Set the stage

Gather

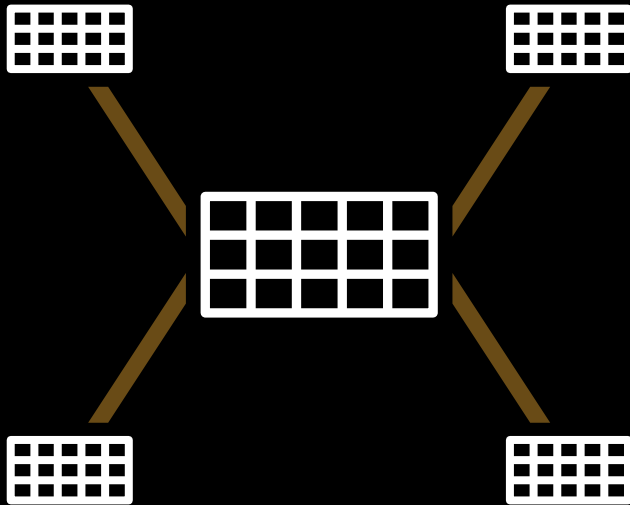**Clean**

Model

Visualize

Your basic understanding

Star Schema

Relationship types

Role Playing Dimensions

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Learning objectives
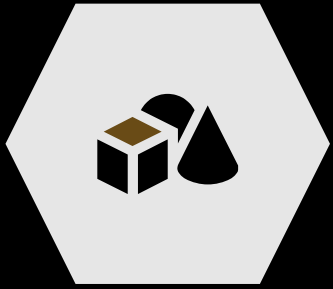
Explain data modeling best practices in general

Leverage one and bi-directional relationships

Successfully implement aggregations

Work with real live scenarios containing multiple fact tables

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Today's agenda

- Relationships revisited
- Relationship direction
- Working with multiple fact tables
- Implementing Aggregations
- Wrap-up

Relationships revisited

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Relationship types

1 to 1
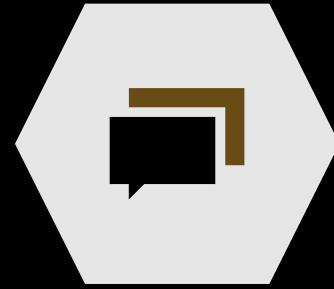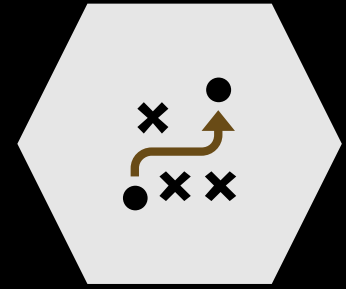
Every **individual record** in dataset A is mapped to one **individual record** in dataset B

Dataset A Customer information		Dataset B Customer information	
Customer ID	Country	Customer ID	Date of Birth
AW000111024	United States	AW000111024	9 april 1990
AW00019377	Germany	AW00019377	9 april 1983

1 to many

One record of dataset A is mapped to **multiple records** in dataset B

Dataset A Customer information		Dataset B Sales Information		
Customer ID	Country	Customer ID	Product	Order Quantity
AW000111024	United States	AW00011024	CA-1098	2
AW00019377	Germany	AW00019377	BC-M005	1
		AW00019377	CA-1098	1
		AW00019377	FE-6654	1
		AW00019377	HL-U509-B	1
		AW00019377	TI-M602	1
		AW00019377	TT-M928	1
		AW00019377	WB-H098	1

Many to many

Multiple records of dataset A are mapped to **multiple records** in dataset B

Dataset A Customer information			Dataset B Sales Information		
Customer ID	Store ID	Store Type	Customer ID	Product	Order Quantity
AW00011024	ON-1	Online	AW00011024	CA-1098	2
AW00011024	ST-1	Regional City Store	AW00011024	TT-M928	5
AW00011024	ST-2	Regional City Store	AW00019377	BC-M005	1
AW00019377	ON-1	Online	AW00019377	CA-1098	1
AW00019377	ST-1	Regional City Store	AW00019377	FE-6654	1
AW00019377	ST-2	Regional City Store	AW00019377	HL-U509-B	1
			AW00019377	TI-M602	1
			AW00019377	TT-M928	1
			AW00019377	WB-H098	1

