Getting Started

Introduction to Power BI & to This Course

What is Power BI?

Connect to and visualize any data using the unified, scalable platform for self-service and enterprise business intelligence (BI) that's easy to use and helps you gain deeper data insight.

What is Power BI?

1 Why?

Data

Preparation + Analysis + Visualization

2 Who?

Individuals

Teams

3 How?

Power BI Desktop	Power BI Pro	Power BI Mobile
Prepare & Create	Collaborate & Share	Access Anywhere

Can't I Use Excel Instead?

Excel

Power BI

- Quick Calculations
- Reports in Tabular Format
- Single Tool Only

- Big Data
- Interactive Visualizations
- Collaboration

Course Outline

Single User (Power BI Desktop) ⟵ ⟶ Share & Collaborate

- Getting Started
- Preparations
- Query Editor
- Data Preparation & Transformation
- Data Model
- **D**ata **A**nalysis **E**xpressions
- Relationships
- Reports
- Power BI Pro
- Workspaces
- Gateways
- Apps
- Power BI Mobile

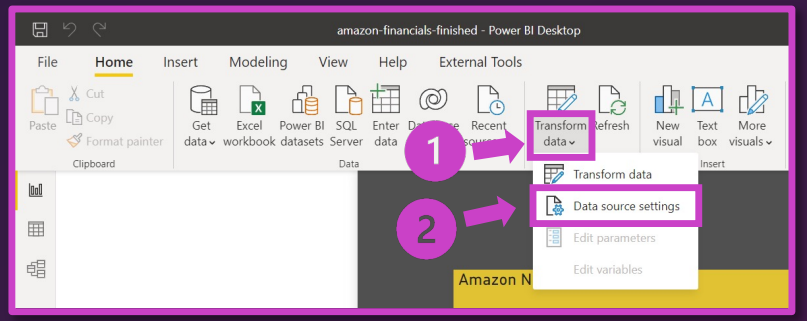
How to Get the Most Out of This Course

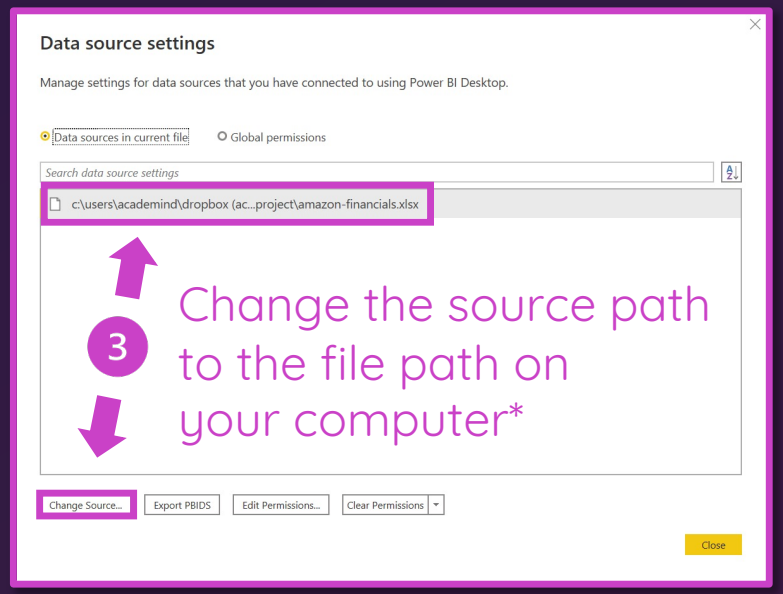
Watch the Videos		Adjust the Playback Speed
Follow Along Actively		Learning by Doing
Fix Errors		Apply Your Knowledge
Be Part of the Community		Ask & Contribute
Be Creative		Explore Options & Create Own Projects

How to Use the Attached Project Files

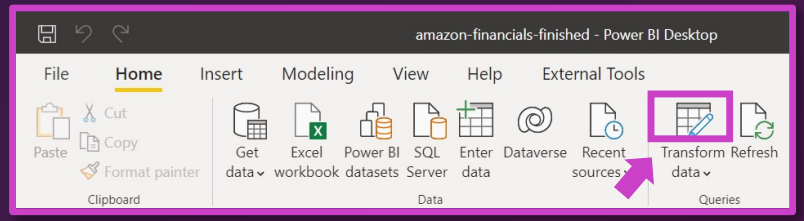
Unzip the downloaded file and copy the .pbix file you're interested in into a folder of your choice

Open the .pbix file





Repeat 3 for all remaining files and close the"Data source settings" afterwards



Open the Query Editor if required for the lecture

* All source files can be found in the "main" branch in the "source-files" folder

Diving Into the Basics

Preparations to Follow Along Conveniently

Module Content

- Understanding the Power BI Desktop Workflow
- A Closer Look at the Power BI Desktop Interface
- Creating the Project File & Recommended Settings

The Power BI Desktop Workflow

Query Editor

Data Preparation

Clean &
Transform

Extract
Transform
Load

Query Editor

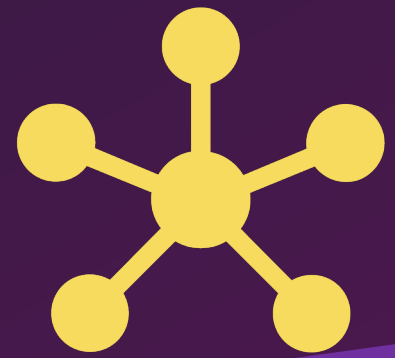
Data Model

The Power BI Desktop Workflow

Query Editor *Data Preparation*	Clean & Transform	**E**xtract **T**ransform **L**oad
Data & Model View *Data Analysis*	Inspect, Explore & Understand Data	View & Edit Relationships between Tables
Report View *Data Visualization*	Create Reports with Multiple Visuals	

Query Editor

Data Model



Working with Power BI Desktop

Understanding the Query Editor

Module Content

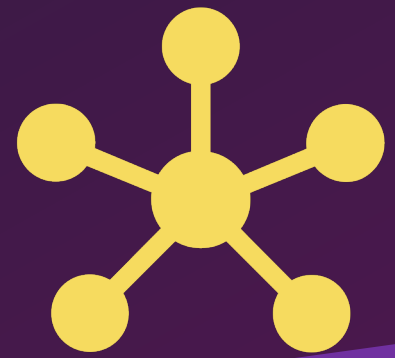
- What is the Query Editor?
- Working with Queries & Editing Rows and Columns
- Transformations, Formatting & Handling Errors

The Power BI Desktop Workflow

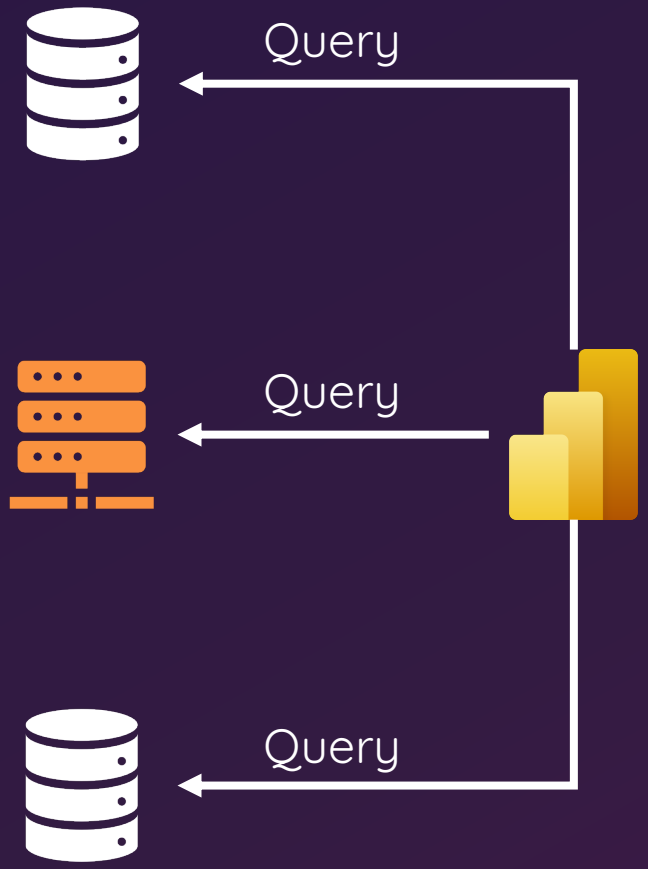
Query Editor *Data Preparation*	Clean & Transform	**E**xtract **T**ransform **L**oad
Data & Model View *Data Analysis*	Inspect, Explore & Understand Data	View & Edit Relationships between Tables
Report View *Data Visualization*	Create Reports with Multiple Visuals	

Query Editor

Data Model



What is “Data Cleansing“ / “Data Cleaning“?

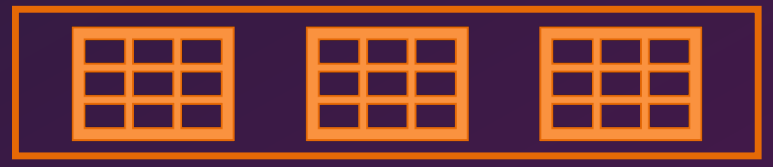


Remove duplicate & unrequired data

Fix errors, missing values, empty fields

Format data (number, text, date, ...)

