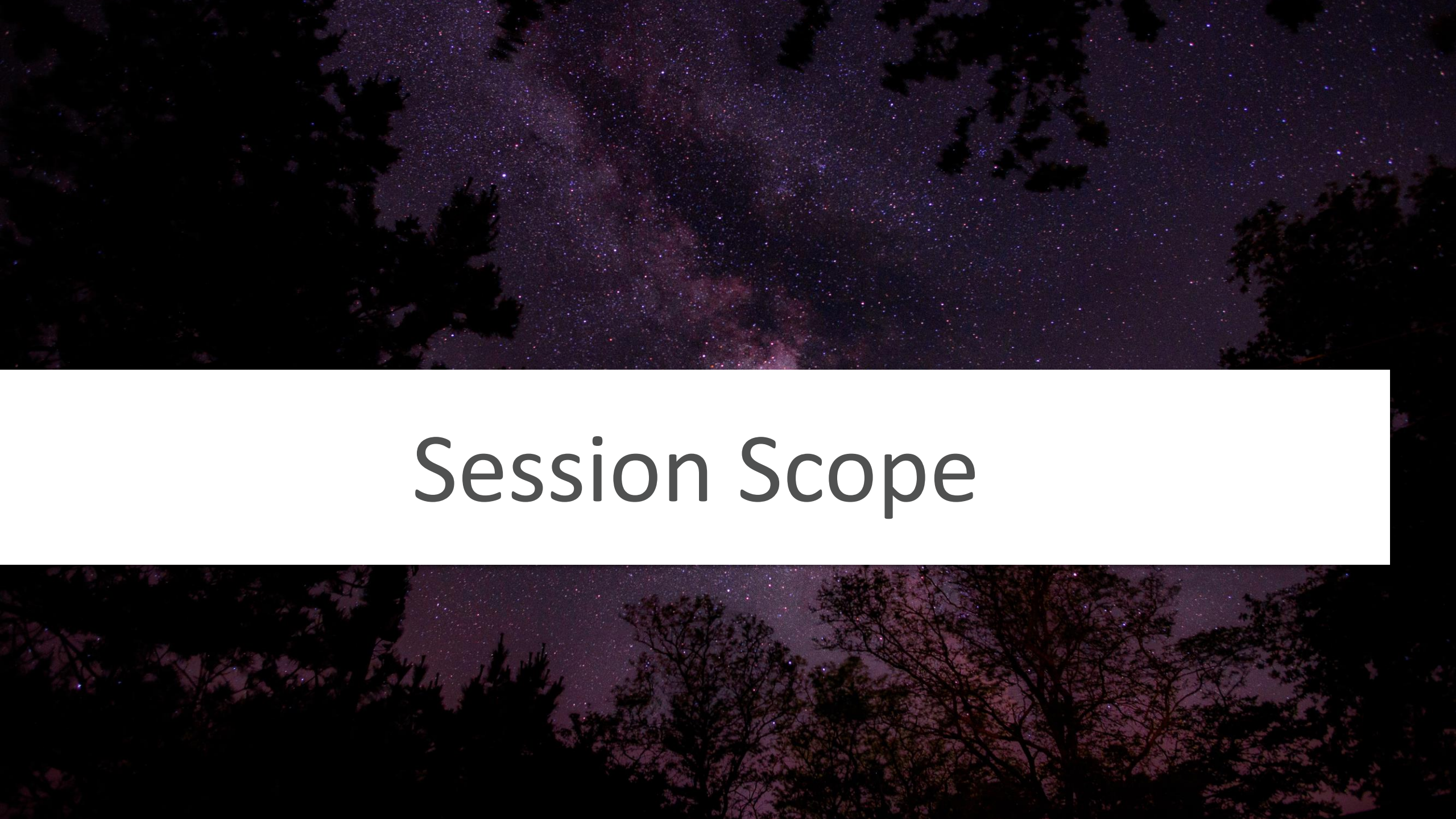
Quest to Delta Optimisation

@falekmiah

falekmiah.com

FalekMiah01



Session Scope

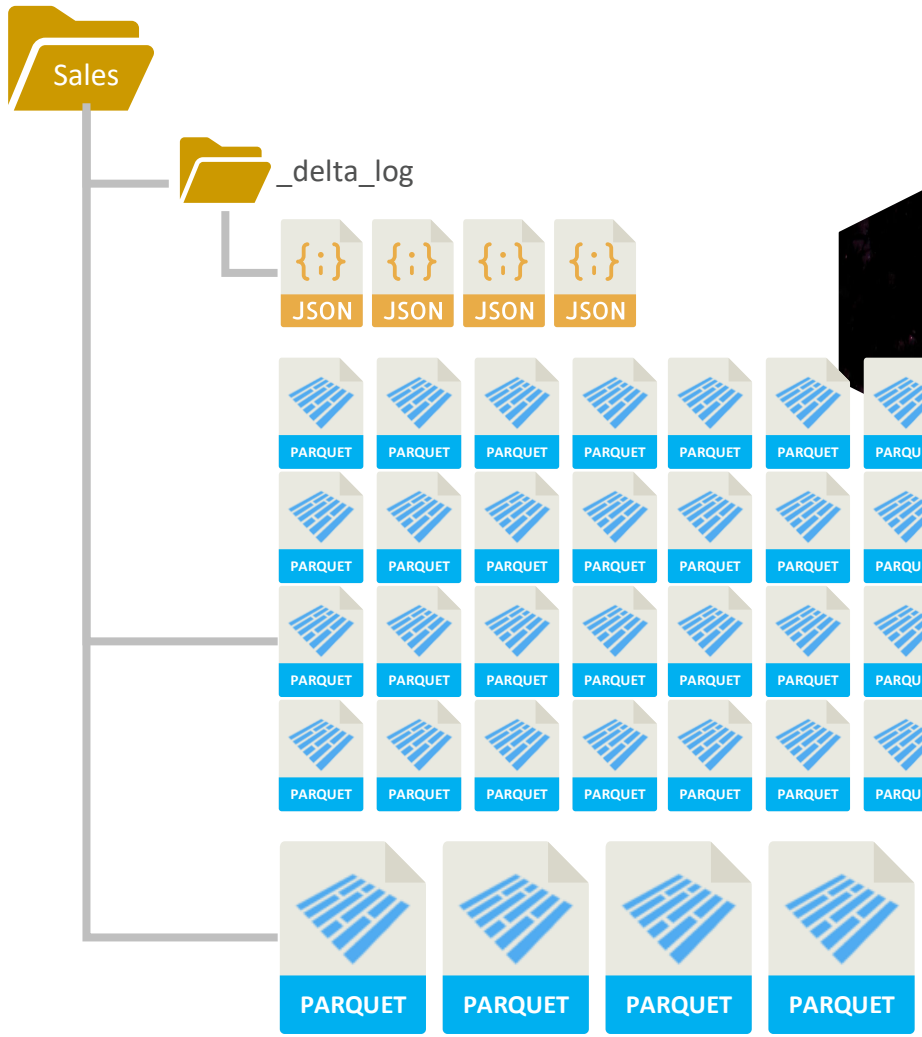
Session Scope

