

# Mastering the Query Features of Power BI Desktop



# Agenda

- Deciding What To Measure
- Understanding Queries in Power BI Desktop
- Working with the Query Editor Window
- Designing Advanced Combine Queries
- Importing OLTP Data Into a Star Schema



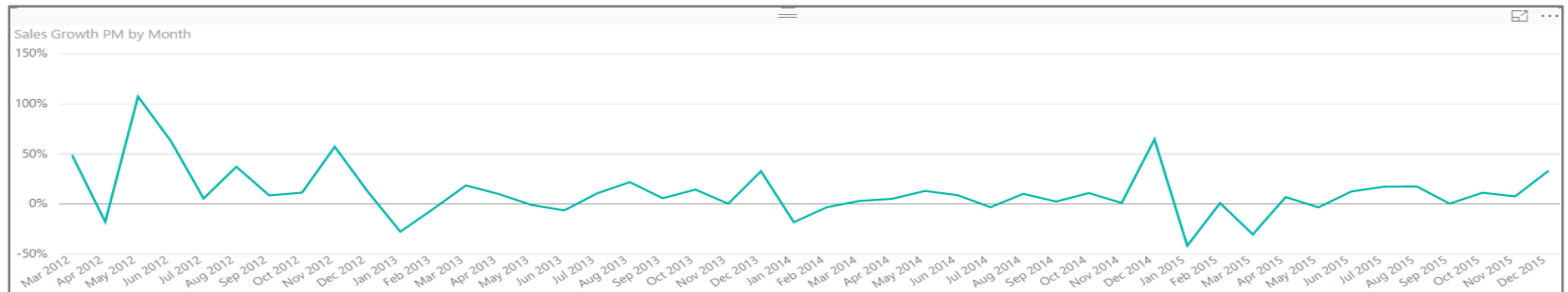
# Data Discovery

- Data can live in a variety of sources
  - Files (e.g. CSV file, Excel workbook)
  - OLTP Databases
  - OLAP Databases
  - SharePoint Lists and Document Libraries
  - Azure-based services
  - Online services & SaaS applications



# Deciding What To Measure

- You Must Determine Measurable Objectives
  - Financial (revenue, expenses, profit margin, etc.)
  - Business processes efficiency
  - Customer Satisfaction Levels



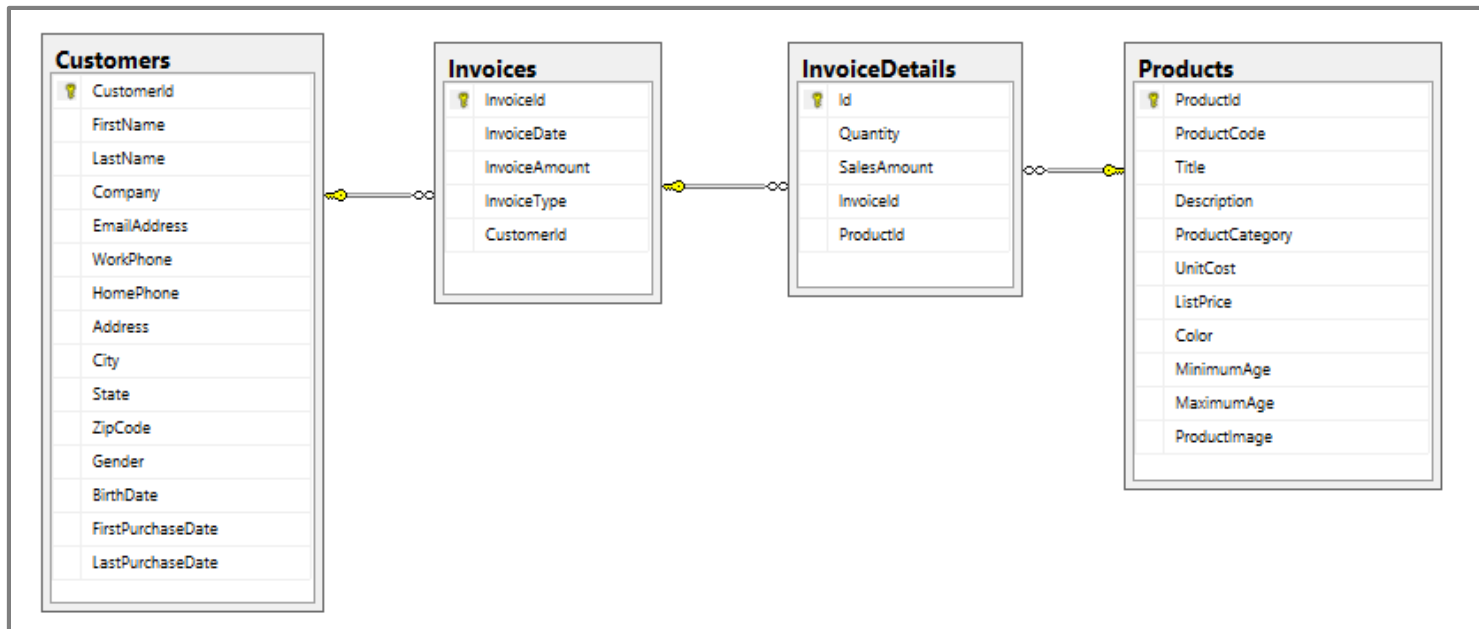
# Defining Grain Statements

- Grain statements should be defined in initial design phase
  - Grain statements helps determine requirements for BI queries
  - Grain statements can be created & understood by business users
- Example grain statements for BI project at Wingtip Toys
  - What was the total sales revenue over the last 4 years?
  - What was the sales revenue by year, quarter and month?
  - What was the sales revenue by region, state, city and zip code?
  - What was the sales revenue by category, subcategory and product?
  - What was the growth in sales revenue from month to month in 2013?
  - What was profit margin for each product by year, quarter and month?
  - Have their been any products with significantly decreasing profit margin?



# Sample OLTP Database: WingtipSalesDB

- Online Transaction Processing (OLTP) System
  - Used for real-time data access and transaction-based data entry
  - Optimized for faster transactions (e.g. inserts, updates & deletes)
  - Tables normalized to reduce/eliminate redundancies
  - Table schemas can be hard for business users to understand



# Agenda

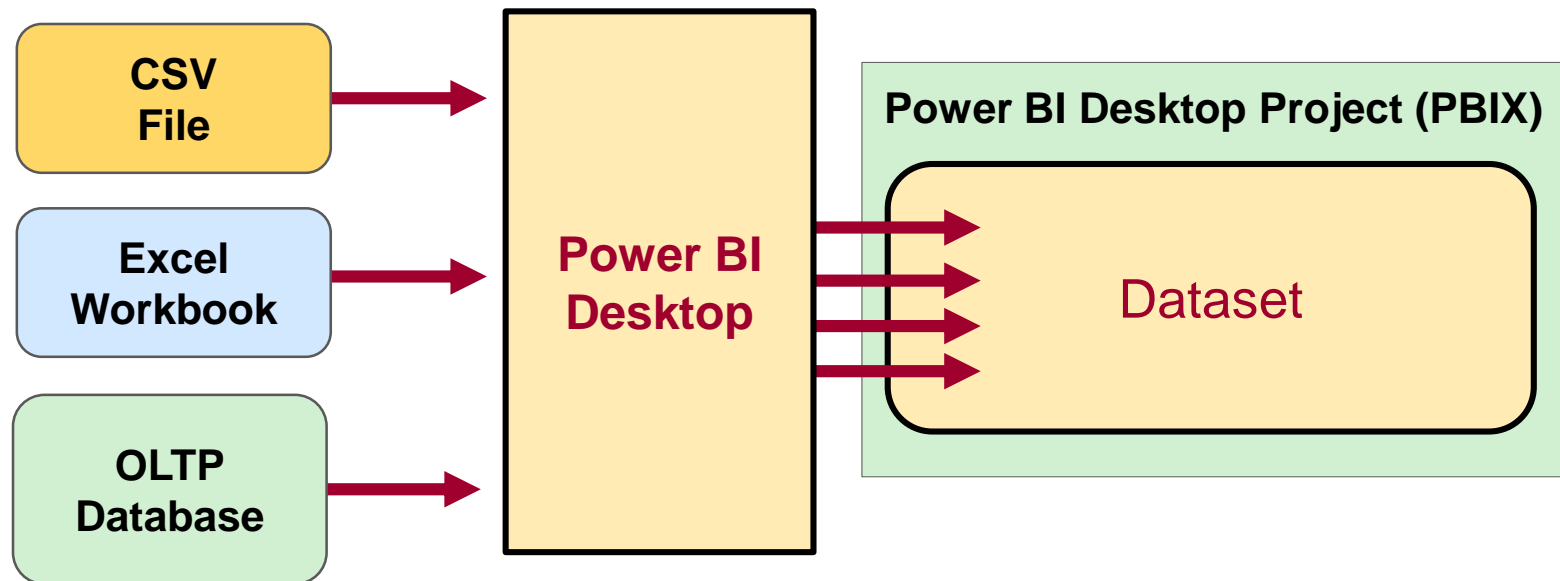
- ✓ Deciding What To Measure
- Understanding Queries in Power BI Desktop
  - Working with the Query Editor Window
  - Designing Advanced Combine Queries
  - Importing OLTP Data Into a Star Schema





# Power BI Desktop is an ETL Tool

- ETL process is essential part of any BI Project
  - **Extract** the data from wherever it lives
  - **Transform** the shape of the data for better analysis
  - **Load** the data into dataset for analysis and reporting





# Query Steps

- A query is created as a sequence of steps
  - Each step is a parameterized operation on the data
  - Each step has formula which can be viewed/edited in formula bar
  - Query starts with Source step to extract data from a data source
  - Additional steps added to perform transform operations on data
  - You can replay query operations one by one by clicking on steps

The screenshot displays the Power BI Query Editor interface. At the top, the ribbon includes 'File', 'Home', 'Transform', 'Add Column', and 'View'. Below the ribbon, the 'Formula Bar' is active, showing the formula: `= Table.ReplaceValue("#Replaced Female Values","M","Male",Replacer.ReplaceText,`. A red dashed box highlights the formula bar, with a callout box labeled 'step formula bar' pointing to it. On the left, the 'Queries [6]' pane lists 'Customers', 'Sales', 'Purchases', 'Products', 'SalesRegions', and 'SalesRegionsSort'. The main area shows a data table with columns: CustomerId, Customer, State, City, Zipcode, and Gender. The table contains 14 rows of data. On the right, the 'Query Settings' pane is open, showing the 'Properties' section with 'Name' set to 'Customers'. Below it, the 'Applied Steps' section is highlighted with a red dashed box, showing a sequential list of steps: Source, Navigation, Removed Other Columns, Merged Columns, Reordered Columns, Replaced Female Values, Replaced Male Values (selected), Changed Type, and Added Conditional Column. A callout box labeled 'sequential list of steps for query' points to this list.

