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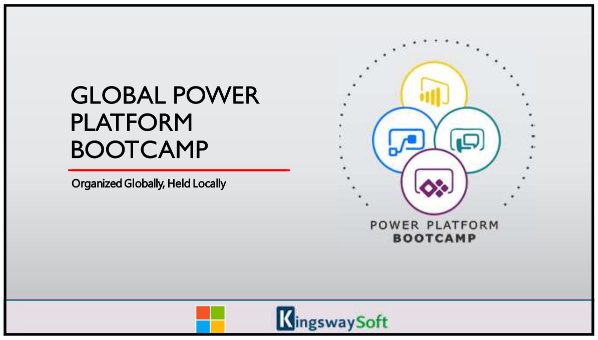

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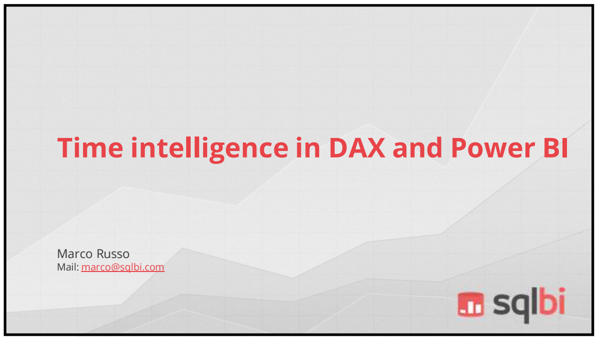

Time intelligence in DAX and Power BI

Marco Russo
Mail: marco@sqlbi.com

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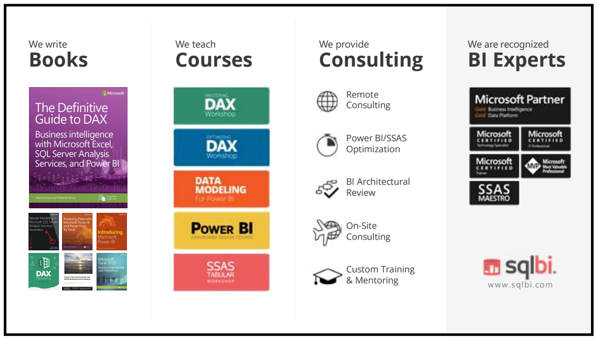

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Agenda

- Power BI and dates
- Building a Date table
- Aggregating over time
- Comparison over time
- Custom calendars

Slides and demo

https://sql.bi/651969

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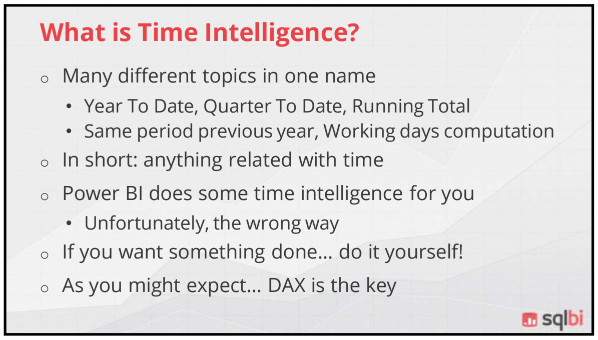

What is Time Intelligence?

- Many different topics in one name
  - Year To Date, Quarter To Date, Running Total
  - Same period previous year, Working days computation
- In short: anything related with time
- Power BI does some time intelligence for you
  - Unfortunately, the wrong way
- If you want something done… do it yourself!
- As you might expect… DAX is the key

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Power BI knows how to slice by date… well, almost.

Power BI and dates

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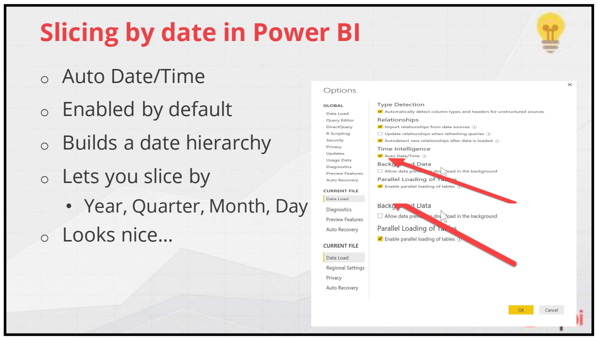

Slicing by date in Power BI

- Auto Date/Time
- Enabled by default
- Builds a date hierarchy
- Lets you slice by
  - Year, Quarter, Month, Day
- Looks nice…

Options

GLOBAL
Data Load
Query Editor
DirectQuery
R Scripting
Security
Privacy
Updates
Usage Data
Diagnostics
Preview Features
Auto Recovery

