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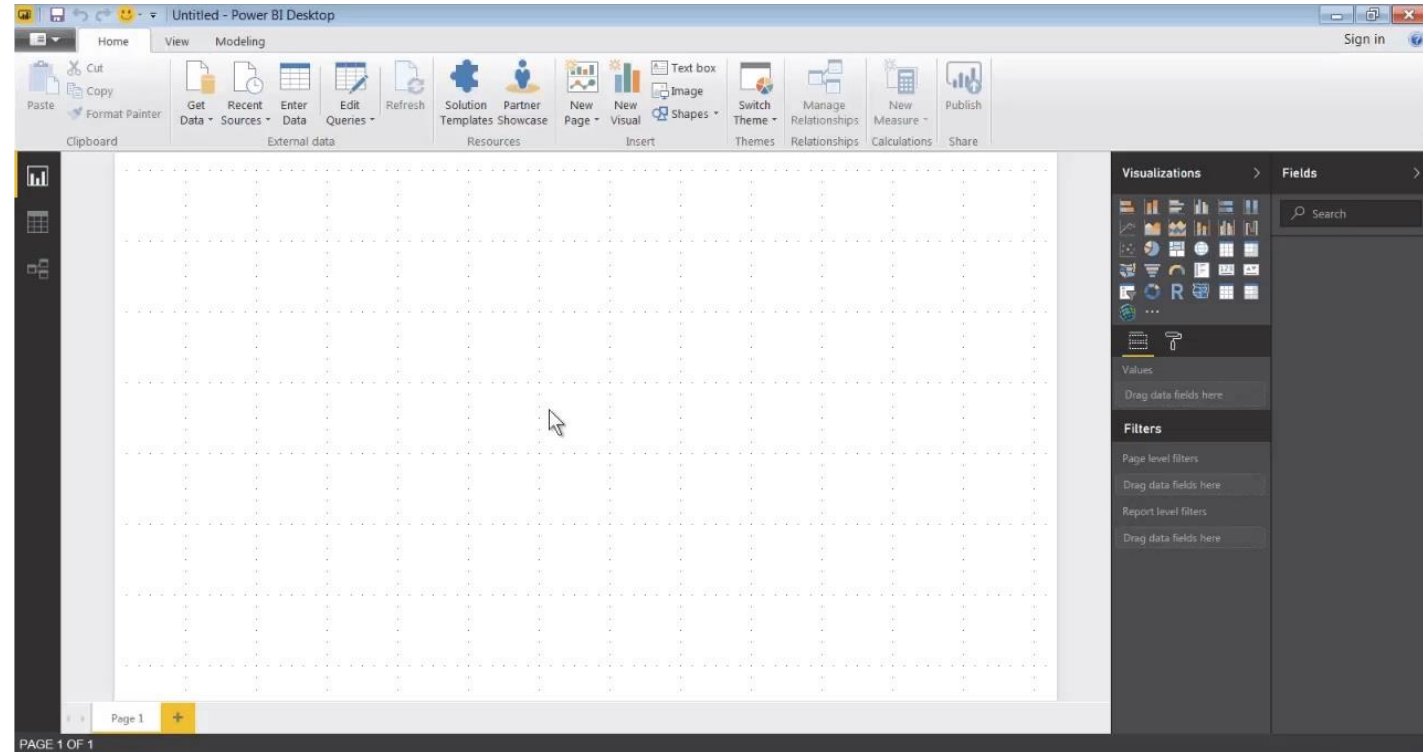


Connecting to Data Sources

USING THE POWER BI DESKTOP

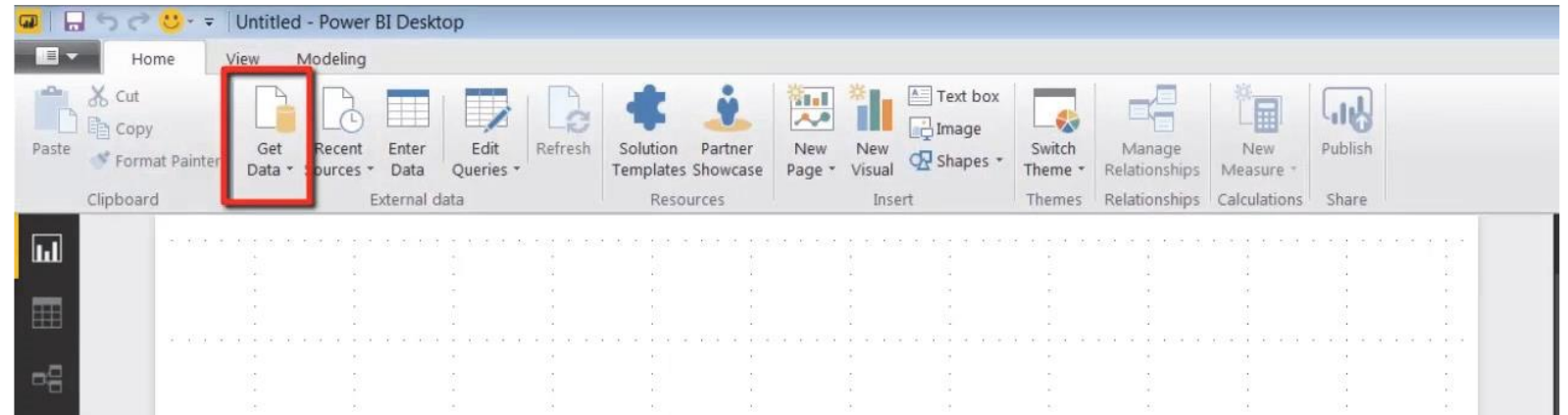
When you launch Power BI Desktop and look at the interface, you will probably notice that it has a very Microsoft-like feel to it, with a Ribbon and a series of Tabs.

And, as is usual on a Microsoft Ribbon, the Home Tab contains all the most frequently used options.



POWER BI DESKTOP

The first thing you do, when you are working on any kind of project in Power BI Desktop, is to grab some data. Do this by going to the Home Tab, clicking on Get Data and choosing the appropriate option.



CONNECTING TO TEXT FILES

- The number of data sources to which you can connect is so numerous, we cannot cover them comprehensively.
- We will be connecting to a variety of different types of data, to give you an idea on how data connections take place in power bi; and how easy it is to make these connections, and to apply transformation rules to the data being imported

CONNECTING TO A CSV FILE

- CSV (Comma Separated Values) is a standard generated by many systems and many software packages, as a medium for exporting report data.
- To connect to a CSV source, in the Home Tab of the Ribbon, click on
- **Get Data > Text/CSV;**
- Then, browse for the required text file.

CONNECTING TO A CSV FILE

- Connect the file called “London.csv”.
- Display a preview of the data which the file contains
- Check if column headings have been recognized, and datatypes easily recognised.
- Check the three drop-down menus
- Choose a different encoding from the first; **the File Origin drop-down menu.**
- Specify a delimiter using the options in the delimiter drop-down menu.
- Check Data Type Detection drop-down
- Save as “Connectcsv.Pbix” → Close.

CONNECTING TO EXCEL DATA

- Excel is the lowest common denominator when it comes to Power BI data sources; since, pretty much everyone will have some data stored in Excel for at least some of their projects.

