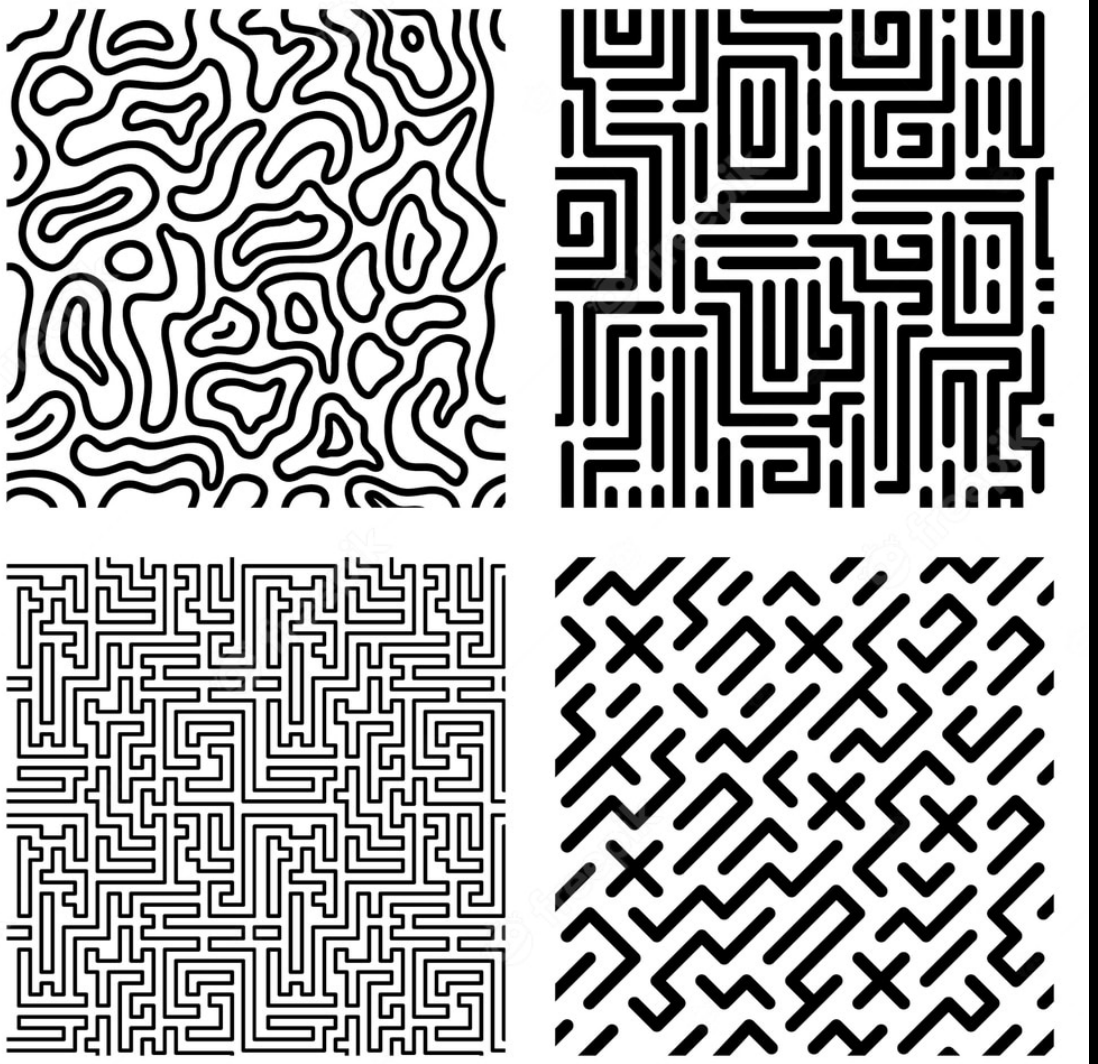


Power BI

Processing Patterns

Streamlining Power BI Refreshes Advanced Methods for Real-Time Refreshes

After this session

Storage modes	Refresh operations	Partitioning	Orchestration
Understand the different storage modes in Power BI and how this relates to refreshes.	Understand which different options there are to refresh your dataset manually as well as in an automated fashion.	Understand how different partitions in the data model are generated and can be triggered to refresh.	Understand how you can orchestrate your Power BI refresh and bind to other processes.

Marc Lelijveld

Solution Architect Data & Analytics
Macaw Netherlands

Microsoft® Most Valuable Professional

Microsoft MCT

@MarcLelijveld

linkedin.com/in/MarcLelijveld

Data-Marc.com

Data-Marc.com

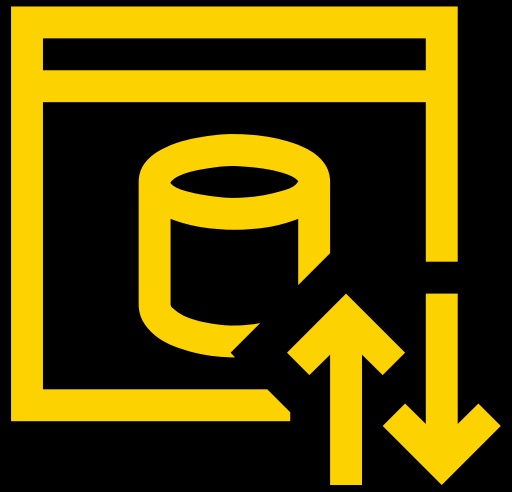
What we cover today

- Refreshes?
- Incremental refresh
- High frequency refreshes & hybrid tables
- Refresh individual objects
- Orchestration
- Wrap-up

