



Mastering Composite Models—

Power BI for the Self-Service Developer

*Presented by
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David Kofod Hanna



Senior Advisor, Data Storytelling @ twoday

+200 courses as Academy Trainer and 10 years as consultant
Certified Tabular Editor 3 Trainer, DP-600, PL-300, CPUX-F



Passionate about guiding self-service Power BI

developers for more enterprise manageable concepts in a consumable and practical way



Born on beautiful “Sunshine island”: Bornholm

Lives in Silkeborg with wife and 3 kids
Love football and running half-marathons



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Mastering Composite Models –

Power BI for the Self-Service Developer

Live connection vs. Composite Model



The Holy Grail for Self-Service BI and implications for Enterprise setup

Enriching our Semantic Model



Let's dive into what's possible for the Self-Service developer now

The Pitfall of Using Calculation Groups



How the remote and local data sources impacts our model and especially calculation groups

I'm from IT – How can I Disable it?



Depending on your setup, you can consider disabling this feature.

Final Considerations



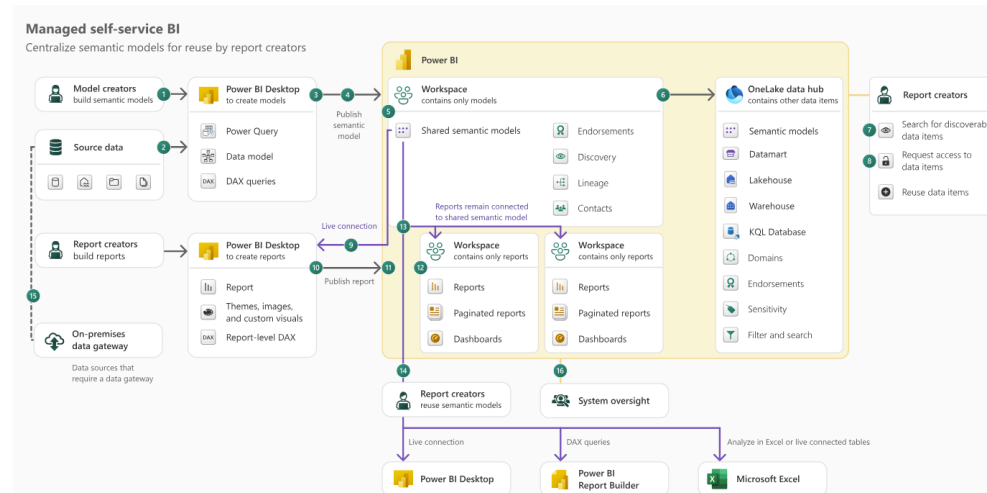
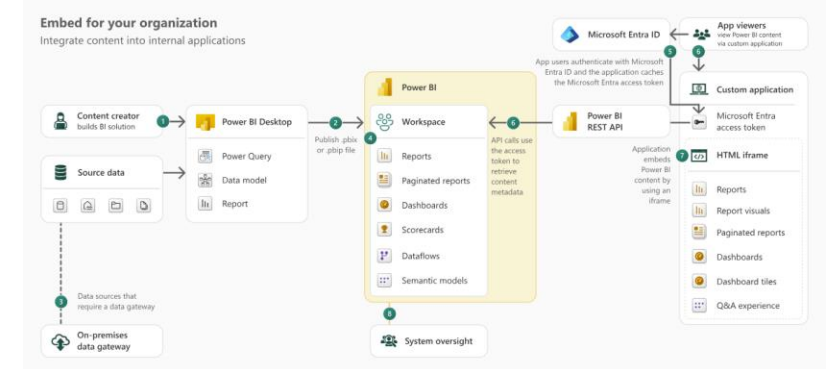
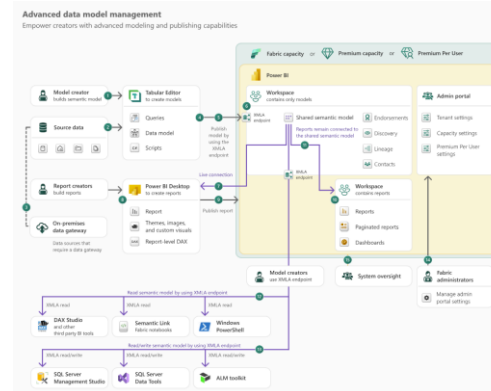
A guide to those who consider using composite model with direct query on Power BI semantic models

How many have explored
Composite Models with
Direct Query to Power BI Semantic
Model?

