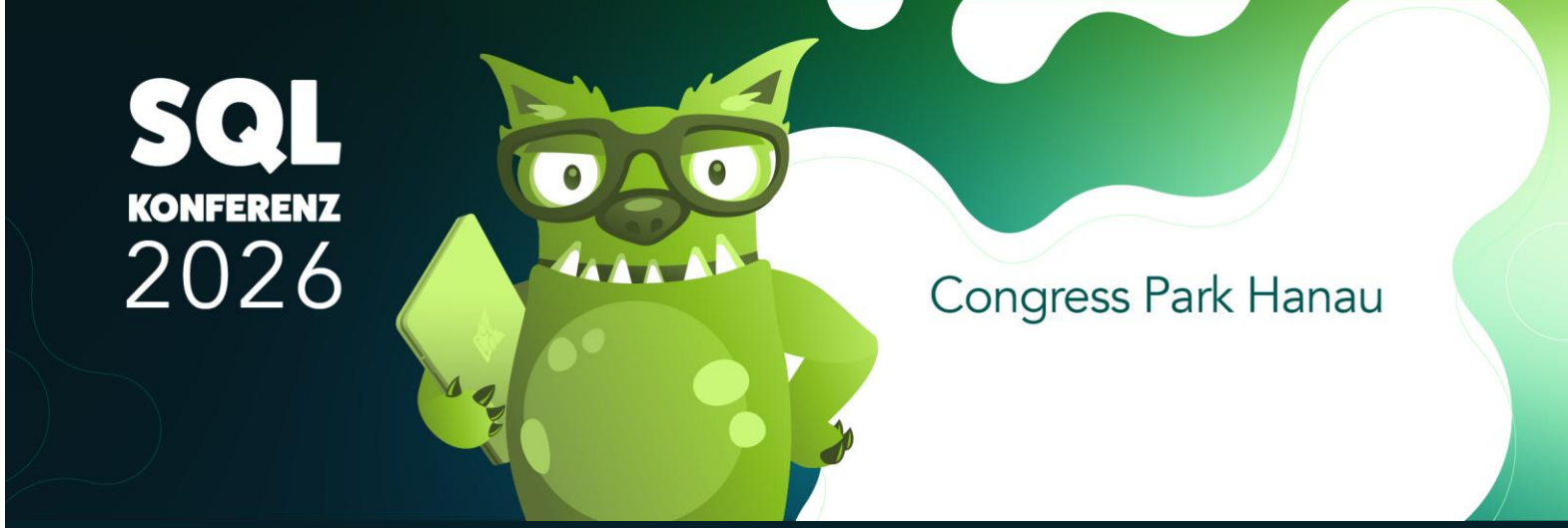




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Mastering Semantic Model Optimization in Microsoft Fabric

Once upon a time...



The Fabric Kingdom is under attack!

Poorly optimized semantic model cause:

- Bad Performance
- Long Refresh Times

- High CU consumption for Refreshes
- High CU consumption for Queries
- High Load on Source Systems (especially with Direct Query)
- High Load on Gateway



Disclaimer: No data monsters or kittens have been harmed!

Impact innocent Data Monsters on your Tenant!

The enemy is revealed!



It is crucial to monitor your tenant continuously to ensure stability:

- Admin Monitoring
- Capacity Metrics App
- Capacity Events
- FUAM

Only if the enemy is revealed, it can be fought!



Know the enemy!

- Important factors in semantic models
  - Unused columns
  - N:M Relationships
  - Bidirectional cross filtering
  - High Column Cardinality
  - Bad DAX Logic
  - Full Load for large data volumes
  - Hitting Query Memory Limits
  - Multi Region Network Latency
  - Wrong Partitioning
  - And many more



Pick the right magical tools!