Relationship direction
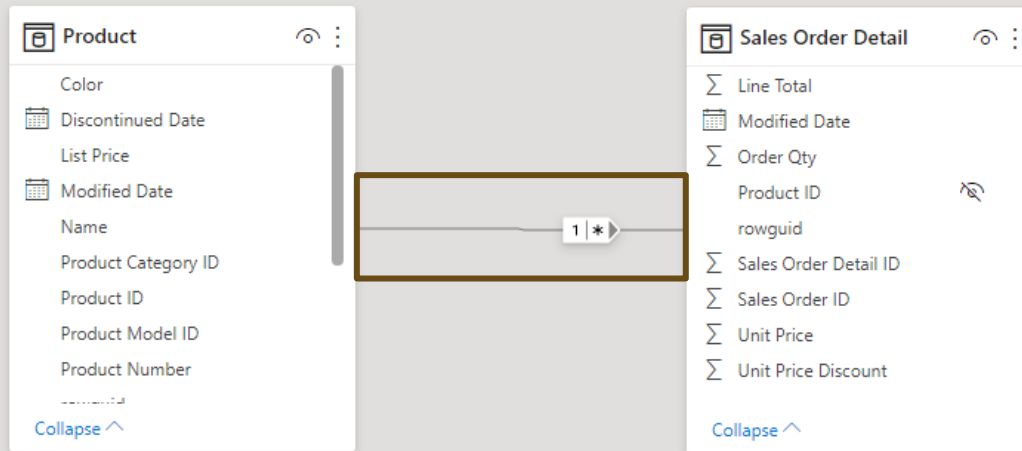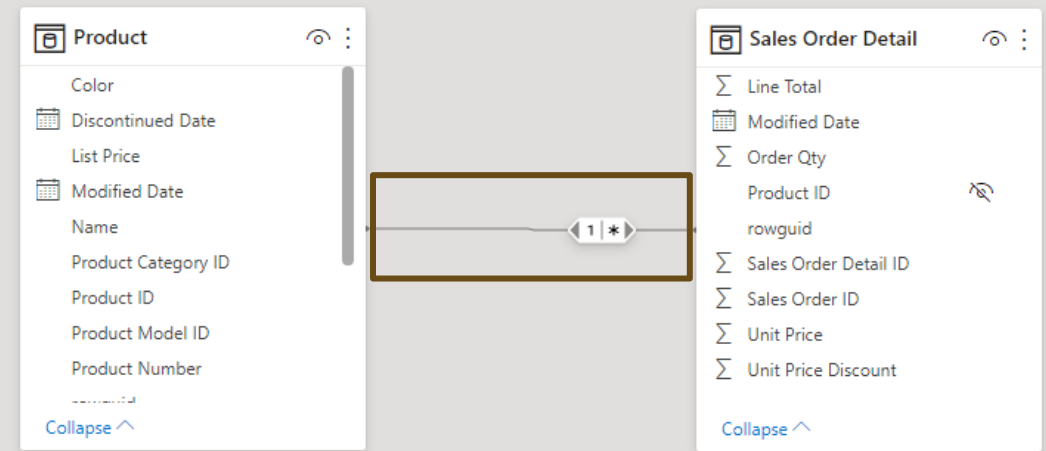
Relationship direction

Bi-directional relationships can result in surprising results, especially when working with multiple fact tables

- It can have performance impacts and 'overfilter'

- Can lead to ambiguity

Try to avoid bi-directional relationships

You can influence the direction of a relationship for the context of a calculation by CROSSFILTER in DAX:

- CROSSFILTER(column1, column2, direction)

