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# Power BI for Enterprise Solutions Workshop

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**3Cloud Solutions**
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Level: Intermediate

January 25, 2024

Microsoft® MVP Most Valuable Professional

# THANK YOU

Data Community Austria

Platinum

smart casual datadesign

redgate

TIMEXTENDER

Gold

b.telligent
smart data. smart decisions.

Lucient

Measure Killer

Spot by NetApp

Silver

veeam

Bronze

ACP CUBIDO Digital Solutions

Power BI Camp
powered by linearis.at

Savory DATA

SOLISYON

# Evaluations, evaluations…

https://evals.datagrillen.com/evals_vienna.aspx

# Paul Turley

My Values:

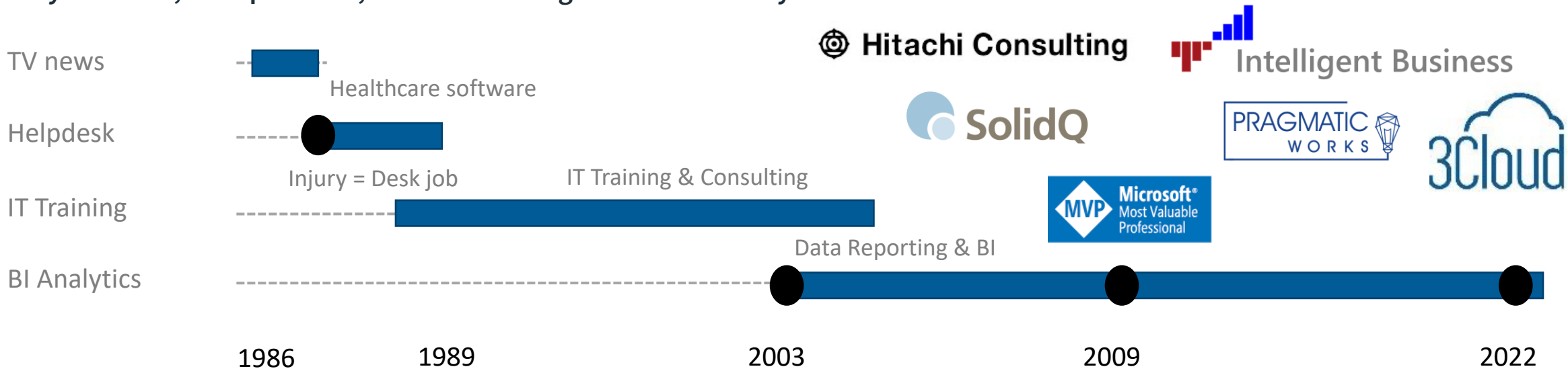
- Family
- Community, Mentorship
- Colleagues, Clients, Career

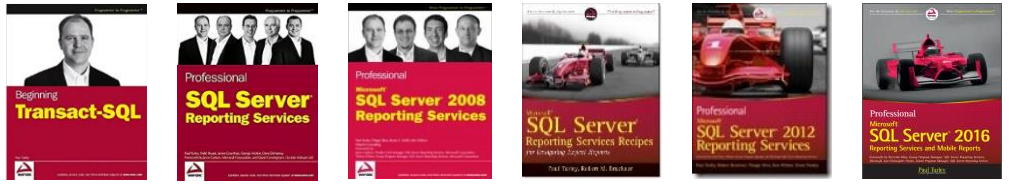

Conferences & Presentations:

- PASS Summit
- SQL Saturdays
- User Groups
- MBAS, Business Analytics Summit, Live!360
- SqlServerBi.Blog – ~2 million viewers

**Principal Consultant, Microsoft Data Platform MVP**

**~25 years in IT, data platform, Business Intelligence & data analytics**




14 books

# SOME BACKGROUND

## ABOUT THIS WORKSHOP

- This presentation developed as a full-day preconference
- Expanded to optional 2-day training
- Scaled-down a version to 3-4 hours
- Way too many slides! - Not going to present all of them
- Not going to complete every exercise
- OK to skip ahead and use completed solution files



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Personal BI

Team BI

Enterprise BI

**Power BI Premium**

**Microsoft Fabric**

- Futureproof
- Scalable
- Extensible
- Governance
- Team Development
- Versioning
- Deployment Process

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# The Business Intelligence Process

Plan

Get Data

Transform

Model

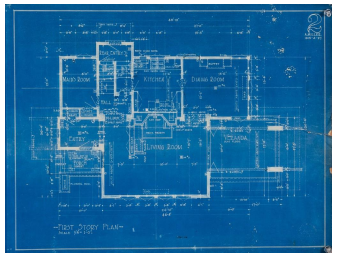
Calculate

$$\sum_{1=0}^{N} \frac{P_t}{(1+i)^t} = 0$$

Visualize

Publish

Manage









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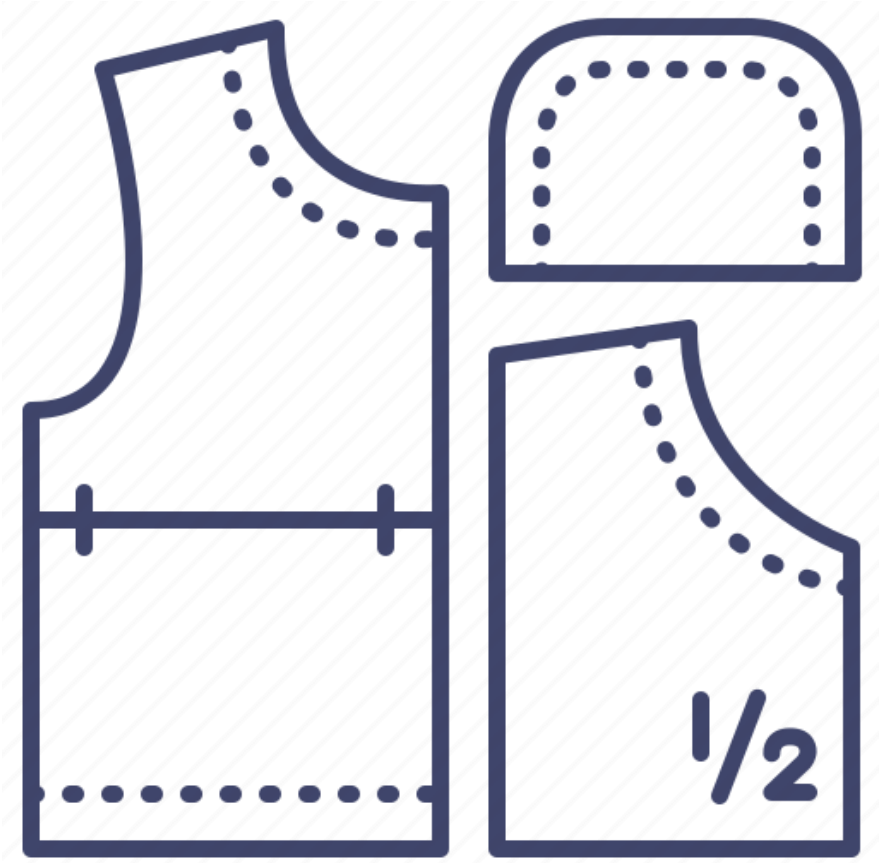
# Objectives: Apply enterprise-scale recipes & patterns

# Futureproof Solutions

# Extensible Design



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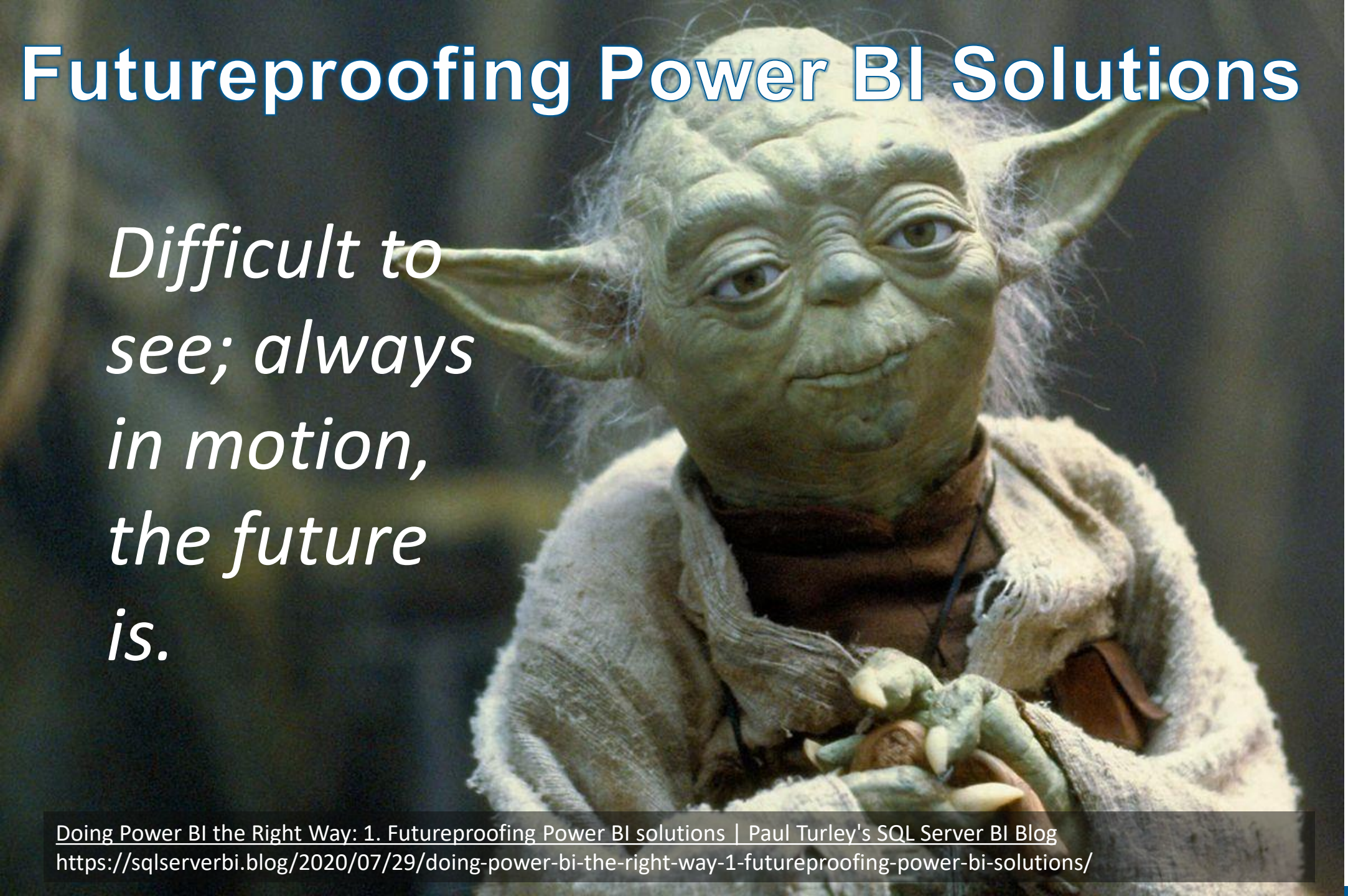
# Futureproofing Power BI Solutions




Doing Power BI the Right Way: 1. Futureproofing Power BI solutions | Paul Turley's SQL Server BI Blog
https://sqlserverbi.blog/2020/07/29/doing-power-bi-the-right-way-1-futureproofing-power-bi-solutions/

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# Extensible Design

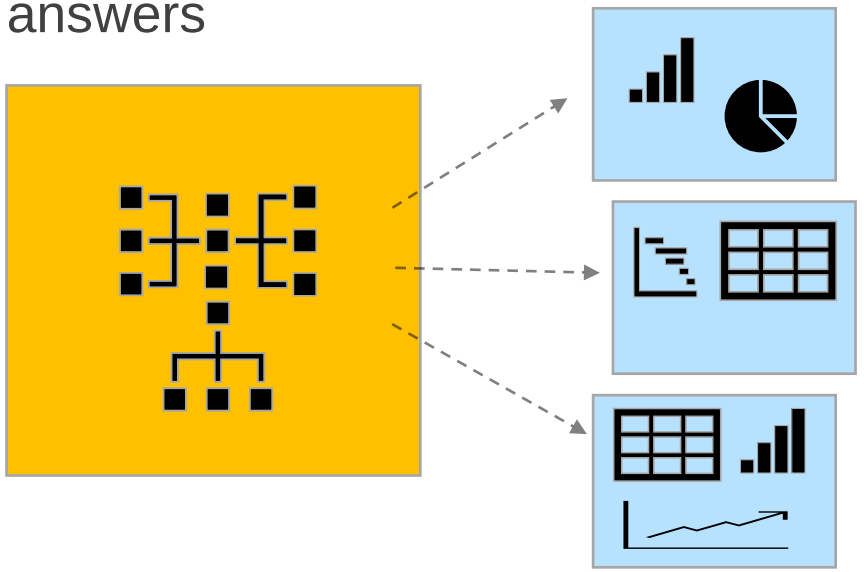
GOING TO EXTREMES AND FINDING BALANCE

One model per Report

Flexibility

Redundancy & inconsistency

One model with all the answers



Central Control

Complexity & inflexibility



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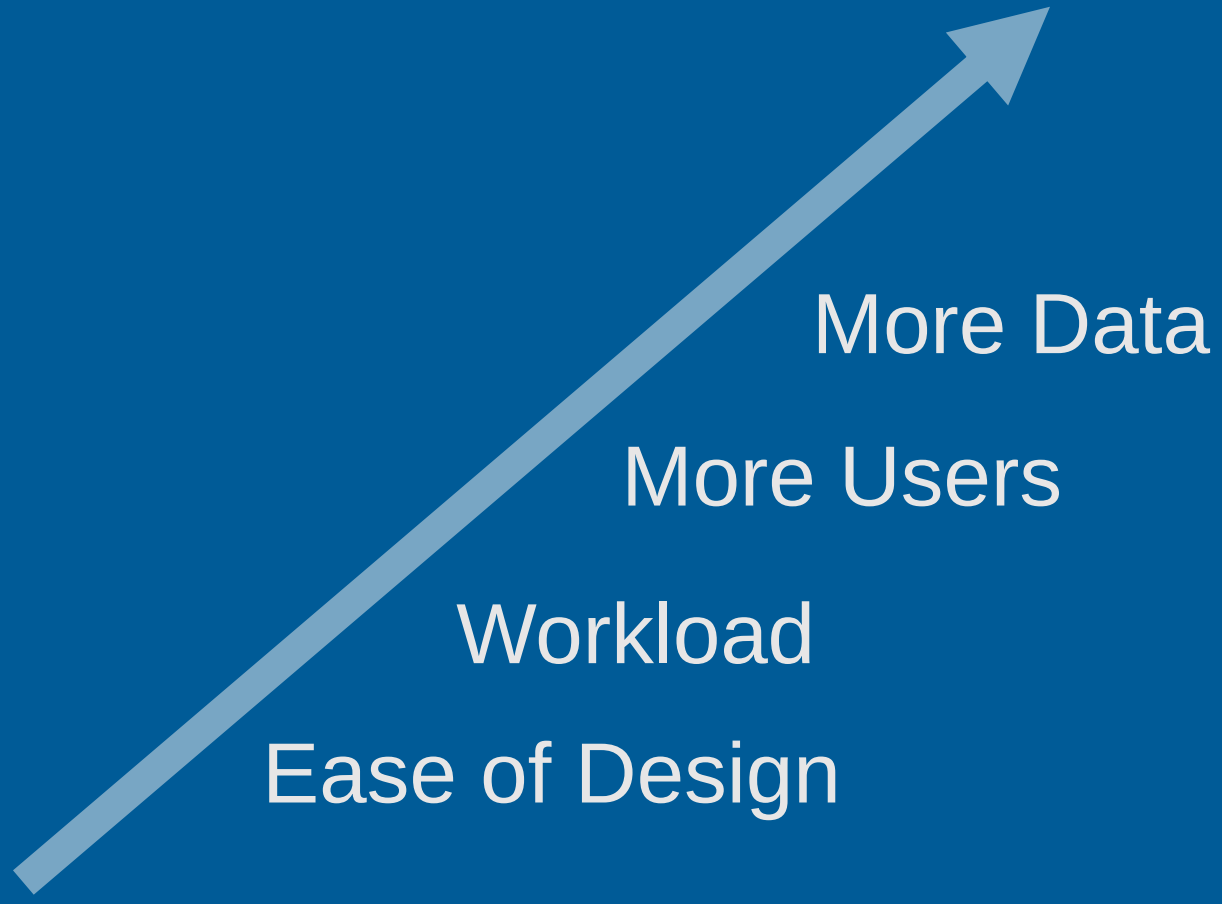
# Scalability



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# Self-Service BI Mindset

We Have Some Data

This data looks OK. Let's import it.

We Need a Report

What visuals should be used?

What color should it be?

How to navigate between pages

How can users export the report data?

Can we design the report to look like the old one?



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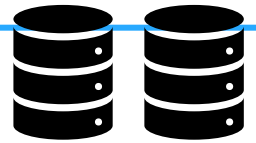
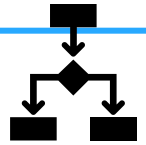
# Enterprise BI Mindset

## Data Sources



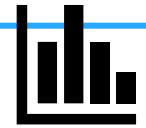
- Who owns & manages this source data?
- How should data quality issues be resolved?
- Which of the three sources for a table is correct?

## Data Shaping & Storage



- How often should records be loaded & refreshed?
- How are records identified & how are tables related?
- Do we need to track changes & history?
- How should data be shaped & modeled for reporting?
- How/who decides how data should be accessed & secured?
- Are there standard definitions for calculations across the organization?

## Report Design



- What business questions are being answered?
- Are calculations accurate & used correctly?
- Visualization choices
- Report page navigation
- Standard report branding, theme colors & layout



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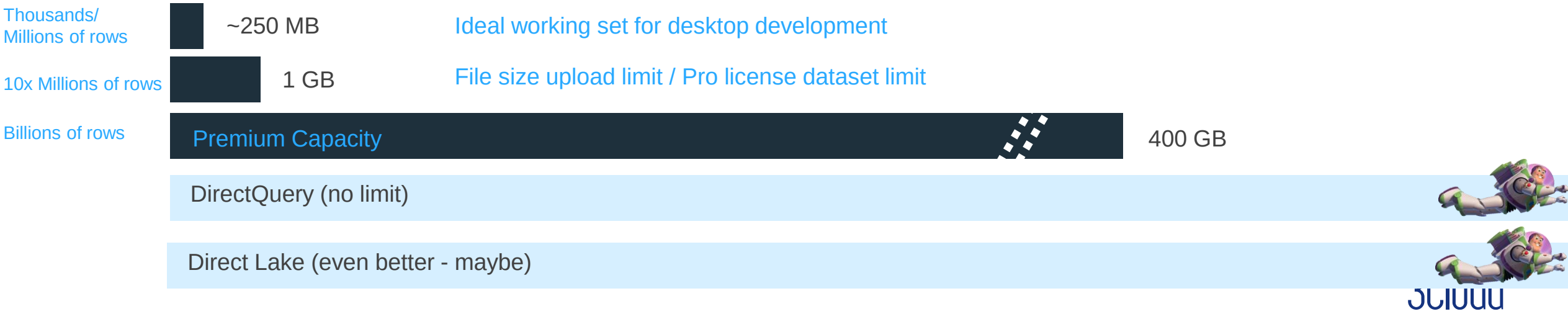
# How Much Data?

## CAN WE MANAGE WITH POWER BI…

- Data models typically require a fraction of the source data storage size (due to column selection & compression)
- Import models run in-memory & are typically very fast.
- DirectQuery enables access to large tables with a performance cost, OK with little grouping and when only light calculations are needed.
- Advanced features enable optimizations over DirectQuery, like aggregations & composite models.



# Team Development
# Versioning & File Management



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# Manage Power BI Desktop Files

- **Store files in a centrally managed network-assessable folder**
  The storage folder should support automatic backup and recovery in the case of storage loss.
- **Report and dataset developers must open files from the Windows file system**
  Files must either reside in or be synchronized with the Windows file system.
- Files containing imported data typically range in size from 100 to 600 MB. Any shared folder synchronization or disaster recovery system should be designed to effectively handle multiple files.

**Options:**

- OneDrive For Business (shared by team, with folder synchronization).
- SharePoint or SharePoint Online (with folder synchronization).
- GitHub and/or VSTS with local repository & folder synchronization. If used, Git must be configured for large file storage (LFS) if PBIX files are to be stored in the repository.
- NEW – Power BI Project with Git integration.

Reduce file size to under 100 MB. We'll talk about this a bit later.

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# Clearing DevOps, Versioning & Team Development Blockers

- Power BI file size
  Keep PBIX files under 100 MB, as a guideline
- Separate data model PBIX from Report PBIX when:
  - Project has matured
  - Parallel data model & report development is feasible
- Treat PBIX file as a binary file
  - Don’t compare, split or merge with app dev schema compare tools
  - More DevOps & object-level integration is coming. Be patient
  - Option: manage data model as .BIM (but realize the trade-offs).
- Store BI project files in simple code repository
  - OneDrive for Business
  - Git / Azure DevOps



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# Data Governance

how it relates to Power BI solutions



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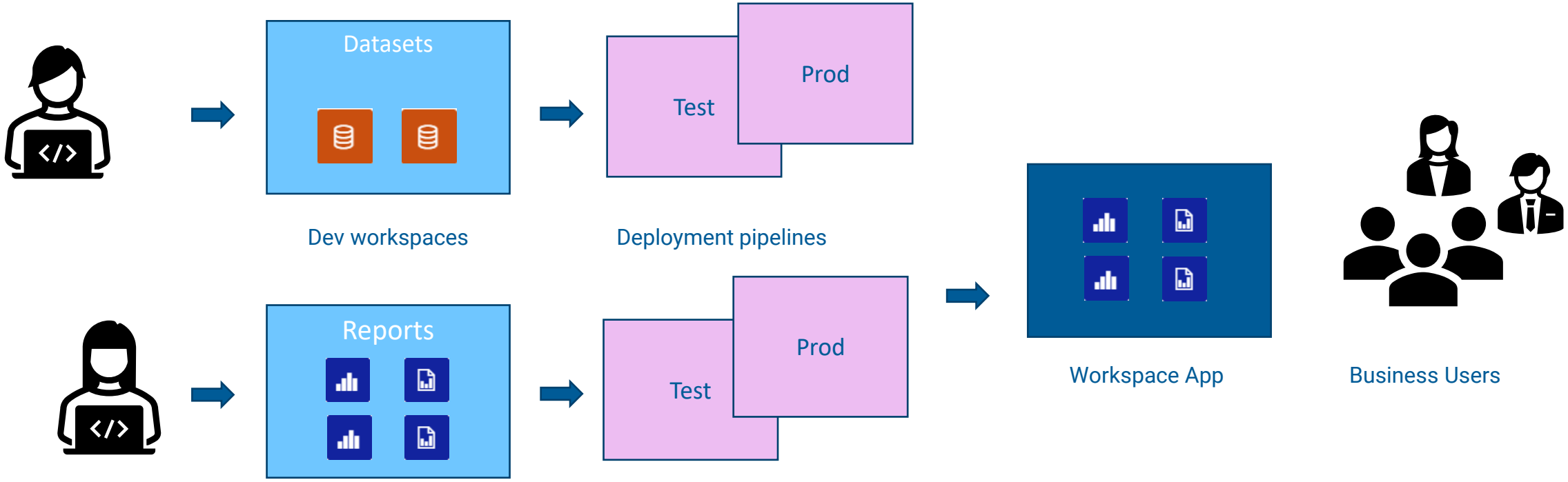
# Dataset, Model and App Deployment & Delivery Cycle

REPORT DELIVERY EN MASS

## Certified Reports on Certified Datasets




Developers deploy datasets and reports to workspaces

Workspaces are promoted through Deployment Pipelines after test acceptance

Report workspace delivered as an App



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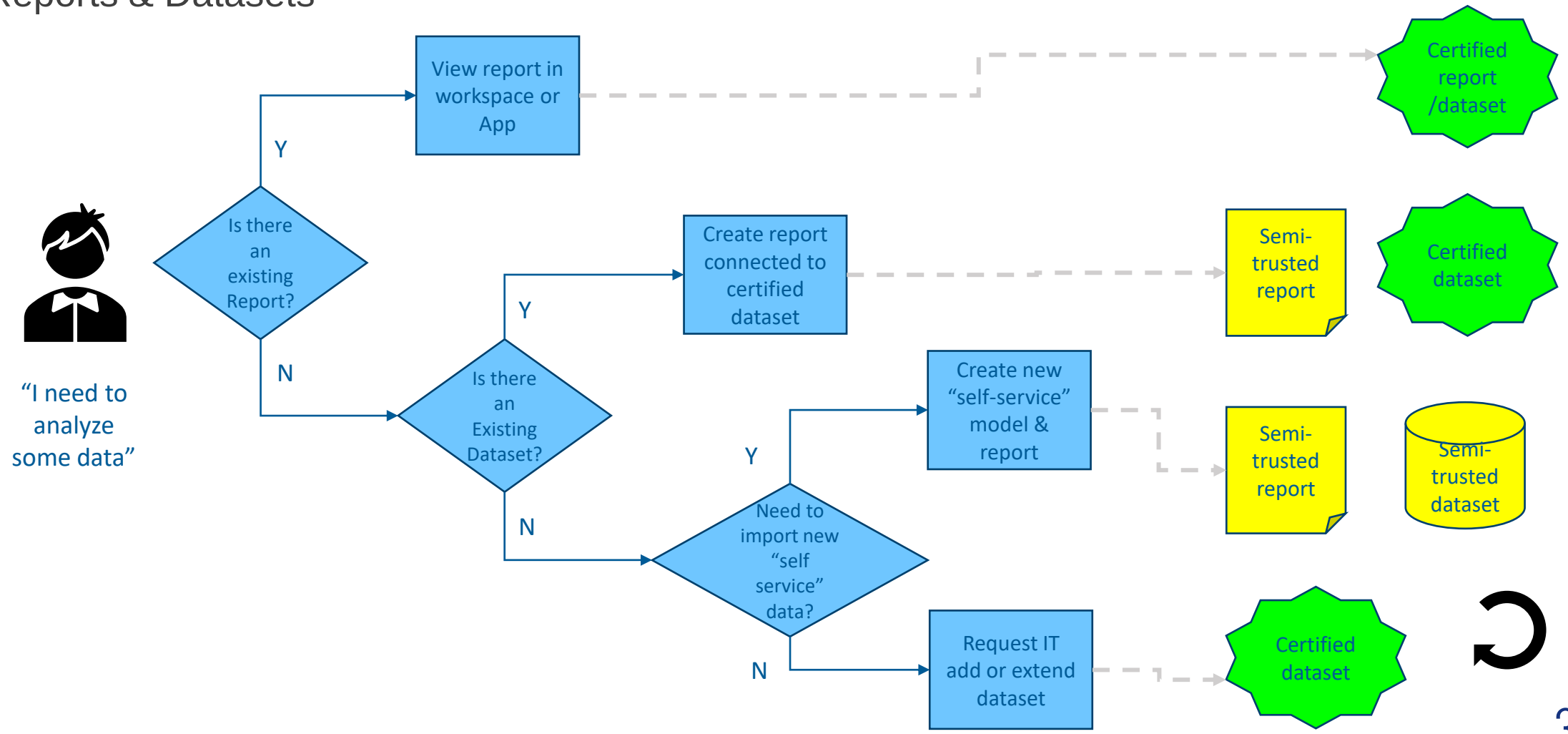
# Certified & Self-Service Decision Tree

