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FEBRUARY

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Reitse Eskens

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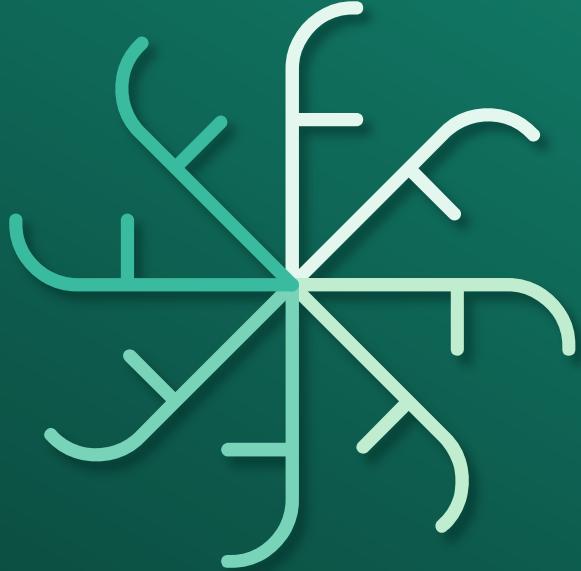
Axians Business Analytics



Reitse.Eskens@axians.com 

/in/reitseeskens 

<https://sqlreitse.com> 



Definitions

A large amount of data



Load testing



Coming from a SQL world



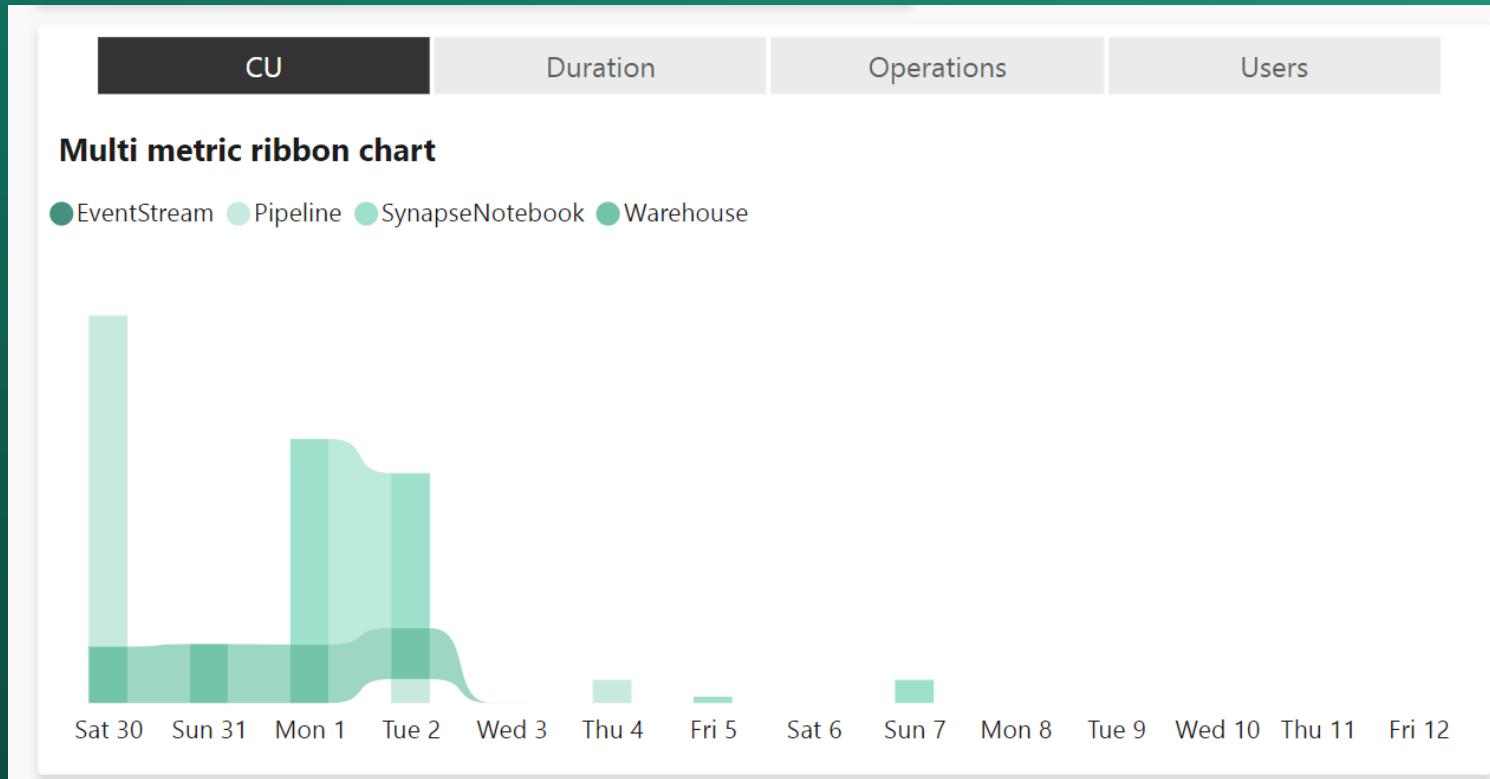


From definitions to Monitoring

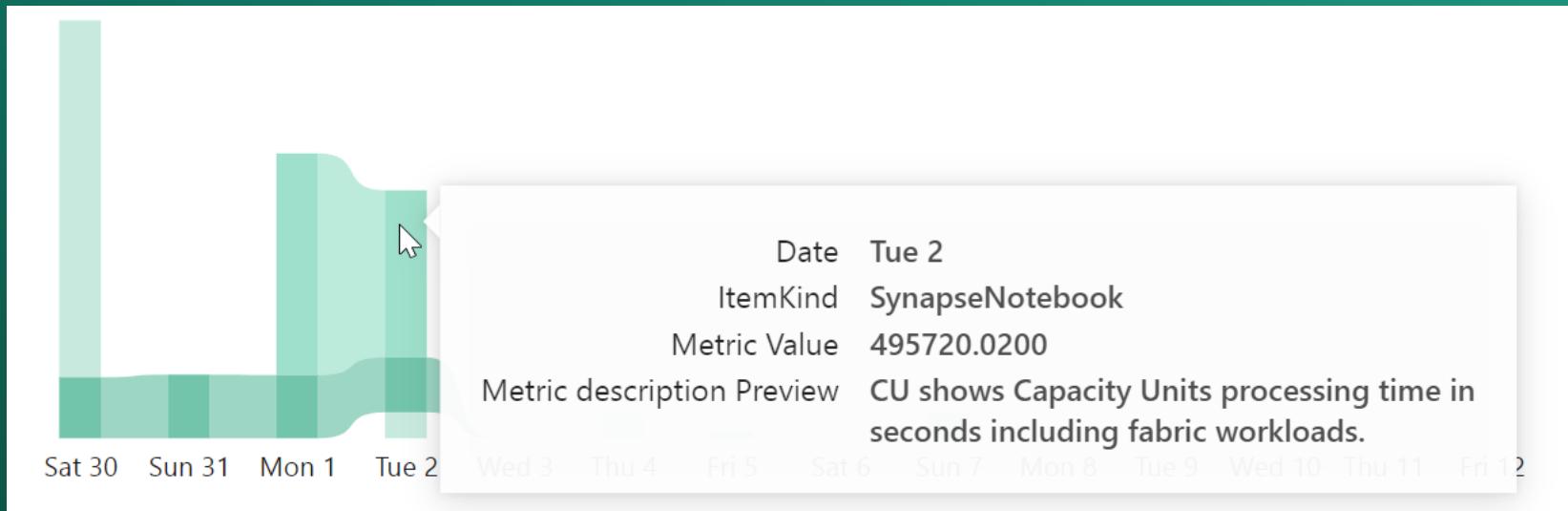
Learning a new tool: Fabric Capacity Metrics



