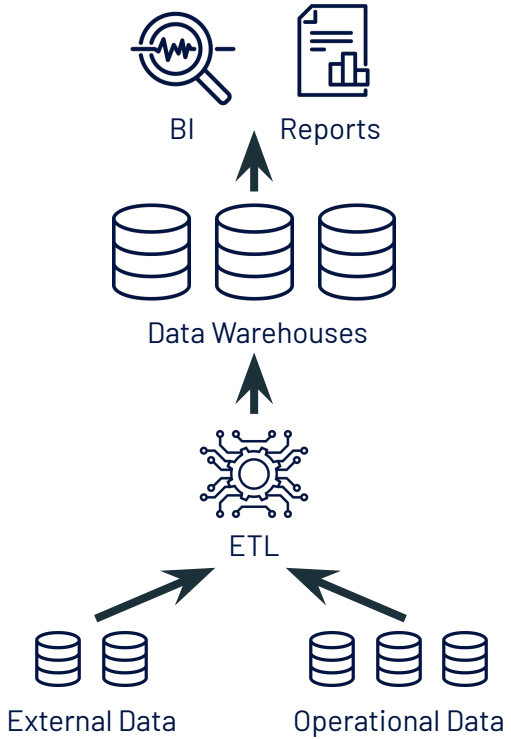
Bring reliability, performance, and security to your data lake

October 5, 2022

Data Warehouses
were purpose-built
for BI and reporting,
however...

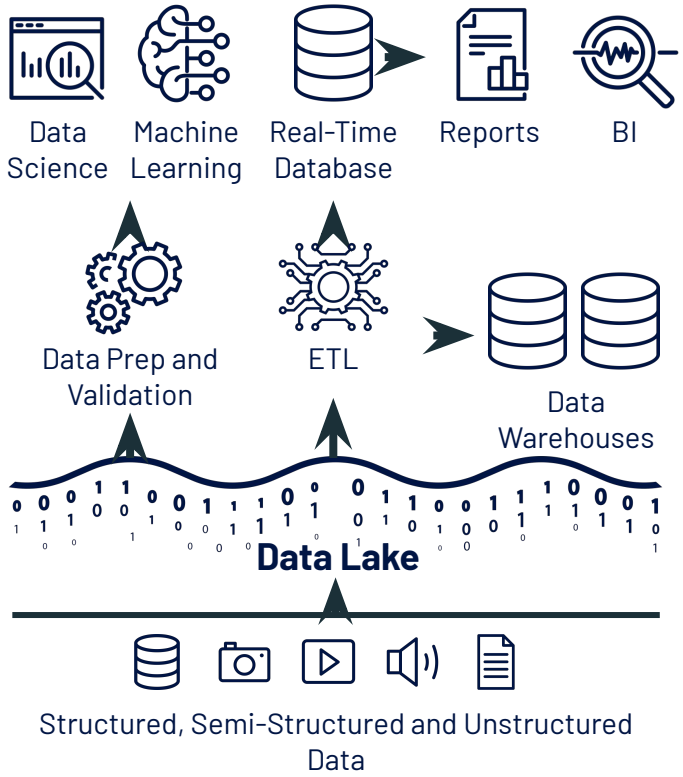
- No support for video, audio, text
- No support for data science, ML
- Limited support for streaming
- Closed & proprietary formats

Therefore, most data is stored in
data lakes & blob stores

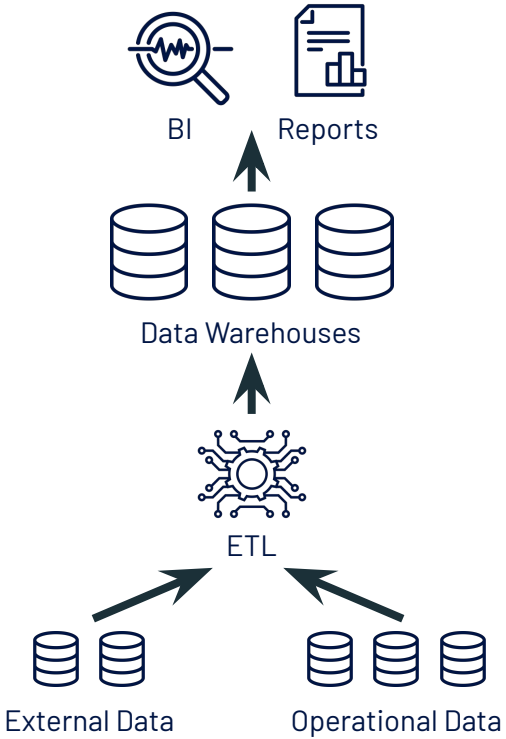


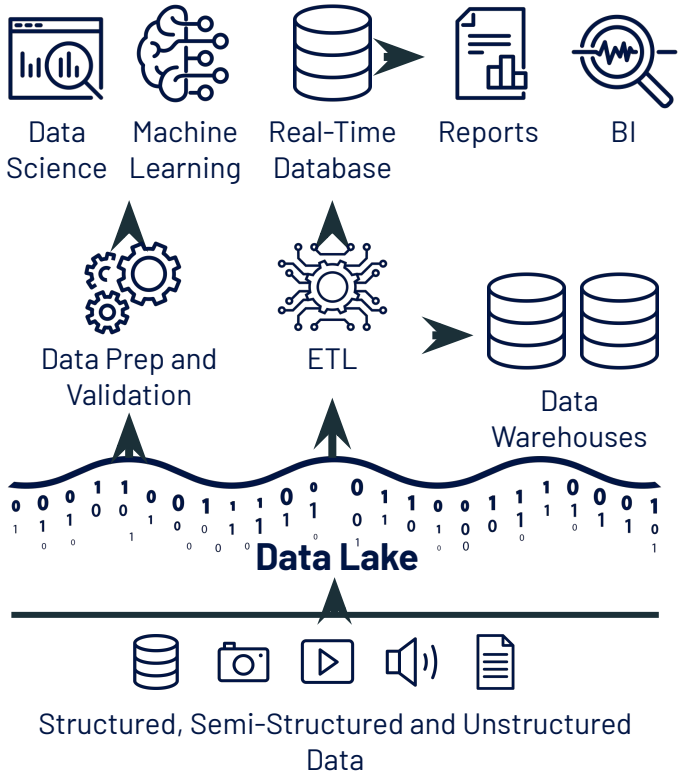
Data Lakes
could handle all your data for data science and ML, however...

- Poor BI support
- Complex to set up
- Poor performance
- Unreliable data swamps



How do we get the best of both worlds?