To analyze different aspects of Semantic Models different tools are provided:

- Workspace Monitoring
- Gateway Monitoring
- Best Practice Analyzer
- Vertipaq Analyzer
- DAX Studio
- …



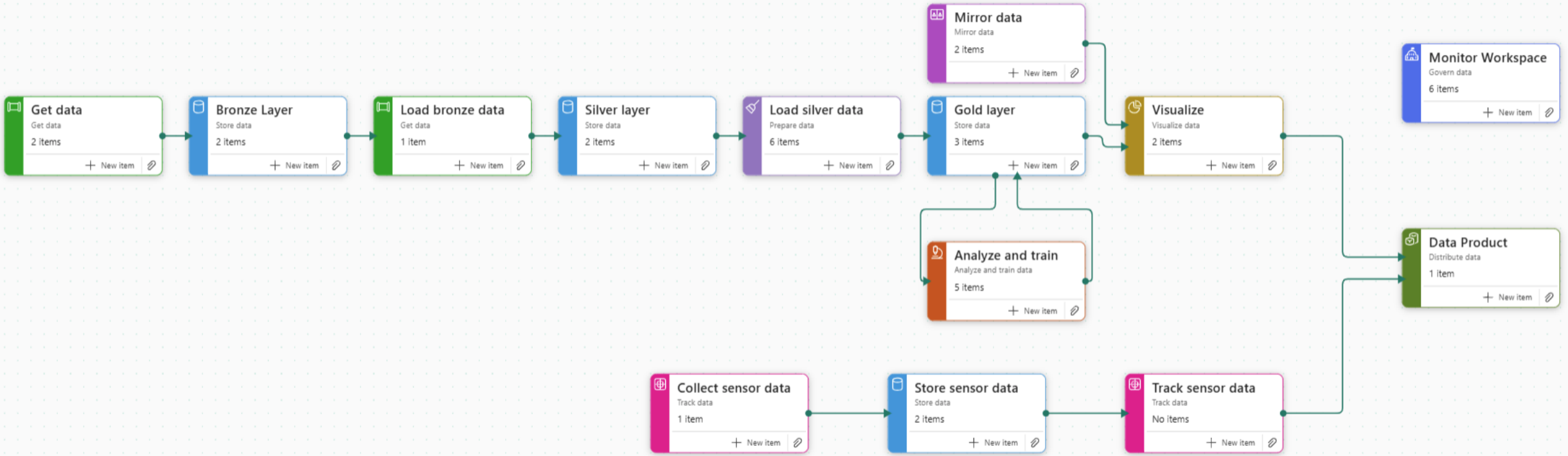
Fight the dragon!

Demo



Disclaimer: No dragons have been harmed!

Dragon’s Terrain



Let’s X-ray the dragon

Let’s run Best Practice Analyzer within Fabric

```
fabric.run_model_bpa(dataset=dataset, workspace=workspace)
```

Let’s run Memory Analyzer within Fabric

```
fabric.model_memory_analyzer(dataset=dataset, workspace=workspace)
```



Let’s X-ray the dragon | BPA

Run the Best Practice Analyzer on your semantic model

```
1  fabric.run_model_bpa(dataset=dataset, workspace=workspace)
```

[2] ✓ 14 sec - Command executed in 14 sec 547 ms by Gellert Gintli on 3/3/2026, 11:57:38 AM

Formatting	Maintenance	Performance
ℹ (23) + ⚠ (12)	ℹ (96) + ⚠ (6)	⚠ (12)

Rule Name	Object Type	Object Name	Severity
Date/calendar tables should be marked as a date table	Table	date	⚠
Do not use floating point data types	Column	'sales_predictions'[CustomerKey]	⚠
Do not use floating point data types	Column	'sales_predictions'[ExchangeRate]	⚠
Do not use floating point data types	Column	'sales_predictions'[LineNumber]	⚠
Do not use floating point data types	Column	'sales_predictions'[NetPrice]	⚠
Do not use floating point data types	Column	'sales_predictions'[OrderKey]	⚠
Do not use floating point data types	Column	'sales_predictions'[ProductKey]	⚠
Do not use floating point data types	Column	'sales_predictions'[Quantity]	⚠
Do not use floating point data types	Column	'sales_predictions'[StoreKey]	⚠
Do not use floating point data types	Column	'sales_predictions'[UnitCost]	⚠
Do not use floating point data types	Column	'sales_predictions'[UnitPrice]	⚠
Model should have a date table	Model	Model	⚠



