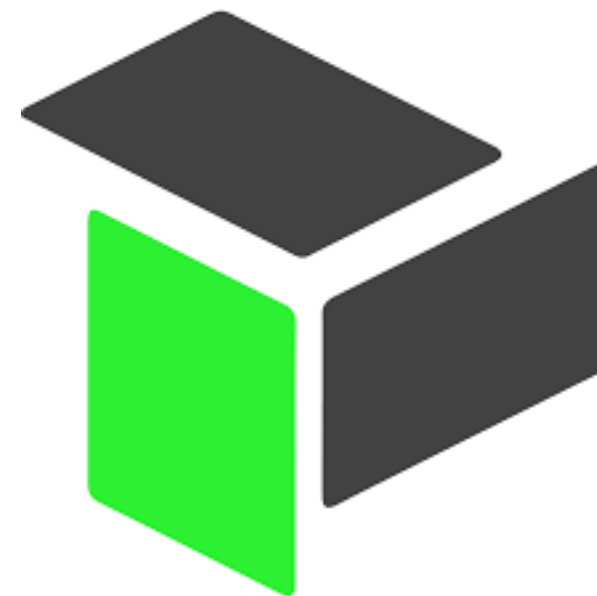


# Power BI – Model Documenter

#PowerBler



DaxStudio - 2.5.0

File Home Help

Run Cancel Clear Cache Output Query Edit Format Query To Upper To Lower Comment Uncomment Merge XML Find Query Plan Server Timings Scan Cache Right Layout Bottom Layout Connect Refresh Metadata

Query1.dax X

```
10 EVALUATE
11 ADDCOLUMNS (
12     SUMMARIZE (
13         Sales,
14         Date, [Calendar Year],
15         Product, [Category Name] ),
16     "Sales", [Sales Amount],
17     "Margin", [Margin]
18 )
```

181 %

Total	SE CPU	Line	Subclass	Duration	CPU	Rows	KB	Query
550 ms	0 ms	1	SQL	301	0			SELECT TOP (1000001) [
	x0.0	2	SQL	231	0			SELECT TOP (1000001) [

FE SE

SELECT TOP (1000001) [Name] SUM([t1].[Line Margin])

C:\Projects\AdventureWorks\Model.bim - Tabular Editor 2.1

File Edit View Model

Perspective: (All objects) Translation: (No translation)

Filter

Model

- Data Sources
- Perspectives
- Relationships
- Roles
- Tables
- Date

DAX Editor Advanced Scripting

```
[Reseller Current Quarter Sales] :=
TOTALQTD([Reseller Total Sales], 'Date'[Date])
```

ALM Toolkit for Power BI

File Home Help

Compare Select Actions Validate Update Generate Script Options Report Differences

Source [azure://southcentralus.azure.windows.net/chwade003/AdventureWorks2] Target [azure://southcentralus.azure.windows.net/chwade003/AdventureWorks3]

Type	Source Name	Status	Target Name	Action
Data Source	SQL/localhost/SPT/AdventureWorksDW	Different Definitions	SQL/localhost/SPT/AdventureWorksDW	Update
Expression	RangeEnd	Missing in Target		Skip
Expression	RangeStart	Missing in Target		Skip
Table	DimCustomer	Same Definition	DimCustomer	Skip
Relationship	'DimCustomer'[GeographyKey] -> 'DimGeography'[GeographyKey]	Same Definition	'DimCustomer'[GeographyKey] -> 'DimGeography'[GeographyKey]	Skip
Table	DimDate	Different Definitions	DimDate	Update
Measure	DaysCurrentQuarterToDate	Same Definition	DaysCurrentQuarterToDate	Skip
Measure	DaysInCurrentQuarter	Same Definition	DaysInCurrentQuarter	Skip
Table	DimEmployee	Different Definitions	DimEmployee	Update
Table	DimGeography	Same Definition	DimGeography	Skip
Table	DimProduct	Same Definition	DimProduct	Skip
Relationship	'DimProduct'[ProductSubcategoryKey] -> 'DimProductSubcategory'[ProductSubcategoryKey]	Same Definition	'DimProduct'[ProductSubcategoryKey] -> 'DimProductSubcategory'[ProductSubcategoryKey]	Skip
Table	DimProductCategory	Missing in Source	DimProductCategory	Delete
Table	DimProductSubcategory	Same Definition	DimProductSubcategory	Skip
Relationship	'DimProductSubcategory'[ProductCategoryKey] -> 'DimProductCategory'[ProductCategoryKey]	Same Definition	'DimProductSubcategory'[ProductCategoryKey] -> 'DimProductCategory'[ProductCategoryKey]	Skip
Table	FactInternetSales	Missing in Target		Skip
Relationship	FactInternetSales[CustomerKey] -> DimCustomer[CustomerKey]	Missing in Target		Skip
Relationship	FactInternetSales[DueDateKey] -> DimDate[DateKey]	Missing in Target		Skip
Relationship	FactInternetSales[OrderDateKey] -> DimDate[DateKey]	Missing in Target		Skip
Relationship	FactInternetSales[ProductKey] -> DimProduct[ProductKey]	Missing in Target		Skip
Measure	InternetCurrentQuarterMargin	Missing in Target		Skip
Measure	InternetCurrentQuarterSales	Missing in Target		Skip
Measure	InternetDistinctCountSalesOrder	Missing in Target		Skip
Measure	InternetOrderLinesCount	Missing in Target		Skip
Measure	InternetPreviousQuarterMargin	Missing in Target		Skip

```
1 {
2   "name": "DimProduct",
3   "columns": [
4     {
5       "name": "Class",
6       "dataType": "string",
7       "sourceColumn": "Class"
8     }
9   ]
10 }
```

```
1 {
2   "name": "DimProduct",
3   "columns": [
4     {
5       "name": "Class",
6       "dataType": "string",
7       "sourceColumn": "Class"
8     }
9   ]
10 }
```

Basic

Description Sales

Display Folder

Hidden False

Name Reseller Current Quarter Sales

Object Type Measure

Metadata

DAX identifier [Reseller Current Quarter Sales]

Format String \[\$#:0.00;(\[\$#:0.00\]);\[\$#:0.00

Options

Other

Translations and Perspectives

Captions 0 empty, 0 translated, 0 default

Descriptions 0 empty, 0 translated, 0 default

Display Folders 0 empty, 0 translated, 0 default

Perspectives Shown in 1 out of 3 perspectives

Internet Operation False

Inventory False

Reseller Operation True

Metadata



# Marc Lelijveld

Data & AI consultant  
Macaw Netherlands



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[@MarcLelijveld](https://twitter.com/MarcLelijveld)



[linkedin.com/in/MarcLelijveld](https://linkedin.com/in/MarcLelijveld)



[Data-Marc.com](http://Data-Marc.com)



# Our agenda for today

- External Tools, what is it?
- Analysis Services in memory
- Building External Tools
- I want to hear from you!



# Documentation

# Documentation?



**Marc Lelijveld**  
@MarcLelijveld

If you deliver or use a [#PowerBI](#) solution which has a shared dataset. Does it come with proper documentation?

Yes, nicely shared in PBI

18.3%

Yes, but too much text!

