

Designing Queries with Power BI Desktop



Agenda

- Class Introduction
- Query Design Fundamentals
- SharePoint Online
- Query Folding
- Designing Data Model using a Star Schema
- Advanced Query Design



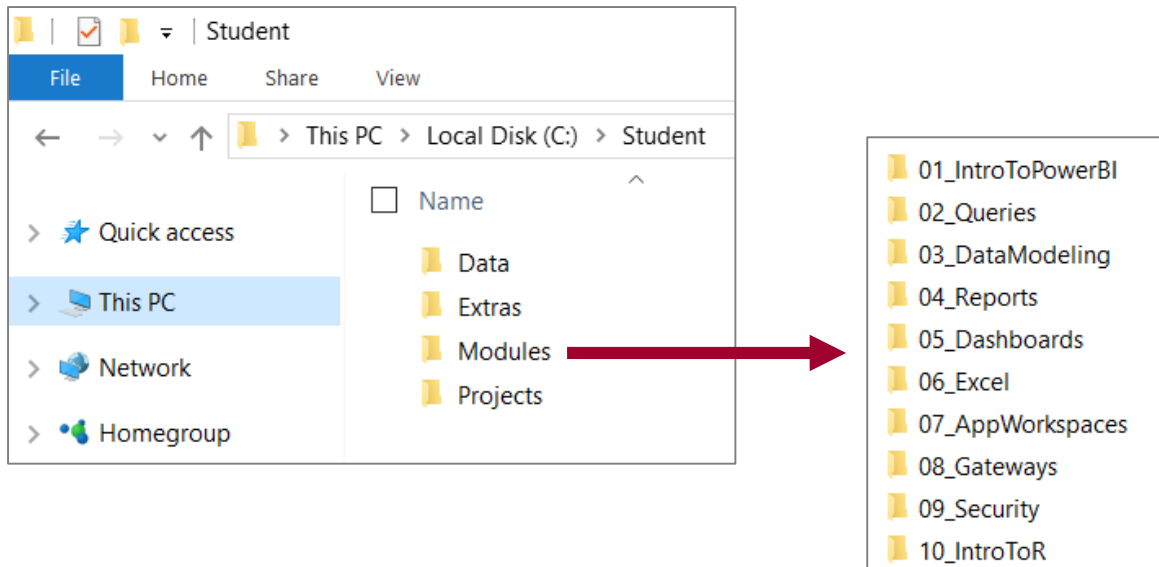
Student Background

- What is your name?
- What are you doing with Power BI?
- Which products/services have you used
 - Excel
 - Access
 - SQL Server, SSRS, SSAS
 - SharePoint and Office 365
 - Tableau
 - Dynamics 365
 - Salesforce
 - Others



Student Files for This Course

- Copy the **Student** folder from the master zip archive
 - Create a new local folder at **C:\Student**
- Each module has folder inside **Student\Modules** folder
 - Slides and lab writeup available through student manual (not in GitHub repository)



What is Power BI?

- What is Power BI?
 - A cloud-based analytics service for licensed subscribers
 - Environment which supports and promotes self-service BI
 - Powerful builder tools for importing, modeling and visualizing data
 - Enterprise-grade platform for deploying reports and dashboards
 - On-premises server product supporting subset of cloud features

Power BI
Service

Power BI
Desktop

Power BI
Report Server



Power BI Licensing

- User-based licensing

| Power BI (free) | Power BI Pro | Office 365 Enterprise E5 |
|--|---|---|
| \$0.00 user/month | \$9.99 user/month | \$35.00 user/month |
| A cloud-based business analytics service that enables anyone to visualize and analyze data with greater speed, efficiency, and understanding. It ... | A cloud-based business analytics service that enables anyone to visualize and analyze data with greater speed, efficiency, and understanding. Power ... | The Office suite, plus email, instant messaging, HD video conferencing, 1 TB personal file storage and sharing, and advanced security, analytics and PSTN ... |
| Office 2016 desktop & mobile apps Not included | Office 2016 desktop & mobile apps Not included | Office 2016 desktop & mobile apps |
| Office 365 services | Office 365 services | Office 365 services |
| ... | ... | ... |

- Capacity-based Licensing

| Power BI Premium P1 | Power BI Premium P2 | Power BI Premium P3 | Power BI Premium EM3 (Month to Month) |
|--|---|---|---|
| \$4,995.00 instance/month | \$9,995.00 instance/month | \$19,995.00 instance/month | \$2,495.00 instance/month |
| Power BI capacity dedicated to your organization, unlocking unlimited content distribution and dependable performance. P1 offers 8 virtual cores ... | Power BI capacity dedicated to your organization, unlocking unlimited content distribution and dependable performance. P1 offers 16 virtual cores ... | Power BI capacity dedicated to your organization, unlocking unlimited content distribution and dependable performance. P1 offers 32 virtual cores ... | Embed Power BI content in your custom application, powered by 4 virtual cores of dedicated capacity. Some Premium features are disabled ... |
| Office 2016 desktop & mobile apps Not included | Office 2016 desktop & mobile apps Not included | Office 2016 desktop & mobile apps Not included | Office 2016 desktop & mobile apps Not included |
| Office 365 services | Office 365 services | Office 365 services | Office 365 services |
| ... | ... | ... | ... |

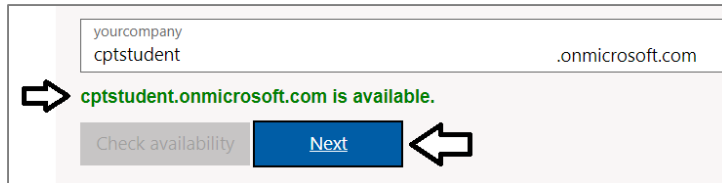


Creating a Power BI Lab Environment

- Sign up for an Office 365 E5 trial account
 - Sign up process creates new Azure AD tenant
 - Tenant created with user account which is Global tenant admin
 - Tenant gets 30-day trial subscription for 25 Office 365 E5 licenses



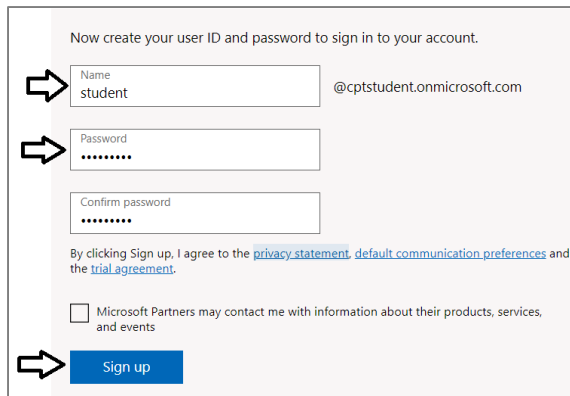
yourcompany
cptstudent .onmicrosoft.com



yourcompany
cptstudent .onmicrosoft.com

→ cptstudent.onmicrosoft.com is available.

Check availability Next →



Now create your user ID and password to sign in to your account.

→ Name student @cptstudent.onmicrosoft.com

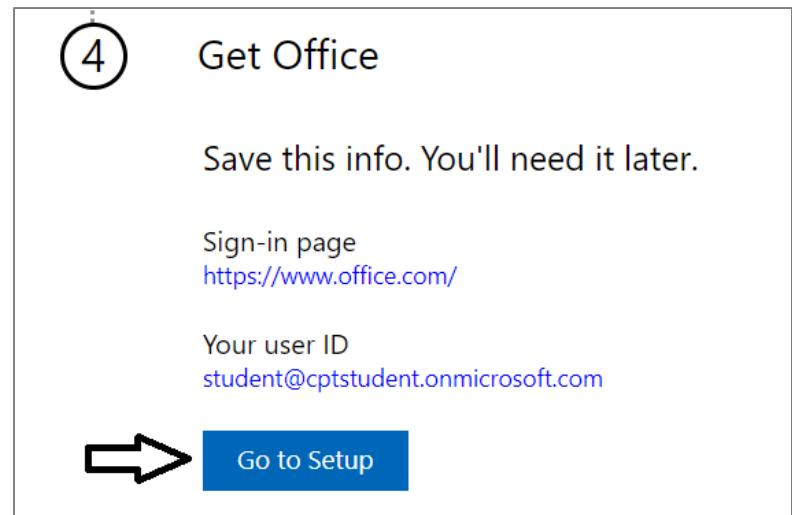
→ Password

Confirm password

By clicking Sign up, I agree to the [privacy statement](#), [default communication preferences](#) and the [trial agreement](#).

☐ Microsoft Partners may contact me with information about their products, services, and events

→ Sign up



④ Get Office

Save this info. You'll need it later.