- | | A | B | C | D | E | F | G | H | I | J |
|----|------------------|----------|--------------|--------|---------------------|---|---|---|---|---|
| 1 | Name | BranchID | Date Claimed | Amount | Category | | | | | |
| 2 | Kian Thompson | 9 | 06/03/2013 | 472.24 | Travel | | | | | |
| 3 | Millie Macdonald | 9 | 20/08/2016 | 16.51 | Vehicle mileage | | | | | |
| 4 | Lewis Francis | 1 | 29/07/2015 | 87.84 | Phone | | | | | |
| 5 | Sam Watson | 5 | 06/07/2014 | 237.83 | Accommodation | | | | | |
| 6 | Harriet Johnson | 1 | 07/06/2014 | 466.33 | Miscellaneous | | | | | |
| 7 | Lewis Francis | 1 | 09/11/2015 | 20.58 | Vehicle maintenance | | | | | |
| 8 | Henry Williams | 2 | 06/06/2012 | 17.20 | Online expenses | | | | | |
| 9 | Kian Thompson | 9 | 03/03/2013 | 183.45 | Vehicle fuel | | | | | |
| 10 | Erin Dale | 13 | 24/02/2012 | 147.80 | Vehicle maintenance | | | | | |
| 11 | Joseph Fisher | 4 | 25/11/2015 | 196.52 | Entertaining | | | | | |
| 12 | Lewis Francis | 1 | 30/06/2013 | 130.73 | Office equipment | | | | | |
| 13 | Harriet Johnson | 1 | 23/07/2012 | 7.77 | Research | | | | | |
| 14 | Lewis Francis | 1 | 22/06/2016 | 94.69 | Vehicle fuel | | | | | |
| 15 | Bradley Wood | 5 | 15/07/2012 | 178.97 | Vehicle fuel | | | | | |
| 16 | Charlie Ross | 2 | 29/11/2014 | 92.31 | Accommodation | | | | | |
| 17 | Ethan Dean | 4 | 15/08/2013 | 51.69 | Public transport | | | | | |
| 18 | Harrison Hart | 6 | 08/06/2014 | 15.68 | Stationery | | | | | |
| 19 | Benjamin Owen | 7 | 24/04/2015 | 183.60 | Miscellaneous | | | | | |
| 20 | Jacob Spencer | 2 | 31/07/2012 | 490.04 | Accommodation | | | | | |

CONNECTING TO EXCEL DATA

- To examine the other objects which Power BI will recognize, simply copy this worksheet and then modify the copy.

13	Harriet Johnson	1	23/07/2012	7.77	Research
14	Lewis Francis	1	22/06/2016	94.69	Vehicle f
15	Bradley Wood	5	15/07/2012	178.97	Vehicle f
16	Charlie Ross	2	29/11/2014	92.31	Accomm
17	Ethan Dean	4	15/08/2013	51.69	Public tra
18	Harrison Hart	6	08/06/2014	15.68	Stationer
19	Benjamin Owen	7	24/04/2015	183.60	Miscellar
20	Jacob Spencer	2	31/07/2012	490.04	Accomm

Expenses Expenses (2) (+)

READY

CONNECTING TO EXCEL DATA

- The second type of Excel object recognized by Power BI is a table
- four ways to create a table in Excel:
 1. Home > Format as Table,
 2. Insert > Table,
 3. Control-T
 4. Control-L.
- When the Create Table dialog appears, make sure the checkbox next to the option My table has headers is activated.
- To name the table, use Table Tools > Design > Table Name.

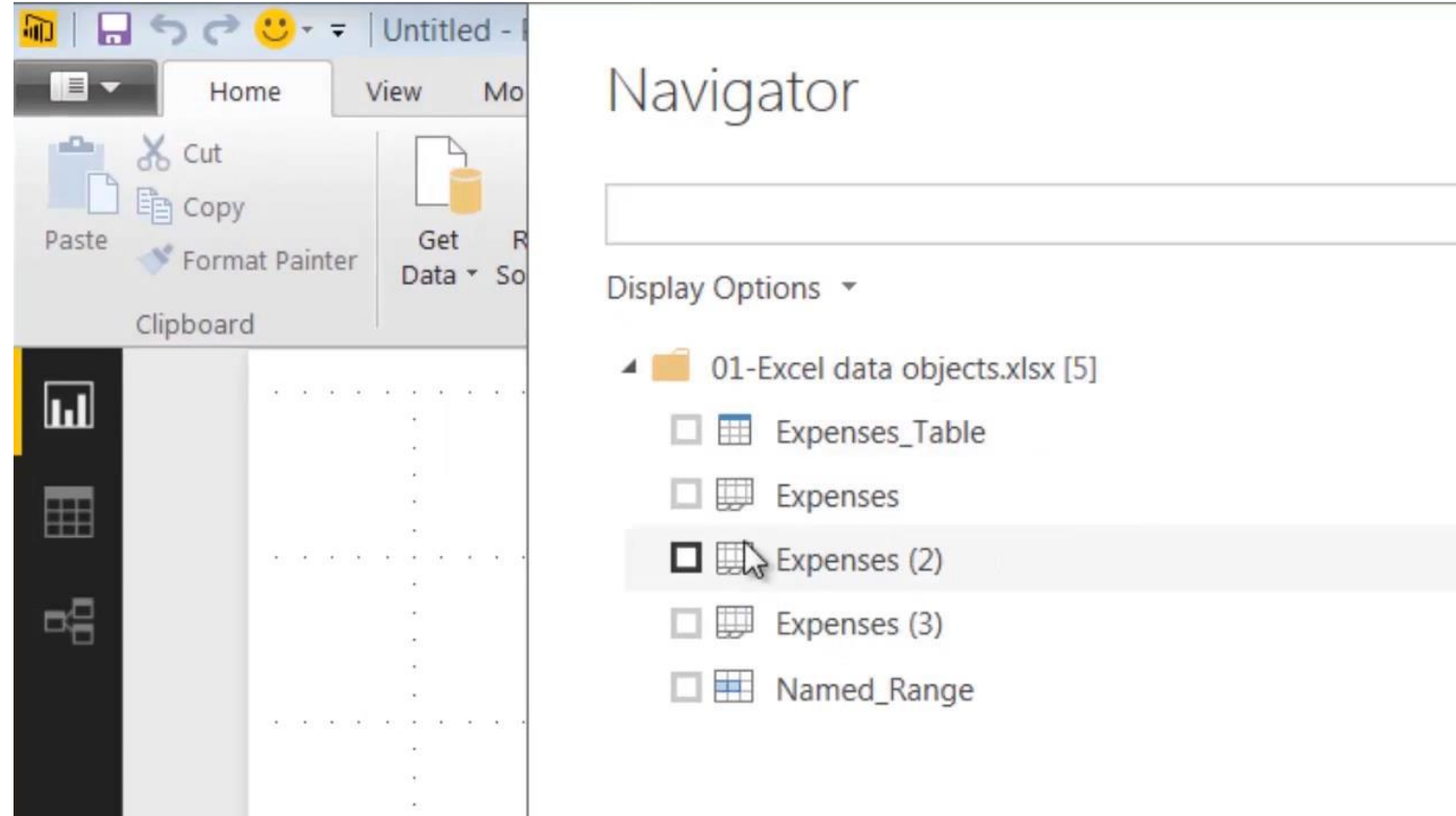


CONNECTING TO EXCEL DATA

- Tables are very much the preferred format when importing Excel data into Power BI. So, if you're optimizing Excel data for Power BI, you should definitely consider converting the data into the table.
- create another copy of the "Expenses" worksheet (using Control-drag) and look at the third Excel object which Power BI recognizes: a named range.
- create a named range which points to the entire dataset contained in your copied "Expenses (3)" worksheet.
- select all the data and then enter the name "Named_Range" in the name box in the top left of the screen, parallel with the formula bar.
- the three types of object which Power BI Desktop will recognise:
 1. ordinary worksheet data,
 2. Excel tables
 3. named ranges