Combine mutiple data sources



Query Data ▶ Clean Data ▶ Analyse / Visualize Data

Understanding Append

Country	Revenue	Cost	Year
Germany	100	-20	2016
Germany	108	-22	2017
Germany	105	-25	2018

Country	Revenue	Cost	Year
Germany	110	-24	2019
Germany	116	-25	2020
Germany	122	-27	2021

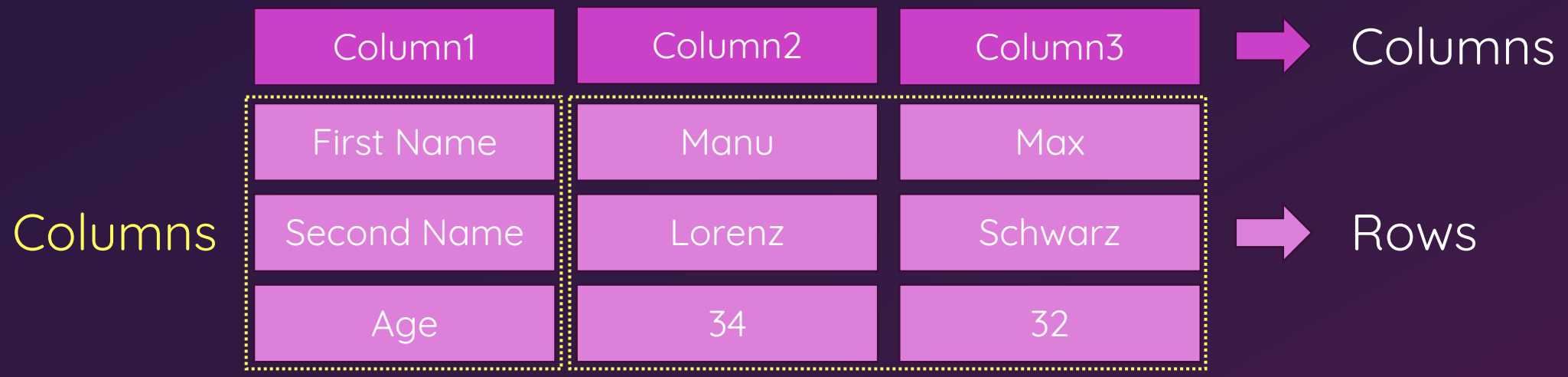
Understanding Append

Country	Revenue	Cost	Year
Germany	100	-20	2016
Germany	108	-22	2017
Germany	105	-25	2018

Country	Revenue	Cost	Year
Germany	110	-24	2019
Germany	116	-25	2020
Germany	122	-27	2021

Country	Revenue	Cost	Year
Germany	100	-20	2016
Germany	108	-22	2017
Germany	105	-25	2018
Germany	110	-24	2019
Germany	116	-25	2020
Germany	122	-27	2021

Transpose


Column1
Column2
Column3
Columns
First Name
Manu
Max
Columns
Second Name
Lorenz
Schwarz
Rows
Age
34
32

Transpose

Columns

Column1	Column2	Column3
First Name	Manu	Max
Second Name	Lorenz	Schwarz
Age	34	32

Rows

Columns

First Name	Second Name	Age
Manu	Lorenz	34
Max	Schwarz	32

Rows

Pivoting & Unpivoting

Attribute

Product	2019	2020	2021
Apple	10	12	13
Banana	23	25	21

Value

Unpivot

Product	Attribute	Value
Apple	2019	10
Apple	2020	12
Apple	2021	13
Banana	2019	23
Banana	2020	25
Banana	2021	21

Pivot

Query Editor Deep Dive

Understanding Data Modeling

Module Content

- Data Modeling Theory
- Understanding & Creating the Star Schema
- Diving Deeper Into Selected Query Editor Features & Understanding Basic Mathematical Calculations

The Current State & Next Steps

- Source File Connection
- Row & Column Operations
- Filtering Data
- Appending Queries
- Pivoting & Unpivoting
- Formatting data
- Handling errors
- Splitting & Extracting Data

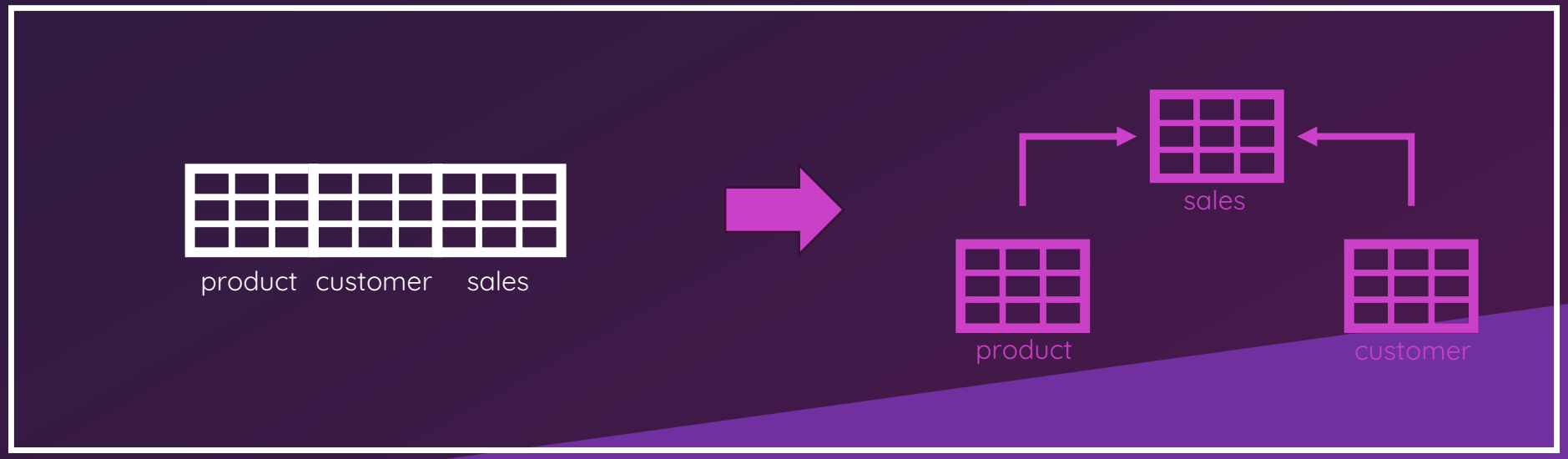
Country-id	country	...	population
36	australia	...	711.4
276	germany	...	1738.8
...	...	...	...

