Optimizing Data File Layout

Learning Objectives

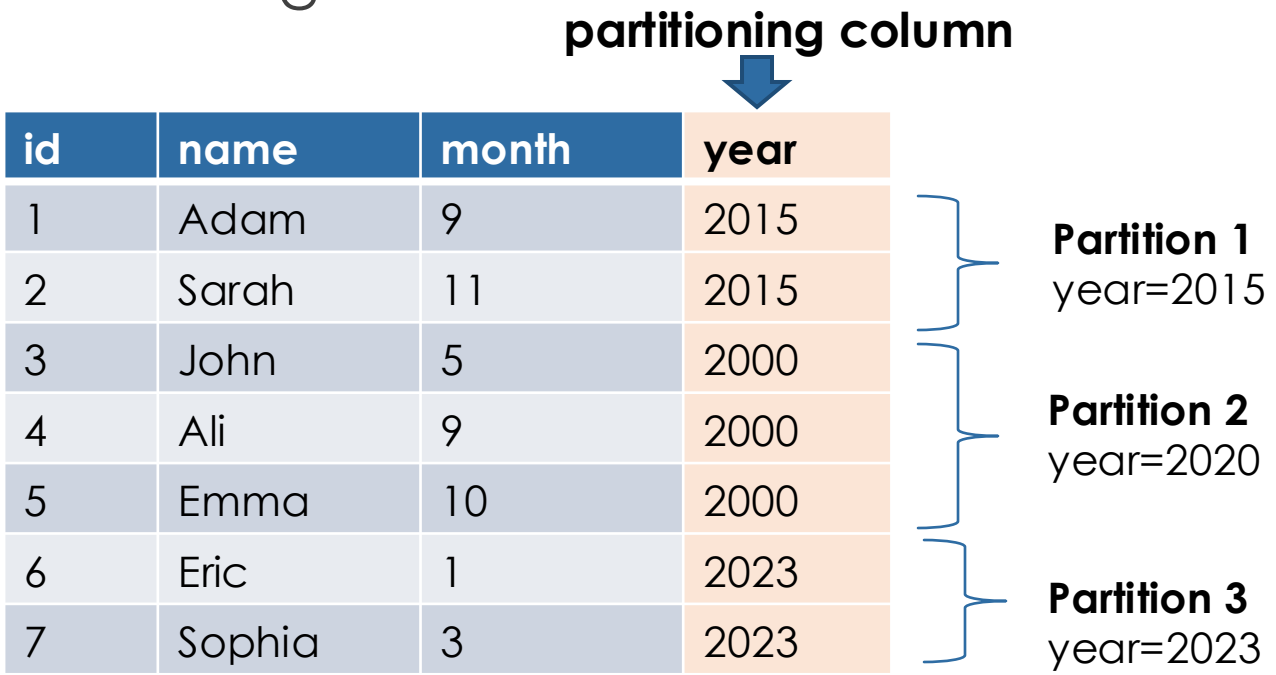
- The concept of data file layout
- Exploring optimization techniques.

Data File Layout

- The organization and storage structure of the underlying data files that make up a Delta table.
- Optimizing layout helps leveraging data-skipping algorithms
- Optimization techniques:
  - Partitioning
  - Z-Order Indexing
  - Liquid Clustering