CURRENT FILE
Data Load
Diagnostics
Preview Features
Auto Recovery

Type Detection
☑ Automatically detect column types and headers for unstructured sources

Relationships
☑ Import relationships from data sources
□ Update relationships when refreshing queries
☑ Autodetect new relationships after data is loaded

Time Intelligence
☑ Auto Date/Time

Background Data
□ Allow data preview to download in the background

Parallel Loading of Tables
☑ Enable parallel loading of tables

Background Data
□ Allow data preview to download in the background

Parallel Loading of Tables
☑ Enable parallel loading of tables

CURRENT FILE
Data Load
Regional Settings
Privacy
Auto Recovery

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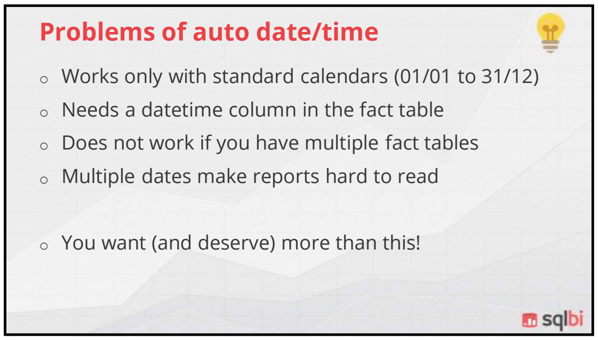

Problems of auto date/time

- Works only with standard calendars (01/01 to 31/12)
- Needs a datetime column in the fact table
- Does not work if you have multiple fact tables
- Multiple dates make reports hard to read
- You want (and deserve) more than this!

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Probably the most important table in your model

Building a Date Table

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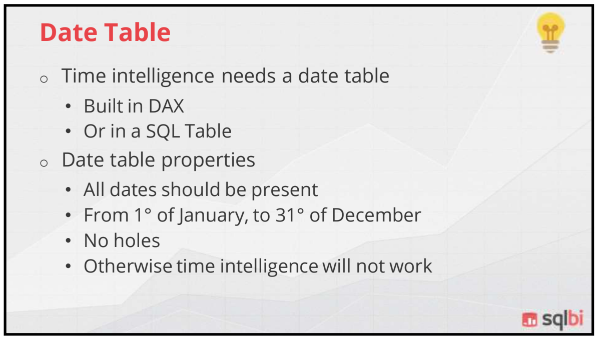

Date Table

- Time intelligence needs a date table
  - Built in DAX
  - Or in a SQL Table
- Date table properties
  - All dates should be present
  - From 1° of January, to 31° of December
  - No holes
  - Otherwise time intelligence will not work

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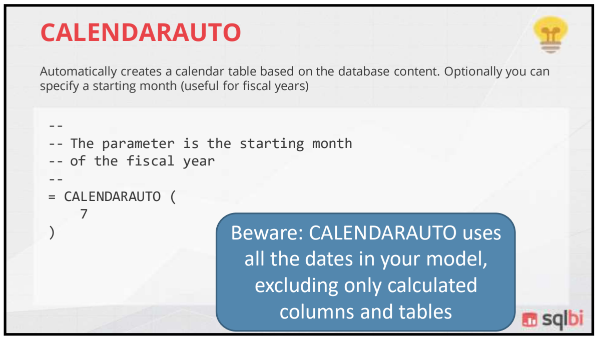

CALENDARAUTO

Automatically creates a calendar table based on the database content. Optionally you can specify a starting month (useful for fiscal years)

```
--
-- The parameter is the starting month
-- of the fiscal year
--
= CALENDARAUTO (
    7
)
```

Beware: CALENDARAUTO uses all the dates in your model, excluding only calculated columns and tables

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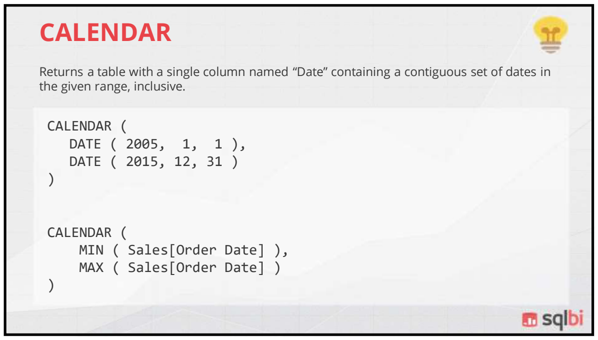

CALENDAR

Returns a table with a single column named "Date" containing a contiguous set of dates in the given range, inclusive.

```
CALENDAR (
   DATE ( 2005,  1,  1 ),
   DATE ( 2015, 12, 31 )
)


CALENDAR (
    MIN ( Sales[Order Date] ),
    MAX ( Sales[Order Date] )
)
```