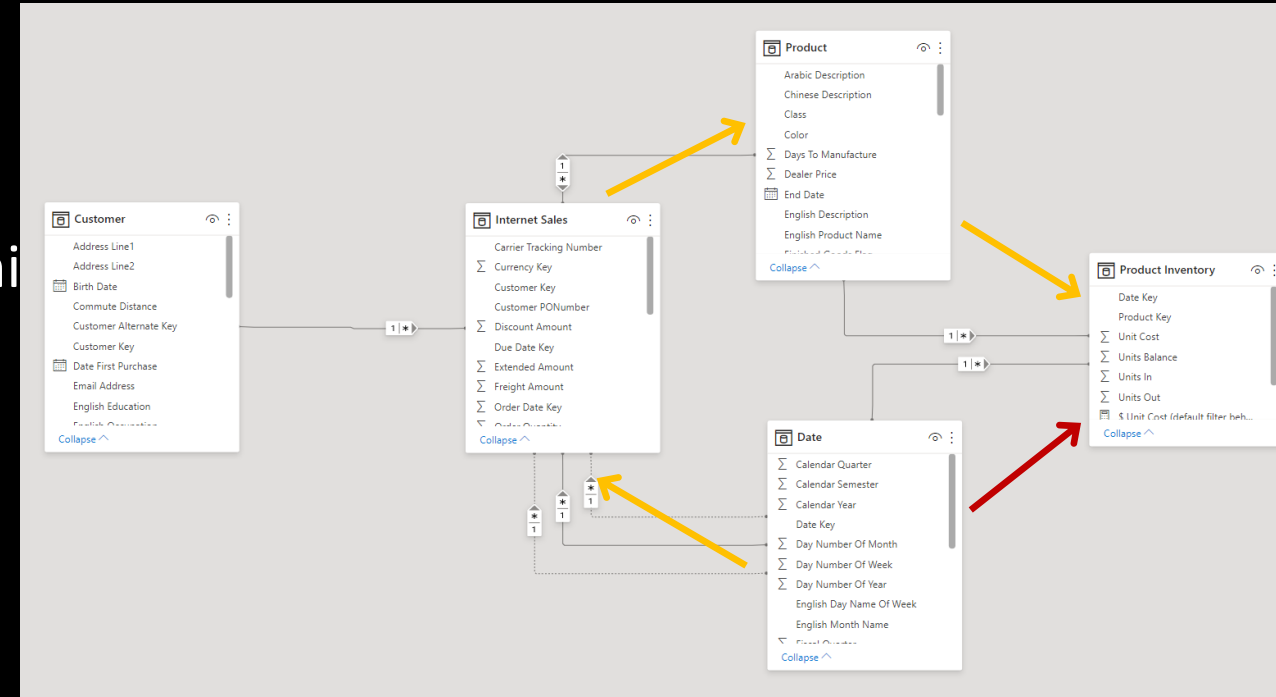Data-Marc.com

Relationships direction

Ambiguous data models

Two filter paths to the same table
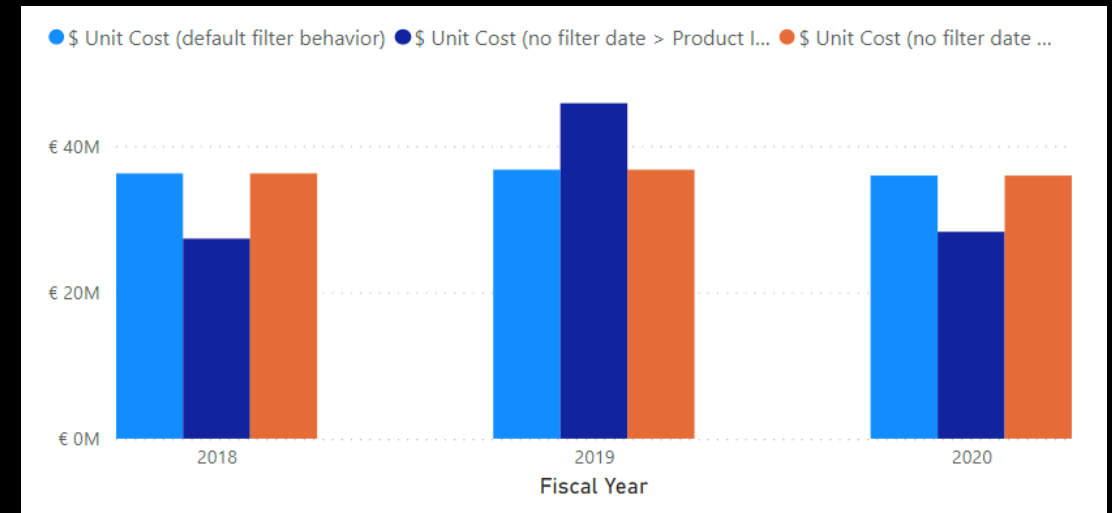
- Leads to unexpected results

Can happen with bi-directional relationshi

- Avoid bi-directional relationships
  as much as possible

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Ambiguous data models

- Can lead to unpredictable results
- Each of these measures calculates the same, but removes one of the relationships
- By using CROSSFILTER you can change relationships in a measure context

Fiscal Year	$ Unit Cost (default filter behavior)	$ Unit Cost (no filter date > Product Inventory)	$ Unit Cost (no filter date > Internet Sales)
2018	€ 36.244.707,62	€ 27.337.603,34	€ 36.244.707,62
2019	€ 36.758.094,11	€ 45.834.231,75	€ 36.758.094,11
2020	€ 35.954.533,19	€ 28.267.611,68	€ 35.954.533,19
Total	**€ 108.957.334,92**	**€ 108.957.334,92**	**€ 108.957.334,92**

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Ambiguous data models

Unexpected filter behavior

🔶 Result will be filtered by a subset of products as part of the Internet Sales (dark blue filter path)