IMPORTING EXCEL OBJECTS INTO POWER BI

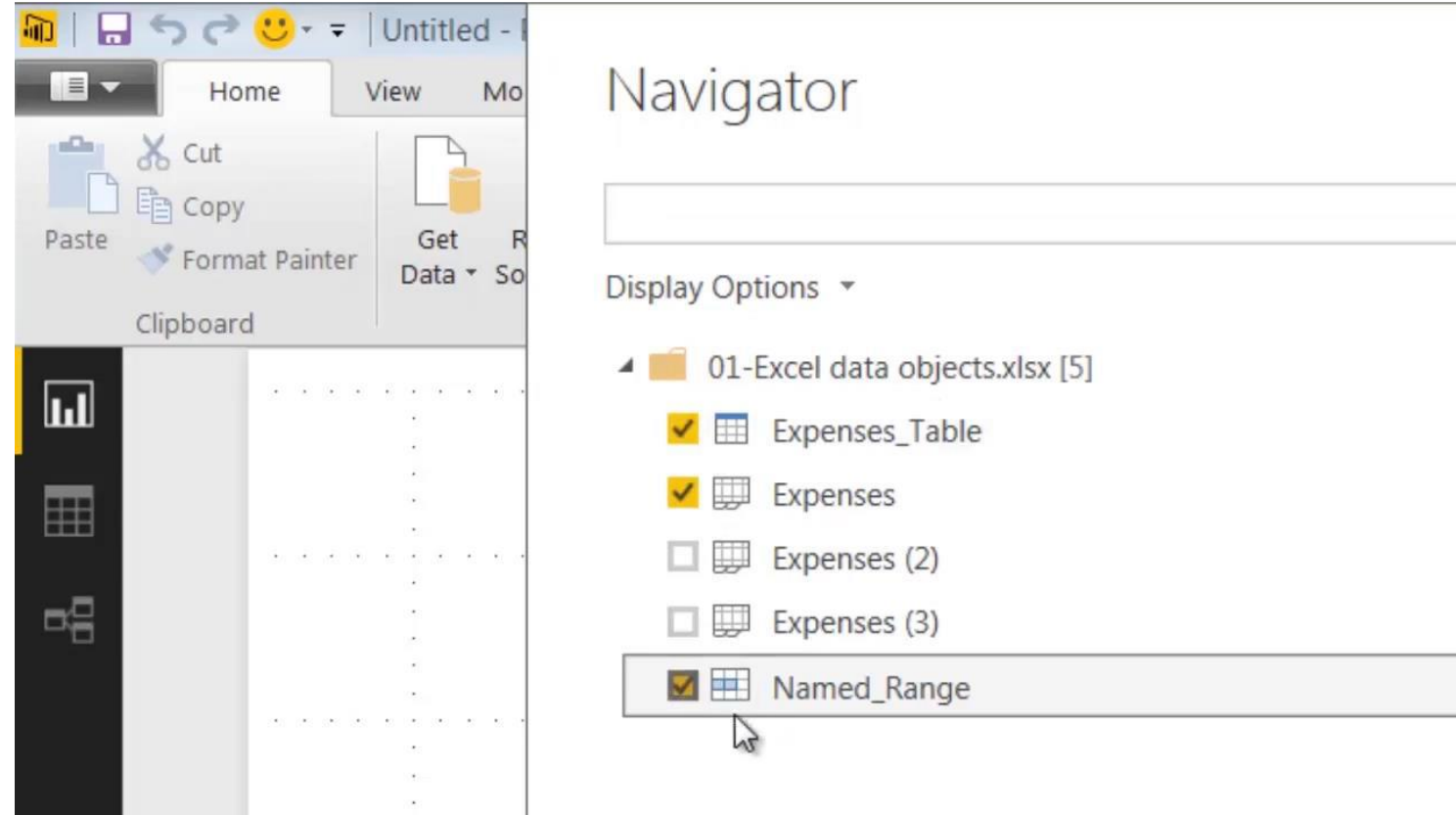
- to import the data, we choose **Home > Get Data > Excel**; and then double-click on **“Excel objects.xlsx”**.
- Power BI recognizes five objects in total:
 1. the table,
 2. the named range
 3. the three worksheets (“Expenses”, “Expenses (2)” and “Expenses (3)”).



CONNECTING TO EXCEL DATA

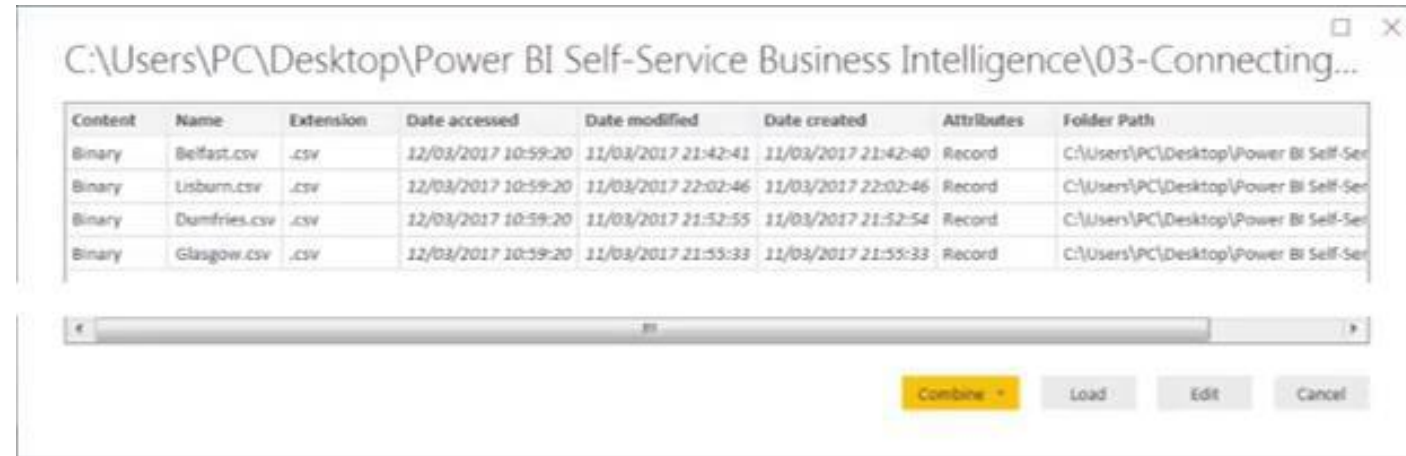
- Recognizing the Icons
- different icons which are used to indicate tables, worksheets and named ranges:
 1. The table icon has a blue bar at the top.
 2. The worksheet icon has tiny sheet tabs in the bottom left.
 3. The named range icon has a light blue shading in the middle of the icon.

import all three types of Excel object, activate the checkboxes next to Expenses_Table, Expenses and Named_Range, then click the Edit button.



