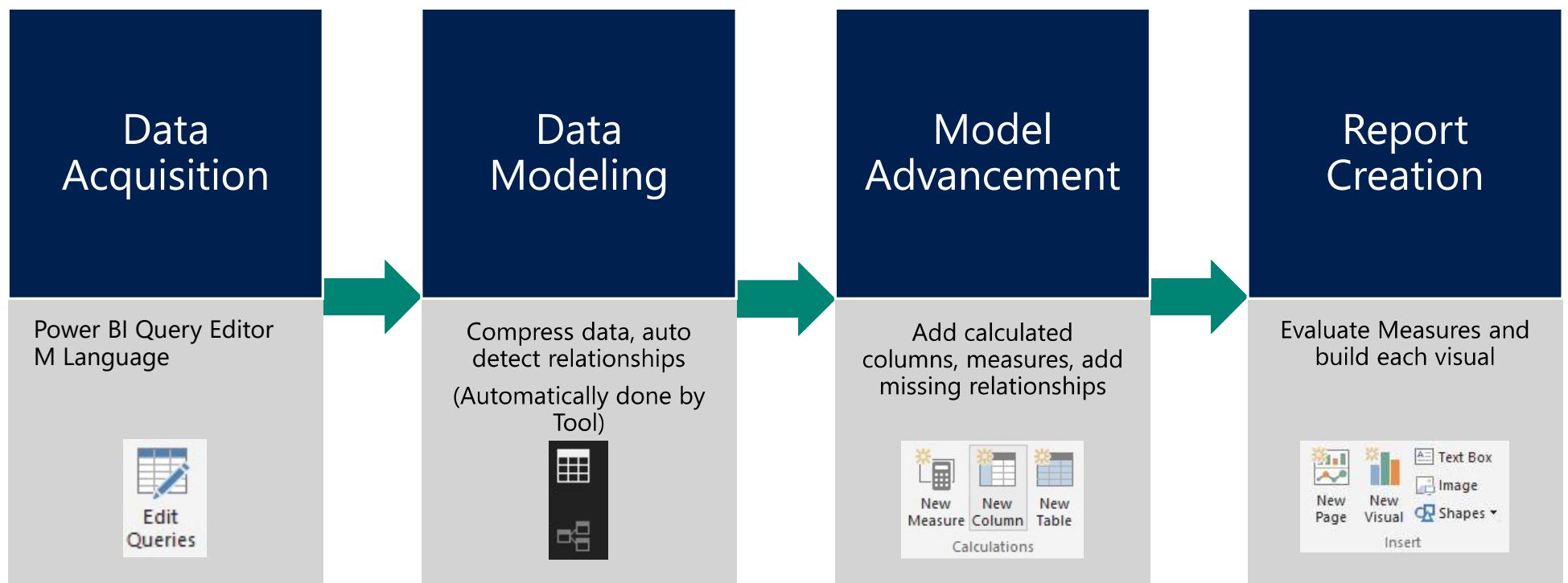


Agenda

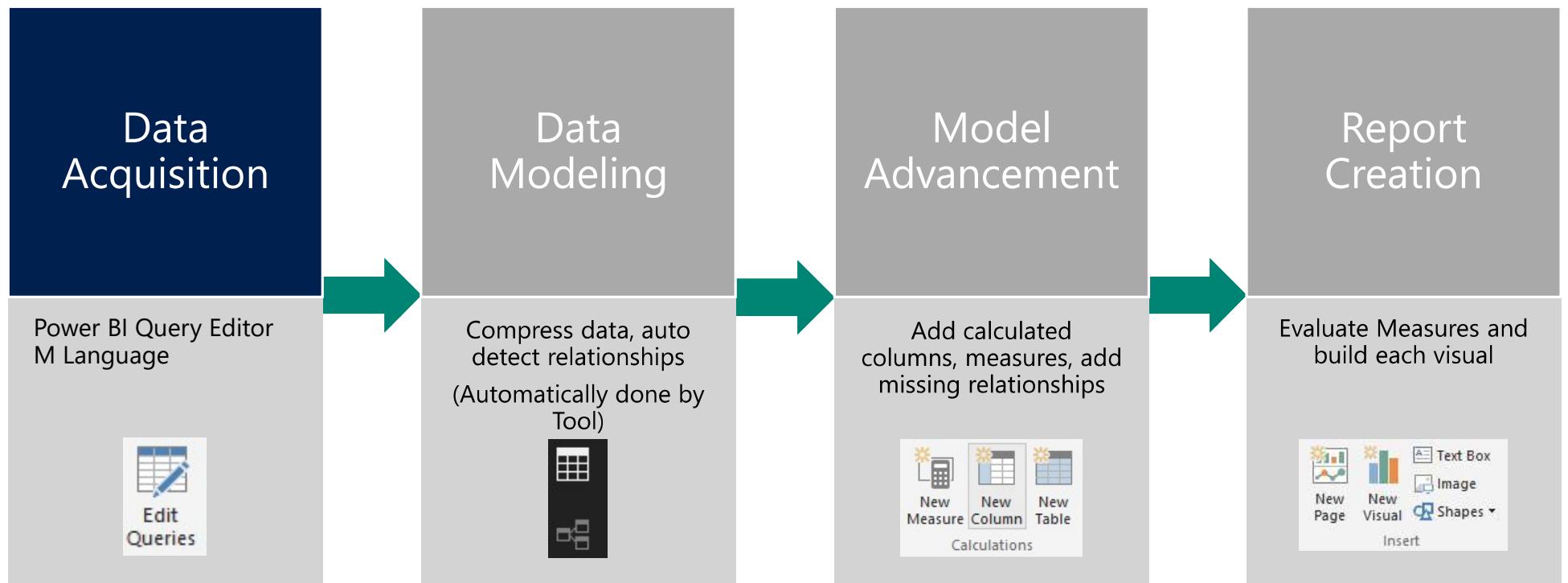
- Advanced Power BI Data Modeling
 1. Dataset, Dataflow, Datamart and Storage Mode
 2. Advance DAX Concept
 3. Performance Tuning
 4. Custom Visual (Synoptic Design)
- Power BI Premium Platform
 1. Power BI Premium Overview
 2. Data Incremental Refresh
- Enterprise Governance and Administration in Power BI
 1. Workspace/Dataset 權限管理 / RLS 權限管理
 2. Workspace Deployment Pipeline 生命週期管理
 3. Power BI App 功能介紹
- AI in Power BI
 1. Power BI Artificial intelligence (Optional)

Understand Different Phases in Power BI Development

Phases in Building a Power BI Desktop File



Data Acquisition



Data Acquisition

Introduction

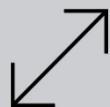
Data in Power BI can be acquired in two different ways

- **Import:** Import models copy the data from source to PBIX file and carry the data to Service.
- **Direct Query:** Direct Query models store only meta data information and will query the data source based on the requirement.

Use Import as much as possible for performance reasons and when the goals of the reports are not met then plan to use Direct Query as it provides – Latest data and higher data sizes.

Import or Direct Query?

Some considerations for using the Direct Query



Use it when the size limitations are not supporting the import model



Use it to support real time scenarios



Use it when the concurrency and capacity are planned and notified to the DBA / Data Source owner.



Use it when the model is analytical but not transactional

Get Data – Power BI datasets

In Power BI Desktop, users can now consume datasets (models) from another report through shared datasets

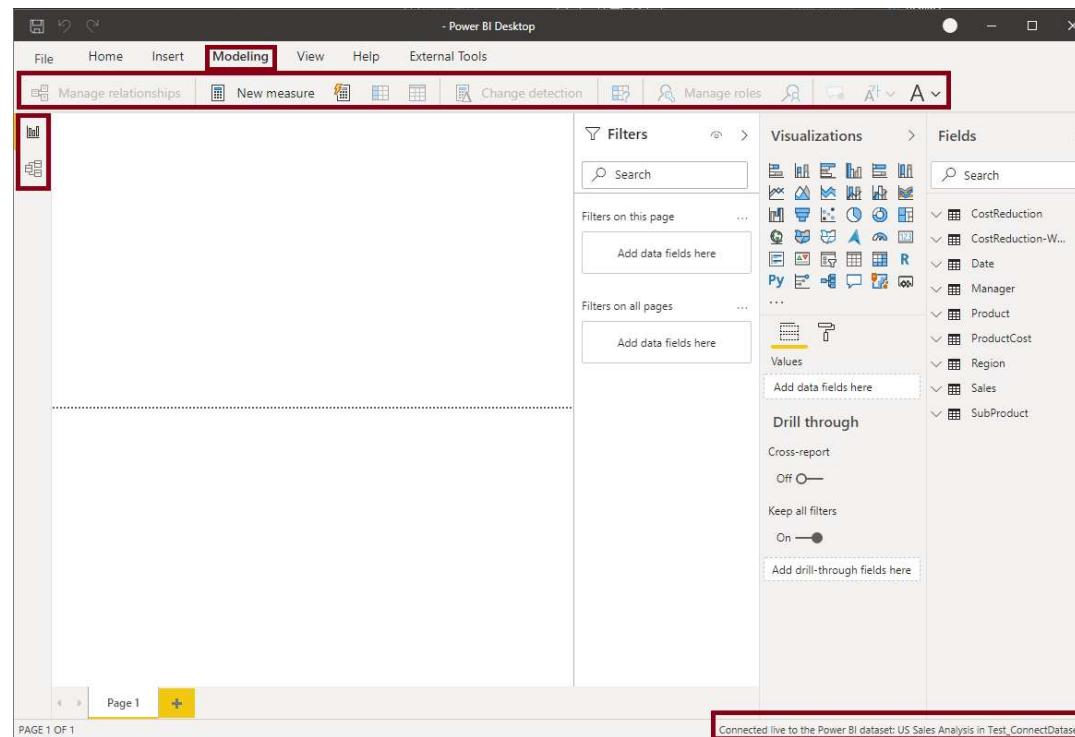
The screenshot shows the Power BI Desktop interface. On the left, the 'Get Data' ribbon is selected, displaying options like 'Power Platform', 'Power BI datasets' (which is highlighted with a red arrow), 'Power BI dataflows', and 'Common Data Service'. On the right, a modal window titled 'Select a dataset to create a report' lists several datasets with columns for NAME, ENDORSEMENT, OWNER, WORKSPACE, and LAST REFRESHED.

NAME	ENDORSEMENT	OWNER	WORKSPACE	LAST REFRESHED
Power BI Lifecycle	Certified	Tamas Zsolt Polner	Power BI Lifecycle	8 hours ago
MTC Insights Model	Promoted	Scott Hulke	US MTC Reporting	an hour ago
PowerBI Governance Dashboard	Promoted	Willie Ahlers	wiahlers@microsoft.com	18 days ago
SERPDashboardProd		Rahul Satish	STCI Travel Segment team	a year ago
TravelTopQueriesDashboardProd		Nitesh Kumar	STCI Travel Segment team	a year ago
(BETA) ESI Program Metrics		Kishore Nambala	Worldwide Learning BI	2 days ago
(BETA) ESI Program Metrics		Kishore Nambala	Worldwide Learning BI U...	6 days ago

Notice that it is a **Power BI dataset**.

Get Data – Power BI datasets

When reusing a shared dataset, any changes to the Data Model (incl. Relationships) are disabled in Power BI Desktop.



Permissions to Access your Dataset

Developer of the Dataset must grant build permission so it can be shared and used by others in their report.

The screenshot illustrates the process of granting permissions to a dataset in the Power BI service. On the left, the 'Datasets' page shows a single item named 'IT Spend Analysis'. A pink box highlights the 'Manage permissions' option in the context menu for this dataset. On the right, a 'Share report' dialog box is open, showing the 'Access' tab. It includes fields for entering recipient email addresses ('PowerBI com content team') and a message, and several permission checkboxes. Two checkboxes are highlighted with pink boxes: 'Allow users to build new content using the underlying datasets' and 'Allow recipients to share your report'. At the bottom are 'Share' and 'Cancel' buttons.

Dataset Certification

Model (transformations, relationship, measures, etc.) is reviewed by business knowledge experts for accuracy and gets “Certified” or “Promoted”.

▲ Endorsement and discovery

Help coworkers find your quality content by endorsing this dataset and making it discoverable. [Learn more](#)

None
This dataset will appear in search results but isn't endorsed.

Promoted
When you're ready to distribute the dataset to your coworkers, promote it to let them know.

Certified
Certify your dataset to show coworkers that it's been reviewed and meets your org's certification criteria. [How do I get my dataset certified?](#)

Make discoverable
Allow users without access to this dataset to discover it and request permissions to access the data [Learn more](#)

ⓘ This dataset will be made discoverable. Others in your org will be able to find it by such details as name, tables, columns, etc. [Learn more](#)

Apply **Discard**

This is a dataset setting

Dataflows, reports and apps can now also be endorsed in a similar way

Dataset – Best Practices

Consider sharing datasets if the use case is to only provide end user the ability to change the visuals as the data model such as schema and relationships incl. row level security is preserved with master dataset.

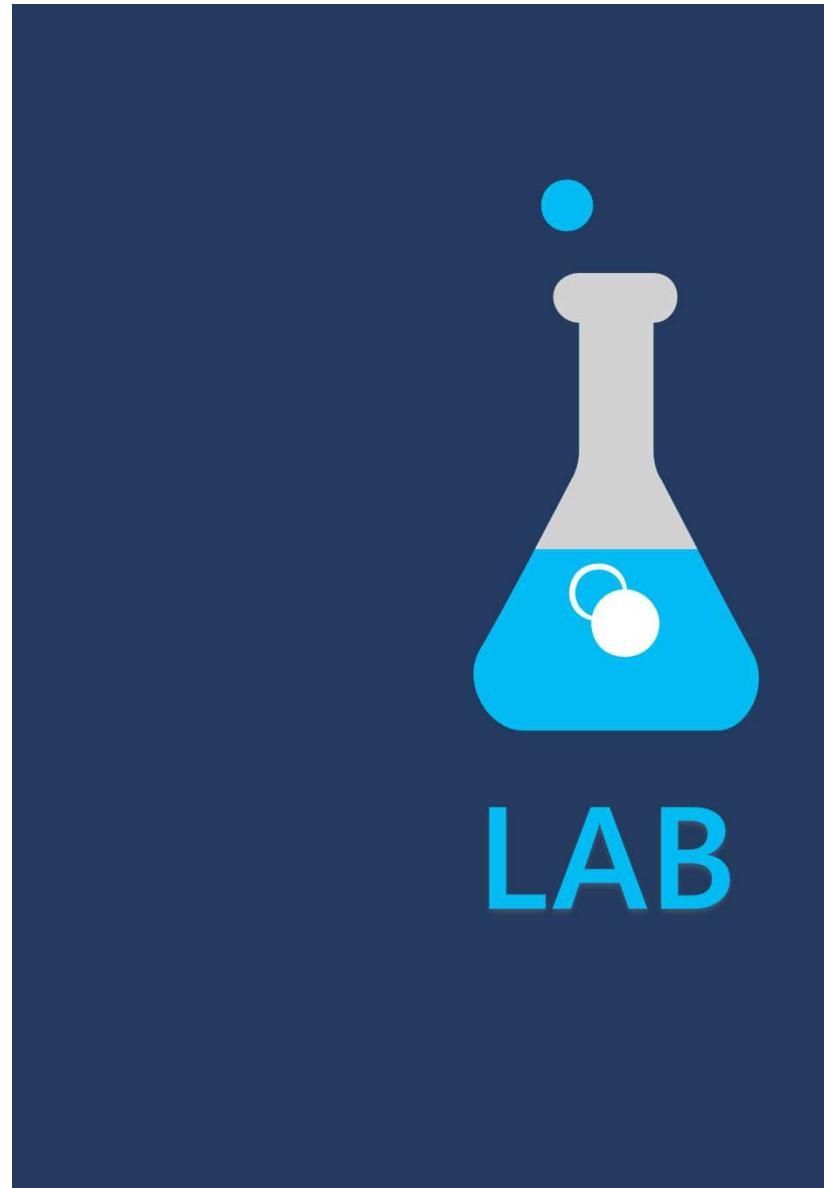
- Please note that end **users won't be able to create columns**, but they will be able to **create calculations** through measures.

Shared Datasets connect in Live mode so the updates to the dataset are automatically reflected.

Certified datasets provide for master data management within the enterprise and allow end users to search and find the datasets easily.

Shared Dataset

Create a Sharing Dataset Report



Composite Models

Introduction

With composite **models**, you can connect to all sorts of different data sources when using **Power BI Desktop** or the **Power BI service**.

You can Import data to Power BI, which is the most common way to get data, or you can connect directly to data in its original source repository using **Direct Query**.

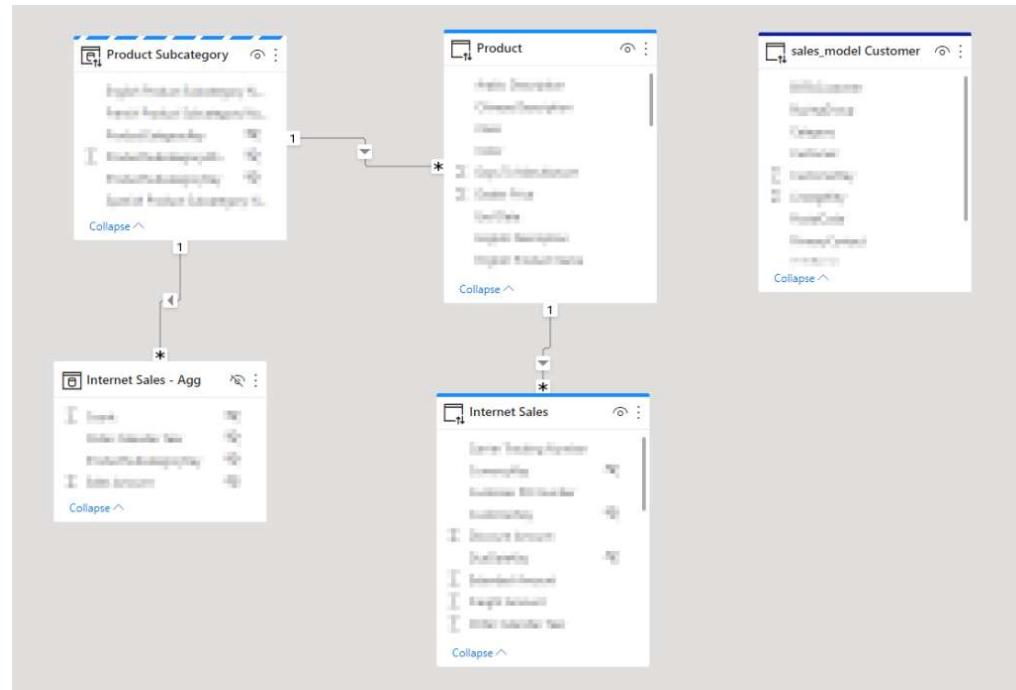
- To boost DQ Model performance, **use appropriate storage** mode for each table and **add aggregations**.
- You want to combine a Direct Query model with additional data, which must be imported into the model. Imported data can be loaded from a different data source, or from calculated tables.
- You want to combine two or more Direct Query data sources into a single model.

Can use to Extend, Enrich and to provide a Dashboard view to enterprise models.

- Reconsider if used to join large dimensions or facts.

Source Groups

Composite Models



Each data source in the data model is a **Source Group**. Represented by a color in the Model view.

- Each DQ belongs to its own source group
- All imported data belongs to one source group

Storage Mode

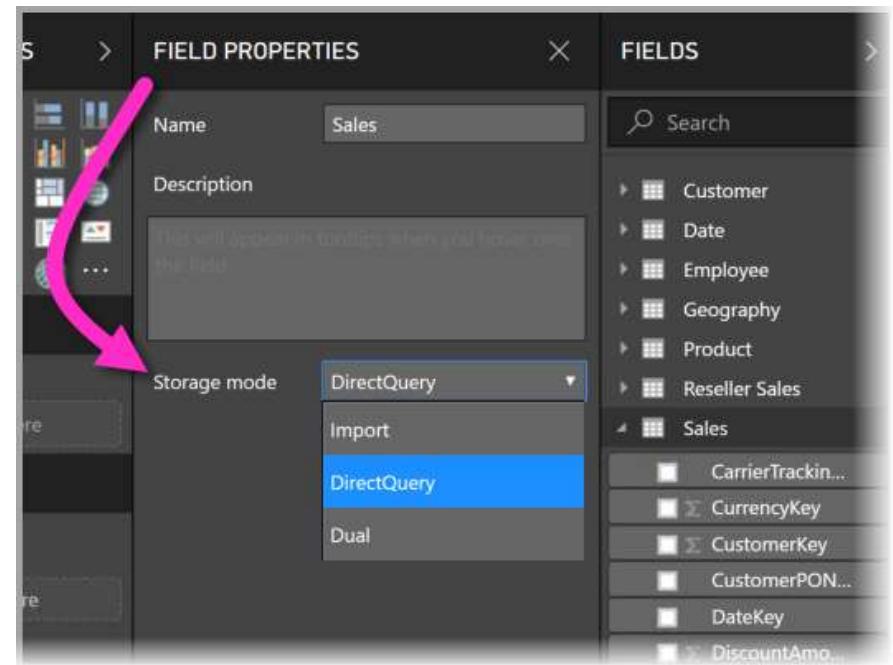
Composite Models

Specifies if the table can be cached in memory.

Can be set per table.

Three Modes

- Import
- Direct Query
- Dual



Storage Mode Advantages

Composite Models

Important !

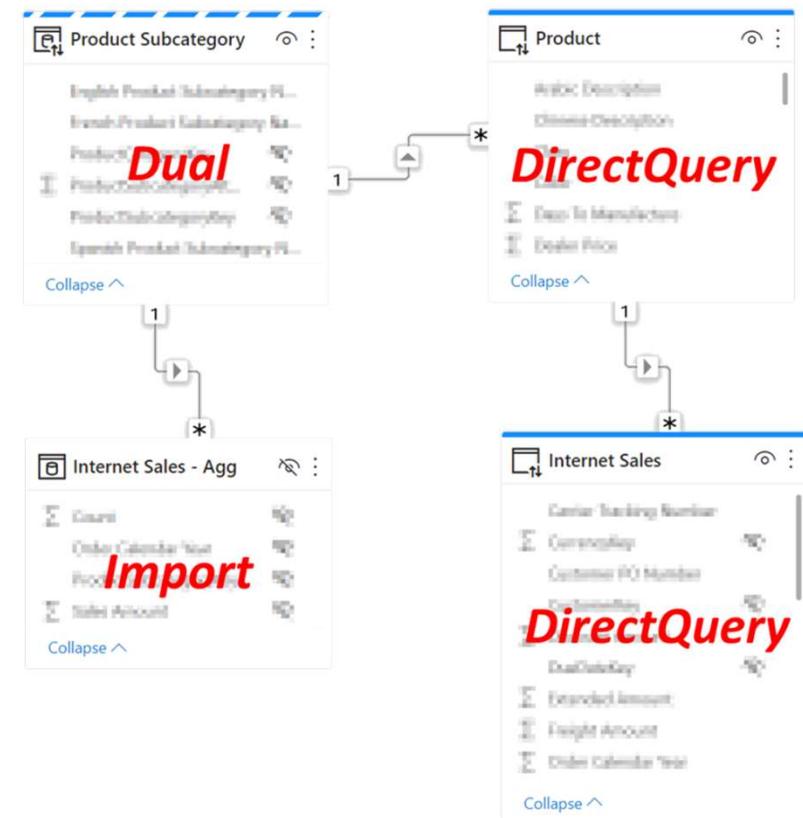
Query Performance

Large Datasets

Data Refresh Optimization

Near-Real Time Optimization

Writeback

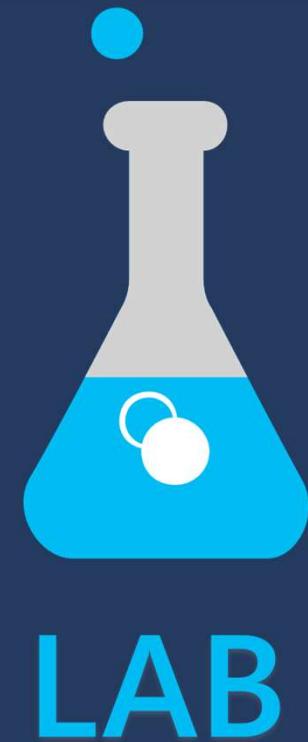


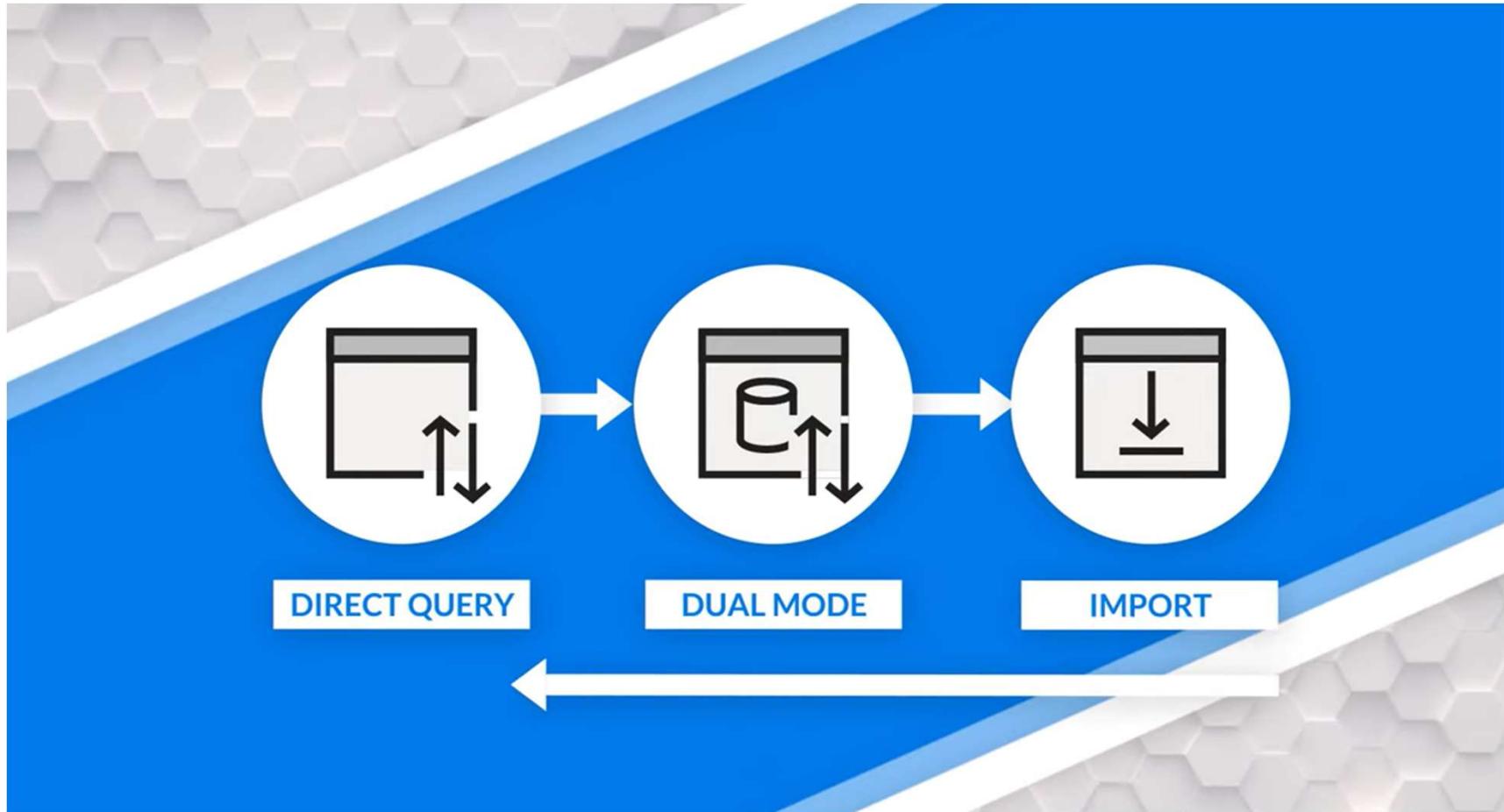
* Be aware of limitations on setting relationships and data sources that are not supported

