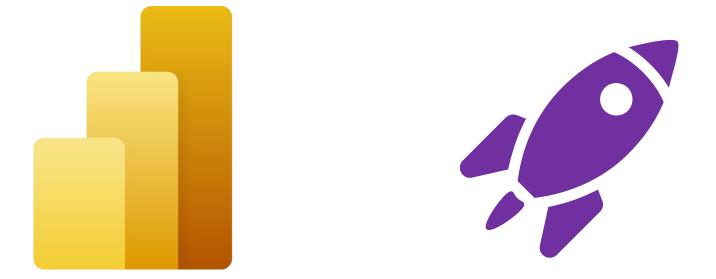
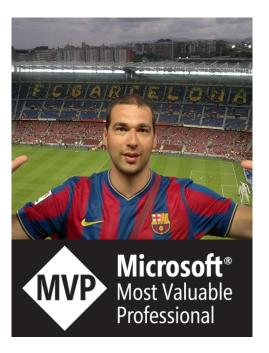
Cracking the Power BI Performance!



Nikola Ilic

Data Mozart, Microsoft Data Platform MVP





Nikola Ilic

Data Platform Consultant & Trainer



Data-mozart.com









- > I'm making music from the data!
- Power BI and SQL Server addict, Data Platform MVP, MCT, blogger, speaker...
- Father of 2, Barca & Leo Messi fan...





✓ Creating Power BI report is an easy task!











Where do I start?!

- 1. Data Model size
- 2. Data refresh process
- 3. DAX calculations
- 4. Visualization rendering time
- 5. Storage mode choice







- ✓ VertiPaq is a columnar database
- ✓ Data snapshot in memory
- ✓ Periodically refreshed

Formula Engine





Storage Engine











DATA MODEL SIZE BEST PRACTICES

- ✓ Reduce the amount of data for import
- ✓ Reduce the column cardinality
- ✓ Avoid using calculated columns
- ✓ Disable Auto Date/Time







Cardinality ~ 8.8 Million Column size ~ 455 MB

Cardinality ~ 1.300 Column size ~ 7 MB

🕼 🗅 💭 🖹 🛛 🔅									DAX Studie
File Home Advanced Help									
Import Import<	t View Run As Benchm	SQL Anal nark Profiler in Ex	/ze cel						
Metrics Expor	i Security Performa	ance External loois							
Metadata Functions DMV	I Enter ye	our DAX query he	re						
PBI Performance	/								
Y Model									
Q Search									
> III Chats									
	Log Results H	istory VertiPag Analyz	er						
Ghats Gnine Sales Filtered		istory VertiPaq Analyz	-						
	Log Results H	istory VertiPaq Analyz Name	er Cardinality	Total Size \downarrow	Data	Dictionary	Hier Size	Encoding	Data Type
			-	Total Size ↓ 551,891,644	Data 80,984,232	Dictionary 358,000,596	Hier Size 112,906,816	Encoding Many	Data Type
	Tables	Name	Cardinality						
	Tables Columns Relationships	Name Chats	Cardinality 9,292,338	551,891,644	80,984,232	358,000,596	112,906,816	Many	-
	Tables Columns Relationships Partitions	Name Chats datetmStartUTC	Cardinality 9,292,338 8,836,161	551,891,644 454,846,712	80,984,232 26,177,720	358,000,596 357,979,696	112,906,816 70,689,296	Many HASH	- DateTime
	Tables Columns Relationships	Name Chats datetmStartUTC chatID	Cardinality 9,292,338 8,836,161 9,292,338	551,891,644 454,846,712 64,745,320	80,984,232 26,177,720 27,575,824	358,000,596 357,979,696 136	112,906,816 70,689,296 37,169,360	Many HASH VALUE	- DateTime Int64

File	Home Home Export Metrics		Help Export Data Export	O View As Security	Run Benchmark Performance	SQL Profiler Extern	Analyz in Exce	e						DAX Stud
PBI F Mod Q Sear > III (ce	~ \$	1 E	nter your	DAX que	ry her	e						
						y VertiPaq	Analyze	r						
				Table	s	Name	\uparrow	Cardinality	Total Size	Data	Dictionary	Hier Size	Encoding	Data Type
				Colur Relat	nns 🔺 ionships	Chats chatID		9,292,338 9,292,338	106,067,164 64,745,320	62,686,304 27,575,824	1,152,476 136	42,228,384 37,169,360	Many VALUE	- Int64
				Partit	ions	customerIE		1,261,875	33,458,160	28,410,520	136	5,047,504	VALUE	Int64
				Sumr	narv	datetmStar	tUTC	1,356	6,710,736	6,615,272	84,600	10,864	HASH	DateTime
						productID		31	68,676	66,960	1,460	256	HASH	Int64
						subject		48	1,084,136	17,728	1,066,008	400	HASH	String



DATA REFRESH PROCESS



DATA REFRESH PROCESS

✓ Data transformations – currency conversion, filtering, calculations...

