
fabric
FEBRUARY

Let your Fabric work!

Reitse Eskens

Thank you to our Fabric February Friends!

twoday

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www.solisyon.de

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Reitse Eskens

Engineer | Architect

Axians Business Analytics

Reitse.Eskens@axians.com

/in/reitseeskens

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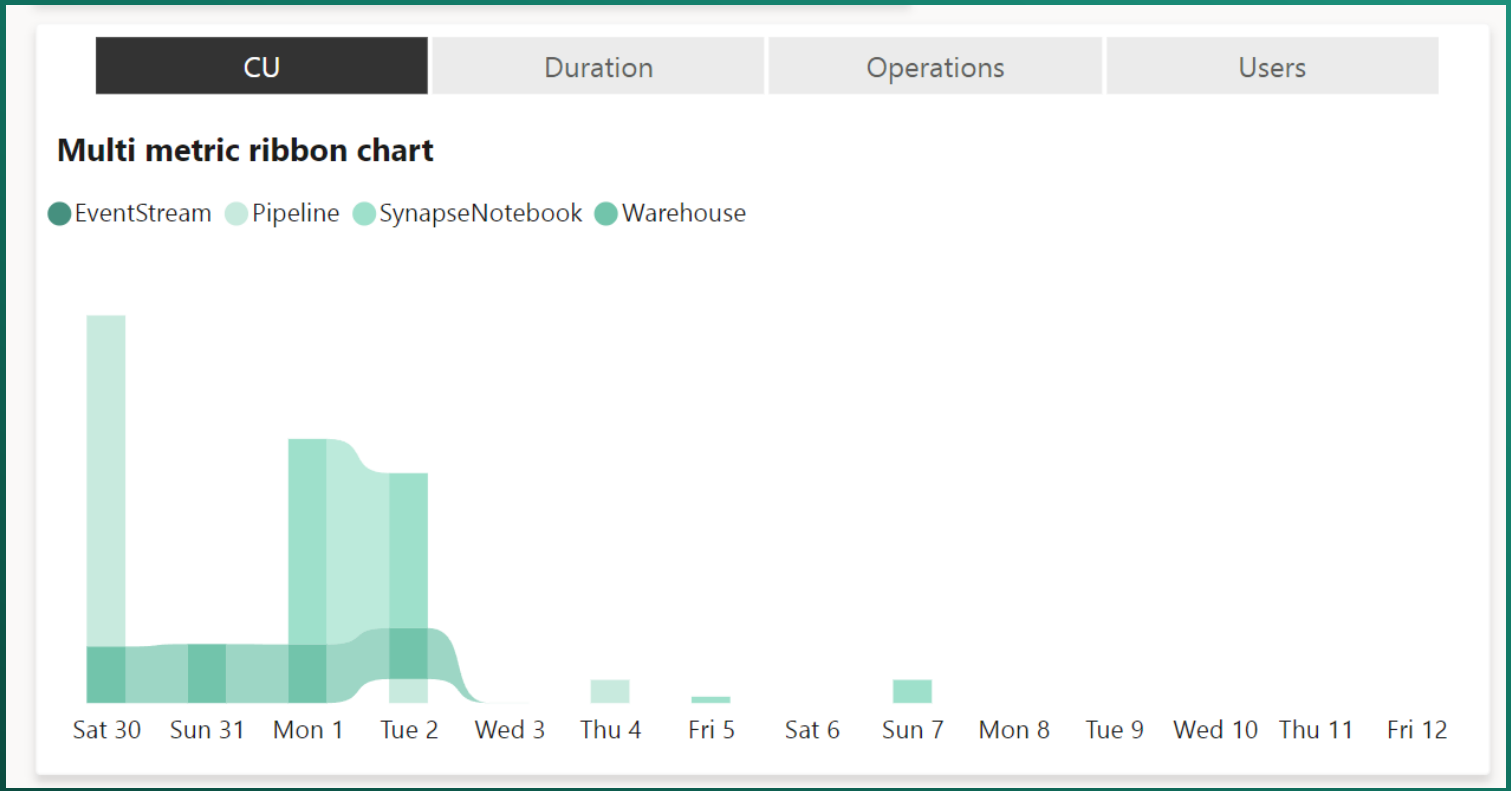
A large amount of data

Load testing

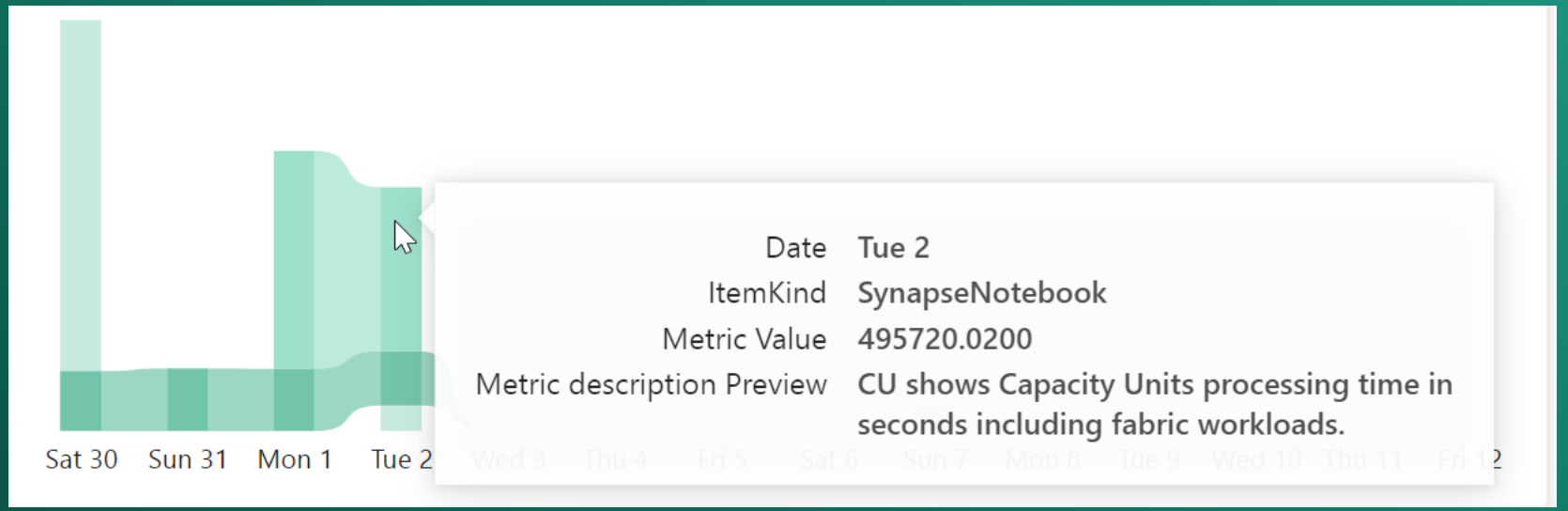
Coming from a SQL world

Learning a new tool:
Fabric Capacity Metrics

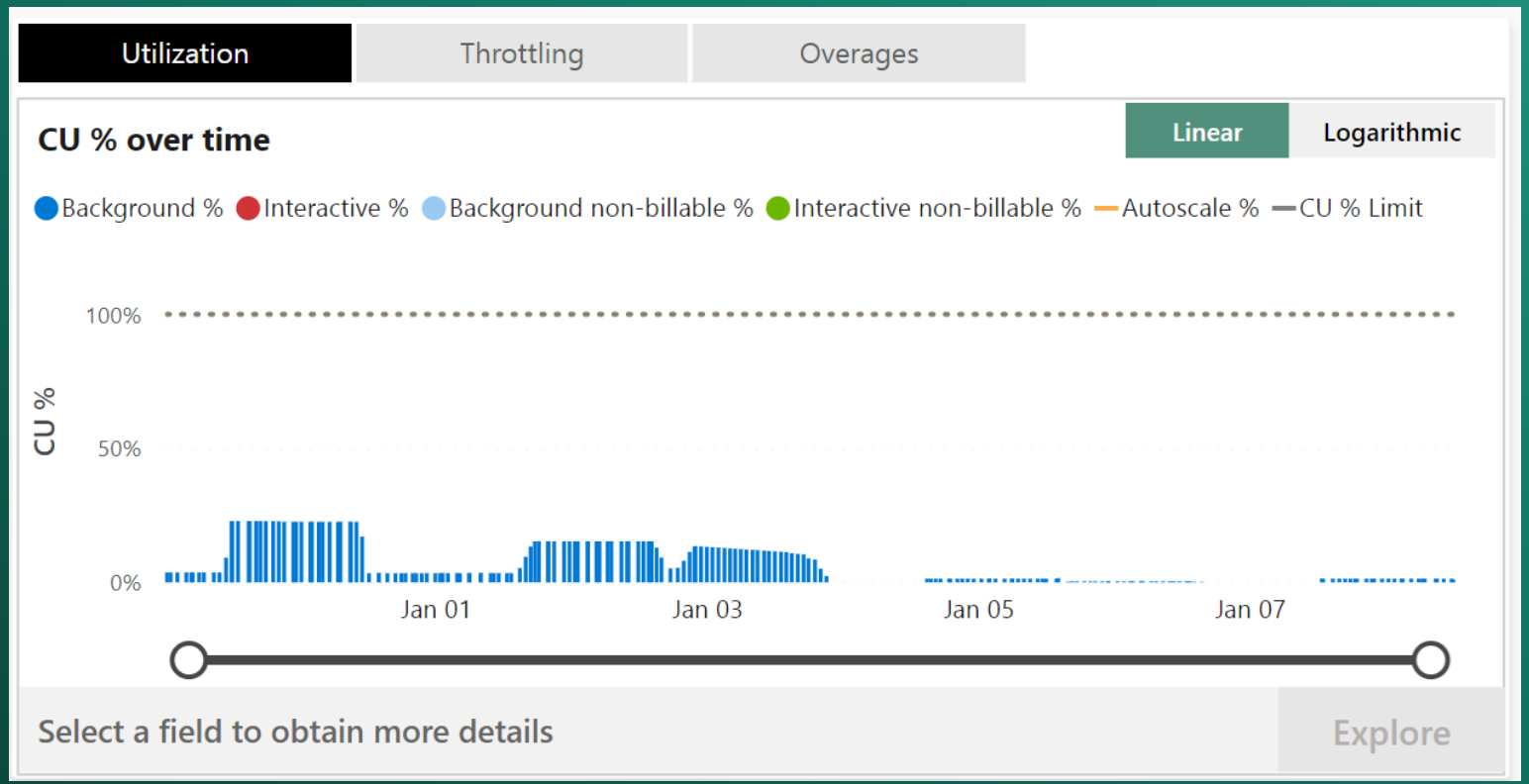
Fabric Capacity Metrics: Multi metric ribbon chart