Let’s X-ray the dragon | Memory Analyzer

Run the Memory Analyzer on your semantic model

```
1  fabric.model_memory_analyzer(dataset=dataset, workspace=workspace)
```

[2] ✓ 40 sec - Command executed in 40 sec 761 ms by Gellert Gintli on 3/3/2026, 12:10:04 PM

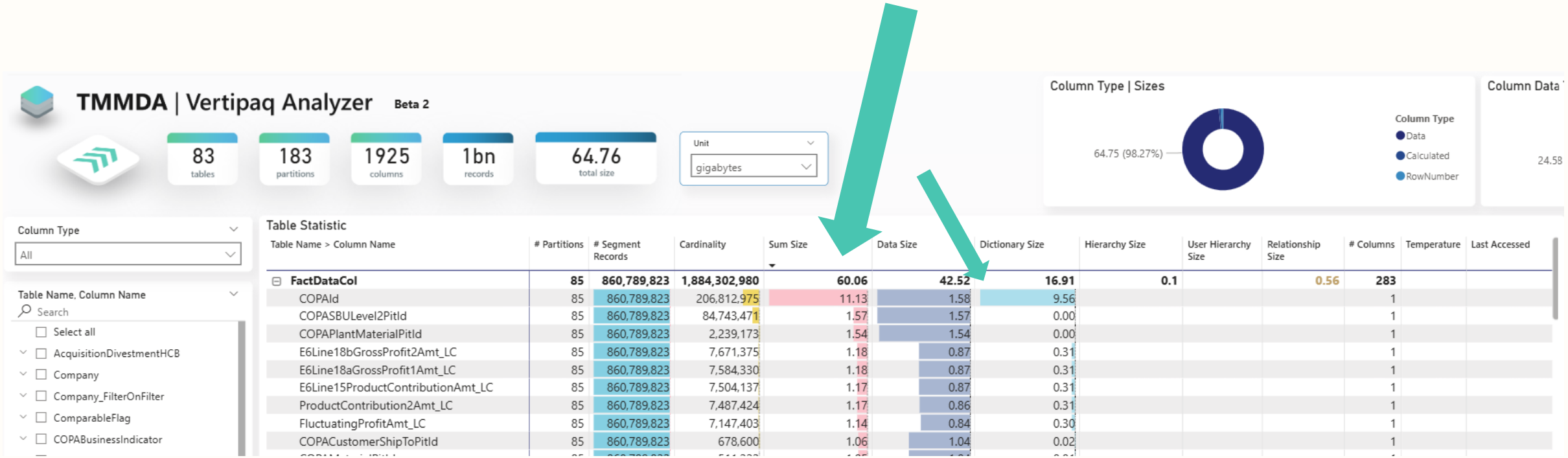
Model Summary | Tables | Partitions | Columns (Total Size) | Columns (Temperature) | Relationships | Hierarchies

Tables

	Table Name	Type	Row Count	Total Size	Dictionary Size	Data Size	Hierarchy Size	Relationship Size	User Hierarchy Size	Partitions	Columns	% DB
0	SalesTable	Table	2,832,193	26,105,798	968,902	24,897,000	198,176	41,720	0	1	16	90.57%
1	Customers	Table	18,484	1,092,182	819,118	113,480	159,584	0	0	1	12	3.79%
2	SalesFact	Table	74,041	708,760	352,440	172,856	146,976	36,488	0	1	7	2.46%
3	Dates	Table	2,556	491,908	397,044	38,688	47,120	0	9,056	1	32	1.71%
4	Products	Table	2,517	384,751	288,655	13,072	41,136	0	41,888	1	7	1.33%
5	Dynamic Field	Calculated Table	4	35,528	34,792	536	200	0	0	1	3	0.12%
6	Events	Table	0	4,728	3,640	1,088	0	0	0	1	7	0.02%
7	Simulation Parameter	Calculated Table	21	664	288	272	104	0	0	1	1	0.00%



Let’s X-ray the dragon | TMMDA | Huge ID Column



Download TMMDA from Github



Let’s X-ray the dragon | Bi-Directional + RLS

Single directional relationship



Bi-directional relationship



Red Dragon 2 – Semantic model

Fact Table:

199 Measures
work with single directional relationship

1 Measure
Really needs bi-directional relationship

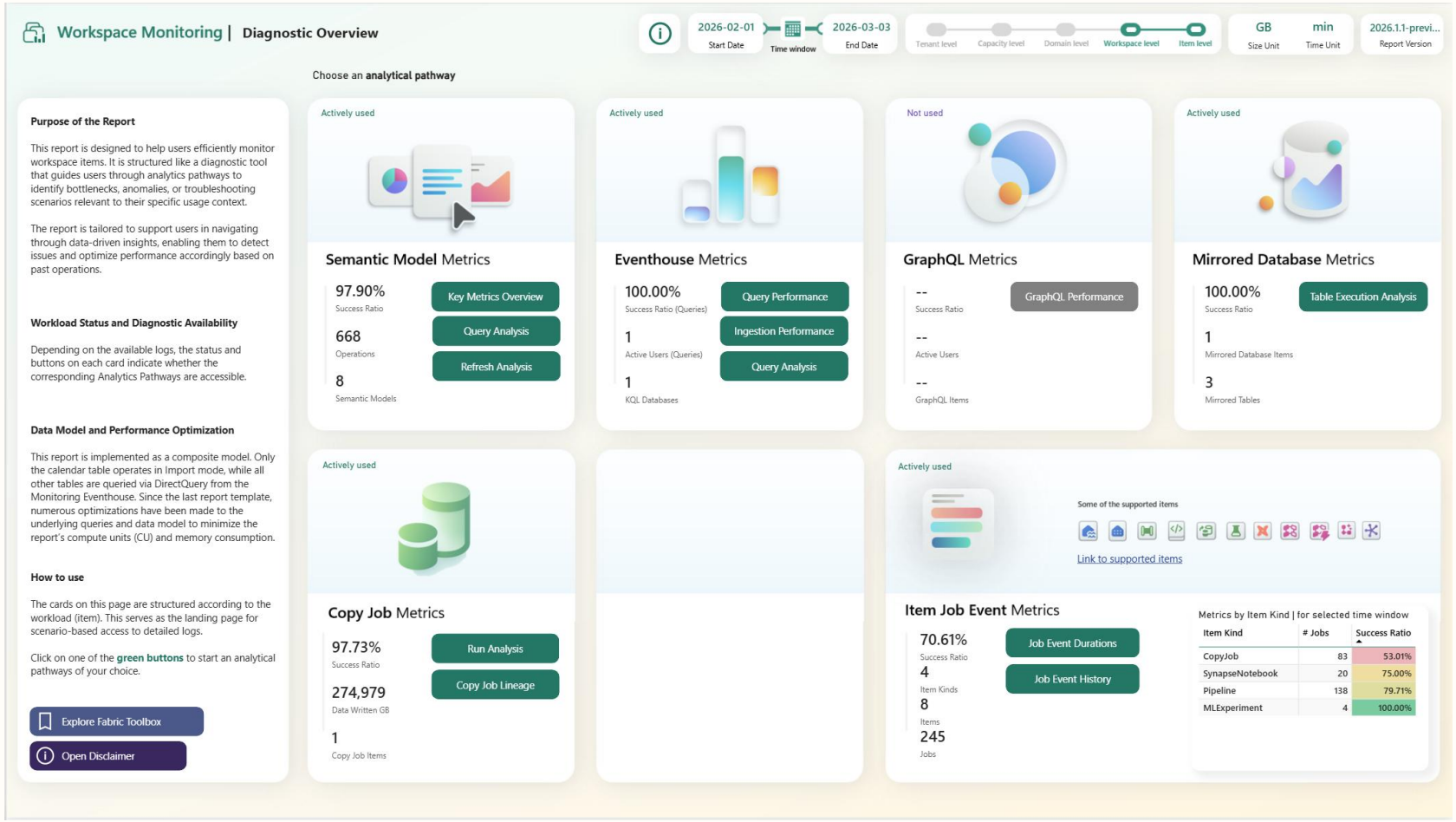


Let’s X-ray the dragon | Bi-Directional + RLS

```
This one Measure =
CALCULATE(
        SUM(InternetSales[SalesAmount]),
        CROSSFILTER(FactInternetSales[ProductKey], DimProduct[ProductKey] , Both)
)
```