5%

If I've time left

30%

**No, what is documentation**

**46.7%**



**Ásgeir Gunnarsson**  
@bidgeir

Als antwoord op [@MarcLelijveld](#)

You're missing an option. If it's prioritised. I always ask for it to be part of the task but too often it's not prioritised. Even though clients pay me for advice, documentation is sadly one of those they most often ignore

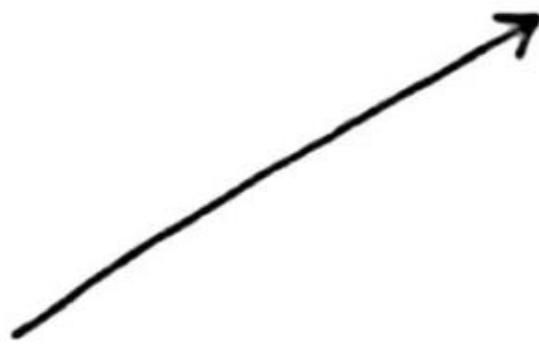


# Handover projects



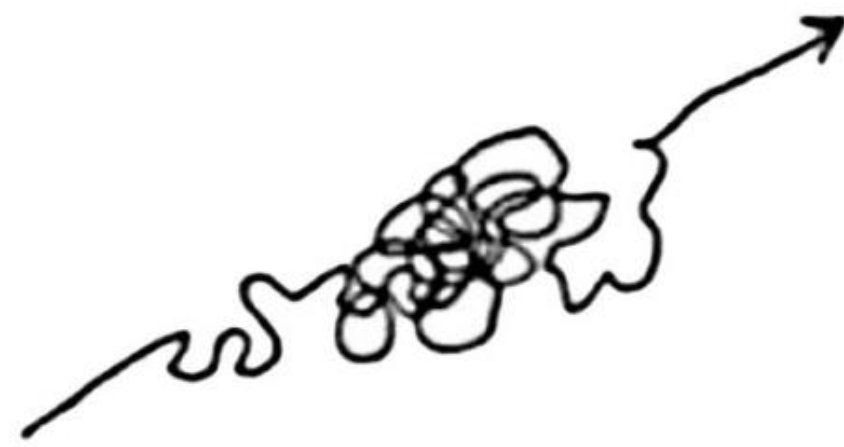


Success



what people think  
it looks like

Success

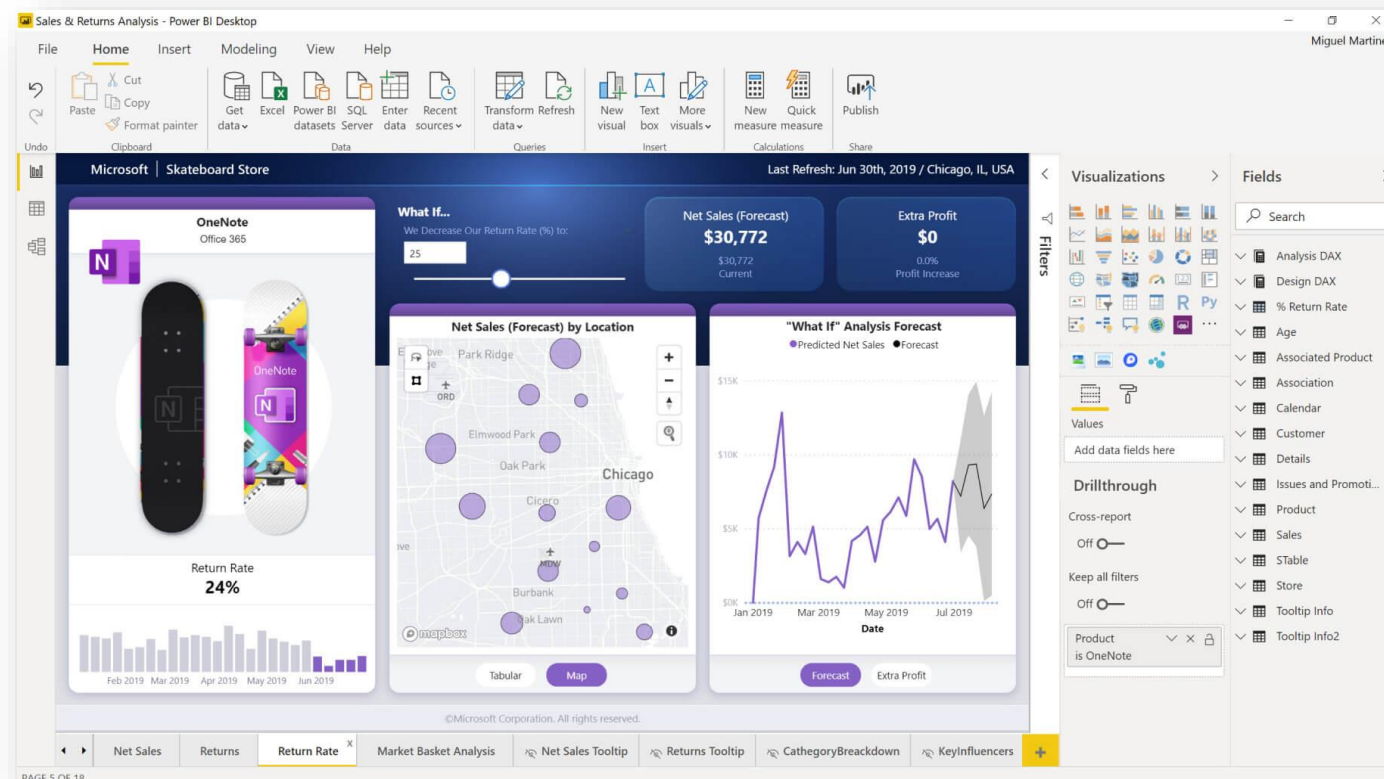



what it really  
looks like

# But what about the rest?

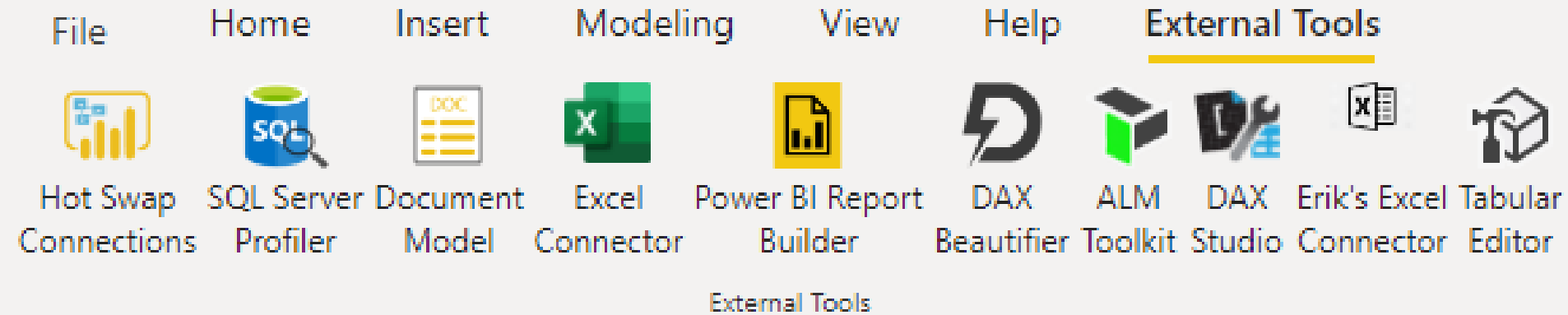
- Visuals
- Bookmarks
- Page navigation

The report in general...



Powered by  Data-Marc.com		7474e-23d1-	One > Many	SalesLT ProductModel - SalesLT ProductModel
	88e8-4066-a74e-30976a78e82b			
True	LocalDateTable_5f6068d5-8854-4772-b45f-7eeadde302ec - LocalDateTable_5f6068d5-8854-4772-b45f-7eeadde302ec		One > Many	SalesLT ProductModelProductDescription - SalesLT ProductModelProductDescription
True	SalesLT ProductDescription - SalesLT ProductDescription		One <> One	SalesLT ProductModelProductDescription - SalesLT ProductModelProductDescription
True	SalesLT ProductModel - SalesLT ProductModel		Many > Many	SalesLT ProductModelProductDescription - SalesLT ProductModelProductDescription
True	LocalDateTable_1f72160e-4147-4e47-8a96-23a31f53f17e - LocalDateTable_1f72160e-4147-4e47-8a96-23a31f53f17e		One > Many	SalesLT SalesOrderHeader - SalesLT SalesOrderHeader

