Online Meetup

Multi-Table Transactions with LakeFS and Delta Lake

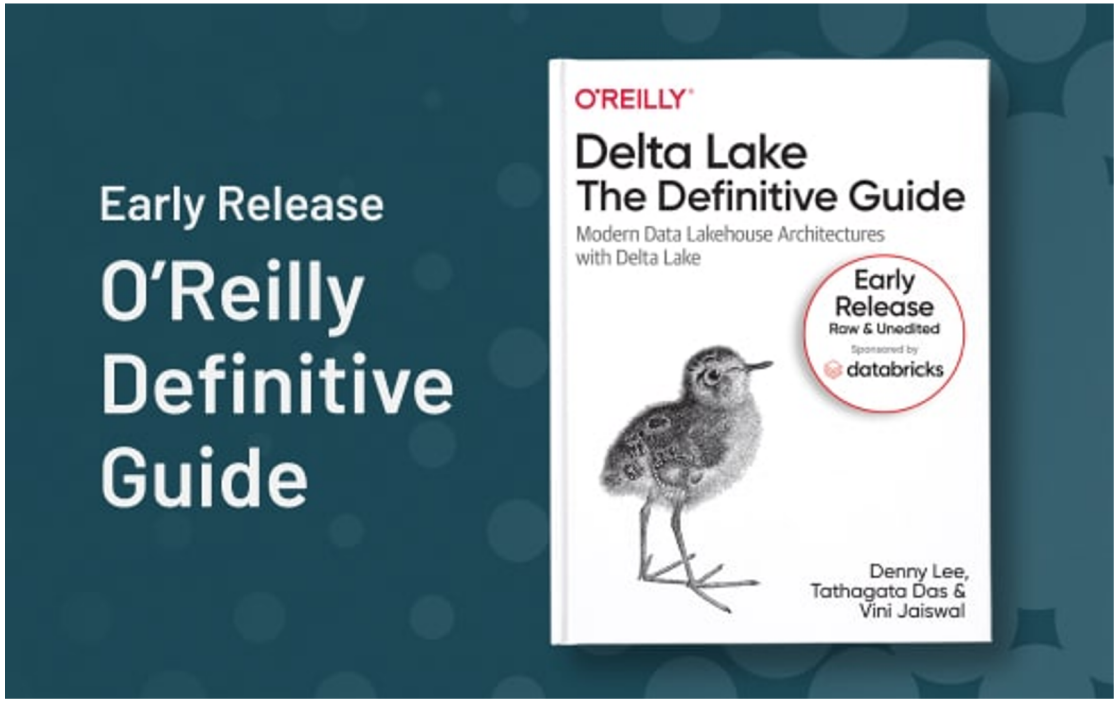
lakeFS

DELTA LAKE

About the Speaker

Denny Lee is a Developer Advocate at Databricks. He is a hands-on distributed systems and data sciences engineer with extensive experience developing internet-scale infrastructure, data platforms, and predictive analytics systems for both on-premise and cloud environments.

O'Reilly Delta Lake: The Definitive Guide (*Early Release*)



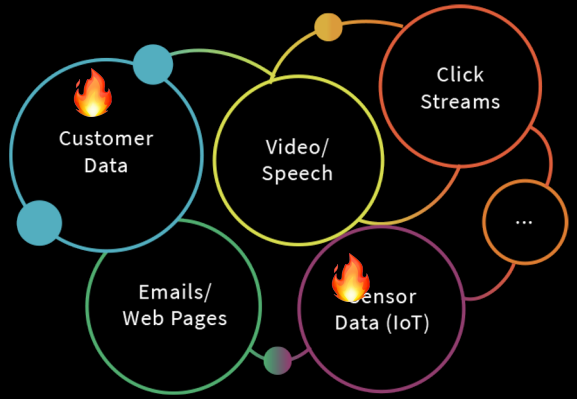
https://dbricks.co/dldg

About the Speaker

Paul Singman is a Developer Advocate at lakeFS. He previously led a Platform Engineering team at Equinox Fitness, where he worked on operational and user-facing analytic services. When not staring at screens, he likes to run, golf, play ping-pong and backgammon.

The Promise of the Data Lake

1. Collect Everything



Garbage In

2. Store it all in the Data Lake

Garbage Stored

3. Data Science & Machine Learning

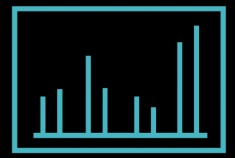
- Recommendation Engines
- Risk, Fraud Detection
- IoT & Predictive Maintenance
- Genomics & DNA Sequencing

Garbage Out

What does a typical
data lake project look like?

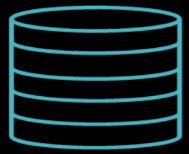
Evolution of a Cutting-Edge Data Lake

Events



Streaming Analytics

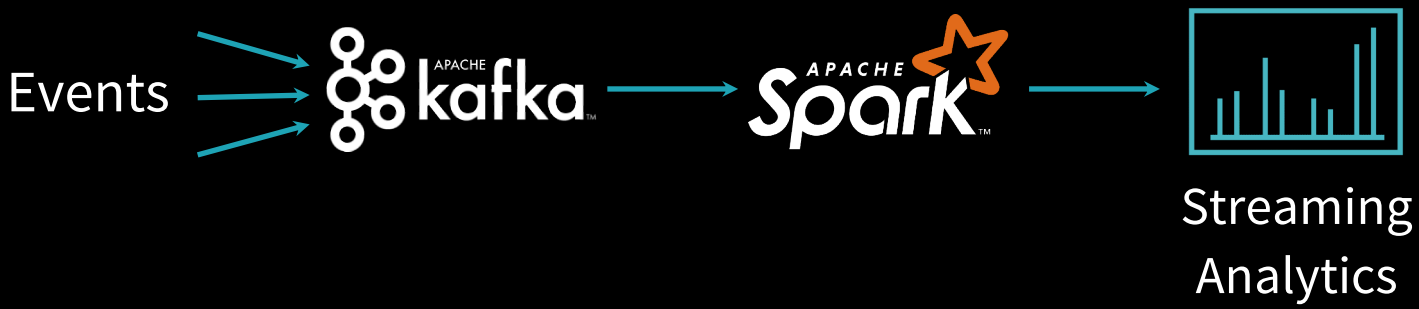
?