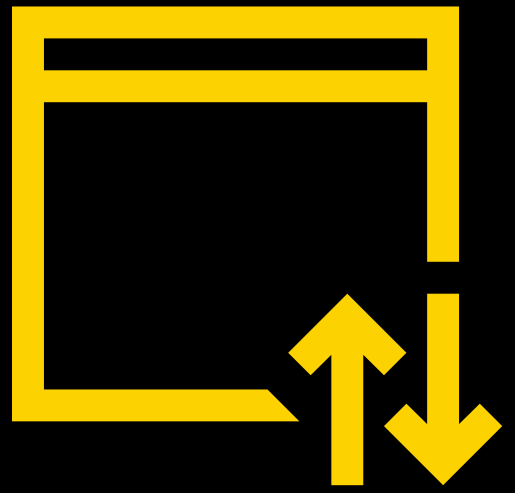
Refreshes

Understanding storage modes

Import

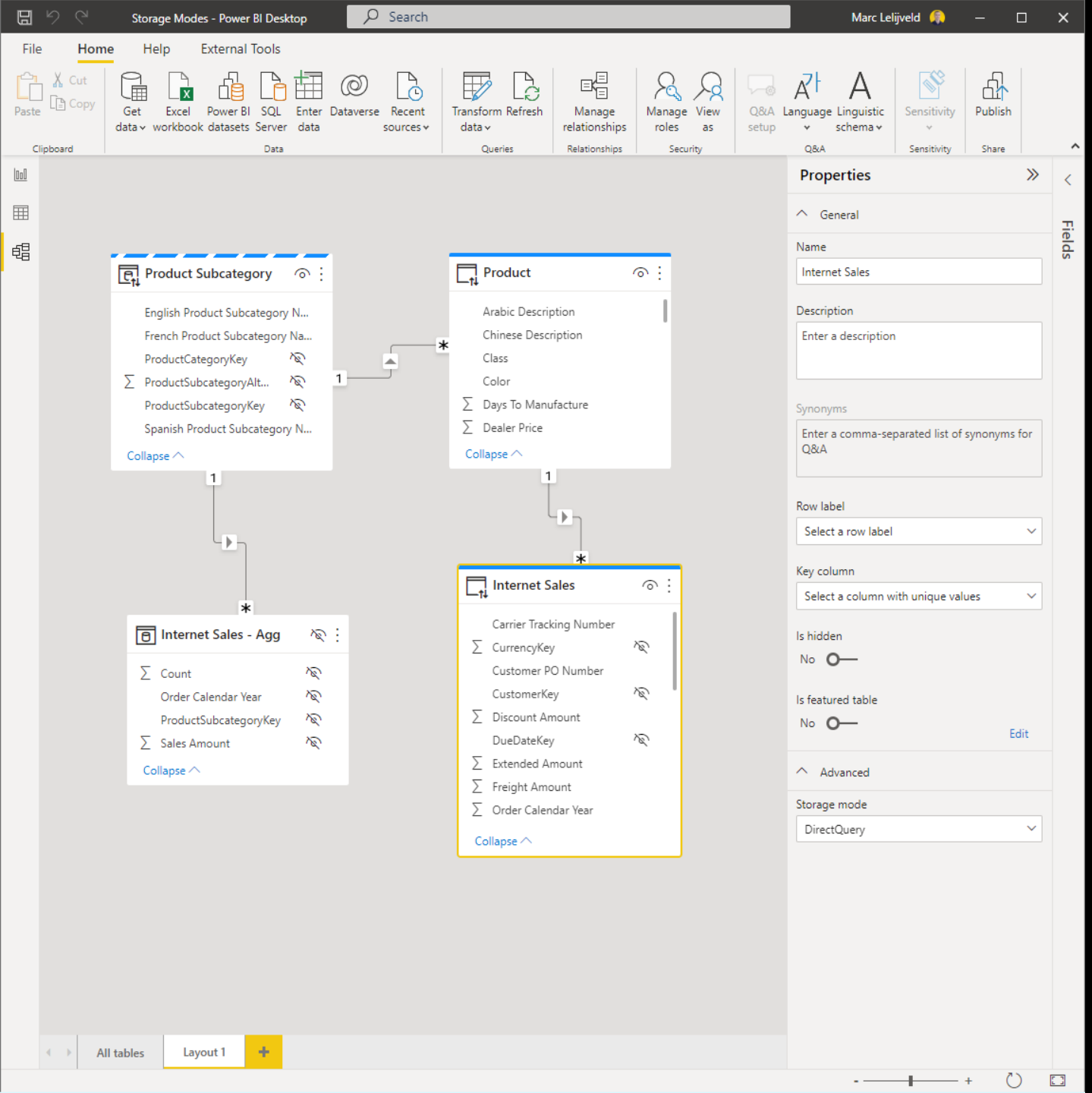


Dual



DirectQuery

Oh wait… we now also have DirectLake!



Understanding Storage Modes

Three 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

Configuring storage modes

- Storage modes are set on table level
- Setting storage mode to Import is an irreversible operation
- Data in DirectQuery mode cannot be displayed in the data tab

Caches and DirectQuery

Risks of mixing storage modes

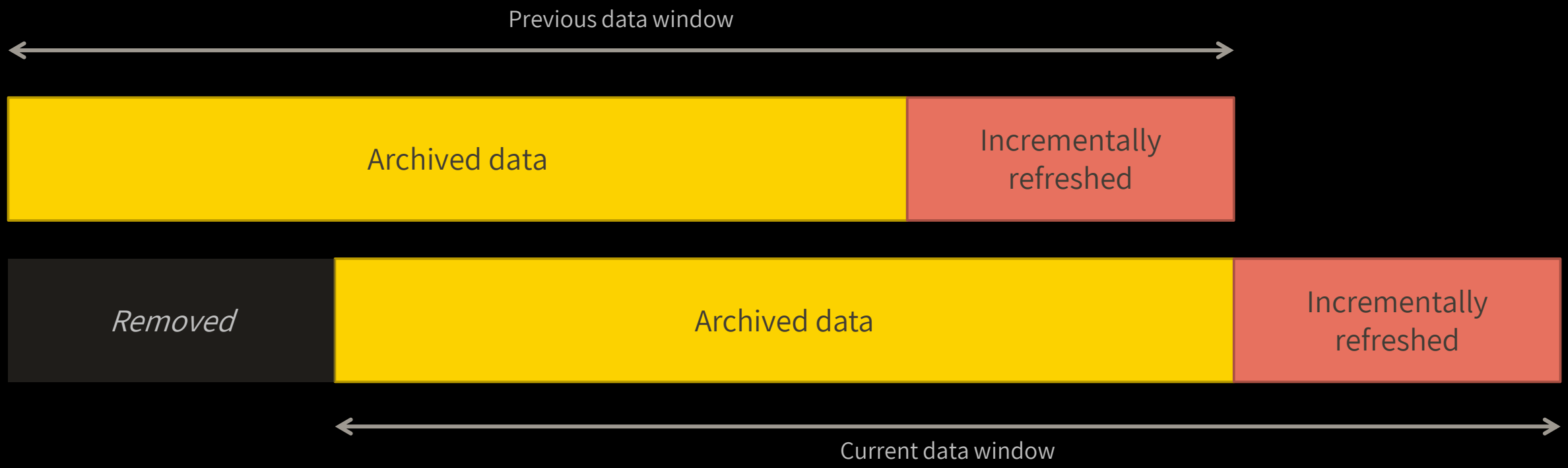
- Avoid mismatch in results when query bits DirectQuery compared to Import
- Data cached (import) could be behind compared to DirectQuery data
- Make sure cached data is kept in sync – regularly refresh!

Benefits to choose one or the other

- Improve query performance – cache data for faster end-user performance
- Data refresh optimization – no need to refresh for non-cached data
- Near-real time requirements – reduce query latency when in DirectQuery mode
- Large datasets – choose to not import certain data

Different refresh operation types

Type	What	Power BI Desktop	Power BI Service
Manual	Individual Table	✓	✗
	Full model	✓	✓
Scheduled	Individual Table	✗	✗
	Full model	✗	✓

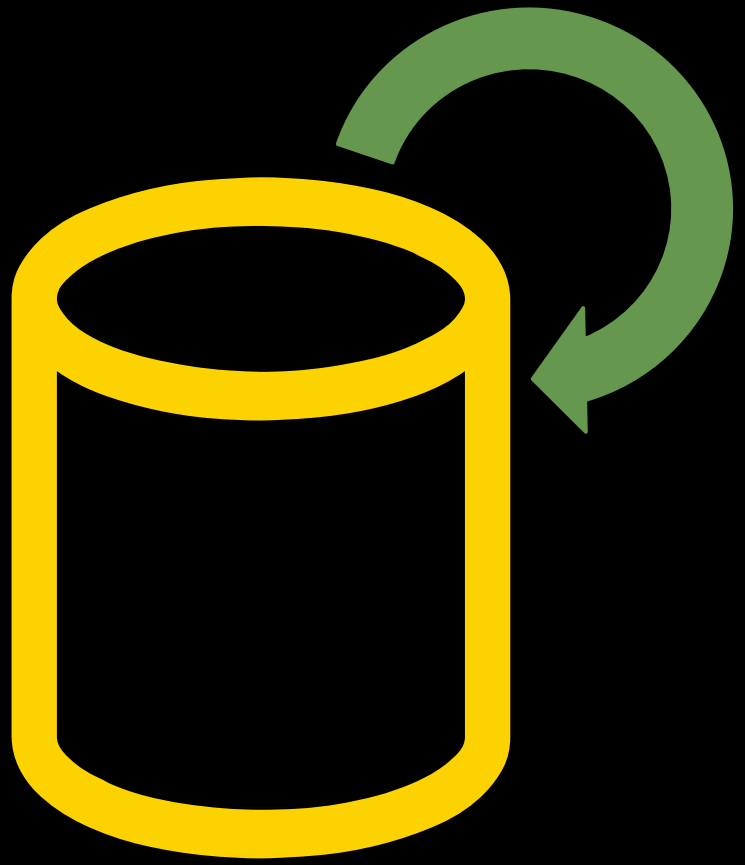


Incremental refresh

Considering incremental refresh

Why should you use it?