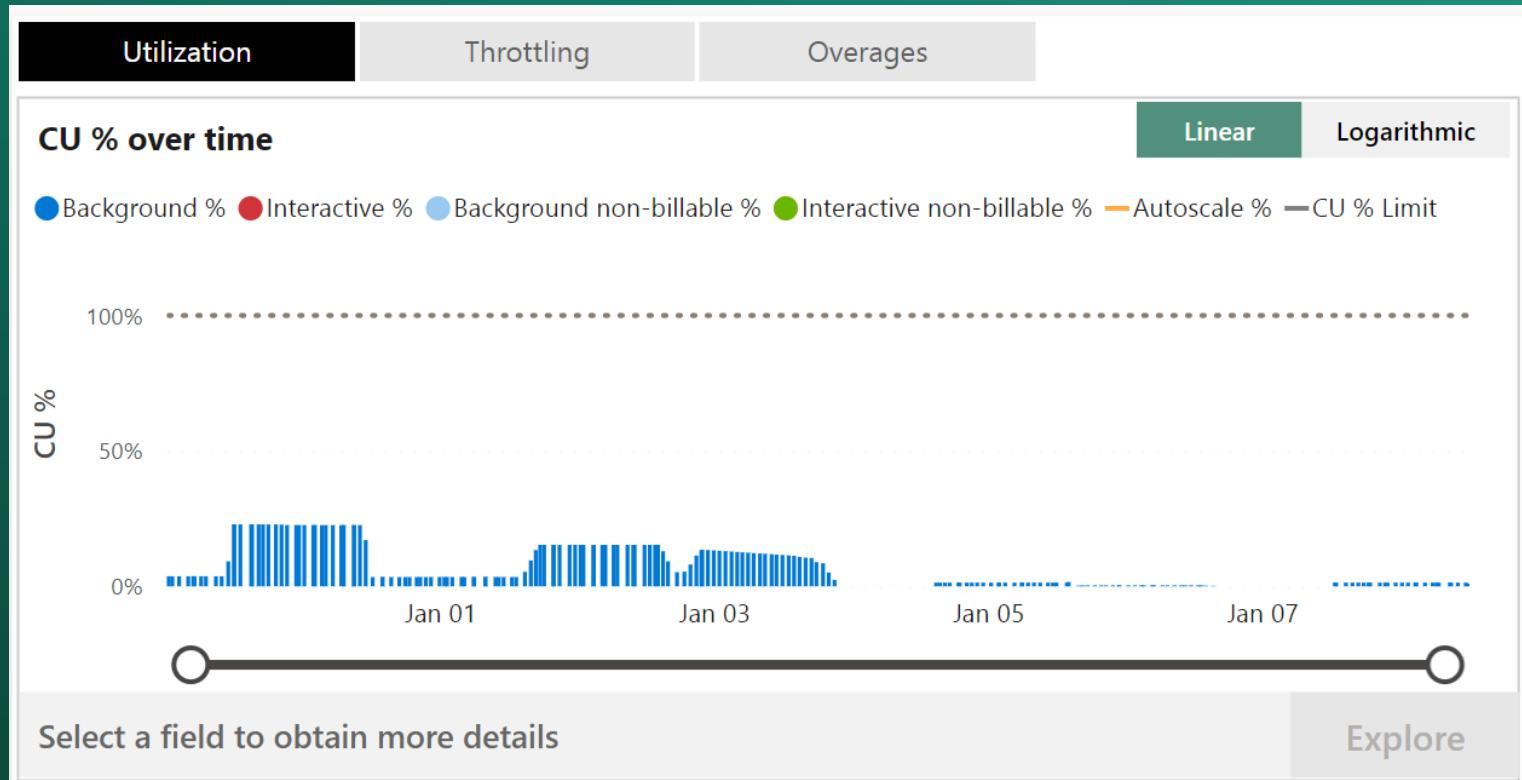
Fabric Capacity Metrics: Multi metric ribbon chart



Fabric Capacity Metrics: Multi metric ribbon chart



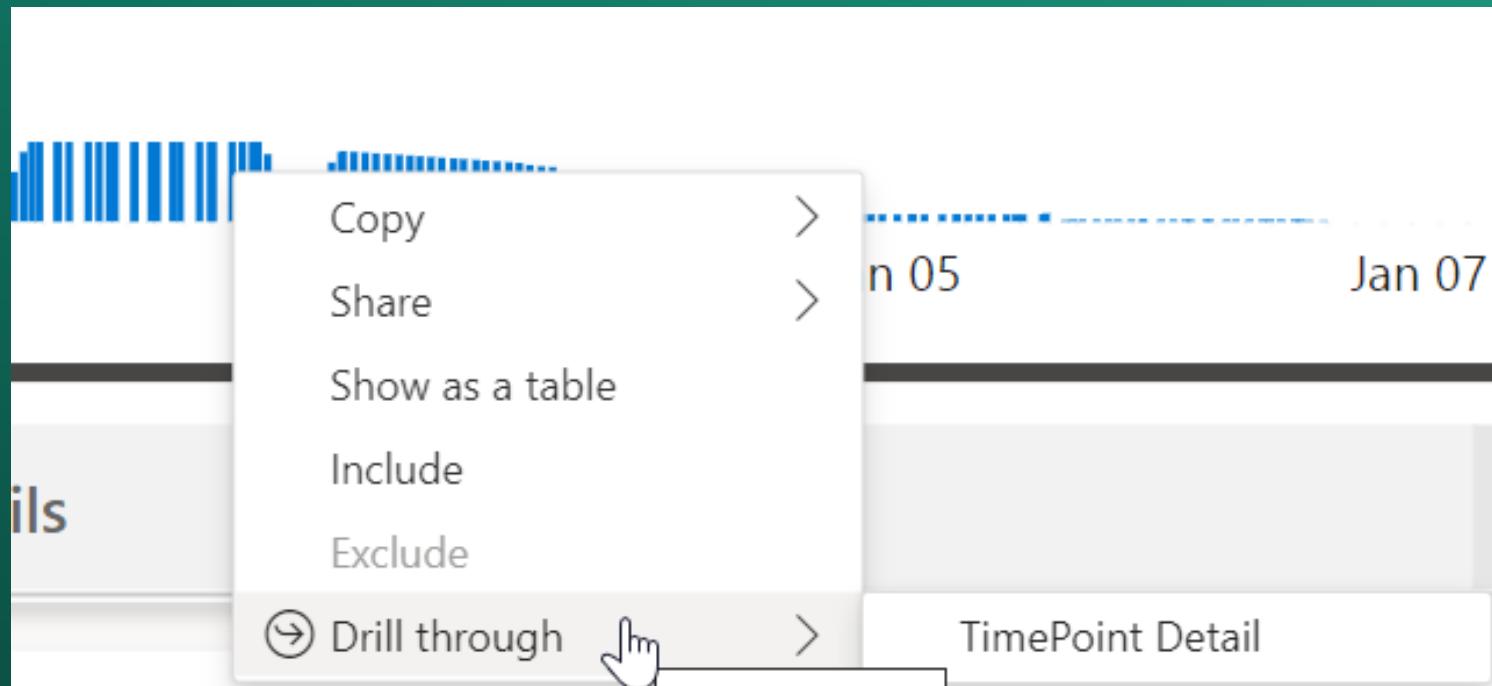
Fabric Capacity Metrics: Capacity Utilization and Throttling