Basic Cleaning & Shaping ☑

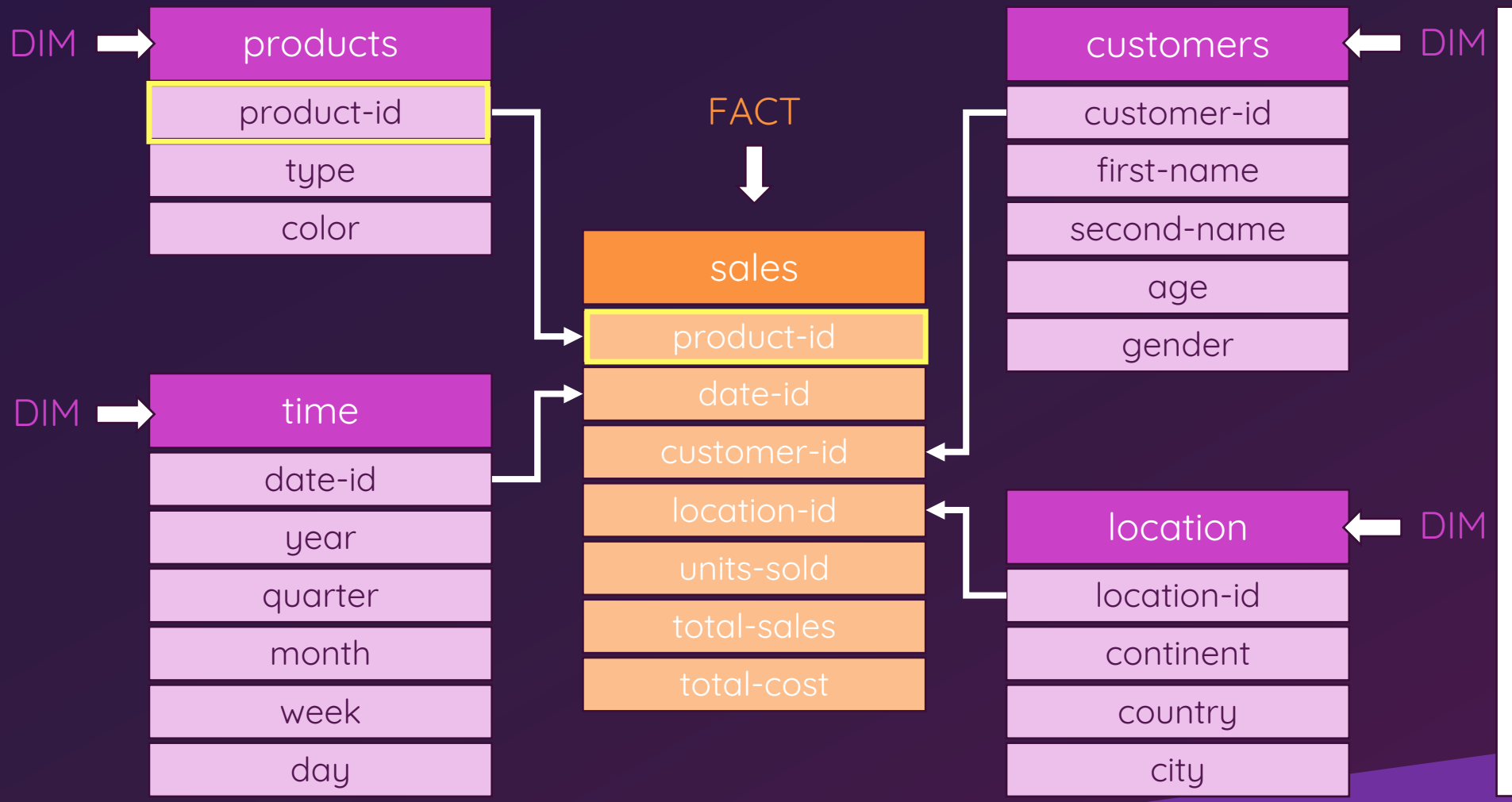
Develop &
Create Data Model

Data Models – What & Why?

Data Warehouse	Data Model	Multidimensional Schema
Large store of data retrieved from various sources designed to enable BI activities	Structured & logical organization of data elements (e.g. tables) and the relationship between different data elements	Model different dimensions to keep track of entities / actions concerning the warehouse‘s actitivies