Creating a Dual Storage Report

1. Creating Direct Query + Dual Report
2. Creating Direct Query + Import Report

Comparison 2 Reports



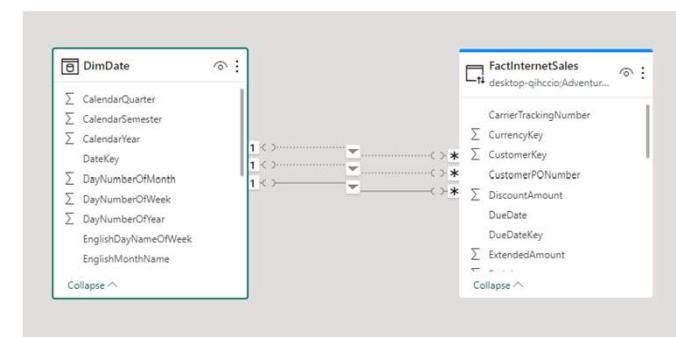
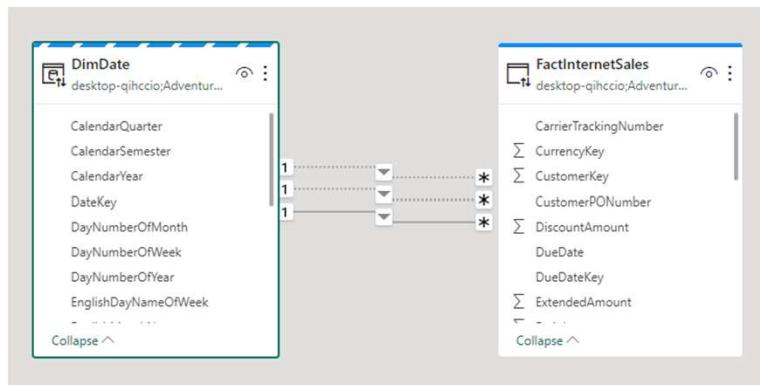


Direct Query + Dual Report

Clear Export	
Name	Duration (ms) ↓
⌚ Recording started (2023/7/3 下午 10:49:13)	-
⌚ Refreshed visual	-
▣ Sum of TaxAmt by EnglishMonthName	169
DAX query	73
Direct query	67
Visual display	28
Other	67
✓ Copied	

Direct Query + Import Report

Clear Export	
Name	Duration (ms) ↓
⌚ Refreshed visual	-
▣ Sum of TaxAmt by EnglishMonthName	1219
DAX query	781
Direct query	756
Visual display	66
Other	373
Copy query	



Dataflows

Introduction

Bring **self-service data preparation** capabilities to the service, through a Power Query experience, online.

Centralizes ETL processes and eliminates the need to duplicate logic in Power BI Desktop datasets

Builds a **common repository with entities** that can be reused for additional transformations or for report creation through the Desktop.

A dataflow is a first-class object that is **stored within a workspace**.

Support for CDM entities, mapping any data to pre-defined data structures.

Best Practices

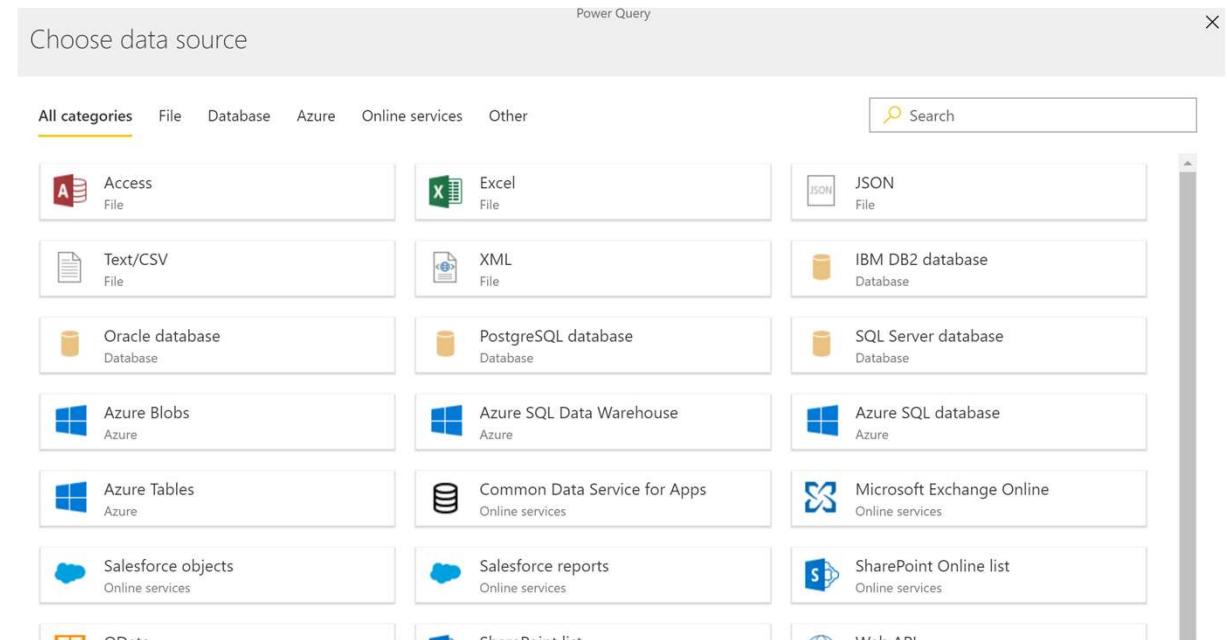
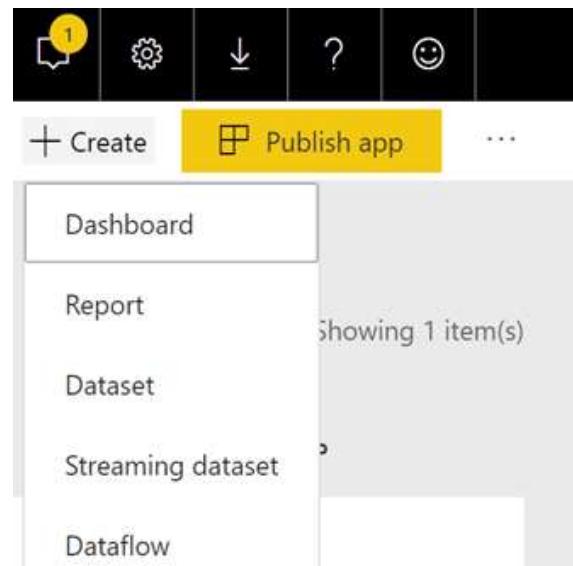
Composite Models

- Limited relationships in Composite model
 - Consider Dual mode for dimension tables
- Performance is poor!
 - All Direct Query limitations apply.
 - Consider aggregations!
 - Reconsider the approach if the goal is to combine multiple large - fact tables or Shared dimensions.
 - Potential import of PBI Premium Models through XMLA endpoints.

Creating a Dataflow

Dataflows

Within a workspace, you can start by creating a new **Dataflow**. After that you can choose to map data to **CDM entities** or define custom entities



Power Query Online

Dataflows

Transform

Power Query - Edit queries

Home Transform Add column View

Get data Enter data Options Manage parameters Refresh Properties Advanced editor Query Choose columns Remove columns Keep rows Remove rows Sort Split column Group by ABC Data type: Whole number Use first row as headers Split into multiple files Replace values Transform

Queries [4] fx

	CustomerID	NameStyle	Title	FirstName	MiddleName	LastName	Suffix	CompanyName	
1	1	7	FALSE	Mr.	Orlando	N.	Gee	A Bike Store	
2	2	2	FALSE	Mr.	Keith		Harris	Progressive Sports	
3	3	3	FALSE	Ms.	Donna	F.	Carreras	Advanced Bike Components	
4	4	4	FALSE	Ms.	Janet	M.	Gates	Modular Cycle Systems	
5	5	5	FALSE	Mr.	Lucy		Harrington	Metropolitan Sports Supply	
6	6	6	FALSE	Ms.	Rosmarie	J.	Carroll	Aerobic Exercise Company	
7	7	7	FALSE	Mr.	Dominic	P.	Gash	Associated Bikes	
8	10	10	FALSE	Ms.	Kathleen	M.	Garza	Rural Cycle Emporium	
9	11	11	FALSE	Ms.	Katherine		Harding	Sharp Bikes	
10	12	12	FALSE	Mr.	Johnny	A.	Caprio	Bikes and Motorbikes	
11	16	16	FALSE	Mr.	Christopher	R.	Beck	Jr.	Bulk Discount Store
12	18	18	FALSE	Mr.	David	J.	Liu	Catalog Store	
13	19	19	FALSE	Mr.	John	A.	Beaver	Center Cycle Shop	
14	20	20	FALSE	Ms.	Jean	P.	Handley	Central Discount Store	
15	21	21	FALSE		Jinghao		Liu	Chic Department Stores	
16	22	22	FALSE	Ms.	Linda	E.	Burnett	Travel Systems	
17	23	23	FALSE	Mr.	Kerim		Hanif	Bike World	
18	24	24	FALSE	Mr.	Kevin		Liu	Eastside Department Store	
19	25	25	FALSE	Mr.	Donald	L.	Blanton	Coalition Bike Company	
20	28	28	FALSE	Ms.	Jackie	E.	Blackwell	Commuter Bicycle Store	
21	29	29	FALSE	Mr.	Bryan		Hamilton	Cross-Country Riding Supplies	
22	30	30	FALSE	Mr.	Todd	R.	Logan	Cycle Merchants	

3 warnings Completed (2.05 s) Columns: 17 Rows: 99+

Step Cancel Save & close

Query settings Properties Name SalesLT Customer Entity type Custom Applied steps Source Navigation 1 Navigation 2

Diagram View

Dataflows – Power Query Editor

Graphical representation of queries, steps and dependencies

Interactive, including step level modifications and creation of new steps

The screenshot shows the Power Query Editor interface. At the top, there's a ribbon with tabs like Home, Transform, Add column, and View. Below the ribbon is a toolbar with various icons for data operations such as Get data, Enter data, Options, Manage parameters, Refresh, Advanced editor, Properties, Choose columns, Remove columns, Keep rows, Remove rows, Sort, Split column, Group by, Replace values, Data type, Merge queries, Append queries, Combine files, and Combine. The main area is titled "Power Query - Edit queries". It displays a graphical dataflow diagram with two main queries: "Customers" and "Orders". The "Customers" query has steps for OData, Navigation, Choose columns, Remove dupl., and Filter rows. The "Orders" query has steps for OData, Navigation, Expand, Remove dupl., and Group by. These two queries are connected via a "Merge" step, which is highlighted with a blue border. Below the diagram, a table titled "Table.NestedJoin(Customers, {"CustomerID"}, Orders, {"CustomerID"}, "Orders", JoinKind.Inner)" is shown. The table has columns for CustomerID, CompanyName, ContactName, ContactTitle, Address, City, Region, PostalCode, Country, Phone, and Orders. Each column includes a data validation summary bar at the top. The data itself lists six rows of customer information from the Northwind database.

	CustomerID	CompanyName	ContactName	ContactTitle	Address	City	Region	PostalCode	Country	Phone	Orders
1	RATTC	Patterson Canyon Grocery	Paula Wilson	Assistant Sales Representative	2817 Milton Dr.	Albuquerque	NM	87110	USA	(505) 555-9399	[Table]
2	WHITC	White Cover Markets	Kari Jabonski	Owner	305 - 14th Ave. S. Suite 3B	Seattle	WA	98128	USA	(206) 555-4112	[Table]
3	SPLIR	Split Rail Beer & Ale	Art Brunscheiger	Sales Manager	P.O. Box 555	Lander	WY	82523	USA	(307) 555-4680	[Table]
4	OLDWO	Old World Delicatessen	Rene Phillips	Sales Representative	2743 Bering St.	Anchorage	AK	99508	USA	(907) 555-7584	[Table]
5	LONPE	Lonesome Pine Restaurant	Fran Wilson	Sales Manager	89 Chiaroscuro Rd.	Portland	OR	97219	USA	(503) 555-9573	[Table]
6	THEBI	The Big Cheese	Liz Nixon	Marketing Manager	89 Jefferson Way Suite 2	Portland	OR	97201	USA	(503) 555-3612	[Table]

Schema View (Preview)

Dataflows – Power Query Editor

Offers more convenient column management without having to scroll across

Changes are faster as data does not require to be previewed

Power Query - Edit queries

Home Transform Add column View Schema tools

Refresh Advanced editor
Properties Manage columns
Remove other columns
Mark as key

ABC Data type: Whole number
Detect data type
Rename Duplicate Move column
Close schema view Close

Queries < Customers Employees Order_Details Orders Shippers

Name Type Key Search

Column	Type	Key
OrderID	Whole number	
CustomerID	Text	
EmployeeID	Whole number	
OrderDate	Date/Time	
RequiredDate	Date/Time	
ShippedDate	Date/Time	
ShipVia	Whole number	
Freight	Decimal number	
ShipName	Text	
ShipAddress	Text	
ShipCity	Text	
ShipRegion	Text	
ShipPostalCode	Text	
ShipCountry	Text	
Customer.CustomerID	Text	
Customer.CompanyName	Text	
Customer.ContactName	Text	
Customer.ContactTitle	Text	
Customer.Address	Text	
Customer.City	Text	
Customer.Region	Text	
Customer.PostalCode	Text	

Query settings Name: Orders

Entity type: Custom

Applied steps: Source, Navigation 1, Expanded Customer

5 warnings Columns: 30 Column profiling based on top 1,000 rows Completed (1.00 s) Step

Entities

Dataflows

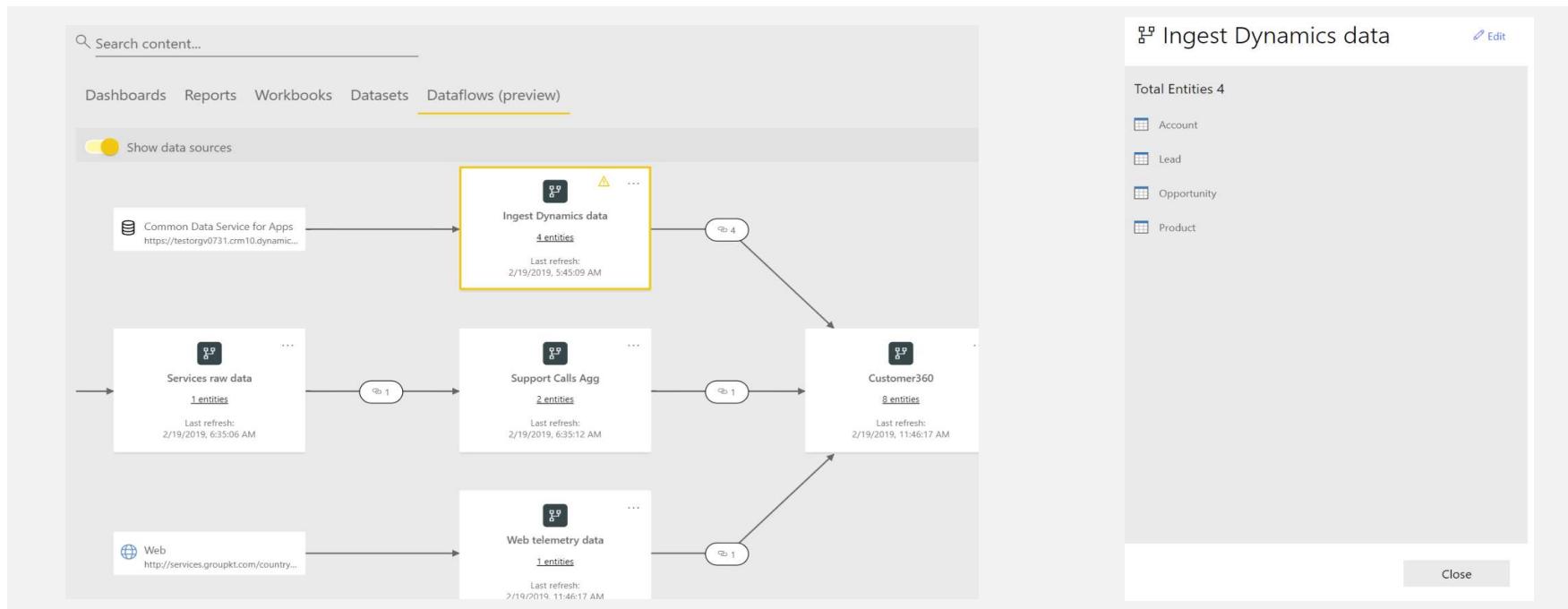
The Dataflow can include several entities. Dataflows support full and incremental refreshes and Dataflows support linked entities (**Premium**) between workspaces.

ENTITY NAME	ENTITY TYPE	ACTIONS
▶ Export_DimAccount	Custom	
▶ Export_DimScenario	Custom	 Incremental Refresh
▶ Export_DimTime	Custom	
▶ Export_FactBalance	Custom	
▶ Export_FactMovement	Custom	

Data Lineage

Dataflows

Data Lineage allows users to understand the flow of data from its source to its destination. Which is a key challenge if you have built advanced analytical projects spanning multiple data sources, artifacts, and dependencies.



Get Data Experience in Desktop

Dataflows

In Power BI **Desktop**, users can now **consume or edit centralized** defined and integrated **entities**.

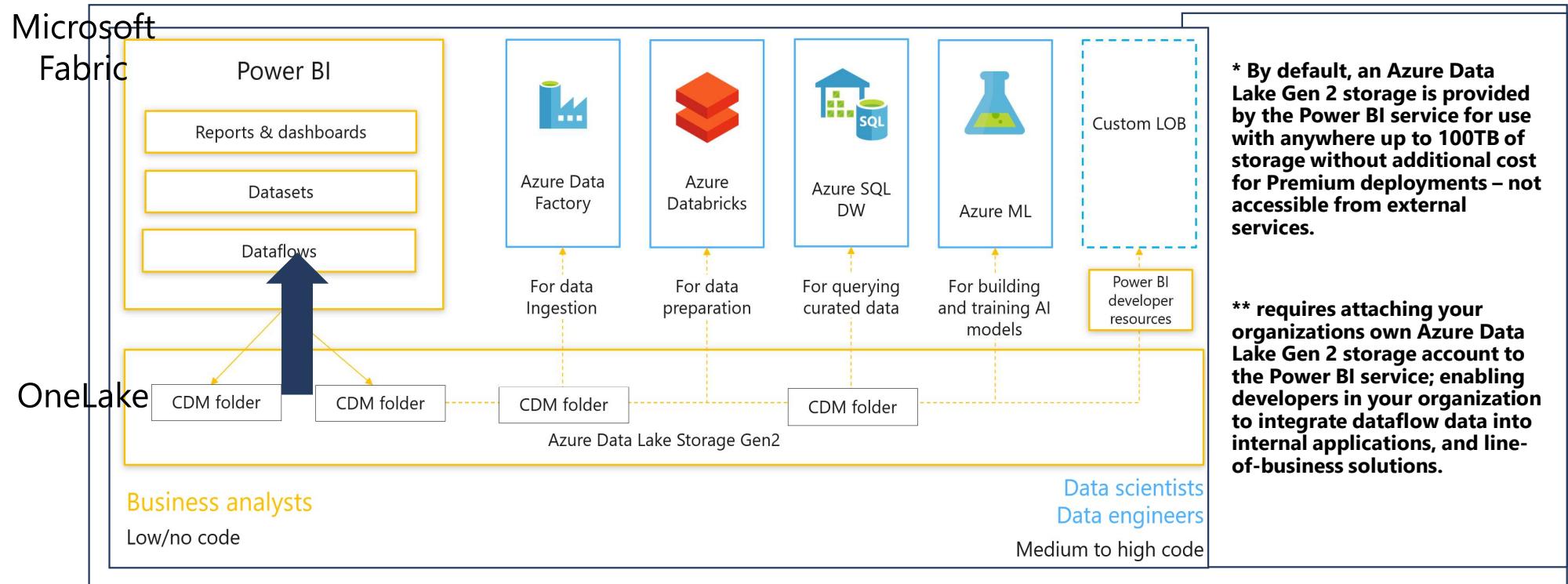
The screenshot shows the Power BI Desktop interface. On the left, the 'Get Data' dialog is open, displaying a search bar and a list of categories: All, File, Database, and Power Platform. 'Power Platform' is selected. Under 'Power Platform', there are options for Power BI datasets, Power BI dataflows (which is highlighted), and Common Data Service. On the right, the 'Navigator' pane is visible, showing a tree view of dataflows. The 'IAM Dataflow [5]' node is expanded, revealing five child nodes: Export_DimAccount, Export_DimScenario, Export_DimTime, and Export_FactBalance.

Notice that it is **not a Power BI dataset**.

Storage

Dataflows

Data is stored in ***Azure Data Lake Gen2**, which means ****reuse** for other purposes and services (Azure Machine Learning, Databricks and others)



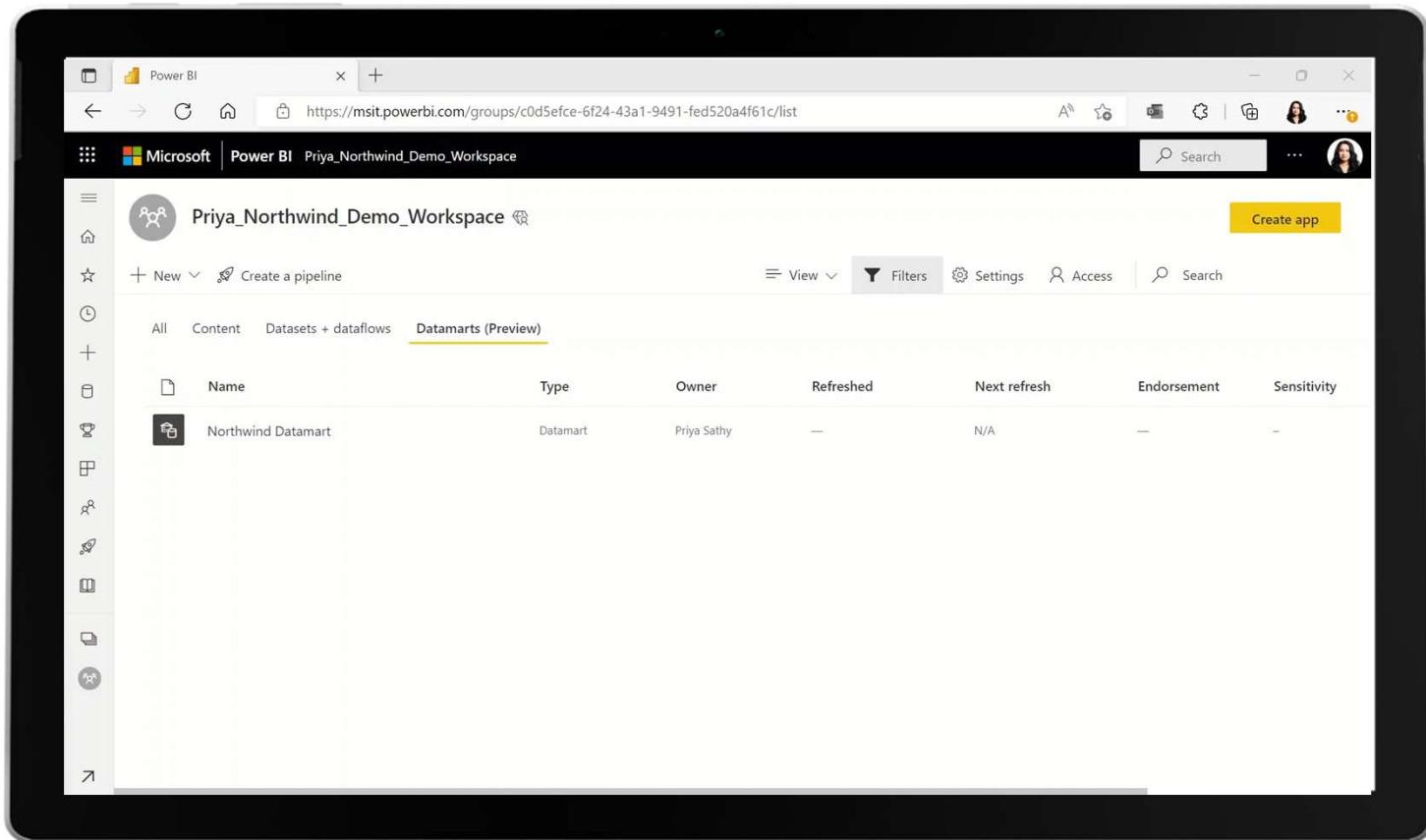
Datamarts

Introduction

- Datamart in Power BI is a self-service capability, providing simple frictionless experiences for businesses to be more productive
- Democratize data for every level of your organization.
- Balances the needs of IT (governance, security, scalability) with the needs of Business (agility, speed, flexibility).
- Low-Code approach
- Removes IT from critical path
- Guardrails

Datamarts

Demo



The screenshot shows the Microsoft Power BI workspace interface. The URL in the browser is <https://msit.powerbi.com/groups/c0d5efce-6f24-43a1-9491-fad520a4f61c/list>. The workspace is named "Priya_Northwind_Demo_Workspace". The navigation bar includes "Create app", "Filters", "Settings", "Access", and "Search". The main area shows a table titled "Datamarts (Preview)".