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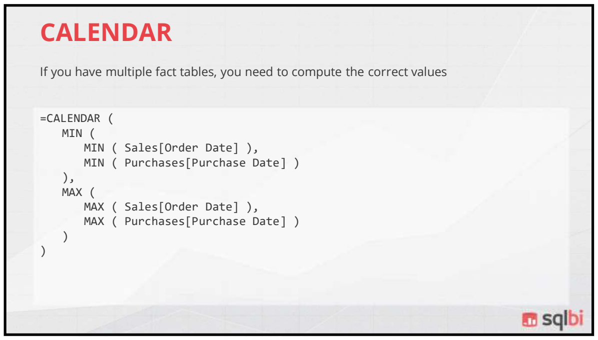

CALENDAR

If you have multiple fact tables, you need to compute the correct values

```
=CALENDAR (
    MIN (
        MIN ( Sales[Order Date] ),
        MIN ( Purchases[Purchase Date] )
    ),
    MAX (
        MAX ( Sales[Order Date] ),
        MAX ( Purchases[Purchase Date] )
    )
)
```

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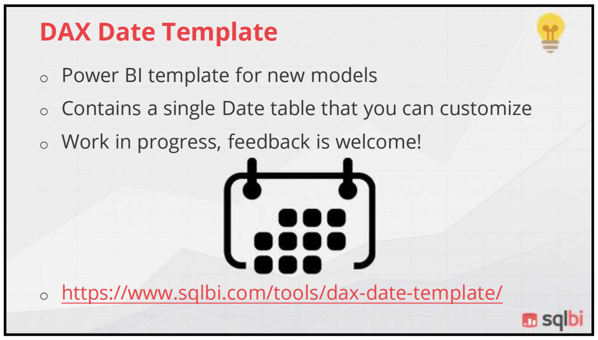

DAX Date Template

- Power BI template for new models
- Contains a single Date table that you can customize
- Work in progress, feedback is welcome!
- https://www.sqlbi.com/tools/dax-date-template/

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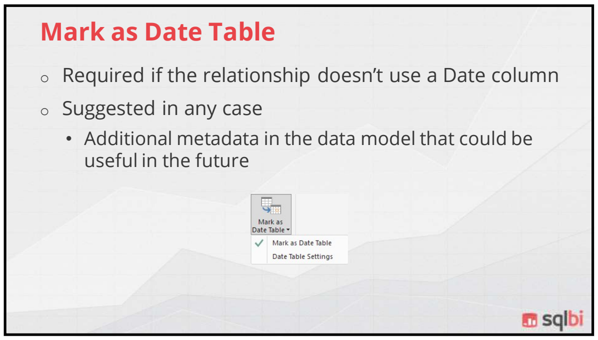

Mark as Date Table

- Required if the relationship doesn't use a Date column
- Suggested in any case
  - Additional metadata in the data model that could be useful in the future

Mark as Date Table
Mark as Date Table
Date Table Settings

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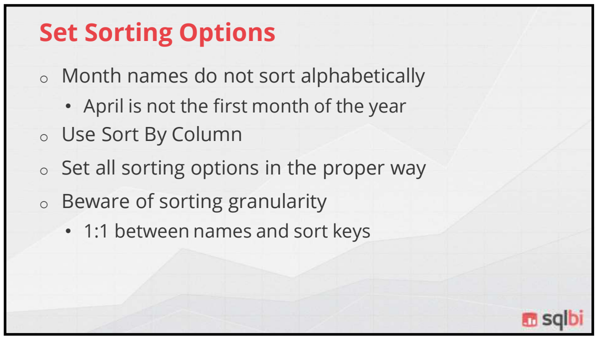

Set Sorting Options

- Month names do not sort alphabetically
  - April is not the first month of the year
- Use Sort By Column
- Set all sorting options in the proper way
- Beware of sorting granularity
  - 1:1 between names and sort keys

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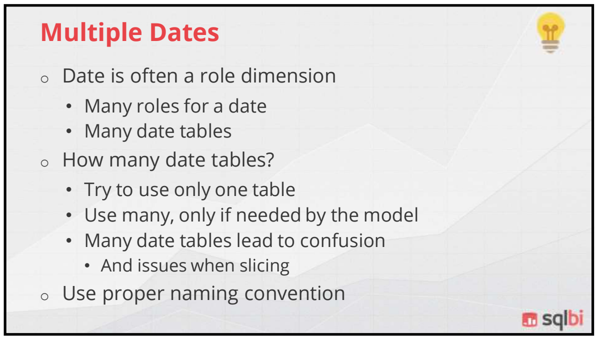