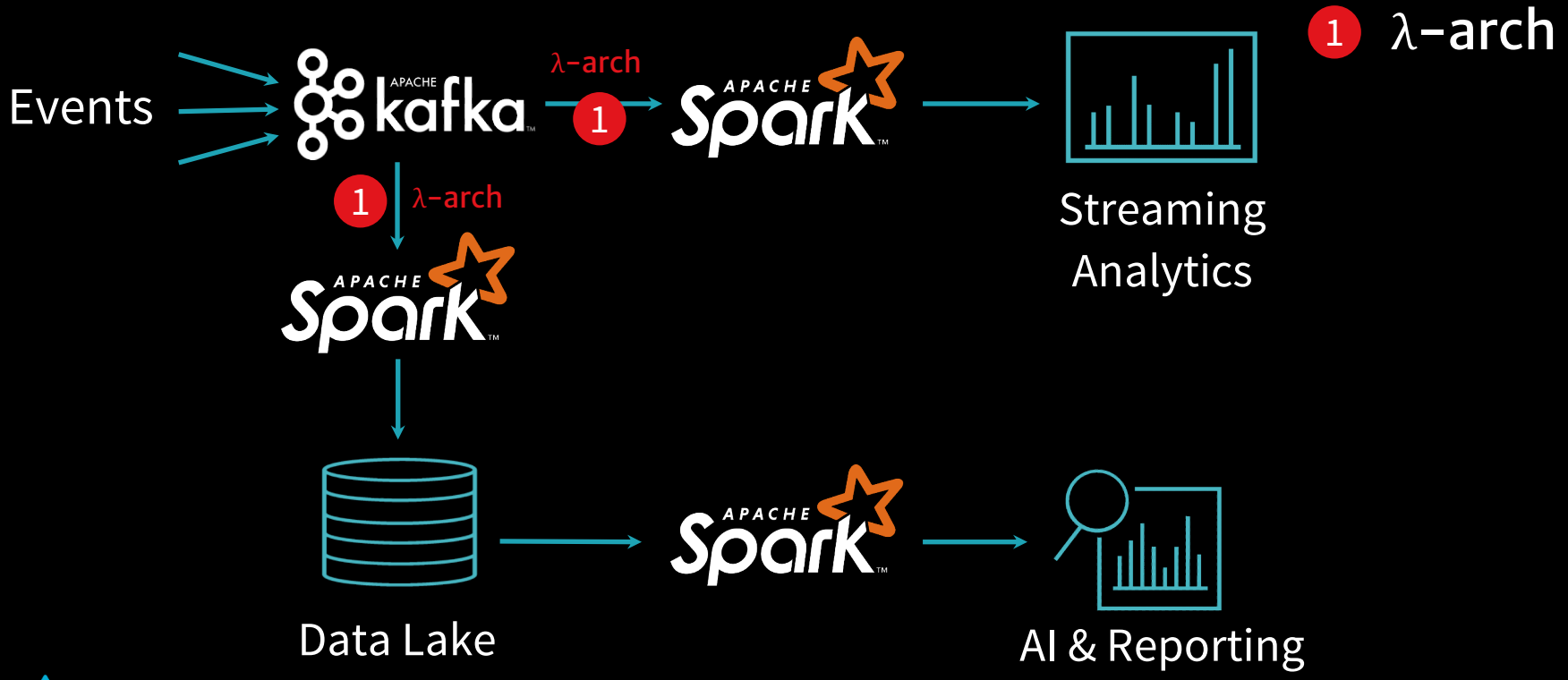
Data Lake

AI & Reporting

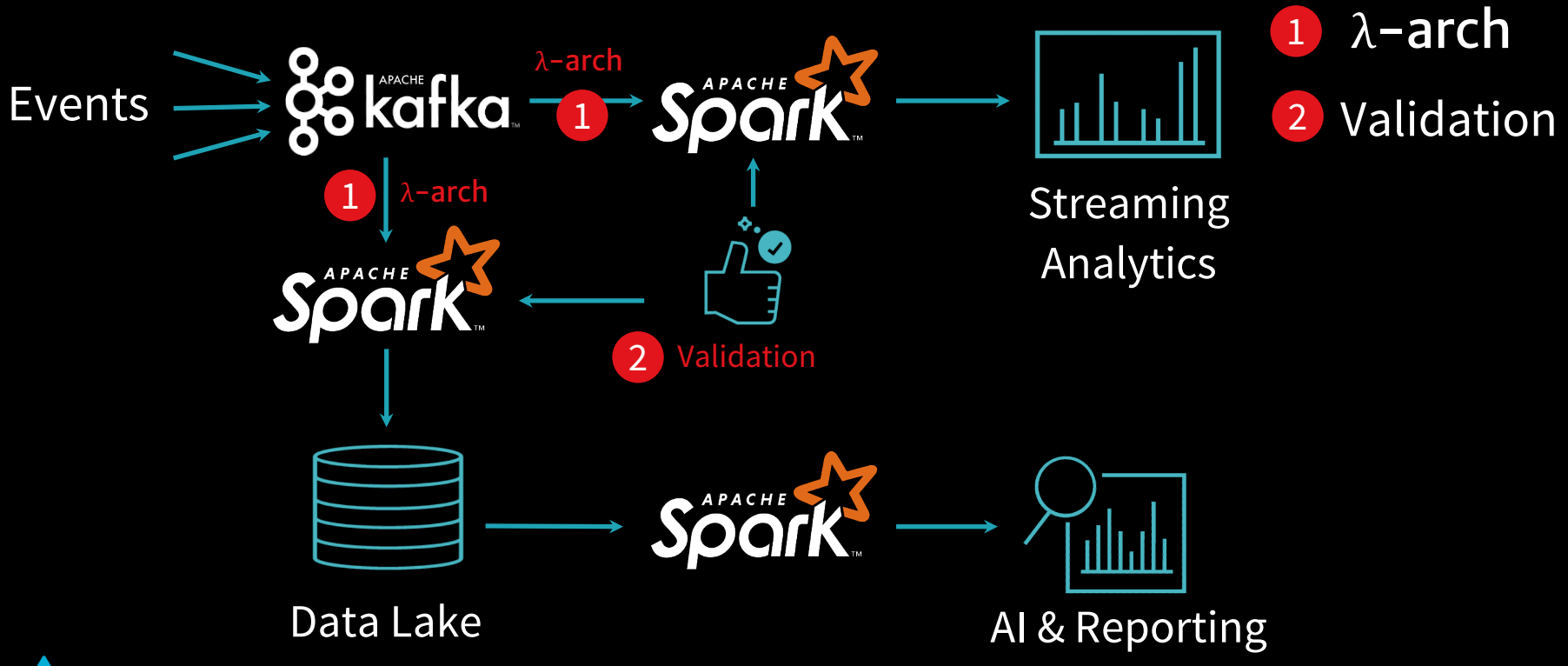