Name	Type	Owner	Refreshed	Next refresh	Endorsement	Sensitivity
Northwind Datamart	Datamart	Priya Sathy	—	N/A	—	—

Datasets, Dataflows, Datamarts

Important !

Considerations

Item	Recommended Use Case	Considerations	What if exceeds limitation
Datasets	Metrics and semantic layer for BI reporting	Consider using datasets on PowerBI Premium .	Add additional Power BI Premium capacity as needed.
Dataflows	Reusable data prep (ETL) for datasets or marts	Recommended for data size - small to medium – in thousands to few tens of millions .	Use scalable ETL tools such as Azure Data Factory
Datamarts	User-based data warehousing and SQL access to your data	Datamarts currently officially support data volumes of up to 100 GB. <i>In Preview, consider reading the limitations.</i>	Consider using Azure Data Platform incl. Synapse, SQL, Cosmos DB etc...

Often real time scenarios include architectures that involve one or more of these approaches.

Creating a data flow in Power BI service

Creating a Data Flows



LAB

Creating a Data Flow

The screenshot shows the Microsoft Power Query Editor interface. The top navigation bar includes Home, Transform, Add column, View, and Help tabs. The ribbon menu has sections for Home, Transform, Add column, View, and Help. The main area displays a table titled "Table.TransformColumnTypes#" with 33 rows and 5 columns. The columns are labeled "ABC Column1", "ABC Column2", "ABC Column3", "ABC Column4", and "ABC Column5". The data consists of product details, such as ProductID, Product, Category, ManufacturerID, and Price. The right side of the screen features a "Query settings" pane with sections for Properties (Name: product, Entity type: Custom), and Applied steps (Source: Navigation 1, Changed column step). The bottom status bar indicates 3 warnings, completed in 0.87 seconds, with 5 columns and 99 rows.

ABC Column1	ABC Column2	ABC Column3	ABC Column4	ABC Column5
1 Product Details	null	null	null	null
2 ProductID	Product	Category	ManufacturerID	Price
3 1 Abbas MA-01 All Season	Mix	1	USD 412.13	
4 2 Abbas MA-02 All Season		1	USD 329.78	
5 3 Abbas MA-03 All Season		1	USD 963.38	
6 4 Abbas MA-04 All Season		1	USD 828.98	
7 5 Abbas MA-05 All Season		1	USD 745.5	
8 7 Abbas MA-07 All Season		1	USD 451.45	
9 6 Abbas MA-06 All Season		1	USD 329.78	
10 8 Abbas MA-08 All Season		1	USD 485.89	
11 9 Abbas MA-09 All Season		1	USD 634.73	
12 10 Abbas MA-10 All Season		1	USD 681.98	
13 11 Abbas MA-11 All Season		1	USD 761.25	
14 12 Abbas MA-12 All Season		1	USD 456.7	
15 13 Abbas MA-13 All Season		1	USD 456.7	
16 14 Abbas MA-14 All Season		1	USD 419.95	
17 15 Abbas MA-15 All Season		1	USD 472.45	
18 16 Abbas MA-16 All Season		1	USD 711.38	
19 17 Abbas MA-17 All Season		1	USD 414.75	
20 18 Abbas MA-18 All Season		1	USD 393.7	
21 19 Abbas MA-19 All Season		1	USD 393.7	
22 20 Abbas MA-20 All Season		1	USD 509.25	
23 21 Abbas MA-21 All Season		1	USD 430.5	
24 22 Abbas MA-22 All Season		1	USD 551.25	
25 23 Abbas MA-23 All Season		1	USD 758.63	
26 25 Abbas MA-25 All Season		1	USD 792.75	
27 26 Abbas MA-26 All Season		1	USD 847.88	
28 24 Abbas MA-24 All Season		1	USD 329.78	
29 27 Abbas MA-27 All Season		1	USD 446.2	
30 28 Abbas MA-28 All Season		1	USD 431.8125	
31 29 Abbas MA-29 All Season		1	USD 524.48	
32 30 Abbas MA-30 All Season		1	USD 854.7	
33 31 Abbas MA-31 All Season		1	USD 761.25	
34 32 Abbas MA-32 All Season		1	USD 711.25	

US Sales | Confidential\Microsoft Extended ▾

Search

Changes saved

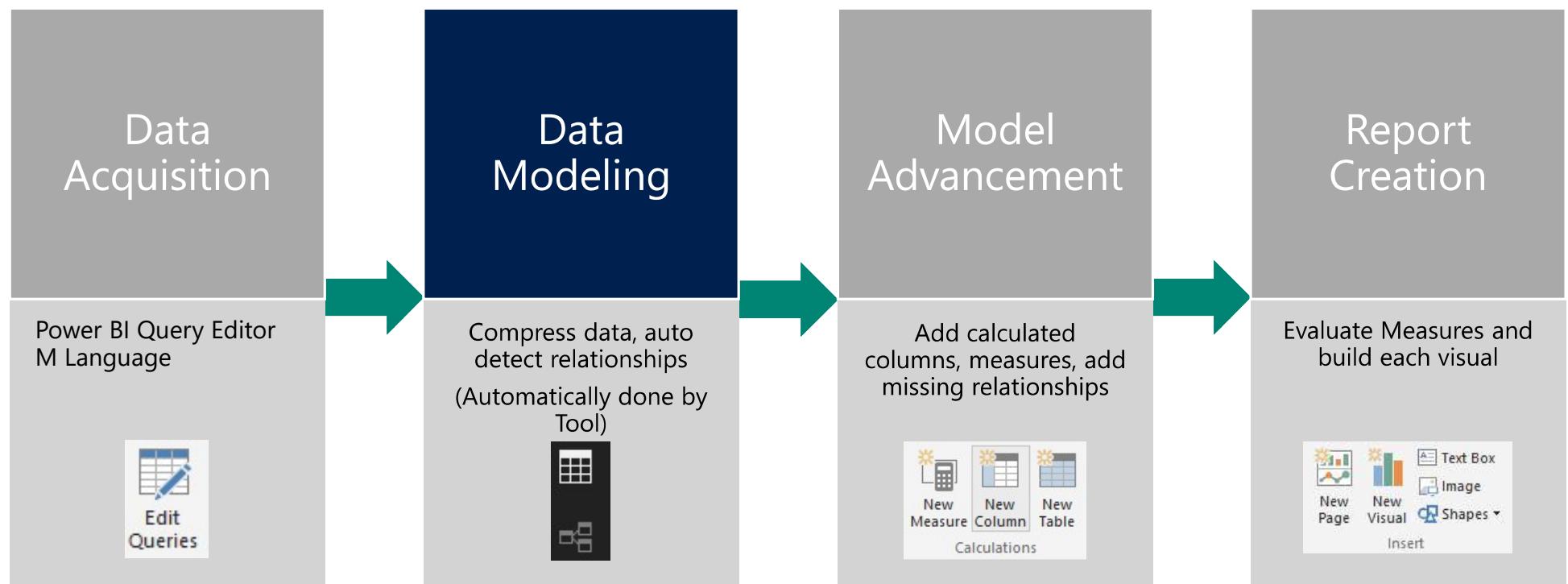
Edit tables Add tables Close

Tables Machine learning models

TABLE NAME	TABLE TYPE	ACTIONS
Sales	Custom	
product	Custom	
manufacturer	Custom	
geo	Custom	

Home Create Browse OneLake data hub Apps Metrics Workspaces AdventureW orkKaren

Data Modeling



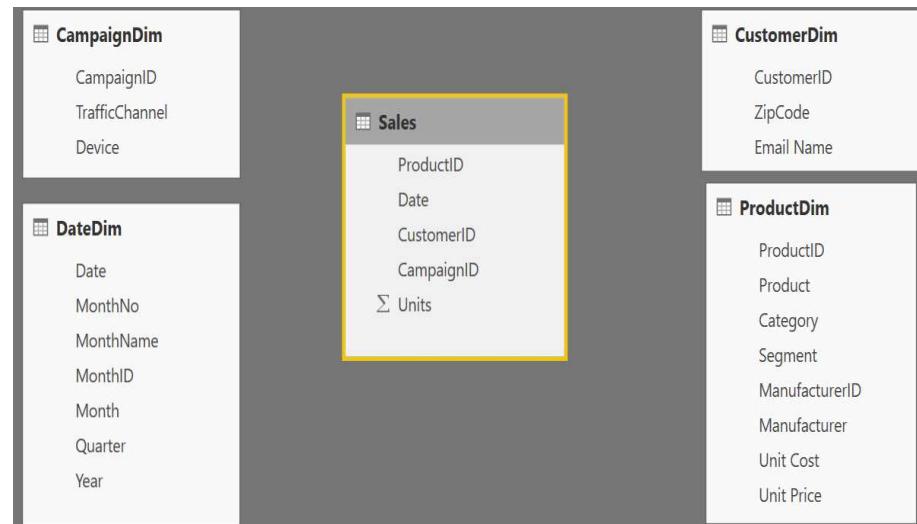
Components of Data Model - Facts

The real-world transaction stored as a Table.

Contains aggregations / measures of the facts

Example – Sales Revenue, Profit, Transaction Count

Contains the keys to slice the aggregated data.
Example – Sales Revenue by Product...



Different Types of Data Models

Flat / Denormalized

Star

Snowflake

Data Model Types - Flat

Fact tables are merged with all the required dimensional attributes.

No relationships and denormalized.

Highly ineffective with respect to Data redundancy

Size can be a concern as there will be a lot of data duplication.

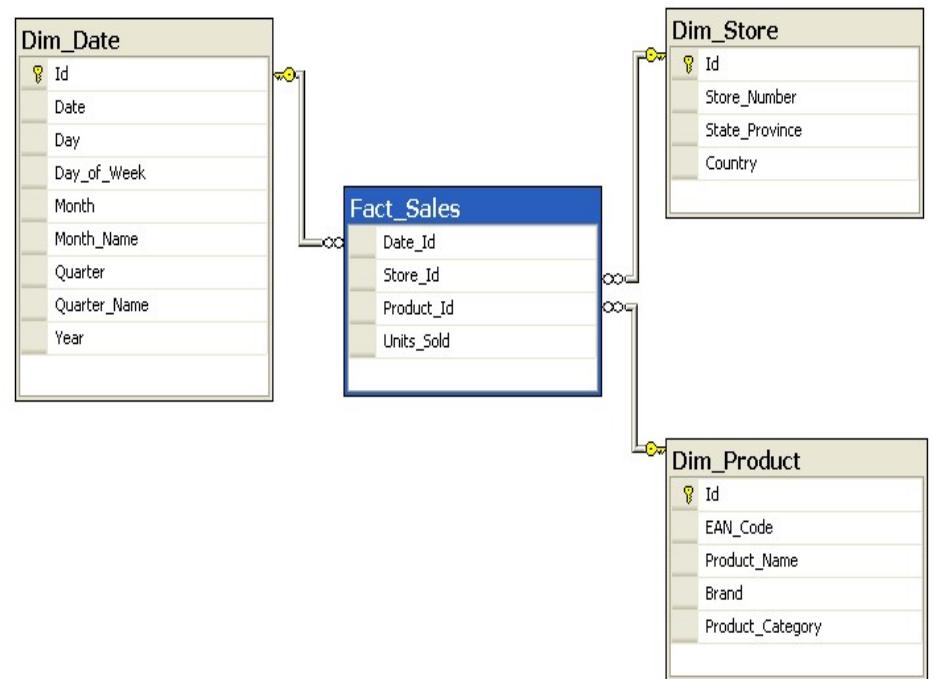
#	ProductID	Product	Date	CustomerID	Email	Last Name	First Name	Full Name	CampaignID	Units	CatSegID
1	676	Maximus UC-41	9/25/2011	70283	Farrah.Kent@xyz.com	Kent	Farrah	Farrah Kent	22	1	10
2	585	Maximus UC-50	3/24/2014	70283	Farrah.Kent@xyz.com	Kent	Farrah	Farrah Kent	15	1	10
3	585	Maximus UC-50	11/30/2014	138334	Martha.McClain@xyz.com	McClain	Martha	Martha McClain	8	1	10
4	585	Maximus UC-50	6/21/2015	27193	Hedda.McIntosh@xyz.com	Mcintosh	Hedda	Hedda McIntosh	22	1	10
5	585	Maximus UC-50	1/6/2013	238970	Lunea.Walker@xyz.com	Walker	Lunea	Lunea Walker	21	1	10
6	585	Maximus UC-50	3/22/2013	182241	Upton.Page@xyz.com	Page	Upton	Upton Page	17	1	10
7	449	Maximus UM-54	9/25/2011	195385	Drake.Wells@xyz.com	Wells	Drake	Drake Wells	22	1	4
8	449	Maximus UM-54	9/30/2014	168009	Wallace.Bender@xyz.com	Bender	Wallace	Wallace Bender	17	1	4
9	449	Maximus UM-54	8/12/2014	110391	Astra.Erickson@xyz.com	Erickson	Astra	Astra Erickson	20	1	4
10	449	Maximus UM-54	4/16/2014	49327	Echo.Bradley@xyz.com	Bradley	Echo	Echo Bradley	7	1	4
11	449	Maximus UM-54	2/28/2013	65952	Yoko.Gross@xyz.com	Gross	Yoko	Yoko Gross	17	1	4
12	449	Maximus UM-54	6/6/2013	97	Yoshi.Grant@xyz.com	Grant	Yoshi	Yoshi Grant	10	1	4
13	449	Maximus UM-54	5/14/2013	56757	Brian.Carrillo@xyz.com	Carrillo	Brian	Brian Carrillo	10	1	4
14	449	Maximus UM-54	4/9/2015	248715	Mark.Hewitt@xyz.com	Hewitt	Mark	Mark Hewitt	19	1	4
15	449	Maximus UM-54	4/28/2013	248715	Mark.Hewitt@xyz.com	Hewitt	Mark	Mark Hewitt	8	1	4
16	449	Maximus UM-54	3/28/2014	240831	Oscar.Avila@xyz.com	Avila	Oscar	Oscar Avila	18	1	4
17	449	Maximus UM-54	2/28/2014	201004	Duncan.McIntosh@xyz.com	Mcintosh	Duncan	Duncan McIntosh	19	1	4
18	615	Maximus UC-80	5/14/2012	212645	Jacob.Santiago@xyz.com	Santiago	Jacob	Jacob Santiago	22	1	10
19	615	Maximus UC-80	5/14/2012	70666	Hilary.Coller@xyz.com	Collier	Hilary	Hilary Collier	22	1	10
20	615	Maximus UC-80	5/14/2012	114459	Chester.Mitchell@xyz.com	Mitchell	Chester	Chester Mitchell	22	1	10
21	615	Maximus UC-80	5/14/2012	221670	Sage.Yang@xyz.com	Yang	Sage	Sage Yang	22	1	10
22	615	Maximus UC-80	6/3/2012	168009	Wallace.Bender@xyz.com	Bender	Wallace	Wallace Bender	22	1	10
23	615	Maximus UC-80	6/3/2012	154439	Iliana.Dunlap@xyz.com	Dunlap	Iliana	Iliana Dunlap	22	1	10
24	615	Maximus UC-80	6/4/2012	191391	Joelle.Lee@xyz.com	Lee	Joelle	Joelle Lee	22	1	10

Data Model Types - Star

Facts and dimensions relate to a Many to One relationship

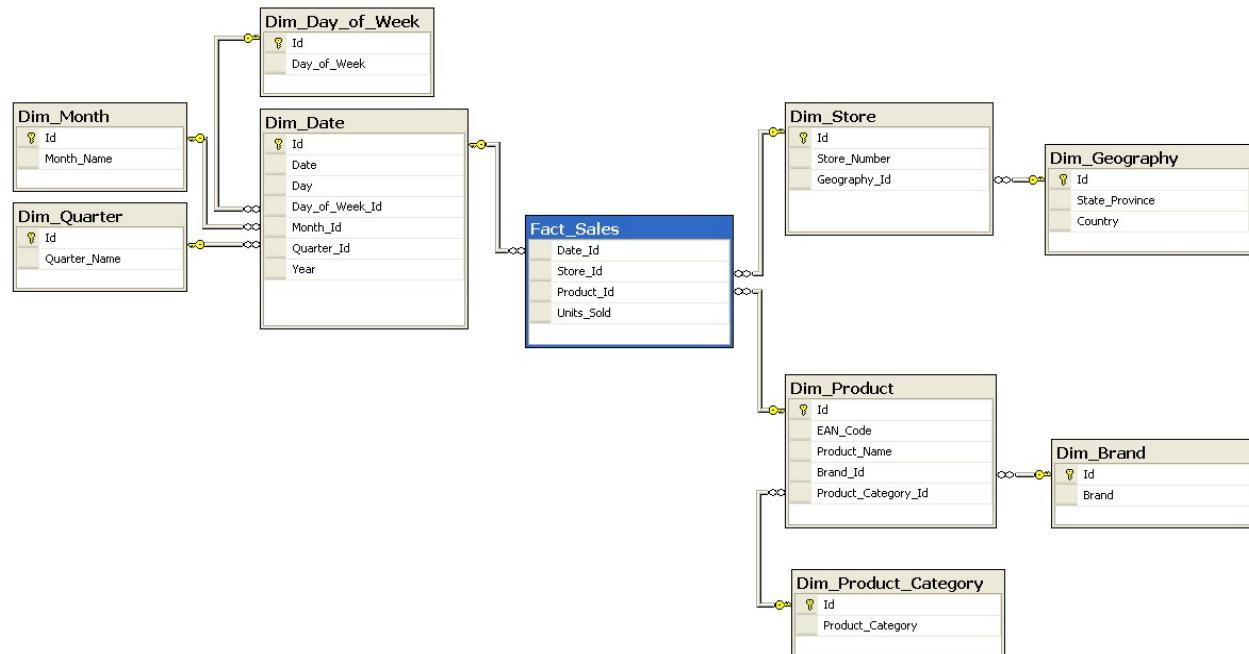
The Fact table is placed in the middle connected to dimensions tables.

Each Fact row will have a key relating to a Dimension which will avoid the data duplication.



Data Model Types - Snowflake

To avoid the data redundancy in a dimension, each dimension can have sub dimensions creating a snowflake design.



Power BI Desktop and Data Models

In - memory data engine

- Data is loaded into the physical memory (RAM)
- As the data is readily available the engine acts fast for read/write.
- Might have size limitations as the machines have a limited physical memory.
- Power BI applies effective compression rates to conserve space
 - Value encoding
 - Dictionary based encoding
 - Run length encoding

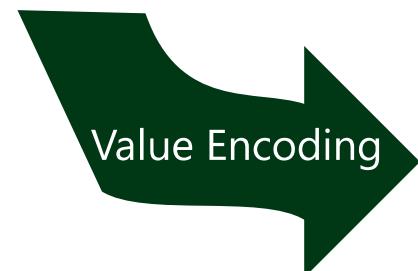
Value based encoding

Used to reduce size of numeric columns

Applies mathematical operation to original value

900
901
902
903
904

16 bits needed



900 (base value)

0
1
2
3
4

2bits needed

Dictionary based encoding

Creates a dictionary to store integer values instead of text values.

Works well when there are fewer number of unique values in the column

Store is a good example and Sale ID is a bad example

Sale Id	Store	Amount	Sale Id	Store	Amount	Store Dictionary
390a30e0-dc37	Fred Meyer	\$10	390a30e0-dc37	1	\$10	1 Fred Meyer
390a30e1-dc37	Costco	\$25	390a30e1-dc37	2	\$25	2 Costco
390a30e2-dc37	Fred Meyer	\$35	390a30e2-dc37	1	\$35	3 Wegmans
390a30e3-dc37	Fred Meyer	\$15	390a30e3-dc37	1	\$15	
390a30e4-dc37	Fred Meyer	\$25	390a30e4-dc37	1	\$25	
390a30e5-dc37	Costco	\$30	390a30e5-dc37	2	\$30	
390a30e6-dc37	Wegmans	\$10	390a30e6-dc37	3	\$10	
390a30e7-dc37	Wegmans	\$12	390a30e7-dc37	3	\$12	
390a30e8-dc37	Wegmans	\$15	390a30e8-dc37	3	\$15	
390a57f0-dc37	Wegmans	\$18	390a57f0-dc37	3	\$15	
390a57f1-dc37	Costco	\$25	390a57f1-dc37	2		

Run Length based encoding

Every column is stored as different logical file in columnar database the Store column is stored as -

- 1 – 1 (1 instance of One)
- 1 – 2 (1 instance of Two)
- 3 – 1 (3 instances of One)
- 1 – 2 (1 instance of Two)
- 4 – 3 (4 instances of Three)
- 1 - 2 (1 instance of Two)

Effective if the columns are sorted and have fewer unique values.

Sale Id	Store	Amount	Sale Id	Store	Amount	Store
390a30e0-dc37	Fred Meyer	\$10	390a30e0-dc37	1	\$10	1 – 1
390a30e1-dc37	Costco	\$25	390a30e1-dc37	2	\$25	1 – 2
390a30e2-dc37	Fred Meyer	\$35	390a30e2-dc37	1	\$35	3 – 1
390a30e3-dc37	Fred Meyer	\$15	390a30e3-dc37	1	\$15	1 – 2
390a30e4-dc37	Fred Meyer	\$25	390a30e4-dc37	1	\$15	4 – 3
390a30e5-dc37	Costco	\$30	390a30e5-dc37	2	\$18	1 – 2
390a30e6-dc37	Wegmans	\$10	390a30e6-dc37	3	\$25	1 - 2
390a30e7-dc37	Wegmans	\$12	390a30e7-dc37	3	\$15	390a30e8-dc37
390a30e8-dc37	Wegmans	\$15	390a30e8-dc37	3	\$15	390a57f0-dc37
390a57f0-dc37	Wegmans	\$18	390a57f0-dc37	3	\$15	390a57f1-dc37
390a57f1-dc37	Costco	\$25	390a57f1-dc37	2	\$15	1 – 2

Store Dictionary

1	Fred Meyer
2	Costco
3	Wegmans

Optimization of Data Modeling

Aggregations

Data Profiling

Other Guidelines

Aggregations in Power BI

Using aggregations in Power BI enables interactive analysis over big data in ways that previously were not possible.

Aggregations can dramatically reduce the cost of unlocking large datasets for decision making.

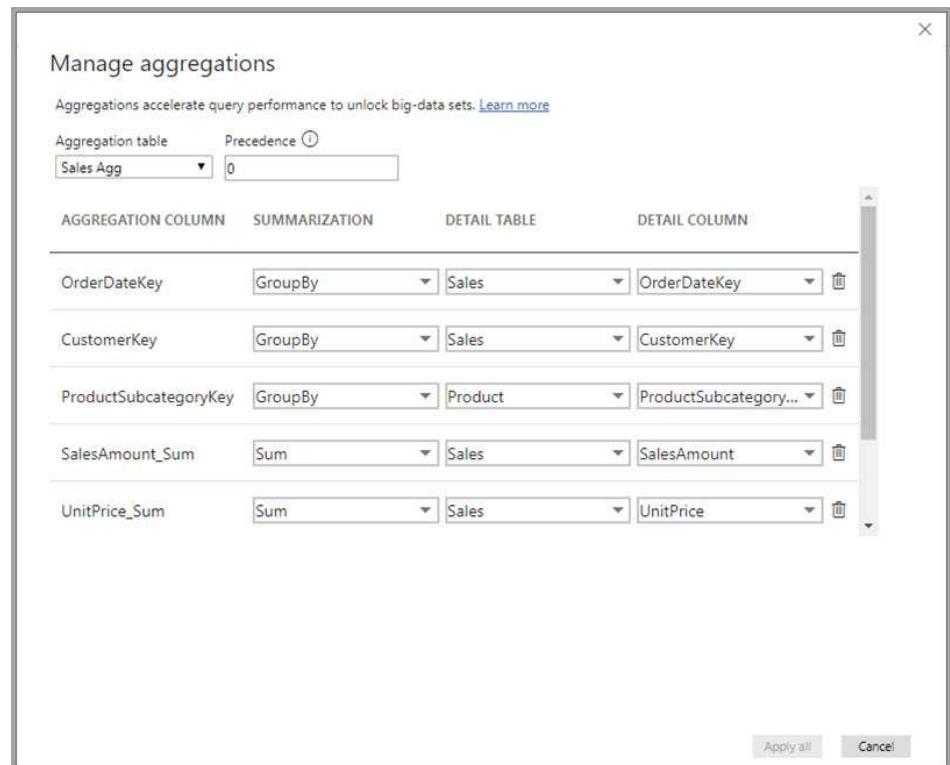
Aggregations are created based off a summarized value through a dimensional attribute. Table that is resulted of a such operation is known as Aggregations table.

The aggregations in Power BI can be managed through the “Manage Aggregations” dialog box.

