A deep dive into Direct Lake

Mathias Halkjær – Marc Lelijveld

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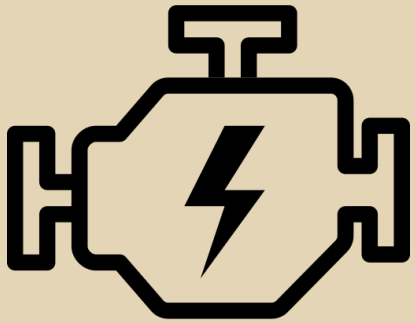
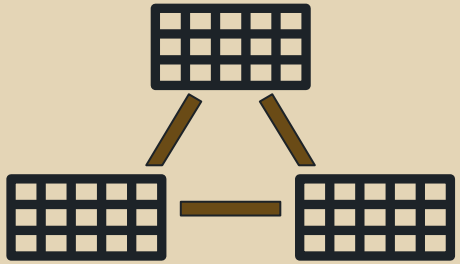
After this session

Understanding the engine for Direct Lake	Analyzing performance across different scenarios	Data modeling benefitting from Direct Lake	Go next level with advanced patterns
			

Assumptions

aka Qualified guessing

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Microsoft® Most Valuable Professional

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Storage modes

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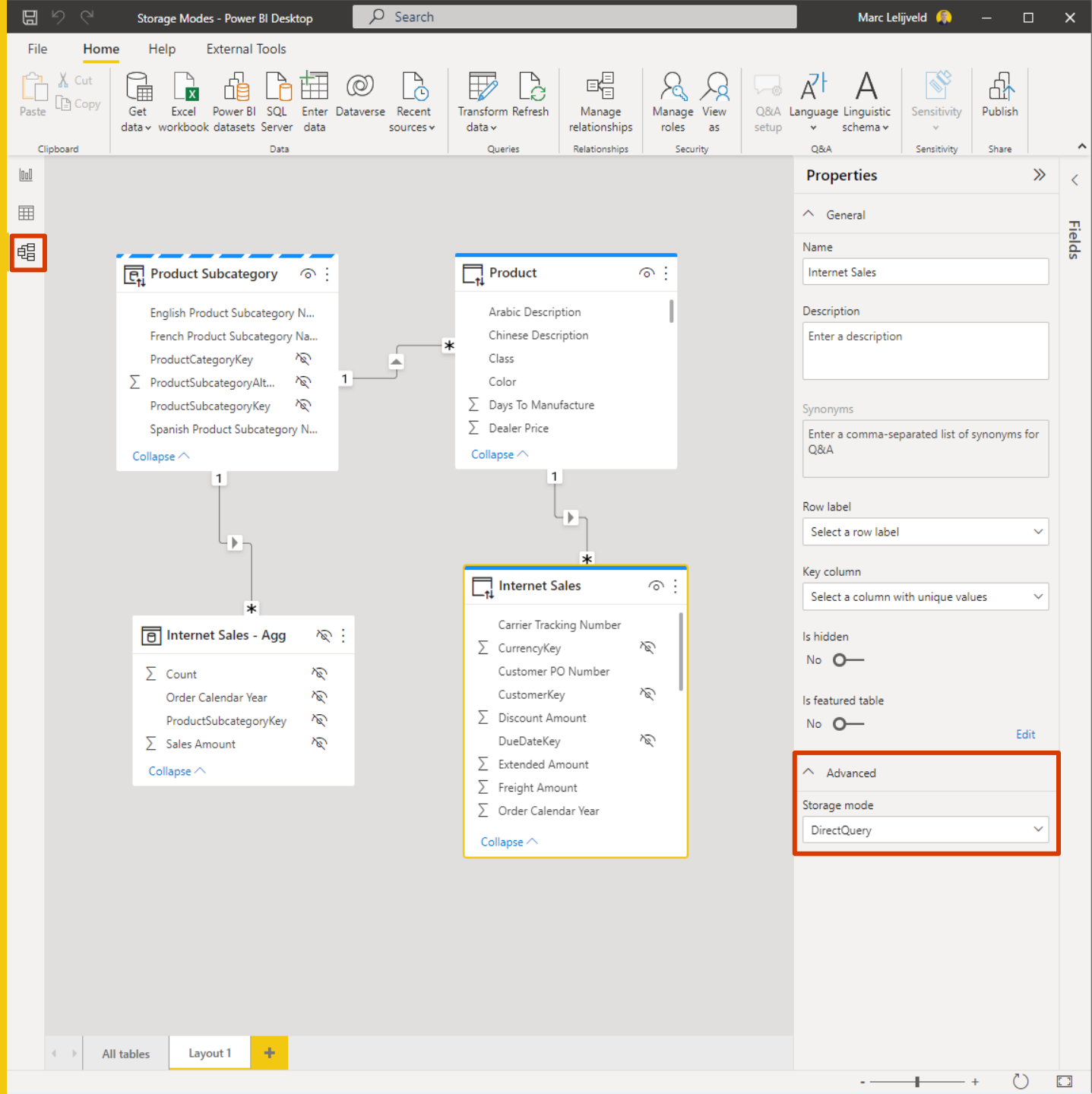
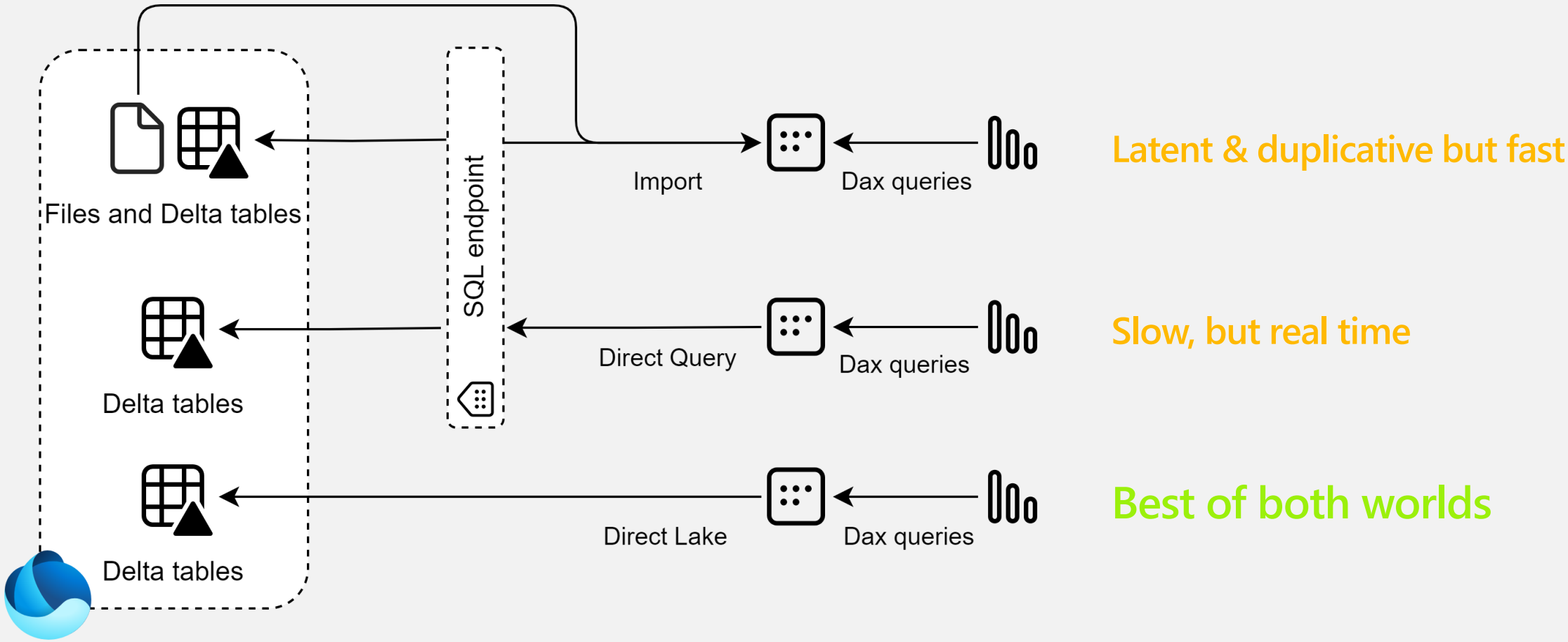
Different types of storage modes

Three familiar storage modes

- **Import** – data cached in the model
- **DirectQuery** – queries are submitted to the back-end data source
- **Dual** – can act in both above storage modes, depending on query context