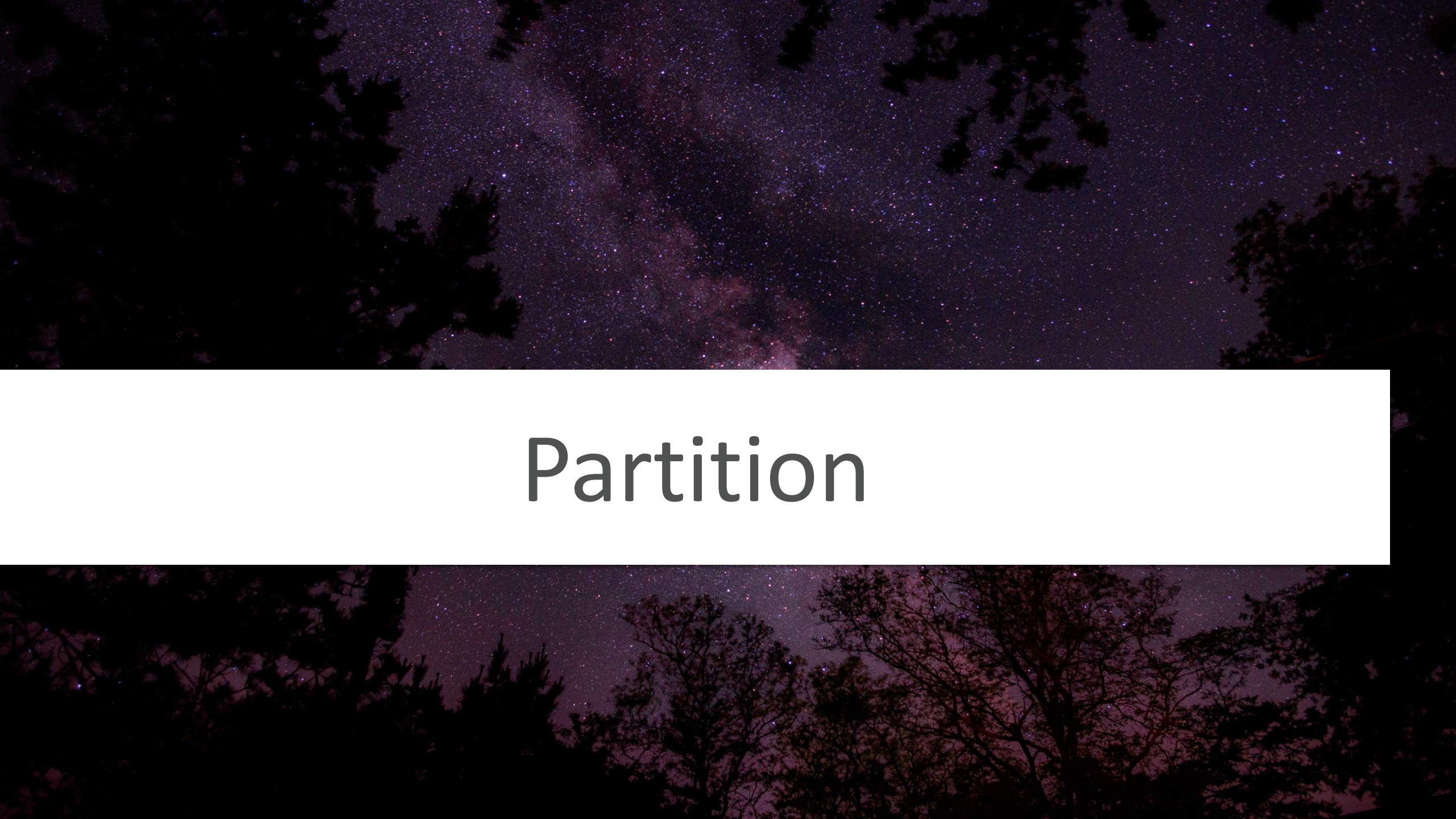
- Optimizing delta files and tables can be challenging and even a daunting task.
- Techniques like partitioning and z-ordering can be limited and inflexible
  - Partition – Difficult & Complex
  - Z-Order – Expensive Operation
- In this session
  - Small File Problem
  - Different Optimizing Approaches
  - 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