Evolution of a Cutting-Edge Data Lake



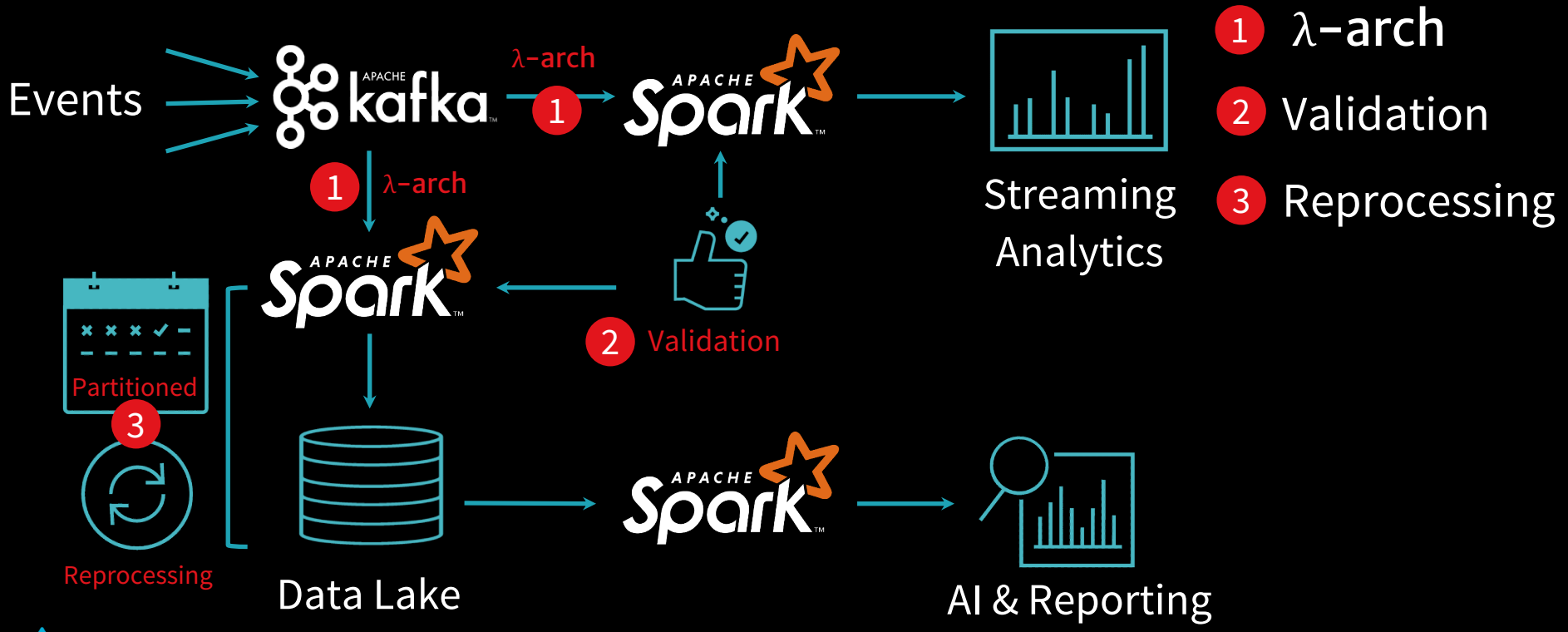
Challenge #1: Historical Queries?