🔶 Result will be filtered by a subset of dates (orange filter path)
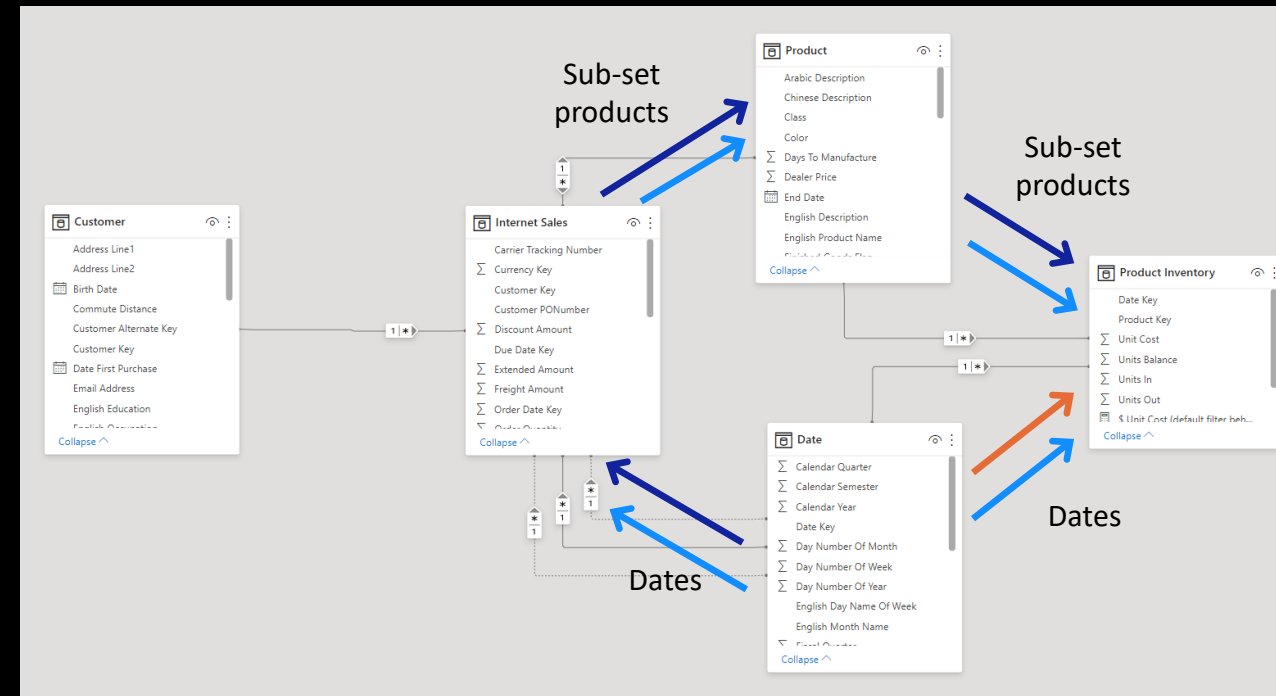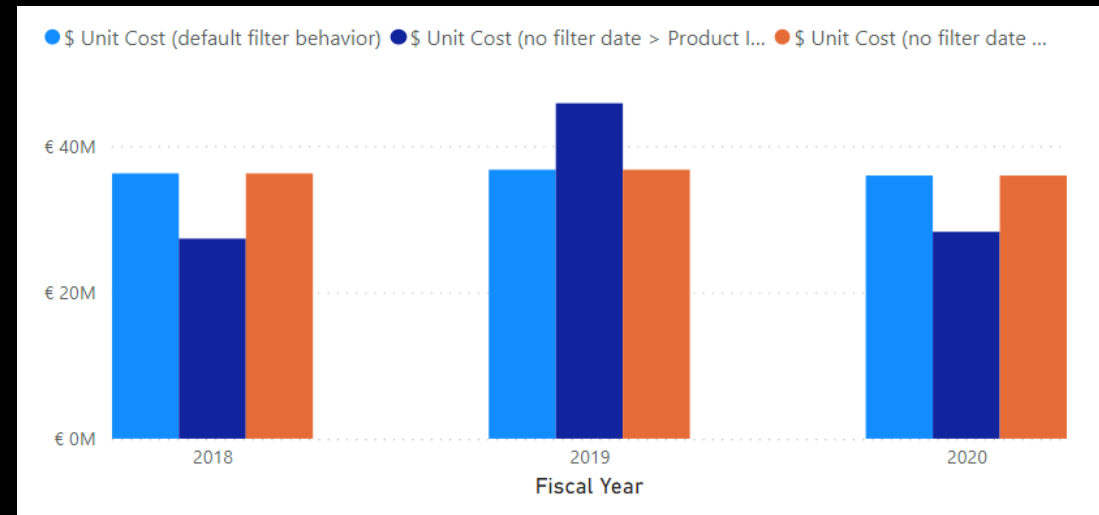
Demo – relationships direction