The Star Schema – An Example



FACT

Central & (Typically) Single Table

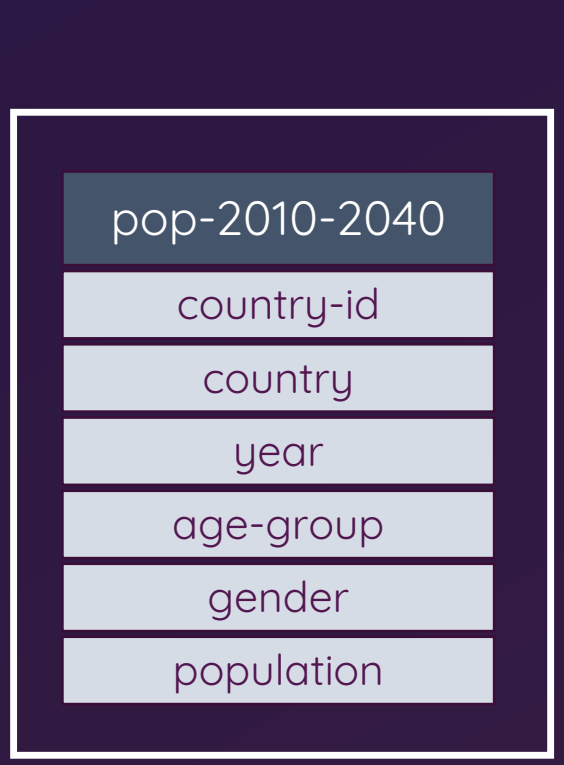
Foreign Keys + Quantitative Information

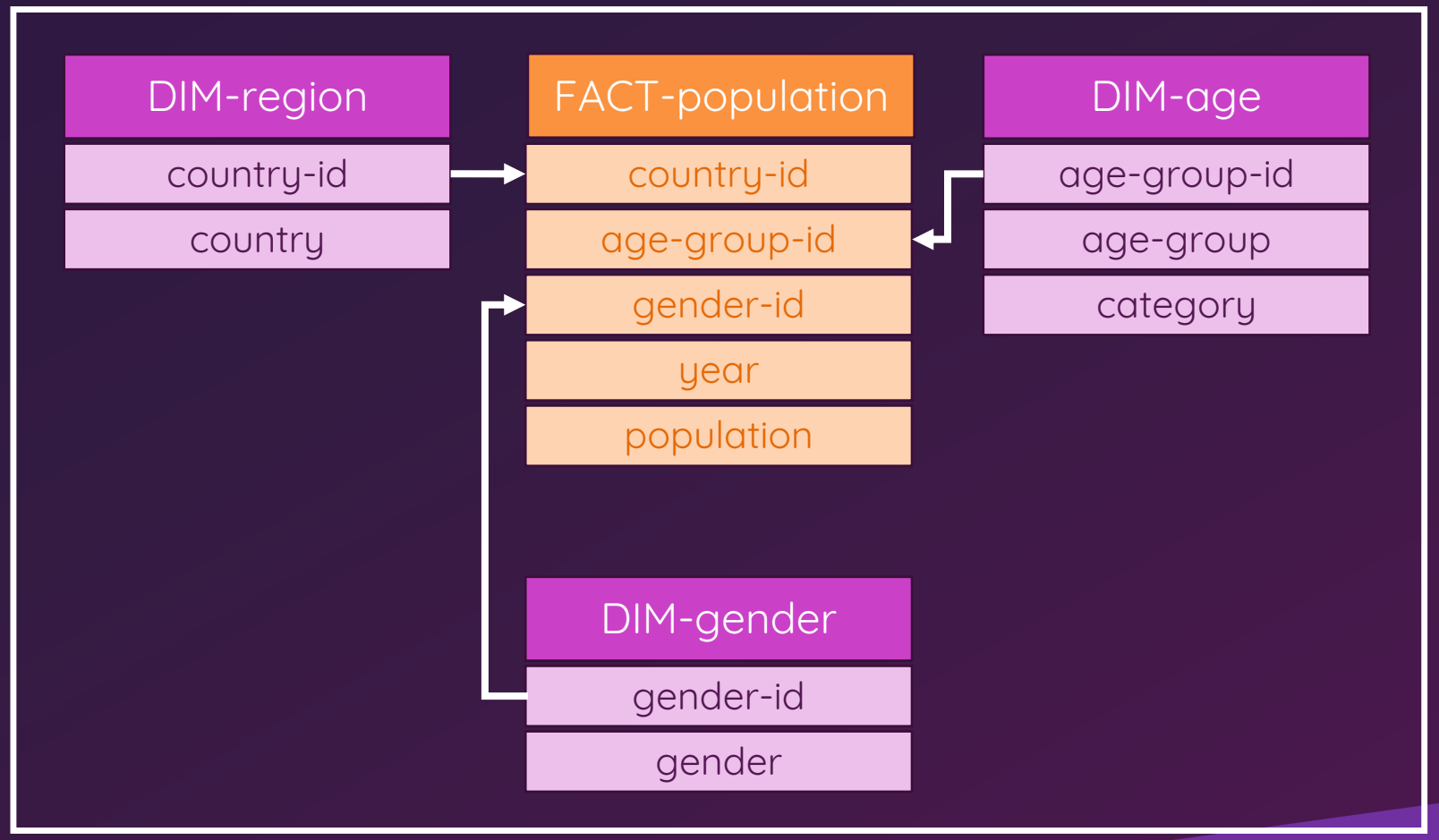
DIM

(At Least) One Table with Primary Keys

Supporting Information For FACT Table

Applying the Star Schema to the Course Project





Single Table VS Multidimensional (Star) Schema

Reference vs Duplicate

Query 1

Reference

Query 2

Applied Steps

Filtered Data
Changed Data Type

Applied Steps

Query refers to "final state" of initial query, no applied steps displayed

Changes in Query 1 have an effect on Query 2

Query 1

Duplicate

"Copy" of Query 1

Applied Steps