REPORTING & ANALYTICS PATHS

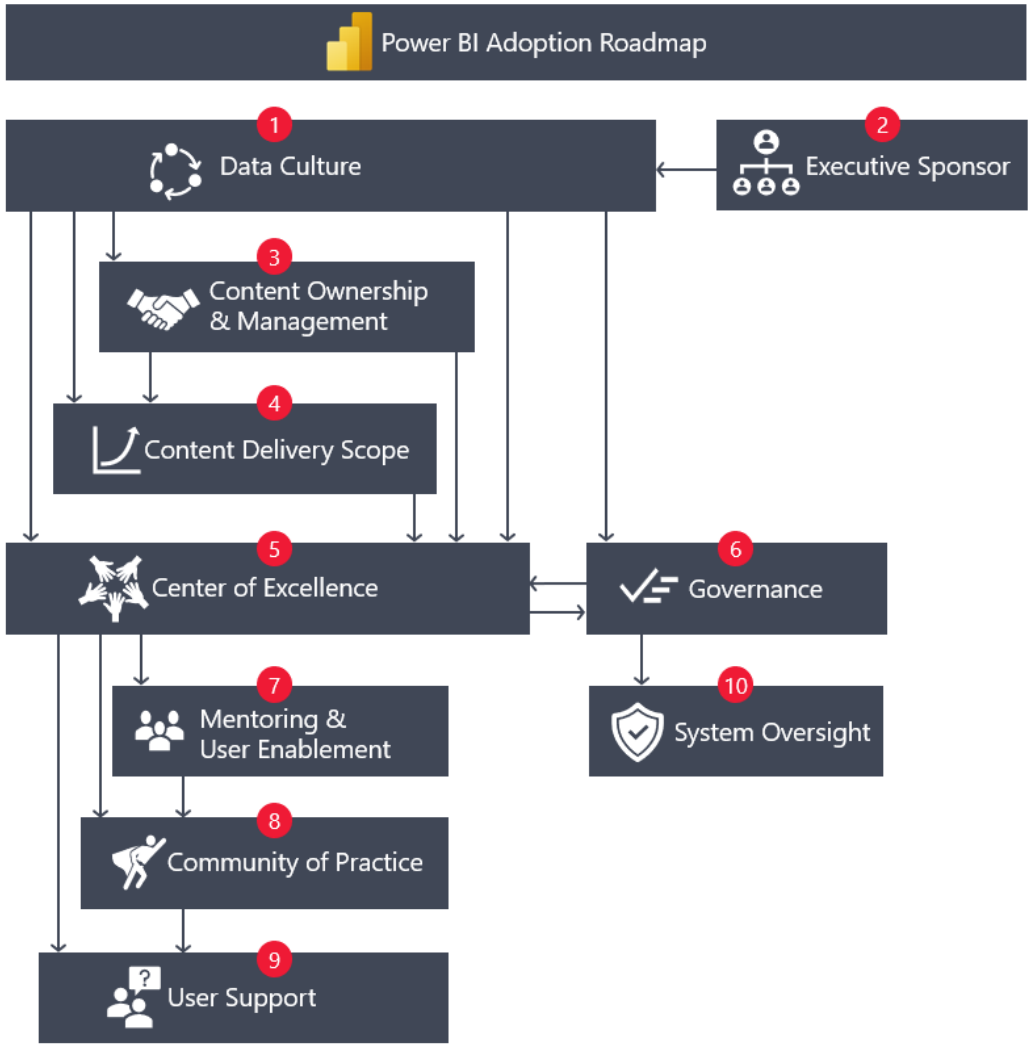
## Reports & Datasets



# Power BI Adoption

Power BI adoption should blend with the organizational data governance strategy

- Data culture
- Sponsorship
- Content ownership (Data Stewardship)
- Content delivery (Certification, self-service)
- Community of Practice / training & knowledge sharing
- Security & system oversight




https://docs.microsoft.com/en-us/power-bi/guidance/powerbi-adoption-roadmap-overview



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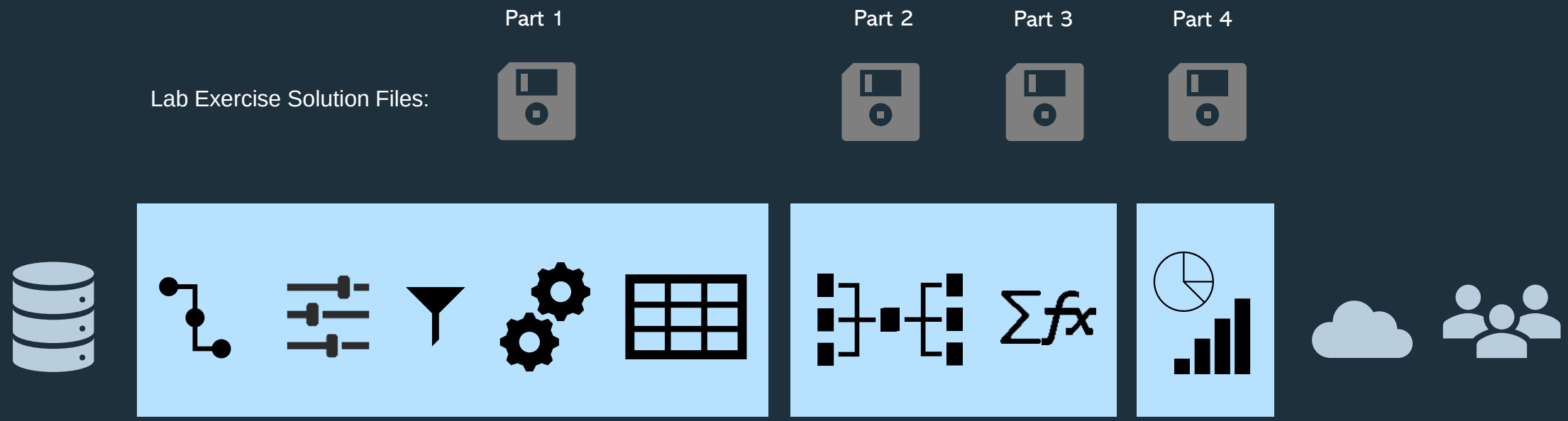
# Hands On Exercises




- Prepare source data
- Connect to data sources
- Create parameters
- Filter records

- Transform data
- Import tables
- Create data model
- Create base measures

- Create advanced measures
- Visualize
- Deploy to cloud service
- Deliver to user audience

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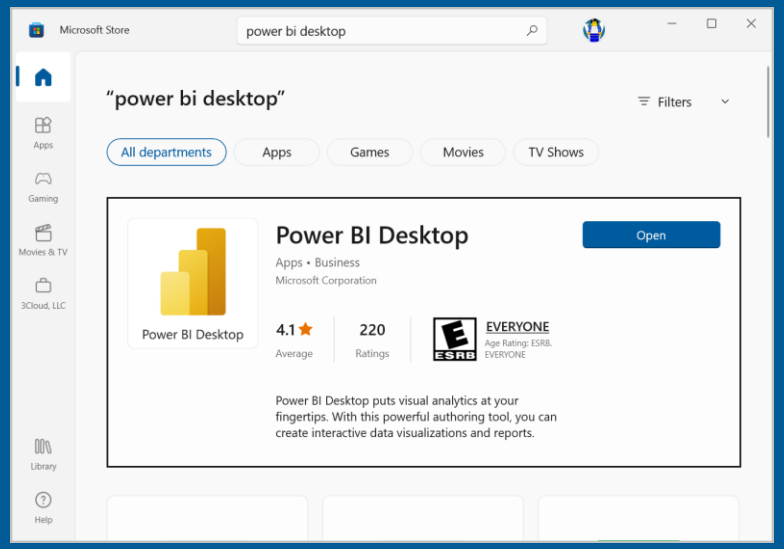
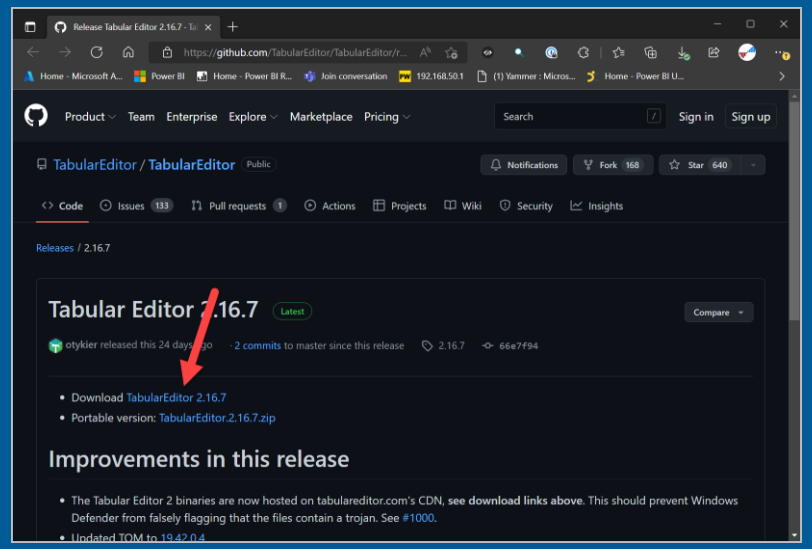
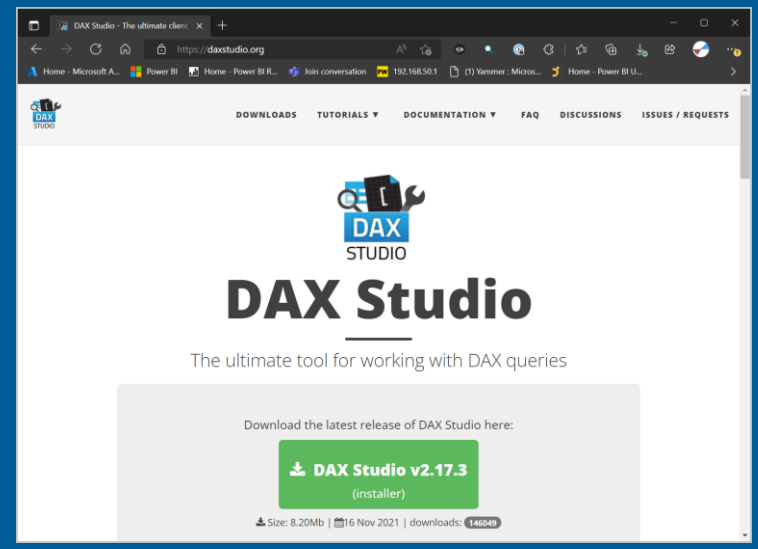
# Setup



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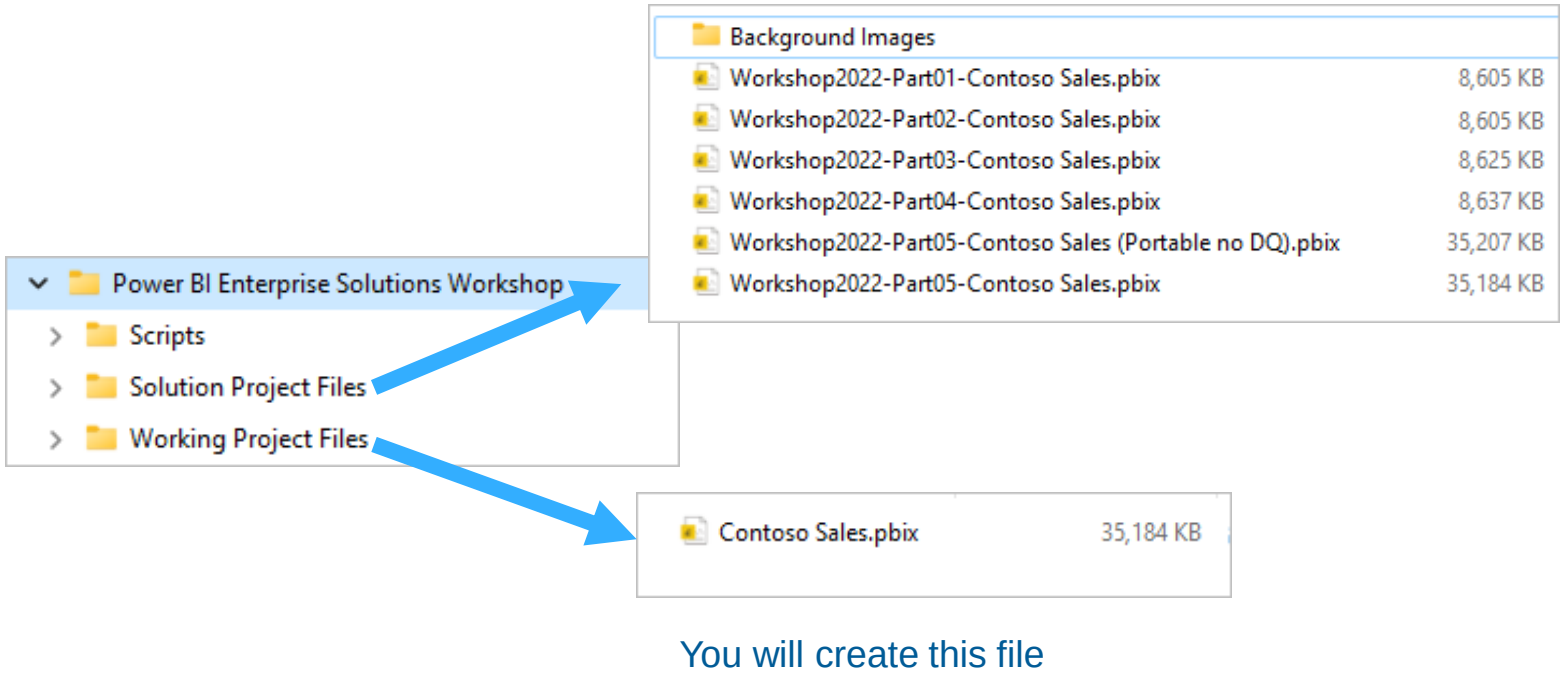
# Lab Project Files & Folders

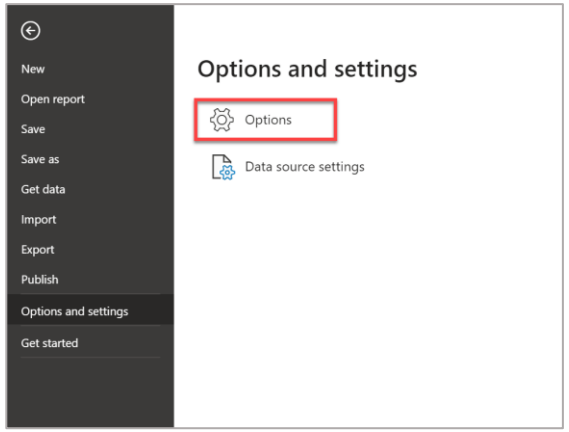
Using Windows File Explorer, copy the folder **Power BI Enterprise Solutions Workshop** from the USB drive to the C: drive on your computer.

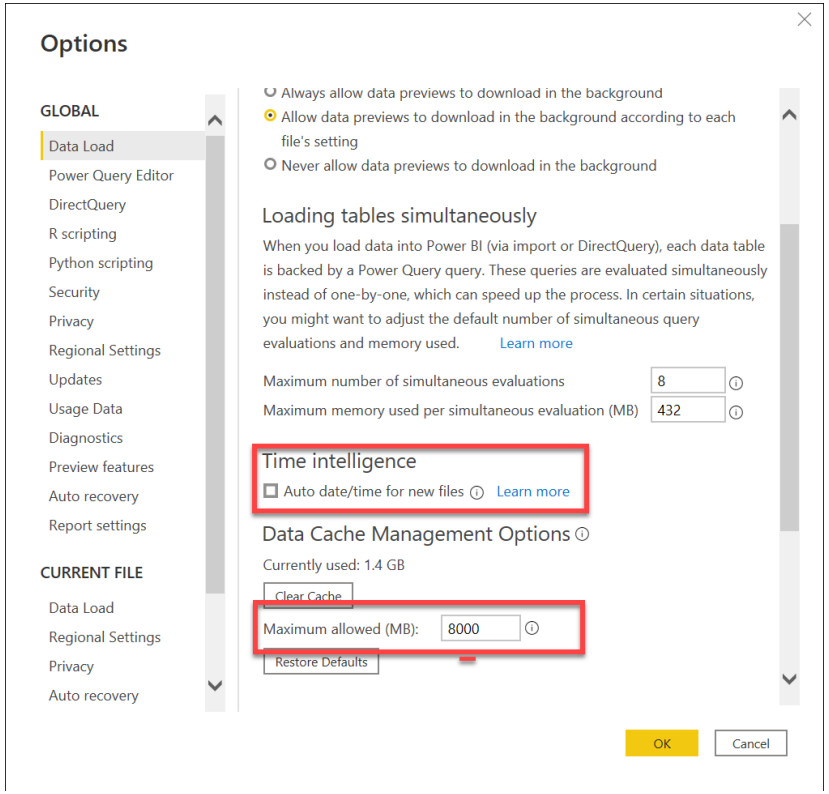
Follow instructions to:

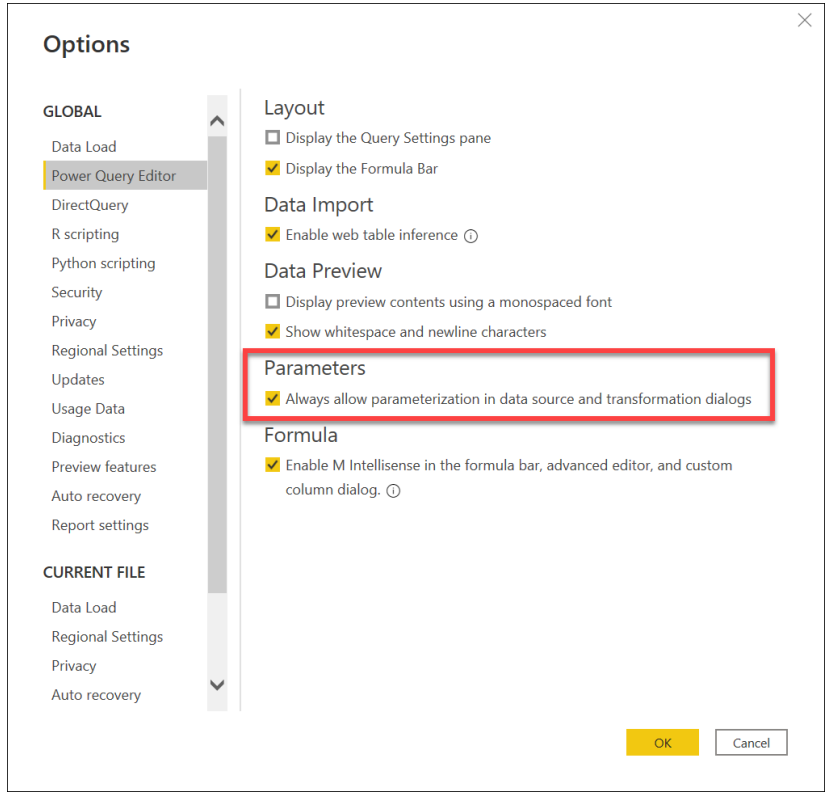
- Work in the **Working Project Files** folder
- Copy solution files from the **Solution Project Files** folder



# Power BI Desktop Options



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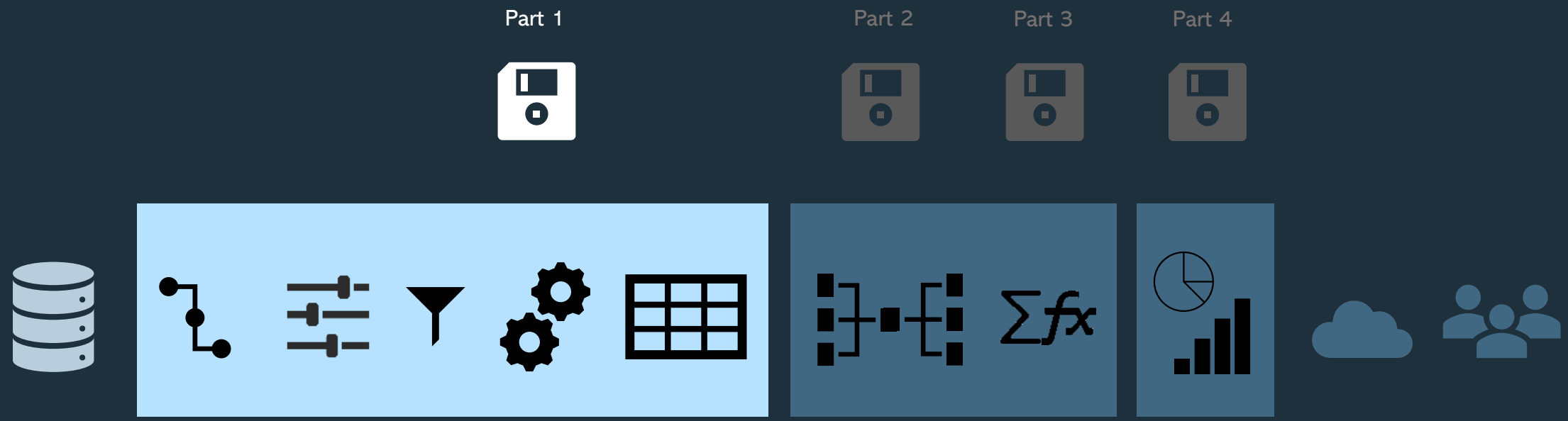
# Hands On Exercise
# Part 1:
# Connect & Transform Data

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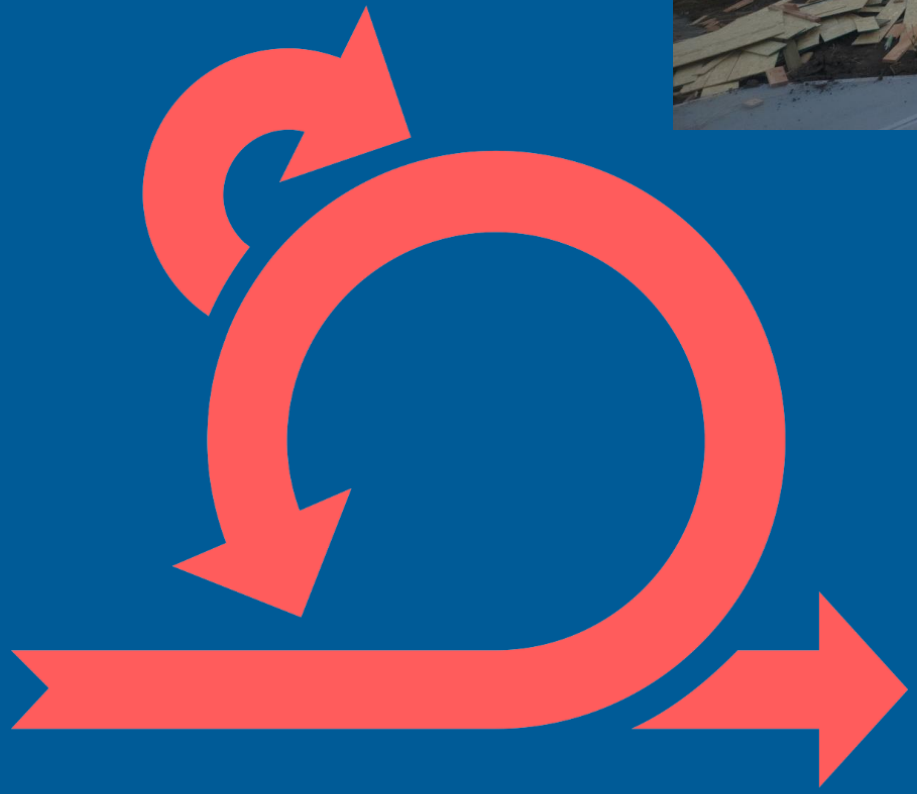
# Iteration 1

## Fact tables & related dimensions:

- Online Sales
- Store Sales



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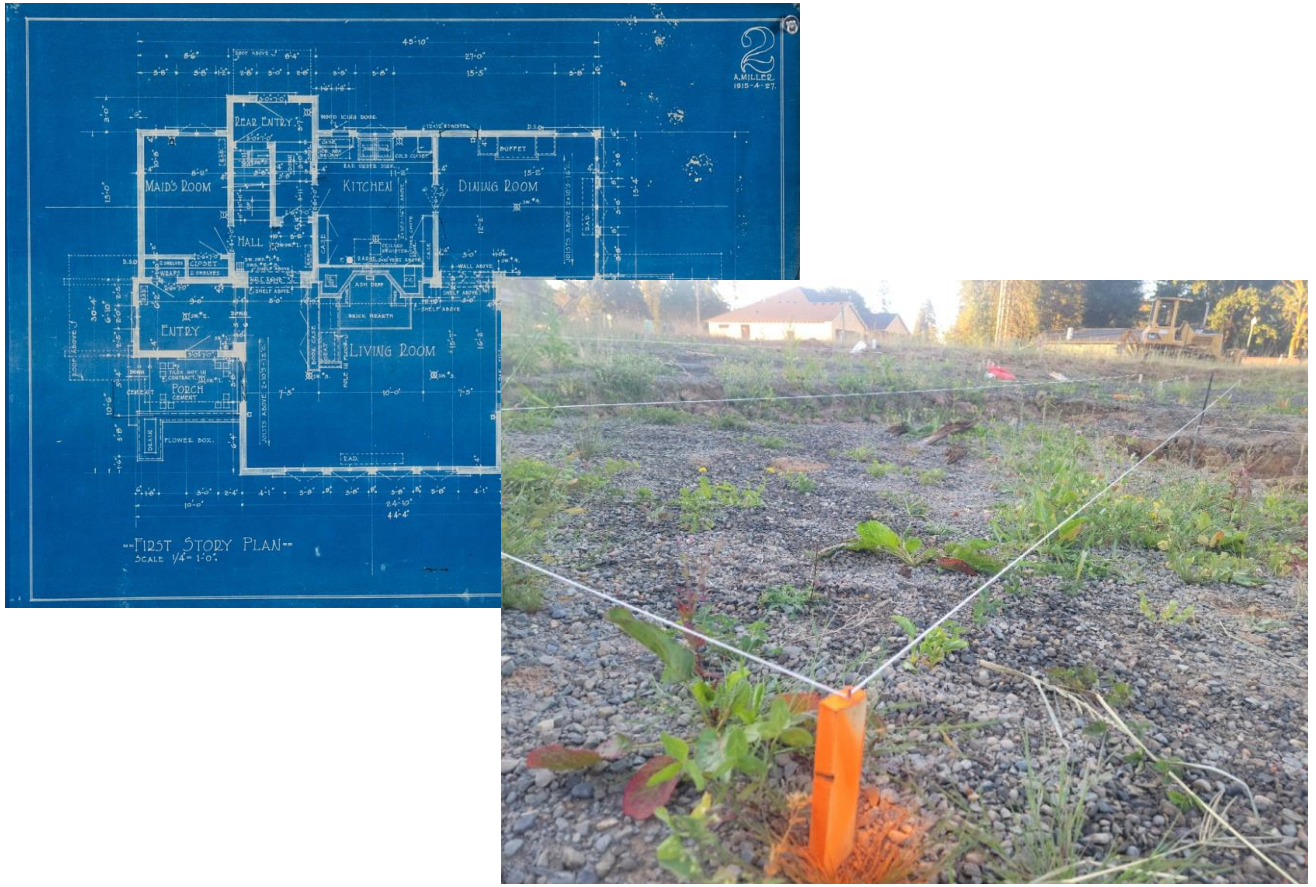
# Iteration 1 Requirements

## FUNCTIONAL REQUIREMENTS

The Sales organization needs…

- Online Sales Qty
- Online Sales Amt
- Store Sales Qty
- Store Sales Amt

Executive Leadership needs…



# Iteration 1 Requirements

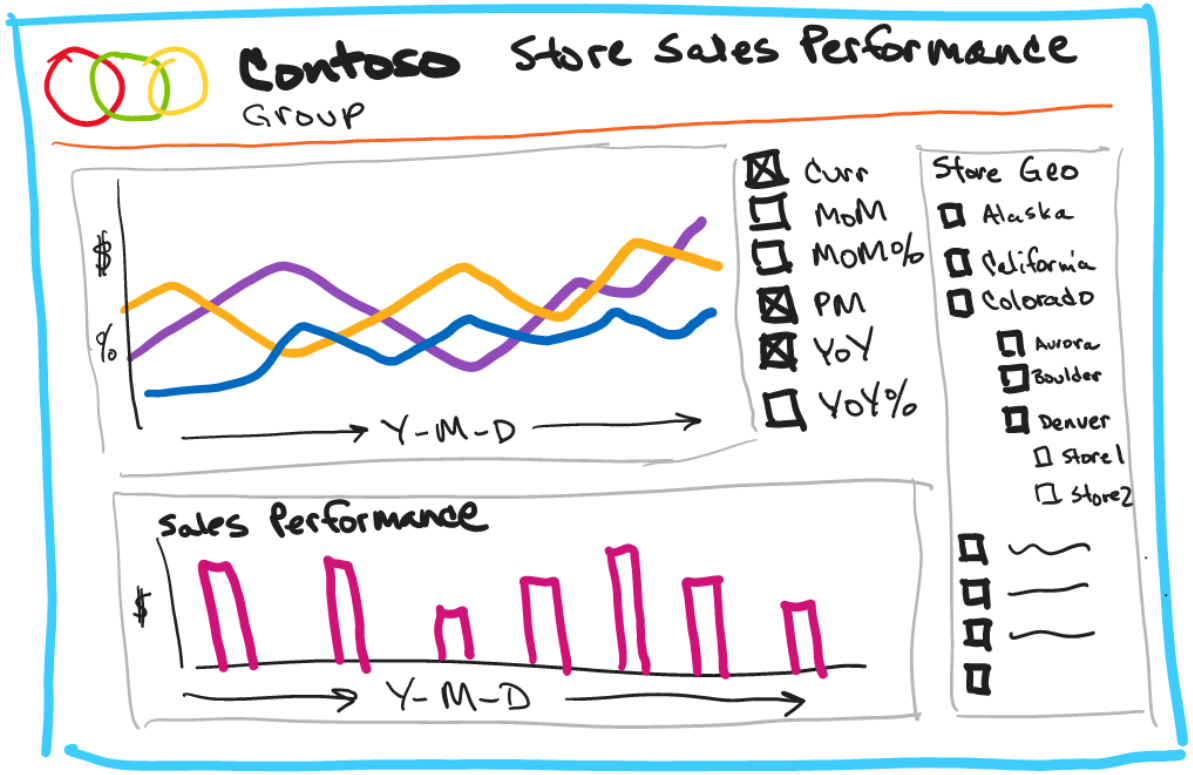
REPORT CAPABILITIES & WIREFRAME

## Functional Report Requirements

"Back of the napkin report design"

Business questions:

- What is the Sales Amount grouped by Year or Month or Day, for a specific period of time.
- Trend chart should allow a user to select a time series metric (like Month Over Month, Month Over Month % Change, Month To Date, Prior Month, Year To Date) & then show them along the axis of Years, Months or Days.
- All of the data on the report can be filtered by store regions, such as State, City or an individual Store.