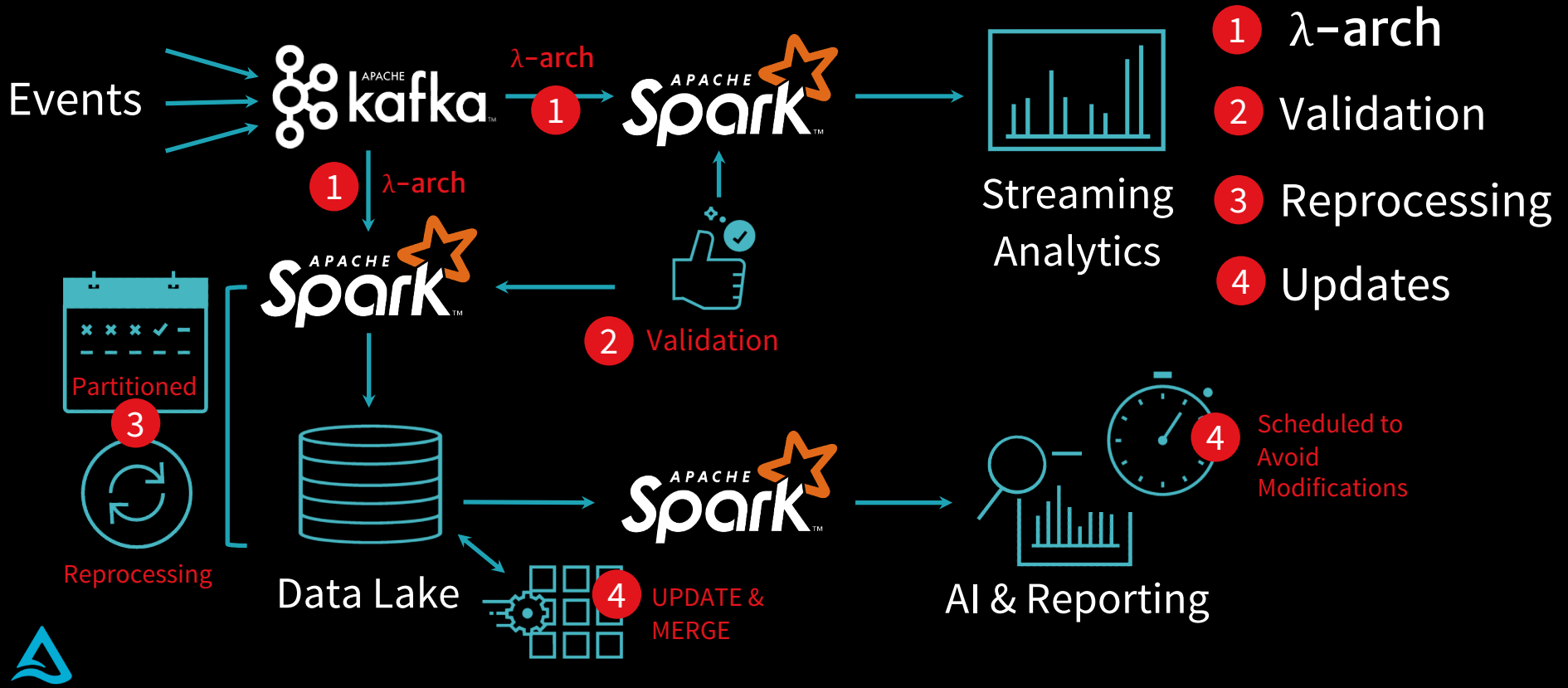
Challenge #2: Messy Data?



Challenge #3: Mistakes and Failures?



Challenge #4: Updates?



Wasting Time & Money

Solving Systems Problems

Instead of Extracting Value From Data

Data Lake Distractions

No atomicity means failed production jobs leave data in corrupt state requiring tedious recovery

No quality enforcement creates inconsistent and unusable data

No consistency / isolation makes it almost impossible to mix appends and reads, batch and streaming

OSS Delta Lake Key Features

Feature	
ACID Transactions	Delta Lake brings ACID transactions to your data lakes. It provides serializability, the strongest level of isolation level. Learn more at Diving into Delta Lake: Unpacking the Transaction Log.
Scalable Metadata Handling	Delta Lake can handle petabyte-scale tables with billions of partitions and files at ease.
Time Travel (data versioning)	Delta Lake provides data snapshots to access and revert to earlier versions of data for audits, rollbacks or to reproduce experiments.
Open Format	All data in Delta Lake is stored in Apache Parquet format enabling Delta Lake to leverage the efficient compression and encoding schemes that are native to Parquet
Unified Batch and Streaming Source and Sink	A table in Delta Lake is both a batch table, as well as a streaming source and sink. Streaming data ingest, batch historic backfill, and interactive queries all just work out of the box.

OSS Delta Lake Key Features (Continued)

Feature	
Schema Enforcement and Evolution	Delta Lake provides the ability to specify your schema and enforce it. This helps ensure that the data types are correct and required columns are present, preventing bad data from causing data corruption. For more information, refer to Diving Into Delta Lake: Schema Enforcement & Evolution.
Audit History	Delta Lake transaction log records details about every change made to data providing a full audit trail of the changes.
DML Operations	Delta Lake supports SQL, Scala / Java and Python APIs to merge, update and delete datasets allowing you to easily comply with GDPR and CCPA and simplifying use cases like change data capture. For more information, refer to Diving Into Delta Lake: DML Internals
100% Compatible with Apache Spark API	Developers can use Delta Lake with their existing data pipelines with minimal change as it is fully compatible with Spark, the commonly used big data processing engine.

Delta Lake CY21H2 Roadmap

https://github.com/delta-io/delta/issues/748

- Delta Standalone Reader (Q3)
- Delta Standalone Writer (Q4)

- Flink/Delta Source (Q4)
- Flink/Delta Sync (22Q1)

- Pulsar/Delta Source (Q4)
- Pulsar/Delta Sync (22Q1)

- Spark 3.2 Support (Q4)

Hive3 Connector (Q3)

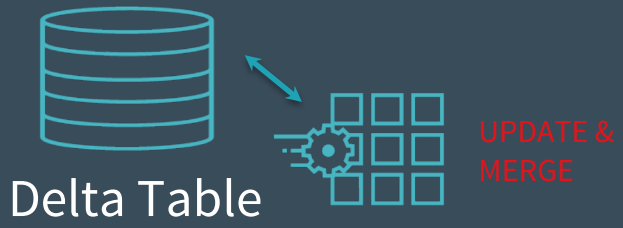
LakeFS Integration (Q3)

Nessie Integration (Q4)

Community meetings: every two weeks have meetings with Trino, Flink, Nessie, LakeFS, Pulsar, Rust, and Core

