Boosting Power BI Performance with Query Folding Techniques

Gökberk Uzuntaş · Follow

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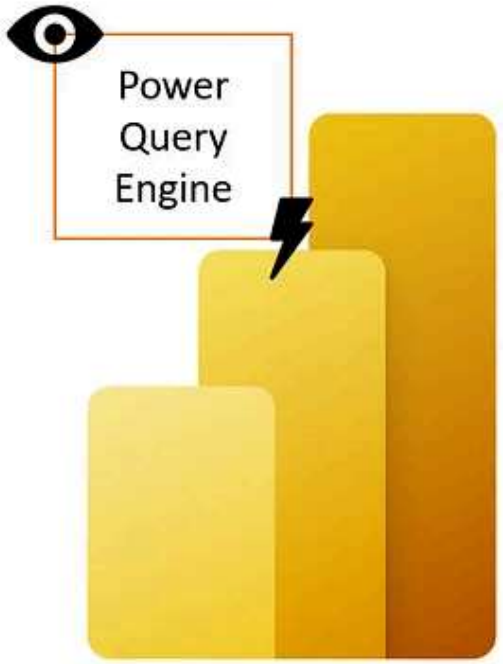
Query folding is a crucial process in Power BI that helps optimize data transformations by executing them directly at the data source. By minimizing the amount of data transferred to Power BI that improves both performance and efficiency.



The examples will demonstrate both Power BI Dataflow and Power BI Desktop. Before diving the cases let's getting know Query Folding.

Query Folding overview

Query folding in Power Query is a process where data transformations are pushed to the data source for execution, optimizing performance by

reducing the load on Power Query's engine. Query folding is automatically applied when the data source supports query folding and all transformation steps are foldable.

Query folding outcomes depend on how the query is structured. **Full query folding** occurs when all transformations are pushed to the data source, minimizing Power Query processing. **Partial query folding** happens when only some transformations can be executed at the data source, with the rest processed by Power Query. **No query folding** occurs when none of the transformations can be pushed to the data source, forcing Power Query to process the entire query on its engine.

Step Diagnostics Indicators

Query folding indicators rely on an underlying query plan to gather information about the query and report its status.

Indicator	Icon	Description
Folding		The folding indicator tells you that the query up to this step is evaluated by the data source.
Not folding		The not-folding indicator tells you that some part of the query up to this step is evaluated outside the data source. You can compare it with the last folding indicator, if there is one, to see if you can rearrange your query to be more performant.
Might fold		Might fold indicators are uncommon. They mean that a query "might" fold. They indicate either that folding or not folding is determined at runtime, when pulling results from the query, and that the query plan is dynamic. These indicators likely only appear with ODBC or OData connections.
Opaque		Opaque indicators tell you that the resulting query plan is inconclusive for some reason. It generally indicates that there's a true "constant" table, or that that transform or connector isn't supported by the indicators and query plan tool.
Unknown		Unknown indicators represent an absence of a query plan, either due to an error or attempting to run the query plan evaluation on something other than a table (such as a record, list, or primitive).

https://learn.microsoft.com/en-us/power-query/step-folding-indicators

Advantages of Query Folding

- Significantly improves performance
- Reduces memory consumption
- Enables faster refresh times
- Incremental refresh can be used

Supported data connectors for Query Folding

The method described in the following sections is applicable to the following data connectors:

- PostgreSQL
- SAP HANA
- SAP BW
- SQL Server
- Amazon Redshift
- BigQuery
- OData

Applied Steps That Support Query Folding in Power Query

- Filtering
- Sorting
- Replace Value
- Rename
- GroupBy
- Merge Queries

- Append Queries

...

Applied Steps That Doesn't Support Query Folding in Power Query

- Replace Error
- Remove Duplicates
- Split Column
- Fill Down, Fill Up
- Reverse Rows
- Marked Key Column
- Expand Record, List

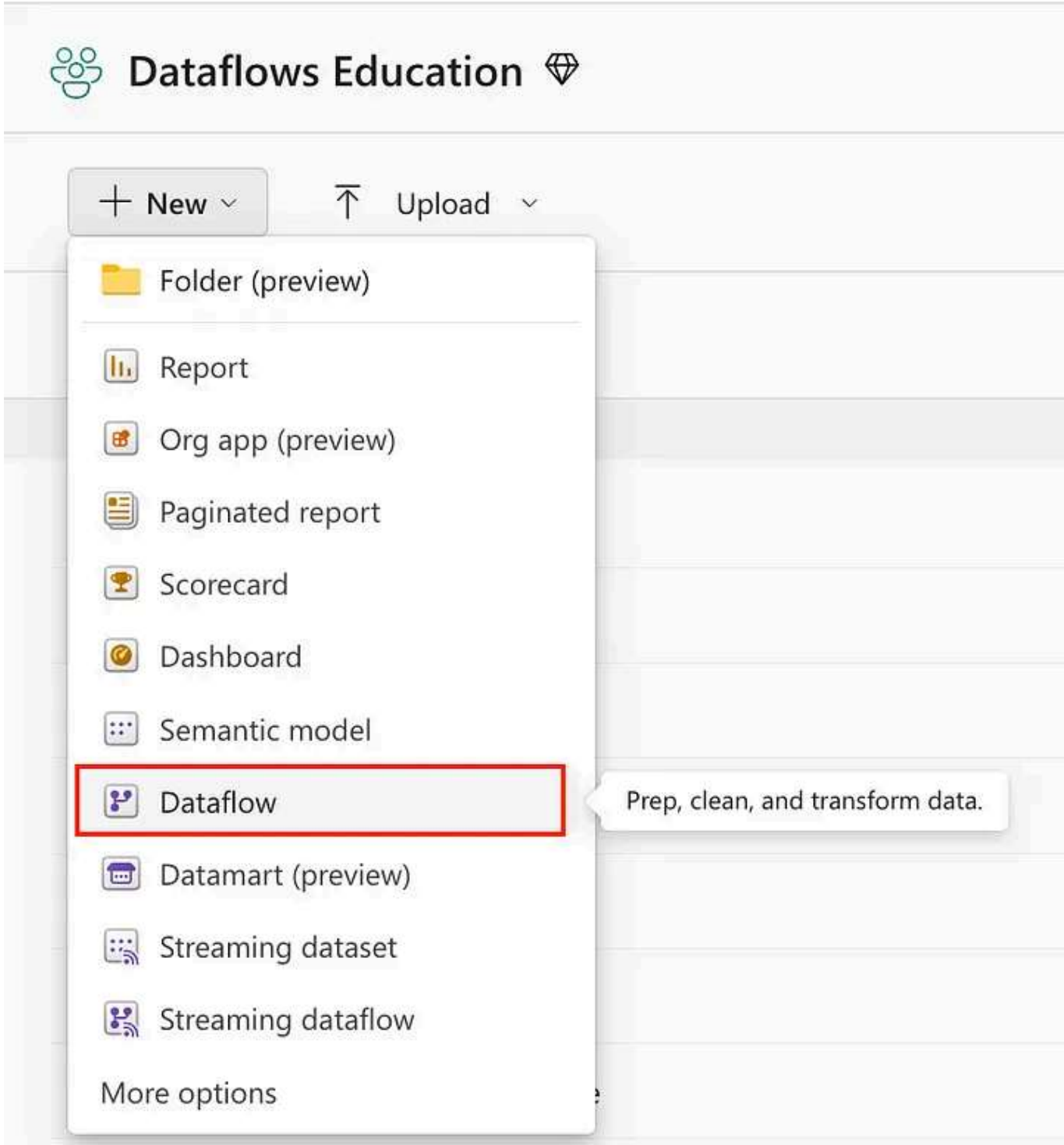
...

Case Study: Query Folding in Power BI Dataflows

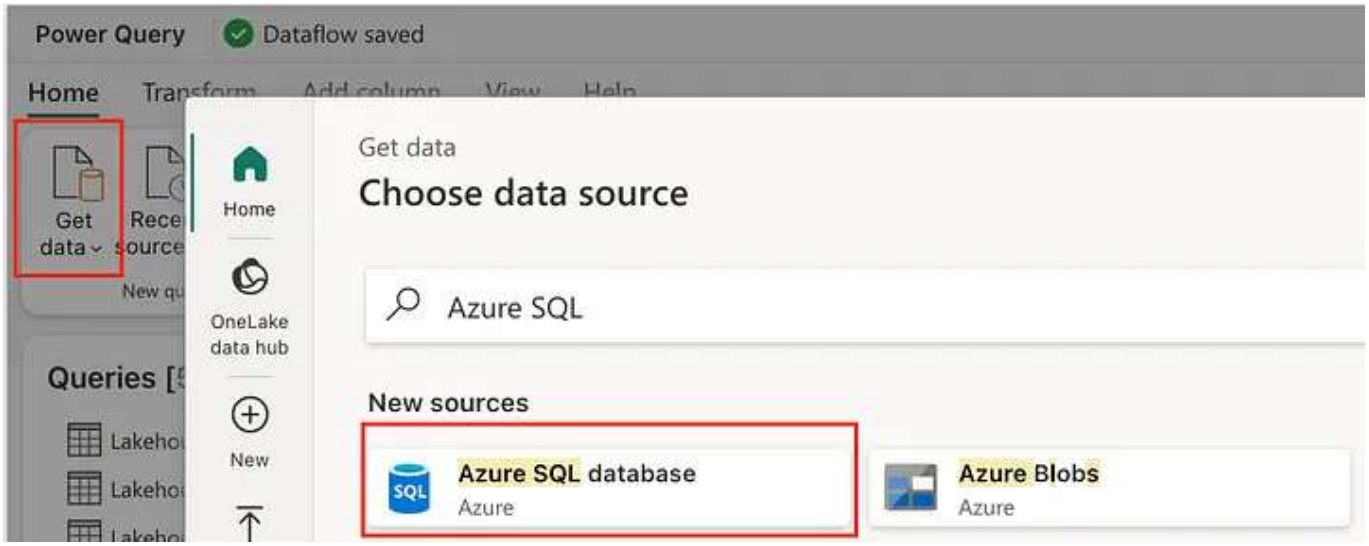
Imagine a demo with a table containing 1.8 million rows and stored in Azure SQL. Here is the sample preview.

