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Relationships in DAX

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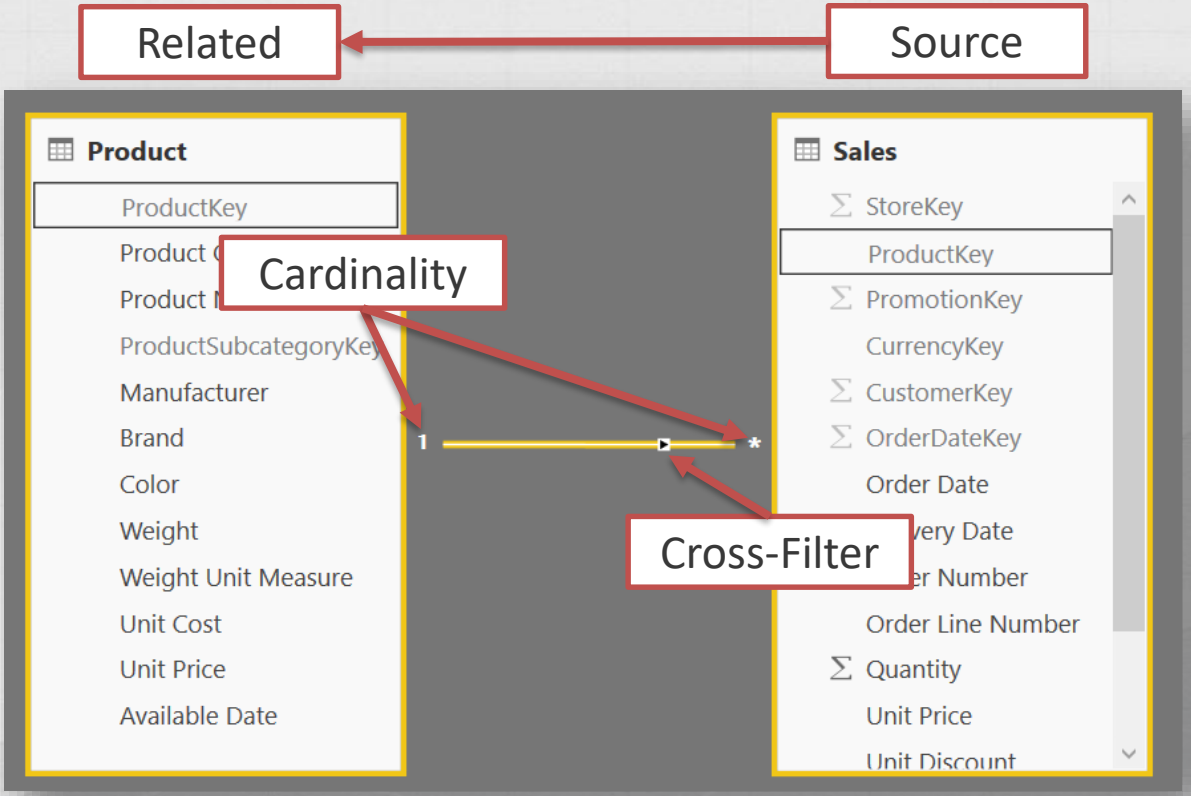
Agenda

- Basic concepts about relationships
- Invalid relationships and the blank row
- Bidirectional filtering and ambiguity
- Circular dependencies
- Weak relationships and computing at the correct granularity
- Take-away: *do not use features that you do not totally master*

Relationships 101



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Cardinality

- One
  - Column needs unique values
  - Target of table expansion
  - Source for filter context propagation
- Many
  - Column may contain duplicates
  - Source of table expansion
  - Target for filter context propagation