| CustomerId | Customer          | State | City       | Zipcode | Gender |
|------------|-------------------|-------|------------|---------|--------|
| 1          | Nina Diaz         | CA    | Eureka     | 95501   | Female |
| 2          | Melinda Carter    | CA    | Napa       | 94558   | Female |
| 3          | Pam Miller        | CA    | Napa       | 94558   | Female |
| 4          | Merle Blackwell   | CA    | Sacramento | 95823   | Female |
| 5          | Ariel Hale        | CA    | Sacramento | 95818   | Male   |
| 6          | Randy Carter      | CA    | Sacramento | 95818   | Male   |
| 7          | Lillie Hinton     | CA    | Eureka     | 95501   | Female |
| 8          | Ladonna Moody     | CA    | Napa       | 94559   | Female |
| 9          | Buddy McKay       | OR    | Bend       | 97701   | Male   |
| 10         | Warren Sykes      | CA    | Sacramento | 95818   | Male   |
| 11         | Jan Rutledge      | OR    | Portland   | 97216   | Female |
| 12         | Dallas Lester     | OR    | Eugene     | 97402   | Male   |
| 13         | Matthew Zimmerman | OR    | Portland   | 97220   | Male   |
| 14         | Sheryl Hernandez  | CA    | Sacramento | 95823   | Female |

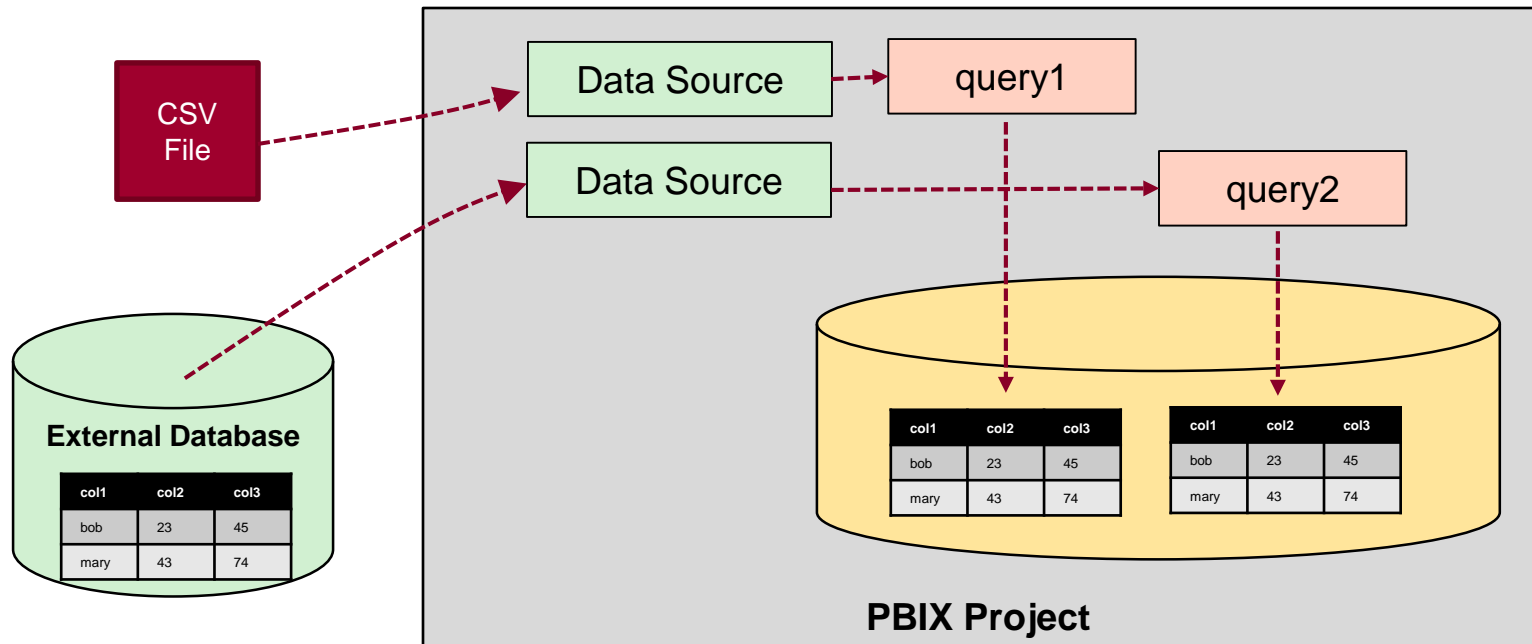
# Advanced Editor

- Power BI Desktop based on "M" functional language
  - Query in Power BI Desktop saved as set of M statements in code
  - Query Editor generates code in M behind the scenes
  - Advanced users can view & modify query code in Advanced Editor



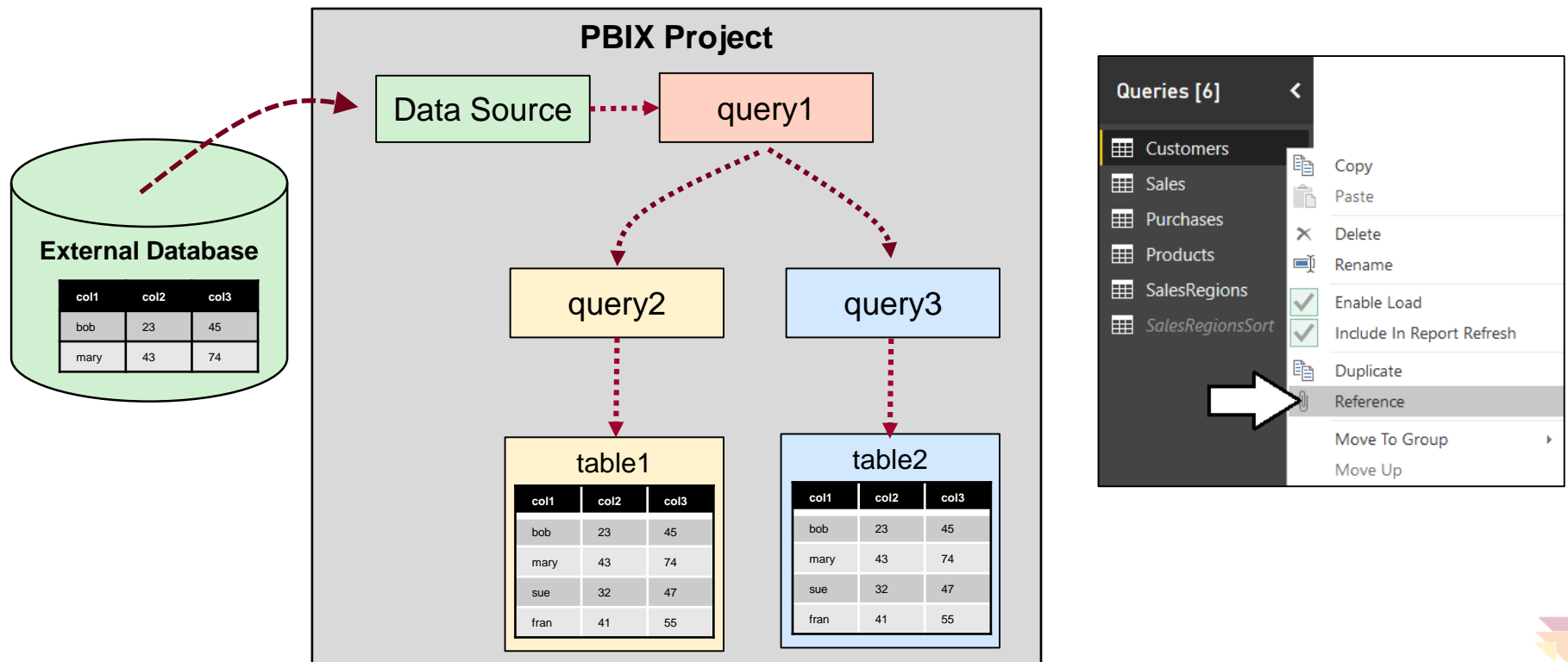
# Understanding Query Input and Output

- PBIX project is container for data sources and queries
  - Queries created and saved within scope of Power BI project
  - Queries can pull data from local files
  - Queries can pull data from external content sources
  - Queries main purpose is to load imported data into data model



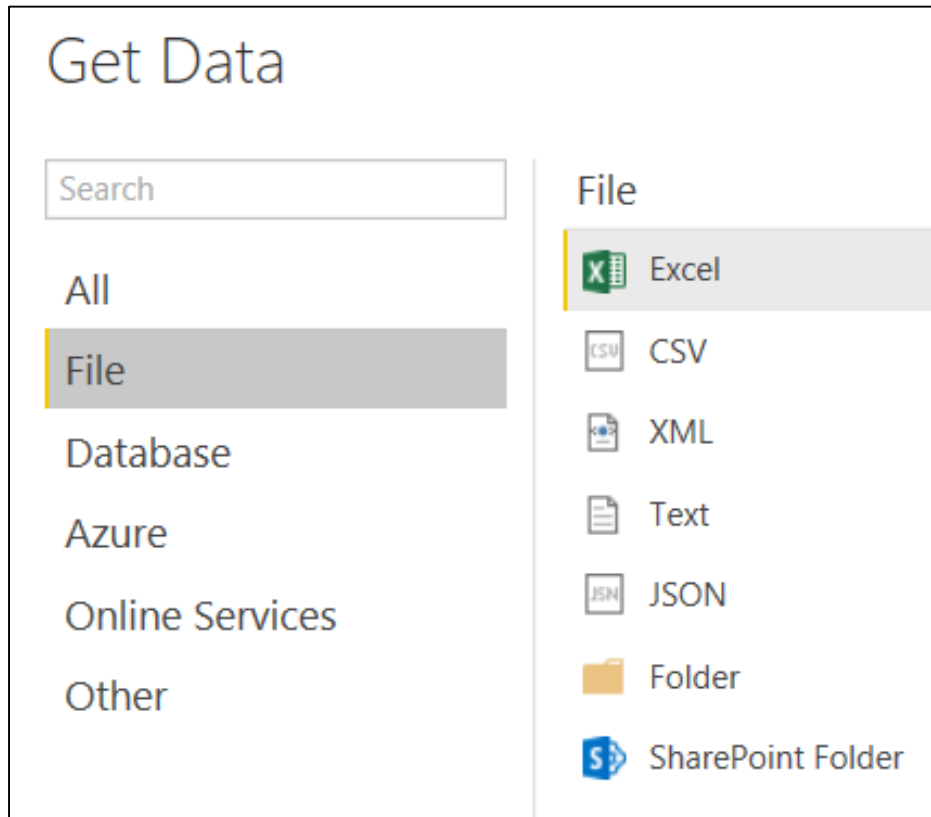
# Query Composition

- Query can serve as source for other queries
  - Allows for creation of reusable base queries & query composition
  - Complexity can be hidden in base queries
  - **Reference** command creates new query based on another query



