

The image features a central logo for 'sqlbits 2025' enclosed in a blue neon rectangle. The text 'sqlbits' is in a large, orange-outlined font, and '2025' is in a smaller, pink-outlined font below it. The background is a dark brick wall. Surrounding the central logo are various neon icons: an ice cream cone (top left), two cherries (top left), a girl's face with a bow (top right), a four-pointed star (top right), a planet with a ring (middle right), a lightning bolt (middle right), a four-pointed star (middle right), a leaf (bottom right), a four-pointed star (bottom right), a girl's face with a bow (bottom left), a four-pointed star (bottom left), a four-pointed star (middle left), a lightning bolt (middle left), a planet with a ring (middle left), and a leaf (middle left).

# sqlbits

2025

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# Optimizing Power BI: Enhancing Performance Through Data Modeling



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**Geek by design**

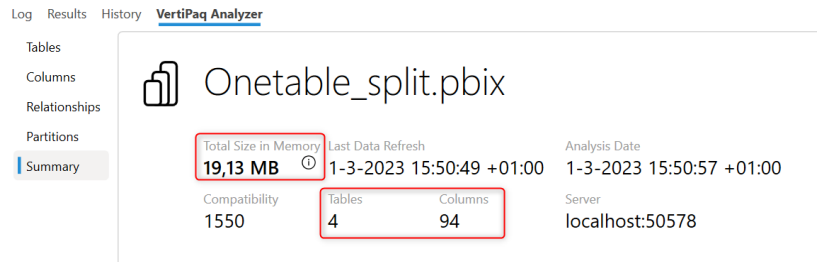
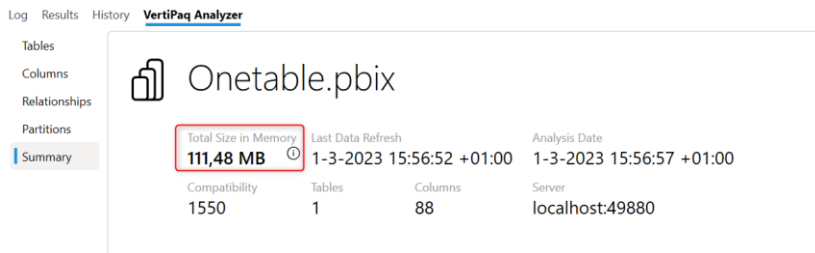
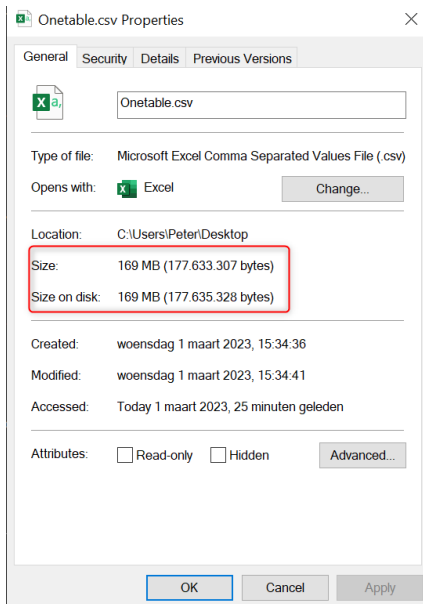
*Because performance isn't optional*

# Why is the Data Model Important?

- The data model is the foundation of Power BI.
- A well-designed data model improves performance and speeds up queries.
- 80% of performance issues are related to the data model.
- A better data model makes DAX queries easier and more efficient.
- Reduces data redundancy and minimizes errors.