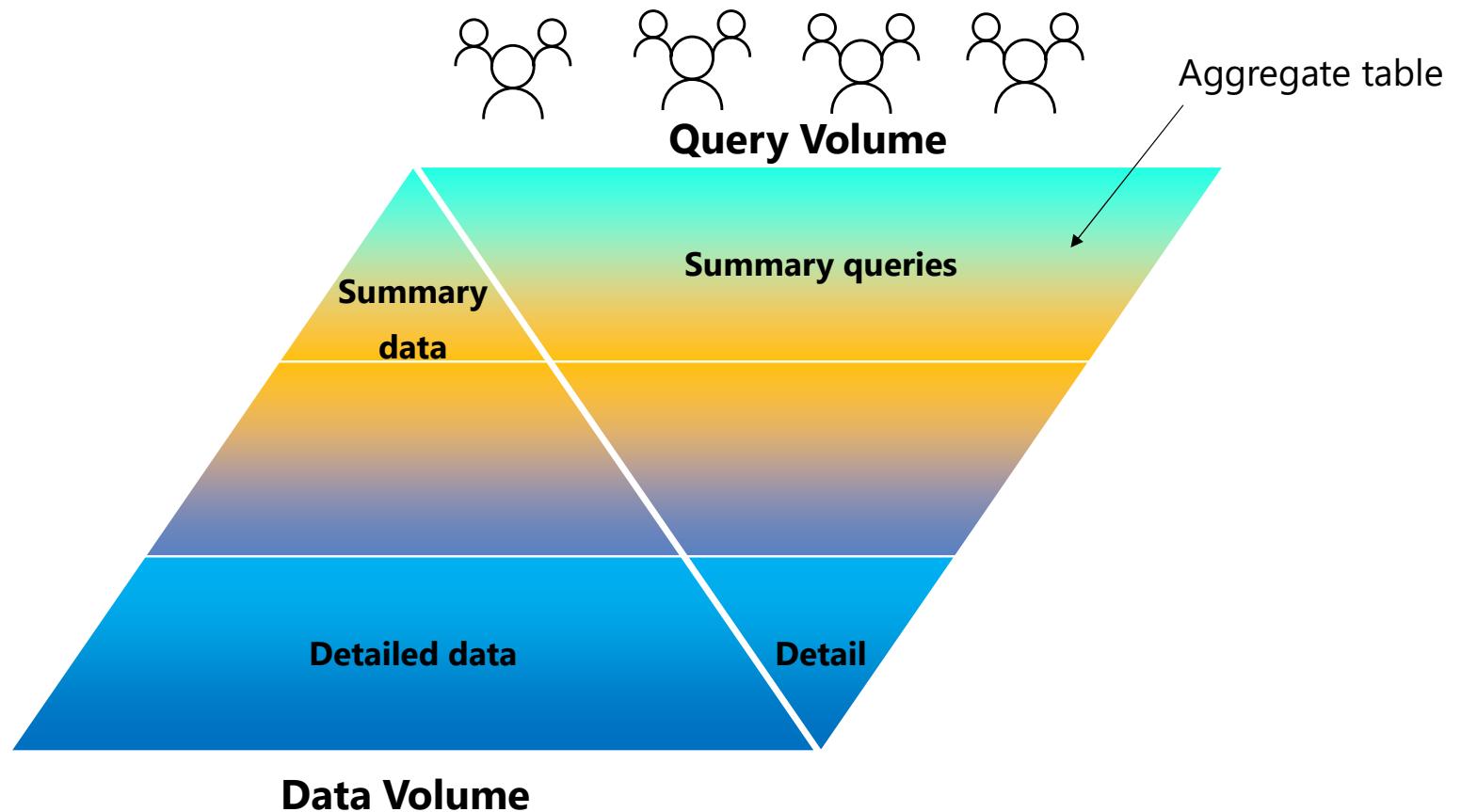
Aggregations in Power BI

Storage mode of an Aggregate table can be set as Import so that the results are quick.

Setting the storage mode for an aggregate table will change the dependent dimension storage modes to “Dual” as needed.



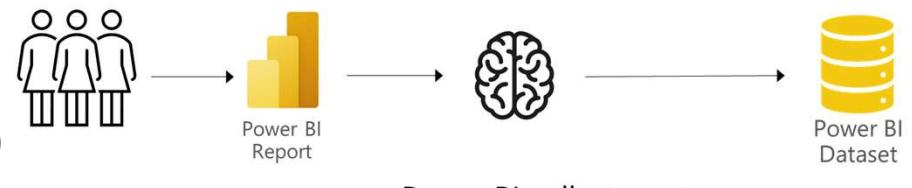
Performance acceleration: a composite approach



Automatic aggregations

Aggregations

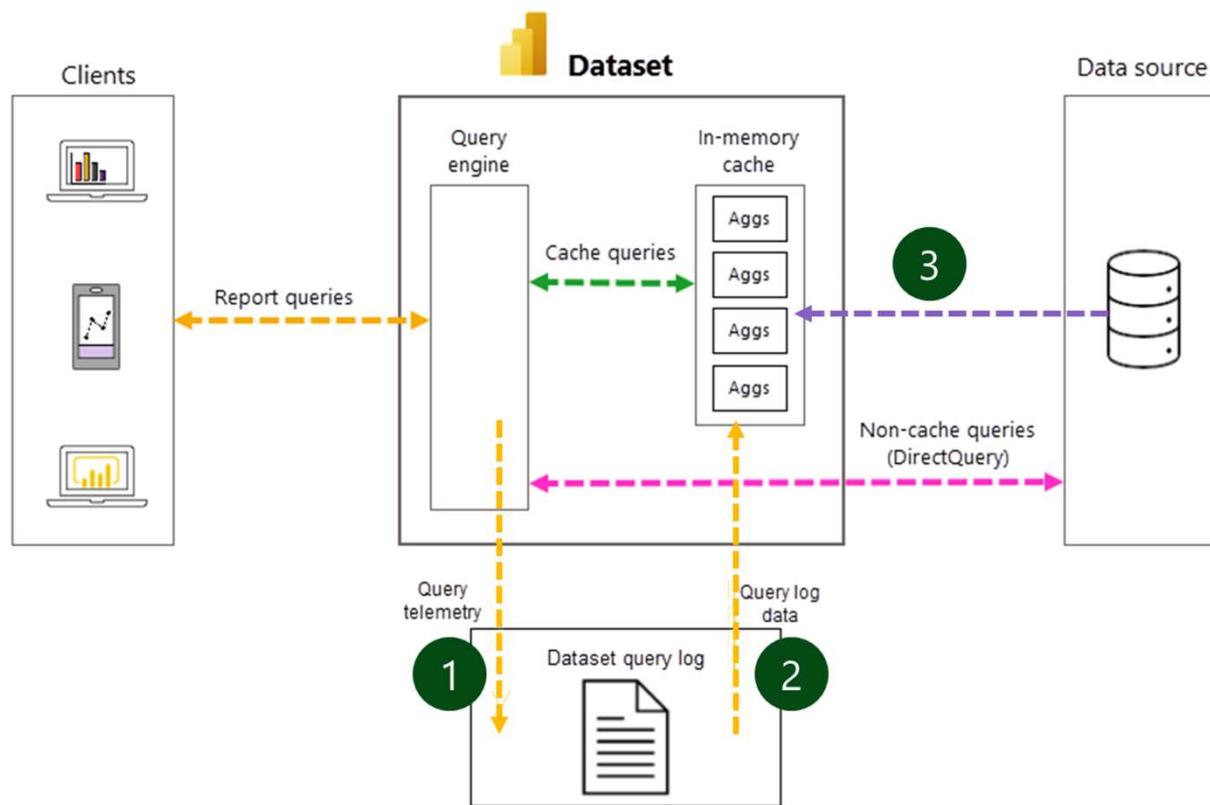
- Automatic Aggregations are automatically built over the **Direct Query** data sets for maximize report performance.
- Supported on Power BI Premium (User / Capacity) and Embedded.
- Self-Trained / Self-Optimized
- Supported Data sources –
 - Azure SQL
 - Azure Synapse Dedicated Pool
 - Google Big Query
 - Snowflake
 - Databricks
 - Amazon Redshift



Power BI collects query patterns and automatically defines aggregations

Query Execution and Training / Refresh Operations

Automatic Aggregations

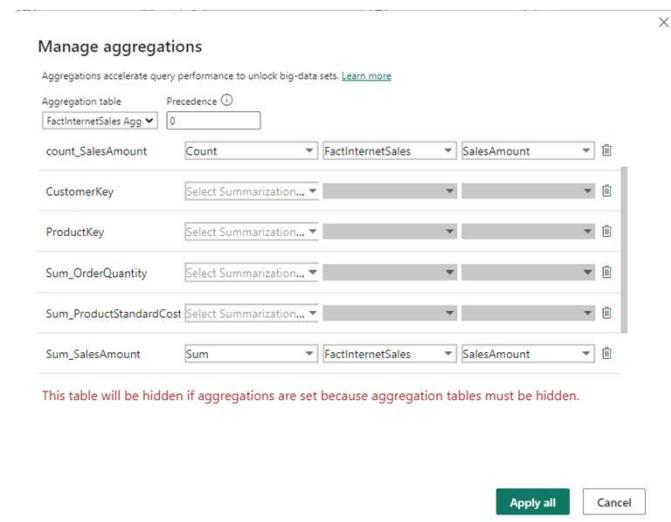
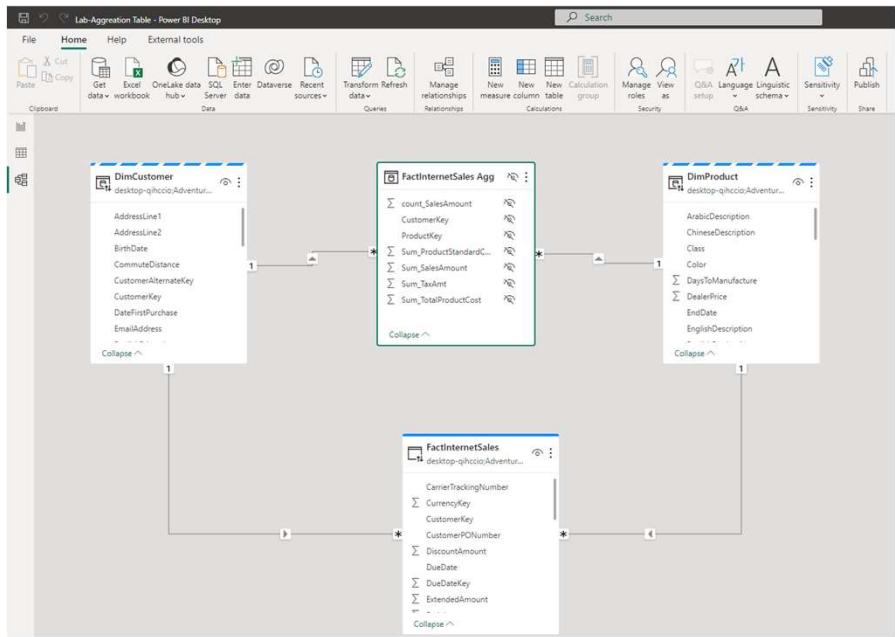


Aggregations in Power BI

Aggregations in Power BI



Aggregations in Power BI



Aggregations in Power BI

Log Results History **All Queries** Server Timings

Record Pause Stop Clear Copy Export Info

StartTime	Type	Duration	User	Database	Query
07:14:22	DAX	31ms	FAREAST\...	Lab-Aggr...	EVALUATE ROW("SalesAmountAvg", 'FactInternetSales'[SalesAmountAvg])
07:14:21	DAX	57ms	FAREAST\...	Lab-Aggr...	EVALUATE ROW("SalesAmountAvg", 'FactInternetSales'[SalesAmountAvg])
● 07:14:10	DAX	6ms	FAREAST\...	Lab-Aggr...	EVALUATE ROW("SalesAmountSum", 'FactInternetSales'[SalesAmountSum])

Match Result:
✗ attemptFailed

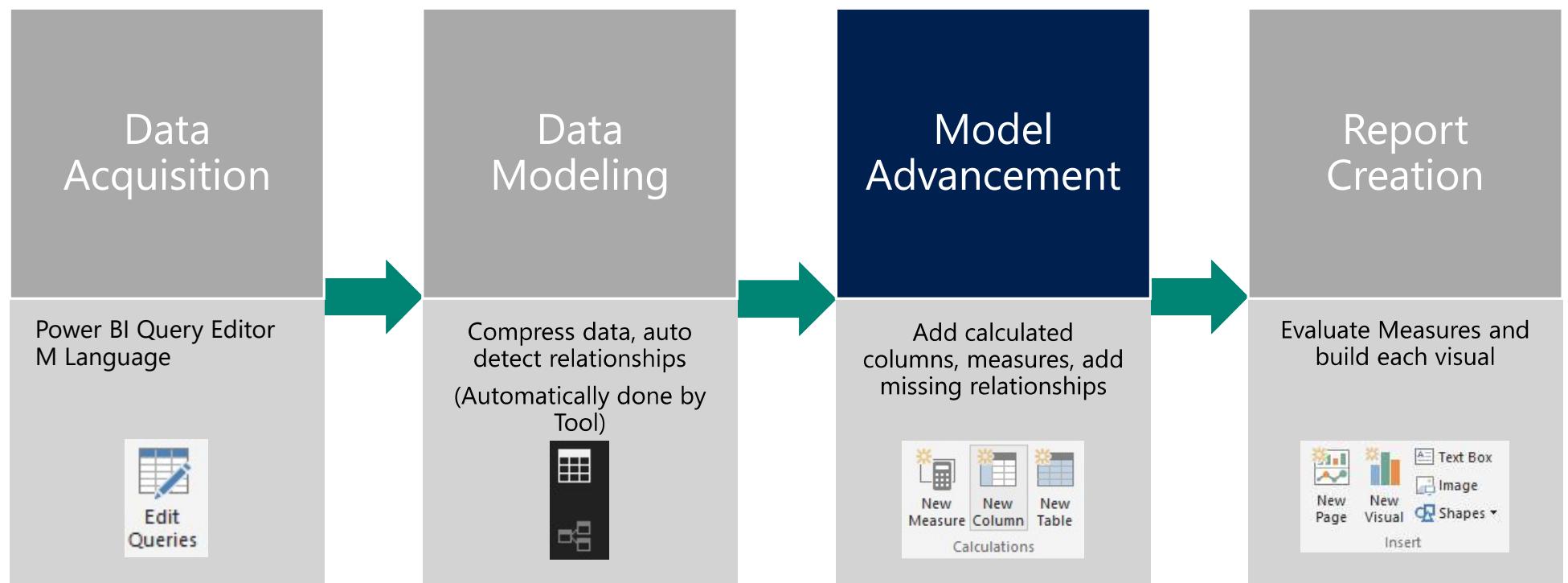
Original Table:
FactInternetSales

Mapped To:

▲ Details

```
{  
  "table": "FactInternetSales",  
  "matchingResult": "attemptFailed",  
  "failureReasons": [  
    {  
      "alternateSource": "FactInternetSales Agg",  
      "reason": "missing aggregation",  
      "column": "FactInternetSales[SalesAmount]"  
    }  
  ],  
  "dataRequest": [  
    {  
      "aggregation": "Sum",  
      "table": "FactInternetSales",  
      "column": "SalesAmount"  
    },  
    {  
      "aggregation": "Count",  
      "table": "FactInternetSales",  
      "column": "SalesAmount"  
    }  
  ]  
}
```

Data Modeling



DAX Basics

DAX stands for Data Analysis Expressions

Like excel functions but not same.

Needs "Lot" of practical experience to understand subtle differences that are needed to optimize the performance.

Data Analysis Expressions (DAX) is a library of functions, operators, and constants that can be combined to build formulas and expressions

DAX Usage

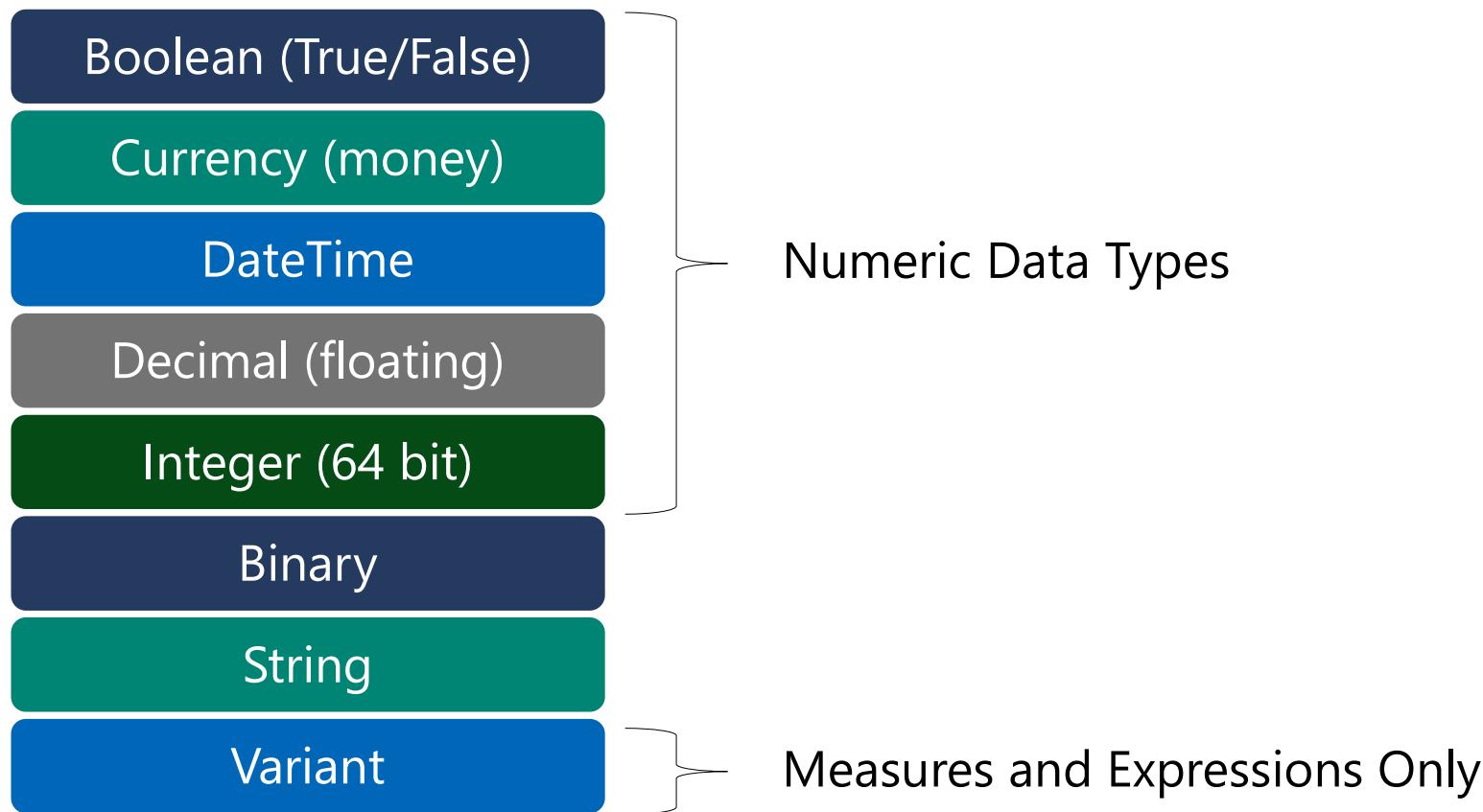
Power BI

SQL Server Analysis Services
(Tabular Models)

Excel (Power Pivot)

```
AudioSales =CALCULATE  
    ( [Total Sales],  
        FILTER (   
            'Product',  
            'Product'[ProductCategoryName] ="Audio" )
```

DAX Basics – Data types



DAX Basics - Operators

- DAX supports the following operators with specified “priority”.
- Example: If an expression contains both a sum and a comparison, the sum is executed before the comparison

PRIORITY LEVEL	OPERATOR	DESCRIPTION
1	()	Parentheses – grouping
1	F()	Scalar functions
1	IN	Inclusive OR list
2	^	Exponentiation
3	+,-	Sign – unary plus/minus (-1)
4	*, /	Multiplication, division
5	NOT	Logical negation
6	+,-	Addition, subtraction
7	&	Text concatenation
8	=, ==, <>, <, >, <=, >=	Comparison operators
9	&&	Logical AND
10		Logical OR

DAX Basics - Operators

DAX Operators are not strongly typed i.e. same operators can be used with different inputs for different outputs.

Type Conversions are automatic.

Be aware of unwanted type conversions.

Example: $(10 + 20 = 30)$ and $('10' + '20' = 30)$, $1 \& 21 = ???$

DAX Basics - Operators

All comparison operators except == treat BLANK as equal to

- number 0,
- empty string "",
- DATE(1899, 12, 30),
- FALSE.

As a result, [Column] = 0 will be true when the value of [Column] is either 0 or BLANK. In contrast, [Column] == 0 is true only when the value of [Column] is 0.

== is read as "strict equal to" where as = reads as "equal to"

DAX Basics - Operators

Using appropriate operators are helpful for readability and performance reasons. For Example: Using the IN operator can assist in avoiding writing multiple OR operators.

```
'Product'[ProductCategoryName] IN {"Audio", "Computers", "Cell Phones"}
```

```
'Product'[ProductCategoryName] = "Audio" ||  
'Product'[ProductCategoryName] = "Computers" ||  
'Product'[ProductCategoryName] = "Cell Phones"
```

DAX Basics – Supported Statements

DEFINE

EVALUATE

ORDER BY

RETURN

VAR

DAX Basics – Statements

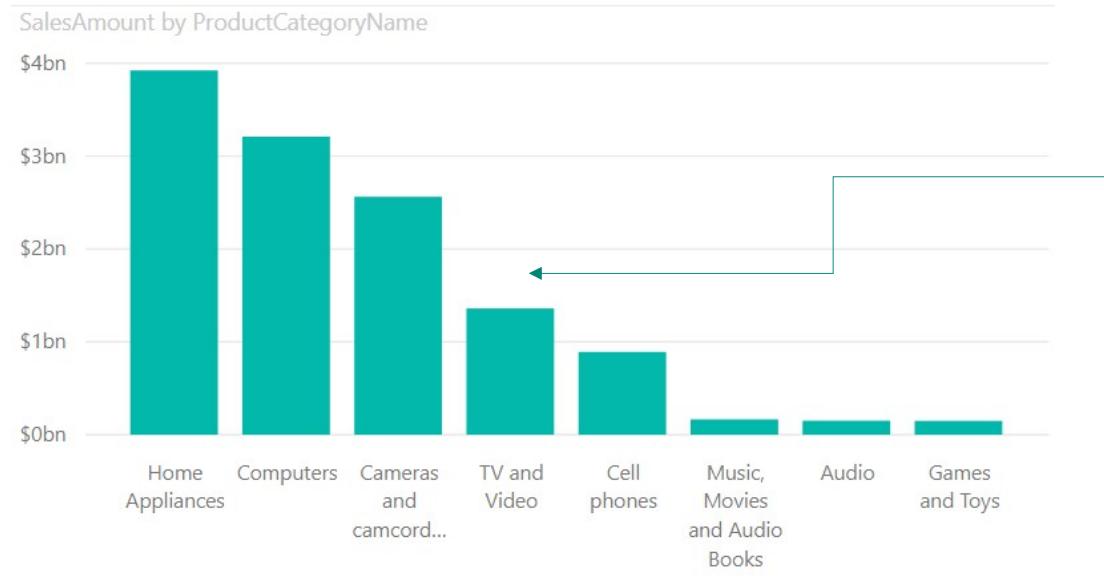
Using variables are suggested in complex DAX expressions to avoid repeating the calculating the same value again.

```
[Percentage of Product Net Revenue] =  
    VAR TotalSales =  
        SUM ( 'Sales'[SalesAmount] )  
    VAR AllSales =  
        CALCULATE(  
            SUM ( 'Sales'[SalesAmount] ),  
            ALL ( 'Product'[Product Name] )  
        )  
    RETURN  
        DIVIDE ( [TotalSales], [AllSales] )
```

DAX – Evaluation Contexts

Evaluation contexts are very important concepts of DAX.

Every formula that is written in DAX is calculated by the context.



The same calculation of total sales here is clustered by the product categories.

DAX – Evaluation Contexts

There are always two contexts under which all DAX calculations are evaluated

- Row Context
- Filter Context

DAX - Row Context

The concept of "Current Row"

Row context is invoked in formulas when written to get a related value.

- Example: Sale Quantity in Row 1

To get the values from the related tables should be using the following DAX functions

- Related
- RelatedTable
- Example: Product Name from Product table for Row 2 in Sales table.

DAX - Row Context

Row Context iterates rows for all the rows available.

It also is an Iterator operation.

Row Context

Product

Product SKU	Product Name	Product Category	UnitPrice
2030-PCUB-3C	Tailspin Heli - Max Pro Flight - 6ch	Collective pitch	50
4040-6CCP-A-6C	6CCP-A Helicopter	Collective pitch	10
4010-3CAX-B-3C	3CAX-B Helicopter	Co-Axial	20

Related
Related Table

Sales

Sale ID	Product SKU	Quantity	Sale Amount
1	4040-6CCP-A-6C	10	100
2	2030-PCUB-3C	20	1000
3	4040-6CCP-A-6C	30	300
4	2030-PCUB-3C	10	500
5	4040-6CCP-A-6C	50	500

DAX – Calculated Columns

Extending the table with the attributes of the data that are not existing at the time of ingestion.

Use DAX functions to calculate the value for each row in the table.

Once the formula is written the value becomes visible in the Data view in the Power BI Desktop.

X ✓ Gross Revenue = [Quantity] * [UnitPrice]

Product Category	Product Item Group	Product Demographic	State Name	Region Name	Cost	Gross Revenue
Collective pitch	Helicopter	Professional	Nebraska	Midwest	367	458.95
Collective pitch	Helicopter	Professional	Nebraska	Midwest	367	458.95
Collective pitch	Helicopter	Professional	Nebraska	Midwest	367	458.95
Collective pitch	Helicopter	Professional	Nebraska	Midwest	367	458.95
Collective pitch	Helicopter	Professional	Nebraska	Midwest	367	458.95
Collective pitch	Helicopter	Professional	Nebraska	Midwest	367	458.95
Collective pitch	Helicopter	Professional	Nebraska	Midwest	367	458.95
Collective pitch	Heliconter	Professional	Nebraska	Midwest	367	458.95

Calculated Columns with Related Tables

Row Context does not propagate via the relationship

Use RELATED function to write a function involving multiple tables so that **Row Context** is kept.