Sign-in page
<https://www.office.com/>

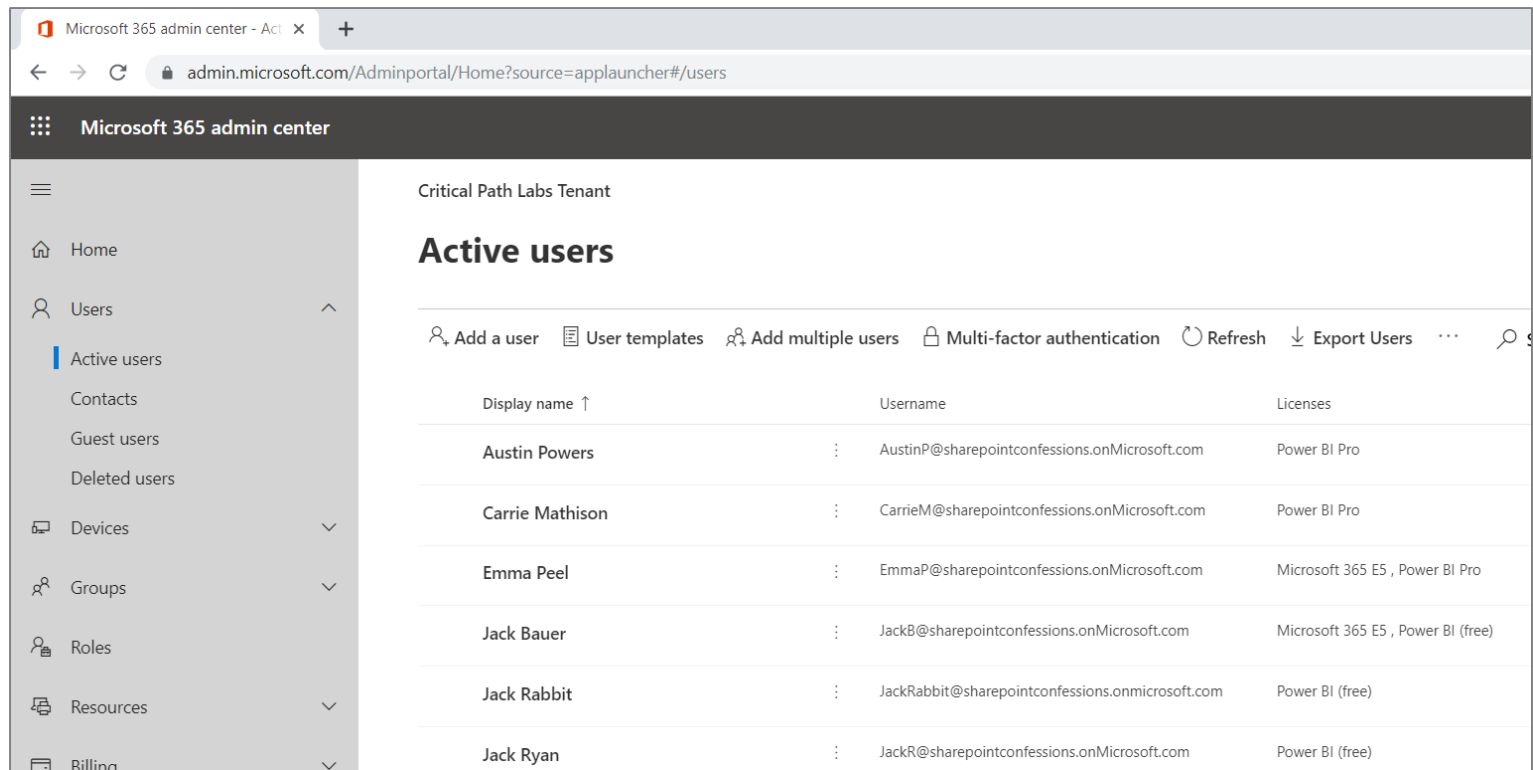
Your user ID
[student@cptstudent.onmicrosoft.com](#)

→ Go to Setup



Microsoft 365 admin center

- Microsoft 365 admin center used for tenant administration
 - You will have full control because you are a Global tenant admin
 - You can create user accounts and groups
 - You can create subscriptions and assign licenses



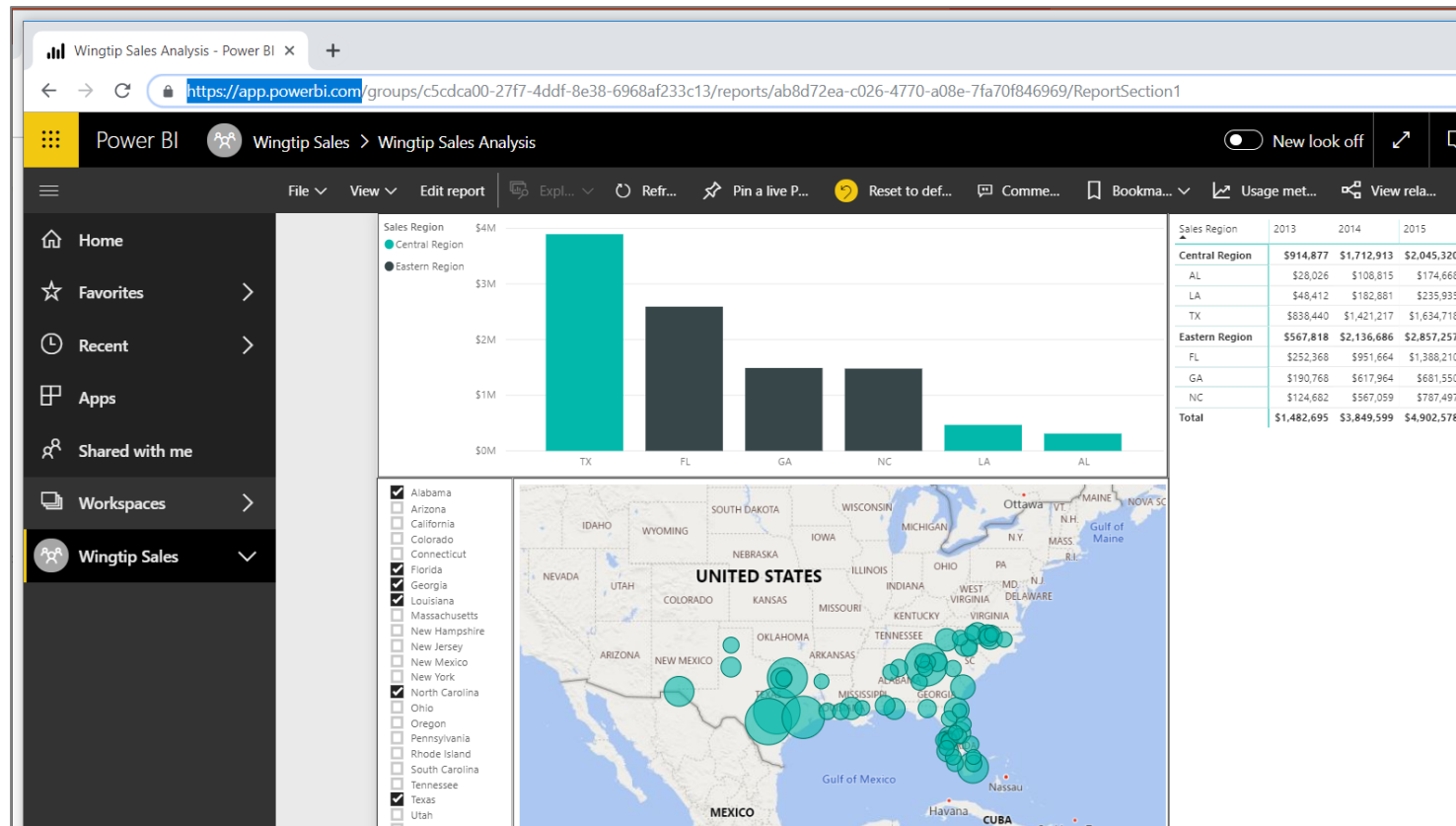
The screenshot displays the Microsoft 365 Admin Center interface. The left-hand navigation pane includes links for Home, Users, Active users (selected), Contacts, Guest users, Deleted users, Devices, Groups, Roles, Resources, and Billing. The main content area is titled 'Critical Path Labs Tenant' and 'Active users'. It features a toolbar with options: Add a user, User templates, Add multiple users, Multi-factor authentication, Refresh, Export Users, and a search icon. Below the toolbar is a table listing active users with columns for Display name, Username, and Licenses.

| Display name ↑ | Username | Licenses |
|-----------------|--|-----------------------------------|
| Austin Powers | AustinP@sharepointconfessions.onmicrosoft.com | Power BI Pro |
| Carrie Mathison | CarrieM@sharepointconfessions.onmicrosoft.com | Power BI Pro |
| Emma Peel | EmmaP@sharepointconfessions.onmicrosoft.com | Microsoft 365 E5, Power BI Pro |
| Jack Bauer | JackB@sharepointconfessions.onmicrosoft.com | Microsoft 365 E5, Power BI (free) |
| Jack Rabbit | JackRabbit@sharepointconfessions.onmicrosoft.com | Power BI (free) |
| Jack Ryan | JackR@sharepointconfessions.onmicrosoft.com | Power BI (free) |