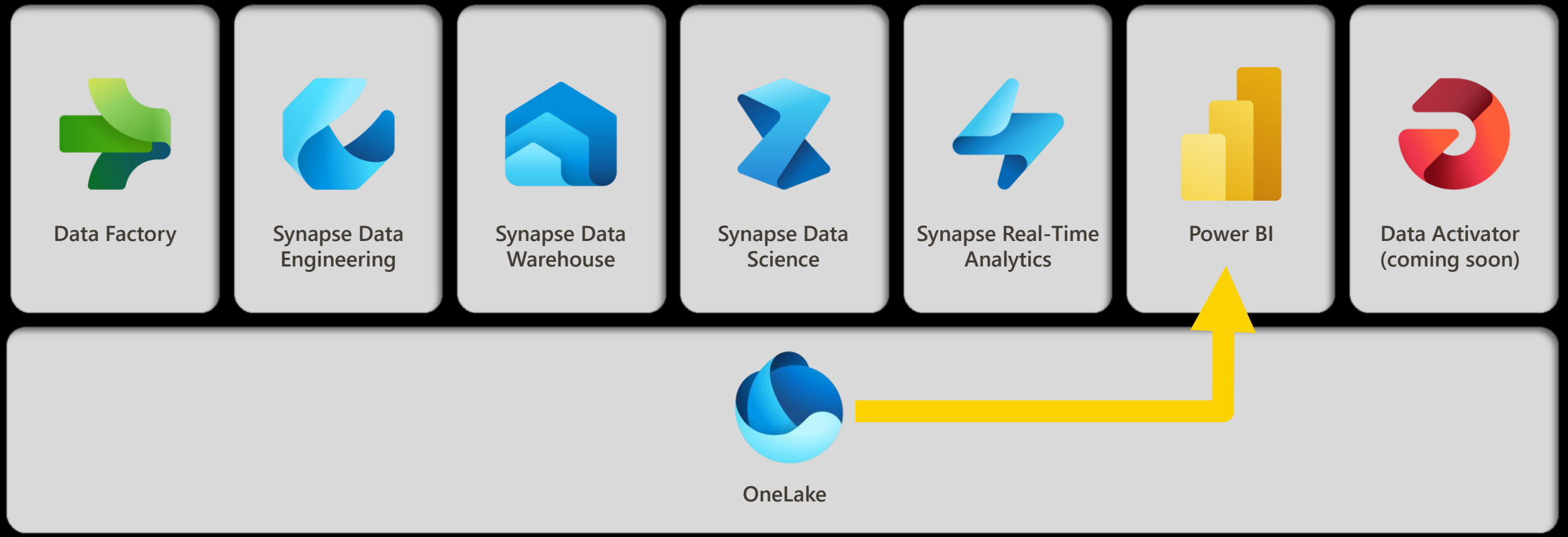


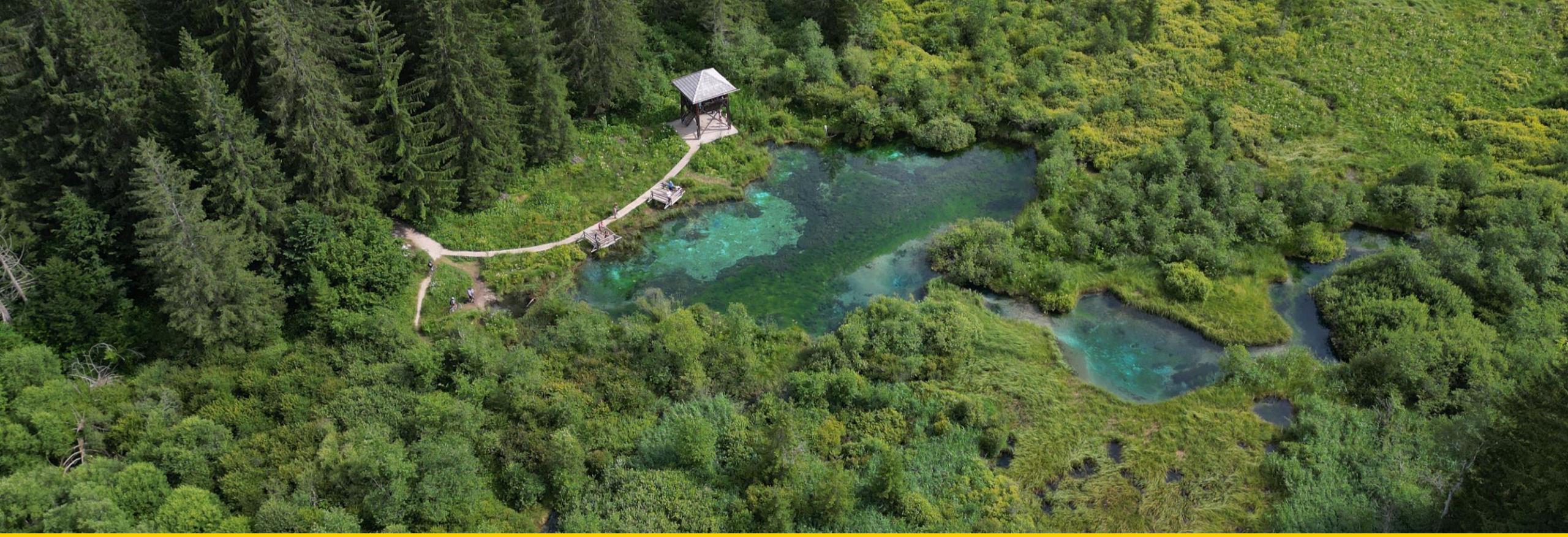
Direct Lake


Files and Delta tables
Delta tables
Delta tables
SQL endpoint
Import
Dax queries
Direct Query
Dax queries
Direct Lake
Dax queries
Latent & duplicative but fast
Slow, but real time
Best of both worlds

Direct Lake is only applicable to Fabric

Fabric


Data Factory
Synapse Data Engineering
Synapse Data Warehouse
Synapse Data Science
Synapse Real-Time Analytics
Power BI
Data Activator (coming soon)
OneLake



Build your data model benefitting Direct Lake

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Data transformations

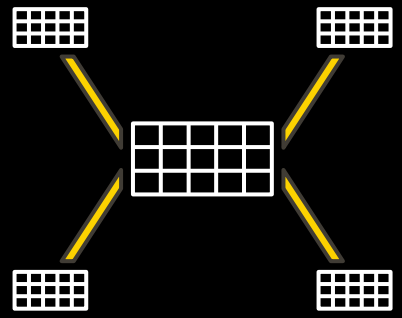
No Power Query or other data transformation capabilities*

Data transformations should be done as far upstream as possible

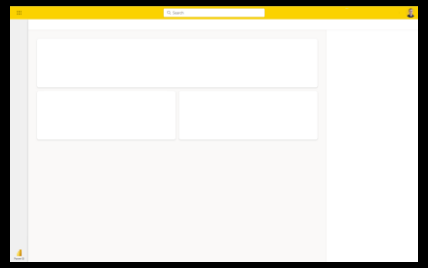
Data transformation directly in the Lakehouse unlocks “new” possibilities

Medallion architecture

Data modeling



General best practice to have a star schema still applies



Web (browser) experience only to develop data models

Data modeling best practices unchanged

- Starschema all the things!
- Avoid bi-directional or many-to-many relationships
- Avoid limited relationships
- Implement role-playing dimensions rather than duplication
- Minimize redundant measure using calculation groups
- Avoid ambigiuous data models

… etcetera

Demo

Internals & performance

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Delta (Parquet)

Parquet (File format)

- Column-store
- Open industry standard
- Compressed & Encoded
- Parallelism

Enables fast bulk operations of large data volumes

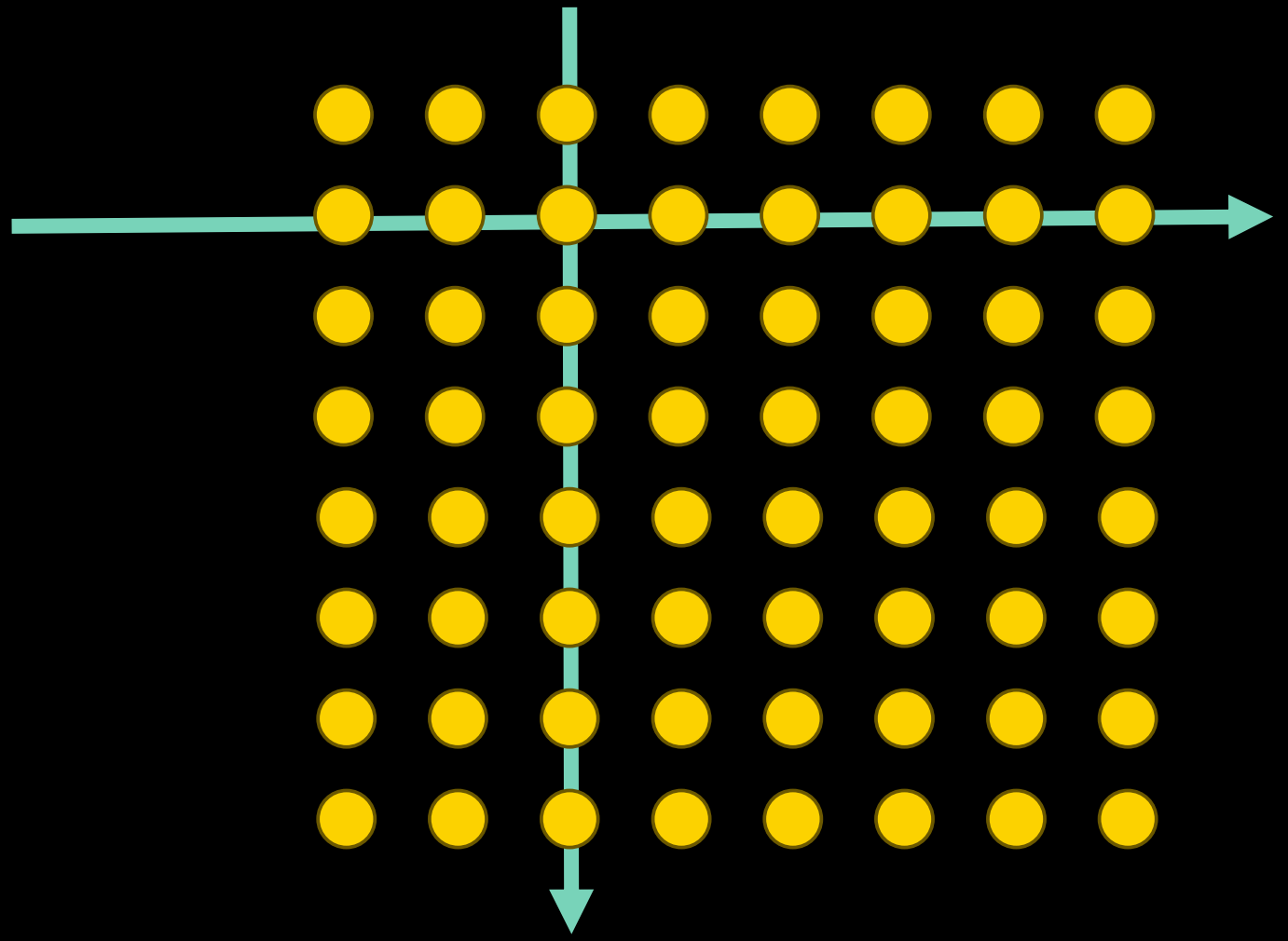
Delta (Storage layer management)

- Also, an open industry standard
- ACID transactions & schema enforcement
- Delete, update, merge
- Time-travel
- Optimized for querying, skipping and pruning