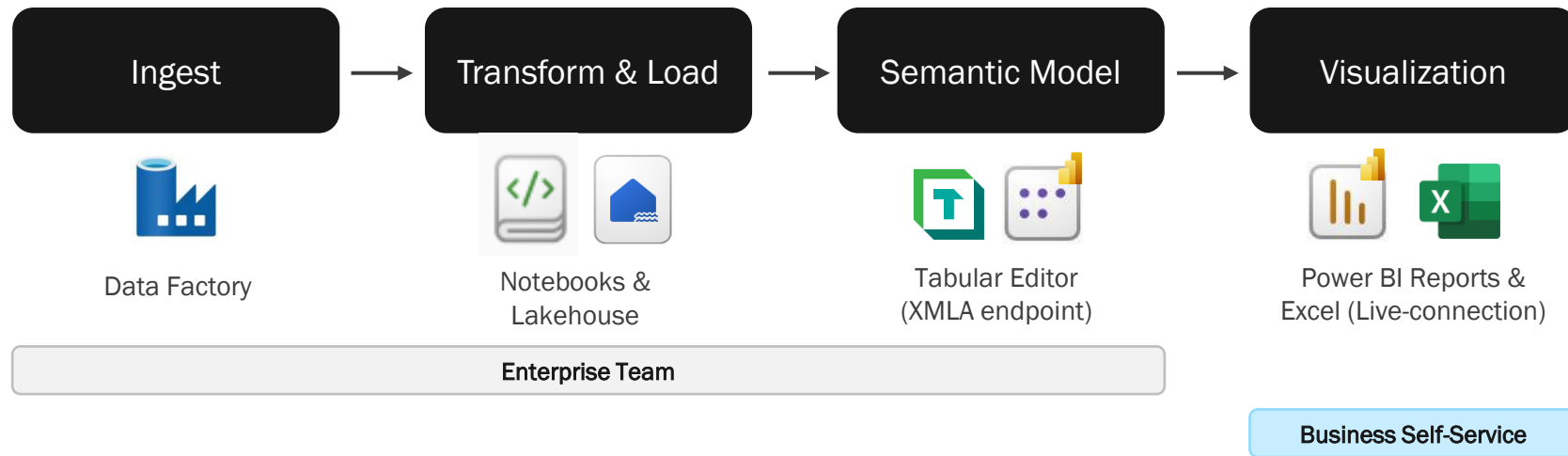


One Size Fits All?

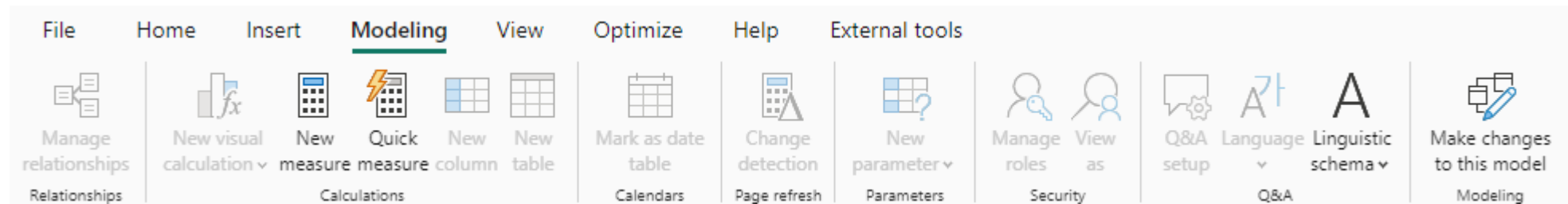
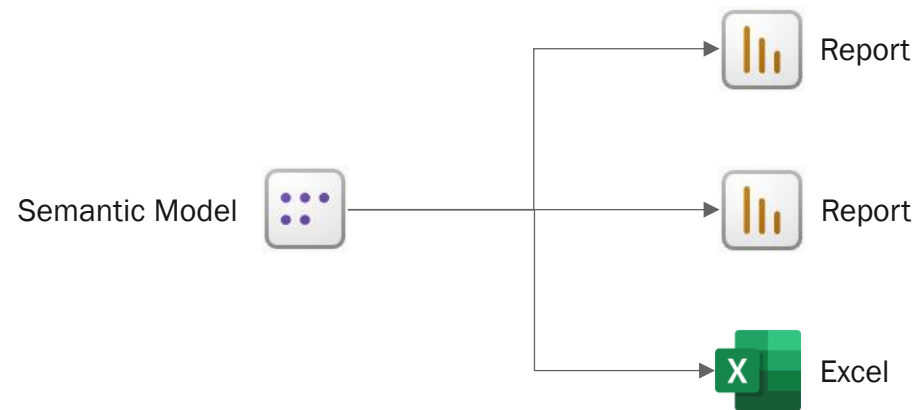
1. Advanced data model management
2. Advanced data preparation
3. Customizable managed self-service BI
4. Departmental BI
5. Embed for your customers
6. Embed for your organization
7. Enterprise BI
8. Enterprise content publishing
9. Managed self-service BI
10. On-premises reporting
11. Personal BI
12. Prototyping and sharing
13. Self-service content publishing
14. Self-service data preparation
15. Self-service real-time analytics
16. Team BI



Scenario



I Love Live-Connection, but ...



