Troubleshoot
Data Partitioning Bottlenecks

Partitioning

- **Partitioning** – Process of physically dividing data into separate data store
- **Why Partitioning**
  - **Improve** – Scalability, Security and availability
  - **Reduce** – Contention
  - **Optimize** – Performance
- **Three strategies of partitioning**
  - Horizontal partitioning
  - Vertical partitioning
  - Functional partitioning

Horizontal Partitioning

Key	Name	Description	Stock	Price	LastOrdered
ARC1	Arc welder	250 Amps	8	119.00	25-Nov-2013
BRK8	Bracket	250mm	46	5.66	18-Nov-2013
BRK9	Bracket	400mm	82	6.98	1-Jul-2013
HOS8	Hose	1/2"	27	27.50	18-Aug-2013
WGT4	Widget	Green	16	13.99	3-Feb-2013
WGT6	Widget	Purple	76	13.99	31-Mar-2013

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Vertical Partitioning

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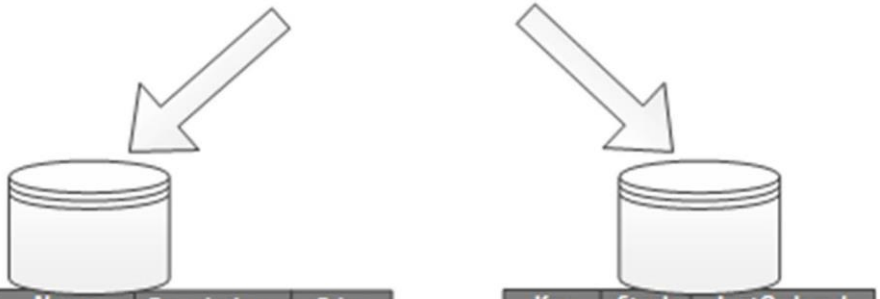

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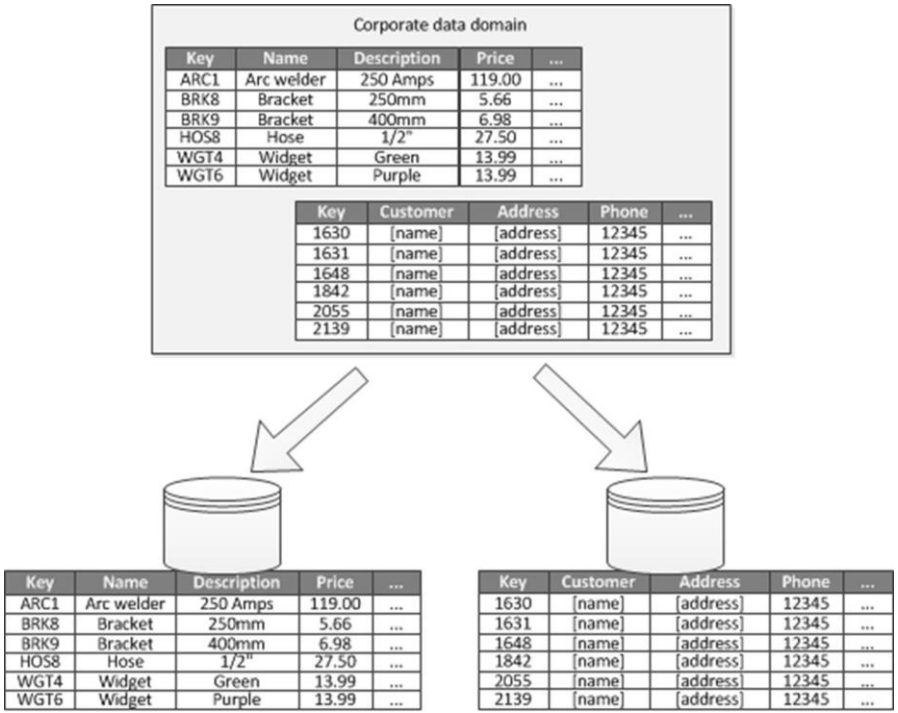
Functional Partitioning

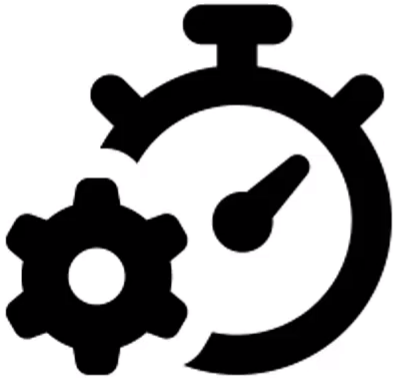


Partitioning

Design Considerations

- Balance data distribution
- Balance workload distribution
- Minimize cross-partition data access or joins operations.
- Replicate static reference data
- Prefer eventual consistency
- Replicate partitions

Data Lake Optimization Techniques



- **Data Ingestion considerations**
  - Storage hardware
  - High speed internal network
  - Fast network connection b/w on-premises and cloud
- **Parallel read/write**
  - e.g. Data Factory parallel copies settings
- **Structure your data set**
  - File size vs number of files
    - File size b/w 256 MB to 100 GB
  - Folder and file structure
    - e.g. Dataset\YYYY\MM\DD\datafile_YYYY_MM_DD_HH_MM.tsv
- **Same region**
- **Batch Data**