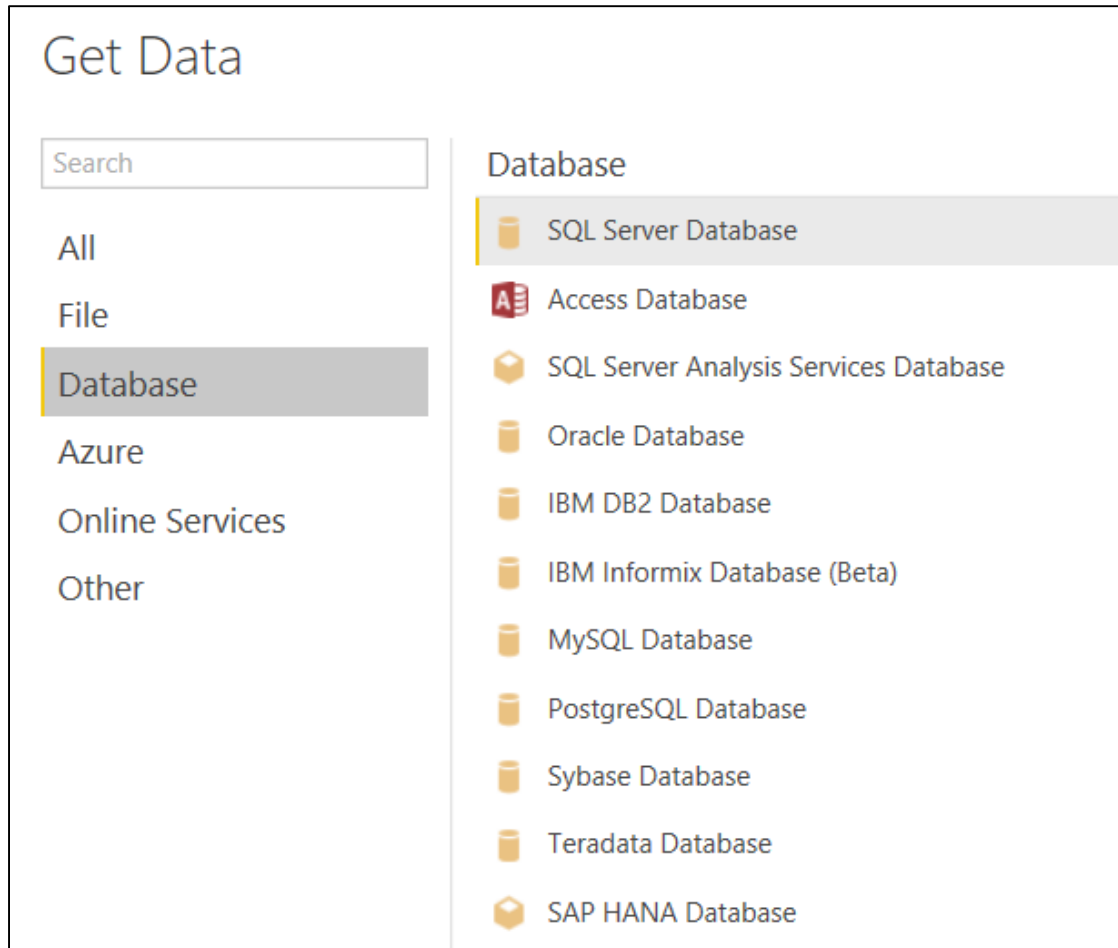
# File-based Data Sources

- Power BI Desktop supports common file types



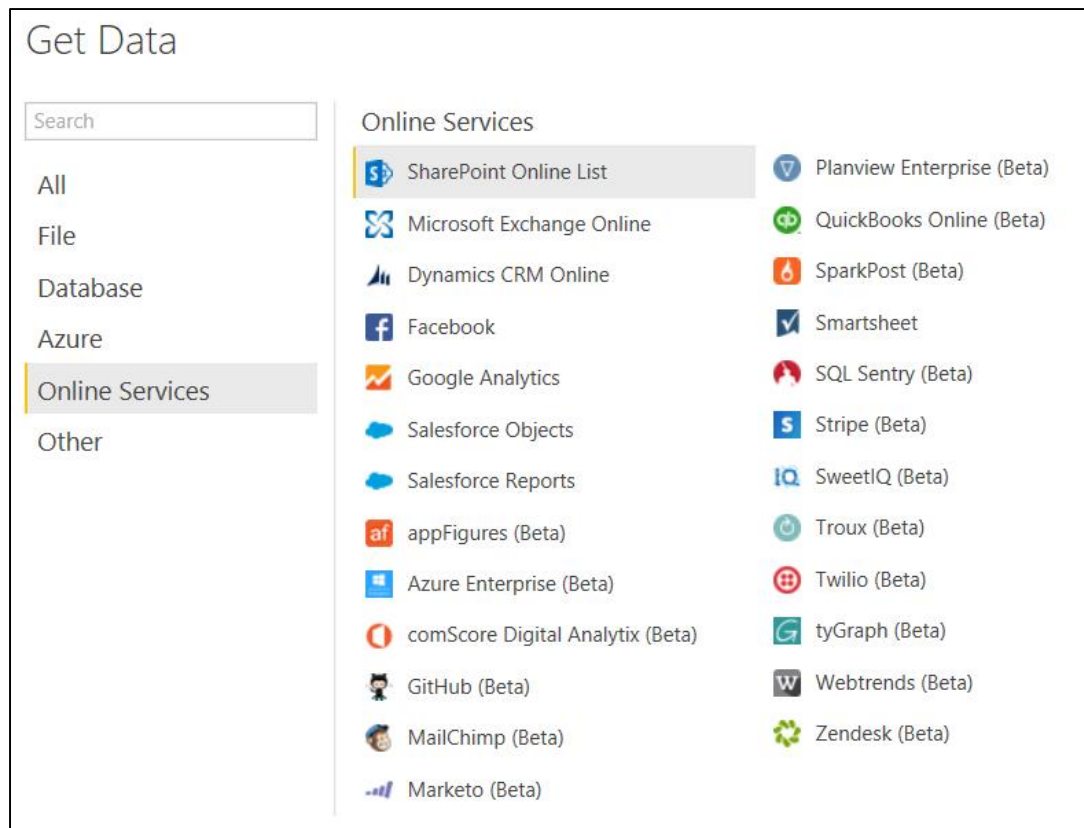
# Supported Databases

- Power BI Desktop supports many database systems



# Online Service Data Sources

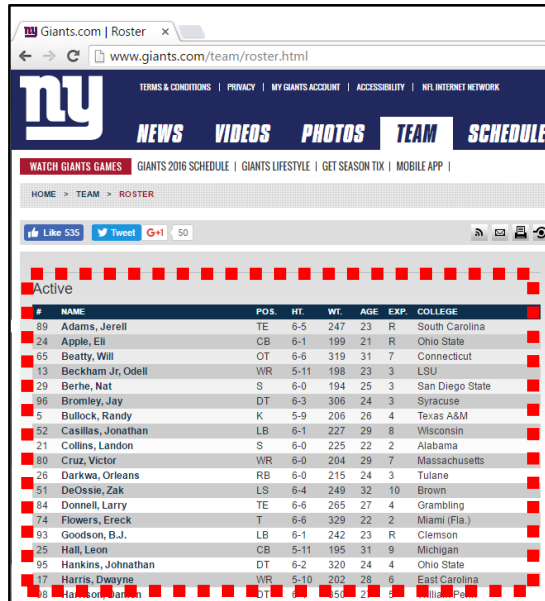
- Power BI Desktop Supports Online Services
  - Includes popular Software-as-a-Service (SaaS) applications
  - Microsoft is working with 3<sup>rd</sup> vendors to expand this list





# Working with Web Data Sources

- Many public websites publish data using HTML tables
- Power BI desktop can scrape data from tables in HTML pages



Active

| #  | NAME               | POS. | HT.  | WT. | AGE | EXP. | COLLEGE         |
|----|--------------------|------|------|-----|-----|------|-----------------|
| 89 | Adams, Jerrell     | TE   | 6-5  | 247 | 23  | R    | South Carolina  |
| 24 | Apple, Eli         | CB   | 6-1  | 199 | 21  | R    | Ohio State      |
| 65 | Beatty, Will       | OT   | 6-6  | 319 | 31  | 7    | Connecticut     |
| 13 | Beckham Jr, Odell  | WR   | 5-11 | 198 | 23  | 3    | LSU             |
| 29 | Berhe, Nat         | S    | 6-0  | 194 | 25  | 3    | San Diego State |
| 96 | Bromley, Jay       | DT   | 6-3  | 306 | 24  | 3    | Syracuse        |
| 5  | Bullock, Randy     | K    | 5-9  | 206 | 26  | 4    | Texas A&M       |
| 52 | Casillas, Jonathan | LB   | 6-1  | 227 | 29  | 8    | Wisconsin       |
| 21 | Collins, Landon    | S    | 6-0  | 225 | 22  | 2    | Alabama         |
| 80 | Cruz, Victor       | WR   | 6-0  | 204 | 29  | 7    | Massachusetts   |
| 26 | Darkwa, Orleans    | RB   | 6-0  | 215 | 24  | 3    | Tulane          |
| 51 | DeOssie, Zak       | LS   | 6-4  | 249 | 32  | 10   | Brown           |
| 84 | Donnell, Larry     | TE   | 6-6  | 265 | 27  | 4    | Grambling       |
| 74 | Flowers, Ereck     | T    | 6-6  | 329 | 22  | 2    | Miami (Fla.)    |
| 93 | Goodson, B.J.      | LB   | 6-1  | 242 | 23  | R    | Clemson         |
| 25 | Hall, Leon         | CB   | 5-11 | 195 | 31  | 9    | Michigan        |
| 55 | Hankins, Johnathan | DT   | 6-2  | 320 | 24  | 4    | Ohio State      |
| 17 | Harris, Devyne     | WR   | 5-10 | 202 | 28  | 6    | East Carolina   |
| 16 | Hunter, Brian      | DT   | 6-4  | 255 | 22  | 5    | Illinois        |

From Web

Basic ☒ Advanced ☐

Enter a Web page URL.

