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Dive into the DELTA LAKE

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Agenda

- What are lakehouse files?
- The anatomy of Delta Lake
- Parquet 101
- Loading and querying data with Delta Lake
- Optimizing Delta Lake

What is lakehouse format?

- Wrapper around binary datafiles – most often parquet
- Provides RDBMS-like functionality for data lake
- All 4 formats are OSS
- Delta Lake originated at Databricks, and now Microsoft are all in
- Iceberg orignated at Netflix. Snowflake are all in
- Hudi originated at Uber. Not gained much traction
- Paimon originated at Alibaba. Mostly used in Chinese companies

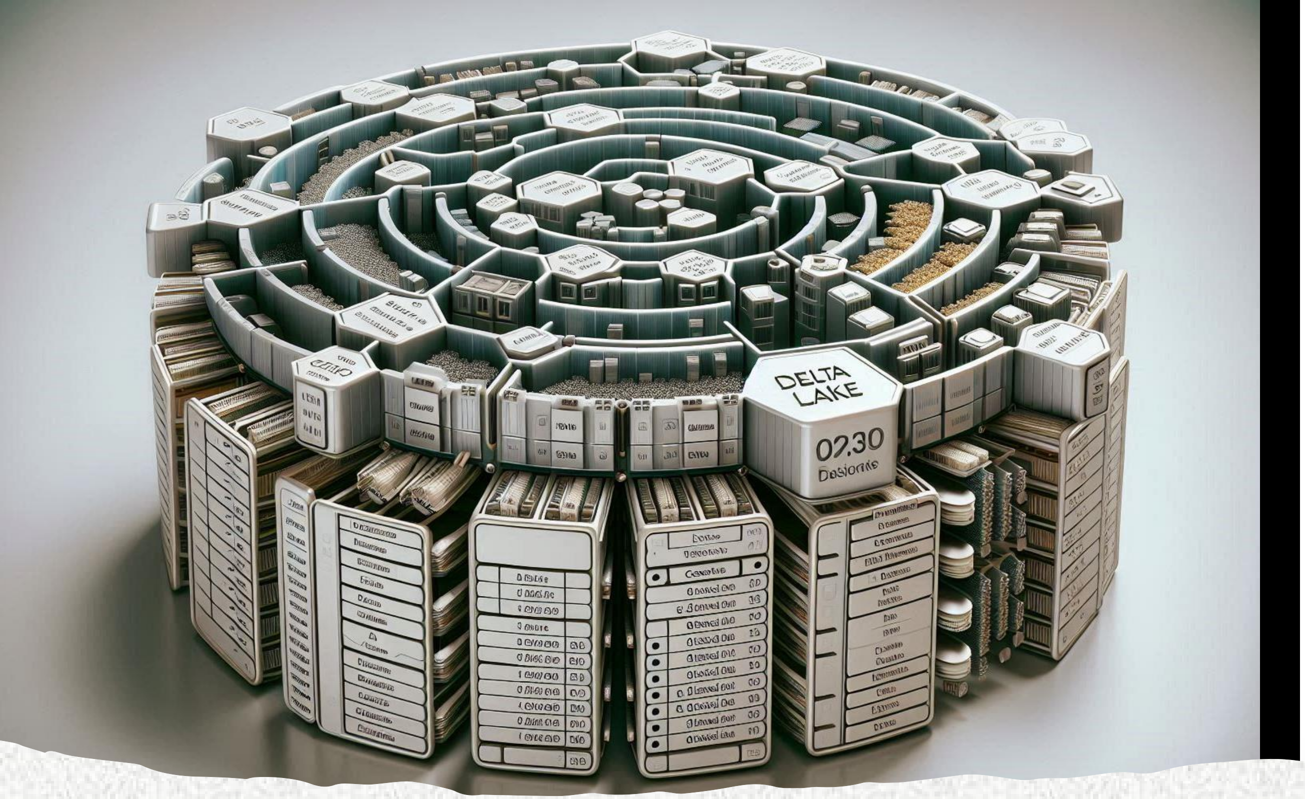
Lakehouse format

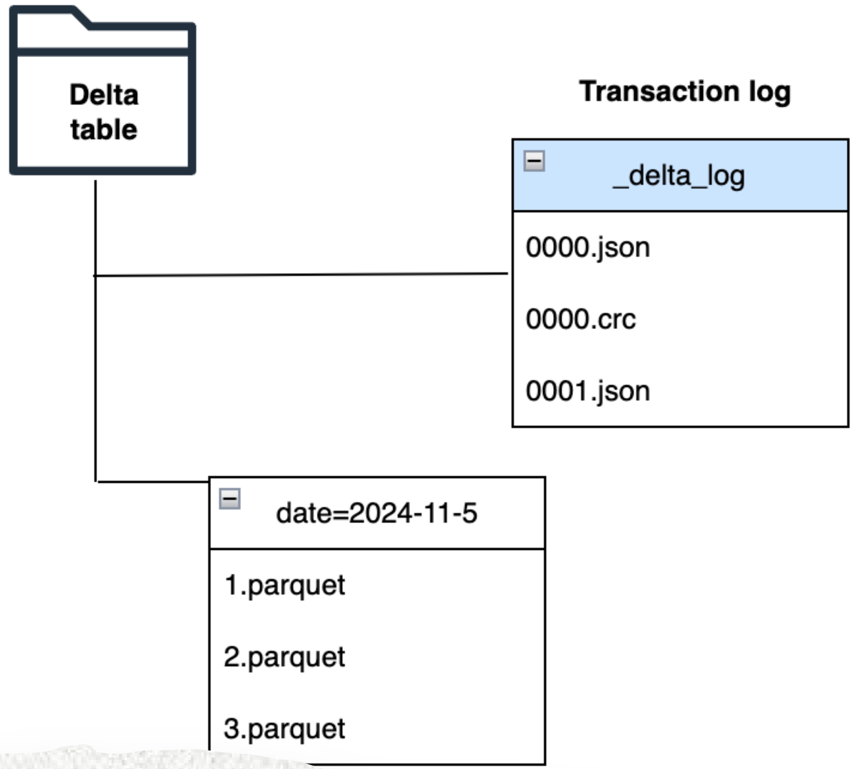
- Metadata stored in metastores
  - Unity Catalog
  - Hive
  - Polaris (new)
  - Internal to Fabric
- Transaction logs
- Various mechanisms for optimizations, indexing, partitioning etc (this is what we will look at today)

But Microsoft says Delta-Parquet?

- Microsoft marketing…

- Fabric actually uses DELTA LAKE
- Though they add a custom V-Order at write time (more on that later).