# Example of Why the Data Model is Important.



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CustomerType	CompanyName	GeographyKey	StoreManager	StoreType	StoreName	StoreDescription	Status	OpenDate	CloseDate	EntityKey	ZipCode	ZipCodeExtension	StorePhone	StoreFax	
Company	SapporoCompany	710	292	Online	Contoso Asia Online Store	Contoso Asia Online Store	On	2004-10-11 00:00:00.000	NULL	946	10093	10093	55-555-0117	55-555-0117	China B
Company	LisbonCompany	586	246	Online	Contoso Europe Online Store	Contoso Europe Online Store	On	2004-09-03 00:00:00.000	NULL	945	10178	10178	731-555-0117	731-555-0117	Downtc
Company	Green BayCompany	800	212	Online	Contoso North America Online Store	Contoso Online Store	On	2004-08-25 00:00:00.000	NULL	59	20817	20817	450-555-0152	450-555-0152	Marbur
Company	DublinCompany	586	246	Online	Contoso Europe Online Store	Contoso Europe Online Store	On	2004-09-03 00:00:00.000	NULL	945	10178	10178	731-555-0117	731-555-0117	Downtc
Company	RidgelyCompany	800	212	Online	Contoso North America Online Store	Contoso Online Store	On	2004-08-25 00:00:00.000	NULL	59	20817	20817	450-555-0152	450-555-0152	Marbur
Company	LakelandCompany	800	212	Online	Contoso North America Online Store	Contoso Online Store	On	2004-08-25 00:00:00.000	NULL	59	20817	20817	450-555-0152	450-555-0152	Marbur
Company	RichardsonCompany	800	212	Online	Contoso North America Online Store	Contoso Online Store	On	2004-08-25 00:00:00.000	NULL	59	20817	20817	450-555-0152	450-555-0152	Marbur
Company	GlasgowCompany	586	246	Online	Contoso Europe Online Store	Contoso Europe Online Store	On	2004-09-03 00:00:00.000	NULL	945	10178	10178	731-555-0117	731-555-0117	Downtc
Company	GoulburnCompany	710	292	Online	Contoso Asia Online Store	Contoso Asia Online Store	On	2004-10-11 00:00:00.000	NULL	946	10093	10093	55-555-0117	55-555-0117	China B
Company	NagoyaCompany	710	292	Online	Contoso Asia Online Store	Contoso Asia Online Store	On	2004-10-11 00:00:00.000	NULL	946	10093	10093	55-555-0117	55-555-0117	China B
Company	DublinCompany	586	246	Online	Contoso Europe Online Store	Contoso Europe Online Store	On	2004-09-03 00:00:00.000	NULL	945	10178	10178	731-555-0117	731-555-0117	Downtc
Company	TaipeiCompany	710	292	Online	Contoso Asia Online Store	Contoso Asia Online Store	On	2004-10-11 00:00:00.000	NULL	946	10093	10093	55-555-0117	55-555-0117	China B
Company	ShanghaiCompany	710	292	Online	Contoso Asia Online Store	Contoso Asia Online Store	On	2004-10-11 00:00:00.000	NULL	946	10093	10093	55-555-0117	55-555-0117	China B
Company	EdinburghCompany	586	246	Online	Contoso Europe Online Store	Contoso Europe Online Store	On	2004-09-03 00:00:00.000	NULL	945	10178	10178	731-555-0117	731-555-0117	Downtc
Company	JacksonvilleCompany	800	212	Online	Contoso North America Online Store	Contoso Online Store	On	2004-08-25 00:00:00.000	NULL	59	20817	20817	450-555-0152	450-555-0152	Marbur
Company	AppletonCompany	800	212	Online	Contoso North America Online Store	Contoso Online Store	On	2004-08-25 00:00:00.000	NULL	59	20817	20817	450-555-0152	450-555-0152	Marbur
Company	Citrus HeightsCompa	800	212	Online	Contoso North America Online Store	Contoso Online Store	On	2004-08-25 00:00:00.000	NULL	59	20817	20817	450-555-0152	450-555-0152	Marbur
Company	JacksonvilleCompany	800	212	Online	Contoso North America Online Store	Contoso Online Store	On	2004-08-25 00:00:00.000	NULL	59	20817	20817	450-555-0152	450-555-0152	Marbur
Company	LewisvilleCompany	800	212	Online	Contoso North America Online Store	Contoso Online Store	On	2004-08-25 00:00:00.000	NULL	59	20817	20817	450-555-0152	450-555-0152	Marbur
Company	EdinburghCompany	586	246	Online	Contoso Europe Online Store	Contoso Europe Online Store	On	2004-09-03 00:00:00.000	NULL	945	10178	10178	731-555-0117	731-555-0117	Downtc
Company	BerlinCompany4	586	246	Online	Contoso Europe Online Store	Contoso Europe Online Store	On	2004-09-03 00:00:00.000	NULL	945	10178	10178	731-555-0117	731-555-0117	Downtc
Company	HoustonCompany	800	212	Online	Contoso North America Online Store	Contoso Online Store	On	2004-08-25 00:00:00.000	NULL	59	20817	20817	450-555-0152	450-555-0152	Marbur
Company	ShanghaiCompany	710	292	Online	Contoso Asia Online Store	Contoso Asia Online Store	On	2004-10-11 00:00:00.000	NULL	946	10093	10093	55-555-0117	55-555-0117	China B
Company	MumbaiCompany	710	292	Online	Contoso Asia Online Store	Contoso Asia Online Store	On	2004-10-11 00:00:00.000	NULL	946	10093	10093	55-555-0117	55-555-0117	China B
Company	CologneCompany	586	246	Online	Contoso Europe Online Store	Contoso Europe Online Store	On	2004-09-03 00:00:00.000	NULL	945	10178	10178	731-555-0117	731-555-0117	Downtc
Company	BerlinCompany4	586	246	Online	Contoso Europe Online Store	Contoso Europe Online Store	On	2004-09-03 00:00:00.000	NULL	945	10178	10178	731-555-0117	731-555-0117	Downtc
Company	CorvallisCompany	800	212	Online	Contoso North America Online Store	Contoso Online Store	On	2004-08-25 00:00:00.000	NULL	59	20817	20817	450-555-0152	450-555-0152	Marbur
Company	EdinburghCompany	586	246	Online	Contoso Europe Online Store	Contoso Europe Online Store	On	2004-09-03 00:00:00.000	NULL	945	10178	10178	731-555-0117	731-555-0117	Downtc
Company	Lane CoveCompany	710	292	Online	Contoso Asia Online Store	Contoso Asia Online Store	On	2004-10-11 00:00:00.000	NULL	946	10093	10093	55-555-0117	55-555-0117	China B
Company	ShanghaiCompany	710	292	Online	Contoso Asia Online Store	Contoso Asia Online Store	On	2004-10-11 00:00:00.000	NULL	946	10093	10093	55-555-0117	55-555-0117	China B
Company	YorkCompany	586	246	Online	Contoso Europe Online Store	Contoso Europe Online Store	On	2004-09-03 00:00:00.000	NULL	945	10178	10178	731-555-0117	731-555-0117	Downtc
Company	Round RockCompany	800	212	Online	Contoso North America Online Store	Contoso Online Store	On	2004-08-25 00:00:00.000	NULL	59	20817	20817	450-555-0152	450-555-0152	Marbur