	ID	Name	Description	Amount	CreatedDate	Status	Category
1	29	Name_29	Description for item 29	290	1/30/2021	Inactive	Category_5
2	59	Name_59	Description for item 59	590	1/30/2021	Inactive	Category_5
3	89	Name_89	Description for item 89	890	1/30/2021	Inactive	Category_5
4	129	Name_29	Description for item 29	290	1/30/2021	Inactive	Category_5
5	159	Name_59	Description for item 59	590	1/30/2021	Inactive	Category_5
6	189	Name_89	Description for item 89	890	1/30/2021	Inactive	Category_5
7	229	Name_29	Description for item 29	290	1/30/2021	Inactive	Category_5
8	259	Name_59	Description for item 59	590	1/30/2021	Inactive	Category_5
9	289	Name_89	Description for item 89	890	1/30/2021	Inactive	Category_5
10	329	Name_29	Description for item 29	290	1/30/2021	Inactive	Category_5
11	359	Name_59	Description for item 59	590	1/30/2021	Inactive	Category_5
12	389	Name_89	Description for item 89	890	1/30/2021	Inactive	Category_5
13	429	Name_29	Description for item 29	290	1/30/2021	Inactive	Category_5
14	459	Name_59	Description for item 59	590	1/30/2021	Inactive	Category_5
15	489	Name_89	Description for item 89	890	1/30/2021	Inactive	Category_5
16	529	Name_29	Description for item 29	290	1/30/2021	Inactive	Category_5
17	559	Name_59	Description for item 59	590	1/30/2021	Inactive	Category_5
18	589	Name_89	Description for item 89	890	1/30/2021	Inactive	Category_5

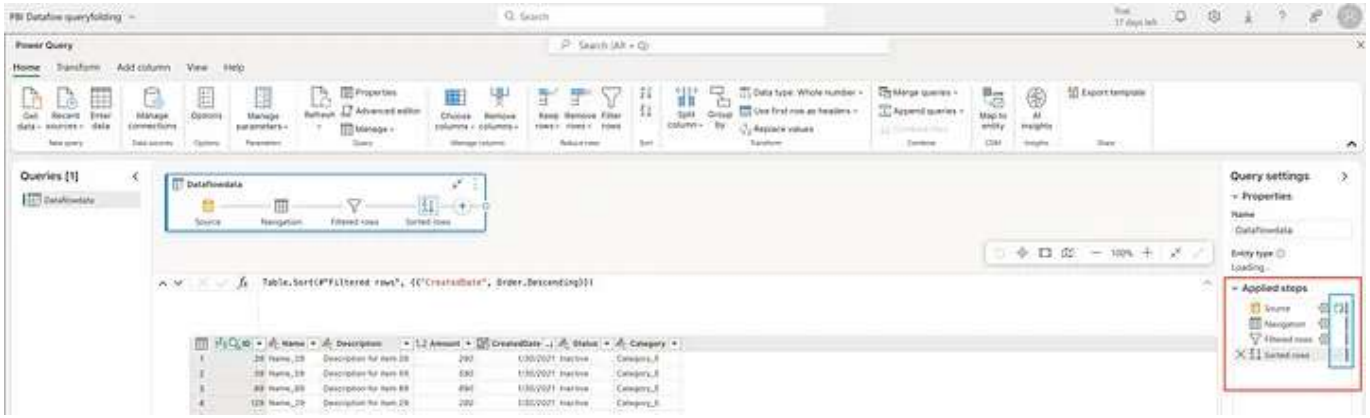
Created a Premium Capacity or Premium Per User or Pro workspace and creating Power BI Dataflow.


Dataflows Education
New
Upload
Folder (preview)
Report
Org app (preview)
Paginated report
Scorecard
Dashboard
Semantic model
Dataflow
Prep, clean, and transform data.
Datamart (preview)
Streaming dataset
Streaming dataflow
More options

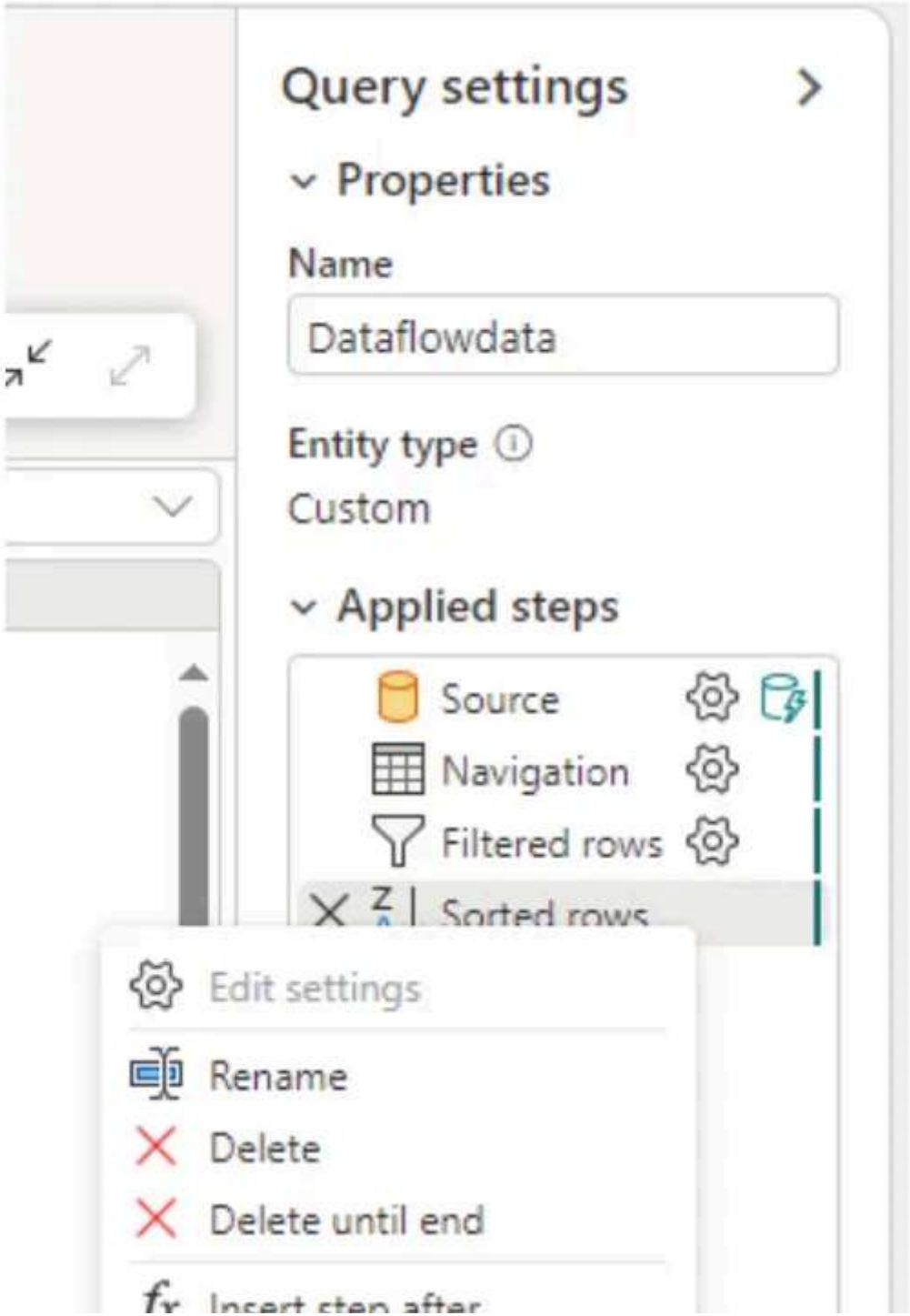
Retrieving data from Azure SQL where the table is stored.



Some steps have been applied as shown in the red box on the right and information regarding the query folding status is provided in the blue box. Query folding is confirmed to be active as indicated by the folding icon.



The appearance of “Clicking View Data Source Query” indicates that query folding is active allowing you to see the underlying query behind the folding process.


