

Query Folding in Power BI

Who Are You? <http://bit.ly/query-folding>


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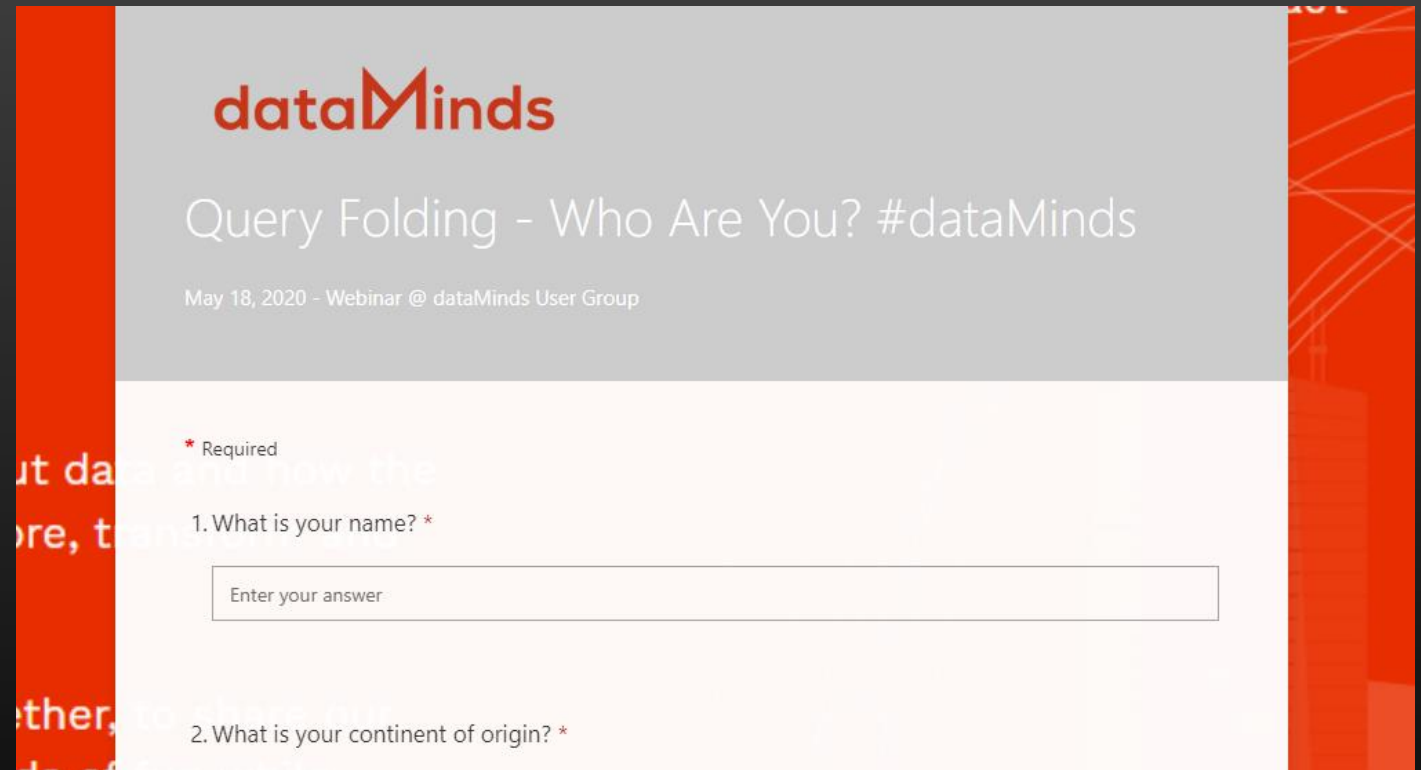
 Power BI Days Dutch chapter co-founder
powerbidays.com



Who Are You? <http://bit.ly/query-folding>

Who Are You?

Check out my blog for a how-to:
www.nickyvv.com/2019/12



The screenshot shows a survey interface for dataMinds. At the top, the dataMinds logo is displayed in red. Below it, the title 'Query Folding - Who Are You? #dataMinds' is shown in a light gray box. Underneath the title, the text 'May 18, 2020 - Webinar @ dataMinds User Group' is visible. The survey questions are listed below, with a red asterisk indicating required fields. The first question is '1. What is your name? *' with a text input field below it containing the placeholder 'Enter your answer'. The second question is '2. What is your continent of origin? *'.

dataMinds

Query Folding - Who Are You? #dataMinds

May 18, 2020 - Webinar @ dataMinds User Group

* Required

1. What is your name? *

Enter your answer

2. What is your continent of origin? *

Who Are You? <http://bit.ly/query-folding>

Agenda

- Power Query
- Query Folding
- Constraints
- Demo

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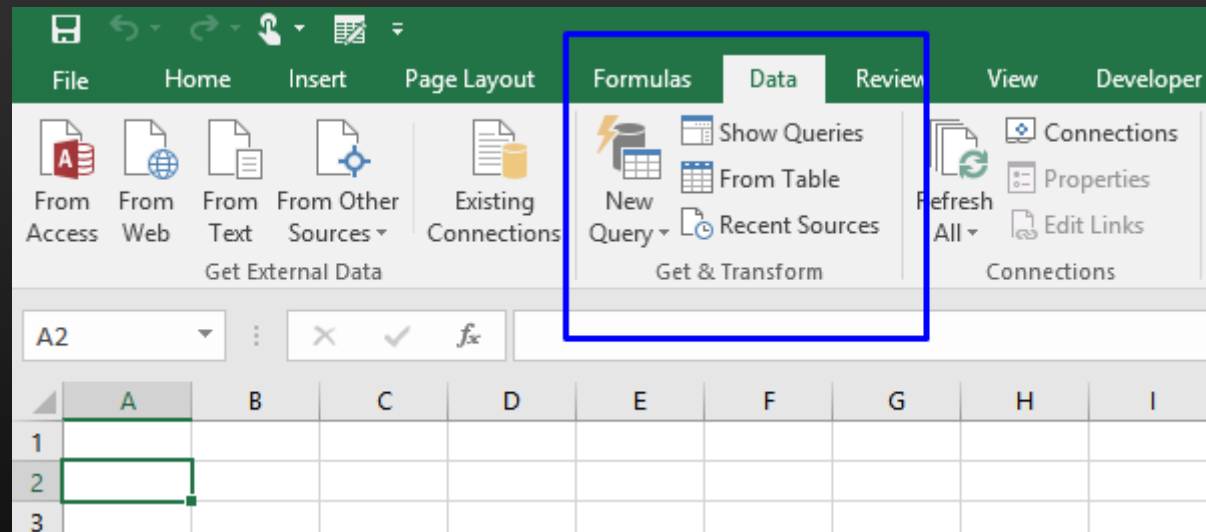
Power Query