# VertiPaq Compression

UnitCost	StoreName
€ 10,00	Contoso North America Online Store
€ 11,00	Contoso Europe Online Store
€ 14,00	Contoso Europe Online Store
€ 18,00	Contoso Europe Online Store
€ 15,00	Contoso North America Online Store
€ 14,00	Contoso North America Online Store
€ 19,00	Contoso Asia Online Store
€ 14,00	Contoso North America Online Store
€ 17,00	Contoso Europe Online Store
€ 19,00	Contoso Asia Online Store

# Dictionary Encoding

- Replaces unique text values with numeric keys
- Saves memory: text → integer
- Values stored once in a dictionary, referenced via keys
- Especially effective for low-cardinality columns

StoreName	StoreName.ID
Contoso North America Online Store	1
Contoso Europe Online Store	2
Contoso Europe Online Store	2
Contoso Europe Online Store	2
Contoso North America Online Store	1
Contoso North America Online Store	1
Contoso Asia Online Store	3
Contoso North America Online Store	1
Contoso Europe Online Store	2
Contoso Asia Online Store	3



# Run-Length Encoding (RLE)

- Compresses consecutive repetitions of the same value
- Stores as (value + count)
- Only works well when the column is sorted
- Applied only if it actually saves memory

StoreName.ID	StoreName	StoreName.ID	Count	Rows
1	1	1	0	4
2	1	2	4	4
2	1	3	7	2
2	1			
1	2			
1	2			
3	2			
1	2			
2	3			
3	3			

# Value Encoding (Bit-Packing)

- VertiPaq chooses the smallest number of bits per column
- Smaller range of values = fewer bits needed
- Works after dictionary encoding or on numeric columns

Original	Optimized
UnitCost	UnitCost
€ 10,00	0 +10
€ 11,00	1 +10
€ 14,00	4 +10
€ 18,00	8 +10
€ 15,00	5 +10
€ 14,00	4 +10
€ 19,00	9 +10
€ 14,00	4 +10
€ 17,00	7 +10
€ 19,00	9 +10

