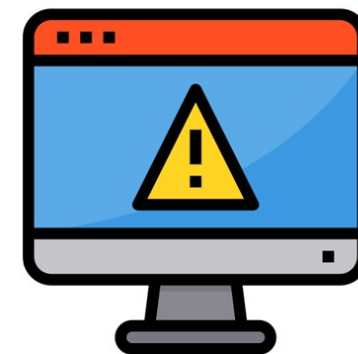# HAVENS
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Performance, Optimization, and **Error Handling** in **Power Query**

Presenter Introduction

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  - Microsoft MVP
  - PBI User Group Co-Organizer – Redmond, WA
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Performance, Optimization, and Error Handling in Power Query

Reducing Query Data

Optimizing Query Performance

Leveraging Query Folding

Utilizing the Query Diagnostics Tool

Handling Conversion Errors

Performance, Optimization, and Error Handling in Power Query

Reducing Query Data

Optimizing Query Performance
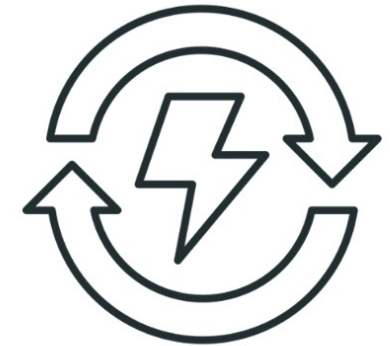
Leveraging Query Folding

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Reducing Query Data
Common Transformations

- **Common reduction transformations are:**
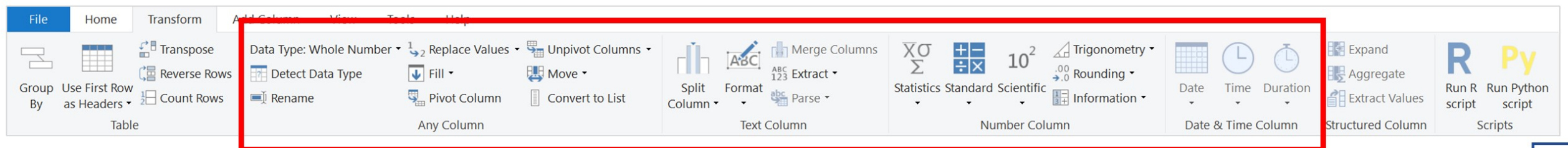 - Column modification
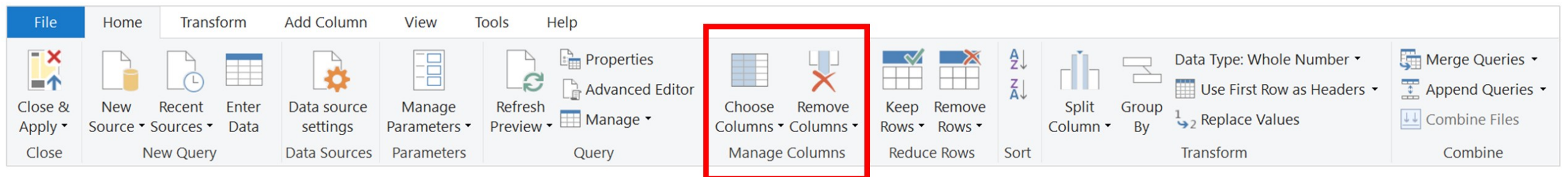 - Reducing rows

Reducing Query Data

Common Transformations ► Column Modification

- **Types of column modifications:**
  - *Choosing* or *removing* columns
  - *Modifying* columns