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# Iteration 1 Requirements

## DIMENSIONAL MATRIX

| | Date | Account | Customer | Product | Store |
|---|---|---|---|---|---|
| **Online Sales** | X | | X | X | |
| Online Sales Qty | | | | | |
| Online Sales Amt | | | | | |
| **Store Sales** | X | | | X | X |
| Store Sales Qty | | | | | |
| Store Sales Amt | | | | | |



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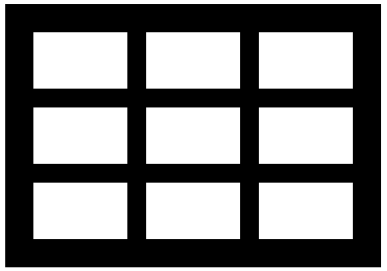
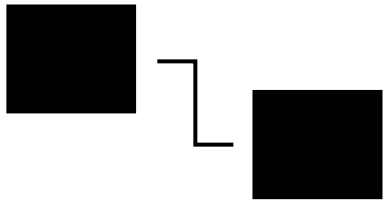
# Data Modeling Essentials & Best Practices in Power BI

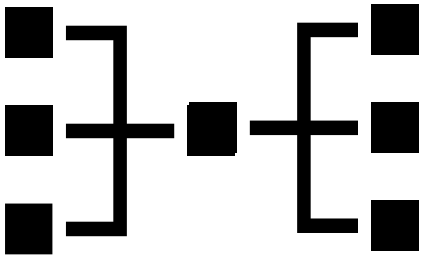
## Flat Model



## Master/Detail



## Dimensional



Doing Power BI the Right Way: 5. Data Modeling Essentials & Best Practices (1 of 2) | Paul Turley's SQL Server BI Blog
https://sqlserverbi.blog/2020/12/25/doing-power-bi-the-right-way-6-data-modeling-essentials-best-practices-1-of-2/

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# Transformation Options

TO PREPARE & SHAPE DATA FOR MODELING

## Dataflows

Design in browser

Execute in service

In-place of data warehouse

Reusable queries

## Power Query

Design in Desktop

Execute in service

Small-moderate data volume

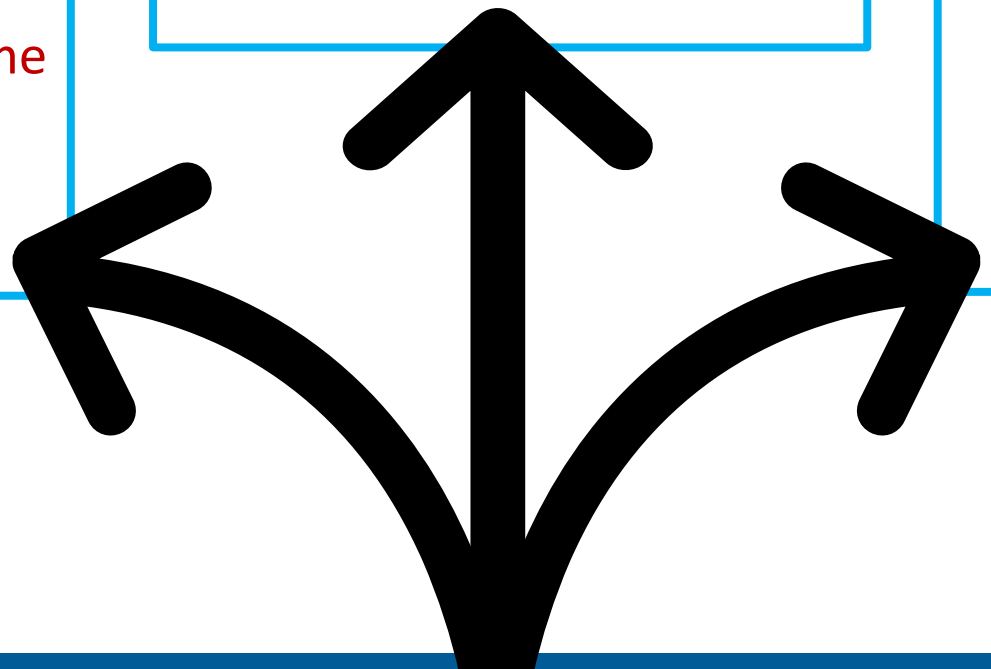
Self-service data mashup

## ETL/ELT & Views

Execute in database

Integrated in data warehouse

Enterprise-scale



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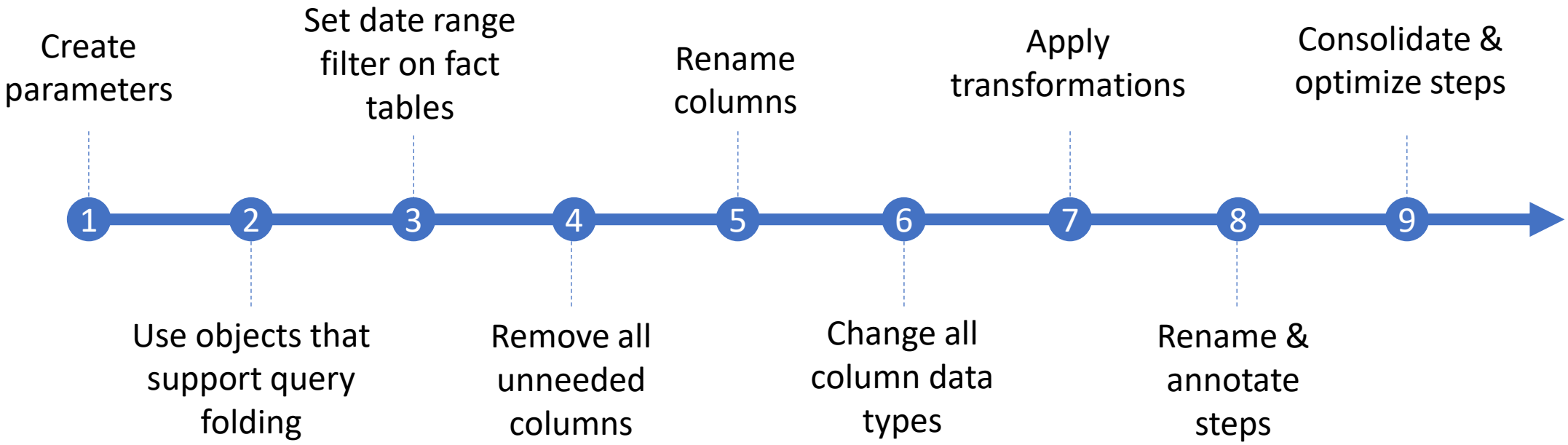
# Preparing, shaping & transforming source data using Power Query




[Doing Power BI the Right Way: 2. Preparing, shaping & transforming source data | Paul Turley's SQL Server BI Blog](https://sqlserverbi.blog/2020/08/16/doing-power-bi-the-right-way-2-preparing-source-data/)
https://sqlserverbi.blog/2020/08/16/doing-power-bi-the-right-way-2-preparing-source-data/

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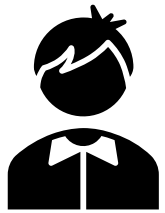
# Object Naming Conventions

## Database Developer



- Table, field/colun
- Measure names
- Code-friendly nar
- Cryptic object na
  Pascal case, Cam
  notation,

## BI Solution Designer

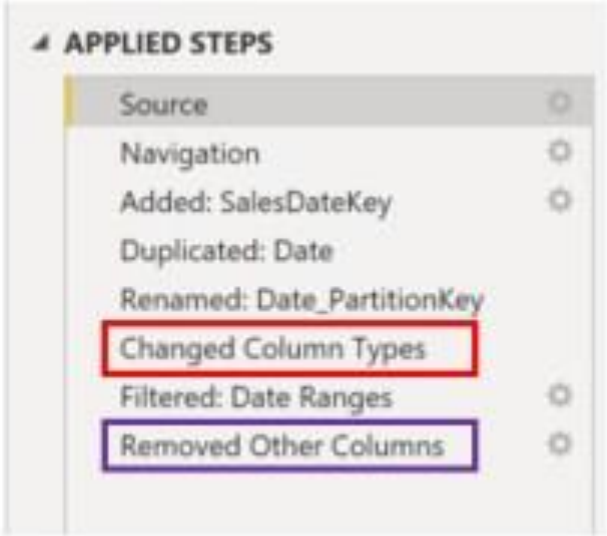
## Balance

- All objects exposed to users should have friendly names
- Hide key columns & utility objects
- Hide numeric columns & create friendly named measures

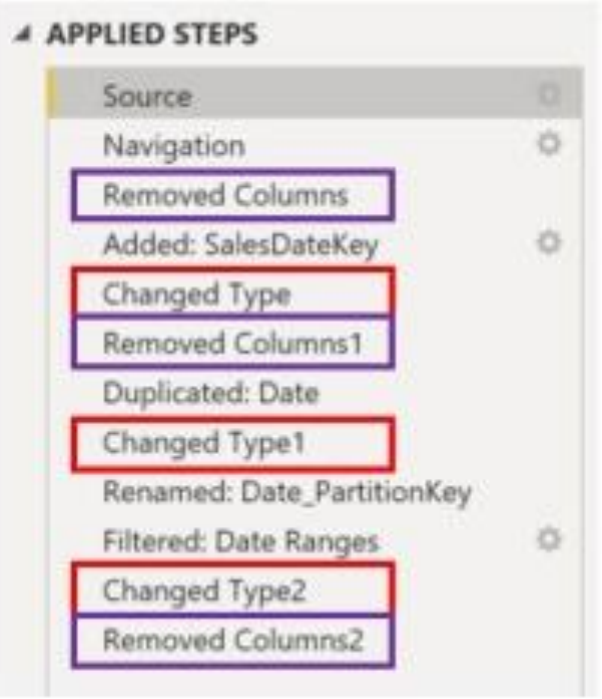
# Optimize Power Query

- Test transformations with large data volumes
- Pivot, unpivot & Transpose actions are costly & may not work effectively with large data volume
- Complex and “creative” transformations might work in Desktop or with small data volumes but not in production
- Web service API calls & nested M functions may not work in the service.

Do this:




…not this:




This query, with redundant, dependent steps; takes three times longer to load records

# Using Parameters
# Importing Dimensions
# Importing Facts

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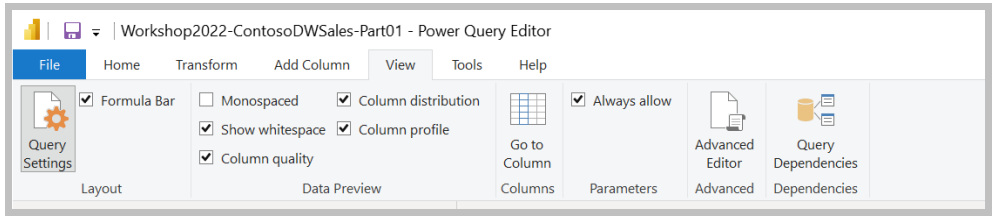
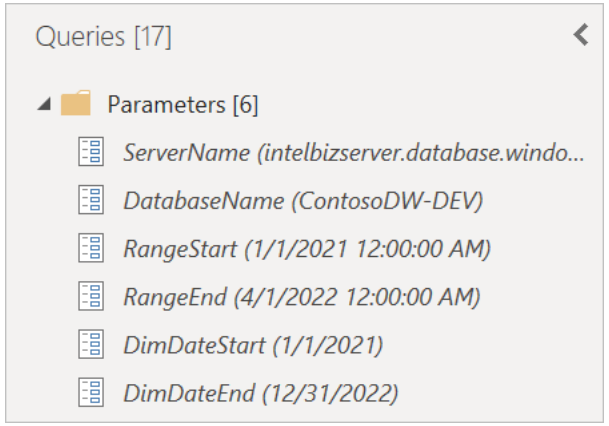
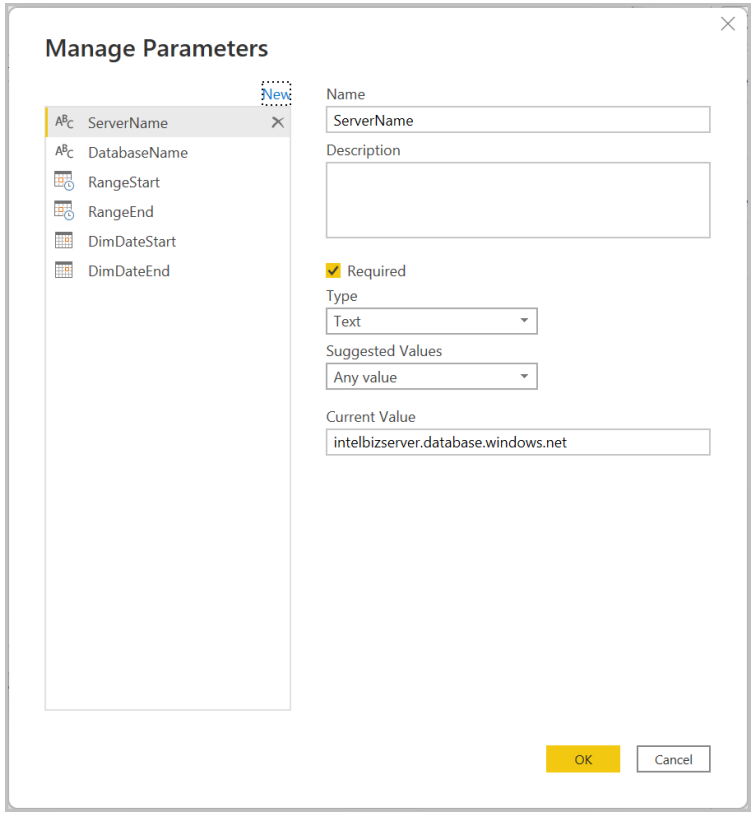
# Add Query Parameters

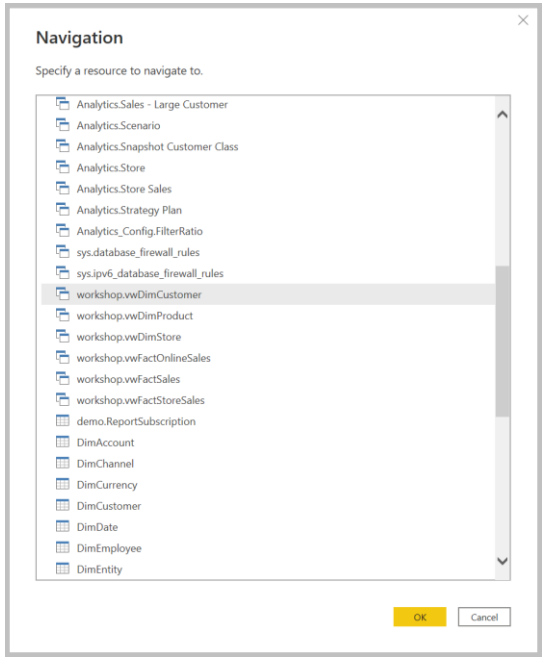


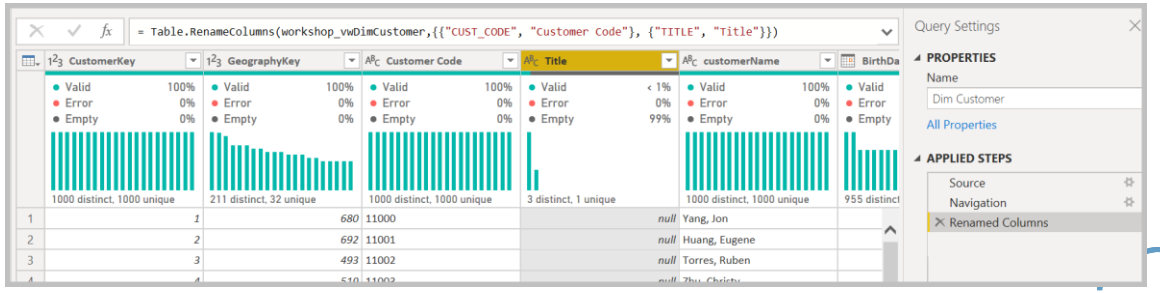



# Importing Dimension Data

- Dim Customer
- Dim Product
- Dim Store
- Dim Date


- Parameterize connection information
- Import from tables or views, not using in-line SQL statements
- Remove unneeded columns
- Rename columns to apply friendly names



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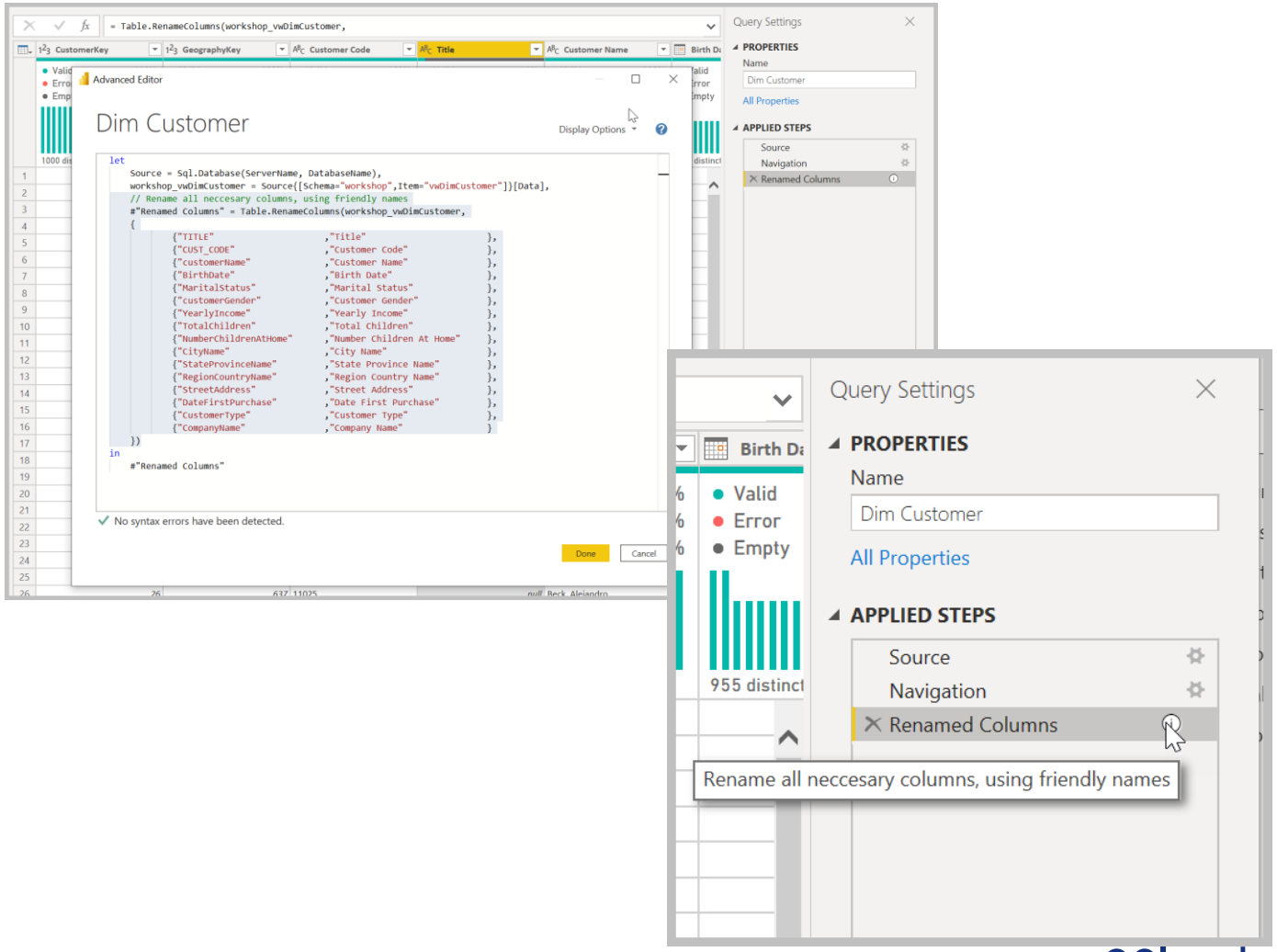
# Power Query Optimization

- Power Query steps generate M code
- Formatted code can be easier to read and debug
- Generate steps to establish code pattern & then enhance code
- Code comments create tooltips in the designer



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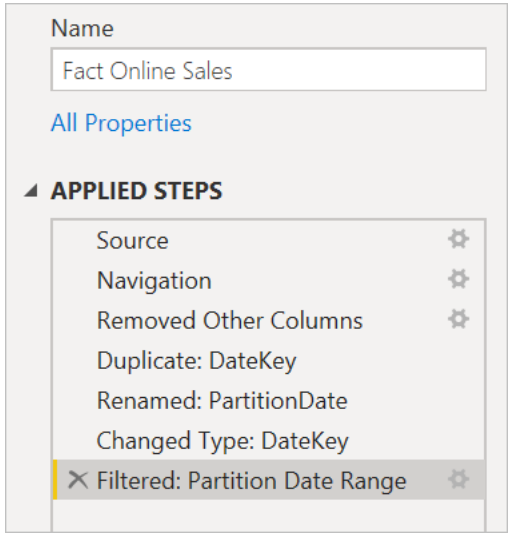
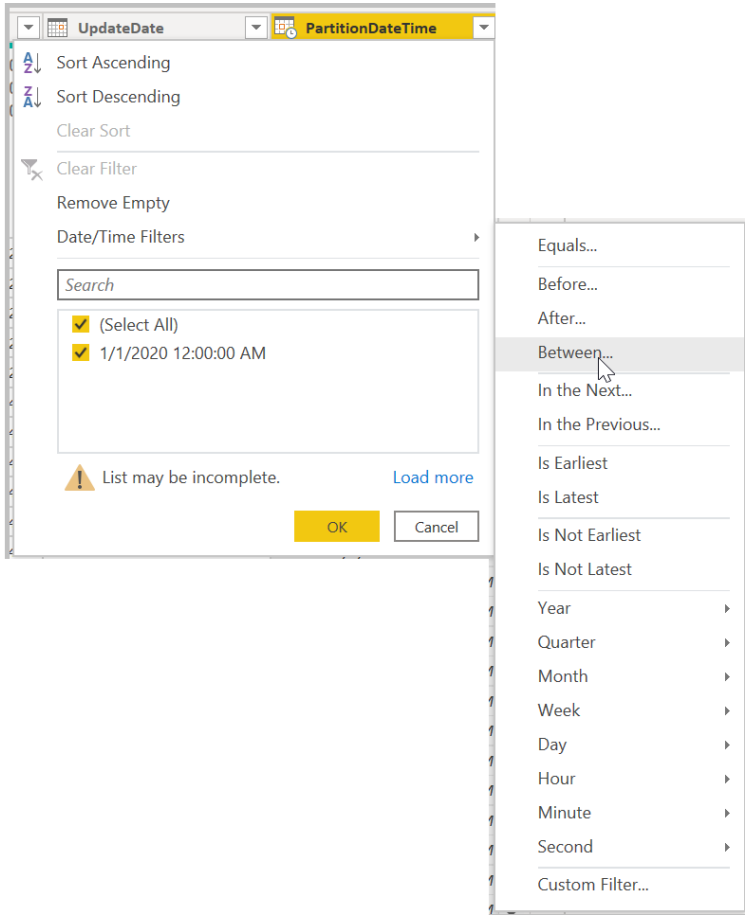
# Importing Fact Tables

- Tables contain tens of millions of rows
- Use date range parameters to reduce local working set and keep PBIX file small.
- PartitionDateTime:
  - Row count reduction
  - Incremental Refresh
- UpdateDate:
  - Detect changes
- No need to rename fact table columns