+



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

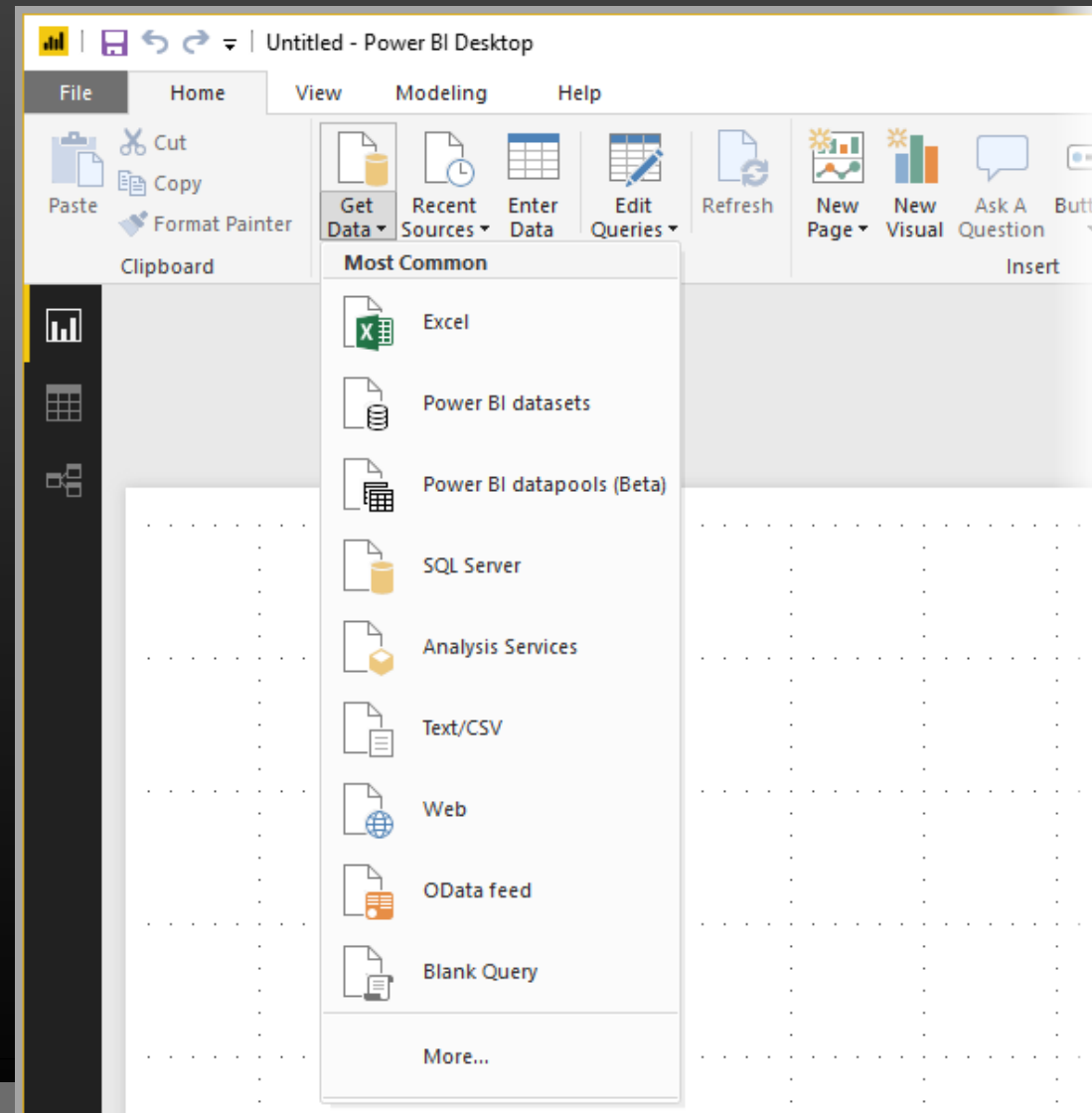
Source{[Schema, ...], [Status]]}[Data]

meta_dt_load meta_nm meta_dt_reportdate meta_corr_nr

1	10/3/2018, 8:14:00 PM	EM_MIFID_cor	0/3/2018	
2	10/2/2018, 3:01:00 PM	EM_MIFID_xm	0/3/2018	
3	10/2/2018, 3:01:00 PM	EM_MIFID_xm	0/3/2018	
4	10/2/2018, 3:01:00 PM	EM_MIFID_xm	0/3/2018	

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

Power Query



Agenda

- Power Query
- Query Folding
- Constraints
- Demo

Converts M to native query

Fact Movement

```

1 let
2     Source = Sql.Databases("."),
3     WideWorldImportersDW = Source[{"Name="WideWorldImportersDW"}][Data],
4     Fact_Movement = WideWorldImportersDW[{"Schema="Fact",Item="Movement"}][Data],
5     #"Filtered Rows" = Table.SelectRows(Fact_Movement, each Date.QuarterOfYear([Date Key]) = 1),
6     #"Expanded Dimension.Customer" = Table.ExpandRecordColumn(#"Filtered Rows", "Dimension.Customer", {"Customer"}, {0}),
7     #"Uppercased Text" = Table.TransformColumns(#"Expanded Dimension.Customer",{{"Dimension.Customer.Customer",Text.Upper}},{0}),
8     #"Expanded Dimension.Supplier" = Table.ExpandRecordColumn(#"Uppercased Text", "Dimension.Supplier", {"Primary Supplier"}, {0}),
9     #"Merged Columns" = Table.CombineColumns(Table.TransformColumnTypes(#"Expanded Dimension.Supplier", {{"Dimension.Supplier.Supplier",Text.Upper}},{0}),{"Customer","Supplier"},ConcatenateDelimiter="_"),
10 in
11     #"Merged Columns"