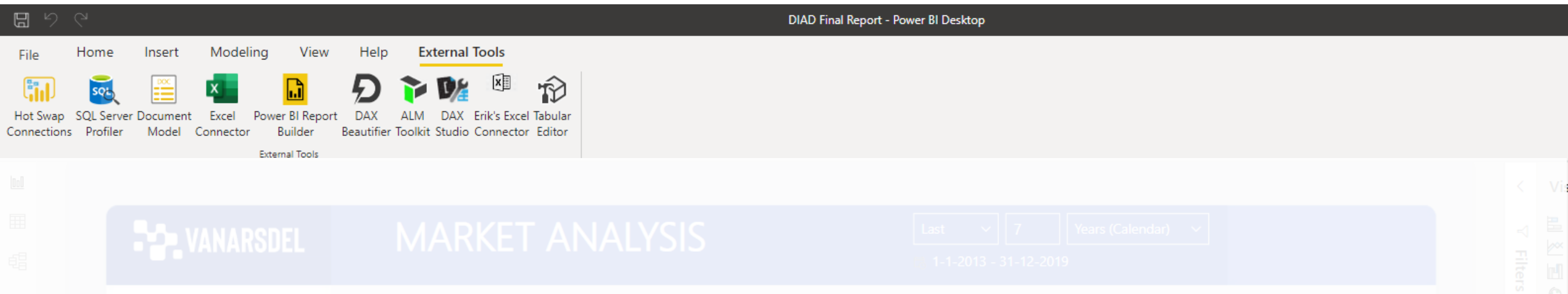




# External Tools, what is it?

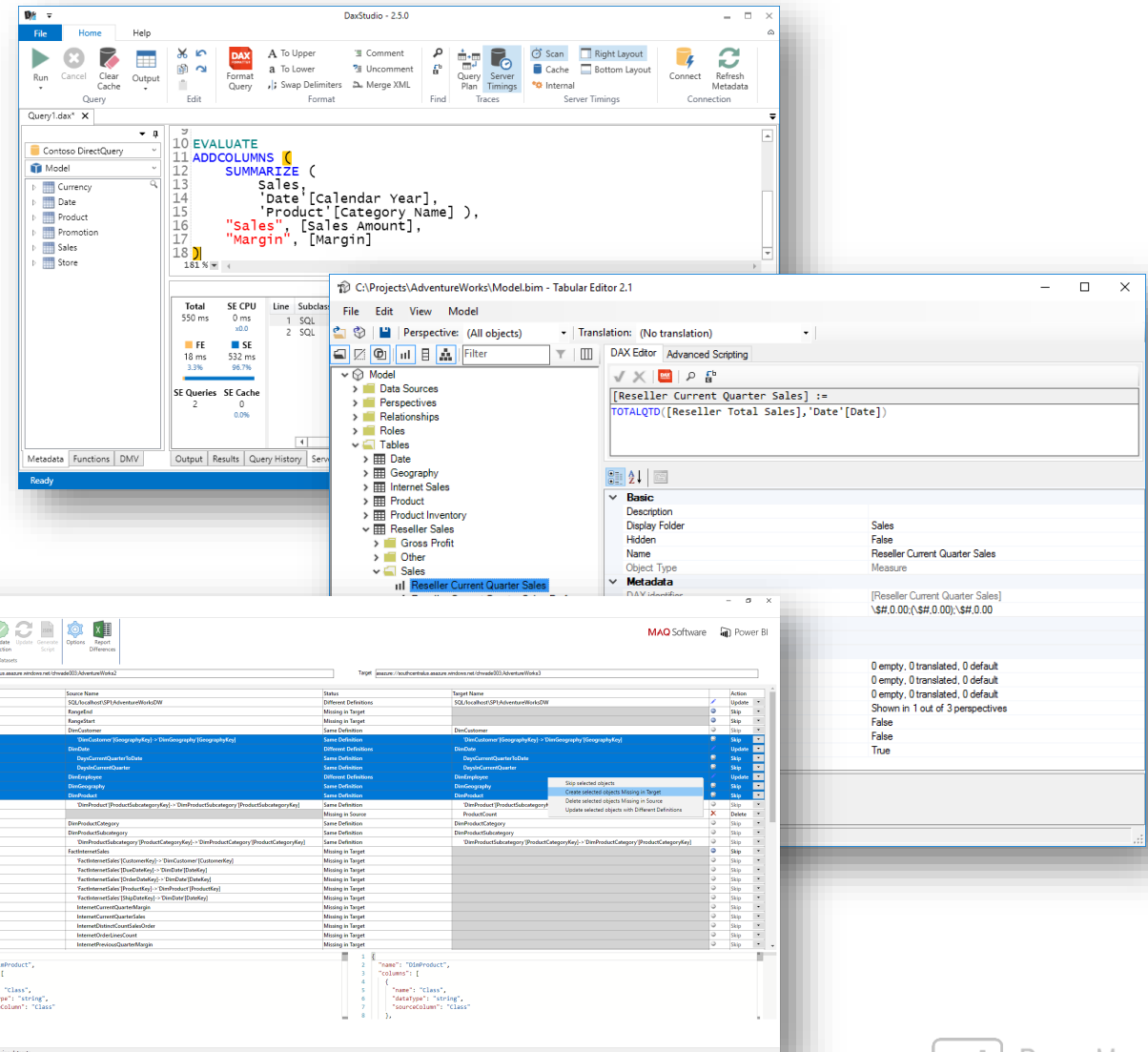
# What are external tools in Power BI?

- **GA since September release!!**
- 3<sup>rd</sup> party tooling
- Depending on new metadata
- Read + Write to TOM



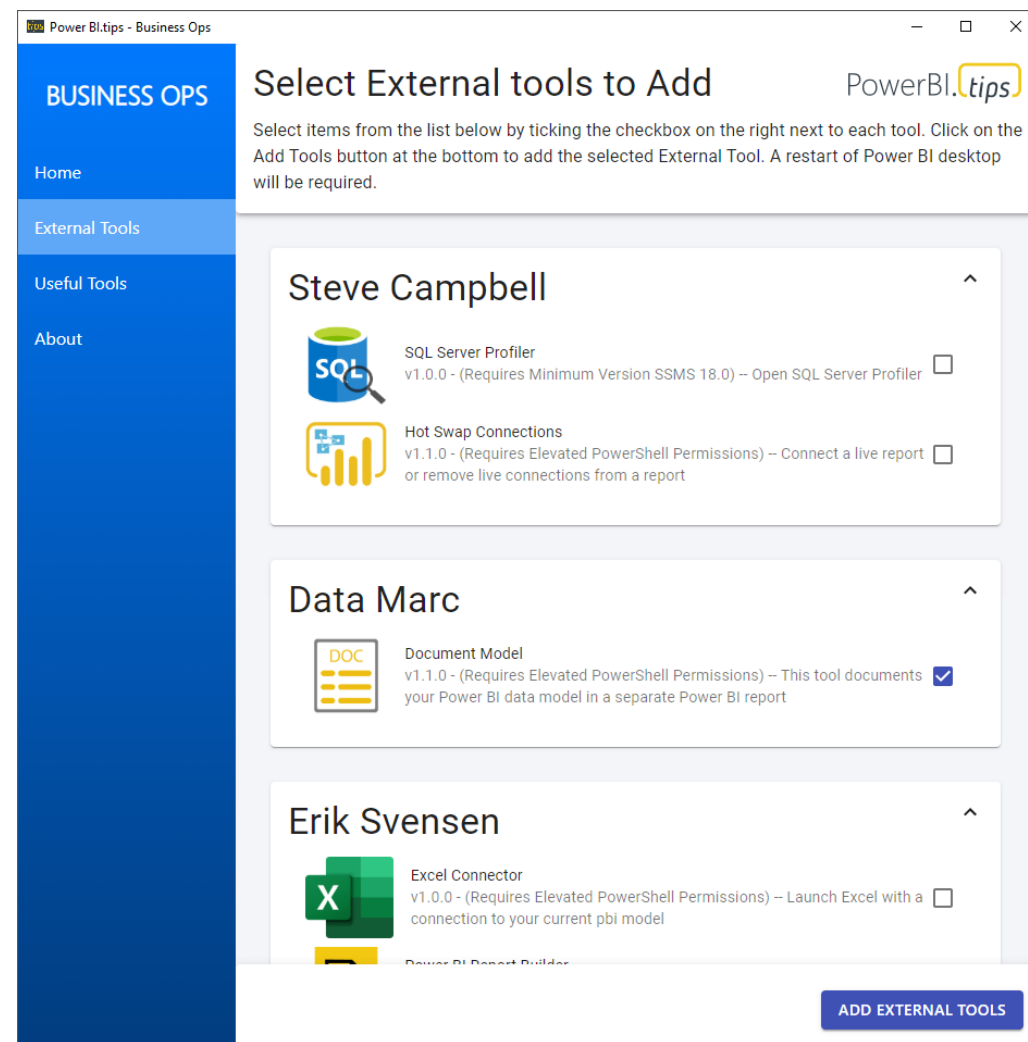
# Connect with 3<sup>rd</sup> party tools

- DAX Studio
- Tabular Editor
- ALM Toolkit
- ...
- Your tool?