- Large data volumes
- Faster refreshes
- Resource consumption reduced
  (Both source & Power BI side)



Incremental refresh

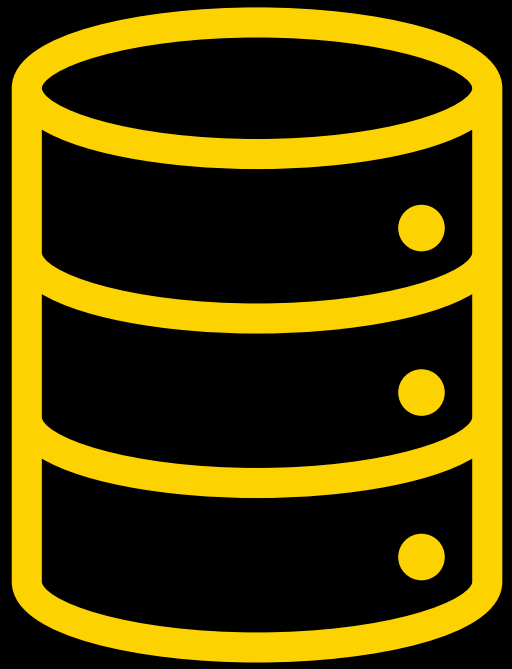
Incremental refresh is supported for Power BI Premium, Premium per user, **Power BI Pro**, and Power BI Embedded datasets.

Getting the latest data in **real time** with DirectQuery is **only supported for Power BI Premium**, Premium per user, and Power BI Embedded datasets.

Supported data sources

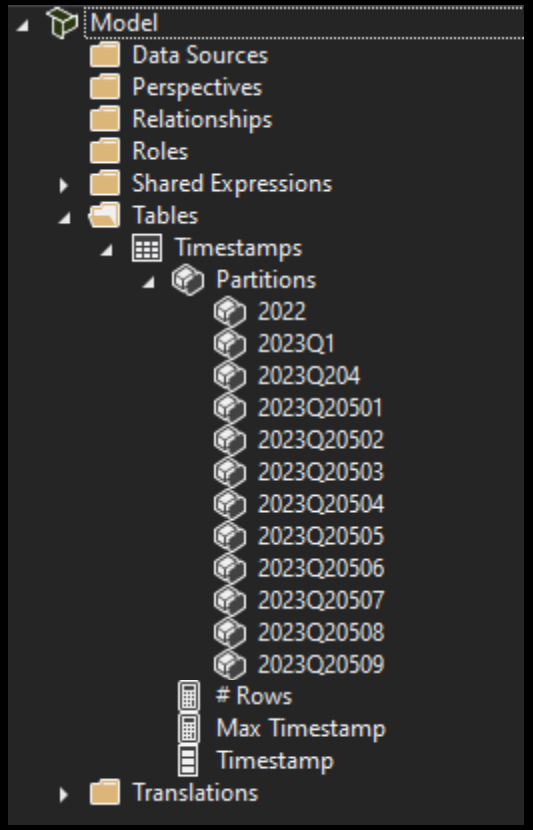
Data sources must be

- Structured
- Relational
- Allow query folding
- Typically – SQL like sources

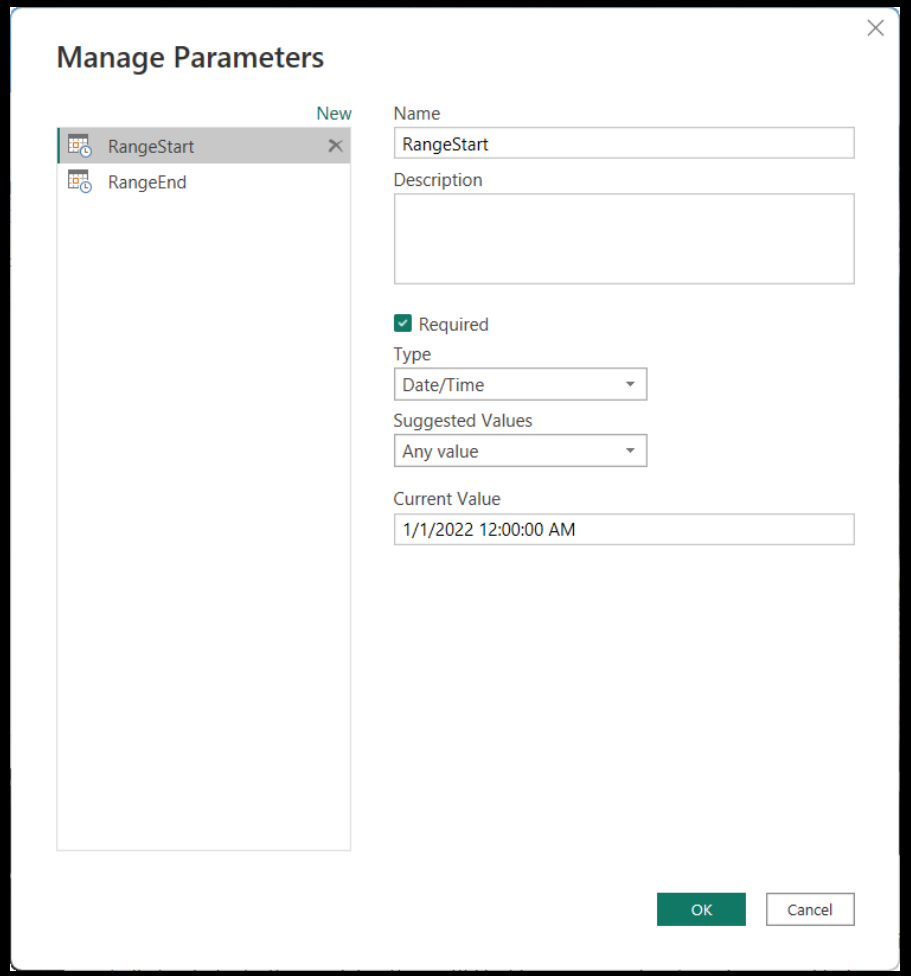


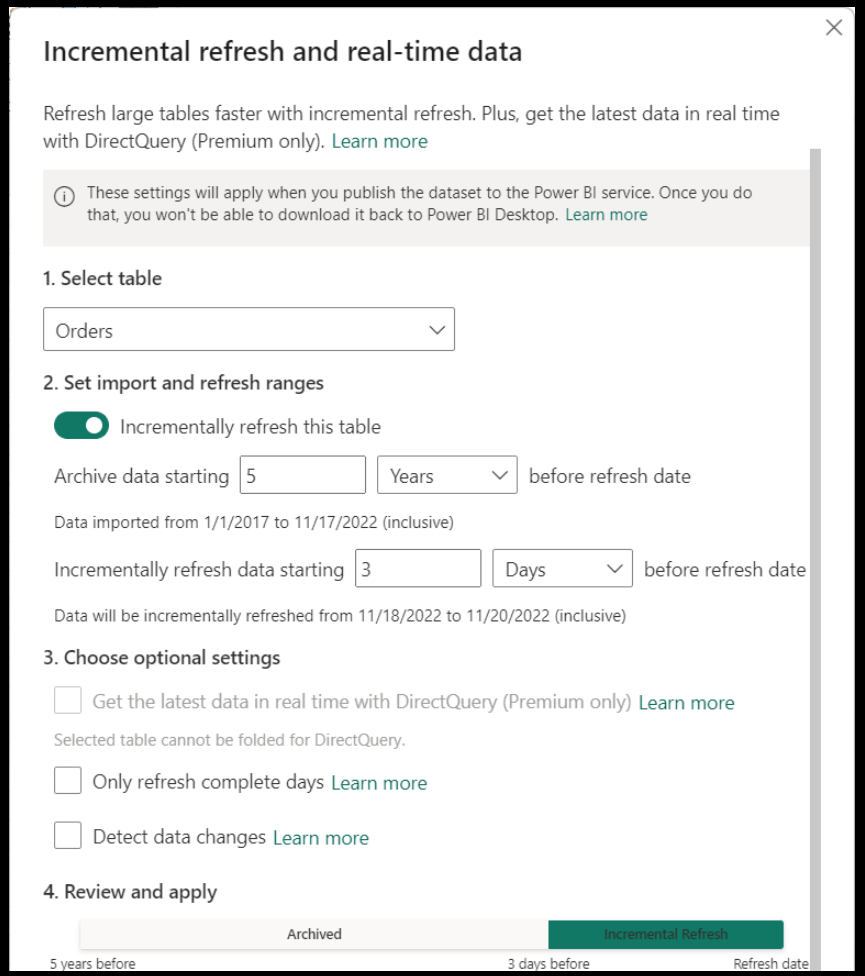
Breaking up your data in partitions

- Each partition represents a time frame
- New partitions get added automatically
- Old partitions (in archive) get merged