URL

Open file as

OK Cancel

Query Input

|   | #  | Name              | Pos. | Ht.  | Wt. | Age | Exp. | College         |
|---|----|-------------------|------|------|-----|-----|------|-----------------|
| 1 | 89 | Adams, Jerrell    | TE   | 6-5  | 247 | 23  | R    | South Carolina  |
| 2 | 24 | Apple, Eli        | CB   | 6-1  | 199 | 21  | R    | Ohio State      |
| 3 | 65 | Beatty, Will      | OT   | 6-6  | 319 | 31  | 7    | Connecticut     |
| 4 | 13 | Beckham Jr, Odell | WR   | 5-11 | 198 | 23  | 3    | LSU             |
| 5 | 29 | Berhe, Nat        | S    | 6-0  | 194 | 25  | 3    | San Diego State |
| 6 | 96 | Bromley, Jay      | DT   | 6-3  | 306 | 24  | 3    | Syracuse        |

Query Output

|    | Number | Last Name         | First Name | Weight | Height | Age | Experience | Position         | Category            | Side    | College         |
|----|--------|-------------------|------------|--------|--------|-----|------------|------------------|---------------------|---------|-----------------|
| 1  | 89     | Adams             | Jerrell    | 247    | 77     | 23  | 0          | Tight End        | Backs and Receivers | Offense | South Carolina  |
| 2  | 84     | Donnell           | Larry      | 265    | 78     | 27  | 4          | Tight End        | Backs and Receivers | Offense | Grambling       |
| 3  | 45     | Tye               | Will       | 262    | 74     | 24  | 1          | Tight End        | Backs and Receivers | Offense | Stony Brook     |
| 4  | 24     | Apple             | Eli        | 199    | 73     | 21  | 0          | Cornerback       | Defensive Backs     | Defense | Ohio State      |
| 5  | 25     | Hall              | Leon       | 195    | 71     | 31  | 9          | Cornerback       | Defensive Backs     | Defense | Michigan        |
| 6  | 20     | Jenkins           | Janoris    | 198    | 70     | 27  | 5          | Cornerback       | Defensive Backs     | Defense | North Alabama   |
| 7  | 41     | Rodgers-Cromartie | Dominique  | 205    | 74     | 30  | 8          | Cornerback       | Defensive Backs     | Defense | Tennessee State |
| 8  | 65     | Beatty            | Will       | 319    | 78     | 31  | 7          | Offensive Tackle | Offensive Line      | Offense | Connecticut     |
| 9  | 13     | Beckham Jr        | Odell      | 198    | 71     | 23  | 3          | Wide Receiver    | Backs and Receivers | Offense | LSU             |
| 10 | 80     | Cruz              | Victor     | 204    | 72     | 29  | 7          | Wide Receiver    | Backs and Receivers | Offense | Massachusetts   |

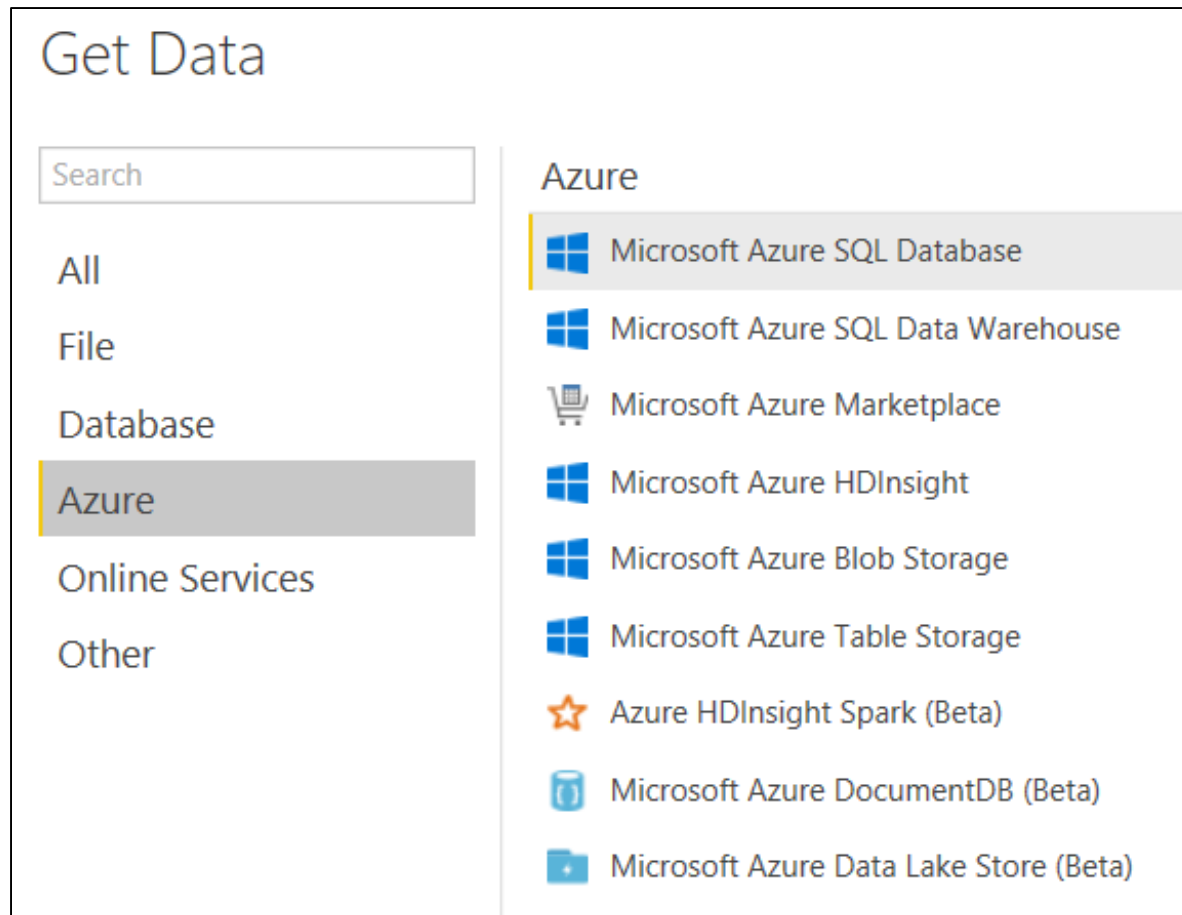


**DEMO**

# Scraping Data from a Web Page

# Azure Data Sources

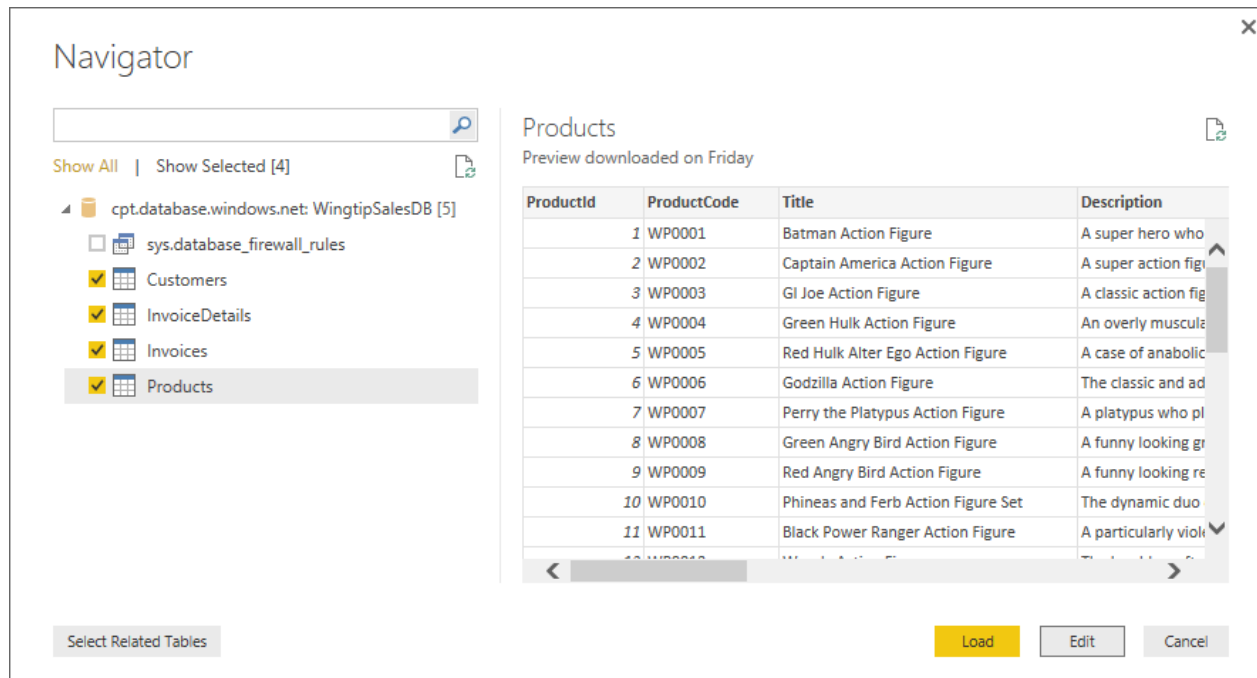
- Power BI Desktop supports many Azure data sources





# Selecting Tables from a SQL Database

- Power BI Desktop provides Navigator dialog
  - Allows you to select tables
  - Navigator understands existing table relationships
  - Clicking **Load** will run query and import data
  - Clicking **Edit** will open queries in Query Editor window





**DEMO**

## **Creating Queries to Import Data from an Azure SQL Database**

# Agenda

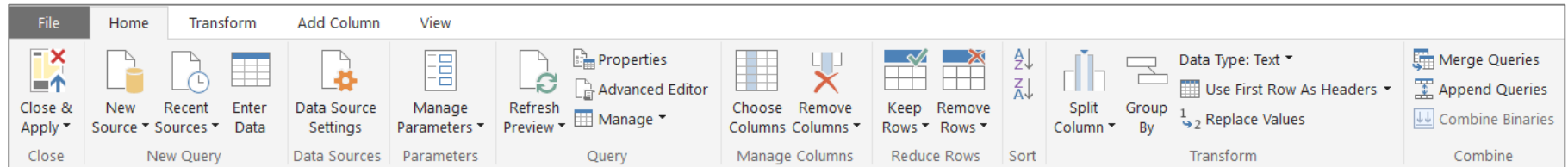
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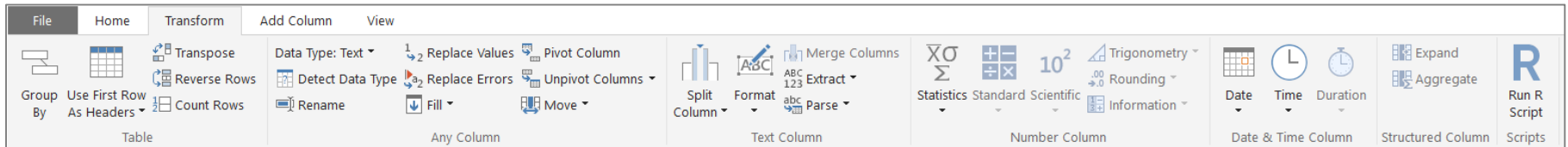