1

```
Sales[SalesAmount] = RELATED(ProductCost[UnitPrice]) * Sales[Quantity]
```

Row Context

Product

Related
Related Table

Sales

Product SKU	Product Name	Product Category	UnitPrice
2030-PCUB-3C	Tailspin Heli - Max Pro Flight - 6ch	Collective pitch	50
4040-6CCP-A-6C	6CCP-A Helicopter	Collective pitch	10
4010-3CAX-B-3C	3CAX-B Helicopter	Co-Axial	20

Sale ID	Product SKU	Quantity	Sale Amount
1	4040-6CCP-A-6C	10	100
2	2030-PCUB-3C	20	1000
3	4040-6CCP-A-6C	30	300
4	2030-PCUB-3C	10	500
5	4040-6CCP-A-6C	50	500

Calculated Columns with Related Tables (Contd.)

Can also use RELATEDTABLE function to nest the **Row Context** within the same or different tables.

```
Product[SalesCount] = COUNTROWS(RELATEDTABLE(Sales))
```

Row Context	Product					Related Related Table		Sales			
	Product SKU	Product Name	Product Category	UnitPrice	SalesCount			Sale ID	Product SKU	Quantity	Sale Amount
	2030-PCUB-3C	Tailspin Heli - Max Pro Flight - 6ch	Collective pitch	50	2			1	4040-6CCP-A-6C	10	100
	4040-6CCP-A-6C	6CCP-A Helicopter	Collective pitch	10	3			2	2030-PCUB-3C	20	1000
	4010-3CAX-B-3C	3CAX-B Helicopter	Co-Axial	20	0			3	4040-6CCP-A-6C	30	300
								4	2030-PCUB-3C	10	500
								5	4040-6CCP-A-6C	50	500

Calculated Columns – Best Practices



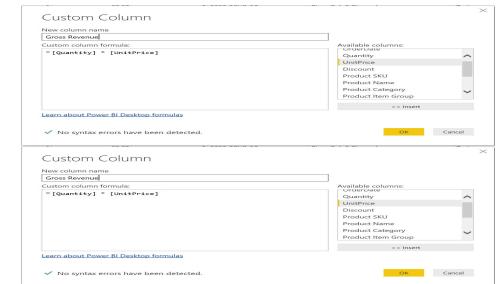
Avoid helper columns – they take up memory!



Create calculated columns in dimensional tables if possible



Move the DAX based columns into Power Query Editor based M language
“Add Columns”



DAX - Filter Context

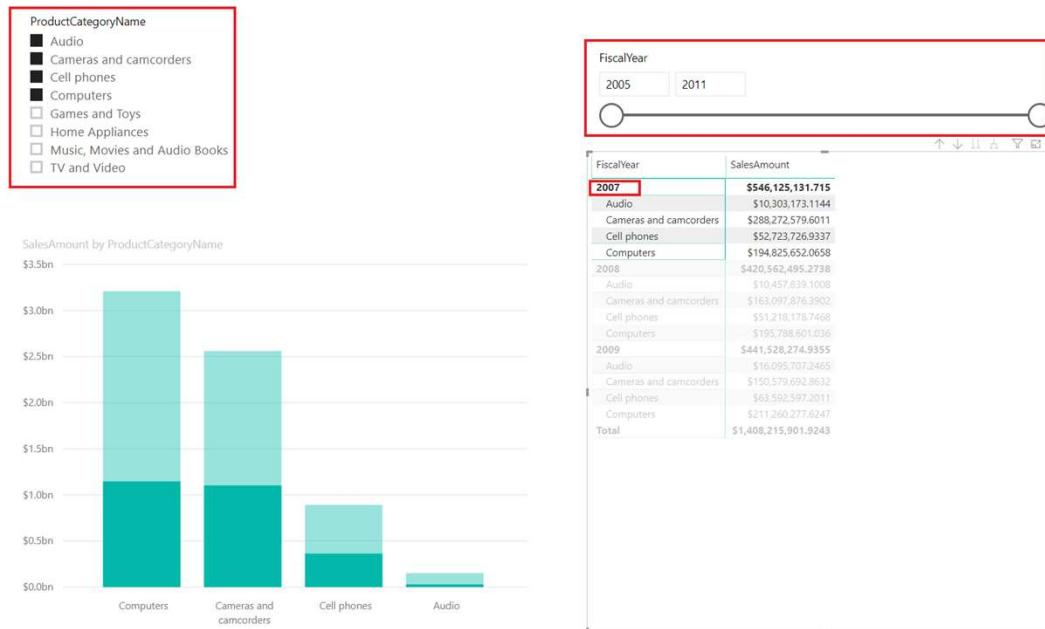
Ability to aggregate the DAX functions based on a limiting condition.

- Example: Sales Volume for Discounted Products

Most of the times the filter context is provided at run time by the on-screen visuals, filters, drill operations and so on.

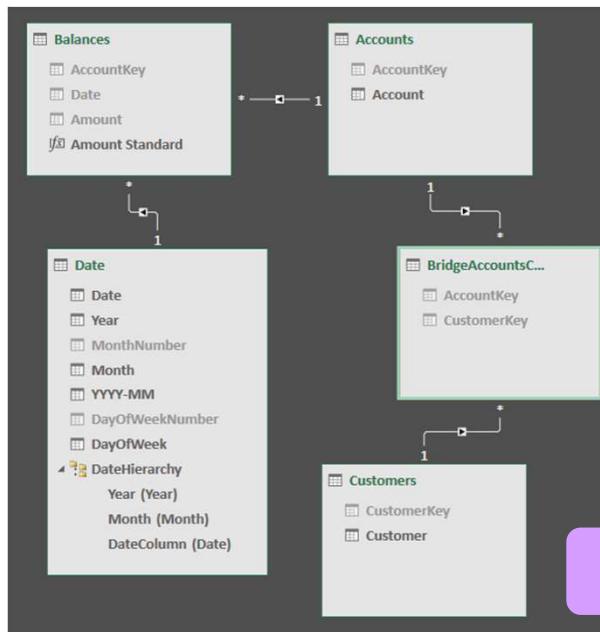
Filter Context in Power BI

Filter context in Power BI can come from filters, slicers, cross selections, etc.



Filter Context & Relationships

Filter context is propagated by default based on the direction of the filtering direction in relationship diagram.



Filter context is propagated from one to many direction when the relationship is single.

In case of both sided cross filtering it propagates in both ways.

Filter Context

DAX – Calculated Measures

Summarization on a specific number in the model.

Internally stored in one table – so no duplicate names are allowed

Does not have to be prefixed with the table name but it is a best practice to do so.

Keep measures at the Fact table. Transactional level data that might need aggregation.

Reuse measures – Call a measure from another measure.

They are evaluated at run time!

DAX - CALCULATE

The only DAX to edit the Filter Context is using CALCULATE

Add Filter Context through Calculate statement

Product

Product SKU	Product Name	Product Category	UnitPrice
2030-PCUB-3C	Tailspin Heli - Max Pro Flight - 6ch	Collective pitch	50
4040-6CCP-A-6C	6CCP-A Helicopter	Collective pitch	10
4010-3CAX-B-3C	3CAX-B Helicopter	Co-Axial	20

Sales

Sale ID	Product SKU	Quantity	Sale Amount
1	4040-6CCP-A-6C	10	100
2	2030-PCUB-3C	20	1000
3	4040-6CCP-A-6C	30	300
4	2030-PCUB-3C	10	500
5	4040-6CCP-A-6C	50	500

Filter Context

```
= CALCULATE (
    SUM ( 'Sales'[Sale Amount] ),
    FILTER ( 'Product',
        'Product'[Product Category] = "Co-Axial" )
)
```

Default Summarization / Implicit Measures

Out of the box aggregations that are by default created by the Power BI with a pre-defined aggregation function.

Report author can change the default aggregation at visual level.

Don't have to create a formula in DAX

Do not summarize if the aggregation is not needed by default.

The screenshot shows two tables in Power BI: one for 'Region Name' and 'Net Revenue', and another for 'Manager Name' and 'Net Revenue'. Below the tables, a context menu is open for a visual element, specifically for the 'Net Revenue' column. The menu is titled 'Values' and includes options like 'Remove field', 'Rename', 'Conditional formatting', and a dropdown for 'Default Summarization'. The 'Sum' option is selected under 'Default Summarization: Sum'. Other options in the dropdown include Average, Minimum, Maximum, Count (Distinct), Count, and Show value as.

Region Name	Net Revenue
Southeast	24,175,851.85
Midwest	21,431,131.85
Northeast	10,540,174.05
Pacific Northwest	9,714,528.15
Southwest	9,320,308.05
New England	6,230,308.05
Total	81,289,615.50

Manager Name	Net Revenue
Ananya Kumar	45,649,319.40
Dee Bell	21,385,155.00
Ty Johnston	15,385,594.30
Jane Campbell	10,540,174.65
Bob Miller	9,320,308.05
Carmen Carrington	9,155,286.25
John Bishop	6,230,308.05
Total	81,289,615.50

DAX Common – Product Filter

2

```
[Sales Amount of Co-Axial] =  
= CALCULATE (  
    SUM ( 'Sales' [Sales Amount] ),  
    FILTER ( 'Product', 'Product' [Product Category] = "Co-Axial" )  
)
```

DAX Common – Percentage of Product

3

```
[Percentage of Product Net Revenue] =  
VAR TotalSales =  
    SUM ( 'Online Sales'[SalesAmount] )  
VAR AllSales =  
    CALCULATE(  
        SUM ('Online Sales'[SalesAmount] ),  
        ALL ( 'Product'[Product Name] )  
    )  
RETURN  
    DIVIDE ( [TotalSales], [AllSales] )
```

DAX Common – Growth Rate

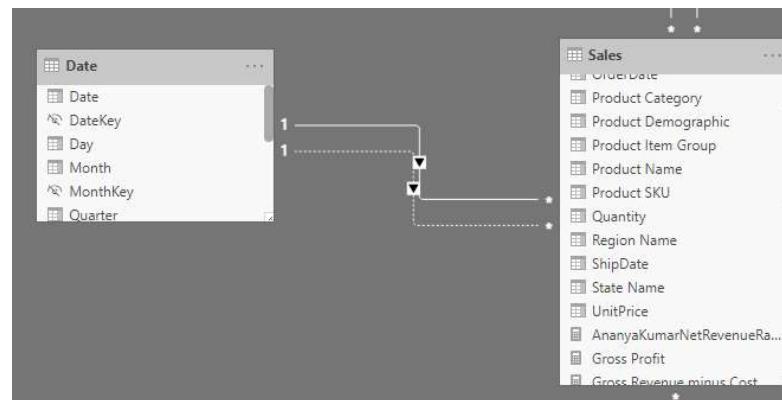
```
[Growth Rate] =  
VAR TotalSales =  
    SUM ( 'Online Sales'[SalesAmount] )  
VAR LySales =  
    CALCULATE(  
        SUM ('Online Sales'[SalesAmount] ),  
        SAMEPERIODLASTYEAR ( 'Date'[DateKey] )  
    )  
RETURN  
    DIVIDE ( [TotalSales], [LySales] ) - 1
```

DAX – USERELATIONSHIP Function

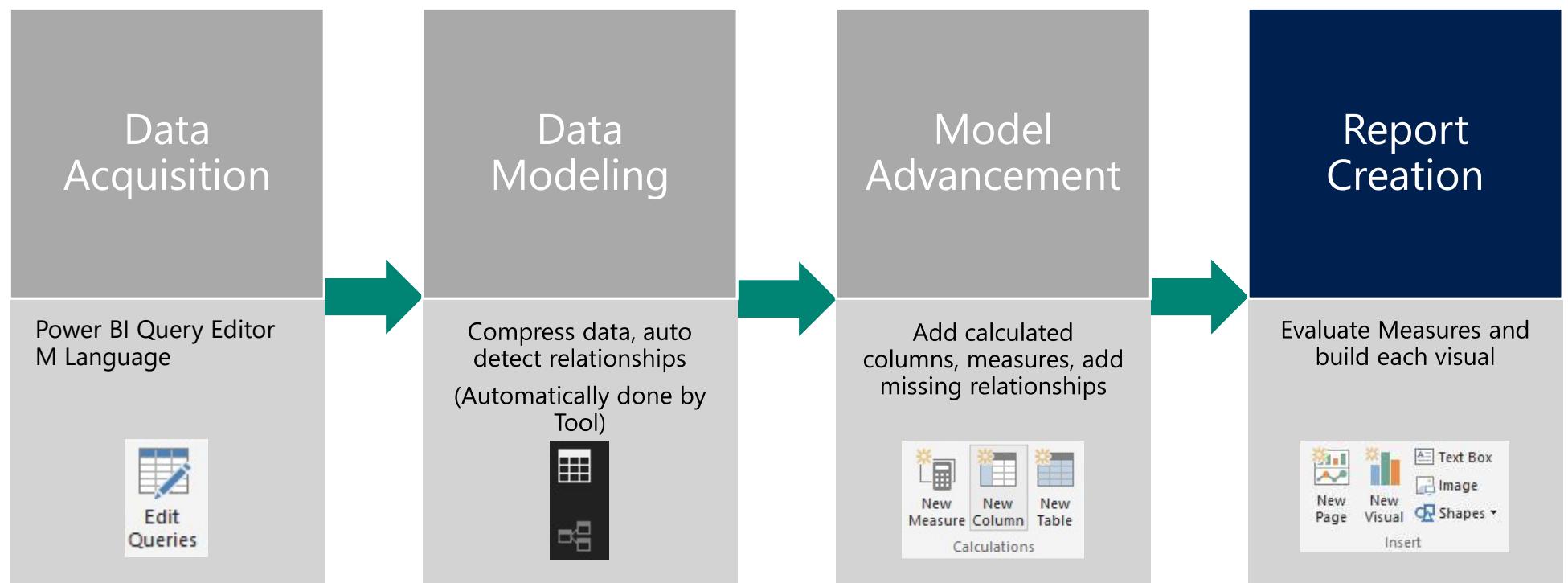
USERELATIONSHIP is used for activating an inactive relationship

```
NetRevenueByShipDate =  
    CALCULATE(  
        Sum(Sales[Net Revenue]),  
        USERELATIONSHIP(Sales[ShipDate], 'Date'[Date])) // Inactive relationship dotted line  
        below
```

5



Data Modeling



Calculated Columns vs Measure



As a general practice - calculated columns can be used if used in rows, columns, filters, slicers, axis and so on and the measures can be used as values section.



Calculated columns are extending the table – can be applicable for both the fact and dimensions.



Calculated Measures are aggregating the table – should mostly be applicable to the fact table.

Calculated Columns vs Measures (Contd.)

DAX Evaluation Contexts - It is important to note that the measures can not infer row context when a single value is used in the formula.

- Example: SaleAmount = OnlineSales[UnitPrice] * OnlineSales[Quantity]
- This will work as long as SaleAmount is a calculated column but not when it is a measure because for all the rows applicable (after applying the filter context) there is no single value of UnitPrice or Quantity.
- Using an aggregate function such as Sum can result in a single value.
- Example: SaleAmount = Sum(OnlineSales[UnitPrice]) * Sum(OnlineSales[Quantity])

Calculated Columns vs Measures (Contd.)

Calculated Columns follow Row Context iterates rows for all the rows available.

How to USE SUMX to create Row Context

Sales

Sale ID	Product SKU	Quantity	UnitPrice	SaleAmount
1	4040-6CCP-A-6C	10	10	100
2	2030-PCUB-3C	20	50	1000
3	4040-6CCP-A-6C	30	10	300
4	2030-PCUB-3C	10	50	500
5	4040-6CCP-A-6C	50	10	500

Option1

SaleAmount = Sales[UnitPrice] *
Sales[Quantity]
SumSaleAmount = **SUM**(Sales[SaleAmount])

Option2

Sum_SaleAmount =
SUMX(Sales, OnlineSales[UnitPrice] *
Sales[Quantity])

Creating Row Context

Sales

Sale ID	Product SKU	Quantity	UnitPrice	SaleAmount	Sum_SaleAmount	Add_SaleAmount
1	4040-6CCP-A-6C	10	10	100		
2	2030-PCUB-3C	20	50	1000		
3	4040-6CCP-A-6C	30	10	300		
4	2030-PCUB-3C	10	50	500		
5	4040-6CCP-A-6C	50	10	500		

6

Sum_SaleAmount =
SUMX(

Sales,
Sales[UnitPrice] * Sales[Quantity])

Add_SaleAmount =
SUMX(

Sales,
Sales[SaleAmount] *1.1)

Add_SaleAmount = **SUM**(Sales[SaleAmount]) *1.1

Row Context vs Filter Context (Context Transit)

Sales

Sale ID	Product SKU	Quantity	UnitPrice	SaleAmount	Test
1	4040-6CCP-A-6C	10	10	100	
2	2030-PCUB-3C	20	50	1000	
3	4040-6CCP-A-6C	30	10	300	
4	2030-PCUB-3C	10	50	500	
5	4040-6CCP-A-6C	50	10	500	

TEST = `SUM('Sales'[SaleAmount]) ??`

TEST = `CALCULATE(SUM('Sales'[SaleAmount])) ??`

TEST =
`COUNTROWS (`
 `FILTER (`
 `'Fact Sale',`
 `'Fact Sale'[SalesAmount] > EARLIER (`
 `'Fact Sale'[SalesAmount])`
 `)`
`) + 1`

Creating a Data Model in Power BI

Creating a Data Model in
Power BI



Custom Visual

Creating a Synoptic Design
Visual



Custom Visual



Synoptic Panel by OKViz

by OKVIZ Corp.

Power BI visuals

PBI Certified

★ 4.5 (54 ratings)

Pricing Free

Get it now

Download Sample

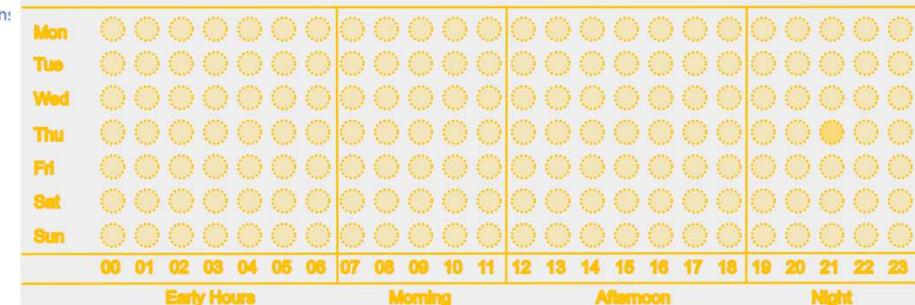
Instruction:

<https://synoptic.design/>

SYNOPTIC DESIGNER FOR POWER BI

Synoptic Designer is the companion tool of [Synoptic Panel](#), a certified custom visual for Microsoft Power BI created by OKVIZ.

EDITOR GALLERY ABOUT



SVG editing is quite limited at the moment, use a [graphic designer](#) such as Inkscape to modify this file.

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AREAS

1	Area name (to display)	B100
2	Area name (to display)	B100
3	Area name (to display)	B100
4	Area name (to display)	B100
5	Area name (to display)	B100
6	Area name (to display)	B100
7	Area name (to display)	B100
8	Area name (to display)	B100
9	Area name (to display)	B100

EXPORT TO POWER BI
SUBMIT TO GALLERY

CONTACT

<https://appsource.microsoft.com/en-us/product/power-bi-visuals/WA104380873>

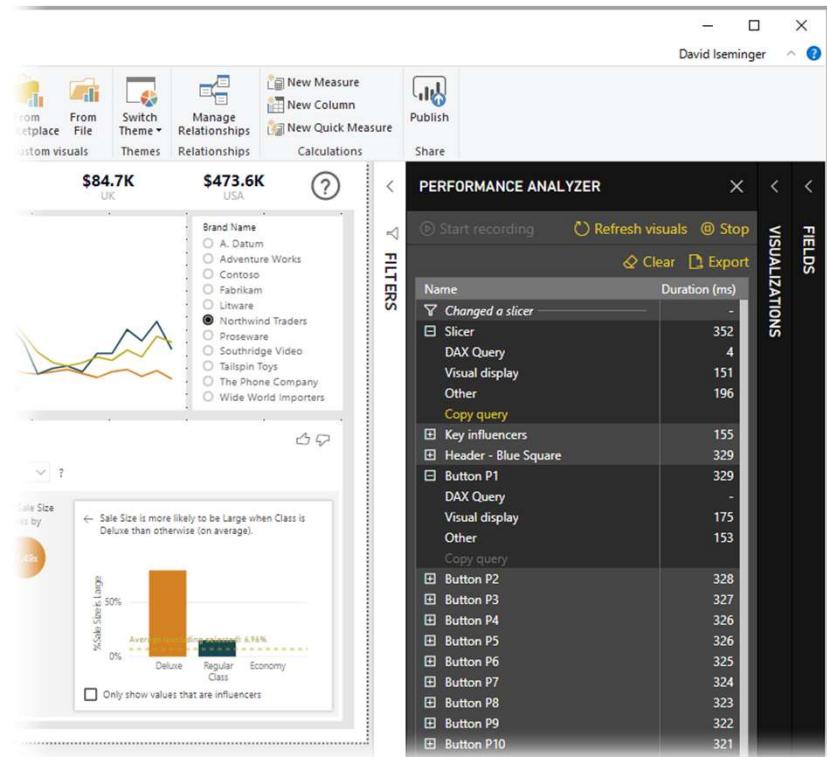
Performance Optimization and Best Practices

Performance Analyzer

In Power BI Desktop you can find out how each of your report elements, such as visuals and DAX formulas, are performing.

Using the Performance Analyzer,

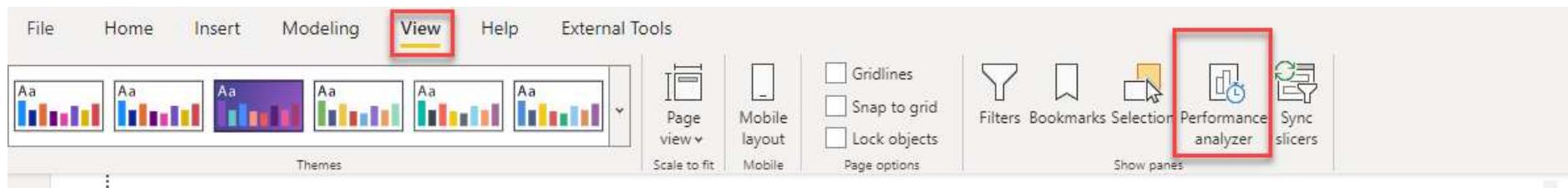
- See and record logs that measure report elements performance
- Understand which DAX formulas and visuals are resource intensive.



Performance Analyzer

To show performance analyzer tab

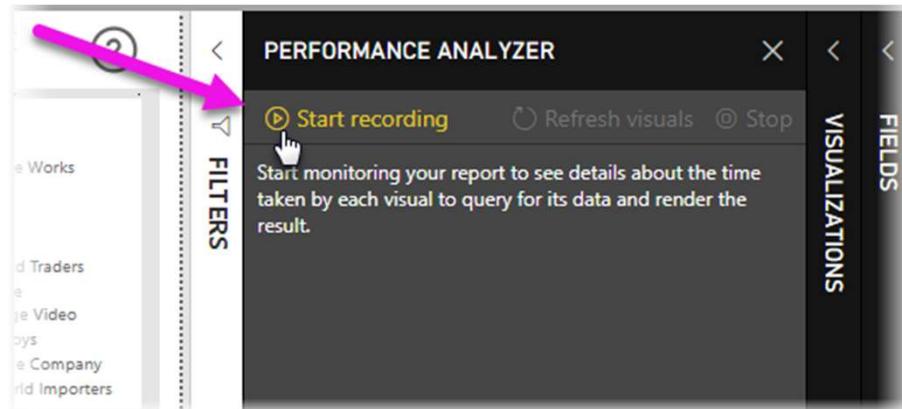
- Click on **View** -> **Show** -> **Performance Analyzer** checkbox



Performance Analyzer

To start analyzing the performance of the report visuals click on **Start Recording**

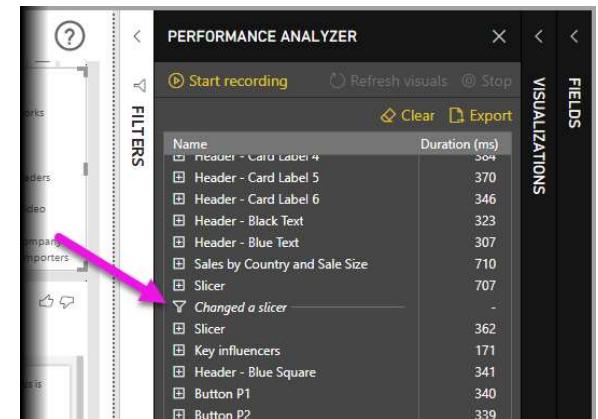
Once clicked **Stop** button will be activated and each of the activity will be recorded with their duration.



Performance Analyzer

Each recorded activity will be shown as a section with the log information.

- **DAX query** - if a DAX query was required, this is the time between the visual sending the query, and for Analysis Services to return the results.
- **Visual display** - time required for the visual to draw on the screen, including time required to retrieve any web images or geocoding.
- **Other** - time required by the visual for preparing queries, waiting for other visuals to complete, or performing other background processing.



The screenshot shows the Power BI Performance Analyzer interface. It features a sidebar with 'FILTERS' and 'VISUALIZATIONS' sections, and a main area titled 'PERFORMANCE ANALYZER' with a table of recorded activities and their durations. A pink arrow points from the text in the previous slide to the 'Slicer' entry in the table, which has a expanded disclosure icon.