Query settings
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Edit settings
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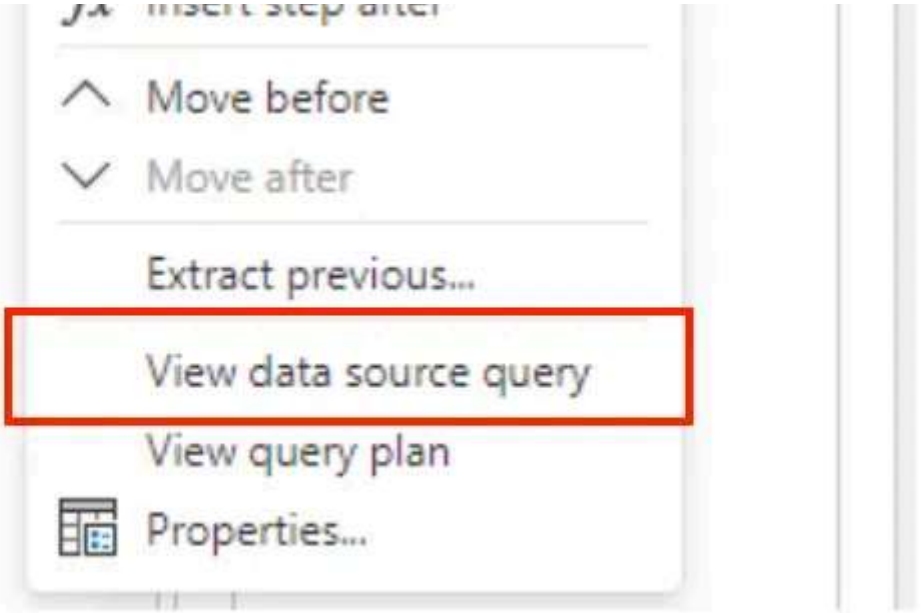
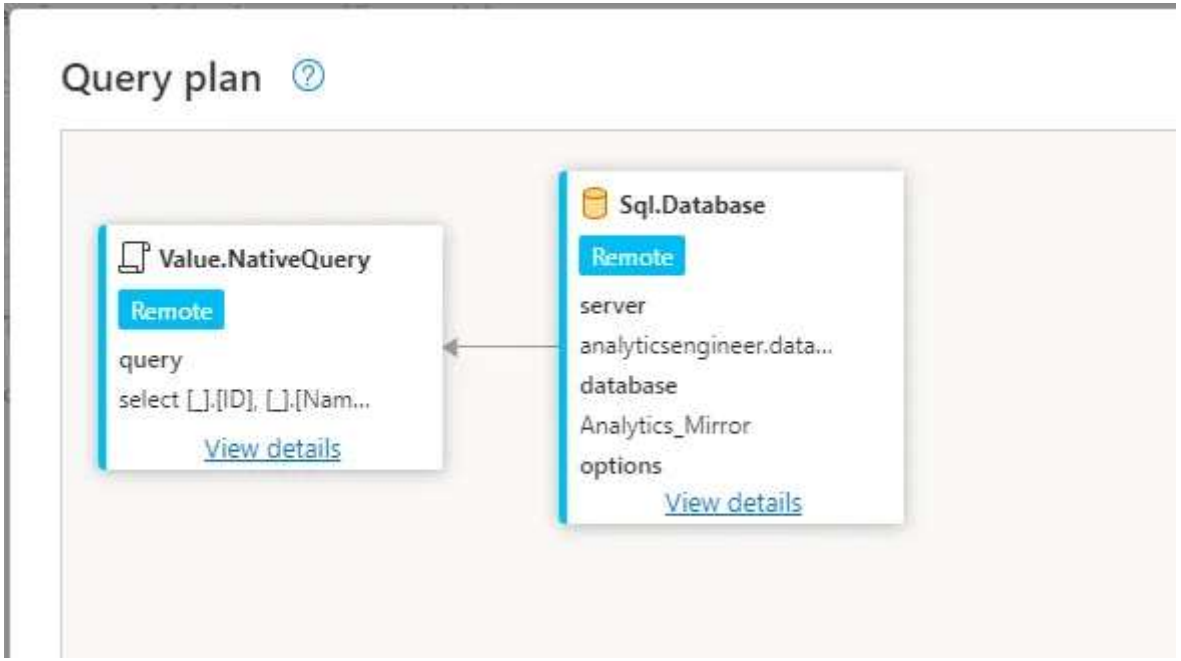
Delete until end

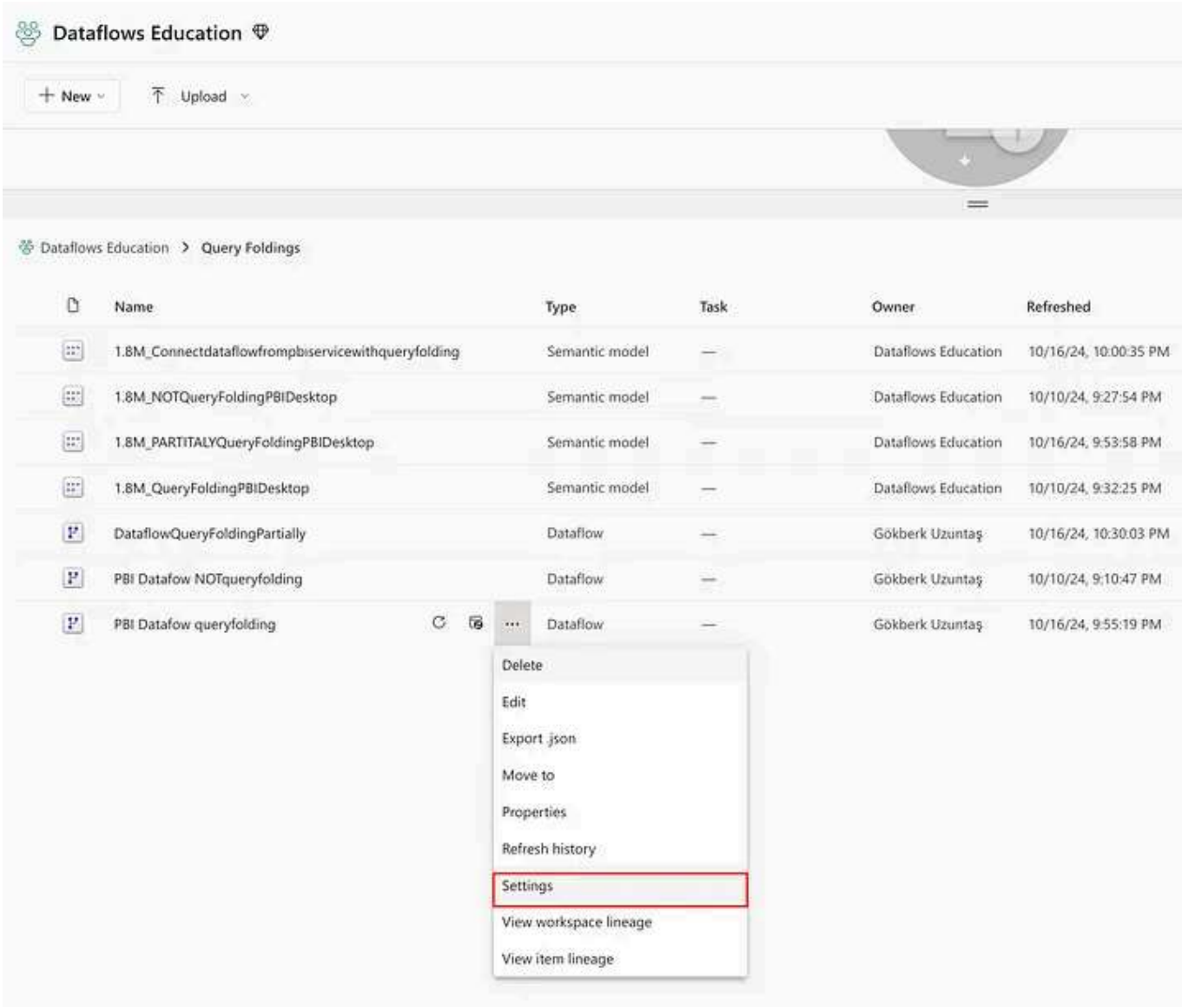


The dialog box below indicates that query folding has been successfully applied to this last column.