Let’s trace the dragon | Workspace Monitoring





Download the Workspace Monitoring Templates from Fabric-Toolbox

Let’s trace the dragon | Long DAX duration | Multi-geo

Workspace Monitoring | Semantic Models | Query History

2026-02-20 Start Date | Time window | 2026-03-02 End Date

Tenant level | Capacity level | Domain level | Workspace level | Item level

GB Size Unit | sec Time Unit | 2026.2.1-previ... Report Version

Selected Semantic Model

6 Active Users | 1,160 Unique Operations | 95.10% Success Ratio

Find more for "Memory Peak" metric here:
Semantic Model SKU limitation

Select a row from the table below to continue the analysis.

Go to Query Details

Query History for selected Semantic Model and Date

Status	ReplicaId	ExecutingUser	Query Dialect	TimeStart				Total Duration	Total CPU Time	Query Processing CPU Time	VertiPaq CPU Time	PowerQuery CPU Time	Memory Peak	Query Result Rows	Execution Delay	Capacity Throttling	OperationId
Failed	AQQ		DAX	2026-0	09:36:16	2026-0		225.93 sec	7.39 sec	0.42 sec	0.00 sec	6.69 sec	1.05 GB	0			8dd80cfd-a733-4a16-ac9b-00c7bb4
Failed	ANQ		DAX	2026-0	12:28:32	2026-0	12:32:18	225.83 sec	2.09 sec	0.02 sec	0.02 sec	1.41 sec	0.63 GB	0			28c752c7-77f6-4e03-b4dc-9b594bf
Failed	ANQ		DAX	2026-0	11:43:02	2026-0	11:46:48	225.56 sec	2.78 sec	0.33 sec	0.02 sec	2.09 sec	0.59 GB	0			92900662-bbc5-489b-b85e-6c3915
Succeeded	AHH		DAX	2026-0	13:16:02	2026-0	13:19:11	188.79 sec	4.67 sec	0.52 sec	0.00 sec	3.95 sec	0.48 GB	25			3fd17b71-f103-493d-87ed-7bc51b21
Succeeded	AHJ		DAX	2026-0	07:54:37	2026-0	07:57:07	149.51 sec	1.80 sec	0.39 sec	0.00 sec	1.20 sec	0.51 GB	25			766e8146-2993-46ad-a07e-cf33437
Succeeded	ANQ		DAX	2026-0	13:06:07	2026-0	13:08:32	145.60 sec	1.95 sec	0.02 sec	0.00 sec	1.42 sec	0.61 GB	502			8d4884af-8aa7-45a1-9a4a-5a9d877
Succeeded	ADX		DAX	2026-0	07:41:52	2026-0	07:44:06	134.12 sec	4.77 sec	0.05 sec	0.00 sec	3.97 sec	0.51 GB	204	0.00 sec		5f69a28b-5168-4f7e-a591-fef17086c
Succeeded	AHJ		DAX	2026-0	07:36:55	2026-0	07:38:34	98.10 sec	2.89 sec	0.33 sec	0.00 sec	2.34 sec	0.48 GB	25			9b6399c7-8bf9-41c4-8d01-c0bc838
Succeeded	AOE		DAX	2026-0	11:58:09	2026-0	11:59:39	90.71 sec	12.64 sec	0.59 sec	0.00 sec	11.58 sec	0.48 GB	8	0.00 sec		ff517d4e-cc83-438c-85e5-eead8f1a
Succeeded	AHH		DAX	2026-0	13:17:54	2026-0	13:19:14	80.11 sec	2.13 sec	0.38 sec	0.03 sec	1.53 sec	0.39 GB	25			cb754340-30ee-43de-8035-e1e21f5
Failed	AHH		DAX	2026-0	13:39:07	2026-0	13:40:09	61.71 sec	2.31 sec	0.03 sec	0.00 sec	1.86 sec	0.52 GB	0			5c5da59f-61a9-4263-b047-6d68aca
Succeeded	BFT		DAX	2026-0	09:57:32	2026-0	09:58:28	56.20 sec	2.02 sec	0.25 sec	0.17 sec	1.38 sec	0.25 GB	502			d06a4a95-7259-4221-9e0b-04d6e0
Succeeded	AWB		DAX	2026-0	09:14:27	2026-0	09:15:22	54.39 sec	1.81 sec	0.11 sec	0.00 sec	1.59 sec	0.23 GB	7			8cba40b1-6437-43af-91cf-fa71cc4dc
Succeeded	ARZ		DAX	2026-0	06:11:13	2026-0	06:12:05	51.79 sec	3.94 sec	0.28 sec	0.00 sec	3.44 sec	0.25 GB	426			b2770184-4b5d-47ad-81a8-e28ee47
Succeeded	ARZ		DAX	2026-0	08:22:02	2026-0	08:22:46	43.78 sec	6.53 sec	0.05 sec	0.00 sec	6.05 sec	0.23 GB	394	0.01 sec		62f3bbad-0b36-40fd-a55b-ea4efba