Brings warehouse reliability to the data lake

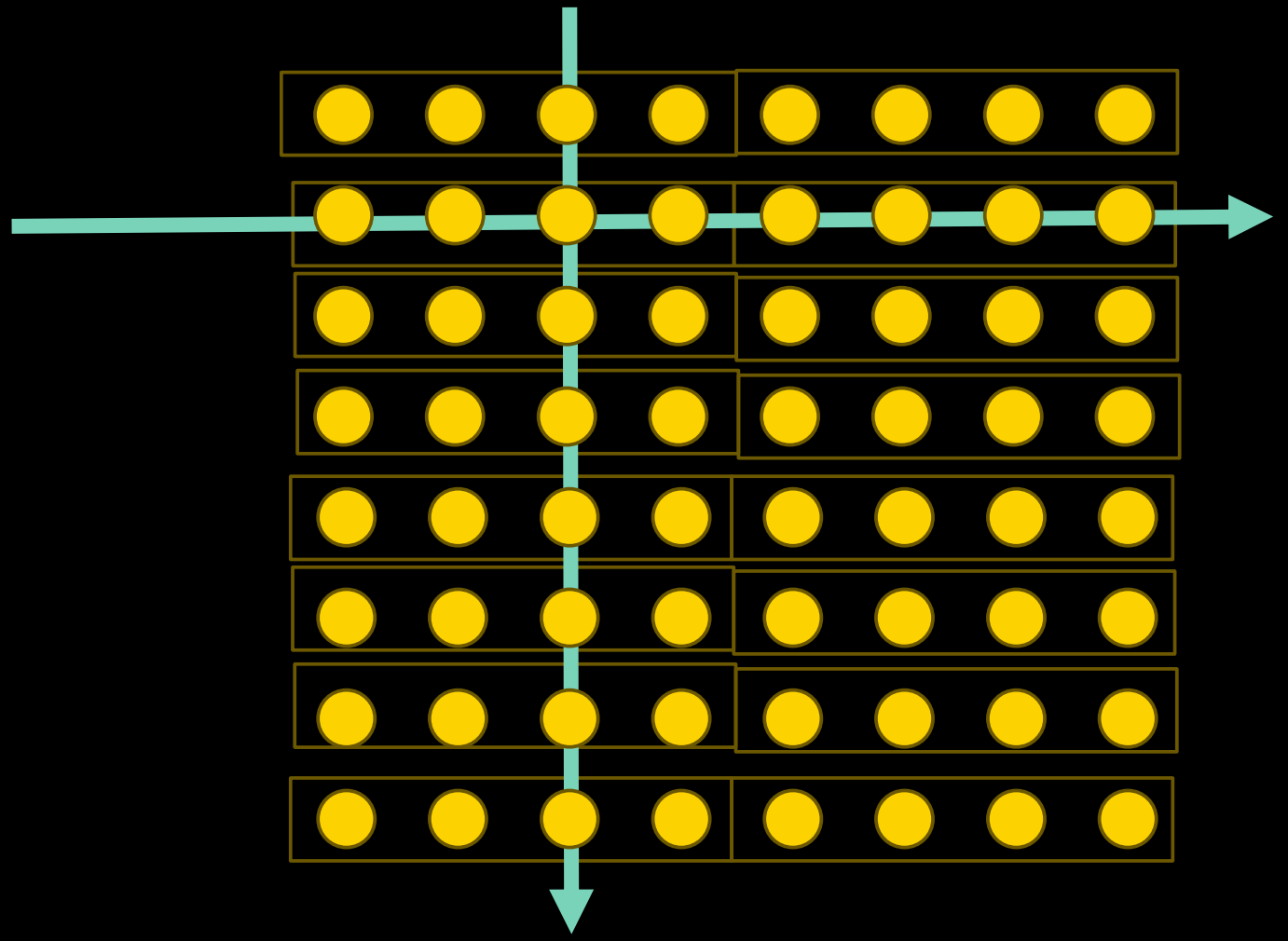
From Z-order to V-order

SELECT * FROM points WHERE x=3 or y=2



From Z-order to V-order

SELECT * FROM points WHERE x=3 or y=2



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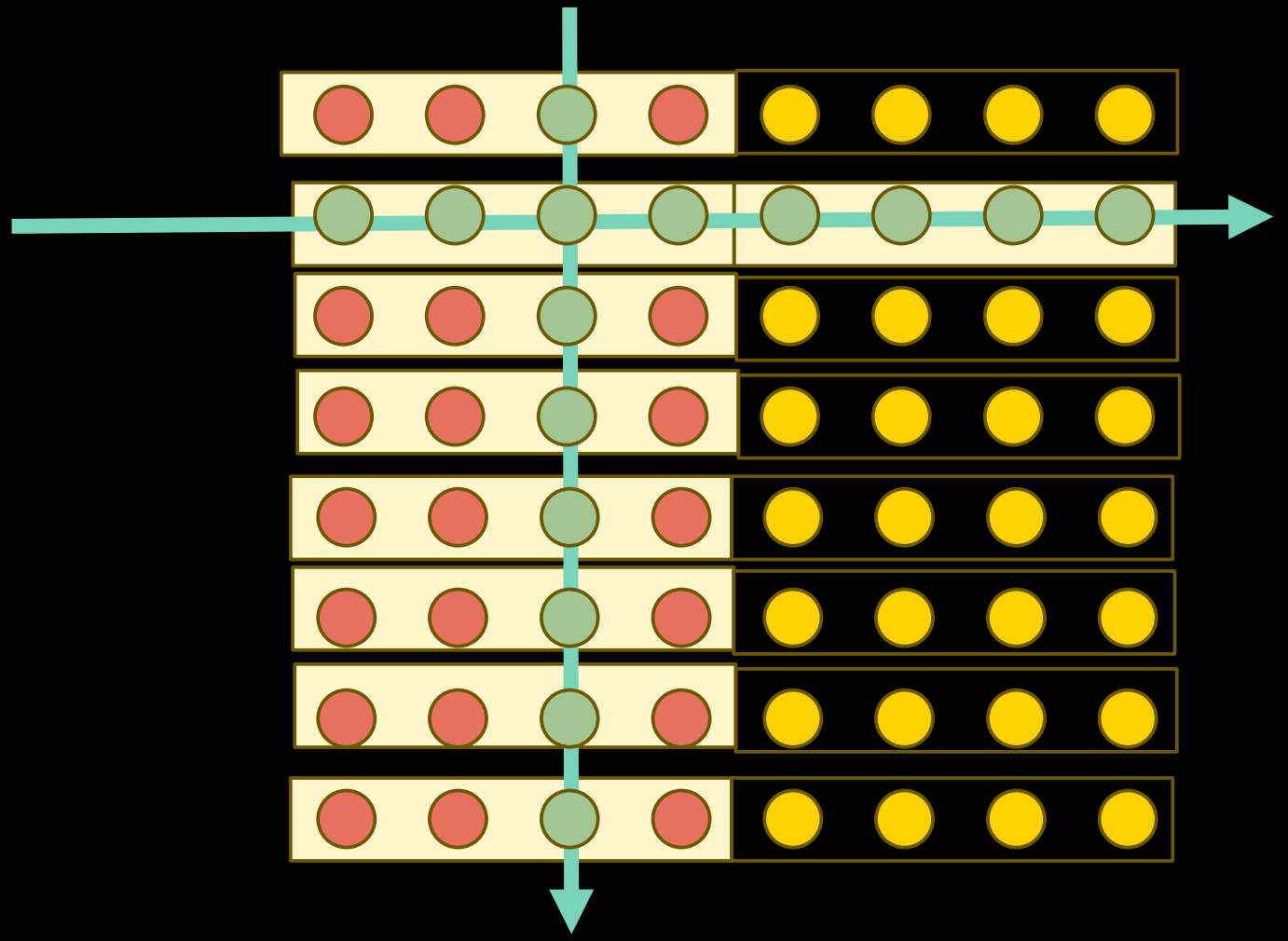

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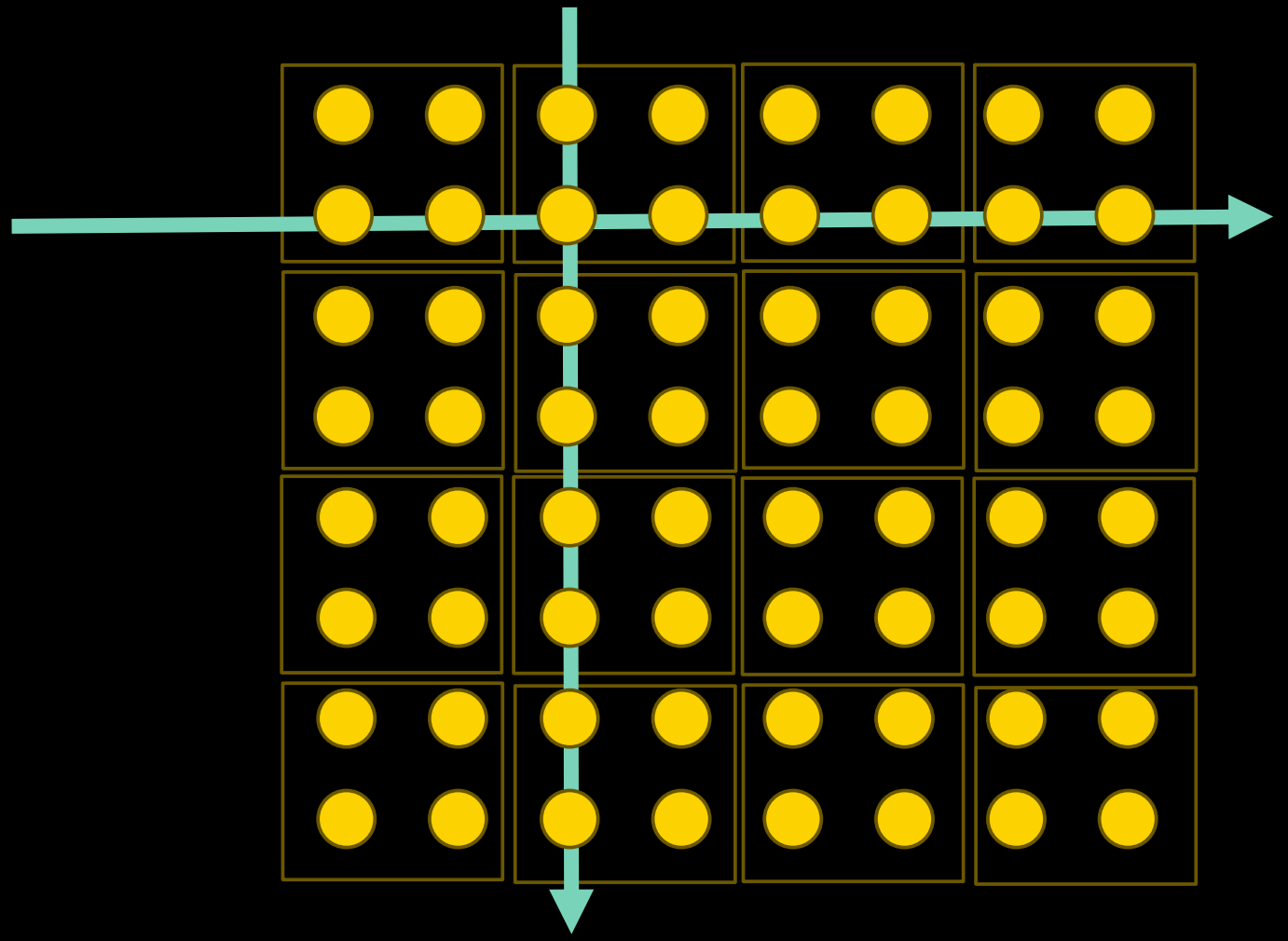

