Query Folding in Power BI

Nicky van Vroenhoven

Who Are You? http://bit.ly/qf-pbi

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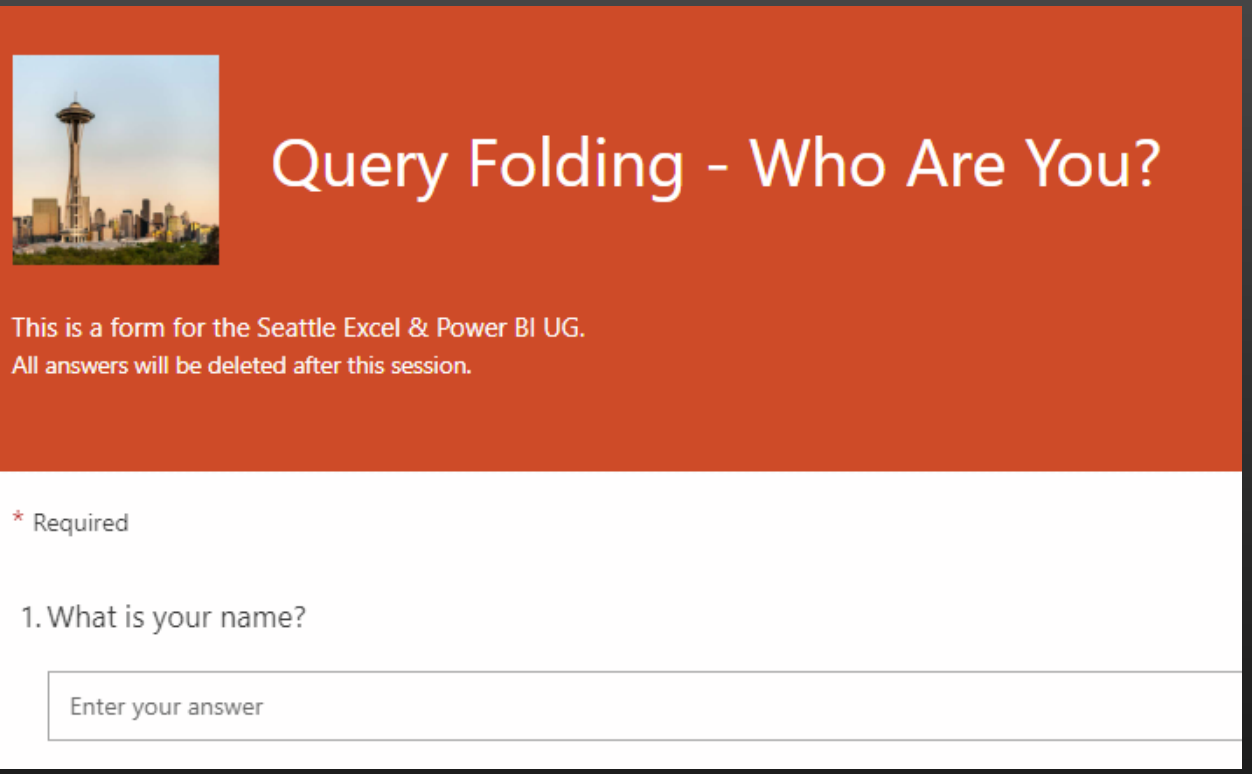


http://bit.ly/qf-pbi

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

Nicky van Vroenhoven

Unit Lead Power BI @Powerdobs

@NickyvV

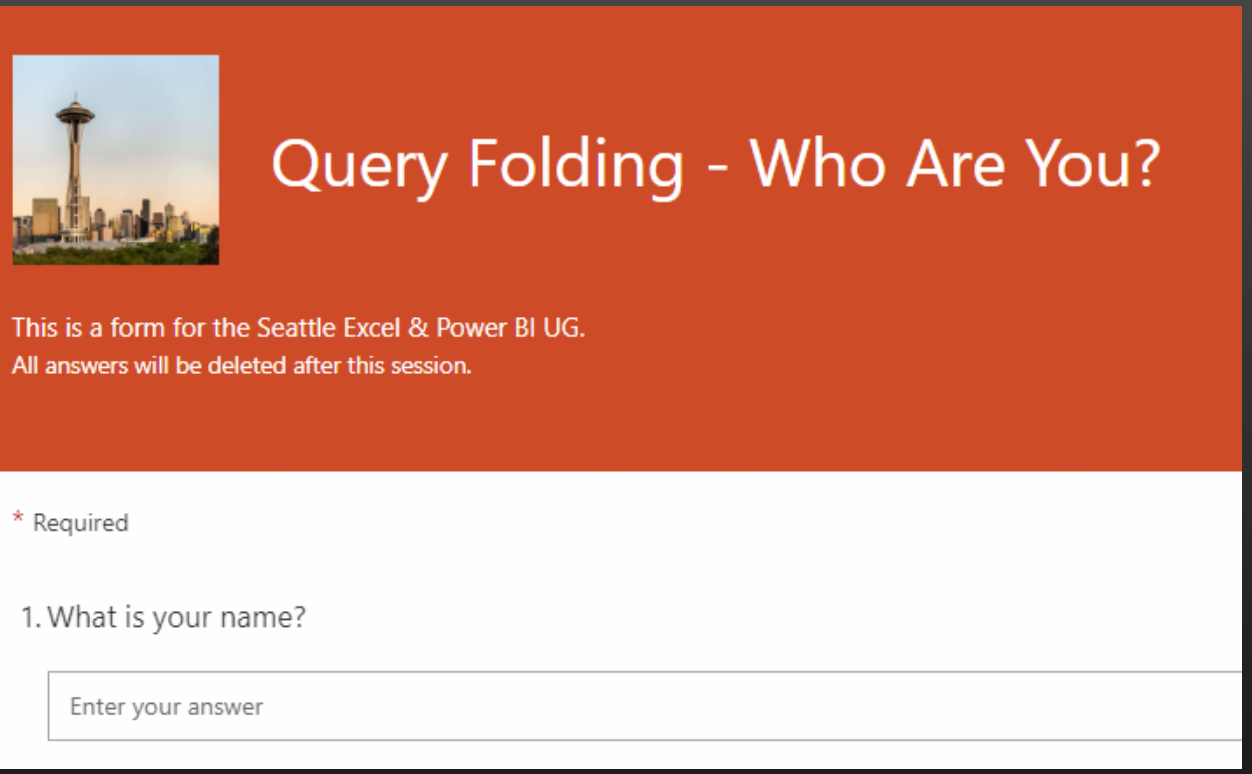
nickyvv.com

Power BI Super User
community.powerbi.com

Data Platform MVP

Who Are You? http://bit.ly/qf-pbi

Who Are You?



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www.nickyvv.com/2019/12

Agenda

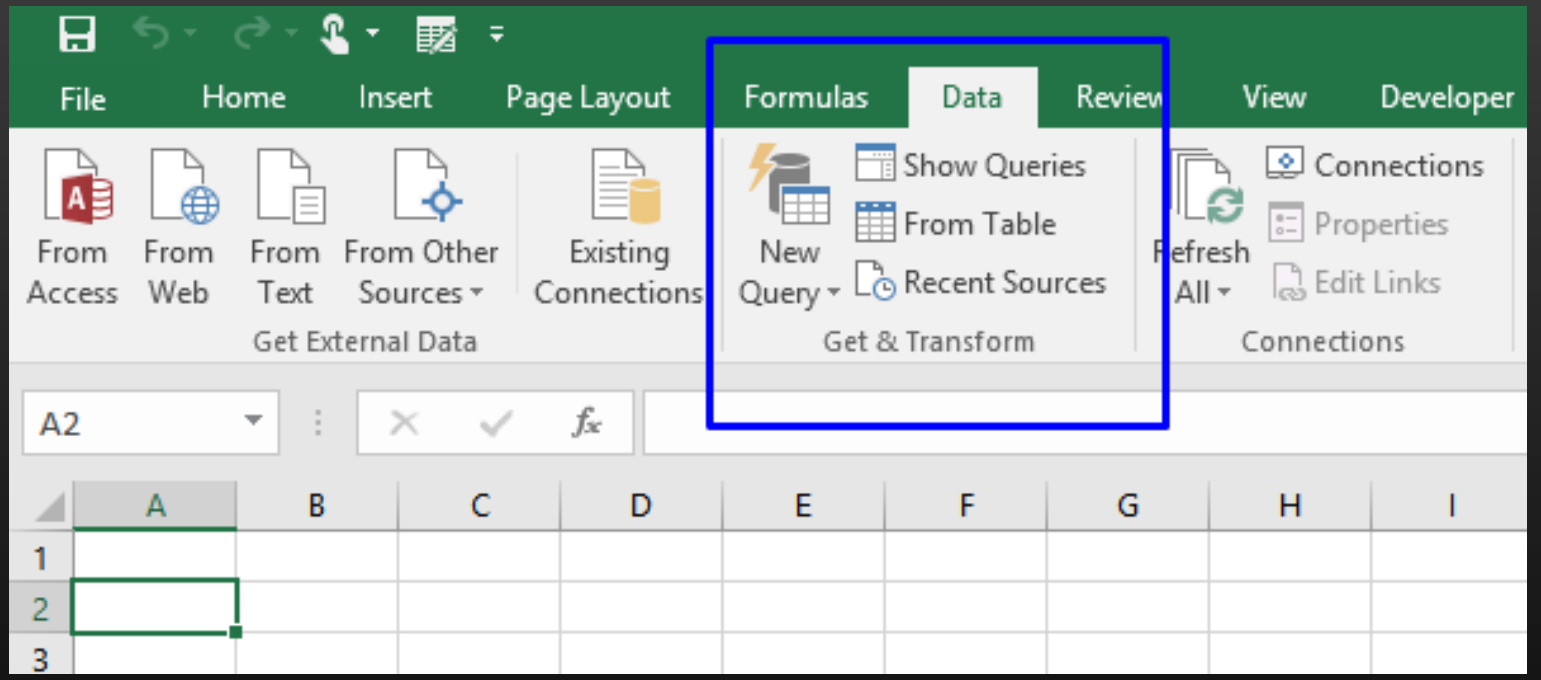
- Query Folding?
  - What, How, Why
- Constraints
- Query diagnostics
- Value.NativeQuery
- Demo, Demo, Demo!