Partitioning

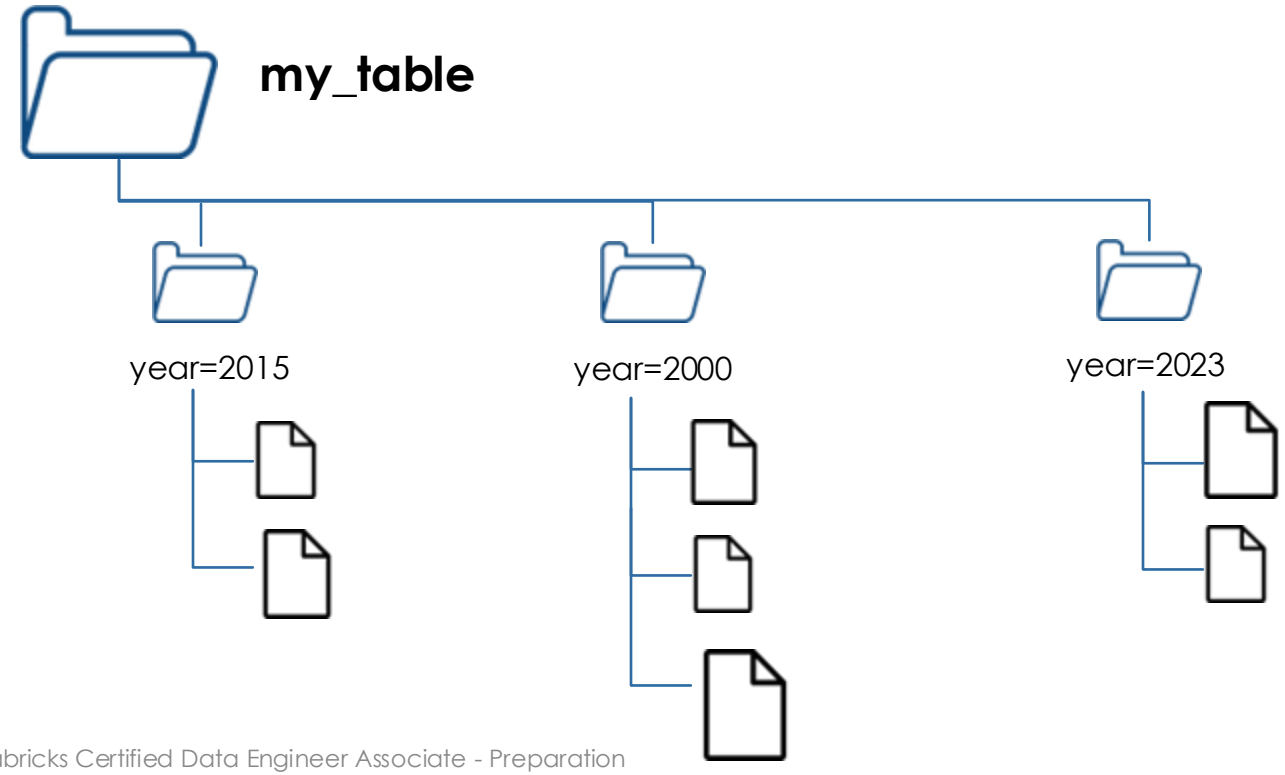
- Organizing a table by grouping rows that share the same values for predefined partitioning columns



Partitioning Delta Lake Tables

CREATE TABLE my_table (id INT, name STRING, year INT, month INT)

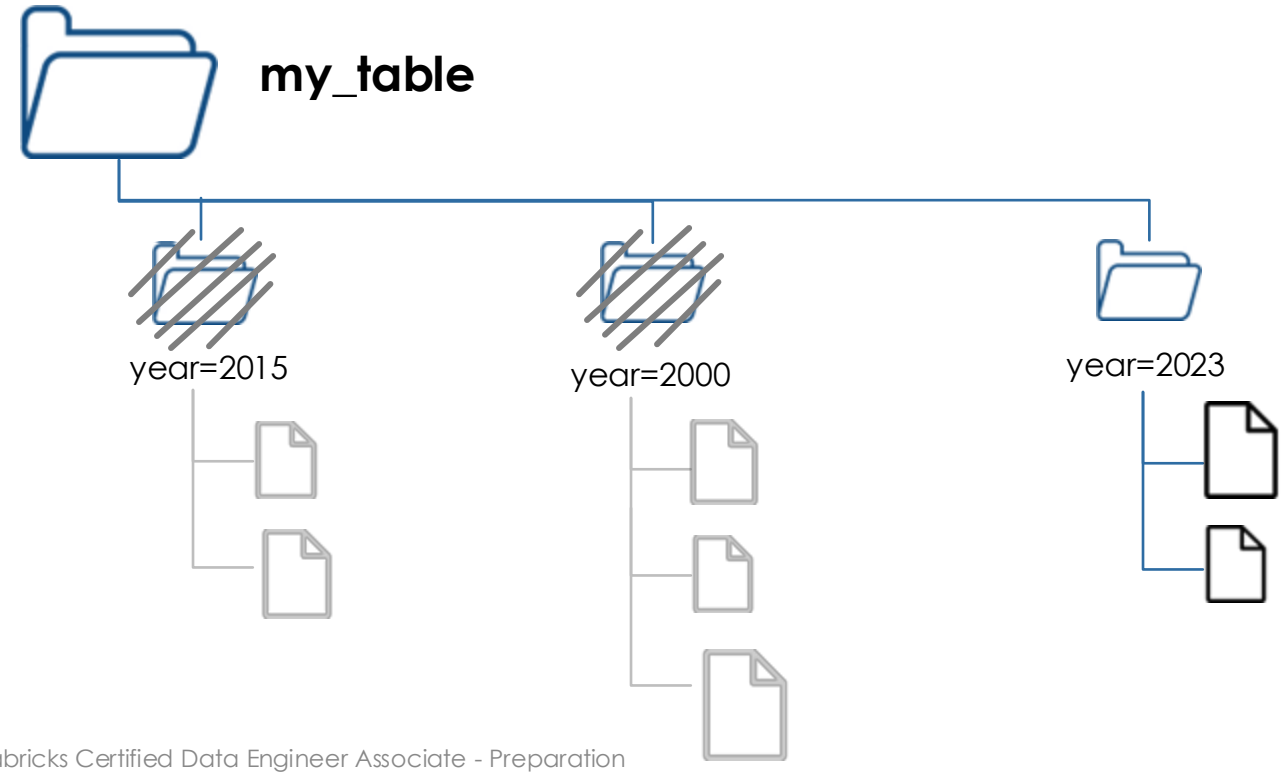
PARTITIONED BY (year)