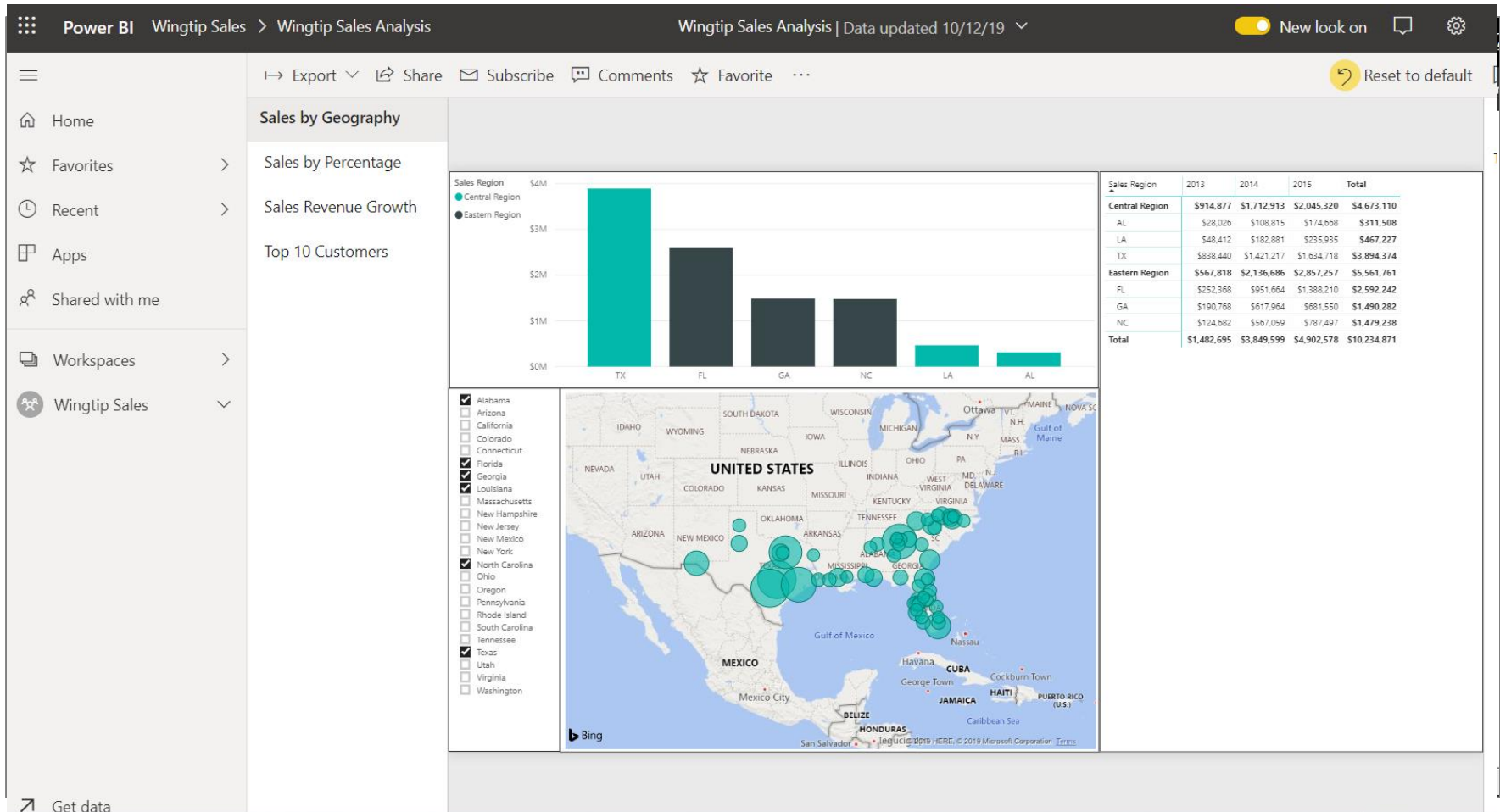


The Power BI Service

- The Power BI Service
 - Provides cloud-based foundation for Power BI platform
 - Provides browser-based portal at <https://app.powerbi.com>

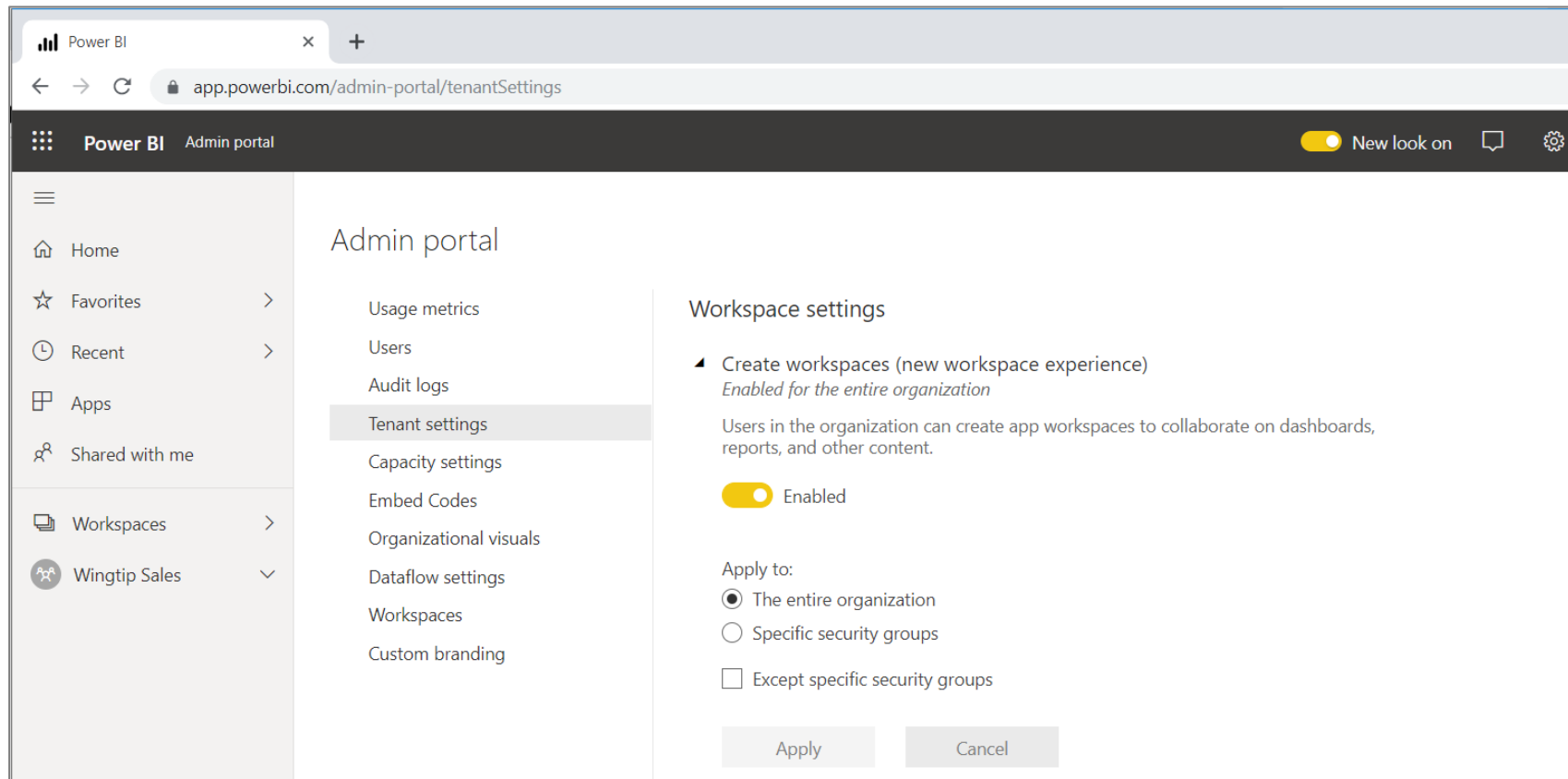


Light Grey is the New Black



The Power BI Admin Portal

- Admin portal used to configure tenant-level settings
 - Accessible at <https://app.powerbi.com/admin-portal>
 - Accessible by global tenant admins and Power BI Service admins



Central Power BI Concepts

- Workspace
 - Secured container for Power BI resources
 - Created as personal workspaces and app workspaces
- Dashboard
 - Consolidated high-level view into reports and datasets
 - Provides great experience on mobile device (*e.g. iPhone, Android, tablet, etc.*)
- Report
 - Collection of one or more pages with tables & visualizations
 - Provides consumer with interactive control through filtering and bookmarks
- Dataset
 - In-memory data model containing one or more tables
 - Used to supply the underlying data to reports and dashboards
- Dataflows
 - Persistent data store used for more complex ETL requirements
 - Not required in most Power BI scenarios