# Install additional External Tools?

- Requires Admin permissions
- Download them 1-by-1
- Use BusinessOps by PowerBI.tips





# What is out there now?

## Erik Svensen



### Excel Connector

v1.0.0 - (Requires Elevated PowerShell Permissions) -- Launch Excel with a connection to your current pbi model ☐



### Power BI Report Builder

v1.0.0 - (Requires Install of Power BI Report Builder) -- Open a template report in Power BI Report Builder



### Open In Tableau

v1.0.0 - (Requires Install of Tableau Desktop) -- Open a report in Tableau Desktop

## PBI.tips - Themes Gallery



### Themes Gallery

v1.0.0 - (Opens in Google Chrome) Pick colors from palettes



### Themes Gallery

v1.0.0 - (Opens in Edge) Pick colors from thousands of color palettes

## David Eldersveld



### Open Python

v1.0.0 - (Requires Python3 All Users Install) -- Opens a connection to a Python Script ☐

## Steve Campbell



### SQL Server Profiler

v1.0.0 - (Requires Minimum Version SSMS 18.0) -- Open SQL Server Profiler ☐



### Hot Swap Connections

v1.1.0 - (Requires Elevated PowerShell Permissions) -- Connect a live report or remove live connections from a report ☐

## Davis Zhang



### DAX Beautifier

v1.0.2 - (Requires install of AMO library) -- Use this tool to format all DAX code with one click! ☐

## SQL BI



### Analyze in Excel

v1.1.2 - Analyze in Excel for Power BI Desktop ☐



**Huh...**

We were talking about  
Power BI, right?