Name	Duration (ms)
Header - Card Label 4	504
Header - Card Label 5	370
Header - Card Label 6	346
Header - Black Text	323
Header - Blue Text	307
Sales by Country and Sale Size	710
Slicer	707
Changed a slicer	
Slicer	362
Key influencers	171
Header - Blue Square	341
Button P1	340
Button P2	339

Header - Blue Text	307
Sales by Country and Sale Size	710
DAX Query	-
Visual display	184
Other	526
Copy query	
Slicer	707
DAX Query	-
Visual display	183
Other	524

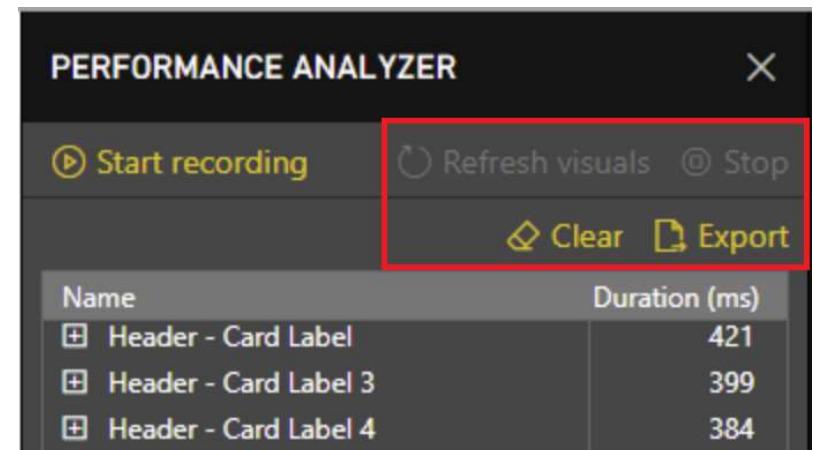
Performance Analyzer

Stop – To stop recording activities

Clear – To clear the results on the performance analyzer screen.

Export – To export the performance analyzer results into a Json file.

Refresh Visuals – To refresh all visuals and record duration.



The screenshot shows the 'PERFORMANCE ANALYZER' interface. At the top, there is a toolbar with five buttons: 'Start recording' (yellow), 'Refresh visuals' (grey), 'Stop' (grey), 'Clear' (red border), and 'Export' (red border). Below the toolbar is a table displaying performance data. The table has two columns: 'Name' and 'Duration (ms)'. The data rows are: 'Header - Card Label' (421 ms), 'Header - Card Label 3' (399 ms), and 'Header - Card Label 4' (384 ms).

Name	Duration (ms)
Header - Card Label	421
Header - Card Label 3	399
Header - Card Label 4	384

Techniques to Optimize the Data Model

You can perform the following tasks to optimize the data model

- Check for high cardinality columns
- Check and omit the unused columns and tables using Shaping activities.
- Try to convert the string-based columns into number-based columns as string comparison is costlier than the number comparison. e.g. GUIDs
- If possible - Reduce precision scale for numbers
- If possible - Convert DateTime to Dates
- Look for Bi-Directional filters on the relationships and optimize them by converting to Single directional filters.
- Try to aim for a Star schema
- Evaluate the DAX that is running on the model by using the tools such as SSMS and DAX editor.

Techniques to Optimize DAX

You can perform the following tasks to optimize DAX

- Use Variables to precompute and reuse
- Reuse created measures and columns instead of retyping the expression.
- Replace filters on tables with specific columns or using different approaches.
- Use optimal functions such as ISEMPTY Instead of COUNTROWS() = 0
- Understand costly operations – rethink and rewrite
- Use Performance Analyzer to get the DAX and analyze
- Avoid non-performant visuals and double check the performance of custom visuals

Using DAX Studio

DAX Studio can show the queries and show the plans

Easy to troubleshoot by using the trace options

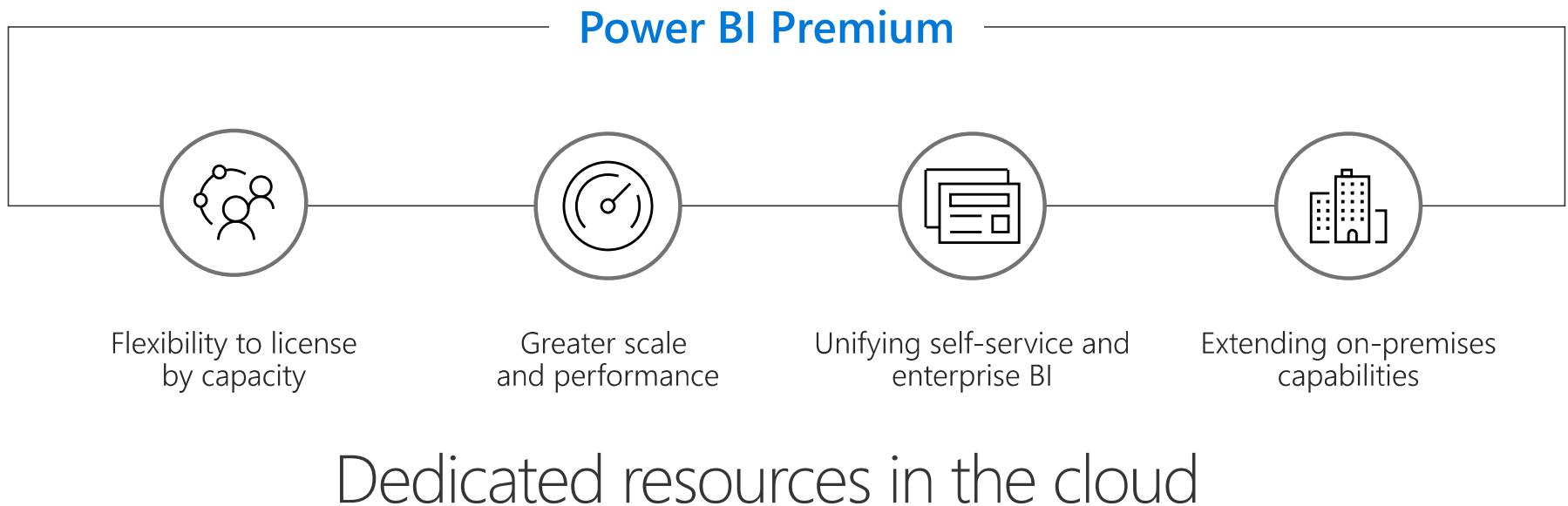
Optimizing Data Model in Power BI

Optimizing Data Model



Power BI Premium Overview

Power BI Premium - Overview



Power BI Premium - Overview

Unifying self-service and enterprise BI

Capacity or Per User

SQL Server Analysis Services integrated into Power BI

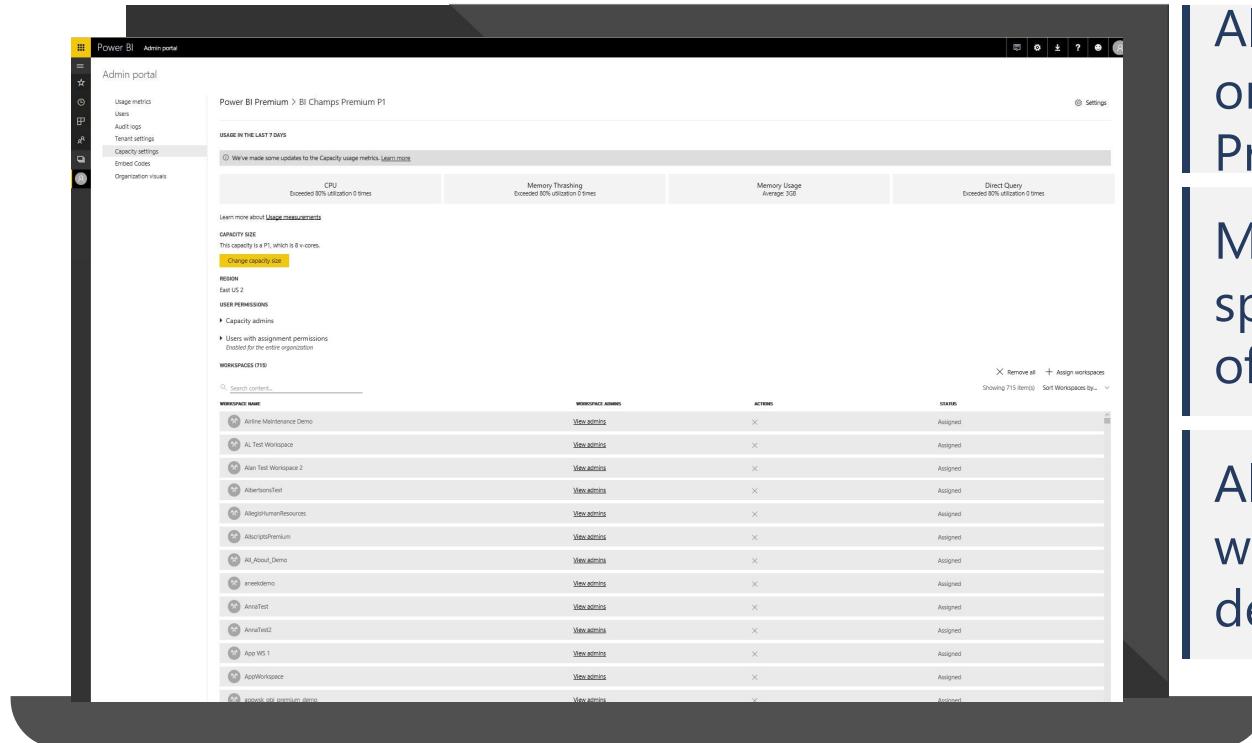
SQL Server Reporting Services technology now part of Power BI

Flexibility to deploy Power BI in specific global regions with multi-geo*

Advanced feature set such as AI, Self serve data prep availability

**Applicable for enterprise premium capacities but not premium users*

Assign workspaces to your dedicated capacity



The screenshot shows the Power BI Admin portal interface. At the top, it displays usage metrics for 'Power BI Premium > BI Champs Premium P1' over the last 7 days, including CPU, Memory Thresholding, Memory Usage, and Direct Query utilization. Below this, there's a 'Capacity size' section indicating a capacity of 1 P1, which is 8 v-cores, with a 'Change capacity size' button. The 'REGION' is listed as East US 2. Under 'USER PERMISSIONS', it shows 'Capacity admins' and 'Users with assignment permissions' (Enabled for the entire organization). The 'WORKSPACES (118)' section lists 118 workspaces, each with a thumbnail, name, and 'View admin' link. A table at the bottom summarizes workspace assignments:

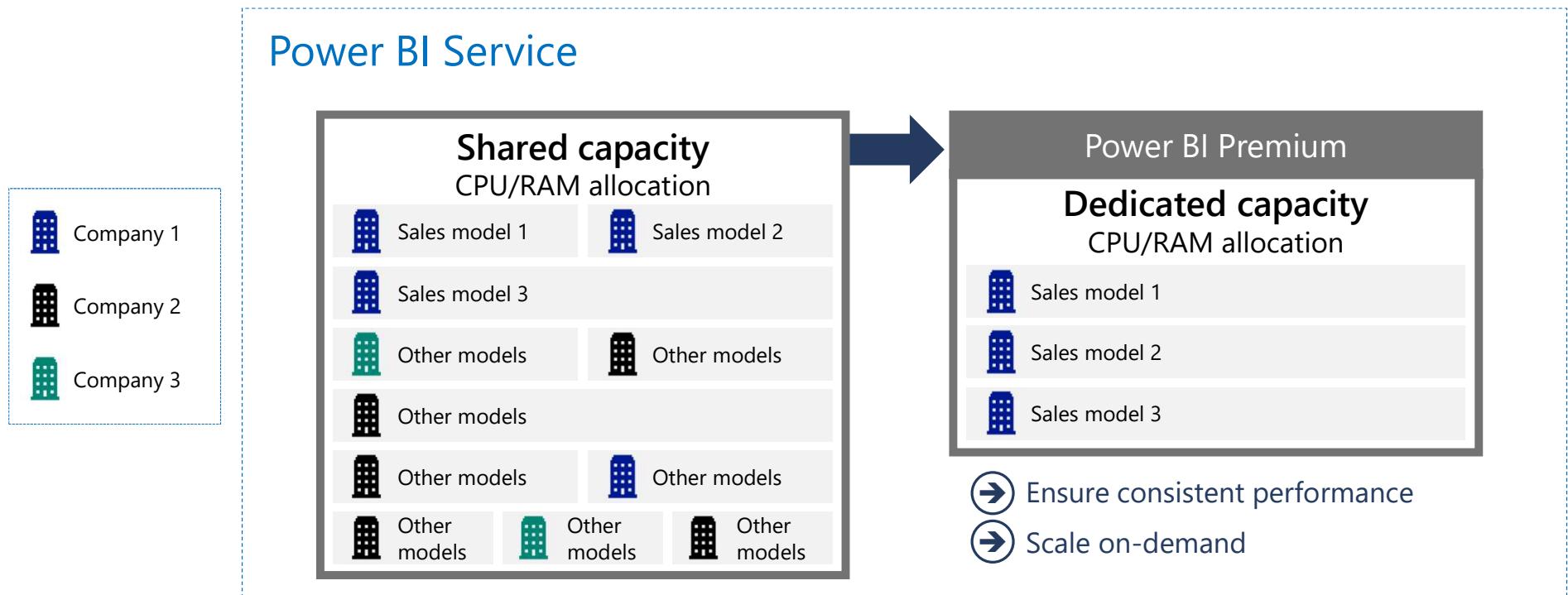
WORKSPACE NAME	WORKSPACE ADMIN	ACTIONS	STATUS
Alin Maintenance Demo	View admin	X	Assigned
AI Test Workspace	View admin	X	Assigned
Alan Test Workspace 2	View admin	X	Assigned
AlbertoTest	View admin	X	Assigned
AllegiumResources	View admin	X	Assigned
AlsicioPimentel	View admin	X	Assigned
Alt_About_Demo	View admin	X	Assigned
anekidemo	View admin	X	Assigned
AnnaTest	View admin	X	Assigned
ArnauTest2	View admin	X	Assigned
App WS 1	View admin	X	Assigned
AppWorkspace	View admin	X	Assigned
giovanni_and_remmi_demo	View admin	X	Assigned

Allow the entire organization to use Premium capacity

Migrate workspaces for a specifically scoped team of users

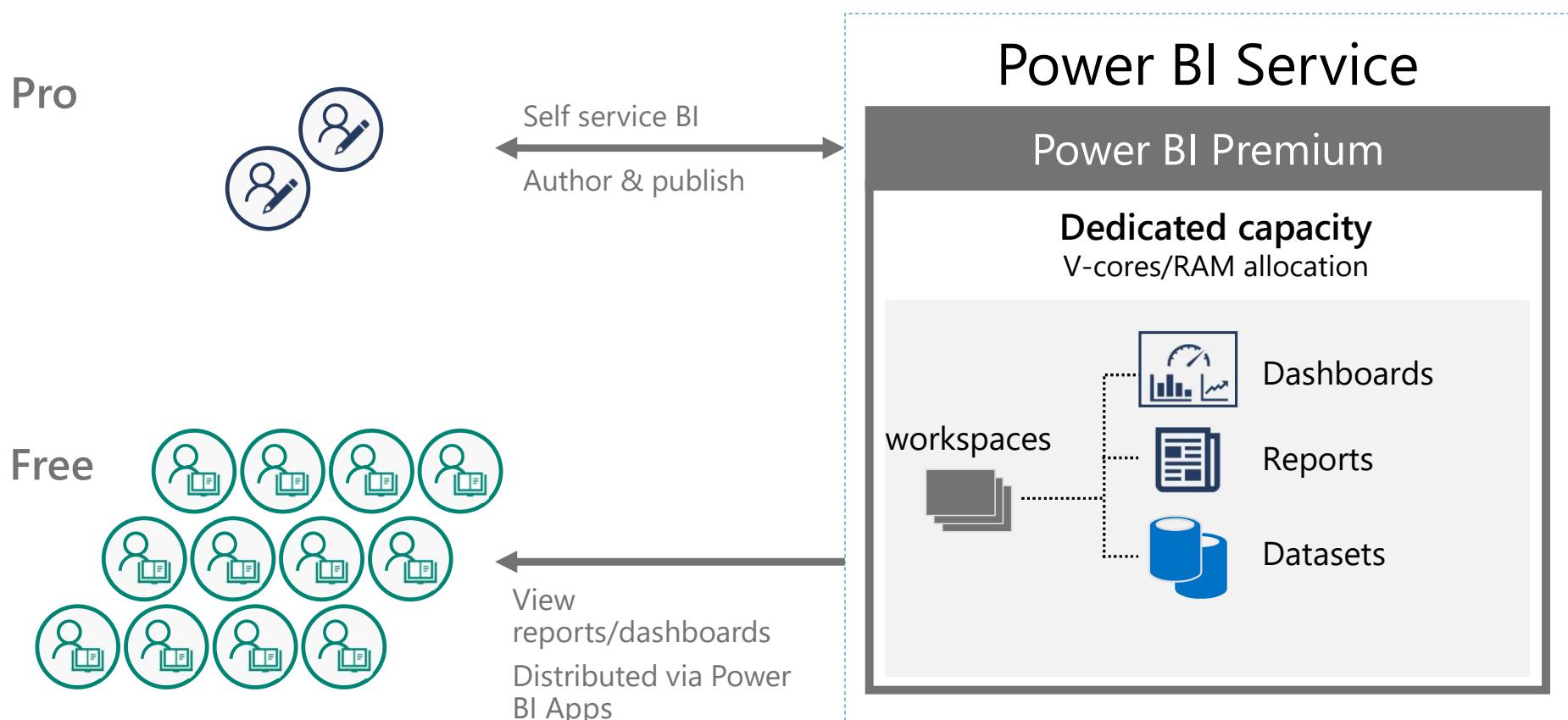
All content within migrated workspaces runs on dedicated capacity

Assign workspaces to your dedicated capacity



Models run on distributed hardware servicing multiple tenants

Distribute content to all users



*Applicable for enterprise premium capacities but not premium users

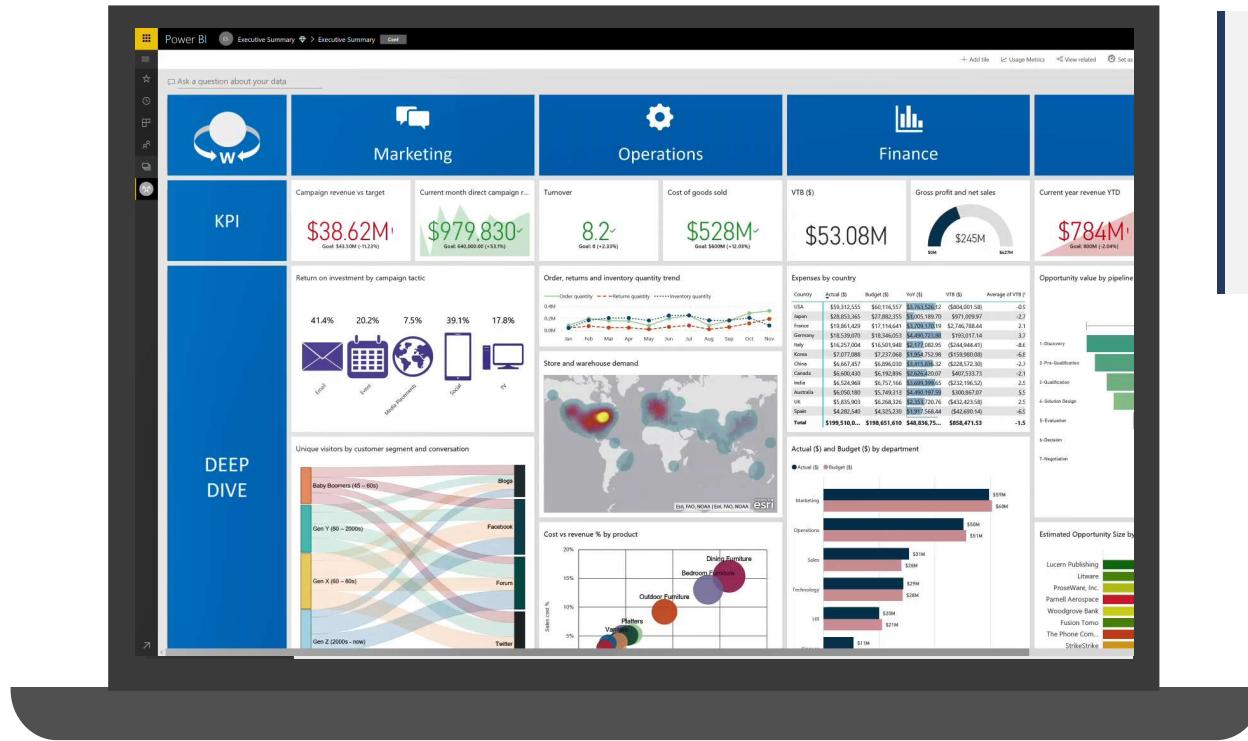
Shared (Power BI Pro) vs Premium (per User / Capacity)

	Pro (shared capacity)	Premium (per user)	Premium (capacity)
Total storage size	10 GB	100 TB	100 TB
Refresh rate	8/day	48/day	48/day
Max imported dataset size	1 GB	12 GB (up to 100 GB)	12 GB (up to 400 GB)
AI Capabilities	✗	✓	✓
Advanced Data Flows Features	✗	✓	✓
Usage based aggregate optimization	✗	✓	✓
Deployment Pipelines (ALM)	✗	✓	✓
Multi Geo	✗	✗	✓
Unlimited Enterprise Distribution	✗	✗	✓
Bring Your Own Key	✗	✗	✓
Power BI Report Server (On-Premises)	✗	✗	✓
Embedding for Customers	✗	✗	✓
Paginated Reports	✗	✓	✓
XMLA Endpoints	✗	✓	✓

- User **must have a Premium per user license** to view/access content in a Premium per user workspace. This includes scenarios where they are accessing the content through the XMLA endpoint, Analyze in Excel, Composite Models, Embedded etc.
- With a **Premium per user license** there is no need to administer the capacity.

Power BI Apps

- Distribute to all users

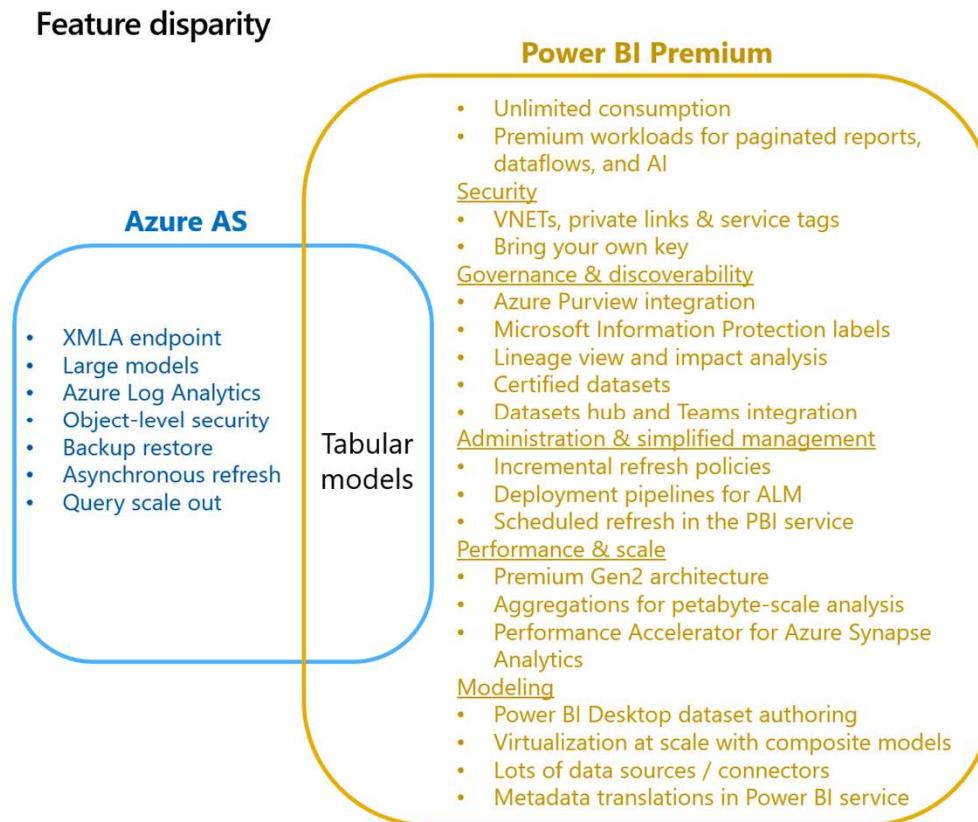


Package reports, dashboards and distribute to specific groups and users with Power BI Premium

*Applicable for enterprise premium capacities but not premium users

Power BI Premium and Azure Analysis Services

The full set of Power BI workloads, features and capabilities represent a modern, cloud-born BI platform that goes far beyond comparable functionality available on premises.



Multi-Geo Capabilities (per Capacity)

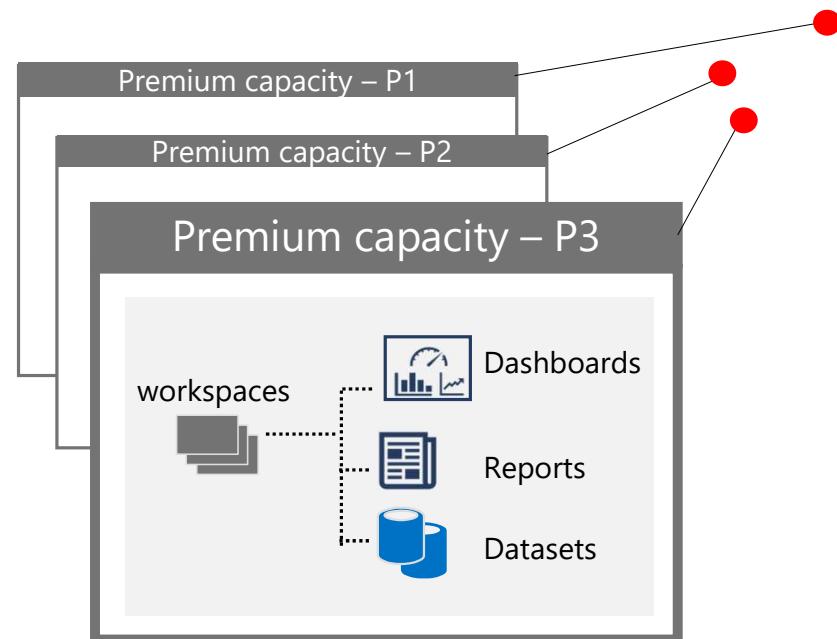


Geo location to support compliance



Increase performance with queries
nearest to your data

Power BI Service



Multi-Geo Capabilities (per Capacity)

Define the region for the capacity node

Set workspaces to the desired capacity

Content in that node will reside in that region

Multiple region content will need to be manually duplicated between workspaces

Not supported with Premium Per User license.