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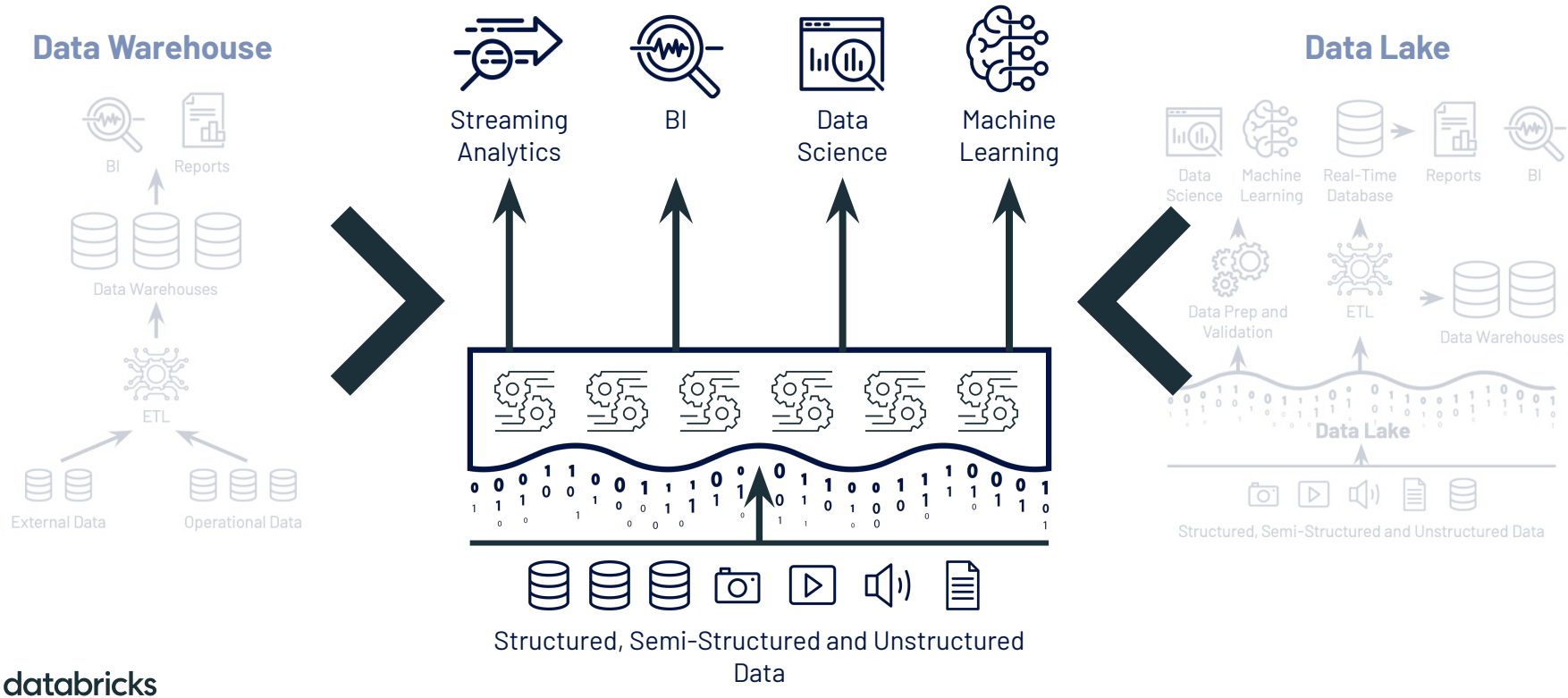
Lakehouse



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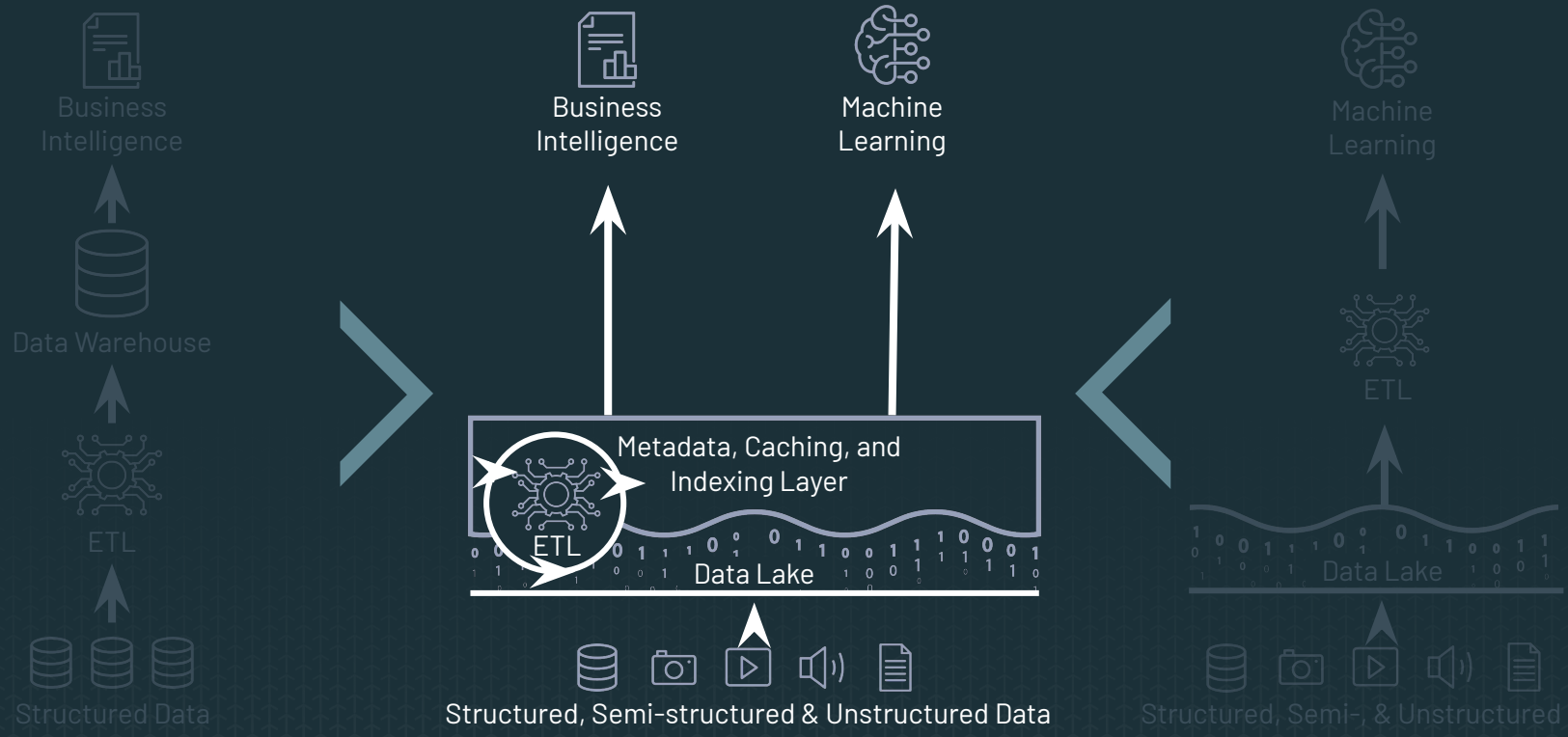
New Way Forward: lakehouse



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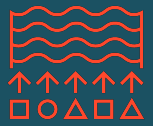
Data Lake