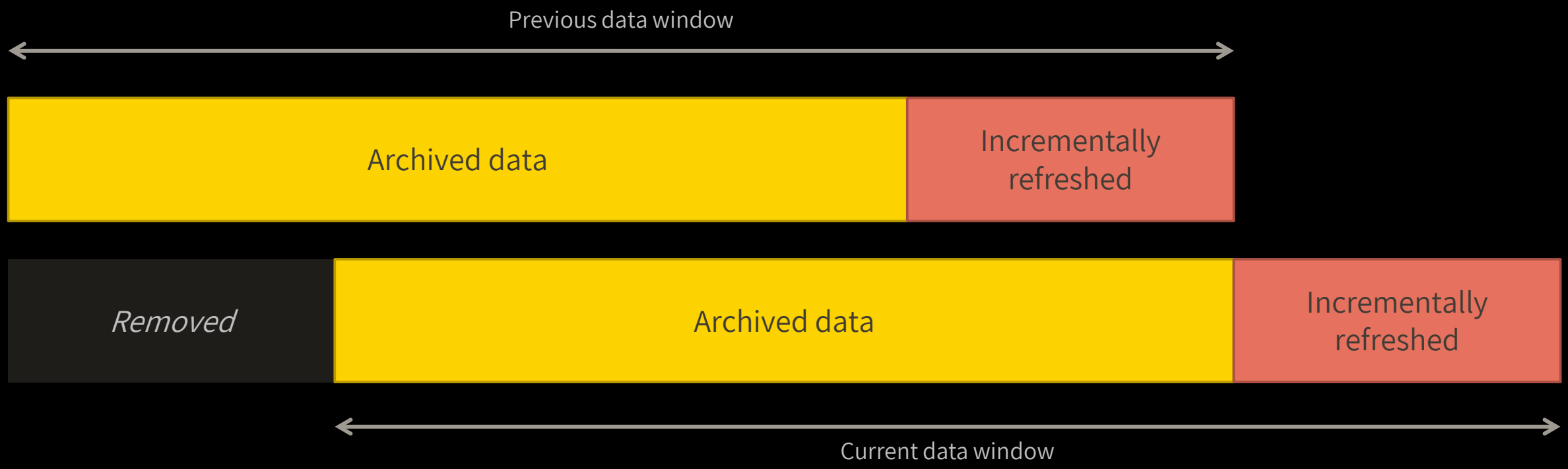


Configure Incremental Refresh



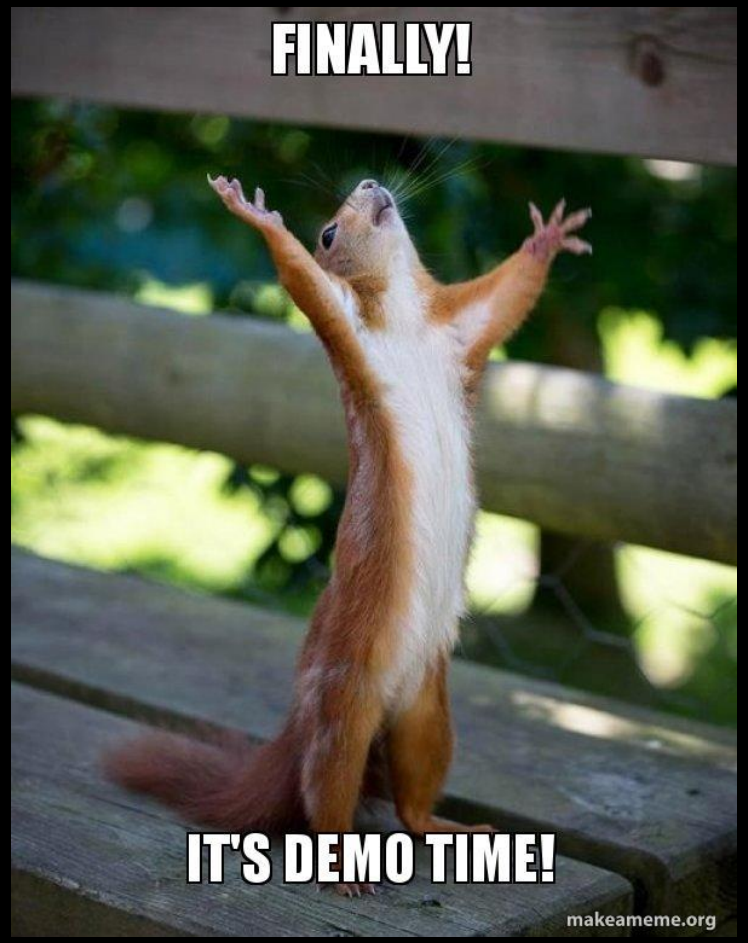


Moving time frame

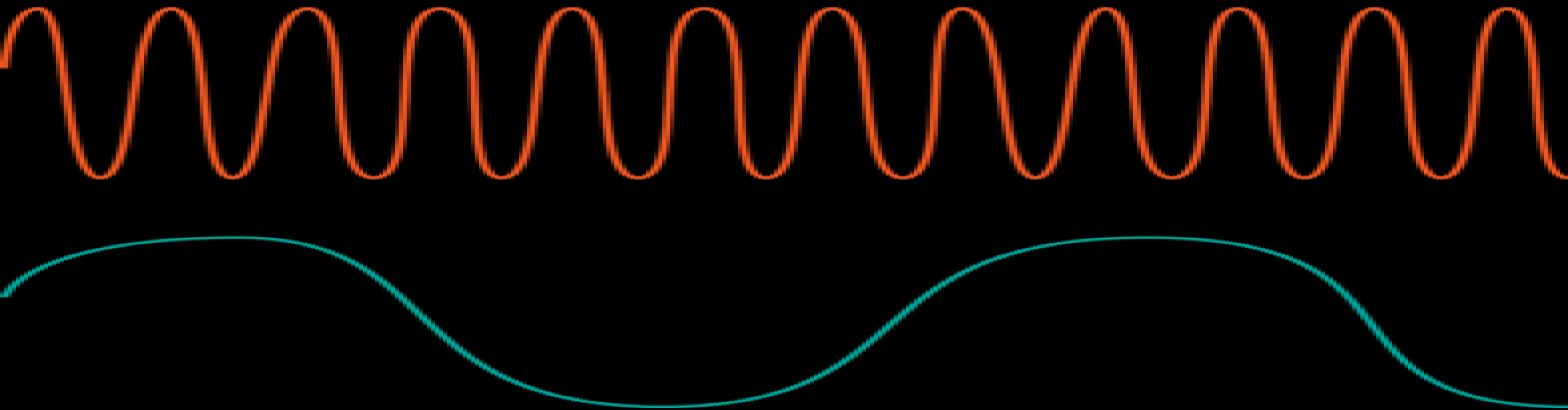


Detect data changes

- Even more selective refresh – only that what has been changed
- Based date/time column used to identify and refresh only those days where the data has changed
- Typically, system generated dates like Modified Date Time
- Should never be the same column as your incremental periods
- The maximum value is evaluated for each partition in the incremental range to detect whether the partition should be refreshed or not



Demo - configure incremental refresh

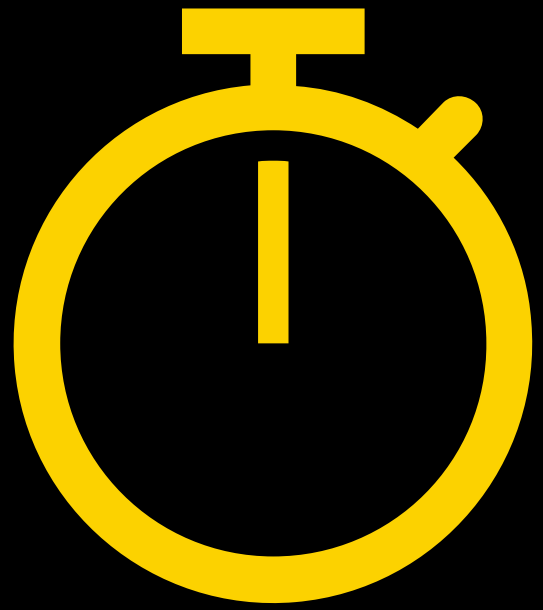


High frequency refreshes & hybrid tables

What is high frequency?