# Where to Perform Calculations

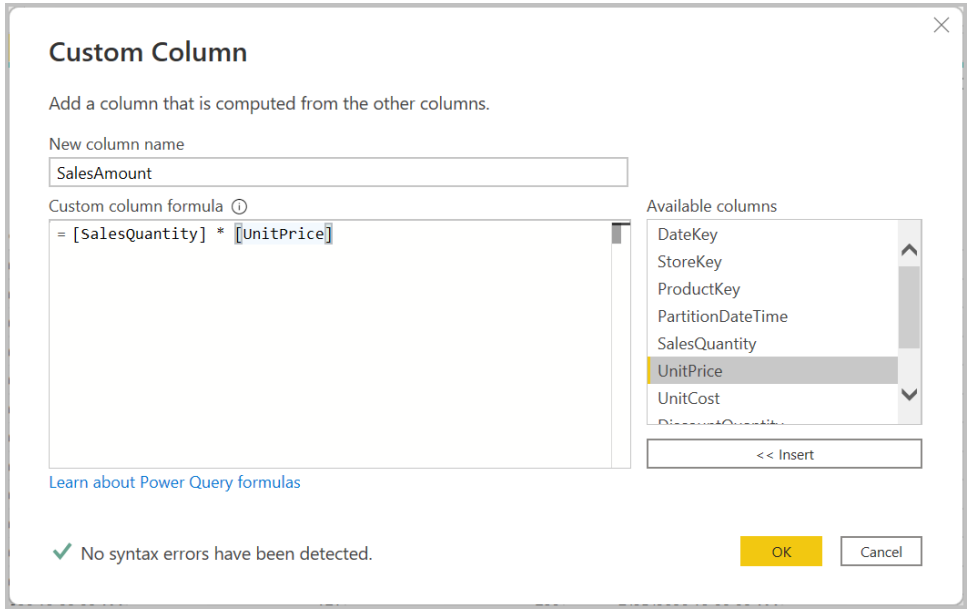
**Store Sales Amt**

**If calculated at the row-level**:

1. Perform calculation in the upstream ETL process & store value
2. Calculate at the source, in a view
3. Custom field in Power Query
4. Calculated column in DAX

**If calculated outside of a single row context, or if the calculation on a single row is affected by filter context**:

- Perform calculation in DAX as a measure




**Store Sales Amt = SalesQuantity * UnitPrice**
(on a single row)



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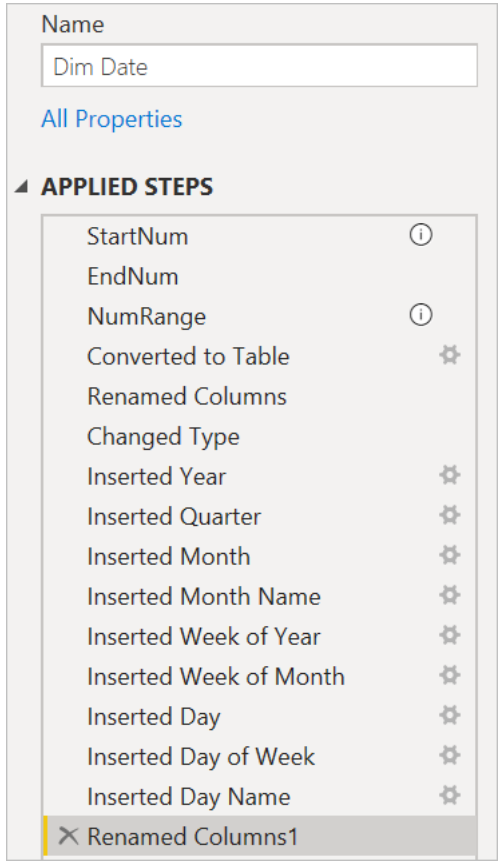
# Date Dimension

## Generating a Date dimension table options:

- ETL pipeline
- SQL script in the source database
- Power Query/M
- Calculated table using DAX



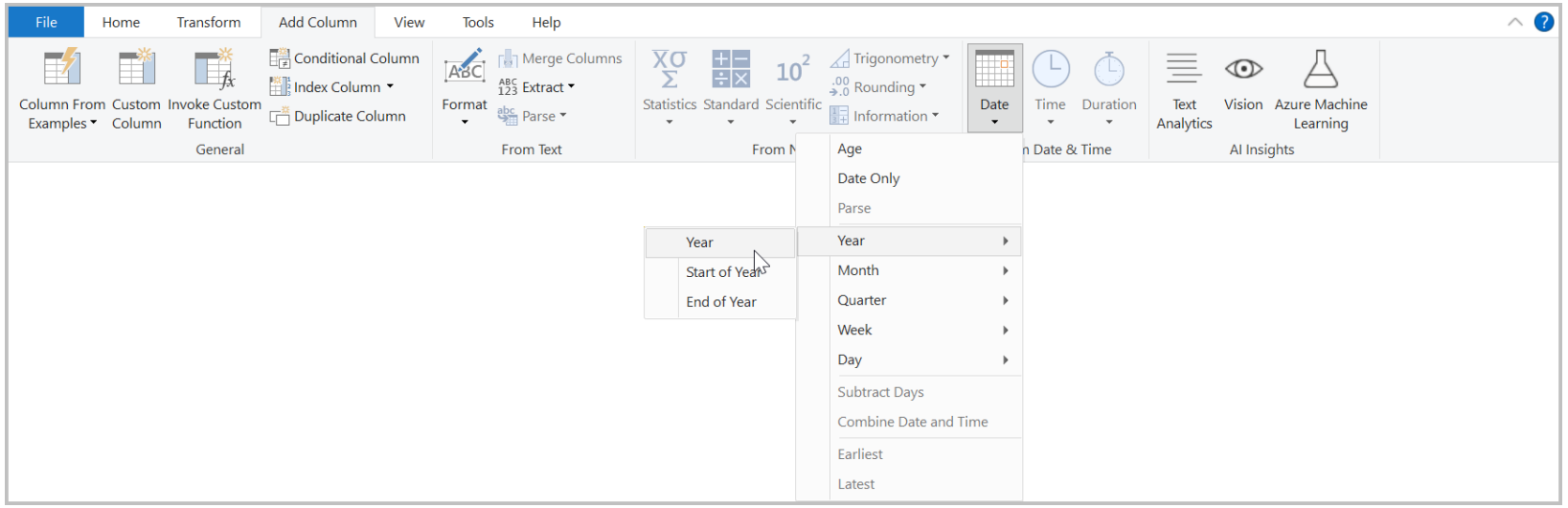

### Convert date values to numbers

```
// Convert dates to numbers
StartNum    =   Number.From( DimDateStart ),
EndNum      =   Number.From( DimDateEnd )
```

### Create a range of numbers using the variable values

```
// Generate number range
NumRange    =   { StartNum..EndNum }
```

# Adding Date Part Columns to the Dim Date Table




- Quarter > Quarter of Year
- Month > Month
- Month > Name of Month
- Week > Week of Year
- Week > Week of Month
- Day > Day
- Day > Name of Day



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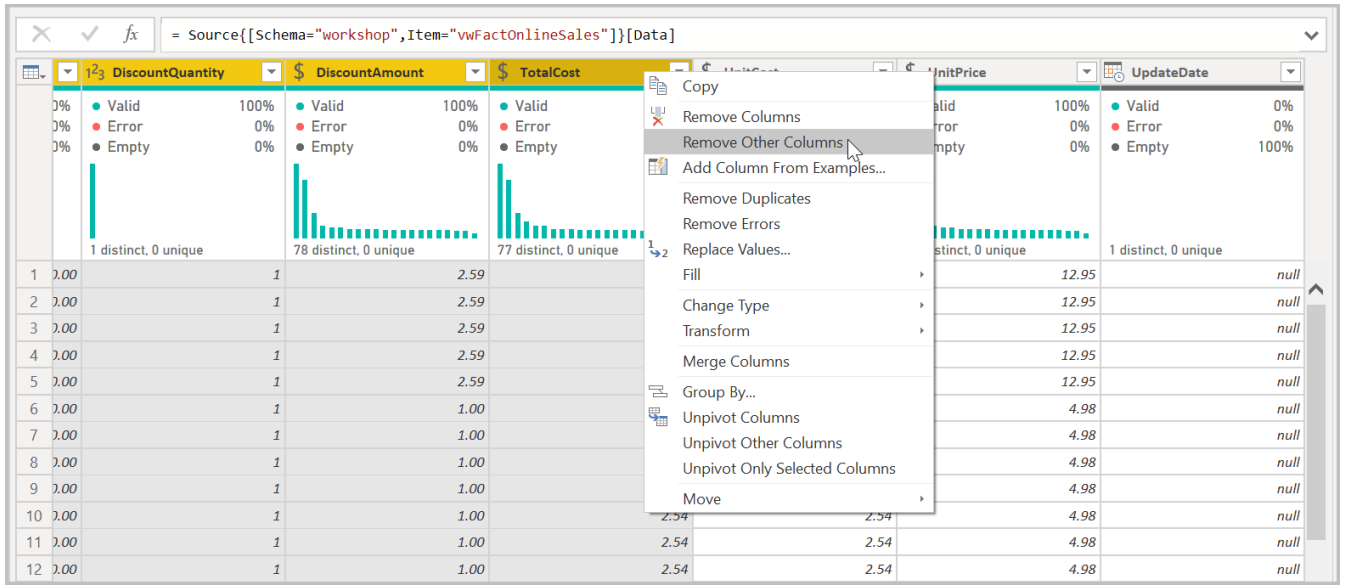
# Fact Table Transformations

GENERAL GUIDANCE

- Remove all unnecessary columns
- Ideally only contains keys and numeric measure base columns
- Utility columns for partitioning & change tracking
- Table will be hidden in the data model
- No need to rename columns with friendly names

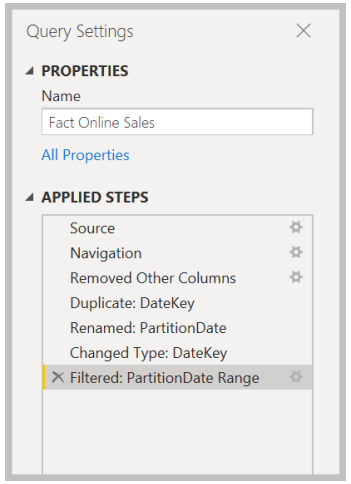
- **Fact Online Sales**
- **Fact Store Sales**

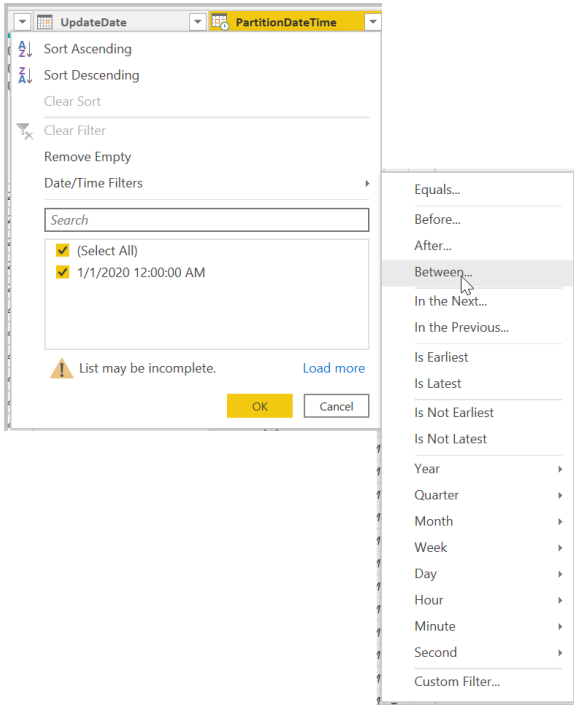


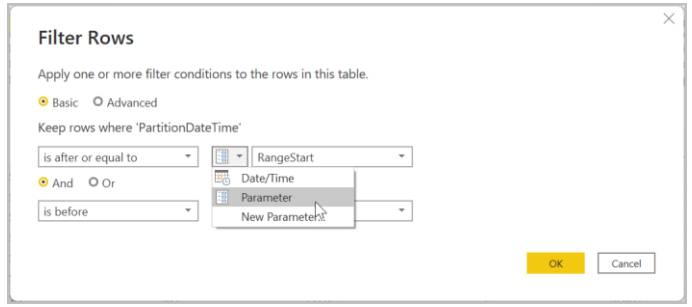
# Fact Table Transformations

## MANAGING DATA VOLUME

- Add Partition key date/time type column
- Set date range filter to use **RangeStart** & **RangeEnd** parameters




The FactOnlineSales table contains about 21 million rows.

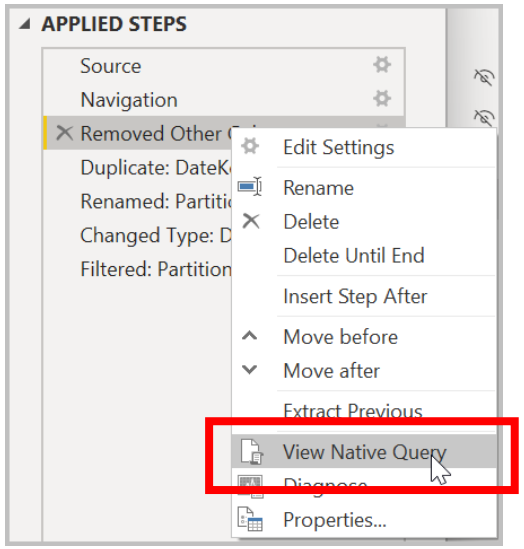
Load only data needed for development into the local copy of the model.

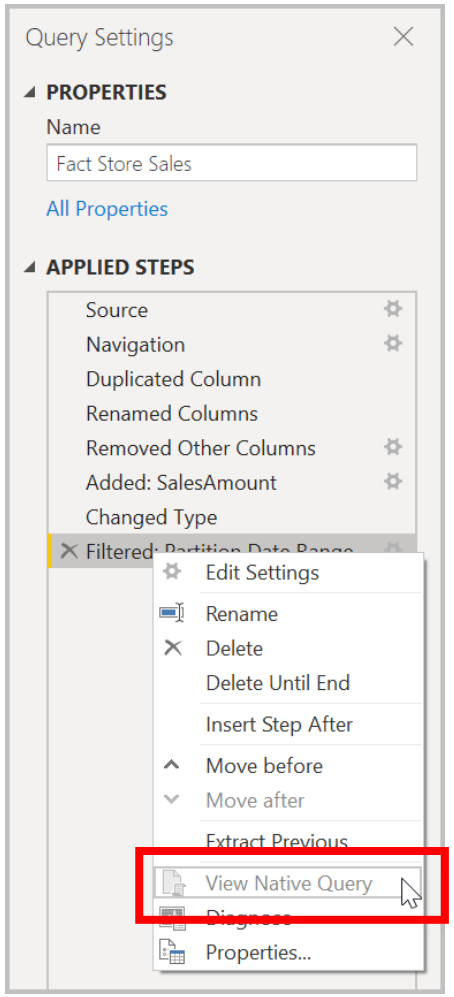
# You Gotta Know When to Fold 'Em

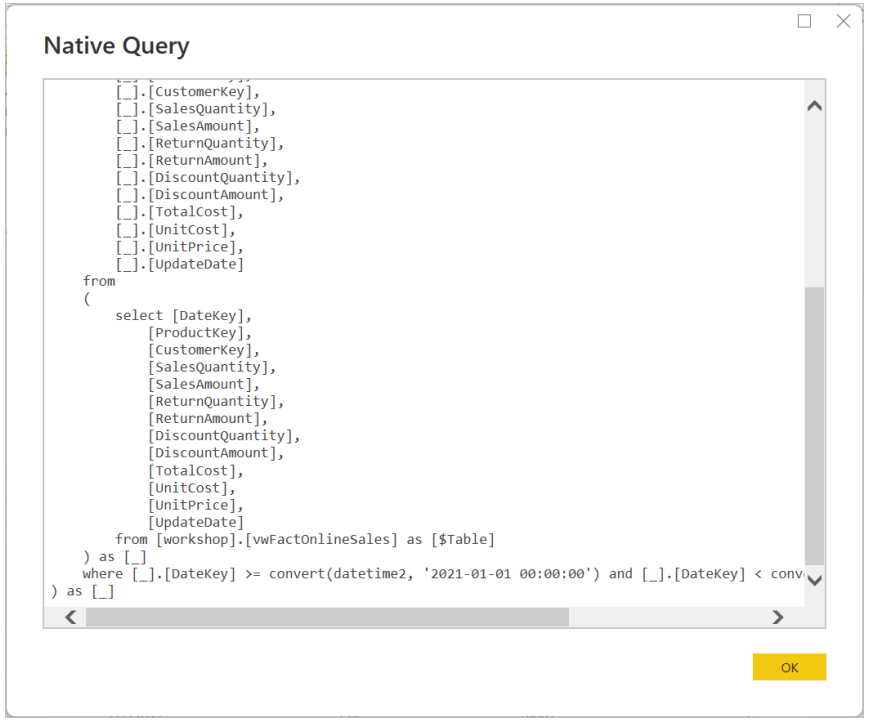
## UNDERSTANDING QUERY FOLDING

- Query folding produces a query, in the native language of the data source.
- Many query steps can be folded
- Some steps cannot
- Perform the most critical steps first:
  - Filtering
  - Grouping
  - Remove columns
  - Change data type

1. Try to get entire query to fold
2. Perform less impactful steps later, if folding is broken



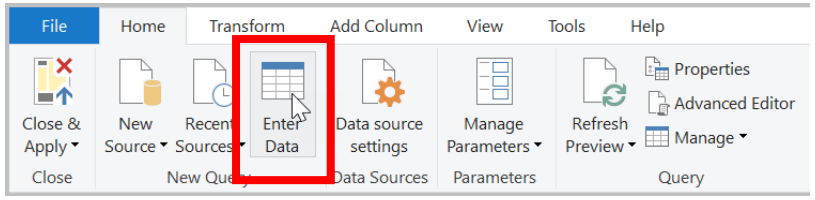



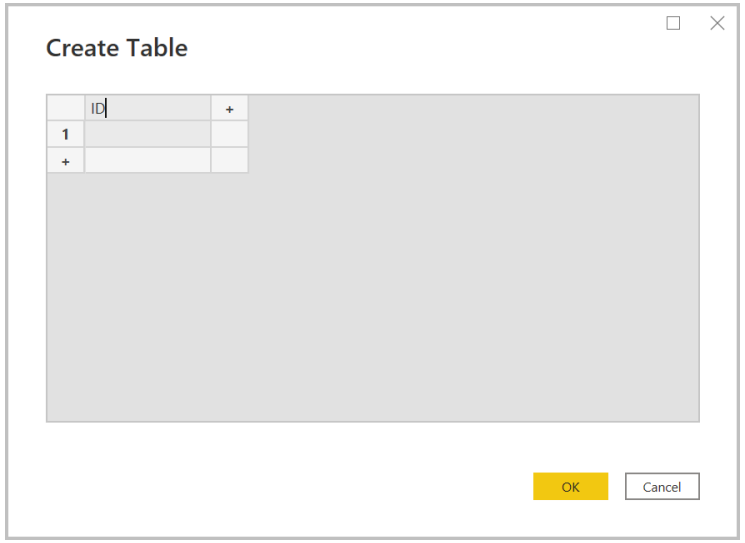



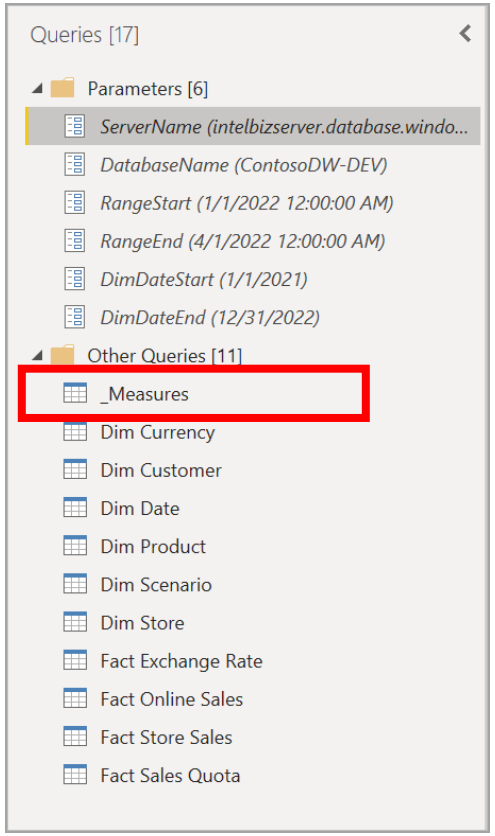
# Create a Measure Container Table

## A PLACE TO PUT MY MEASURES

- Create a single measure group/container table for all measures
- Fact tables in the data model will be hidden
- Some measures are based on values from multiple fact tables



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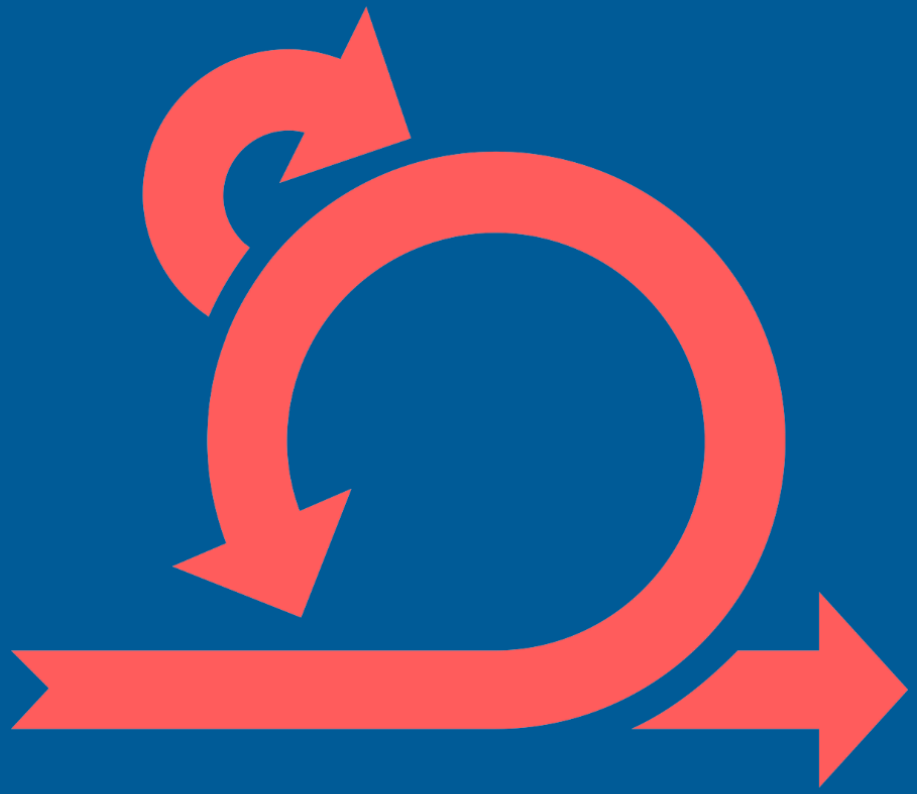
# Iteration 2

Introduce new fact tables & related dimensions:

- Scenario Plan
- Exchange Rate





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# Iteration 2 Requirements

## CHANGE REQUEST

Our business stakeholder has requested that an addition be made to the current project due to business conditions that have changed since the beginning of the project. Our **Project Manager** has met with the **CFO** and the **CIO**, suggesting that the current work be completed and delivered before making additions. However, the additional request is deemed to be a critical need, and the business have asked that the project scope be expanded to include these additional tables and report functionality. **A change request has been written and approved** to include these new requirements and the **project budget and schedule have been adjusted** to reflect this new request.

Financial Planners need:

- Sales Quota table with Actual Sales & Budget

Sales Organization needs:

- Exchange Rates
- Currency Rates change during the day and reports with currency converted measures must include **real-time** updates as the source data changes



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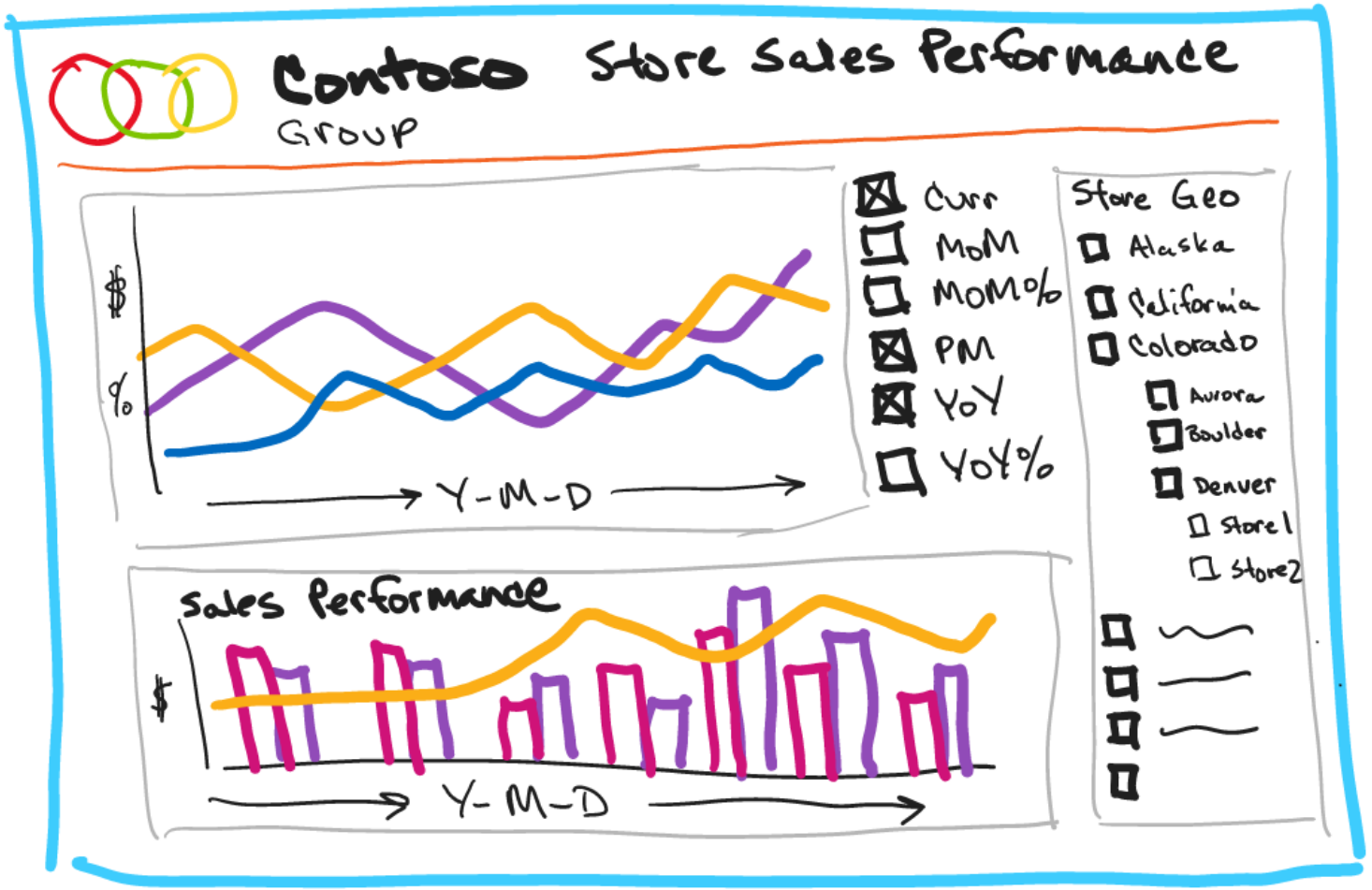
# Iteration 2 Requirements

## REPORT CAPABILITIES & WIREFRAME

- The bottom visual should be enhanced to include **Actual Sales Amount** and **Budget Sales Amount** from the Sales Quota system
- Calculated difference between Actual Sales and Budget



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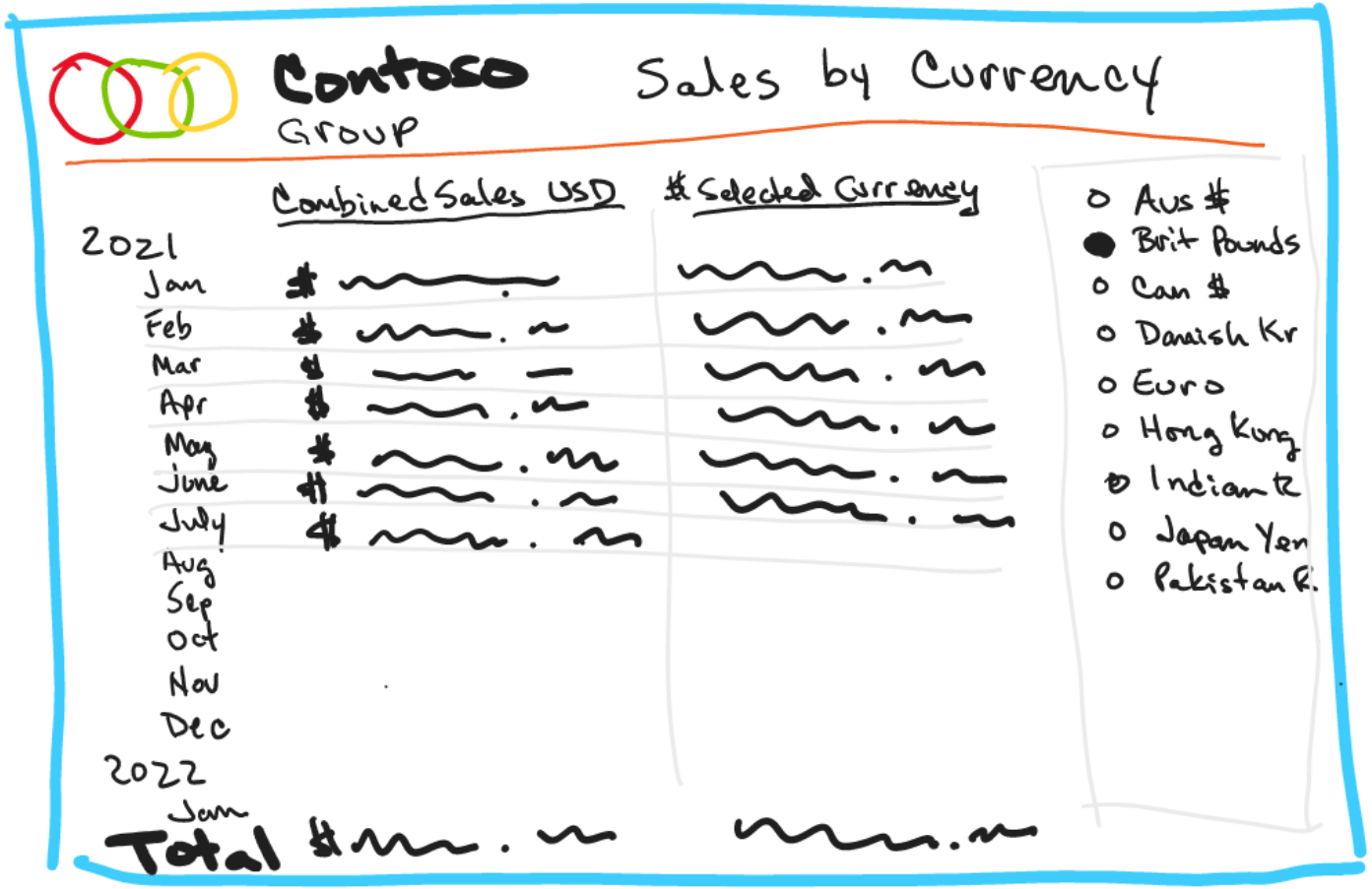
# Iteration 2 Requirements

## REPORT CAPABILITIES & WIREFRAME

- A second report page will show **Combined Sales Amount** values in US dollars alongside the sales value converted to any selected foreign currency.
- Currency conversion is based on the **most current** exchange rate, using real-time source data.