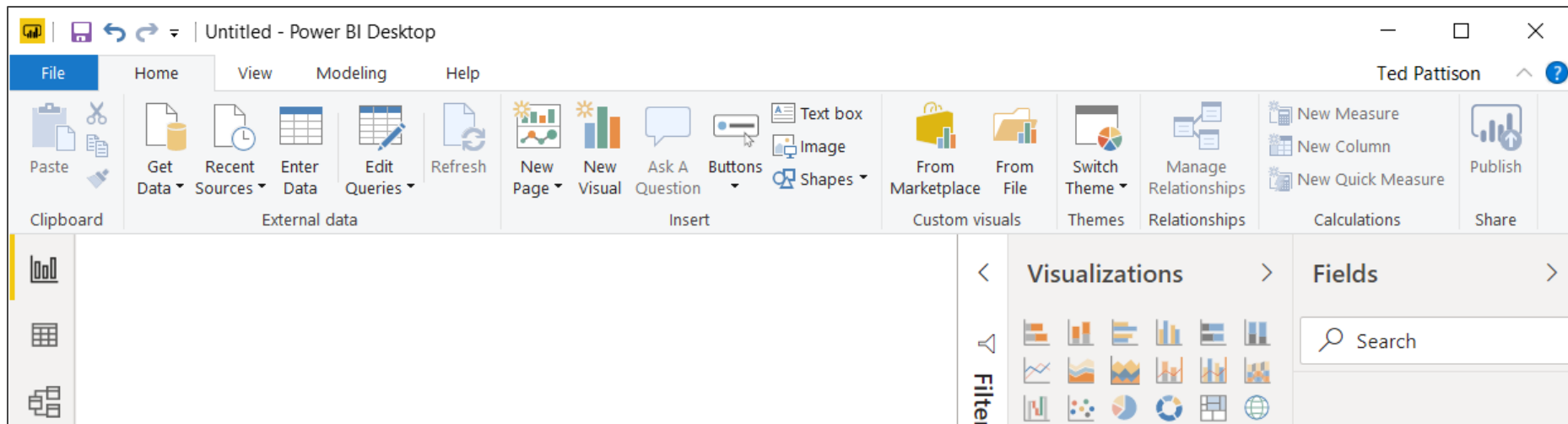


DEMO

Creating Azure AD User Accounts in an Office 365 Tenant

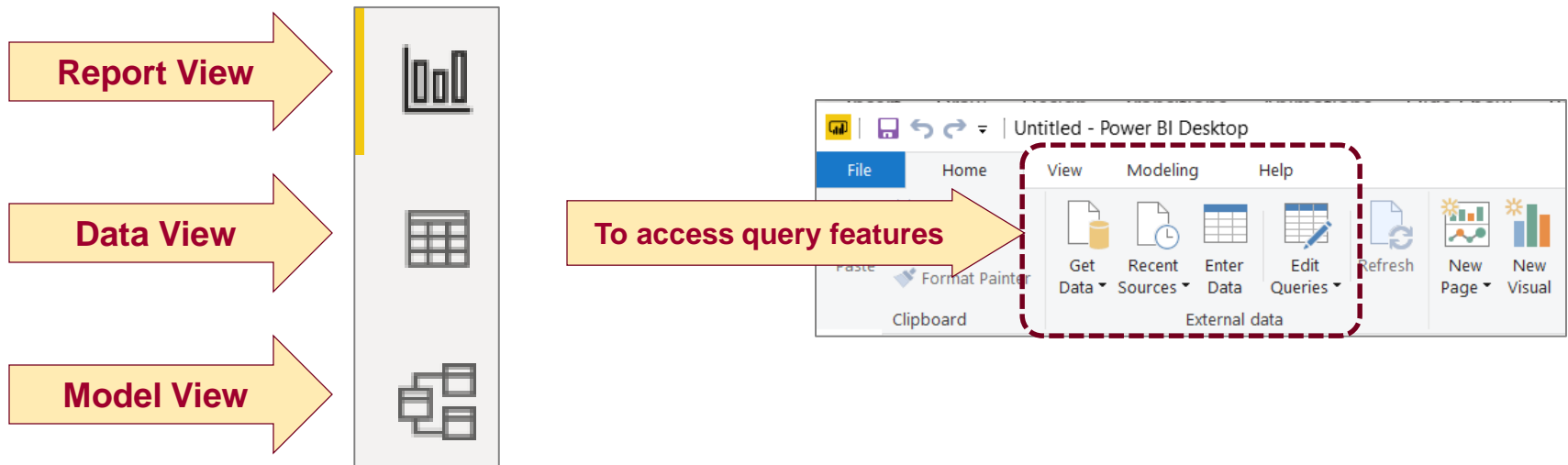
Working with Power BI Desktop

- Power BI Desktop is a Windows application
 - Work is saved and published in terms of PBIX projects
 - You can work on multiple projects at once
 - Each project runs in its own Power BI Desktop instance
 - Power BI Desktop can freeze up or act buggy
 - Quit & restart Power BI Desktop if it acts strangely



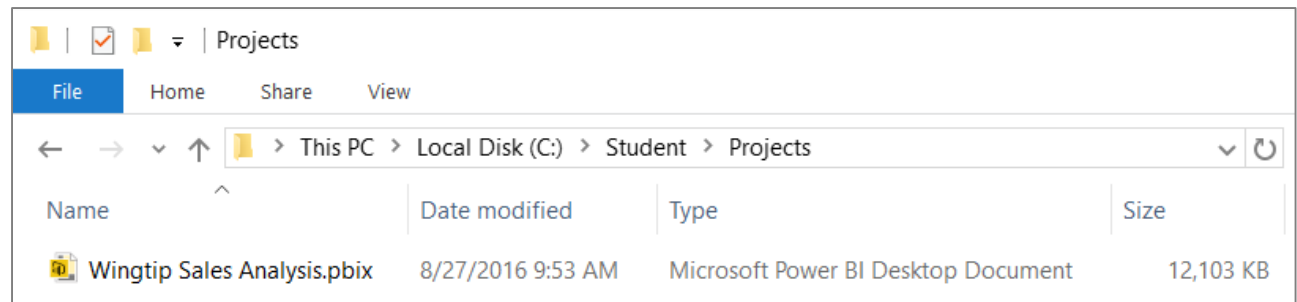
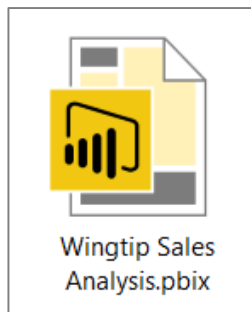
Getting Around in Power BI Desktop

- What do you need to learn to use Power BI Desktop?
 - Query features for importing data
 - Designing data model & writing DAX expressions
 - Designing reports with Power BI Desktop report designer
- Navigating between view modes



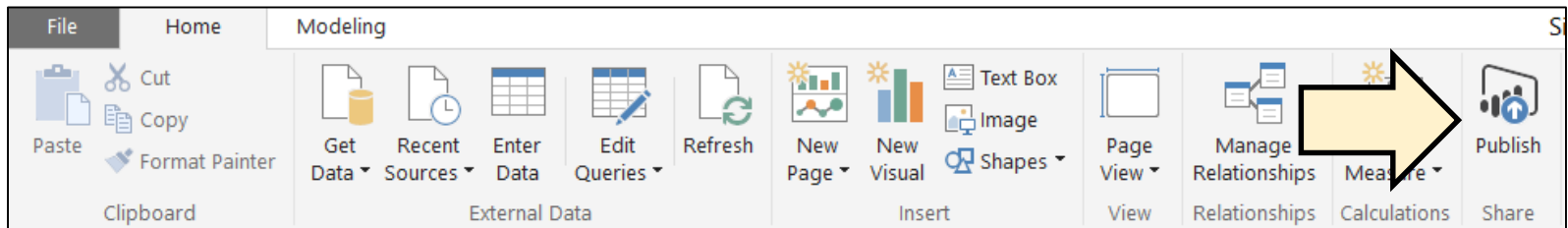
Projects and PBIX Files

- Power BI Desktop projects saved using PBIX files
 - PBIX file contains data source definitions
 - PBIX file contains query definitions
 - PBIX file contains data imported from queries
 - PBIX file contains exactly one data model definition
 - PBIX file contains exactly one report
 - PBIX file never contains data source credentials

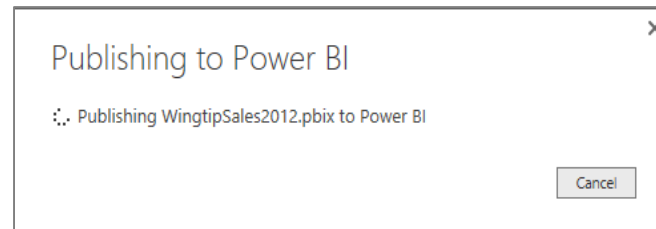
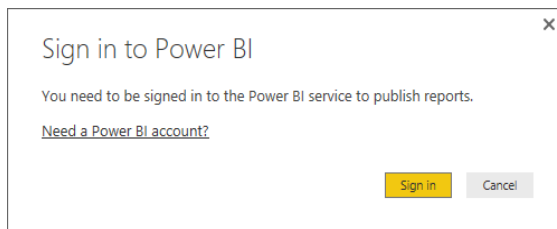


Publishing a Power BI Desktop Project

- Power BI Desktop provides **Publish** command
 - Used to publish project to Power BI service



- Requires logging into your Office 365 account



- Published articles added to target workspace



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



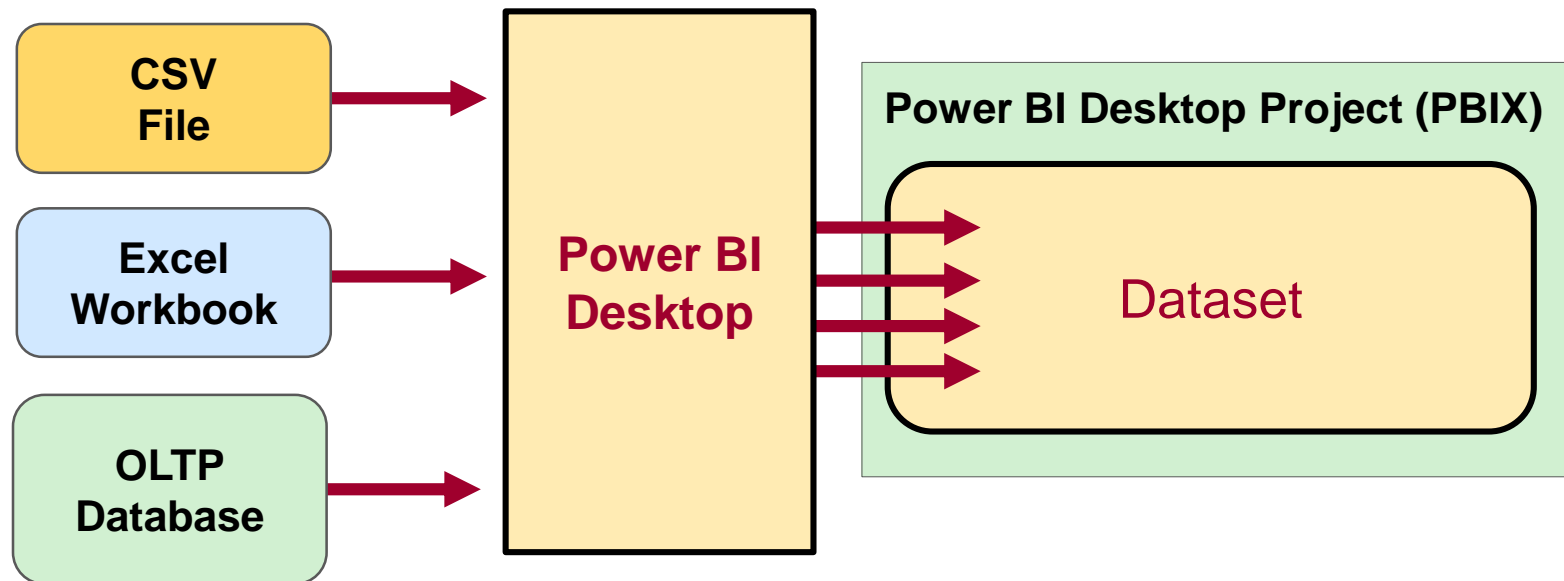
Defining Grain Statements

- 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?