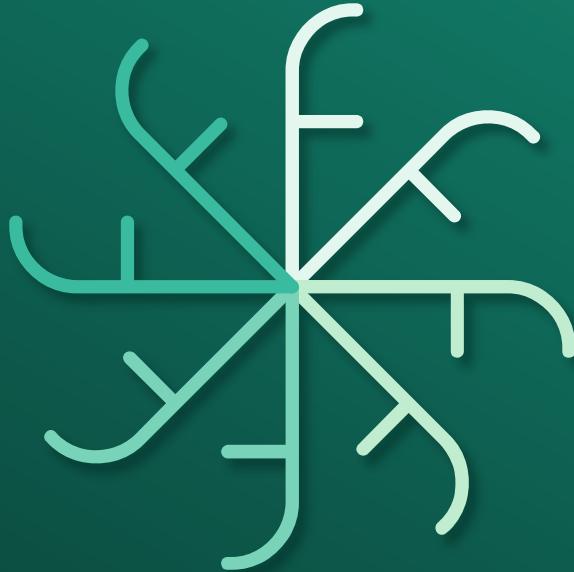


Fabric Capacity Metrics: Capacity Utilization and Throttling

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





From theory to data

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

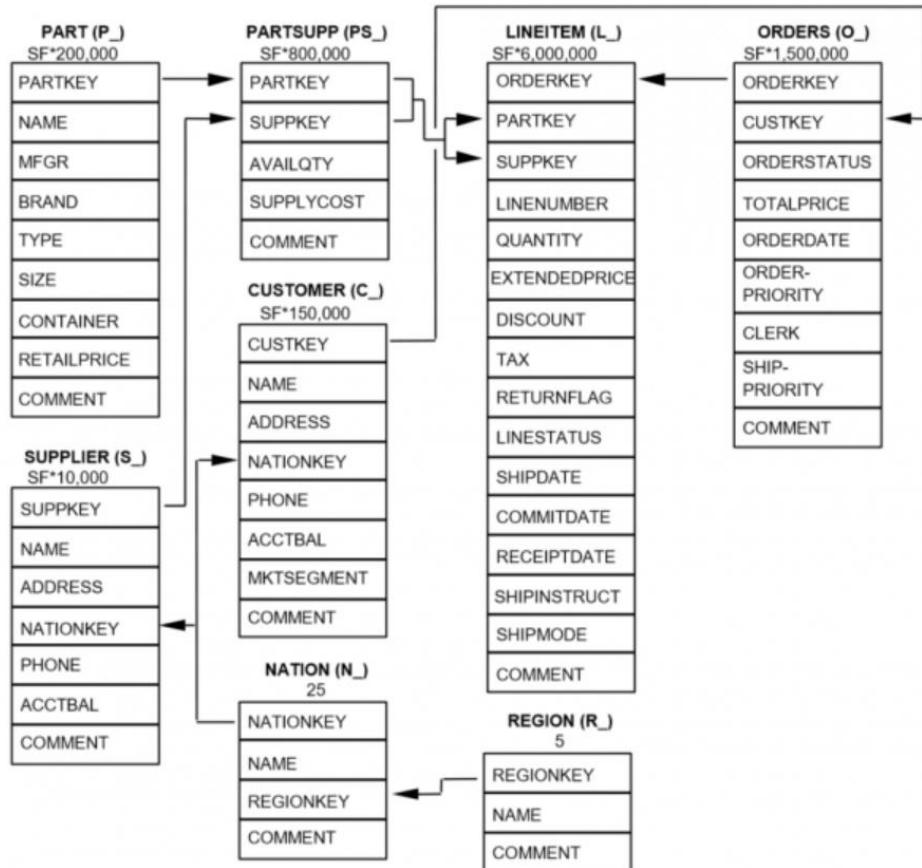
- .\dbgen.exe -v -U200
 - -v = verbose
 - -U 200 = 200 sets of update and delete sets