✓ Where do you shape the data?

✓ **QUERY FOLDING** = Ability to generate single SQL query to be executed on the data source side

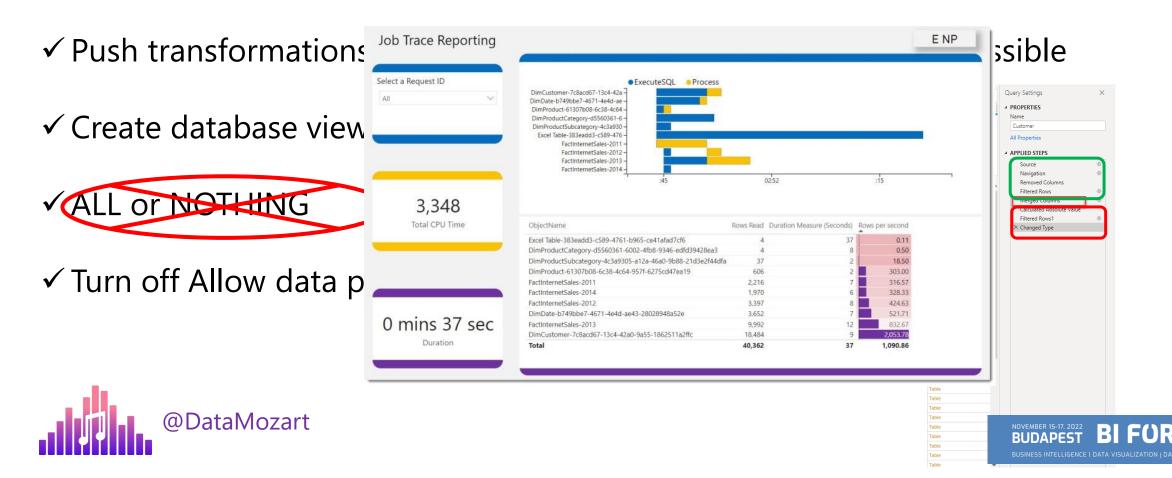






DATA REFRESH BEST PRACTICES

✓ https://dax.tips/2021/02/15/visualise-your-power-bi-refresh/



DATA REFRESH PROCESS GOLDEN RULE



"Push transformations and calculations as upstream as possible,

and as downstream as necessary!"

Matthew Roche







DAX CALCULATIONS



DAX CALCULATIONS

✓ Unique customers, top selling products, running totals...

✓ The "beauty" of DAX – get same result in multiple different ways

✓ Little nuances can make a huge difference!







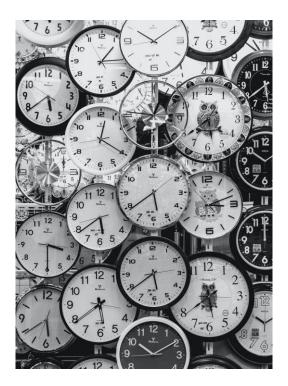
VISUALS RENDERING TIME



VISUALS RENDERING TIME

✓ Performance Analyzer feature in PBI Desktop

✓ The more visuals – the longer time for rendering!







VISUALS RENDERING BEST PRACTICES

- ✓ Reduce the number of visuals!
- ✓ Use PowerPoint to design background of Power BI report page
- ✓ Reduce the number of DAX query generated Card visuals->Matrix
- ✓ Display aggregated data by default, enable Drill-through for details
- ✓ Consider disabling cross-filtering
- ✓ Sync Slicers?