```

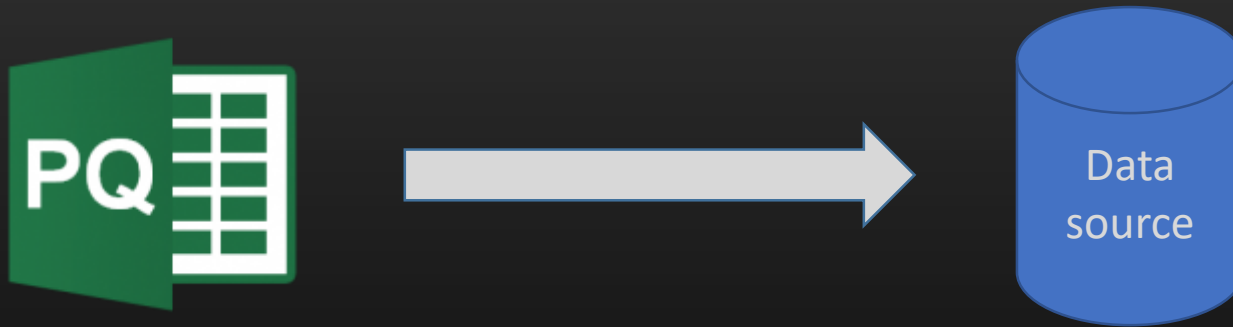
Native Query

```

select [$Outer].[Movement Key] as [Movement Key],
[$Outer].[Date Key] as [Date Key],
[$Outer].[Stock Item Key] as [Stock Item Key],
[$Outer].[Customer Key2] as [Customer Key],
[$Outer].[Supplier Key2] as [Supplier Key],
[$Outer].[Transaction Type Key] as [Transaction Type Key],
[$Outer].[WWI Stock Item Transaction ID] as [WWI Stock Item Transaction ID],
[$Outer].[WWI Invoice ID] as [WWI Invoice ID],
[$Outer].[WWI Purchase Order ID] as [WWI Purchase Order ID],
[$Outer].[Quantity] as [Quantity],
[$Outer].[Lineage Key2] as [Lineage Key],
[$Outer].[t0_0] as [Dimension.Customer.Customer],
[$Outer].[Category2] as [Dimension.Customer.Category],
[$Inner].[Primary Contact] as [Dimension.Supplier.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 [t0_0]
    from
    (
        select [$Outer].[Movement Key],
            [$Outer].[Date Key],
            [$Outer].[Stock Item Key],