In the beginning, there was…

But then…

+

Power Query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From Web
From Text
From Other Sources
Existing Connections
Get External Data
New Query
Show Queries
From Table
Recent Sources
Get & Transform
Refresh All
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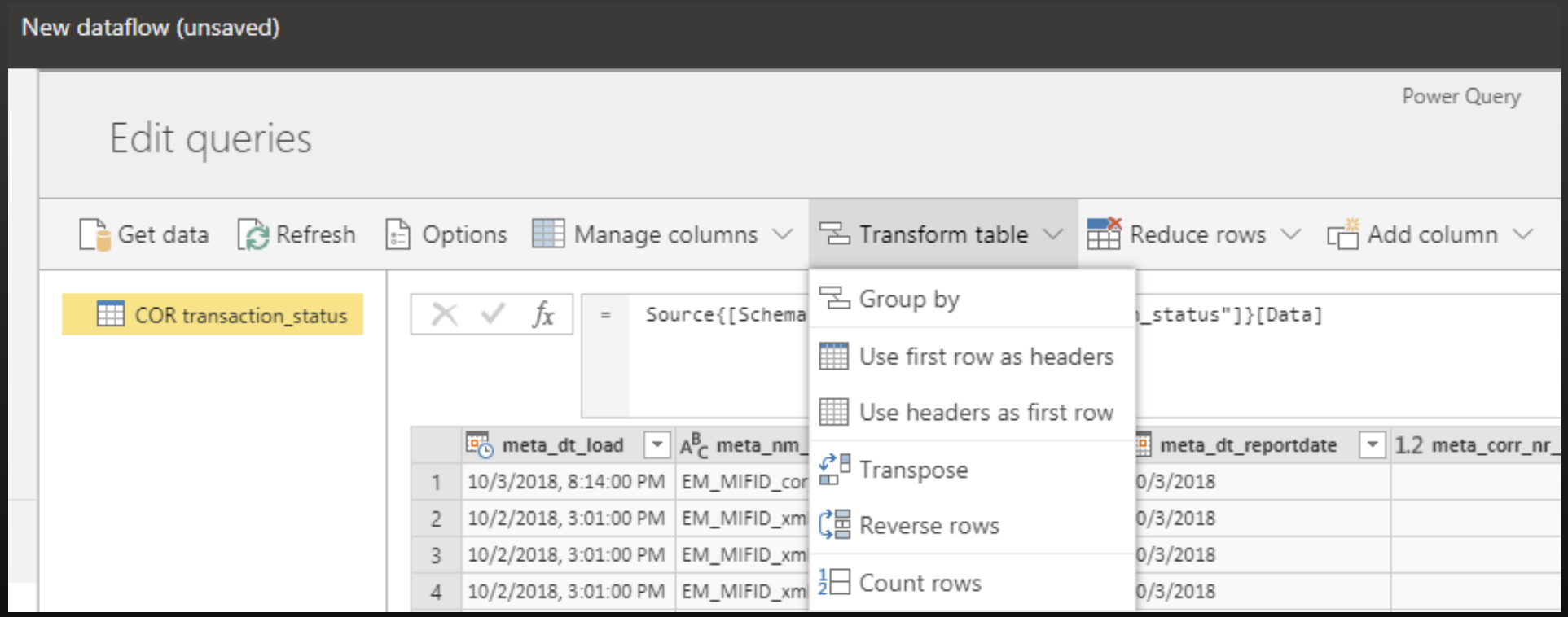
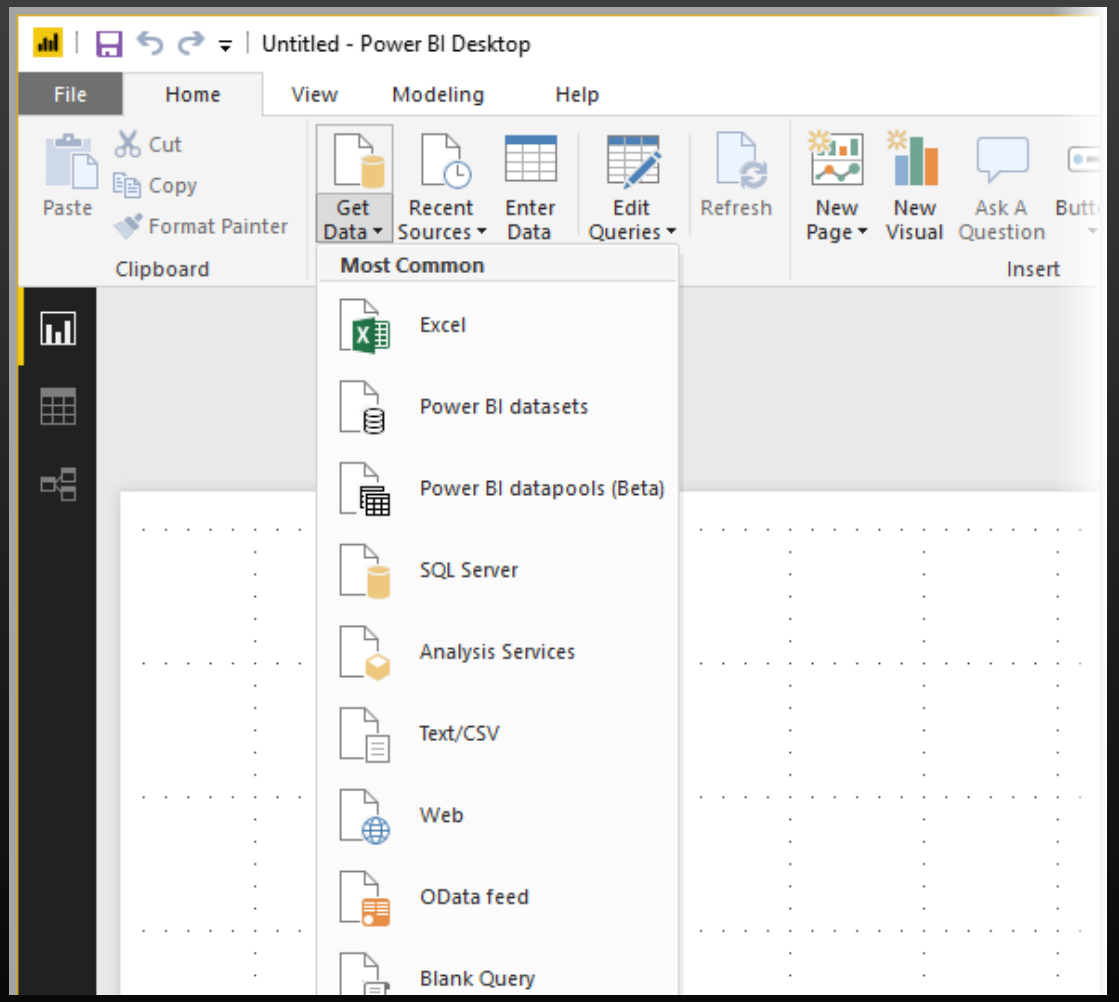
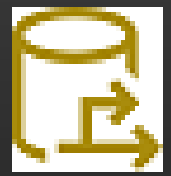
Power Query