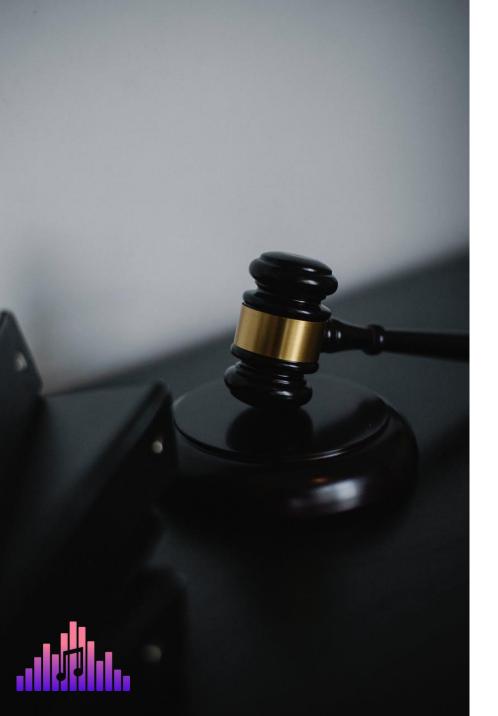


VISUALS RENDERING TIME

10 visuals = 10 queries Other???

2 queries = the same result! Design!

Image: Signed with the first with t	Aa	Home Insert Modeling	ormance - Power BI Desktop	Gridlines	Search			File Home In Copy Paste Format painter Cipboard	ert Modeling	ata SOL Enter Dataverse Recent	Transform Refresh New Te	ext More New Quick Sension	Stority Publish "" " Share	Performance analyzer		Visualizations >>>	■ - o × Fields >>
M 01-Jan-07 13M 2516 31-Dec-09 Integre Sales Integre Produets 01 di Sales (2) Unique Produets 01 di Sales (2) Integre Sales Integre Produets 01 di Sales (2) Integre Sales Integre Produets Integre Sales Integre Sales </td <td></td> <td>\$215</td> <td>\$239</td> <td>\$3.2K</td> <td>\$2.72bn</td> <td>Start recording Start recording Name O Refreshed visual Card</td> <td>○ Refresh visuals</td> <td>\$</td> <td>215 e Sales</td> <td>\$239 First Sales Date</td> <td>\$3.2K</td> <td>\$2.72bn</td> <td>\$1bn</td> <td>Admix Admix DAX query Visual display Other ([) -copy query Ithere Admix Shape</td> <td>♦ Clear Duration (ms) ↑ 0.76 3 177 53</td> <td></td> <td>AVG Sales Amt AVG Unit Price ∑ ETLLoadD First Sales Date Last Sales Date</td>		\$215	\$239	\$3.2K	\$2.72bn	Start recording Start recording Name O Refreshed visual Card	○ Refresh visuals	\$	215 e Sales	\$239 First Sales Date	\$3.2K	\$2.72bn	\$1bn	Admix Admix DAX query Visual display Other ([) -copy query Ithere Admix Shape	♦ Clear Duration (ms) ↑ 0.76 3 177 53		AVG Sales Amt AVG Unit Price ∑ ETLLoadD First Sales Date Last Sales Date
	ĺ					Visual display Other Control Cand Cand Cand Cand Cand Cand Cand Cand	117						31-Dec-U9	C-	sports performance on our succost all two second se	Add data fetol here Colume Add data fetol here Values Usakas fetol ware Ten Sales Data V Ten Sales Data V Sales data fetol here Sales at fieto series	 Total Sales Ant Total Sales Ant Total Sales Oty Total Sales Oty Unique Castomers Unique Castomers Unique Sales



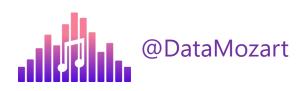
STORAGE MODE DECISION



WHAT IS A DIRECT QUERY?!

✓ Data is retrieved from the source at the query time!

- ✓ Data resides outside of Power BI before, during, and after the query execution
- ✓ Direct Query will NEVER improve performance of your Power BI report!!!





WHEN TO USE A DIRECT QUERY ?!

- 1. Data is too large for Import mode
- 2. Real-time reporting requirements
 - Is it really necessary?
- 3. Security policies on the data source side



DIRECT QUERY BEST PRACTICES

Permissions on the data source?



- ✓ Create proper indexes
- ✓ Data integrity
- ✓ Persistent data objects



- ✓ Avoid complex PQ transformations
- ✓ Avoid complex DAX measures
- \checkmark Avoid relationship on GUIDs
- ✓ Limit parallelism and apply Query reduction
- ✓ Check Assume referential integrity



DIRECT QUERY BEST PRACTICE!



AVOID DIRECT QUERY IF POSSIBLE!







MONDAY TO-DO LIST

- ✓ Identify the poor performing area(s)
- ✓ Remove unnecessary data
- ✓ Check Query folding
- \checkmark Be mindful when writing DAX
- \checkmark Reduce the number of visuals on the page
- ✓ Stay away from Direct Query!









QUESTIONS



Data-mozart.com



@DataMozart



THANK YOU!





Data-mozart.com