Most column modifications can be added without any coding required

Reducing Query Data
Common Transformations ► Reducing Rows
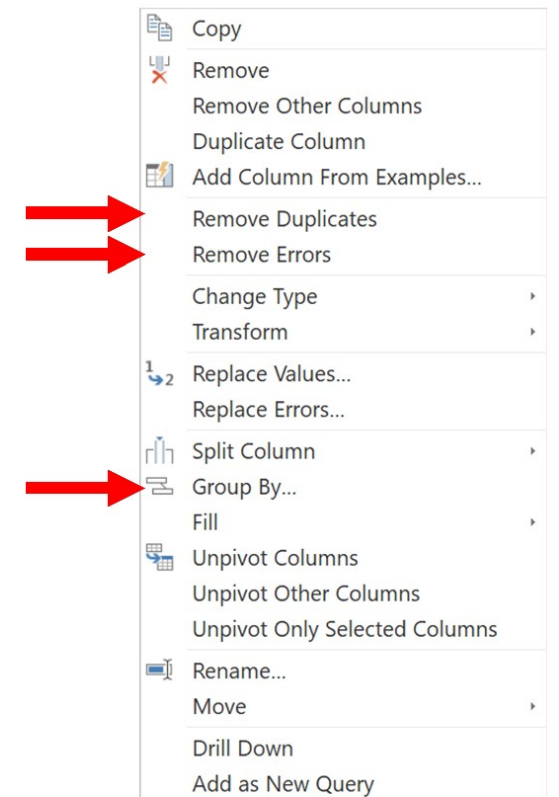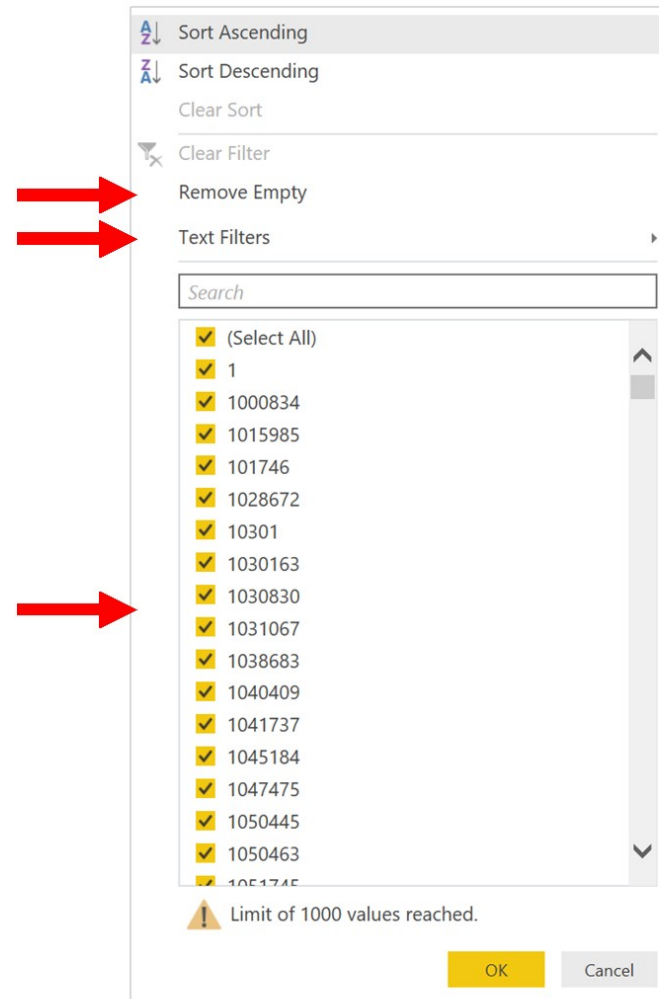
- Types of row reduction:
  - **Filtering rows:**
    - Filtering by *category* or *date*[1]
    - Removing *empty rows*
    - Removing *duplicates*
    - Removing *errors*
  - **Group by column(s)**[2]

1: Depending on data type
2: The **Group By** function aggregates rows up to a level higher than the original granularity of the table

Demonstration

Reducing Query Data

Recommended Practices

- Query data reduction practices:
  - **Select columns:**
    - Select only columns that meet the current report requirements
  - **Filter rows:**
    - Filter by date (history)
    - Filter by category (subset of source data)
  - **Reduce granularity:**
    - Remove row level details outside the scope of report requirements
  - **Change data type:**
    - Set columns to appropriate data types

References

- Power Query Docs
  - https://docs.microsoft.com/en-us/power-query/
- Common Power Query Tasks
  - https://docs.microsoft.com/en-us/power-bi/desktop-common-query-tasks
- HC – Power Query Videos Playlist
  - https://www.youtube.com/playlist?list=PLzN99cpDw6oBuidLOD20RVv83RusrBQ3o

Questions?

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Recommended Practices

- Query optimization practices:
  - **Row and column selection first:**
    - Choose columns and filter rows before transformations to reduce the amount of information processed by the mashup engine
  - **Avoid duplicate applied steps:**
    - Try to avoid having multiple applied steps for the same types of transformations. Common transformations where this occurs are: change type, rename columns, or choose columns.
  - **Remove duplicates:**
    - When remove duplicates from a column – avoid using the Group By command, unless an aggregation is required. Otherwise use the remove duplicates command
  - **Add columns using left joins:**
    - Left joins with other tables typically calculate faster than adding a new column using the conditional column command

Recommended Practices

- Query optimization practices:
  - **Use list commands for column calculations:**
    - Whenever a calculation against a column is needed, such as min/max or sort commands. It is better to treat the column as a list using Statistical commands or the Group By and aggregate commands.