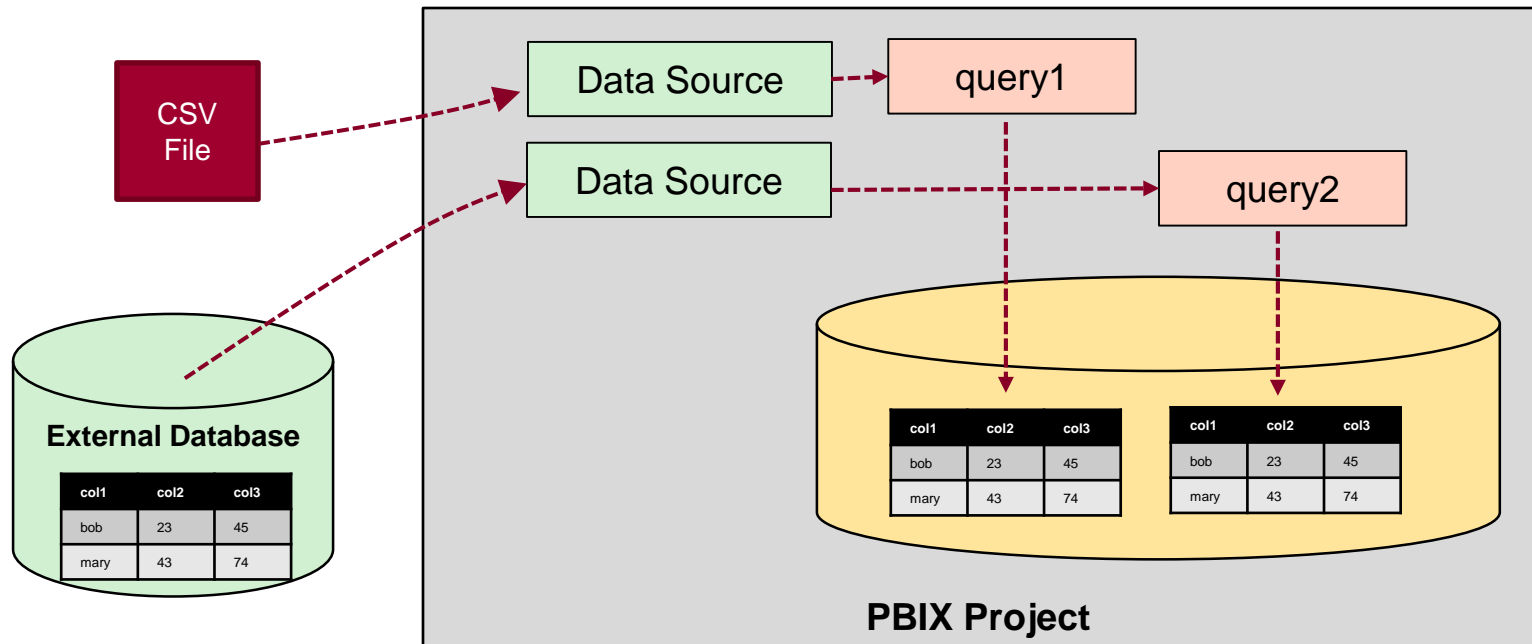
Power BI Desktop is an ETL Tool

- 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



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 Editor Window

- Power BI Desktop provides separate Query Editor window
 - Provides powerful features for designing queries
 - Displays list of all queries in project on the left
 - Displays **Properties** and **Applied Steps** for selected query on right
 - Preview of table generated by query output shown in the middle
 - Query can be executed using **Apply** or **Close & Apply** command



Query Steps

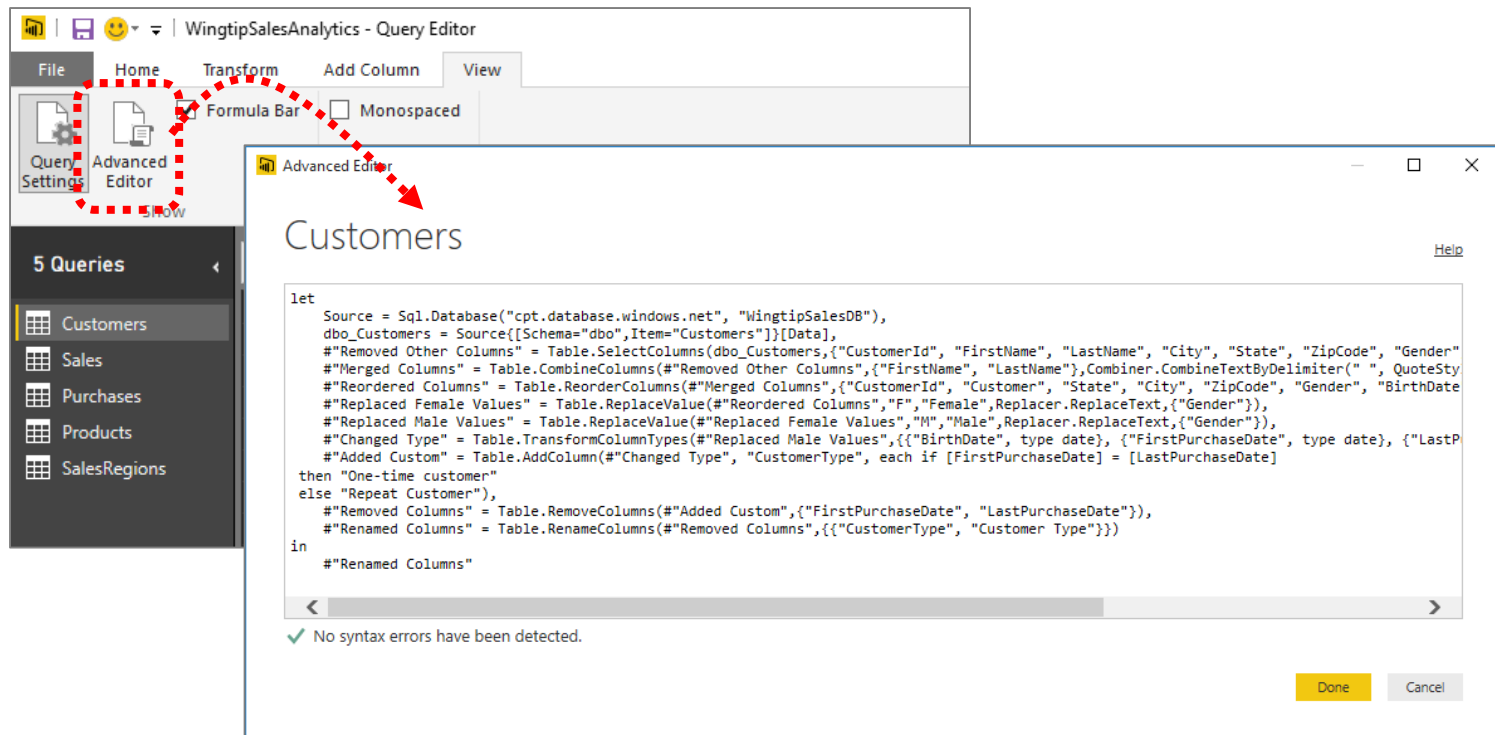
- A query is created as a sequence of steps
 - Each step is a parameterized operation on the data
 - Each step has formula which can be viewed/edited in formula bar
 - Query starts with Source step to extract data from a data source
 - Additional steps added to perform transform operations on data
 - 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 yellow 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 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 and a yellow callout box labeled 'sequential list of steps for query'. The 'Applied Steps' list includes: Source, Navigation, Removed Other Columns, Merged Columns, Reordered Columns, Replaced Female Values, Replaced Male Values (which is selected with a mouse cursor), Changed Type, and Added Conditional Column.