Demo

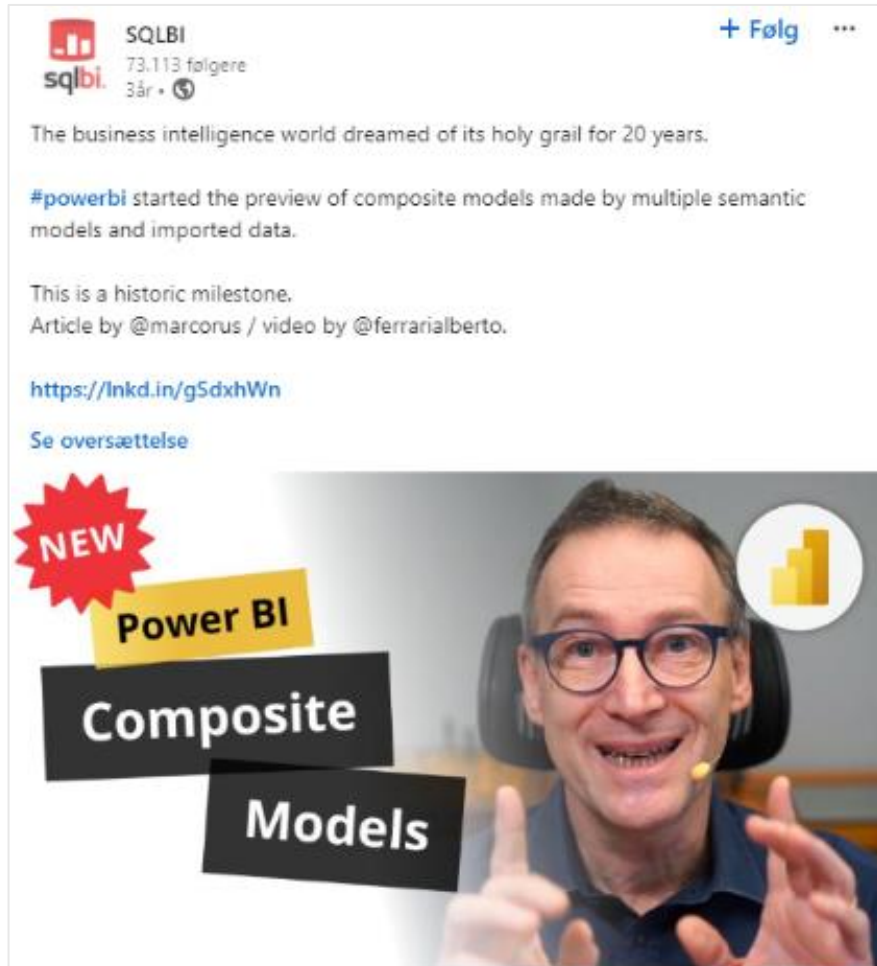
”

Roche's Maxim of Data Transformation:

Data should be transformed
as far upstream as possible, and
as far downstream as necessary.

The Holy Grail for self-service BI

Public Preview in Dec 2020 and General Available in Apr 2023





<https://www.sqlbi.com/articles/new-composite-models-in-power-bi-a-milestone-in-business-intelligence/>


Composite Model (“Mixed storage mode”)

 Is that you Fabric **Metrics Set**?





 **Extend Enterprise Model**


 Direct Query on Power BI Semantic Model


 Import (VertiPaq)

Using composite models with Power BI semantic models and Analysis Services, you can build a composite model using a Direct Query connection to connect to Power BI semantic models, Azure Analysis Services (AAS), and SQL Server 2022 Analysis Services


 **I Want It All In One Page Dashboard**


 Direct Query on Power BI Semantic Model


 Direct Query on Power BI Semantic Model


 Direct Query on Power BI Semantic Model


Bernat Agulló Roselló: <https://www.esbrina-ba.com/i-want-it-all-in-one-page/>


 **Near-live + Historic analysis**

 Direct Query to Database


 Import (VertiPaq)

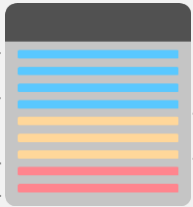
 **Direct Lake (OneLake) + Import** May-2025

 Direct Lake

 Import (VertiPaq)

Zoe Douglas [LinkedIn Post](#)