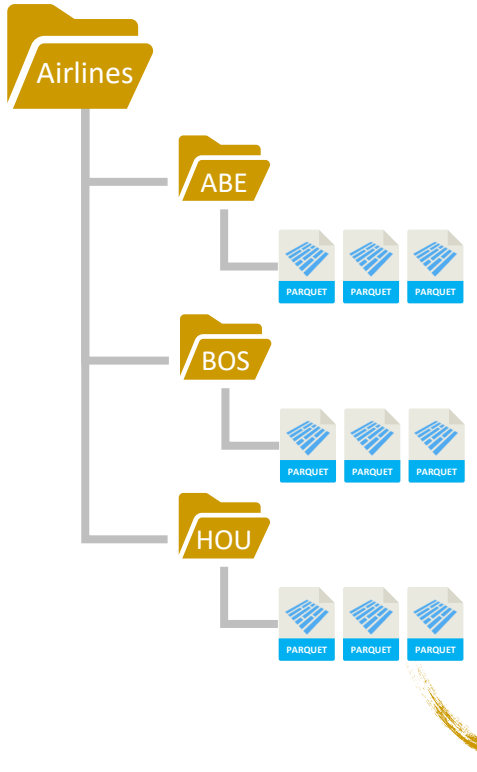
Partition

Partition

- Data is stored as multiple small files in folder

	path	name	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

- Partition divides those data file into useful slices



	path	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

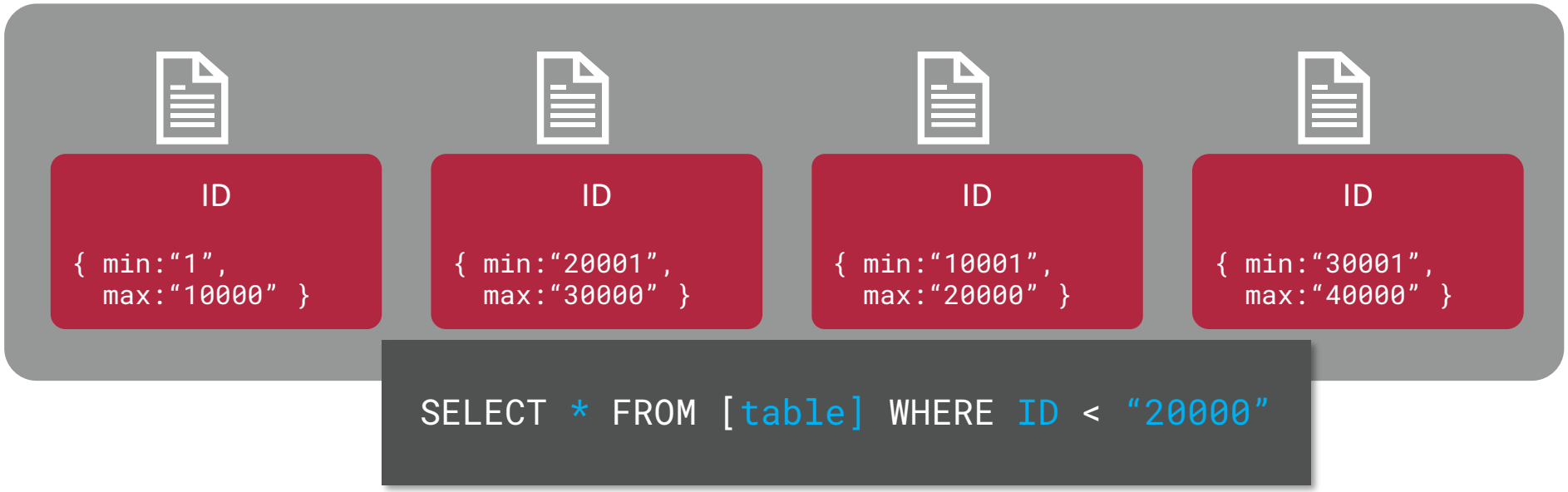
	path	name
1	abfss://main-unitycat@fmsandbox1adlseusdev.dfs.core.windows.net/fm_sandbox_demo/deltaoptimize/airlines_partitioned/Origin=ABE/...	part-00000-9785acf9-a70b-47c0-b80c-14d66474
2	abfss://main-unitycat@fmsandbox1adlseusdev.dfs.core.windows.net/fm_sandbox_demo/deltaoptimize/airlines_partitioned/Origin=ABE/...	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