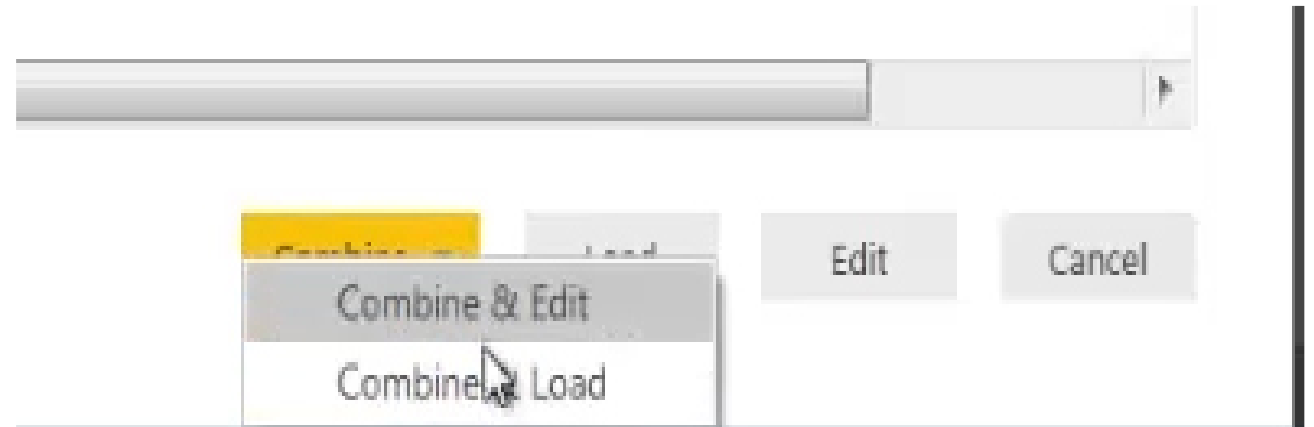
CONNECTING TO THE FOLDER

- open Power BI Desktop; and, in a blank file, click on **Get Data > More > Folder**.
- click the Browse button and specify the path to the “All Data” folder.
- When you click OK, the Navigator displays a list of all the files which have been found in the specified folder



CONNECTING TO THE FOLDER

- At the bottom of the Navigator screen, **click the Combine** button to reveal a drop-down menu containing two options: **Combine and Edit**
- and **Combine and Load** (which will load the data straight into the data model).
- choose **Combine and Load** .
- Save As “FolderData.Pbix”



CONNECTING TO WEB DATA

- Retrieving data from a web URL, Power BI also allows you to retrieve data from within the web page itself.

EXAMINING THE SOURCE DATA

- Open the sub-folder called “content”. Inside it, you will find an excel file called “travel budget.Xlsx”. Let us begin by opening this file.

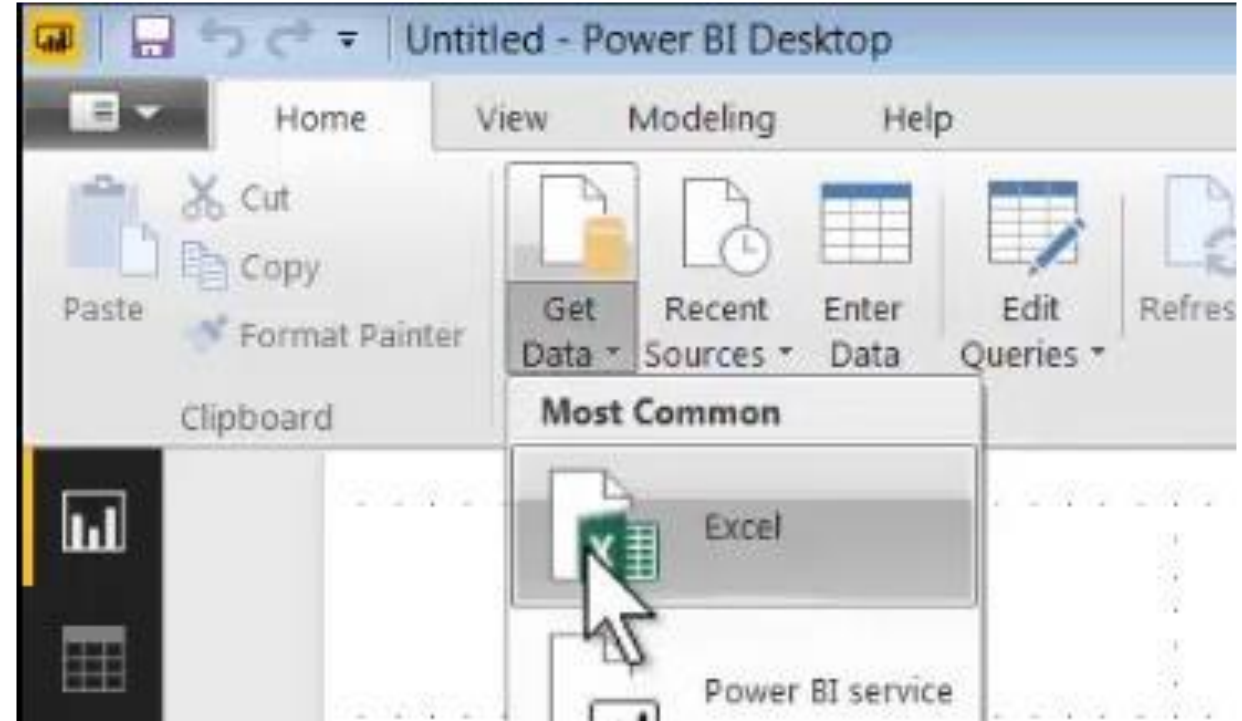
	File	Home	Insert	Page Layout	Formulas	Data	Review	View	Developer	Design	Tell me what you want to do
	Paste	Clipboard	Font	Alignment	Number						
E2											
	A	B	C	D	E	F	G				
1	Staff ID	Name	Country	Month	Month Num	Month Offse	Budget USD				
2	ST0011181	Dominic Faulkner	United States	Nov	11	1	2475				
3	ST0011187	Tanisha Carpenter	United States	Nov	11	1	3400				
4	ST0011458	Robert Hughes	United States	Nov	11	1	6950				
5	ST0012502	Dana Kauffman	United States	Nov	11	1	2500				

EXAMINING THE SOURCE DATA

- There is a table containing budget data which shows the estimated travel costs for all our employees.
- To keep the data fresh, instead of putting static data in the "**Month Num**" column, **used is a formula**; so that, whenever you open the file, Excel recalculates the next three months.
- The figures in **the "Budget USD"** will stay the same, but the month columns will change depending on the current date.