 **Hybrid Table**



Import {

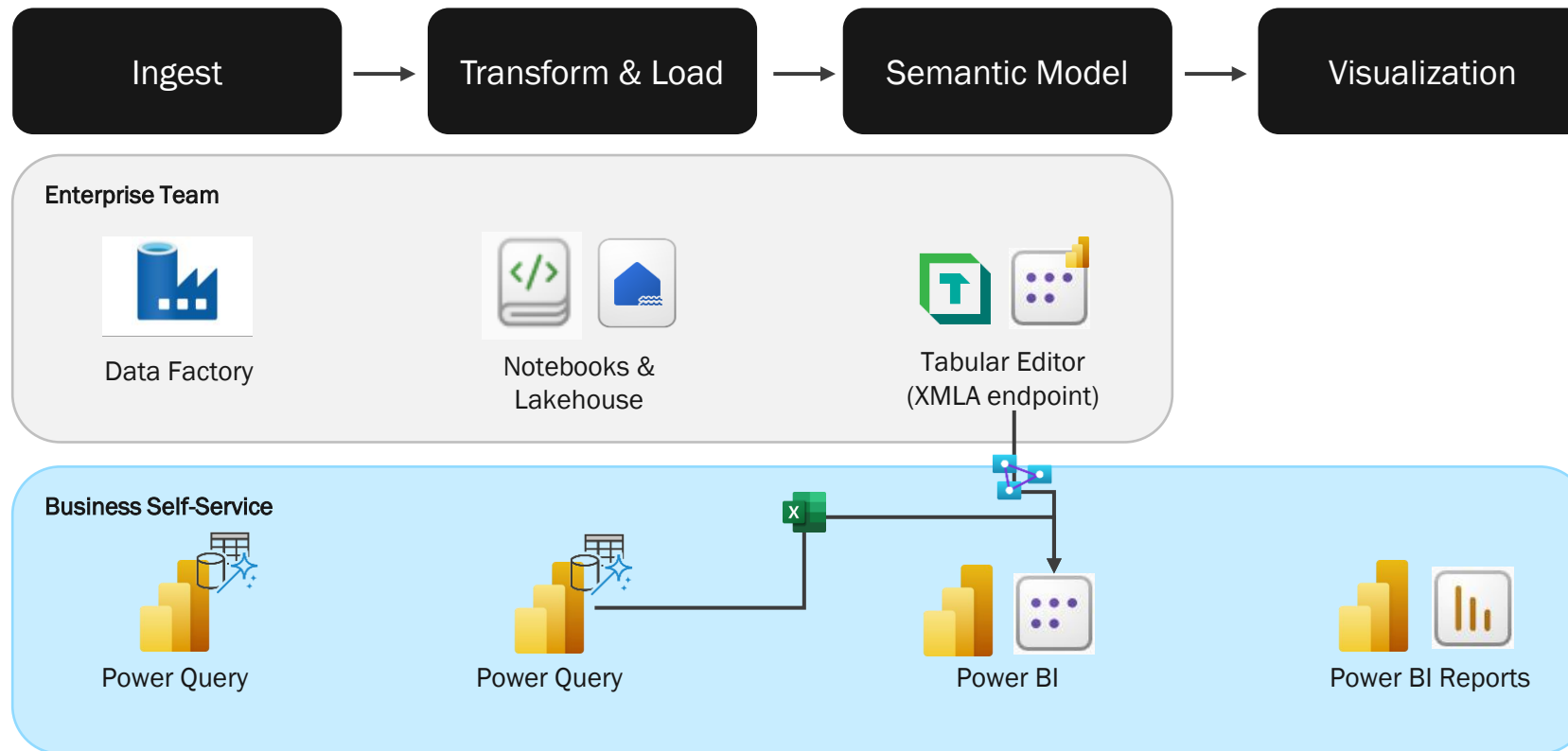
Direct Query {

Incremental Refresh

There is also Hybrid tables that within one table have import, incremental refresh and Direct Query.

Customizable managed self-service BI

discipline at the core and flexibility at the edge



Demo



Wholesale



Retail

discipline at the core and **flexibility** at the edge

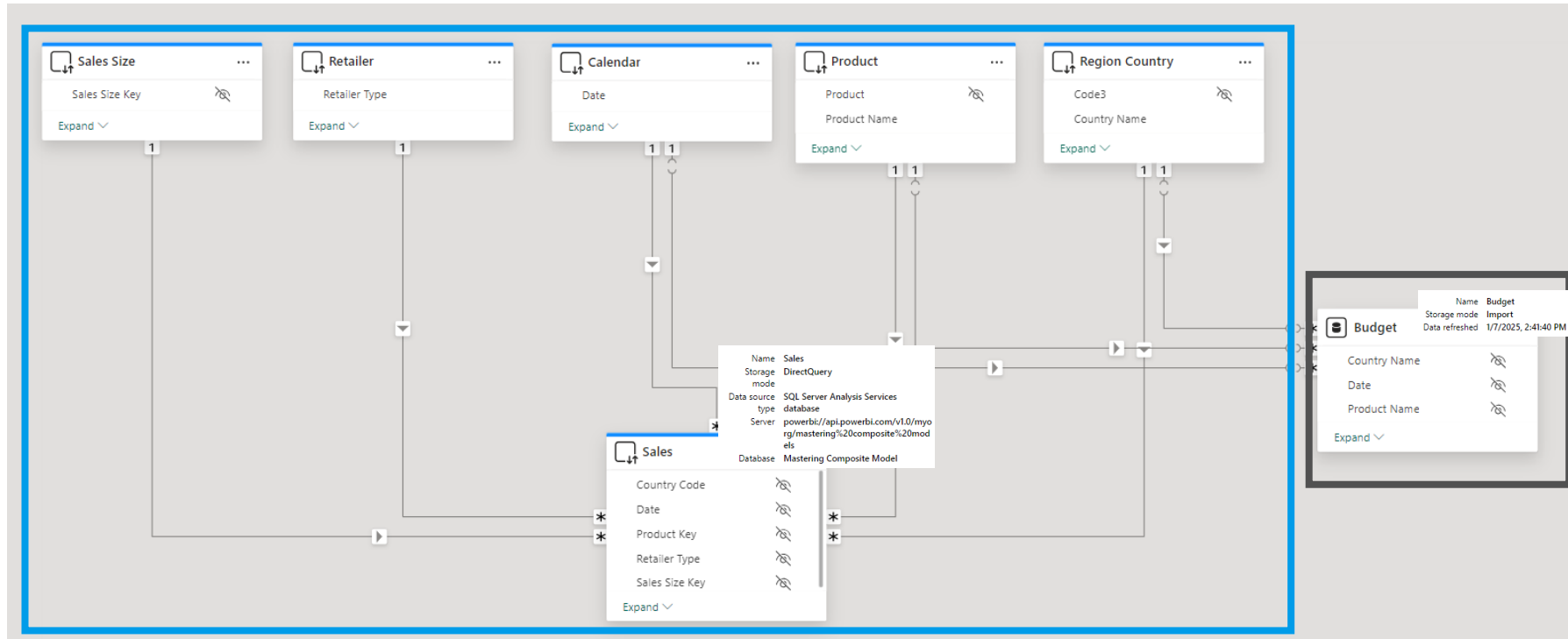


Wholesale
(Remote)
Enterprise Team



Retail
(Local)
Self-Service Business
Dev

Remote & Local



Who loves to include a
calculation group in their
semantic model?