Fabric Capacity Metrics: Multi metric ribbon chart



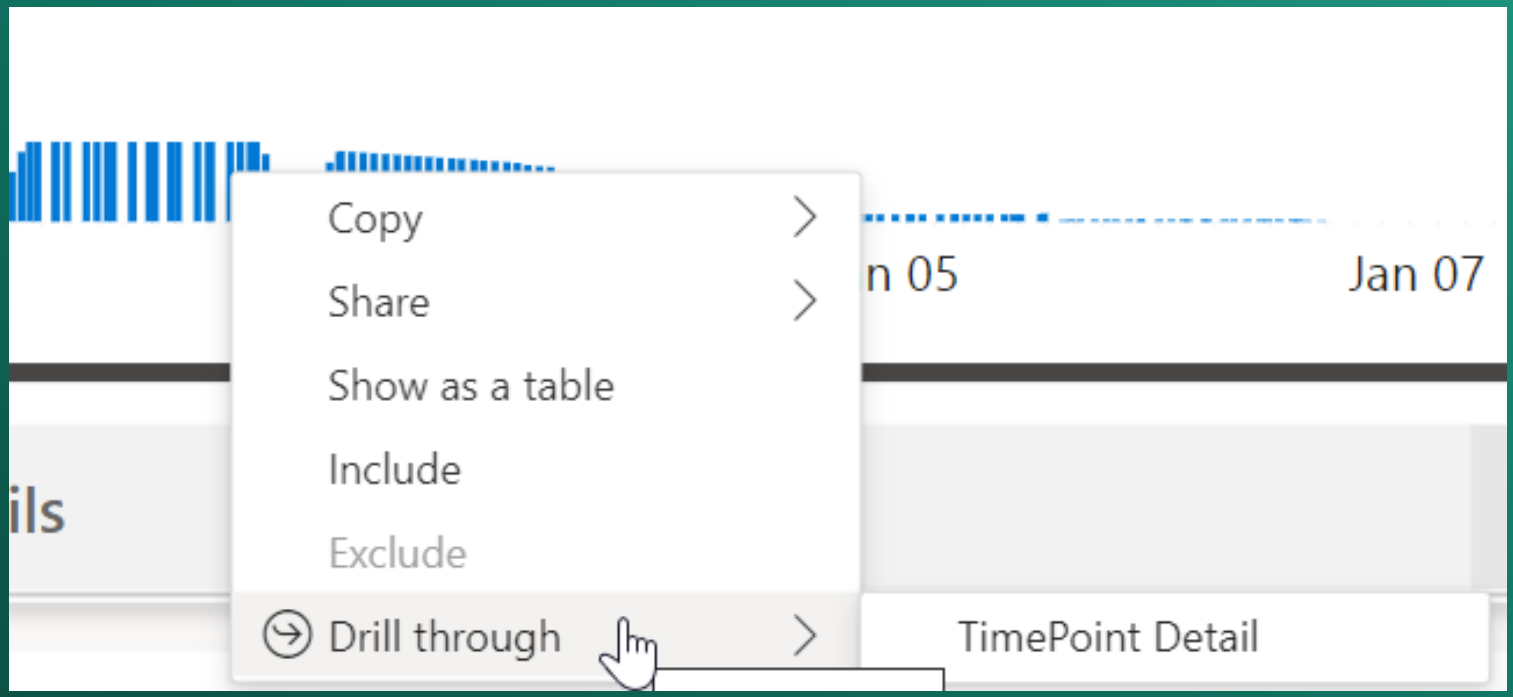
Fabric Capacity Metrics:
Capacity Utilization and Throttling



Fabric Capacity Metrics: Capacity Utilization and Throttling

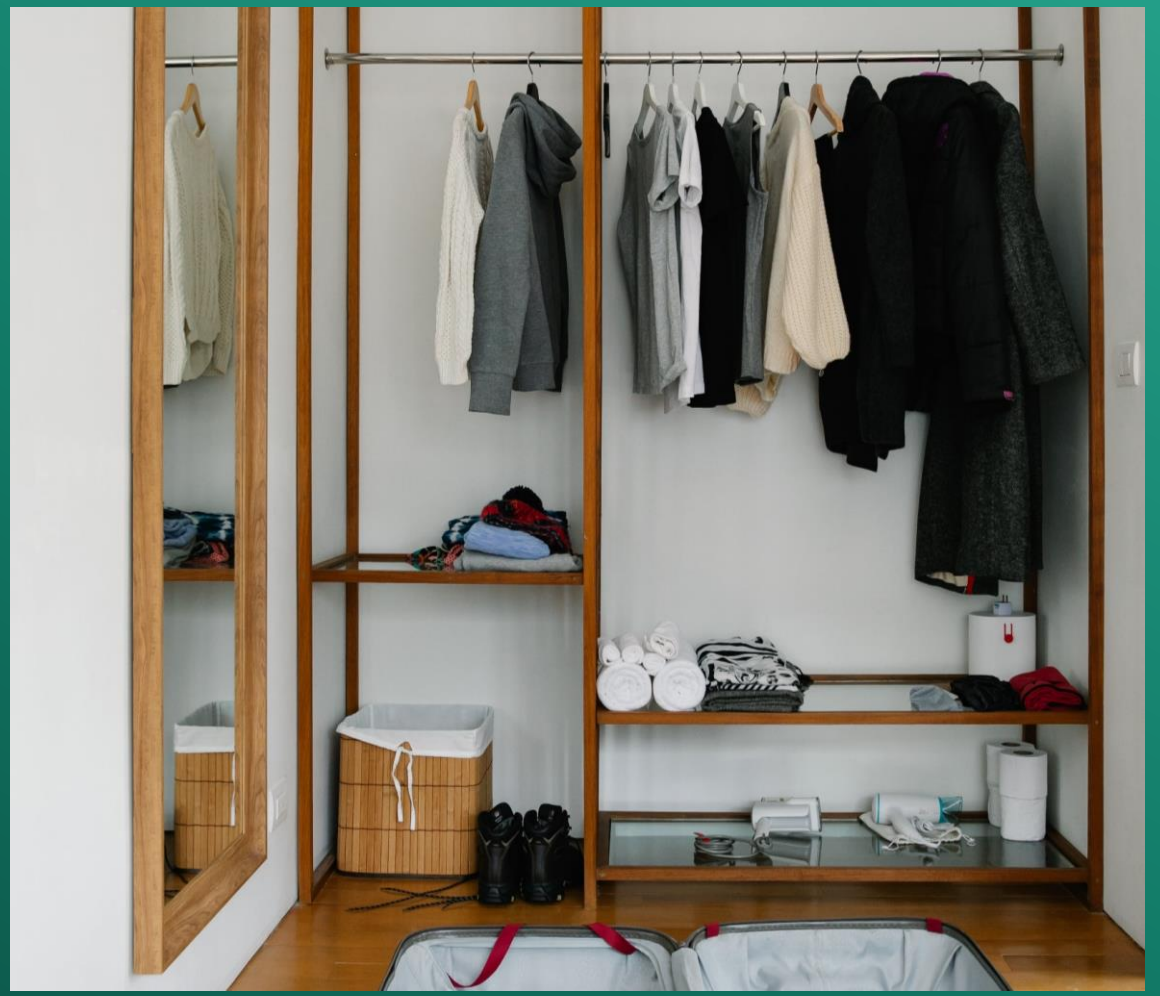
Policy	Consumption	Impact
Overage protection	Usage <= 10 minutes	Jobs can consume 10 minutes of future capacity use without throttling.
Interactive delay	10 minutes < usage <= 60 minutes	User requested interactive jobs are throttled.
Interactive rejection	60 minutes < usage <= 24 hours	User requested interactive jobs are rejected.
Background rejection	Usage > 24 hours	User scheduled background jobs are rejected and not executed.

Fabric Capacity Metrics: Drill through



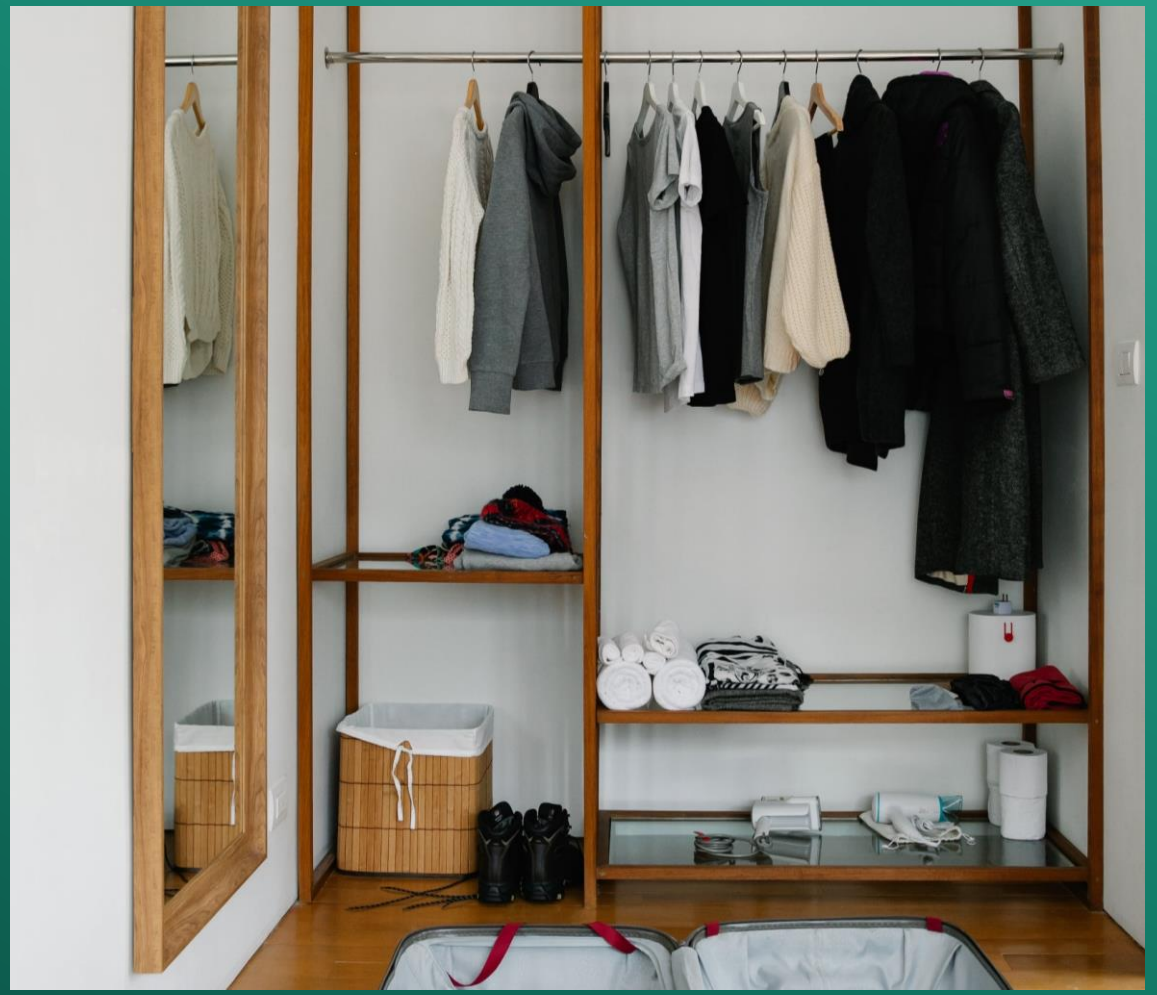
Preparing the data

- TPC-H
- .\dbgen.exe -s 10 -C 3 -v -S 1
  - -s 10 = 10 GB of data
  - -C 3 = three sets of tables
  - -v = verbose
  - -S 1 = first set of the three sets