From Z-order to V-order

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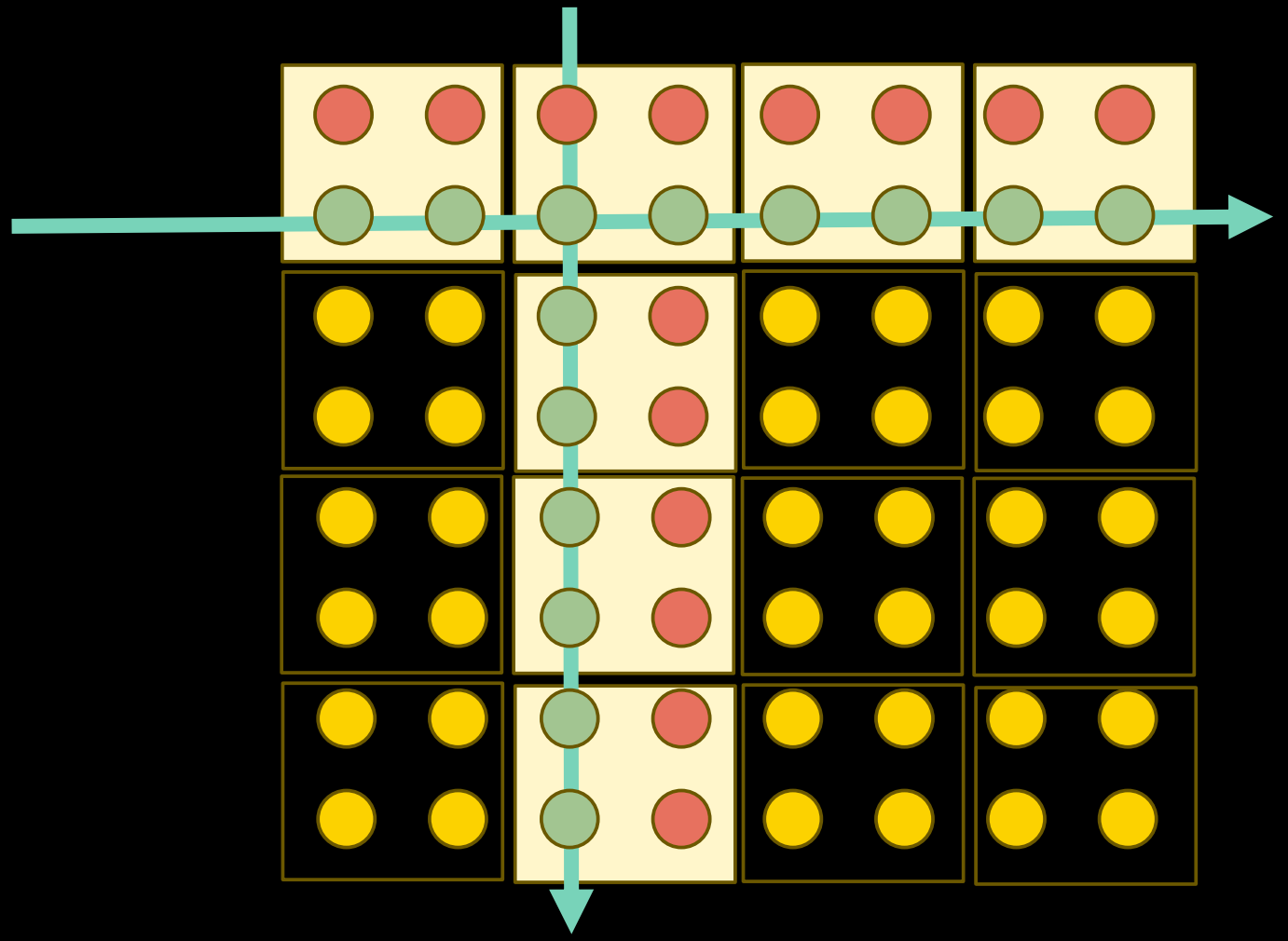
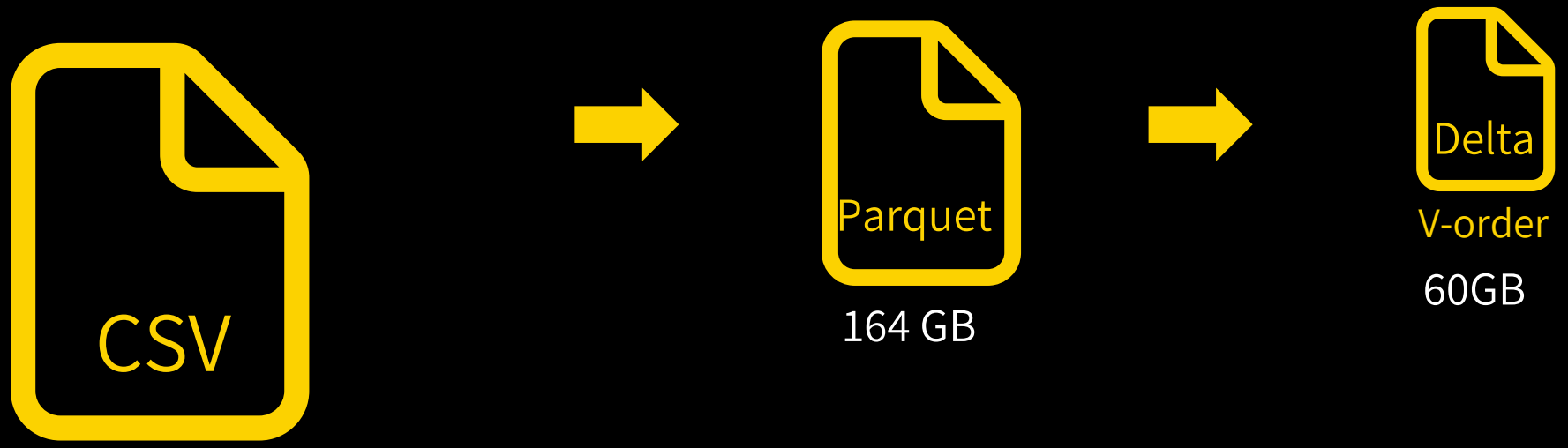


From Z-order to V-order

Yellow taxi (3 Billion rows)



416 GB

164 GB

60GB

x3.2

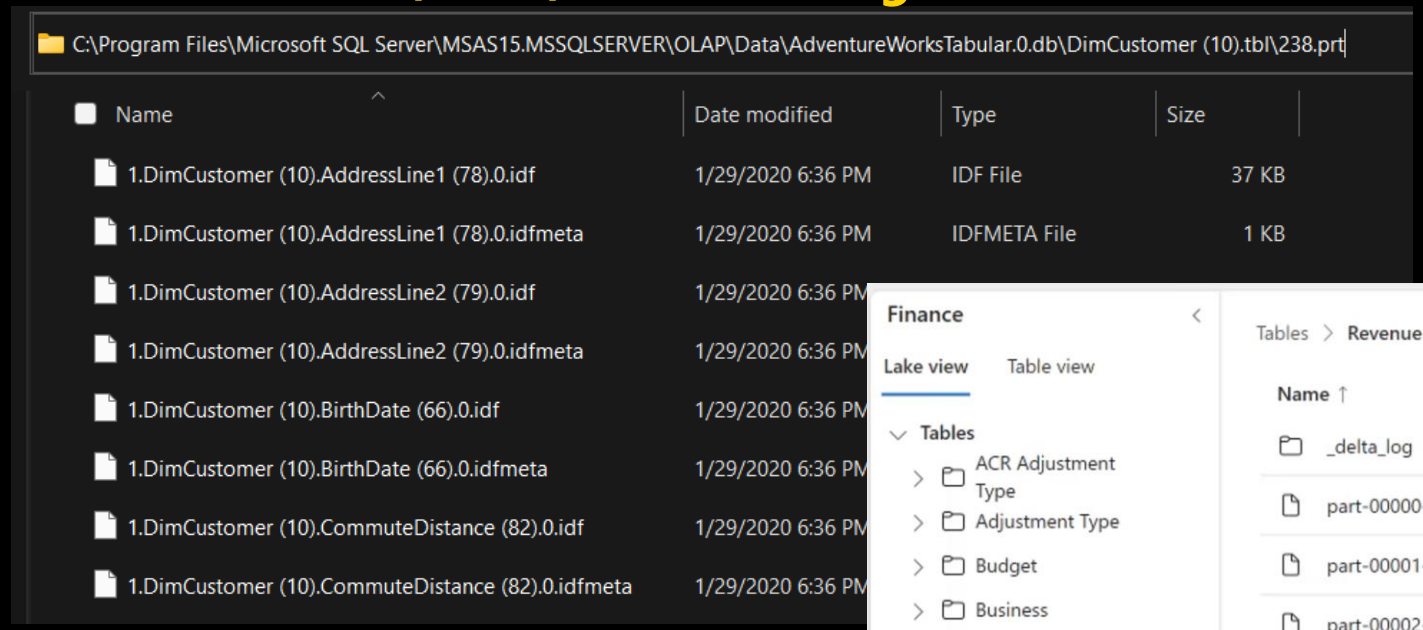
Less I/O for all * workloads

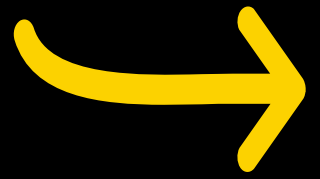
* Microsoft benchmark

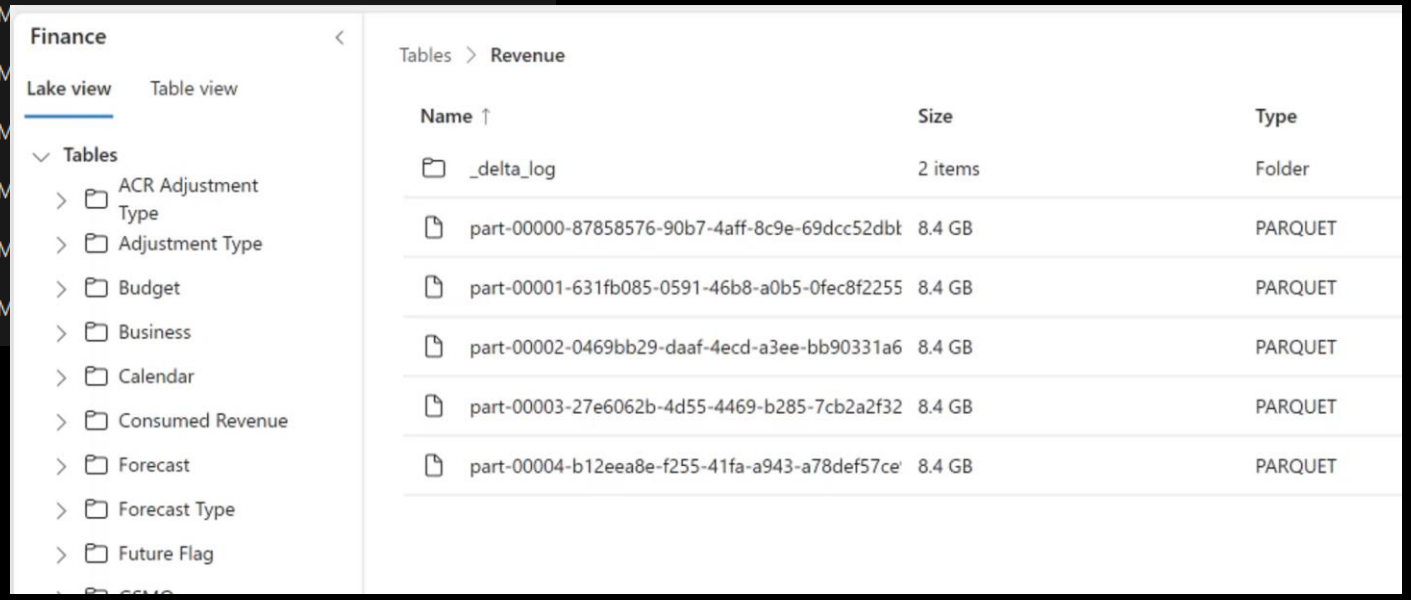
Data saving

The Analysis Services column-oriented storage using Delta Lake/Parquet open standard for Direct Lake