Database schema

1 Database schema

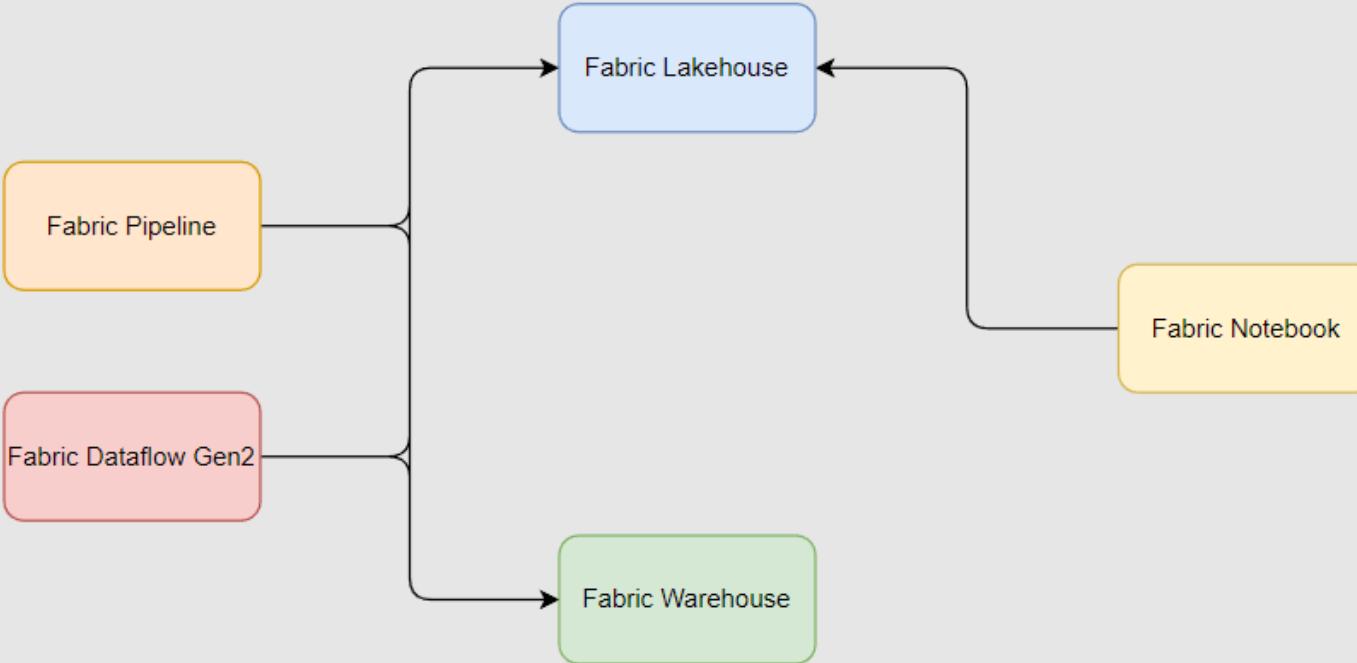
The TPC-H Schema



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

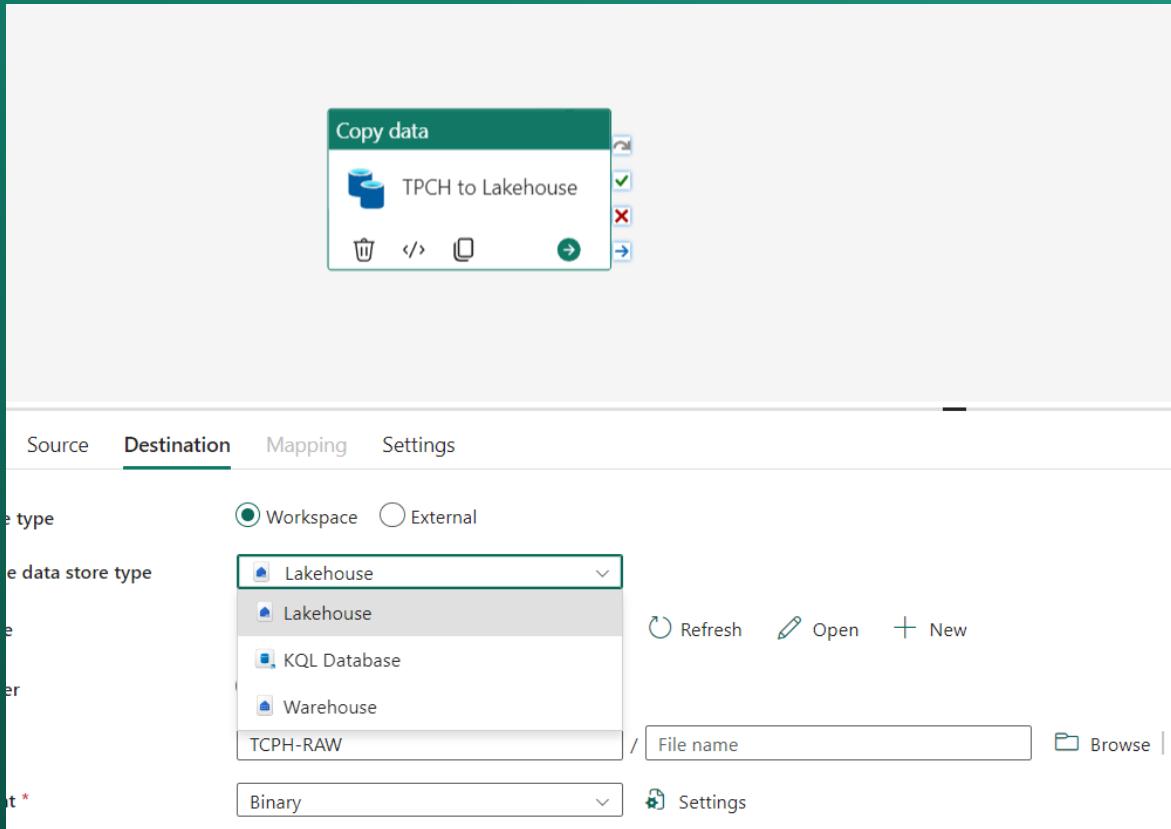


Loading...