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

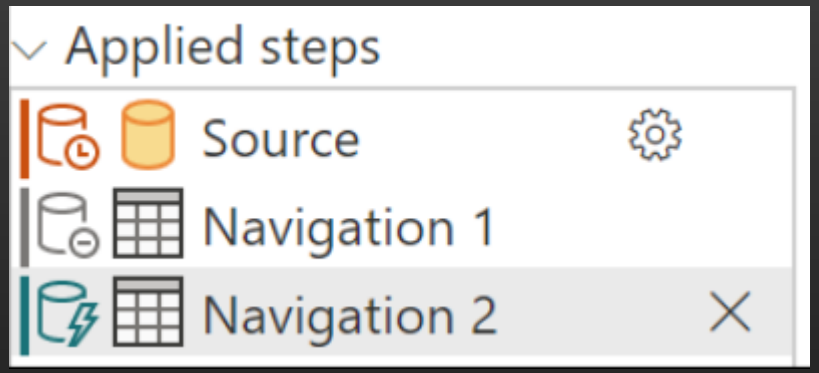
Power Query

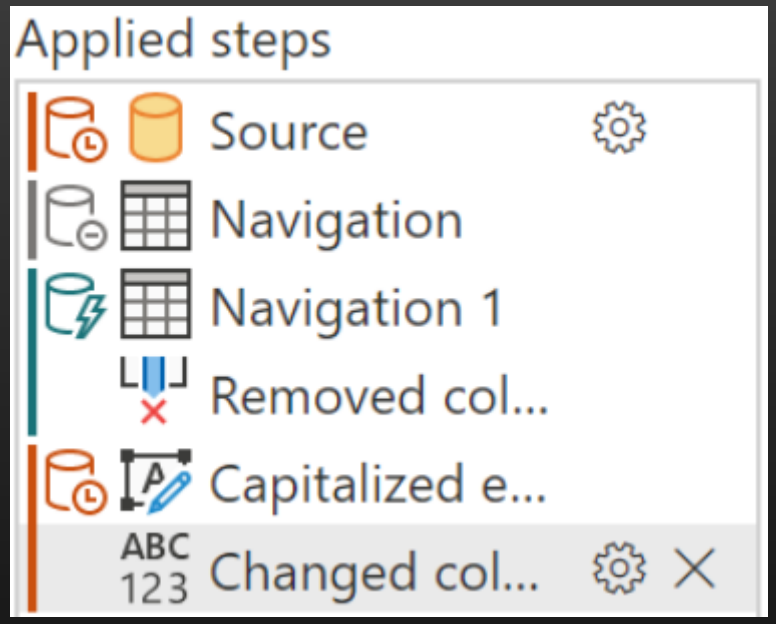

Untitled - Power BI Desktop
File
Home
View
Modeling
Help
Paste
Cut
Copy
Format Painter
Clipboard
Get Data
Recent Sources
Enter Data
Edit Queries
Refresh
New Page
New Visual
Ask A Question
Insert
Most Common
Excel
Power BI datasets
Power BI datapools (Beta)
SQL Server
Analysis Services
Text/CSV
Web
OData feed
Blank Query