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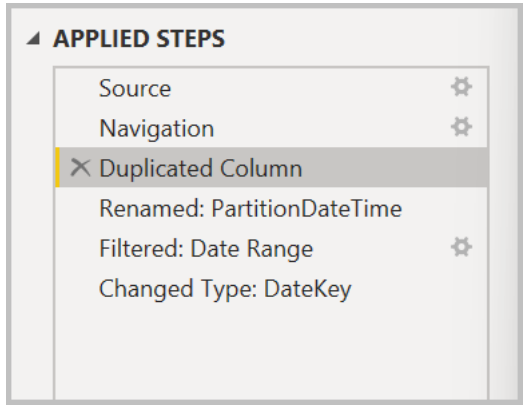
# Iteration 2 Requirements

| | Date | Customer | Product | Store | Scenario | Currency |
|---|---|---|---|---|---|---|
| **Online Sales** | X | X | X | | | |
| Online Sales Amt | | | | | | |
| Online Sales Qty | | | | | | |
| **Store Sales** | X | | X | X | | |
| Store Sales Qty | | | | | | |
| Store Sales Amt | | | | | | |
| **Sales Quota** | X | | X | | X | |
| Quota Qty | | | | | | |
| Quota Amt | | | | | | |
| **Exchange Rate** | X | | | | | |
| End of Day Rate | | | | | | X |

# New Fact Table Queries

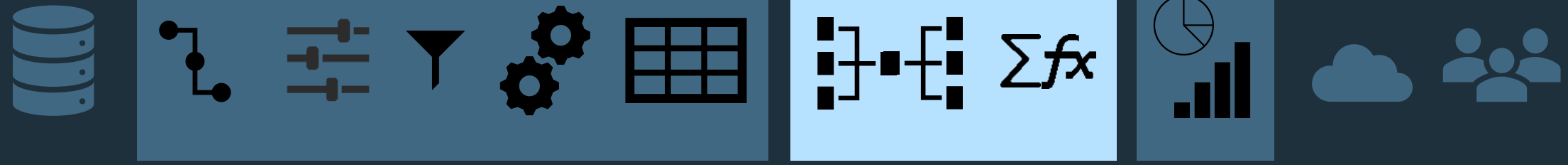
- Fact Sales Quota
  - Simple query, import from **vwFactSalesQuota**
  - Apply the same pattern as previous fact table queries except no UpdateDate column




- Fact Exchange Rate
  - Based on **vwFactExchangeRate** view
  - Connect using **DirectQuery**

# Hands On Exercise
# Part 2:
# Data Modeling for Scale

Part 1 | **Part 2** | Part 3 | Part 4



- Prepare source data
- Connect to data sources
- Create parameters
- Filter records

- Transform data
- **Import tables**
- **Create data model**
- **Create base measures**

- Create advanced measures
- Visualize
- Deploy to cloud service
- Deliver to user audience

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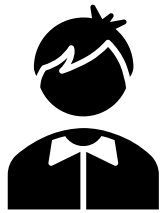
# Model Design

## Database Developer



- Flattened results
- Transform in SQL
- Wide tables
- Pre-aggregated re
- Import summary

## BI Solution Designer

er Query

## Balance

- Build dimensional star schema
- Avoid wide tables
- Remove long text fields
- Remove unused fields
- Tall tables are OK if they are optimized for storage & analytics

# Model Design



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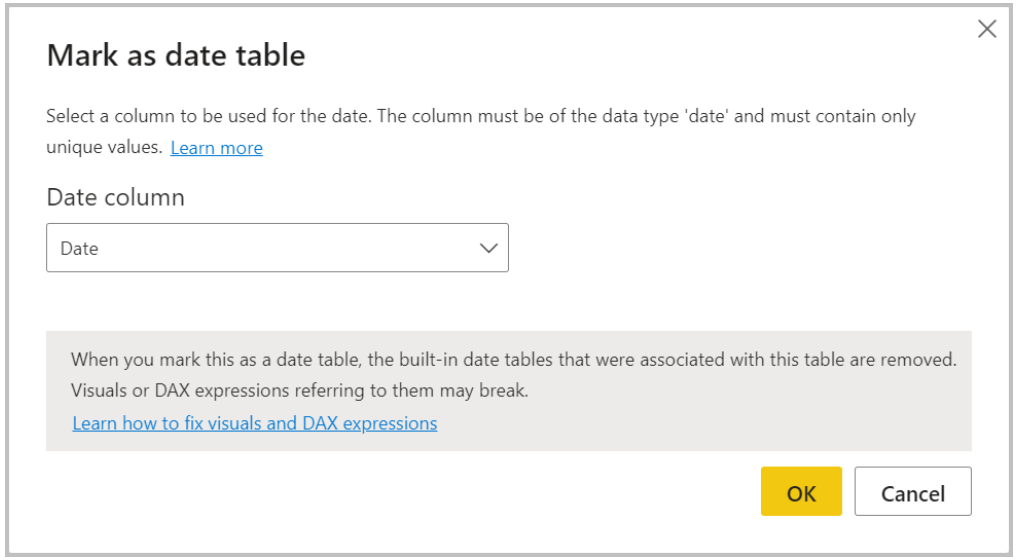
# Date Dimension

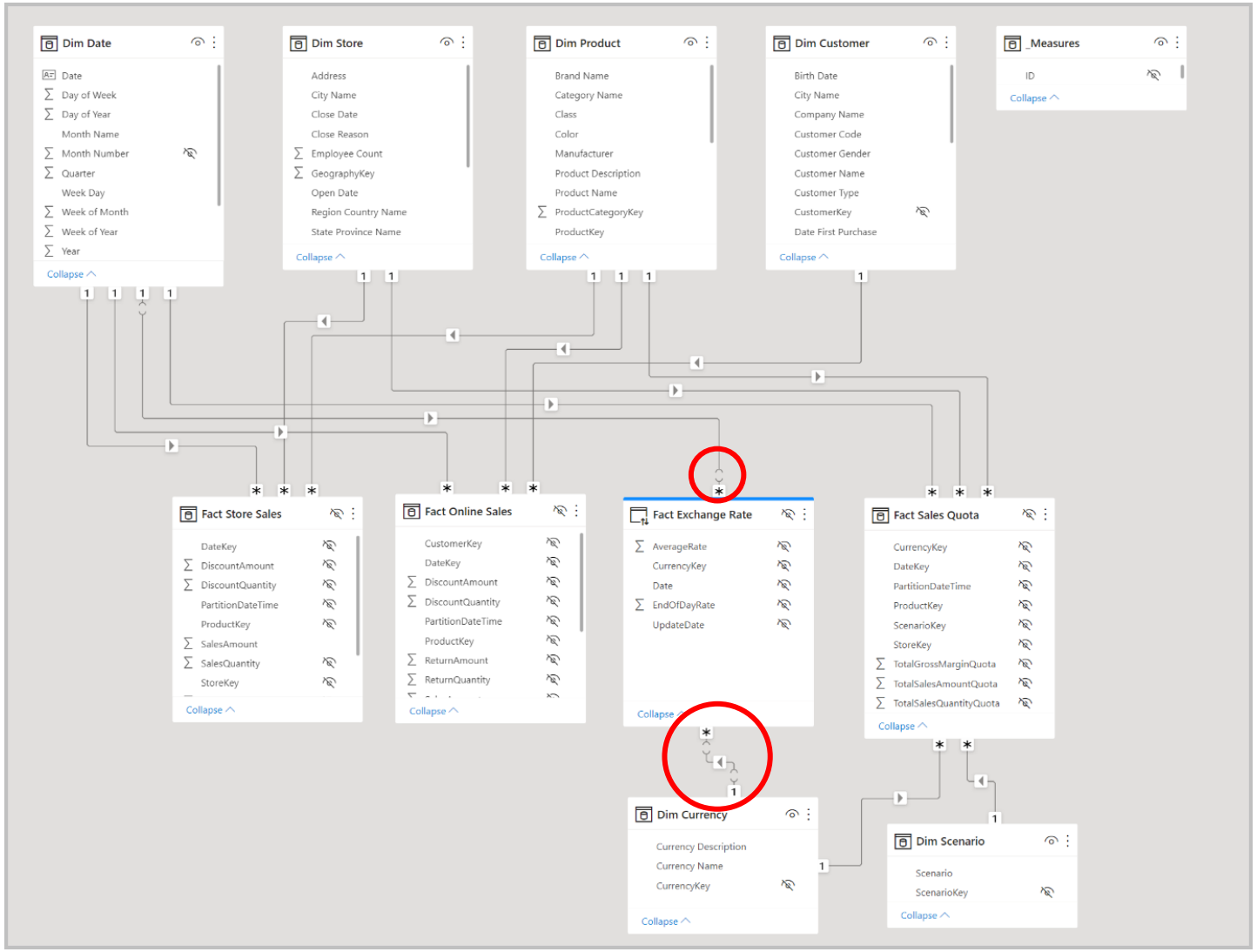
- Mark table as Date table, select Date type key column
- Create date part hierarchies to support report drill-down navigation



# Build the Data Model

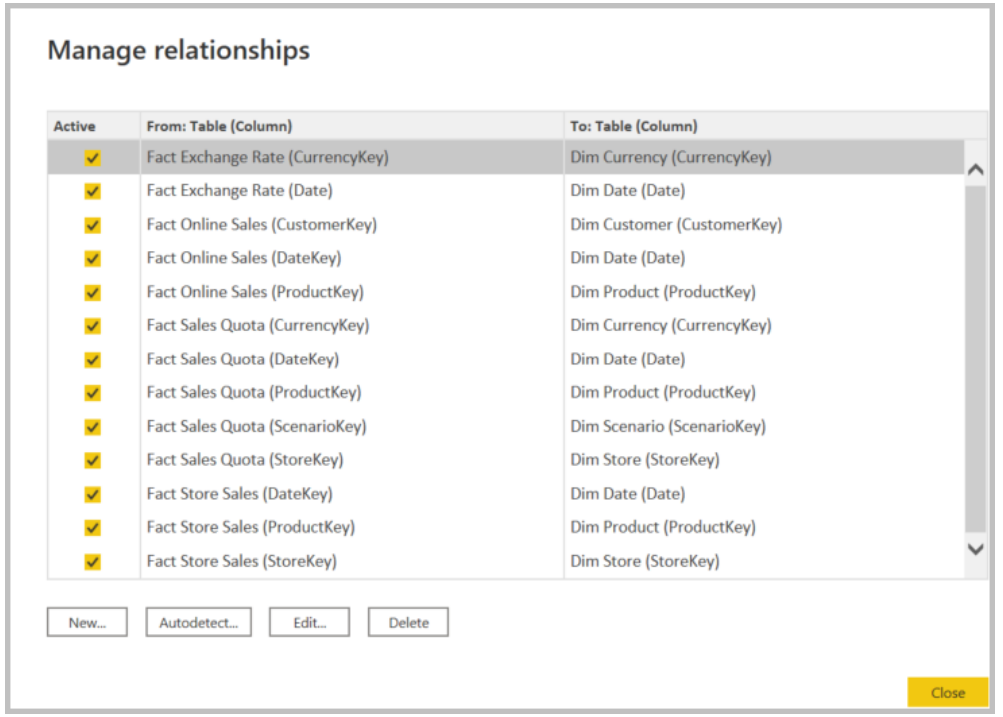
- Create relationships
- Arrange tables
- Create multiple layouts for large models

- Proper query and transformation design simplifies data model design
- Adding DirectQuery tables to an import model creates a “composite model”
- DirectQuery tables are displayed with different colored headings
- A composite model contains “soft” relationships



# Build the Data Model

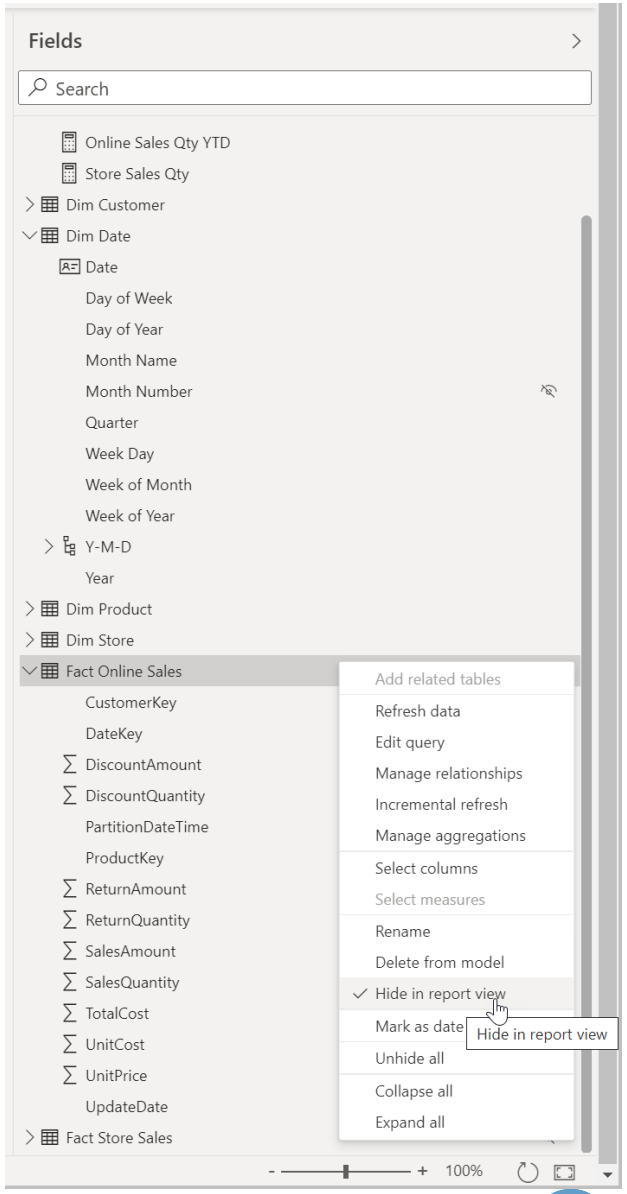
- True dimensional design makes relationship mapping simple
- Avoid bi-directional relationships, but use them when necessary (typically for many-to-many)
- Manage user expectations with dimension>dimension cross filtering
- High cardinality dimensions affect performance at scale
- Consistent key naming simplifies model and helps avoid mistakes
- Some exceptions are OK
  (for example: DateKey > Date)
- Be careful with relationship Autodetect
  (which is on by default)
- Relationship MUST be on the same data type. watch for:
  - Date <> DateTime
  - WholeNumber <> Decimal



# Quick… Hide the Facts

## HIDE ALL FACT TABLES

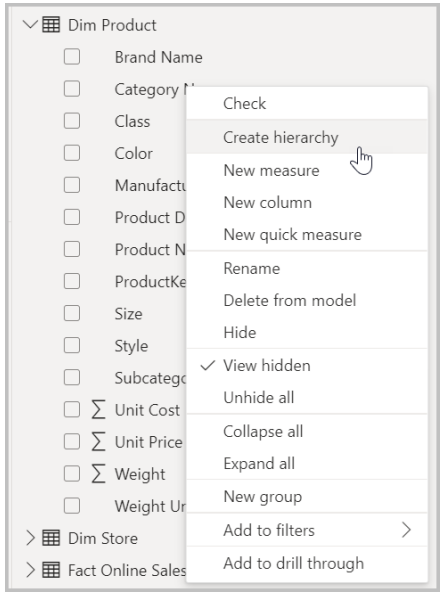
- Implicit & Explicit Measures
  - Ideally, expose only measures and hide all summable numeric columns
  - Some client tools don't support implicit measures (like Excel)
  - Explicit measures, although a little more work, provide more control and flexibility
- Hide key & utility fields
- Hiding a table effectively hides the individual columns

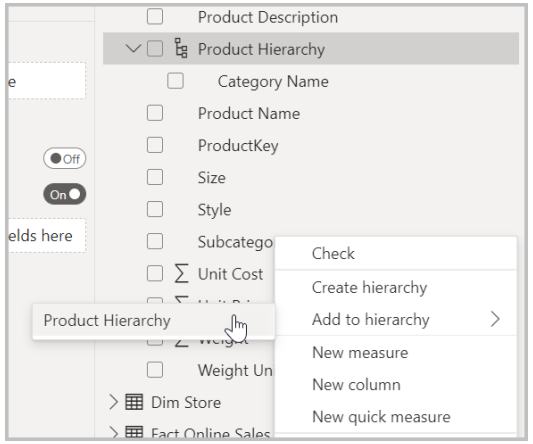


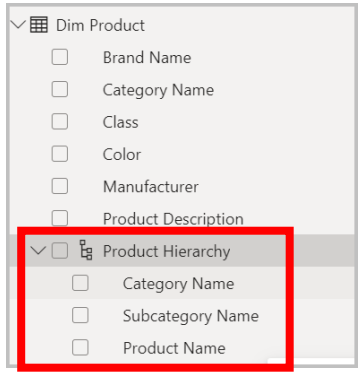
# Hierarchies

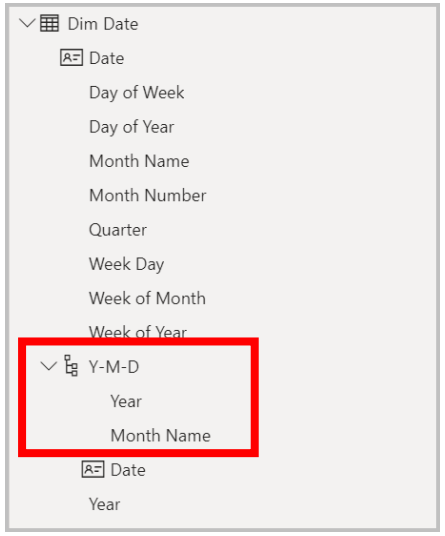
## SUPPORT DRILL-DOWN NAVIGATION

- Product hierarchy
- Date hierarchies
- Create multiple hierarchies for different reporting needs
- Parent-child hierarchies (chart of accounts or employee org chart) are more complicated.



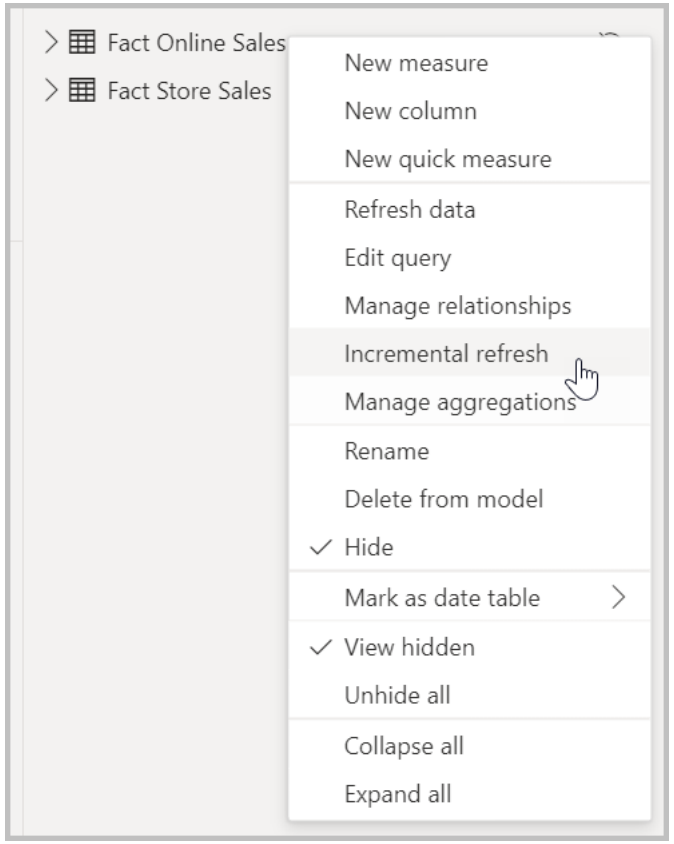



# Table Partitioning & Incremental Refresh

# Date Range Filtering & Incremental Refresh

## SOLVES MULTIPLE PROBLEMS

- In a data model without Incremental Refresh, data volume can be managed in the service using RangeStart & RangeEnd parameters
- In a data model with Incremental Refresh, date range partitioning is automatically managed in the service & the parameters are removed from view
- Using the RangeStart & RangeEnd parameter filtering approach provide a consistent best practice design pattern



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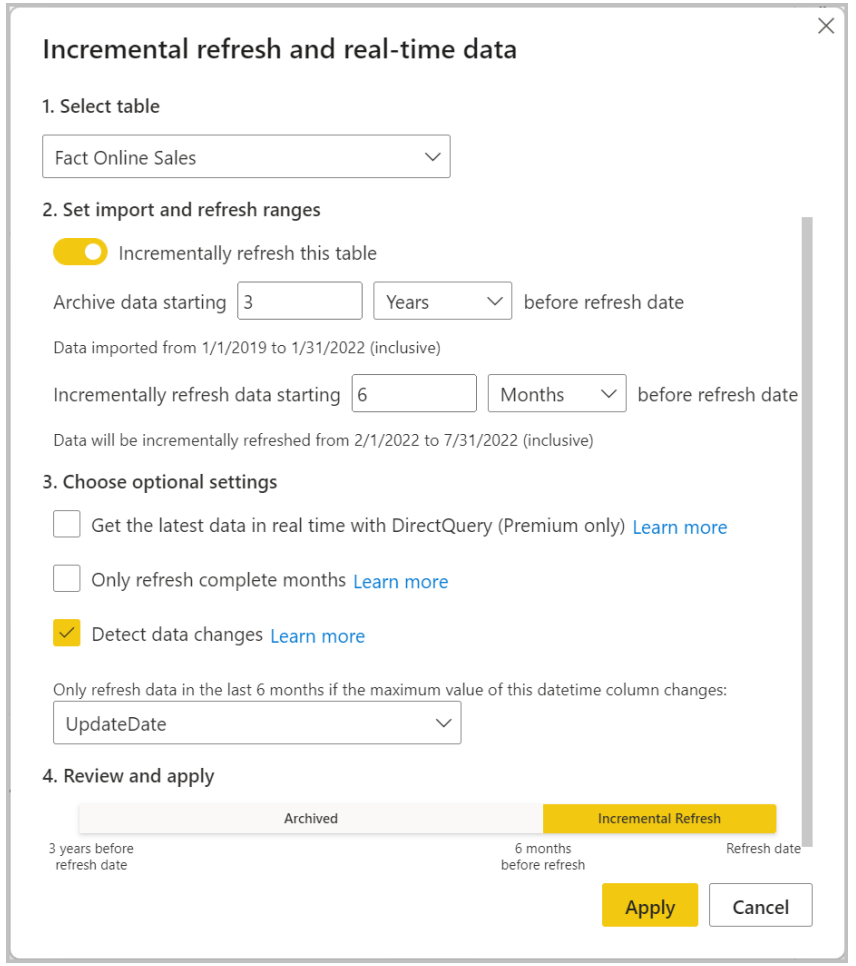
# Configure Incremental Refresh

## FOR EACH FACT TABLE

- Archive periods:
  Generates one static partition per specified period
- Incremental refresh periods:
  Generates one partition per specified period
- Detect data changes:
  Reprocesses any partition with a date newer than the last refresh date.
- Get the latest data in real time with DirectQuery:
  Create a hybrid model with a DirectQuery partition newly inserted records

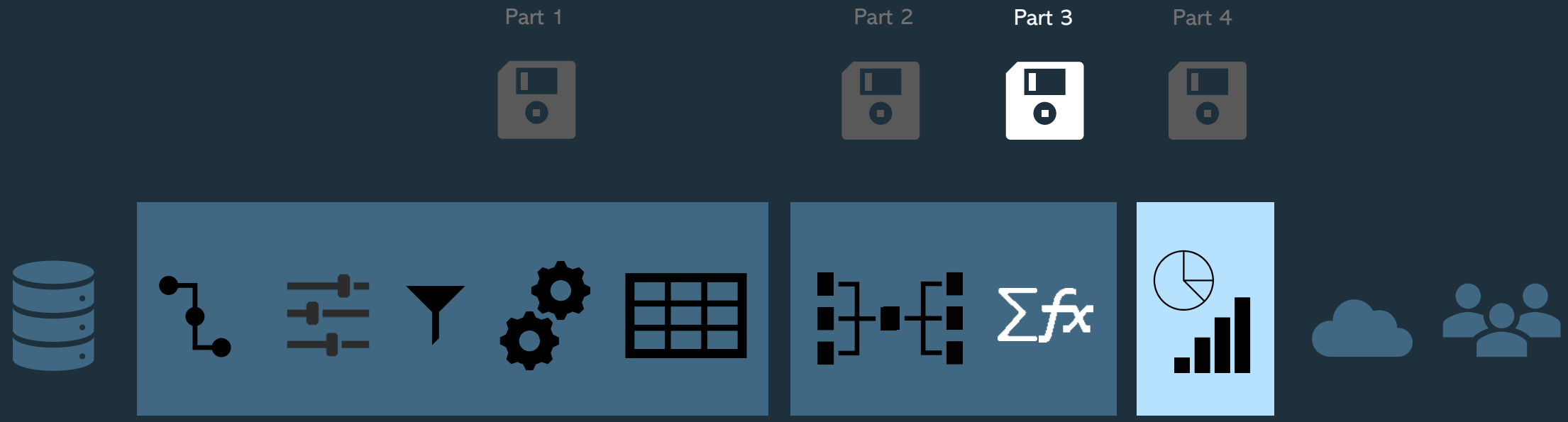


# Incremental Refresh & Partition Demonstration

FOR EACH FACT TABLE

- First data refresh process takes time to create all partitions

# Hands On Exercise
# Part 3:
# Measure Development in the Enterprise




- Prepare source data
- Connect to data sources
- Create parameters
- Filter records

