



Query Folding in Power BI

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Data Platform MVP





Agenda

- Query Folding?
 - What, How, Why
- Constraints
- Query diagnostics
- Value.NativeQuery
- Demo, Demo, Demo!





In the beginning, there was...





But then...

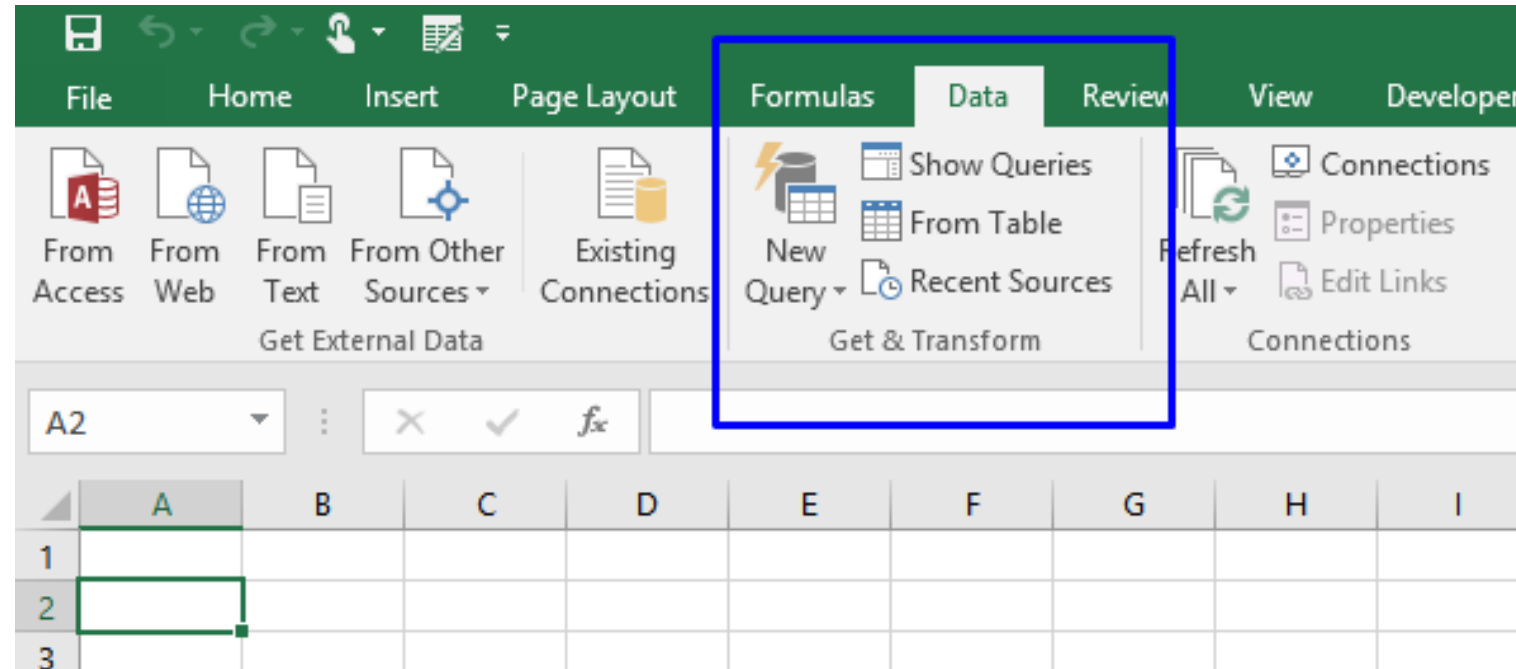


+





Power Query





Power Query

New dataflow (unsaved)