References

- The BIccountant – Speed and Performance Aspects in Power Query
  - https://www.thebiccountant.com/speedperformance-aspects/
- HC – Power Query Videos Playlist
  - https://www.youtube.com/playlist?list=PLzN99cpDw6oBuidLOD20RVv83RusrBQ3o

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Query Folding

- Query folding is the ability for a Power Query query to generate a **single query statement** to retrieve and transform data *at the source*
  - Query folding is the **most efficient path** to connect a Power BI model table to its *underlying data source*
- Query folding **may occur** for an *entire Power Query query*, or for a *subset of its steps*
  - When query folding cannot be achieved for an applied step – the transformation is imported and processed by Power Query[1]
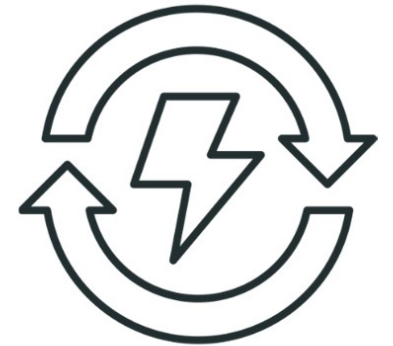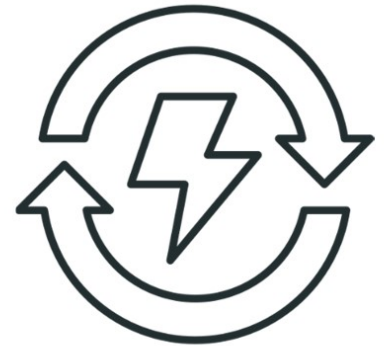
1: For large datasets this can be very resource intensive and slow

Query Folding

- Most data sources that have the **concept of a query language** *support query folding* – these can include:
  - Relational databases
  - OData feeds (including SharePoint lists), Exchange, and Active Directory.

- Data sources that are <u>**not**</u> **supported:**
  - Flat files
  - Blob
  - Web

Query Folding

Applied steps that **can** be query folded:

- Removing columns
- Renaming columns
- Changing a column data type
- Filtering rows with static values or Power Query parameters
- Grouping and summarizing
- Expanding record columns
- Non-fuzzy merging of fold-able queries from the same source
- Appending fold-able queries from the same source
- Adding custom columns with simple logic
- Pivoting and unpivoting
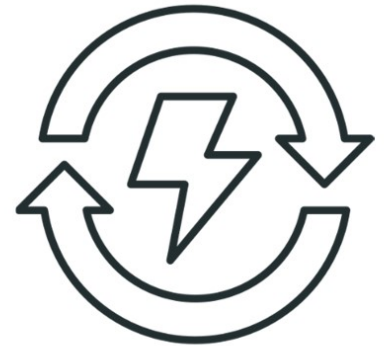
Query Folding
Incompatible Applied Steps

Applied steps that cannot be query folded:

- Using a custom SQL statement[1]
- Merging queries based on different sources
- Appending queries based on different sources
- Adding custom columns with complex logic.
- Adding index columns
- Using the Buffer command
- Using any command to remove errors
- Transformations that use a List function[2]

1: Compared to connecting to a **native SQL query** that support folding
2: Unless used as an aggregation function inside a **Group By** command
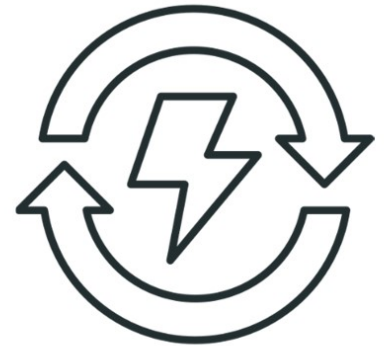
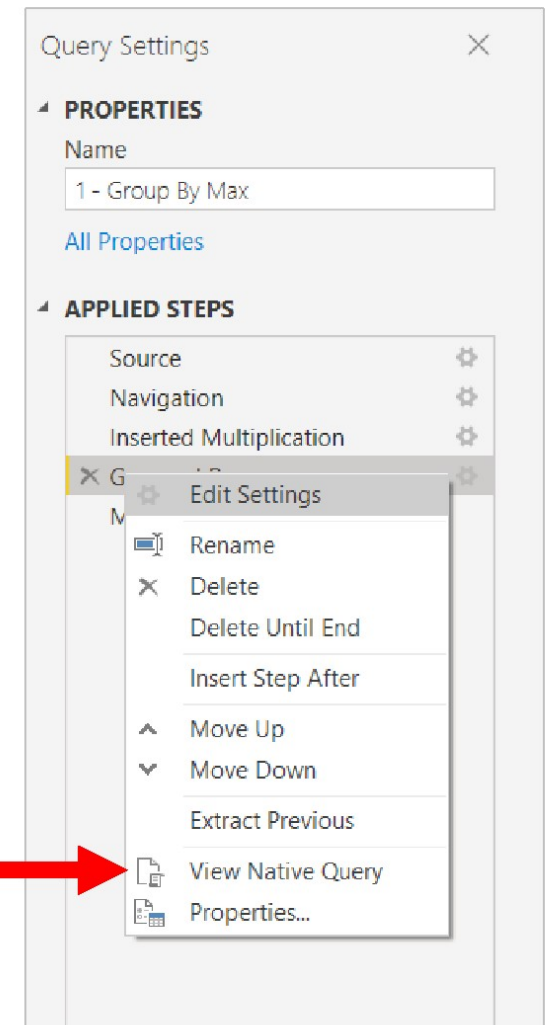# Query Folding