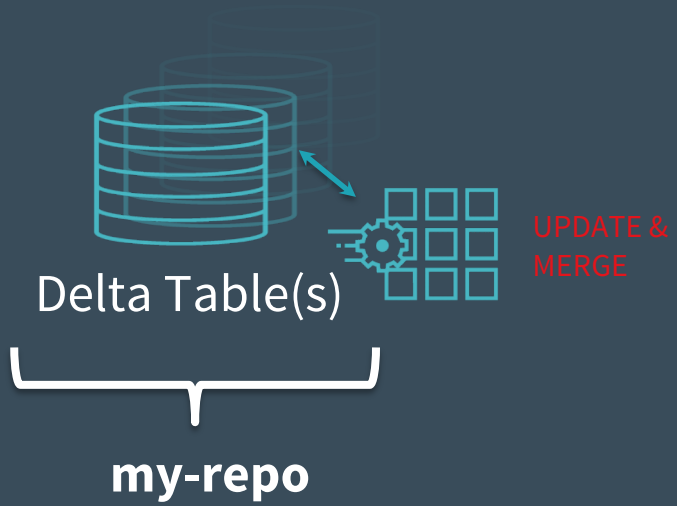
databricks

Single-Table Consistency



Multi - Table Consistency

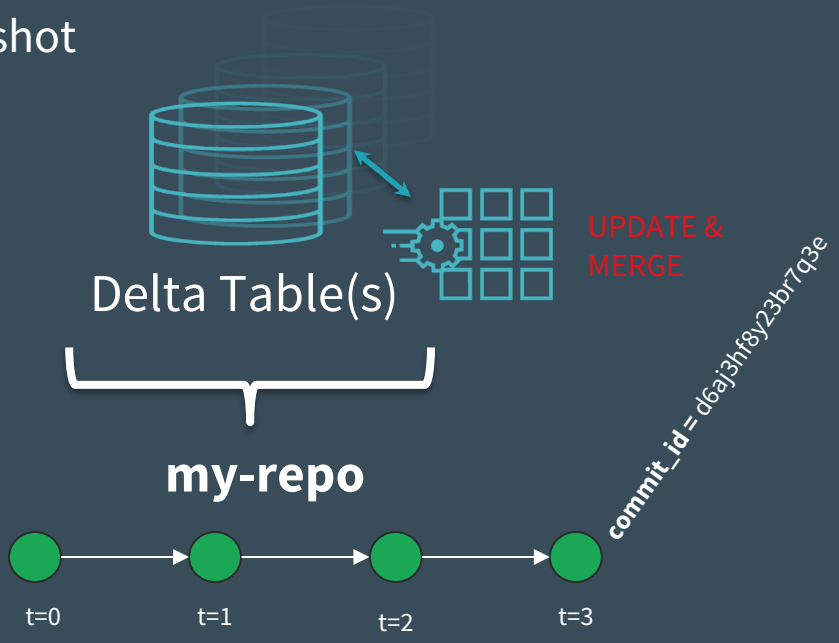
Multi - Table Consistency



+ lakeFS

Multi - Table Consistency

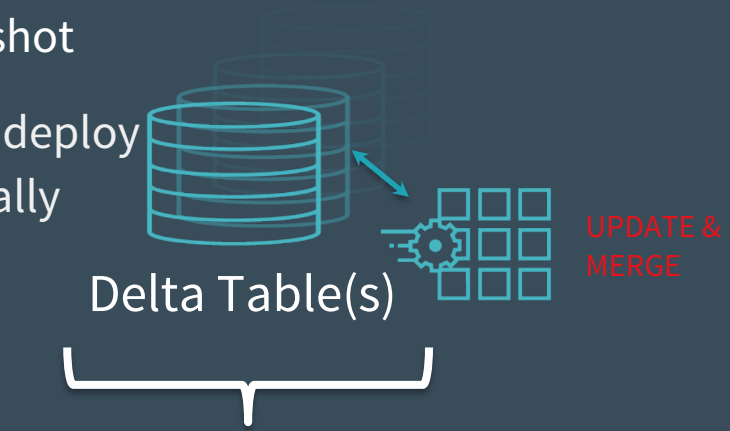
1. **commit** - save cross collection snapshot



+ lakeFS

Multi - Table Consistency

1. **commit** - save cross collection snapshot
2. **branch/merge** - deploy data atomically



+ lakeFS

How it works – Metadata All the Way Down

Transaction Log
Table Versions

(Optional) Partition Directories
Data Files

```
my_table/
├─ _delta_log/
│  ├─ 00000.json
│  └─ 00001.json
└─ date=2019-01-01/
   └─ file-1.parquet
```

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my_table/
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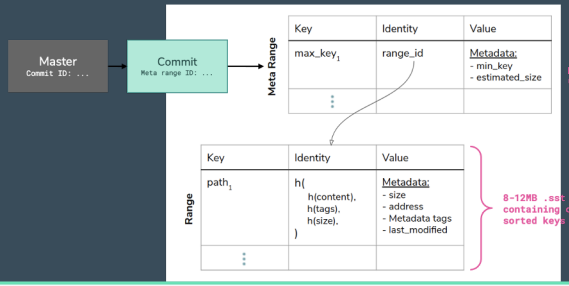
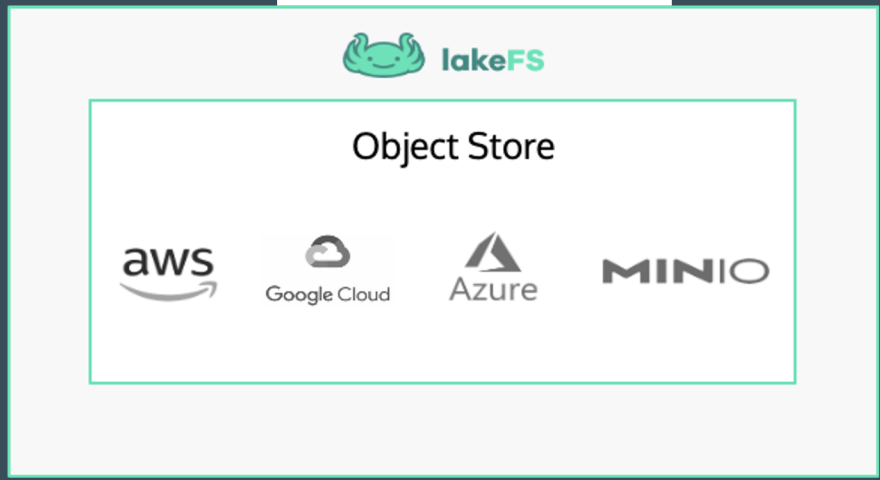