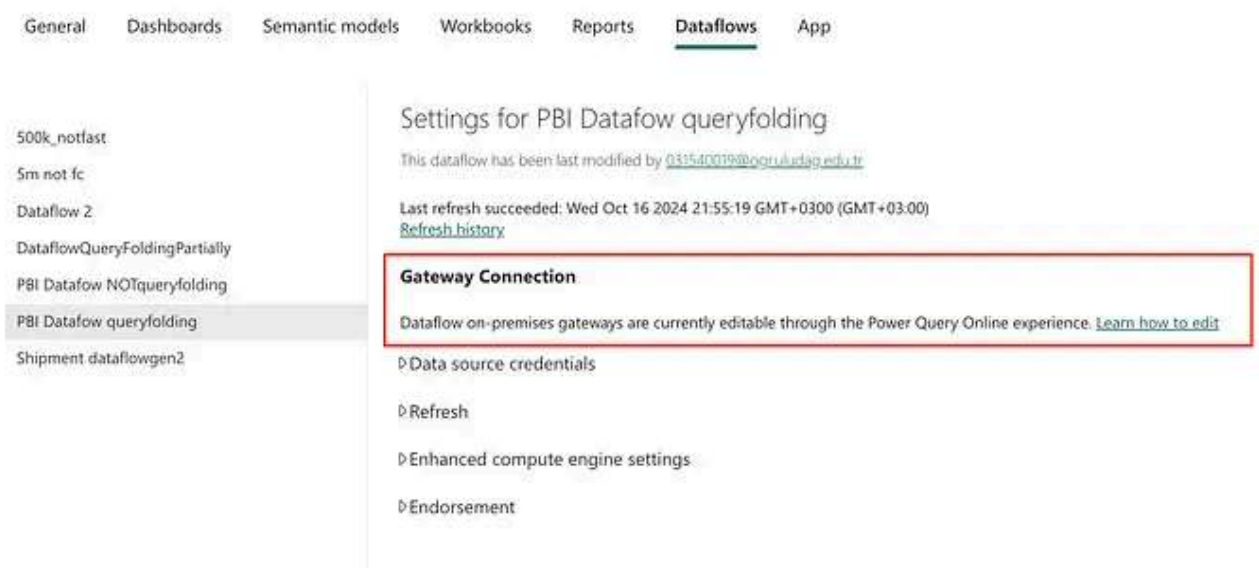
By clicking on “Query Plan” you can gain valuable insights into why a particular query might not fold at a specific step.



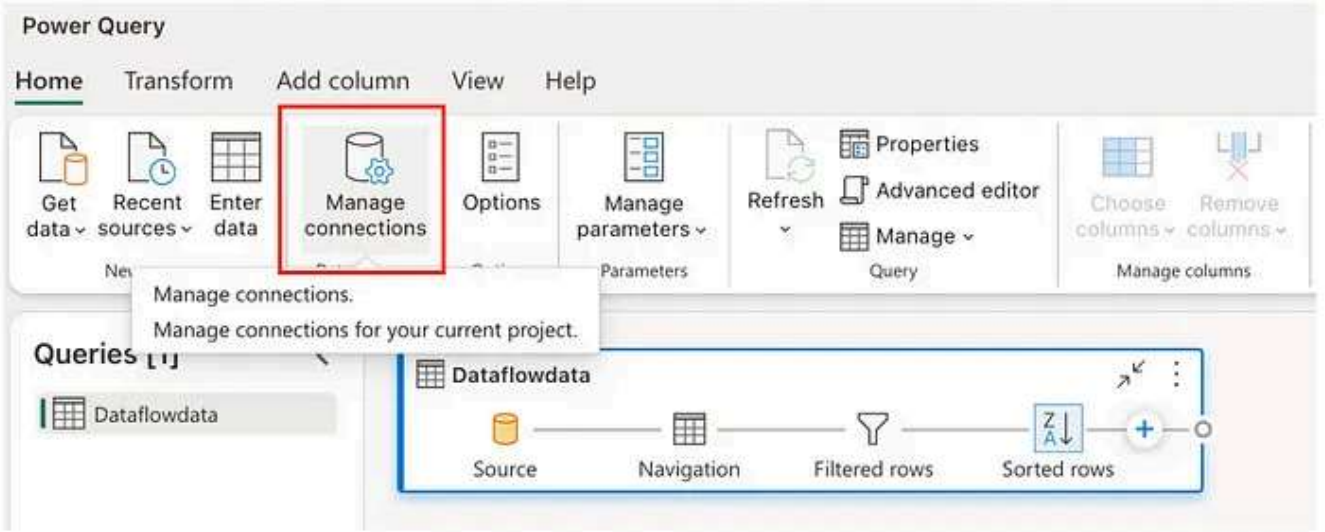
The query folding for the dataflow has been completed. “Save & Close” and “Refresh Now” should be clicked next or schedule refresh. The following step is to check the refresh duration by navigating to the settings in your workspace.



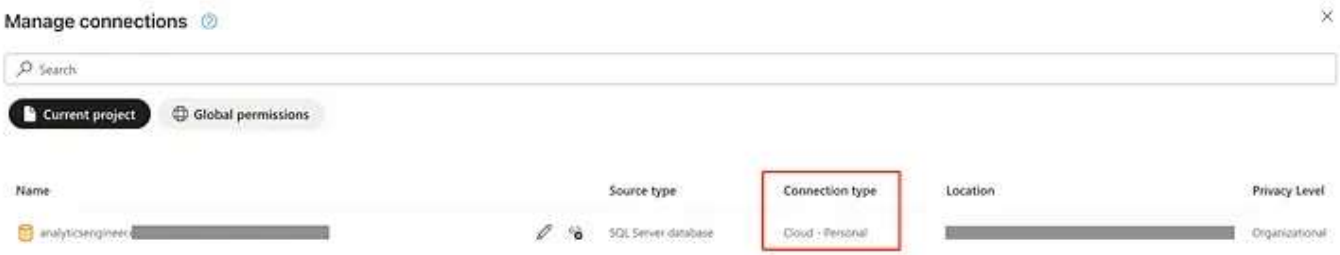
The Gateway Connection is not visible here. For Dataflows, the Gateway connection can be viewed within the Dataflow itself.



Navigate to your dataflow where you'll find the "Manage Connections" option.

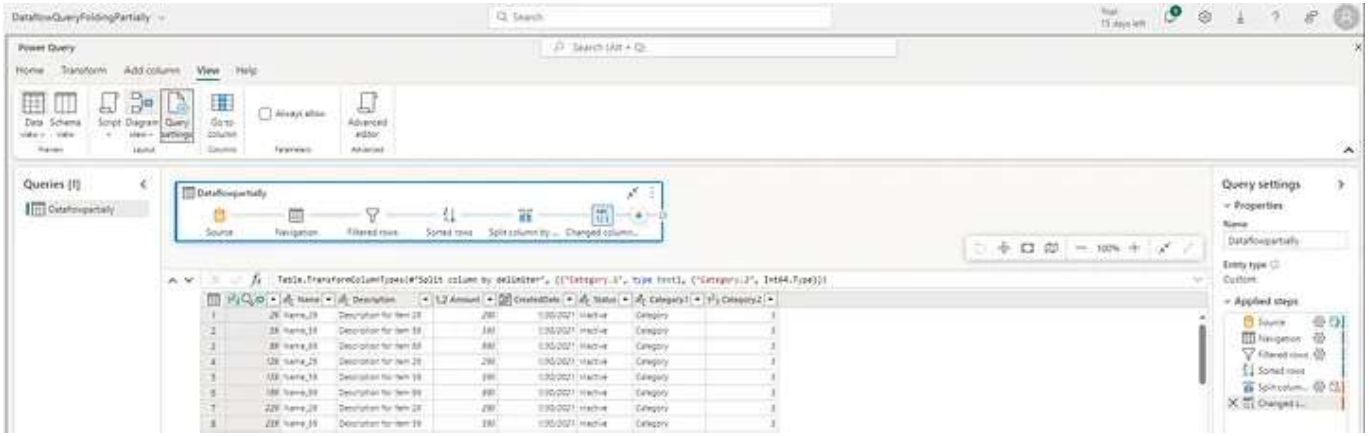


Here, we can track which connection type has been established. Additionally, the connection was initially made in the first step during the "Get Data" process.