Delta table

Transaction log

_delta_log

0000.json

0000.crc

0001.json

date=2024-11-5

1.parquet

2.parquet

3.parquet

Anatomy of the Delta Lake

- Data in Parquet files
- Transaction logs
- Metadata
- Schema
- Checkpoints

Parquet

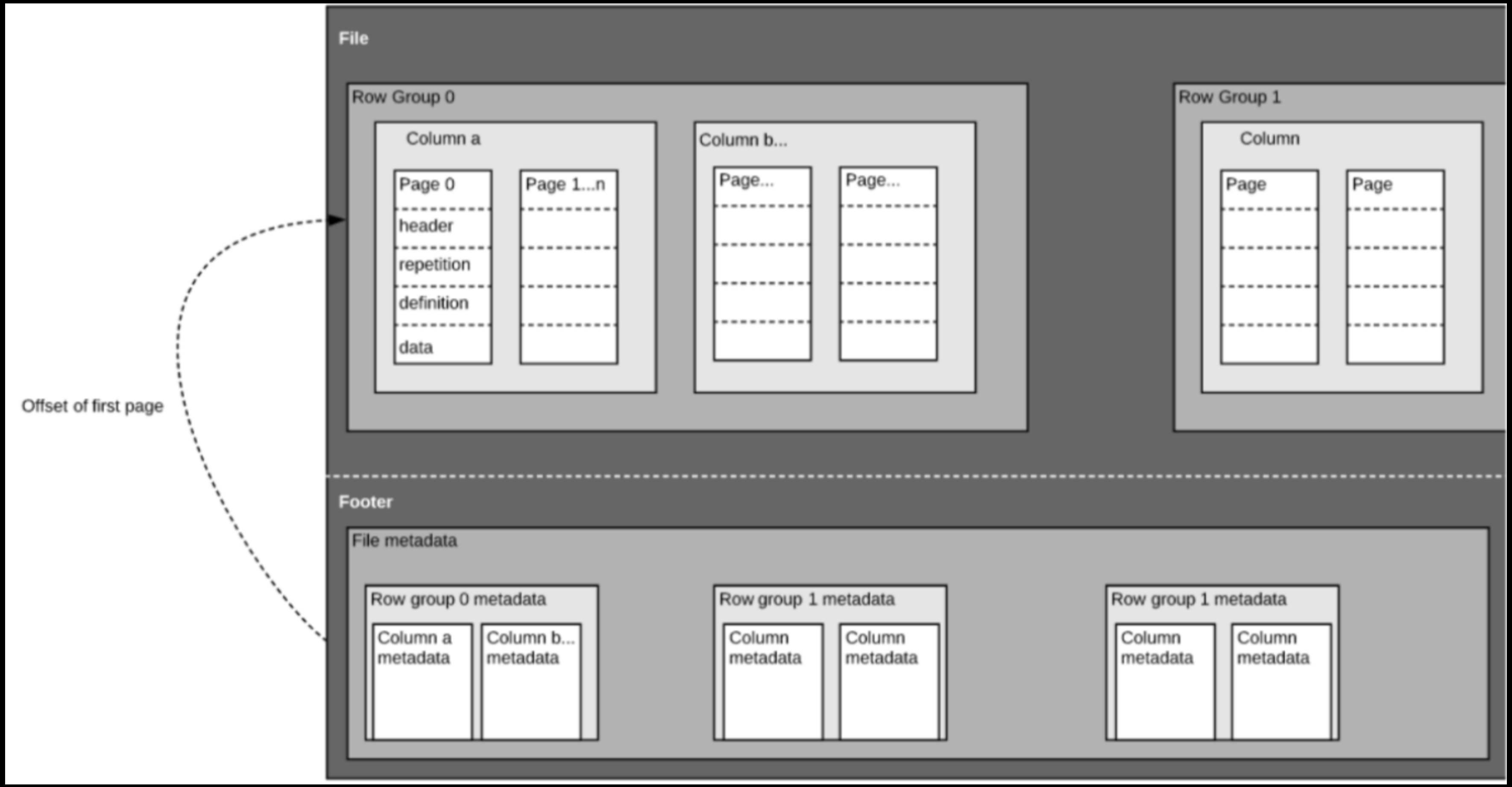
- Columnar
- Self-describing
- Optimized for read performance
  i.e. Write Once, Read Many
- Compressed
  - Supports 7 different algorithms
  - Default Snappy

Parquet

Self describing?

- Header
- Row groups
  - Columns
    - Pages
- Footer
  - Metadata
    - Row groups
      - Columns

- Optimal row group size 1GB



https://www.upsolver.com/blog/apache-parquet-why-use

Transaction log

Also called Delta Log

- Series of JSON files
- Each transaction stored in new JSON file
  - Type of operation
  - Files added or removed
  - Schema at time of transaction
- Each transaction also has a CRC file
  - Key statistics of table version