Partition Skipping

SELECT * FROM my_table

Where year = 2023

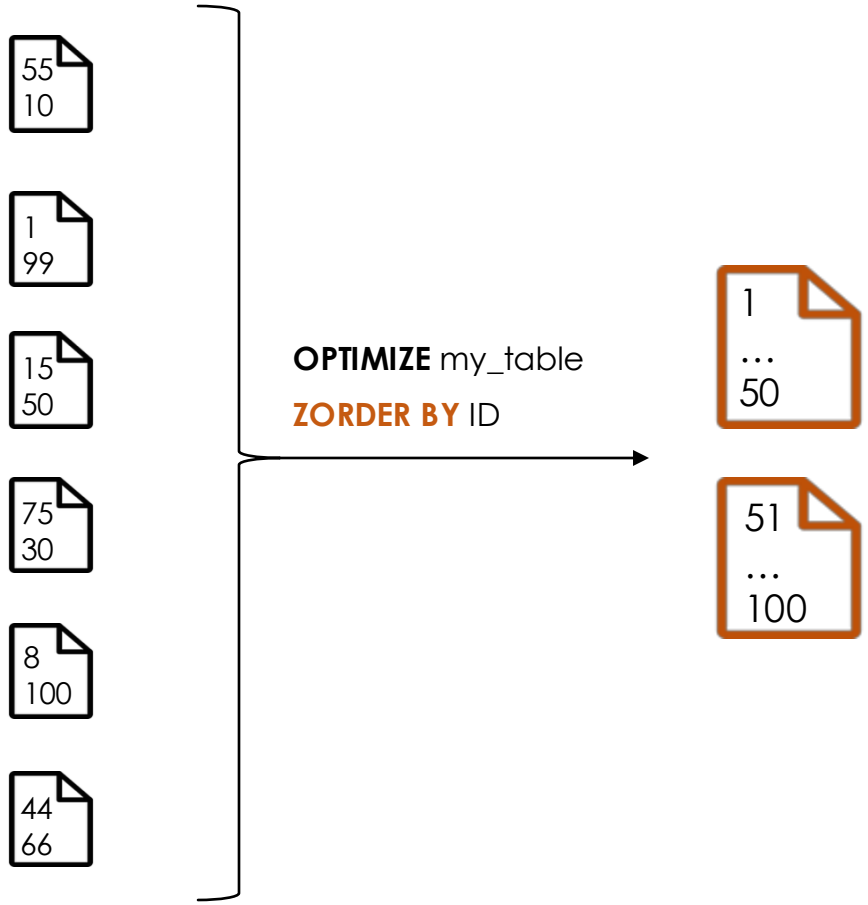


Partitioning Limitations

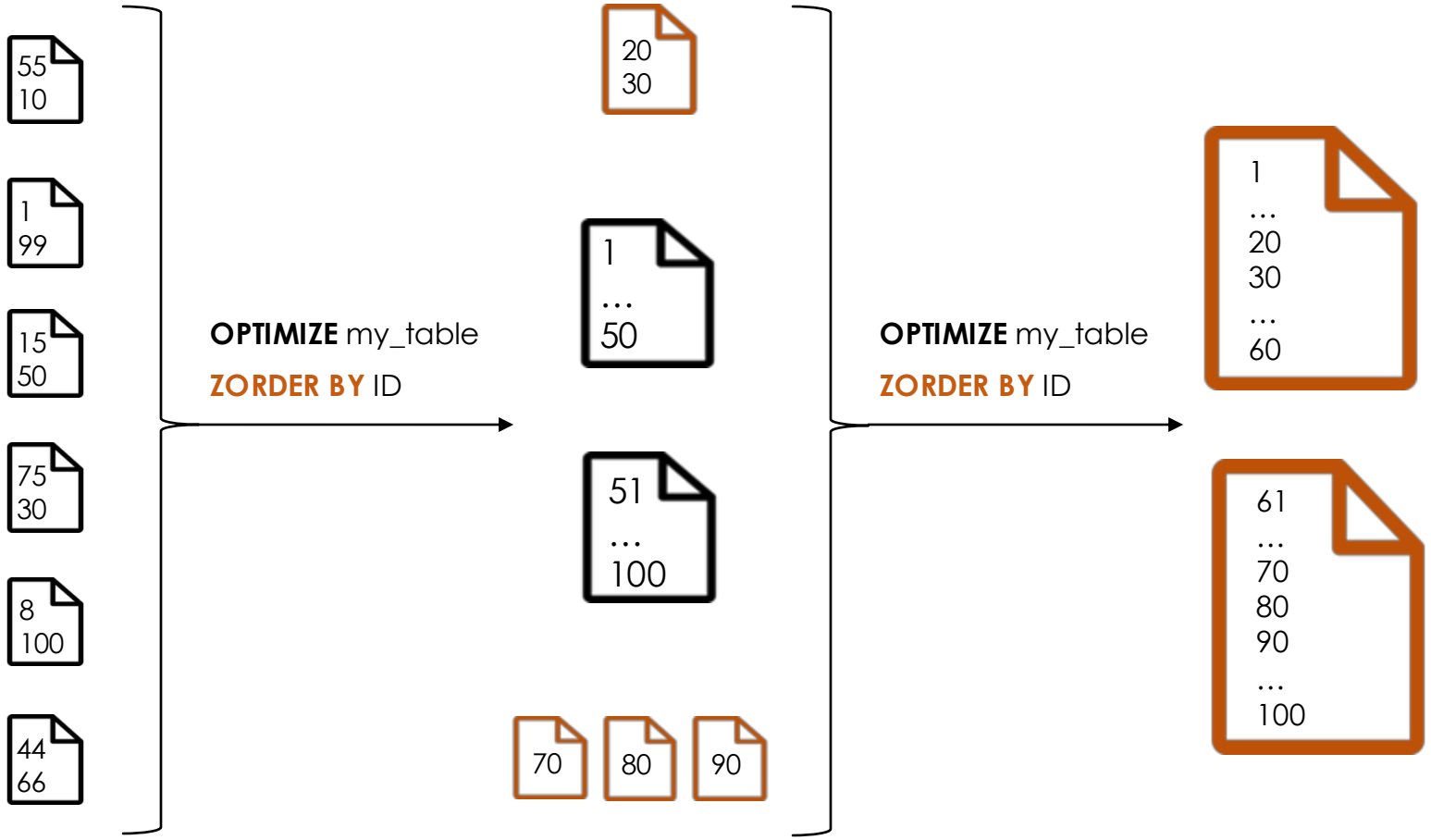
- Prevents file compaction across partition boundaries
  - Results in a small files problem
- Inefficient for high-cardinality columns
  - Results in a small files problem
- Static: Re-prartitioning requires a full table rewrite

Z-Order Indexing

- Group similar data into optimized files without creating directories
- Leverage data-skipping algorithms
- Effective for High-cardinality columns



Z-Ordering: Not Incremental



Liquid Clustering

- Improved version of Z-order indexing with more flexibility and better performance.
- Table-level definition
  - New tables:

```
CREATE TABLE table1(col1, INT, col2 STRING, col3 DATE)
CLUSTER BY (col1, col3)
```