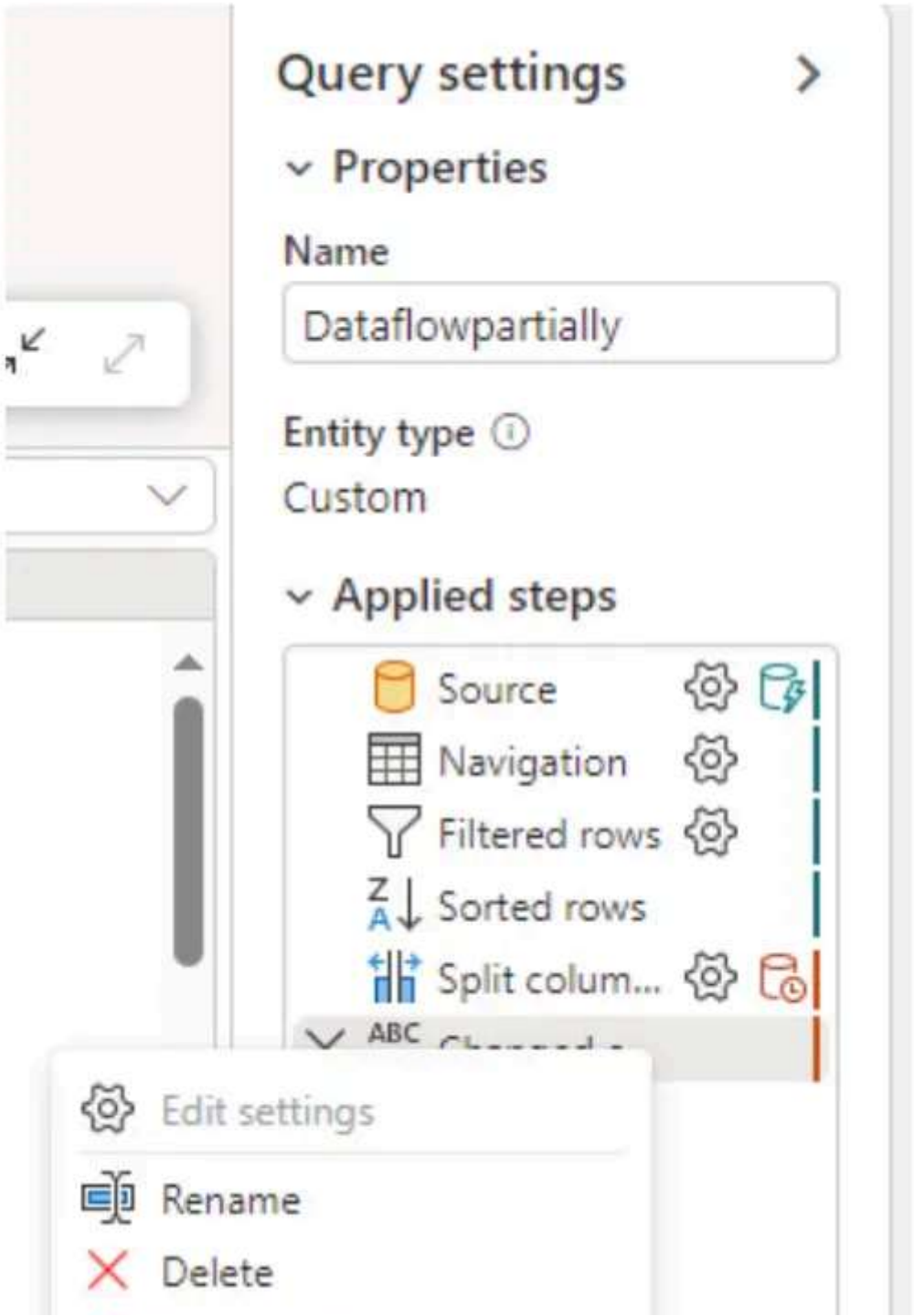


The **full query folding** dataflow refresh completed in 17 seconds.

Second dataflow example demonstrates **partial query folding.** While some steps support folding the last two steps do not.



As shown, the last steps did not fold which is why “View Data Source Query” is greyed out and unavailable to click.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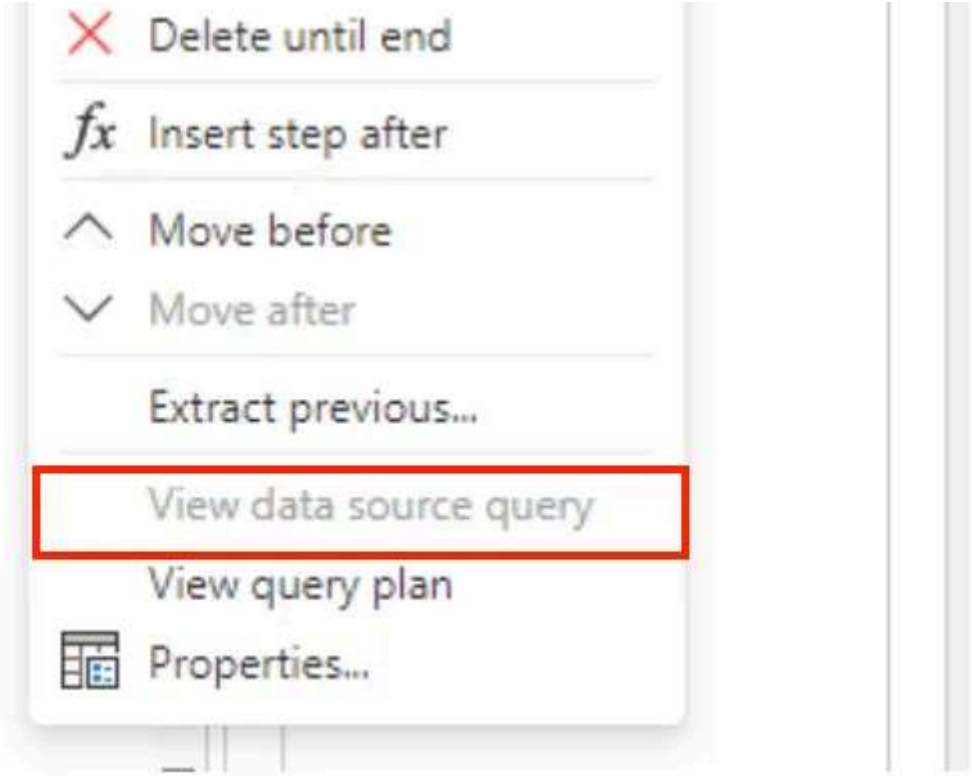
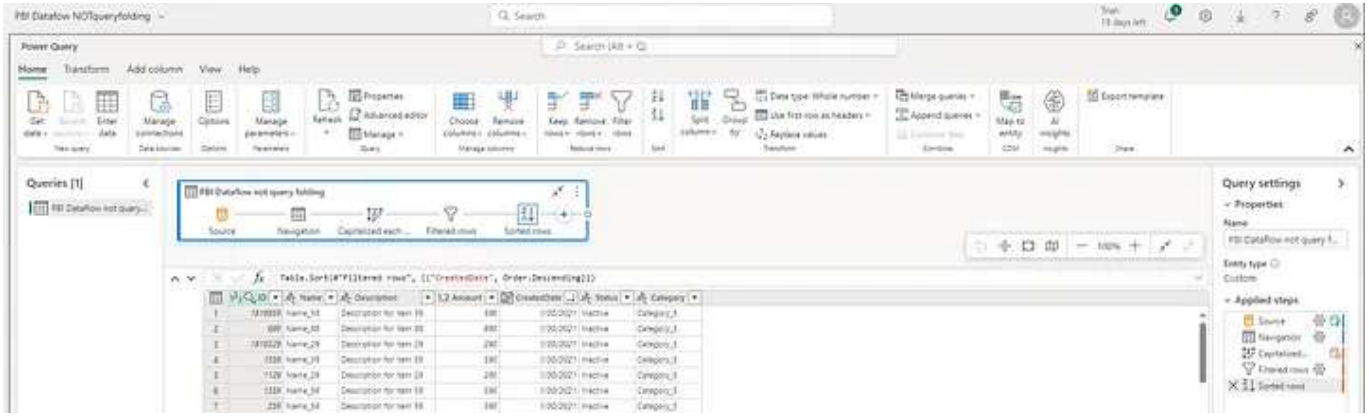


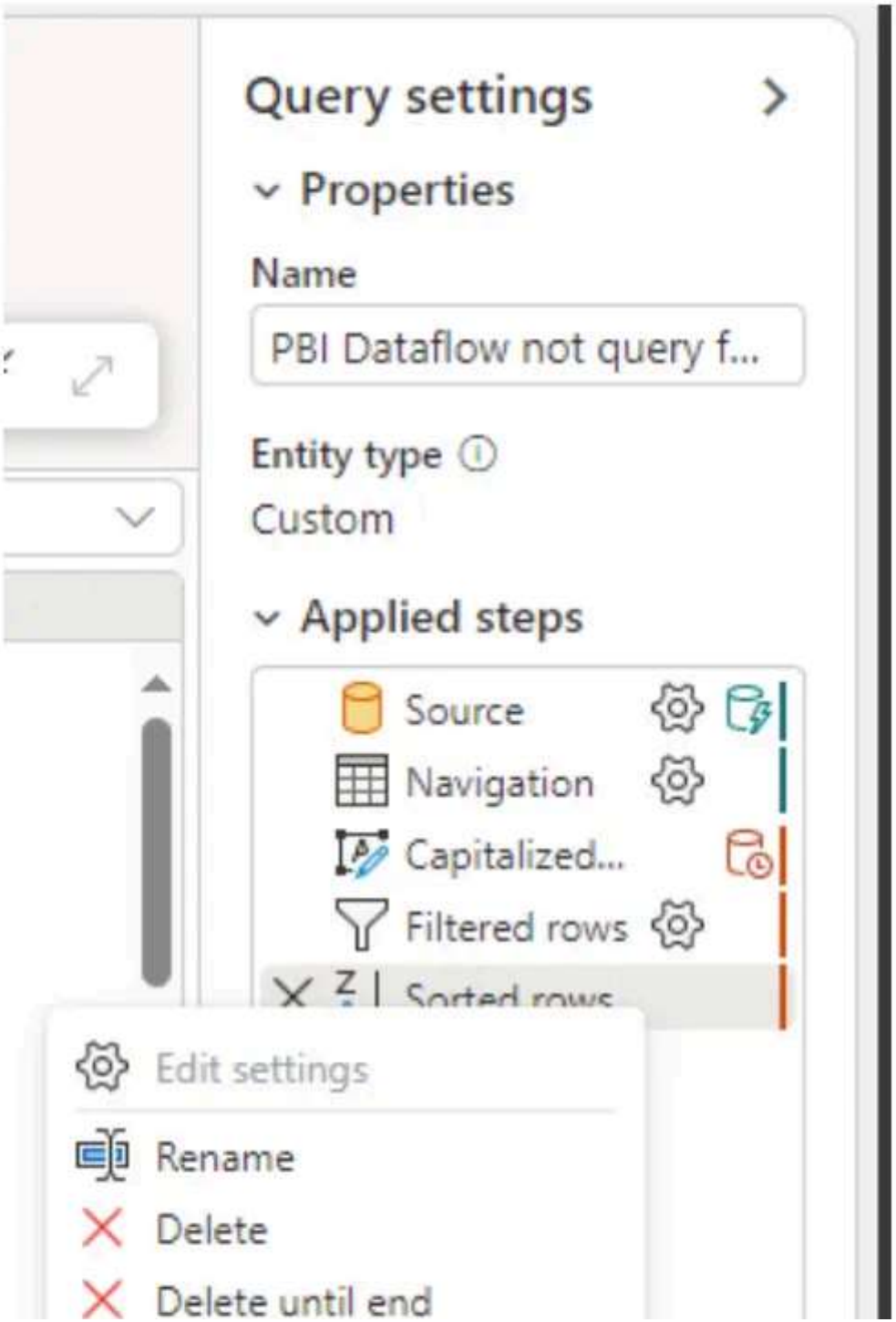
By clicking on “Query Plan” we can see that only two nodes support folding while the rest don’t support.