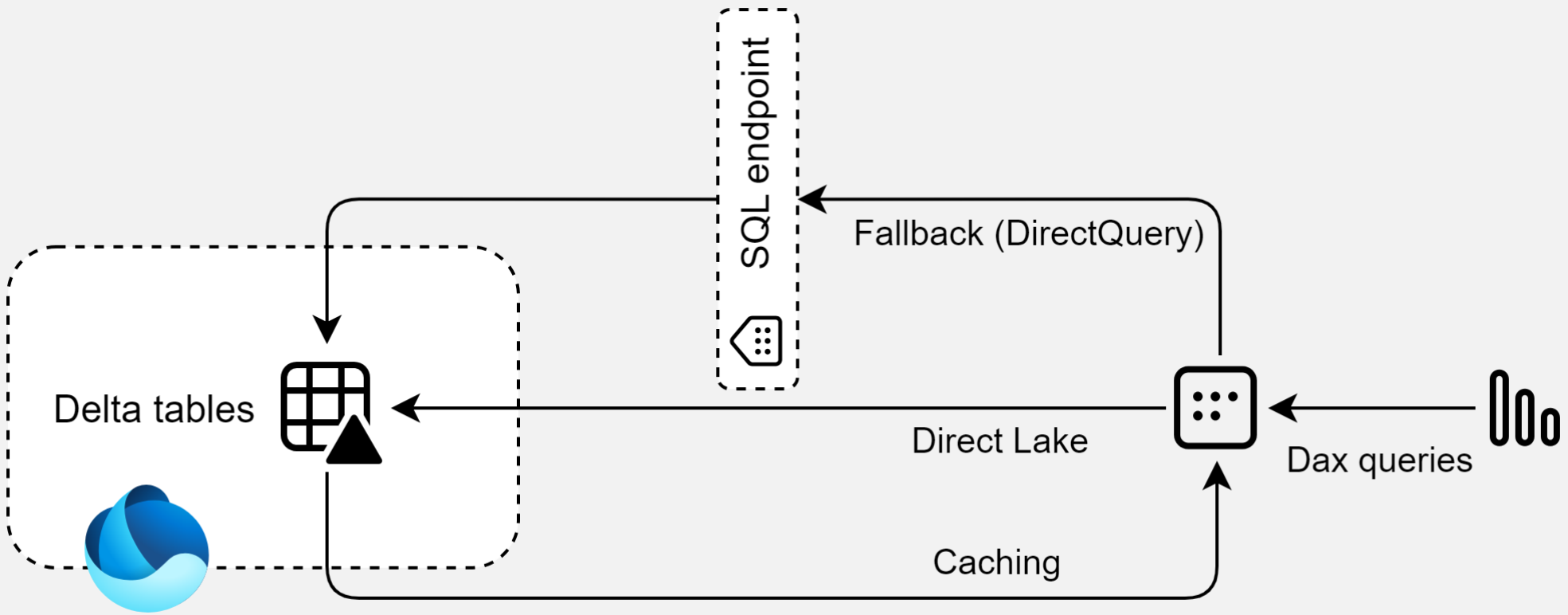
SSAS, AAS, Power BI large models







Fallback & Caching



Fallback

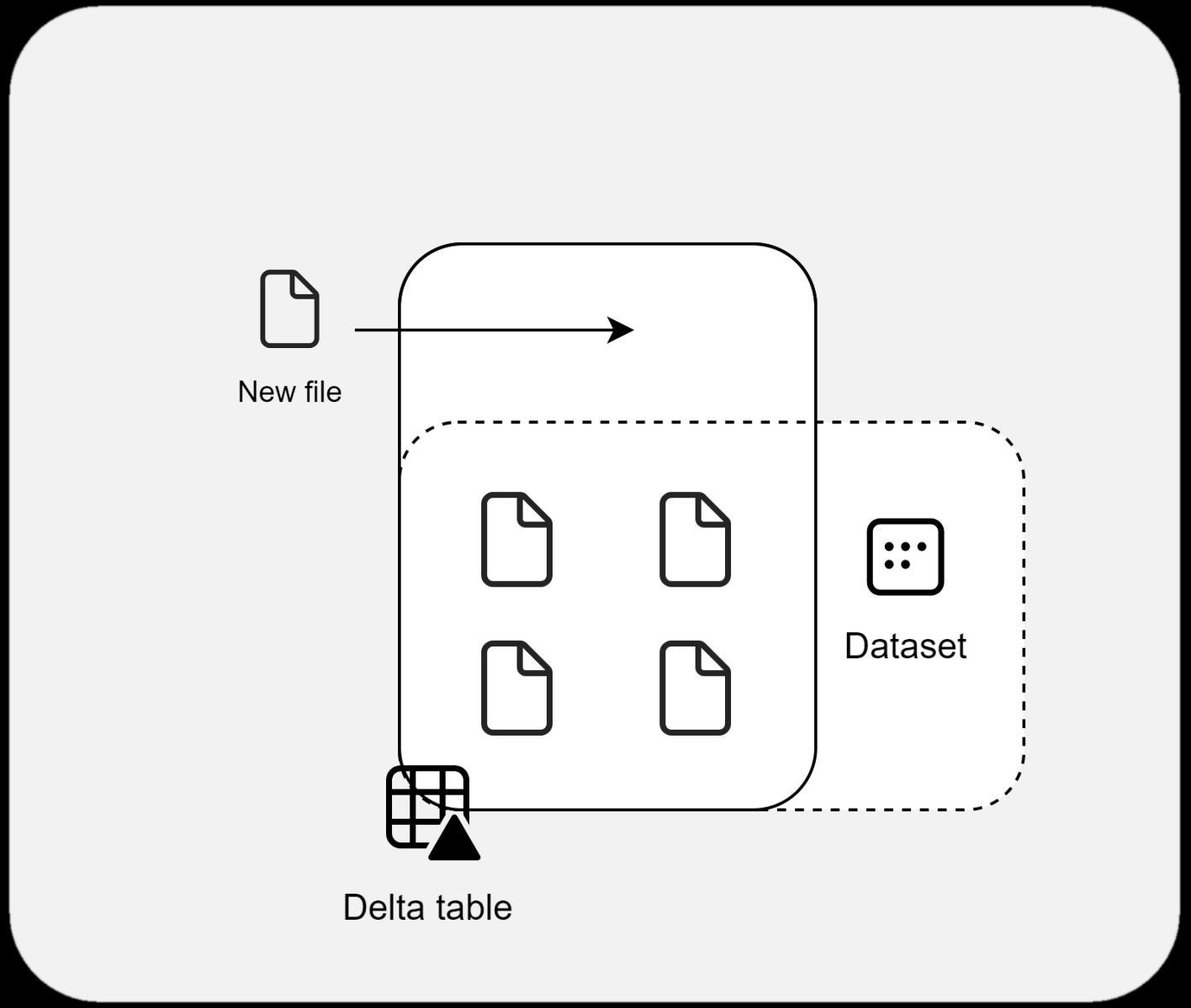
When could fallback to DirectQuery happen?

- Special data types
- Large data volumes that does not fit the capacity size
- Composite models
- When you manually configure security
  Item level on lakehouse

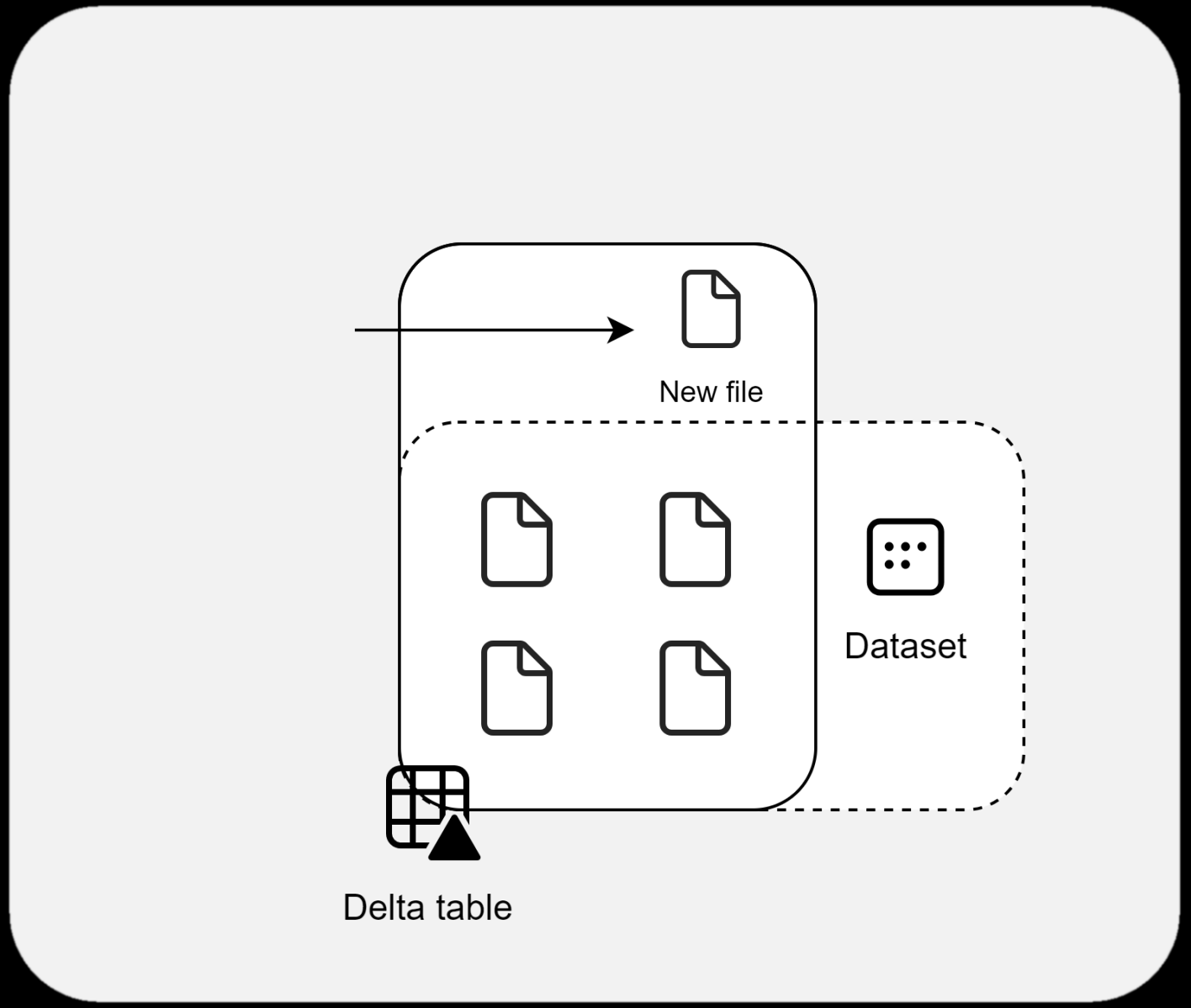
Introducing Framing

Metadata **refresh** which does not actually load the data, but only the delta table definitions.