Multiple Dates

- Date is often a role dimension
  - Many roles for a date
  - Many date tables
- How many date tables?
  - Try to use only one table
  - Use many, only if needed by the model
  - Many date tables lead to confusion
    - And issues when slicing
- Use proper naming convention

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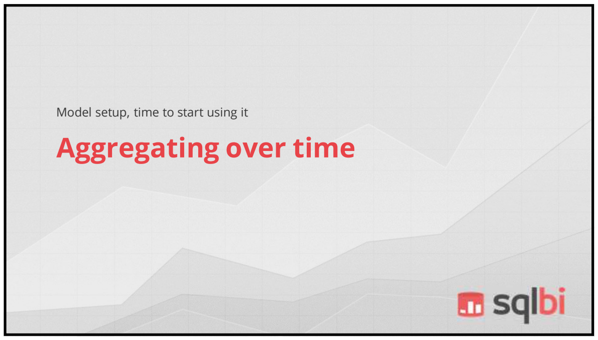

Model setup, time to start using it

Aggregating over time

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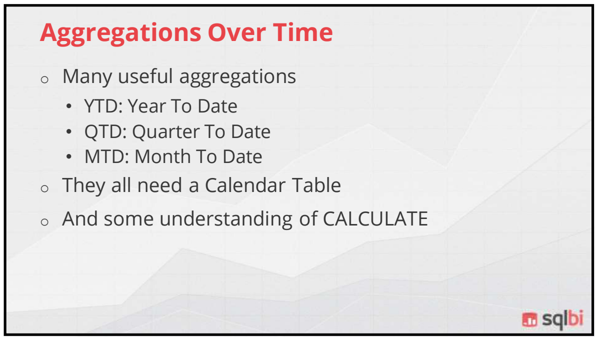

Aggregations Over Time

- Many useful aggregations
  - YTD: Year To Date
  - QTD: Quarter To Date
  - MTD: Month To Date
- They all need a Calendar Table
- And some understanding of CALCULATE

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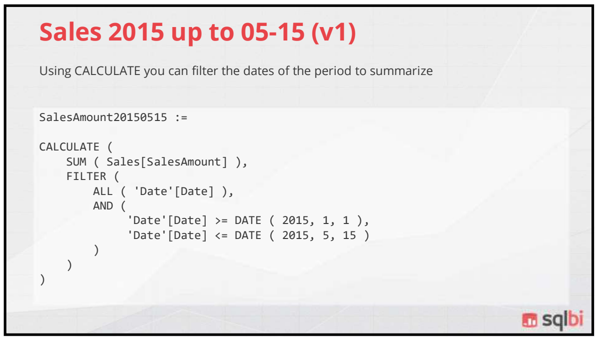

Sales 2015 up to 05-15 (v1)

Using CALCULATE you can filter the dates of the period to summarize

```
SalesAmount20150515 :=

CALCULATE (
    SUM ( Sales[SalesAmount] ),
    FILTER (
        ALL ( 'Date'[Date] ),
        AND (
             'Date'[Date] >= DATE ( 2015, 1, 1 ),
             'Date'[Date] <= DATE ( 2015, 5, 15 )
        )
    )
)
```

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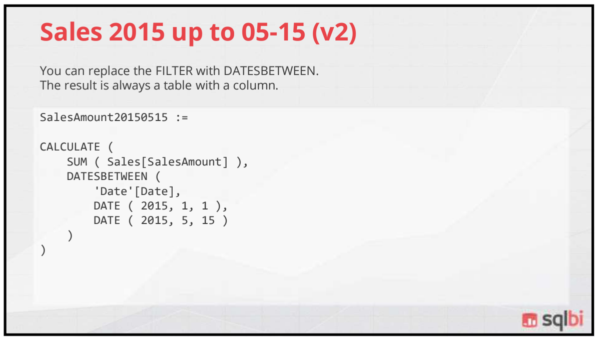

Sales 2015 up to 05-15 (v2)

You can replace the FILTER with DATESBETWEEN.
The result is always a table with a column.

```
SalesAmount20150515 :=

CALCULATE (
    SUM ( Sales[SalesAmount] ),
    DATESBETWEEN (
        'Date'[Date],
        DATE ( 2015, 1, 1 ),
        DATE ( 2015, 5, 15 )
    )
)
```