# Query Editor Ribbon Tabs

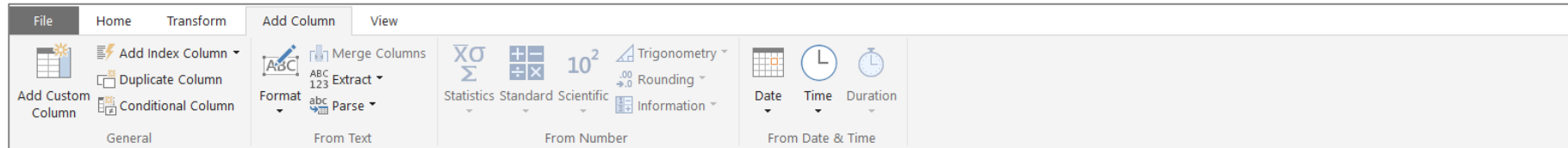
## Home tab



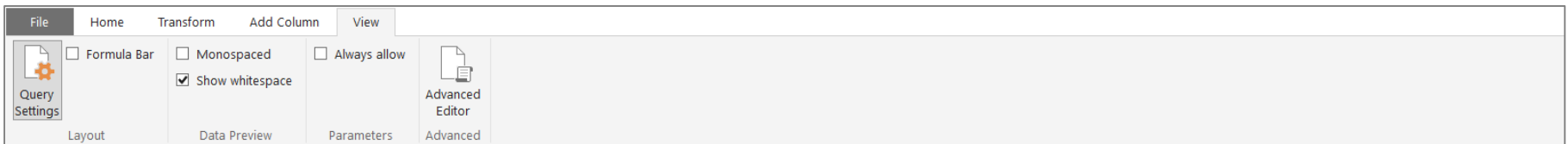
## Transform tab



## Add Column tab



## View tab





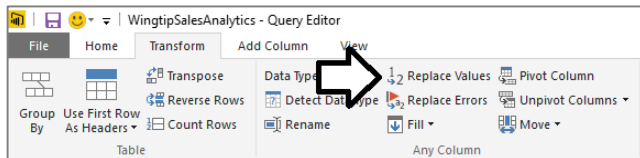
# Examples of Basic Power BI Desktop Steps

- Rename column
- Convert column type
- Format column values
- Reorder columns
- Replace column values
- Expanding related column
- Merging columns
- Splitting columns



# Replacing Values

- Used to substitute values during import



Replace Values

Replace one value with another in the selected columns.

Value To Find  
M

Replace With  
Male

Advanced options

OK Cancel

Query Editor showing a table with columns: ZipCode, Gender, BirthDate, FirstPurchase. The formula bar shows: `= Table.ReplaceValue("#Replaced`

| ZipCode | Gender | BirthDate              | FirstPurchase |
|---------|--------|------------------------|---------------|
| 90266   | Male   | 2/24/1966 12:00:00 AM  | 1/28          |
| 78753   | Male   | 2/3/1941 12:00:00 AM   | 1/28          |
| 80924   | Male   | 10/20/1954 12:00:00 AM | 1/28          |
| 79121   | Female | 11/4/1974 12:00:00 AM  | 1/28          |
| 79407   | Male   | 8/14/1954 12:00:00 AM  | 1/28          |
| 85281   | Male   | 6/11/1971 12:00:00 AM  | 1/28          |
| 79936   | Male   | 4/25/1974 12:00:00 AM  | 1/25          |
| 78730   | Male   | 10/2/1944 12:00:00 AM  | 1/25          |
| 78253   | Female | 10/26/1956 12:00:00 AM | 1/25          |
| 90266   | Male   | 10/2/1955 12:00:00 AM  | 1/25          |
| 85044   | Male   | 1/11/1945 12:00:00 AM  | 1/25          |
| 95630   | Female | 2/1/1956 12:00:00 AM   | 1/25          |
| 98052   | Male   | 5/13/1990 12:00:00 AM  | 1/25          |
| 97701   | Female | 5/14/1958 12:00:00 AM  | 1/25          |

Query Settings

PROPERTIES

Name  
Customers

All Properties

APPLIED STEPS

- Source
- Navigation
- Removed Other Columns
- Merged Columns
- Reordered Columns
- Replaced Value
- Replaced Value1

Replace Values

Replace one value with another in the selected columns.

Value To Find  
F

Replace With  
Female

Advanced options

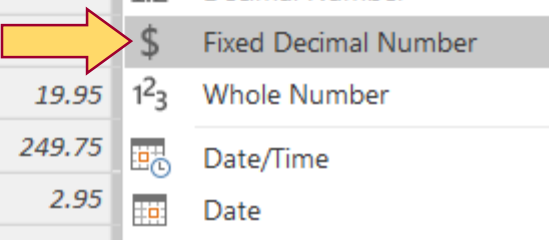
OK Cancel



# Converting Column Types

- Transform data to make it more reliable
  - Convert date-time column to date column
- Transform data to make it more efficient
  - Convert decimal to fixed decimal number for currency

| PurchaseDate | Quantity | \$ SalesAmount | \$ ProductCost |
|--------------|----------|----------------|----------------|
| 1/28/2012    | 1        | 2.95           | 1.2            |
| 1/28/2012    | 6        |                | \$             |
| 1/28/2012    | 1        | 19.95          | 123            |
| 1/28/2012    | 5        | 249.75         |                |
| 1/28/2012    | 1        | 2.95           |                |



- Beware: Conversion can have destructive effect on data



# Expanding Related Columns

- Used to pull data from related tables
  - Saves you from performing SQL joins or VLOOKUP

| SalesAmount | Invoices |       |
|-------------|----------|-------|
| 119.8       | Value    | Value |
| 29.95       | Value    | Value |
| 59.9        | Value    | Value |
| 399.6       | Value    | Value |
| 29.9        | Value    | Value |
| 59.8        | Value    | Value |

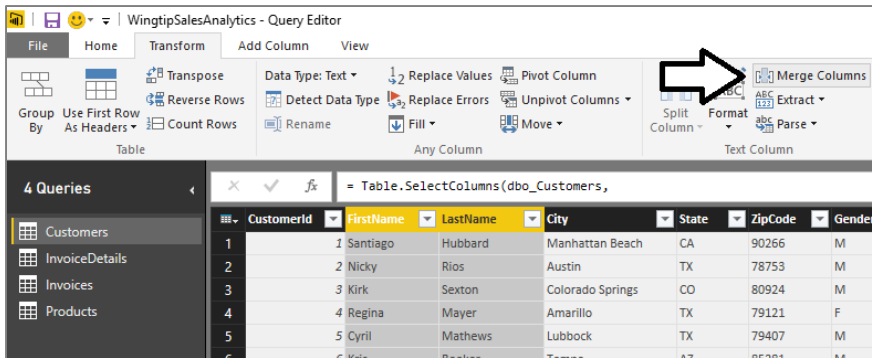
| Id | InvoiceId | ProductId | Quantity | SalesAmount | Invoices | Products |
|----|-----------|-----------|----------|-------------|----------|----------|
| 1  | 1         | 1         |          |             |          | Value    |
| 2  | 2         | 1         |          |             |          | Value    |
| 3  | 3         | 2         |          |             |          | Value    |
| 4  | 4         | 3         |          |             |          | Value    |
| 5  | 5         | 3         |          |             |          | Value    |
| 6  | 6         | 3         |          |             |          | Value    |
| 7  | 7         | 4         |          |             |          | Value    |
| 8  | 8         | 5         |          |             |          | Value    |
| 9  | 9         | 6         |          |             |          | Value    |
| 10 | 10        | 6         |          |             |          | Value    |
| 11 | 11        | 7         |          |             |          | Value    |
| 12 | 12        | 7         |          |             |          | Value    |
| 13 | 13        | 8         |          |             |          | Value    |
| 14 | 14        | 9         |          |             |          | Value    |

| Id | InvoiceId | ProductId | Quantity | SalesAmount | InvoiceDate | CustomerId            | Products |
|----|-----------|-----------|----------|-------------|-------------|-----------------------|----------|
| 1  | 1         | 1         | 22       | 4           | 119.8       | 1/28/2012 12:00:00 AM | 1 Value  |
| 2  | 2         | 1         | 22       | 1           | 29.95       | 1/28/2012 12:00:00 AM | 1 Value  |
| 3  | 3         | 2         | 22       | 2           | 59.9        | 1/28/2012 12:00:00 AM | 2 Value  |
| 4  | 4         | 3         | 17       | 8           | 399.6       | 1/28/2012 12:00:00 AM | 3 Value  |
| 5  | 5         | 3         | 18       | 2           | 29.9        | 1/28/2012 12:00:00 AM | 3 Value  |
| 6  | 6         | 3         | 18       | 4           | 59.8        | 1/28/2012 12:00:00 AM | 3 Value  |
| 7  | 7         | 4         | 16       | 1           | 2.95        | 1/28/2012 12:00:00 AM | 4 Value  |



# Merging Columns

- Merge two columns into a single column



WingtipSalesAnalytics - Query Editor

File Home Transform Add Column View

Group By Use First Row As Headers Count Rows

Transpose Reverse Rows Detect Data Type Replace Values Replace Errors Fill Rename

Pivot Column Unpivot Columns Move

Merge Columns Split Column Format Text Column

4 Queries

Customers InvoiceDetails Invoices Products

CustomerId FirstName LastName City State ZipCode Gender

1 1 Santiago Hubbard Manhattan Beach CA 90266 M

2 2 Nicky Rios Austin TX 78753 M

3 3 Kirk Sexton Colorado Springs CO 80924 M

4 4 Regina Mayer Amarillo TX 79121 F

5 5 Cyril Mathews Lubbock TX 79407 M

6 6 Kris Booker Tempe AZ 85281 M

= Table.SelectColumns(dbo\_Customers,

Merge Columns

Choose how to merge the selected columns.