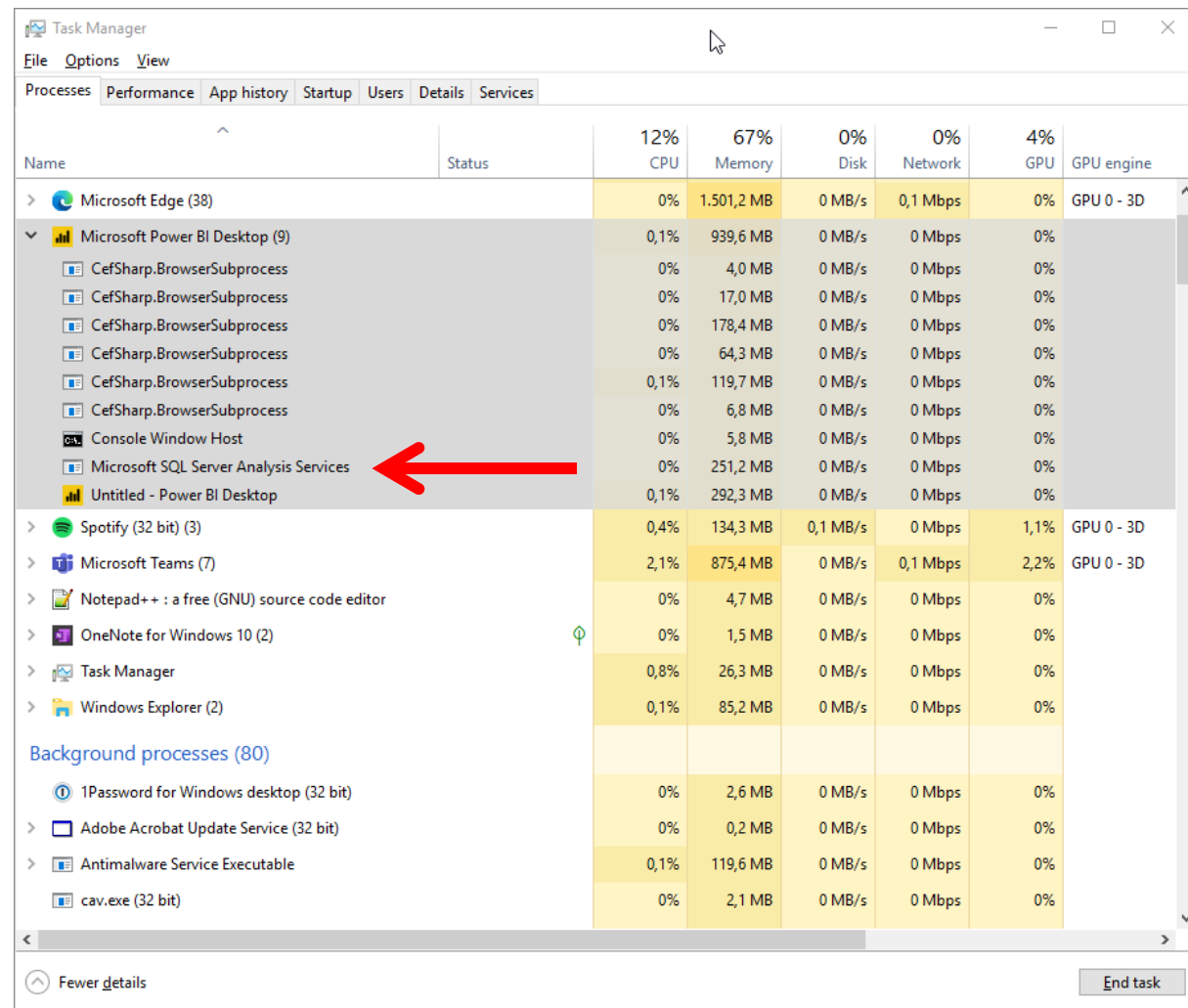
# Analysis Services in memory

# Analysis services in memory

Power BI

=

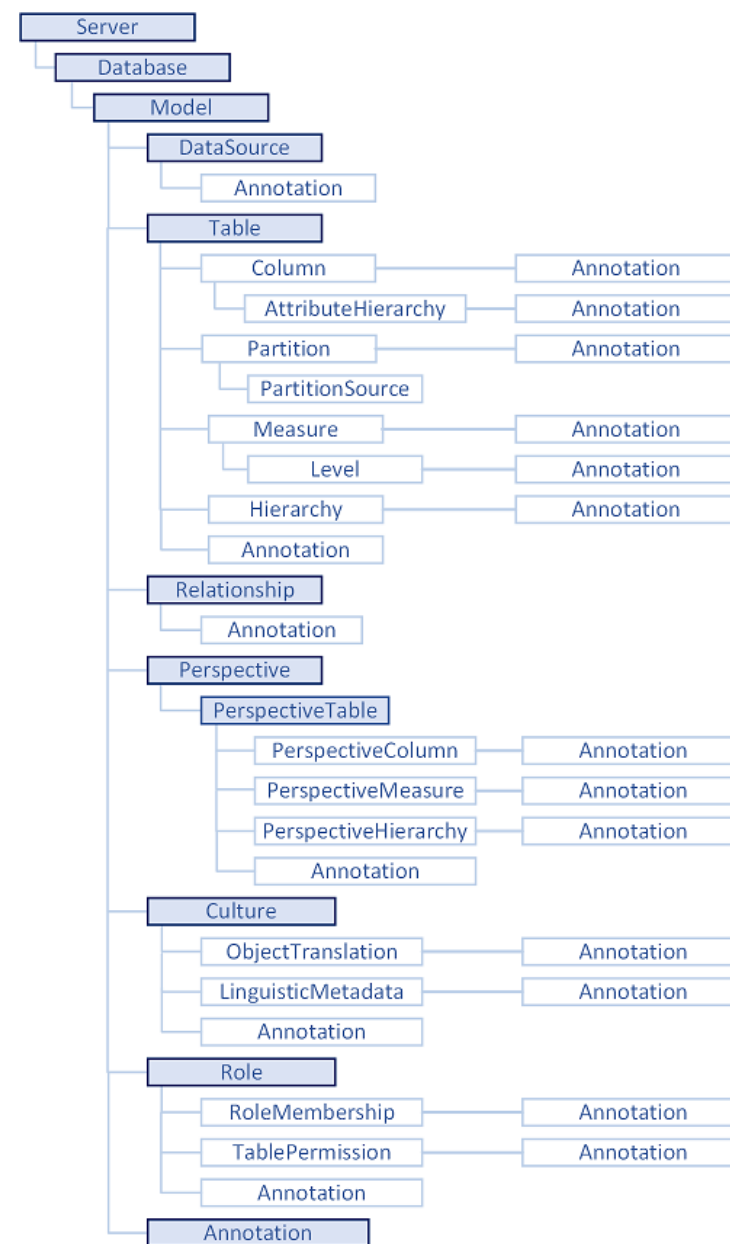
Analysis Services  
under the hood



Name	Status	12% CPU	67% Memory	0% Disk	0% Network	4% GPU	GPU engine
> Microsoft Edge (38)		0%	1,501,2 MB	0 MB/s	0,1 Mbps	0%	GPU 0 - 3D
▼ Microsoft Power BI Desktop (9)		0,1%	939,6 MB	0 MB/s	0 Mbps	0%	
CefSharp.BrowserSubprocess		0%	4,0 MB	0 MB/s	0 Mbps	0%	
CefSharp.BrowserSubprocess		0%	17,0 MB	0 MB/s	0 Mbps	0%	
CefSharp.BrowserSubprocess		0%	178,4 MB	0 MB/s	0 Mbps	0%	
CefSharp.BrowserSubprocess		0%	64,3 MB	0 MB/s	0 Mbps	0%	
CefSharp.BrowserSubprocess		0,1%	119,7 MB	0 MB/s	0 Mbps	0%	
CefSharp.BrowserSubprocess		0%	6,8 MB	0 MB/s	0 Mbps	0%	
Console Window Host		0%	5,8 MB	0 MB/s	0 Mbps	0%	
Microsoft SQL Server Analysis Services		0%	251,2 MB	0 MB/s	0 Mbps	0%	
Untitled - Power BI Desktop		0,1%	292,3 MB	0 MB/s	0 Mbps	0%	
> Spotify (32 bit) (3)		0,4%	134,3 MB	0,1 MB/s	0 Mbps	1,1%	GPU 0 - 3D
> Microsoft Teams (7)		2,1%	875,4 MB	0 MB/s	0,1 Mbps	2,2%	GPU 0 - 3D
> Notepad++ : a free (GNU) source code editor		0%	4,7 MB	0 MB/s	0 Mbps	0%	
> OneNote for Windows 10 (2)		0%	1,5 MB	0 MB/s	0 Mbps	0%	
> Task Manager		0,8%	26,3 MB	0 MB/s	0 Mbps	0%	
> Windows Explorer (2)		0,1%	85,2 MB	0 MB/s	0 Mbps	0%	
Background processes (80)							
1Password for Windows desktop (32 bit)		0%	2,6 MB	0 MB/s	0 Mbps	0%	
> Adobe Acrobat Update Service (32 bit)		0%	0,2 MB	0 MB/s	0 Mbps	0%	
> Antimalware Service Executable		0,1%	119,6 MB	0 MB/s	0 Mbps	0%	
cav.exe (32 bit)		0%	2,1 MB	0 MB/s	0 Mbps	0%	

# New metadata

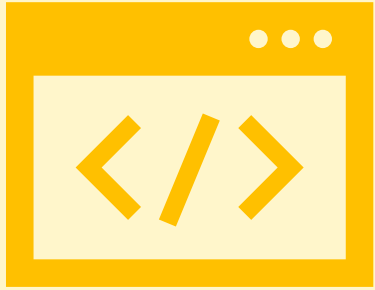
- General Available since September 2020 release!
- Matches Analysis Services metadata
- Model.bim
- Tabular Object Model (TOM)
- Open format (json)



```
1
2
3
4
5 = {
6     "version": "1.1.0",
7     "name": "Document Model",
8     "description": "This tool documents your Power BI data model in a separate Power BI report",
9     "path": "C:\\Windows\\System32\\WindowsPowerShell\\v1.0\\powershell.exe",
10    "arguments": "C:\\temp\\Data-Marc_WriteConnectionDetailsToFile.ps1 \"%server%\" \"%databa",
11    "iconData": "data:image/png;base64,iVBORw0KGgoAAAANSUhEUgAAANUAAAD7CMAAADK0CH3AAAAAXNSR0
12 }
13
14
15
16
```

# Building External Tools

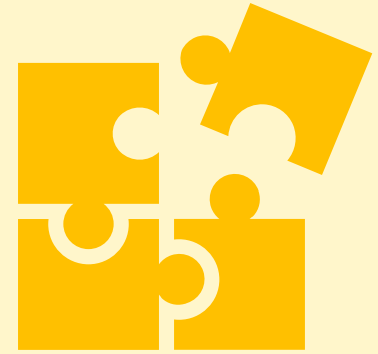
# How to setup your own External Tool?



**Build your  
application**

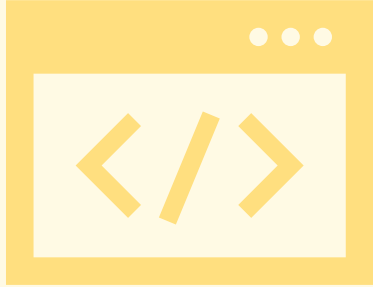


**Create your icon**



**Integrate in  
Power BI Desktop**

# How to setup your own External Tool?



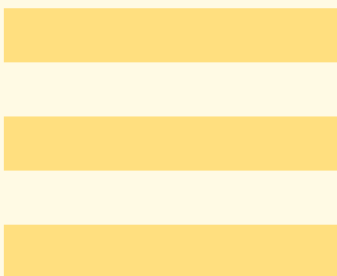
Build your  
application

```
10 # Below you can define your personal preference for file saving and reading.
11 # The default location can be changed and will be leverages throughout the entire script.
12 # InstallerLocation only applies to installation via PowerBI.tips Business Ops.
13 $InstallerLocation = 'TOOL_INSTALL_DIR_\
14 $DefaultLocation = 'C:\BusinessOpsTemp\
15 $FinalLocation = if($InstallerLocation -like '*TOOL_INSTALL_DIR*')
16 {$DefaultLocation} else {$InstallerLocation}
17
18 # Write out file locations
19 Write-Host 'installer location ' + $InstallerLocation
20 Write-Host 'default location ' + $DefaultLocation
21 Write-Host 'final location ' + $FinalLocation
22
23 #This part starts tracing to catch unfortunate errors and defines where to write the file.
24 $LogFile = $FinalLocation + 'PBI_DocumentModel_LogFile.txt'
25 Start-Transcript -Path $LogFile
26
27 # Function to automatically download the pbit file if it cannot be found on the defined location.
28 # Function based on https://gist.github.com/chrisbrownie/f20cb4508975fb7fb5da145d3d38024a
29 function DownloadFilesFromRepo {
30 Param(
31     $Owner = 'marcelelijveld',
32     $Repository = 'External-Tools-Model-Documentation',
33     $Path = 'ModelDocumentationTemplate.pbit',
34     $DestinationPath = 'C:\BusinessOpsTemp'
35 )
36
37 $baseUri = "https://api.github.com/"
38 $uriPath = "repos/$Owner/$Repository/contents/$Path"
39 $swr = Invoke-WebRequest -Uri $($baseUri+$uriPath)
40 $objects = $swr.Content | ConvertFrom-Json
41 $files = $objects | Where-Object {$_.type -eq "file"} | Select-Object -exp download_url
42 $directories = $objects | Where-Object {$_.type -eq "dir"}
43
44 $directories | ForEach-Object {
45     DownloadFilesFromRepo -Owner $Owner -Repository $Repository -Path $_.path -DestinationPath $($DestinationPath)
46 }
47
48 if (-not (Test-Path $DestinationPath)) {
49     # Create the path if it does not exist
50 }
```