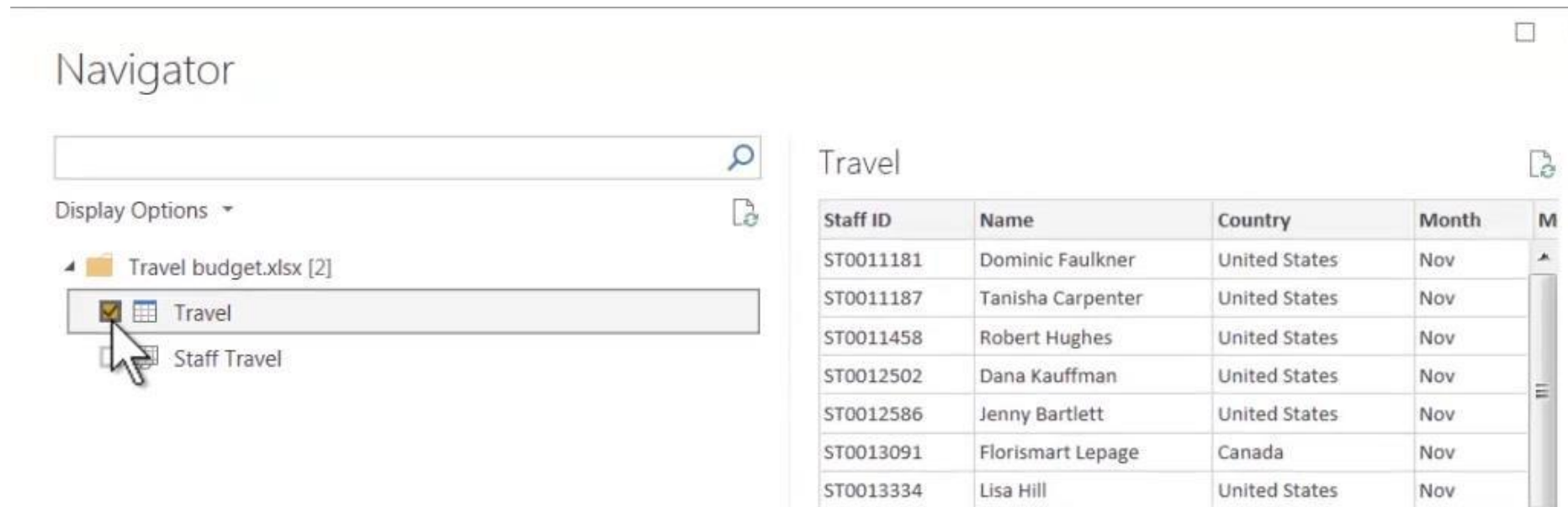
CONNECTING TO THE EXCEL DATA

- choose Home > Get Data > Excel and navigate to the "Travel budget" file, then double-click to connect to it.



CONNECTING TO THE EXCEL DATA

- Activate the **checkbox** next to the **"travel"** table and click the edit button to view the table in the **query editor**.



Navigator

Display Options

Travel budget.xlsx [2]

☒ Travel

☐ Staff Travel

Travel

Staff ID	Name	Country	Month	M
ST0011181	Dominic Faulkner	United States	Nov	
ST0011187	Tanisha Carpenter	United States	Nov	
ST0011458	Robert Hughes	United States	Nov	
ST0012502	Dana Kauffman	United States	Nov	
ST0012586	Jenny Bartlett	United States	Nov	
ST0013091	Florismart Lepage	Canada	Nov	
ST0013334	Lisa Hill	United States	Nov	

CONNECTING TO THE CURRENCY EXCHANGE RATE DATA

- In the Query Editor, choose Home > New Source > Web. Enter the following URL and click OK to connect:

<http://www.currency-converter.org.uk/currency-exchange-rates.html>.



```
let
Source = Web.Page(Web.Contents("http://www.currency-
converter.org.uk/currency-exchange-rates.html")), Data =
Source{0}[Data]
in
Data
```

CONNECTING TO THE WEB DATA

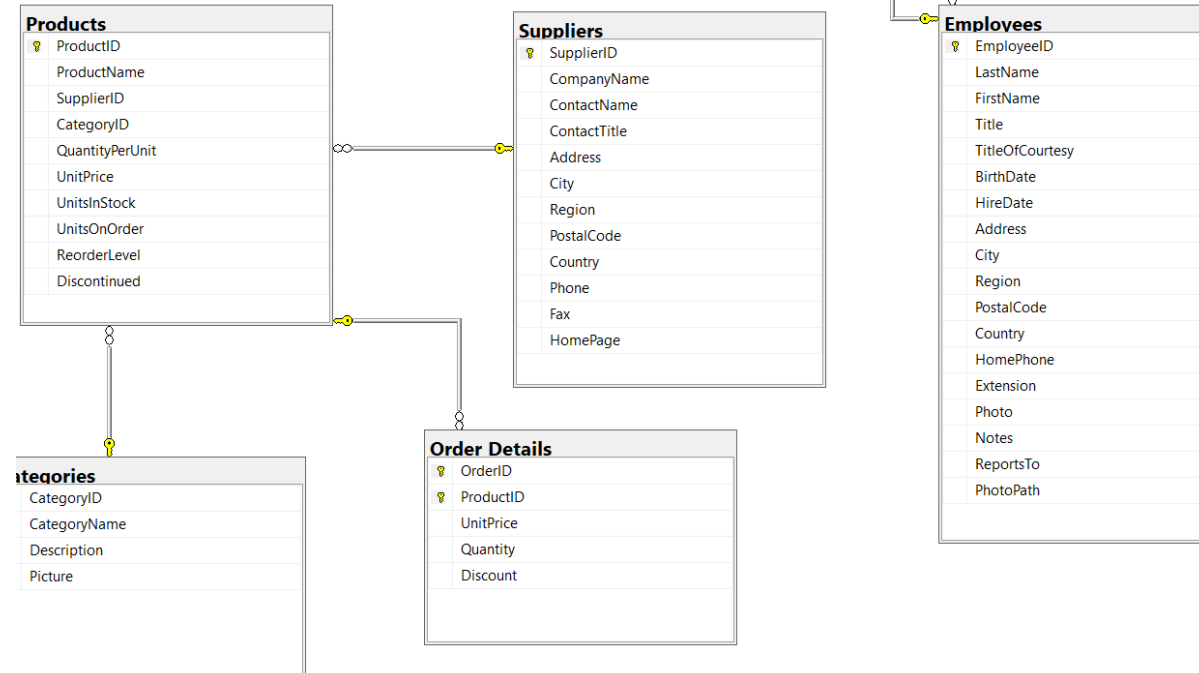
- When examining the web page, power BI will focus on tabular data; basically, it is going to look for HTML tables, as indicated by the HTML <table> element; and it shows you all of the tables it has retrieved.
- Click on the checkbox next to each one, and you will be given a preview of the data which that table contains.
- The table we are looking for is the one which contains the exchange rate information.
- You are given a preview of the table as it appears on the web page. This makes it fairly easy to locate the correct table; in our case, we need the table called "foreign currency exchange rates today...".
- The table contains exchange rates for converting a number of different currencies into six major currencies: gbp, eur, usd, aud, nzd and cad.
- Load a and Save file as WebData.Pbix
- Exit