# Example of Why the Data Model is Important.

CustomerType	CompanyName	GeographyKey	StoreManager	StoreType	StoreName	StoreDescription	Status	OpenDate	CloseDate	EntityKey	ZipCode	ZipCodeExtension	StorePhone	StoreFax	
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Company	Lisbon Company	586	246	Online	Contoso Europe Online Store	Contoso Europe Online Store	On	2004-09-03 00:00:00.000	NULL	945	10178	10178	731-555-0117	731-555-0117	Downtc
Company	Green Bay Company	800	212	Online	Contoso North America Online Store	Contoso Online Store	On	2004-08-25 00:00:00.000	NULL	59	20817	20817	450-555-0152	450-555-0152	Marbur
Company	Dublin Company	586	246	Online	Contoso Europe Online Store	Contoso Europe Online Store	On	2004-09-03 00:00:00.000	NULL	945	10178	10178	731-555-0117	731-555-0117	Downtc
Company	Ridgely Company	800	212	Online	Contoso North America Online Store	Contoso Online Store	On	2004-08-25 00:00:00.000	NULL	59	20817	20817	450-555-0152	450-555-0152	Marbur
Company	Lakeland Company	800	212	Online	Contoso North America Online Store	Contoso Online Store	On	2004-08-25 00:00:00.000	NULL	59	20817	20817	450-555-0152	450-555-0152	Marbur
Company	Richardson Company	800	212	Online	Contoso North America Online Store	Contoso Online Store	On	2004-08-25 00:00:00.000	NULL	59	20817	20817	450-555-0152	450-555-0152	Marbur
Company	Glasgow Company	586	246	Online	Contoso Europe Online Store	Contoso Europe Online Store	On	2004-09-03 00:00:00.000	NULL	945	10178	10178	731-555-0117	731-555-0117	Downtc
Company	Goulburn Company	710	292	Online	Contoso Asia Online Store	Contoso Asia Online Store	On	2004-10-11 00:00:00.000	NULL	946	10093	10093	55-555-0117	55-555-0117	China B
Company	Nagoya Company	710	292	Online	Contoso Asia Online Store	Contoso Asia Online Store	On	2004-10-11 00:00:00.000	NULL	946	10093	10093	55-555-0117	55-555-0117	China B
Company	Dublin Company	586	246	Online	Contoso Europe Online Store	Contoso Europe Online Store	On	2004-09-03 00:00:00.000	NULL	945	10178	10178	731-555-0117	731-555-0117	Downtc
Company	Taipei Company	710	292	Online	Contoso Asia Online Store	Contoso Asia Online Store	On	2004-10-11 00:00:00.000	NULL	946	10093	10093	55-555-0117	55-555-0117	China B
Company	Shanghai Company	710	292	Online	Contoso Asia Online Store	Contoso Asia Online Store	On	2004-10-11 00:00:00.000	NULL	946	10093	10093	55-555-0117	55-555-0117	China B
Company	Edinburgh Company	586	246	Online	Contoso Europe Online Store	Contoso Europe Online Store	On	2004-09-03 00:00:00.000	NULL	945	10178	10178	731-555-0117	731-555-0117	Downtc
Company	Jacksonville Company	800	212	Online	Contoso North America Online Store	Contoso Online Store	On	2004-08-25 00:00:00.000	NULL	59	20817	20817	450-555-0152	450-555-0152	Marbur
Company	Appleton Company	800	212	Online	Contoso North America Online Store	Contoso Online Store	On	2004-08-25 00:00:00.000	NULL	59	20817	20817	450-555-0152	450-555-0152	Marbur
Company	Citrus Heights Company	800	212	Online	Contoso North America Online Store	Contoso Online Store	On	2004-08-25 00:00:00.000	NULL	59	20817	20817	450-555-0152	450-555-0152	Marbur
Company	Jacksonville Company	800	212	Online	Contoso North America Online Store	Contoso Online Store	On	2004-08-25 00:00:00.000	NULL	59	20817	20817	450-555-0152	450-555-0152	Marbur
Company	Lewisville Company	800	212	Online	Contoso North America Online Store	Contoso Online Store	On	2004-08-25 00:00:00.000	NULL	59	20817	20817	450-555-0152	450-555-0152	Marbur
Company	Edinburgh Company	586	246	Online	Contoso Europe Online Store	Contoso Europe Online Store	On	2004-09-03 00:00:00.000	NULL	945	10178	10178	731-555-0117	731-555-0117	Downtc
Company	Berlin Company4	586	246	Online	Contoso Europe Online Store	Contoso Europe Online Store	On	2004-09-03 00:00:00.000	NULL	945	10178	10178	731-555-0117	731-555-0117	Downtc
Company	Houston Company	800	212	Online	Contoso North America Online Store	Contoso Online Store	On	2004-08-25 00:00:00.000	NULL	59	20817	20817	450-555-0152	450-555-0152	Marbur
Company	Shanghai Company	710	292	Online	Contoso Asia Online Store	Contoso Asia Online Store	On	2004-10-11 00:00:00.000	NULL	946	10093	10093	55-555-0117	55-555-0117	China B
Company	Mumbai Company	710	292	Online	Contoso Asia Online Store	Contoso Asia Online Store	On	2004-10-11 00:00:00.000	NULL	946	10093	10093	55-555-0117	55-555-0117	China B
Company	Cologne Company	586	246	Online	Contoso Europe Online Store	Contoso Europe Online Store	On	2004-09-03 00:00:00.000	NULL	945	10178	10178	731-555-0117	731-555-0117	Downtc
Company	Berlin Company4	586	246	Online	Contoso Europe Online Store	Contoso Europe Online Store	On	2004-09-03 00:00:00.000	NULL	945	10178	10178	731-555-0117	731-555-0117	Downtc
Company	Corvallis Company	800	212	Online	Contoso North America Online Store	Contoso Online Store	On	2004-08-25 00:00:00.000	NULL	59	20817	20817	450-555-0152	450-555-0152	Marbur
Company	Edinburgh Company	586	246	Online	Contoso Europe Online Store	Contoso Europe Online Store	On	2004-09-03 00:00:00.000	NULL	945	10178	10178	731-555-0117	731-555-0117	Downtc
Company	Lane Cove Company	710	292	Online	Contoso Asia Online Store	Contoso Asia Online Store	On	2004-10-11 00:00:00.000	NULL	946	10093	10093	55-555-0117	55-555-0117	China B
Company	Shanghai Company	710	292	Online	Contoso Asia Online Store	Contoso Asia Online Store	On	2004-10-11 00:00:00.000	NULL	946	10093	10093	55-555-0117	55-555-0117	China B
Company	York Company	586	246	Online	Contoso Europe Online Store	Contoso Europe Online Store	On	2004-09-03 00:00:00.000	NULL	945	10178	10178	731-555-0117	731-555-0117	Downtc
Company	Round Rock Company	800	212	Online	Contoso North America Online Store	Contoso Online Store	On	2004-08-25 00:00:00.000	NULL	59	20817	20817	450-555-0152	450-555-0152	Marbur