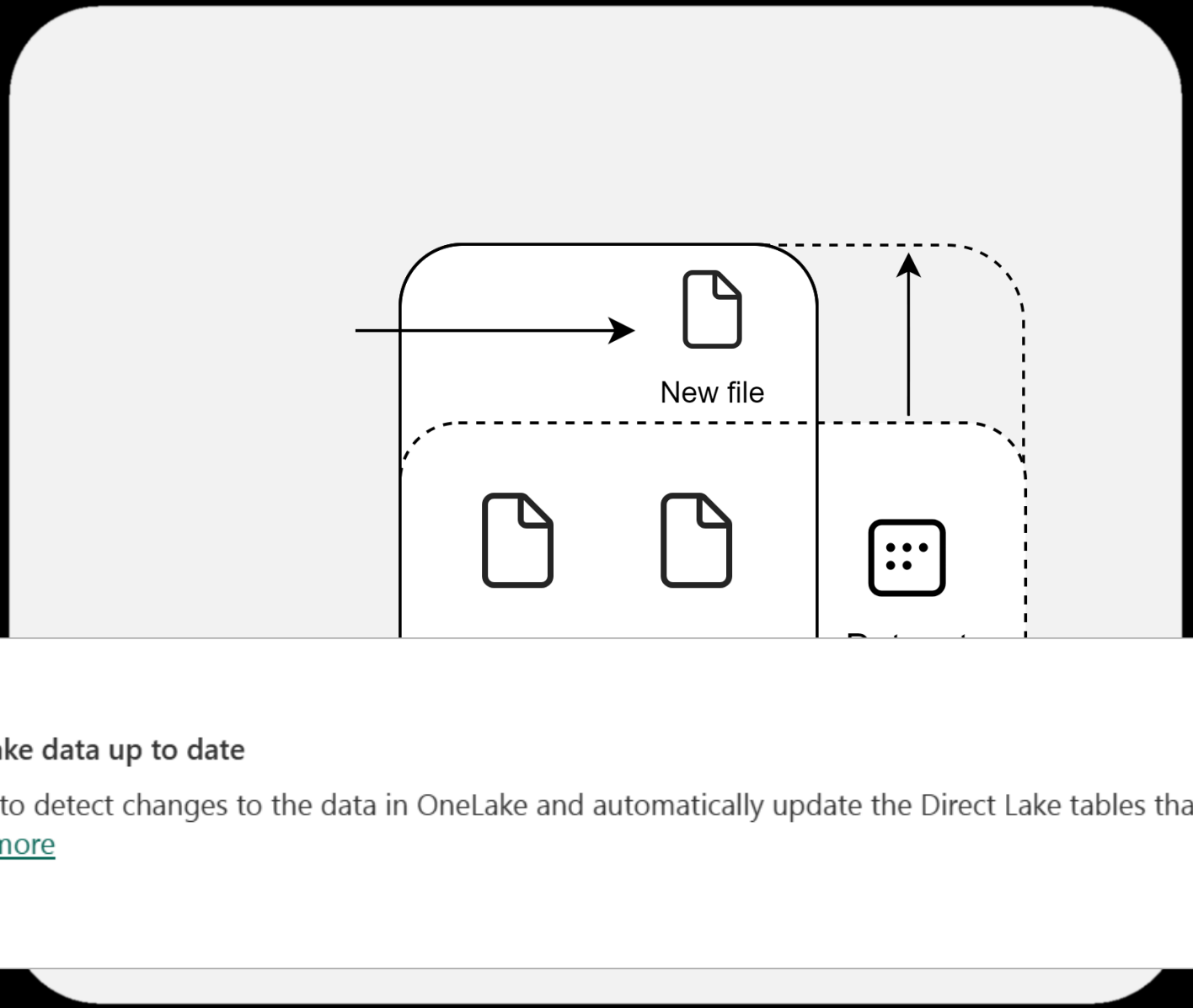
Framing



Framing



Framing



Refresh

Keep your Direct Lake data up to date

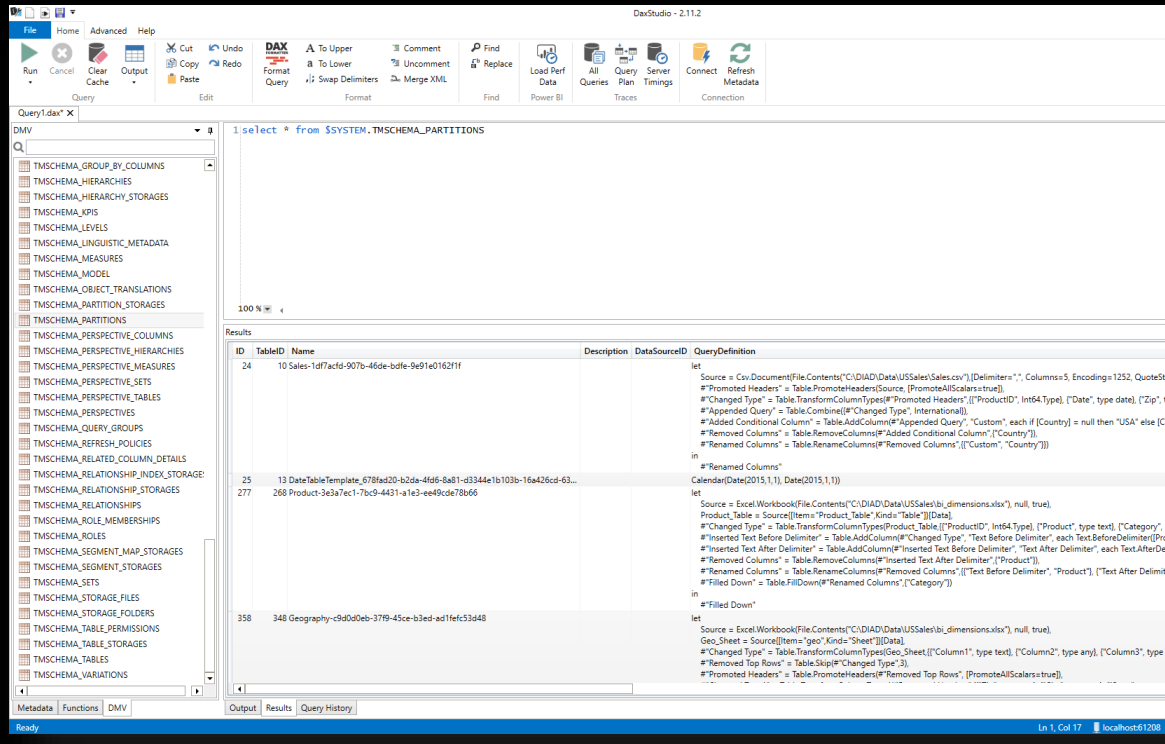
Configure Power BI to detect changes to the data in OneLake and automatically update the Direct Lake tables that are included in this dataset. Learn more

Off

Dynamic Management Views

Analysis Services Dynamic Management Views (DMVs) are queries that return information about model objects, server operations, and server health.

- DB Schema = Database model
- DISCOVER = Operations & Sessions
- TM Schema = Tabular = Power BI / AAS
- MD Schema = MDX = Multidimensional



Demo

Advanced patterns

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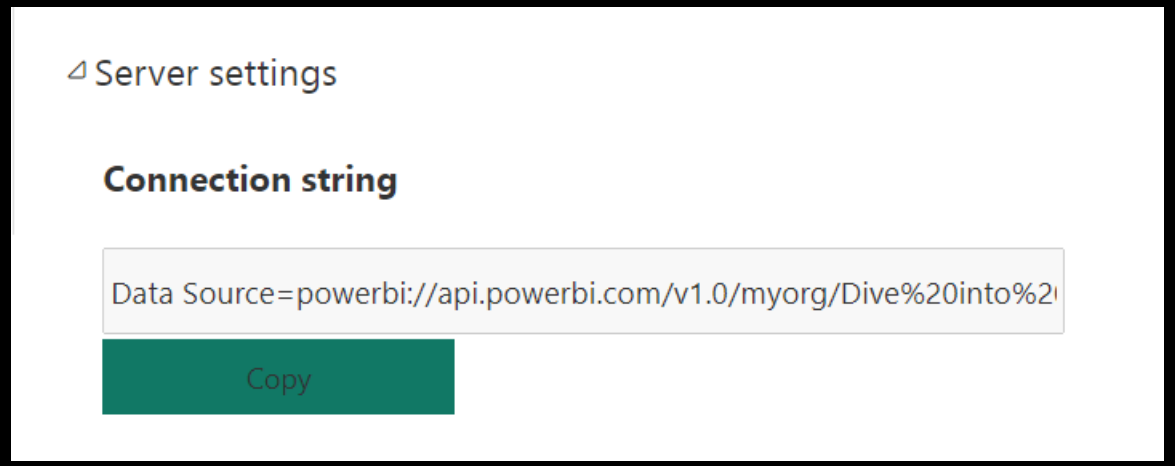
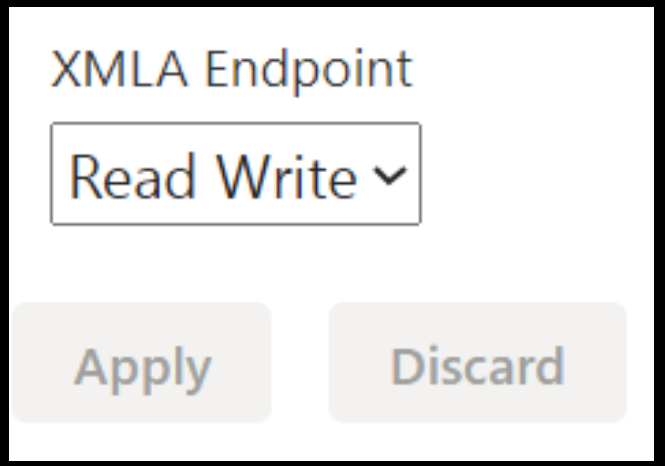
XMLA

Talk with the back-end server, just like an Analysis Services server (read / write)





⊗ Caution

At this time, a write operation on a dataset authored in Power BI Desktop will prevent it from being downloaded back as a PBIX file. Be sure to retain your original PBIX file.

Introducing calculation groups

Benefits

- Reduce the number of redundant measures and grouping common measure expressions as calculation items
- Avoids duplicating logic in different measures
- Typical use cases are
  - Time-intelligence calculations (YTD / QTD / MTD / …)
  - Format string change, like currency conversions

Limitations

- Can only be created from external tools in Power BI (Any tool using the XMLA endpoint such as Tabular Editor) **– but stay tuned….**
- Object level security on Calculation group items is not supported
- Smart narrative visuals in Power BI are not supported with Calculation Groups

Introducing calculation groups

Specific DAX expressions for Calculation Groups

- SELECTEDMEASURE( )
- SELECTEDMEASURENAME( )
- ISSELECTEDMEASURE( )
- SELECTEDMEASUREFORMATSTRING( )

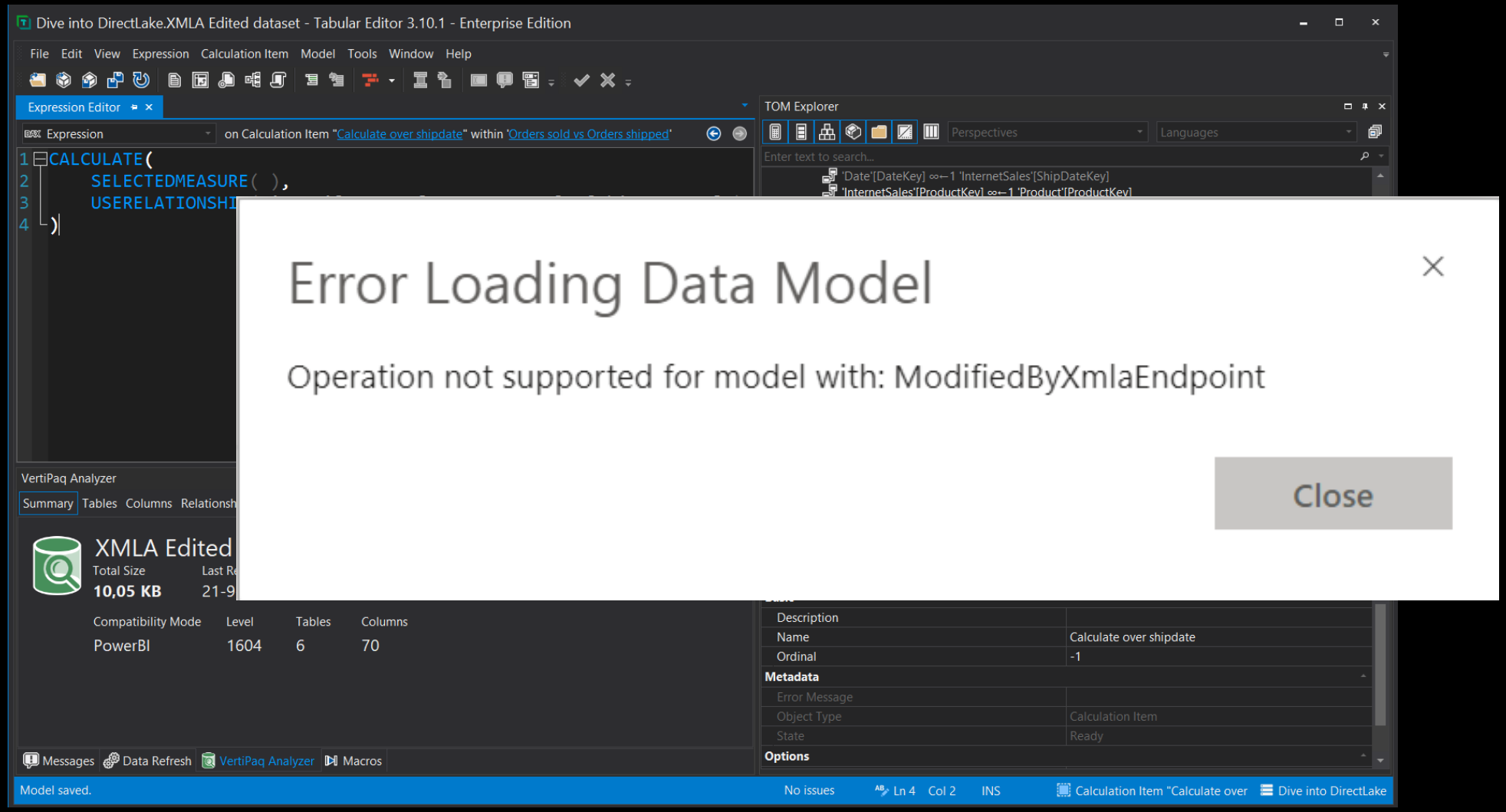
Classic measure:

```
MTD =
CALCULATE (
        SUM ( Sales[SalesAmount] ),
        DATESMTD ( DimDate[Date] )
)
```