Power Query

Edit queries

Get data Refresh Options Manage columns Transform table Reduce rows Add column

COR transaction_status

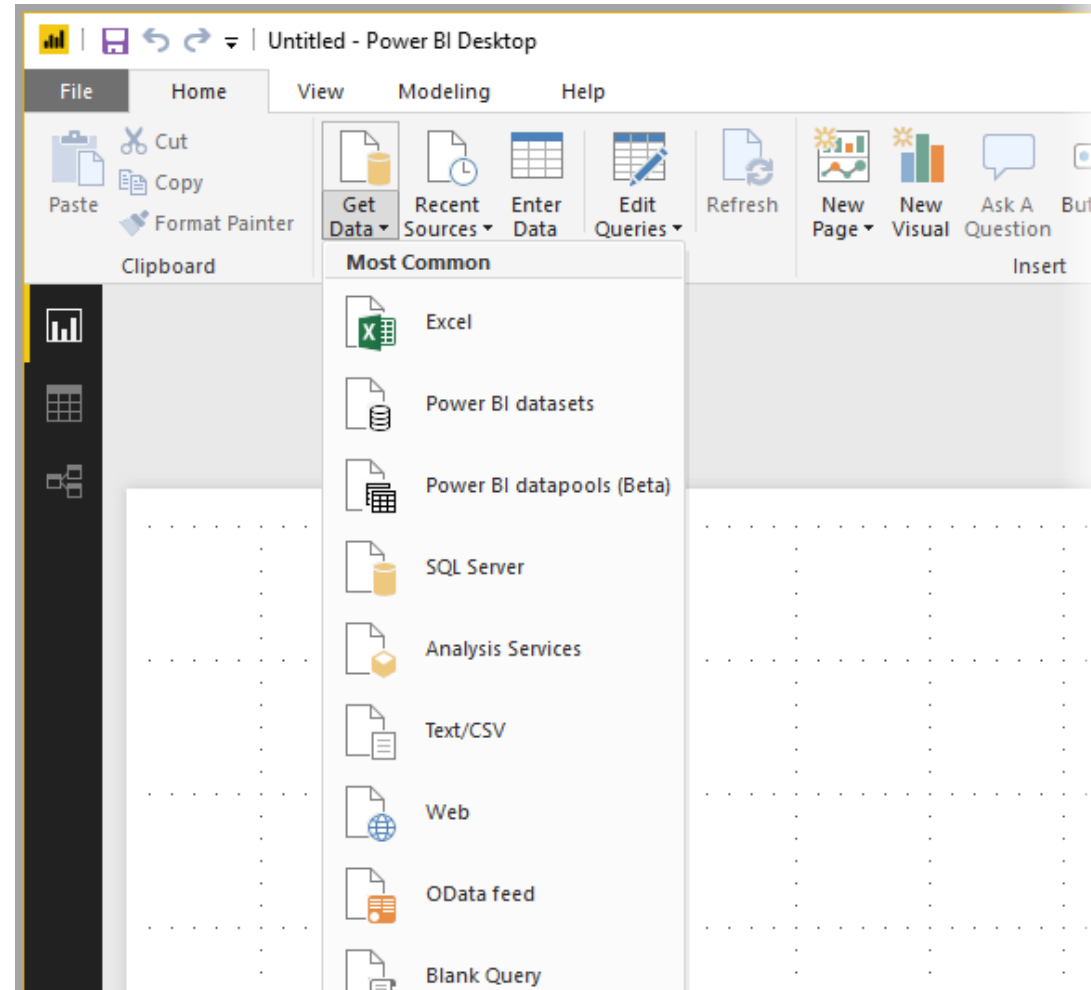
Source{[Schema, "transaction_status"]}[Data]

	meta_dt_load	meta_nm	meta_dt_reportdate	meta_corr_nr
1	10/3/2018, 8:14:00 PM	EM_MIFID_cor	10/3/2018	
2	10/2/2018, 3:01:00 PM	EM_MIFID_xm	10/3/2018	
3	10/2/2018, 3:01:00 PM	EM_MIFID_xm	10/3/2018	
4	10/2/2018, 3:01:00 PM	EM_MIFID_xm	10/3/2018	

- Group by
- Use first row as headers
- Use headers as first row
- Transpose
- Reverse rows
- Count rows



Power Query



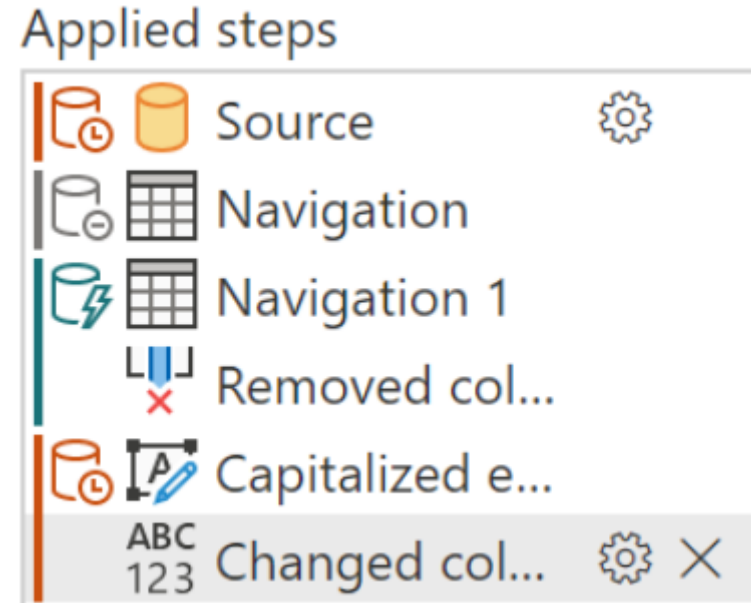
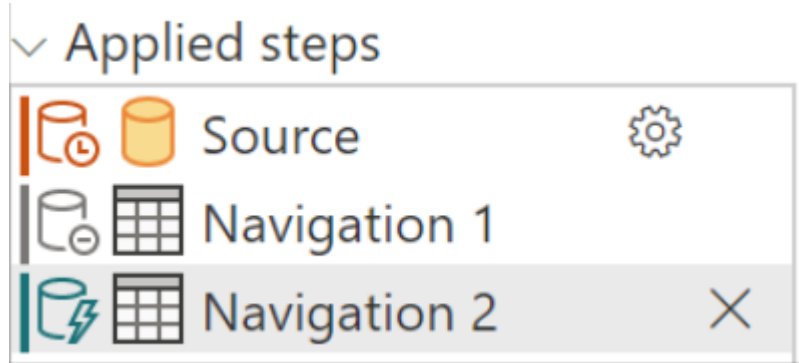