Calculation Group 101

SELECTEDMEASURE()

Reuseable calculation items based on measures in the report canvas

- Time Intelligence (*MTD, QTD, YTD, LY, YOY %*)
- Unit conversion (*show figures in abs, in k, in m*)
- Format String Expressions (*like dynamic format string for measures*)
- Handling Multiple Dates (*USERRELATIONSHIP to switch between order and invoice date*)
- Custom Date or Week Periods as slicer in report
- My vs. All stats
- And more ...

Calculation Groups to the Rescue



Self-Service Power BI & Fabric Newsletter
by David K. Hanna

Last 30 Days

Last 3 Months

Last 6 Months

Current Year

Last Year

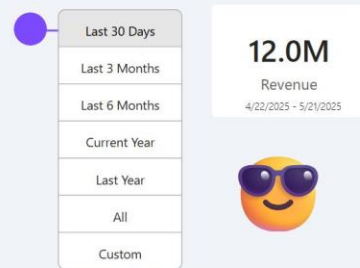
All

Custom

12.0M

Revenue

4/22/2025 - 5/21/2025



Dynamic Calculation Groups
Our slicer default in Power BI should have the UX as this option, but until then let's make it easy for our end users with a click of a button.

Remember to add a **Date periods** measure that shows the days included from the date slicer - again to provide clarity of what we are looking at.

```
-- Calculation Group: 'Date Slicer'
CALCULATIONGROUP 'Date Slicer'[Date slicer column]

CALCULATIONITEM 'Last 30 Days' =
VAR _IsDateFiltered =
    CALCULATE( ISFILTERED( 'Date'[Date] ), ALLSELECTED( ) )
VAR _Day = 30
VAR _Result =
    IF(
        _IsDateFiltered,
        SELECTEDMEASURE( ),
        CALCULATE(
            SELECTEDMEASURE( ),
            KEEPFILTERS(
                DATESINPERIOD( 'Date'[Date], TODAY( ), -_Day, DAY )
            )
        )
    )
RETURN
    _Result
Ordinal = 0

CALCULATIONITEM 'Last 3 Months' =
VAR _IsDateFiltered =
    CALCULATE( ISFILTERED( 'Date'[Date] ), ALLSELECTED( ) )
VAR _Day = 90
VAR _Result =
    IF(
        _IsDateFiltered,
        SELECTEDMEASURE( ),
        CALCULATE(
            SELECTEDMEASURE( ),
            KEEPFILTERS(
                DATESINPERIOD( 'Date'[Date], TODAY( ), -_Day, DAY )
            )
        )
    )
RETURN
    _Result
Ordinal = 1
```

<https://www.linkedin.com/feed/update/urn:li:activity:7331027969357824000/>

Demo

Consideration ...

Create perspectives to exclude calculation group when create composite

Connect to your data

Databases

Search

Settings

Select the database or specific tables you'd like to connect to. [Learn more](#)

powerbi://api.powerbi.com/v1.0/myorg/Mastering%20Composite%20Models

Mastering Composite Model

Sales

Time Intelligence

Calendar

Product

Region Country

Retailer

Sales Size

Submit

Cancel

Connect to your data

Perspectives

Search

Settings

A perspective will connect you to the whole model, but only show you the subset of data curated by the model author for your convenience. [Learn more](#)

powerbi://api.powerbi.com/v1.0/myorg/Mastering%20Composite%20Models

Mastering Composite Model

Sales

Sales

Calendar

Product

Region Country

Retailer

Sales Size

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“Have you tried Visual Calculations?”



Kommentarer 14



@charliemather3368

for 6 timer siden

Discovered the benefit of using a visual calc when using measures dependent on two separate data islands in a composite model. It allowed me to perform a difference calculation with ease!

4 1



@dutchdatadude

for 4 timer siden

Awesome!



Visual Calculations

- Defined on a visual
- “Visible context”
- Computed at query execution
- Can refer to visual structure

```
// DAX Query
DEFINE
COLUMN '___SQDSOVisualCalcs'[Diff] =
    (/= USER DAX BEGIN =/
[Revenue ACT] - [Budget ACT]
/= USER DAX END =/)