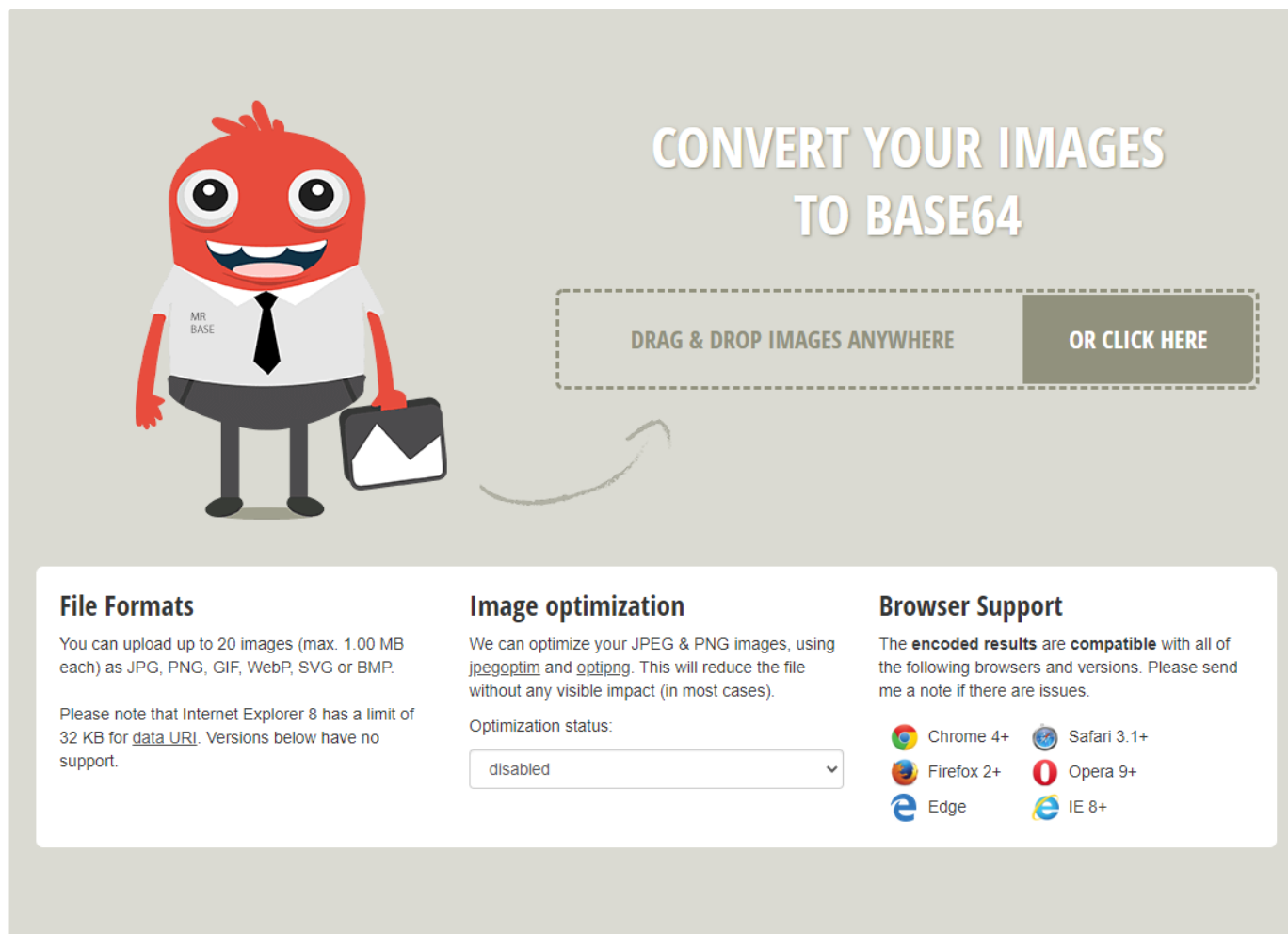
PS D:\OneDrive Macaw\OneDrive - Macaw\External Tools - Model Documentation>



# How to setup your own External Tool?



Create your icon



The screenshot shows the homepage of a web tool titled "CONVERT YOUR IMAGES TO BASE64". On the left, there is a cartoon character named "MR. BASE", a red creature with large eyes, wearing a white shirt, a black tie, and holding a briefcase. To the right of the character is a large dashed box containing the text "DRAG & DROP IMAGES ANYWHERE" and a button labeled "OR CLICK HERE". Below this, there are three sections: "File Formats", "Image optimization", and "Browser Support".

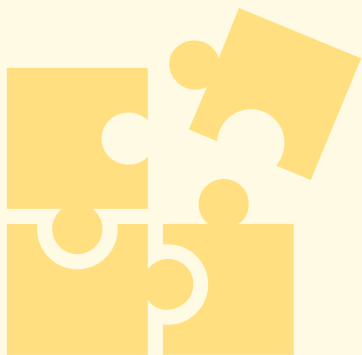
**File Formats**  
You can upload up to 20 images (max. 1.00 MB each) as JPG, PNG, GIF, WebP, SVG or BMP.  
Please note that Internet Explorer 8 has a limit of 32 KB for [data URI](#). Versions below have no support.

**Image optimization**  
We can optimize your JPEG & PNG images, using [jpegoptim](#) and [optipng](#). This will reduce the file without any visible impact (in most cases).  
Optimization status:

**Browser Support**  
The **encoded results** are **compatible** with all of the following browsers and versions. Please send me a note if there are issues.

- Chrome 4+
- Firefox 2+
- Edge
- Safari 3.1+
- Opera 9+
- IE 8+

# How to setup your own External Tool?



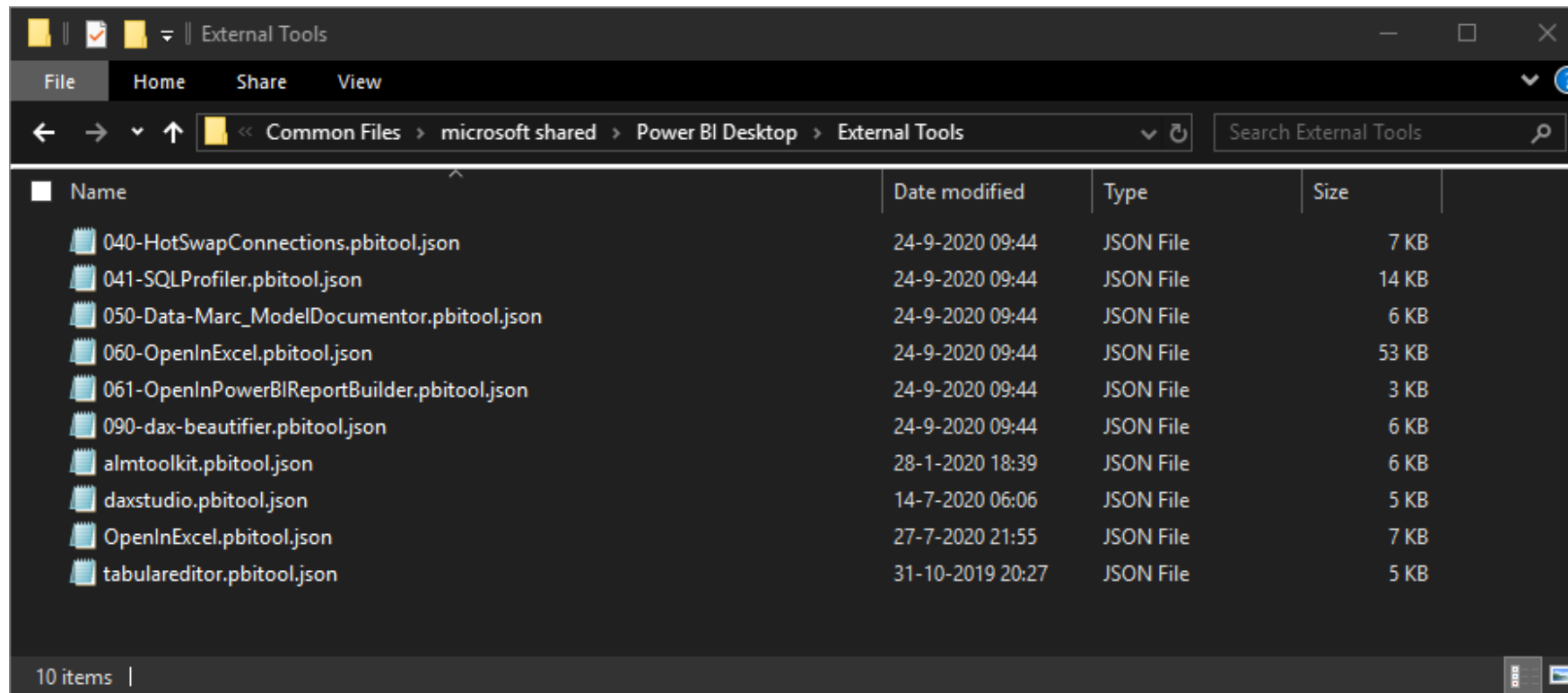
**Integrate in  
Power BI Desktop**

- \*.pbitool.json file
- \%server%\
- \%database%\

```
{  
  "version": "1.1.0",  
  "name": "Document Model",  
  "description": "This tool documents your Power BI data model in a separate Power BI report",  
  "path": "C:\\Windows\\System32\\WindowsPowerShell\\v1.0\\powershell.exe",  
  "arguments": "C:\\temp\\Data-Marc_WriteConnectionDetailsToFile.ps1 \"%server%\" \"%database%\"",  
  "iconData": "data:image/png;base64,iVBORw0KGgoAAAANSUhEUgAAANUAAAD7CMAAADK0CH3AAAAAXNSR0:"  
}
```