Let’s say real time?

- Hourly?
- Minutes?
- Seconds?



Or…

- Just daily batches

Refresh limitations

Frequency	Manual	Scheduled (via the service)
Free	Up to 8 times per day	
Pro	Up to 8 times per day	
Premium per User	Unlimited	48 times per day
Premium Capacity	Unlimited	48 times per day

Hybrid tables

- Live / Realtime data in Power BI
- Combines different storage modes on partition level in a single table
- Goes hand-in-hand with Incremental Refresh

Granularity	Name	Row Count
Year	2011	295,489,717
Year	2012	297,678,498
Year	2013	295,575,442
Year	2014	292,477,875
Year	2015	297,780,469
Year	2016	294,060,081
Year	2017	300,419,682
Year	2018	296,541,108
Year	2019	292,787,420
Year	2020	299,273,979
Quarter	2021Q1	74,135,277
Month	2021Q104	24,939,498
Day	2021Q10501	820,805
Day	2021Q10502	826,885
Day	2021Q10503	821,043
Day-DirectQuery	2021Q10504-DQ	271,110
Total		**3,063,898,887**

Archived: **Import**

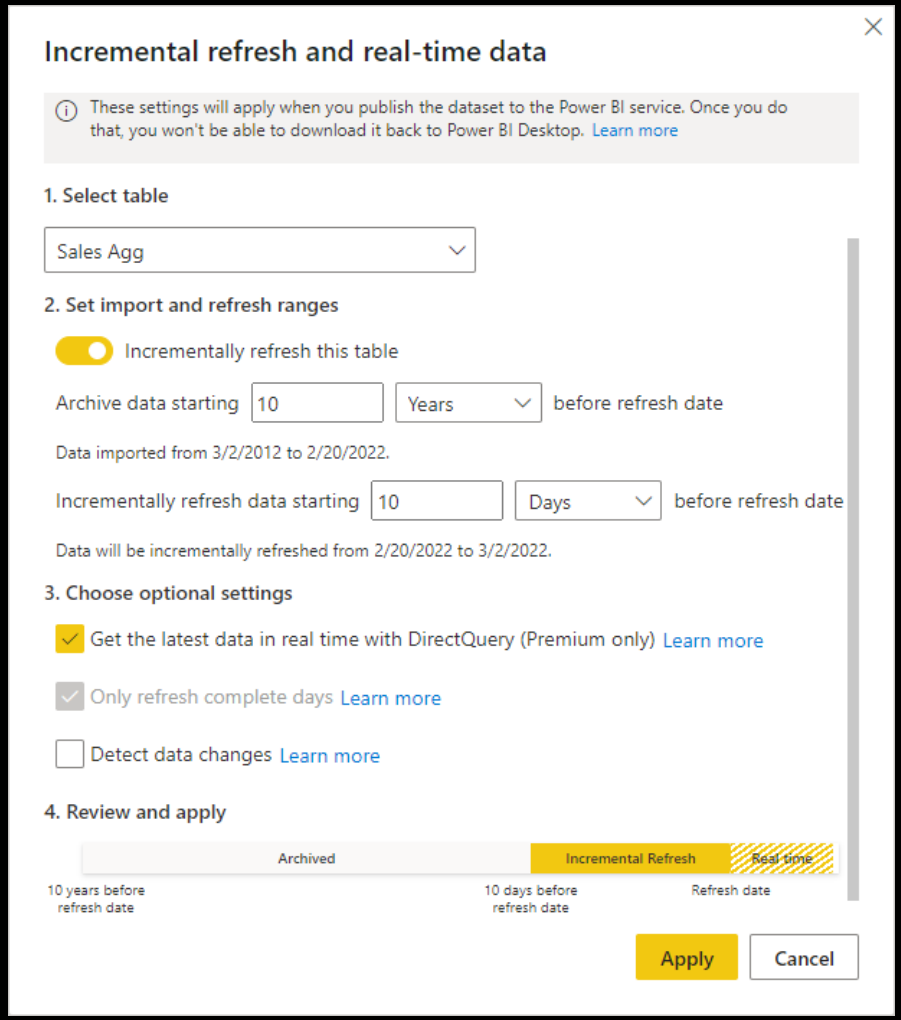
Incremental refresh: **Import**

Real time: **DirectQuery**

Hybrid tables

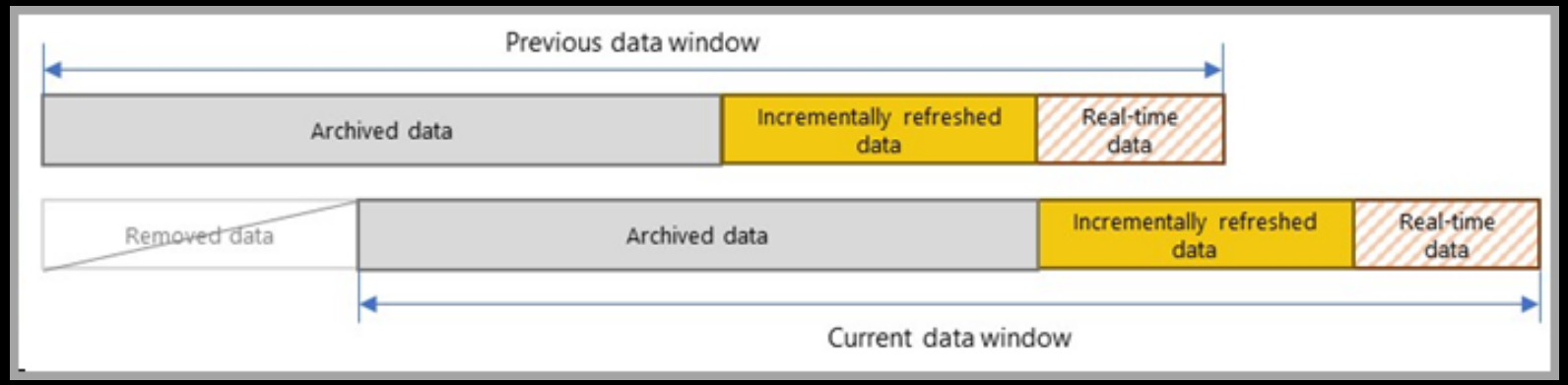
- Implementation with Incremental Refresh
- Customizable via 3rd party tooling like Tabular Editor

Limitation: Only 1 DQ partition per table allowed at the moment.



Hybrid tables – what challenge does it solve?