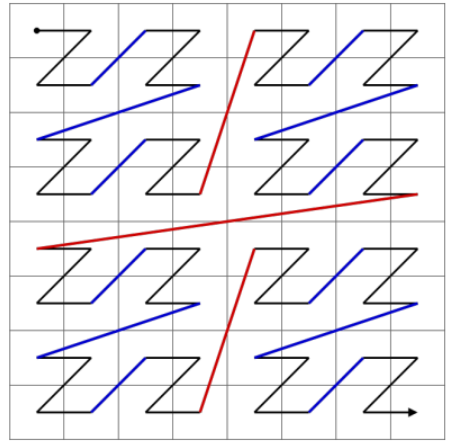
Z-Ordering

"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

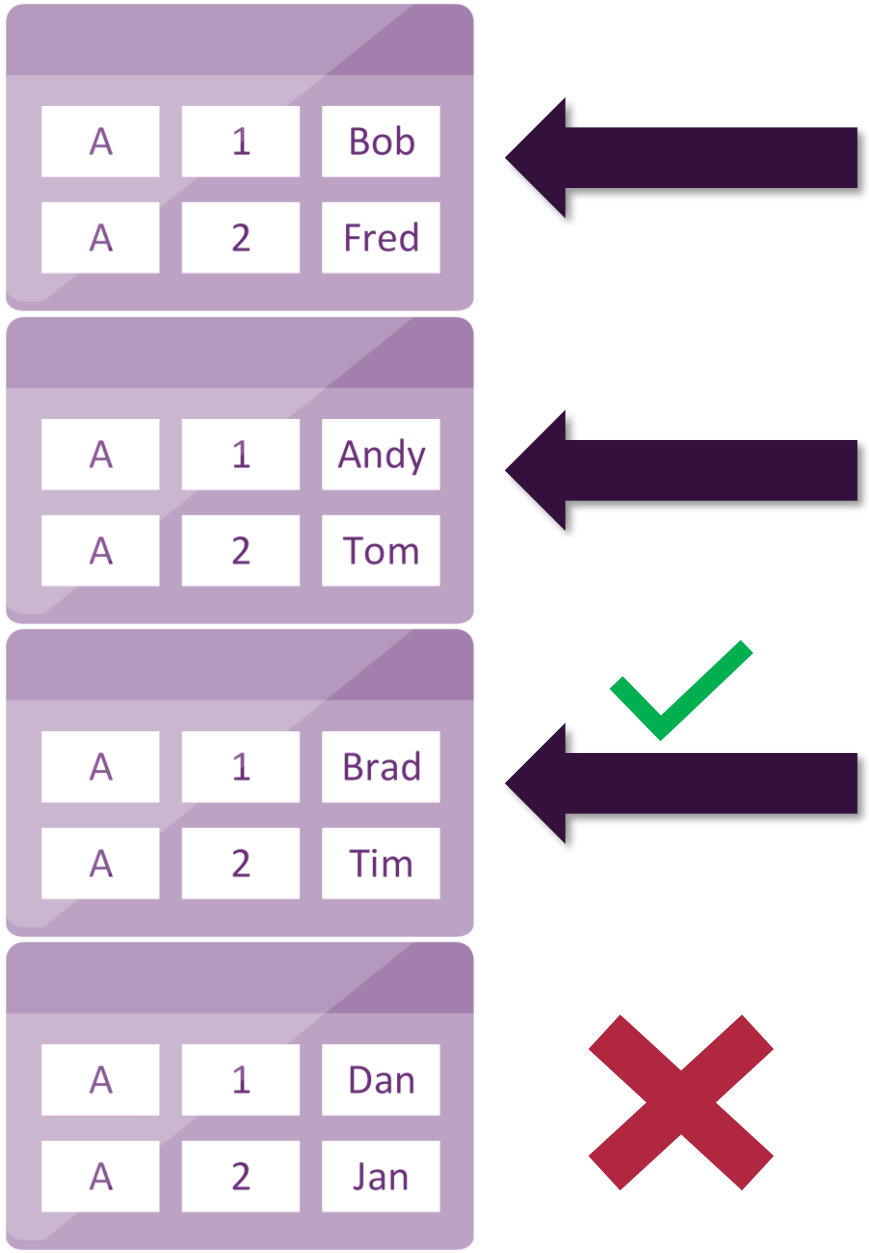
Z-Order Curve



Source: https://en.wikipedia.org/wiki/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

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

OPTIMZE

```
ZORDER BY
Name
```

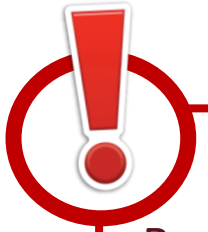
A	1	Andy
A	1	Bob
A	1	Brad
A	2	Dan

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 expense!
Best to perform as an out-of-hours maintenance operation