+ lakeFS

Configuring lakeFS + Delta

Configuring lakeFS + Delta

1. Set Spark configs to S3 API endpoint

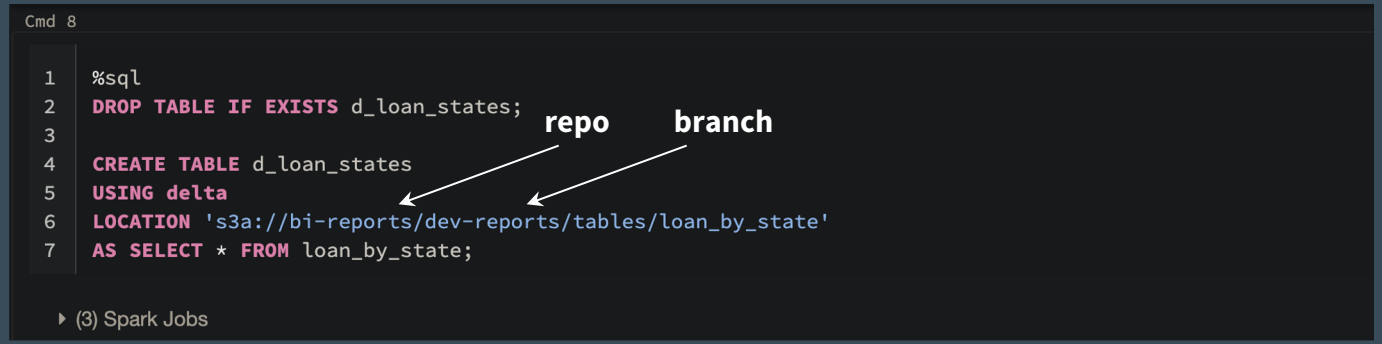
```
spark.hadoop.fs.s3a.bucket.<repo-name>.access.key AKIAIOSFODNN7EXAMPLE
spark.hadoop.fs.s3a.bucket.<repo-name>.secret.key wJalrXUtnFEMI/K7MDENG/bPxRfiCYEXAMPLEKEY
spark.hadoop.fs.s3a.bucket.<repo-name>.endpoint https://lakefs.example.com
spark.hadoop.fs.s3a.path.style.access true
```

Configuring lakeFS + Delta

1. Set Spark configs to S3 API endpoint

```
spark.hadoop.fs.s3a.bucket.<repo-name>.access.key AKIAIOSFODNN7EXAMPLE
spark.hadoop.fs.s3a.bucket.<repo-name>.secret.key wJalrXUtnFEMI/K7MDENG/bPxRfiCYEXAMPLEKEY
spark.hadoop.fs.s3a.bucket.<repo-name>.endpoint https://lakefs.example.com
spark.hadoop.fs.s3a.path.style.access true
```

2. Update object store location paths



Recap

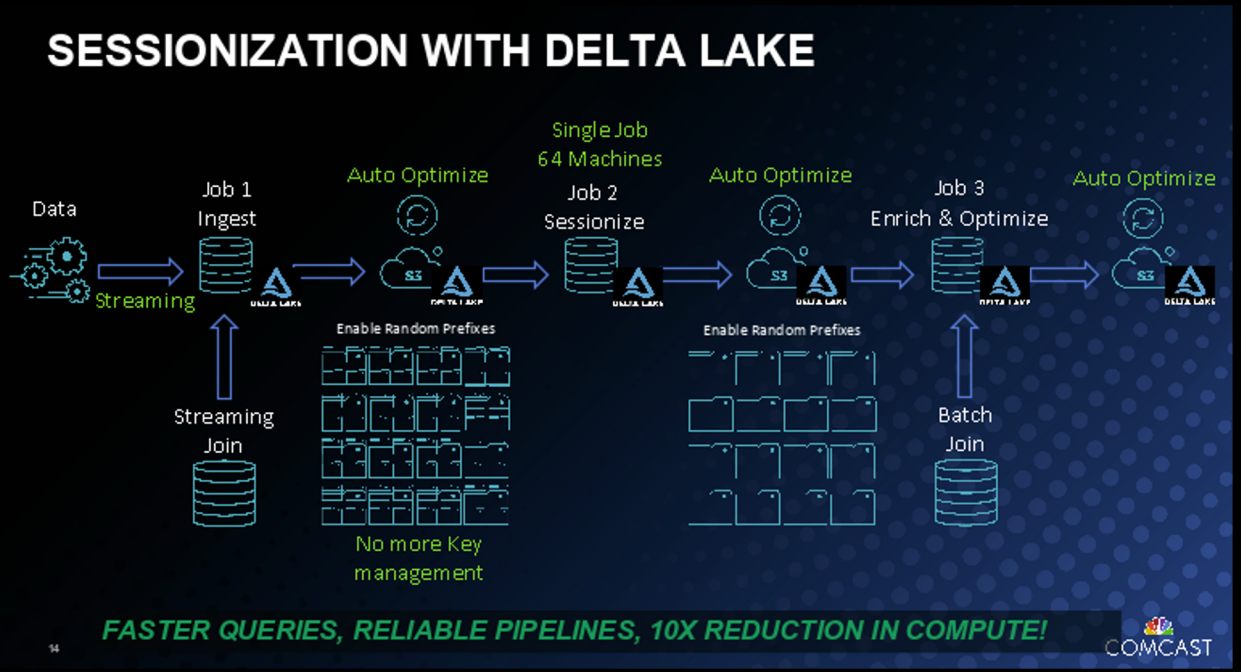
- Add your Delta tables to a lakeFS repository.
- Utilize git-inspired operations to provide atomicity on transactions across multiple tables.