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

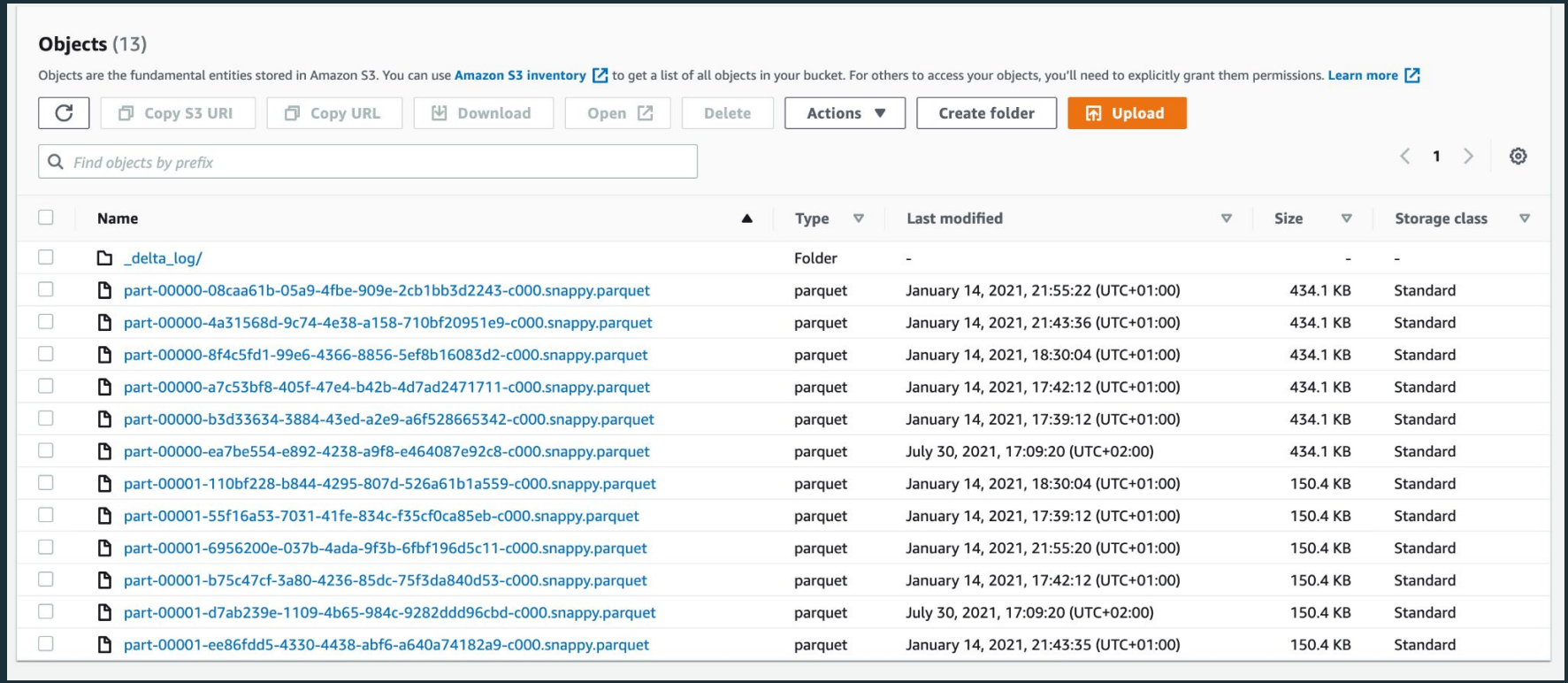
Innovations lay the foundation for Lakehouse Architecture

Delta Lake Innovations			Positive Business Impact
Reliability	---►	**ACID Transactions**	Quality data accelerates innovation
Performance	---►	**Indexing**	Lower TCO with a simple architecture
Governance	---►	**Table ACLs**	Automation increases productivity
Quality	---►	**Expectations**	Reduces security risk

Open

- Open Source
- Data is in your cloud store (It’s mostly parquet)
- No lock-in. Easy to convert to parquet in-place

Under the Covers - Mostly Parquet



Objects (13)

Objects are the fundamental entities stored in Amazon S3. You can use Amazon S3 inventory to get a list of all objects in your bucket. For others to access your objects, you'll need to explicitly grant them permissions. Learn more

Copy S3 URI | Copy URL | Download | Open | Delete | Actions | Create folder | Upload

Find objects by prefix

1

Name	Type	Last modified	Size	Storage class
_delta_log/	Folder	-	-	-
part-00000-08caa61b-05a9-4fbe-909e-2cb1bb3d2243-c000.snappy.parquet	parquet	January 14, 2021, 21:55:22 (UTC+01:00)	434.1 KB	Standard
part-00000-4a31568d-9c74-4e38-a158-710bf20951e9-c000.snappy.parquet	parquet	January 14, 2021, 21:43:36 (UTC+01:00)	434.1 KB	Standard
part-00000-8f4c5fd1-99e6-4366-8856-5ef8b16083d2-c000.snappy.parquet	parquet	January 14, 2021, 18:30:04 (UTC+01:00)	434.1 KB	Standard
part-00000-a7c53bf8-405f-47e4-b42b-4d7ad2471711-c000.snappy.parquet	parquet	January 14, 2021, 17:42:12 (UTC+01:00)	434.1 KB	Standard
part-00000-b3d33634-3884-43ed-a2e9-a6f528665342-c000.snappy.parquet	parquet	January 14, 2021, 17:39:12 (UTC+01:00)	434.1 KB	Standard
part-00000-ea7be554-e892-4238-a9f8-e464087e92c8-c000.snappy.parquet	parquet	July 30, 2021, 17:09:20 (UTC+02:00)	434.1 KB	Standard
part-00001-110bf228-b844-4295-807d-526a61b1a559-c000.snappy.parquet	parquet	January 14, 2021, 18:30:04 (UTC+01:00)	150.4 KB	Standard
part-00001-55f16a53-7031-41fe-834c-f35cf0ca85eb-c000.snappy.parquet	parquet	January 14, 2021, 17:39:12 (UTC+01:00)	150.4 KB	Standard
part-00001-6956200e-037b-4ada-9f3b-6fbf196d5c11-c000.snappy.parquet	parquet	January 14, 2021, 21:55:20 (UTC+01:00)	150.4 KB	Standard
part-00001-b75c47cf-3a80-4236-85dc-75f3da840d53-c000.snappy.parquet	parquet	January 14, 2021, 17:42:12 (UTC+01:00)	150.4 KB	Standard
part-00001-d7ab239e-1109-4b65-984c-9282ddd96cbd-c000.snappy.parquet	parquet	July 30, 2021, 17:09:20 (UTC+02:00)	150.4 KB	Standard
part-00001-ee86fdd5-4330-4438-abf6-a640a74182a9-c000.snappy.parquet	parquet	January 14, 2021, 21:43:35 (UTC+01:00)	150.4 KB	Standard

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
6. Difficult to handle large metadata
7. “Too many files” problems
8. Poor performance
9. Data quality issues

ACID Transactions

Make every operation transactional

- It either fully succeeds - or it is fully aborted for later retries

```
/path/to/table/_delta_log
  -  0000.json
  -  0001.json
  -  0002.json
  -  ...
  -  0010.parquet
  -  0010.json
  -  0011.json
```

Delta Lake Key Features

ACID Transactions

Protect your data with serializability, the strongest level of isolation.