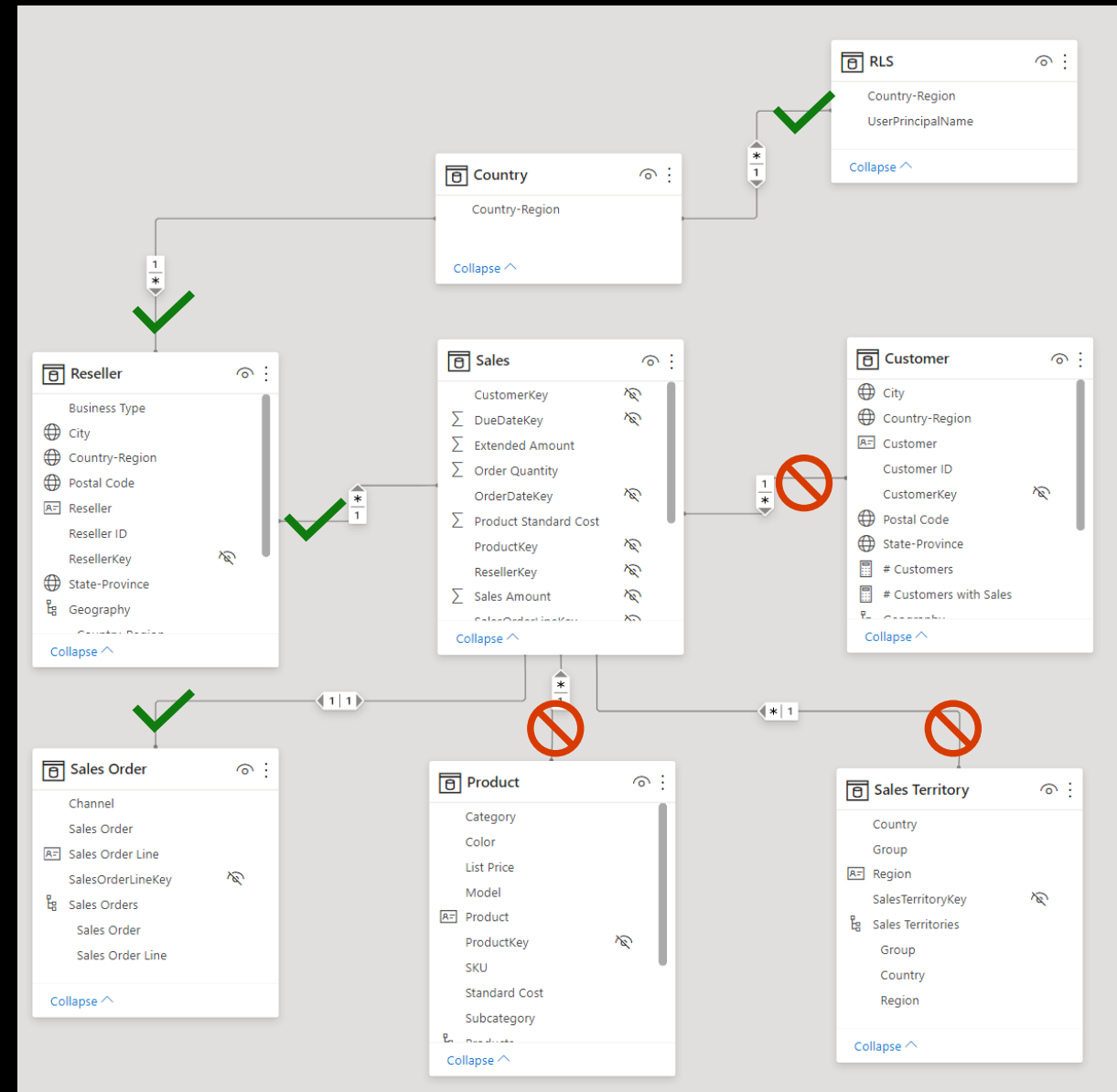Demo time!

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Relationships &
Row level security

Does not filter dimensional tables

- ![SQL] Except over 1:1 bi-directional relationships

- ![SQL] Possible when adding a RLS filter to each table individually

- ![SQL] Requires a specific setup regarding relationships

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Relationships & Row level security

Uses single directional filters by default

- 🟠 you can set 'Apply the Filter Direction when using Row Level security' on a bi-directional relationship to force RLS to use bi-directional filtering

- 🟠 Useful for dynamic row level security

Edit relationship

Select tables and columns that are related.

RLS

Country-Region	UserPrincipalName
Australia	user 1
Canada	user 2
Germany	user 3

Country

Country-Region
[Not Applicable]
Australia
Canada

Cardinality

Many to one (*:1)

Cross filter direction

Both

☑ Make this relationship active

☑ Apply security filter in both directions

☐ Assume referential integrity

OK   Cancel

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Demo – Row Level Security

Demo time!

Handle multiple fact tables

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Multiple fact tables

Multiple fact tables are common in real-life scenarios. Common scenarios:

Fact tables that you can append into one because they share common dimensions

Facts on different levels of granularity, different topics or that do not share common dimensions

Not sure what scenario you have? Use a mapping table.

	Currency	Customer	Due date	Employee	Order date	Product	Promotion	Reseller	Sales territory	Ship date
Internet sales	X	X	X	X	X	X	X	X	X	X
Reseller sales	X		X	X	X	X	X	X	X	X

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Multiple fact tables

	Currency	Customer	Due date	Employee	Order date	Product	Promotion	Reseller	Sales territory	Ship date
Internet sales	X	X	X		X	X	X		X	X
Reseller sales	X		X	X	X	X	X	X	X	X

If you decide to append these, you will get (blanks) when you use one of the unmatched columns

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Demo – Multiple fact tables

Demo
time!