```

```
37 VAR ___SQDSOVisualCalcsInput =
38     SELECTCOLUMNS(
39         KEEPFILTERS(
40             SELECTCOLUMNS(
41                 ___SQDSOCore,
42                 "Name", [Time Intelligence][Name],
43                 "Ordinal", [Time Intelligence][Ordinal],
44                 "IsSQDSOGrandTotalRowTotal", [IsSQDSOGrandTotalRowTotal],
45                 "Revenue_ACT", [Revenue_ACT],
46                 "Budget_ACT", [Budget_ACT]
47             )
48         ),
49         "Name", [Name],
50         "Ordinal", [Ordinal],
51         "IsSQDSOGrandTotalRowTotal", [IsSQDSOGrandTotalRowTotal],
52         "Revenue_ACT", [Revenue_ACT],
53         "Budget_ACT", [Budget_ACT]
54     )
55
56 TABLE '___SQDSOVisualCalcs' =
57     ___SQDSOVisualCalcsInput
58     WITH VISUAL SHAPE
59     AXIS rows
60     GROUP
61         [Name],
62         [Ordinal]
63     TOTAL [IsSQDSOGrandTotalRowTotal]
64     ORDER BY
65         [Ordinal] ASC,
66         [Name] ASC
67     DENSIFY "IsDensifiedRow"
68
69 VAR ___SQDSORemoveEmptyDensified =
70     FILTER(
71         KEEPFILTERS('___SQDSOVisualCalcs'),
72         OR(
73             NOT('___SQDSOVisualCalcs'[IsDensifiedRow]),
74             NOT(ISBLANK('___SQDSOVisualCalcs'[Diff]))
75         )
76     )
77
78 VAR ___DSOCore =
79     SELECTCOLUMNS(
80         KEEPFILTERS(
81             FILTER(
82                 ___SQDSORemoveEmptyDensified,
83                 '___SQDSOVisualCalcs'[IsSQDSOGrandTotalRowTotal] = FALSE
84             )
85         ),
86         "___SQDSOVisualCalcs'[Name]", '___SQDSOVisualCalcs'[Name],
87         "___SQDSOVisualCalcs'[Revenue_ACT]", '___SQDSOVisualCalcs'[Revenue_ACT],
88         "___SQDSOVisualCalcs'[Budget_ACT]", '___SQDSOVisualCalcs'[Budget_ACT],
89         "___SQDSOVisualCalcs'[Diff]", '___SQDSOVisualCalcs'[Diff],
90         "___SQDSOVisualCalcs'[Ordinal]", '___SQDSOVisualCalcs'[Ordinal]
91     )
92
93 VAR ___DSOPrimaryWindowed =
94     TOPN(501, ___DSOCore, '___SQDSOVisualCalcs'[Ordinal], 1, '___SQDSOVisualCalcs'[Name], 1)
95
96 EVALUATE
97     ___DSOPrimaryWindowed
98
99 ORDER BY
100     '___SQDSOVisualCalcs'[Ordinal], '___SQDSOVisualCalcs'[Name]

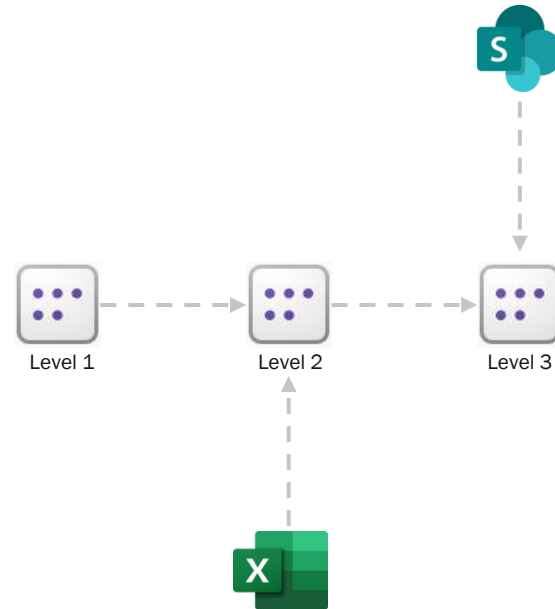
```

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A Dream in a Dream in A Dream 🧠

The maximum length of a chain of models is three.

Extending beyond the chain length of three isn't supported and results in errors.

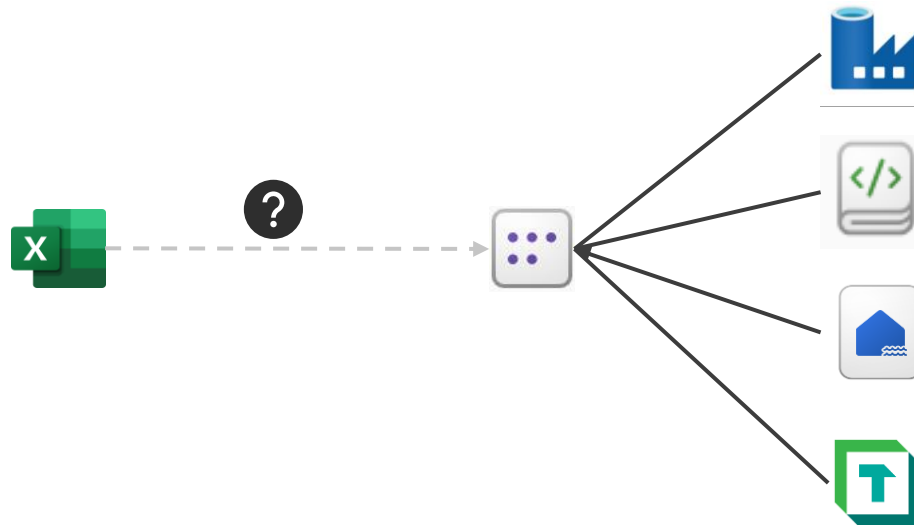


Who owns the data?

- Who owns the semantic model?
- Who supports it?
- Do you have an agreed data contract?
- Would enterprise modelers even accept integrating an important Excel-file into an enterprise setup?