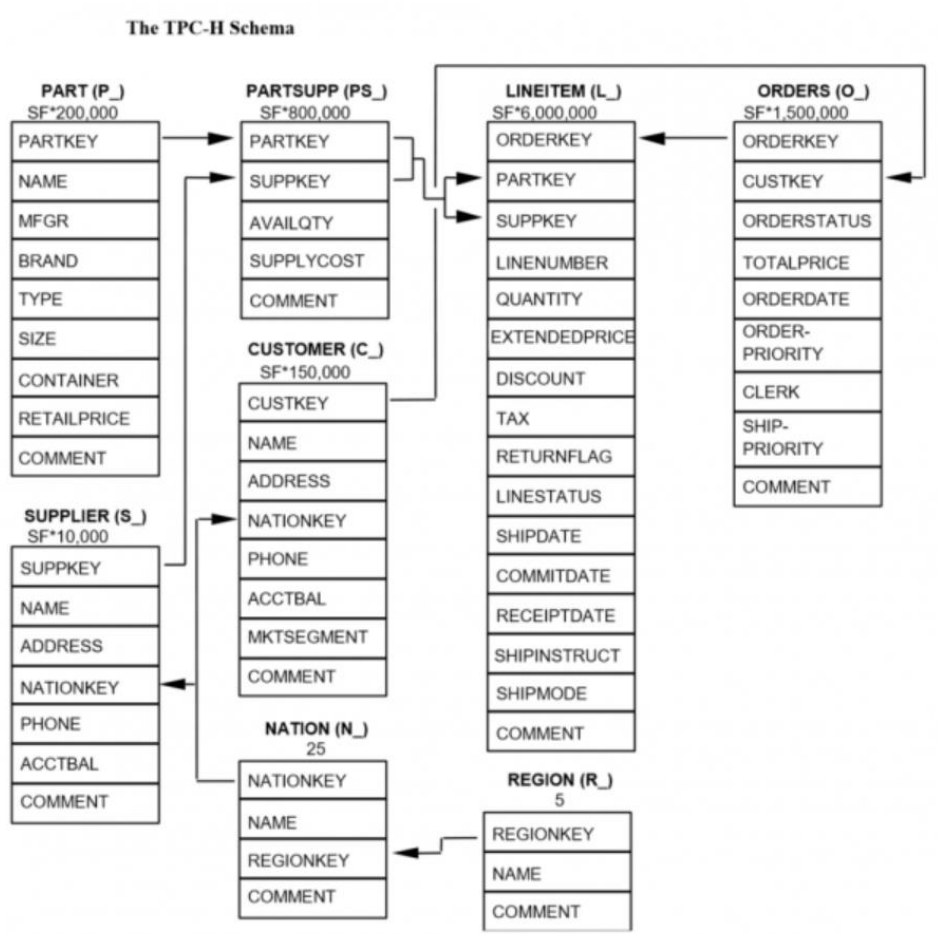
Preparing the data

- .\dbgen.exe -v -U200
  - -v = verbose
  - -U 200 = 200 sets of update and delete sets



Database schema

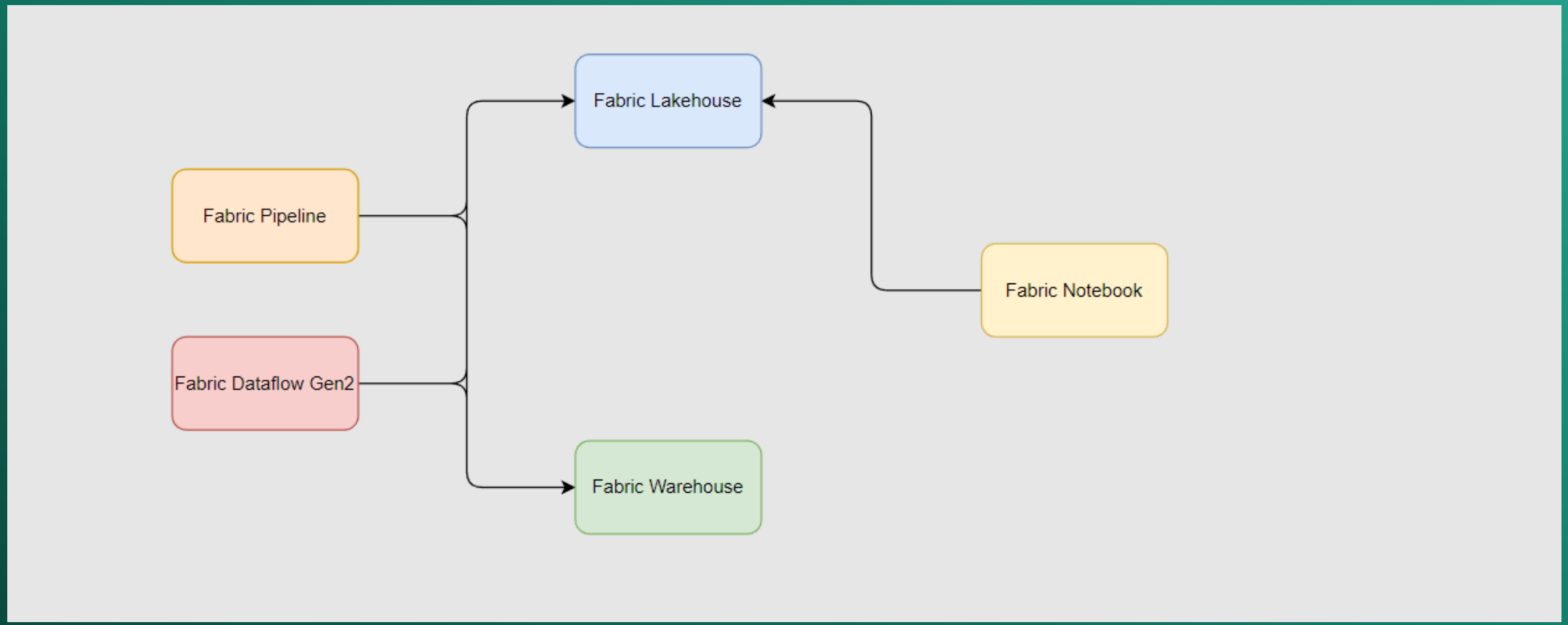
1 Database schema



Files

Name	Access Tier	Access Tier Last Modified	Last Modified	Blob Type	Content Type	Size	Status
region.tbl.csv	Hot (inferred)		2-1-2024 15:45	Block Blob	text/plain	394 B	Active
nation.csv	Hot (inferred)		2-1-2024 15:45	Block Blob	text/plain	2,20 KiB	Active
supplier.tbl.1.csv	Hot (inferred)		2-1-2024 15:08	Block Blob	text/plain	137,20 MiB	Active
supplier.tbl.5.csv	Hot (inferred)		2-1-2024 16:13	Block Blob	text/plain	138,24 MiB	Active
supplier.tbl.2.csv	Hot (inferred)		2-1-2024 15:44	Block Blob	text/plain	138,25 MiB	Active
supplier.tbl.3.csv	Hot (inferred)		2-1-2024 16:02	Block Blob	text/plain	138,29 MiB	Active
supplier.tbl.4.csv	Hot (inferred)		2-1-2024 16:35	Block Blob	text/plain	138,29 MiB	Active
part.tbl.1.csv	Hot (inferred)		2-1-2024 16:26	Block Blob	text/plain	2,30 GiB	Active
part.tbl.5.csv	Hot (inferred)		2-1-2024 15:45	Block Blob	text/plain	2,31 GiB	Active
part.tbl.4.csv	Hot (inferred)		2-1-2024 16:15	Block Blob	text/plain	2,31 GiB	Active
part.tbl.2.csv	Hot (inferred)		2-1-2024 16:34	Block Blob	text/plain	2,31 GiB	Active
part.tbl.3.csv	Hot (inferred)		2-1-2024 15:08	Block Blob	text/plain	2,31 GiB	Active
customer.tbl.3.csv	Hot (inferred)		2-1-2024 16:38	Block Blob	text/plain	2,32 GiB	Active
customer.tbl.5.csv	Hot (inferred)		2-1-2024 15:33	Block Blob	text/plain	2,32 GiB	Active
customer.tbl.2.csv	Hot (inferred)		2-1-2024 16:19	Block Blob	text/plain	2,32 GiB	Active
customer.tbl.4.csv	Hot (inferred)		2-1-2024 16:35	Block Blob	text/plain	2,32 GiB	Active
partsupp.tbl.1.csv	Hot (inferred)		2-1-2024 15:50	Block Blob	text/plain	11,51 GiB	Active
partsupp.tbl.3.csv	Hot (inferred)		2-1-2024 15:33	Block Blob	text/plain	11,55 GiB	Active
partsupp.tbl.5.csv	Hot (inferred)		2-1-2024 15:44	Block Blob	text/plain	11,55 GiB	Active
partsupp.tbl.2.csv	Hot (inferred)		2-1-2024 16:15	Block Blob	text/plain	11,55 GiB	Active
partsupp.tbl.4.csv	Hot (inferred)		2-1-2024 16:39	Block Blob	text/plain	11,55 GiB	Active
orders.tbl.1.csv	Hot (inferred)		2-1-2024 15:59	Block Blob	text/plain	16,79 GiB	Active
orders.tbl.2.csv	Hot (inferred)		2-1-2024 16:37	Block Blob	text/plain	16,87 GiB	Active
orders.tbl.4.csv	Hot (inferred)		2-1-2024 16:34	Block Blob	text/plain	16,96 GiB	Active
orders.tbl.3	Hot (inferred)		2-1-2024 16:18	Block Blob	text/plain	16,96 GiB	Active
orders.tbl.5.csv	Hot (inferred)		2-1-2024 16:01	Block Blob	text/plain	16,96 GiB	Active
lineitem.tbl.1	Hot (inferred)		2-1-2024 15:43	Block Blob	text/plain	75,42 GiB	Active
lineitem.tbl.1.csv	Hot (inferred)		2-1-2024 15:31	Block Blob	text/plain	75,42 GiB	Active
lineitem.tbl.2.csv	Hot (inferred)		2-1-2024 16:34	Block Blob	text/plain	75,70 GiB	Active
lineitem.tbl.3.csv	Hot (inferred)		2-1-2024 15:56	Block Blob	text/plain	76,07 GiB	Active
lineitem.tbl.5.csv	Hot (inferred)		2-1-2024 15:21	Block Blob	text/plain	76,08 GiB	Active
lineitem.tbl.4.csv	Hot (inferred)		2-1-2024 16:13	Block Blob	text/plain	76,08 GiB	Active