Implementing Aggregations

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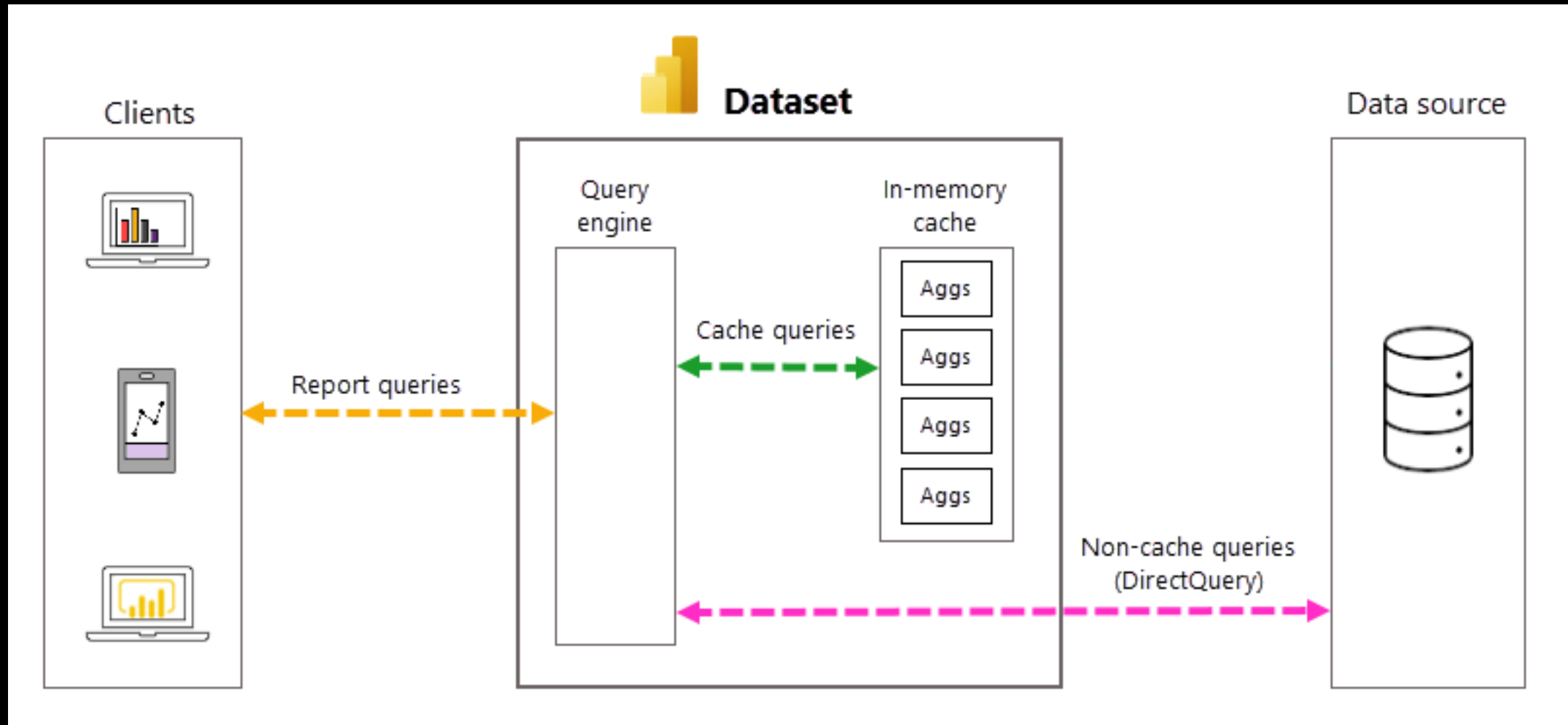
Aggregations

Benefits

🔶 Report visualizations are faster

🔶 Balanced architecture by combining Direct Query and Import storage modes

Store data at a higher level of granularity than the original table

The following aggregations are available:
count, groupby, max, min, sum, and count table rows

🔶 Aggregated data is stored in-memory (imported), details are accessed through DirectQuery

🔶 You can create the aggregated table in the
Data Transformations (Power Query) or in your source (preferred)

Aggregations

Aggregations & storage modes

- Aggregation, that hit based on relationships, require *regular* relationships.