Stream Analytics – Optimization

Stream Analytics – Optimization

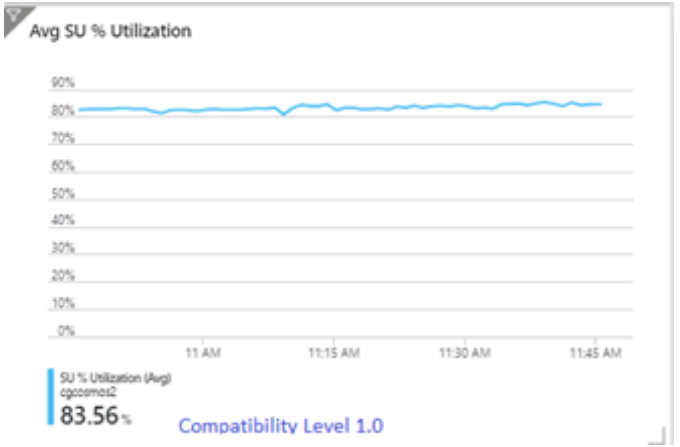
Three main component

- Input
- output
- Data processing Query

Stream Analytics – Optimization

Streaming Units (SUs)

- Processing power (CPU and Memory) allocated to your stream analytics job.
- Azure Stream Analytics jobs perform all processing in memory
- If SU% utilization is low and input events get backlogged
- Microsoft recommends setting an alert on 80% SU Utilization metric to prevent resource exhaustion
- The best practice is to start with 6 SUs for queries that don't use PARTITION BY
- Complex query logic could have high SU% utilization even when it is not continuously receiving input events.



Stream Analytics – Optimization

Parallelization

- Partitioning helps to divide data in subsets.
- This would be based on partition key.
- If the data in the Event Hub has a partition key defined, then it is highly recommended to define the partition key in the input of Stream Analytics Job.
- Input are already partitioned, output needs to be partitioned
- Embarrassingly parallel jobs
  - An embarrassingly parallel job is the most scalable scenario in Azure Stream Analytics.
  - It connects one partition of the input to one instance of the query to one partition of the output.
  - The number of input partitions must equal the number of output partitions.

```SQL
SELECT *
INTO output
FROM input
PARTITION BY DeviceID
INTO 10
```

Stream Analytics – Optimization

Steps in Query

- You can have multiple step in a query.
- You can start with 6 SUs for queries that don't use PARTITION BY
- You can also add 6 streaming units for each partition in a partitioned step.
- Example:
  - Let’s say your input stream is partitioned by value of 10, and you only hav one step in query

SQL

```
SELECT *
INTO output
FROM input
PARTITION BY DeviceID
INTO 10
```

Synapse Analytics Optimization

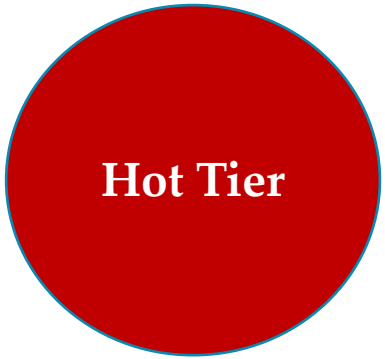
- **Maintain Statistics**
  - Automatically detect and create statistics on columns
  - AUTO_CREATE_STATISTICS
  - Update statistics of more relevant columns like date (or columns used in joins, where and group by clause)
- **PolyBase**
  - ADF or BCP can be used for small load
  - PolyBase is best choice for large volume of data
  - MPP architecture
  - CTAS or INSERT INTO
- **Hash distribution large tables**
  - Default is Round Robin distribution
  - Small tables joins – Round Robin is fine
  - Big tables joins – use Hash Distribution

Synapse Analytics Optimization

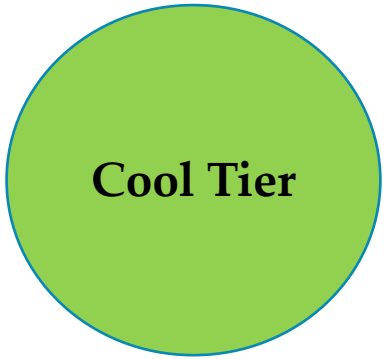
- **Do not over partition**
  - Too many partition can slow down query
  - Partition should have more than 1 million rows
  - 60 partition by default
  - So if you manually create 100 partition, behind the scene it is 100*60 = 6000 partitions.
- **Use the smallest possible column size**
  - Important for char or varchar type columns
  - Use varchar instead nvarchar
- **Scaling**
  - Before you perform a heavy data loading or transformation operation
  - During peak business hours
- **Pausing and resuming compute**
  - Storage and compute are seperate
  - Transaction cancel

Managing Data Lifecycle

Blob Access Tiers



Highest storage cost
Lowest data access cost



Lowest storage cost
Higher data access cost

Lowest storage cost
Highest data retrieval cost
Data is offline