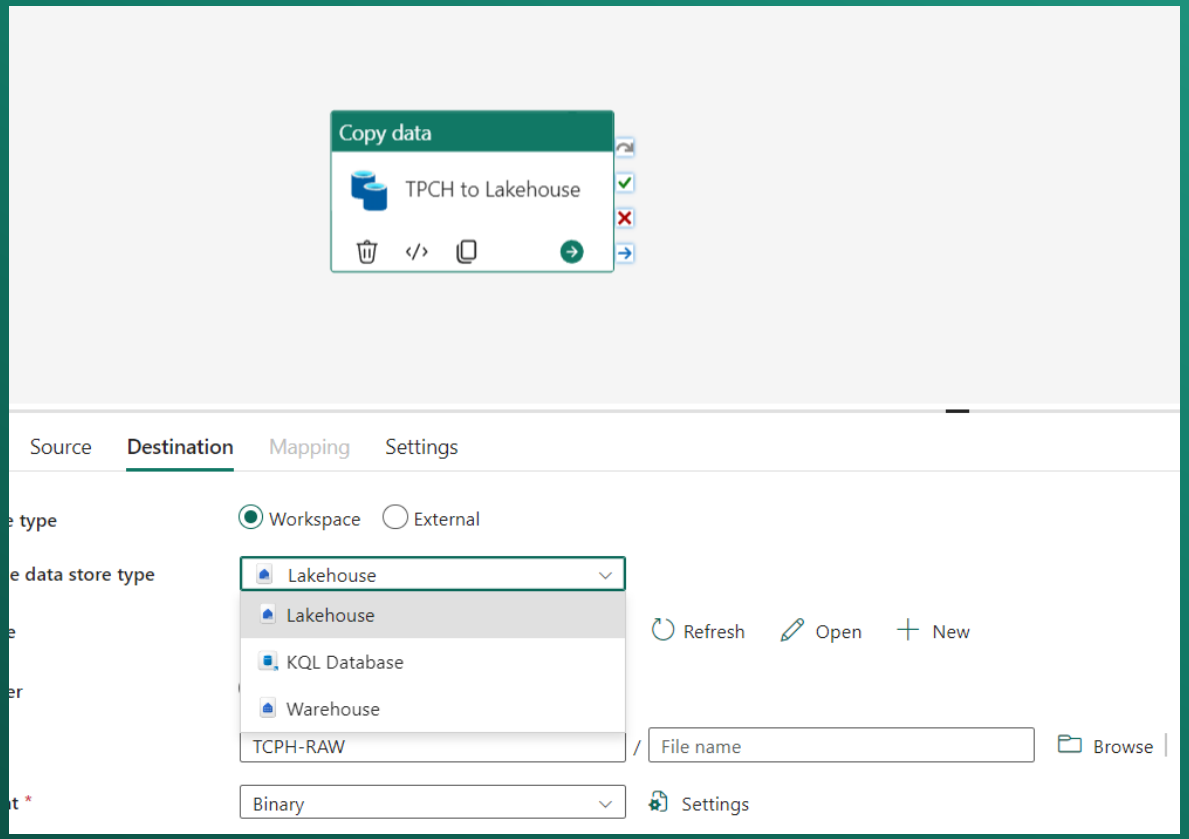
Loading options



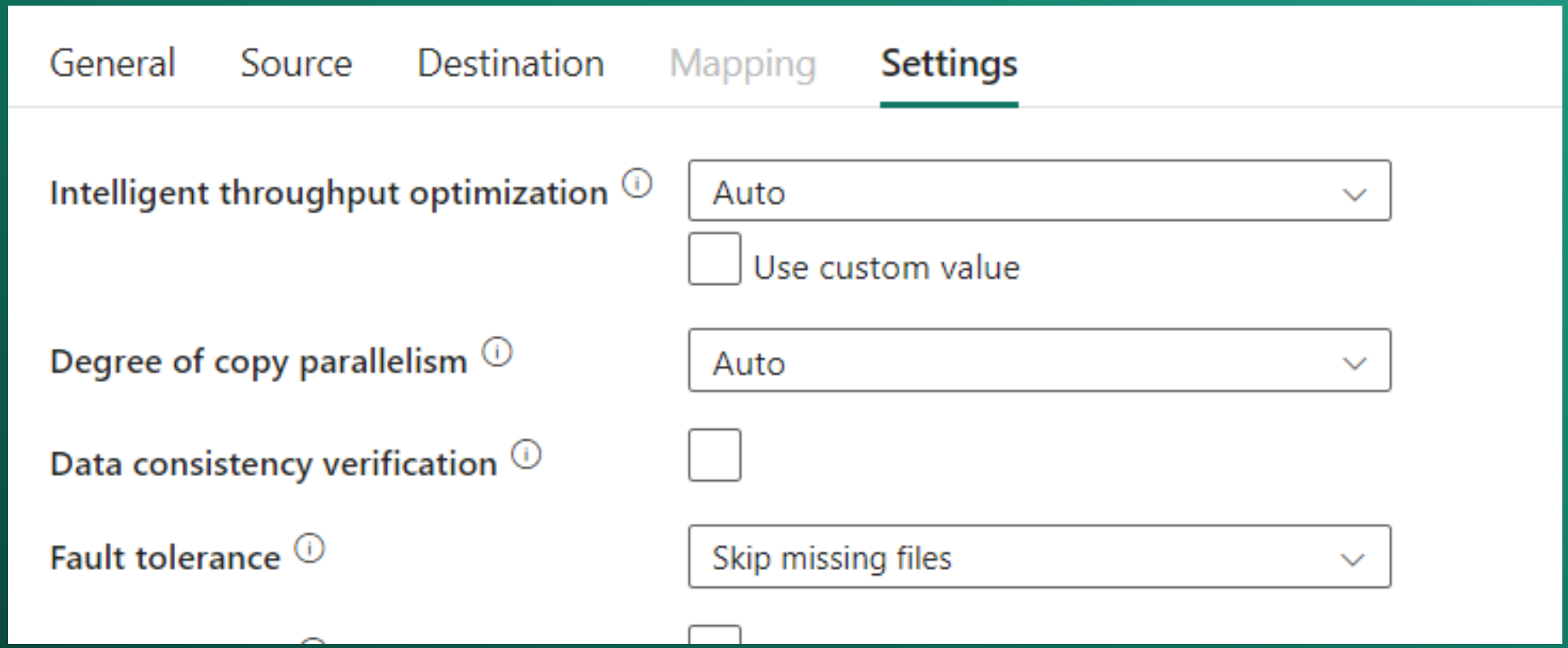
Loading…

- Pipeline
- Notebook
- Dataflow Gen2

Pipeline


Copy data
TPCH to Lakehouse
Source
Destination
Mapping
Settings
type
Workspace
External
e data store type
Lakehouse
Lakehouse
KQL Database
Warehouse
Refresh
Open
New
er
TCPH-RAW
/
File name
Browse
t *
Binary
Settings

Pipeline


General
Source
Destination
Mapping
Settings
Intelligent throughput optimization
Auto
Use custom value
Degree of copy parallelism
Auto
Data consistency verification
Fault tolerance
Skip missing files

