
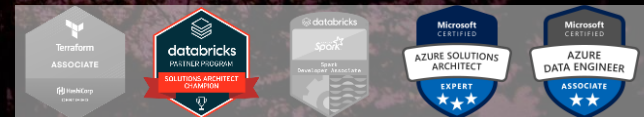
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 | FalekMiah01

# Quest to Delta Optimisation







# Session Scope

# Session Scope

🔗 Optimizing delta files and tables can be challenging and even a daunting task.

🔗 Techniques like partitioning and z-ordering can be limited and inflexible

🔗 Partition – Difficult & Complex

🔗 Z-Order – Expensive Operation

⚙️ In this session

⚙️ Small File Problem

⚙️ Different Optimizing Approaches

⚙️ Liquid Clustering



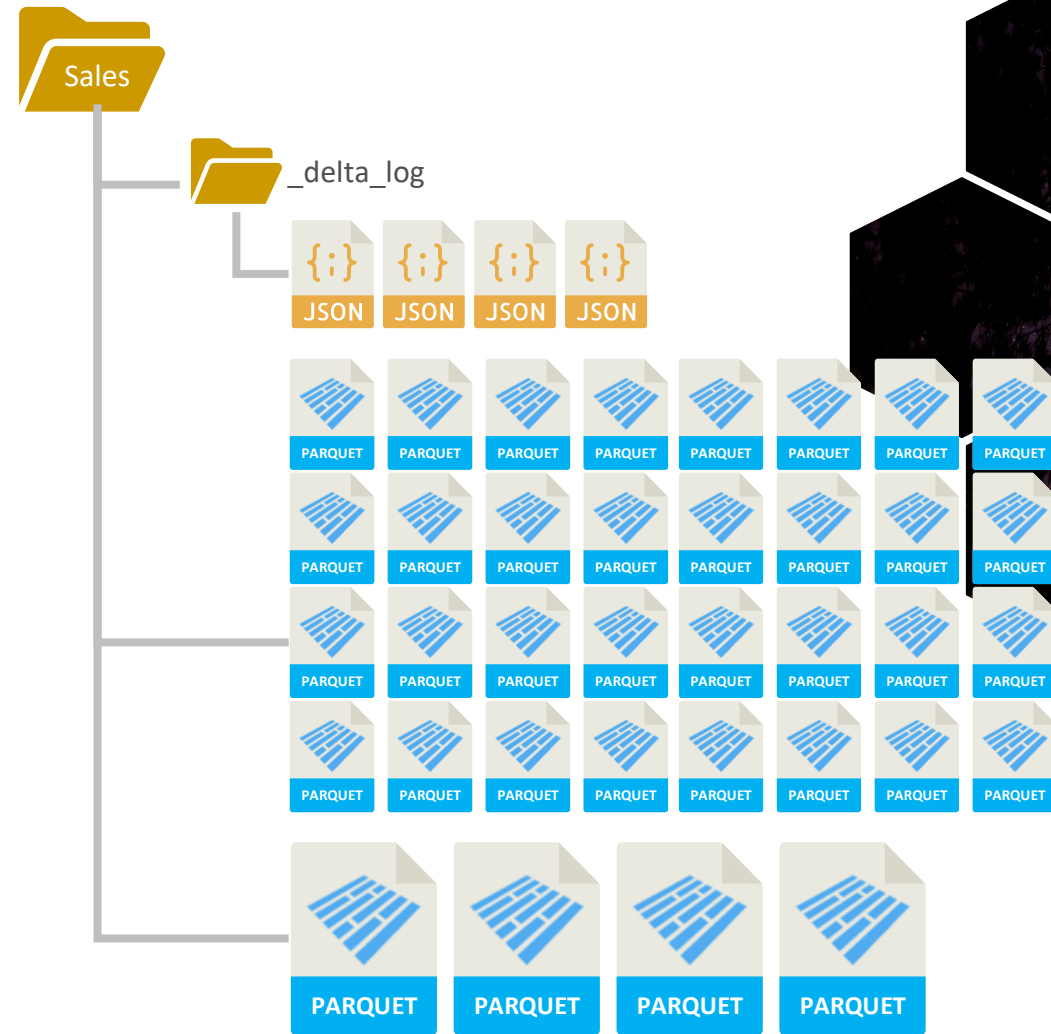




# Small File Problem

# Small File Problem

- ❗ Parquet files have an **optimal size**
- ❗ Updates **small and inefficient files**
- ❗ **OPTIMIZE** command
  - ❗ Compacts small files into larger
  - ❗ Performed on entire table
- ❗ Files are **NOT** deleted and add to the JSON transaction log
- ❗ To remove obsolete history files using **VACUUM** command





A photograph of the Milky Way galaxy arching across a dark night sky, framed by the silhouettes of trees at the top and bottom. A white horizontal bar is positioned across the middle of the image, containing the word "Partition" in a dark, sans-serif font.