Next-level Query Folding



Step Folding Indicators in PQO

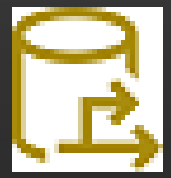




Step Folding Indicators in PQO

Folding

Not folding



Might fold

Opaque

Unknown

Agenda

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

Converts M to native query

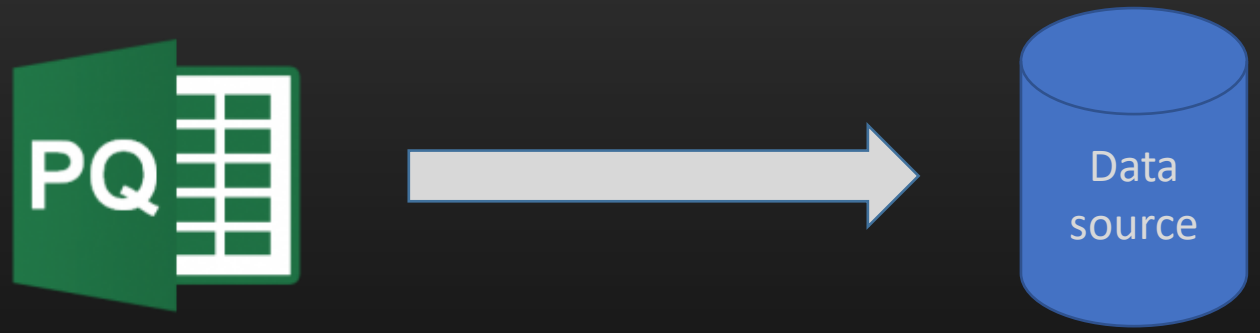
Fact Movement

```
let
    Source = Sql.Databases("."),
    WideWorldImportersDW = Source{[Name="WideWorldImportersDW"]}[Data],
    Fact_Movement = WideWorldImportersDW{[Schema="Fact",Item="Movement"]}[Data],
    #"Filtered Rows" = Table.SelectRows(Fact_Movement, each Date.QuarterOfYear([Date Key]) = 1),
    #"Expanded Dimension.Customer" = Table.ExpandRecordColumn(#"Filtered Rows", "Dimension.Customer", {"Customer"