Scalable Metadata

Handle petabyte-scale tables with billions of partitions and files at ease

Time Travel

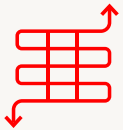
Access/revert to earlier versions of data for audits, rollbacks, or reproduce

Open Source

Community driven, open standards, open protocol, open discussions

Unified Batch/Streaming

Exactly once semantics ingestion to backfill to interactive queries



Schema Evolution / Enforcement

Prevent bad data from causing data corruption

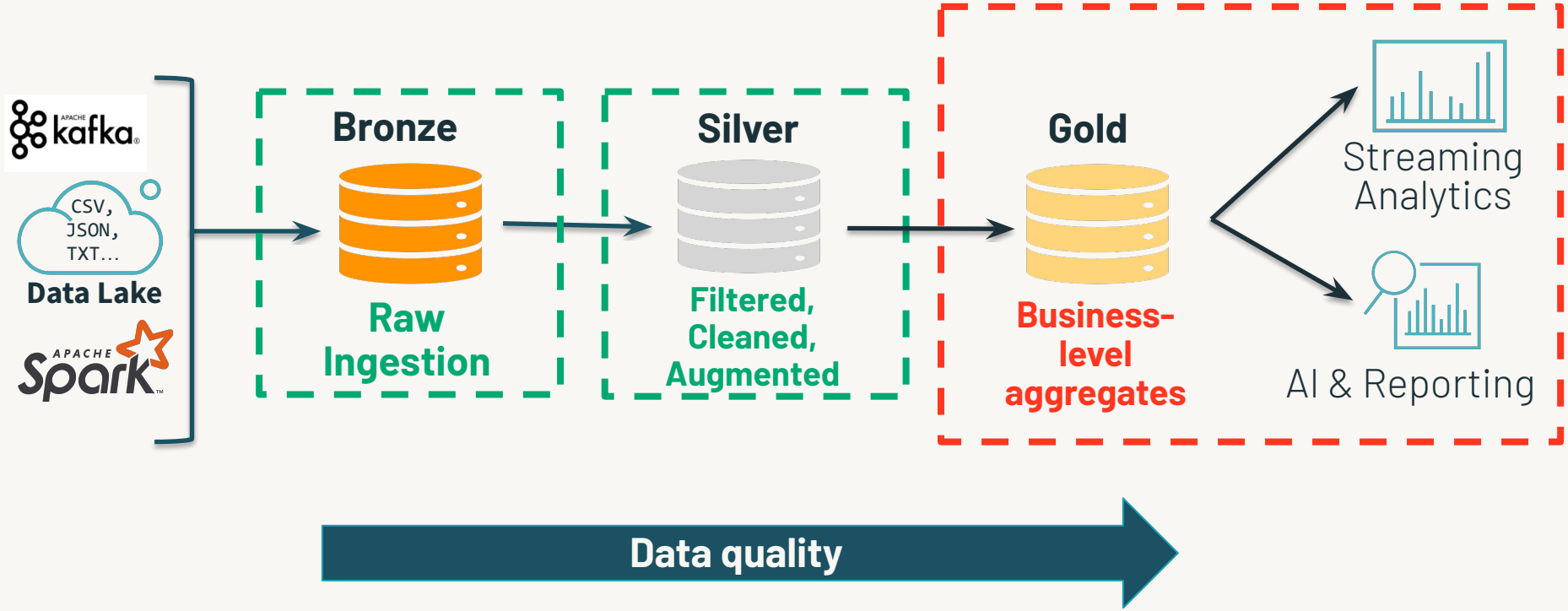
Audit History

Delta Lake log all change details providing a full audit trail

DML Operations

SQL, Scala/Java and Python APIs to merge, update and delete datasets

The Delta Lake -- Multihop medallion architecture



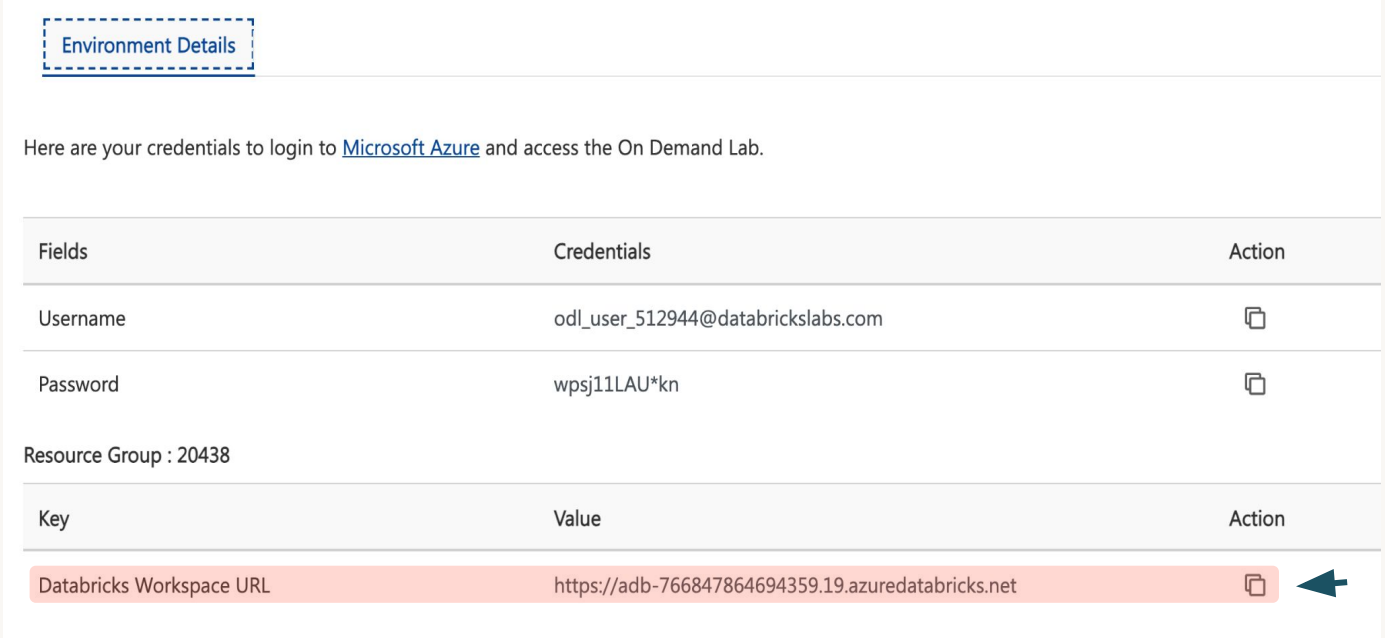
Walkthrough of Databricks Workspace

Workspace Setup

Step 3: Accessing the Workspace

Copy-paste the provided Databricks Workspace URL into an **incognito window**.