| 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



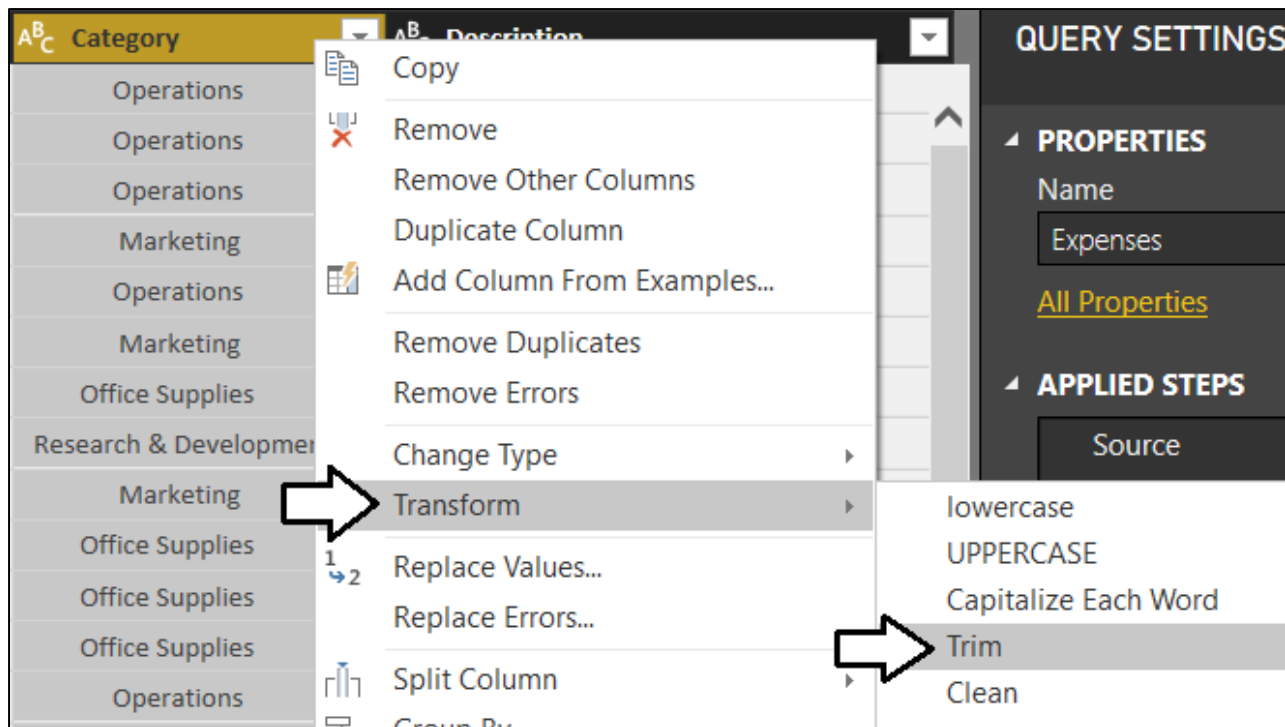
Examples of Basic Power BI Desktop Steps

- Rename column
- Convert column type
- Trim and clean column values
- Replace column values
- Format column values
- Expanding related column
- Merging columns
- Splitting columns











Cleaning Data

- Special steps available to clean up string-based data
 - **Transform > Trim** removes whitespace
 - **Transform > Clean** removed non-printable characters



Converting Column Types

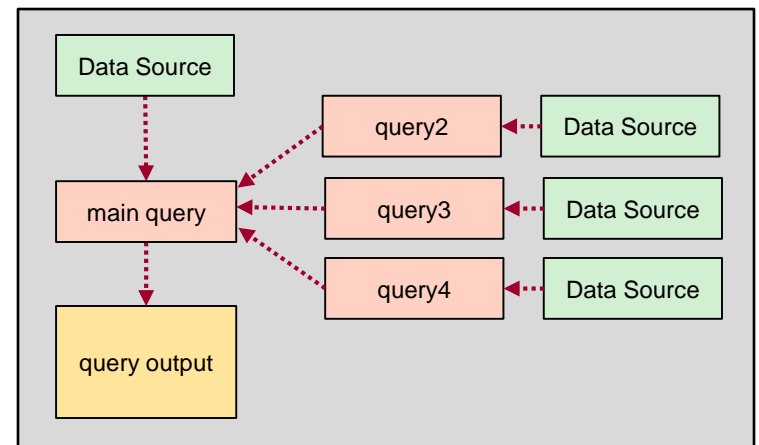
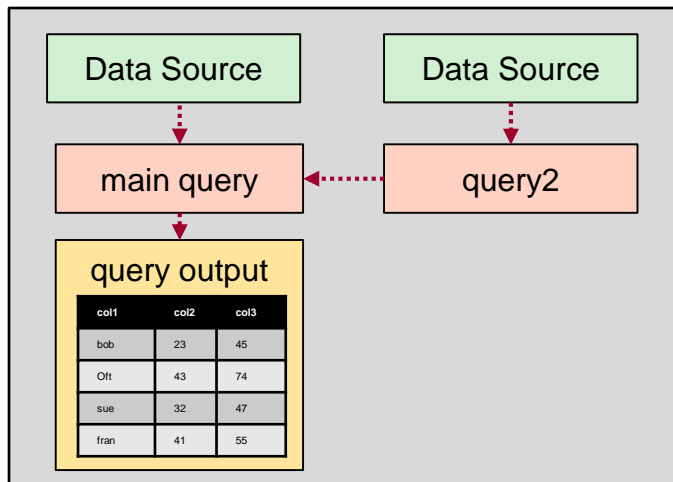
- Transform data to make it more reliable
 - Convert date-time column to date column
- Transform data to make it more efficient
 - Convert decimal to fixed decimal number for currency

|  PurchaseDate |  | 10^3 Quantity |  | \$ SalesAmount |  | \$ ProductCost |  |
|--|---|-----------------|---|----------------|---|---|---|
| 1/28/2012 | | 1 | | 2.95 | | 1.2 | Decimal Number |
| 1/28/2012 | | 6 | | |  | \$ | Fixed Decimal Number |
| 1/28/2012 | | 1 | | 19.95 | | 10^3 | Whole Number |
| 1/28/2012 | | 5 | | 249.75 | |  | Date/Time |
| 1/28/2012 | | 1 | | 2.95 | |  | Date |



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 can be created with connection-only load setting



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 |

Search Columns to Expand

(Select All Columns)

☐ InvoiceId

☒ InvoiceDate

☐ InvoiceAmount

☐ InvoiceType

☒ CustomerId

☐ Customers

☐ InvoiceDetails

☐ Use original column name as prefix

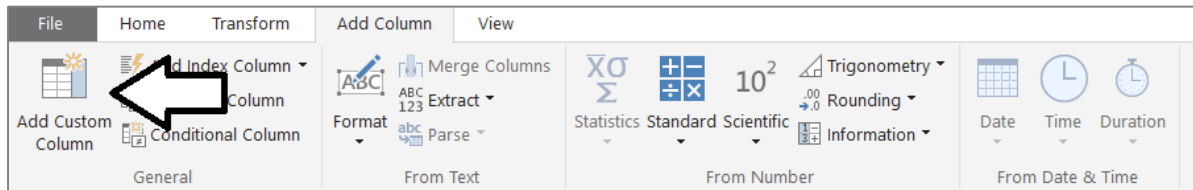
OK Cancel

| 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 |



Adding a Custom Column

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



Add Custom Column

New column name:

Custom column formula:

```
= if [FirstPurchaseDate]=[LastPurchaseDate]  
then "One-time Customer"  
else "Repeat Customer"
```

Available columns:
CustomerId
Customer
State
City
ZipCode
Gender
BirthDate
FirstPurchaseDate
LastPurchaseDate
CustomerType

<< Insert

[Learn about Power BI Desktop formulas](#)

✓ No syntax errors have been detected.