# Drop the file in the right location

C:\Program Files (x86)\Common Files\Microsoft Shared\Power BI Desktop\External Tools





ALM  
Toolkit



Document  
Model



DAX  
Studio

External Tools



Document your  
model

# Power BI Model Documenter

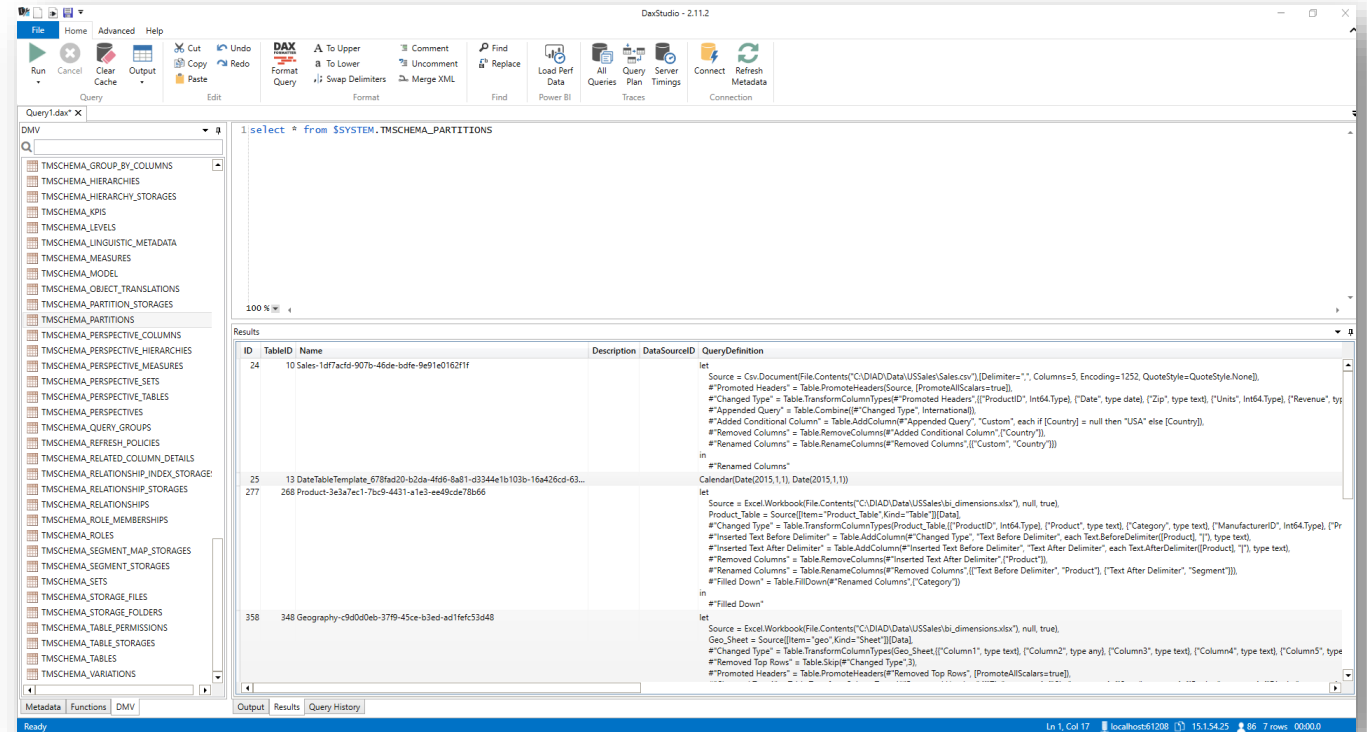
# Dynamic Management Views

Analysis Services Dynamic Management Views (DMVs) are queries that return information about model objects, server operations, and server health.

- DB Schema = Database model
- DISCOVER = Operations & Sessions
- TM Schema = Tabular = Power BI / AAS
- MD Schema = MDX = Multidimensional

# Dynamic Management Views

- Analysis Services metadata
  - Tables
  - Columns
  - Measures
  - Perspectives
  - Partitions
  - ...
- Query via DAX Studio



# DEMO!

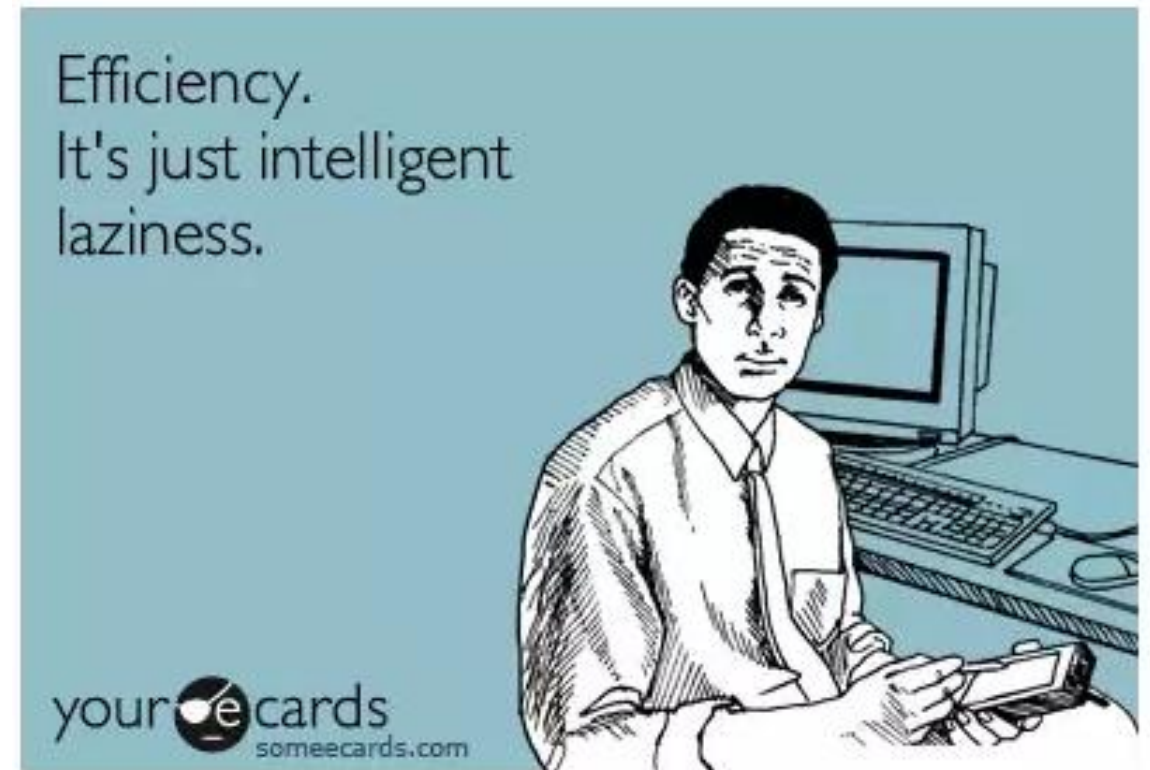
- Show all tables in model
  - Table Expressions
- Show all measures
- Show Perspectives
  - Measures in perspectives
  - Columns in perspectives
- Show columns
- Roles
  - Role expressions





# Automation of documentation

- Need for something to execute tasks automatically.
- Something that runs on every computer