Separator

Space

New column name (optional)

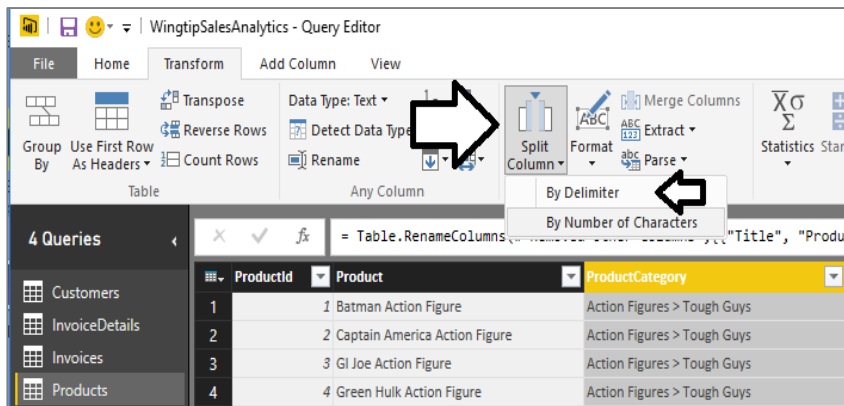
Customer

OK Cancel

|   | CustomerId | Customer          |
|---|------------|-------------------|
| 1 | 1          | Santiago Hubbard  |
| 2 | 2          | Nicky Rios        |
| 3 | 3          | Kirk Sexton       |
| 4 | 4          | Regina Mayer      |
| 5 | 5          | Cyril Mathews     |
| 6 | 6          | Kris Booker       |
| 7 | 7          | Tracy Christensen |
| 8 | 8          | Reed Glover       |

# Splitting Columns

- Split a single column up into two columns



Split Column by Delimiter

Specify the delimiter to split the text column.

Select or enter delimiter

--Custom--

>

Split

☐ At the left-most delimiter

☐ At the right-most delimiter

☒ At each occurrence of the delimiter

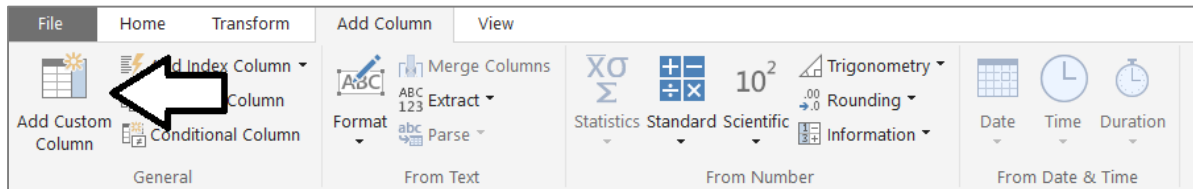
Advanced options

OK Cancel

| ProductId | Product                            | Category       | Subcategory       |
|-----------|------------------------------------|----------------|-------------------|
| 1         | 1 Batman Action Figure             | Action Figures | Tough Guys        |
| 2         | 2 Captain America Action Figure    | Action Figures | Tough Guys        |
| 3         | 3 GI Joe Action Figure             | Action Figures | Tough Guys        |
| 4         | 4 Green Hulk Action Figure         | Action Figures | Tough Guys        |
| 5         | 5 Red Hulk Alter Ego Action Figure | Action Figures | Tough Guys        |
| 6         | 6 Godzilla Action Figure           | Action Figures | Tough Guys        |
| 7         | 7 Perry the Platypus Action Figure | Action Figures | Cute and Huggable |
| 8         | 8 Green Angry Bird Action Figure   | Action Figures | Cute and Huggable |

# Adding a Custom Column

- Custom column provide custom logic
  - Logic must be written in M programming language



**Add Custom Column**

New column name  
CustomerType

Custom column formula:  
`= if [FirstPurchaseDate]=[LastPurchaseDate]  
then "One-time Customer"  
else "Repeat Customer"`

Available columns:  
CustomerId  
Customer  
State  
City  
ZipCode  
Gender  
BirthDate

<< Insert

[Learn about Power BI Desktop formulas](#)

✓ No syntax errors have been detected.

OK Cancel

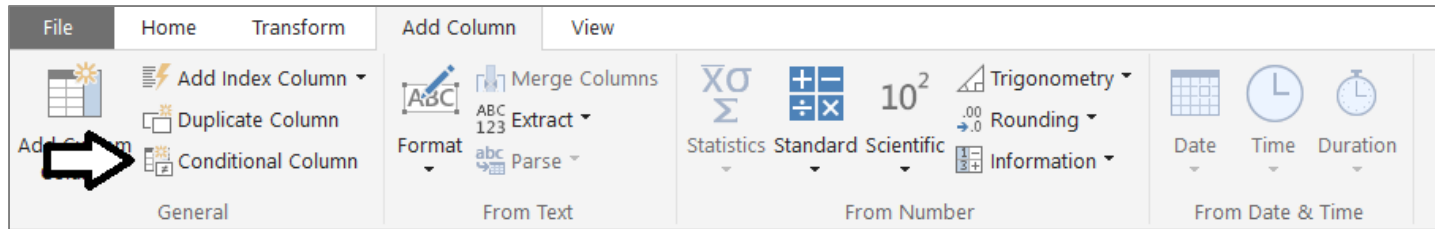
| FirstPurchaseDate | LastPurchaseDate | CustomerType      |
|-------------------|------------------|-------------------|
| 1/28/2012         | 1/28/2012        | One-time Customer |
| 1/28/2012         | 1/28/2012        | One-time Customer |
| 1/28/2012         | 1/28/2012        | One-time Customer |
| 1/28/2012         | 1/28/2012        | One-time Customer |
| 1/28/2012         | 1/28/2012        | One-time Customer |
| 1/28/2012         | 1/28/2012        | One-time Customer |
| 1/29/2012         | 11/22/2015       | Repeat Customer   |
| 1/29/2012         | 10/2/2015        | Repeat Customer   |
| 1/29/2012         | 1/29/2012        | One-time Customer |
| 1/29/2012         | 5/6/2015         | Repeat Customer   |
| 1/29/2012         | 1/29/2012        | One-time Customer |





# Adding a Conditional Column

- Abstracts away need to write M code



**Add Conditional Column** [X]

Add a conditional column that is computed from the other columns or values.

New column name  
Customer Type

|    | Column Name       | Operator | Value            |      | Output            |
|----|-------------------|----------|------------------|------|-------------------|
| If | FirstPurchaseDate | equals   | LastPurchaseDate | Then | One-time Customer |

+ Add Rule

Otherwise

|         |                 |
|---------|-----------------|
| ABC 123 | Repeat Customer |
|---------|-----------------|

OK Cancel





**DEMO**

## **Using Queries to Transform Data During the Load Process**

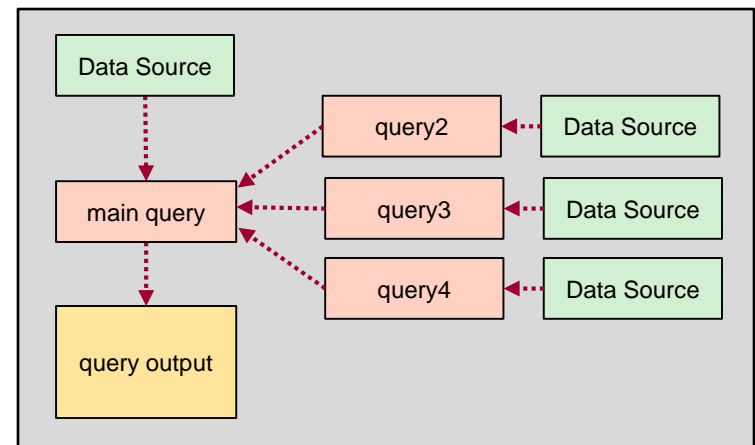
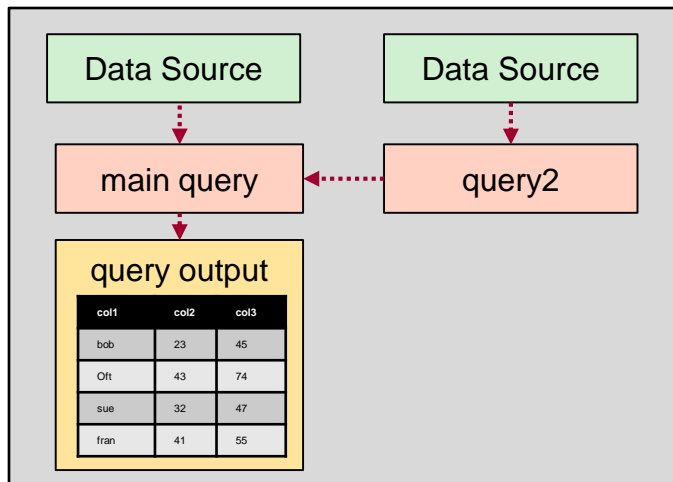
# Agenda

- ✓ Deciding What To Measure
- ✓ Understanding Queries in Power BI Desktop
- ✓ Working with the Query Editor Window
- Designing Advanced Combine Queries
  - Importing OLTP Data Into a Star Schema



# Combining Queries

- Query can be merged or appended with another query
  - Merge operation allows you combine columns from two tables
  - Append operation allows you to combine rows from two tables
- Two queries are combined into single output for loading
  - Load settings of main query determines where output is loaded
  - Secondary query acts as source for main query
  - Secondary query be can created with connection-only load setting





# Merging Columns

Main Query Input

| FirstName | LastName    | JobTitle                              | Department             | Email                        |
|-----------|-------------|---------------------------------------|------------------------|------------------------------|
| Matthew   | McDermott   | IT Manager                            | Information Technology | matthewmcdermott@wingtip.com |
| Keith     | Moon        | System Administrator                  | Information Technology | keithmoon@wingtip.com        |
| Spencer   | Reed        | Records Manager                       | Information Technology | spencerreed@wingtip.com      |
| Paul      | Schaefflein | Software Developer                    | Information Technology | paulschaefflein@wingtip.com  |
| Scot      | Hillier     | CFO                                   | Finance                | scothillier@wingtip.com      |
| Bernie    | Madeoff     | Accountant                            | Finance                | berniemadeoff@wingtip.com    |
| Andrew    | Connell     | Sales Director                        | Sales                  | andrewconnell@wingtip.com    |
| Chandler  | Bing        | Sales Representative                  | Sales                  | chandlerbing@wingtip.com     |
| Wilson    | Picket      | Sales Representative                  | Sales                  | wilsonpicket@wingtip.com     |
| Christina | Wheeler     | Marketing Director                    | Marketing              | christinawheeler@wingtip.com |
| Katie     | Bowman      | Web Designer                          | Marketing              | katiebowman@wingtip.com      |
| Asif      | Rehmani     | Vice President of Product Development | Product Development    | asifrehmani@wingtip.com      |
| Ted       | Pattison    | Senior Toy Scientist                  | Product Development    | tedpattison@wingtip.com      |
| David     | Mann        | Toy Scientist                         | Product Development    | davidmann@wingtip.com        |
| Gary      | Lapointe    | Toy Scientist                         | Product Development    | garylapointe@wingtip.com     |