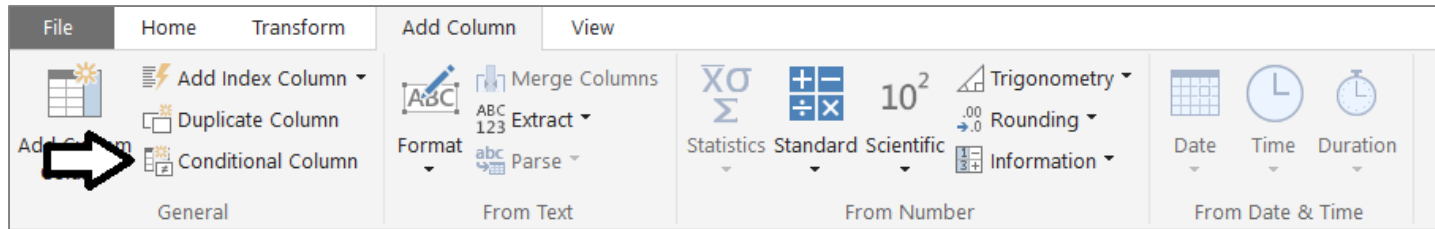
OK Cancel

| 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 ✕

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

New column name

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

Otherwise

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





DEMO

Using Queries to Transform Data During the Load Process

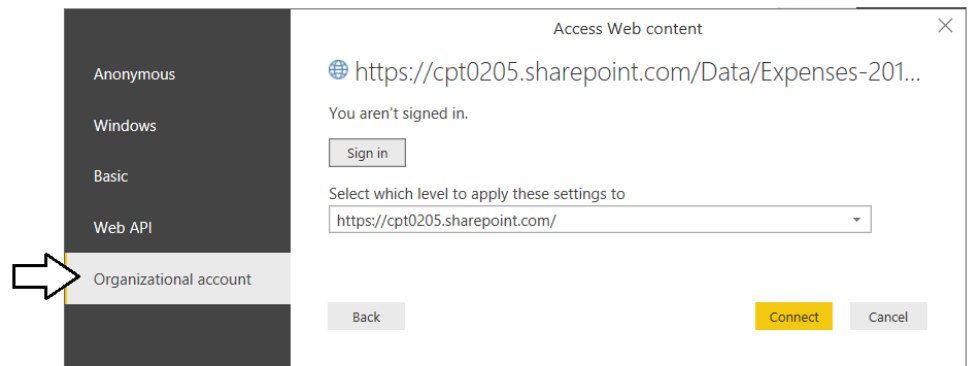
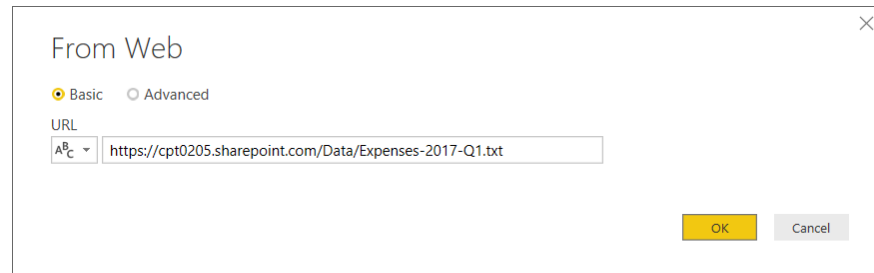
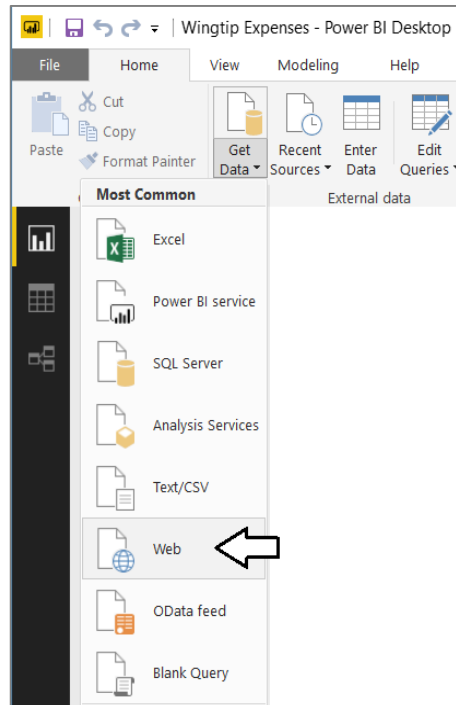
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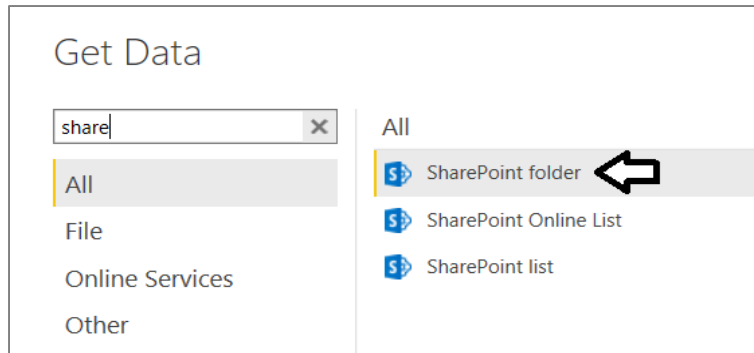
Importing Files using the Web Datasource

- Files in SharePoint document library exposed via HTTPS
 - Use **Web** datasource to import files in SharePoint Online
 - Use the absolute path to file in document library
 - Authenticate using **Organizational account**



Importing using the SharePoint Folder

- Select the **SharePoint folder** datasource



- Query returns a row for each file in the site

The query results window displays the URL <https://cpt0205.sharepoint.com> and a table of files. The table has columns for Content, Name, Extension, Date accessed, Date modified, Date created, Attributes, and Folder Path. The data shows five files, all created on 2/3/2018 at 8:09 AM, with various extensions (.txt, .docx, .pptx).

| Content | Name | Extension | Date accessed | Date modified | Date created | Attributes | Folder Path |
|---------|--------------------------|-----------|---------------|------------------|------------------|------------|--|
| Binary | Expenses-2017-Q2.txt | .txt | null | 2/3/2018 8:09 AM | 2/3/2018 8:09 AM | Record | https://cpt0205.sharepoint.com/Data/ |
| Binary | Expenses-2017-Q1.txt | .txt | null | 2/3/2018 8:09 AM | 2/3/2018 8:09 AM | Record | https://cpt0205.sharepoint.com/Data/ |
| Binary | Expenses-2017-Q3.txt | .txt | null | 2/3/2018 8:09 AM | 2/3/2018 8:09 AM | Record | https://cpt0205.sharepoint.com/Data/ |
| Binary | LibertyPowerBISetup.docx | .docx | null | 2/3/2018 7:54 AM | 2/3/2018 7:54 AM | Record | https://cpt0205.sharepoint.com/Shared Documents/ |
| Binary | RealtimeDashboards.pptx | .pptx | null | 2/3/2018 7:54 AM | 2/3/2018 7:54 AM | Record | https://cpt0205.sharepoint.com/Shared Documents/ |

Buttons at the bottom: Combine & Edit, Edit, Cancel.





DEMO

Importing Content from Files in SharePoint Online

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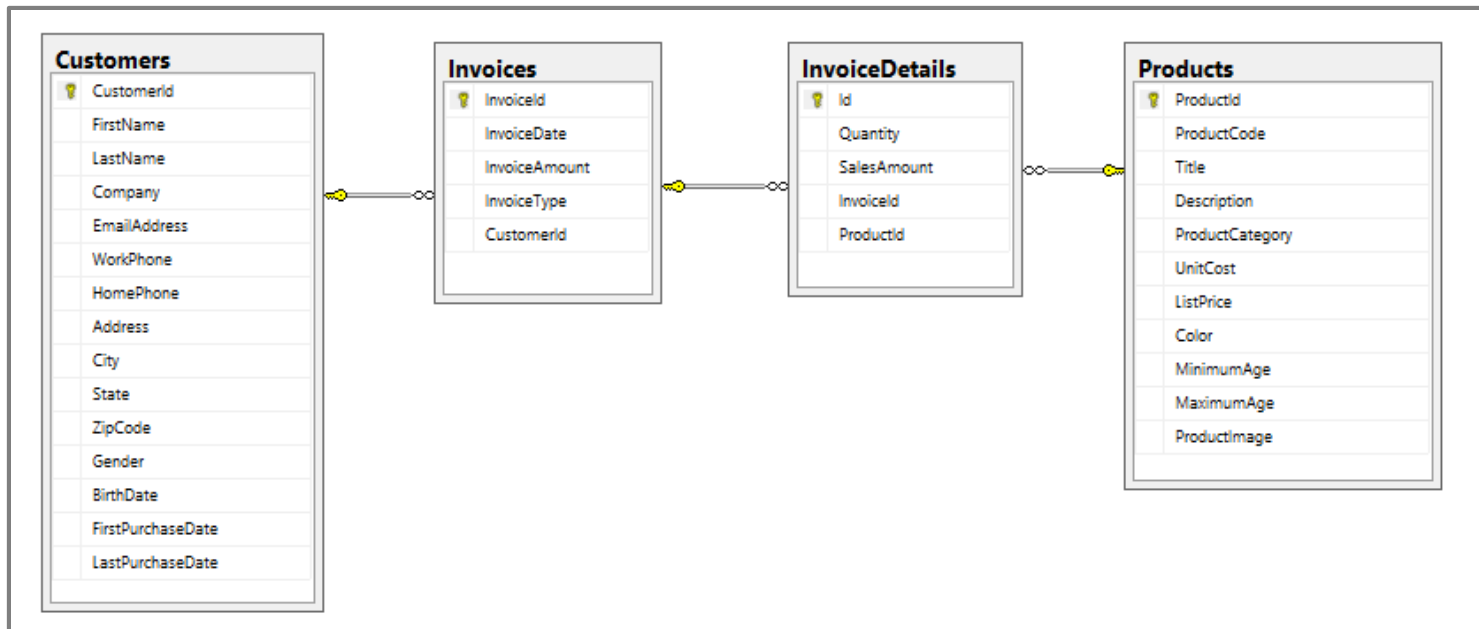
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- Designing Data Model using a Star Schema
 - Advanced Query Design