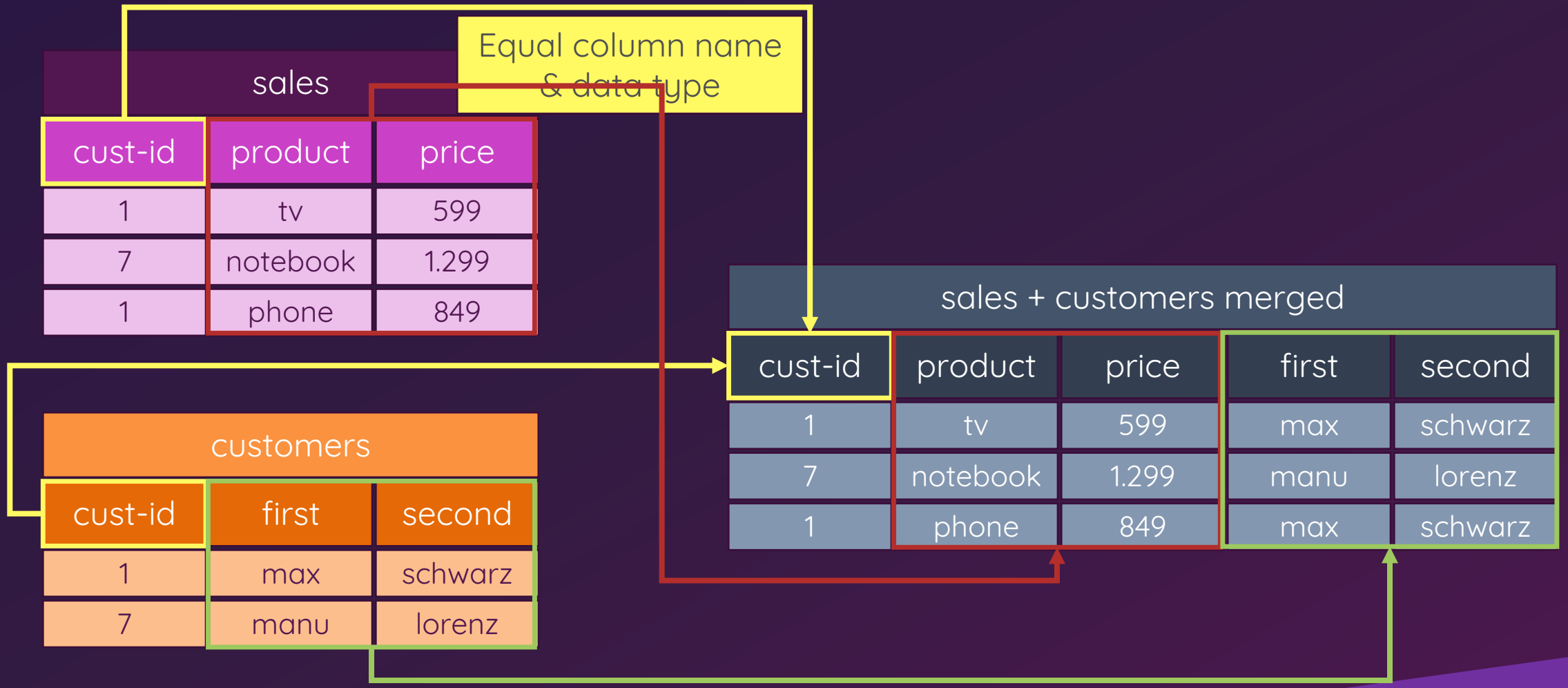
Filtered Data
Changed Data Type

Applied Steps

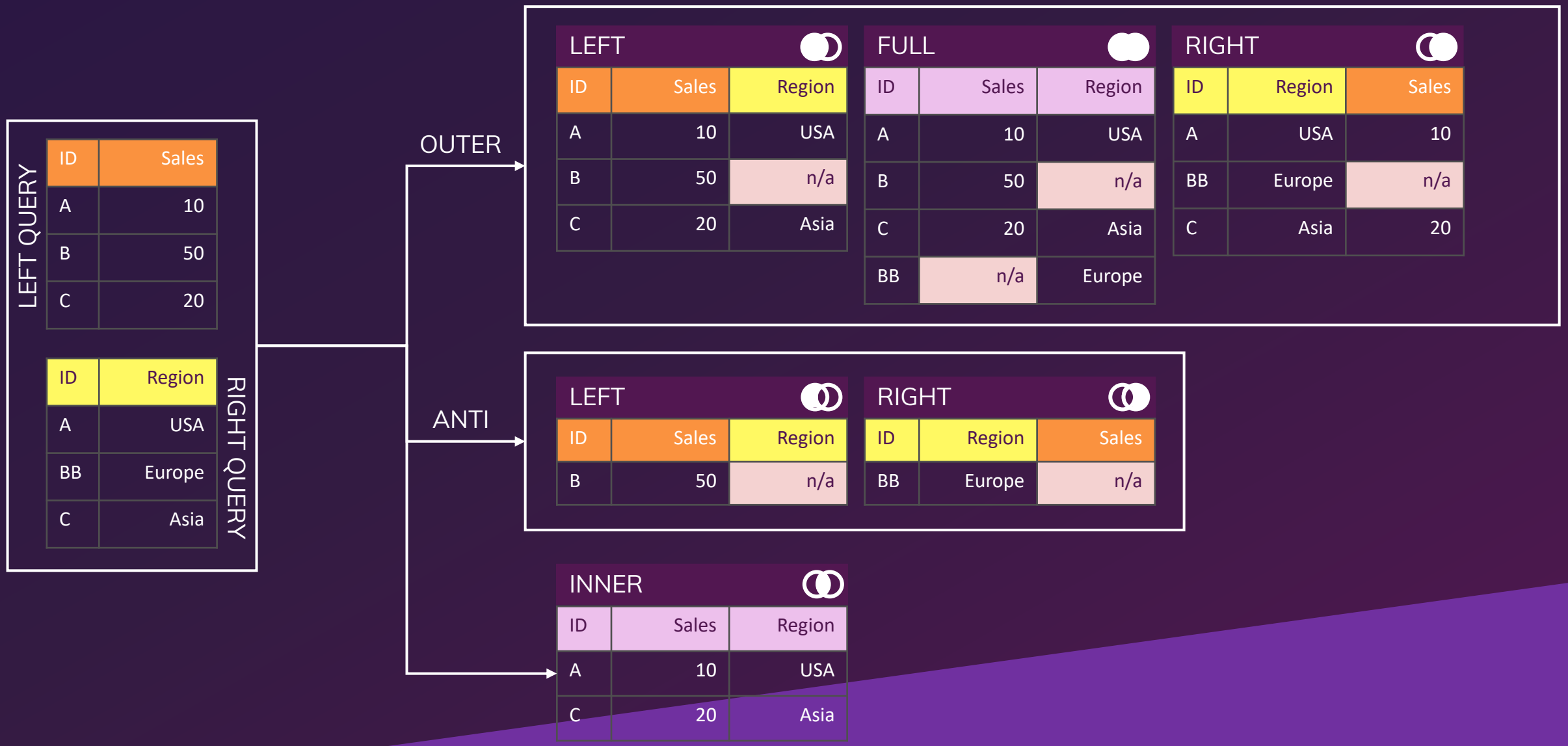
Filtered Data
Changed Data Type

Changes in Query 1 have no effect on Query 2

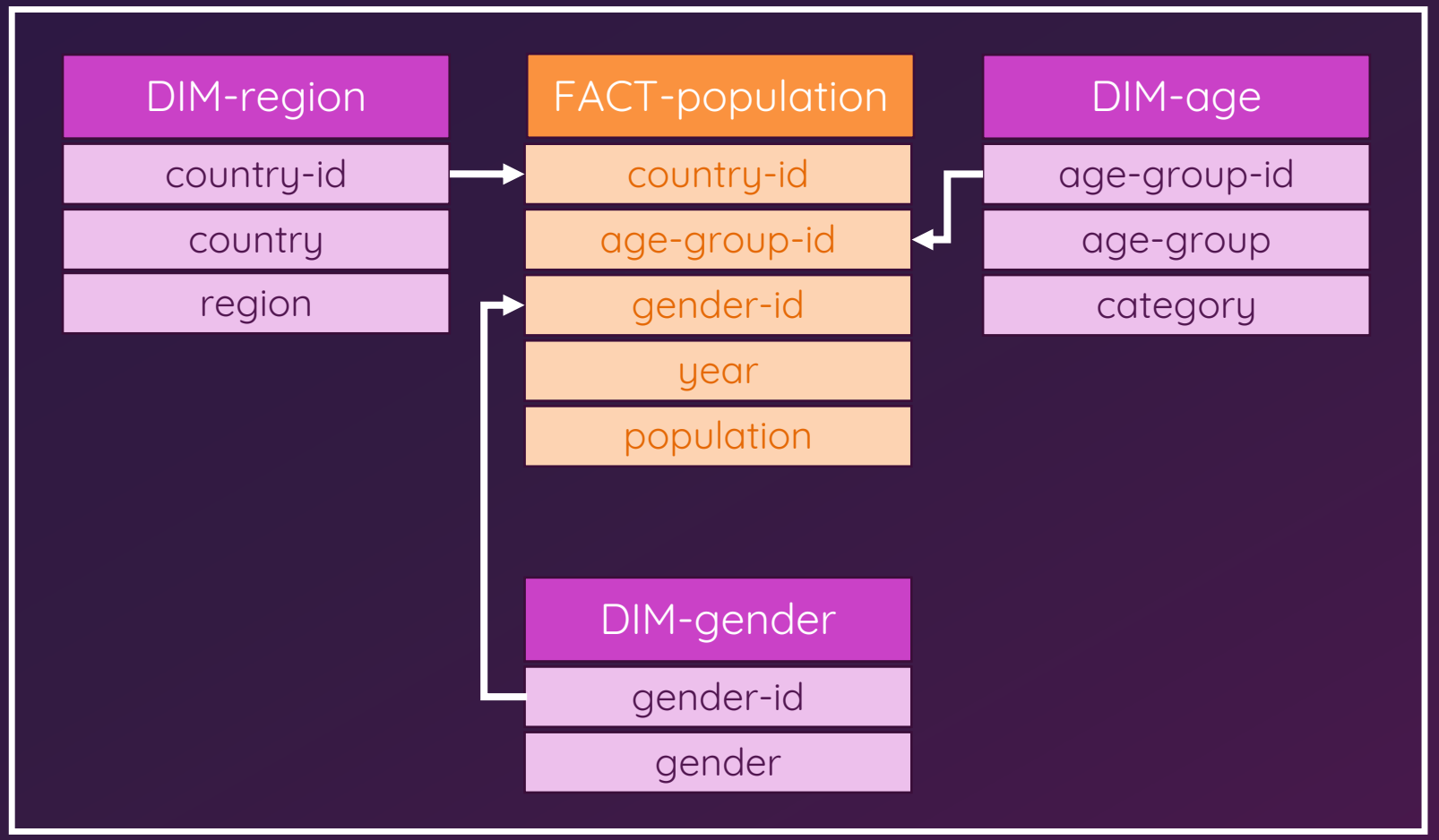
Merging Queries - Theory



Understanding “Join Kind“

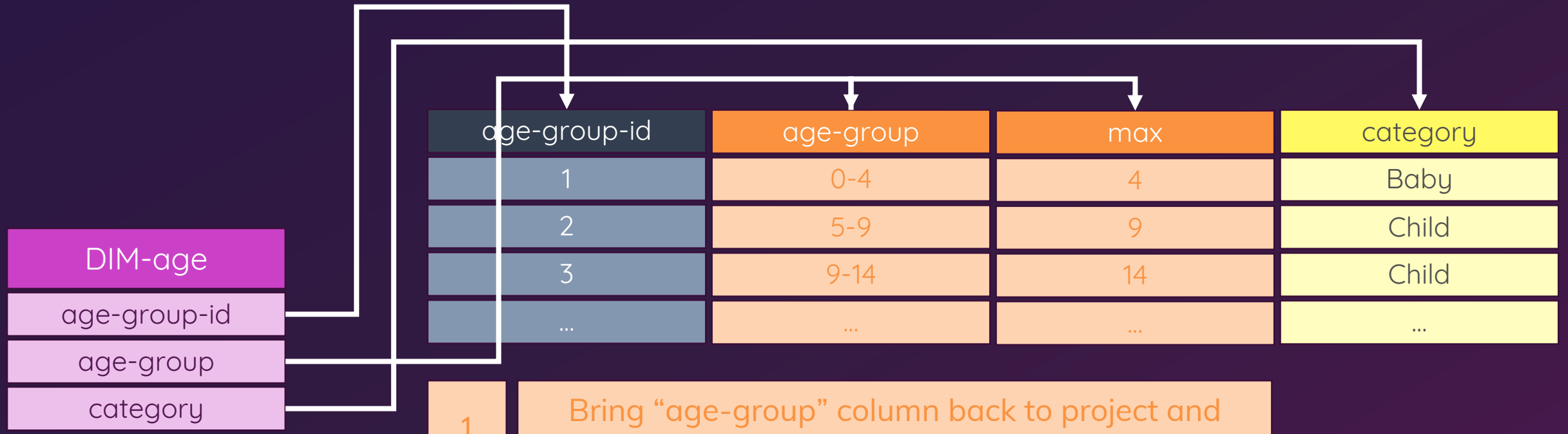


Adding More DIM Tables



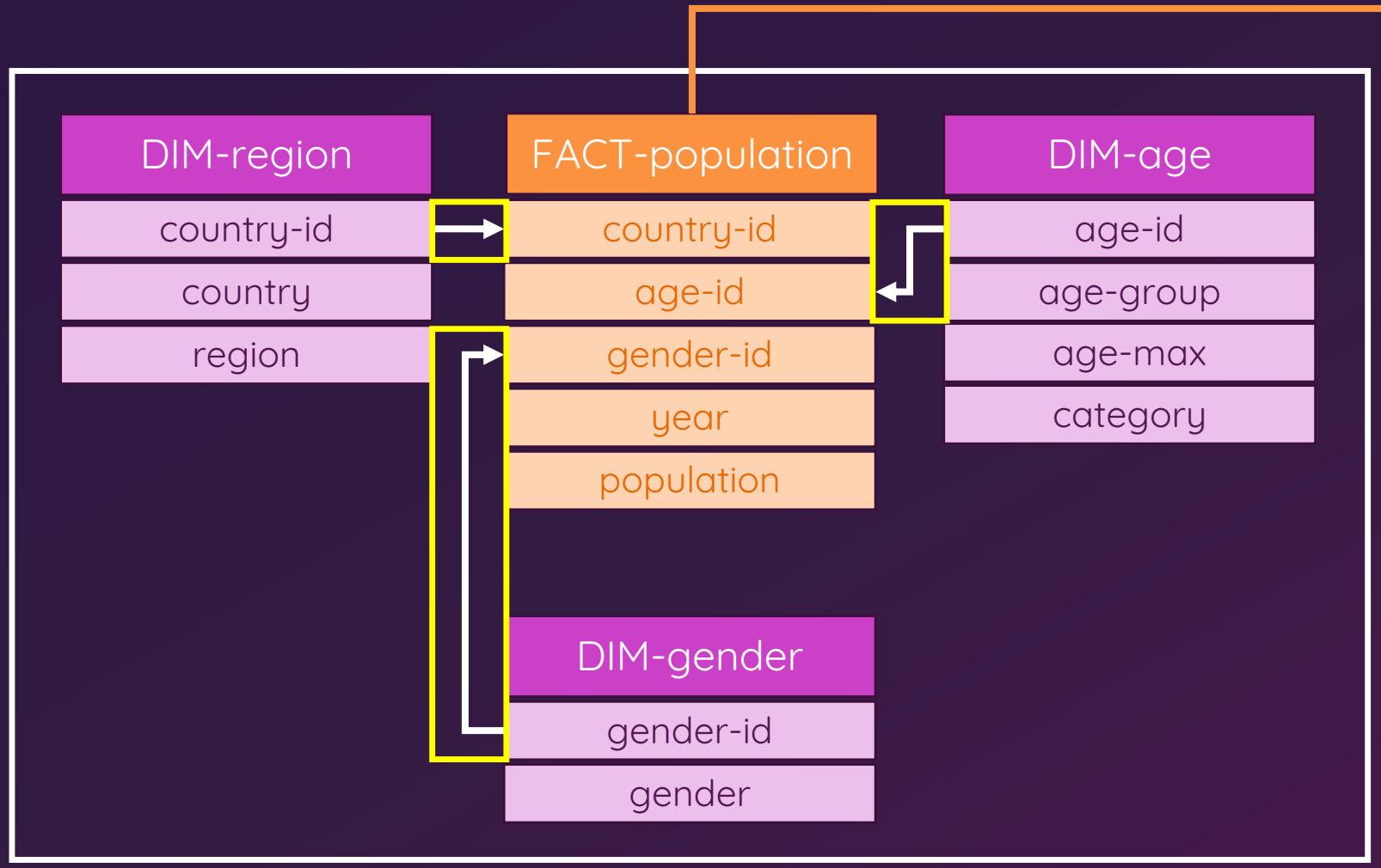
Multidimensional (Star) Schema

The DIM-age Table



1	Bring “age-group” column back to project and extract maximum value from each group
2	Add Conditional Column to define category based on maximum value for each age-group
3	Add automatically generated Index Column