Join Column

Merge Query Input

| Email                        | City          | State |
|------------------------------|---------------|-------|
| matthewmcdermott@wingtip.com | Austin        | TX    |
| keithmoon@wingtip.com        | Hollywood     | CA    |
| spencerreed@wingtip.com      | Washington    | DC    |
| paulschaefflein@wingtip.com  | St Paul       | MN    |
| scothillier@wingtip.com      | Hartford      | CT    |
| berniemadeoff@wingtip.com    | NY            | NY    |
| andrewconnell@wingtip.com    | Jacksonville  | FL    |
| chandlerbing@wingtip.com     | NY            | NY    |
| wilsonpicket@wingtip.com     | San Francisco | CA    |
| christinawheeler@wingtip.com | Atlanta       | GE    |
| katiebowman@wingtip.com      | Autsin        | TX    |
| asifrehmani@wingtip.com      | Chicago       | IL    |
| tedpattison@wingtip.com      | Tampa         | FL    |
| davidmann@wingtip.com        | Philidephia   | PA    |
| garylapointe@wingtip.com     | Dever         | CO    |

Join Column

Query Output

| First Name | Last Name   | Email                        | Job Title                             | Department             | City          | State |
|------------|-------------|------------------------------|---------------------------------------|------------------------|---------------|-------|
| Matthew    | McDermott   | matthewmcdermott@wingtip.com | IT Manager                            | Information Technology | Austin        | TX    |
| Keith      | Moon        | keithmoon@wingtip.com        | System Administrator                  | Information Technology | Hollywood     | CA    |
| Spencer    | Reed        | spencerreed@wingtip.com      | Records Manager                       | Information Technology | Washington    | DC    |
| Paul       | Schaefflein | paulschaefflein@wingtip.com  | Software Developer                    | Information Technology | St Paul       | MN    |
| Scot       | Hillier     | scothillier@wingtip.com      | CFO                                   | Finance                | Hartford      | CT    |
| Bernie     | Madeoff     | berniemadeoff@wingtip.com    | Accountant                            | Finance                | NY            | NY    |
| Andrew     | Connell     | andrewconnell@wingtip.com    | Sales Director                        | Sales                  | Jacksonville  | FL    |
| Chandler   | Bing        | chandlerbing@wingtip.com     | Sales Representative                  | Sales                  | NY            | NY    |
| Wilson     | Picket      | wilsonpicket@wingtip.com     | Sales Representative                  | Sales                  | San Francisco | CA    |
| Christina  | Wheeler     | christinawheeler@wingtip.com | Marketing Director                    | Marketing              | Atlanta       | GE    |
| Katie      | Bowman      | katiebowman@wingtip.com      | Web Designer                          | Marketing              | Autsin        | TX    |
| Asif       | Rehmani     | asifrehmani@wingtip.com      | Vice President of Product Development | Product Development    | Chicago       | IL    |
| Ted        | Pattison    | tedpattison@wingtip.com      | Senior Toy Scientist                  | Product Development    | Tampa         | FL    |
| David      | Mann        | davidmann@wingtip.com        | Toy Scientist                         | Product Development    | Philidephia   | PA    |
| Gary       | Lapointe    | garylapointe@wingtip.com     | Toy Scientist                         | Product Development    | Dever         | CO    |



# Appending Rows

Main Query Input

| FirstName | LastName | Company                     | Email                                       | City          | State | ZipCode |
|-----------|----------|-----------------------------|---|---------------|-------|---------|
| Joe       | Stephens | Initech                     | Joe.Stephens@initech.com                    | Sacramento    | CA    | 95823   |
| Basil     | Frazier  | Nordyne Defense Dynamics    | Basil.Frazier@NordyneDefenseDynamics.com    | Sacramento    | CA    | 95823   |
| Ignacio   | Duran    | Yoyodyne Propulsion Systems | Ignacio.Duran@YoyodynePropulsionSystems.com | Beaverton     | OR    | 97005   |
| Alvaro    | Brock    | W.C. Boggs & Co.            | Alvaro.Brock@W.C.Boggs&Co..com              | Beaverton     | OR    | 97005   |
| Alec      | Miller   | Krusty Burger               | Alec.Miller@KrustyBurger.com                | Vancouver     | WA    | 98662   |
| Maureen   | Griffin  | VersaLife Corporation       | Maureen.Griffin@VersaLifeCorporation.com    | Vancouver     | WA    | 98662   |
| Guillermo | Sykes    | Soar Airlines               | Guillermo.Sykes@SoarAirlines.com            | Sacramento    | CA    | 95818   |
| Solomon   | Warner   | Wayne Enterprises           | Solomon.Warner@WayneEnterprises.com         | Seattle       | WA    | 98125   |
| Humberto  | Petersen | W.C. Boggs & Co.            | Humberto.Petersen@W.C.Boggs&Co..com         | San Francisco | CA    | 94118   |
| Keven     | Griffith | Fabrikam                    | Keven.Griffith@Fabrikam.com                 | Bend          | OR    | 97701   |

Append Query Input

| FirstName | LastName   | Company                       | Email   | City          | State | ZipCode |
|-----------|------------|-------------------------------|---|---------------|-------|---------|
| Rich      | Pierce     | The Regal Beagle              | Rich.Pierce@TheRegalBeagle.com                  | Portland      | OR    | 97216   |
| Ronnie    | Donaldson  | Union Aerospace Corporation   | Ronnie.Donaldson@UnionAerospaceCorporation.com  | Vancouver     | WA    | 98684   |
| Willard   | Frazier    | Benthic Petroleum             | Willard.Frazier@BenthicPetroleum.com            | Portland      | OR    | 97220   |
| Marina    | Caldwell   | Ewing Oil                     | Marina.Caldwell@EwingOil.com                    | Portland      | OR    | 97205   |
| Milagros  | Mercer     | Hishii Industries             | Milagros.Mercer@HishiiIndustries.com            | Salem         | OR    | 97301   |
| Kirsten   | Little     | Binford                       | Kirsten.Little@Binford.com                      | Ventura       | CA    | 93003   |
| Terri     | Ferrell    | Black Mesa Research Facility  | Terri.Ferrell@BlackMesaResearchFacility.com     | Portland      | OR    | 97205   |
| Francine  | Doyle      | Peach Pit                     | Francine.Doyle@PeachPit.com                     | Vancouver     | WA    | 98662   |
| Dannie    | Powers     | Deon International            | Dannie.Powers@DeonInternational.com             | Issaquah      | WA    | 98027   |
| Noah      | Best       | Shinra Electric Power Company | Noah.Best@ShinraElectricPowerCompany.com        | Portland      | OR    | 97217   |
| Keenan    | Holmes     | Biffco                        | Keenan.Holmes@Biffco.com                        | Portland      | OR    | 97220   |
| Douglas   | Maynard    | Cyberdyne Systems             | Douglas.Maynard@CyberdyneSystems.com            | San Francisco | CA    | 94118   |
| Gerald    | Harrington | Yoyodyne Propulsion Systems   | Gerald.Harrington@YoyodynePropulsionSystems.com | Portland      | OR    | 97217   |
| Josue     | Robinson   | North Western Railway         | Josue.Robinson@NorthWesternRailway.com          | Beaverton     | OR    | 97005   |

Query Output

| FirstName | LastName   | Company                       | Email   | City          | State | ZipCode |
|-----------|------------|-------------------------------|---|---------------|-------|---------|
| Joe       | Stephens   | Initech                       | Joe.Stephens@initech.com                        | Sacramento    | CA    | 95823   |
| Basil     | Frazier    | Nordyne Defense Dynamics      | Basil.Frazier@NordyneDefenseDynamics.com        | Sacramento    | CA    | 95823   |
| Ignacio   | Duran      | Yoyodyne Propulsion Systems   | Ignacio.Duran@YoyodynePropulsionSystems.com     | Beaverton     | OR    | 97005   |
| Alvaro    | Brock      | W.C. Boggs & Co.              | Alvaro.Brock@W.C.Boggs&Co..com                  | Beaverton     | OR    | 97005   |
| Alec      | Miller     | Krusty Burger                 | Alec.Miller@KrustyBurger.com                    | Vancouver     | WA    | 98662   |
| Maureen   | Griffin    | VersaLife Corporation         | Maureen.Griffin@VersaLifeCorporation.com        | Vancouver     | WA    | 98662   |
| Guillermo | Sykes      | Soar Airlines                 | Guillermo.Sykes@SoarAirlines.com                | Sacramento    | CA    | 95818   |
| Solomon   | Warner     | Wayne Enterprises             | Solomon.Warner@WayneEnterprises.com             | Seattle       | WA    | 98125   |
| Humberto  | Petersen   | W.C. Boggs & Co.              | Humberto.Petersen@W.C.Boggs&Co..com             | San Francisco | CA    | 94118   |
| Keven     | Griffith   | Fabrikam                      | Keven.Griffith@Fabrikam.com                     | Bend          | OR    | 97701   |
| Rich      | Pierce     | The Regal Beagle              | Rich.Pierce@TheRegalBeagle.com                  | Portland      | OR    | 97216   |
| Ronnie    | Donaldson  | Union Aerospace Corporation   | Ronnie.Donaldson@UnionAerospaceCorporation.com  | Vancouver     | WA    | 98684   |
| Willard   | Frazier    | Benthic Petroleum             | Willard.Frazier@BenthicPetroleum.com            | Portland      | OR    | 97220   |
| Marina    | Caldwell   | Ewing Oil                     | Marina.Caldwell@EwingOil.com                    | Portland      | OR    | 97205   |
| Milagros  | Mercer     | Hishii Industries             | Milagros.Mercer@HishiiIndustries.com            | Salem         | OR    | 97301   |
| Kirsten   | Little     | Binford                       | Kirsten.Little@Binford.com                      | Ventura       | CA    | 93003   |
| Terri     | Ferrell    | Black Mesa Research Facility  | Terri.Ferrell@BlackMesaResearchFacility.com     | Portland      | OR    | 97205   |
| Francine  | Doyle      | Peach Pit                     | Francine.Doyle@PeachPit.com                     | Vancouver     | WA    | 98662   |
| Dannie    | Powers     | Deon International            | Dannie.Powers@DeonInternational.com             | Issaquah      | WA    | 98027   |
| Noah      | Best       | Shinra Electric Power Company | Noah.Best@ShinraElectricPowerCompany.com        | Portland      | OR    | 97217   |
| Keenan    | Holmes     | Biffco                        | Keenan.Holmes@Biffco.com                        | Portland      | OR    | 97220   |
| Douglas   | Maynard    | Cyberdyne Systems             | Douglas.Maynard@CyberdyneSystems.com            | San Francisco | CA    | 94118   |
| Gerald    | Harrington | Yoyodyne Propulsion Systems   | Gerald.Harrington@YoyodynePropulsionSystems.com | Portland      | OR    | 97217   |
| Josue     | Robinson   | North Western Railway         | Josue.Robinson@NorthWesternRailway.com          | Beaverton     | OR    | 97005   |