Metadata

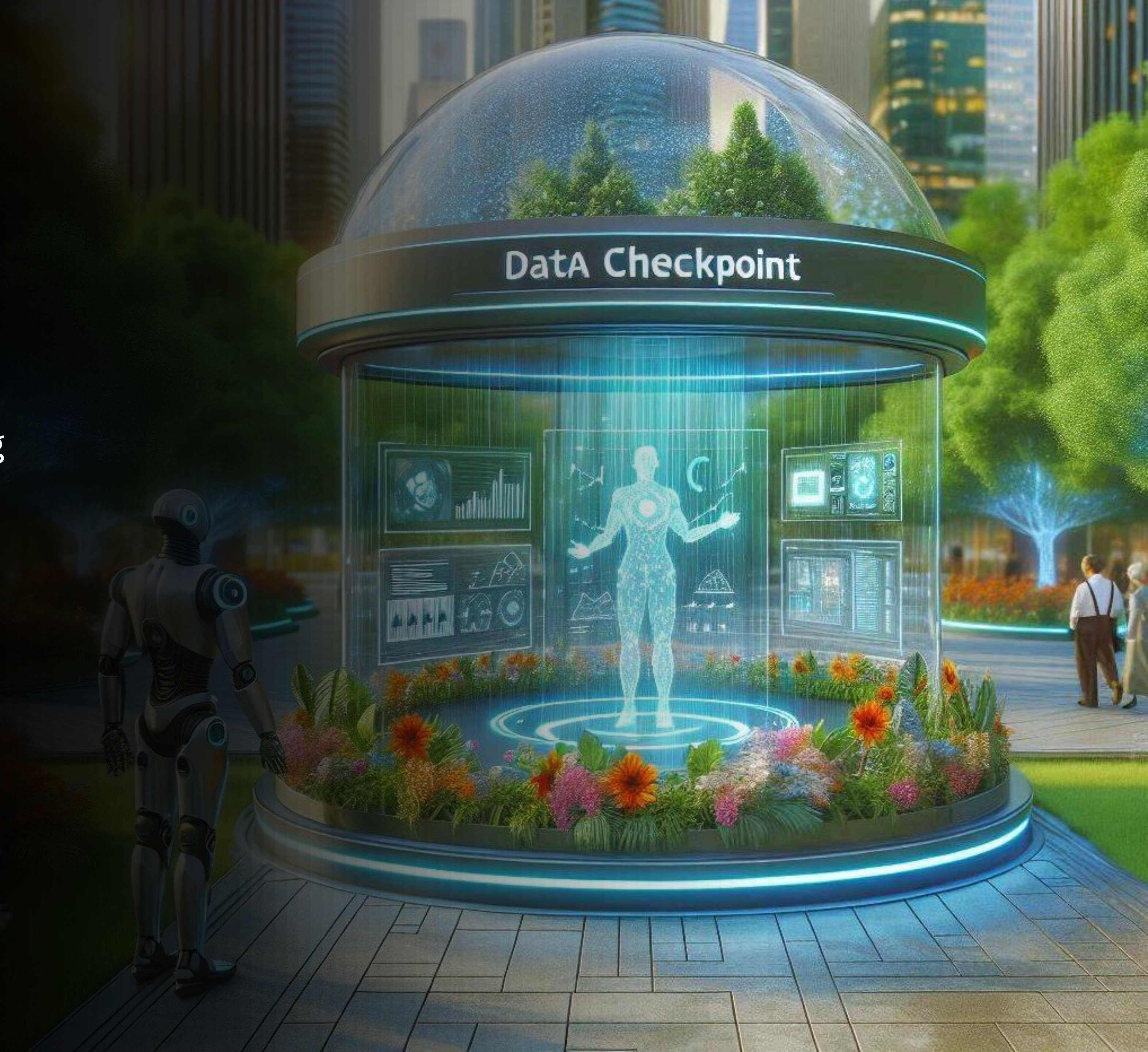
- Stored in the transaction log
- Contains information on schema, partitioning and configuration
- Important for managing and optimizing tables
- Can be queried with SQL, Python & Rust

Schema

- Enforces Schema on Write
- Allows for schema evolution
- As expected – defines the table structure

Checkpoints

- Periodic snapshots of transaction log
- Speeds up read- and recovery
- Checkpoint created automatically every 10 transactions
- Also created during optimization
- Stored as parquet files



Demo

Working with DELTA LAKE

- As mentioned, you can use SQL or several other languages
- CREATE
- INSERT
- SELECT
- UPDATE
- DELETE
- MERGE

Demo

Maintaining your delta lake

- Table properties
- Optimizing
- Table management
- Repairing

Table properties

- TBLPROPERTIES stored with metadata
- Enables automatic maintenance
  - Cleaning
  - Tuning
  - Repairing
- Enables better control over tables