    #"Uppercased Text" = Table.TransformColumns(#"Expanded Dimension.Customer",{{"Dimension.Customer.Customer", T
    #"Expanded Dimension.Supplier" = Table.ExpandRecordColumn(#"Uppercased Text", "Dimension.Supplier", {"Primary
    #"Merged Columns" = Table.CombineColumns(Table.TransformColumnTypes(#"Expanded Dimension.Supplier", {{"Custom
in
    #"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

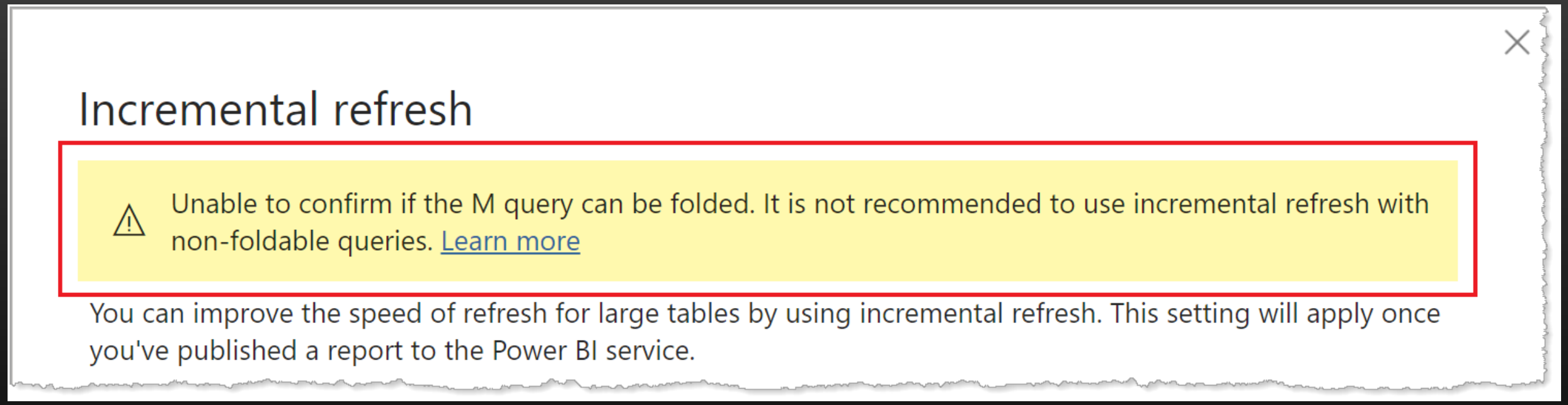
More efficient data processing

Partial folding

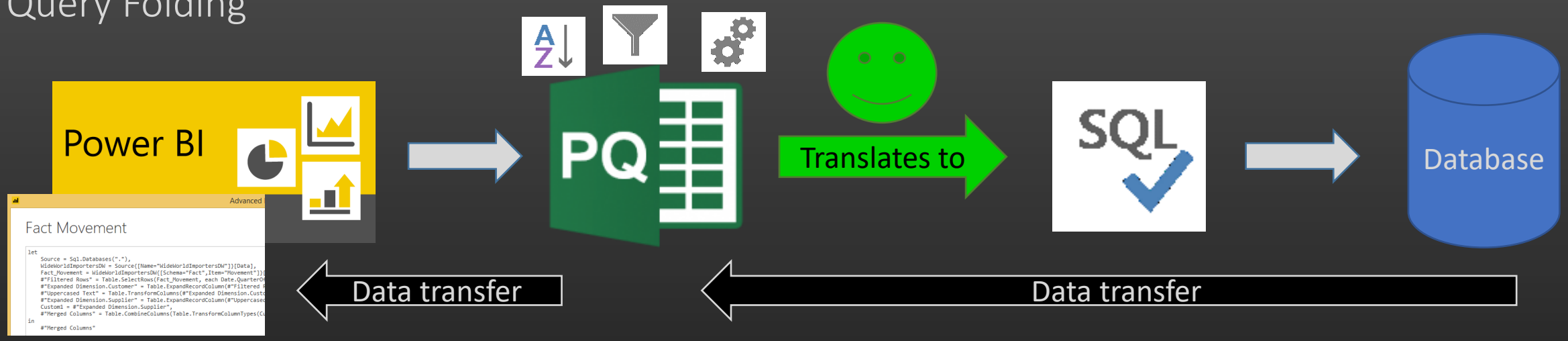
Important because…

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

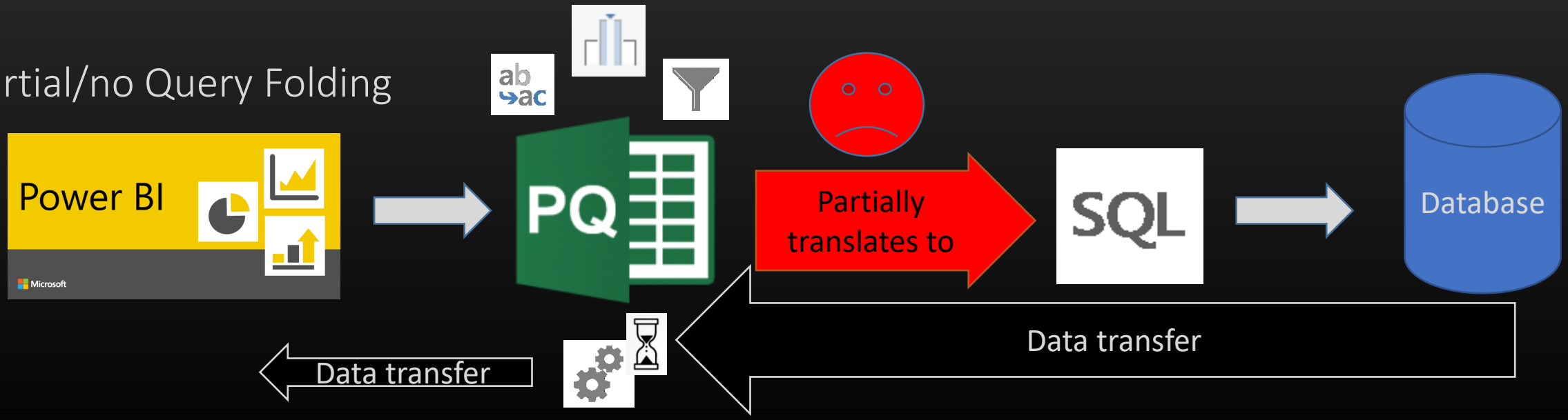
Folding with Incremental Refresh



Query Folding