Who is using  DELTA LAKE?

Used by 5000+ of organizations world wide

> 1+ exabyte processed every three days

COMCAST



Improved reliability:
Petabyte-scale jobs

10x lower compute:
640 instances to 64!

Simpler, faster ETL:
84 jobs → 3 jobs
halved data latency

How do I use  DELTA LAKE ?

Get Started with Delta using Spark APIs

Add Spark Package

```
pyspark --packages io.delta:delta-core_2.12:0.1.0

bin/spark-shell --packages io.delta:delta-core_2.12:0.1.0
```

Maven

```
<dependency>
  <groupId>io.delta</groupId>
  <artifactId>delta-core_2.12</artifactId>
  <version>0.1.0</version>
</dependency>
```

Instead of `parquet`...

```
dataframe
    .write
    .format("parquet")
    .save("/data")
```

... simply say `delta`

```
dataframe
    .write
    .format("delta")
    .save("/data")
```

How does  DELTA LAKE work?

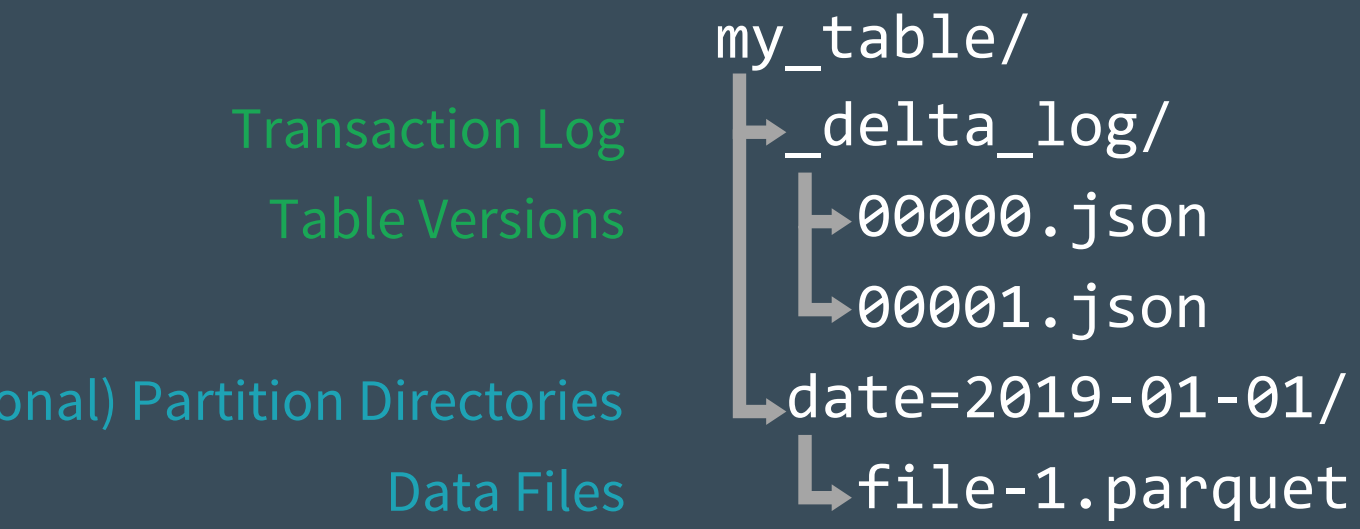
Delta On Disk

Transaction Log

Table Versions

(Optional) Partition Directories

Data Files



Version N = Version N-1 + Actions

Change Metadata – name, schema, partitioning, etc

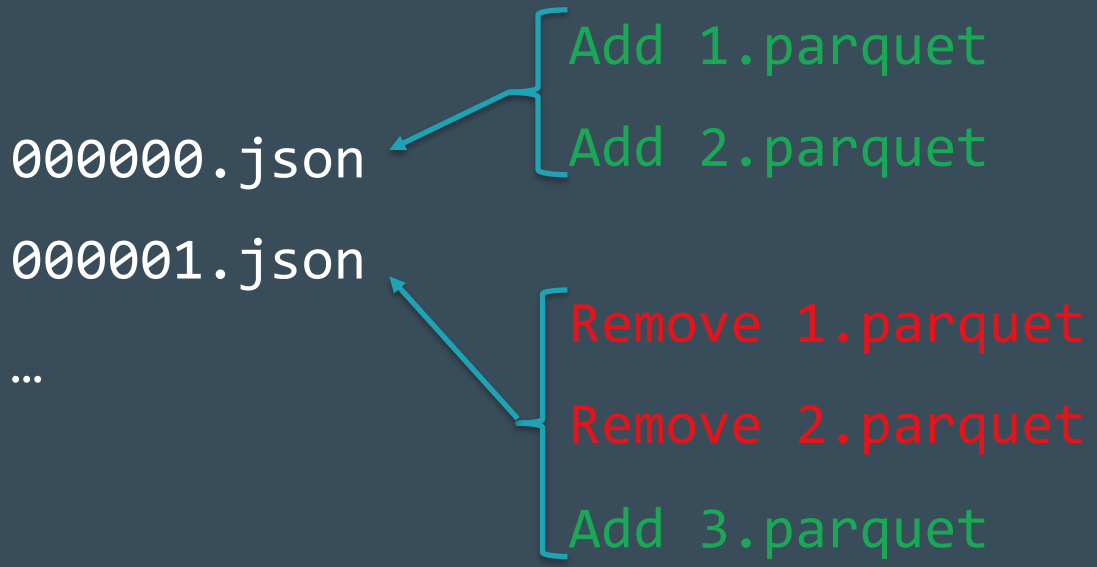
Add File – adds a file (with optional statistics)