Next-level Query Folding





Step Folding Indicators in PQO





Step Folding Indicators in PQO



Folding



Not folding



Might fold



Opaque



Unknown






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Fact Movement



Power BI Summit



Transformation pushed back to data source



From M to SQL, MySQL, OData, etc





More efficient data processing





Partial folding





Important because...

- Import model tables
- DirectQuery and Dual storage mode tables
- Incremental refresh





Folding with Incremental Refresh

Incremental refresh

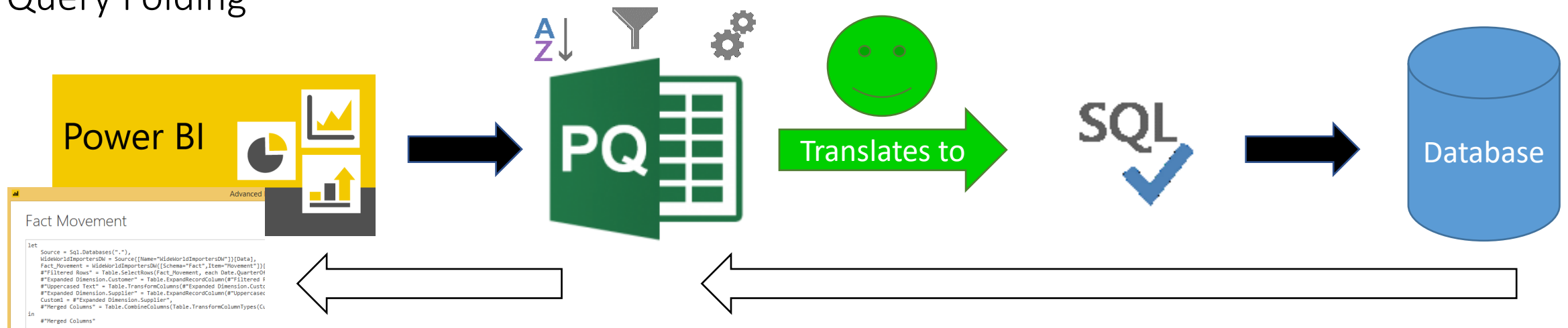


Unable to confirm if the M query can be folded. It is not recommended to use incremental refresh with non-foldable queries. [Learn more](#)

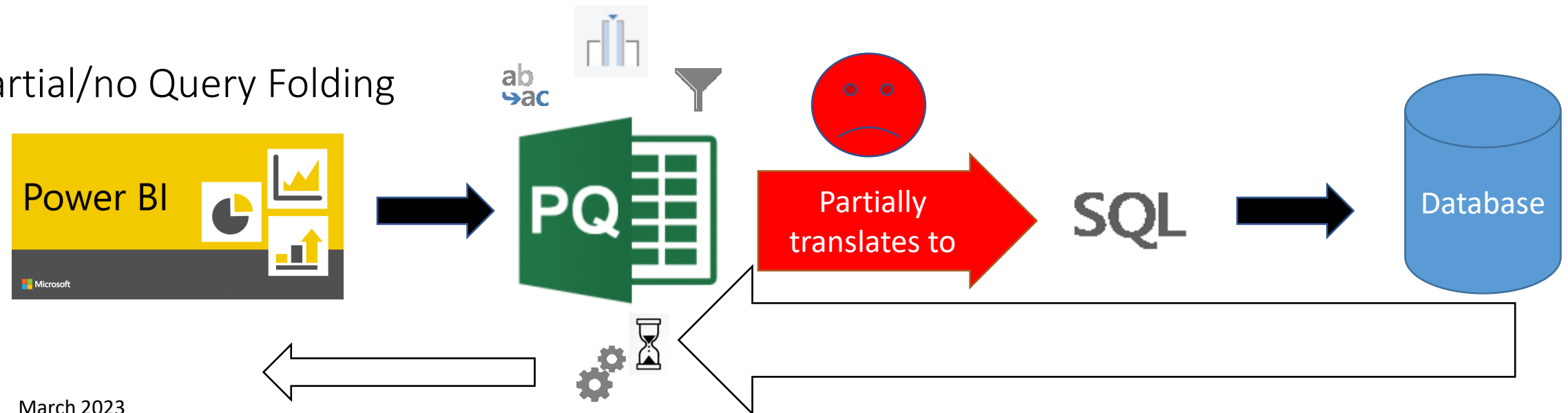
You can improve the speed of refresh for large tables by using incremental refresh. This setting will apply once you've published a report to the Power BI service.