# Partition

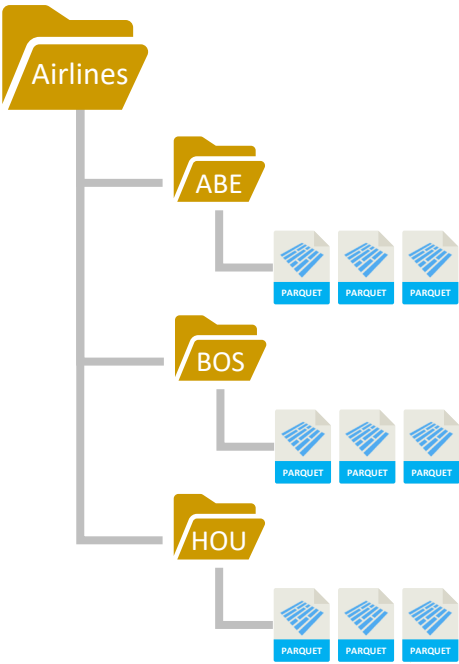


# Partition

⚙️ Data is stored as multiple small files in folder

⚙️ Partition divides those data file into useful slices

	$A^B_C$ path	$A^B_C$ name	$1^2_3$ size
1	> abfss://main-unitycat@fmsandbox1adlseusdev.dfs.core.windows.net/fm_sandbox_demo/delta...	_delta_log/	0
2	> abfss://main-unitycat@fmsandbox1adlseusdev.dfs.core.windows.net/fm_sandbox_demo/delta...	part-00000-b98e881e-3f4c-4c79-b302-d39913d8152c-c000.snappy.parquet	26219543
3	> abfss://main-unitycat@fmsandbox1adlseusdev.dfs.core.windows.net/fm_sandbox_demo/delta...	part-00001-7f97abda-c878-4267-969e-49b2a481ae1e-c000.snappy.parquet	25866380
4	> abfss://main-unitycat@fmsandbox1adlseusdev.dfs.core.windows.net/fm_sandbox_demo/delta...	part-00002-93951a0f-1e1c-4702-8cf8-1b31a8558f0d-c000.snappy.parquet	25550022
5	> abfss://main-unitycat@fmsandbox1adlseusdev.dfs.core.windows.net/fm_sandbox_demo/delta...	part-00003-cfa00f58-315e-4d71-8d93-4077ffe274b9-c000.snappy.parquet	25725017
6	> abfss://main-unitycat@fmsandbox1adlseusdev.dfs.core.windows.net/fm_sandbox_demo/delta...	part-00004-14412e3d-48d7-43e2-90b4-1eb3df04810d-c000.snappy.parqu...	24631235
7	> abfss://main-unitycat@fmsandbox1adlseusdev.dfs.core.windows.net/fm_sandbox_demo/delta...	part-00005-2f098aac-2975-4915-8992-545ff1d1751a-c000.snappy.parquet	3152233