The **partial query folding** dataflow refresh completed in 27 seconds.

Third dataflow example demonstrates **no query folding.** After Navigation steps doesn't support folding.



As you can see, most of the steps did not fold. As a result "View Data Source Query" is greyed out and cannot be clicked.


Query settings
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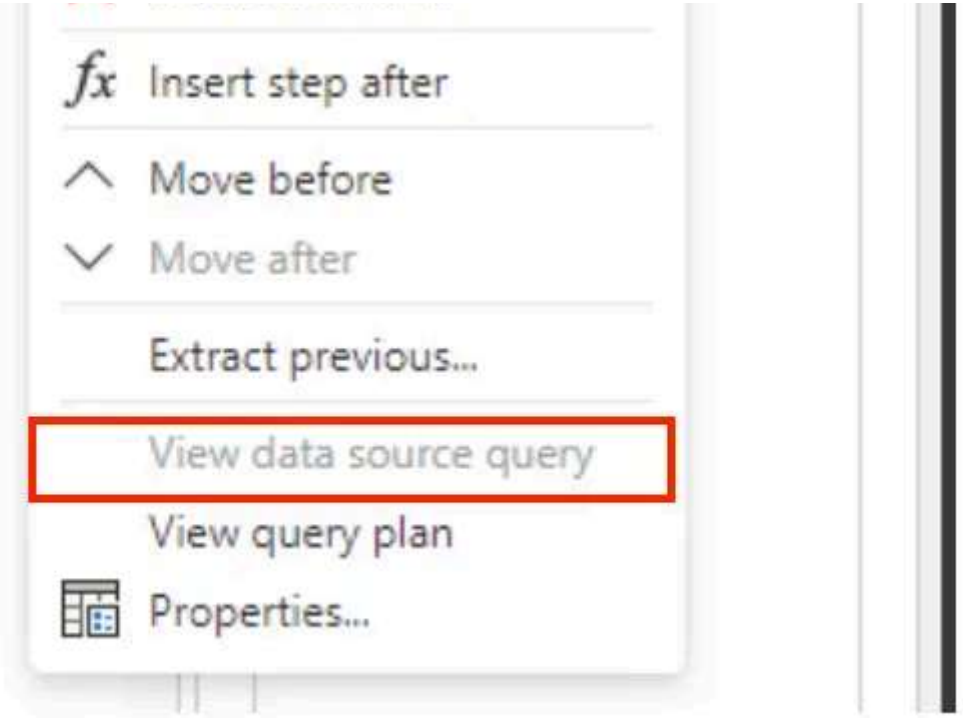
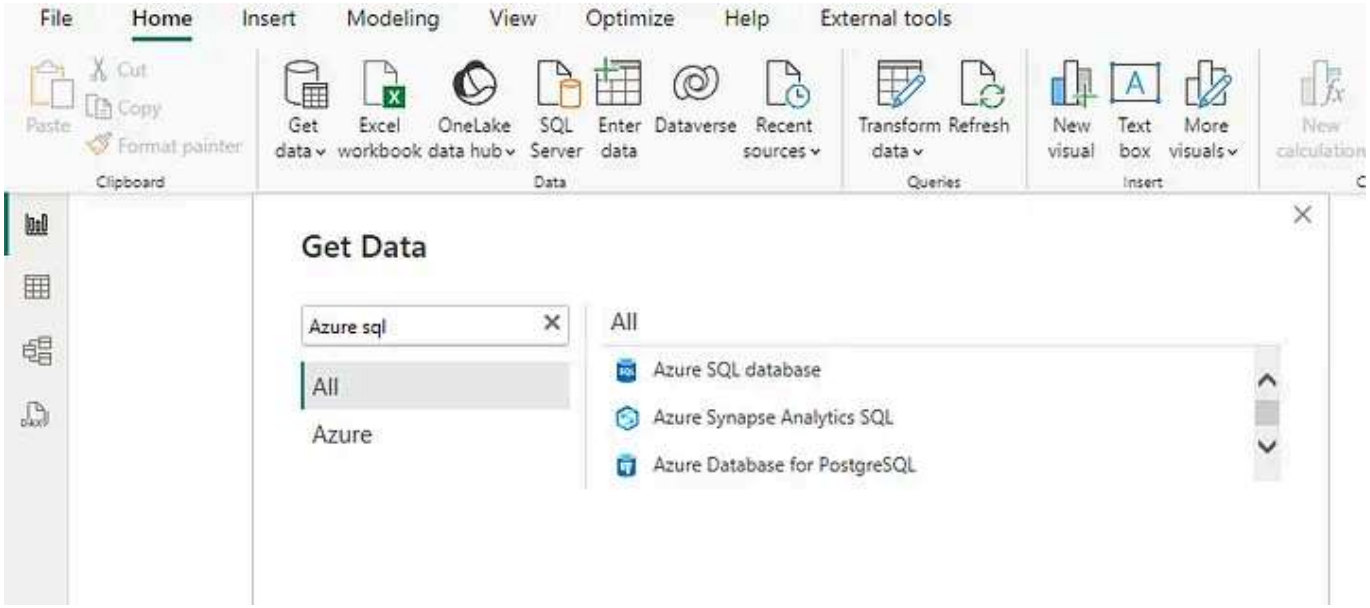


By clicking on “Query Plan” we can see that only two nodes support folding while the rest don’t support.

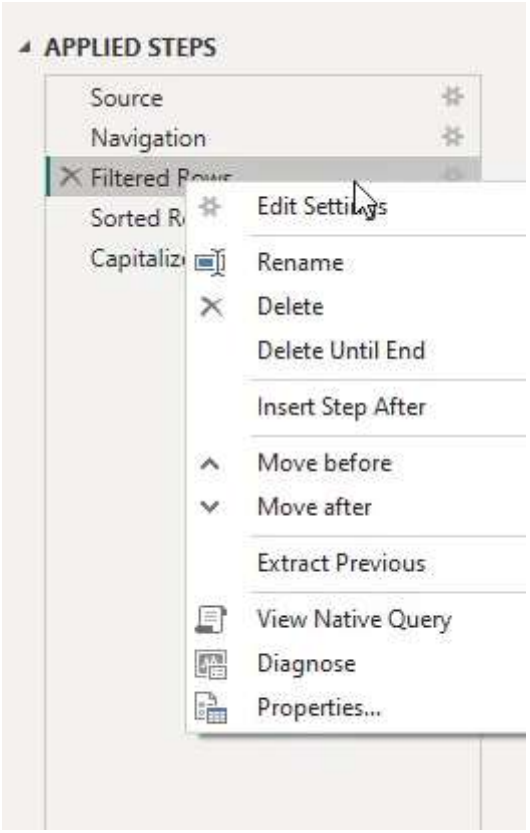
The **no query folding** dataflow refresh completed in 1 minutes 41 seconds.