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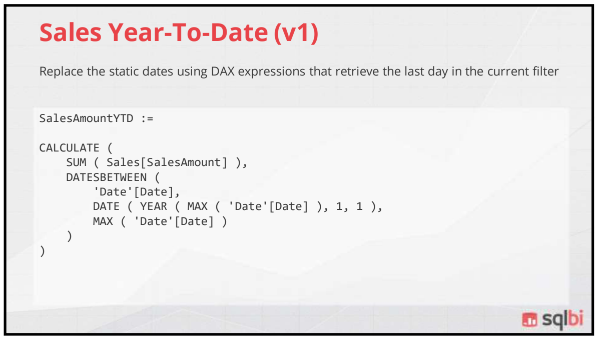

Sales Year-To-Date (v1)

Replace the static dates using DAX expressions that retrieve the last day in the current filter

```
SalesAmountYTD :=

CALCULATE (
    SUM ( Sales[SalesAmount] ),
    DATESBETWEEN (
        'Date'[Date],
        DATE ( YEAR ( MAX ( 'Date'[Date] ), 1, 1 ),
        MAX ( 'Date'[Date] )
    )
)
```

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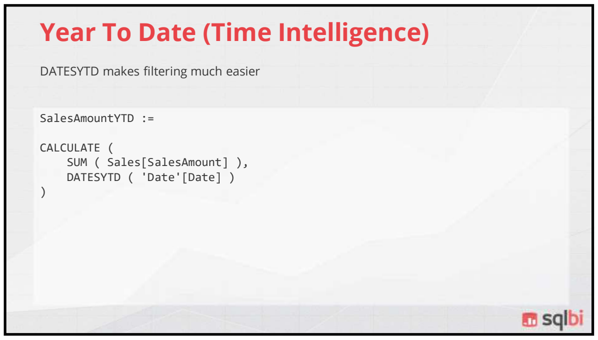

Year To Date (Time Intelligence)

DATESYTD makes filtering much easier

```
SalesAmountYTD :=

CALCULATE (
    SUM ( Sales[SalesAmount] ),
    DATESYTD ( 'Date'[Date] )
)
```

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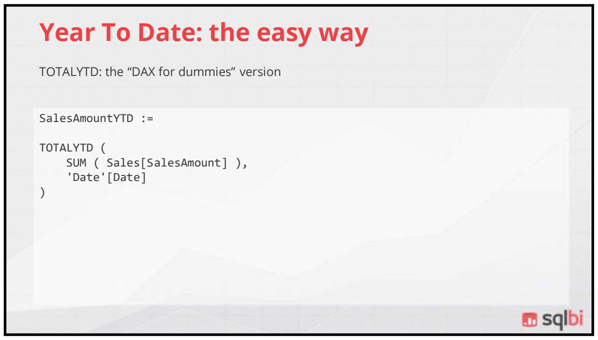

Year To Date: the easy way

TOTALYTD: the “DAX for dummies” version

```
SalesAmountYTD :=

TOTALYTD (
    SUM ( Sales[SalesAmount] ),
    'Date'[Date]
)
```

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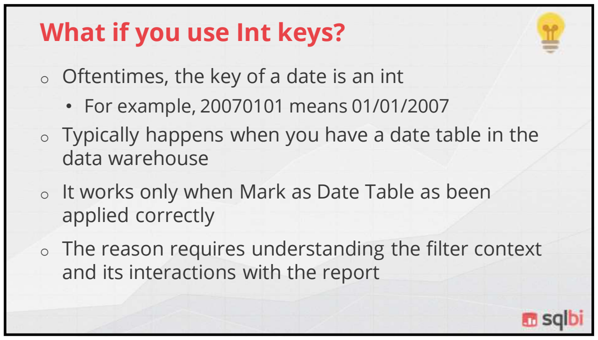

What if you use Int keys?

- Oftentimes, the key of a date is an int
  - For example, 20070101 means 01/01/2007
- Typically happens when you have a date table in the data warehouse
- It works only when Mark as Date Table as been applied correctly
- The reason requires understanding the filter context and its interactions with the report

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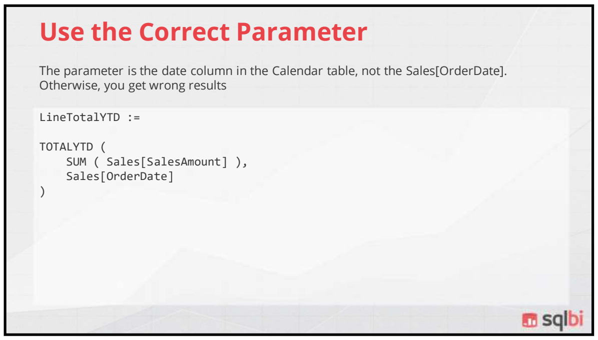