```

Transformation pushed back to data source



From M to SQL, MySQL, oData, etc

More efficient data processing



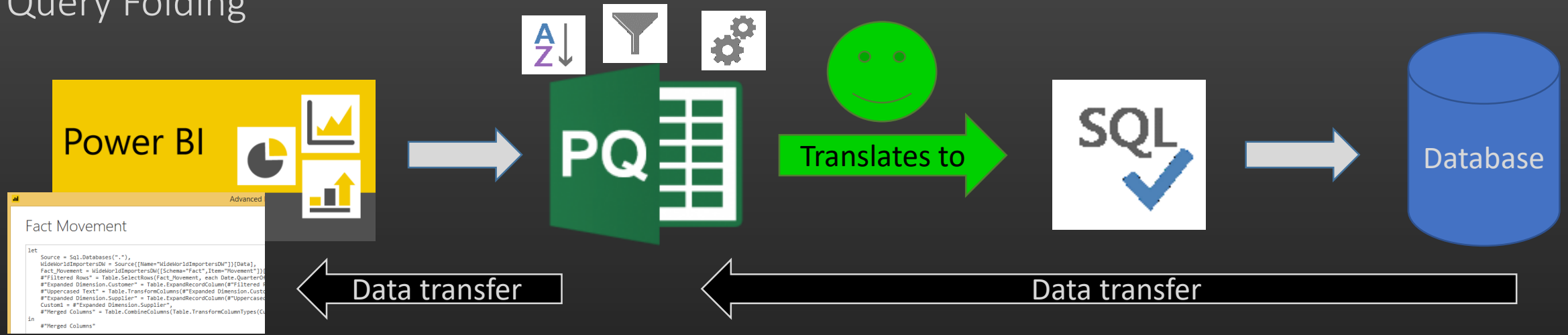
Partial folding



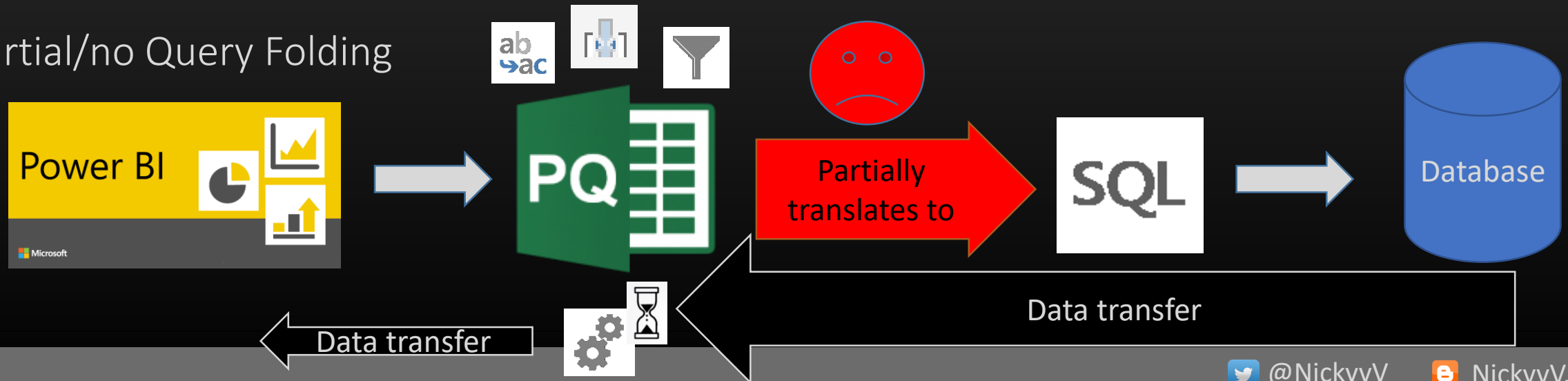
Importance

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

Query Folding



Partial/no Query Folding



To Fold or Not To Fold

- Import mode only

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

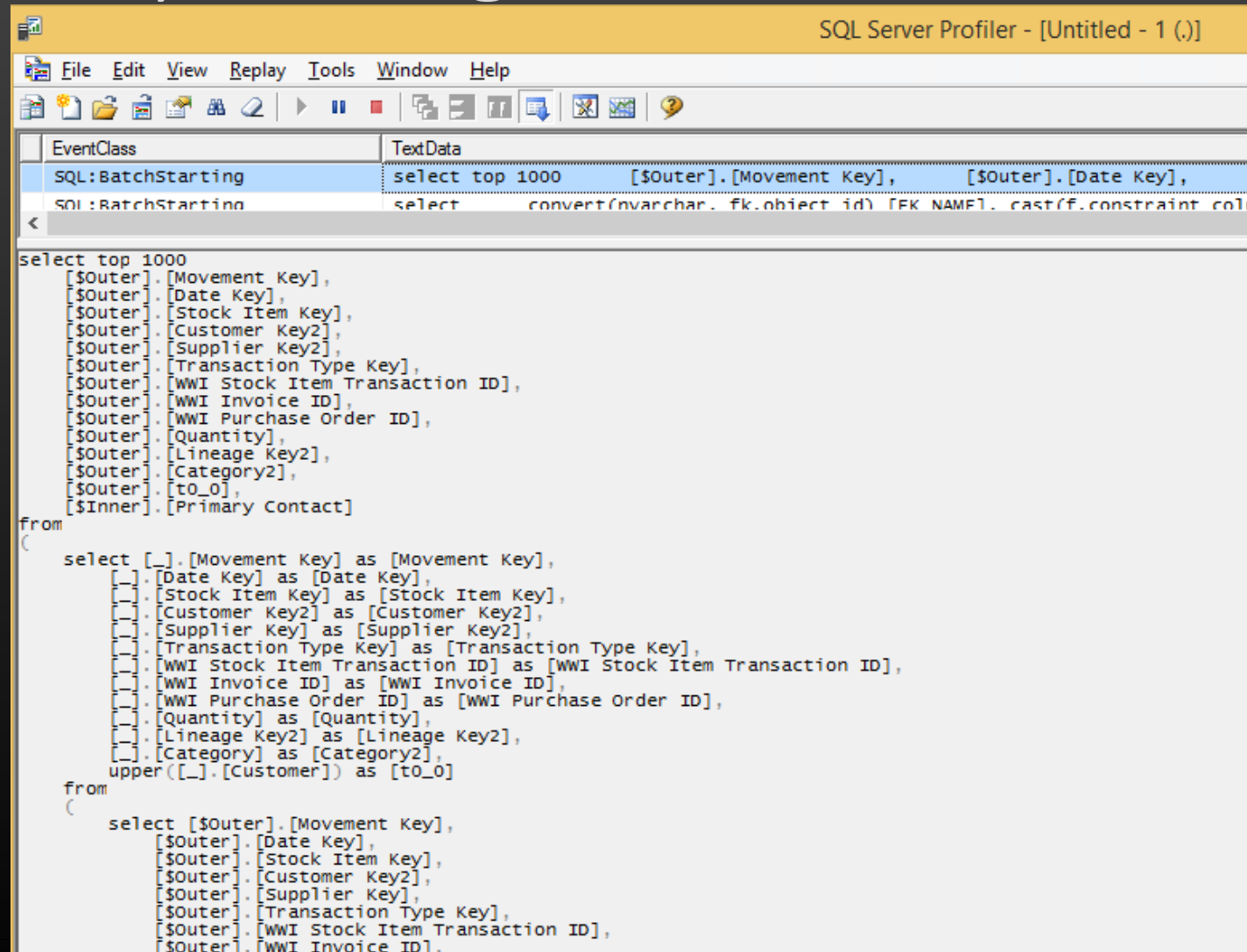


Join
(Append)



Group By

Is My Query Folding? - SQL



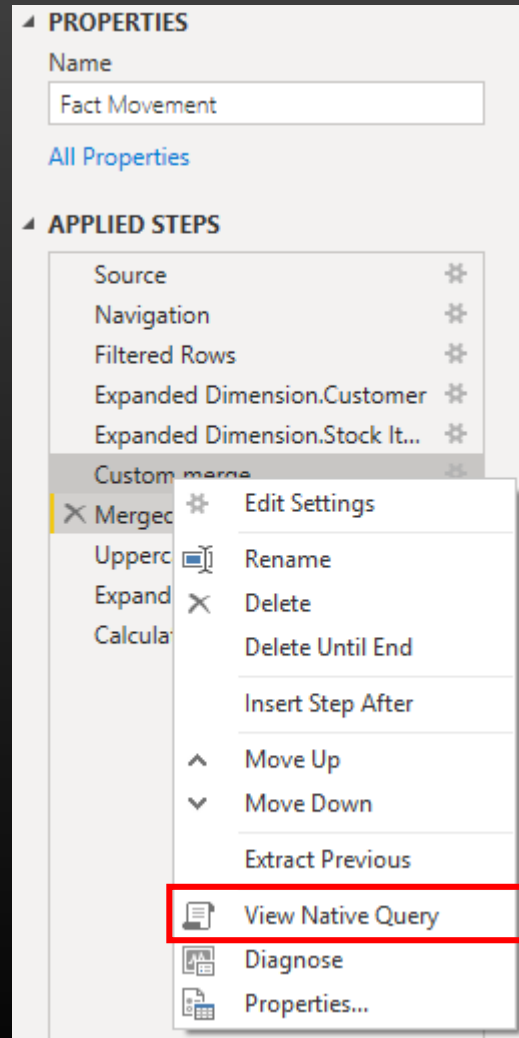
The screenshot shows the SQL Server Profiler interface. The title bar reads "SQL Server Profiler - [Untitled - 1 (.)]". The menu bar includes File, Edit, View, Replay, Tools, Window, and Help. The toolbar contains various icons for file operations, execution, and viewing. Below the toolbar is a table with two columns: "EventClass" and "TextData". The table contains two rows, both with "SQL:BatchStarting" in the EventClass column. The first row's TextData is "select top 1000 [\$Outer].[Movement Key], [\$Outer].[Date Key],". The second row's TextData is "select convert(nvarchar, fk.object id) [FK NAME], cast(f.constraint col". Below the table, the full SQL query is displayed in a text area. The query is a complex SELECT statement with multiple columns from a table named [\$Outer], joined to a subquery in the FROM clause. The subquery selects various columns from a table named [Inner] and includes an upper() function on the [Customer] column.