Comparison

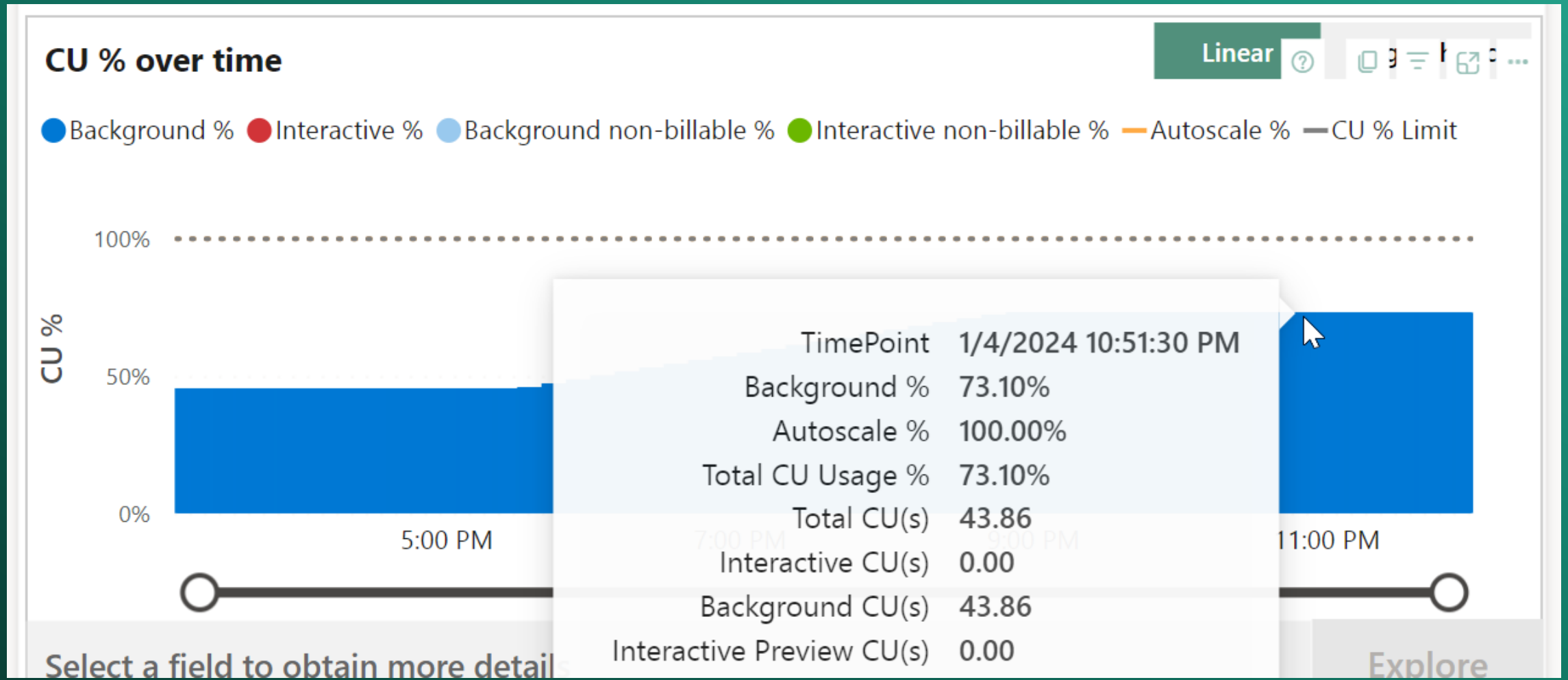
Pipeline F64

Throughput	335.235 MB/s
Total duration	00:33:14
Duration breakdown	
Start time	1/2/2024, 4:54:14 PM
Optimized throughput	Balanced
Used parallel copies	638

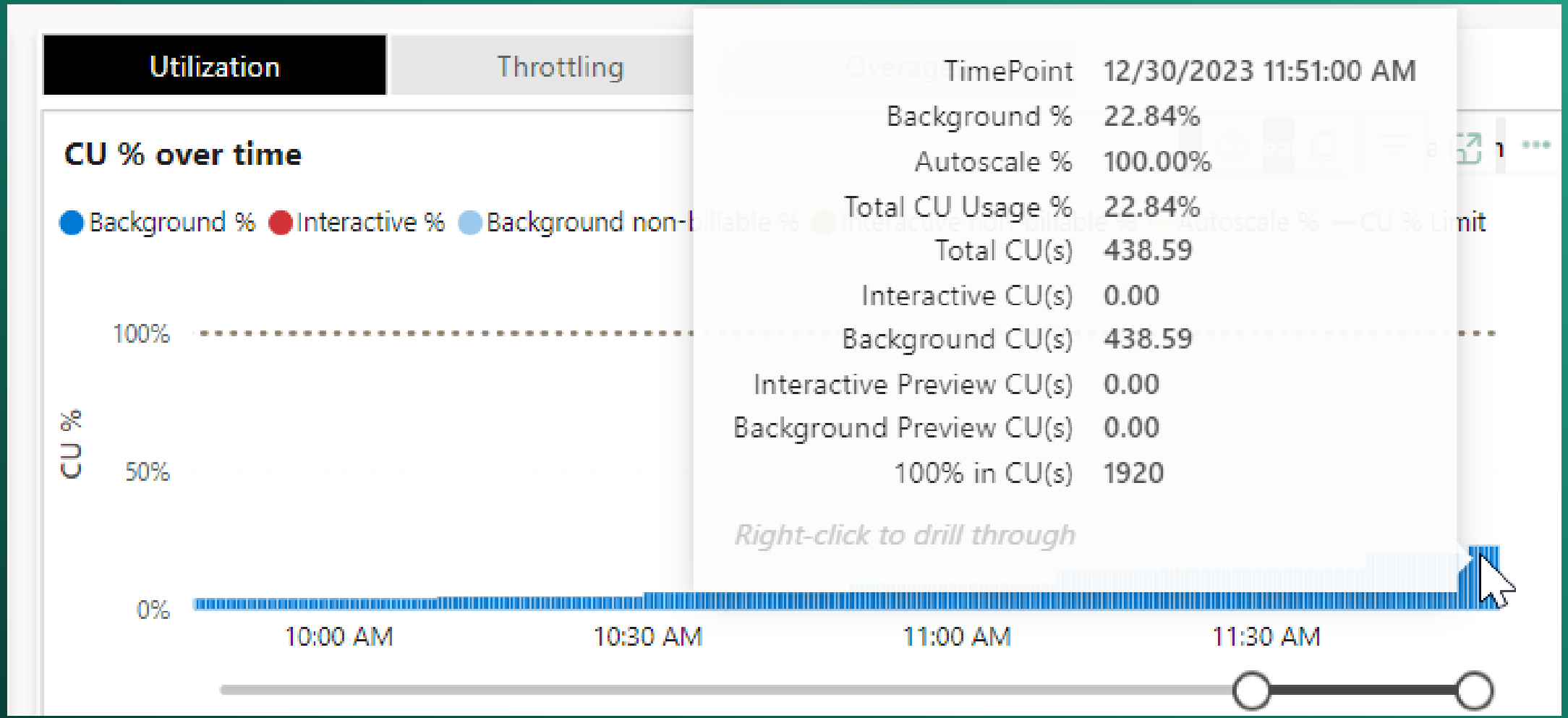
Pipeline F2

Throughput	341.603 MB/s
Total duration	00:32:39
Duration breakdown	
Start time	1/4/2024, 2:29:49 PM
Optimized throughput	Balanced
Used parallel copies	638

Pipeline F2


CU % over time
Linear
Background %
Interactive %
Background non-billable %
Interactive non-billable %
Autoscale %
CU % Limit
100%
50%
0%
CU %
5:00 PM
11:00 PM
TimePoint 1/4/2024 10:51:30 PM
Background % 73.10%
Autoscale % 100.00%
Total CU Usage % 73.10%
Total CU(s) 43.86
Interactive CU(s) 0.00
Background CU(s) 43.86
Interactive Preview CU(s) 0.00
Select a field to obtain more detail
Explore

Pipeline F64



Pipeline F64

- **Timepoint CU(s)** - This metric is the total CU(s) divided by 2,880, and is used to determine how much CU(s) the background operation contributes to this timepoint.

	Status	User	Duration (s)	Total CU (s)	Timepoint CU (s)	Throttling (s)	% of Base capacity	Billing type
.	Success	Power BI Service	920	318,240.0000	110.5000	0	5.76%	Billable
.	Success	Power BI Service	938	243,000.0000	84.3750	0	4.39%	Billable
.	Success	Power BI Service	459	145,080.0000	50.3750	0	2.62%	Billable
.	Success	Power BI Service	701	120,960.0000	42.0000	0	2.19%	Billable
.	Success	Power BI Service	1,087	88,560.0000	30.7500	0	1.60%	Billable
.	Success	Power BI Service	218	50,040.0000	17.3750	0	0.90%	Billable
.	Success	Power BI Service	179	46,800.0000	16.2500	0	0.85%	Billable
.	Success	Power BI Service	188	46,440.0000	16.1250	0	0.84%	Billable

(24 * 60 *60) / 2880 = 30 (seconds)

Pipeline

F2 uses 73% capacity

F64 uses 2,2% capacity

What else is going on?

Notebook (CSV to Parquet)

```
folderPath = "Files/TCPH-RAW/files/customer.tbl.*.csv"
table_name = "raw_customers"

schema = StructType([
    StructField("C_CUSTKEY", IntegerType()),
    StructField("C_NAME", StringType()),
    StructField("C_ADDRESS", StringType()),
    StructField("C_NATIONKEY", IntegerType()),
    StructField("C_PHONE", StringType()),
    StructField("C_ACCTBAL", DoubleType()),
    StructField("C_MKTSEGMENT", StringType()),
    StructField("C_COMMENT", StringType()),
    StructField("C_Empty", StringType())
])

df = spark.read.csv(
    folderPath,
    header=False,
    mode="DROPMALFORMED",
    sep="|",
    schema=schema
)
df.write.mode("overwrite").format("delta").save("Tables/" + table_name)
```

Notebook (CSV to Parquet) F2

✓ 2 min 29 sec -Command executed in 2 min 28 sec 902 ms by Admin on 11:15:34 AM, 1/05/24

Tasks	Duration	Processed	Data read	Data written
2/2 succeeded	198 ms	19 rows	12.12 KB	0 B
76/76 succeeded	1 min 4 sec 806 ms	120,000,000 rows	0 B	6.3 GB
5/5 succeeded	1 min 17 sec 26 ms	120,000,000 rows	6.3 GB	4.68 GB

Notebook (CSV to Parquet) F64

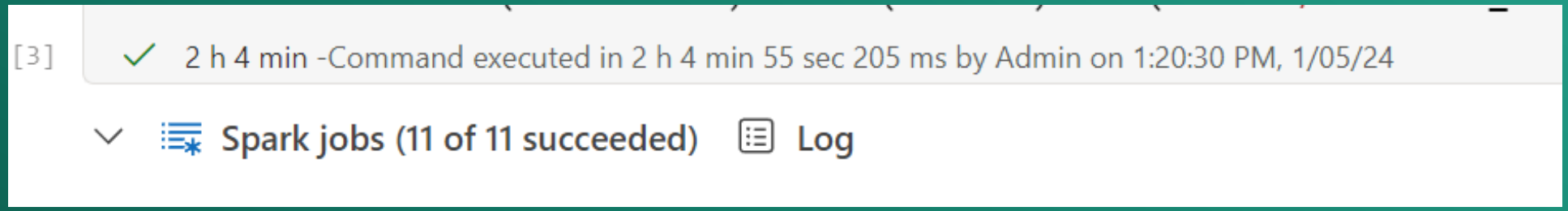
✓ 1 min 13 sec -Command executed in 1 min 13 sec 264 ms by Admin on 1:46:41 PM, 1/05/24

Tasks	Duration	Processed	Data read	Data written
1/1 succeeded	186 ms	16 rows	5.96 KB	5.25 KB
50/50 succeeded	466 ms	58 rows	5.25 KB	4.37 KB
1/1 succeeded	47 ms	50 rows	4.37 KB	0 B
76/76 succeeded	33 sec 632 ms	120,000,000 rows	0 B	6.3 GB
5/5 succeeded	35 sec 49 ms	120,000,000 rows	6.3 GB	4.68 GB