Use the Correct Parameter

The parameter is the date column in the Calendar table, not the Sales[OrderDate]. Otherwise, you get wrong results

```
LineTotalYTD :=

TOTALYTD (
    SUM ( Sales[SalesAmount] ),
    Sales[OrderDate]
)
```

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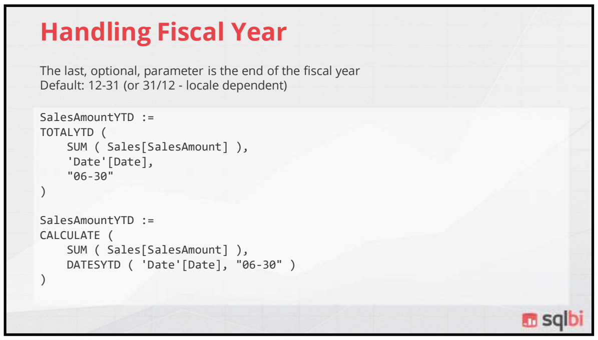

Handling Fiscal Year

The last, optional, parameter is the end of the fiscal year
Default: 12-31 (or 31/12 - locale dependent)

```
SalesAmountYTD :=
TOTALYTD (
    SUM ( Sales[SalesAmount] ),
    'Date'[Date],
    "06-30"
)

SalesAmountYTD :=
CALCULATE (
    SUM ( Sales[SalesAmount] ),
    DATESYTD ( 'Date'[Date], "06-30" )
)
```

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Another type of Time Intelligence calculation

Comparison over time

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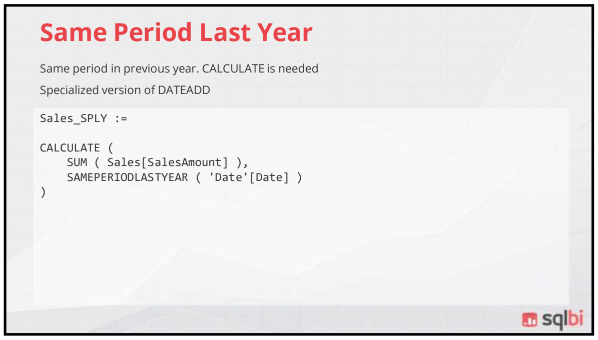

Same Period Last Year

Same period in previous year. CALCULATE is needed

Specialized version of DATEADD

```
Sales_SPLY :=

CALCULATE (
    SUM ( Sales[SalesAmount] ),
    SAMEPERIODLASTYEAR ( 'Date'[Date] )
)
```

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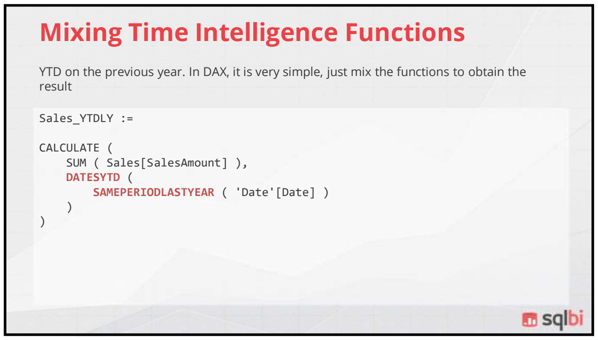

Mixing Time Intelligence Functions

YTD on the previous year. In DAX, it is very simple, just mix the functions to obtain the result

```
Sales_YTDLY :=

CALCULATE (
    SUM ( Sales[SalesAmount] ),
    DATESYTD (
        SAMEPERIODLASTYEAR ( 'Date'[Date] )
    )
)
```

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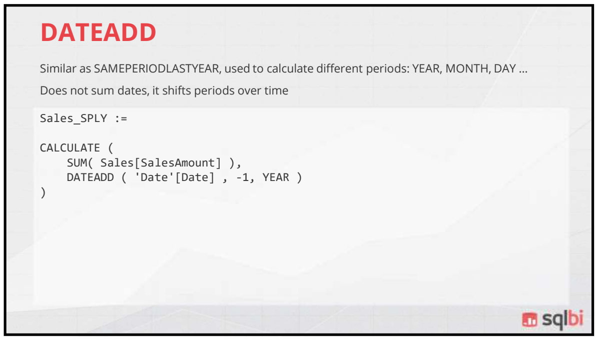

DATEADD

Similar as SAMEPERIODLASTYEAR, used to calculate different periods: YEAR, MONTH, DAY …

Does not sum dates, it shifts periods over time

```
Sales_SPLY :=

CALCULATE (
    SUM( Sales[SalesAmount] ),
    DATEADD ( 'Date'[Date] , -1, YEAR )
)
```