EventClass	TextData
SQL:BatchStarting	select top 1000 [\$Outer].[Movement Key], [\$Outer].[Date Key],
SQL:BatchStarting	select convert(nvarchar, fk.object id) [FK NAME], cast(f.constraint col

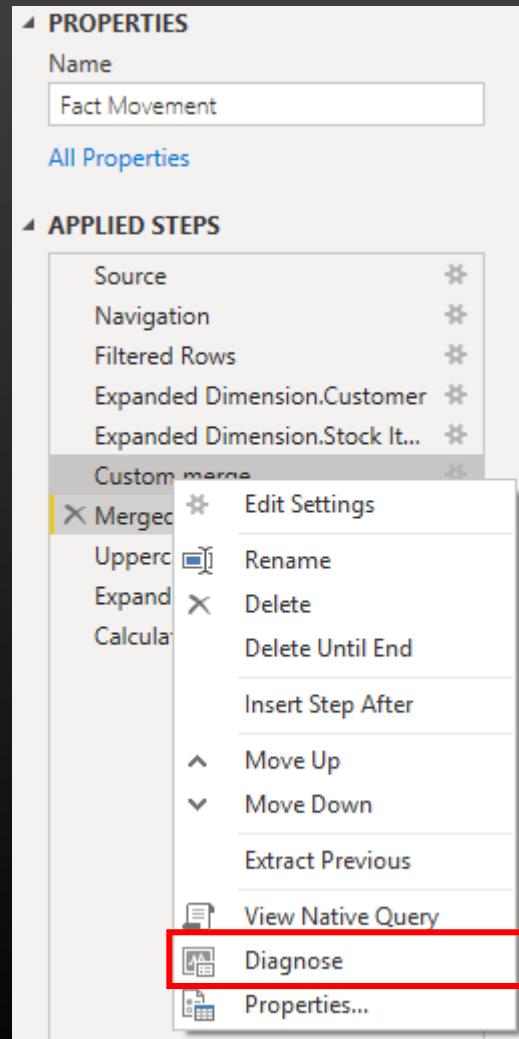
```
select top 1000
  [$Outer].[Movement Key],
  [$Outer].[Date Key],
  [$Outer].[Stock Item Key],
  [$Outer].[Customer Key2],
  [$Outer].[Supplier Key2],
  [$Outer].[Transaction Type Key],
  [$Outer].[WWI Stock Item Transaction ID],
  [$Outer].[WWI Invoice ID],
  [$Outer].[WWI Purchase Order ID],
  [$Outer].[Quantity],
  [$Outer].[Lineage Key2],
  [$Outer].[Category2],
  [$Outer].[t0_0],
  [$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 [t0_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],
```



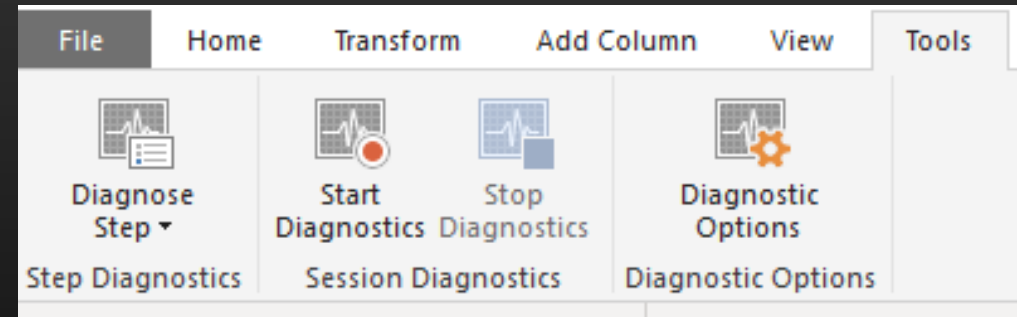
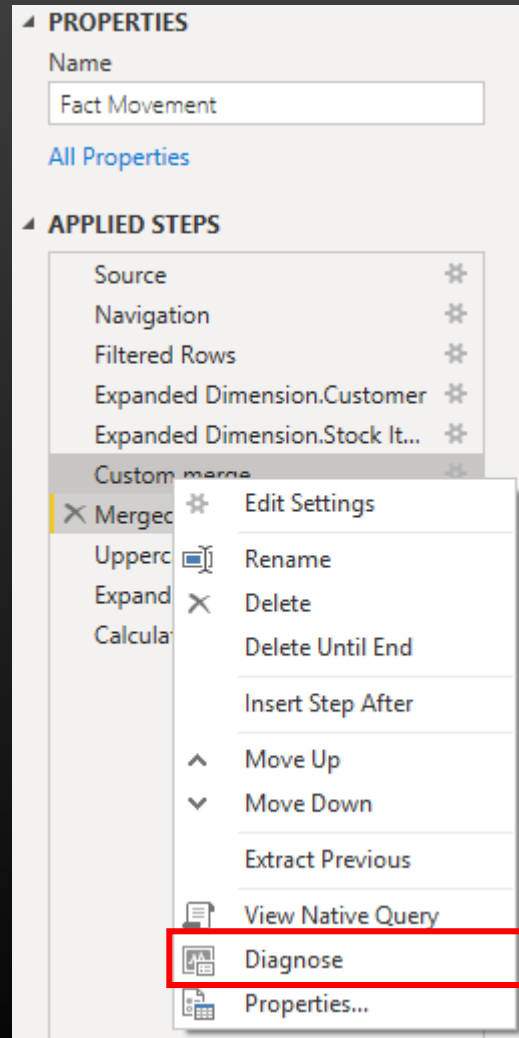
Is My Query Folding? - SQL