The screenshot shows a configuration interface for 'Capacity Size'. At the top, it displays 'V-cores' with '0 of 16 used' and a progress bar reaching 16 v-cores. Below this is a dropdown menu for 'Available v-cores' with the placeholder 'Select v-cores' and a link to 'Learn more about capacity sizes'. A 'Region' dropdown is set to 'West Europe'. A note below states: 'By default, your capacity is in your home region. Changing your region can have implications on compliance and performance.' with a link to 'Learn more about multi-region support'. An 'Advanced' section is partially visible, showing 'Premium' status as 'On' (indicated by a yellow switch), 'Workspace capacity' set to 'Studio 44', and 'Region' set to 'East US'. There are also links to 'Learn more about capacities' and 'Learn more about regions'.

Workloads in Power BI Premium (per Capacity)

AI – Cognitive Services and AutoML

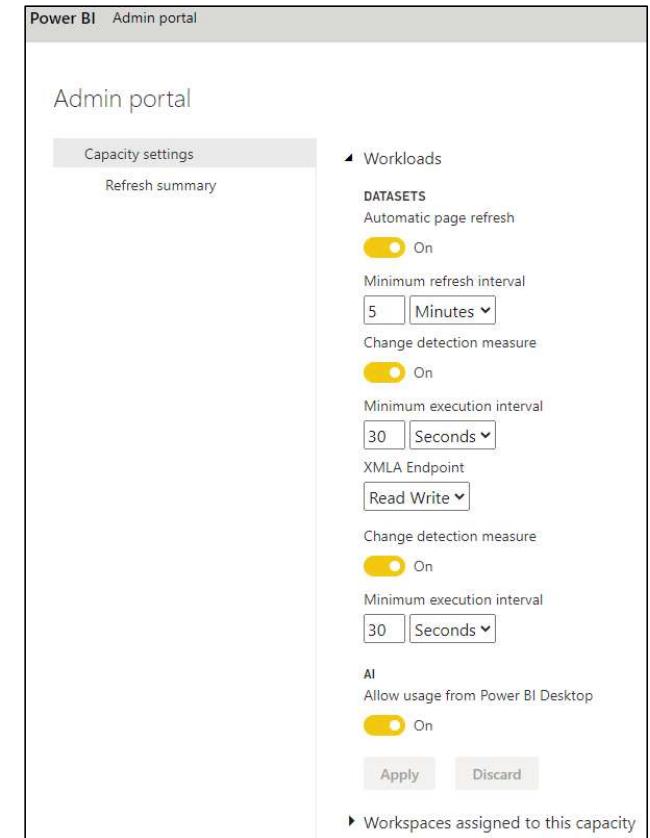
*Datasets – Dataset configuration.

Dataflows – Self Service Data Prep

Paginated Reports – Support for RDL reports

- All compete for resources
- Capacity planning/sizing is important

* In Gen2, only the Datasets workload is user configurable



Dataflow capabilities on Power BI Premium

Dataflow capability	Power BI Pro	Power BI Premium
Scheduled refresh	8 per day	48
Total Storage	10 GB/user	100 TB/node
Dataflow Authoring with Power Query Online	Yes	Yes
Dataflow Management within Power BI	Yes	Yes
Dataflows Data Connector in the Power BI Desktop	Yes	Yes
Integration with Azure	Yes	Yes
Computed Entities (in-storage transformations via M)	No	Yes
New connectors	Yes	Yes
Dataflow incremental refresh	No	Yes
Running on Power BI Premium capacity / Parallel execution of transforms	No	Yes
Dataflow linked entities	No	Yes
Standardized Schema / Built-In Support for the Common Data Model	Yes	Yes

AI – Cognitive Services

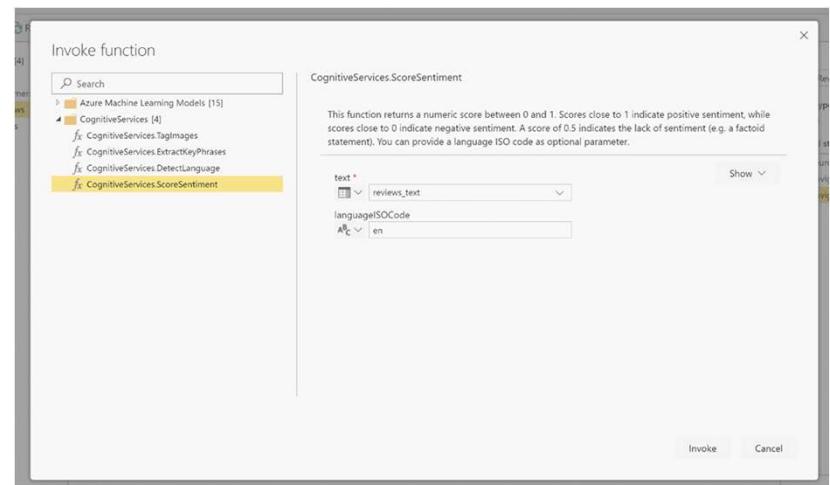
Cognitive services can be used part of dataflows in Power BI Service.

Supported cognitive services –

- Sentiment Analysis
- Key Phrase Extraction
- Language Detection
- Image Tagging

Appropriate functions will be provided as a transformation input for the dataflow.

Supported with Premium Per User licensing.



Uses premium capacity nodes to run the computation needs.

AI – AutoML

AutoML can be used part of dataflows in Power BI Service.

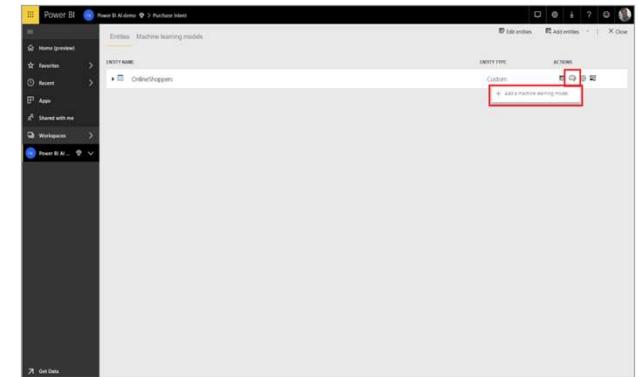
Supported ML Models –

- Binary Prediction
- Classification
- Regression

Provides a step-by-step approach to create the model on the entity.

After the dataflow is refreshed a new **enriched** dataflow is created.

Use the Dataflows input from PBI Desktop to connect to the entity that is output from the dataflow.



Uses premium capacity nodes to run the computation needs.

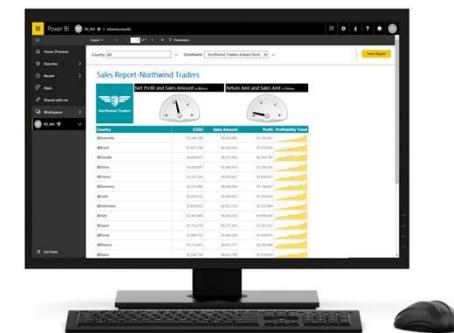
Paginated Reports

Develop and Publish **SQL Server Reporting Services (SSRS)** reports to Power BI Service or On-premises report server.

Use **Power BI Report Builder** to build paginated reports.

Once created they can be published to the premium workspaces and can be refreshed using **Gateways** if necessary.

Supported with Premium Per User licensing.



Bring your own encryption keys for Power BI (per Capacity)

Customers can bring their own encryption keys to Power BI to encrypt data that is published into premium datasets.

Following is not encrypted with BYOK –

- Query result caches for tiles and visuals
- Datasets configured to source from SQL Server Analysis Services via Live Connect, because the dataset resides in a customer owned Analysis Services Server.
- Excel workbooks (unless data is first imported into Power BI Desktop)
- Paginated Reports' data
- Dataflow Data

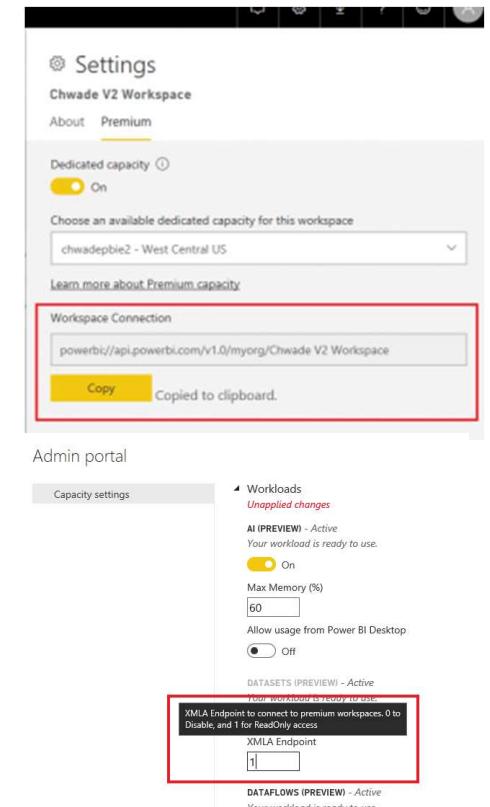
Currently enablement of BYOK is through cmdshell only.

XMLA for Power BI Premium Datasets

XMLA endpoints are supported for PBI Datasets that are in Premium capacities in read-only mode currently.

XMLA endpoints setting In Workloads -> Datasets needs to be enabled.

XMLA Read / Write enables scenarios around programmatic access to the dataset through tools that support XMLA such as SSDT, SSMS, Tableau etc..





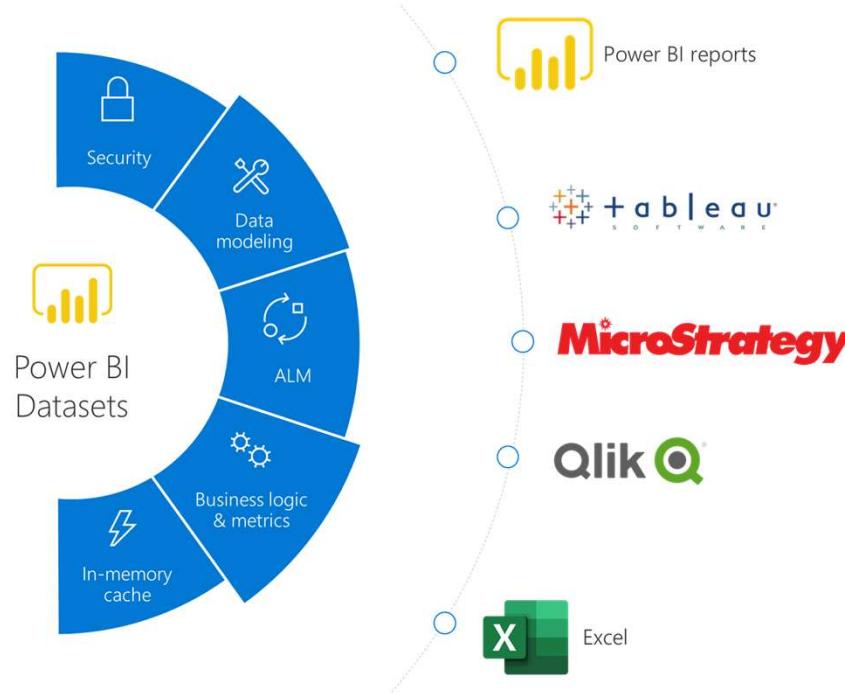
XMLA End Points

Helps building solutions with Power BI datasets

Enables Single source of truth

Value of semantic model available across 1st and 3rd party tools

Single consistent XML/A endpoint that is an industry standard

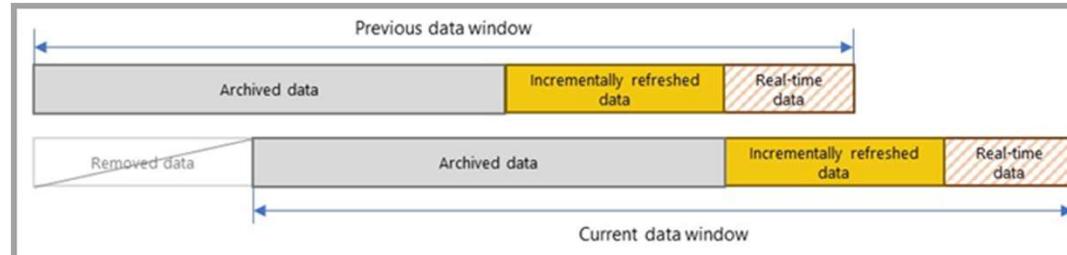


Incremental Refresh

Supported on Power BI Pro, Premium, Embedded.

Auto managed by Power BI through Policies

With XMLA endpoints this feature can be advanced to managing the partitions through SSMS/ Tabular Editor etc.



```
let
    Query = "select * from dbo.FactInternetSales where OrderDateKey >= ""&
Text.From(Int32.From( DateTime.ToString(RangeStart,"yyyyMMdd") )) &"" and OrderDateKey <
""& Text.From(Int32.From( DateTime.ToString(RangeEnd,"yyyyMMdd") )) &"" ",
    Source = Sql.Database("dwdev02","AdventureWorksDW2017"),
    Data = Value.NativeQuery(Source, Query, null, [EnableFolding=false])
in
    Data
```

Advanced Incremental Refresh

Imported Archive Data

Caching the data that is Near Real Time periodically

Direct Query the real time data.

Granularity	Name	Row Count
Year	2011	295,489,717
Year	2012	297,678,498
Year	2013	295,575,442
Year	2014	292,477,875
Year	2015	297,780,469
Year	2016	294,060,081
Year	2017	300,419,682
Year	2018	296,541,108
Year	2019	292,787,420
Year	2020	299,273,979
Quarter	2021Q1	74,135,277
Month	2021Q104	24,939,498
Day	2021Q10501	820,805
Day	2021Q10502	826,885
Day	2021Q10503	821,043
Day-DirectQuery	2021Q10504-DQ	271,110
Total		3,063,898,887

Archived: Import

Incremental refresh: Import

Real time: DirectQuery

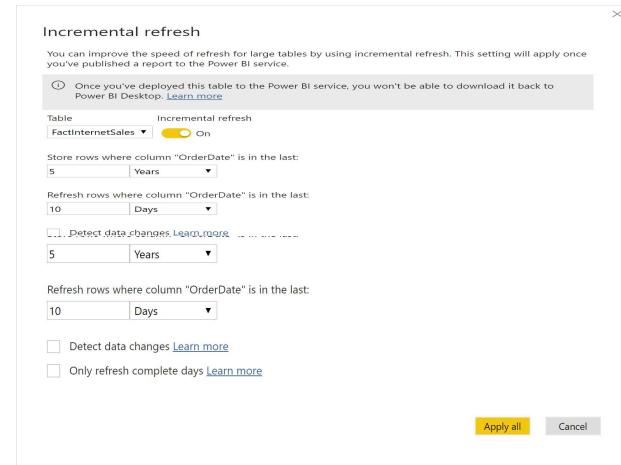
Enabling Incremental Refresh

Users can enable incremental refresh on large datasets to refresh only part of the dataset.

Requirements

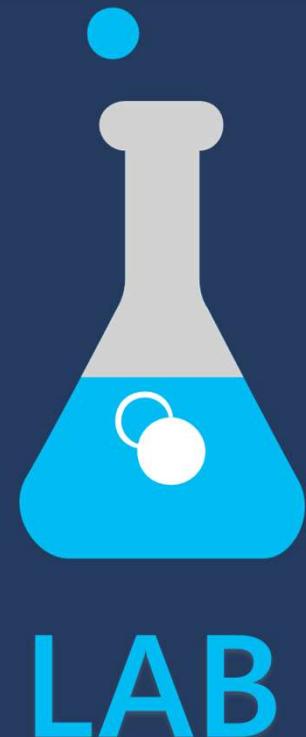
- Query Folding support to the data source
- Two Date/Time Parameters defined in the Power Query – RangeStart and RangeEnd
- Table with Date Fields filtered on the above parameters

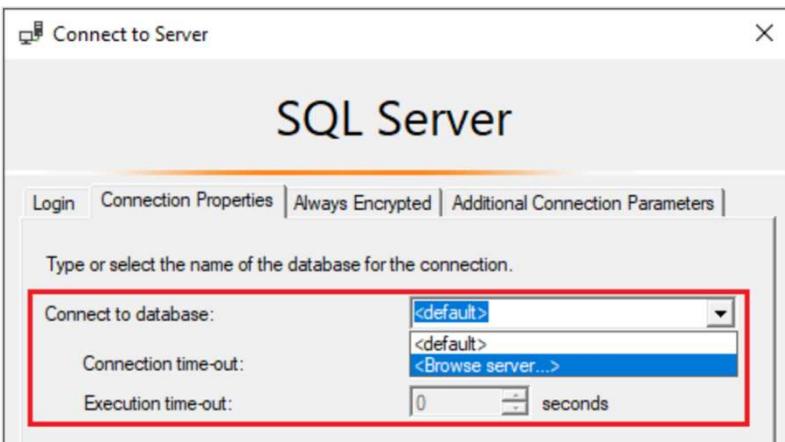
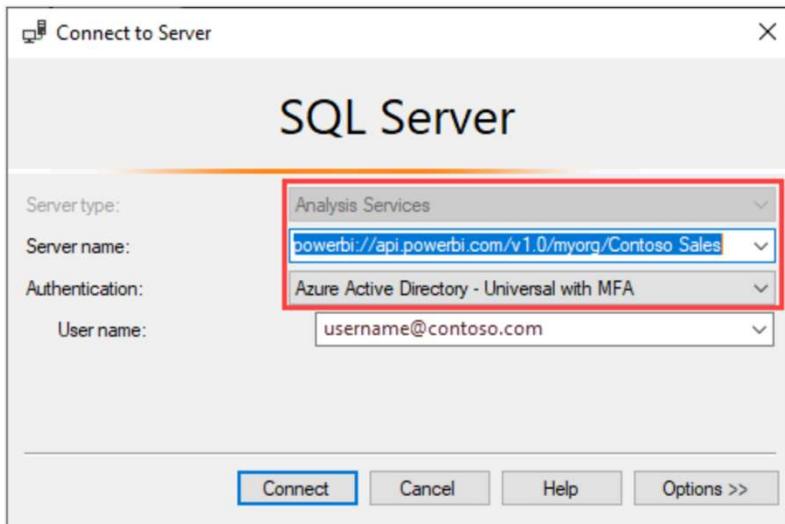
With XMLA R/W it is possible to customize your refreshes selectively and can integrate with appropriate tools.



Connect XMLA endpoint for Power BI Dataset

Connect Dataset using SSMS





\$SYSTEM.TMSCHEMA_ROLES
\$SYSTEM.TMSCHEMA_ROLE_MEMBERSHIPS
\$SYSTEM.TMSCHEMA_TABLES
\$SYSTEM.TMSCHEMA_TABLE_PERMISSIONS

ID	ModelID	Name	Description	ModelPermission	ModifiedTime
205	1	2 JpKo		2	7/5/2023 5:56:0...
206	1	2 SE ASIA RU		2	7/5/2023 5:56:0...
207	1	2 Taiwan RU		2	7/5/2023 5:56:0...
208	1	2 US OEM		2	7/5/2023 5:56:0...
209	1	3 Americas - Central US LaTAM		2	7/5/2023 5:57:0...
210	1	3 Americas - LATAM		2	7/5/2023 5:56:0...
211	1	3 Americas - Eastern US Canada		2	7/5/2023 5:57:0...
212	1	3 Americas - WEST US CANADA		2	7/5/2023 5:57:1...
213	1	3 CHINA - Central N China		2	7/5/2023 5:57:2...
214	1	3 CHINA - China Automotive		2	7/5/2023 5:56:0...
215	1	3 CHINA - China Dongguan		2	7/5/2023 5:56:0...
216	1	3 CHINA - China Suzhou		2	7/5/2023 5:56:0...
217	1	3 CHINA - South China		2	7/5/2023 5:56:0...
218	1	3 EMEA - CENTRAL EUROPE		2	7/5/2023 5:56:0...

ID	RoleID	MemberName	MemberID	IdentityProvider	MemberType	ModifiedTime
1092	199	YAGEO\China	S-1-5-21-17459...	1	7/5/2023 5:56:0...	
6493	264	YAGEO\Hanson...	S-1-5-21-17459...	1	7/5/2023 6:23:4...	

Sharing in Power BI - Overview



Adhoc Sharing

- *Active Sharing – using share option on reports/dashboards*



Collaborative Sharing

- *Using app workspaces with multiple roles*
- *Shared Datasets*



Distribution

- *Apps*
- *Shared Datasets*



Embedding

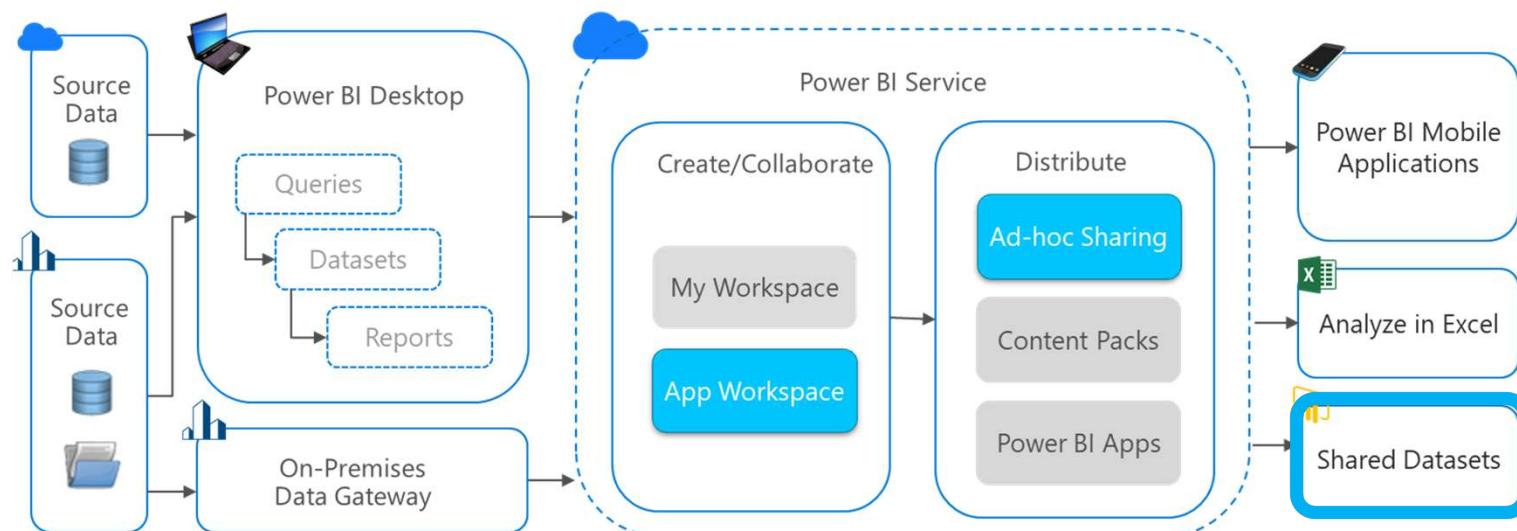
- *Used to publish Power BI reports into the custom business apps*



Sharing Strategies in Power BI

Sharing/Distribution to Self Service Teams (Small)

Teams which need more customization and analytical capabilities.



Collaboration – Roles in App Workspaces

金卡

銀卡

棕卡

Administrator

- Can change and delete workspaces
- Add Admins
- Everything a Member can do

Member

- “Reshare” – add new users to be Members or lower permissions
- Publish and update Apps
- Everything a Contributor can do

Contributor

- Add/edit/delete content within the workspaces
- Everything a viewer can do

Viewer

- View content within the workspace

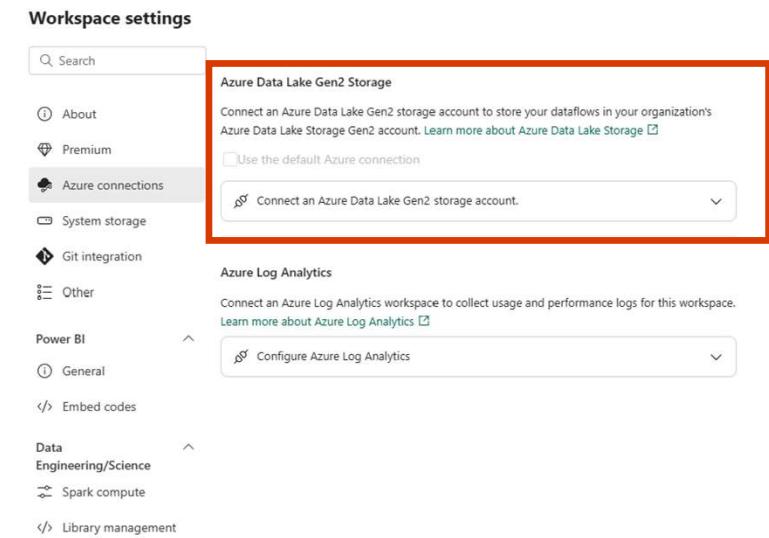
Workspace Settings - Azure Data Lake Gen 2 Integration

Dataflows

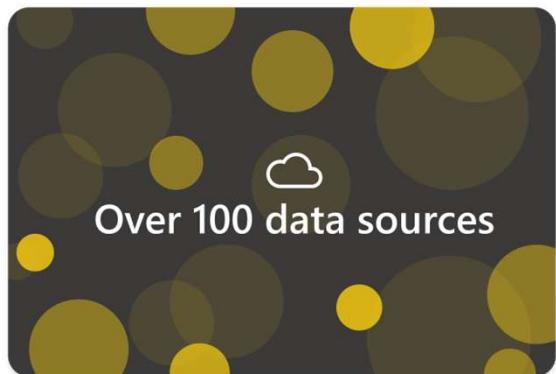
Data used with Power BI is stored in internal storage provided by Power BI by default.

With the integration of dataflows and Azure Data Lake Storage Gen 2 (ADLS Gen2), dataflows can be stored in organization's Azure Data Lake Storage Gen2 account.