Liquid Clustering

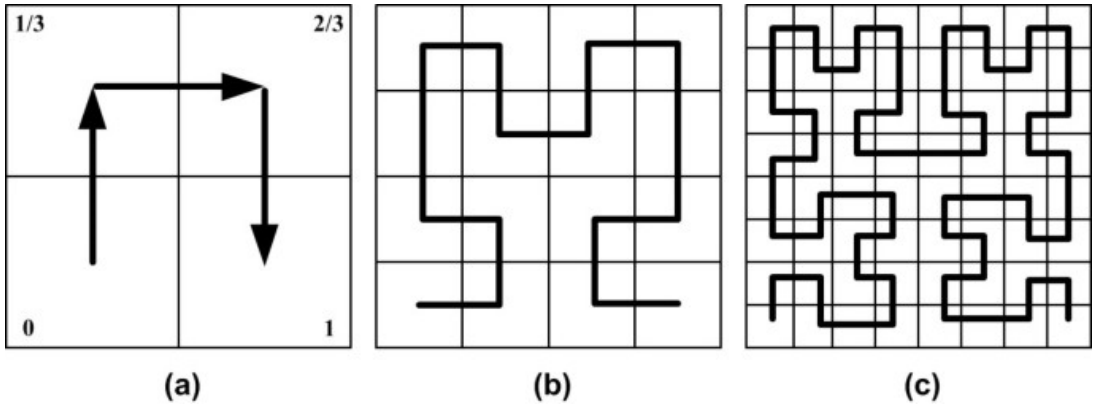
Liquid Clustering

- 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

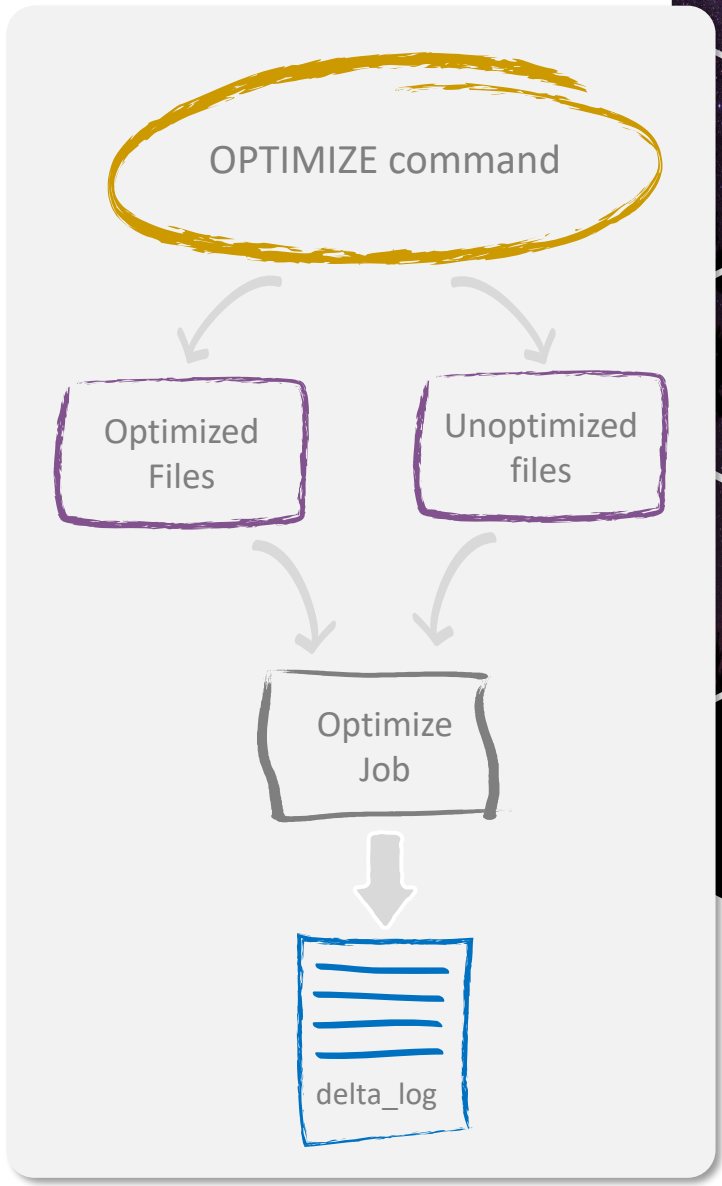


Source: https://asp-eurasipjournals.springeropen.com/articles/10.1186/1687-6180-2012-181/figures/1