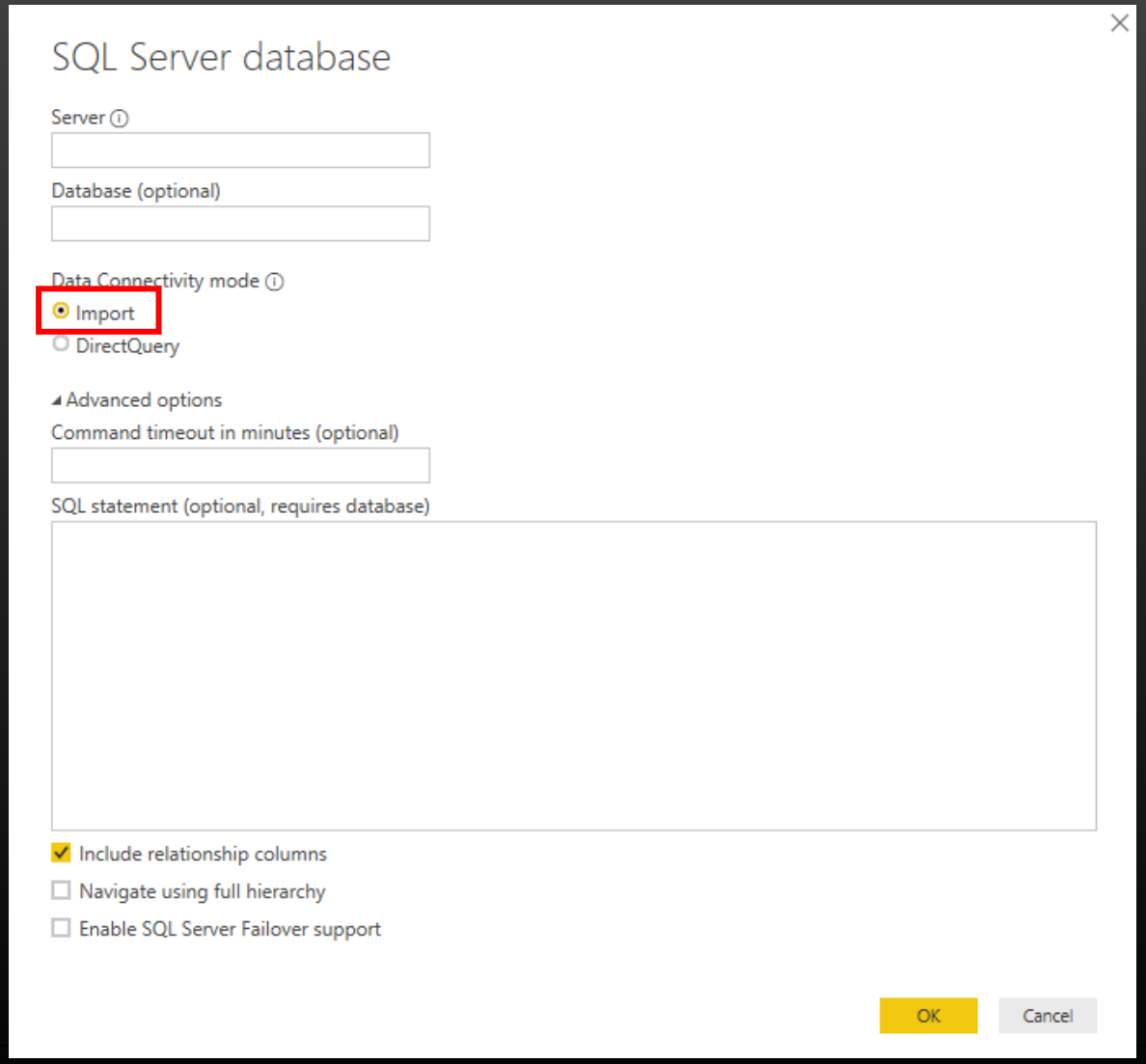


Partial/no Query Folding



To Fold or Not To Fold

- Import mode



Supported Data Sources

Supported Transformations
(most commonly used)

Filter

Sort

(Un)Pivot

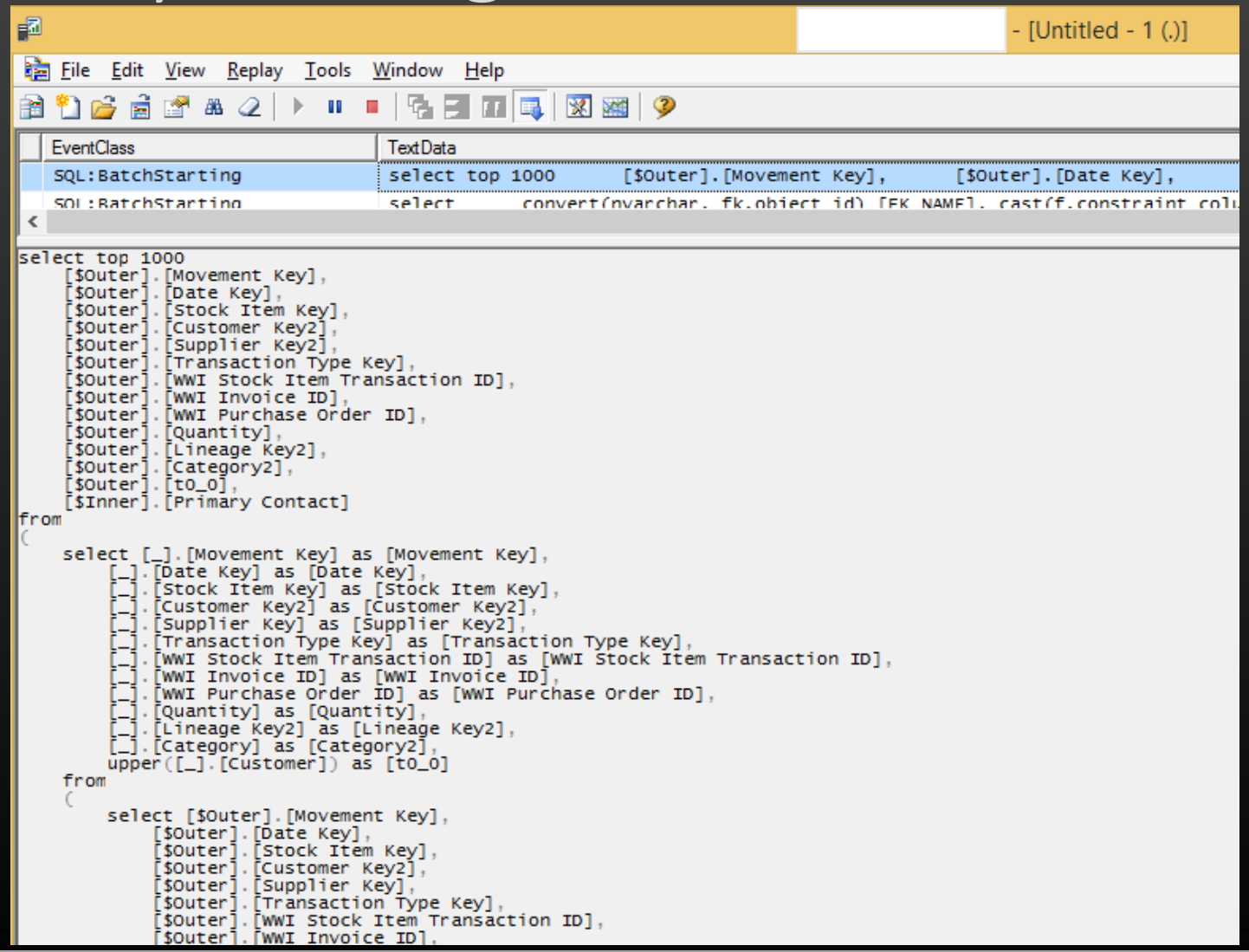
String Manipulations

Top Rows

Join (Append)

Group By

Is My Query Folding? - SQL



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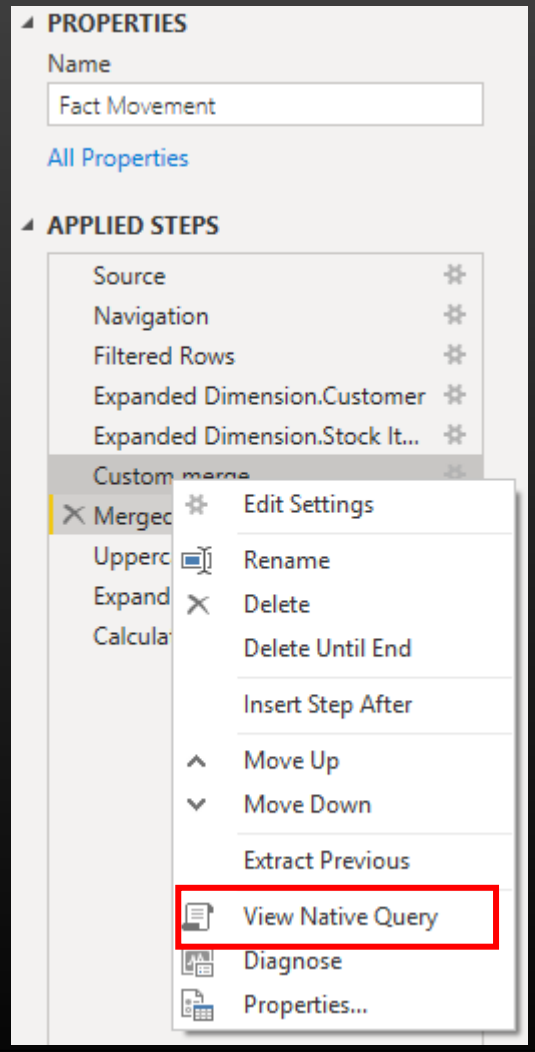

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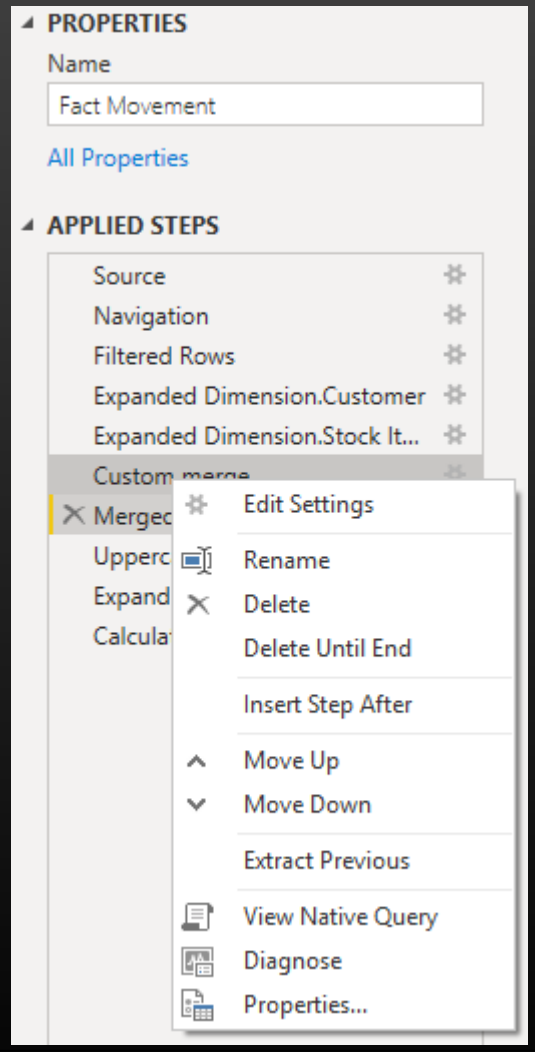

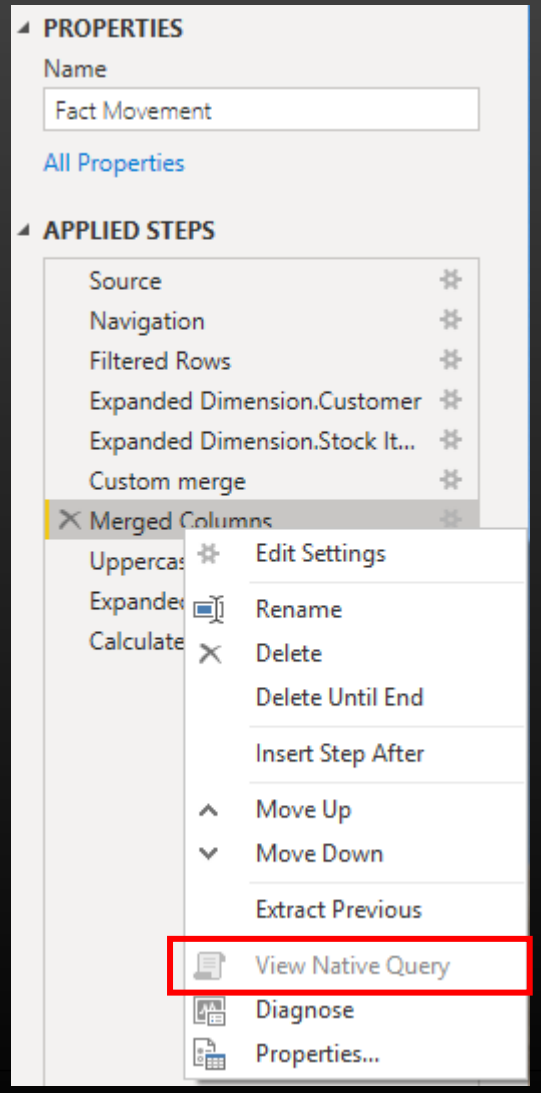

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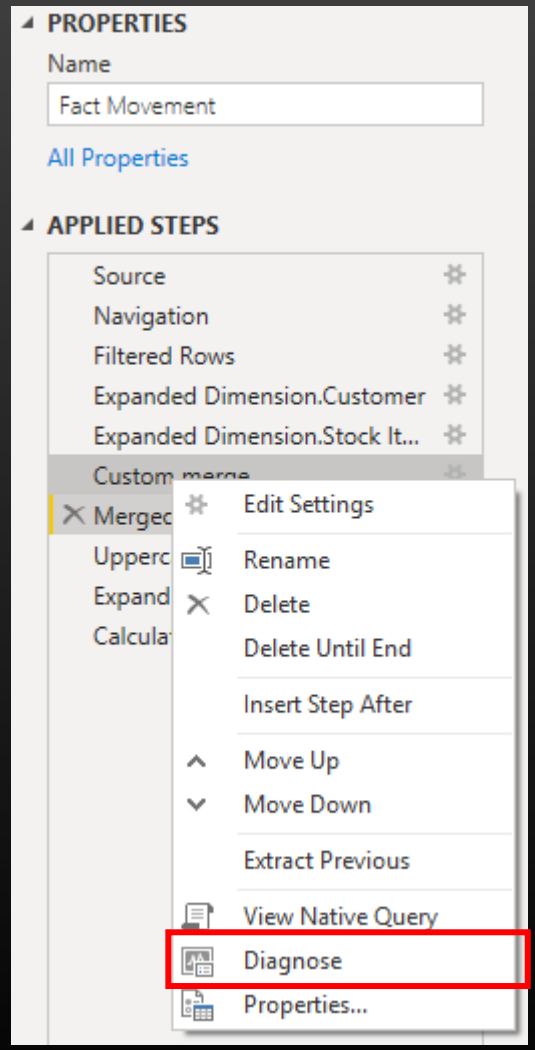
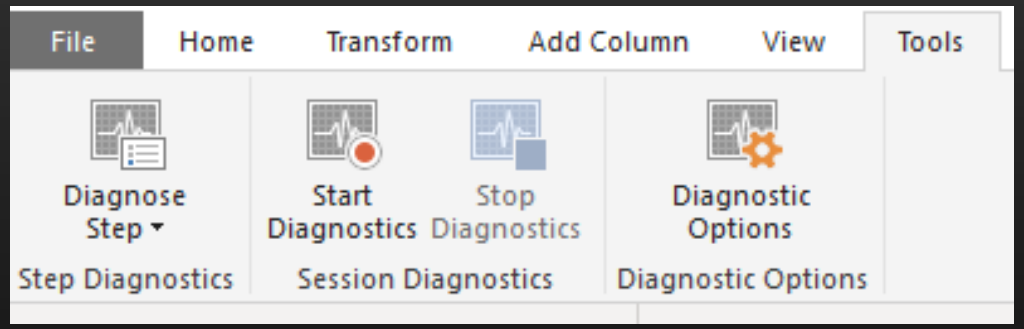