Cross-filter direction

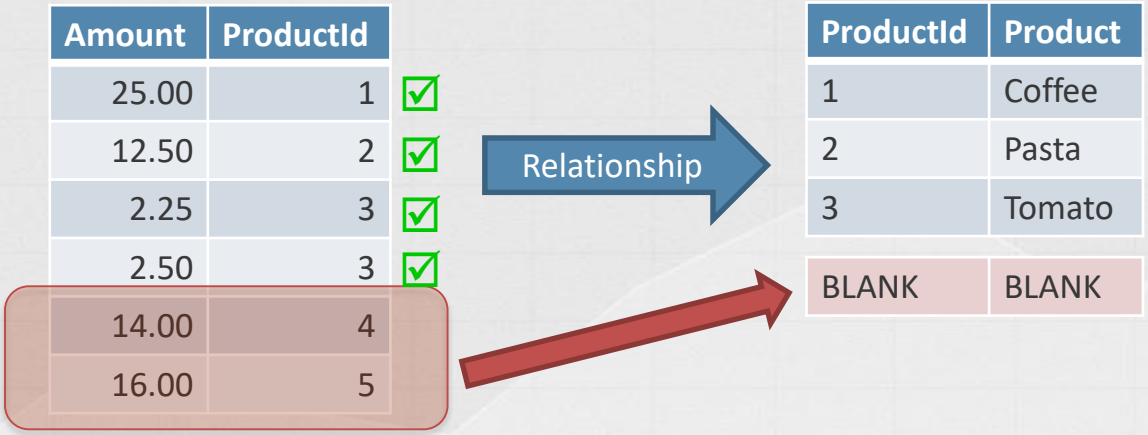
- Single
  - Filter context propagates from the one side to the many side
  - Default behavior
  - Safe, fast, convenient
- Both
  - Filter context propagates in both directions
  - Need to be activated
  - Unsafe, slow, extremely dangerous

Types of relationships

- One-to-many
  - The most common type of relationship
- One-to-one
  - Quite uncommon
  - Expansion goes both ways
  - Cross-filter need to be both
- Weak relationships (many-to-many cross-filter)
  - New and dangerous
  - No expansion
  - Need to decide the cross-filter direction

Blank rows

The additional blank row



Tables with an incoming relationship might contain an additional blank row, created by DAX to guarantee referential integrity

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Counting values

- DISTINCT / VALUES
  - DISTINCT does not return the blank row
  - VALUES returns the blank row
- ALL / ALLNOBLANKROW
  - ALLONOBLANKROW does not return the blank row
  - ALL returns the blank row
- Need to use the right function, depending on the need
- Using the wrong one, simply results in wrong figures

Iterating, might be harder than expected

Does this iteration take into account the blank row, or not?
What is the average sales of the blank row?

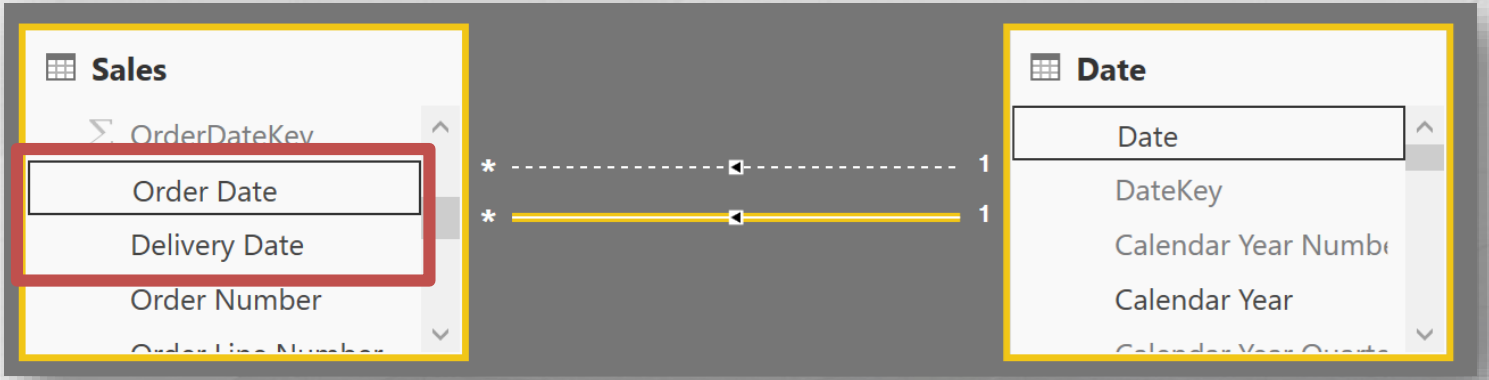
```
Avg Sales :=

AVERAGEX (
    Product,
    [Sales Amount]
)
```

Ambiguity

Ambiguity

- Multiple paths between any two tables
- DAX does not work on ambiguous models
- Therefore, one of the relationships is deactivated