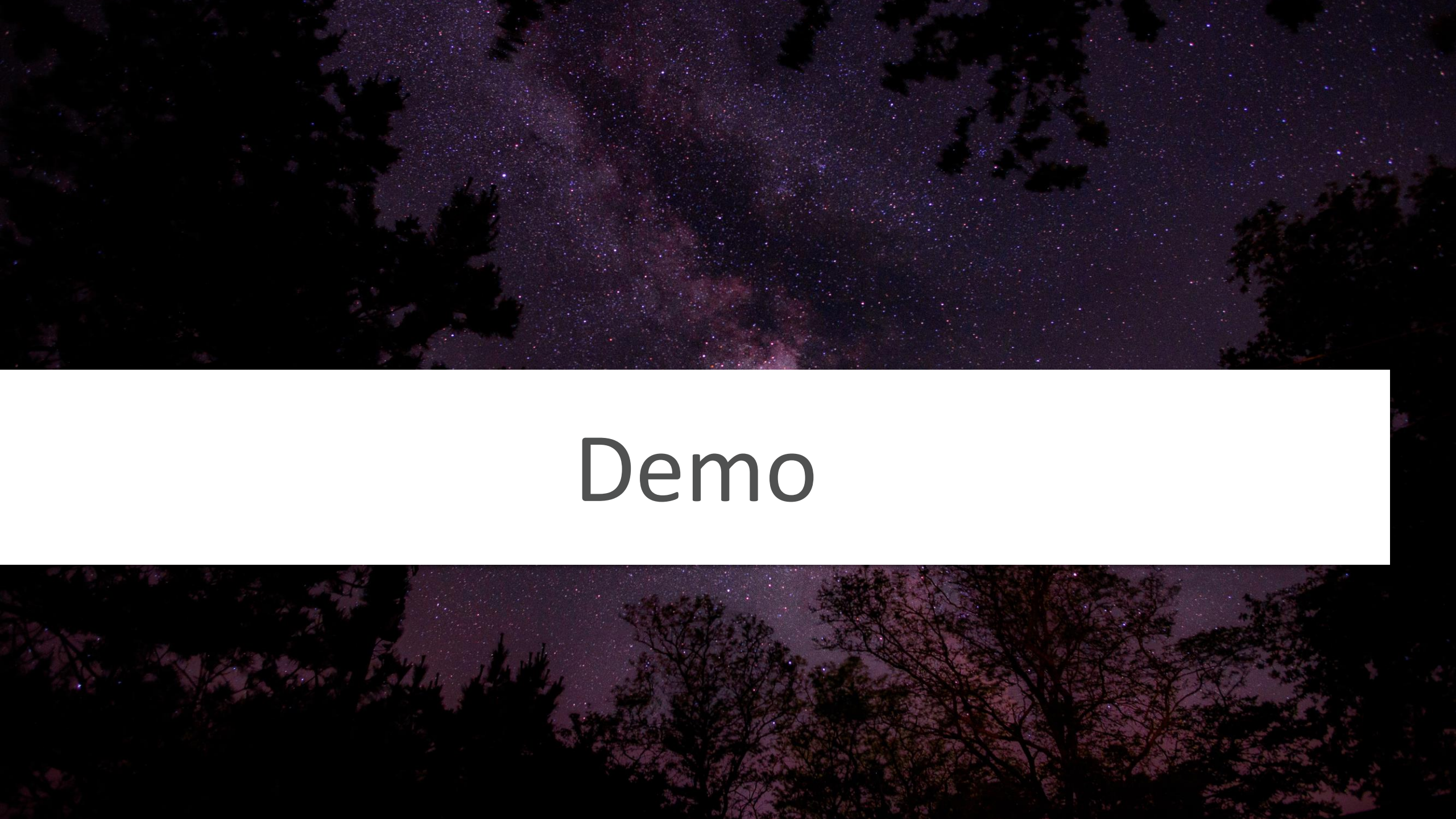
Liquid Clustering

- Incremental Clustering

- Optimize Flow



- Metadata Integration



Demo

Liquid Clustering – Consideration

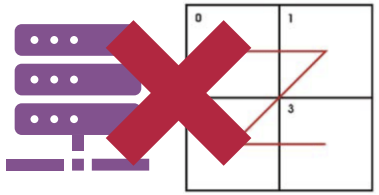
- Default Choice

- Compatibility

```
> Databricks Runtime 13.3 LTS
```

- Uses Specific Delta Versions

- Not Compatible With Previous Strategies



- Eliminates OPTIMIZE ZORDER BY

```
OPTIMIZE [da      e].[table]
ZORDER BY [c      Name]
```