Notebook (CSV to Parquet)

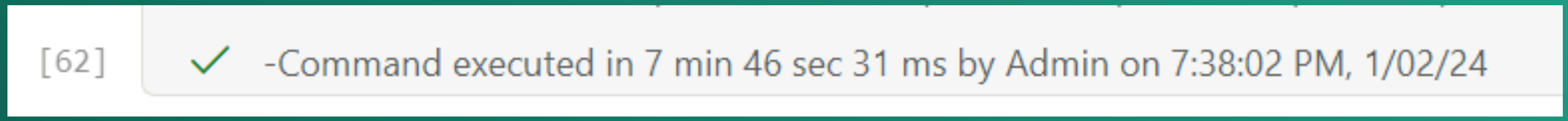
```
folderPath = "Files/TCPH-RAW/files/lineitem.tbl.*.csv"
table_name = "raw_lineitems"

schema = StructType([
    StructField("L_ORDERKEY", IntegerType()),
    StructField("L_PARTKEY", IntegerType()),
    StructField("L_SUPPKEY", IntegerType()),
    StructField("L_LINENUMBER", IntegerType()),
    StructField("L_QUANTITY", IntegerType()),
    StructField("L_EXTENDEDPRICE", DoubleType()),
    StructField("L_DISCOUNT", DoubleType()),
    StructField("L_TAX", DoubleType()),
    StructField("L_RETURNFLAG", StringType()),
    StructField("L_LINESTATUS", StringType()),
    StructField("L_SHIPDATE", StringType()),
    StructField("L_COMMITDATE", StringType()),
    StructField("L_RECEIPTDATE", StringType()),
    StructField("L_SHIPINSTRUCT", StringType()),
    StructField("L_SHIPMODE", StringType()),
    StructField("L_COMMENT", StringType()),
    StructField("L_Empty", StringType())
])

df = spark.read.csv(
    folderPath,
    header=False,
    mode="DROPMALFORMED",
    sep="|",
    schema=schema
)
df.write.mode("overwrite").format("delta").save("Tables/" + table_name)
```

Notebook (CSV to Parquet) F2



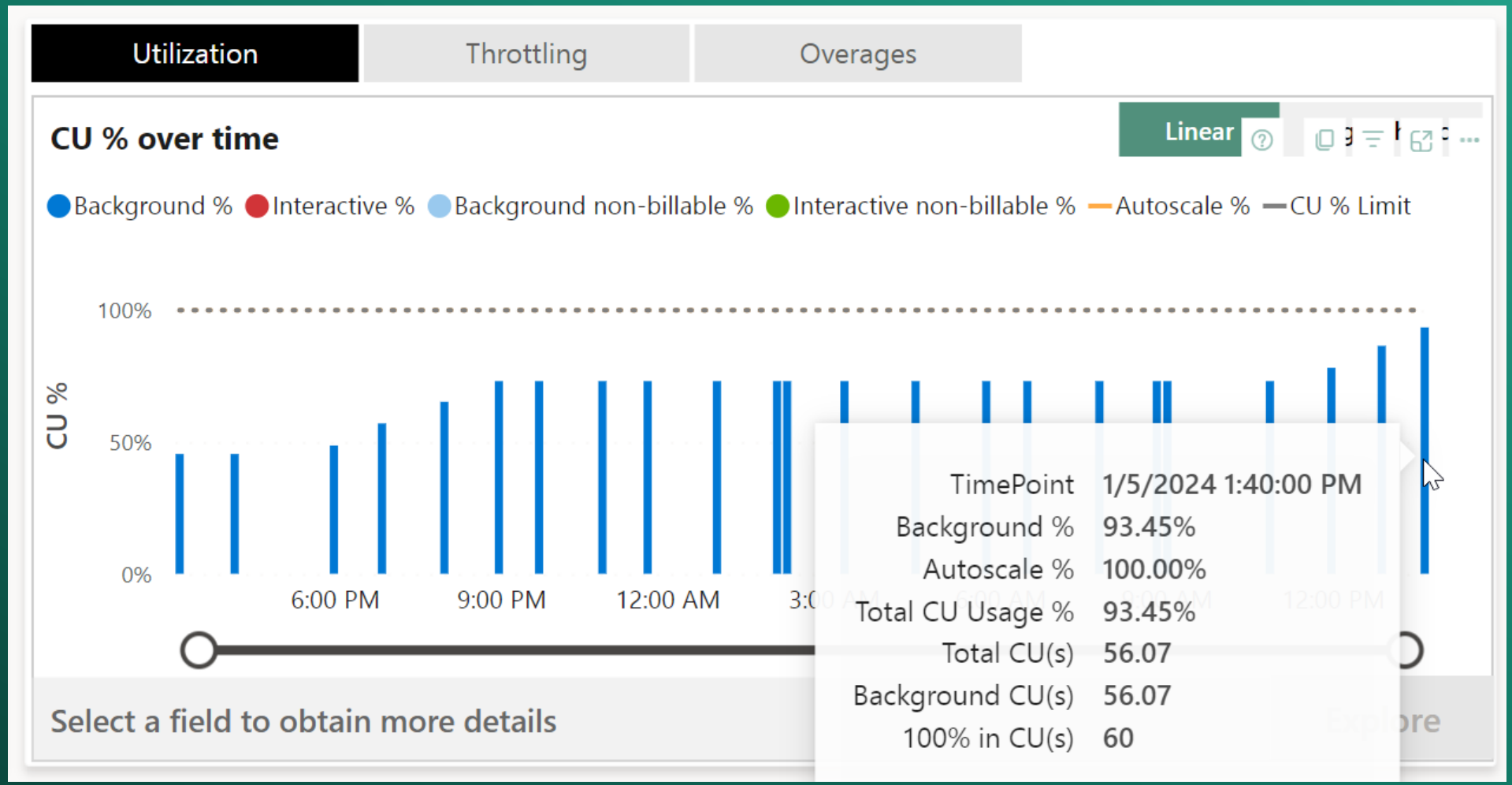
3036/3044 succeeded, 8 failed	1 h 17 min 29 sec 991 ms	4,294,965,612 rows	6 GB	174.67 GB
136/136 succeeded	47 min 19 sec 41 ms	4,294,965,612 rows	174.67 GB	77.44 GB

Notebook (CSV to Parquet) F64

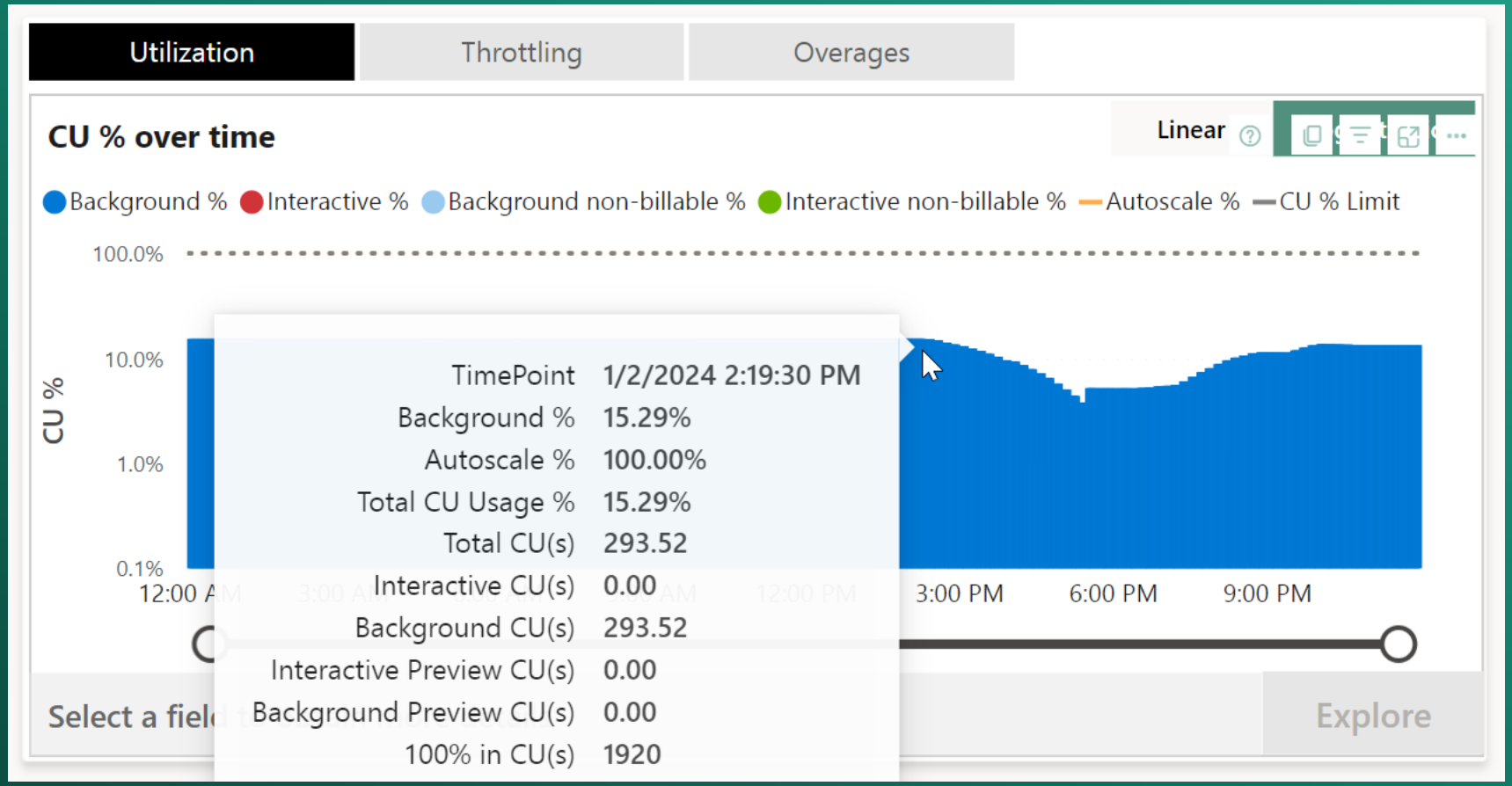


3036/3044 succeeded, 8 failed	1 h 17 min 29 sec 991 ms	4,294,965,612 rows	6 GB	174.67 GB
136/136 succeeded	47 min 19 sec 41 ms	4,294,965,612 rows	174.67 GB	77.44 GB