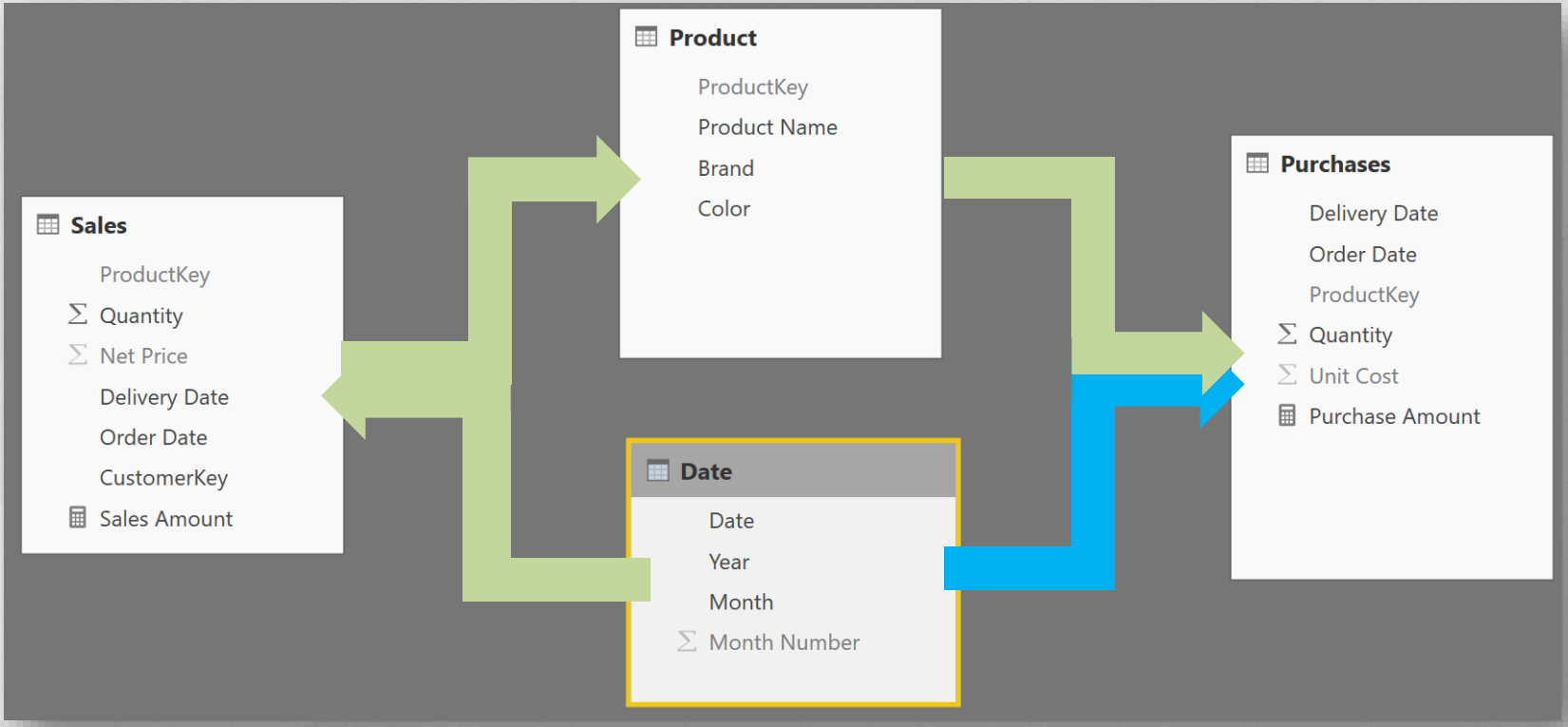


Ambiguity and bidirectional cross-filter

- Do you love bidirectional relationship? Better not

- Bidirectional cross-filter increases the chances of ambiguity
- Filter propagation always goes both ways
- Therefore, the complexity increases on every relationship

Is this an ambiguous model?