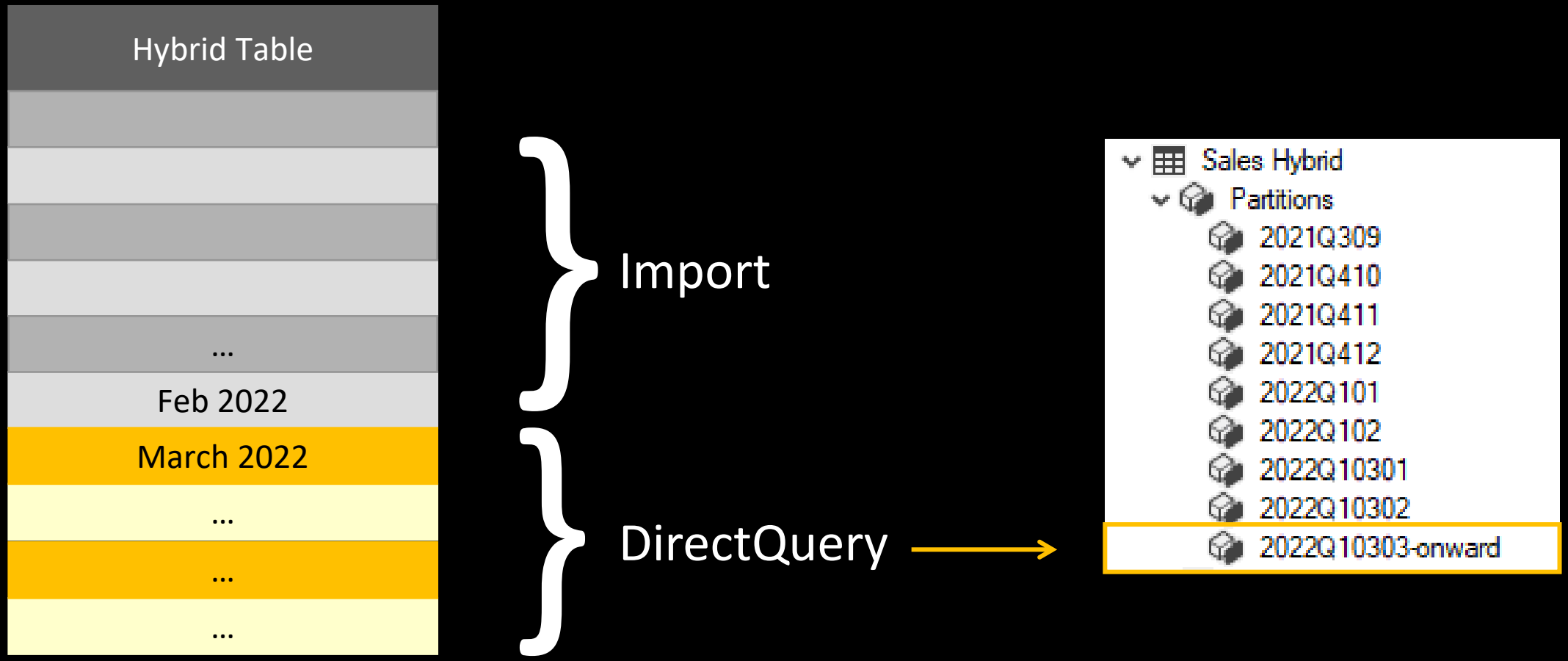
- Realtime scenarios without full tables on DQ mode
- No complex refresh mechanisms needed with partition refresh and queries over XMLA
- No more multiple tables and complex DAX to combine to achieve the same goal



Hybrid tables – Keep in mind that…

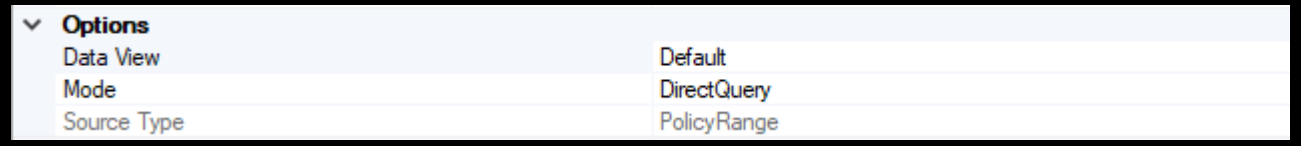
- Premium feature
- DAX restrictions for DirectQuery apply
- Limited Power Query capabilities (due to DQ)
- Requires Large Dataset Format (storage) in workspace
- Performance hit on upstream data sources

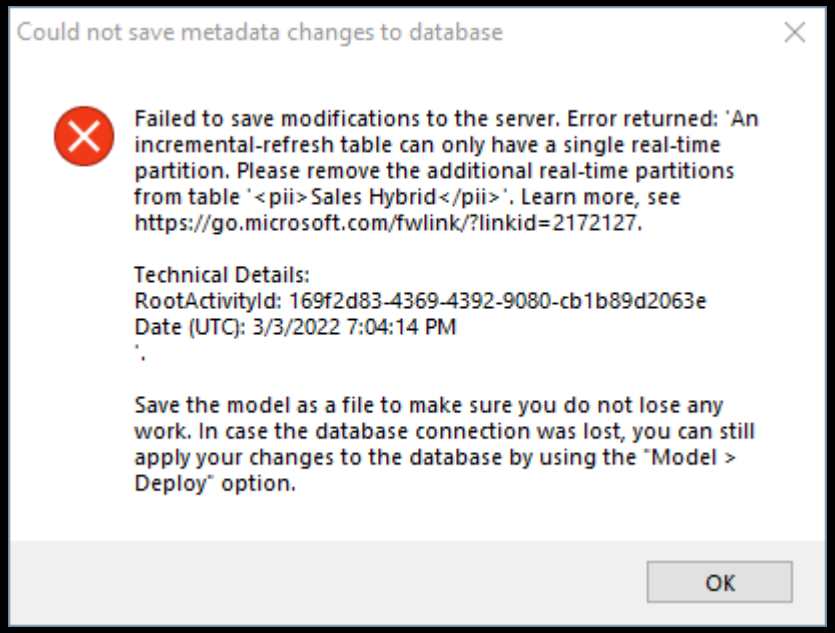
Demo - configure hybrid tables and streaming data



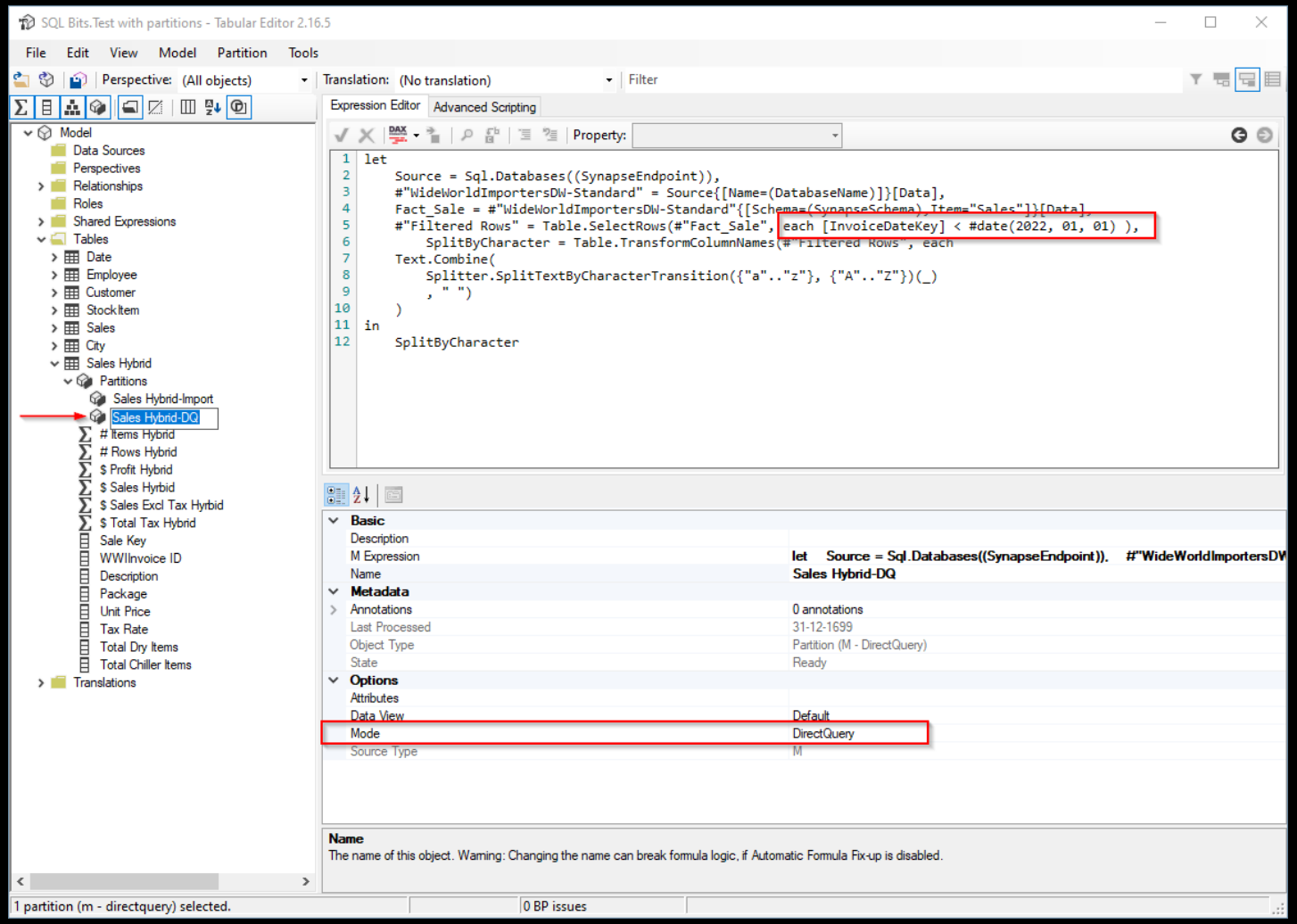
Can I change partition storage modes?