Business:

I want to solve my business problems today



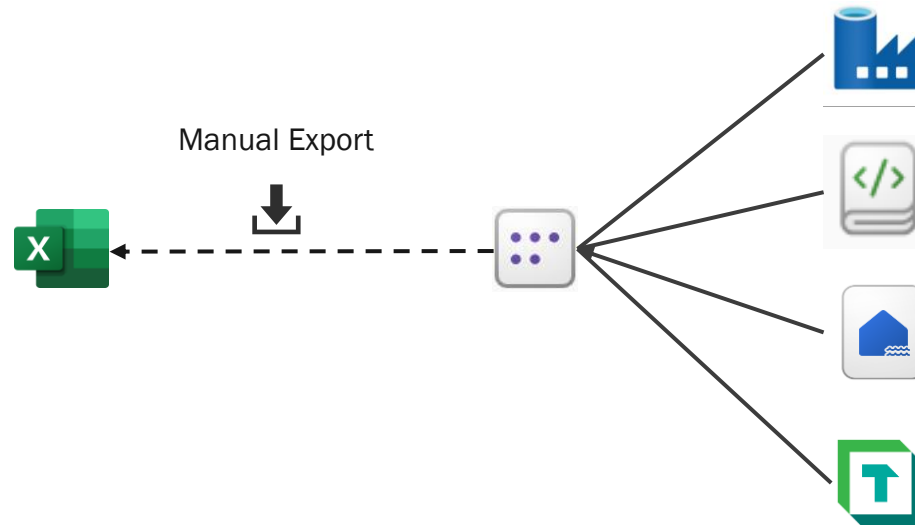
IT / Enterprise:

Do it the right way with best performance and validated numbers

Well then – I will **Export your Enterprise data to Excel** and continue my work to solve my business problems

Business:

I want to solve my business problems today



IT / Enterprise:

Do it the right way with best performance and validated numbers

I'm from IT or Enterprise team: How can I **disable** this?



[Individual model]

Power BI Desktop settings before publishing

CURRENT FILE

- Data Load
- Regional Settings
- Privacy
- Auto recovery
- Published semantic model settings**
- Query reduction
- Report settings

DirectQuery connections to this semantic model

This prevents users from creating DirectQuery connections to this semantic model in Power BI Desktop. If you change this setting, you'll need to republish your report to save it.

☐ Discourage DirectQuery connections [Learn more](#)



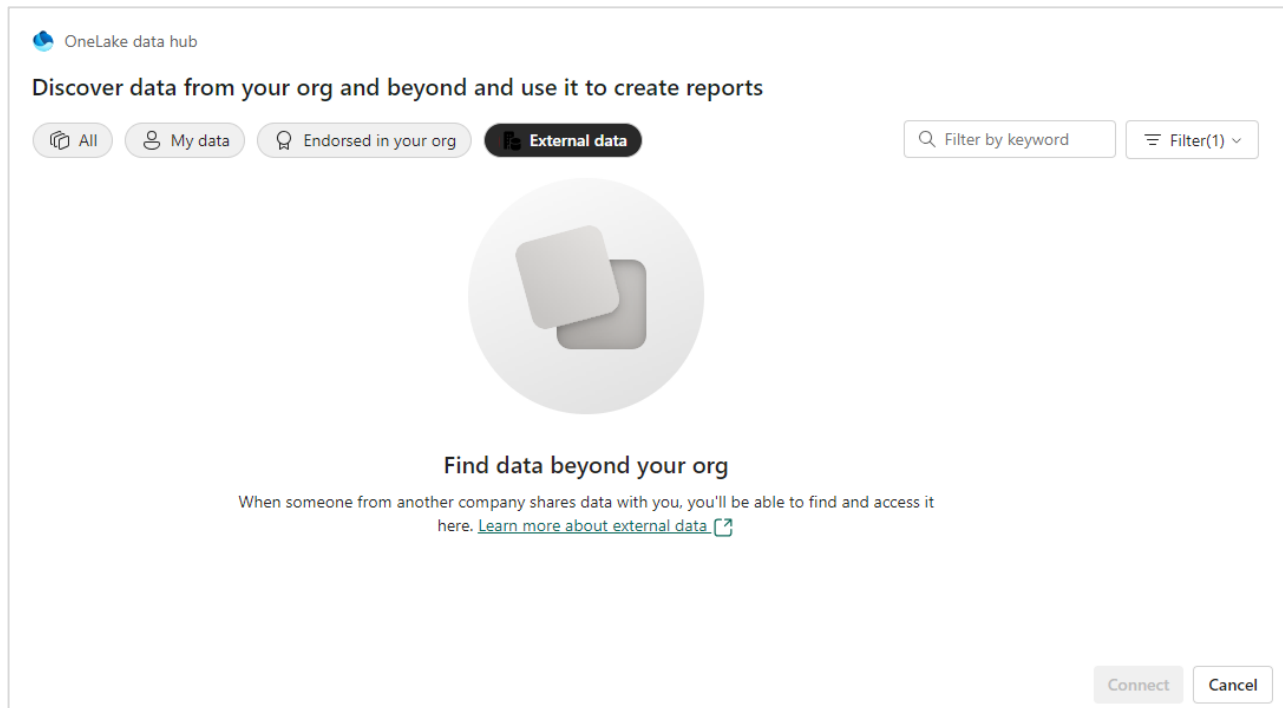
[Tenant]

Admin Portal in Tenant Settings

Export and sharing settings

- ⚡ Allow **DirectQuery** connections to Power BI semantic models
Enabled for the entire organization
DirectQuery connections allow users to make changes to existing semantic models or use them to build new ones. [Learn More](#)
☒ Enabled

What about sharing semantic models to **external** partners?