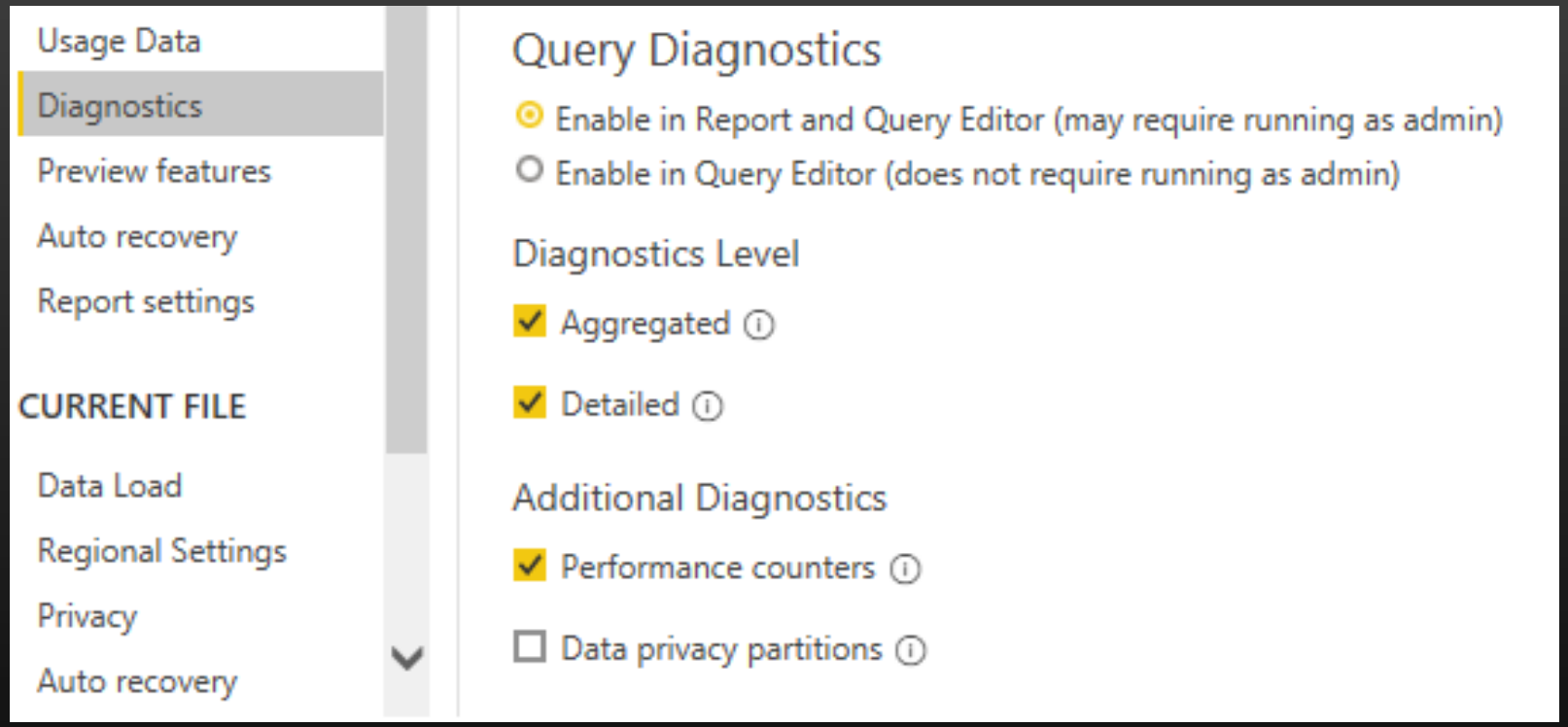
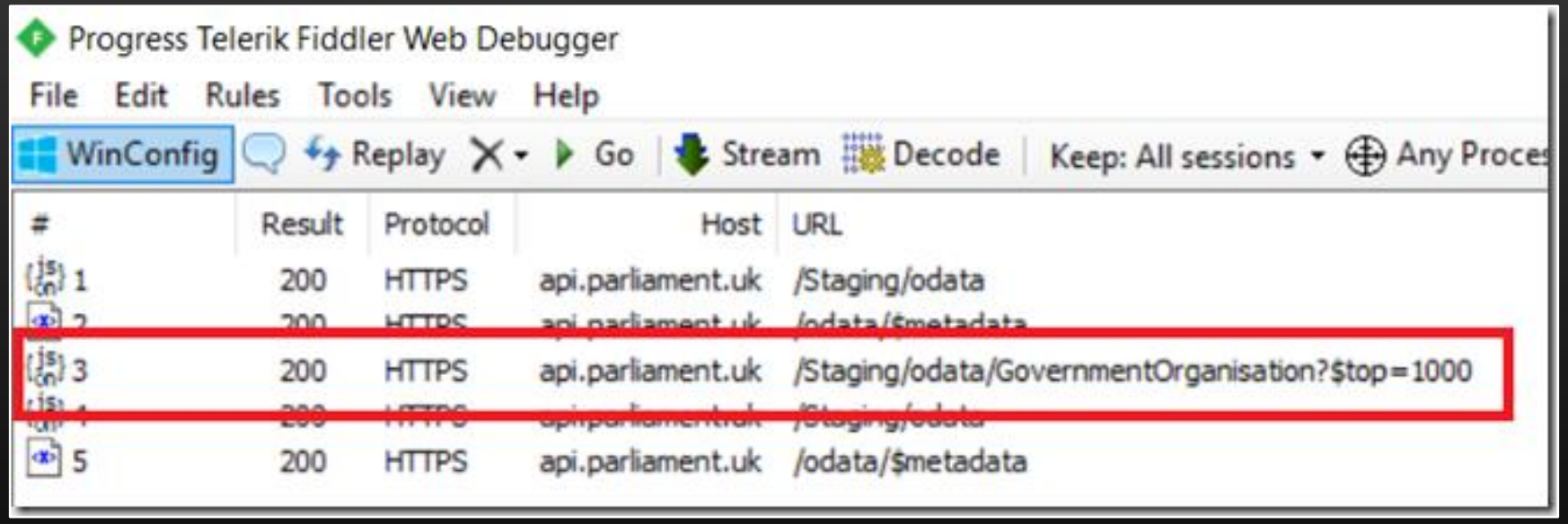




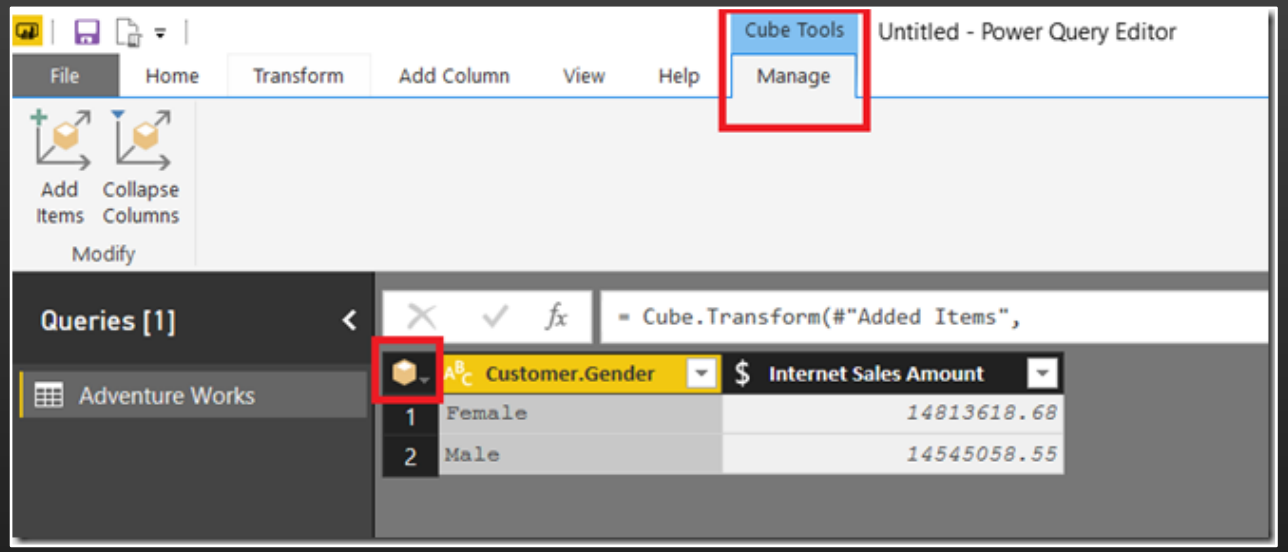
Query Diagnostics Options

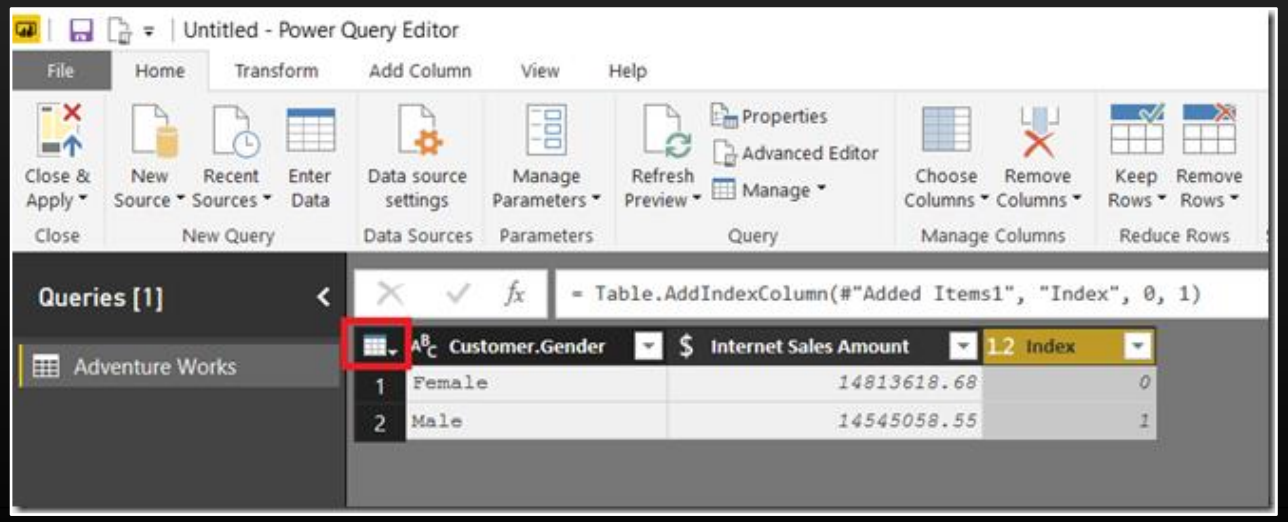


Is My Query Folding? - OData



Is My Query Folding? - SSAS





Agenda

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

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

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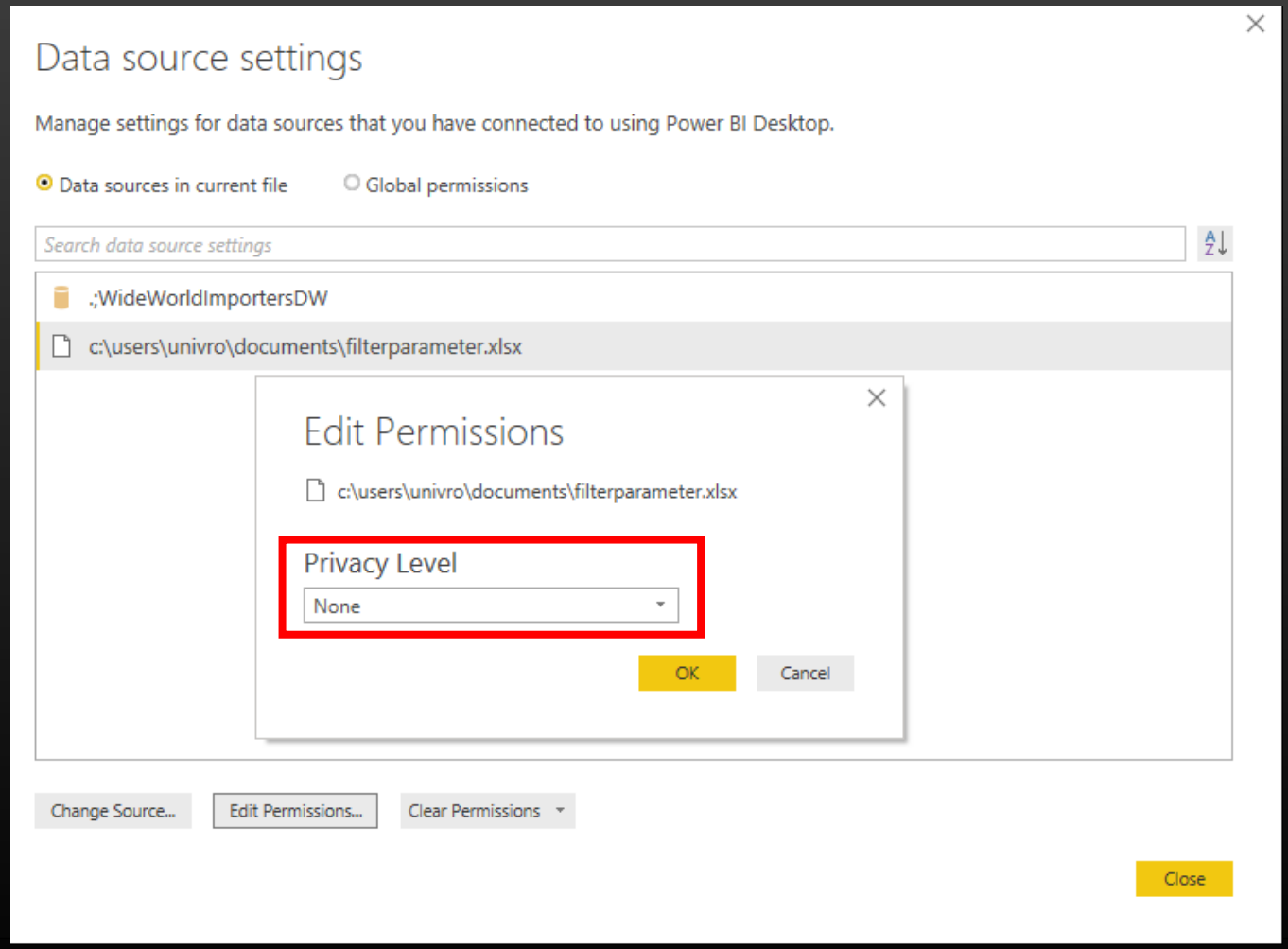
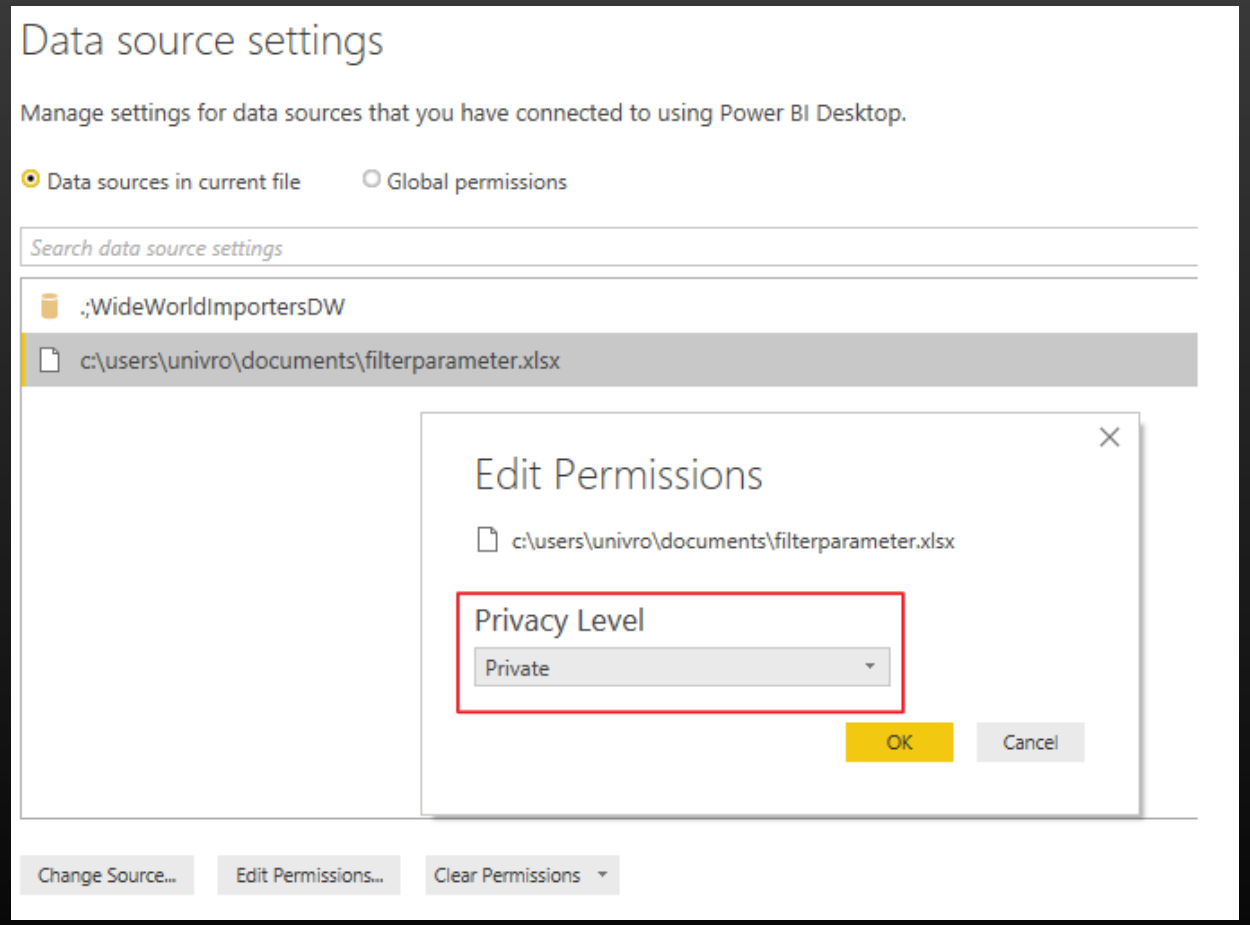
Limitations – Data source privacy level



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 ([$Out
        ) as [_]
        where [_].[Calendar Year] = 2018 and [_].[Calendar Year] is
    ) as [_]
as [$Outer]
```