The FACT Table



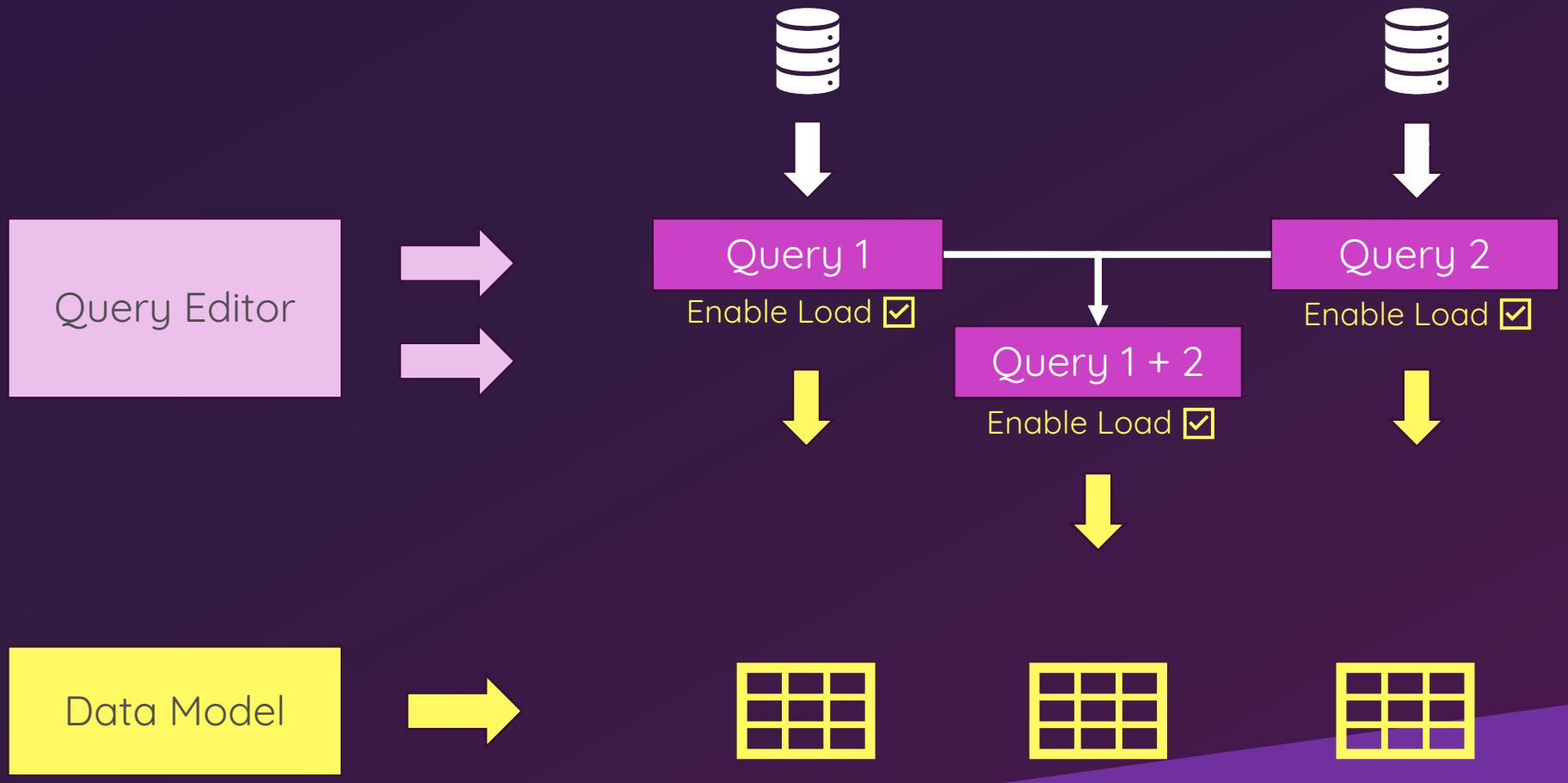
Quantitative Information

Foreign Keys to combine quantitative data with descriptive data from DIM tables

Missing link between tables to be added outside the Query Editor in the “Data Model“ module

Multidimensional (Star) Schema

Understanding “Enable Load“



Data View & Relationships

Leaving the Query Editor

Module Content

- Understanding Relationships
- M-Language vs DAX & DAX Introduction
- Working with Calculated Columns & Measures

The Power BI Desktop Workflow

Query Editor

Data Preparation

Clean &
Transform

Extract
Transform
Load

Query Editor

Data Model

The Power BI Desktop Workflow

Query Editor *Data Preparation*	Clean & Transform	**E**xtract **T**ransform **L**oad
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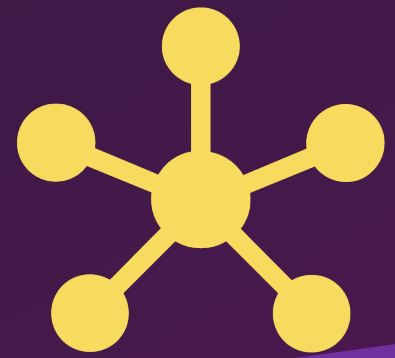
Query Editor

Data Model



Query Editor vs Data Model

(Power) Query Editor

Prepare / Transform Data

Data Model

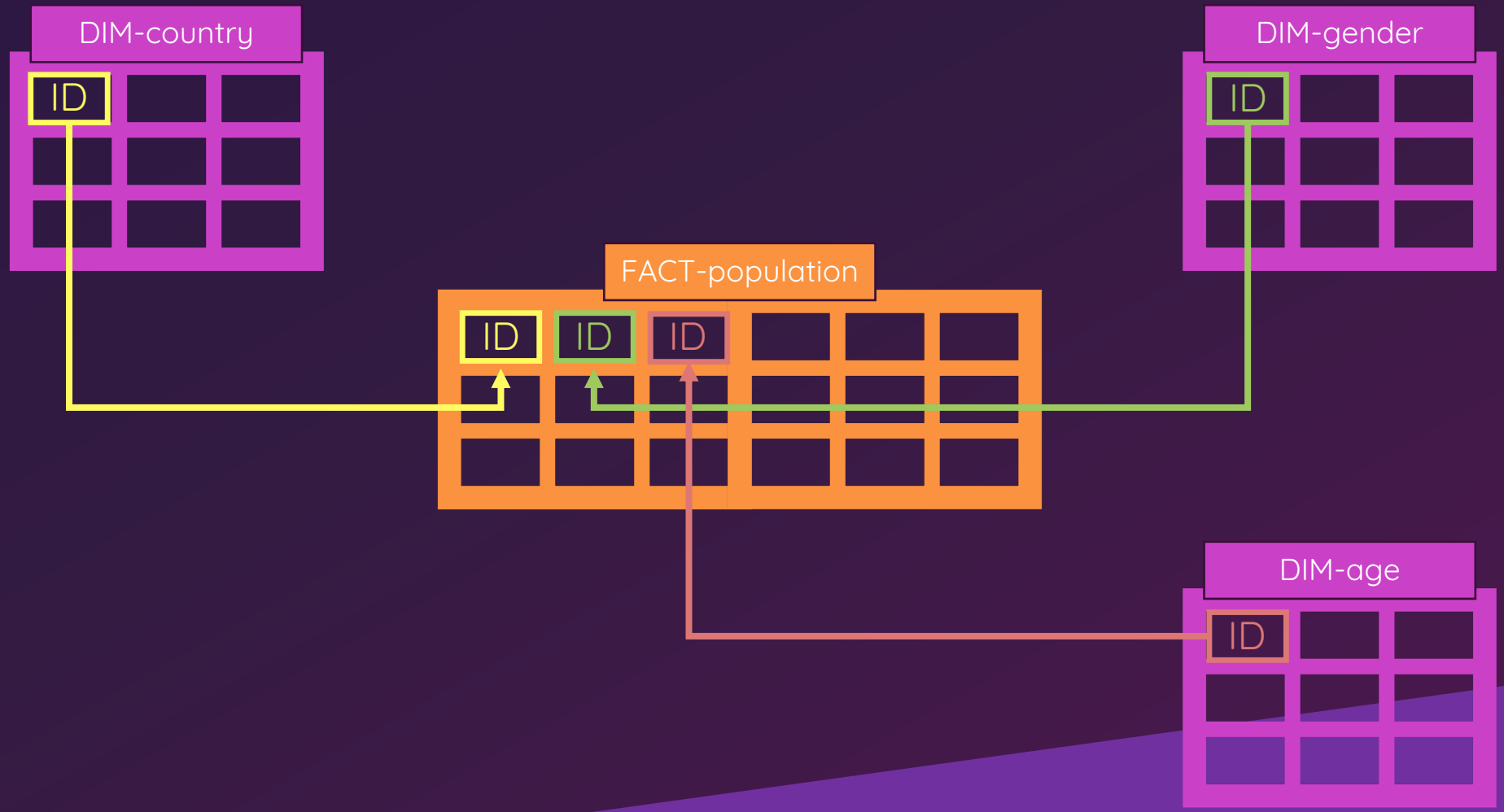
Analyze Data

Relationships

Calculations

Calculations can be applied in both the **Query Editor** and the **Data Model**

Relationships to the Rescue!



Understanding Relationships

Cardinality

Relationship Type

Cross Filter Direction

Active Properties

Different Kinds Of Data Relationships

One-to-Many
(1:n)

One record in table A has one or many related records in table B

e.g. an employee belongs to one company but a company has many employees

Many-to-Many
(n:n)

One record in table A has one or many related tables in table B – and vice versa

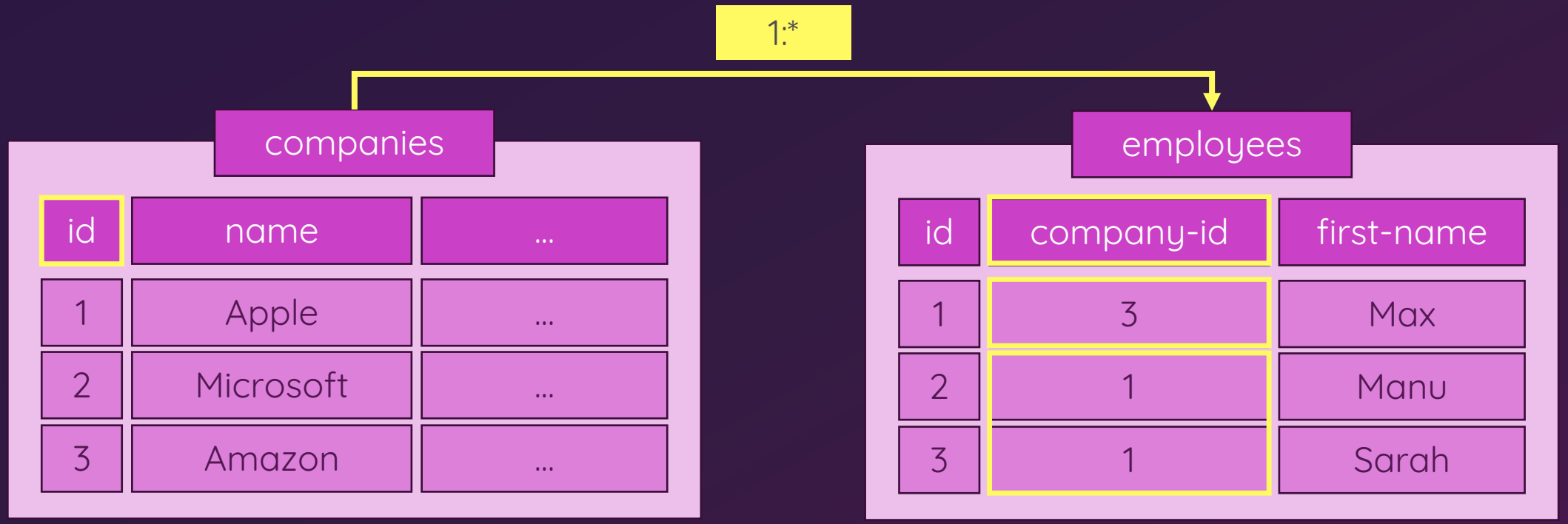
e.g. an employee is part of multiple projects and every project has multiple employees assigned to it