# Example of Why the Data Model is Important.

OnlineSalesKey	DateKey	StoreKey	ProductKey	PromotionKey	CurrencyKey	CustomerKey	SalesOrderLineNumber	SalesQuantity	ReturnQuantity	ReturnAmount	DiscountQuantity	DiscountAmount	TotalCost	UnitCost	UnitPrice	DueDate
20473555	2019-08-14 00:00:00.000	199	1670	1	1	1123	1	1	0	0	0	0	4.13	4.13	8.99	2019-08-23 00:00:00.000
23353743	2020-07-23 00:00:00.000	199	1676	1	1	17042	1	1	0	0	0	0	4.13	4.13	8.99	2020-07-28 00:00:00.000
20706373	2019-09-12 00:00:00.000	199	1676	1	1	7817	1	1	0	0	0	0	4.13	4.13	8.99	2019-09-14 00:00:00.000
20676937	2019-09-09 00:00:00.000	199	1682	1	1	6510	1	1	0	0	0	0	4.13	4.13	8.99	2019-09-10 00:00:00.000
20538889	2019-08-22 00:00:00.000	199	1670	1	1	3107	1	1	0	0	0	0	4.13	4.13	8.99	2019-09-05 00:00:00.000
23812925	2020-09-05 00:00:00.000	199	1682	1	1	4888	1	1	0	0	0	0	4.13	4.13	8.99	2020-09-10 00:00:00.000
29910972	2022-01-22 00:00:00.000	199	1664	1	1	625	1	1	0	0	0	0	4.13	4.13	8.99	2022-01-28 00:00:00.000
20708187	2019-09-13 00:00:00.000	199	1676	1	1	7952	1	1	0	0	0	0	4.13	4.13	8.99	2019-09-26 00:00:00.000
20708865	2019-09-13 00:00:00.000	199	1670	1	1	8131	1	1	0	0	0	0	4.13	4.13	8.99	2019-09-17 00:00:00.000
20878449	2019-10-04 00:00:00.000	199	1676	1	1	10712	1	1	0	0	0	0	4.13	4.13	8.99	2019-10-12 00:00:00.000
29961007	2022-01-26 00:00:00.000	199	1676	1	1	1085	1	1	0	0	0	0	4.13	4.13	8.99	2022-02-09 00:00:00.000
25165468	2021-01-17 00:00:00.000	199	1676	1	1	1079	1	1	0	0	0	0	4.13	4.13	8.99	2021-01-19 00:00:00.000
28113041	2021-09-19 00:00:00.000	199	1682	1	1	13257	1	1	0	0	0	0	4.13	4.13	8.99	2021-10-01 00:00:00.000
23445712	2020-08-01 00:00:00.000	199	1682	1	1	18199	1	1	0	0	0	0	4.13	4.13	8.99	2020-08-02 00:00:00.000
23524547	2020-08-09 00:00:00.000	199	1676	1	1	1073	1	1	0	0	0	0	4.13	4.13	8.99	2020-08-23 00:00:00.000
20635474	2019-09-04 00:00:00.000	199	1664	1	1	5246	1	1	0	0	0	0	4.13	4.13	8.99	2019-09-15 00:00:00.000
20878393	2019-10-04 00:00:00.000	199	1676	1	1	10643	1	1	0	0	0	0	4.13	4.13	8.99	2019-10-05 00:00:00.000
21843045	2020-02-03 00:00:00.000	199	1664	1	1	10939	1	1	0	0	0	0	4.13	4.13	8.99	2020-02-12 00:00:00.000

StoreKey	GeographyKey	StoreManager	StoreType	StoreName	StoreDescription	Status	OpenDate	CloseDate	EntityKey	ZipCode	ZipCodeExtension	StorePhone	StoreFax	AddressLine1_s
307	710	292	Online	Contoso Asia Online Store	Contoso Asia Online Store	On	2004-10-11 00:00:00.000	NULL	946	10093	10093	55-555-0117	55-555-0117	China Beijing Chaoyang district Shanlitun Rd
306	586	246	Online	Contoso Europe Online Store	Contoso Europe Online Store	On	2004-09-03 00:00:00.000	NULL	945	10178	10178	731-555-0117	731-555-0117	Downtown Berlin, Germany
199	800	212	Online	Contoso North America Online Store	Contoso Online Store	On	2004-08-25 00:00:00.000	NULL	59	20817	20817	450-555-0152	450-555-0152	Marbury St Shopping mall

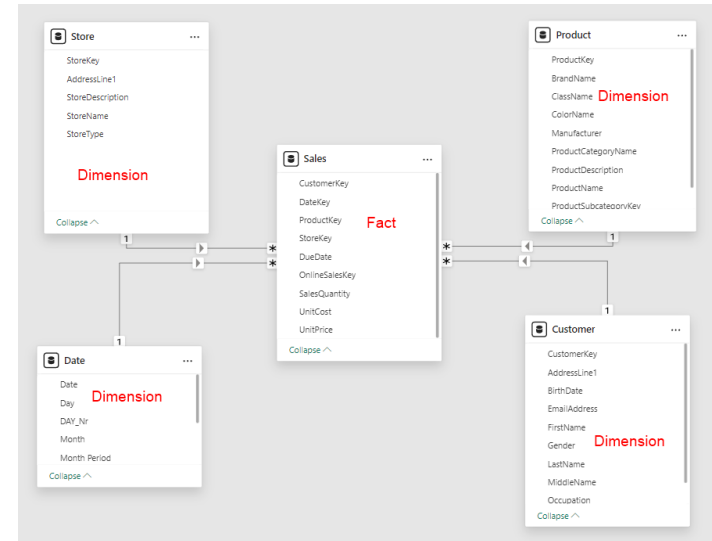
# Star Schema

## Fact Tables:

- Contain facts, representing an event with dimensions.
- A sale includes a product, a customer, and a date.
- Metrics that can be aggregated to gain insights.