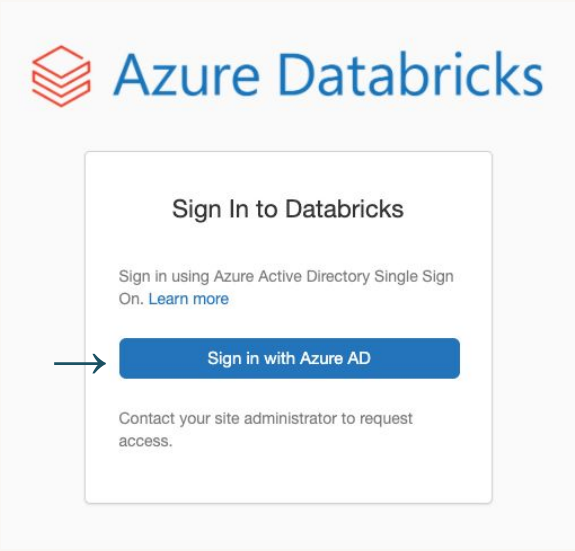
Tip: Using an incognito window prevents you from logging into an existing workspace. If issues persists, try disconnecting from VPN and trying again.



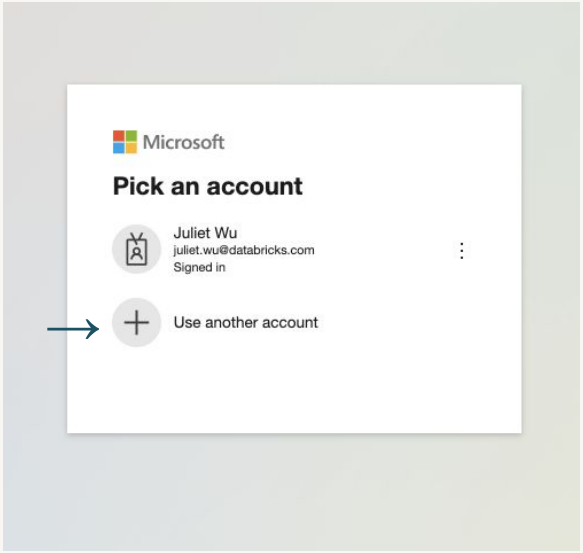
Step 4-5: Signing in on Azure

Sign in with the provided username and password from the credentials page

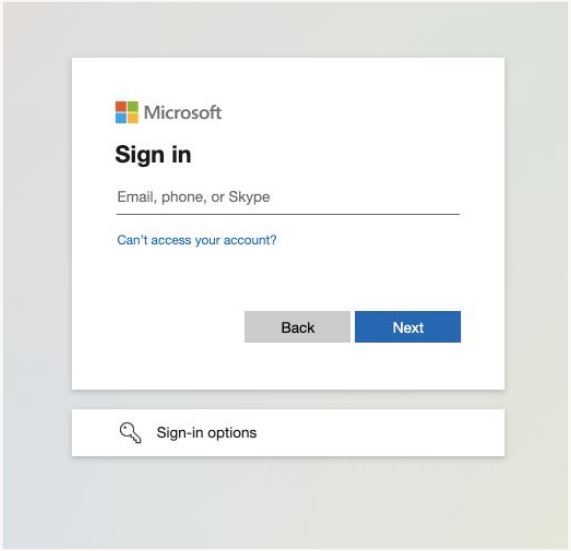
Select **Sign in with Azure AD**



Select **Use another account**



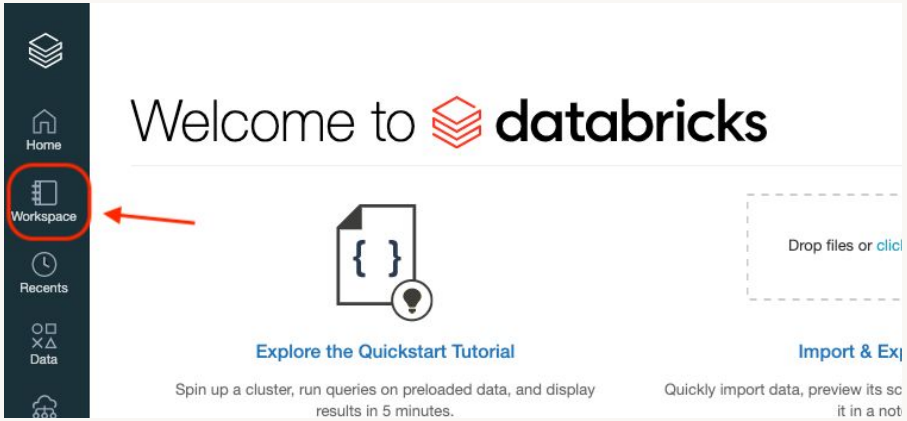
Copy-paste **provided credentials**



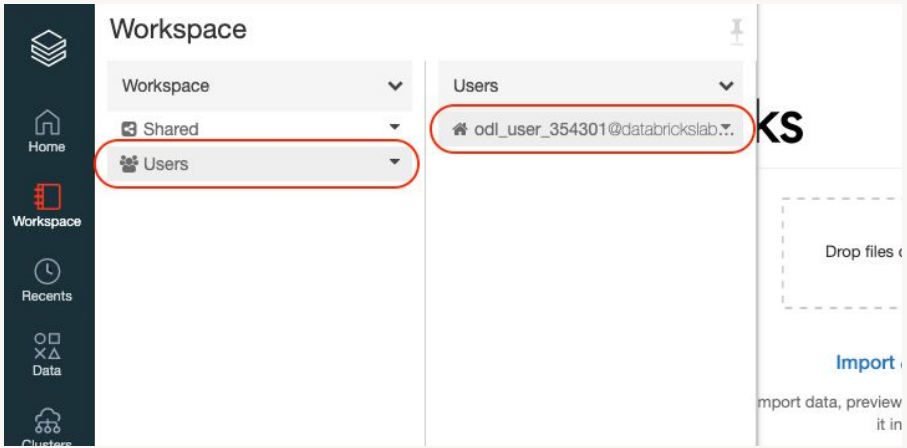
Arrive in your Databricks Workspace

Find the notebook under the Workspace tab and within your User folder.