One-to-One
(1:1)

One record in table A belongs to exactly one record in table B – and vice versa

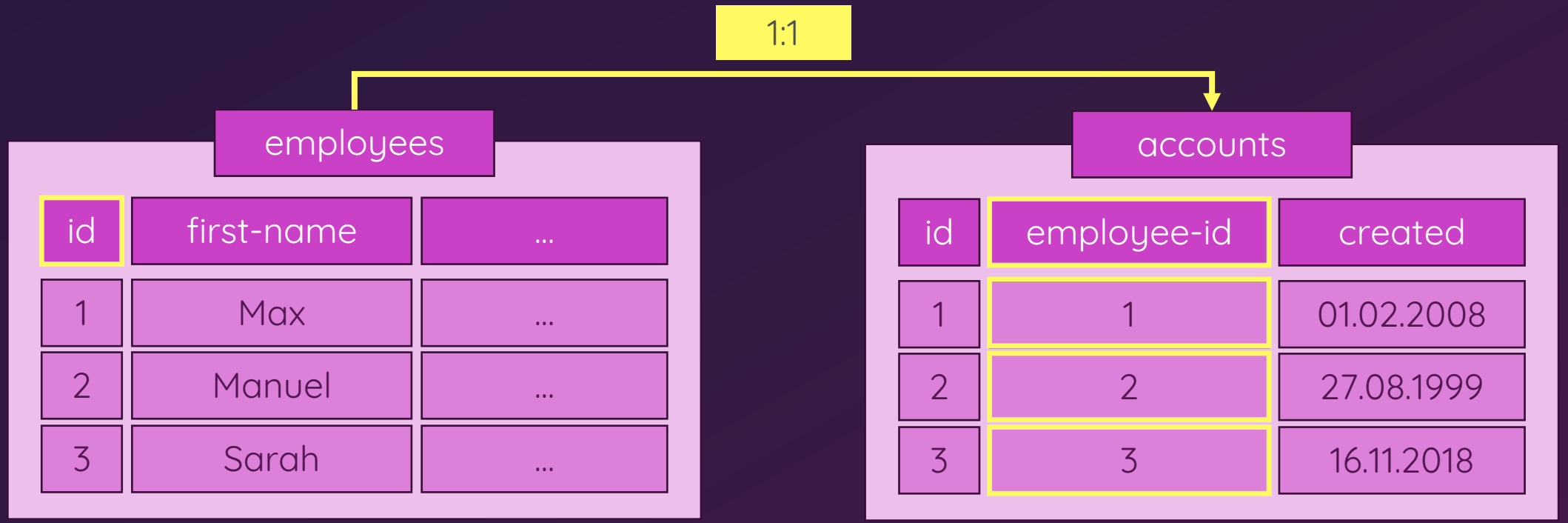
e.g. an employee has exactly one intranet account and every intranet account belongs to exactly one employee

One to Many (1:*)



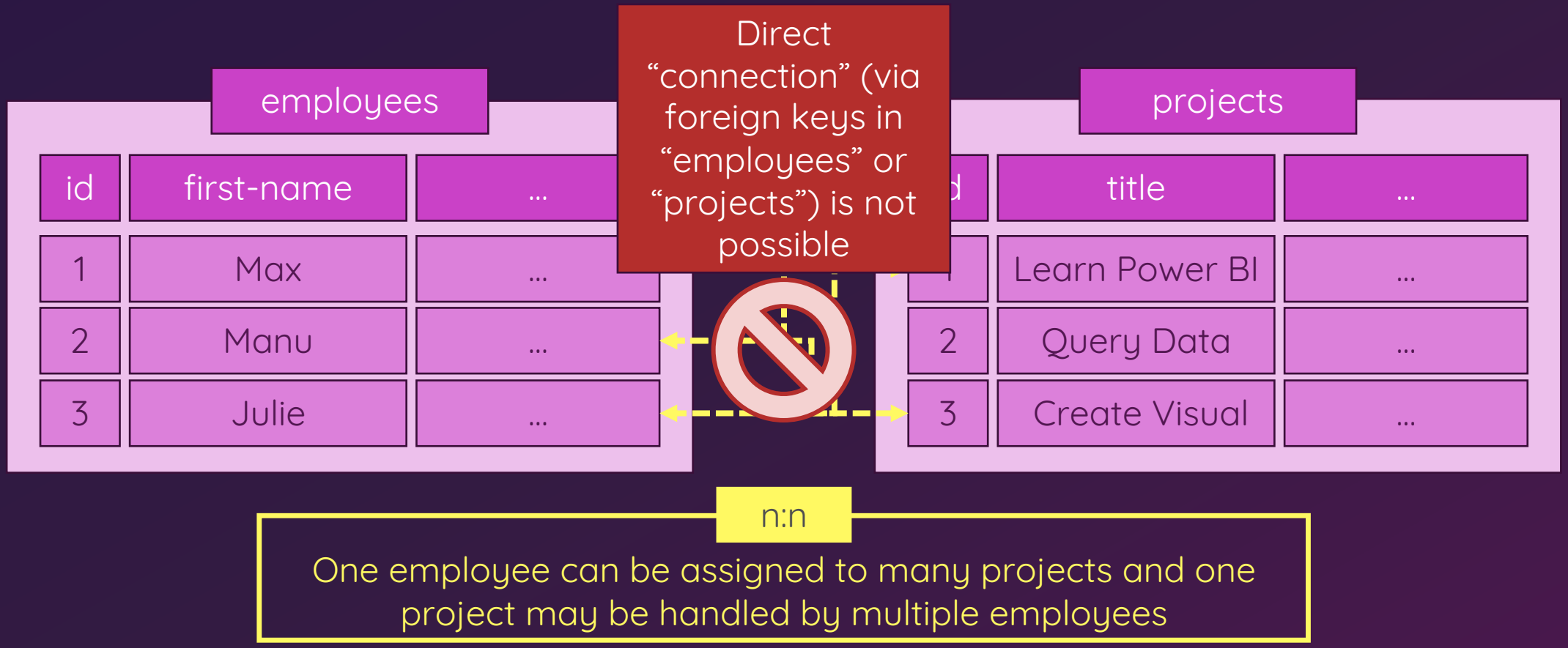
"One": **Unique** entry for **primary key**
"Many": **One or multiple** entries for **foreign key**

One to One (1:1)