	$A^B_C$ path	$A^B_C$ name
1	abfss://main-unitycat@fmsandbox1adlseusdev.dfs.core.windows.net/fm_sandbox_demo/deltaoptimize/airlines/Origin=ABE/	Origin=ABE/
2	abfss://main-unitycat@fmsandbox1adlseusdev.dfs.core.windows.net/fm_sandbox_demo/deltaoptimize/airlines/Origin=ABI/	Origin=ABI/
3	abfss://main-unitycat@fmsandbox1adlseusdev.dfs.core.windows.net/fm_sandbox_demo/deltaoptimize/airlines/Origin=ABQ/	Origin=ABQ/
4	abfss://main-unitycat@fmsandbox1adlseusdev.dfs.core.windows.net/fm_sandbox_demo/deltaoptimize/airlines/Origin=ABY/	Origin=ABY/
5	abfss://main-unitycat@fmsandbox1adlseusdev.dfs.core.windows.net/fm_sandbox_demo/deltaoptimize/airlines/Origin=ACK/	Origin=ACK/
6	abfss://main-unitycat@fmsandbox1adlseusdev.dfs.core.windows.net/fm_sandbox_demo/deltaoptimize/airlines/Origin=ACT/	Origin=ACT/
7	abfss://main-unitycat@fmsandbox1adlseusdev.dfs.core.windows.net/fm_sandbox_demo/deltaoptimize/airlines/Origin=ACV/	Origin=ACV/
8	abfss://main-unitycat@fmsandbox1adlseusdev.dfs.core.windows.net/fm_sandbox_demo/deltaoptimize/airlines/Origin=ACY/	Origin=ACY/
9	abfss://main-unitycat@fmsandbox1adlseusdev.dfs.core.windows.net/fm_sandbox_demo/deltaoptimize/airlines/Origin=ADK/	Origin=ADK/
10	abfss://main-unitycat@fmsandbox1adlseusdev.dfs.core.windows.net/fm_sandbox_demo/deltaoptimize/airlines/Origin=ADQ/	Origin=ADQ/
11	abfss://main-unitycat@fmsandbox1adlseusdev.dfs.core.windows.net/fm_sandbox_demo/deltaoptimize/airlines/Origin=AEX/	Origin=AEX/
12	abfss://main-unitycat@fmsandbox1adlseusdev.dfs.core.windows.net/fm_sandbox_demo/deltaoptimize/airlines/Origin=AGS/	Origin=AGS/
13	abfss://main-unitycat@fmsandbox1adlseusdev.dfs.core.windows.net/fm_sandbox_demo/deltaoptimize/airlines/Origin=AKN/	Origin=AKN/
14	abfss://main-unitycat@fmsandbox1adlseusdev.dfs.core.windows.net/fm_sandbox_demo/deltaoptimize/airlines/Origin=ALB/	Origin=ALB/

```
-- Query
SELECT * FROM airline
WHERE Origin = "ABE"
```

# Partition - Consideration

 High Cardinality

 Small Files Problem

	$\frac{B}{A \cdot C}$ path	$\frac{B}{A \cdot C}$ name
1	> abfss://main-unitycat@fmsandbox1adlseusdev.dfs.core.windows.net/fm_sandbox_demo/deltaoptimize/airlines_partitioned/Origin=ABE/...	part-00000-9785acf9-a70b-47c0-b80c-14d66474c
2	> abfss://main-unitycat@fmsandbox1adlseusdev.dfs.core.windows.net/fm_sandbox_demo/deltaoptimize/airlines_partitioned/Origin=ABE/...	part-00001-3169b574-8b80-4924-948c-6b1ddc9e
3	> abfss://main-unitycat@fmsandbox1adlseusdev.dfs.core.windows.net/fm_sandbox_demo/deltaoptimize/airlines_partitioned/Origin=ABE/...	part-00002-4742872c-1605-4b56-a64e-8ce72275
4	> abfss://main-unitycat@fmsandbox1adlseusdev.dfs.core.windows.net/fm_sandbox_demo/deltaoptimize/airlines_partitioned/Origin=ABE/...	part-00003-3052ec3d-66b8-4f61-a934-8de64ed6
5	> abfss://main-unitycat@fmsandbox1adlseusdev.dfs.core.windows.net/fm_sandbox_demo/deltaoptimize/airlines_partitioned/Origin=ABE/...	part-00004-bc9d9030-58bb-4083-b2e1-972cc365
6	> abfss://main-unitycat@fmsandbox1adlseusdev.dfs.core.windows.net/fm_sandbox_demo/deltaoptimize/airlines_partitioned/Origin=ABE/...	part-00005-15affa18-c806-45b9-bdf4-668bab88f

 Not Flexible







# Data Skipping & Z-Ordering

# Data Skipping

⚙️ Collect Statistics in Transaction Log

⚙️ Collects “min/max” Value For First 32 Columns

⚙️ Selectively Ignore Files

## commitInfo

```
object
  clusterId: ""
  engineInfo: "Databricks-Runtime/14.3.x-scala2.12"
  isBlindAppend: false
  isolationLevel: "SnapshotIsolation"
  notebook: {"notebookId": "518233935283640"}
  operation: "OPTIMIZE"
  operationMetrics:
    {"maxFileSize": "133687631", "minFileSize": "133687631", "numAddedBytes": "133687631", "numAddedFiles": "1",
    "numDeletionVectorsRemoved": "0", "numRemovedBytes": "131237140", "numRemovedFiles": "18", "p25FileSize":
    "133687631", "p50FileSize": "133687631", "p75FileSize": "133687631"}
  operationParameters: {"auto": false, "batchId": "0", "predicate": "[]", "zOrderBy": "[]"}
  readVersion: 12
  tags: {"delta.rowTracking.preserved": "false"}
  timestamp: 1706885757825
```