The screenshot displays the Power BI interface. On the left, the 'Navigator' pane shows a list of tables retrieved from the website 'http://www.currency-converter.org.uk/currency-exchange-rates...'. The tables listed are 'Document', 'Foreign Currency Exchange Rates Today (16th Oct 2017)', and 'Table 1'. The 'Foreign Currency Exchange Rates Today (16th Oct 2017)' table is selected, and its checkbox is checked. On the right, the 'Web View' pane shows a preview of the website. The website is titled 'CurrencyConverter' and displays 'MONDAY, 16TH OCTOBER 2017'. It includes a navigation bar with links like 'HOME', 'SEND MONEY ONLINE', and 'CURRENCY EXCHANGE'. Below the navigation bar, there are links for 'FREE RATE QUOTE', 'CURRENCY CONVERTER', and 'DAILY CURRENCY'. The main content area shows 'Home » Currency Exchange Rates' and 'Currency Exchange Rates Today'.

Connecting to SQL Server

COMPARING THE DATABASE TO THE DATA MODEL

- Let us look at the structure of the database by expanding the Database Diagrams folder and double-clicking the diagram, dbo.



CREATE A STAR SCHEMA

The data model, has six tables, only five of which have been imported from the original database: The most important table in the data model, Dates Table, has been created in Power BI: Dates Table (Date, Year, Month Num, Month)
Almost all data models in Power BI require a date table containing all the different time related categories by which you want to categorize your data



CREATE A STAR SCHEMA

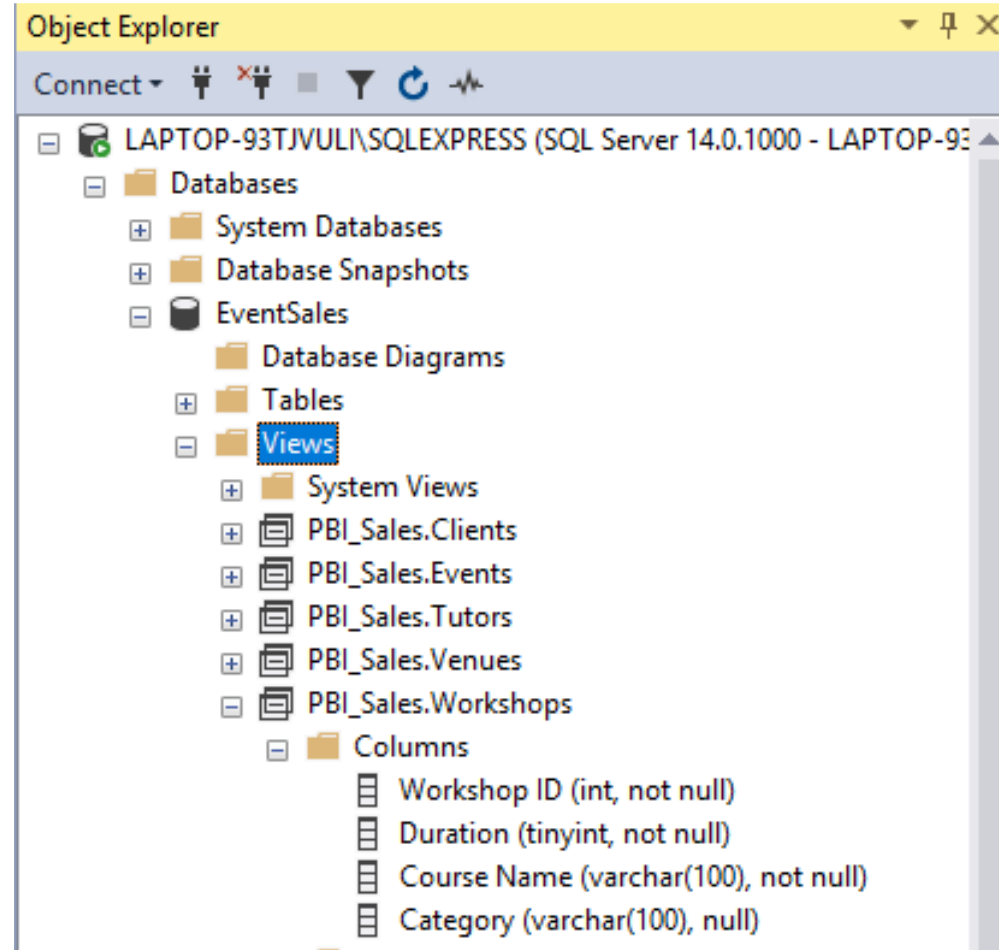
- The reduction in the number of tables from database to data model is typical of Power BI workflows.
- As our focus shifts towards reporting and analysis, we denormalize the relational database and introduce a certain amount of redundancy in order to facilitate data analysis.
- The structure of our data model is referred to as a star schema.
- It consists of a single main table, referred to as a fact table; and several supporting tables, all linked to the central fact table, which will be used to categorize the data in the fact table, and which are referred to as dimension tables.

IMPORTING SQL SERVER VIEWS

- When importing data from SQL Server, you always need to think ahead to the data model you wish to create, and devise a strategy which will facilitate its creation.
- In general, the most efficient approach is to avoid connecting directly to the tables in your relational database.
- you can create a series of views, each corresponding to one of the tables which will be present in your data model.
- In Power BI, you then connect to these views rather than to the original database tables.
- Taking this approach makes it easier to update your Power BI data models if modifications are made to the database tables or to the database structure