Case Study: Query Folding in Power BI Desktop & Semantic Model

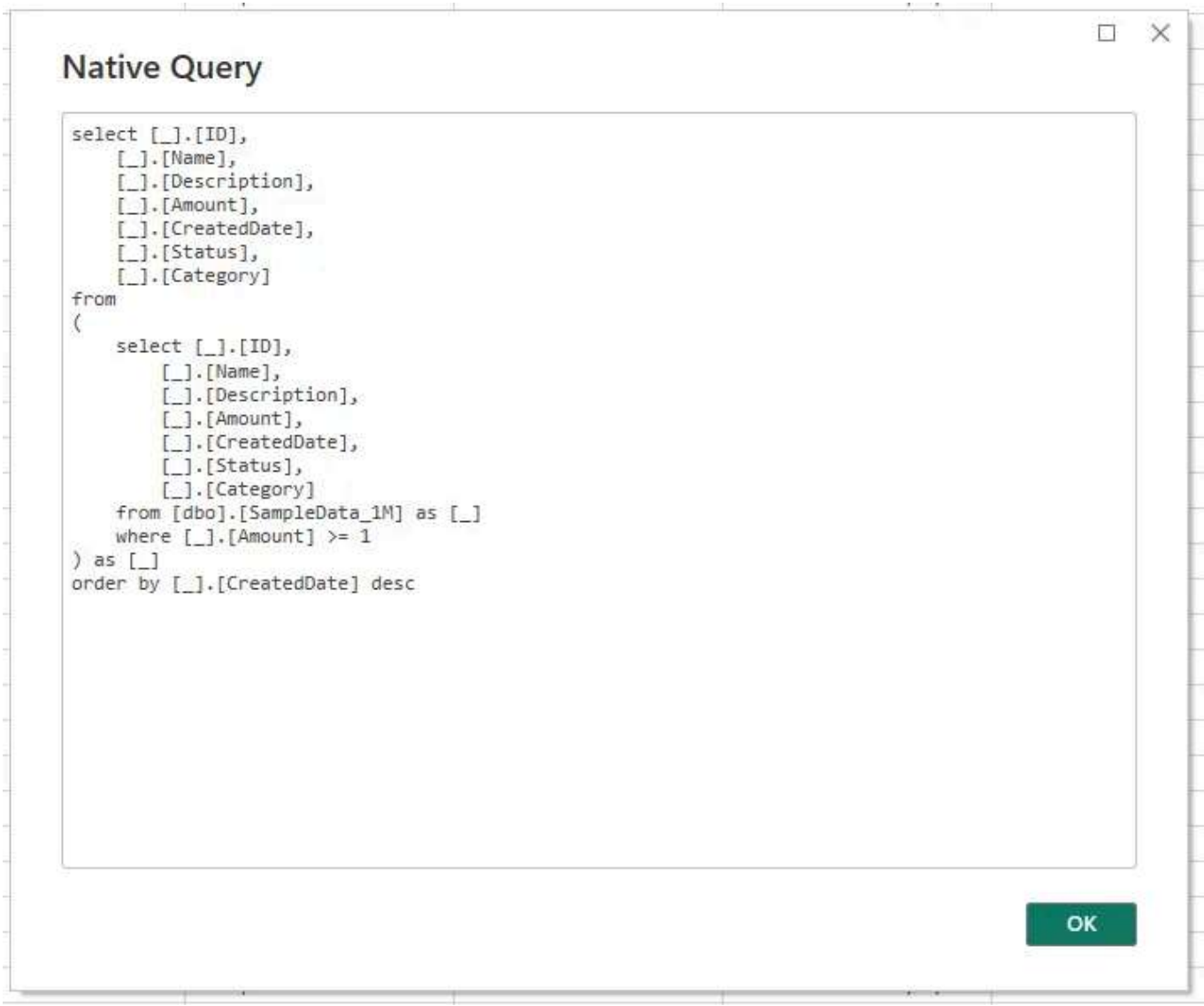
The same demo table from Azure SQL is being used. Now, a demo will be created in Power BI Desktop by retrieving data from Azure SQL.



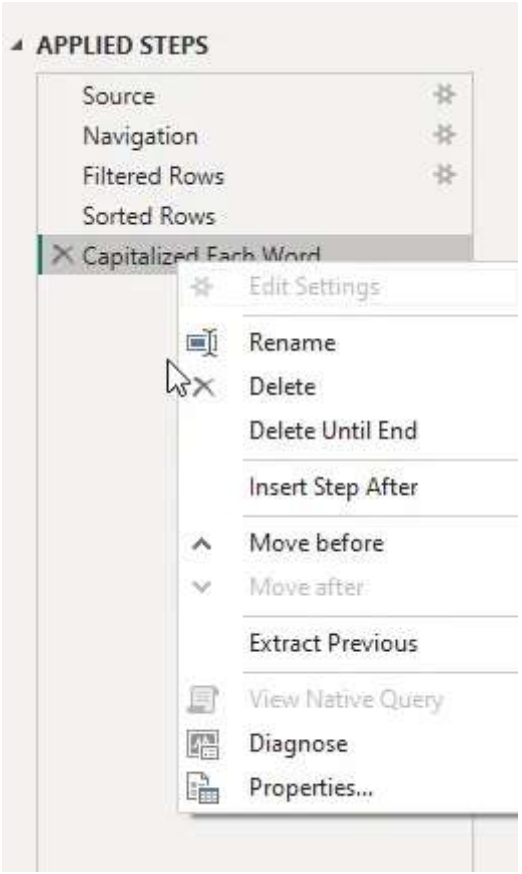
Some transformations were applied in Power Query (Transform Data), but the folding icon is not visible. However, we can verify this by right-clicking on the step and selecting “View Native Query” If this option is not greyed out, query folding is active. Also, you can check with Diagnose option.



The dialog box below indicates that query folding has been successfully applied to this last column.



If an additional step that doesn't support folding is added "View Native Query" will be greyed out for last step.



Lastly, three reports one with full query folding, one with partial query folding and one with no query folding were published to Power BI Service to compare refresh times.

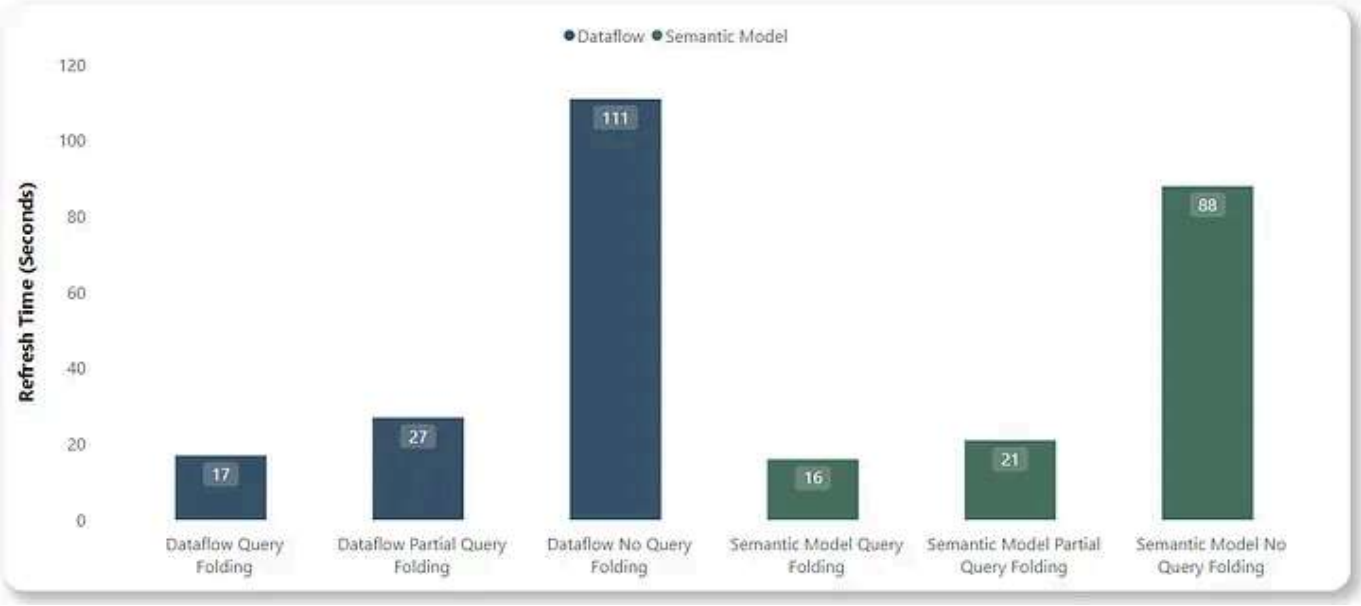
The **semantic model that has query folding** dataflow refresh completed in 16 seconds.

The **semantic model that has partial query folding** dataflow refresh completed in 21 seconds.

The **semantic model that has no query folding** dataflow refresh completed in 1 minutes 28 seconds.