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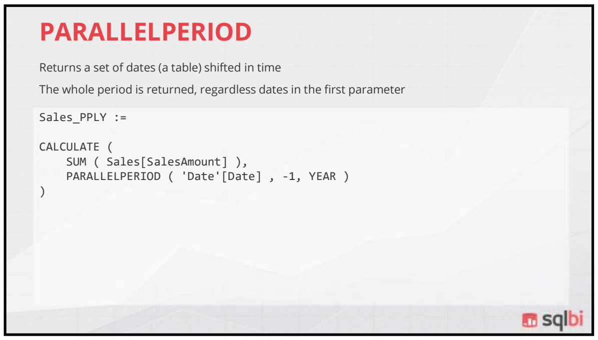

PARALLELPERIOD

Returns a set of dates (a table) shifted in time

The whole period is returned, regardless dates in the first parameter

```
Sales_PPLY :=

CALCULATE (
    SUM ( Sales[SalesAmount] ),
    PARALLELPERIOD ( 'Date'[Date] , -1, YEAR )
)
```

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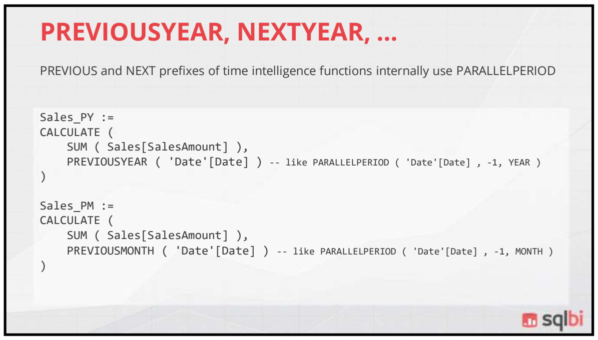

PREVIOUSYEAR, NEXTYEAR, …

PREVIOUS and NEXT prefixes of time intelligence functions internally use PARALLELPERIOD

```
Sales_PY :=
CALCULATE (
    SUM ( Sales[SalesAmount] ),
    PREVIOUSYEAR ( 'Date'[Date] ) -- like PARALLELPERIOD ( 'Date'[Date] , -1, YEAR )
)

Sales_PM :=
CALCULATE (
    SUM ( Sales[SalesAmount] ),
    PREVIOUSMONTH ( 'Date'[Date] ) -- like PARALLELPERIOD ( 'Date'[Date] , -1, MONTH )
)
```

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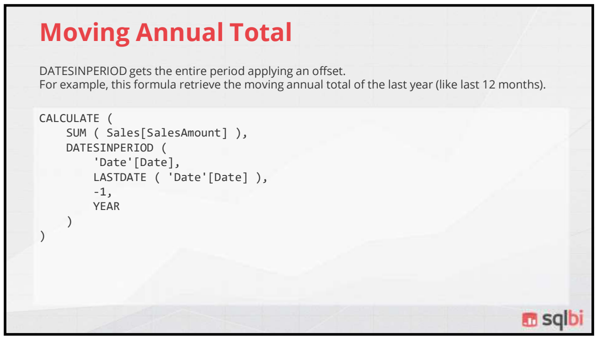

Moving Annual Total

DATESINPERIOD gets the entire period applying an offset.
For example, this formula retrieve the moving annual total of the last year (like last 12 months).

```
CALCULATE (
    SUM ( Sales[SalesAmount] ),
    DATESINPERIOD (
        'Date'[Date],
        LASTDATE ( 'Date'[Date] ),
        -1,
        YEAR
    )
)
```

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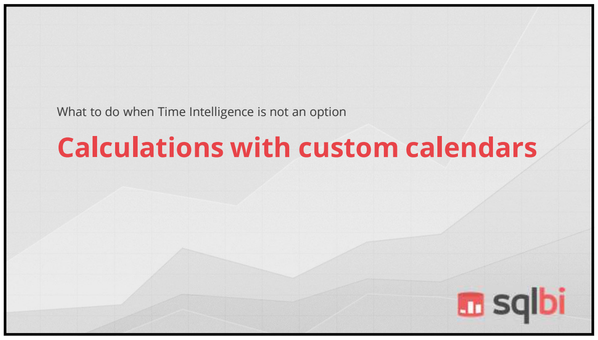

What to do when Time Intelligence is not an option

Calculations with custom calendars

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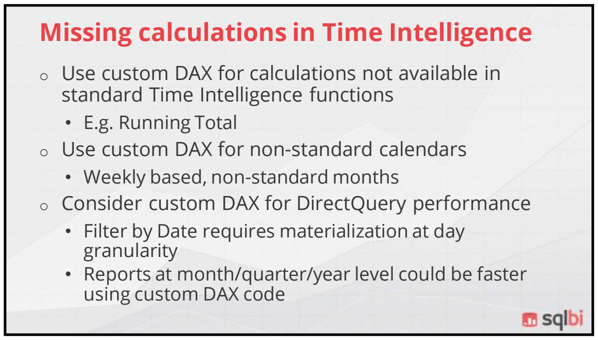