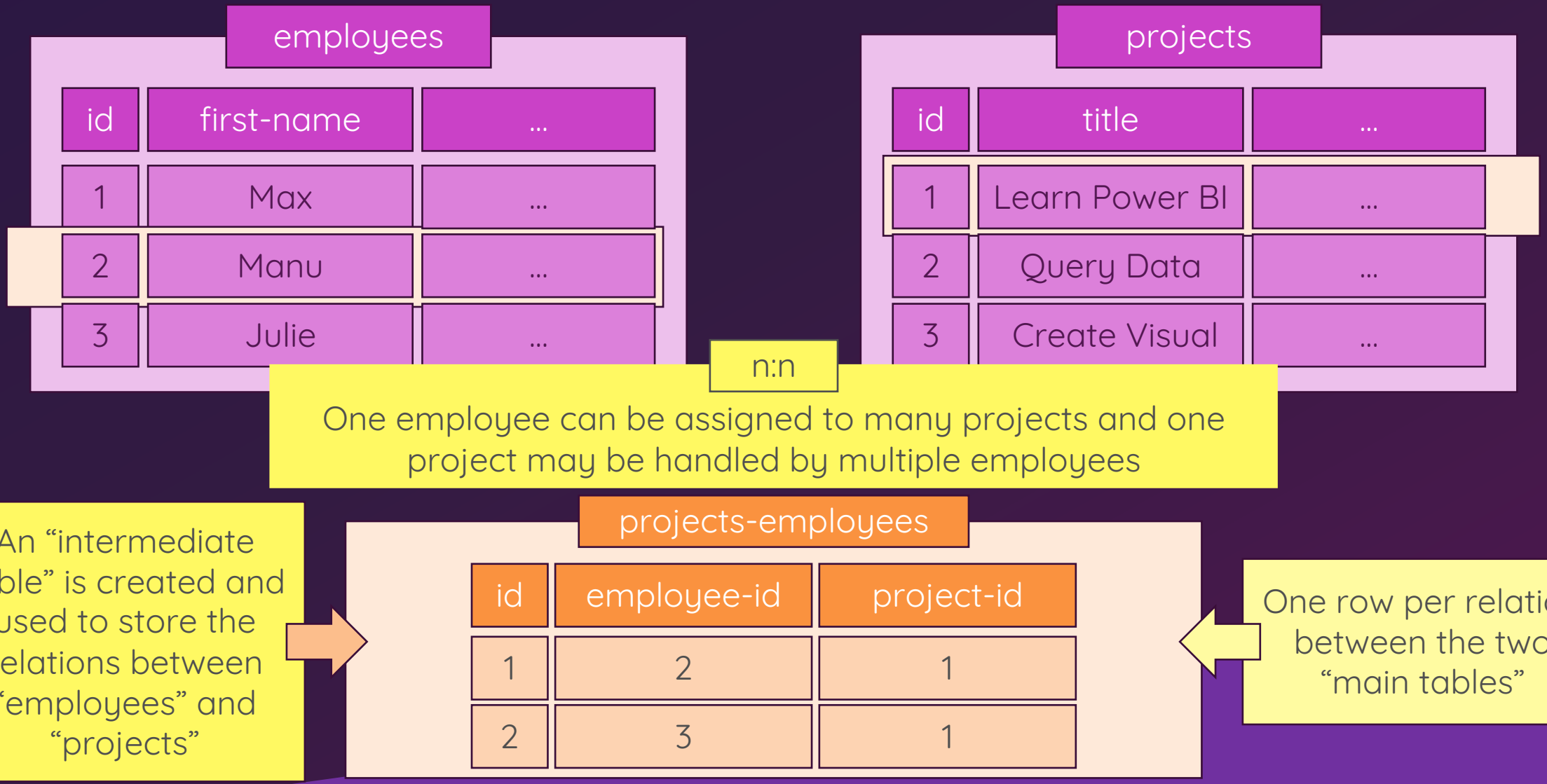


"One": **Unique** entry for **primary key**
"One": **Unique** entry for **foreign key**

Many-To-Many Relations Need Intermediate Tables



Many-To-Many Relations Need Intermediate Tables



Understanding Relationships

Cardinality	Cross Filter Direction	Active Properties
Relationship Type	Table “Communication”	

Understanding Relationships

Cardinality	Cross Filter Direction	Active Properties
Relationship Type	Table “Communication”	Activate / Deactivate Relationship

M vs DAX (Data Analysis Expressions)

	Description	Application
M	Power Query Formula Language	Data Preparation
	Data Transformation	Before Data Model
DAX	**D**ata **A**nalysis **E**xpression Language	Create Insights
	Analytical Data Calculations	In Data Model
	Comparable to Excel Functions	

DAX Basics

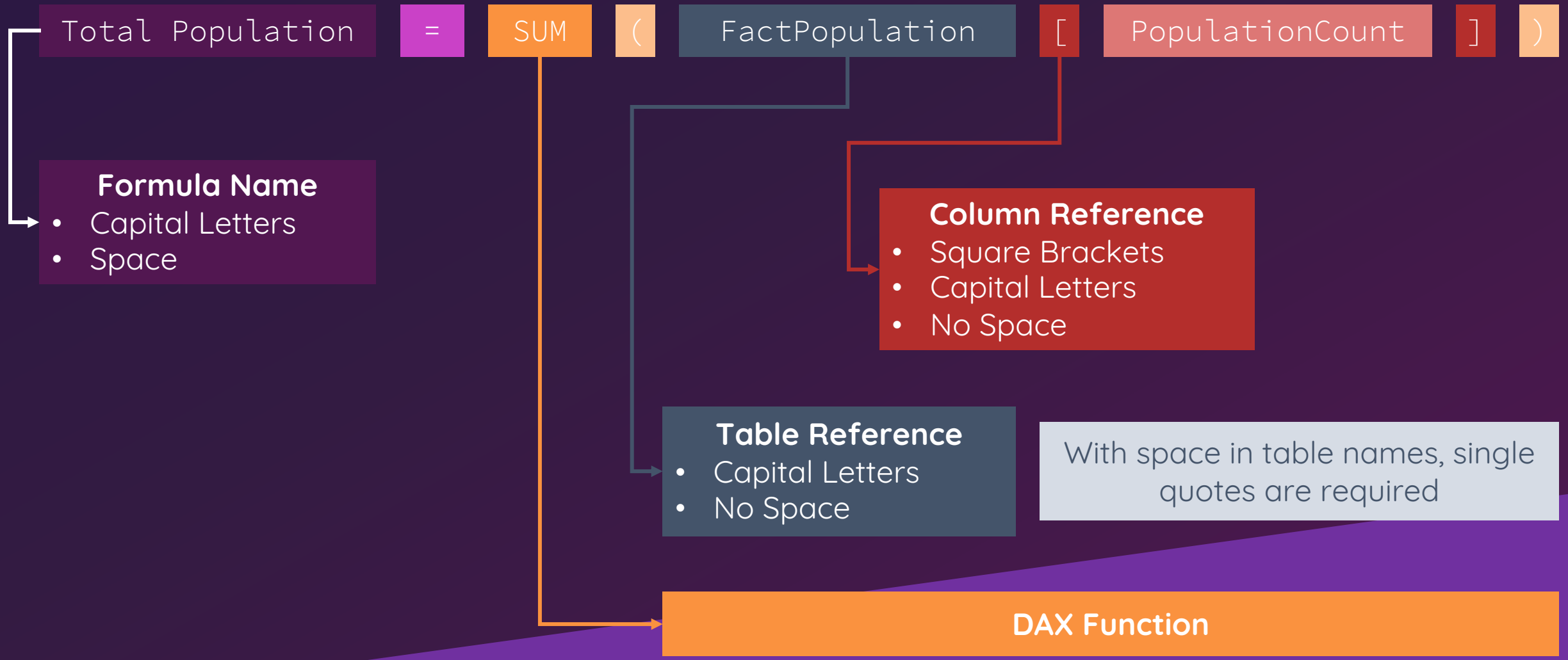
DAX Reference	https://docs.microsoft.com/en-us/dax/		
Syntax	`Formula = …`		
Data Types	`String`	`Number`	…
Operators	`+`	`-`	…
Functions	`CONCATENATE()`		

Basics

Advanced

DAX Statements	`DEFINE`	`EVALUATE`	`ORDER BY`	`VAR`
DAX Queries				

The Core DAX Syntax



DAX Data Types

String (Text)	`"The DAX Basics"`	
Whole & Decimal Numbers	`564`	`949.59`
Boolean	`TRUE`	`FALSE`
Date/Time	`January 1st 2020`	
Currency		
Blank (NA)		

DAX Operators

Arithmetic	Comparison	Logical	Text concat.
+	=	&&	&
-	==	||	
*	>	IN	
/	>=		
^	<>		

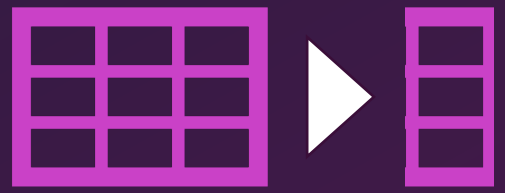
DAX Core Functions

Type	Function	Output
Text	CONCATENATE("I Love Power","BI")	I Love PowerBI
Information	ISNUMBER(2020)	TRUE
Logical	IF([Population]>100000,"Big","Small")	Big / Small
Math	ROUND(352.867, 2)	352.87
Statistical	AVERAGE(Fact-Pop[Population])	
Filter	FILTER(Fact-Pop[Year]=2020)	
Date & Time	CALENDAR(DATE(2000,01,01),DATE(2020,12,31))	

Calculated Column or Measure?

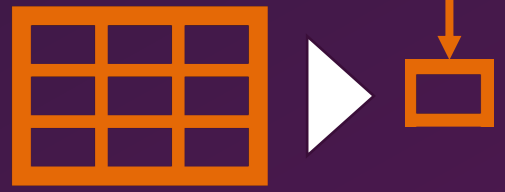
Calculated Column

"Perform an operation that generates results for each row of your table"



Measure

"Return a single result of a calculation or an aggregated value (e.g. Averages)"



The "FILTER" & "CALCULATE" Functions

The "FILTER" & "CALCULATE" Functions

SUM('FACT-population'[population])

Filter function

CALCULATE (<expression> , FILTER (<table> , <filter>))

'FACT-population'[gender]="Female"

CALCULATE (<expression> , <filter1> , <filter2>)

Argument

The Report View

Creating Beautiful Visuals & Reports

Module Content

- Creating Visuals & Reports
- Formatting Visuals / Charts & Understanding Report Themes
- Working with Filters, Hierarchies & Interactions

A (Final) Look at the Power BI Desktop Workflow

Query Editor *Data Preparation*	Clean & Transform	**E**xtract **T**ransform **L**oad
Data & Model View *Data Analysis*	Inspect, Explore & Understand Data	View & Edit Relationships between Tables
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Query Editor

Data Model