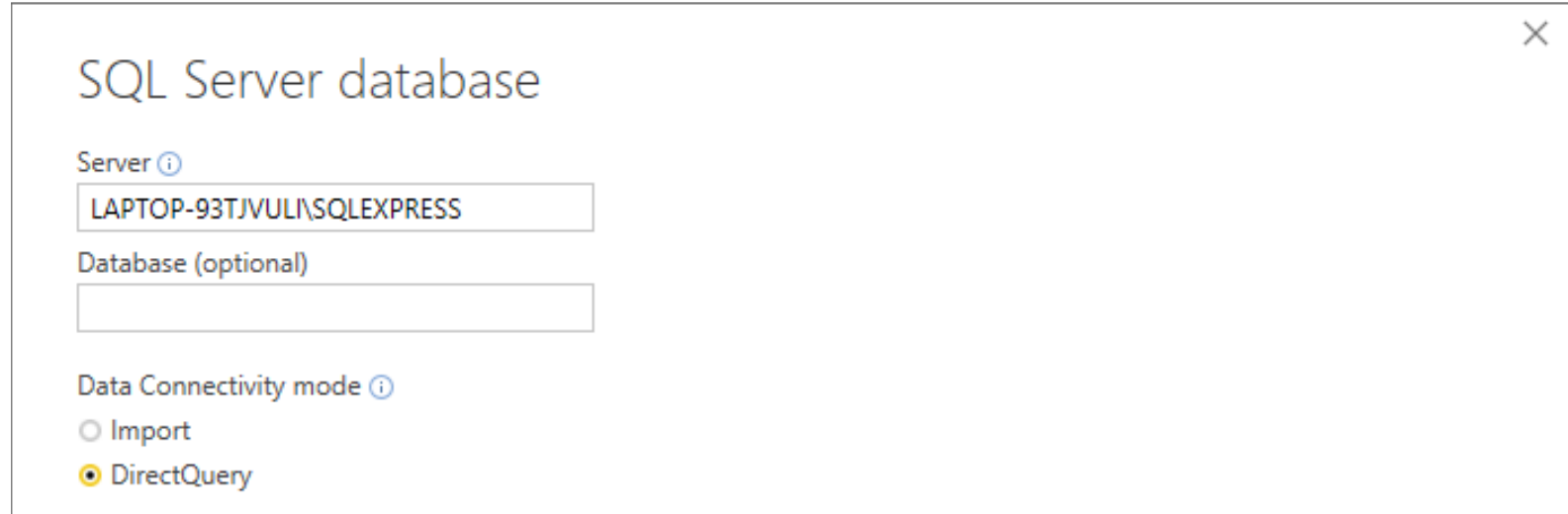
CREATE A STAR SCHEMA

- In SQL Server Management Studio's Object Explorer, expand the northwind database; then, expand the Views folder.



IMPORTING SQL SERVER VIEWS

- To import data from a SQL Server database, choose
- **Home > Get Data > SQL Server.**
- When the SQL Server connection dialog appears, enter the name of your SQL Server instance in the Server field.
- You do not need to enter a name in the Database field; since, if the database field is left blank, when you click the OK button, you will be given access to all the databases on the server.



SQL Server database

Server ⓘ
LAPTOP-93TJVULI\SQLEXPRESS

Database (optional)

Data Connectivity mode ⓘ
☐ Import
☒ DirectQuery

IMPORTING SQL SERVER VIEWS

- Click on the Advanced options button and make sure that that Navigate using Full Hierarchy is checked.
- This causes Power BI to display all objects in easily recognizable groups, making it much easier to find stuff.
- Click OK.

- ☐ Include relationship columns
- ☒ Navigate using full hierarchy
- ☐ Enable SQL Server Failover support

OK

Cancel

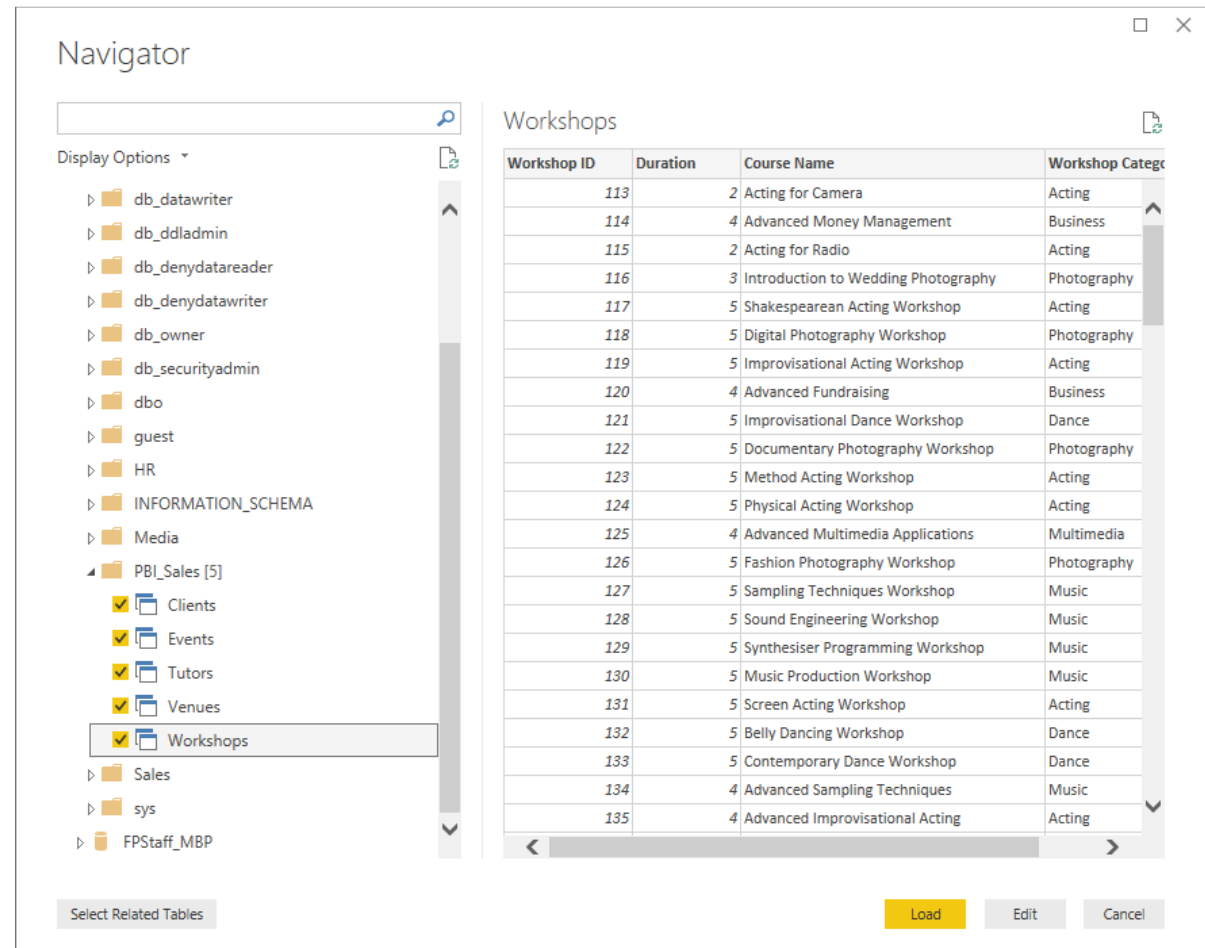
AUTHENTICATION MODE

- When you connect to SQL Server, you need to specify the authentication mode you wish to use. There are three options: Windows, Database and Microsoft account.
- The default selection, Windows, should be selected.
- Click the **Connect** button to advance to the next screen. If you receive a message ("We were unable to connect to the data source using an encrypted connection") Click OK to dismiss it

The screenshot shows a dialog box titled "SQL Server database" with a close button (X) in the top right corner. On the left is a dark sidebar with three options: "Windows" (highlighted with a yellow bar), "Database", and "Microsoft account". The main area of the dialog shows the server name "desktop-gm2fu5q\\sqlexpress;EventSales" with a folder icon. Below this, it says "Use your Windows credentials to access this database." There are two radio buttons: "Use my current credentials" (which is selected) and "Use alternate credentials". Below the radio buttons are input fields for "User name" and "Password". Further down is a dropdown menu labeled "Select which level to apply these settings to" with the value "desktop-gm2fu5q\\sqlexpress" selected. At the bottom are three buttons: "Back", "Connect" (highlighted in yellow), and "Cancel".