Limitations – Data source privacy level



Limitations – Data source privacy level

```
select [$Outer].[Movement Key],
    [$Outer].[Date Key],
    [$Outer].[Stock Item Key],
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    [$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

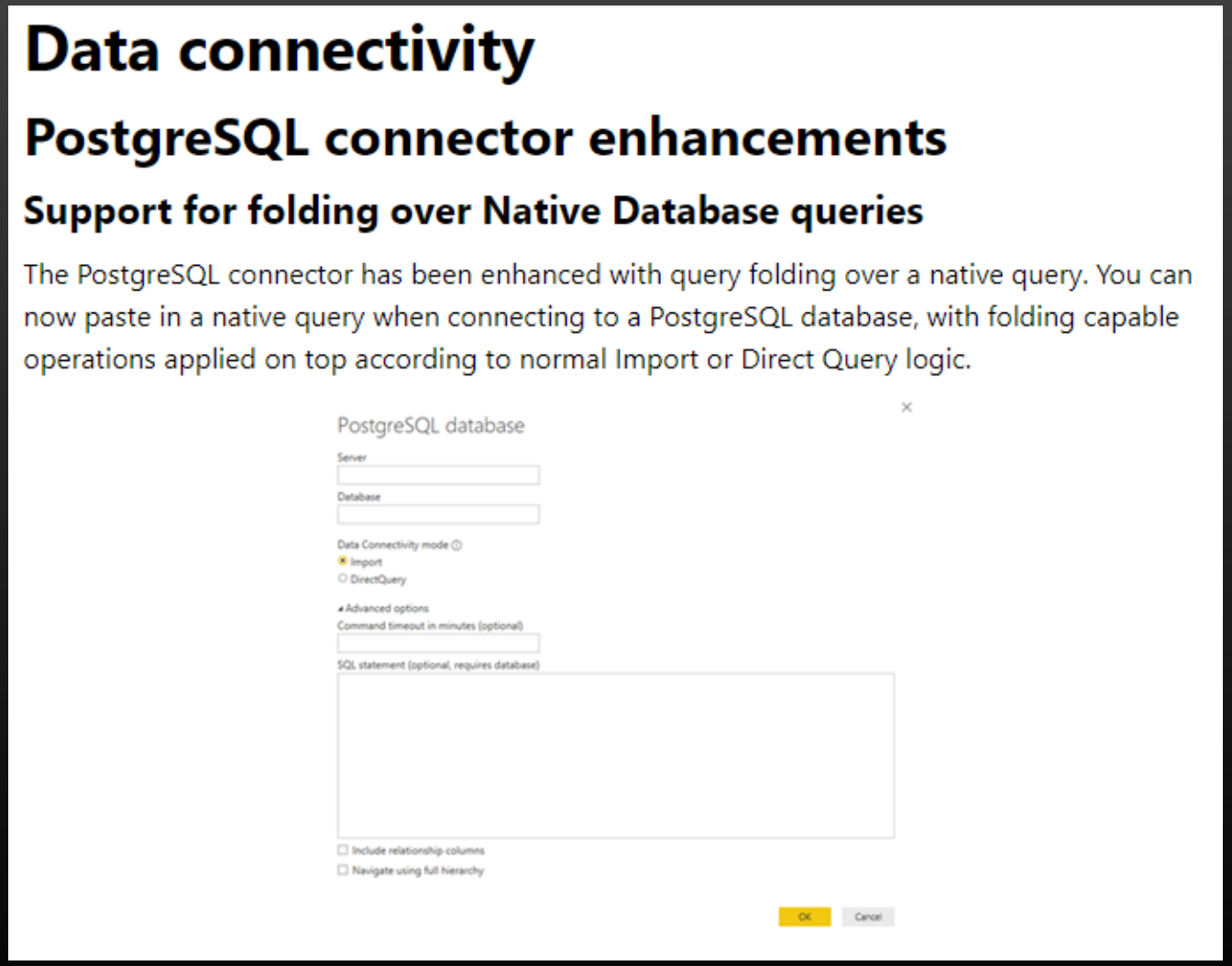
- PQ isn’t sufficient
- Specific requirements/optimizations
- Existing SQL-query
- Stored Procedures

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



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

Thank you

and let’s connect!

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@NickyvV

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