Missing calculations in Time Intelligence

- Use custom DAX for calculations not available in standard Time Intelligence functions
  - E.g. Running Total
- Use custom DAX for non-standard calendars
  - Weekly based, non-standard months
- Consider custom DAX for DirectQuery performance
  - Filter by Date requires materialization at day granularity
  - Reports at month/quarter/year level could be faster using custom DAX code

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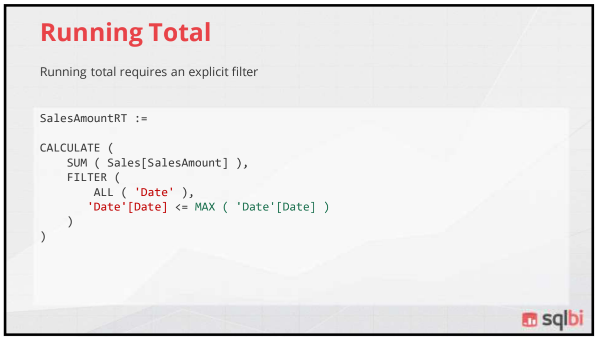

Running Total

Running total requires an explicit filter

```
SalesAmountRT :=

CALCULATE (
    SUM ( Sales[SalesAmount] ),
    FILTER (
        ALL ( 'Date' ),
       'Date'[Date] <= MAX ( 'Date'[Date] )
    )
)
```

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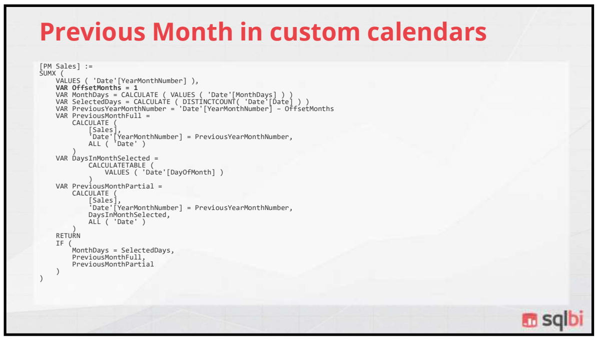

Previous Month in custom calendars

```
[PM Sales] :=
SUMX (
    VALUES ( 'Date'[YearMonthNumber] ),
    VAR OffsetMonths = 1
    VAR MonthDays = CALCULATE ( VALUES ( 'Date'[MonthDays] ) )
    VAR SelectedDays = CALCULATE ( DISTINCTCOUNT( 'Date'[Date] ) )
    VAR PreviousYearMonthNumber = 'Date'[YearMonthNumber] - OffsetMonths
    VAR PreviousMonthFull =
        CALCULATE (
            [Sales],
            'Date'[YearMonthNumber] = PreviousYearMonthNumber,
            ALL ( 'Date' )
        )
    VAR DaysInMonthSelected =
            CALCULATETABLE (
                VALUES ( 'Date'[DayOfMonth] )
            )
    VAR PreviousMonthPartial =
        CALCULATE (
            [Sales],
            'Date'[YearMonthNumber] = PreviousYearMonthNumber,
            DaysInMonthSelected,
            ALL ( 'Date' )
        )
    RETURN
    IF (
        MonthDays = SelectedDays,
        PreviousMonthFull,
        PreviousMonthPartial
    )
)
```

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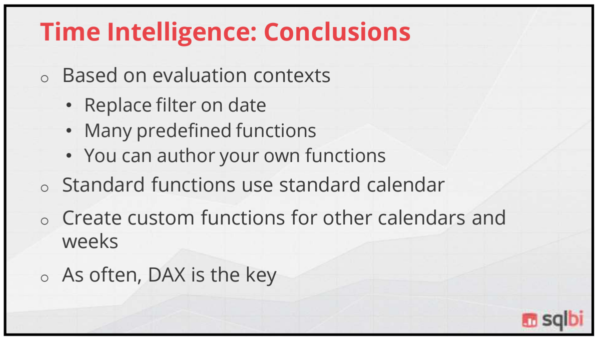

Time Intelligence: Conclusions

- Based on evaluation contexts
  - Replace filter on date
  - Many predefined functions
  - You can author your own functions
- Standard functions use standard calendar
- Create custom functions for other calendars and weeks
- As often, DAX is the key

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Thank you!

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