1. From the navigation panel on the left side, select **Workspace**

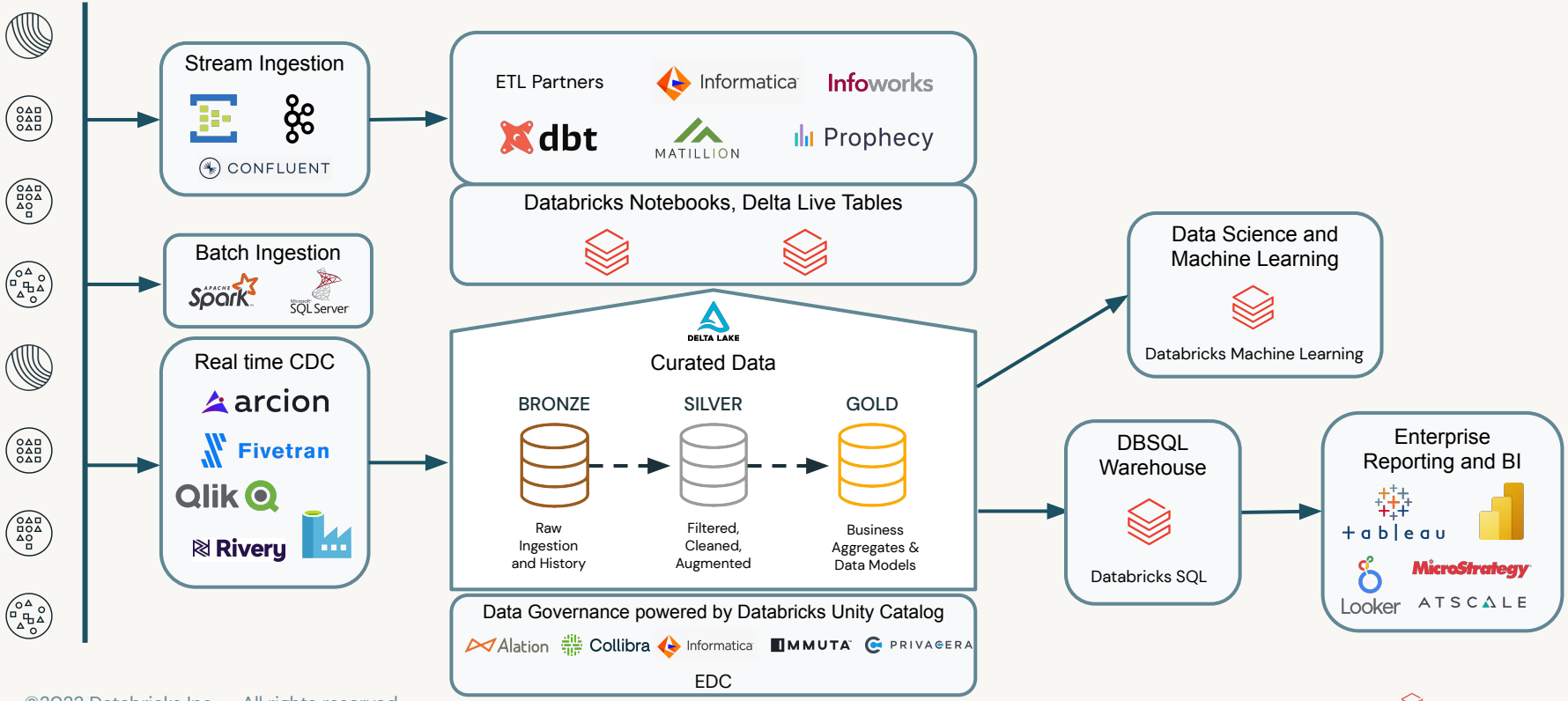


2. Select **Users** to find your folder of course materials



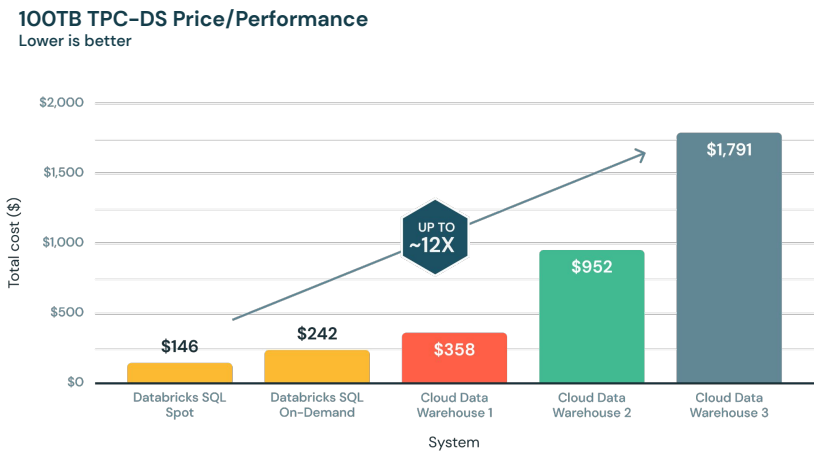
Hands On Exercises

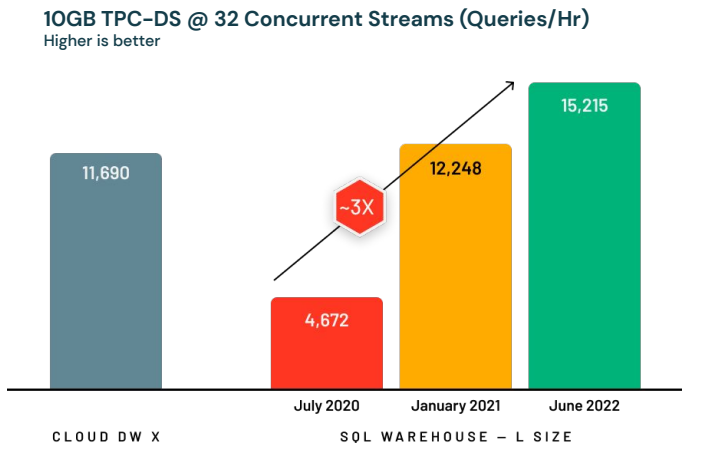
Modern Data Warehousing on Databricks



Built from the ground up for best performance

Lightning fast analytics for all queries





Databricks sets official data warehousing performance record
Learn more: **https://dbricks.co/benchmark**

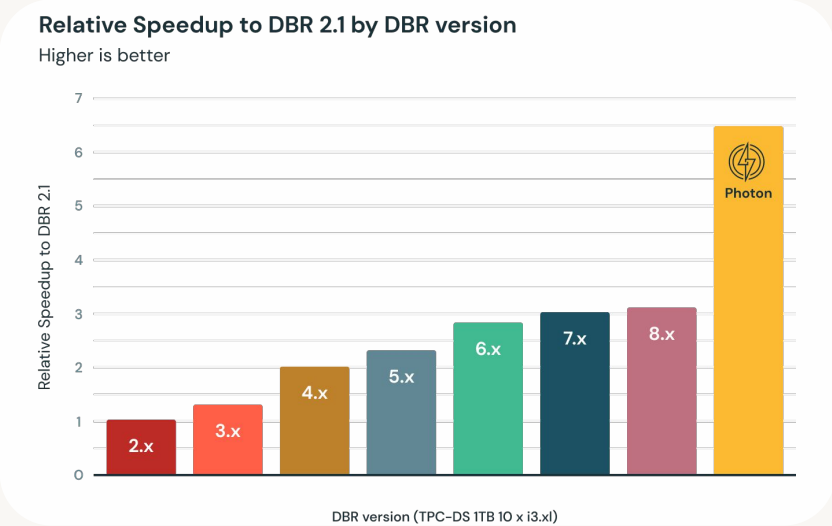
The Journey to Photon

Next Generation Query Engine

MPP Execution model, written in native code and leveraging vectorized CPU primitives.