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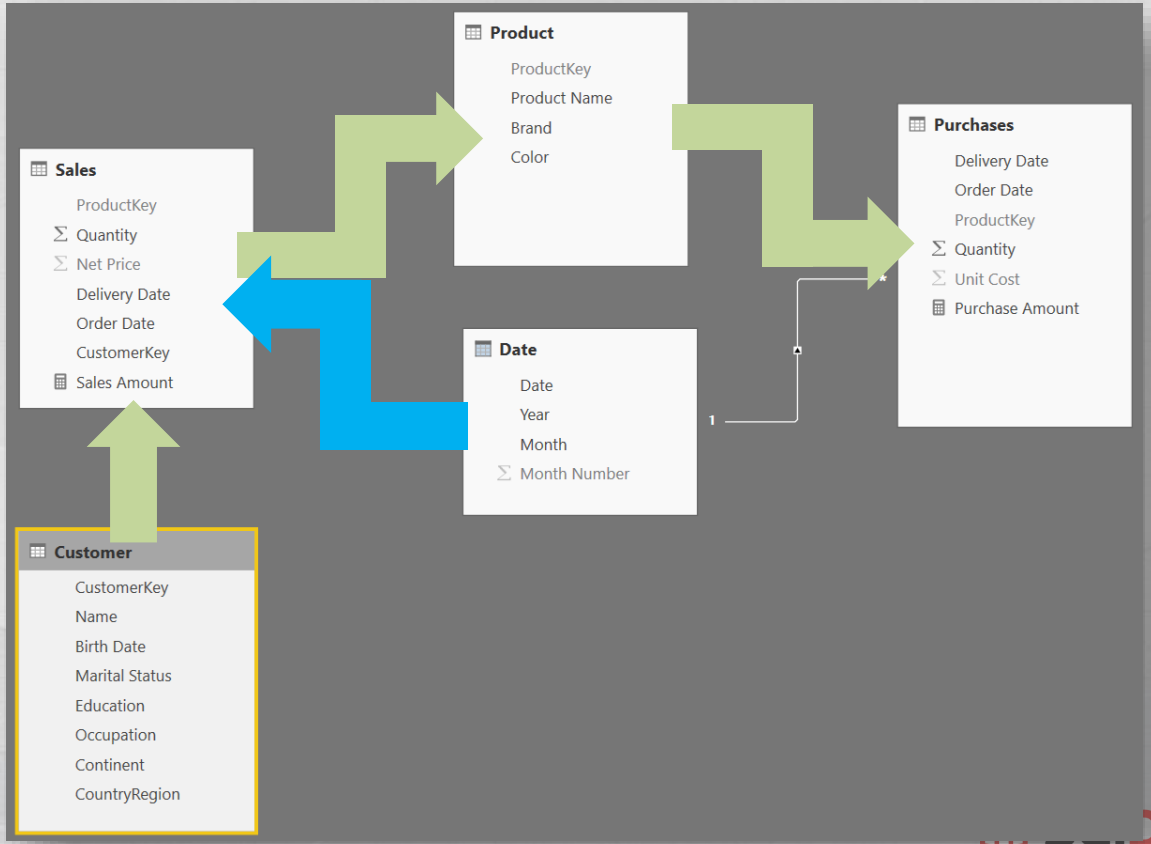
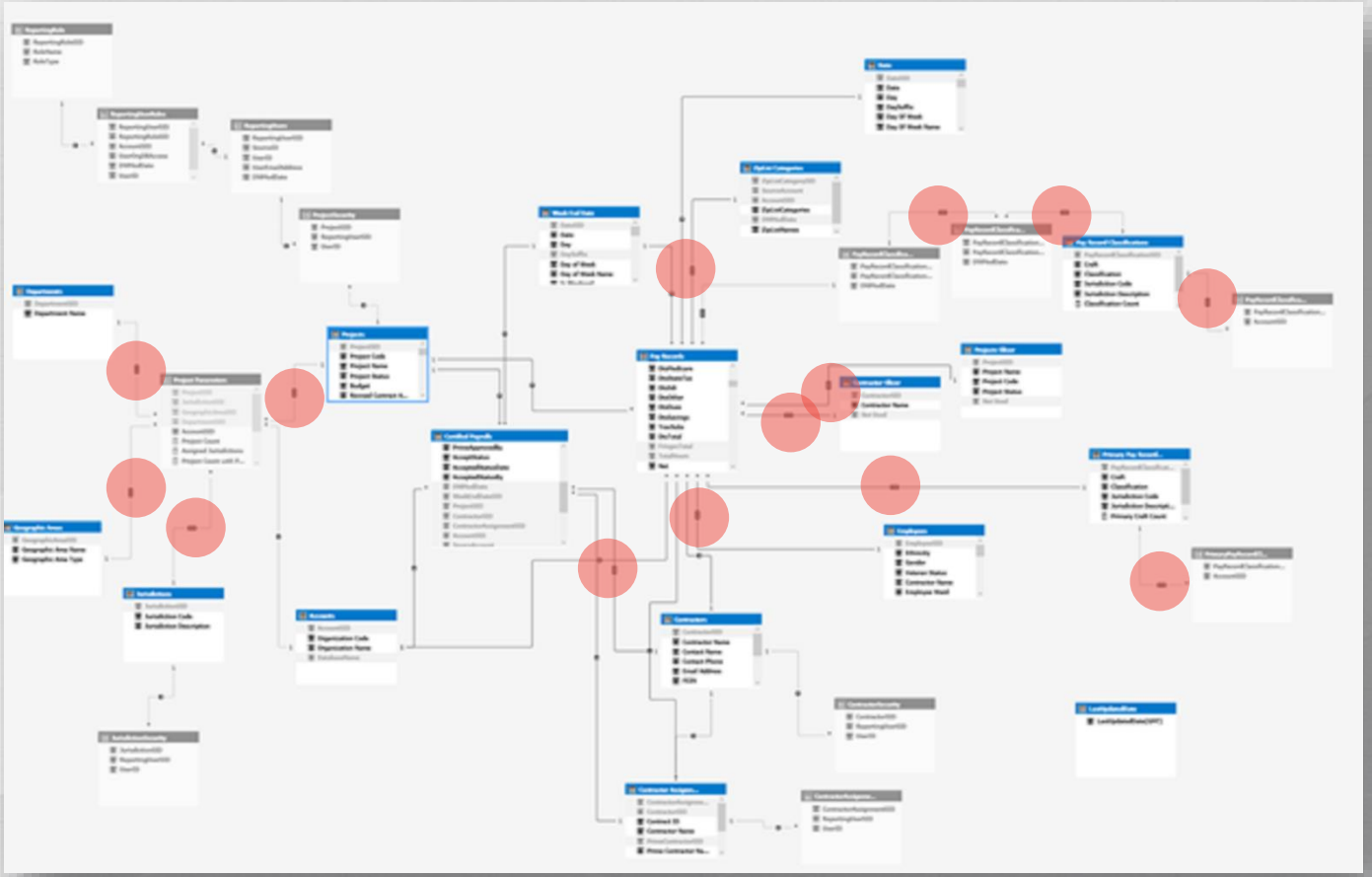
Things are more complex in a larger model