- Pipeline
- Notebook
- Dataflow Gen2



Pipeline



Pipeline

General Source Destination Mapping **Settings**

Intelligent throughput optimization ⓘ Use custom value

Degree of copy parallelism ⓘ

Data consistency verification ⓘ

Fault tolerance ⓘ

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 ^① Balanced

Used parallel copies ^① 638



Pipeline F2

Throughput 341.603 MB/s

Total duration 00:32:39

Duration breakdown

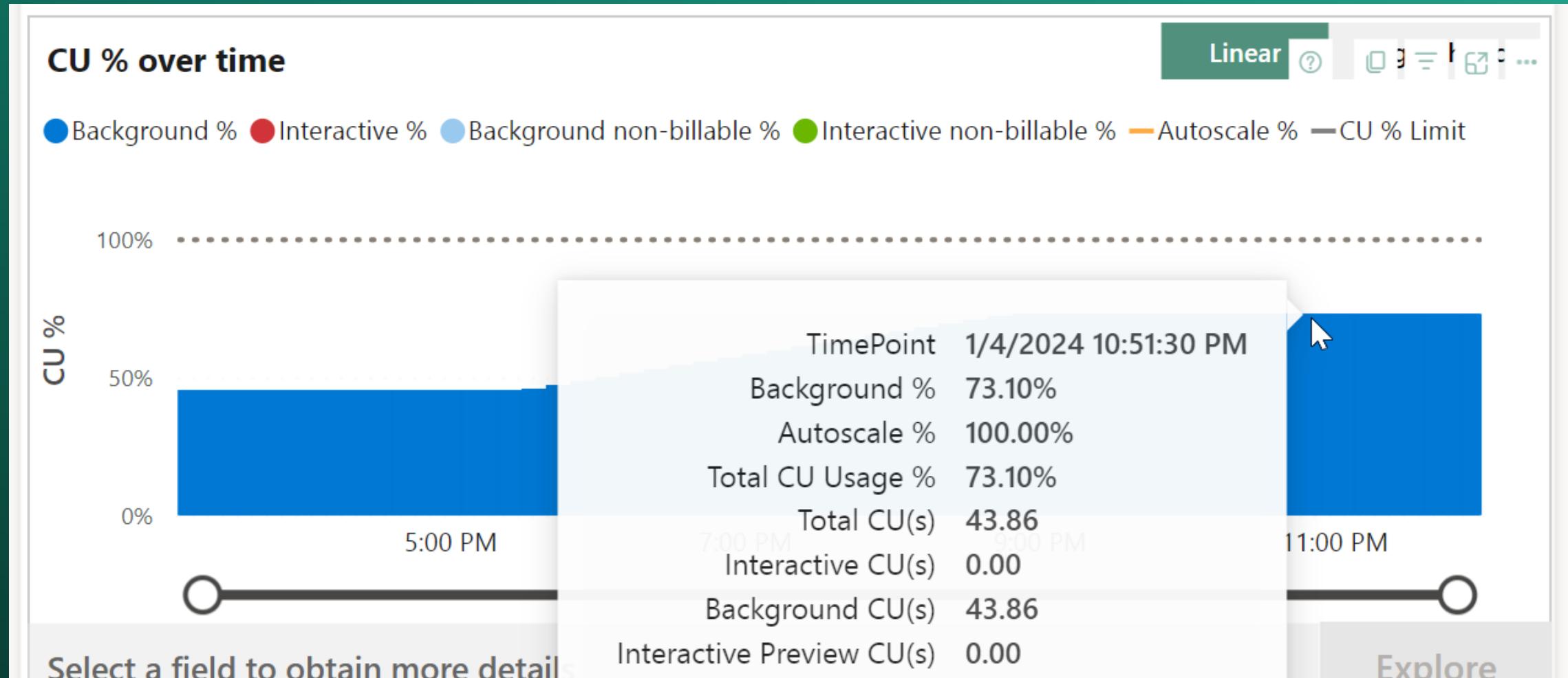
Start time 1/4/2024, 2:29:49 PM

Optimized throughput ^① Balanced

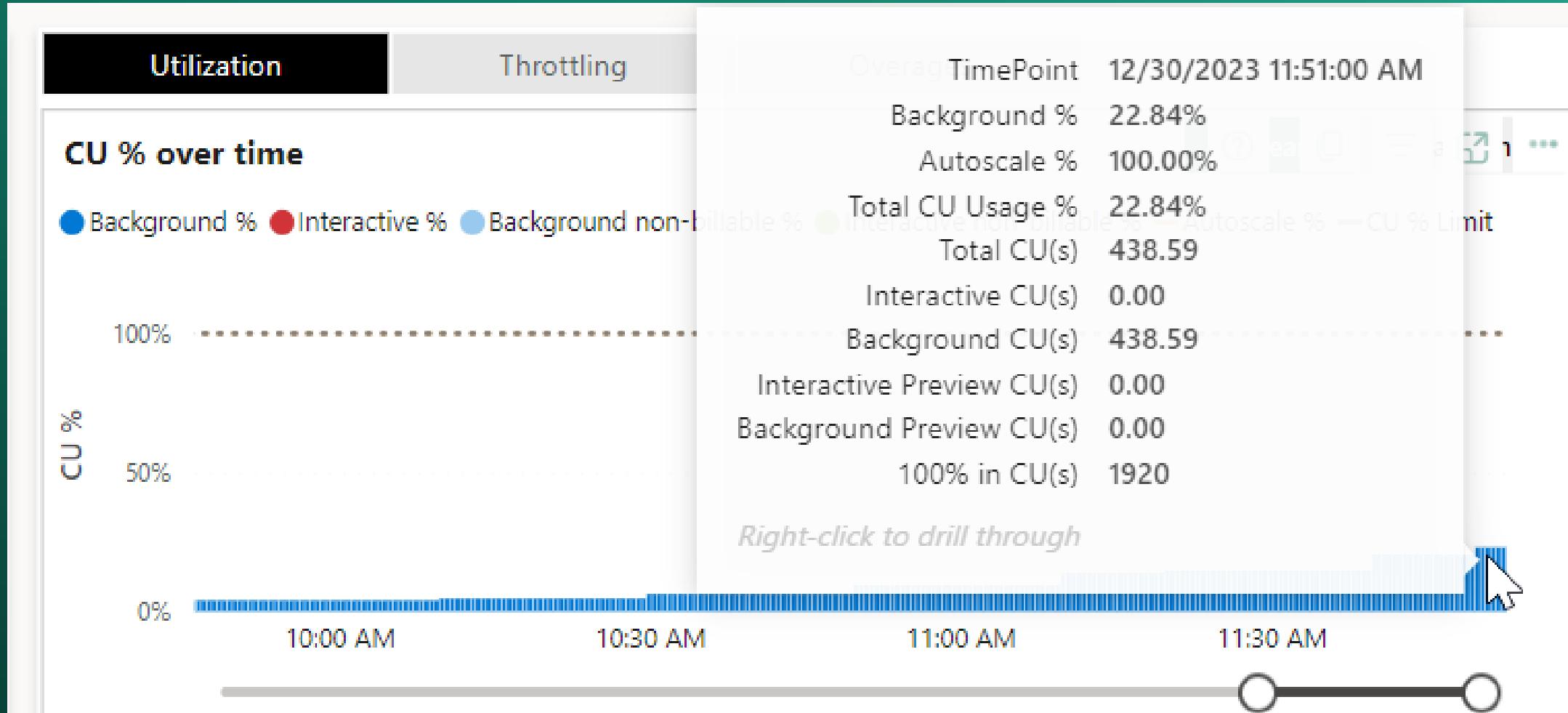
Used parallel copies ^① 638



Pipeline F2



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

$$(24 * 60 * 60) / 2880 = 30 \text{ (seconds)}$$

Pipeline

F2 uses 73% capacity

F64 uses 2,2% capacity

What else is going on?

Notebook (CSV to Parquet)

```
1  folderPath = "Files/TCPH-RAW/files/customer.tbl.*.csv"
2  table_name = "raw_customers"
3
4  schema = StructType([
5      StructField("C_CUSTKEY", IntegerType()),
6      StructField("C_NAME", StringType()),
7      StructField("C_ADDRESS", StringType()),
8      StructField("C_NATIONKEY", IntegerType()),
9      StructField("C_PHONE", StringType()),
10     StructField("C_ACCTBAL", DoubleType()),
11     StructField("C_MKTSEGMENT", StringType()),
12     StructField("C_COMMENT", StringType()),
13     StructField("C_EEmpty", StringType())
14 ])
15
16 df = spark.read.csv(
17     folderPath,
18     header=False,
19     mode="DROPMALFORMED",
20     sep="|",
21     schema=schema
22 )
23 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)