Query Folding



Partial/no Query Folding





To Fold or Not To Fold

- Import mode

SQL Server database

Server ①

Database (optional)

Data Connectivity mode ①

☒ Import

☐ DirectQuery

Advanced options

Command timeout in minutes (optional)

SQL statement (optional, requires database)

☒ Include relationship columns

☐ Navigate using full hierarchy

☐ Enable SQL Server Failover support

OK

Cancel

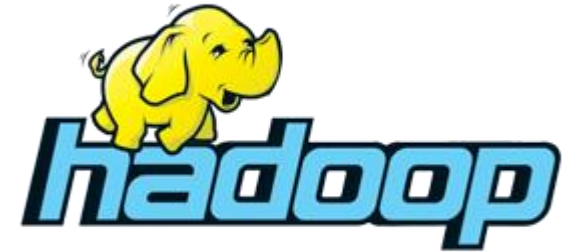




Supported Data Sources



ORACLE®





Supported Transformations

(most commonly used)



Filter



Sort



(Un)Pivot



String
Manipulations



Top Rows



Join
(Append)



Group By



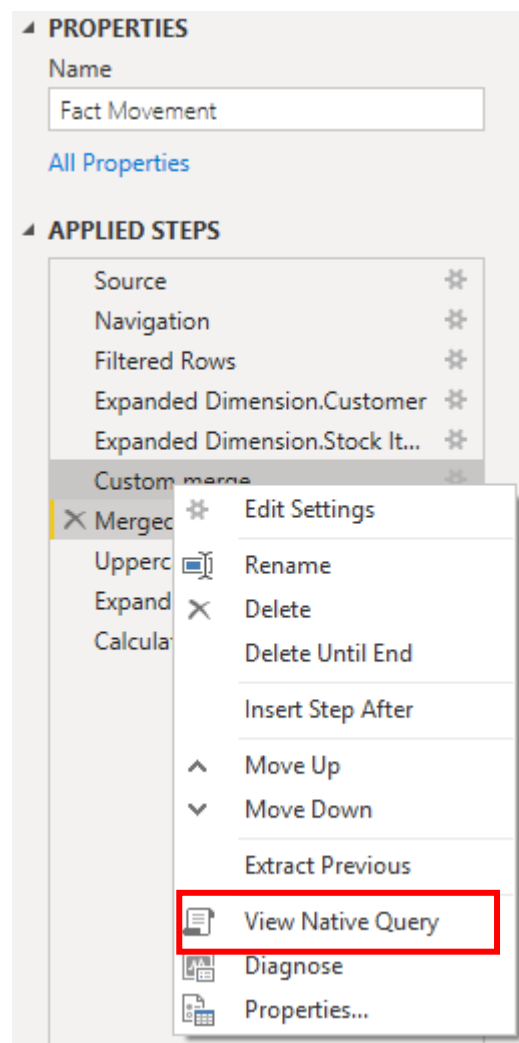
March 2023
Power BI Summit

The screenshot shows the SQL Server Enterprise Manager interface. At the top, there's a menu bar (File, Edit, View, Replay, Tools, Window, Help) and a toolbar. Below that, a tree view on the left shows the database structure. The main pane displays a query window titled "SQL:BatchStarting". The query is as follows:

```
select top 1000
[Outer].[Movement Key],
[Outer].[Date Key],
[Outer].[Stock Item Key],
[Outer].[Customer Key2],
[Outer].[Supplier Key2],
[Outer].[Transaction Type Key],
[Outer].[WWI Stock Item Transaction ID],
[Outer].[WWI Invoice ID],
[Outer].[WWI Purchase Order ID],
[Outer].[Quantity],
[Outer].[Lineage Key2],
[Outer].[Category2],
[Outer].[tO_0],
[Inner].[Primary Contact]
from
(
    select [_].[Movement Key] as [Movement Key],
           [_].[Date Key] as [Date Key],
           [_].[Stock Item Key] as [Stock Item Key],
           [_].[Customer Key2] as [Customer Key2],
           [_].[Supplier Key] as [Supplier Key2],
           [_].[Transaction Type Key] as [Transaction Type Key],
           [_].[WWI Stock Item Transaction ID] as [WWI Stock Item Transaction ID],
           [_].[WWI Invoice ID] as [WWI Invoice ID],
           [_].[WWI Purchase Order ID] as [WWI Purchase Order ID],
           [_].[Quantity] as [Quantity],
           [_].[Lineage Key2] as [Lineage Key2],
           [_].[Category] as [Category2],
           upper([_].[Customer]) as [tO_0]
    from
        (
            select [$Outer].[Movement Key],
                   [$Outer].[Date Key],
                   [$Outer].[Stock Item Key],
                   [$Outer].[Customer Key2],
                   [$Outer].[Supplier Key],
                   [$Outer].[Transaction Type Key],
                   [$Outer].[WWI Stock Item Transaction ID],
                   [$Outer].[WWI Invoice ID]
```