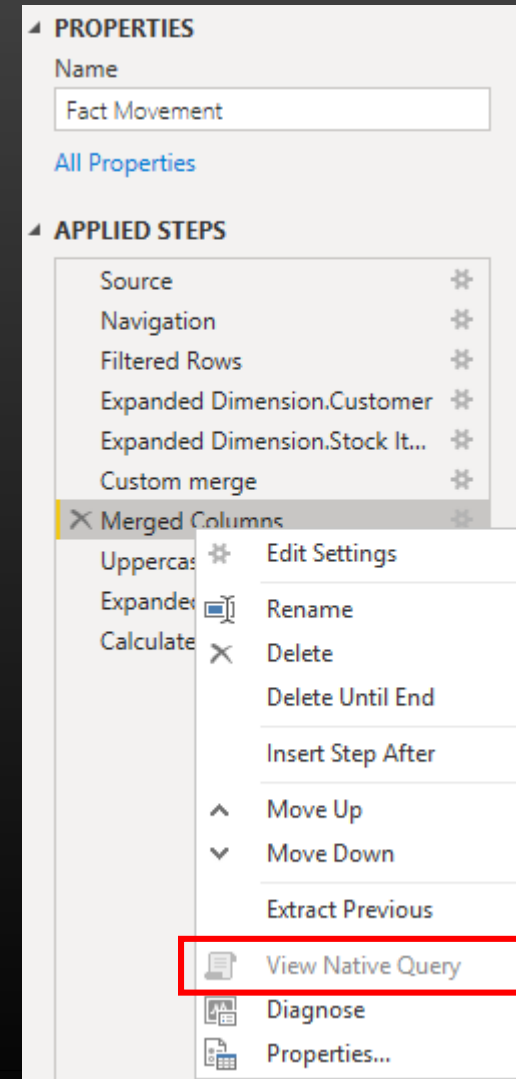
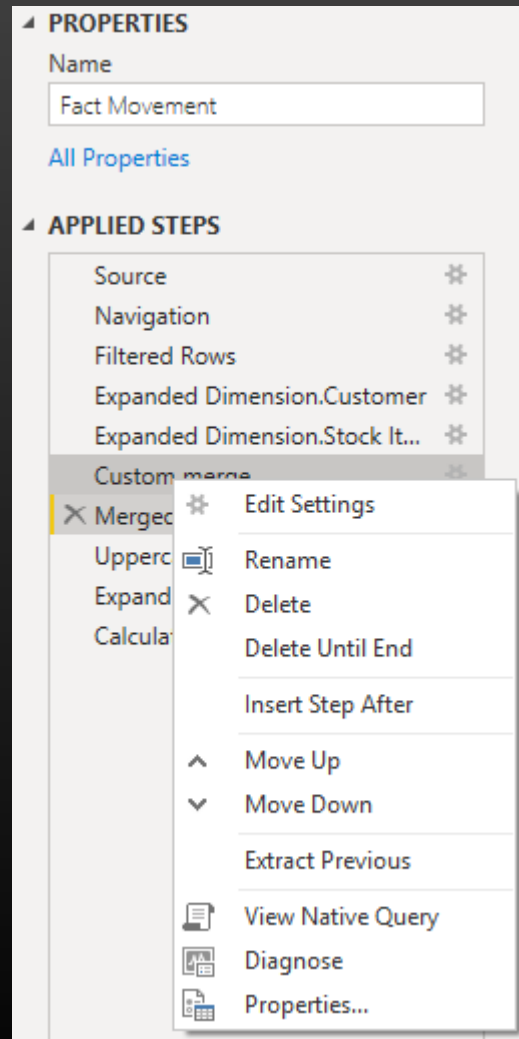
Is My Query Folding? - SQL