  Regular relationships include the following storage mode combinations,
  where both tables are from a single source group:

Table on the many side	Table on the 1 side
Dual	Dual
Import	Import or Dual
DirectQuery	DirectQuery or Dual

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Relationships & storage modes

A model relationship is *limited* when there's no guaranteed "one" side. It can be the case for three reasons:

- The relationship uses a Many-to-many cardinality type (even if one or both columns contain unique values)

- The storage mode combination is Import and DirectQuery

- The relationship is cross source group

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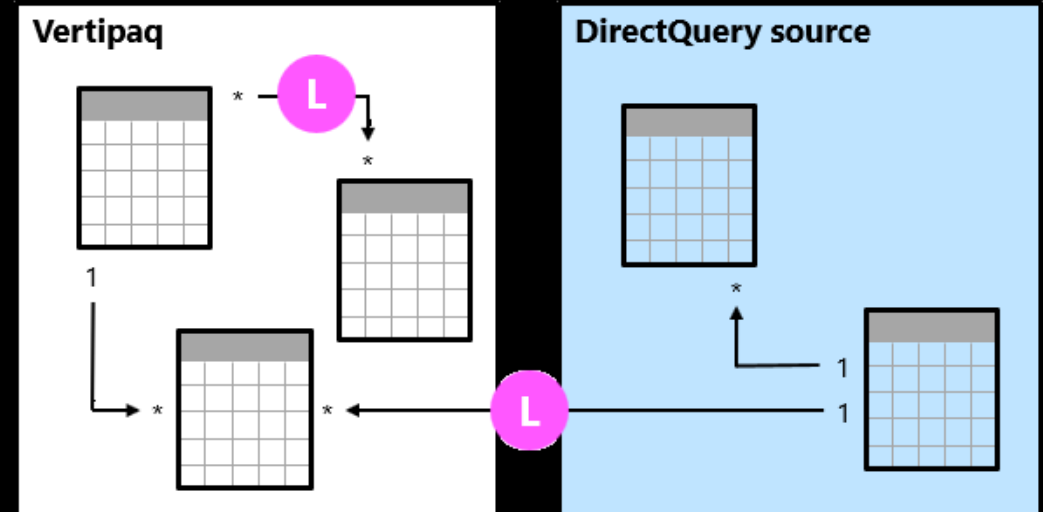
Impact of limited relationships
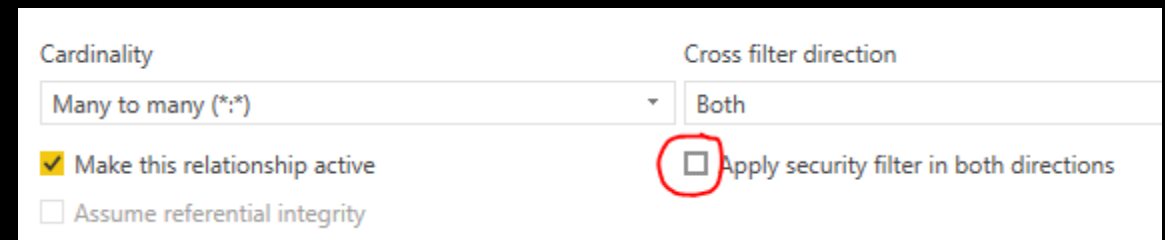
Cross source group relationships have performance implications.

Limited optimalization: joins are done on-demand for DirectQuery.

No blank rows: table joins are achieved by using INNER JOIN.

🔶 Blank rows are not added for referential integrity violations

Additional restrictions:

🔶 RELATED DAX function cannot be used to retrieve the 'one' side of the relationship