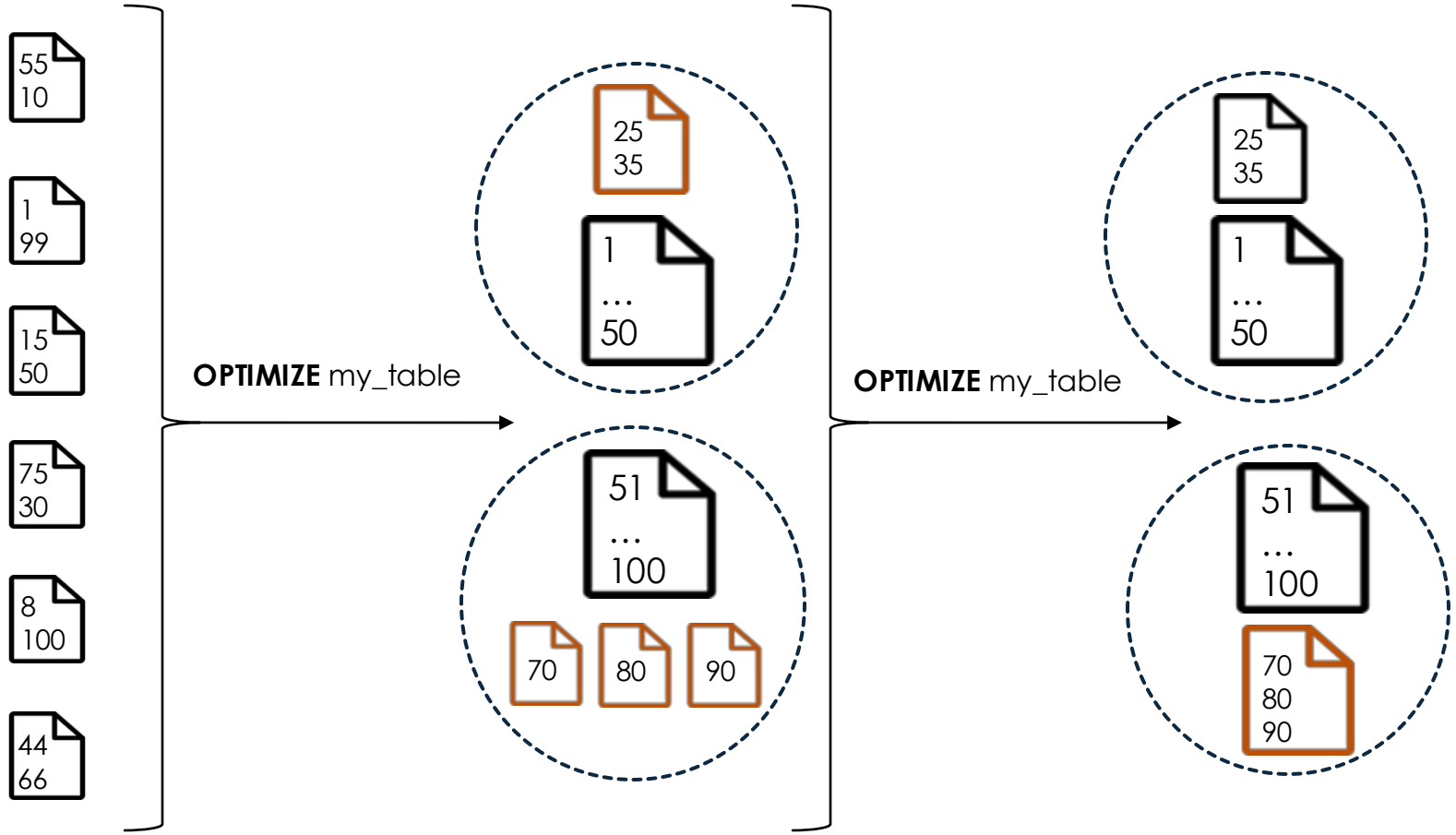
  - Existing tables:

```
ALTER TABLE table2
CLUSTER BY (<clustering_columns>)
```

- Clustering is not compatible with partitioning or ZORDER

Incremental Clustering

```
ALTER TABLE my_table
CLUSTER BY ID
```



Choosing Clustering Keys

- Flexible to redefine clustering keys without rewriting existing data
- Choose clustering keys based on your query pattern

Automatic Liquid Clustering

- Databricks automatically chooses clustering keys by analyzing the table historical query workload.
- Requires Predictive Optimization on Unity Catalog managed tables
- Syntax
  - New tables:

```
CREATE TABLE table1(col1, INT, col2 STRING, col3 DATE)
 CLUSTER BY AUTO
```

  - Existing tables:

```
ALTER TABLE table2
 CLUSTER BY AUTO
```