Few questions:

- Does Date filter Sales?
- Does Customer filter Purchases?
- Does Date filter Purchases?
- Which subset of sales is actually filtering Purchases?



What about a real model?



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Never work with an ambiguous model

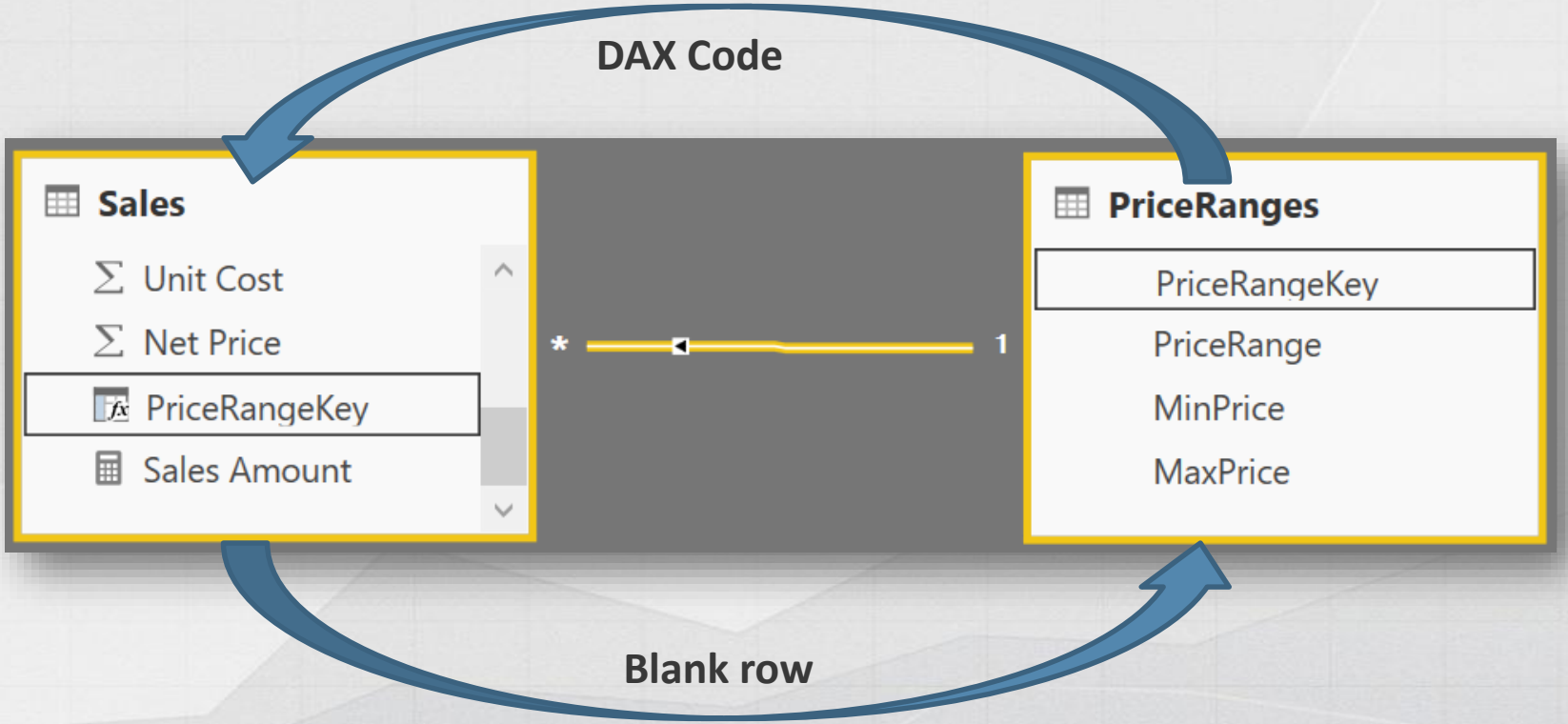
- Ambiguity is not always evident
  - The engine might consider as non-ambiguous a model that is ambiguous
  - The disambiguation rules have never been published
  - Adding a table might completely change the relationships setup
- Bidirectional cross-filter is the major culprit
  - Don’t use it just “because it looks nicer to the user”
  - Wrong values are quite never nice