Remove File – removes a file

Result: Current Metadata, List of Files

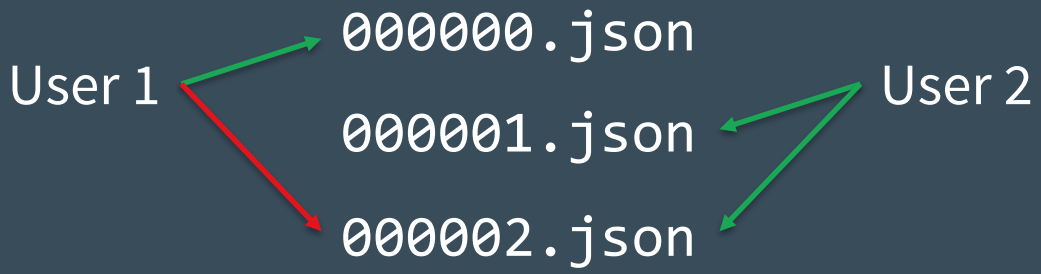
Implementing Atomicity

Changes to the table are stored as *ordered, atomic* units called commits



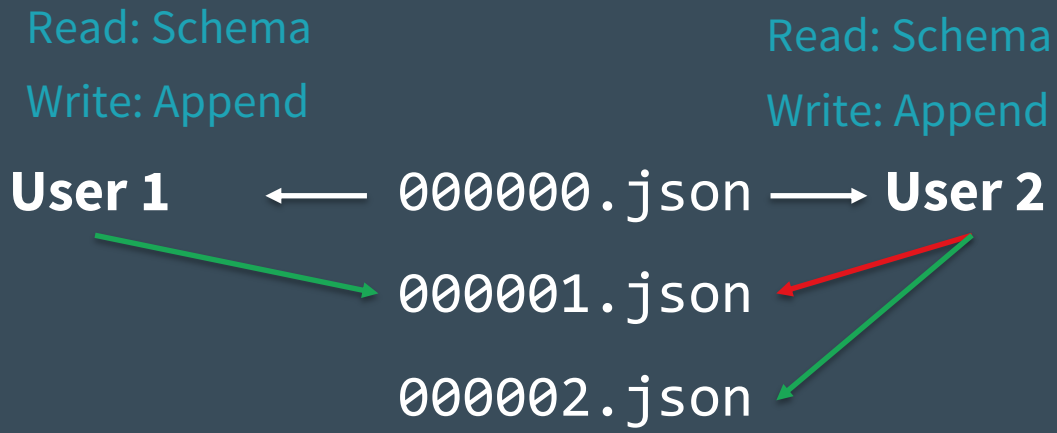
Ensuring Serializablity

Need to agree on the order of changes, even when there are multiple writers.



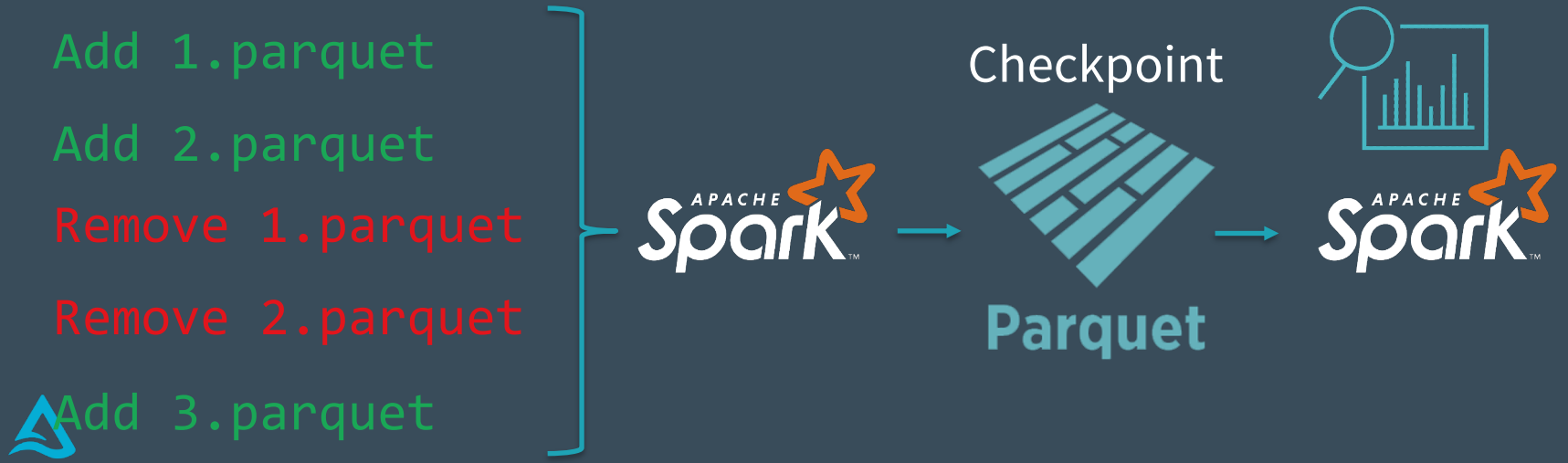
Solving Conflicts Optimistically

1. Record start version
2. Record reads/writes
3. Attempt commit
4. If someone else wins, check if anything you read has changed.
5. Try again.



Handling Massive Metadata

Large tables can have millions of files in them! How do we scale the metadata? Use Spark for scaling!



Build your own Delta Lake at **https://delta.io**