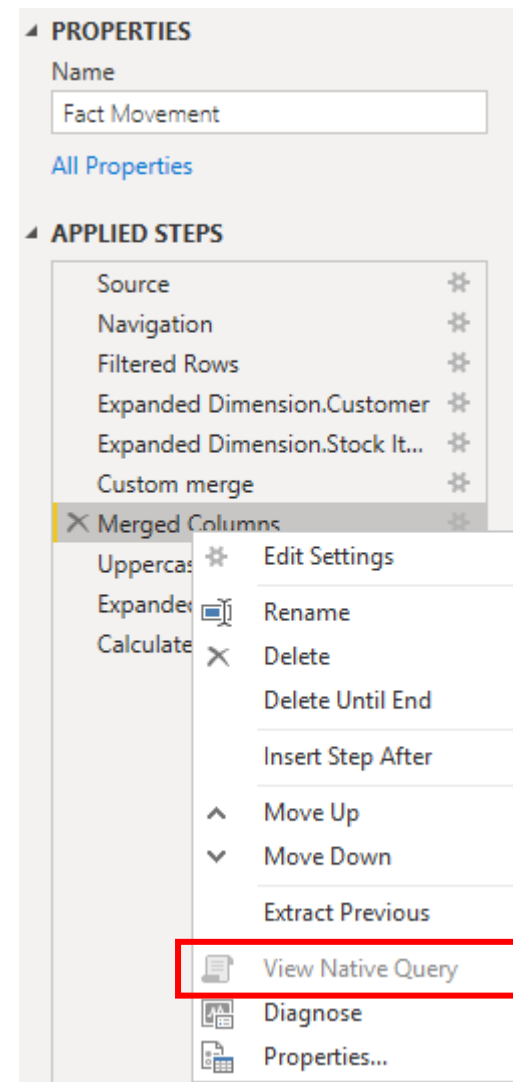
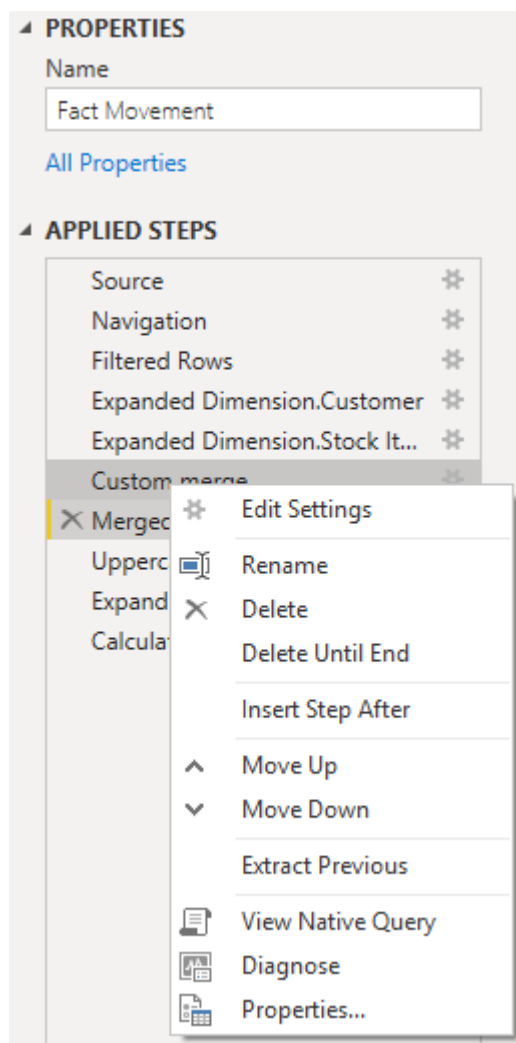