## Dimension Tables:

- Descriptive attributes of entities such as a product, customer, employee, or patient.
- Dimensions have attributes like color, category, manufacturer, or price.





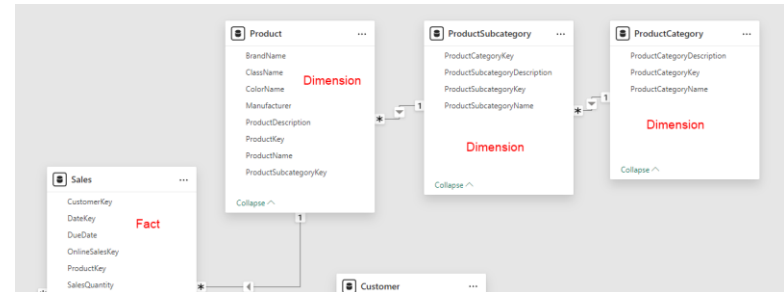
# Snowflake-model

The Snowflake Schema is a Variant of the Star Schema

The difference is that dimension tables that are related to each other are connected.

For example:

- Product
- Product Subcategory
- Product Category



# What Does an Optimized Data Model Consist Of?

The model consists of facts and dimensions.

- A fact table contains values that you can calculate, such as:
  - Revenue, purchase date, sold products, etc.
- A dimension table contains values you want to filter by, such as:
  - Year, month, manufacturer, customer, etc.

# Relationships and Keys

To create relationships between tables, keys are used.

## Primary Key:

- A unique value that appears only once in a dimension table.

## Foreign Key:

- Used in a fact table to indicate how often, for example, a product has been sold.
- The foreign key can appear multiple times in a fact table, as a product is typically sold more than once.



# Relationships and Filtering

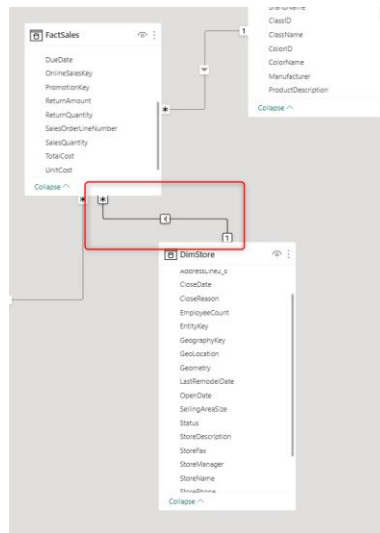
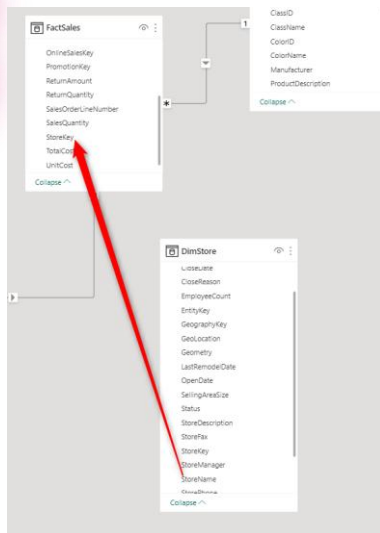
A relationship must be created between facts and dimensions. Possible relationships include:

- One-to-many
- One-to-one
- Many-to-many

You can also choose the filter direction:

- Single
- Both

# Example: Relationships and Filtering



## Edit relationship

Select tables and columns that are related.

FactSales						
OnlineSalesKey	DateKey	StoreKey	ProductKey	PromotionKey	CurrencyKey	CustomerKey
20473555	2019-08-14 00:00:00.000	199	1670	1	1	1123
23353743	2020-07-23 00:00:00.000	199	1676	1	1	17042
20706373	2019-09-12 00:00:00.000	199	1676	1	1	7817

DimStore					
StoreKey	GeographyKey	StoreManager	StoreType	StoreName	StoreDescription
307	710	292	Online	Contoso Asia Online Store	Contoso Asia Online S
306	586	246	Online	Contoso Europe Online Store	Contoso Europe Onlin
199	800	212	Online	Contoso North America Online Store	Contoso Online Store

Cardinality	Cross filter direction
Many to one (":1)	Single
Many to one (":1)	
One to one (1:1)	
One to many (1:*)	
Many to many (*:*)	
<input type="checkbox"/> Apply security filter in both directions	
<input type="button" value="OK"/> <input type="button" value="Cancel"/>	



# Multiple Fact Tables

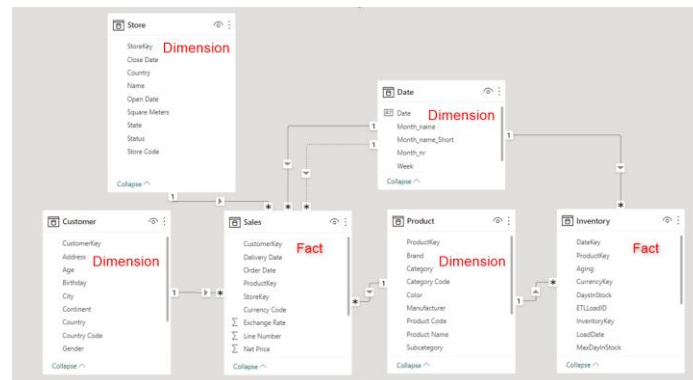
It is possible to use multiple fact tables in your model.

