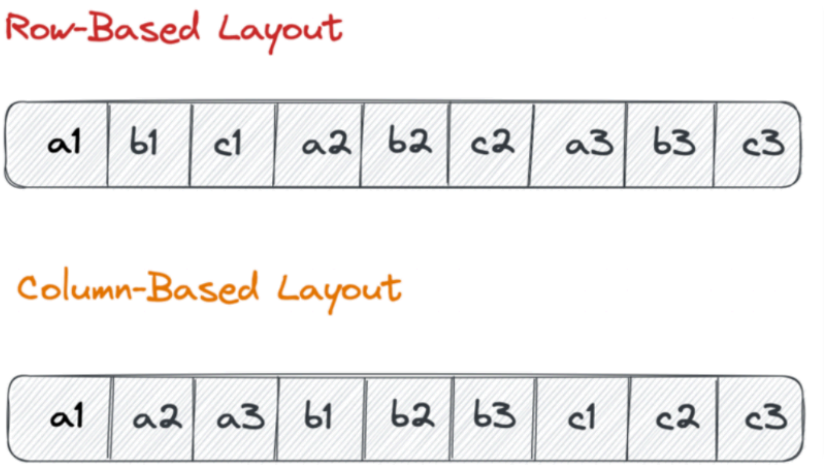
04 Row Vs Columnar

How the data is stored on Disk?



Row VS Column oriented data

Aspect	Row-oriented	Column-oriented
Data Storage	Stores data together by row	Stores data together by column
Read Efficiency	Efficient for reading entire records	Efficient for reading specific columns
Write Efficiency	Generally faster for writing new records	May be slower for writing, as it needs to update multiple column files
Compression	Less efficient compression	More efficient compression, especially for columns with low cardinality
Query Performance	Better for queries that access entire rows	Better for analytical queries that access a subset of columns
OLTP vs OLAP	Suited for OLTP (Online Transaction Processing)	Suited for OLAP (Online Analytical Processing)
Data Retrieval	Retrieves all fields of a record, even if not needed	Can retrieve only the required columns, reducing I/O
Update Operations	Efficient for updating entire records	Less efficient for updating individual records
Aggregations	Less efficient for column-wise aggregations	Very efficient for column-wise aggregations
Storage Overhead	Generally less storage overhead	May have more storage overhead due to metadata
Schema Changes	Easier to add new columns	Can be more complex to add new columns
Data Skipping	Limited data skipping capabilities	Efficient data skipping using column statistics
File Formats	Examples: CSV, JSON	Examples: Parquet, ORC
Memory Usage	May use more memory when only specific columns are needed	Efficient memory usage when working with specific columns

Aspect	Row-oriented	Column-oriented
Vectorized Processing	Less suitable for vectorized processing	Well-suited for vectorized processing
Encoding Schemes	Limited encoding options	Supports various encoding schemes (dictionary, run-length, etc.)
Data Integrity	Easier to maintain referential integrity	Can be more challenging to maintain referential integrity
Use Cases	Transactional systems, real-time record lookups	Data warehouses, analytical workloads, BI tools
Partitioning	Typically partitioned by row ranges	Can be partitioned both by row ranges and column values
Cache Efficiency	Less cache-efficient for analytical queries	More cache-efficient for analytical queries
Scan Performance	Slower for full table scans on specific columns	Faster for full table scans on specific columns