Is My Query Folding? - SQL



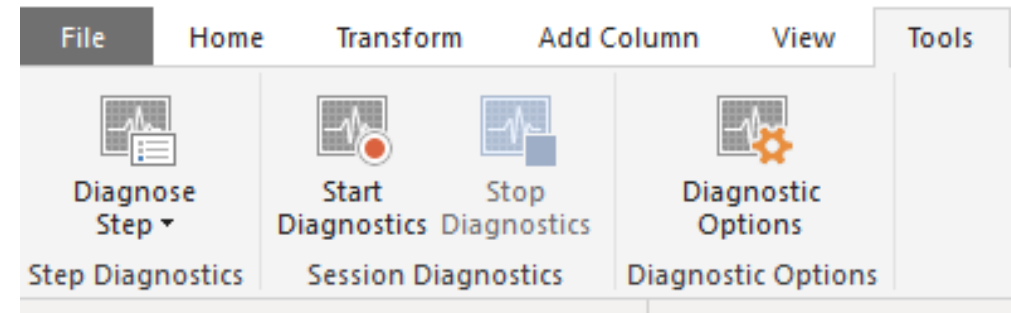
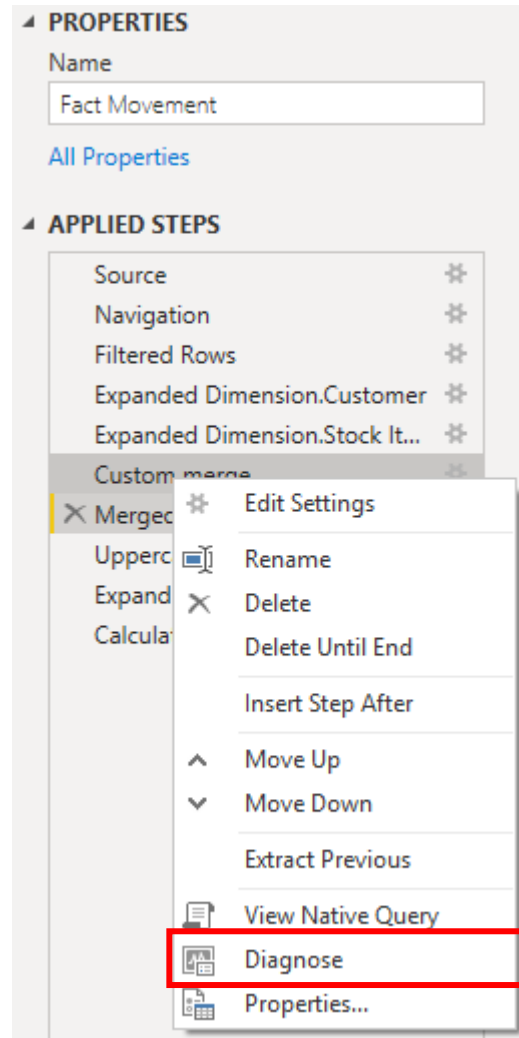


Is My Query Folding? - SQL





Is My Query Folding? - SQL





Query Diagnostics Options

Usage Data

Diagnostics

Preview features

Auto recovery

Report settings

CURRENT FILE

Data Load

Regional Settings

Privacy

Auto recovery

Query Diagnostics

☒ Enable in Report and Query Editor (may require running as admin)

☐ Enable in Query Editor (does not require running as admin)

Diagnostics Level

☒ Aggregated ⓘ

☒ Detailed ⓘ

Additional Diagnostics

☒ Performance counters ⓘ

☐ Data privacy partitions ⓘ



Is My Query Folding? - OData

Progress Telerik Fiddler Web Debugger

File Edit Rules Tools View Help

WinConfig Replay Go Stream Decode Keep: All sessions Any Process

#	Result	Protocol	Host	URL
1	200	HTTPS	api.parliament.uk	/Staging/odata
2	200	HTTPS	api.parliament.uk	/odata/\$metadata
3	200	HTTPS	api.parliament.uk	/Staging/odata/GovernmentOrganisation?\$top=1000
4	200	HTTPS	api.parliament.uk	/Staging/odata
5	200	HTTPS	api.parliament.uk	/odata/\$metadata

Source: Chris Webb



Is My Query Folding? - SSAS

The screenshot shows the Power Query Editor interface. The 'Cube Tools' menu is highlighted with a red box, and the 'Manage' option is visible. The query is named 'Adventure Works' and contains two columns: 'Customer.Gender' and 'Internet Sales Amount'. The data is as follows:

	Customer.Gender	Internet Sales Amount
1	Female	14813618.68
2	Male	14545058.55

The screenshot shows the Power Query Editor interface. The 'Table' menu is highlighted with a red box, and the 'Index' option is visible. The query is named 'Adventure Works' and contains three columns: 'Customer.Gender', 'Internet Sales Amount', and 'Index'. The data is as follows:

	Customer.Gender	Internet Sales Amount	Index
1	Female	14813618.68	0
2	Male	14545058.55	1

Source: Chris Webb



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Limitations

- Unsupported data sources/transformations
- Data source privacy level
- Native database query





Limitations – Unsupported Transformations

- Merge/append queries from different sources
- Split column
- Add Index column
- Table.Buffer() M function
- Complex Group By
- Remove errors, duplicates
- DateTime to Date (Transform vs Date Only)
- And more...