```
1  folderPath = "Files/TCPH-RAW/files/lineitem.tbl.*.csv"
2  table_name = "raw_lineitems"
3
4  schema = StructType([
5      StructField("L_ORDERKEY", IntegerType()),
6      StructField("L_PARTKEY", IntegerType()),
7      StructField("L_SUPPKEY", IntegerType()),
8      StructField("L_LINENUMBER", IntegerType()),
9      StructField("L_QUANTITY", IntegerType()),
10     StructField("L_EXTENDEDPRICE", DoubleType()),
11     StructField("L_DISCOUNT", DoubleType()),
12     StructField("L_TAX", DoubleType()),
13     StructField("L_RETURNFLAG", StringType()),
14     StructField("L_LINESSTATUS", StringType()),
15     StructField("L_SHIPDATE", StringType()),
16     StructField("L_COMMITDATE", StringType()),
17     StructField("L_RECEIPTDATE", StringType()),
18     StructField("L_SHIPINSTRUCT", StringType()),
19     StructField("L_SHIPMODE", StringType()),
20     StructField("L_COMMENT", StringType()),
21     StructField("L_Empty", StringType())
22 ])
23
24 df = spark.read.csv(
25     folderPath,
26     header=False,
27     mode="DROPMALFORMED",
28     sep="|",
29     schema=schema
30 )
31 df.write.mode("overwrite").format("delta").save("Tables/" + table_name)
```

Notebook (CSV to Parquet) F2

[3] ✓ 2 h 4 min -Command executed in 2 h 4 min 55 sec 205 ms by Admin on 1:20:30 PM, 1/05/24

▼ Spark jobs (11 of 11 succeeded) Log

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

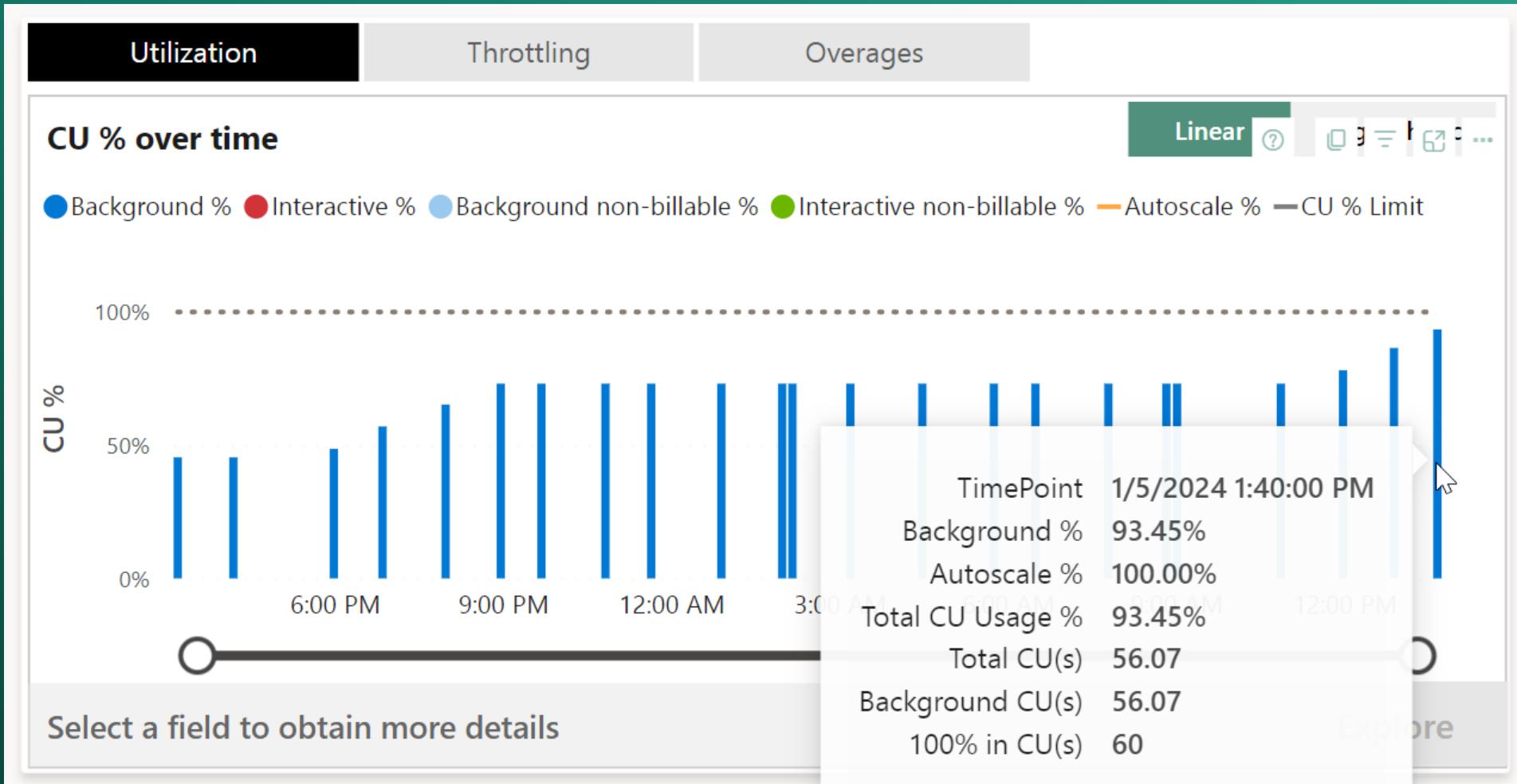
Notebook (CSV to Parquet) F64

[62]

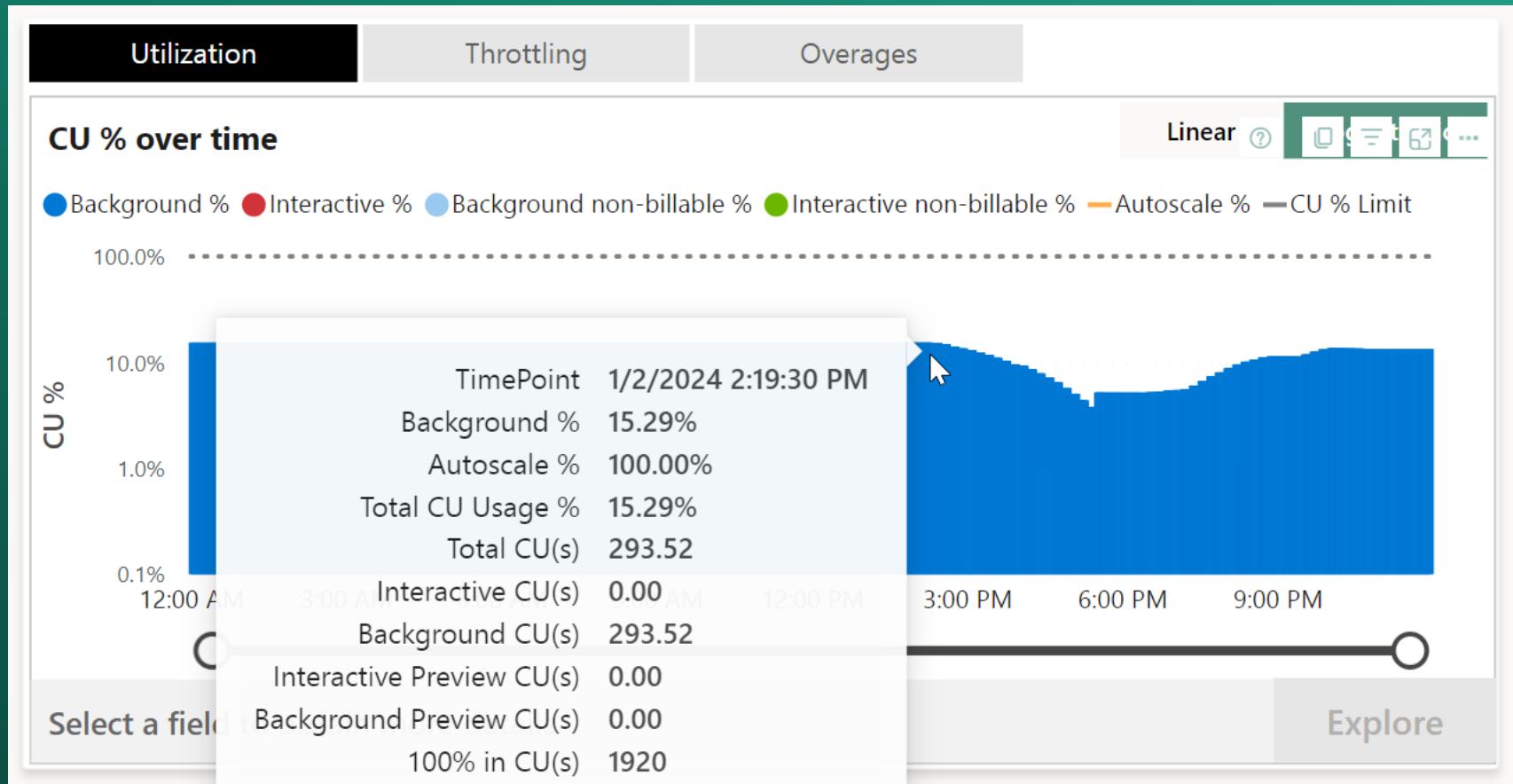
✓ -Command executed in 7 min 46 sec 31 ms by Admin on 7:38:02 PM, 1/02/24

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

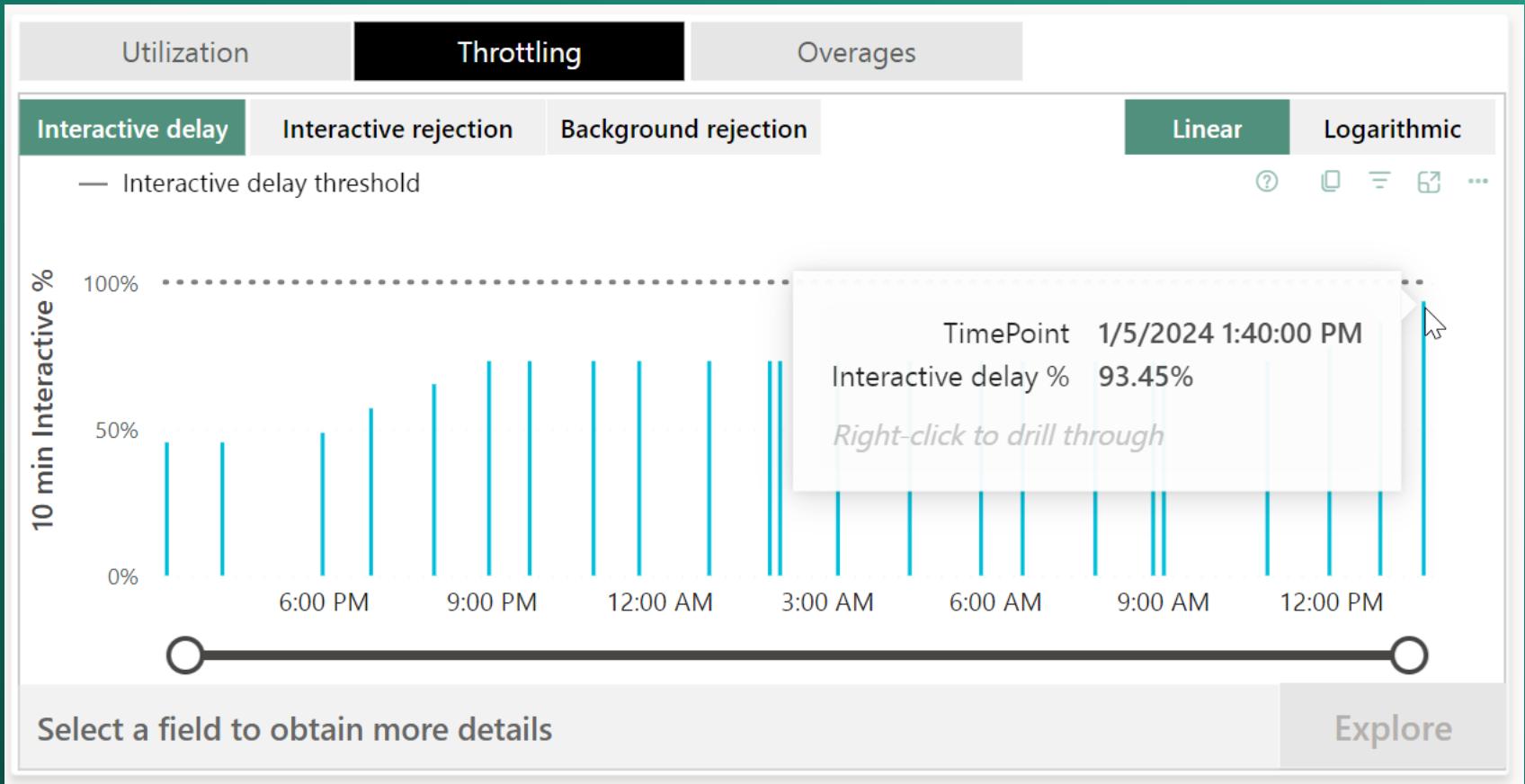
Notebook (CSV to Parquet) Metrics



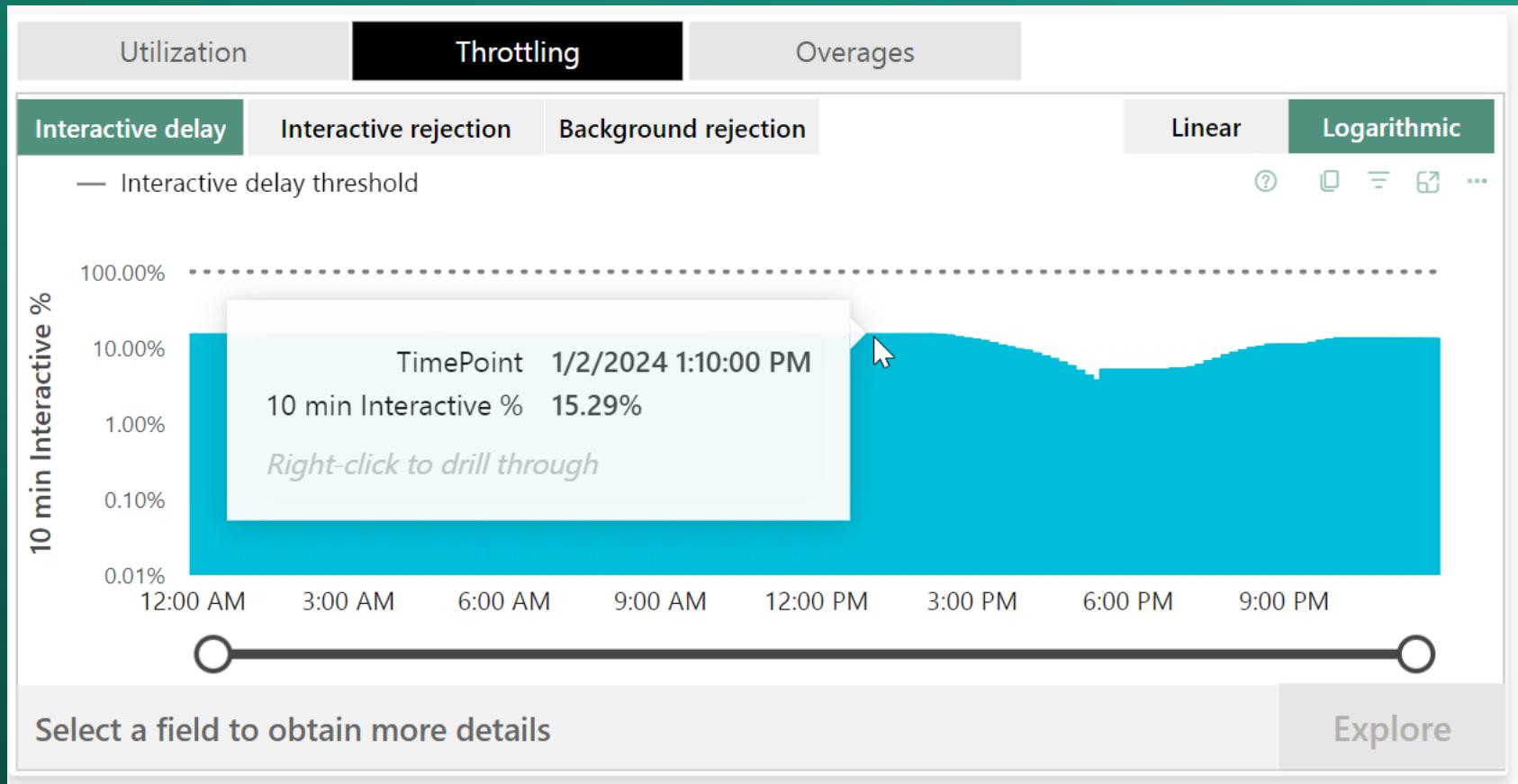
Notebook (CSV to Parquet) Metrics



Notebook (CSV to Parquet) Metrics



Notebook (CSV to Parquet) Metrics



Create a table with some extra columns F2