Exabytes of data processed

Billions of queries executed



3–8x

faster interactive workloads

1/5

compute cost for ETL

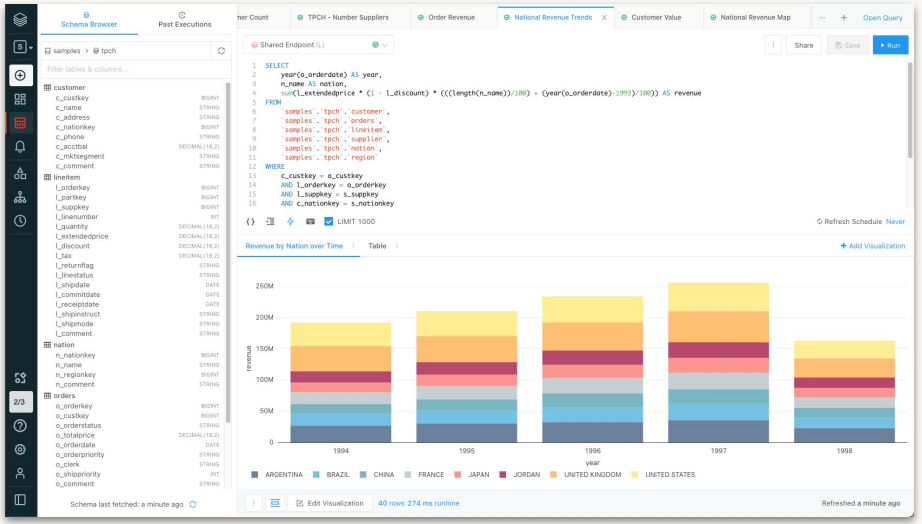
30%

average TCO savings

Databricks SQL Query Editor

Collaboratively query, explore, and transform data in-place

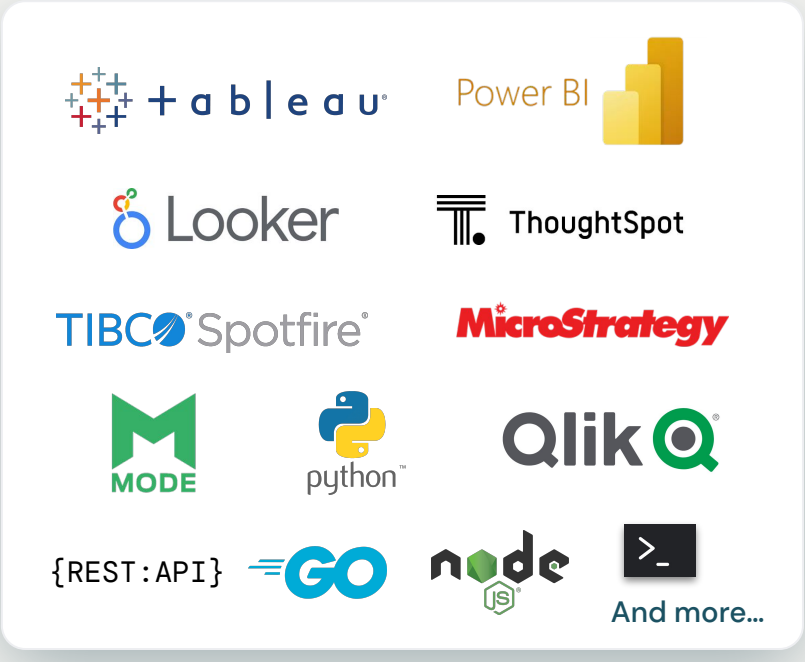
- Easily **ingest** data from cloud storage, local files, or business applications using Fivetran
- Discover data, explore database schema, and query data using **ANSI SQL**
- Save, share, and reuse queries across teams to get to results faster
- Orchestrate queries, alerts, and dashboards with automated **workflows**
- Stay up to date with alerts and automatic refresh schedules



Data Consumption

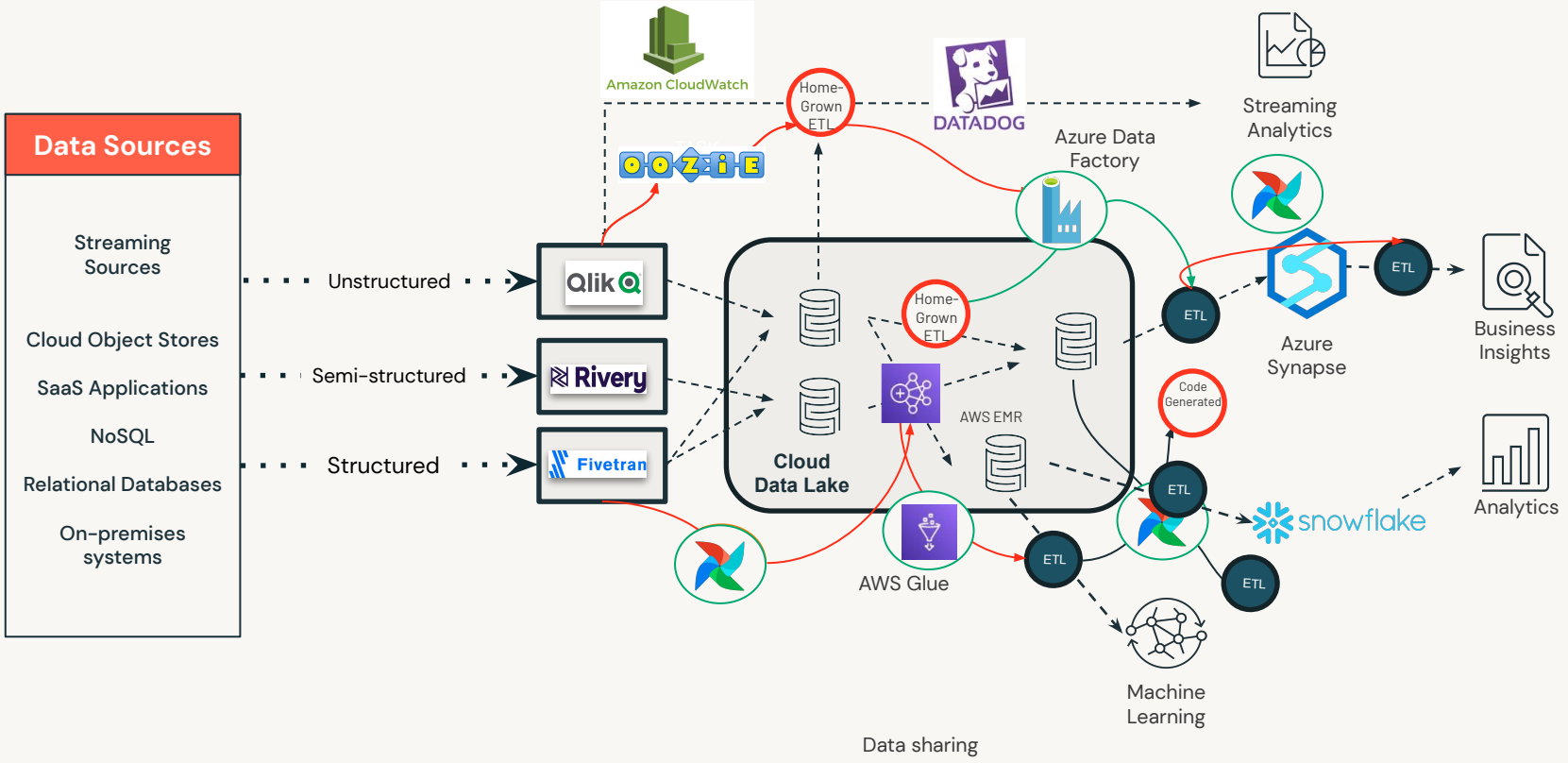
Query from any tool

Connect existing dashboards or brand new ones to the latest and freshest data, leverage your favorite tools to find new insights, and build custom data apps powered by the lakehouse with tools and languages you already know.