Export and sharing settings

- Guest users can work with **shared semantic** models in their own tenants
Enabled for the entire organization

Authorized guest users can discover semantic models shared with them in the OneLake data hub (in Power BI Desktop), and then work with these semantic models in their own Power BI tenants.

☒ Enabled

ⓘ This setting applies to the entire organization

Apply

Cancel

- Allow specific users to turn on external data sharing
Enabled for the entire organization

Turn off this setting to prevent all users from turning on external data sharing. If this setting is on, all or specific users can turn on the external data sharing option, allowing them to share data with authorized guest users. Authorized guest users can then discover, connect to, and work with these **shared semantic** models in their own Power BI tenants.

☒ Enabled

ⓘ If this setting is on, users can allow authorized guest users to work with shared semantic models in their own Power BI tenants and your data might be moved to a different region.

☒ Connect to external semantic models shared with me

Summary of Considerations for Composite Models

- ⚠️ **Choose the right storage mode** for your need and whenever possible add to existing shared model and create live-connection*
- **Composite models are NOT for the enterprise team** to create and deliver large models with relationships
- **Composite models are for the business self-service** developers to provide **flexibility** at the edge (explore, ad-hoc, Pilot, POC, let's go fast and solve business problems today)
- Be aware of implications of composite models when using **calculation groups** and calculating measures between **remote** and **local** data source groups
- Calculation group with **format string expression** or measures with **dynamic format string** works only for **model measures in remote** – even in live connection
- Be aware of **security implications** of a query sent to remote model can **include data values from local** model
- Be aware of **performance** as composite models will not benefit from **visual caches** across reports as with live-connection, assume **referentially integrity** and **multiple query** types
- You should not use composite models with relationships that have **10,000 unique values or more**. For example, create relationship on year or month instead of date
- Be aware of **ownership** (read access to semantic model in Power BI workspace app vs. Org App in Fabric) and **avoid** creating **chain-on-chain-on-chain** models
- **Shared expressions** (parameters in Power Query), **Translations** and **RLS are not imported** from the remote model nor possible to add for remote model objects
- Consumers of a composite model see the results of the **OLS** rules that were applicable to the **author** of the composite model when they created the model
- **Potential break** connection to composite model if **renaming** semantic model or workspace (hard coded for name and not ID)
- For “I Want It All In One Page Dashboard” check **Metric Sets** for a more reusable assets
- As default enabled, but based on your scenario you can **disable** it on individual semantic models or at tenant level (and in addition investigate **external** semantic models)
- **Naming convention “Local”** if duplicates and Enterprise team semantic model owner can utilize **Perspectives** to share subsets of model excl. remote calculation groups
- As with Live-connection, add **model documentation with INFO.VIEW** functions or **measure expression as description** field for self-service developers

*Tools for migrating report-level objects:



Notebooks in Fabric (*Michael Kovalsky's Semantic Link Labs*)



Tabular Editor (*C# Scripts and copy M code from local model*)



ALM Toolkit (*Compare and merge .bim*)

”

Roche's Maxim of Data Transformation:

Data should be transformed
as far upstream as possible, and
as far downstream as necessary.

Credit and resources

- **Microsoft Learn Guidance Composite Model:** <https://learn.microsoft.com/en-us/power-bi/guidance/composite-model-guidance>
- **Microsoft Learn Composite Model:** <https://learn.microsoft.com/en-us/power-bi/transform-model/desktop-composite-models#working-with-a-composite-model-based-on-a-semantic-model>
- **Microsoft Learn Lifecycle Semantic Model:** <https://learn.microsoft.com/en-us/power-bi/connect-data/desktop-report-lifecycle-datasets>
- **Microsoft Learn Usage Scenario:** <https://learn.microsoft.com/en-us/power-bi/guidance/powerbi-implementation-planning-usage-scenario-customizable-managed-self-service-bi>
- **Data Modelling for Expert by Jeroen ter Heerd and Marc Lelijveld:** <https://www.youtube.com/watch?v=3EWmkEdaA2U>
- **Milestone in BI by SQLBI:** <https://www.sqlbi.com/articles/new-composite-models-in-power-bi-a-milestone-in-business-intelligence/>
- **Retail & Wholesale in Composite Models by SQLBI:** <https://www.sqlbi.com/articles/introducing-wholesale-and-retail-execution-in-composite-models/>
- **Direct Lake vs Import article by SQLBI:** <https://www.sqlbi.com/blog/marco/2025/05/13/direct-lake-vs-import-vs-direct-lakeimport-fabric-semantic-models-may-2025/>
- **Introducing Composite Models in Power BI SQL Day 2023 by Alberto Ferrari:** <https://www.youtube.com/watch?v=6lxiywm0sio>
- **External Semantic Model Sharing– Jon Vöge:** <https://medium.com/microsoft-power-bi/how-to-share-fabric-power-bi-semantic-models-with-external-users-16ab8bf8e14e>
- **Roche's Maxim of Data Transformation:** <https://www.youtube.com/watch?v=OAlys79j81Q>



David Kofod Hanna



LinkedIn Newsletter: <https://www.linkedin.com/newsletters/7237000963331420162/>



LinkedIn: <https://www.linkedin.com/in/davidkofod/>



GitHub: <https://github.com/DKH-DK/Self-Service-Power-BI-Fabric>