ID

```
{ min:"1",
  max:"10000" }
```



ID

```
{ min:"20001",
  max:"30000" }
```



ID

```
{ min:"10001",
  max:"20000" }
```



ID

```
{ min:"30001",
  max:"40000" }
```

```
SELECT * FROM [table] WHERE ID < "20000"
```



# Z-Ordering

*“Sort the data on specific columns before writing to files, to optimize data skipping”*

```
--Optimize an entire table  
OPTIMIZE [database].[table] ZORDER BY [columnName]
```

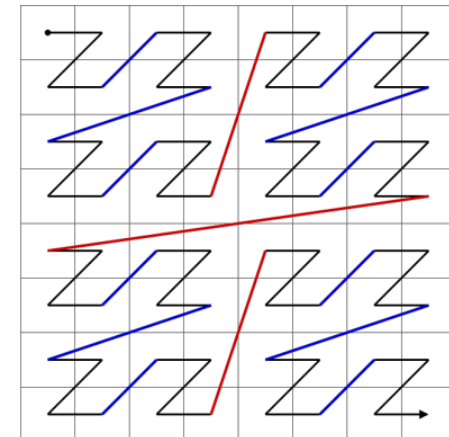


Apply on Join Keys or Commonly Queried Columns



Apply on Columns Statistics Are Collected

Z-Order Curve



# Z-Ordering & Data Skipping

```
SELECT count(*) FROM Employees  
WHERE Name = 'Brad'
```

⚙️ The small files are not ordered

⚙️ SQL statement to query data

A	1	Bob
A	2	Fred



A	1	Andy
A	2	Tom



A	1	Brad
A	2	Tim



A	1	Dan
A	2	Jan





# Z-Ordering & Data Skipping

```
SELECT count(*) FROM Employees  
WHERE Name = 'Brad'
```

A	1	Bob
A	2	Fred

A	1	Andy
A	2	Tom

A	1	Brad
A	2	Tim

A	2	Dan
A	1	Jan

OPTIMIZE

ZORDER BY  
Name

A	1	Andy
A	1	Bob
A	1	Brad
A	2	Dan

A	2	Fred
A	1	Jan
A	2	Tim
A	2	Tom



Z-Order as like a  
Clustered Index



# Z-Ordering – Consideration

 Rewrite All The Data

 No Checkpointing

 No Table Level

 Not Flexible



Z-Order can be expensive!  
Best to perform as an out-of-hours  
maintenance operation







# Liquid Clustering

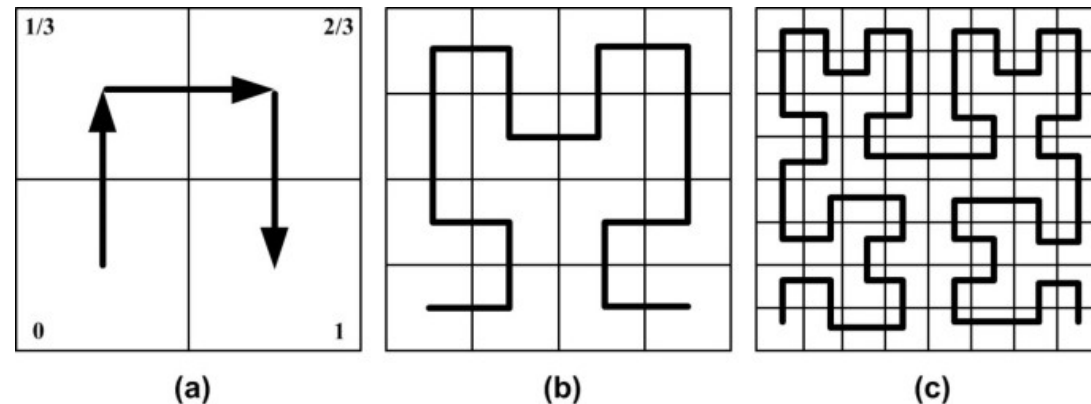
# Liquid Clustering



- ⚙️ Simplifies Data Layout changes
- ⚙️ More Adaptable & Flexible
- ⚙️ Table Level Clustering
- ⚙️ Streamlines Operations
- ⚙️ Simplifies Data Management
- ⚙️ Enhances query performance

```
-- Create table  
CREATE TABLE [database].[table] CLUSTER BY [columnName]  
  
-- Modified Table  
ALTER TABLE [database].[table] CLUSTER BY [columnName]
```