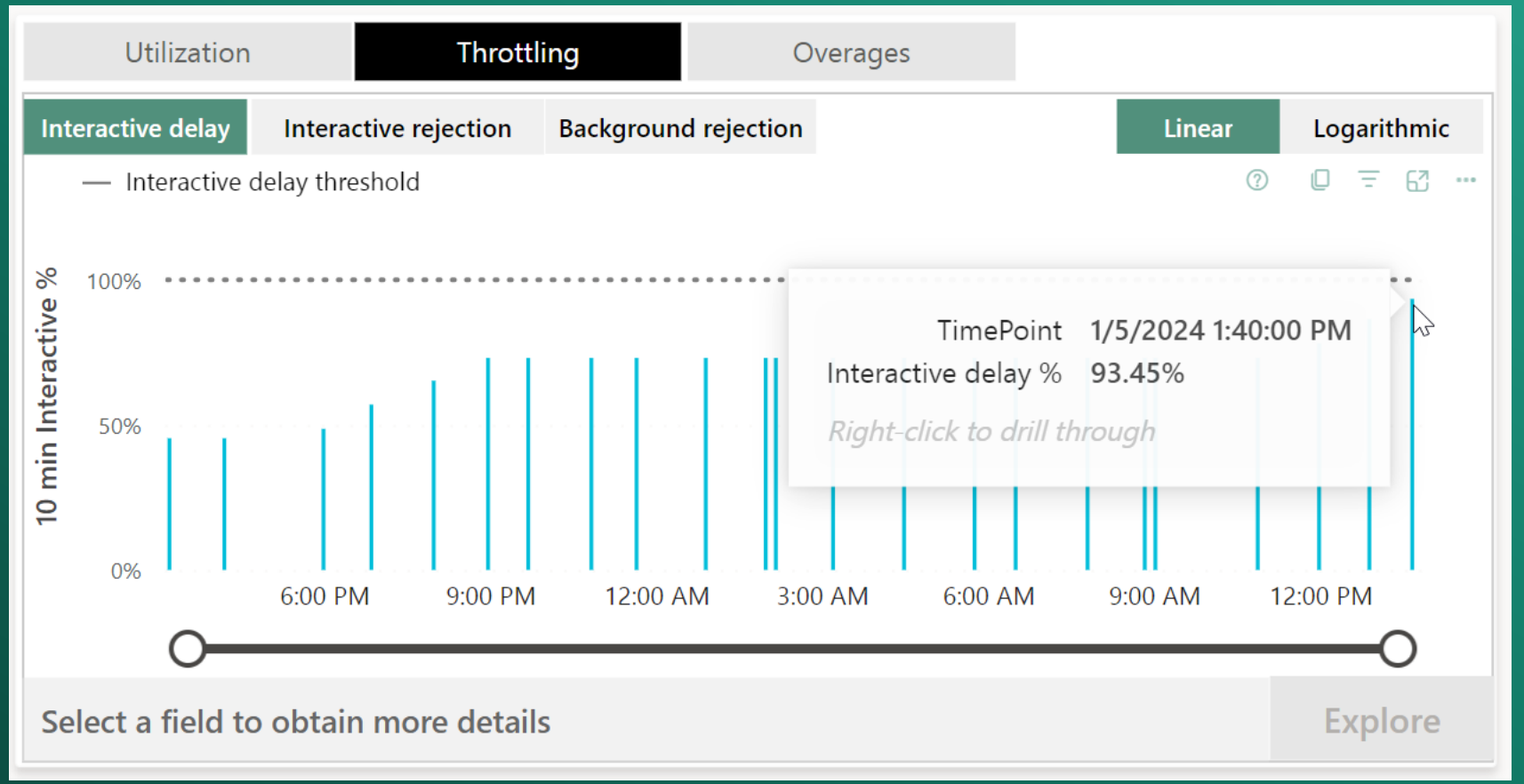
Notebook (CSV to Parquet) Metrics



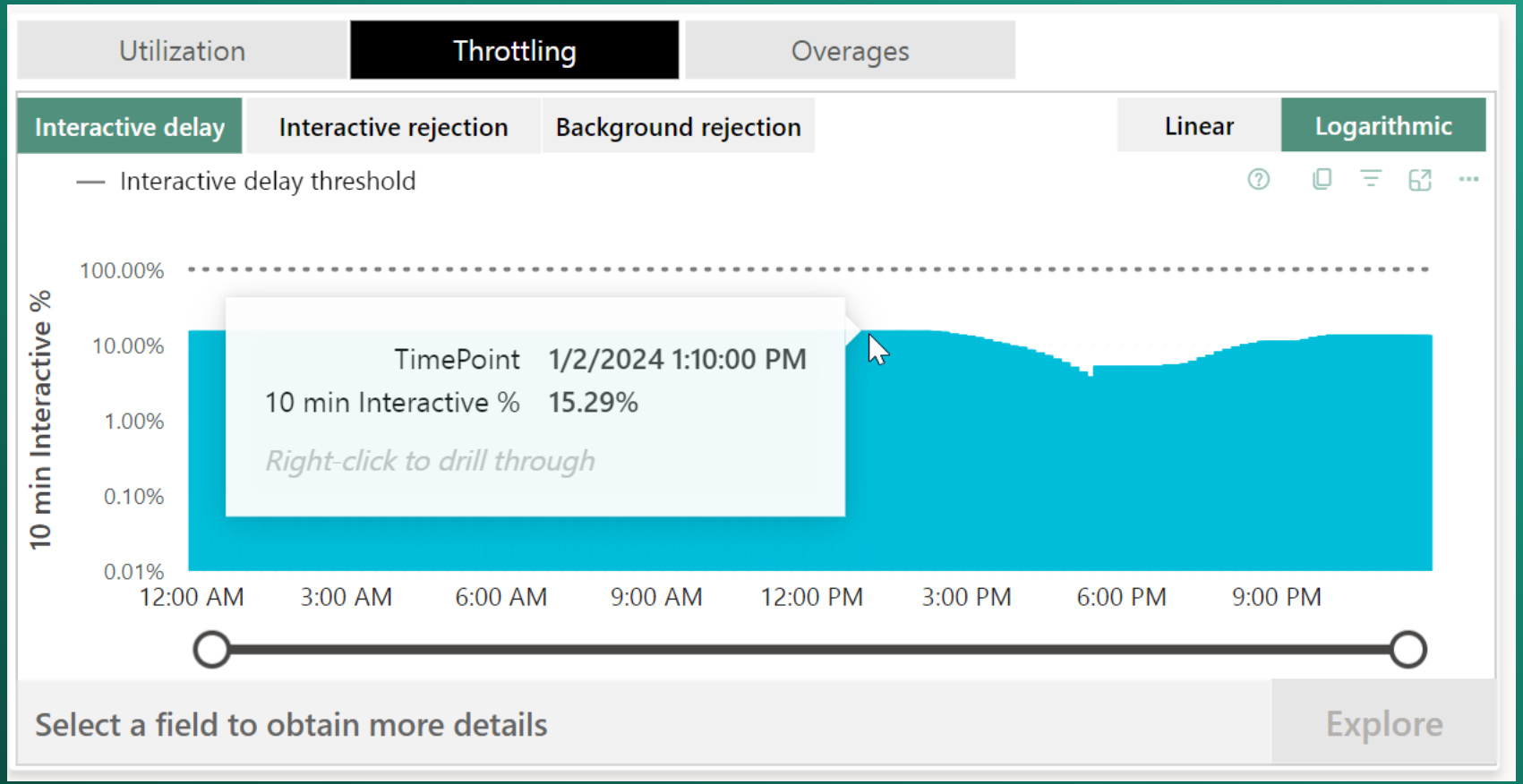
Notebook (CSV to Parquet) Metrics



Notebook (CSV to Parquet) Metrics



Notebook (CSV to Parquet) Metrics



Create a table with some extra colums F2

```python
from pyspark.sql.functions import col, year, month, quarter

table_name = 'fact_orders_2cu'

df = spark.sql("SELECT * FROM Demo_Lakehouse_2CU.raw_orders")
df = df.withColumn('Year', year(col("o_orderdate")))
df = df.withColumn('Quarter', quarter(col("o_orderdate")))
df = df.withColumn('Month', month(col("o_orderdate")))

df.write.mode("overwrite").format("delta").partitionBy("Year","Quarter").save("Tables/" + table_name)
```

✓ 18 min 7 sec -Command executed in 18 min 7 sec 97 ms by Admin on 2:56:34 PM, 1/05/24

s	773,741,822 rows	16.28 GB	23.73 GB
s	773,741,822 rows	23.73 GB	15.85 GB

Create a table with some extra colums F64

```python
from pyspark.sql.functions import col, year, month, quarter

table_name = 'fact_orders'

df = spark.sql("SELECT * FROM FabricLakehouse.raw_orders")
df = df.withColumn('Year', year(col("o_orderdate")))
df = df.withColumn('Quarter', quarter(col("o_orderdate")))
df = df.withColumn('Month', month(col("o_orderdate")))

df.write.mode("overwrite").format("delta").partitionBy("Year","Quarter").save("Tables/" + table_name)
```

✓ 8 min 21 sec -Command executed in 8 min 20 sec 680 ms by Admin on 12:00:16 PM, 1/07/24

s	773,741,822 rows	16.28 GB	23.73 GB
s	773,741,822 rows	23.73 GB	15.85 GB

Join two huge tables F2

```
1   from pyspark.sql.functions import col, year, month, quarter
2
3   table_name = 'fact_orderlines'
4
5   dforder = spark.sql("SELECT * FROM Demo_Lakehouse_2CU.raw_orders")
6   dforder = dforder.withColumn('Year', year(col("o_orderdate")))
7   dforder = dforder.withColumn('Quarter', quarter(col("o_orderdate")))
8   dforder = dforder.withColumn('Month', month(col("o_orderdate")))
9
10  dfline = spark.sql("SELECT * FROM Demo_Lakehouse_2CU.raw_lineitems")
11
12  dforderline = dforder.join(dfline,dforder.O_ORDERKEY == dfline.L_ORDERKEY, how='Inner')
13
14  dforderline.write.mode("overwrite").format("delta").partitionBy("Year","Quarter").save("Tables/" + table_name)
```

Loading...