- Transform data
- Import tables
- Create data model
- Create base measures

- Create advanced measures
- Visualize
- Deploy to cloud service
- Deliver to user audience

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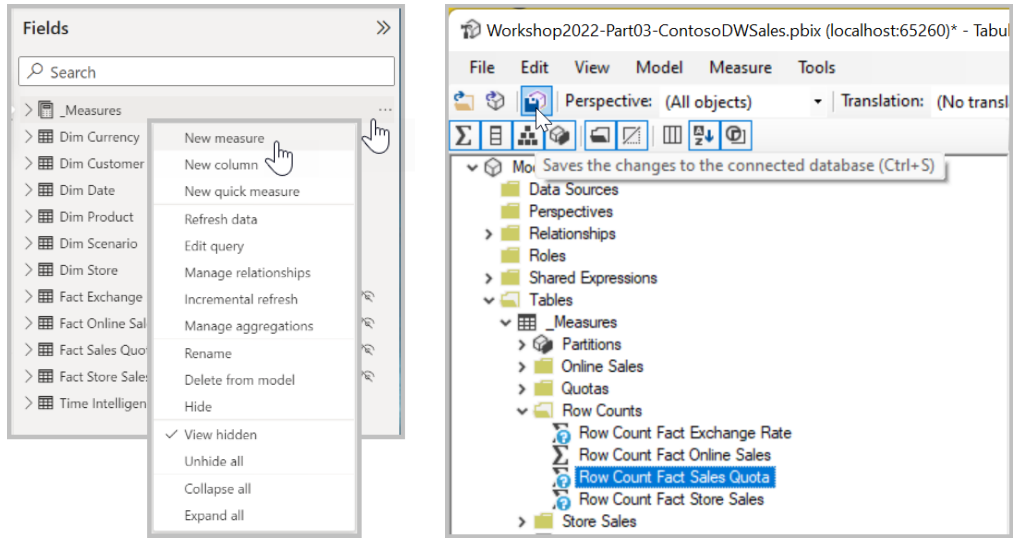
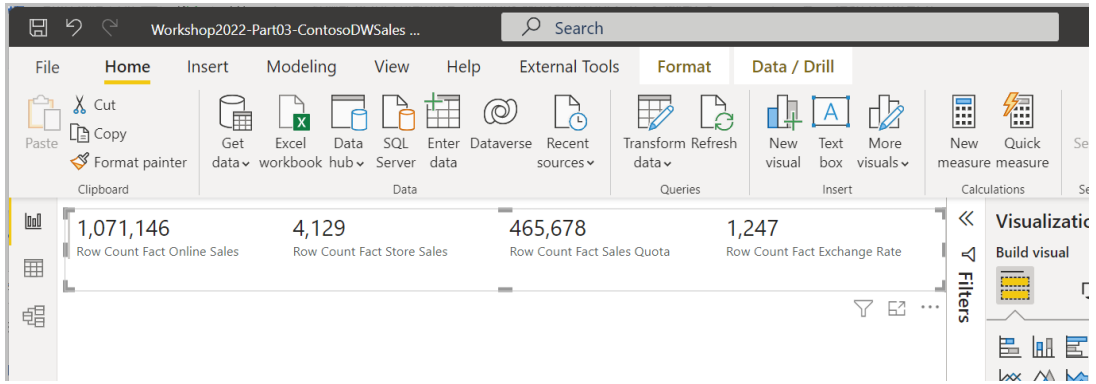
# Row Count & Validation Measures

- Table row counts are a convenient initial data validation test
- Ensures data is loaded as expected
- Use Tabular Editor to duplicate existing measures & add to display folders

```
Row Count Fact Online Sales =
COUNTROWS( 'Fact Online Sales' )
```

Tabular Editor:



# Enhancing the Model with Measures



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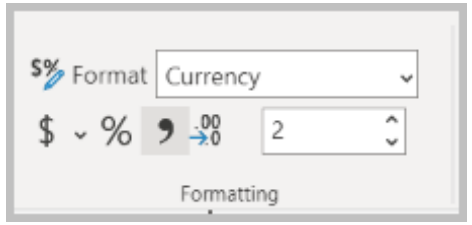
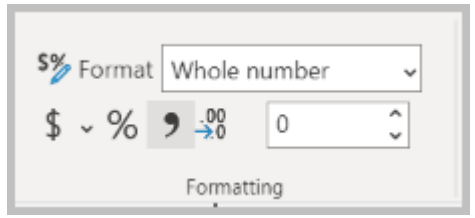
# Base Measures

- Replace “implicit measures” / numeric fact table columns
- Basis for additional measures




| Measure Name | Expression |
|---|---|
| **Online Sales Amt** | = SUM( 'Fact Online Sales'[SalesAmount] ) |
| **Online Sales Qty** | = SUM( 'Fact Online Sales'[SalesQuantity] ) |
| **Store Sales Amt** | = SUM( 'Fact Store Sales'[SalesAmount] ) |
| **Store Sales Qty** | = SUM( 'Fact Store Sales'[SalesQuantity] ) |
| **Combined Sales Amt** | = [Online Sales Qty] + [Store Sales Qty] |
| **Quota Sales Amt** | = SUM( 'Fact Sales Quota'[TotalSalesAmountQuota] ) |
| **Quota Sales Qty** | = SUM( 'Fact Sales Quota'[TotalSalesQuantityQuota] ) |



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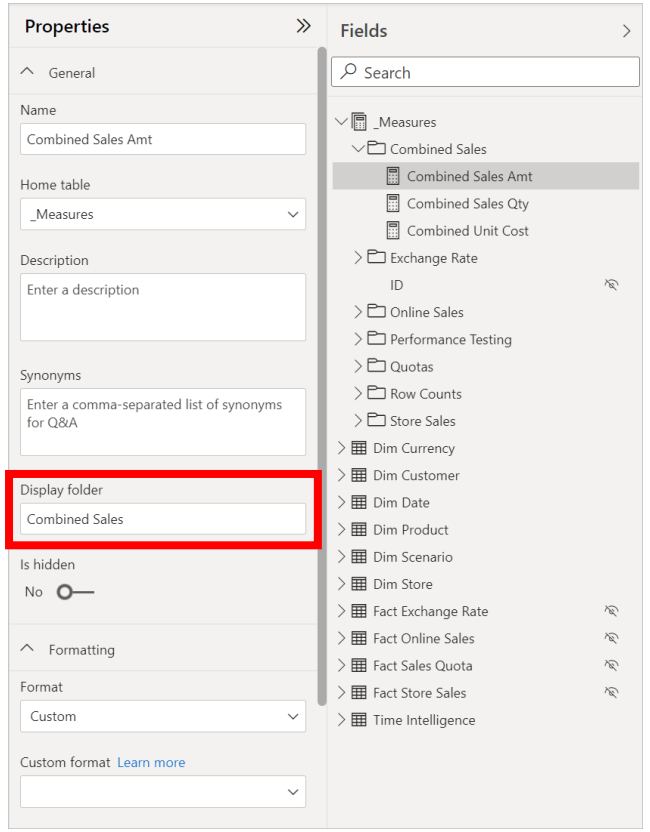
# Display Folders

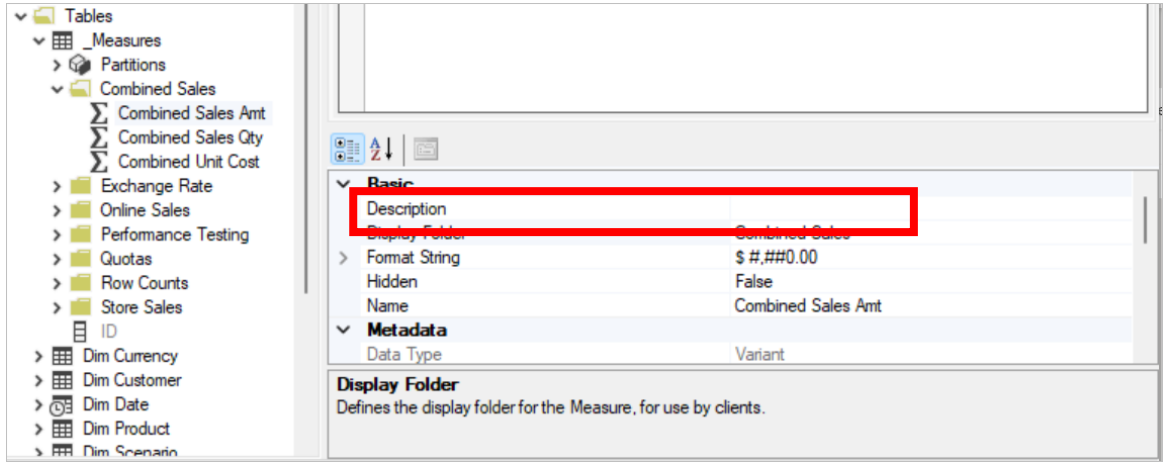
## TO ORGANIZE MEASURES

- Display folder is a measure property (rather than an actual “folder”)
- Set Display Folder property for a measure to “create” a folder
- Use Tabular Editor to drag measures into existing folders

Power BI Desktop – Model view:




Tabular Editor:



# Calculation Groups

Reduce measure count & development effort

Implement time intelligence

Layer complex calculation logic over any selected measure



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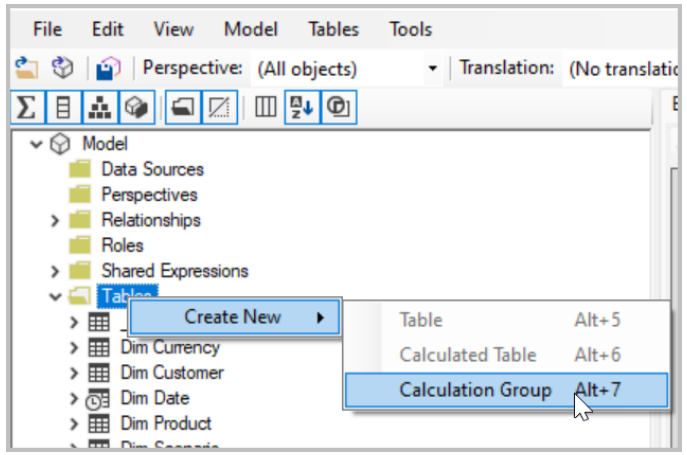
# Creating multiple measures: There has got to be a better way!

## USING TABULAR EDITOR TO CREATE A CALCULATION GROUP

- Enables variation logic to be added to a selected measure
- Can be used to implement calculation enhancements like time intelligence
- Many advanced & creative possibilities
- Specialized DAX functions are used to pass the selected measure into a calculation group expression




| DAX Function | Purpose |
|---|---|
| SELECTEDMEASURE() | Passes the currently selected measure into a calculation group expression. |
| SELECTEDMEASUREFORMATSTRING() | Returns the format string property of the selected measure. |
| SELECTEDMEASURENAME() | Returns the name of the selected measure. |



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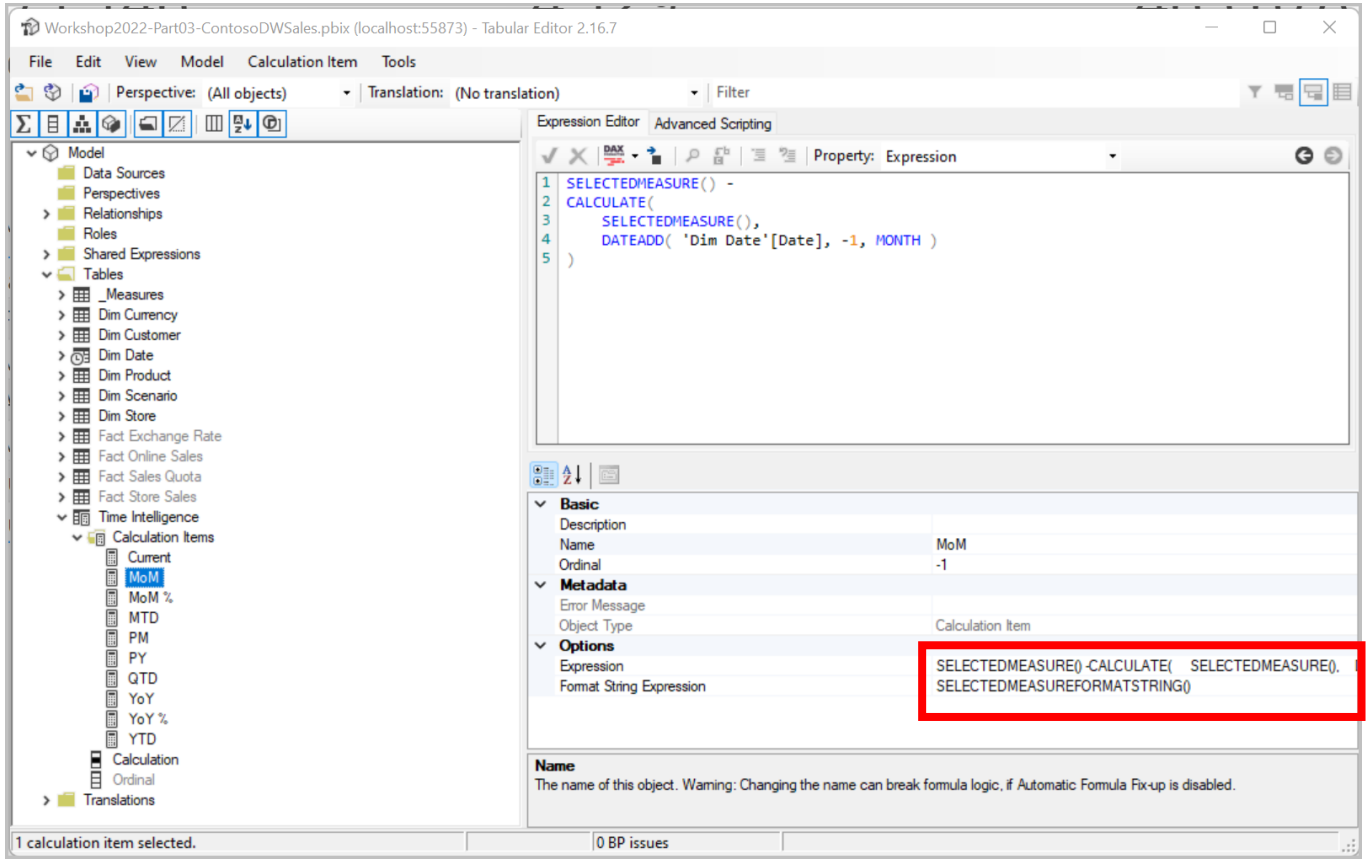
# Calculation Group to Implement Time Intelligence

## USE TABULAR EDITOR TO CREATE A CALCULATION GROUP

Time Intelligence calculation items:

- Current
- MoM
- MoM %
- MTD
- PM
- PY
- QTD
- YoY
- YoY %
- YTD




Completed expressions for all items are in: **Time Intelligence Calculation Group Items.txt**



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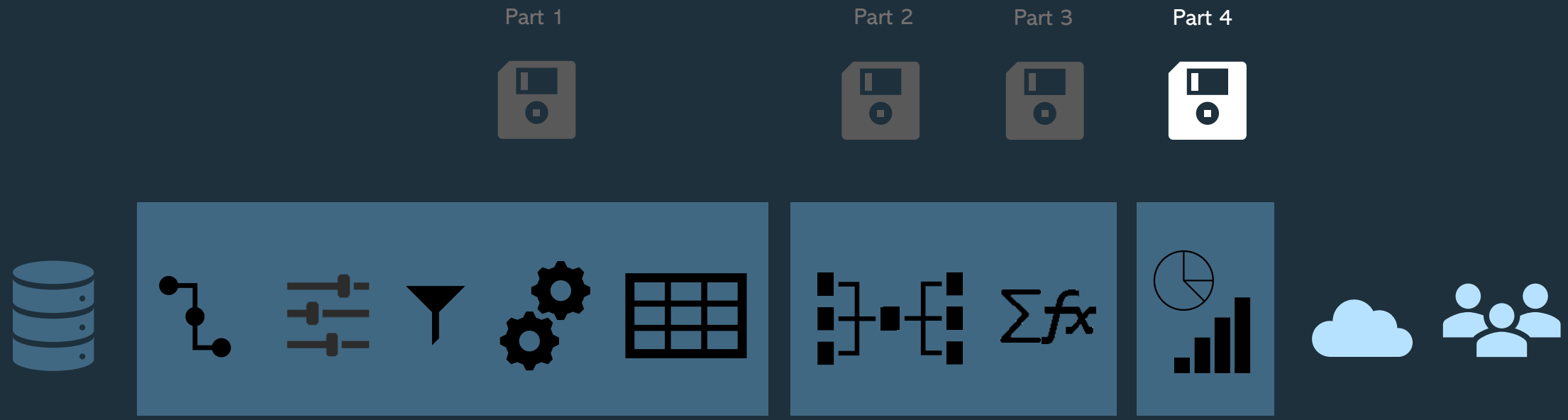
# Hands On Exercise
# Part 4:
# Visualize & Analyze




- Prepare source data
- Connect to data sources
- Create parameters
- Filter records

- Transform data
- Import tables
- Create data model
- Create base measures

- Create advanced measures
- Visualize
- Deploy to cloud service
- Deliver to user audience

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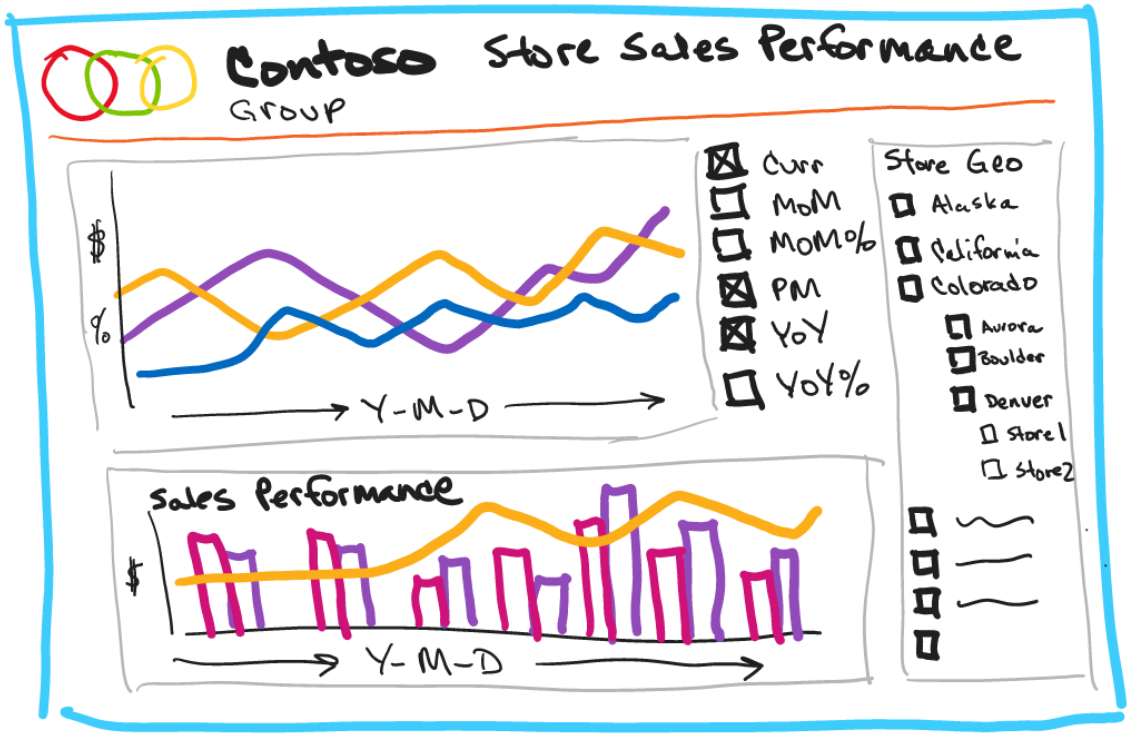
# Report Requirements Review

## REPORT CAPABILITIES & WIREFRAME

Business questions:

- What is the **Sales Amount** grouped by **Year** or **Month** or **Day**, for a specific period of time.
- Trend chart should allow a user to select a **time series metric** (like Month Over Month, Month Over Month % Change, Month To Date, Prior Month, Year To Date) & then show them along the axis of Years, Months or Days.
- All of the data on the report can be filtered by store regions, such as **State**, **City** or an individual **Store**.
- The bottom visual should be enhanced to include **Actual Sales Amount** and **Budget Sales Amount** from the Sales Quota system
- Calculated difference between **Actual Sales** and **Budget**



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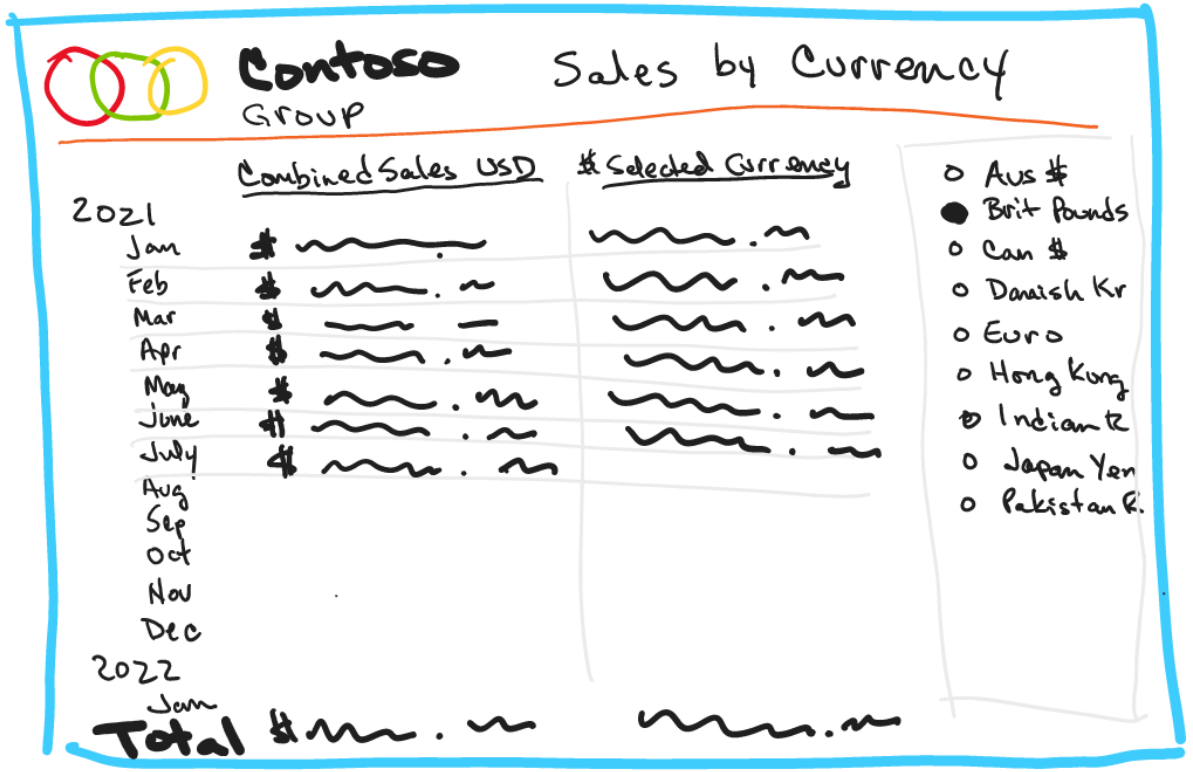
# Report Requirements Review

## ITERATION 2 REPORT CAPABILITIES & WIREFRAME

- A second report page will show **Combined Sales Amount** values in US dollars alongside the sales value converted to any selected foreign currency.
- Currency conversion is based on the **most current** exchange rate, using real-time source data.