Delta Live Tables

But there is complexity in the data delivery….



Delta Live Tables

The best way to do ETL on the lakehouse

```
CREATE STREAMING LIVE TABLE raw_data
AS SELECT *
FROM cloud_files ("/raw_data",
"json")

CREATE LIVE TABLE clean_data
AS SELECT ...
FROM LIVE.raw_data
```

Accelerate ETL development

Declare **SQL or Python** and DLT automatically orchestrates the DAG, handles retries, changing data

Automatically manage your infrastructure

Automates complex tedious activities like **recovery, auto-scaling, and performance optimization**

Ensure high data quality

Deliver reliable data with built-in **quality controls, testing, monitoring, and enforcement**

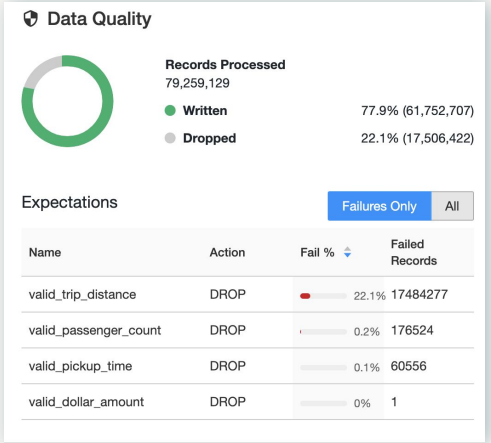
Unify batch and streaming

Get the simplicity of SQL with freshness of streaming with one **unified API**

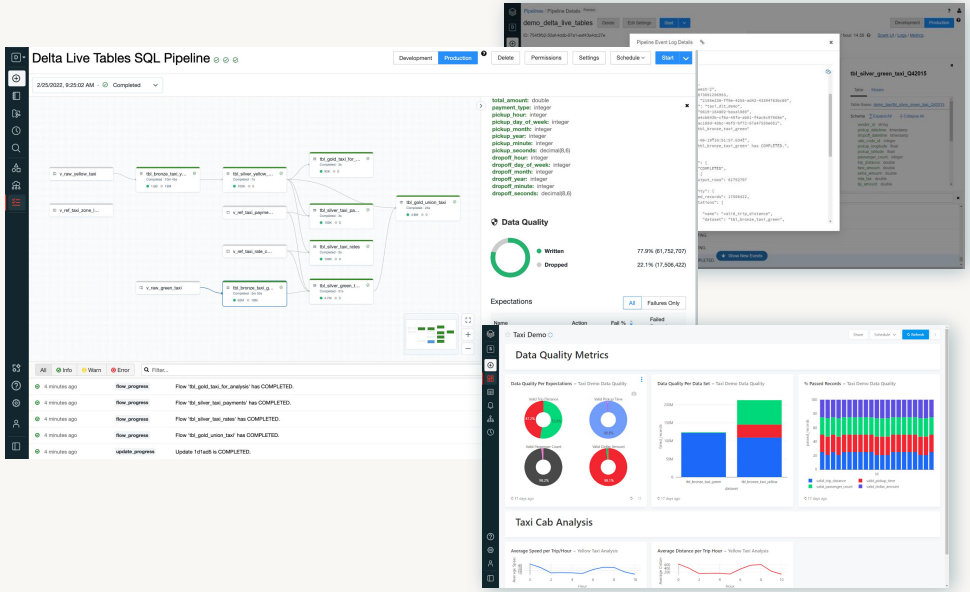
Data quality validation and monitoring

- Define data quality and integrity controls within the pipeline with data expectations
- Address data quality errors with flexible policies: fail, drop, alert, quarantine(future)
- All data pipeline runs and quality metrics are captured, tracked and reported

```
/* Stage 1: Bronze Table drop invalid rows */
CREATE STREAMING LIVE TABLE fire_account_bronze AS
( CONSTRAINT valid_account_open_dt EXPECT (acconut_dt is not null
and (account_close_dt > account_open_dt)) ON VIOLATION DROP ROW
COMMENT "Bronze table with valid account ids"
SELECT * FROM fire_account_raw ...
```



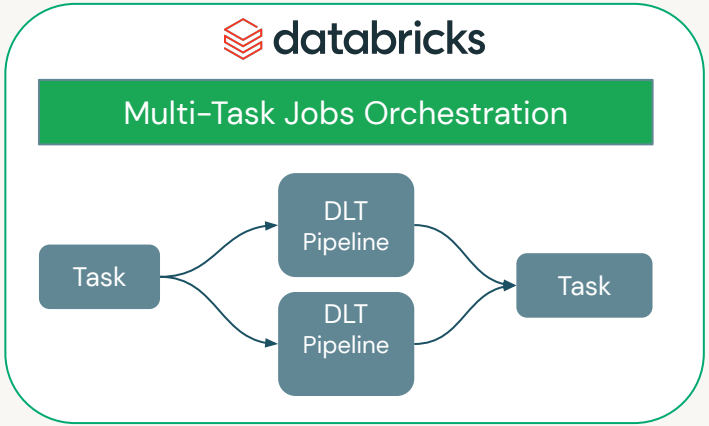
Data pipeline observability



- High-quality, high-fidelity lineage diagram that provides visibility into how data flows for impact analysis
- Granular logging for operational, governance, quality and status of the data pipeline at a row level
- Continuously monitor data pipeline jobs to ensure continued operation
- Notifications using Databricks SQL

Workflow Orchestration

Simplify orchestration and management of data pipelines



- Easily **orchestrate** DLT Pipelines and tasks in the same DAG
- **Fully integrated** in Databricks platform, making inspecting results, debugging faster
- Orchestrate and manage workloads in **multi-cloud environments**
- You can run a Delta Live Tables pipeline as part of a data processing workflow with **Databricks jobs, Apache Airflow, or Azure Data Factory.**

Our Current Work at Occidental

Decline Curve Analysis (DCA) auto-forecasting: automated DCA forecast that updates the EUR forecasts on a monthly basis for all wells in the DJ basin (ca. 9,500) in under two minutes that is on a schedule using Azure Data Factory (ADF)

Econ Engine: Identify the most profitable/economic strategy for well completions

Data Pipeline: data pipelining that executes daily and curates and process DJ data (e.g., production, completion design, well characteristics, geology, operations, etc. all from disparate internal and external sources); critical for well completions strategies, general analysis

Thank you for attending!