🔶 Enforcing RLS requires you to check the following checkbox

▶

Cardinality — Cross filter direction

Many to many (*:*) — Both

☑ Make this relationship active   ☐ Apply security filter in both directions

☐ Assume referential integrity

Demo – Aggregations
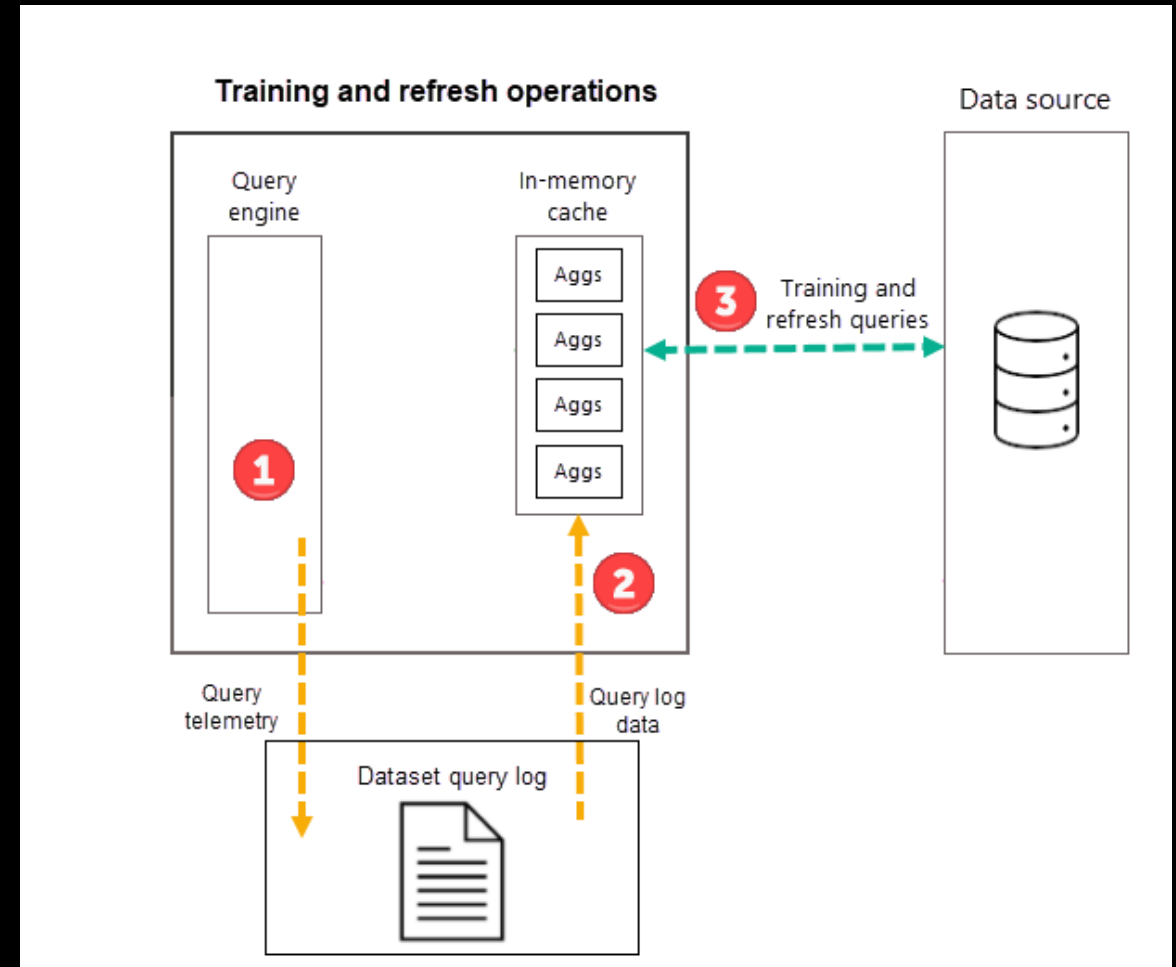
Demo time!

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Automatic Aggregations – Preview!

Power BI Premium per User, Premium Capacity and Embedded datasets

Automatic aggregations based on Query logs (7 days)

Supported sources during preview:

- Azure SQL Database

- Azure Synapse Dedicated SQL pool

- Google BigQuery

- Snowflake

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Wrap up

- Use a **star schema** or snowflake data model to get the best out of Power BI.

- Be careful leveraging **bi-directional** relationships

- Avoid **ambiguous** data models

- Consider leveraging **aggregations** to help analysis of big data

- Be prepared to deal with **multiple fact tables**

Resources

- **Learning path: Model data in Power BI:**
  https://aka.ms/DataModelingLearningPath

- **Learning path: Use DAX in Power BI Desktop:**
  https://aka.ms/DAXLearningPath

- **Aggregations in Power BI Desktop:**
  https://aka.ms/PowerBIDesktopAggregations

- **DAX function: CROSSFILTER:**
  https://aka.ms/DAXCrossfilter

- **Model relationships in Power BI Desktop:**
  https://aka.ms/ModelRelationships

- **Whitepaper: Bidirectional cross-filtering for Power BI Desktop:**
  https://aka.ms/BidirectionalCrossFilteringWhitepaper

- **AdventureWorks 2020 demo dataset:**
  https://aka.ms/AW2020Dataset

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Want to review all this content?

Webinar Series: Mastering Data Modeling with Power BI

Episode 1 - Data Modeling 101: Increasing the Impact of Power BI

by Jeroen ter Heerdt and Marc Lelijveld

Watch now ⬀

Webinar Series: Mastering Data Modeling with Power BI Episode 2 - Learn Advanced Data Modeling with Power BI

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Webinar Series: Mastering Data Modeling with Power BI

Episode 3 - Data Modeling for Experts with Power BI

by Jeroen ter Heerdt and Marc Lelijveld

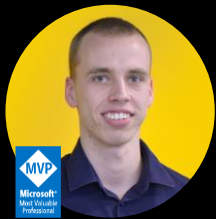Register to watch on September 8th, 2021 10AM – 11AM Pacific Time ⬀

Find them all here: https://docs.microsoft.com/en-us/power-bi/fundamentals/webinars
or: aka.ms/DataModelingWebinarEpisode{1/2/3}

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Thanks for attending!

Please provide me some feedback...

https://sqlb.it/?6994

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