# Pivoting Columns

- Pivot column adds its values are new columns
  - Create table layout like PivotTable

| City             | Year | Population |
|------------------|------|------------|
| New York, NY     | 2010 | 8175133    |
| New York, NY     | 2000 | 8008278    |
| New York, NY     | 1990 | 7322564    |
| Los Angeles, CA  | 2010 | 3792621    |
| Los Angeles, CA  | 2000 | 3694820    |
| Los Angeles, CA  | 1990 | 3485398    |
| Chicago, IL      | 2010 | 2695598    |
| Chicago, IL      | 2000 | 2896016    |
| Chicago, IL      | 1990 | 2783726    |
| Houston, TX      | 2010 | 2100263    |
| Houston, TX      | 2000 | 1953631    |
| Houston, TX      | 1990 | 1630553    |
| Philadelphia, PA | 2010 | 1526006    |
| Philadelphia, PA | 2000 | 1517550    |
| Philadelphia, PA | 1990 | 1585577    |
| Phoenix, AZ      | 2010 | 1445632    |
| Phoenix, AZ      | 2000 | 1321045    |
| Phoenix, AZ      | 1990 | 983403     |



| City             | 2010    | 2000    | 1990    |
|------------------|---------|---------|---------|
| New York, NY     | 8175133 | 8008278 | 7322564 |
| Los Angeles, CA  | 3792621 | 3694820 | 3485398 |
| Chicago, IL      | 2695598 | 2896016 | 2783726 |
| Houston, TX      | 2100263 | 1953631 | 1630553 |
| Philadelphia, PA | 1526006 | 1517550 | 1585577 |
| Phoenix, AZ      | 1445632 | 1321045 | 983403  |
| San Antonio, TX  | 1327407 | 1144646 | 935933  |
| San Diego, TX    | 1307402 | 1223400 | 1110549 |
| Dallas, TX       | 1197816 | 1188580 | 1006877 |
| San Jose, CA     | 945942  | 894943  | 782248  |





# Unpivoting Columns

- Unpivot columns to collapse them into single column
  - Removes PivotTable layout
  - Can be useful to prepare data for charting and analysis

| City             | 2010    | 2000    | 1990    |
|------------------|---------|---------|---------|
| New York, NY     | 8175133 | 8008278 | 7322564 |
| Los Angeles, CA  | 3792621 | 3694820 | 3485398 |
| Chicago, IL      | 2695598 | 2896016 | 2783726 |
| Houston, TX      | 2100263 | 1953631 | 1630553 |
| Philadelphia, PA | 1526006 | 1517550 | 1585577 |
| Phoenix, AZ      | 1445632 | 1321045 | 983403  |
| San Antonio, TX  | 1327407 | 1144646 | 935933  |
| San Diego, TX    | 1307402 | 1223400 | 1110549 |
| Dallas, TX       | 1197816 | 1188580 | 1006877 |
| San Jose, CA     | 945942  | 894943  | 782248  |



| City             | Year | Population |
|------------------|------|------------|
| New York, NY     | 2010 | 8175133    |
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| New York, NY     | 1990 | 7322564    |
| Los Angeles, CA  | 2010 | 3792621    |
| Los Angeles, CA  | 2000 | 3694820    |
| Los Angeles, CA  | 1990 | 3485398    |
| Chicago, IL      | 2010 | 2695598    |
| Chicago, IL      | 2000 | 2896016    |
| Chicago, IL      | 1990 | 2783726    |
| Houston, TX      | 2010 | 2100263    |
| Houston, TX      | 2000 | 1953631    |
| Houston, TX      | 1990 | 1630553    |
| Philadelphia, PA | 2010 | 1526006    |
| Philadelphia, PA | 2000 | 1517550    |
| Philadelphia, PA | 1990 | 1585577    |
| Phoenix, AZ      | 2010 | 1445632    |
| Phoenix, AZ      | 2000 | 1321045    |
| Phoenix, AZ      | 1990 | 983403     |



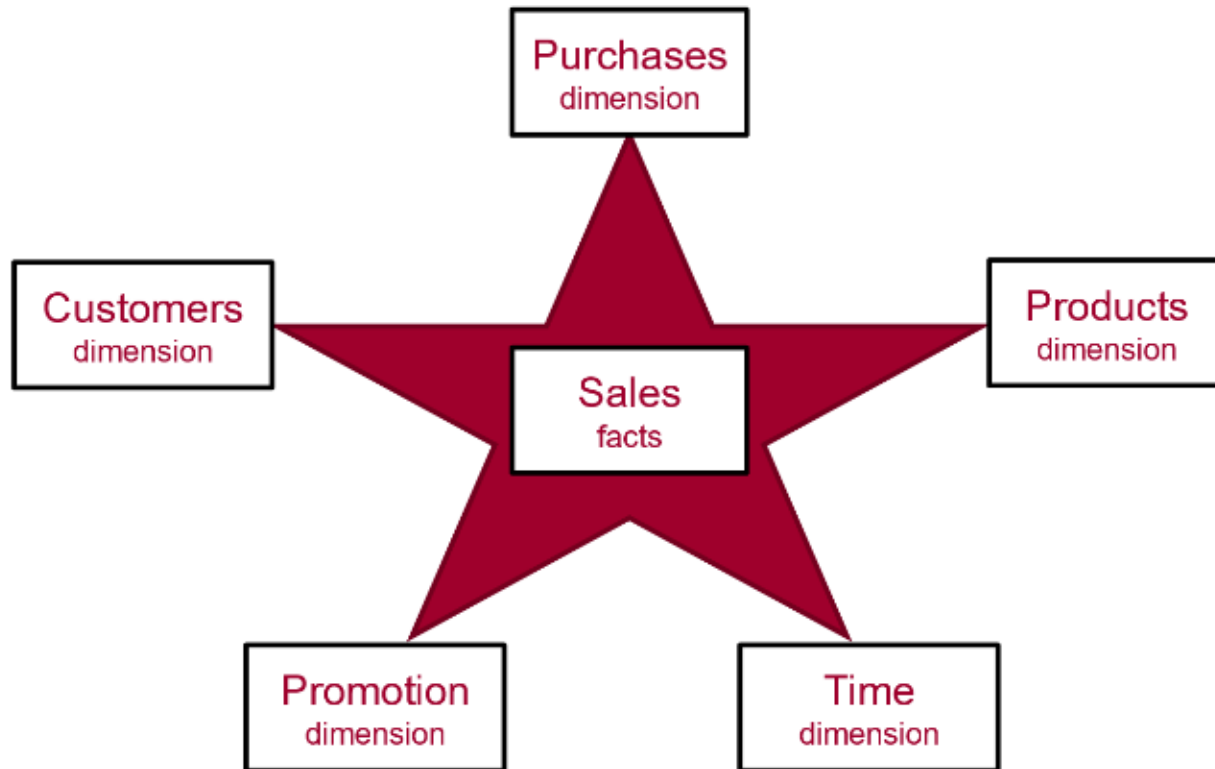
# Agenda

- ✓ Deciding What To Measure
- ✓ Understanding Queries in Power BI Desktop
- ✓ Working with the Query Editor Window
- ✓ Designing Advanced Combine Queries
- Importing OLTP Data Into a Star Schema



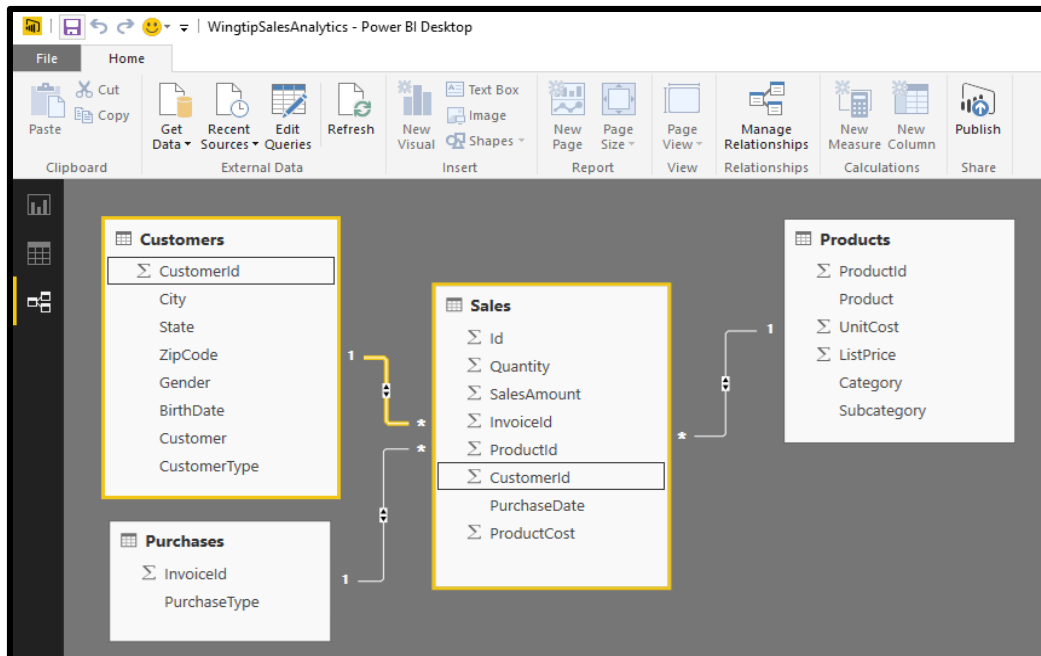
# Data Modeling using a Star Schema

- OLAP Modeling often based on Star Schema
  - Tables defined as fact tables or dimension tables
  - Fact tables related to dimension table using 1-to-many relationships



# Designing Queries to Build a Star Schema

- Converts OLTP Data Model to OLAP Data Model
  - Sales table is modeled as a OLAP Fact Table
  - Other tables are modeled as OLAP Dimension tables
  - Requires pulling CustomerId column into Sales table
  - All dimension tables should be directly related to fact table







**DEMO**

# Using Power BI Desktop to Import Data into a Star Schema

# Summary

- ✓ Deciding What To Measure
- ✓ Understanding Queries in Power BI Desktop
- ✓ Working with the Query Editor Window
- ✓ Designing Advanced Combine Queries
- ✓ Importing OLTP Data Into a Star Schema