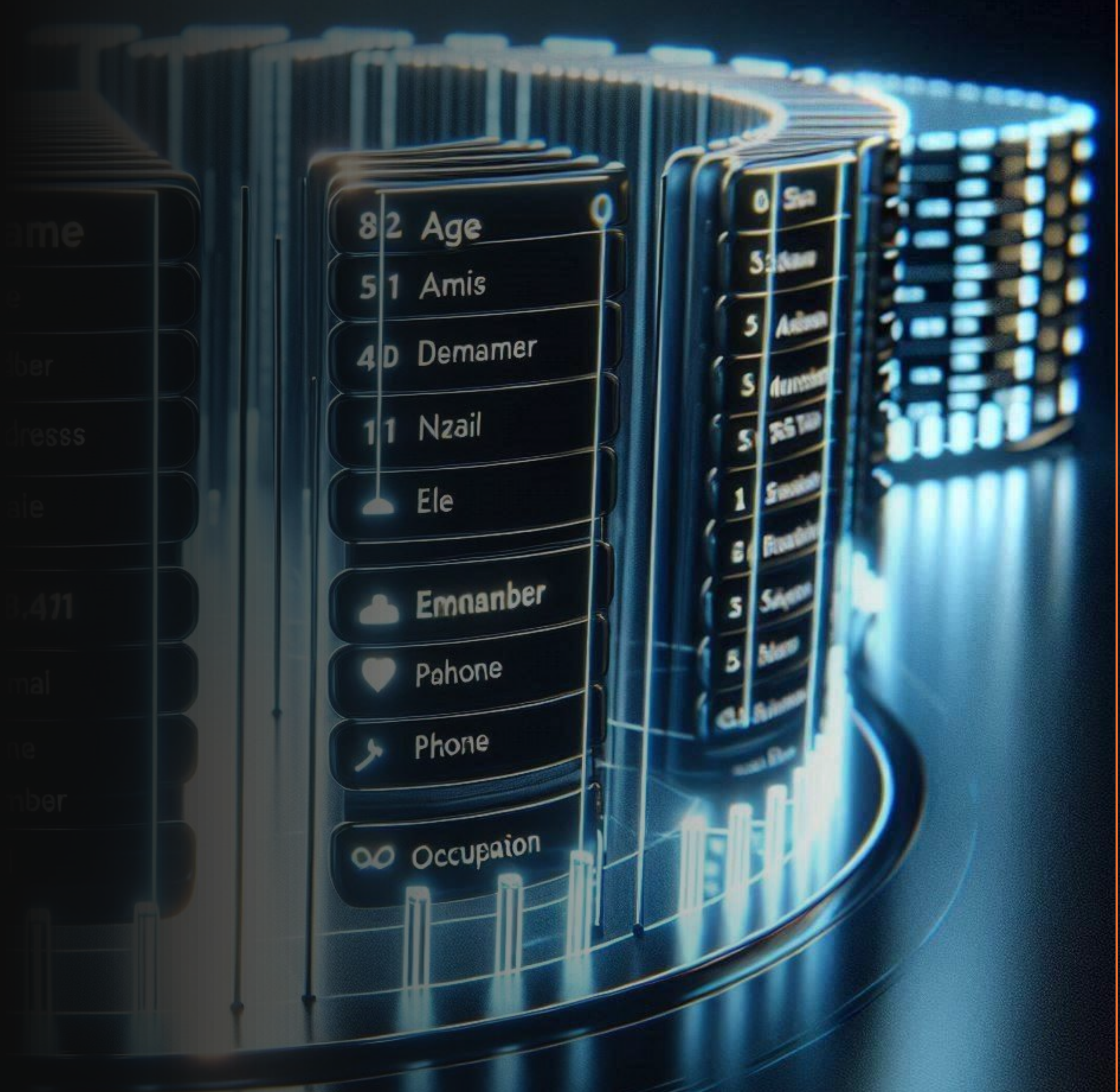


Table properties

Property	Data type	Use with	Default
delta.logRetentionDuration	CalendarInterval	Cleaning	*interval 30 days*
delta.deletedFileRetentionDuration	CalendarInterval	Cleaning	Interval 1 week
delta.setTransactionRetentionDuration	CalendarInterval	*Cleaning, Repairing*	none
*delta.targetFileSize**	String	Tuning	none
*delta.tuneFileSizesForRewrites**	Boolean	Tuning	none
*delta.autoOptimize.optimizeWrite**	Boolean	Tuning	none
delta.autoOptimize.autoCompact	Boolean	Tuning	none
delta.dataSkippingNumIndexedCols	Int	Tuning	32
delta.checkpoint.writeStatsAsStruct	Boolean	Tuning	none
delta.checkpoint.writeStatsAsJson	Boolean	Tuning	True
delta.randomizeFilePrefixes	Boolean	Tuning	False

* Exclusive to Databricks

Optimize

- The small file problem
- Performance hit
- OPTIMIZE
- Z-ORDER BY
- Table properties can be used to help
- File compression algorithm change?

V-ORDER (only Fabric)

- Write-time optimization
- Applies special
  - Sorting
  - Row group distribution
  - Dictionary encoding
  - Compression
- Requires less disk, CPU and bandwidth on read
- 15% more time on write
- 50% better compression
- Applied on parquet files so compatible with Delta level functions such as Z-Order

VACUUM

- Dead files caused by OPTIMIZE
- VACUUM helps clean up dead files
- Uses transaction log
- deletedFileRetentionDuration property sets boundaries
- VACUUM USING INVENTORY
- VACUUM LITE

Table Management

- Partitioning
- Don’t use if table <1 TB
- Choose the right column
  - Low cardinality
  - Partition files >1GB
- Partition at table creation
- Partitioning existing table forces rewrite