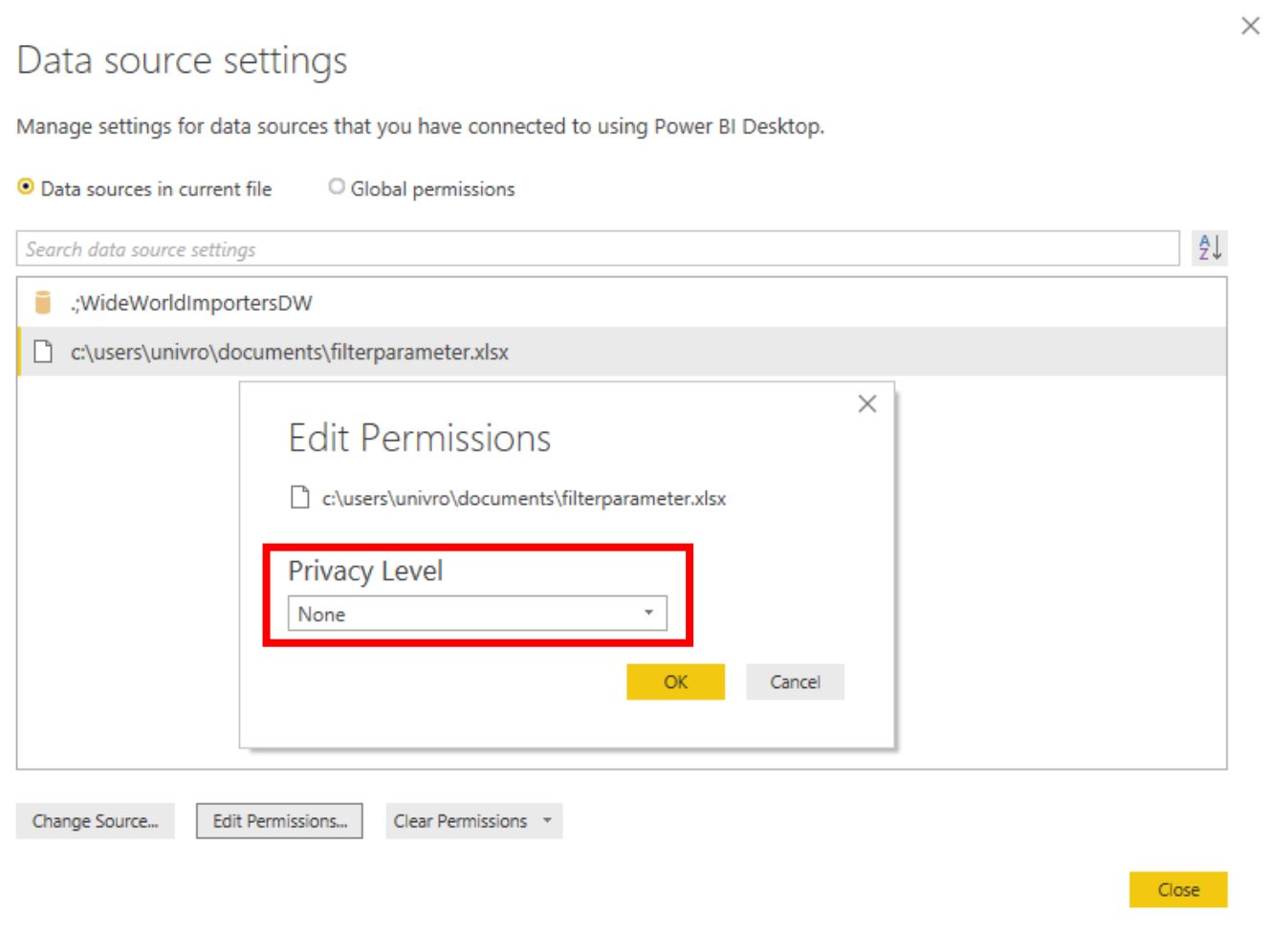
Limitations – Unsupported Transformations

- Merge/append queries from different sources
- Split column
- Add Index column
- Table.Buffer() M function
- Complex Group By
- Remove errors, duplicates
- **DateTime to Date (Transform vs Date Only)**
- And more...