Dependencies

Calculated relationships

- Relationships can be created on calculated columns
  - Performance-wise, there are no issues
  - Model-wise: they are extremely powerful tools
  - Good chances of creating circular dependencies
- Circular dependencies appear because of the blank row

Circular dependencies



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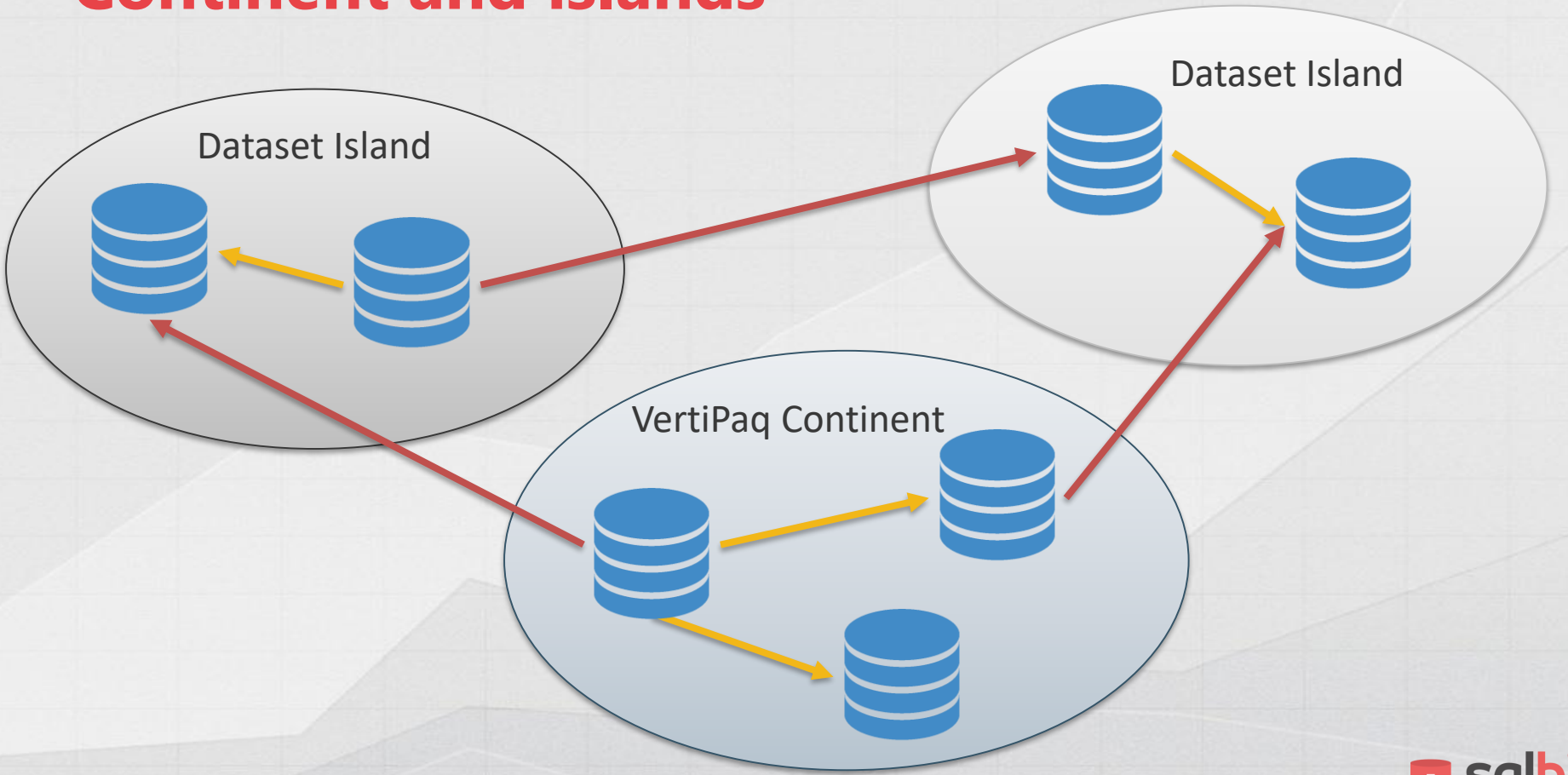
Main sources of circular dependencies