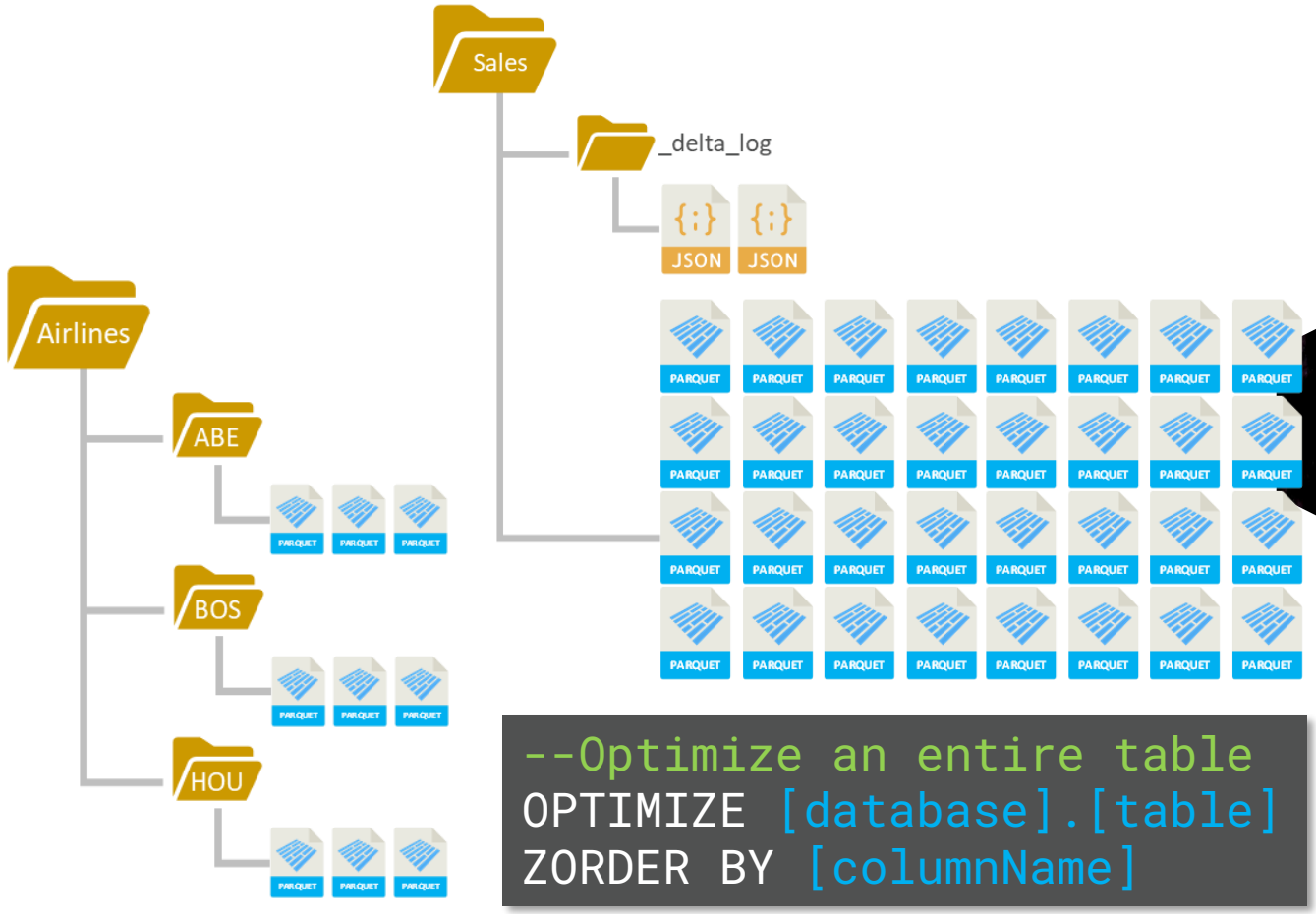
Liquid Clustering – Limitations

- 4 Columns
- Columns With Statistics
- Structured Streaming
- Delta Sharing

Wrap Up

Wrap Up

- Small File Problem
- Partition
- Z-Ordering




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

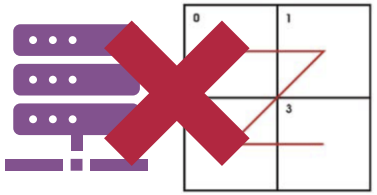
Wrap Up

- 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


falek@advancinganalytics.co.uk


@falekmiah


falekmiah.com


FalekMiah01

PREMIUM SPONSORS

dataon
Power your data

twoday

exmon

Fellowmind

STANDARD SPONSORS

devoteam
Data Driven

INVIXO

INSPARI
a valantic company

backstage

BIWISE
BASED ON INTELLIGENCE

RAFFLE PRIZES