## Hilbert Curve Algorithm



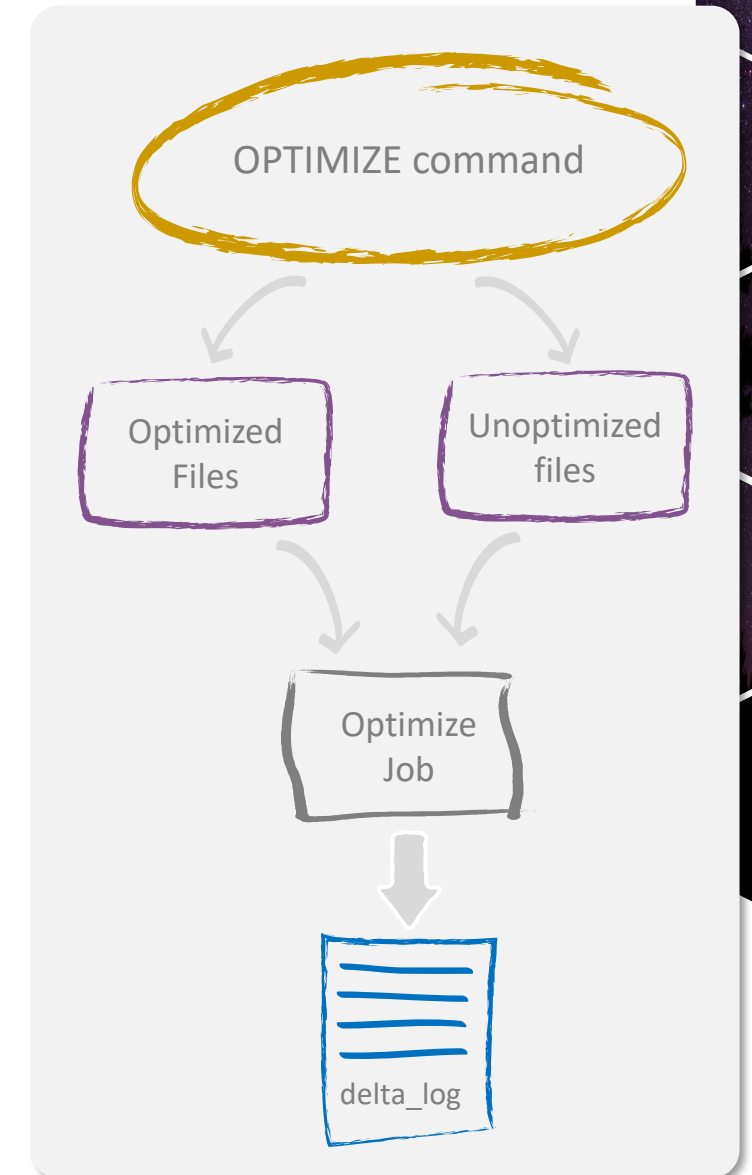


# Liquid Clustering

⚙️ Incremental Clustering



⚙️ Optimize Flow



⚙️ Metadata Integration



A wide-angle photograph of a night sky. The Milky Way galaxy is visible as a bright, hazy band of light stretching diagonally across the frame. The sky is filled with numerous stars of varying brightness. In the foreground, the dark silhouettes of trees and foliage are visible, framing the sky. A white rectangular box is overlaid on the lower half of the image, containing the word "Demo" in a dark, sans-serif font.

Demo



# Liquid Clustering – Consideration



Default Choice



Compatibility

> Databricks Runtime 13.3 LTS



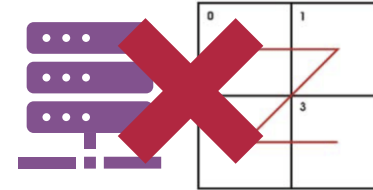
Uses Specific Delta Versions

7  
writer

3  
reader



Not Compatible With Previous Strategies



Eliminates OPTIMIZE ZORDER BY

OPTIMIZE [database].[table]  
ZORDER BY [column Name]