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# Visual Report Design



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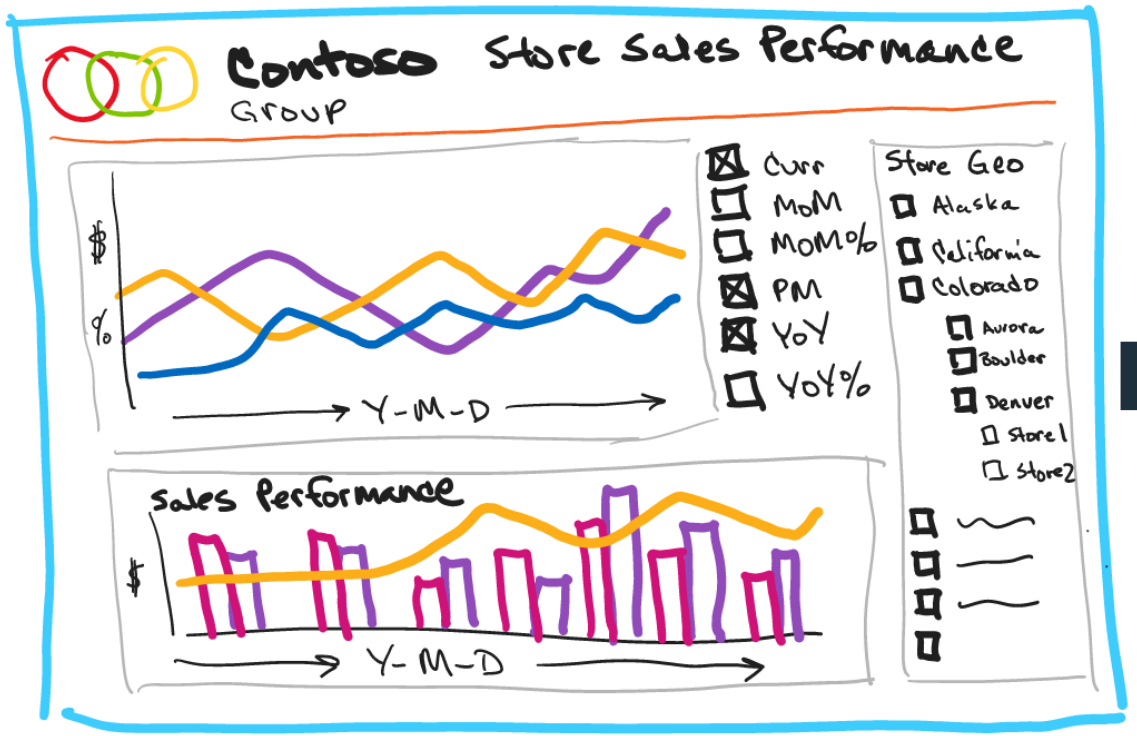
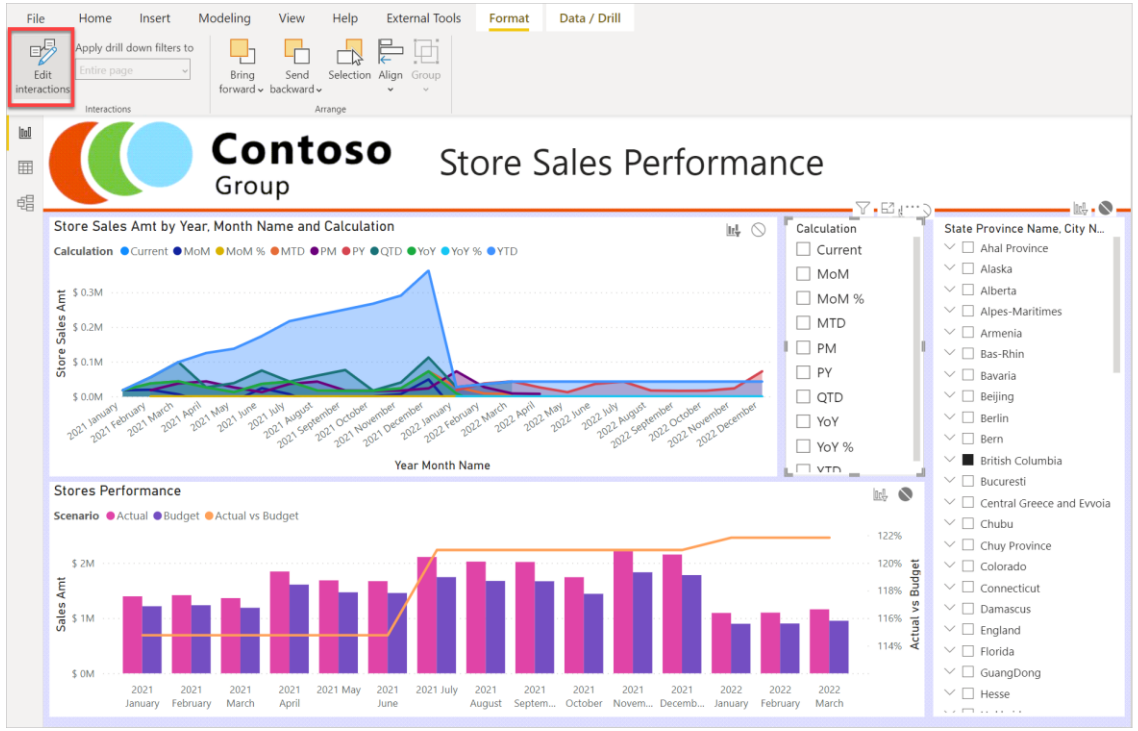
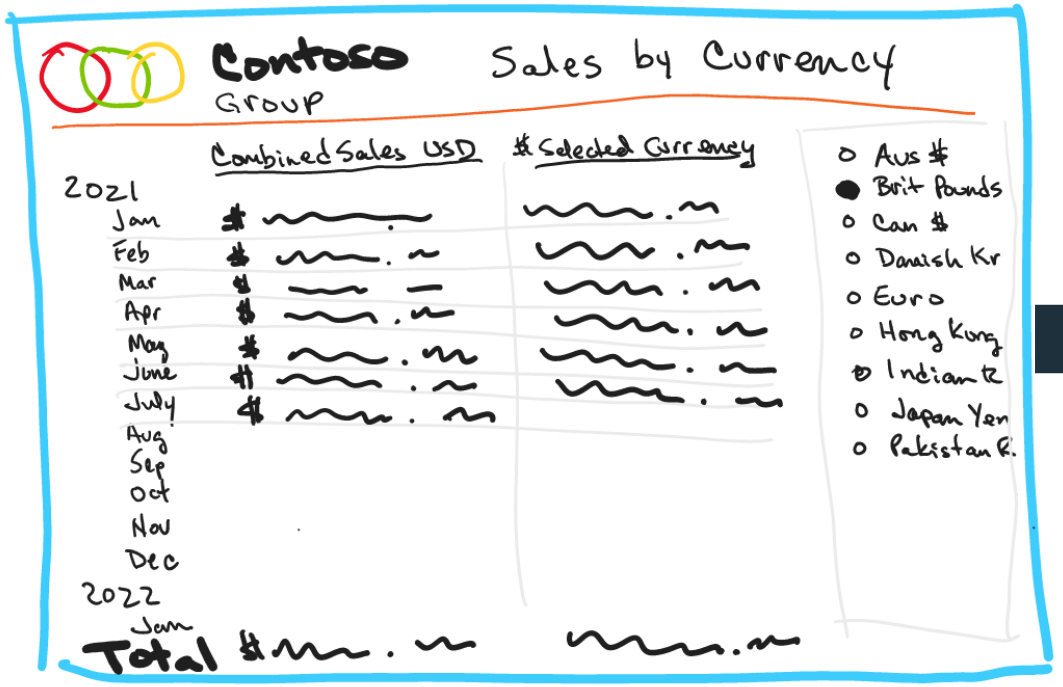
# Functional Design to Physical Design



# Functional Design to Physical Design

## ITERATION 2 REQUIREMENTS




Contoso Group — Sales by Currency

Combined Sales Amt - currency: EUR

| Year | Combined Sales Amt USD | Combined Sales Amt Selected Currency |
|---|---|---|
| **2021** | **$ 929,729,092.88** | **$ 618,883,859.68** |
| July | $ 91,792,832.19 | $ 58,226,029.32 |
| May | $ 84,219,758.38 | $ 46,684,696.46 |
| June | $ 83,384,360.12 | $ 53,563,611.41 |
| April | $ 82,482,170.04 | $ 52,343,185.11 |
| August | $ 81,295,557.56 | $ 54,376,159.59 |
| December | $ 80,625,688.06 | $ 59,682,359.33 |
| September | $ 79,396,970.84 | $ 55,292,050.49 |
| November | $ 76,534,559.75 | $ 60,089,578.90 |
| October | $ 75,754,239.90 | $ 57,047,487.90 |
| February | $ 66,145,895.39 | $ 44,827,073.30 |
| March | $ 66,142,247.12 | $ 36,474,803.60 |
| January | $ 61,954,813.52 | $ 40,276,824.27 |
| **2022** | **$ 194,424,078.21** | **$ 149,081,165.22** |
| March | $ 66,606,671.33 | $ 50,993,401.50 |
| February | $ 65,167,515.46 | $ 50,902,998.00 |
| January | $ 62,649,891.42 | $ 47,184,765.72 |
| **Total** | **$ 1,124,153,171.08** | **$ 767,965,024.90** |

Currency Description

- Armenian Dram
- Australian Dollar
- Bhutan Ngultrum
- British Pound
- Canadian Dollar
- Danish Krone
- EURO
- Hong Kong Dollar
- Indian Rupee
- Iranian Rial
- Japanese Yen
- Maltese Lira
- Pakistan Rupee
- Polish Zloty
- Renminbi Yuan
- Romanian Leu
- Russian Ruble
- Singapore Dollar
- Slovenian Tolar

This page is provided in the Part 5 solution



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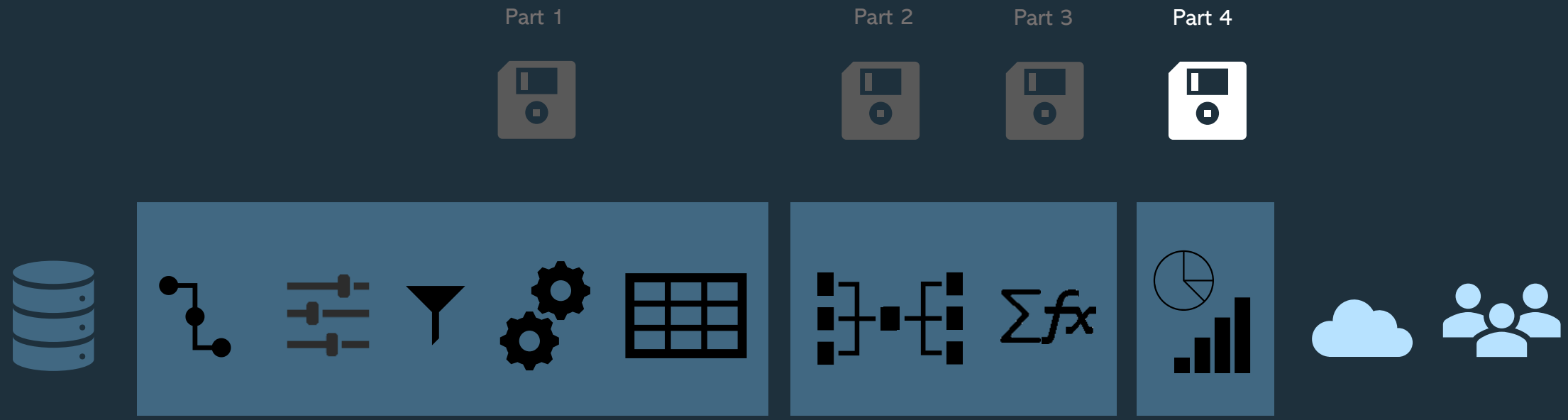
# Hands On Exercise
# Part 5:
# Deploy, Test & Deliver

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- Deliver to user audience

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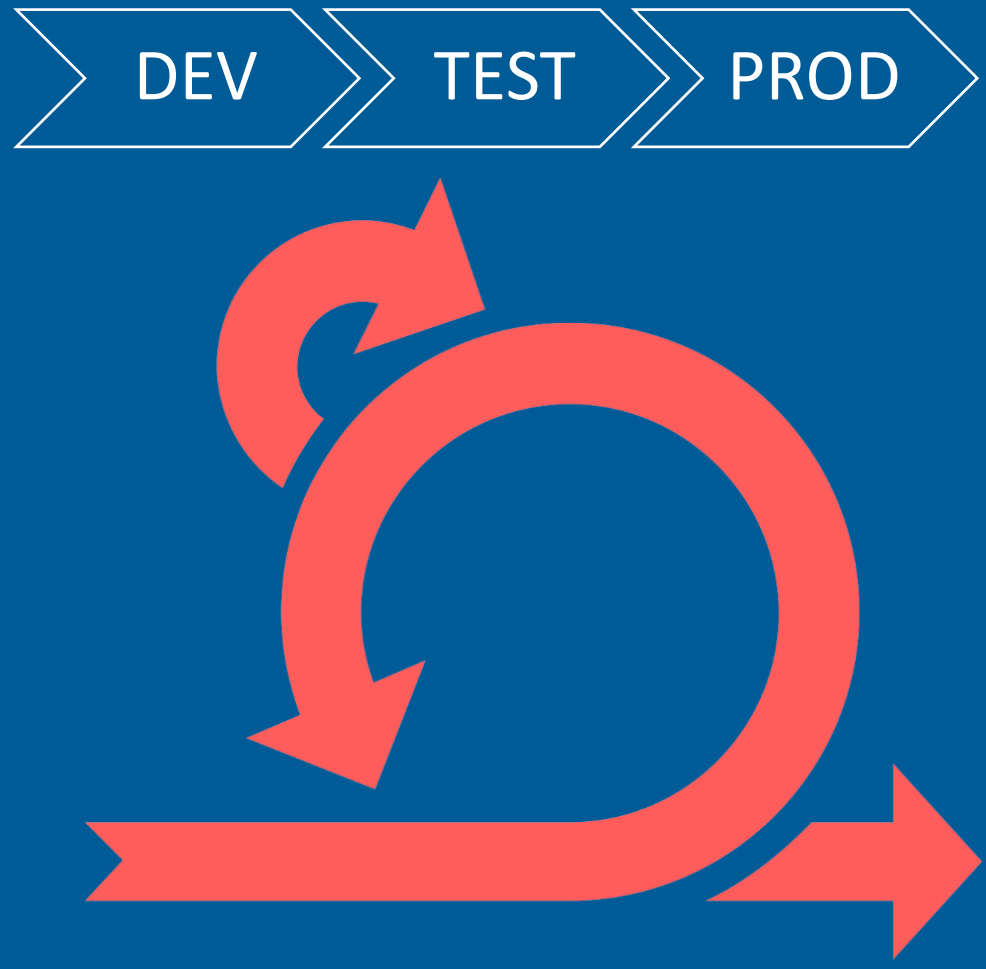
# Managed Deployment & Delivery

# Continuous Integration & Continuous Delivery (CI/CD) for Power BI

A quickly-evolving discipline:

- Manual techniques
- Report & dataset separation
- Deployment pipeline
- Decompose PBIX file objects with Tabular Editor
- Next-generation:
- Desktop capability
- Azure DevOps integration



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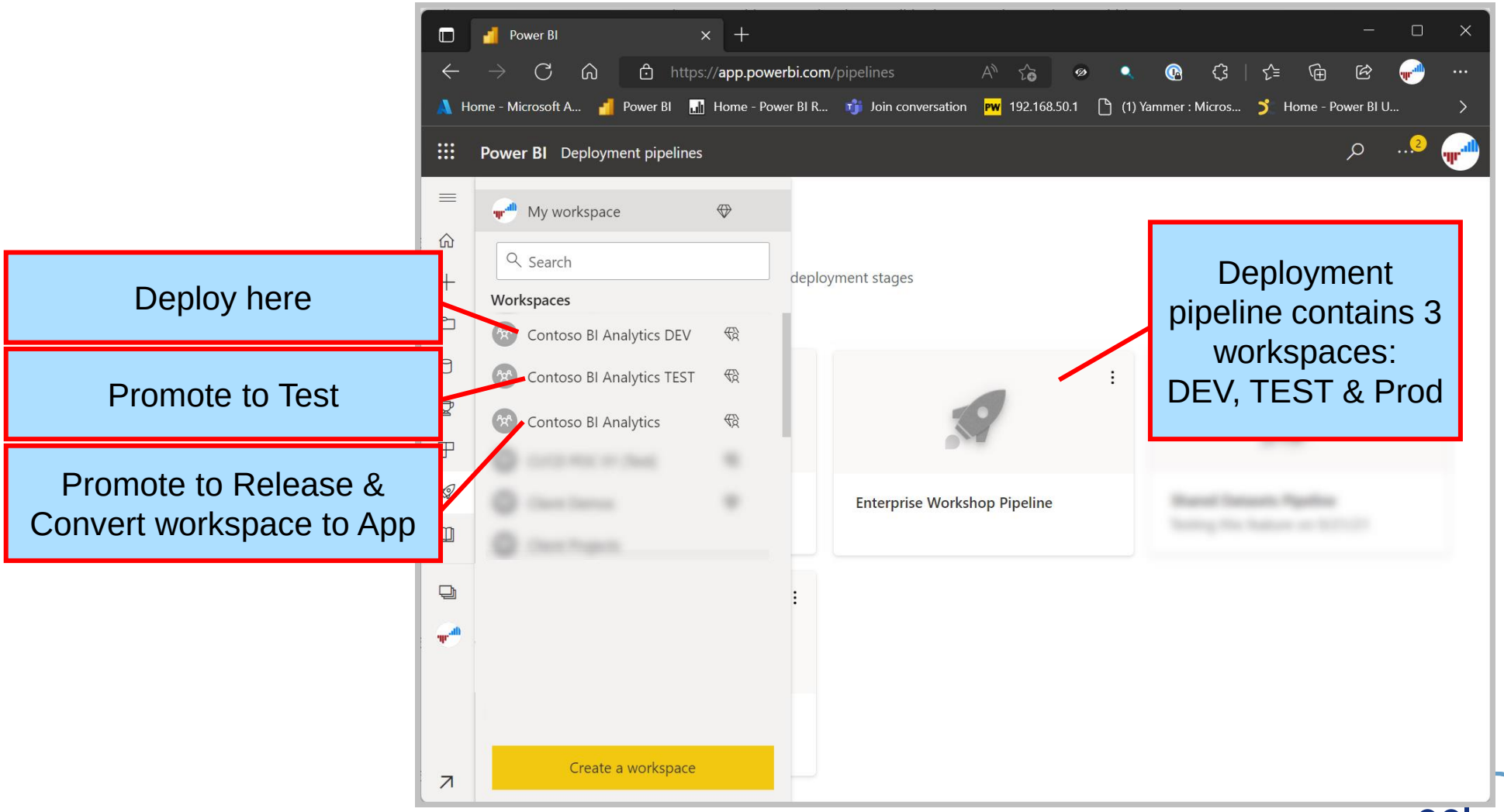
# Using a Deployment Pipeline to Manage Deployment Stages



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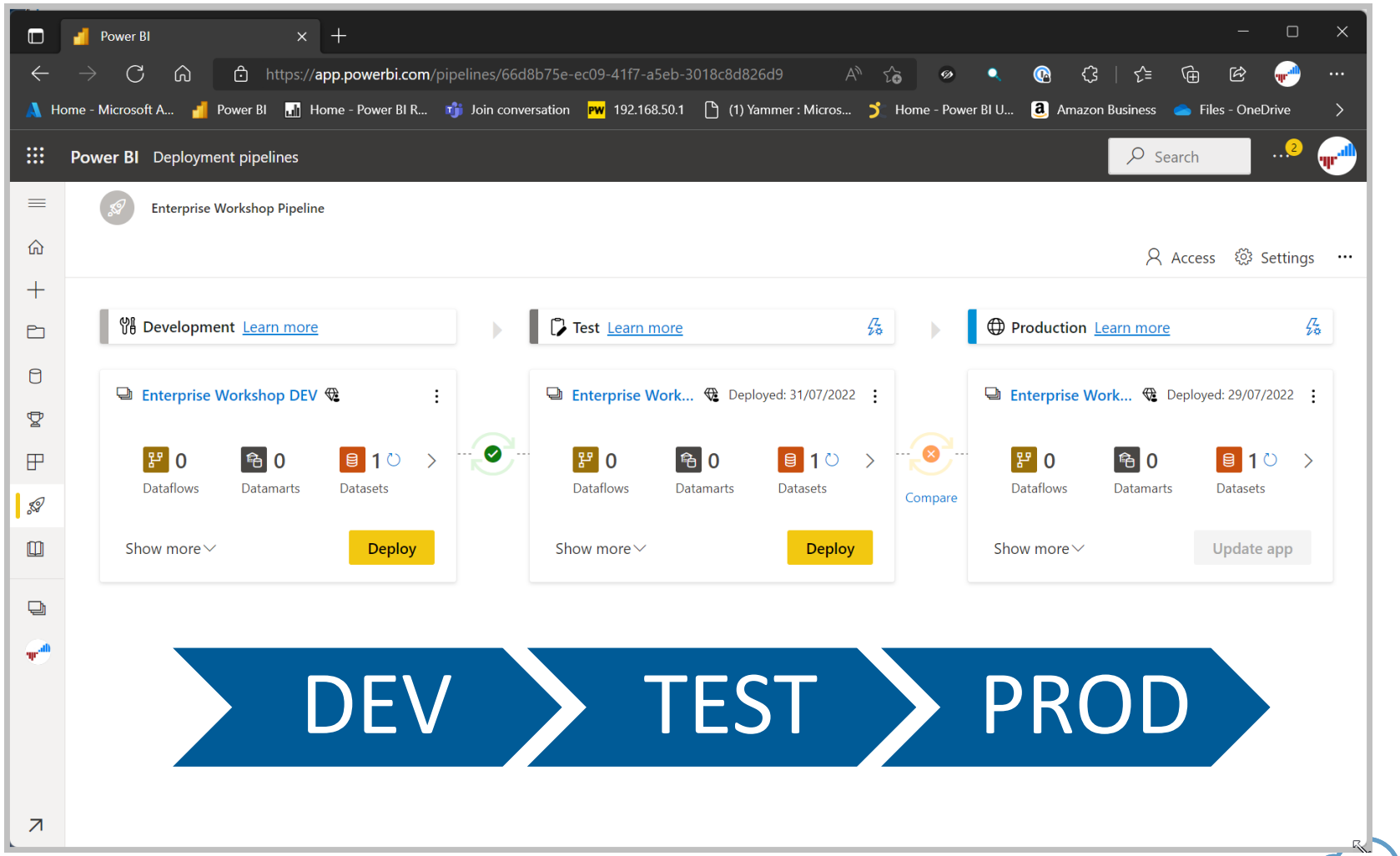
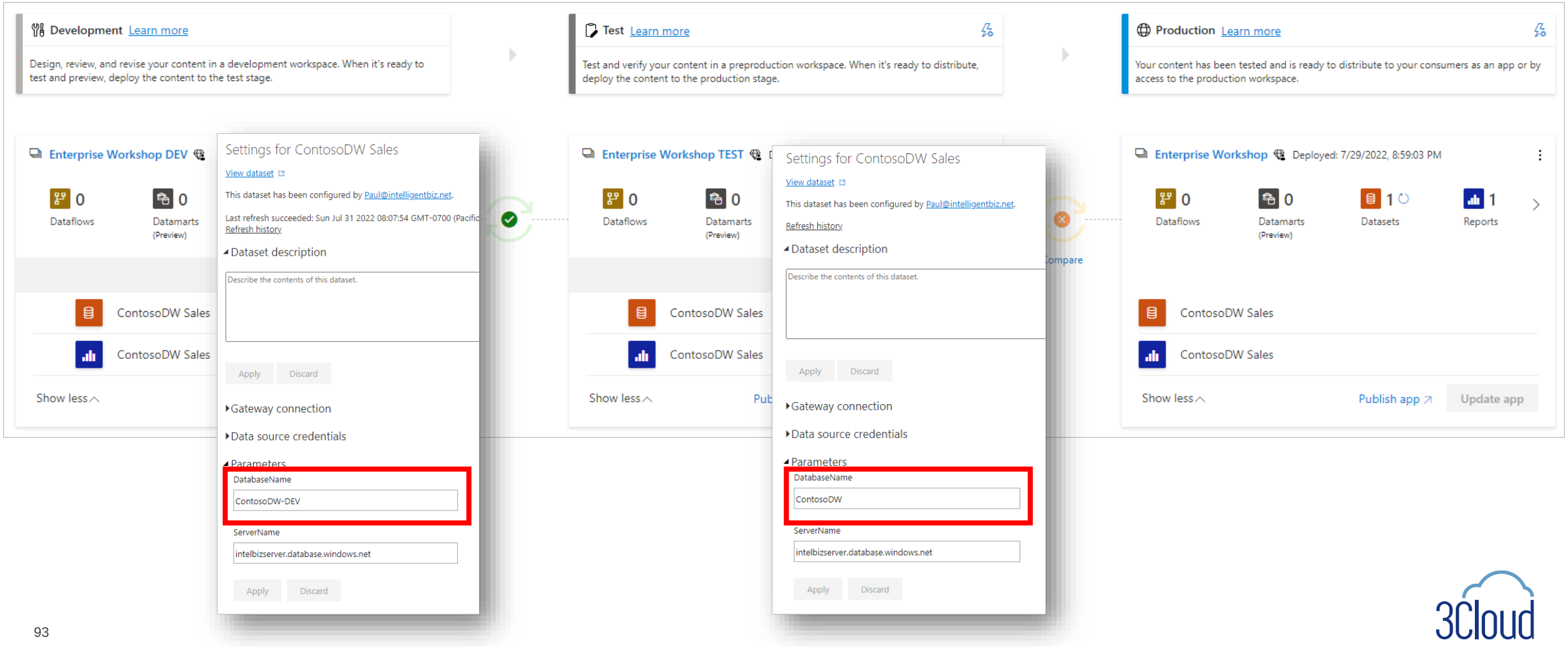
# Using a Deployment Pipeline to Manage Deployment Stages



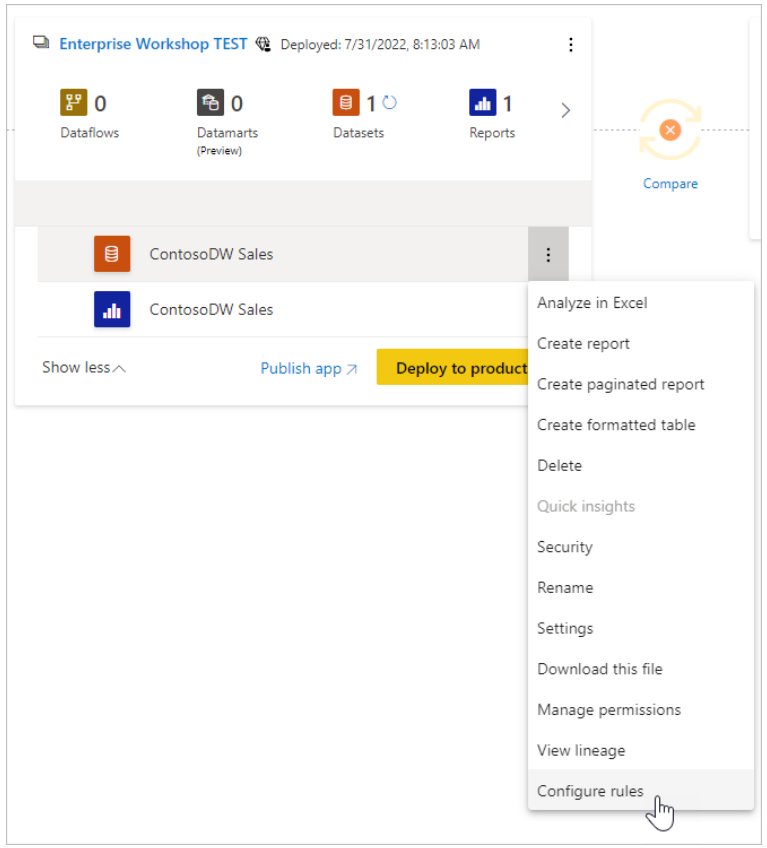
# Dataset Settings

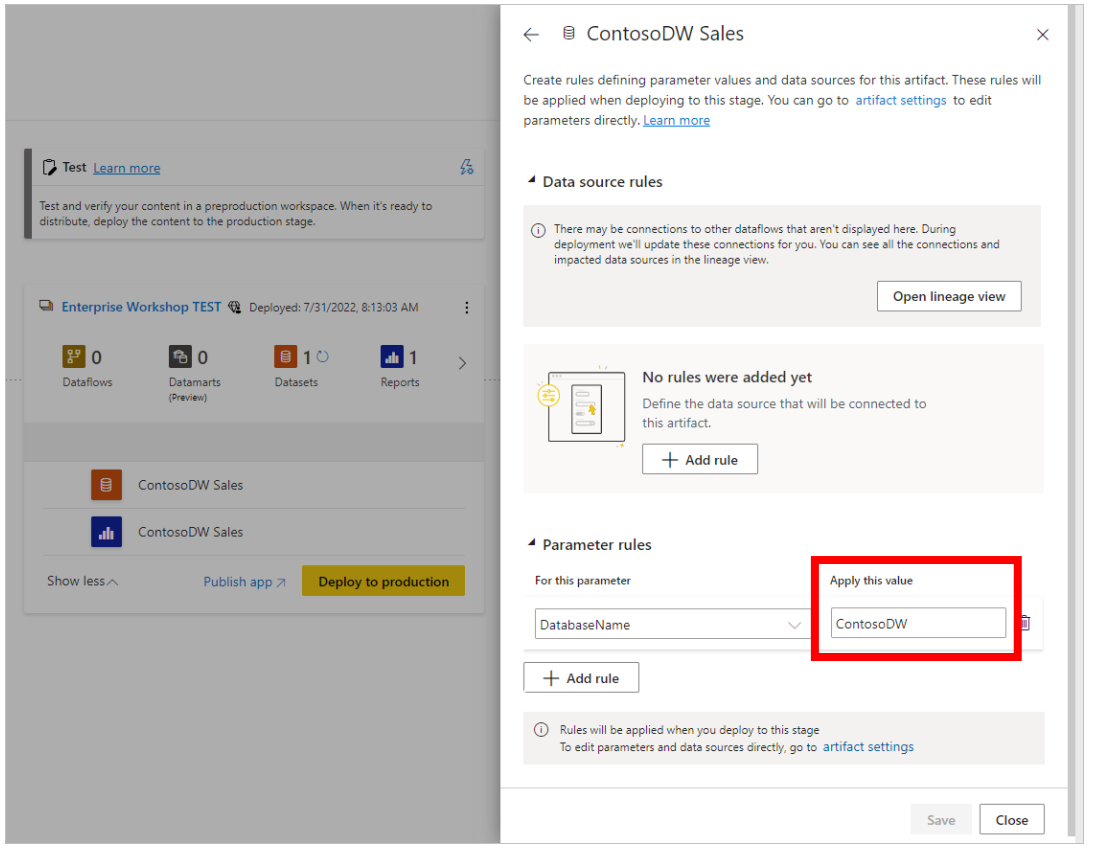
## APPLIES TO DEPLOYED DATASET



# Deployment Rules

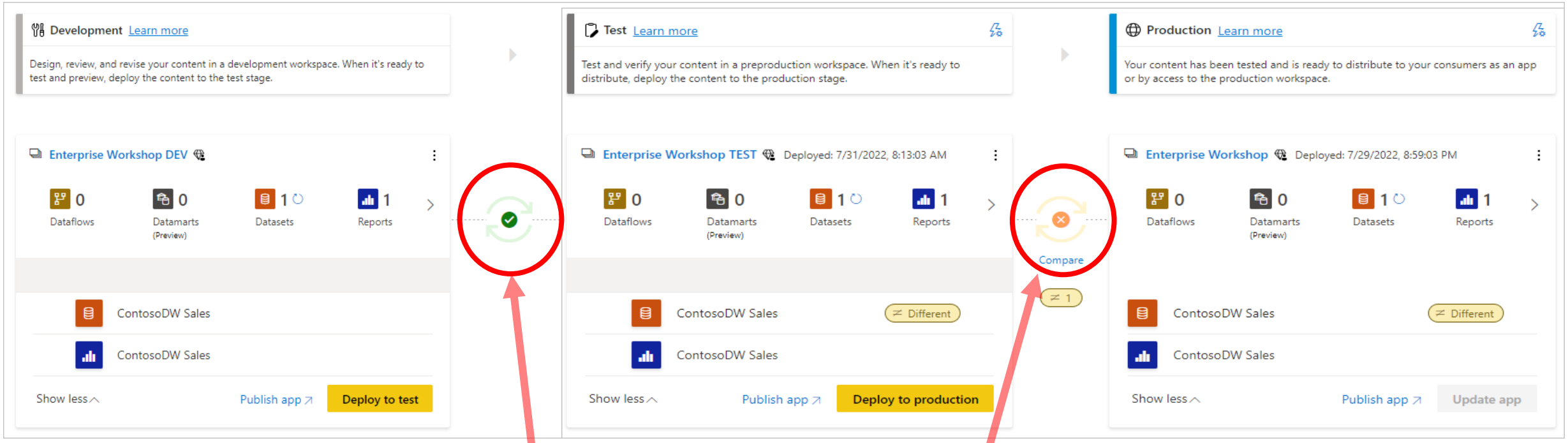
## APPLIES TO EACH VERSION OF A DATASET IN THE WORKSPACE



# Pipeline Comparison

## COMPARES VERSIONS OF EACH OBJECT IN PIPELINE




DEV & TEST versions are the same

TEST & PROD versions are Different PROD is older.