Is My Query Folding? - SQL



Is My Query Folding? - SQL



Is My Query Folding? - OData

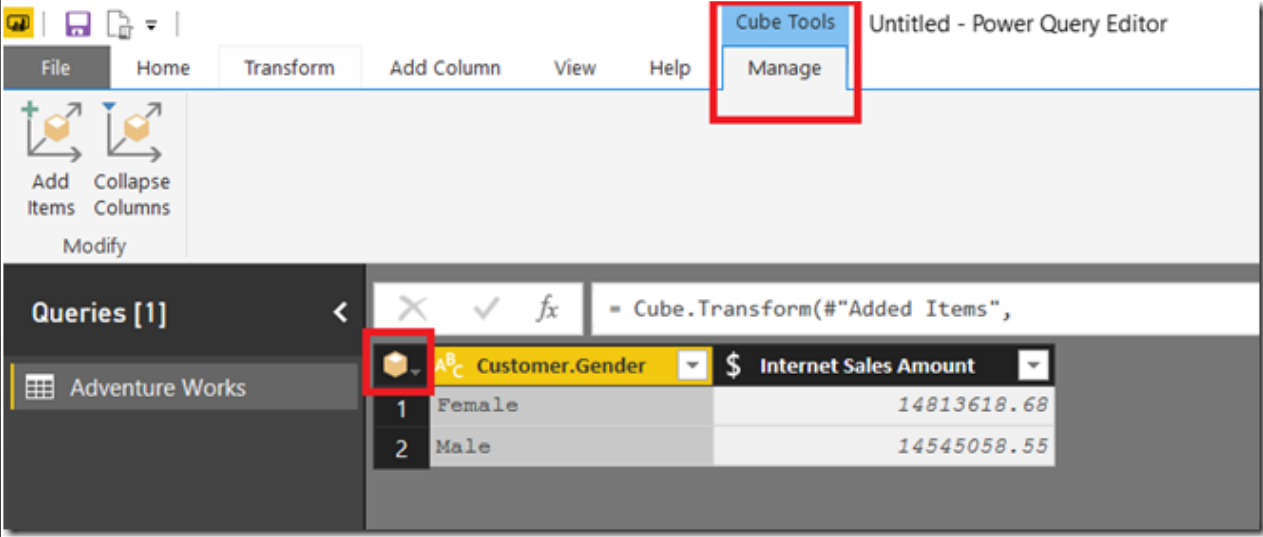
Progress Telerik Fiddler Web Debugger

File Edit Rules Tools View Help

WinConfig Replay Go Stream Decode Keep: All sessions Any Process

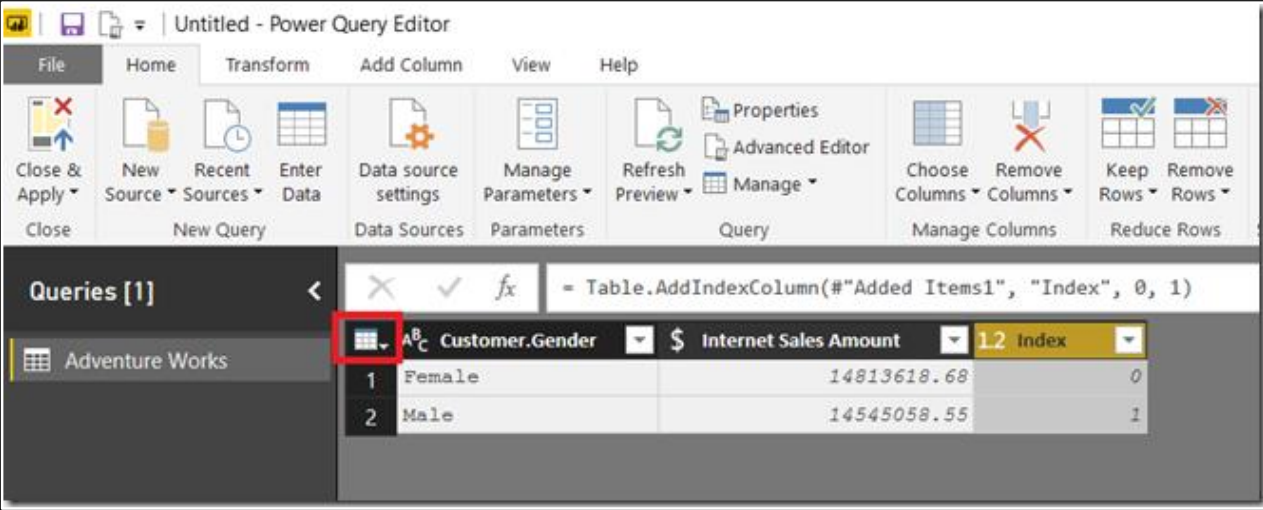
#	Result	Protocol	Host	URL
1	200	HTTPS	api.parliament.uk	/Staging/odata
2	200	HTTPS	api.parliament.uk	/odata/\$metadata
3	200	HTTPS	api.parliament.uk	/Staging/odata/GovernmentOrganisation?\$top=1000
4	200	HTTPS	api.parliament.uk	/Staging/odata
5	200	HTTPS	api.parliament.uk	/odata/\$metadata

Is My Query Folding? - SSAS



The screenshot shows the Power Query Editor interface. The ribbon includes 'File', 'Home', 'Transform', 'Add Column', 'View', and 'Help'. The 'Cube Tools' tab is active, and the 'Manage' button is highlighted with a red box. The 'Queries [1]' pane on the left shows 'Adventure Works' selected. The main area displays a query with the formula bar containing `= Cube.Transform(#"Added Items",`. The data table has two columns: 'Customer.Gender' and 'Internet Sales Amount'.

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



The screenshot shows the Power Query Editor interface after adding an index column. The ribbon includes 'File', 'Home', 'Transform', 'Add Column', 'View', and 'Help'. The 'Advanced Editor' tab is active, and the 'Manage' button is highlighted with a red box. The 'Queries [1]' pane on the left shows 'Adventure Works' selected. The main area displays a query with the formula bar containing `= Table.AddIndexColumn(#"Added Items1", "Index", 0, 1)`. The data table now has three columns: 'Customer.Gender', 'Internet Sales Amount', and 'Index'.

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

Agenda

- Power Query
- Query Folding
- Constraints
- Demo

Limitations

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

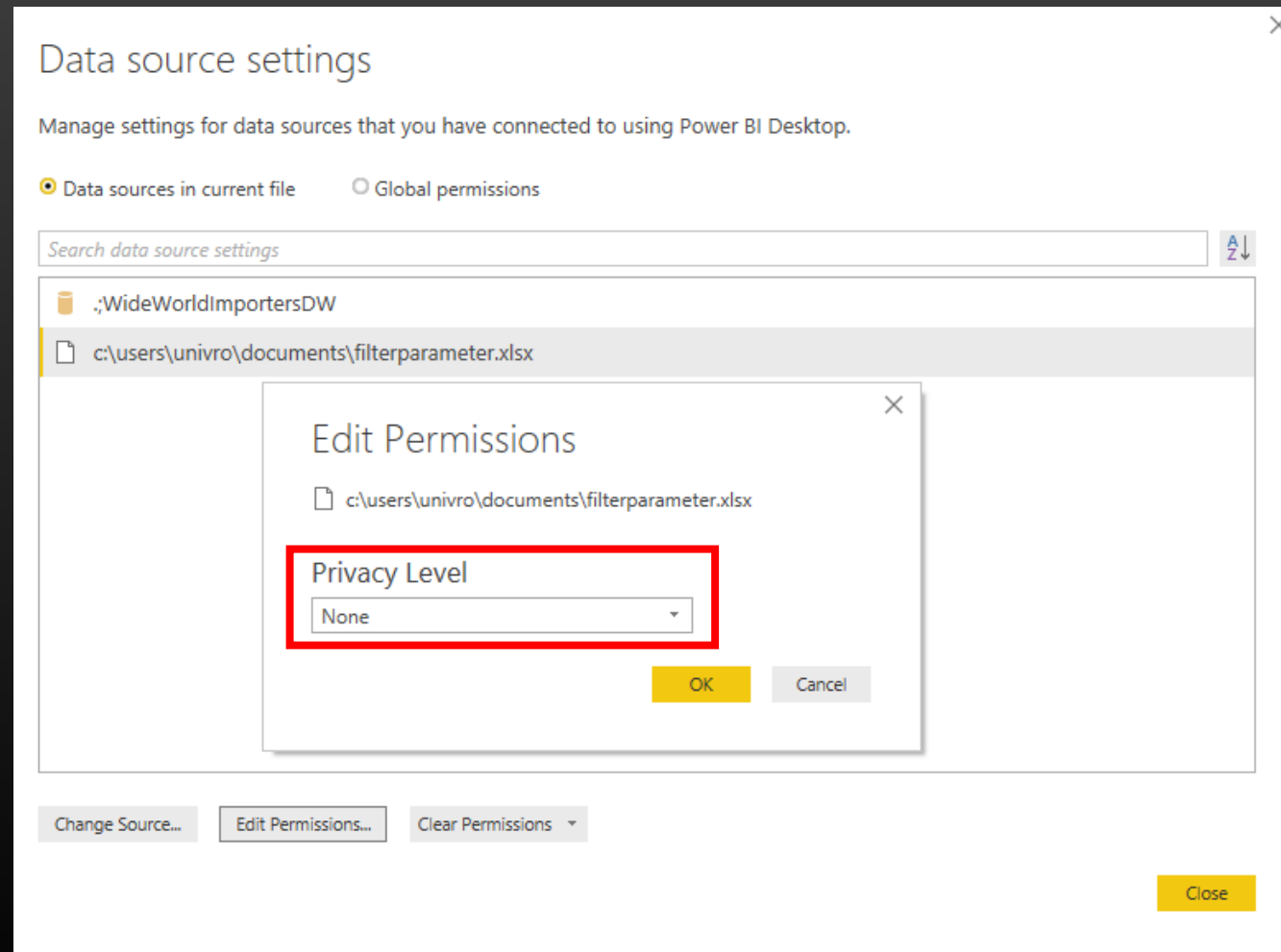
Limitations – Unsupported Transformations

- Merge columns
 - *Solved with a custom column*
- 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 columns**
 - *Solved with a custom column*
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- **DateTime to Date (Transform or Date Only)**
- And more...