# Liquid Clustering – Limitations



4 Columns



Columns With Statistics



Structured Streaming



Delta Sharing







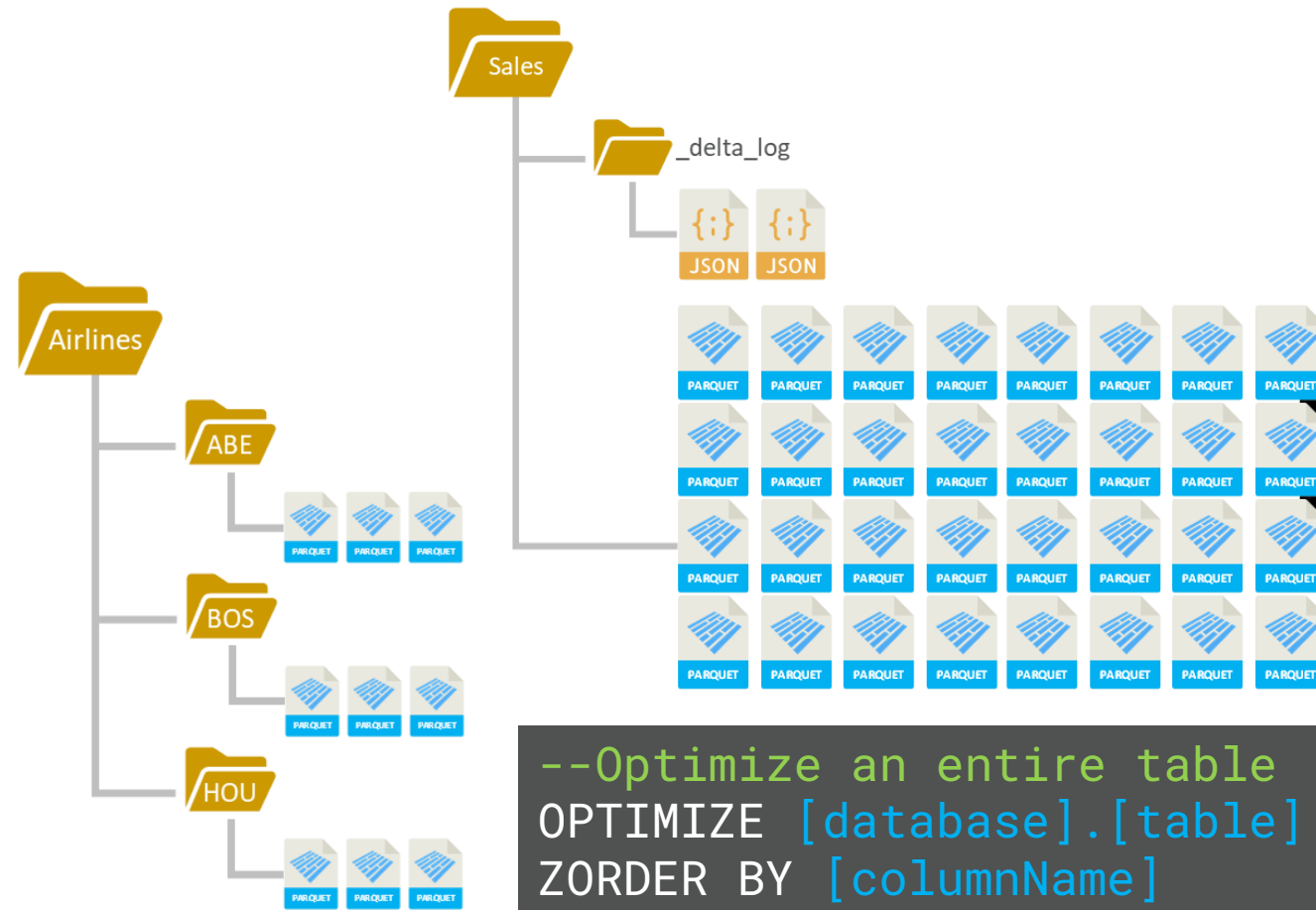
# Wrap Up

# Wrap Up

↻ Small File Problem

↻ Partition

↻ Z-Ordering





# Wrap Up



↻ Small File Problem

↻ Partition

↻ Z-Ordering

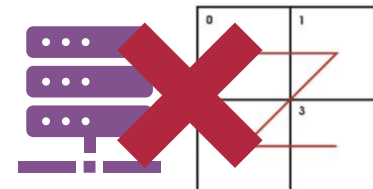
↻ Liquid Clustering

```
-- Create table
CREATE TABLE [database].[table] CLUSTER BY [columnName]

-- Modified Table
ALTER TABLE [database].[table] CLUSTER BY [columnName]
```



👉 **Try it out**



# Thank You

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