# Automate Deployment Pipelines Using APIs and Azure DevOps

REST methods enable automation with:

- Azure DevOps actions
- PowerShell
- Custom code of choice

| | | |
|---|---|---|
| **Assign Workspace** | **Get Pipeline Operation** | **Selective Deploy** |
| **Create Pipeline** | **Get Pipeline Operations** | **Unassign Workspace** |
| **Delete Pipeline** | **Get Pipelines** | **Update Pipeline** |
| **Delete Pipeline User** | **Get Pipeline Stage Artifacts** | **Update Pipeline User** |
| **Deploy All** | **Get Pipeline Stages** | |
| **Get Pipeline** | **Get Pipeline Users** | |

3. **Deploy** - Here you perform the deployment.

PowerShell Copy

```
$url = "pipelines/{0}/Deploy" -f "Insert you pipeline ID here"
$deployResult = Invoke-PowerBIRestMethod -Url $url  -Method Post -Body $body | ConvertFrom-Json
```

4. (Optional) **Deployment completion notification** - As the deployment API is asynchronous, you can program the script to notify you when the deployment is complete.

PowerShell Copy

```
$url =  "pipelines/{0}/Operations/{1}" -f "Insert you pipeline ID here",$deployResult.id
$operation = Invoke-PowerBIRestMethod -Url $url -Method Get | ConvertFrom-Json
while($operation.Status -eq "NotStarted" -or $operation.Status -eq "Executing")
{
    # Sleep for 5 seconds
    Start-Sleep -s 5
    $operation = Invoke-PowerBIRestMethod -Url $url -Method Get | ConvertFrom-Json
}
```



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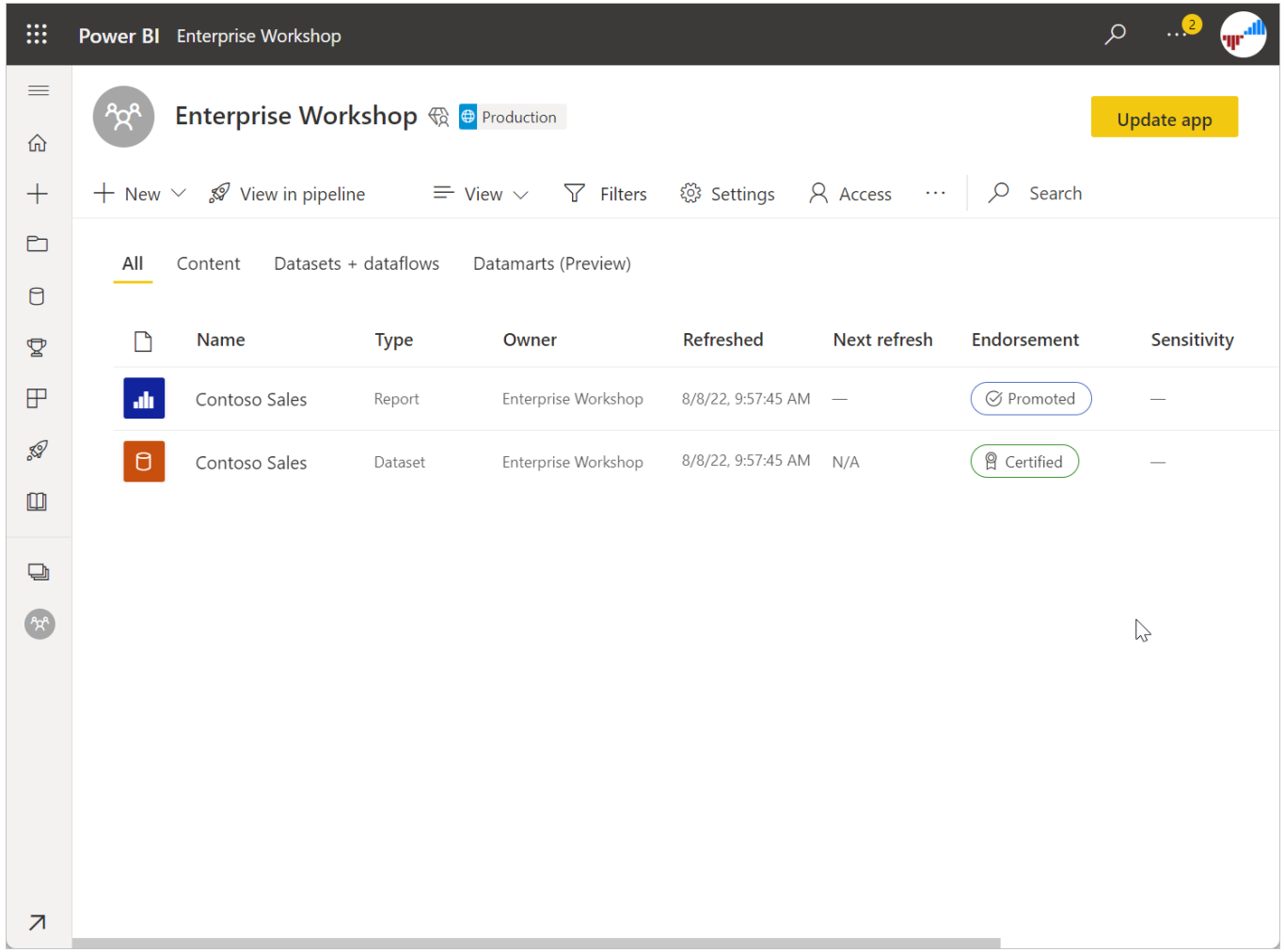
# Certified & Governed Data Models

# Endorsing Certified Datasets & Reports

- Part of the organization's governance & adoption plan
- Governance policy sets criteria for validation & endorsement
- Data steward owns source data & validates dataset trustworthiness



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# Separating Data Models & Reports

# Planning for Separation – data models & reports

## The Thick and Thin of Reports

Separate reports and data models can be:

- Versioned
- Deployed & managed separately
- Central “Certified” dataset
- Use Live Connect when creating new reports

Doing Power BI the Right Way: 7. Planning for separation – data models and reports | Paul Turley's SQL Server BI Blog

5 Tips for Separating Power BI Datasets and Reports — Coates Data Strategies

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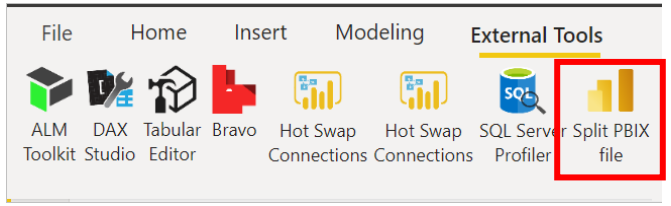
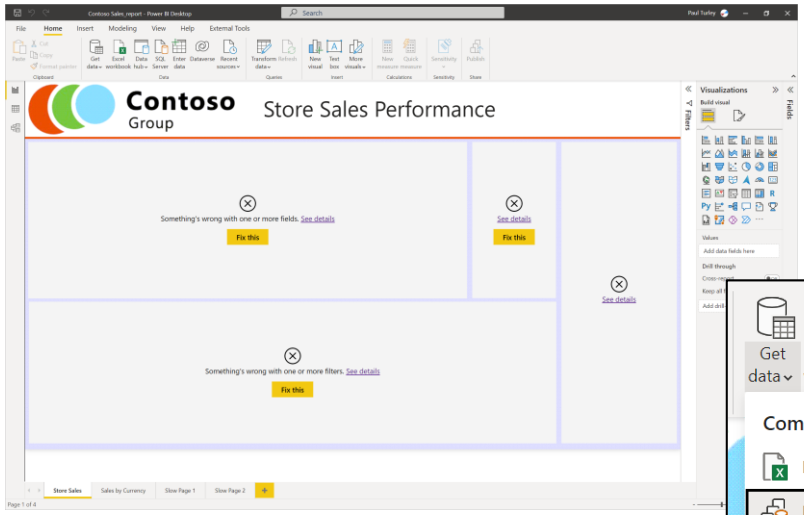
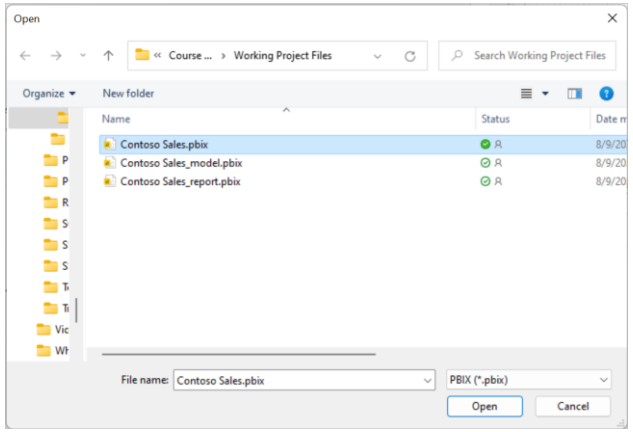
# Separating an Existing Model & Report

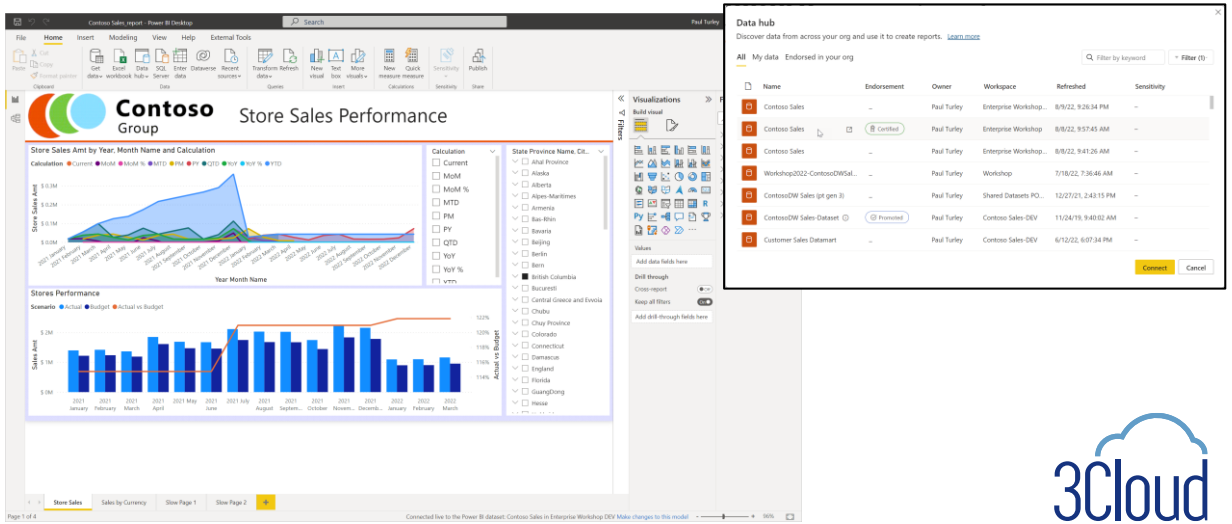
## SPLIT PBIX FILE EXTERNAL TOOL




- Split PBIX & Hot Swap Connections developed by Steve Campbell
- Installs with Business Ops – free tools from PowerBI.tips
- Removes data model & connection from new report file
- Reconnect report to published dataset



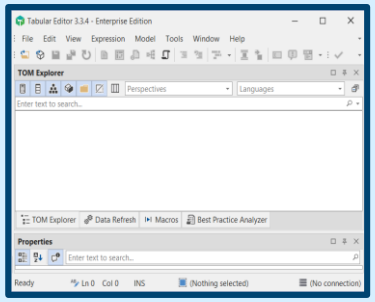



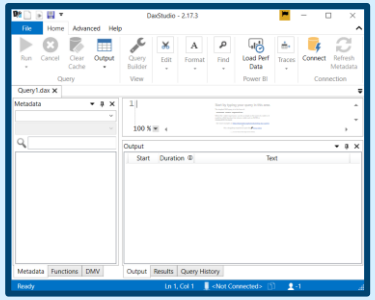



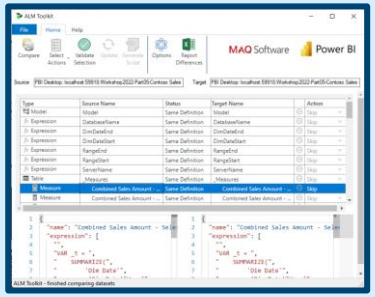
# Analyzing & Tuning Data Models

## CONNECTING TO LOCAL AND REMOTE DATA MODELS

Tools



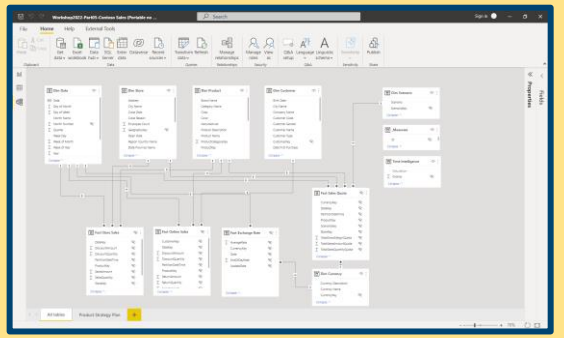




Localhost connection

XMLA endpoint

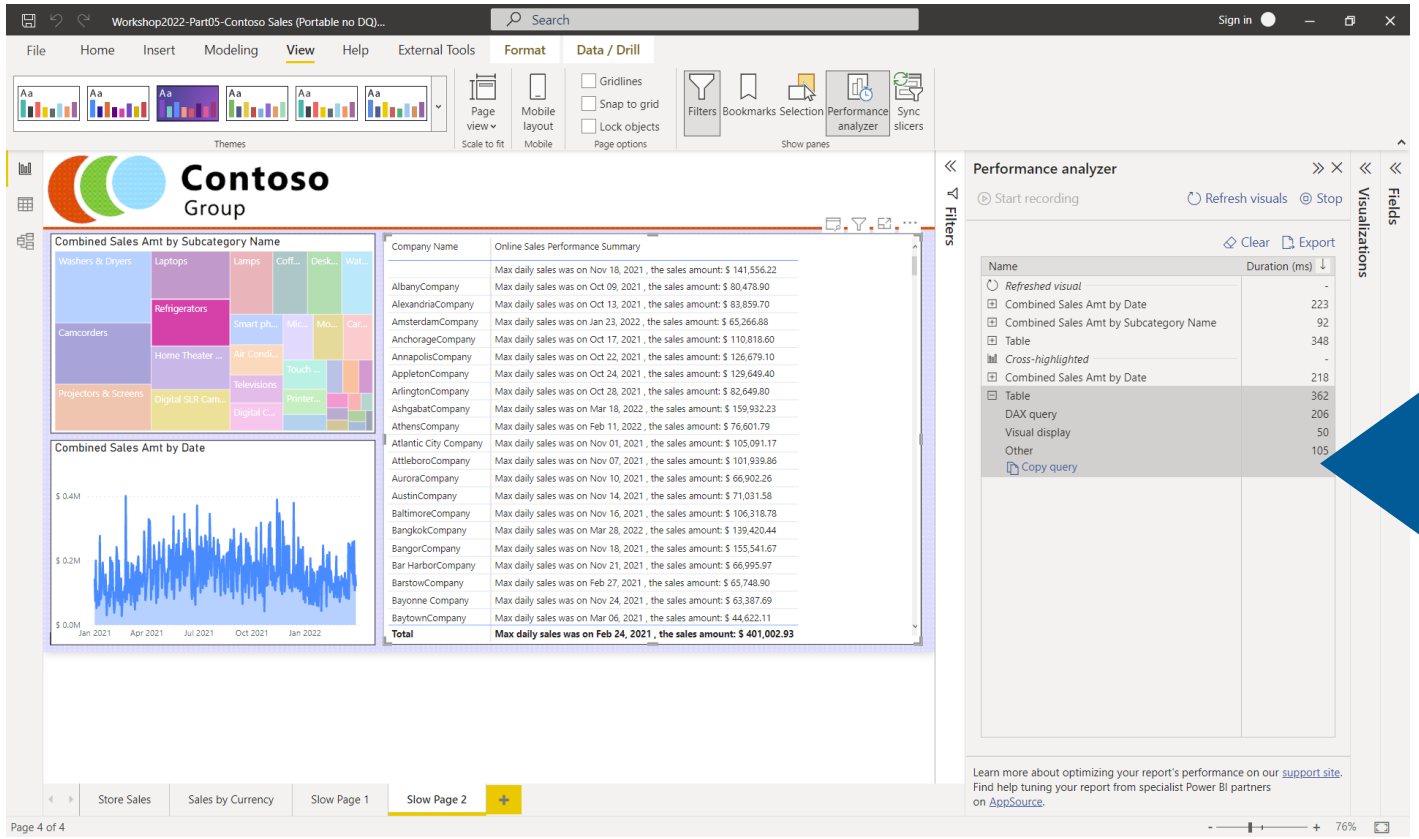
Desktop data model



Published dataset

# Using Performance Analyzer

...




```
// DAX Query
DEFINE
  VAR __DS0FilterTable =
    TREATAS({"Refrigerators"}, 'Dim Product'[Subcategory Name])

  VAR __DS0Core =
    SUMMARIZECOLUMNS(
      ROLLUPADDISSUBTOTAL('Dim Customer'[Company Name],
"IsGrandTotalRowTotal"),
      __DS0FilterTable,
      "Online_Sales_Performance_Summary", '_Measures'[Online Sales
Performance Summary],
      "v_Online_Sales_Performance_Summary_FormatString",
IGNORE('_Measures'[_Online Sales Performance Summary FormatString])
    )

  VAR __DS0PrimaryShowAll =
    ADDMISSINGITEMS(
      'Dim Customer'[Company Name],
      __DS0Core,
      ROLLUPISSUBTOTAL('Dim Customer'[Company Name],
[IsGrandTotalRowTotal]),
      __DS0FilterTable
    )

  VAR __DS0PrimaryWindowed =
    TOPN(502, __DS0PrimaryShowAll, [IsGrandTotalRowTotal], 0, 'Dim
Customer'[Company Name], 1)

EVALUATE
  __DS0PrimaryWindowed

ORDER BY
  [IsGrandTotalRowTotal] DESC, 'Dim Customer'[Company Name]
```



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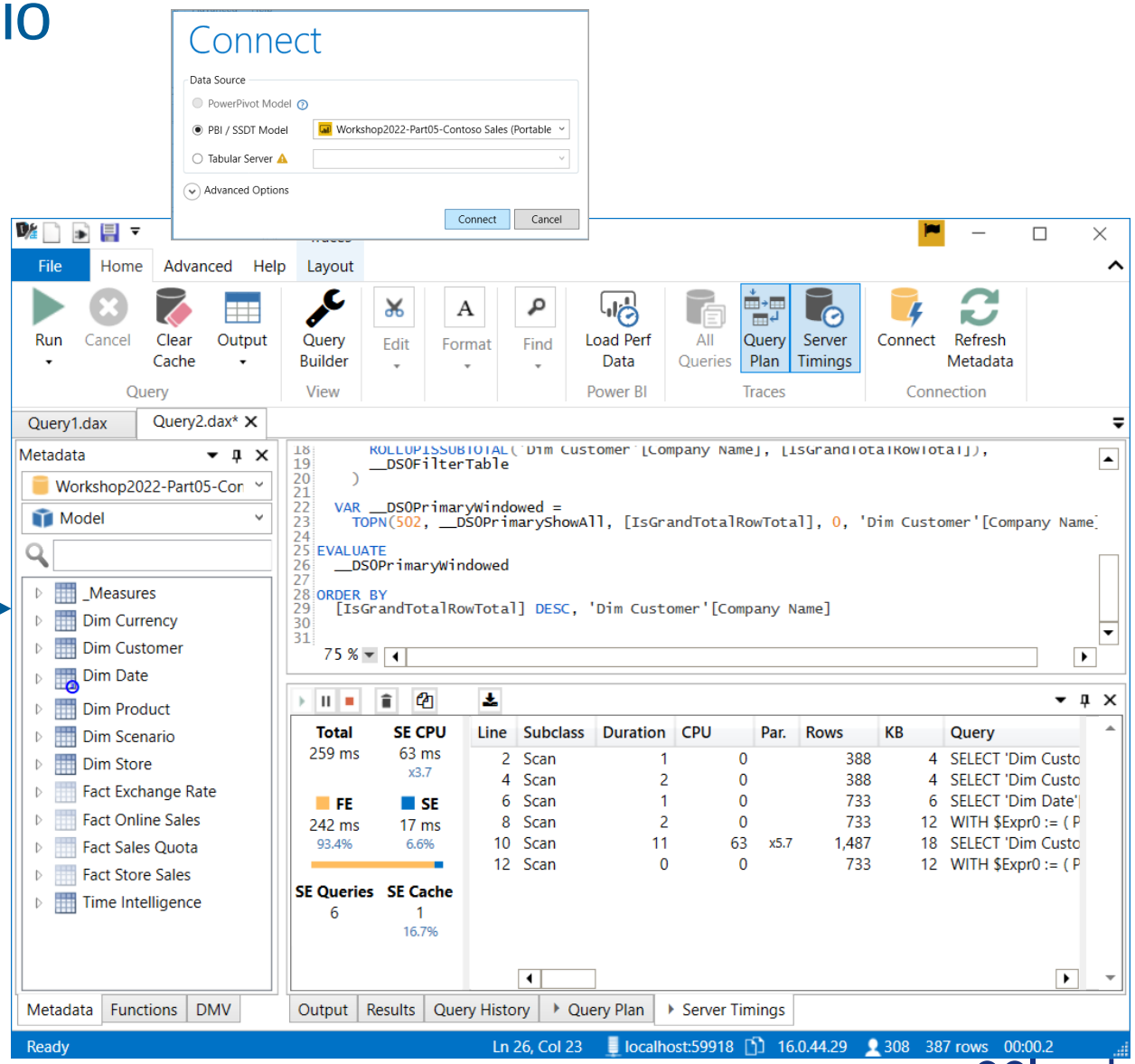
# Performing Analysis with DAX Studio

## CLEAR CACHE, QUERY PLAN & SERVER TIMINGS

```
// DAX Query
DEFINE
  VAR __DS0FilterTable =
    TREATAS({"Refrigerators"}, 'Dim Product'[Subcategory Name])

  VAR __DS0Core =
    SUMMARIZECOLUMNS(
      ROLLUPADDISSUBTOTAL('Dim Customer'[Company Name],
"IsGrandTotalRowTotal"),
      __DS0FilterTable,
      "Online_Sales_Performance_Summary", '_Measures'[Online
Sales Performance Summary],
      "v_Online_Sales_Performance_Summary_FormatString",
IGNORE('_Measures'[_Online Sales Performance Summary
FormatString])
    )

  VAR __DS0PrimaryShowAll =
    ADDMISSINGITEMS(
      'Dim Customer'[Company Name],
      __DS0Core,
      ROLLUPISSUBTOTAL('Dim Customer'[Company Name],
[IsGrandTotalRowTotal]),
      __DS0FilterTable
    )

  VAR __DS0PrimaryWindowed =
    TOPN(502, __DS0PrimaryShowAll, [IsGrandTotalRowTotal], 0,
'Dim Customer'[Company Name], 1)

EVALUATE
  __DS0PrimaryWindowed

ORDER BY
  [IsGrandTotalRowTotal] DESC, 'Dim Customer'[Company Name]
```



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# Evaluations, evaluations…

https://evals.datagrillen.com/evals_vienna.aspx

# Resources

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# Model Design Guidelines

- Dimensional design concepts haven't changed in 20 years & are as true as ever
- Dimensional modeling "rules" should be followed but can be relaxed for Power BI in certain cases, such as:
  - Leaving some dimensional attributes in fact tables
  - Use natural keys rather than generating surrogate keys
- The art of dimensional modeling ranges from simple to complex. Start with the basics.
- Flattened "spreadsheet" models are OK for small, informal projects but have significant limitations
- As models grow in size & complexity, data quality challenges will surface that can be solved by implementing proper governance controls

The Kimball Method: https://www.kimballgroup.com/data-warehouse-business-intelligence-resources/kimball-techniques/dimensional-modeling-techniques

Lawrence Corr, Model Storming Agile method: https://modelstorming.com/hierarchy-map

# Enterprise Scale Options

In many ways, Power BI has now surpassed the capabilities of SQL Server Analysis Services. Microsoft are investing in the enterprise capabilities of the Power BI platform by enhancing Power BI Premium Capacity, adding Paginated Report and features to support massive scale specialized use cases. Consider the present and planned capabilities of the Power BI platform; before, choosing another data modeling tool such as SSAS.

**Resources:**

https://sqlserverbi.blog/2018/07/27/power-bi-for-grownups

https://sqlserverbi.blog/2018/12/13/data-model-options-for-power-bi-solutions