You cannot adjust tables with incremental refresh policies applied. However, there are other options to consider.

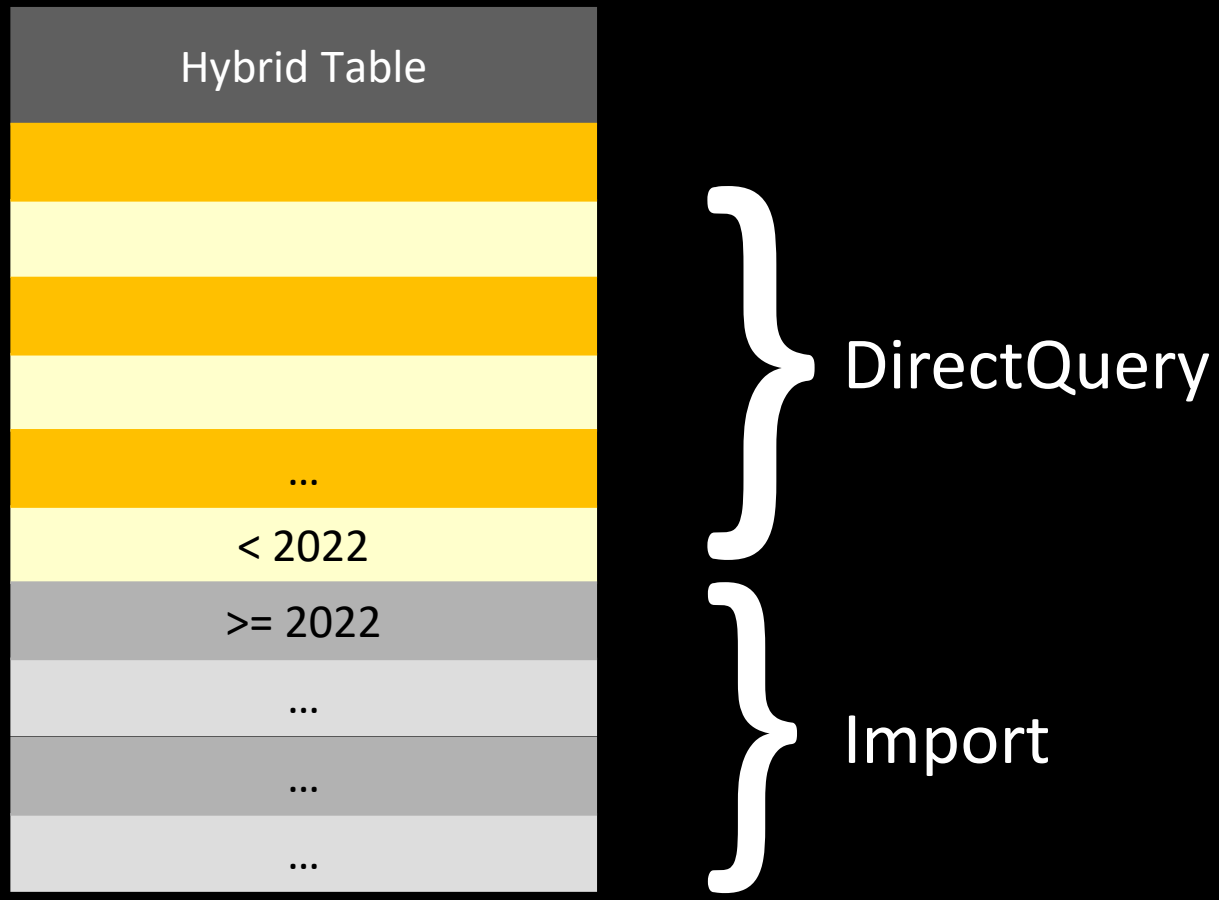




Manually setup partitioning



Create your own hybrid table setup, using 3rd party tooling like Tabular Editor



DirectQuery Partition definition

```
let
    Source = Sql.Databases((SynapseEndpoint)),
    #"WideWorldImportersDW-Standard" = Source{[Name=(DatabaseName)]}[Data],
    Fact_Sale = #"WideWorldImportersDW-
Standard"{[Schema=(SynapseSchema),Item="Sales"]}[Data],
    #"Filtered Rows" = Table.SelectRows(#"Fact_Sale", each
[InvoiceDateKey] < #date(2022, 01, 01) and
[InvoiceDateKey] >= #date(2013, 01, 01)),
        SplitByCharacter = Table.TransformColumnNames(#"Filtered Rows", each
    Text.Combine(
        Splitter.SplitTextByCharacterTransition({"a".."z"}, {"A".."Z"})(_)
        , " ")
    )
in
    SplitByCharacter
```

Import Partition definition

```
let
    Source = Sql.Databases((SynapseEndpoint)),
    #"WideWorldImportersDW-Standard" = Source{[Name=(DatabaseName)]}[Data],
    Fact_Sale = #"WideWorldImportersDW-
Standard"{[Schema=(SynapseSchema),Item="Sales"]}[Data],
    #"Filtered Rows" = Table.SelectRows(#"Fact_Sale", each
[InvoiceDateKey] >= #date(2022, 01, 01) and
[InvoiceDateKey] < #date(2022, 03, 31)),
        SplitByCharacter = Table.TransformColumnNames(#"Filtered Rows", each
    Text.Combine(
        Splitter.SplitTextByCharacterTransition({"a".."z"}, {"A".."Z"})(_)
        , " ")
    )
in
    SplitByCharacter
```

Downsides

Potential performance impact

- Policy definitions and partitions defined by Power BI will be scanned more optimally when a DAX query is executed
- With manual setup partitions, your DAX expression might be broken up in multiple sub-queries which hit all partitions

> ⊗ 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.

Refresh individual objects

Effective refreshing

Considerations

- Refreshing the entire model takes too long with high load on sources
- Can we only refresh certain tables?
- Can we only refresh certain partitions?
- Can we use DQ tables/partitions (Hybrid Tables)

What do we need?

- Enhanced refresh API
- XMLA Endpoints

Smaller increments

Bind your refresh operations in Power BI to refresh operations in for example your data platform

Run smaller increments to speed up the end-to-end process

Trigger one (or multiple) selective table(s) or partition(s) at a time.

Smaller increments

Smaller increments can only be triggered to refresh via:

- Manual processing via Management Studio (or other tools)
- Power BI Enhanced Refresh API - Previously known as Async refresh API
- XMLA endpoints

Enhanced refresh API

More granular controls

- type - full / clearValues / calculate / dataonly / automatic / defragment
- Commitmode – default is transactional
- maxParallism – 10 max
- retryCount – number of retries before failing
- objects – which objects to refresh
- applyRefreshPolicy – true/false whether you want to apply potential incremental refresh if configured
- effectiveDate – in case of incremental refresh, this parameter overwrites the current date

Enhanced refresh API

Specify the objects to refresh

POST
https://api.powerbi.com/v1.0/myorg/groups/f089354e-8366-4e18-aea3-4cb4a3a50b48/datasets/cfafbeb1-8037-4d0c-896e-a46fb27ff229/refreshes

```
{
   "type": "Full",
   "commitMode": "transactional",
   "maxParallelism": 2,
   "retryCount": 2,
   "objects": [
      {
         "table": "DimCustomer",
         "partition": "DimCustomer"
      },
      {
         "table": "DimDate"
      }
   ]
}
```