# PowerShell

- Retrieve Server and Database information
- Dump connection file in json format
- Download template from GitHub
- Opens Power BI template

```
Data-Marc_WriteConnectionDetailsToFile.ps1 X
1  <#
2      External Tools Power BI model documentor script version 1.1.0
3      New in this version:
4          - Support for installation via PowerBI.tips Business Ops.
5          - Automatic detection of installer location vs default location.
6          - Automatic download of the pbit file if it cannot be found.
7
8      Full change log can be found here: https://data-marc.com/model-documenter/
9  #>
10
11  # Below you can define your personal preference for file saving and reading.
12  # The default location can be changed and will be leverages throughout the entire script.
13  # InstallerLocation only applies to installation via PowerBI.tips Business Ops.
14  $InstallerLocation = '__TOOL_INSTALL_DIR__\'
15  $defaultLocation = 'C:\BusinessOpsTemp\'
16  $finalLocation = if($InstallerLocation -like '*TOOL_INSTALL_DIR*')
17  {$defaultLocation} else {$InstallerLocation}
18
19  # Write out file locations
20  Write-Host 'installer location ' + $InstallerLocation
21  Write-Host 'default location ' + $defaultLocation
22  Write-Host 'final location ' + $finalLocation
23
24  #This part starts tracing to catch unfortunate errors and defines where to write the file.
25  $Logfile = $finalLocation + 'PBI_DocumentModel_LogFile.txt'
26  Start-Transcript -Path $Logfile
27
28  # Function to automatically download the pbit file if it cannot be found on the defined location.
29  # Function based on https://gist.github.com/chrisbrownie/f20cb4508975fb7fb5da145d3d38024a
30  function DownloadFilesFromRepo {
31  Param(
32      $Owner = 'marclelijveld',
33      $Repository = 'External-Tools-Model-Documentation',
34      $Path = 'ModelDocumentationTemplate.pbit',
35      $DestinationPath = 'C:\BusinessOpsTemp'
36  )
37
38      $baseUri = "https://api.github.com/"
39      $uriPath = "repos/$Owner/$Repository/contents/$Path"
40      $swr = Invoke-WebRequest -Uri $($baseUri+$uriPath)
41      $objects = $swr.Content | ConvertFrom-Json
42      $files = $objects | Where-Object { $_.type -eq "file" } | Select-Object -ExpandProperty download_url
```

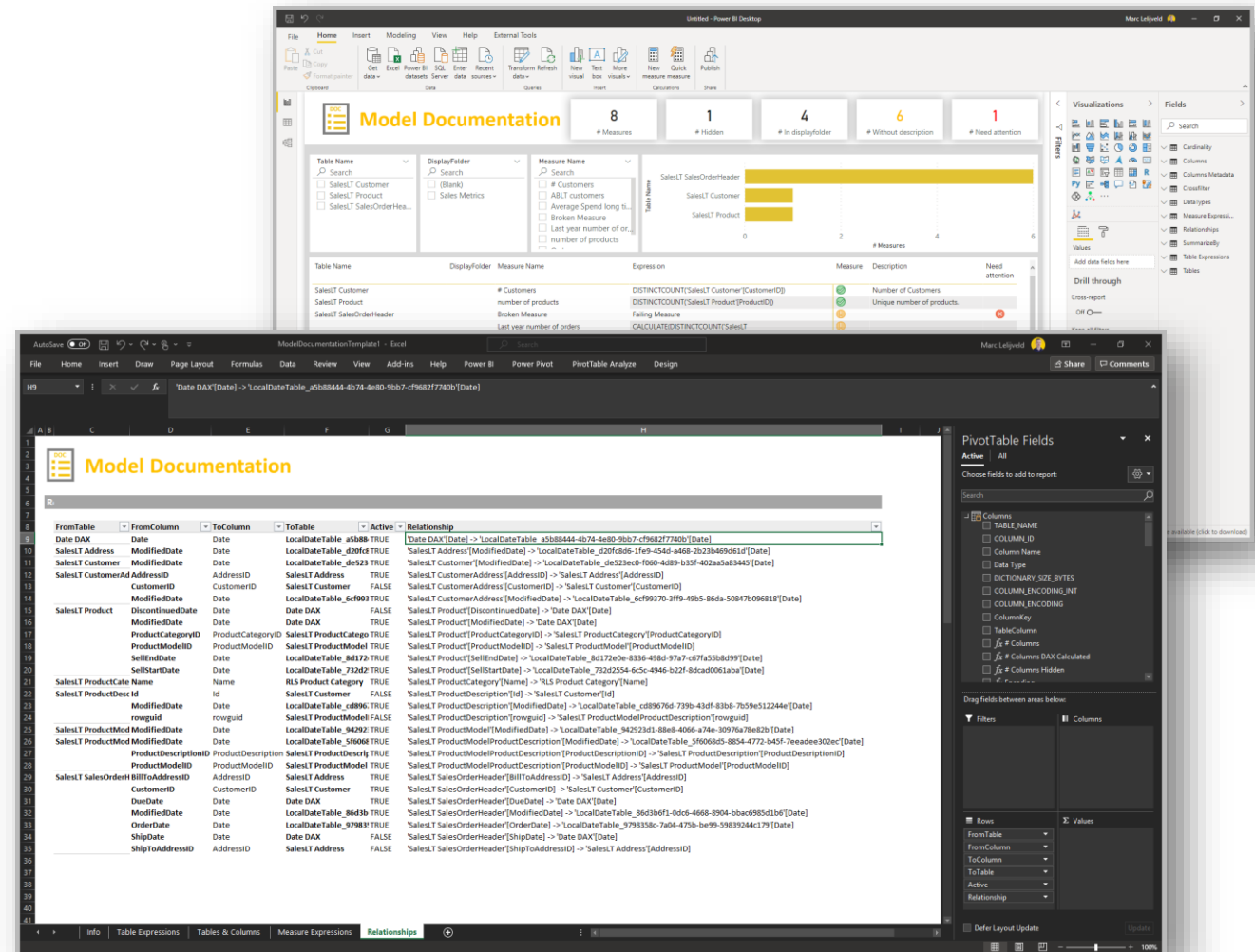
# Learnings

- Capturing server and database parameters
- Double \\ in path took a while to figure out
- PowerShell in general + debugging
- On-demand editing \*.pbit file not possible
- Dump connection json file as “workaround”

Learn from others!

# What's new in v1.2.0

- Better error handling
- Folder creation if not exist yet
- Menu at startup
- Support two export types
  - Power BI Template
  - Excel Template



# DEMO!

## Build new tool for PBIG

- New icon in PBI Desktop

## Demo Model Documenter

- How to query DMVs in Power BI
- The tool itself

Nobody:  
Bugs right before a demo:



# Known limitations (or irritations)

- PowerShell Execution Policies
- Power BI Privacy levels might block loading
- Native database queries
- Requires admin approval for installation
- Requires MSOLAP.8 Provider to be installed
- Excel template requires manual download

```
PS C:\Users\MarcL> Get-ExecutionPolicy -List
```

Scope	ExecutionPolicy
MachinePolicy	Undefined
UserPolicy	Undefined
Process	Undefined
CurrentUser	Undefined
LocalMachine	Unrestricted

## Privacy Levels

- ☐ Always combine data according to your Privacy Level settings for each source
- ☐ Combine data according to each file's Privacy Level settings
- ☒ Always ignore Privacy Level settings ⓘ

## Native Database Queries

- ☐ Require user approval for new native database queries

What is currently missing and do you want to add?



# Planned enhancements

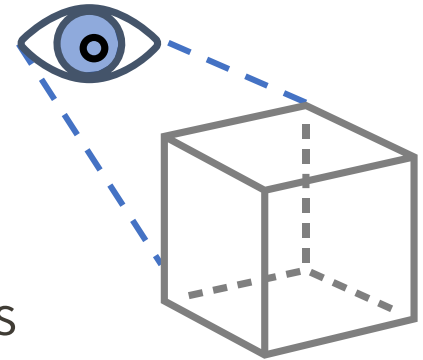
## Soon

- Adding Roles + expressions
- Perspectives
- Auto download Excel template



## Later

- Support for live connected models
- Next-next-finish installer





**So, from now on...**



# Wrap up

LET'S  
RECAP...

## External Tools...

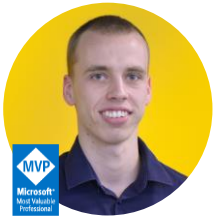
- ...are depending on Analysis Service **metadata** format.
- ...allow you to develop with **3<sup>rd</sup> party tools**.
- ...opens tons of **opportunities to contribute** to Power BI.

## Model Documenter...

- ... allows me to be lazy (or efficient) by **generating** documentation.
- ... opens new opportunities to **hand-over** your solutions.
- ... is super powerful for **self-service purposes** and end-users.

# For resources

<https://data-marc.com/model-documenter/>



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