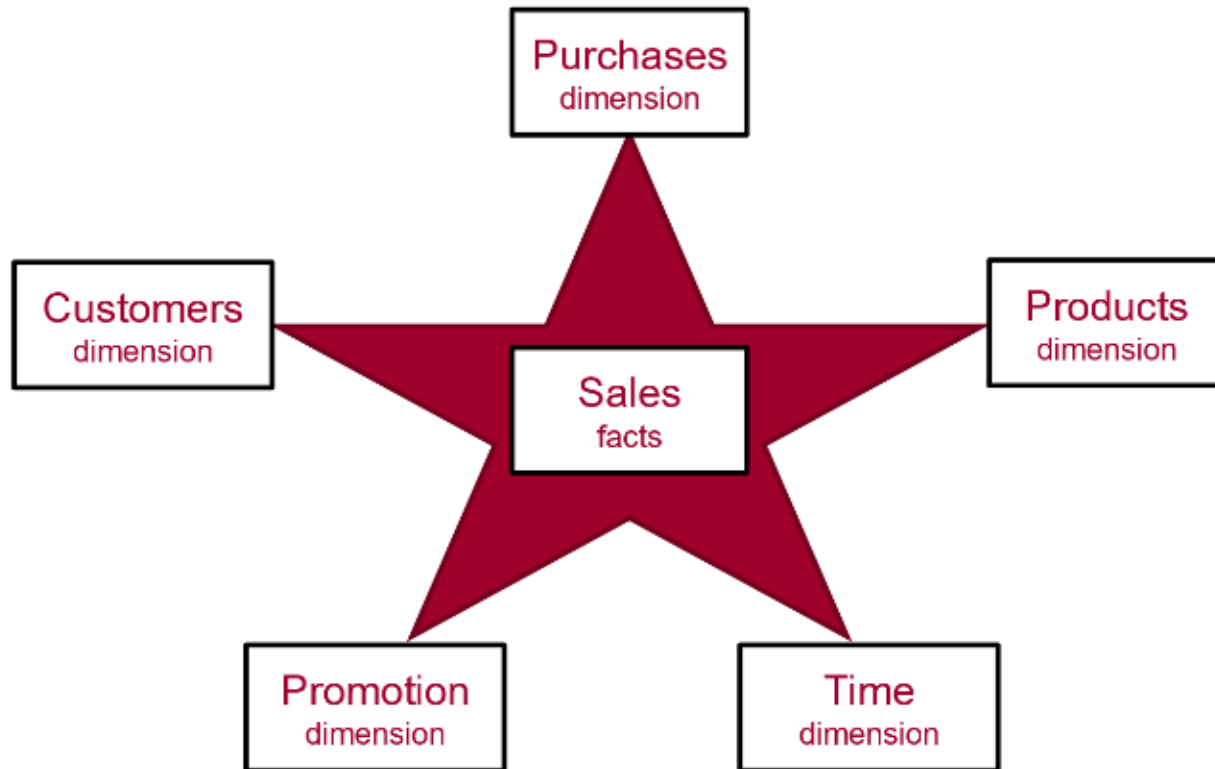
Sample OLTP Database: WingtipSalesDB

- 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



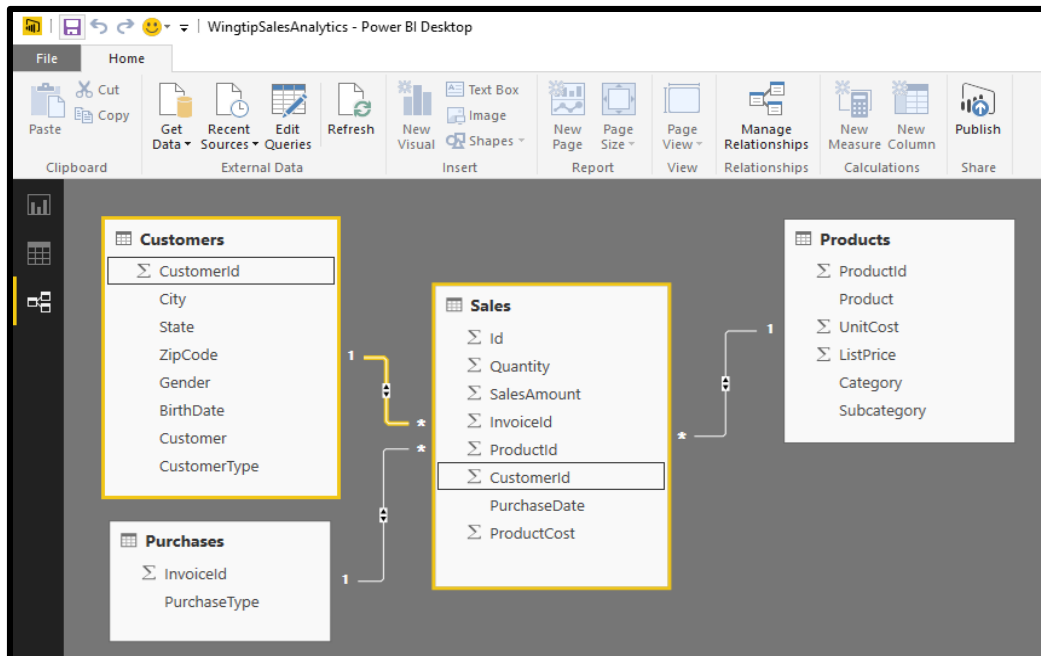
Data Modeling using a Star Schema

- 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

Exploring the Wingtip Sales Analysis Demo Project

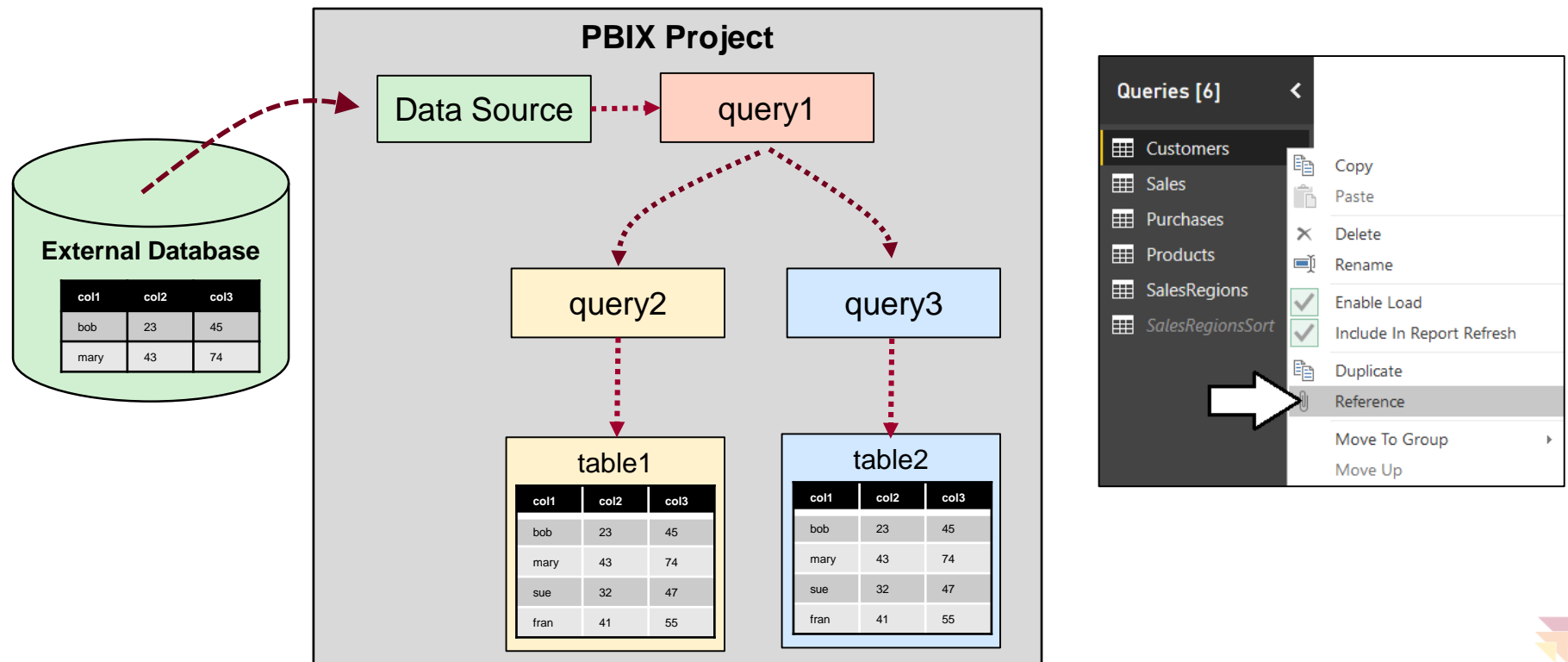
Agenda

- ✓ Class Introduction
- ✓ Query Design Fundamentals
- ✓ SharePoint Online
- ✓ Query Folding
- ✓ Designing Data Model using a Star Schema
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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



Agenda

- ✓ Deciding What To Measure
- ✓ Query Design Fundamentals
- ✓ Designing Data Model using a Star Schema
- ✓ Working with the Query Editor Window
- ✓ Importing Content From SharePoint Online
- Designing with Function Queries
 - Understanding Parameters and Template Files





DEMO

Creating a Function Query

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 | Dar kwa, 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, Jarron | DT | 6-4 | 255 | 22 | 5 | Illinois |

From Web

Basic ☒ Advanced ☐

Enter a Web page URL.

URL

Open file as

OK Cancel

Query Input

| | ¹²³ # | A ^B _C Name | A ^B _C Pos. | A ^B _C HT. | ¹²³ WT. | ¹²³ Age | A ^B _C Exp. | A ^B _C 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

| ¹²³ Number | A ^B _C Last Name | A ^B _C First Name | ¹²³ Weight | ¹²³ Height | ¹²³ Age | ¹²³ Experience | A ^B _C Position | A ^B _C Category | A ^B _C Side | A ^B _C College |
|-----------------------|---------------------------------------|--|-----------------------|-----------------------|--------------------|---------------------------|--------------------------------------|--------------------------------------|----------------------------------|-------------------------------------|
| 1 | Adams | Jerrell | 247 | 77 | 23 | 0 | Tight End | Backs and Receivers | Offense | South Carolina |
| 2 | Donnell | Larry | 265 | 78 | 27 | 4 | Tight End | Backs and Receivers | Offense | Grambling |
| 3 | Tye | Will | 262 | 74 | 24 | 1 | Tight End | Backs and Receivers | Offense | Stony Brook |
| 4 | Apple | Eli | 199 | 73 | 21 | 0 | Cornerback | Defensive Backs | Defense | Ohio State |
| 5 | Hall | Leon | 195 | 71 | 31 | 9 | Cornerback | Defensive Backs | Defense | Michigan |
| 6 | Jenkins | Janoris | 198 | 70 | 27 | 5 | Cornerback | Defensive Backs | Defense | North Alabama |
| 7 | Rodgers-Cromartie | Dominique | 205 | 74 | 30 | 8 | Cornerback | Defensive Backs | Defense | Tennessee State |
| 8 | Beatty | Will | 319 | 78 | 31 | 7 | Offensive Tackle | Offensive Line | Offense | Connecticut |
| 9 | Beckham Jr | Odell | 198 | 71 | 23 | 3 | Wide Receiver | Backs and Receivers | Offense | LSU |
| 10 | Cruz | Victor | 204 | 72 | 29 | 7 | Wide Receiver | Backs and Receivers | Offense | Massachusetts |

Summary

- ✓ Class Introduction
- ✓ Query Design Fundamentals
- ✓ SharePoint Online
- ✓ Query Folding
- ✓ Designing Data Model using a Star Schema
- ✓ Advanced Query Design