These fact tables may not have much in common with each other

- Inventory and sales.

However, it is necessary to have some dimension tables that are connected to the fact tables

- date and product.



- When table relationships are not clear

- 

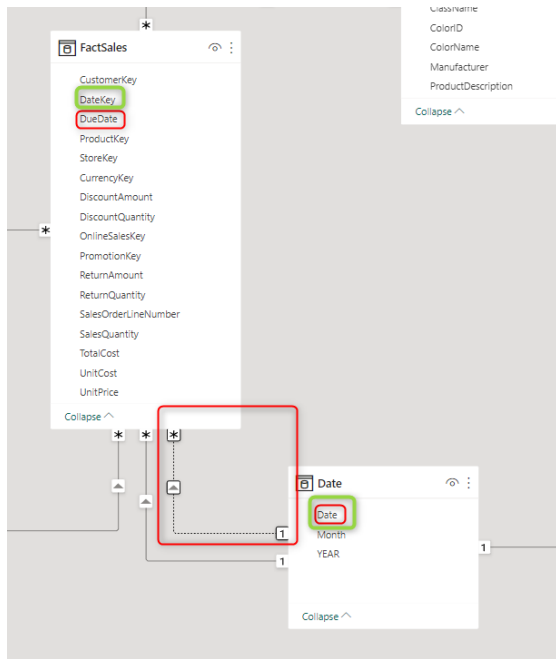




## Multiple date tables

- When comparisons need to be made between dates, multiple date tables are sometimes used.
- The reason for this is that you can only have one active relationship between tables.
- This adds extra data to your model, which can be inefficient.
- It is better to use the USERELATIONSHIP function in DAX.
- This allows for easier comparisons, and the relationship only becomes active when the measure is used.

# Example of multiple date tables



```
€ Total Sales DueDate =  
CALCULATE(  
    SUMX(  
        FactSales,  
        FactSales[SalesQuantity] * FactSales[UnitPrice]  
    ), USERELATIONSHIP('Date'[Date], FactSales[DueDate])  
)
```

YEAR	Month	€ Total Sales	€ Total Sales DueDate
2020	1	33.009.186,00	37.071.480,00
2020	2	35.875.667,00	32.881.523,00
2020	3	37.972.129,00	39.884.837,00
2020	4	23.246.283,00	24.885.072,00
2020	5	25.203.379,00	25.347.549,00
2020	6	22.731.355,00	22.762.326,00
2020	7	31.128.116,00	29.408.149,00
2020	8	26.639.125,00	28.419.751,00
2020	9	27.177.507,00	25.827.772,00
2020	10	29.276.942,00	30.009.064,00
2020	11	24.816.322,00	25.134.687,00
2020	12	28.318.035,00	27.652.516,00
<b>Total</b>		<b>345.394.046,00</b>	<b>349.284.726,00</b>



# Level of detail in the tables

The level of detail at the lowest level in your table.

Consider what is needed at the lowest level of the table, for example:

- What is the lowest level of each individual purchase?
- Is it sufficient to store the revenue per day?

DateKey	TotalCost	Date	€ Total Sales
7-4-2019 0:00:00	52,00	7-4-2019 0:00:00	1.529.817,00
7-4-2019 0:00:00	56,00	8-4-2019 0:00:00	1.140.754,00
7-4-2019 0:00:00	66,00	9-4-2019 0:00:00	1.671.361,00
7-4-2019 0:00:00	115,00	10-4-2019 0:00:00	1.988.986,00
7-4-2019 0:00:00	131,00	11-4-2019 0:00:00	1.707.435,00
7-4-2019 0:00:00	171,00	12-4-2019 0:00:00	1.127.218,00
7-4-2019 0:00:00	242,00	13-4-2019 0:00:00	1.564.933,00
7-4-2019 0:00:00	254,00	14-4-2019 0:00:00	1.837.926,00
7-4-2019 0:00:00	285,00	15-4-2019 0:00:00	1.436.617,00
7-4-2019 0:00:00	356,00	16-4-2019 0:00:00	1.808.614,00
7-4-2019 0:00:00	408,00	17-4-2019 0:00:00	2.025.175,00
7-4-2019 0:00:00	413,00	18-4-2019 0:00:00	1.873.287,00
7-4-2019 0:00:00	436,00	19-4-2019 0:00:00	1.633.725,00
7-4-2019 0:00:00	484,00	20-4-2019 0:00:00	1.544.020,00
7-4-2019 0:00:00	509,00	21-4-2019 0:00:00	1.459.055,00
7-4-2019 0:00:00	758,00	22-4-2019 0:00:00	1.883.524,00
7-4-2019 0:00:00	827,00	23-4-2019 0:00:00	1.520.738,00
7-4-2019 0:00:00	831,00	24-4-2019 0:00:00	1.570.734,00
7-4-2019 0:00:00	1.274,00	25-4-2019 0:00:00	1.704.843,00