Dynamic measure context MTD with Calculation Group:

```
MTD =
CALCULATE (
        SELECTEDMEASURE (),
        DATESMTD ( DimDate[Date] )
)
```

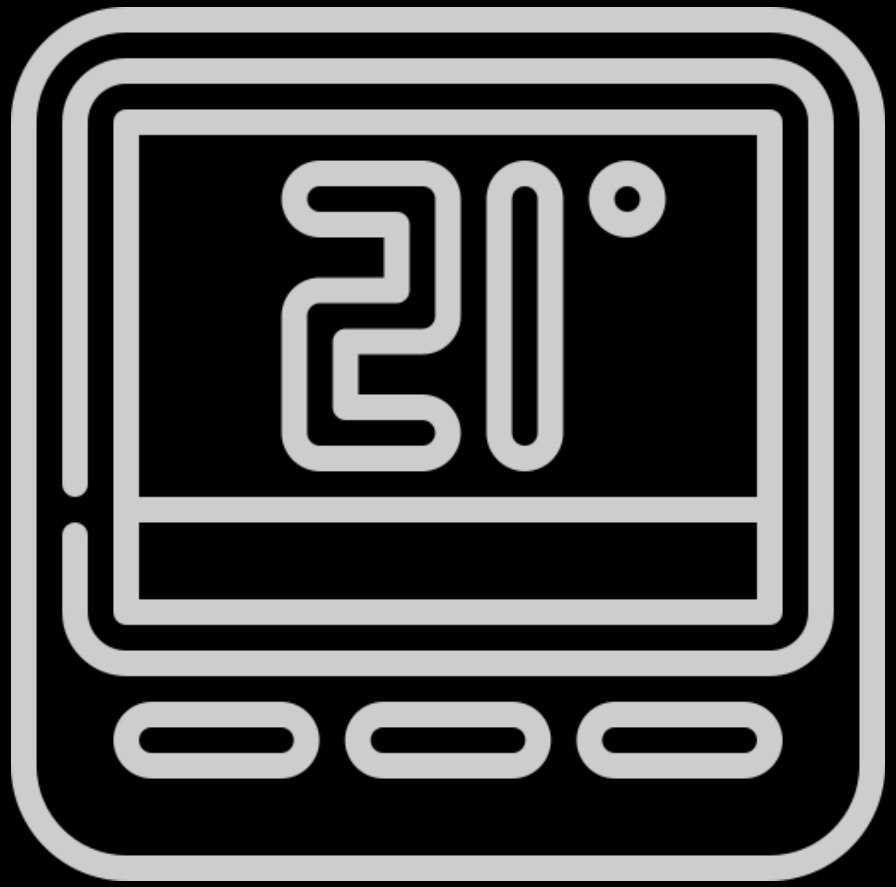
Creating calculation groups over XMLA



Temperature management

Keep it WARM!

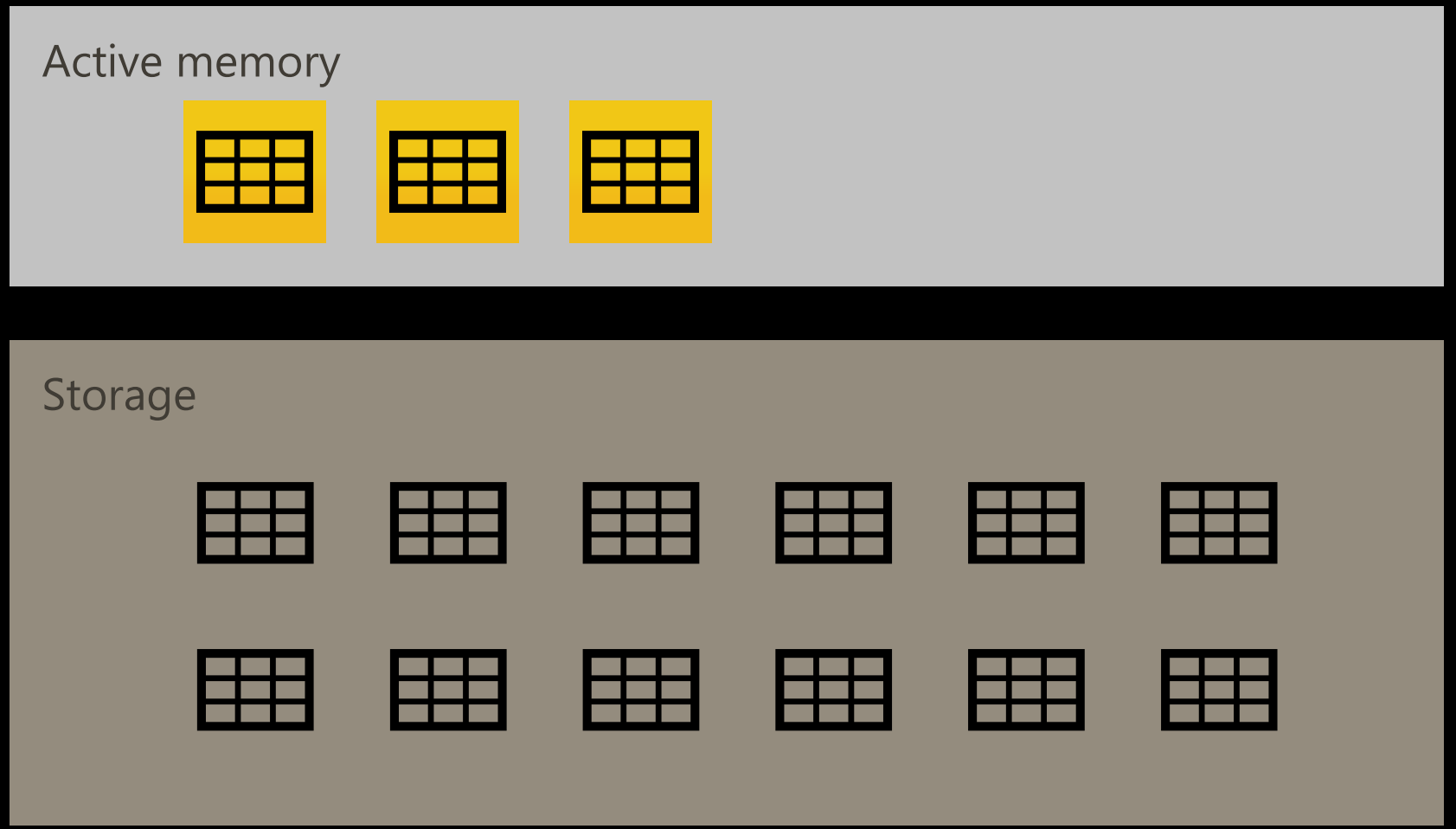
Make sure your users are served optimally
and avoid the capacity memory to be flushed.