Identifying Query Folding

- In the Power Query Editor window, it is possible to determine if any **applied step** *can be folded*

- In the **Query Settings** pane, when you right-click an applied step, if the **View Native Query** option is enabled (not greyed out) – then the query can be folded

Foldable →

Native query
sent to data
source ➡

Native Query

```
select max([rows].[Multiplication]) as [Max Sales Amount]
from
(
    select case
            when [_].[OrderQty] is null and [_].[UnitPrice] is null
            then null
            else (case
                    when [_].[OrderQty] is null
                    then 1
                    else [_].[OrderQty]
            end) * (case
                    when [_].[UnitPrice] is null
                    then 1
                    else [_].[UnitPrice]
            end)
        end as [Multiplication]
    from
    (
        select [OrderQty],
            [UnitPrice]
        from [SalesLT].[SalesOrderDetail] as [$Table]
    ) as [_]
) as [rows]
```

OK

HC

Recommended Practices

- Delegate as much processing to the data source as possible
  - When all steps of a Power Query query cannot be folded, discover the step that prevents query folding
  - When possible, move subsequent steps earlier in sequence so they may be factored into the query folding[1]

- Prepare and transformation data in the source
  - If certain Power Query query steps cannot be folded, it may be possible to apply the transformations in the data source
  - This could be achieved by writing a database view that logically transforms source data, or by physically preparing and materializing data

1: Note that the Power Query mashup engine may be smart enough to reorder your query steps when it generates the source query

References

- Importance of Power Query Folding
  - https://docs.microsoft.com/en-us/power-bi/guidance/power-query-folding
- Handling Query Folding
  - https://docs.microsoft.com/en-us/power-query/handlingqueryfolding

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Query Diagnostics Tool

Introducing the Diagnostics Tool

- Query Diagnostics is a powerful feature that will allow you to record what Power Query is doing during authoring time – specifically it allows authors to see:
  - What queries are being generated
  - Query timing and potential slowdowns during refresh
  - Any background events that are happening
- Results are pared into a summarized and detailed view query for analysis
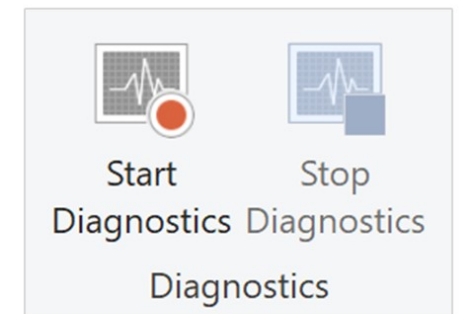
Recommended Practices

- For accurate query diagnostic results, the following options should be disabled:
  - Allow data preview to download in background
  - Parallel loading of tables
- It is also recommended to clear the query cache if running using the diagnostics tool to measure query timings

References

- Query Diagnostics
  - https://docs.microsoft.com/en-us/power-query/querydiagnostics
- Recording Query Diagnostics in Power BI
  - https://docs.microsoft.com/en-us/power-query/recordingquerydiagnostics
- HC – Power Query (Query) Diagnostics Tool
  - https://www.havensconsulting.net/blog-and-media/2019/10/1/power-query-query-diagnostics-in-power-bi

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Recommended Practices

- To build a reliable data model in Power BI, you need to account for and handle errors carefully

- Consider the pros and cons of *replacing values, replacing errors,* or letting the refresh *fail upon error*
  - If you use the replace errors command consider outputting an errors table in the report for review and analysis when errors occur

References

- Exception Report: Error Rows
  - https://radacad.com/exception-reporting-in-power-bi-catch-the-error-rows-in-power-query
- Errors – Power Query
  - https://docs.microsoft.com/en-us/powerquery-m/errors
- Error Handling for Power Query Connectors
  - https://docs.microsoft.com/en-us/power-query/handlingerrors

Questions?

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- http://www.havensconsulting.net/speaking-events

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