IMPORTING SQL SERVER VIEWS

- In the Navigator window, use the arrows on the left to expand, first, the SQL Server instance, then Northwind > View_name (the name of our view). Click in the checkboxes next to each of the views to activate them, then click the Load button.
- Save as **SQLServerData.PBix**



REFRESHING IMPORTED SQL SERVER DATA

- Having imported data from an on-premises SQL Server database, when you upload your report to the Power BI service, you will need to set up a refresh schedule to ensure that the version in the cloud is up to date.
- Once the gateway is configured on the local, on premises computer, it will be visible in the Power BI service.
- A refresh schedule for the SQL Server data source can then be created.
- In a Power BI Pro capacity, you can refresh up to 8 times a day; within a Power BI Premium capacity, up to 48 times a day.

KEY POINTS OF INTEREST WHEN IMPORTING DATA FROM SQL SERVER.

1. It is more efficient to import data from SQL Server views than directly from database tables.
2. Each view should create a data-model-ready table, containing only relevant columns, with report-friendly names.
3. A data model containing imported SQL Server data can be mashed up with data from other sources, as well as with calculated tables.
4. There are no restrictions on the creation of DAX calculated tables, measures and calculated columns.
5. When uploaded to the Power BI service, the imported data needs to be updated via an on-premises gateway using a refresh schedule.

IMPORT VERSUS DIRECTQUERY

- When you use the **DirectQuery option**, data is not imported from SQL Server into the data model of your SQL Server report. Instead, when the report creator configures visuals in Power BI Desktop, the actual data source is always queried, not an imported copy.
- Thus performance of the SQL Server instance will have a big impact on the user experience.
- DirectQuery is a useful option when reports require very up-to-date information

IMPORT VERSUS DIRECT QUERY

- connect to the same SQL Server views as we did when looking at the Import option; but, this time, we will use DirectQuery mode.
- notice that on the left of your screen, only Report and Relationship modes are available;
- **Data mode is not present when working in DirectQuery mode.**
- Switch to Relationship view and you will notice that Power BI has not automatically created relationships, as it did when we imported the data.
- In directquery mode, to create a relationship, you must always drag from the many table to the one table in order to create the many-to-one relationship required by Power BI else you get an error message.

IMPORT VERSUS DIRECTQUERY

×

Create relationship

Select tables and columns that are related.

Clients

Client ID	First Name	Surname	Gender	City	Region	Postal Code	Country	Zone
129044	Chris	Watson	male	Herreid	SD	57632	United States	Americas
130370	Robert	Jacobson	male	Atlanta	GA	30318	United States	Americas
131099	Benedetto	Trentini	male	Passo Rolle	TN	38037	Italy	Western Europe

Events

Event ID	Start Date	Workshop ID	Venue ID	Tutor ID	Tutor Fee	Client ID	Revenue	Rating
1136	03 January 2013	228	1303	212	£800	111569	£450	5.2
1136	03 January 2013	228	1303	720	£600	111569	£450	5.2
1136	03 January 2013	228	1303	212	£800	117387	£530	5.7

Cardinality

Many to one (*:1)

☒ Make this relationship active
 ☐ Assume referential integrity
 [Learn more](#)

Cross filter direction

Single

☐ Apply security filter in both directions

⚠ The filter direction you selected isn't valid for this relationship.

OK

Cancel

IMPORT VERSUS DIRECTQUERY

- After creating your relationships between our tables, if you switch to Report view, and click on the Modelling Tab of the Ribbon, you can see that the Create Table command may be unavailable.
- So, you may not be able to add a data table to your data model at times.
- When connecting to a SQL Server database in DirectQuery mode, you cannot add tables from any other data sources into the data model; and, additionally, all the tables to which you connect must be in the same SQL Server database.

REFRESHING DIRECTQUERY SQL SERVER DATA

- When you upload your report to the Power BI service, you will need a way of directly connecting to your SQL Server instance.
- The solution is again the on-premises data gateway.
- You do not need to create a refresh schedule; Power BI will use the data source credentials to connect to the on-premises SQL Server instance as necessary.

KEY POINTS:

DIRECTQUERY CONNECTION TO A SQL SERVER DATABASE.

1. It is still more efficient to import data from SQL Server views than directly from database tables.
2. All imported tables and views must come from the same database.
3. A data model containing a DirectQuery connection to SQL Server data cannot be mashed up with data from any other sources.
4. Calculated tables cannot be added to the data model.
5. There are severe restrictions on the use of DAX when creating measures and calculated columns. (These options can be overridden in Power BI Desktop's options settings.)
6. When a DirectQuery report is uploaded to the Power BI service, a data source must be created to enable Power BI to connect to the database via an on-premises gateway; however, no refresh schedule needs to be created.

CONNECTING TO DATABASE TABLES USING SQL STATEMENTS

- Some time you may want to use SQL statements.
- The same statements that you would use to create views in the SQL Server database can be executed from within Power BI.
- Write SQL to join Orders, Customers, Products, Employees etc
- ```
. SELECT Sales.EventsData.EventID 'Event ID' ,
Sales.EventsClients.ClientID 'Client ID' , Sales.EventsClients.Revenue ,
Sales.EventsClients.Rating , Sales.EventsData.StartDate 'Start Date' ,
Sales.EventsData.WorkshopID 'Workshop ID' , Sales.EventsData.VenueID
'Venue ID' , HR.EventsTutors.TutorID 'Tutor ID' ,
HR.EventsTutors.TutorFee 'Tutor Fee' FROM Sales.EventsClients INNER JOIN
Sales.EventsData ON Sales.EventsClients.EventID =
Sales.EventsData.EventID INNER JOIN HR.EventsTutors ON
Sales.EventsData.EventID = HR.EventsTutors.EventID
```

# CONNECTING TO DATABASE TABLES USING SQL STATEMENTS

- Choose **Home > Get Data > SQL Server**.
- When the SQL Server connection dialog appears, enter the name of your SQL Server instance in the Server field;
- enter “ODERS” in the Database field; and set the Data Connectivity mode to Import.
- To access the option to execute an SQL statement, click on the **Advanced options** button; then, >write sql statement or paste the text which you copied earlier into the box marked SQL Statement.
- The Advanced options section contains three features which may be activated or deactivated via checkboxes; uncheck all three

# CONNECTING TO DATABASE TABLES USING SQL STATEMENTS

## Advanced options

Command timeout in minutes (optional)

SQL statement (optional, requires database)

```
, Sales.EventsClients.ClientID 'Client ID'
, Sales.EventsClients.Revenue
, Sales.EventsClients.Rating
, Sales.EventsData.StartDate 'Start Date'
, Sales.EventsData.WorkshopID 'Workshop ID'
, Sales.EventsData.VenueID 'Venue ID'
, HR.EventsTutors.TutorID 'Tutor ID'
, HR.EventsTutors.TutorFee 'Tutor Fee'
FROM Sales.EventsClients
INNER JOIN
Sales.EventsData ON Sales.EventsClients.EventID = Sales.EventsData.EventID
INNER JOIN
HR.EventsTutors ON Sales.EventsData.EventID = HR.EventsTutors.EventID
```

- ☐ Include relationship columns
- ☐ Navigate using full hierarchy
- ☐ Enable SQL Server Failover support

OK

Cancel

Click the OK to see a preview of the table generated by your query;