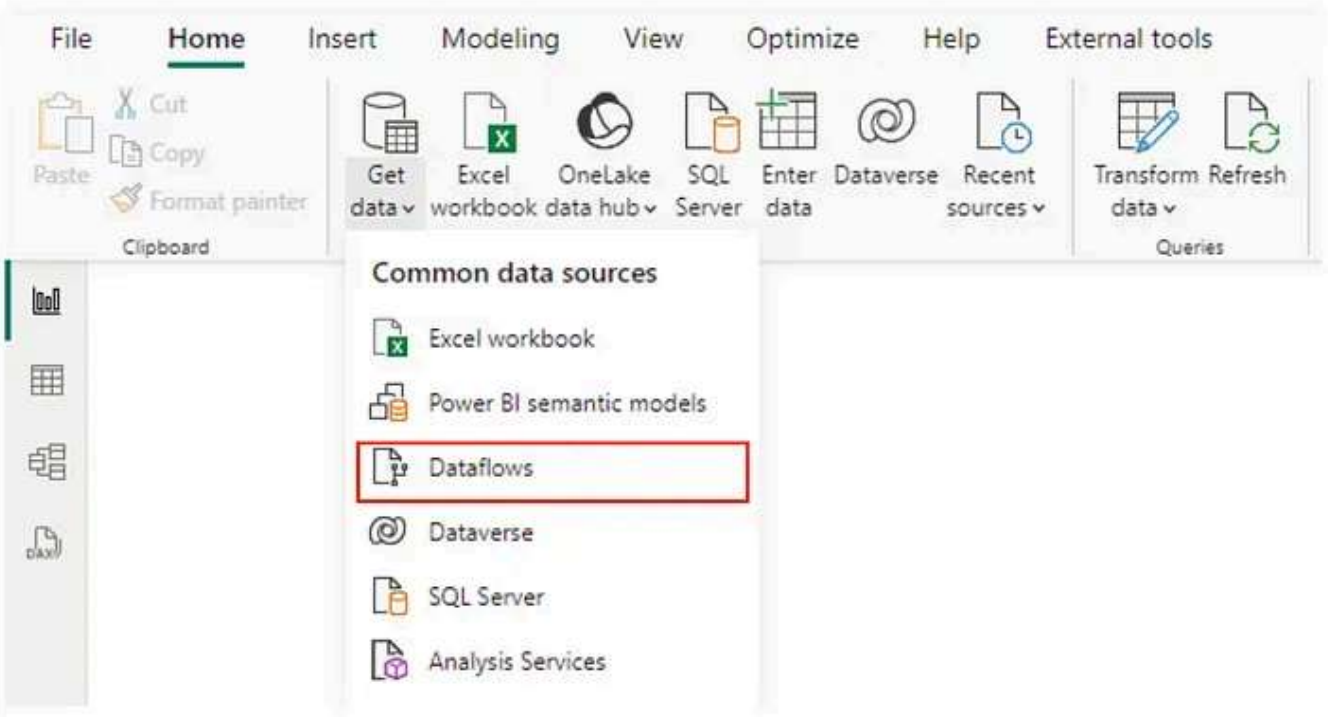
Summary of Refresh Times (in Seconds)

As seen in the graph, we can clearly see the significant difference between queries that support folding and those that do not.



Bonus: Retrieving Data in Power BI Desktop from Power BI Dataflow

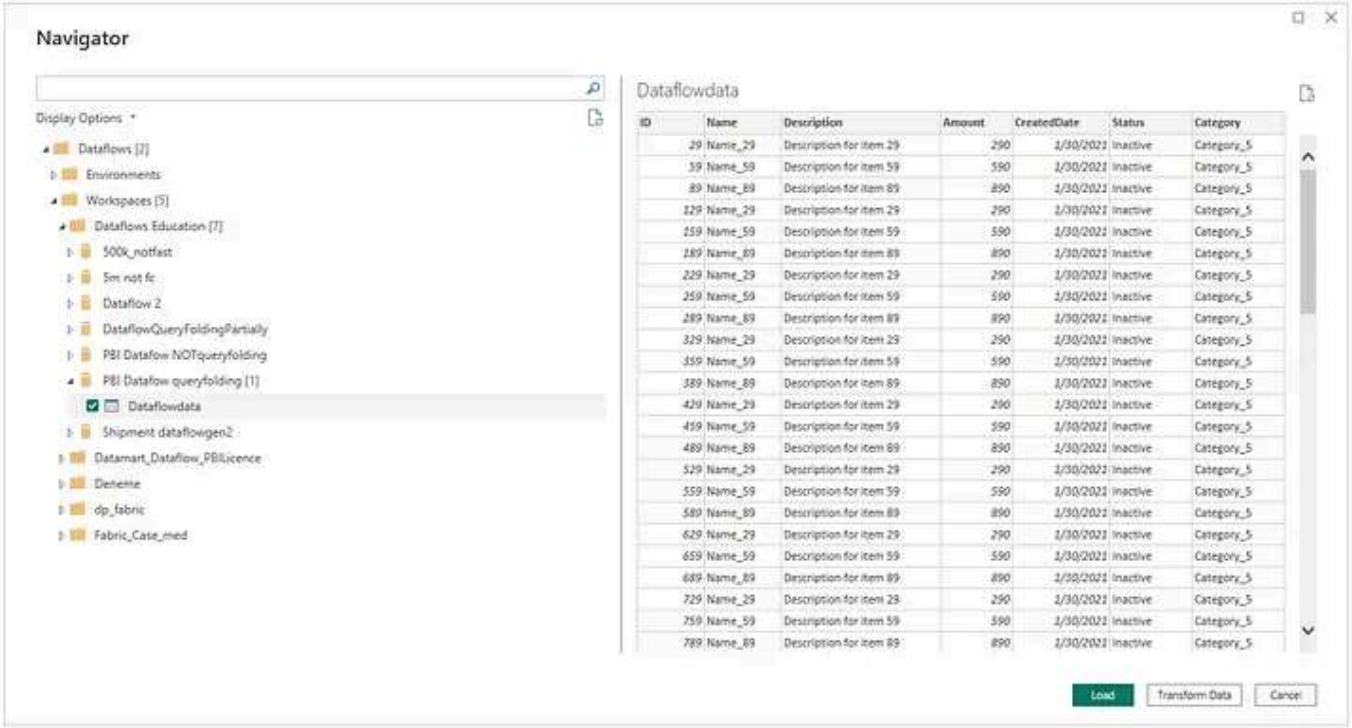
At the beginning, an example of a dataflow supporting full query folding was demonstrated. Currently, data is being retrieved from the Power BI dataflow that was created. **These results apply to the example I conducted on my end. It does not mean that you will encounter the same refresh times in every case, as shown in the image below.**



From the navigator, two different files are seen: Environments and Workspace. Environments are for Power Apps Dataflow, Workspace is for

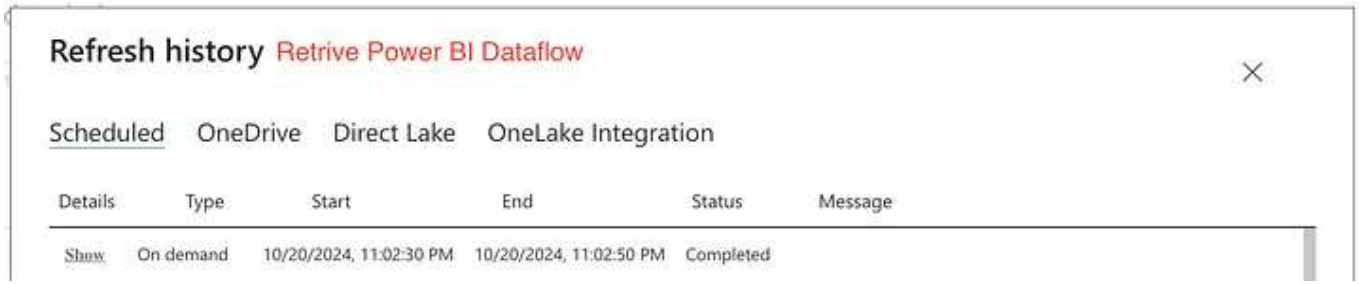
Power BI Dataflow and Fabric Dataflow.

The Dataflow created for the demo, which supports full query folding is clicked.



No steps have done in Transform Data (Power Query) and the report published into Power BI Service.

The **semantic model that Retrive Power BI Dataflow(No Additional applied steps in Local Power Query)** dataflow refresh completed in 20 seconds.



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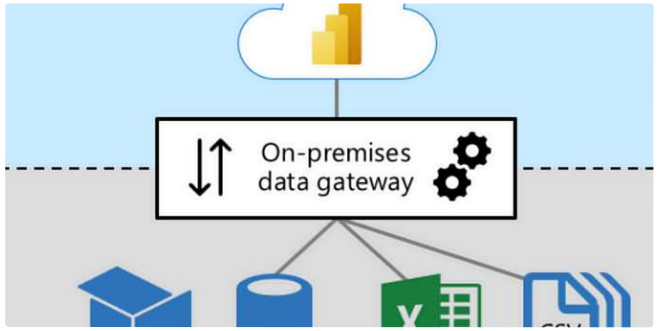

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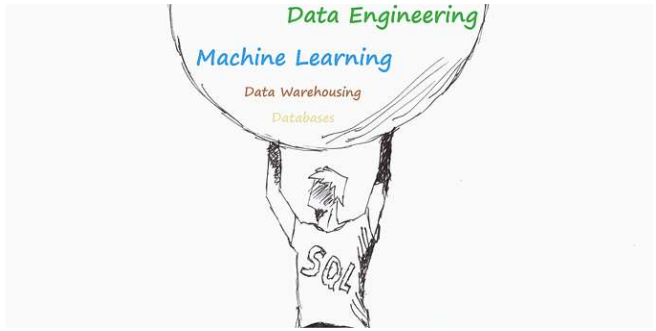

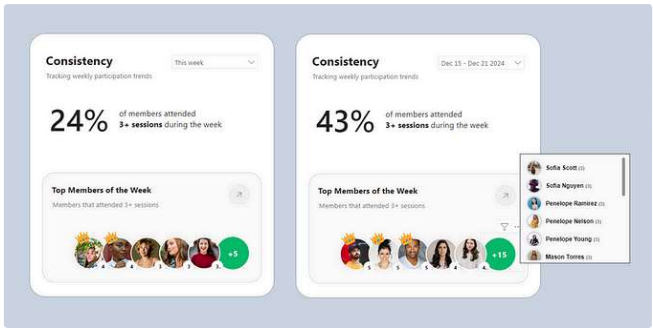

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