Limitations – Data source privacy level





Limitations – Data source privacy level

```
FROM
(
    select [$Outer].[Movement Key],
           [$Outer].[Date Key],
           [$Outer].[Stock Item Key],
           [$Outer].[Customer Key],
           [$Outer].[Supplier Key],
           [$Outer].[Transaction Type Key],
           [$Outer].[WWI Stock Item Transaction ID],
           [$Outer].[WWI Invoice ID],
           [$Outer].[WWI Purchase Order ID],
           [$Outer].[Quantity],
           [$Outer].[Lineage Key],
           [$Inner].[Calendar Year]
    from [Fact].[Movement] as [$Outer]
    left outer join [Dimension].[Date] as [$Inner] on ([$Outer].[Date Key] = [$Inner].[Date Key])
) as [_]
where [_].[Calendar Year] = 2018 and [_].[Calendar Year] is not null
) as [_]
as [$Outer]
```



Limitations – Data source privacy level

Data source settings

Manage settings for data sources that you have connected to using Power BI Desktop.

☒ Data sources in current file ☐ Global permissions

Search data source settings

.;WideWorldImportersDW

c:\users\univro\documents\filterparameter.xlsx

Edit Permissions

c:\users\univro\documents\filterparameter.xlsx

Privacy Level

Private

OK

Cancel

Change Source...

Edit Permissions...

Clear Permissions



Limitations – Data source privacy level

```
select [$Outer].[Movement Key],
       [$Outer].[Date Key],
       [$Outer].[Stock Item Key],
       [$Outer].[Customer Key],
       [$Outer].[Supplier Key],
       [$Outer].[Transaction Type Key],
       [$Outer].[WWI Stock Item Transaction ID],
       [$Outer].[WWI Invoice ID],
       [$Outer].[WWI Purchase Order ID],
       [$Outer].[Quantity],
       [$Outer].[Lineage Key],
       [$Inner].[Calendar Year]
from [Fact].[Movement] as [$Outer]
left outer join [Dimension].[Date] as [$Inner] on ([$Outer].[
```





Limitations – Native Database Queries

Query the source directly

- PQ isn't sufficient
- Specific requirements/optimizations
- Existing SQL-query
- Stored Procedures





Limitations – Native Database Queries

- Functions on top of the query results aren't folded...
 - ...by default 😊 > Value.NativeQuery
- No guarantees on frequency of execution





Native Database Queries

- Value.NativeQuery
- PostgreSQL enhancement
- Documentation difference

Data connectivity

PostgreSQL connector enhancements

Support for folding over Native Database queries

The PostgreSQL connector has been enhanced with query folding over a native query. You can now paste in a native query when connecting to a PostgreSQL database, with folding capable operations applied on top according to normal Import or Direct Query logic.

The screenshot shows the 'PostgreSQL database' connection dialog box. It includes fields for 'Server' and 'Database'. Under 'Data Connectivity mode', 'Import' is selected. There is an 'Advanced options' section with 'Command timeout in minutes (optional)' and 'SQL statement (optional, requires database)' fields. At the bottom, there are checkboxes for 'Include relationship columns' and 'Navigate using full hierarchy'. 'OK' and 'Cancel' buttons are at the bottom right.





Demo Time!

Demo

Take-aways:

- Filter first, transform later
- View Native Query





Improvements

- Desktop June 2018
 - OData V4 connector enhancements:
 - Use [Implementation="2.0"] in OData.Feed()
- Relative date slicers started working
- Desktop February 2019
 - PBI Premium (& pro!): Incremental refresh query verification
- Desktop September 2019
 - PostgreSQL connector enhancements over a native query (EnableFolding)
- Merging two columns
- Desktop August 2021
 - Value.NativeQuery: PreserveTypes





Wrap-up

- Concept of Query Folding
- Supported data sources, transformations
- View Native Query/Query diagnostics
- Don't write native SQL and add steps afterwards
 - Or use Value.NativeQuery with EnableFolding
- Want to practice?
 - 30 days of Query Folding challenge by Alex Powers





Resources

Power Query documentation:

- [Power Query - Query Folding](#)
- [Query Diagnostics Folding](#)
- [Handling Query Folding](#)

Blogs on Query Folding:

- <https://www.mssqltips.com/sqlservertip/3635/query-folding-in-power-query-to-improve-performance/>
- <http://geekswithblogs.net/darrengosbell/archive/2014/05/16/function-folding-in-powerquery.aspx>
- <https://www.mssqltips.com/sqlservertip/4563/power-bi-native-query-and-query-folding/>
- <https://blog.crossjoin.co.uk/2018/06/27/odata-performance-power-bi/>
- <https://blog.crossjoin.co.uk/2021/09/12/preserving-data-types-with-sql-queries-in-power-query-and-power-bi/>
- <https://bengribaudo.com/blog/2022/03/21/6620/power-query-m-primer-part24-query-folding-ii>
- [30 Days of Query Folding](#)

Power BI Incremental refresh

- [Incremental Refresh Query Folding](#)
- [Service Incremental Refresh - Query Folding](#)
- [Guy In A Cube: Case of the Broken Power BI Incremental Refresh](#)





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and let's connect!

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