Let’s trace the dragon | Long DAX duration | Multi-geo

Workspace Monitoring | **Semantic Models | Query Details**

2026-02-20 Start Date | Time window | 2026-03-02 End Date

Tenant level | Capacity level | Domain level | Workspace level | Item level

GB Size Unit | sec Time Unit | 2026.2.1-previ... Report Version

Selected Semantic Model

Failed Status

DAX Query Dialect

2026-02-20 Selected Date

AQQ Replica ID

PowerBI Application Name

Executing User

OperationId

8dd80cfd-a733-4a16-ac9b-00c7bb43d3e9

ReportId	Report Link	VisualId	Visual Link
ce5e011f-2422-4dd0-8943-7b2c4fe528f4		94bbe6604d890a7a2747	

Query Performance Metrics

Based on the "ExecutionMetrics" log event, the selected query has the following performance metrics.
Reference link: ExecutionMetrics event

7.39 sec Total CPU Time	225.93 sec Total Duration	RAM 1.05 GB Memory Peak
0.42 sec Query Processing CPU Time	0.00 sec VertiPaq CPU Time	6.69 sec PowerQuery CPU Time
0 Query Result Rows	-- Execution Delay	-- Capacity Throttling

DirectQuery Performance Metrics

If the query originates from a semantic model using DirectQuery connectivity mode, the ExecutionMetrics log event captures DirectQuery-specific metrics related to the requested query.
Direct Query recommendations: DirectQuery in Power BI - Power BI | Microsoft Learn