Demo – Refresh one table or partition

More than refreshes

Enhanced refresh API also allows you to

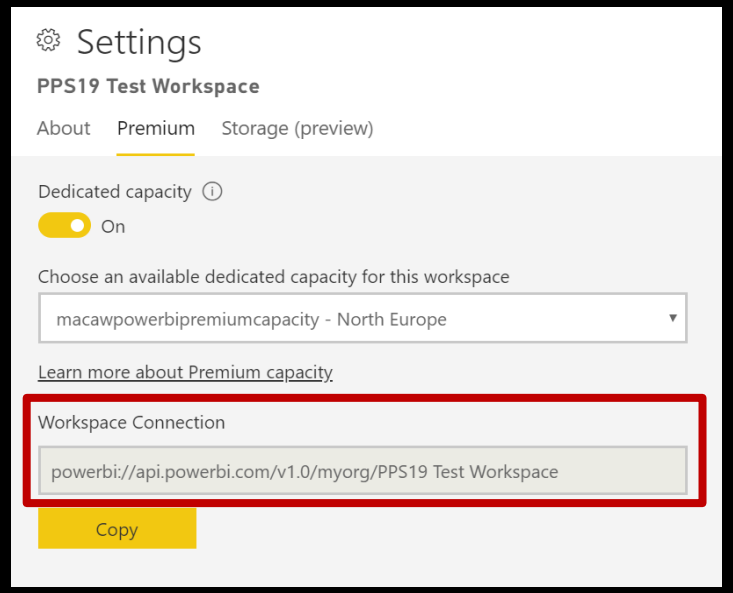
- **GET** refresh history
- **GET** individual refresh details like progress or failures
- **DELETE** a running refresh

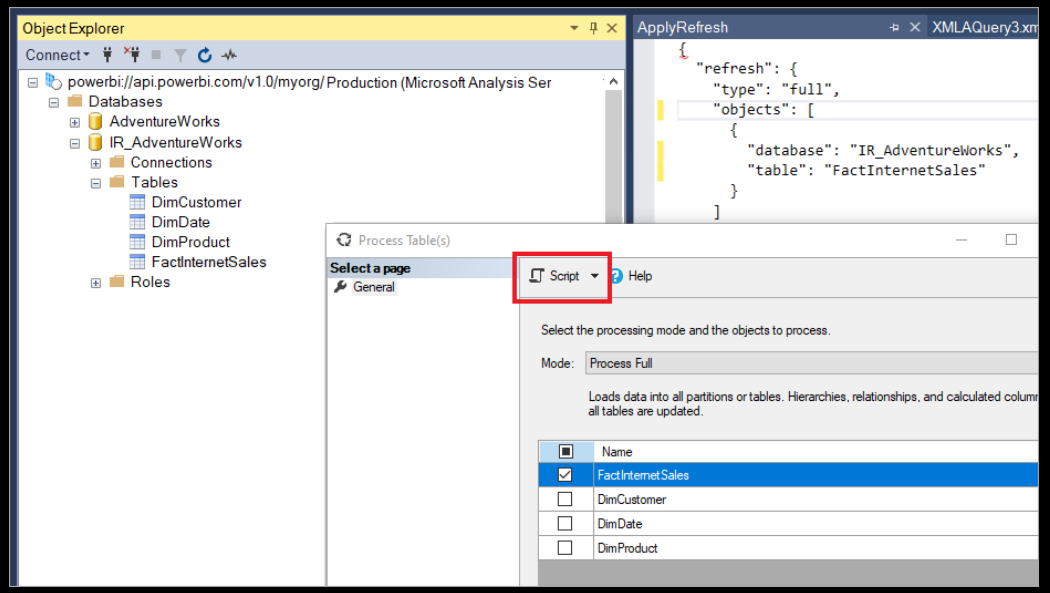
JSON Copy

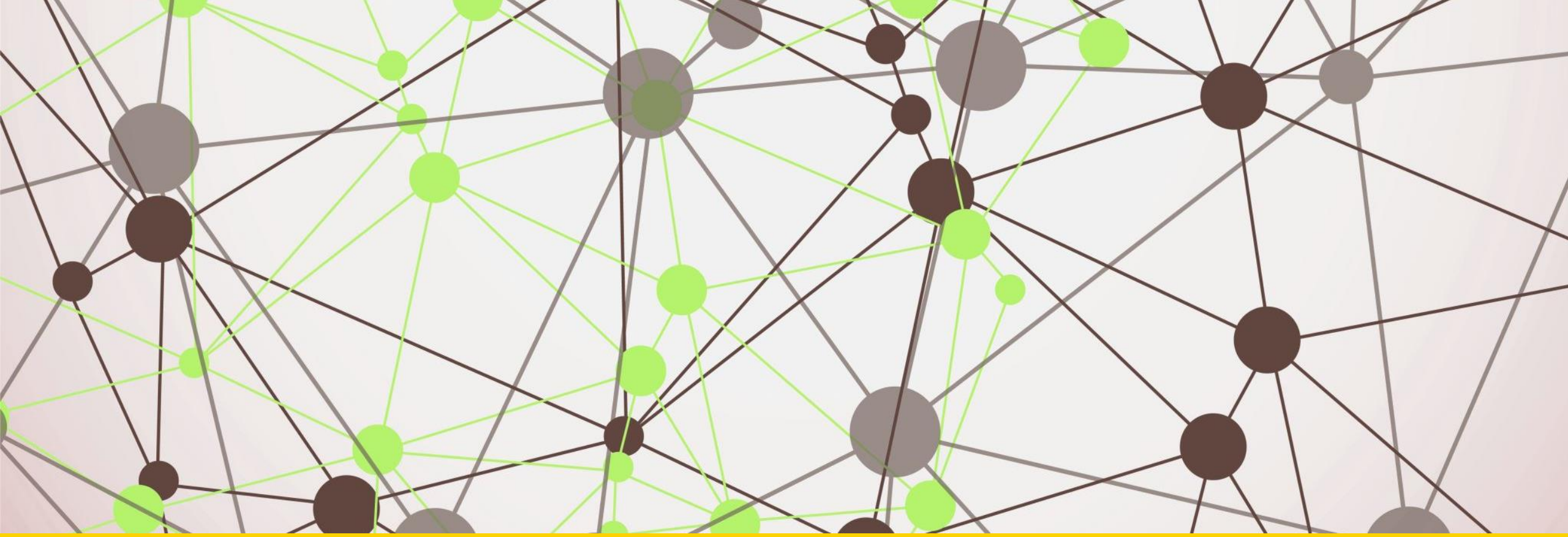

```
{
    "startTime": "2020-12-07T02:06:57.1838734Z",
    "endTime": "2020-12-07T02:07:00.4929675Z",
    "type": "Full",
    "status": "InProgress",
    "currentRefreshType": "Full",
    "objects": [
        {
            "table": "DimCustomer",
            "partition": "DimCustomer",
            "status": "InProgress"
        },
        {
            "table": "DimDate",
            "partition": "DimDate",
            "status": "InProgress"
        }
    ]
}
```

Is the API the only option?

- Execute operations over XMLA endpoints
- Using Tabular Model Scripting Language
- More granular control using SQL Service Management Studio







Binding refreshes to processes

Central E2E orchestration

- Combine pipelines from Data Platform with Power BI
- Lowest latency between source and report
- Incremental loading where possible
- Consider including backup operations for Power BI

What to use to trigger and bind together?

Demo –Refresh API from Synapse Pipeline

Wrap up

LET'S RECAP...

Refreshes can be manual or **automated**

Incremental refresh makes your refresh **more efficient**

With **detect data changes**, further optimization can be done

Partitioning in incremental refresh should be **based on functional dates**

Lower latency by linking Power BI refreshes to other processes

Use the enhanced refresh API to **trigger individual objects**

Use the toolkit of your preference for **end-to-end orchestration**

Resources

Setting up scheduled refreshes
https://learn.microsoft.com/en-us/power-bi/connect-data/refresh-scheduled-refresh

Configure incremental refresh
https://learn.microsoft.com/en-us/power-bi/connect-data/incremental-refresh-configure

Enhanced refresh API
https://learn.microsoft.com/en-us/power-bi/connect-data/asynchronous-refresh

Dataset connectivity with XMLA endpoints
https://learn.microsoft.com/en-us/power-bi/enterprise/service-premium-connect-tools

Tabular Model Scripting Language (TMSL)
https://learn.microsoft.com/en-us/analysis-services/tmsl/tabular-model-scripting-language-tmsl-reference?view=asallproducts-allversions

These slides
https://github.com/marclelijveld/Slide-decks

Thanks for attending!

Marc Lelijveld
Solution Architect Data & Analytics
Macaw Netherlands

Microsoft® Most Valuable Professional
Microsoft MCT

@MarcLelijveld
linkedin.com/in/MarcLelijveld
Data-Marc.com