Eviction

Capacity: F64 / P1
Memory: 25 GB

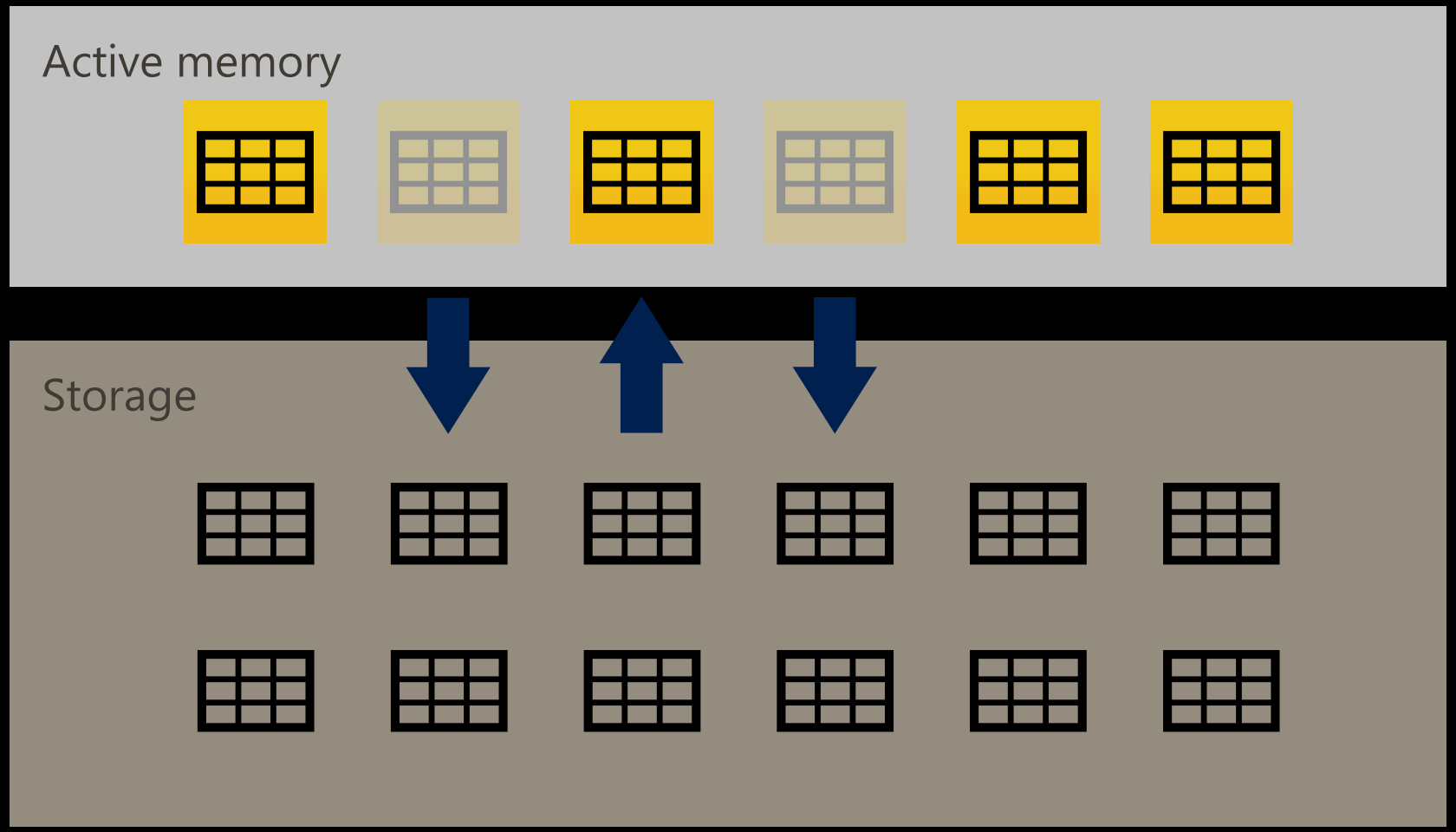
Capacity utilization:
Cool



Eviction

Capacity: F64 / P1
Memory: 25 GB

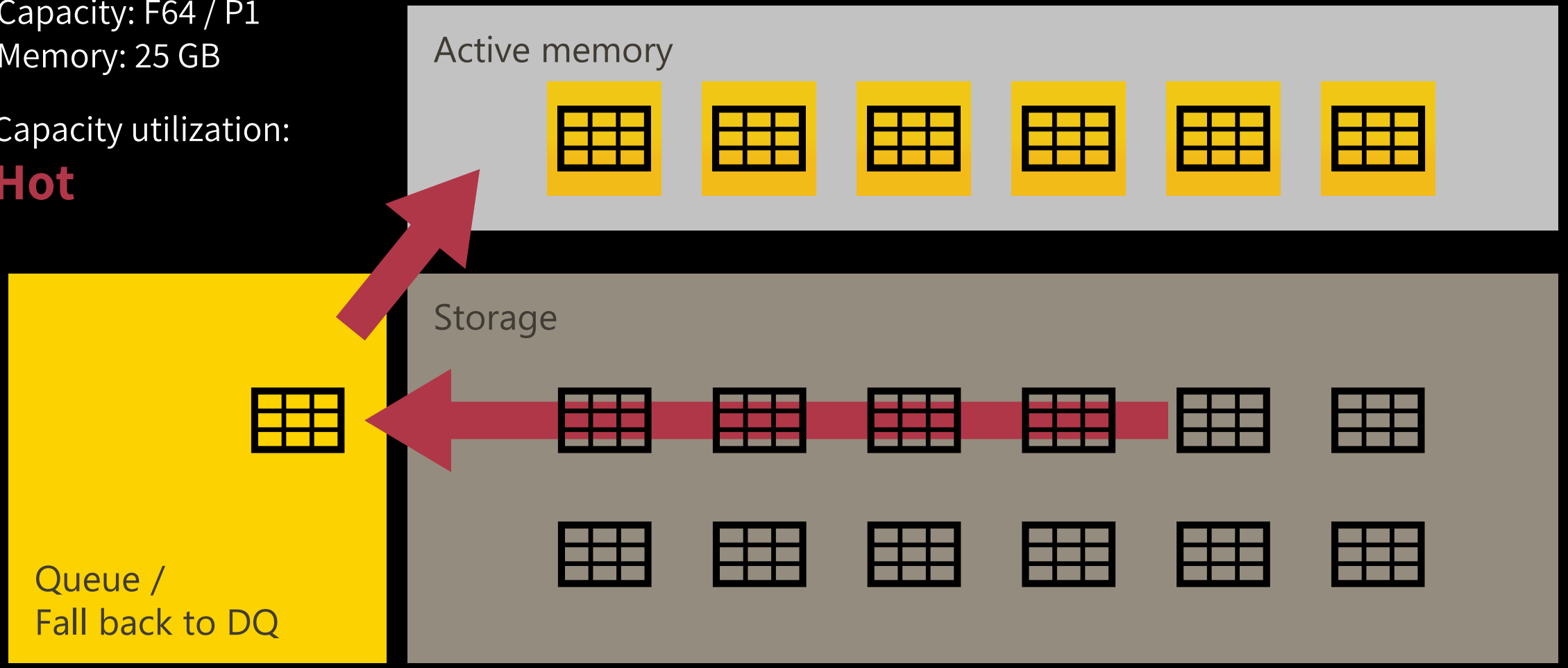
Capacity utilization:
Warm



Eviction – queue / fall-back

Capacity: F64 / P1
Memory: 25 GB

Capacity utilization:
Hot



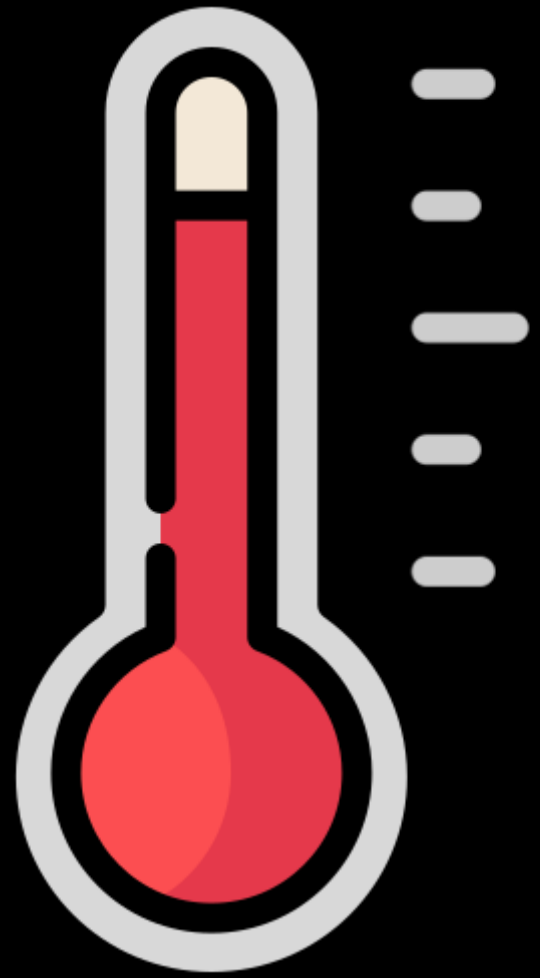
Temperature management

What will be evicted?

Basically, your data will be evicted from active memory, that you want to always have available!

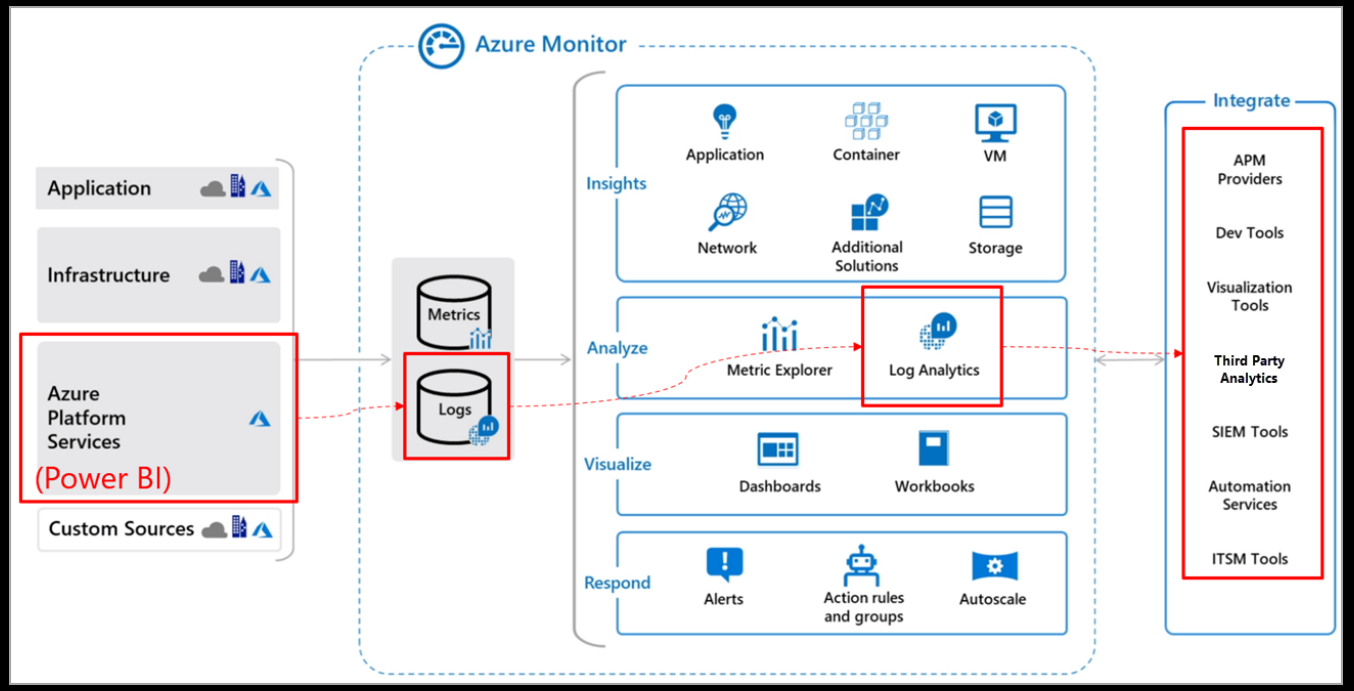
How can you influence that?

Consider setting up a process (notebook, other automated setup) to pro-actively execute queries to keep certain data **WARM**!



What should stay in memory?

Azure Monitor delivers a comprehensive solution for collecting, analyzing, and acting on telemetry from your cloud and on-premises environments. It helps you understand how your applications are performing and proactively identifies issues affecting them and the resources they depend on.



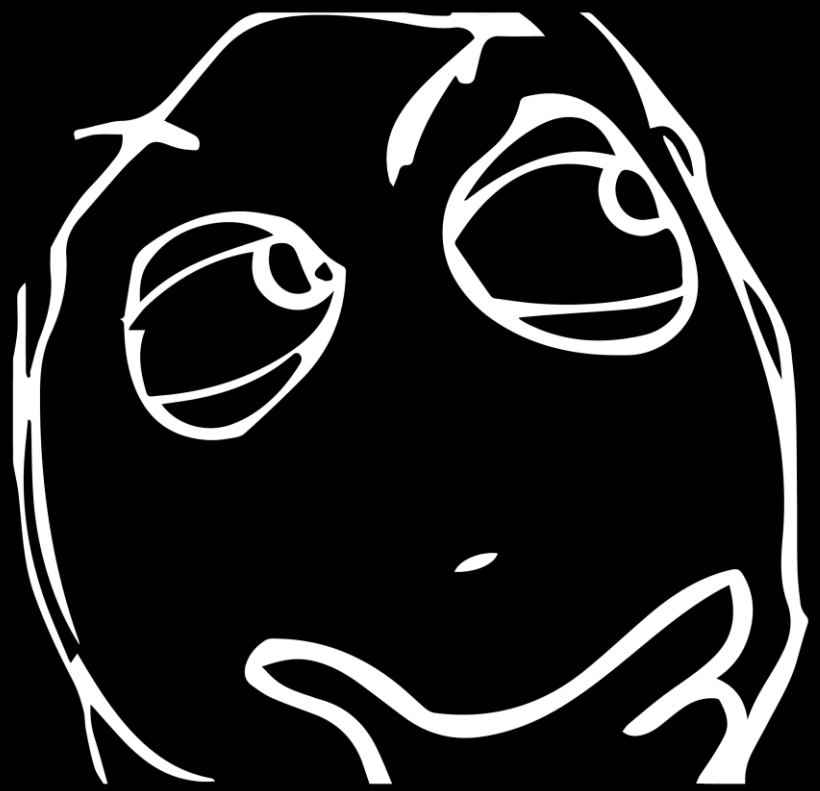
Wrap up

LET'S RECAP...

Direct Lake…

- Only applicable when using MS Fabric
- No data is imported / copied
- On-demand loading
- Reads data from Lake / Parquet format – Delta is a must
- Performance dependent on capacity size/utilization
- Falls back to DirectQuery when limitations are hit!
- Consider implement advanced patterns for specific use cases

Considerations



Should I change all my solutions to start using Direct Lake?

- There is no OneSecurity yet
  RLS / OLS on dataset level is possible
- Consider impact on capacities when falling back to DQ
- Performance is better than DQ
- It is in public preview

Resources

Direct Lake generic documentation
https://learn.microsoft.com/en-us/power-bi/enterprise/Direct Lake-overview

Calculation groups for Direct Lake datasets
https://powerbi.microsoft.com/en-us/blog/announcing-calculation-groups-for-direct-lake-datasets/

Analyze performance for Direct Lake
https://learn.microsoft.com/en-us/power-bi/enterprise/directlake-analyze-qp

On-demand loading of Direct Lake Power BI datasets in Fabric
https://blog.crossjoin.co.uk/2023/07/02/on-demand-loading-of-direct-lake-power-bi-datasets-in-fabric/

Direct Lake Frequently Asked Questions
https://fabric.guru/power-bi-direct-lake-mode-frequently-asked-questions/

Big thanks to Benni and Just for helping us and reference materials ☺

Feedback