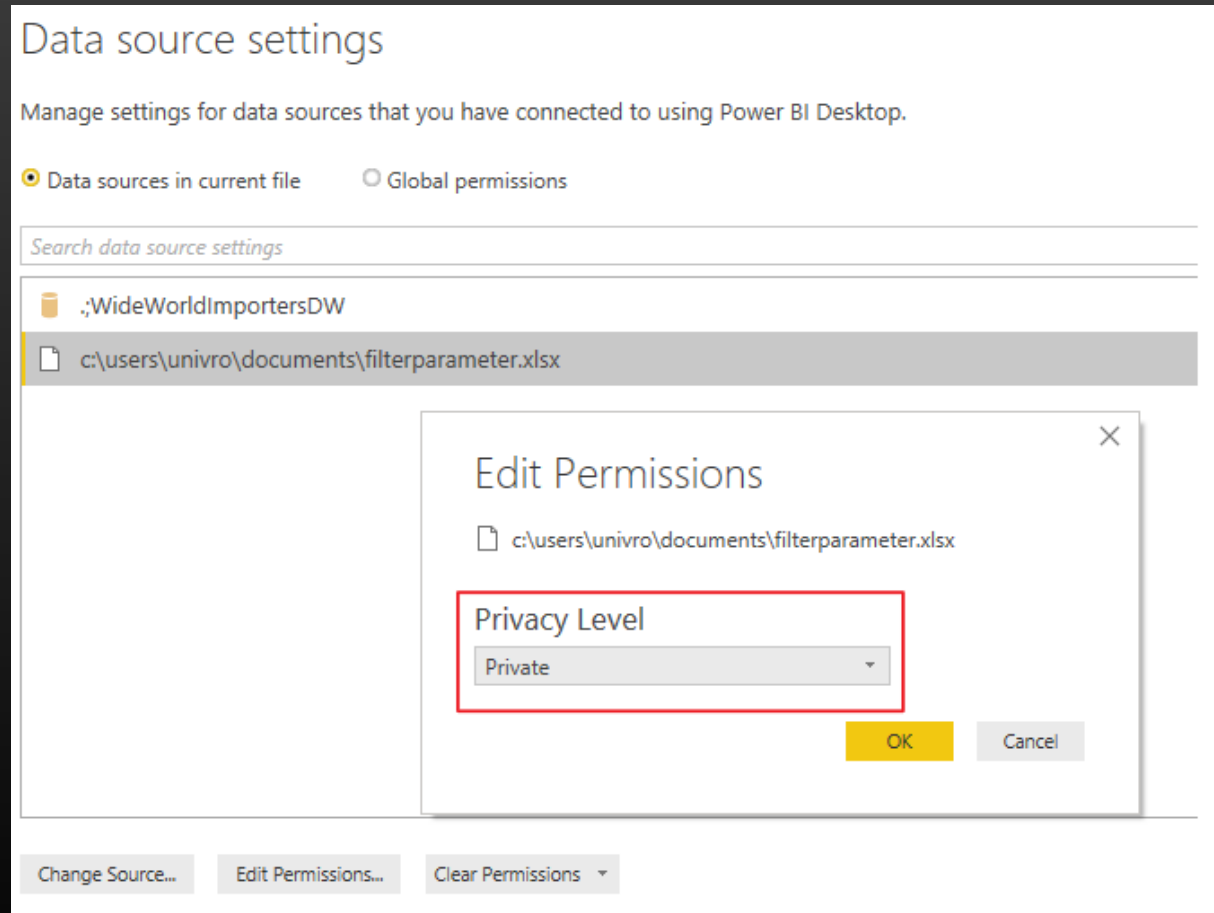
Limitations – Data source privacy level



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 [$Outer]
left outer join [Dimension].[Customer] as [$Inner] on ($Outer.[Customer Key] = $Inner.[Customer Key])
```


Limitations – Data source privacy level



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
- No parsing takes place
- No guarantees on frequency of execution





Demo Time!

Demo Recap

- Import data from SQL Server
- Transform data in several ways

Take-aways:

- Filter first, transform later
- View Native Query



Improvements

- Desktop June 2018:
 - ODBC connector improvements
 - Folding support for top rows
 - OData V4 connector enhancements:
 - Use [Implementation="2.0"] in OData.Feed()
- Relative date slicers now also work
- Desktop February 2019:
 - PBI Premium (& pro!): Incremental refresh query verification
- Desktop June 2019:
 - Cosmos DB connector enhancements
- Desktop September 2019:
 - PostgreSQL connector enhancements over a native query

Improvements

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Wrap-up

- Concept of Query Folding
- Supported data sources, transformations
- Don't write native SQL and add steps afterwards
- View Native Query!

Resources

Power Query documentation:

- <https://docs.microsoft.com/en-us/power-query/power-query-folding>
- <https://docs.microsoft.com/en-us/power-query/querydiagnosticsfolding>
- <https://docs.microsoft.com/en-us/power-query/handlingqueryfolding>

Blogs on Query Folding:

- <https://www.mssqltips.com/sqlservertip/3635/query-folding-in-power-query-to-improve-performance/>
- <http://geekswithblogs.net/darengosbell/archive/2014/05/16/function-folding-in-powerquery.aspx>
- <http://www.mattmasson.com/2013/07/filtering-in-data-explorer/>
- <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/>

Power BI Desktop updates

- <https://powerbi.microsoft.com/en-us/blog/power-bi-desktop-june-2018-feature-summary/#folding>

Power BI Premium Incremental refresh

- <https://powerbi.microsoft.com/en-us/blog/incremental-refresh-query-folding/>
- <https://docs.microsoft.com/en-us/power-bi/service-premium-incremental-refresh#query-folding>
- <https://www.youtube.com/watch?v=RnrCKn5yKcC>

Thank you

and let's connect!



NickyvV.com



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