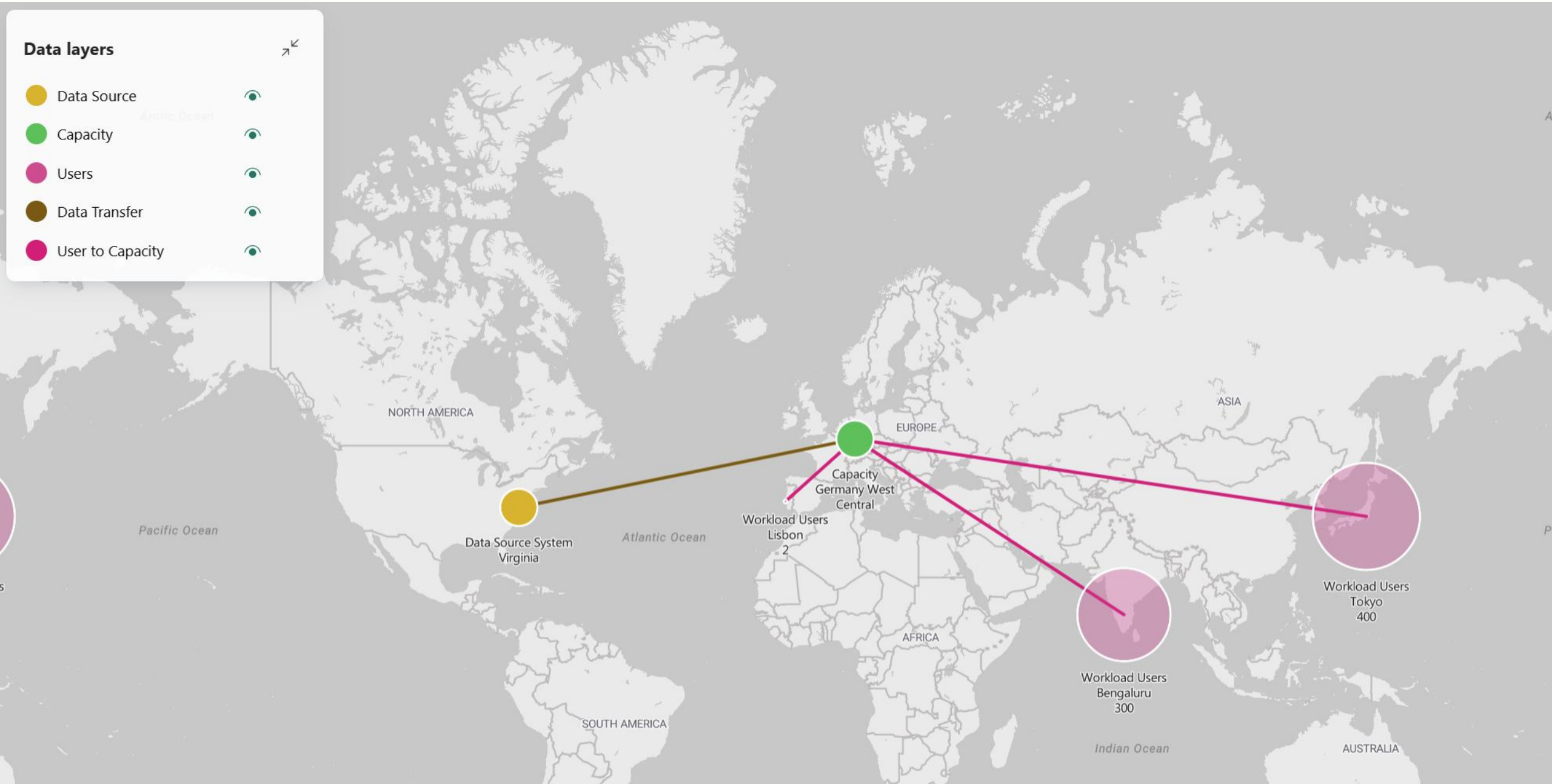
526.66 sec Total DirectQuery Time	2.49 sec DirectQuery Connection Time	0.71 sec DirectQuery Iteration Time
524.16 sec External Query Execution Time	11 DirectQuery Request Count	148 DirectQuery Rows
sec tasource Connection Throttle Time	225.00 sec Tabular Connection Timeout	2.00 sec DirectQuery Timeout

524.16 sec

External Query Execution Time



Let’s trace the dragon | Long DAX duration | Multi-geo



Let’s trace the dragon | Full Refresh & Partitioning

The right approach to fight this specific dragon



Optimized data model

Model Size:
From 66 to 55 GB

Query loading time in visuals from 200 to 25 sec by eliminating X-functions

Optimized multi-region setup

External Query Connection from 355 to 10 sec

Gateway CPU Memory peak consumption from 40 GB to 5 GB

Improved refresh strategy and partition distribution

Smaller partitions:
from 60 Mio row to 8 Mio row

Refresh duration
from 2 hours to 15 min

The battle is won!

- Better performance
- Reduced CU consumption
- No impact on other users



But you need a team to keep the kingdom safe!

- A single optimized Semantic model does not mean your tenant is stable in the future!
- Establish continuous monitoring
- Implement Center of Excellence
- Enable Safety Mechanisms (e.g. Surge Protection)
- Have governance processes in place
- Offer expert level support for self service users
- Fabric Adoption Roadmap



How do you keep your kingdom safe?



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Cloud Solution Architect

Data & AI | Microsoft



Kevin Thomas

Cloud Solution Architect

Data & AI | Microsoft

Session Feedback:



Once upon a time...





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Q&A