# Many-to-many relationships

## Many-to-many (M:N) relationships

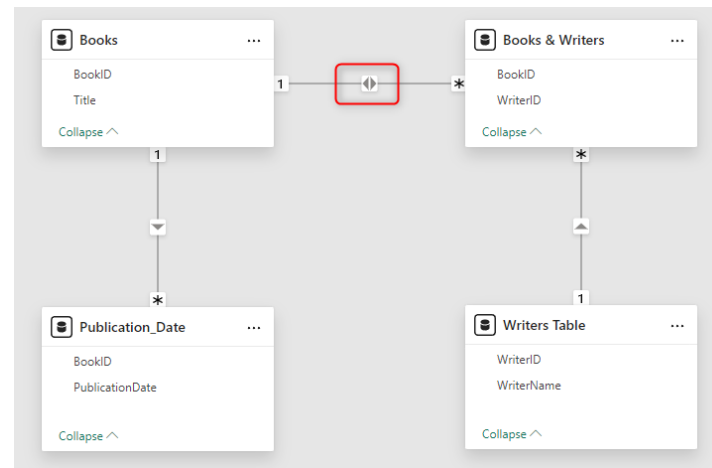
Example: Accounts and Customers  
(CRM vs. ERP)

How to solve this?

- Create a bridge table:
- Make a table containing all keys.

Pay attention to the direction of the cross-filter:

- Filtering only works from the 1 to \* side.





# Importance of the Star Schema for VertiPaq

- Star schema boosts performance:
  - Faster queries by separating dimensions and facts.
  - Simplifies data for efficient VertiPaq processing.
- Proper data preparation is key:
  - Consistent data format ensures better compression and lower RAM usage.
- Small tweaks, big gains:
  - Minor adjustments can greatly improve performance.
  - Next: Three key factors for optimizing compression.



# Importance of Choosing the Right Data Types

- Select the correct data types to optimize model performance
  - Understand data requirements and report needs
- Power Query defaults to "Decimal" for numeric columns:
  - May lead to unnecessary digits after the decimal point
  - Evaluate if fewer decimal places or whole numbers are sufficient
- Correct data type choice is crucial for VertiPaq compression

# Example Decimal number

Metadata Functions DMV

1 Enter your DAX query here...

Test\_decimal\_test

Model

Search

Demo\_distinct

id

1.2 Numbers

**Numbers**  
Demo\_distinct[Numbers]

Type Column

Data Type 1.2 Double

Distinct Values 41,264,868

Min Value 0,00228174037

Max Value 99999,9964857808

Log Results History VertiPaq Analyzer

Tables

Columns

Relationships

Partitions

Summary

Test\_decimal\_test.pbix

Total Size in Memory 2,06 GB

Last Data Refresh 1-10-2024 18:19:56 +02:00

Analysis Date 2-10-2024 18:44:44 +02:00

Compatibility 1550

Tables 1

Columns 2

Server localhost:57692

File Home Insert Modeling View Optimize Help

Name Numbers

Format General

Data type Decimal number

Formatting

Whole number

Decimal number

Fixed decimal number

Date/time

Date

Time

Text

True/false

Binary



# Example Fixed Decimal number

Metadata Functions DMV

Test\_decimal\_test

Model

Search

Demo\_distinct

123 id

1.2 Numbers

**Numbers**  
Demo\_distinct[Numbers]

Type	Column
Data Type	1.2 Double
Distinct Values	40.786.499
Min Value	0.0023
Max Value	99999.9965

Log Results History **VertiPaq Analyzer**

Tables

Columns

Relationships

Partitions

Summary

Test\_decimal\_test.pbix

Total Size in Memory 579,46 MB Last Data Refresh 2-10-2024 18:47:24 +02:00

Compatibility	Tables	Columns
1567	1	2

Name Numbers

123 Data type Fixed decimal number

Format \$% \$ % , .00 %0

Whole number

Decimal number

Fixed decimal number

Date/time

Date

Time

Text

True/false

Binary



# Optimizing Data Loading for Compression

- Load only necessary data to achieve optimal compression
- Reduce the number of columns per table:
  - Fewer columns lead to more effective compression
  - VertiPaq sort order technique: Stores columns with the lowest cardinality first for better compression
  - More columns, especially with higher cardinality, reduce compression efficiency
- Limit to around 15 columns per table to maintain an efficient model



## Calculated Columns: Pros and Cons

- Calculated columns are useful during development:
  - Allow for quick testing and validation without modifying data sources
  - Provide flexibility and speed up development
- Limitations of calculated columns in production:
  - Added after model compression, not compressed efficiently
  - Increase memory usage and reduce performance
  - Can undo optimization efforts by increasing model size

## Best practices

- Always use a star schema, or a snowflake schema if necessary.
- A fact table contains values for calculations.
- A dimension table contains values for filtering.
- Avoid using bidirectional relationships.
- Include only the data you actually use.
- Determine the level of detail for your tables in advance.
- Choose the right data type for each column

# If you have questions or insights, please contact me !



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