```
1 from pyspark.sql.functions import col, year, month, quarter
2
3 table_name = 'fact_orders_2cu'
4
5 df = spark.sql("SELECT * FROM Demo_Lakehouse_2CU.raw_orders")
6 df = df.withColumn('Year', year(col("o_orderdate")))
7 df = df.withColumn('Quarter', quarter(col("o_orderdate")))
8 df = df.withColumn('Month', month(col("o_orderdate")))
9
10 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 columns F64

```
1 from pyspark.sql.functions import col, year, month, quarter
2
3 table_name = 'fact_orders'
4
5 df = spark.sql("SELECT * FROM FabricLakehouse.raw_orders")
6 df = df.withColumn('Year', year(col("o_orderdate")))
7 df = df.withColumn('Quarter', quarter(col("o_orderdate")))
8 df = df.withColumn('Month', month(col("o_orderdate")))
9
10 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)
```

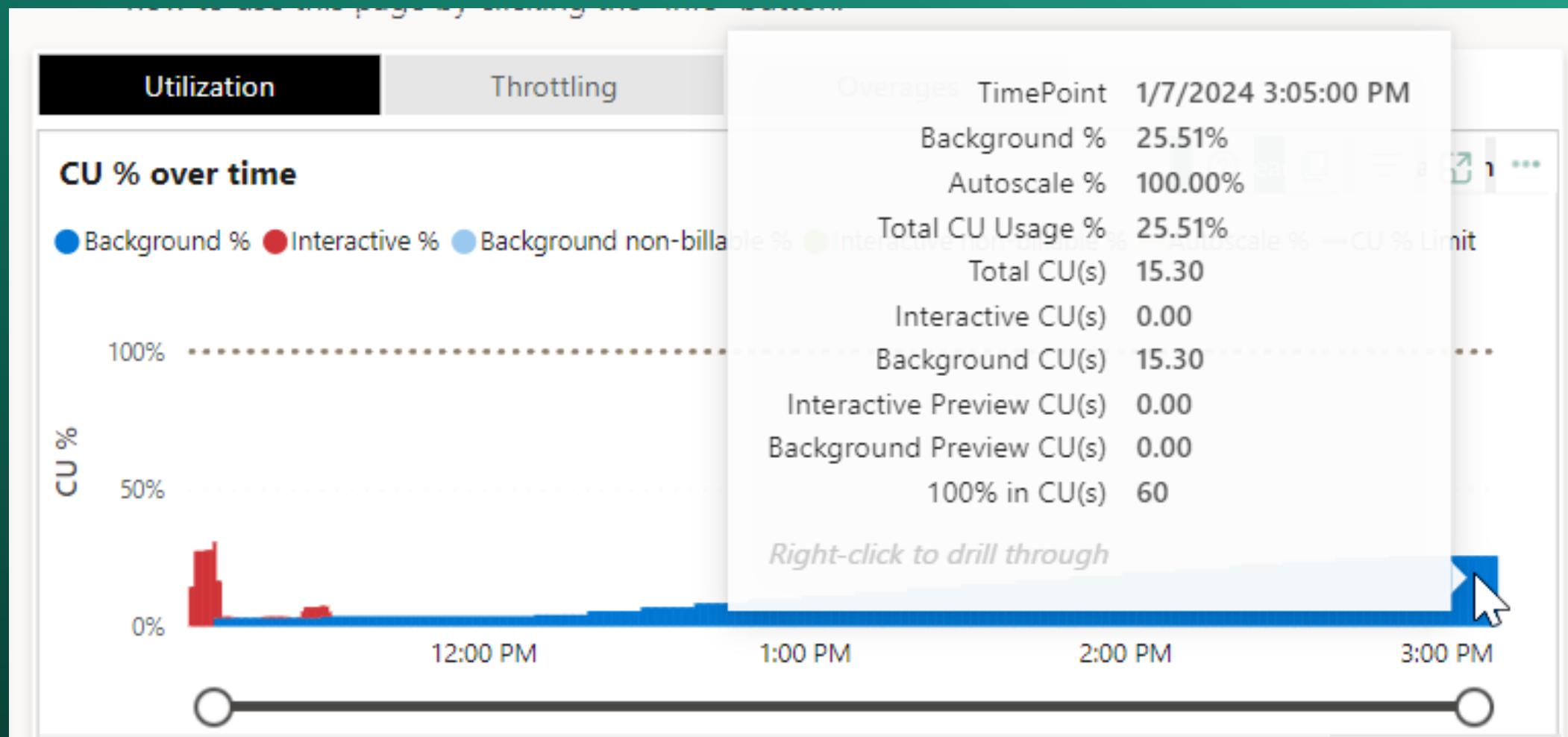
✓ 2 h 16 min -Command executed in 2 h 16 min 23 sec 908 ms by Admin on 2:22:06 PM, 1/07/24

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





Summaries

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	Spark Cores
F2	2	-	0.25	4
F4	4	-	0.5	8
F8	8	EM/A1	1	16
F16	16	EM2/A2	2	32
F32	32	EM3/A3	4	64
F64	64	P1/A4	8	128

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://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/hpsc/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!



Share your feedback in
any language
using voice or text!



Example of Title and Content (with Bullets)

- Content
 - Content
 - Content

Example of Content Only.

(This layout has a hidden title above the visible part of the slide. It helps with accessibility and also makes it easier to change the slide back to a layout with a title.)

Example of Two Content

Content

Content

Content

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Content

Content

Example of Two Content (Center)

Content

Content

Content

Content

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Example of Comparison (Center)

Header

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Section

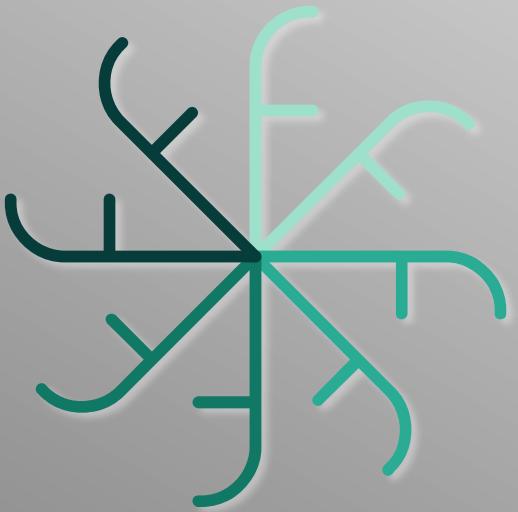
Section and Subtitle

Subtitle

Subsection

Subsection and Subtitle

Subtitle



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Session Title

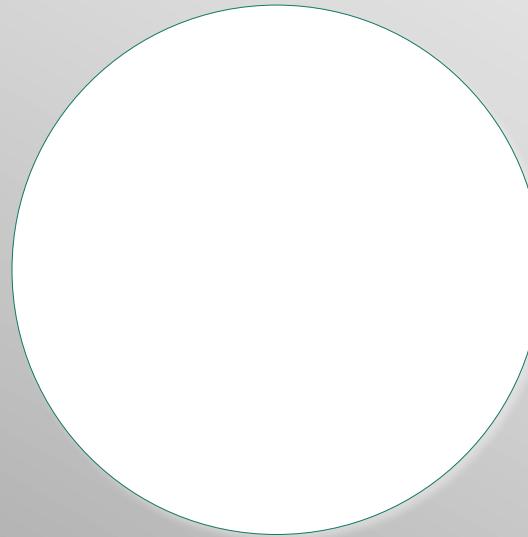
Speaker Name

First Name

Last Name

Fæncy Job Title

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About you

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Content

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Example of Two Content

Content

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Example of Two Content (Center)

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Example of Comparison

Header

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Example of Comparison (Center)

Header

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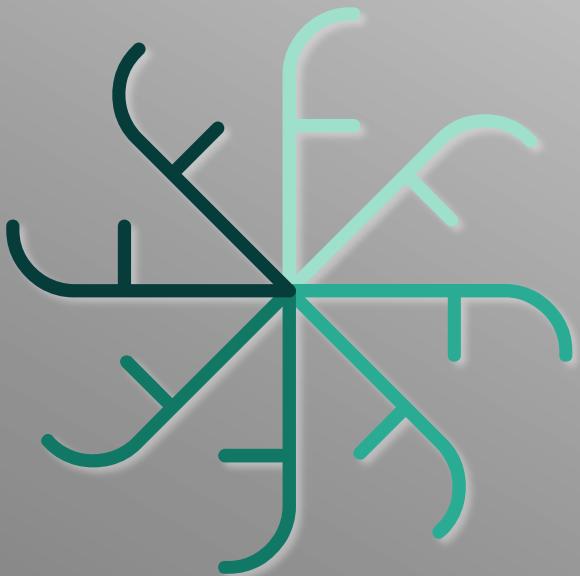
Content

Header

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Content



Part

Section

Section and Subtitle

Subtitle

Subsection

Subsection and Subtitle

Subtitle

Thank you!