- Using ALL instead of ALLNOBLANKROW
- Using VALUES instead of DISTINCT
- Context transition happening
- Filters in CALCULATE

- Same considerations if you use calculated tables

Weak relationships

Continent and islands



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Weak relationships

- Both sides of a relationship can be the many side
  - They are not many-to-many relationships
  - They are relationships at different granularities
- Useful if the column is not a key in both tables
  - Otherwise, a regular strong 1:M relationship works well
- Mandatory, for cross-island relationships
- Need to choose the cross-filter direction
  - Bidirectional, A filters B, B filters A
- Table expansion does not happen, blank row is not enforced

Weak: no expansion, no blank row

Slice by Product[Brand]

Brand	Budget
Adventure Works	4,985,172.00
Contoso	7,127,903.00
Fabrikam	8,667,819.00
Litware	4,284,028.00
Northwind Traders	911,918.00
Proseware	3,192,659.00
Southridge Video	1,643,555.00
Tailspin Toys	600,524.00
The Phone Company	2,233,721.00
Wide World Importers	3,579,429.00
Total	**39,004,512.00**

Slice by Budget[Brand]

Brand	Budget
A. Datum	1,777,784.00
Adventure Works	4,985,172.00
Contoso	7,127,903.00
Fabrikam	8,667,819.00
Litware	4,284,028.00
Northwind Traders	911,918.00
Proseware	3,192,659.00
Southridge Video	1,643,555.00
Tailspin Toys	600,524.00
The Phone Company	2,233,721.00
Wide World Importers	3,579,429.00
Total	**39,004,512.00**

Relationship cardinality

- Weak relationship transfer filters at their cardinality
  - They do not use the table cardinality
  - Browsing with other attributes leads to complex numbers

Category	Budget
Audio	11,619,250.00
Cameras and camcorders	15,795,722.00
Cell phones	9,361,624.00
Computers	29,196,537.00
Games and Toys	2,244,079.00
Home Appliances	32,748,928.00
Music, Movies and Audio Books	8,771,458.00
TV and Video	18,040,658.00
Total	**39,004,512.00**

The value shown is the budget of any brand that contains at least one product of the selected category

In short: it does not make sense

Conclusions

- Standard (strong) 1:M relationships are fast and safe
- Bidirectional cross-filter is dangerous
  - Performance issues
  - Ambiguity, might be very well hidden
- Weak relationships are even more dangerous
  - No blank row
  - No table expansion
  - Filter moved at the key granularity
- **All powerful features**
- **Don’t use all of them until you completely master them**

Thank you!

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