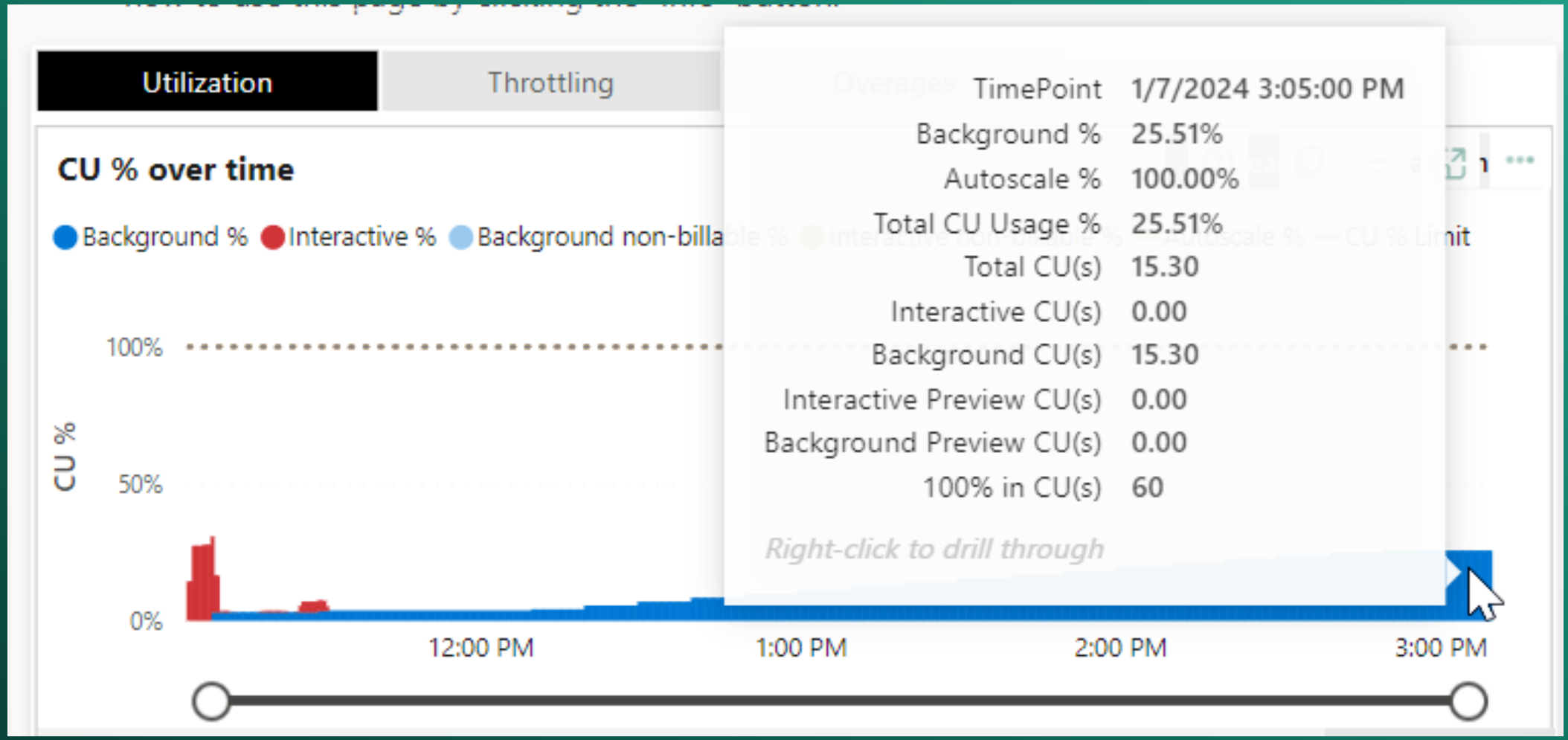
✓ 2 h 16 min -Command executed in 2 h 16 min 23 sec 908 ms by Admin on 2:22:06 PM, 1/07/24

Join two huge tables F64

```
1   from pyspark.sql.functions import col, year, month, quarter
2
3   table_name = 'fact_orderlines'
4
5   dforder = spark.sql("SELECT * FROM FabricLakehouse.raw_orders")
6   dforder = dforder.withColumn('Year', year(col("o_orderdate")))
7   dforder = dforder.withColumn('Quarter', quarter(col("o_orderdate")))
8   dforder = dforder.withColumn('Month', month(col("o_orderdate")))
9
10  dfline = spark.sql("SELECT * FROM FabricLakehouse.raw_lineitems")
11
12  dforderline = dforder.join(dfline,dforder.O_ORDERKEY == dfline.L_ORDERKEY, how='Inner')
13
14  dforderline.write.mode("overwrite").format("delta").partitionBy("Year","Quarter").save("Tables/" + table_name)
```

✓ -Apache Spark session ready in 2 min 39 sec 346 ms. Command executed in 14 min 51 sec 480 ms by Admin on 9:33:17 PM, 1/02/24

Join CU requests



Metrics overview

TableName	Rows	F2	F64	Factor	CU(s)
Pipeline Ingestion	n/a	32 minutes 39 seconds	33 minutes 14 seconds	1x	43
Customers	120 million	2 minutes 29 seconds	1 minute 13 seconds	2x	56
LineItems	4.2 billion	2 hours, 4 minutes 55 seconds	7 minutes 46 seconds	17x	82
Fact_orders	773 million	18 minutes	8 minutes	2.25x	26
Order_lines	4.2 billion	2 hours 16 minutes	2 minutes 39 seconds	45x	15
Sum		**~5 hours**	**~53 minutes**	**5x**	**222**

Fabric licenses

SKU*	Capacity Units (CU)	Power BI SKU	Power BI v-cores
F2	2	-	0.25
F4	4	-	0.5
F8	8	EM/A1	1
F16	16	EM2/A2	2
F32	32	EM3/A3	4
F64	64	P1/A4	8

*SKUs that are smaller than F64 require a Pro or Premium Per User (PPU) license, or a Power BI individual trial to consume Power BI content

Fabric licenses

SKU*	Capacity Units (CU)	Power BI SKU	Power BI v-cores
F2	2	-	0.25
F4	4	-	0.5
F8	8	EM/A1	1
F16	16	EM2/A2	2
F32	32	EM3/A3	4
F64	64	P1/A4	8

Results

- Install the Microsoft Fabric capacity metrics app - Microsoft Fabric | Microsoft Learn
- Test your workload as the CU(s) are like Sql Server Query costs
- Compare numbers and review duration and CU(s)

Resources

- TPC-H
  - https://www.tpc.org/tpch/
  - https://github.com/dimitri/tpch-citus/blob/master/schema/tpch-schema.sql
  - https://docs.deistercloud.com/content/Databases.30/TPCH%20Benchmark.90/index.xml?embedded=true
  - https://support.hpe.com/hpesc/public/docDisplay?docId=sf000078704en_us&docLocale=en_US

Resources

- Fabric App
  - https://gennakerdata.com/2023/12/12/capacity-metrics-app-analysis-english-version/
  - https://learn.microsoft.com/en-us/fabric/enterprise/metrics-app-install?tabs=1st

Thank you!

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Example of Title and Content (with Bullets)

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  - Content
    - Content

Example of Content Only.

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Example of Two Content

Content

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Content

Content

Content

Content

Example of Two Content (Center)

Content

Content

Content

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Example of Comparison (Center)

Header	Header
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Content	Content

Part

Section

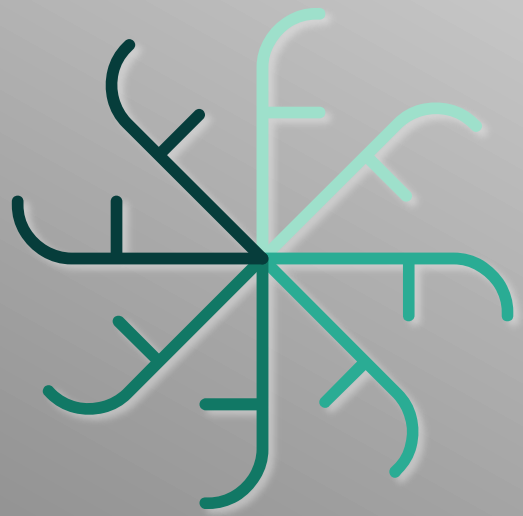
Section and Subtitle

Subtitle

Subsection

Subsection and Subtitle

Subtitle



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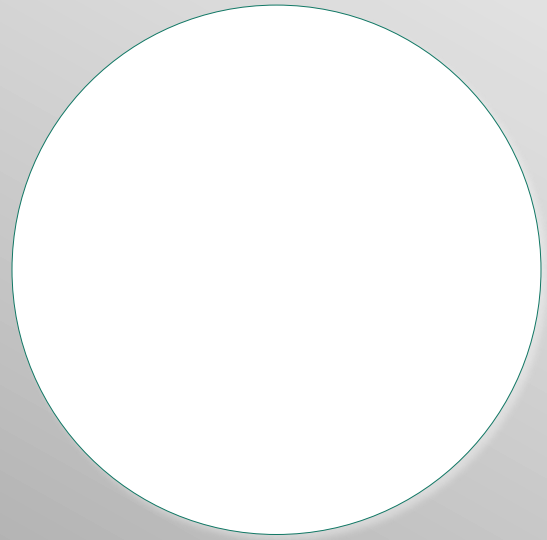
Speaker Name

First Name
Last Name

Fæncy Job Title

Cool Company



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/in/linkedin

Website

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Example of Title and Content

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Example of Title and Content (with Bullets)

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Example of Two Content

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Example of Two Content (Center)

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Example of Comparison

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Example of Comparison (Center)

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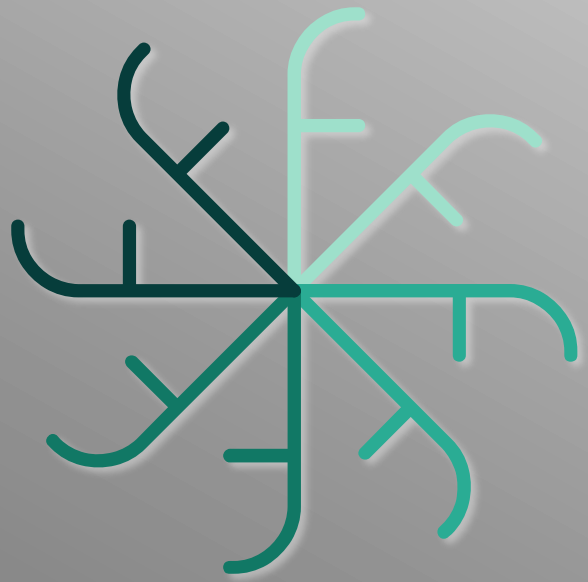

Part

Section

Section and Subtitle

Subtitle

Subsection

Subsection and Subtitle

Subtitle

Thank you!