Liquid Clustering

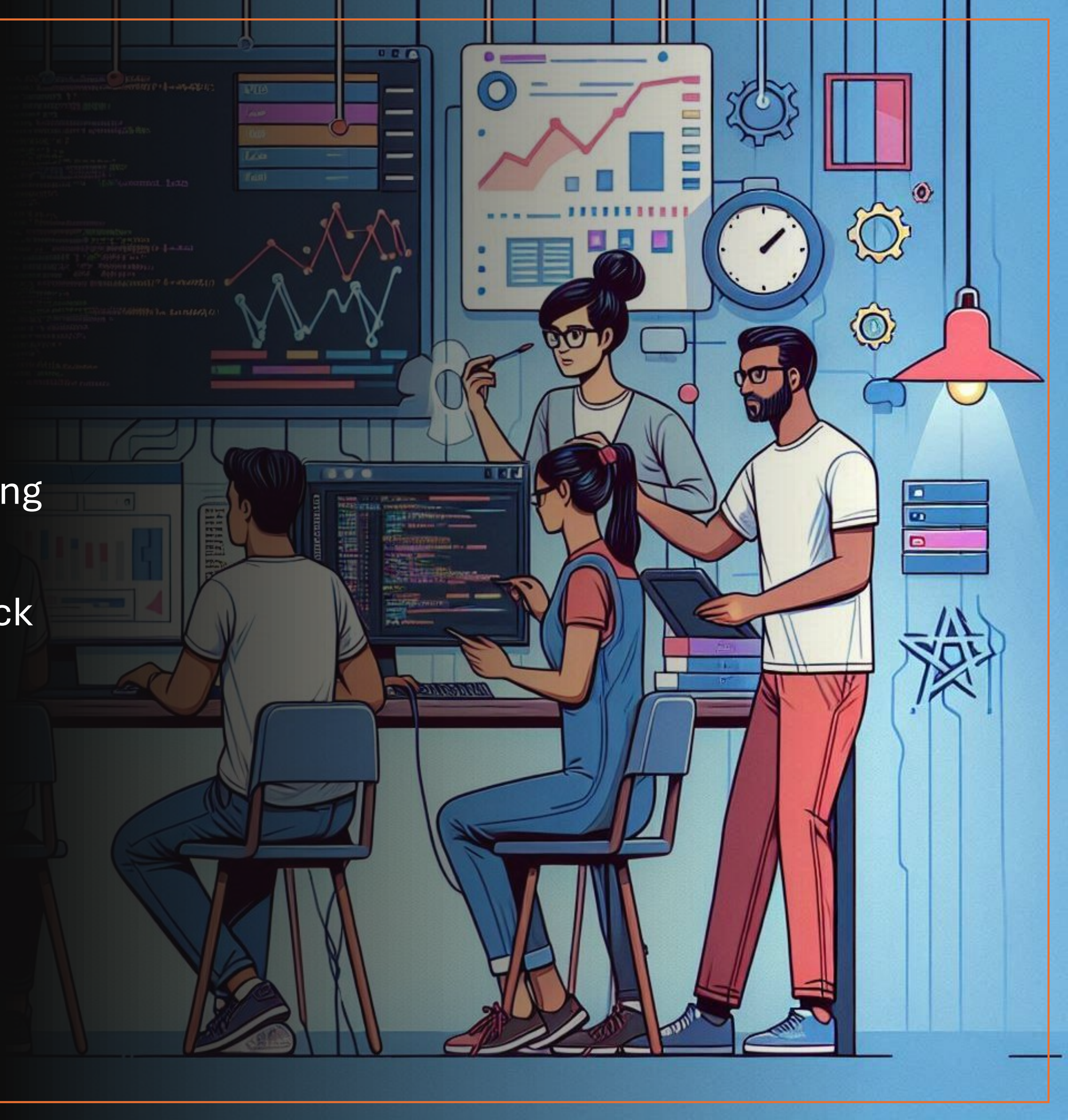
- Similar to partitioning – but also not…
- Replaces Z-ORDER and partitioning
- Can be implemented after table creation
- Better at full scans, or across multiple partitions
- Use on medium sized tables or with high cardinality columns

Worth mentioning?

- Fabric Lakehouse supports Auto Optmization
- Databricks has Predictive Optimization (not in all regions yet)
- Works well for smaller files and daily operations – for Liquid Clustering tables
- Worth using in combination with regular OPTIMIZE – especially if partitioned

Repairing

- Recover data with REPLACEWHERE
    - Replace missing or overwrite existing
- Delete data or remove partitions
    - Timetravel can help us get data back
- Dropping table
    - No undo button
- Keeping a clean house – or table
    - VACUUM to remove deleted files



Demo

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