Allows "bring your own storage" to Power BI dataflows and establish a connection at the tenant or workspace level.



Collaboration - Shared Datasets



►

 **Power BI shared datasets**

Single source of truth • Unified governance

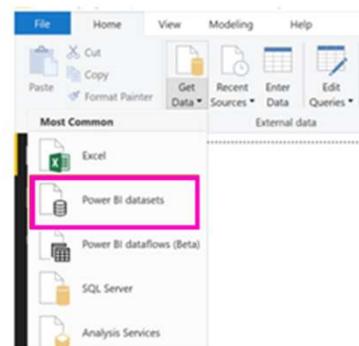
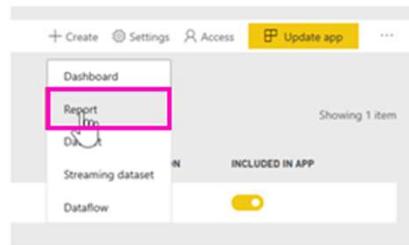
 Dataset catalog  Usage analytics

 Certification  Lineage tracking

- Everyone can explore and reuse
- Use any tool you want
- Create 360° dashboards from your data

Shared Dataset - Discovery

- Easily **search** for datasets from the get data experiences in Power BI Desktop and Service.
- All datasets available to the user are shown in one comprehensive and consistent experience.



Select a dataset to create a report

Search: All Datasets

NAME	ENDORSEMENT	OWNER	WORKSPACE	LAST REFRESHED
Export Visual Data usage	Promoted	Christian	Demo Shared datasets	a month ago
2018SU08 Blog Demo		Christian	Demo Shared datasets	a month ago
30kreport		Joe	Amir - Power BI Dataflows d...	8 days ago
90 Day Performance		Power BI		a year ago
AppOnlyComments		Robert	Power BI service analytics	4 months ago
AS analysis		Christian	Shared Datasets bug bash	3 months ago
ASLive		Robert	v-roru@microsoft.com	now

Analyze in Excel Create Close

The dialog box is titled 'Select a dataset to create a report'. It contains a search bar and a dropdown menu set to 'All Datasets'. The main area is a table listing datasets with columns for Name, Endorsement, Owner, Workspace, and Last Refreshed. The 'Promoted' endorsement is highlighted with a blue box. The 'Create' button is located at the bottom right of the dialog.

Shared Dataset - Endorsements

Help your colleagues find trustworthy datasets by endorsements.

Shared datasets can be endorsed – **Promoted** and **Certified**.

Power BI admin can control who can certify datasets in their organization

Business units can promote dataset they maintain, enabling users to quickly find high quality datasets.

The screenshot shows the Power BI Datasets page. At the top, there are navigation links: Dashboards, Reports, Workbooks, and Datasets. The 'Datasets' link is underlined, indicating it's the active page. Below the navigation, there's a table with columns: NAME (sorted by name), ENDORSEMENT, and ACTIONS. The first dataset row is blurred. The second dataset, 'BirthTrends', is shown with a blue 'Promoted' badge in the ENDORSEMENT column. In the ACTIONS column for 'BirthTrends', there's a 'Settings' button, which is highlighted with a pink box and has a pink arrow pointing to the 'Promoted' section of the endorsement dialog. Other actions like Rename, Delete, and Copy are also visible.

The screenshot shows the 'Endorsement' dialog for the 'BirthTrends' dataset. At the top, it says 'Endorsement' and 'Help your colleagues find, learn about, and connect to your dataset.' There are two options: 'Default' and 'Promoted'. The 'Promoted' option is selected and highlighted with a pink box. It includes the sub-instruction 'Promote this dataset with a badge to show it's ready to be used by others.' Below these are sections for 'Certified' (which is not selected) and 'Description' (which contains the text 'Birth trends sample data.' and shows '1,975 characters left'). At the bottom are 'Apply' and 'Discard' buttons.

Shared Dataset – Share a Dataset

The screenshot shows the Microsoft Power BI dataset sharing interface. On the left, a sidebar menu includes icons for Home, Favorites, Recent, Datasets, Reports, Dashboards, and Help. The main area displays a list of datasets under 'Recommended datasets' and 'All' datasets.

Recommended datasets:

- IT Spend Analysis (Owner: Debra Berger)
- Opportunity Analysis (Owner: Debra Berger)
- IT Spend Analysis Sample (Owner: Adele Vance)

All datasets:

Name	Endorsement	Owner	Workplace
IT Spend Analysis	<input type="button" value="Share"/> Promoted	Debra Berger	IT Analytics
Opportunity Analysis	<input type="button" value="Share"/> Promoted	Debra Berger	IT Analytics
IT Spend Analysis Sample	<input type="button" value="Share"/> Promoted	Adele Vance	Company Level

A context menu is open over the 'IT Spend Analysis Sample' dataset, showing options: Analyze in Excel, Create report, Create paginated report, Settings, Manage permissions, Chat in Teams, View lineage, and Share. The 'Share' option is highlighted with a red box.

Share dialog:

Send link
Artificial Intelligence Sa...

Who would you like the link to work for? [Learn more](#)

- People in your organization
- People with existing access
- Specific people** (selected)

Allow recipients to share this report
Allow recipients to build content with the data associated with this report

Share dataset
Artificial Intelligence Sa...

Enter a name or email address

Allow recipients to share this dataset
Allow recipients to build content with the data associated with this dataset
Send an email notification

Add a message (optional)

Grant access Cancel

Shared Dataset – Share a Report Link

The screenshot shows the Microsoft Power BI interface. On the left, the navigation pane includes options like Home, Create, Browse, OneLake data hub, Apps, Metrics, Monitoring hub, Workspaces, My workspace, and Artificial Intelligence. The main area displays two reports: 'Close % by Product category' (a bar chart) and 'Revenue Won by Product' (a bar chart). A 'Share' button in the top navigation bar is highlighted with a pink box. A modal window titled 'Send link' is open, asking 'Who would you like the link to work for?'. The 'Specific people' option is selected. Below it, there are settings for sharing: 'Allow recipients to share this report' (checked) and 'Allow recipients to build content with the data associated with this report' (unchecked). At the bottom of the modal are 'Apply' and 'Cancel' buttons. In the background, another report titled 'Influence on Opportunity Win/Loss Ratio' is visible, showing a scatter plot with a dashed regression line.

Shared Dataset – Manage Permission

The screenshot shows the Power BI Datasets interface. On the left is a vertical navigation bar with icons for Home, Favorites, Recent, Datasets, Dashboards, Reports, and Help. The main area displays recommended datasets: "IT Spend Analysis" (Promoted), "IT Spend Analysis Sample" (Promoted), and "Opportunity Analysis" (Promoted). Below these are sections for "All datasets", "Recent", and "My datasets". Under "My datasets", there are two entries: "IT Spend Analysis Sample" (Owner: Adele Vance) and "IT Spend Analysis" (Owner: Debra Berger). A context menu is open over the "IT Spend Analysis Sample" entry, with the "Manage permissions" option highlighted by a red box. Another context menu is open over the "IT Spend Analysis" entry, also with the "Manage permissions" option highlighted by a red box.

Explore the datasets in your org to find the data that suits your needs. [Learn more](#)

Select a dataset to view its details, find related reports, and use the data. [What's a dataset?](#)

Recommended datasets

IT Spend Analysis
Promoted

IT Spend Analysis Sample
Promoted

Opportunity Analysis
Promoted

All Recent My datasets

Name Owner Workspace Refreshed

Name	Owner	Workspace	Refreshed
IT Spend Analysis Sample	Adele Vance	Company Level	7/17/21, 6:34:28 PM
IT Spend Analysis	Debra Berger	IT Analysis	7/17/21, 5:58:37 PM

Analyze in Excel
Create report
Create paginated report
Settings
Manage permissions
Chat in Teams

Analyze in Excel
Create report
Create paginated report
Settings
Manage permissions
Chat in Teams
View lineage

Shared Dataset – Dataset Permission & Workspace Role

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Permission	Description
Read	<p>走走</p> <p>Allows user to access reports and other solutions, such as composite models on Premium/PPU workspaces, that read data from the dataset.</p> <p>Allows user to view dataset settings.</p>
Build	<p>吃早餐</p> <p>Allows user to build new content from the dataset, as well as find content that uses the dataset.</p> <p>Allows user to access reports that access composite models on Power BI Pro workspaces.</p> <p>Allows user to build composite models.</p> <p>Allows user to pull the data into Analyze in Excel.</p> <p>Allows querying using external APIs such as XMLA.</p>
Reshare	<p>帶人</p> <p>Allows user to grant dataset access.</p>
Write	<p>完設施</p> <p>Allows user to republish the dataset.</p> <p>Allows user to backup and restore the dataset.</p> <p>Allows user to make changes to the dataset via XMLA.</p> <p>Allows user to edit dataset settings, except data refresh, credentials, and automatic aggregations.</p>
Owner	<p>更多福利</p> <p>The dataset owner is not a permission per se, but rather a conceptual role that has all the permissions on a dataset. The first dataset owner is the person who created the dataset, and afterwards the last person to configure the dataset after taking it over in the dataset settings.</p> <p>The dataset owner can do all of the things mentioned in the permissions above, as well as configure dataset refresh, credentials, and automatic aggregations.</p>

	Admin	Member	Contributor	Viewer
Read	✓	✓	✓	✓
Build	✓	✓	✓	✗
Reshare	✓	✓	✗	✗
Write	✓	✓	✓	✗

建立新的dataset based on 現在的dataset

Shared Dataset – Manage Permission

Links [Add user](#)

[Direct access](#) (highlighted)

People and groups with access	Email Address	Permissions
System Administrator	Admin@M365x643180.OnMicrosoft.com	Workspace Admin, Owner
Debra Berger	DebraB@M365x643180.OnMicrosoft.com	Workspace Member, Owner
Adele Vance	AdeleV@M365x643180.OnMicrosoft.com	Workspace Contributor, Reshare
Lynne Robbins	LynneR@M365x643180.OnMicrosoft.com	Workspace Contributor
Diego Siciliani	DiegoS@M365x643180.OnMicrosoft.com	Owner
Entire organization		Read, Build

[... \(highlighted\)](#)

[Remove reshare](#)
[Remove build](#)
[Remove write](#)
[Remove access](#)

[+ Add user](#)

[Links](#) [Direct access](#) (highlighted)

People and groups with access	Email Address	Permissions
System Administrator	Admin@M365x643180.OnMicrosoft.com	Workspace Admin, Owner
Debra Berger	DebraB@M365x643180.OnMicrosoft.com	Workspace Member, Owner
Adele Vance	AdeleV@M365x643180.OnMicrosoft.com	Workspace Contributor, Reshare
Lynne Robbins	LynneR@M365x643180.OnMicrosoft.com	Workspace Contributor
Diego Siciliani	DiegoS@M365x643180.OnMicrosoft.com	Owner
Entire organization		Read, Build

Grant people access X

Enter a name or email address

Allow recipients to modify this dataset

Allow recipients to share this dataset

Allow recipients to build content with the data associated with this dataset

Send an email notification

Add a message (optional)

[Grant access](#) [Cancel](#)

Shared Dataset – Managing Permission

Grant people access

X

ⓘ People with direct access can view this dataset and use the data associated with it, regardless of its sensitivity label.

Enter a name or email address

Allow recipients to modify this dataset

Allow recipients to share this dataset

Allow recipients to build content with the data associated with this dataset

Send an email notification

Add a message (optional)

**Read, Reshare, Build ,Write ➔ All
Permission granted**

Grant access

Cancel

Grant people access

X

ⓘ People with direct access can view this dataset and use the data associated with it, regardless of its sensitivity label.

Enter a name or email address

Allow recipients to modify this dataset

Allow recipients to share this dataset

Allow recipients to build content with the data associated with this dataset

Send an email notification

Add a message (optional)

Read, Reshare, Build

Grant access

Cancel

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How to Add Build Permission for a specific

棕卡

- Users that have at least a Contributor role in a workspace

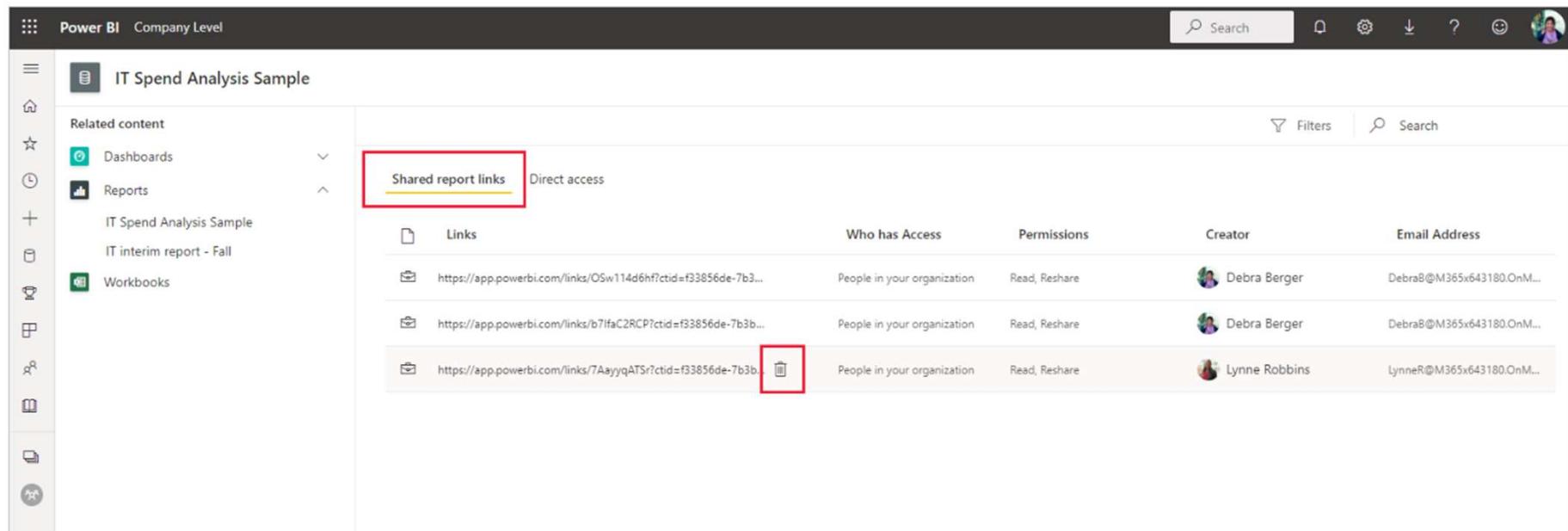
金卡

- Dataset owners can assign Build permission to specific users on the **Manage permissions**
- App publishing that users with permission for the app also get Build permission for the underlying datasets.

帶人

- Reshare and Build permission on a dataset, and you share a report or dashboard you built on that dataset

Manage links generated for report sharing



The screenshot shows the Power BI interface for a "Company Level" workspace. On the left, there's a sidebar with various icons and a list of "Related content" including "Dashboards", "Reports" (with "IT Spend Analysis Sample" and "IT interim report - Fall" listed), and "Workbooks". The main area displays a table titled "Shared report links" under the "IT Spend Analysis Sample" report. The table has columns for "Links", "Who has Access", "Permissions", "Creator", and "Email Address". Three rows of data are shown, each with a red box around the "Links" column and another red box around the delete icon in the "Actions" column. The first row is created by Debra Berger, the second by Lynne Robbins, and the third by Debra Berger.

Links	Who has Access	Permissions	Creator	Email Address
https://app.powerbi.com/links/OSw114d6hf?ctid=f33856de-7b3...	People in your organization	Read, Reshare	Debra Berger	DebraB@M365x643180.OnM...
https://app.powerbi.com/links/b71faC2RCP?ctid=f33856de-7b3b...	People in your organization	Read, Reshare	Debra Berger	DebraB@M365x643180.OnM...
https://app.powerbi.com/links/7AayyqATSr?ctid=f33856de-7b3b...	People in your organization	Read, Reshare	Lynne Robbins	LynneR@M365x643180.OnM...

Distribution - Centralized Datasets

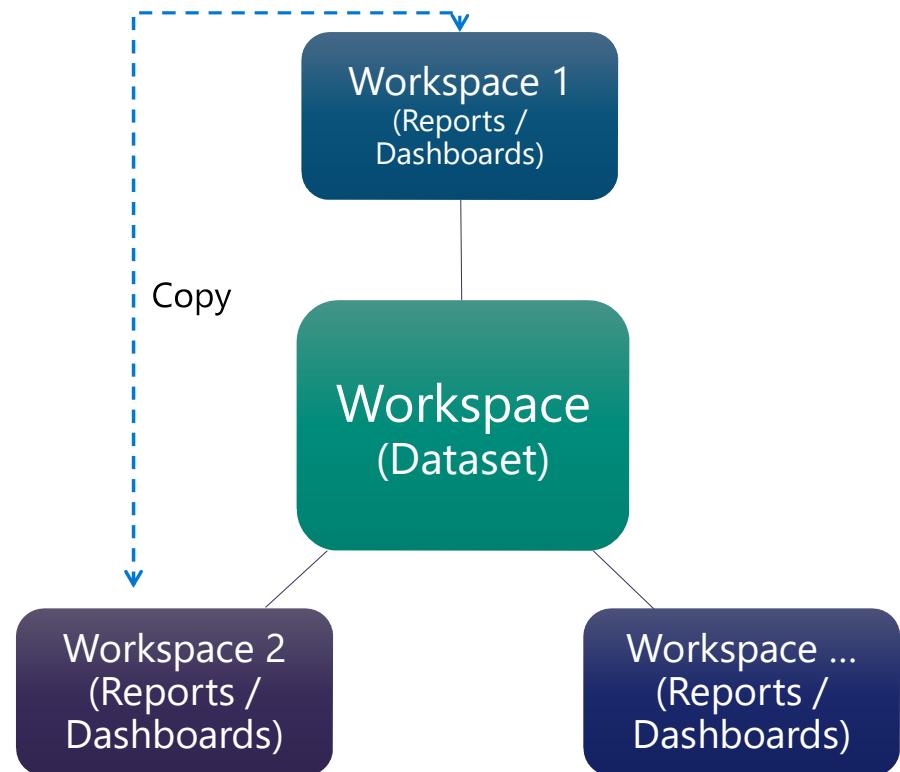


Reuse the same shared dataset across many workspaces and apps.

Save/copy reports to any workspace.

Access datasets through XMLA endpoints

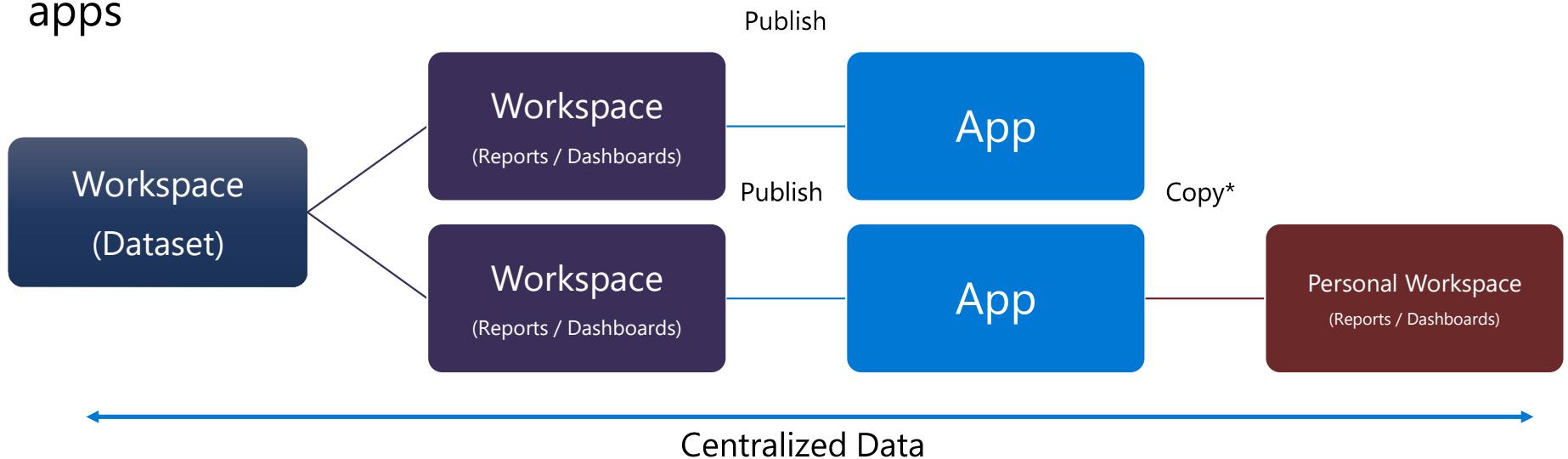
Premium workspaces can be used to provide consumption access to the free users.





Distribution – Personalization of Centralized Datasets

- Reuse the same dataset with many apps and allow personalization of app reports.
- Users would need permissions on the source datasets when shared through apps





Distribution – Personalization of Reports

Save a copy of app report allows users to personalize content to meet their unique needs

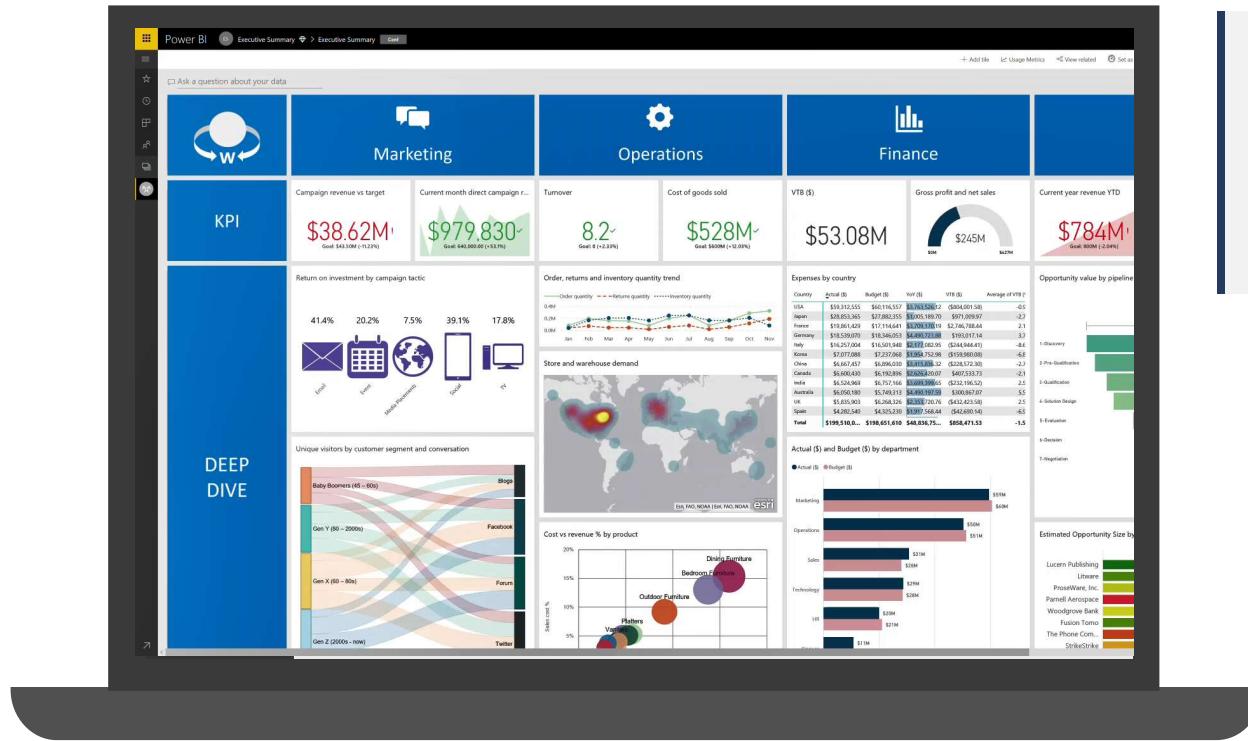
Steps

- App Author enables during app publishing or update
- User can Save the report while viewing a report in the app
- Reports will be saved to the user's My Workspace

The image consists of two screenshots. The top screenshot shows the 'Access' tab of a Power BI workspace named 'New WSv2 Demo 1'. It highlights three checked permissions: 'Allow users to build new content from the underlying datasets', 'Allow users to make a copy of app reports', and 'Allow users to install app automatically'. The bottom screenshot shows a Power BI report titled 'Customer Profitability Sample' in a workspace. A context menu is open over the chart, with the 'Save as' option highlighted by a pink rectangle. The menu also includes 'Print', 'Embed', 'Export to PowerPoint', and 'Export to PDF'.

Power BI Apps

- Distribute to all users

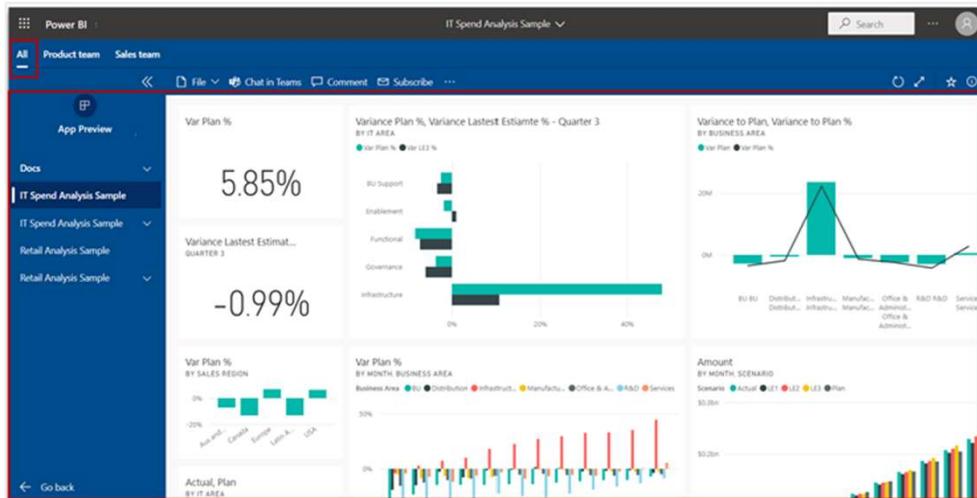


Package reports, dashboards and distribute to specific groups and users with Power BI Premium

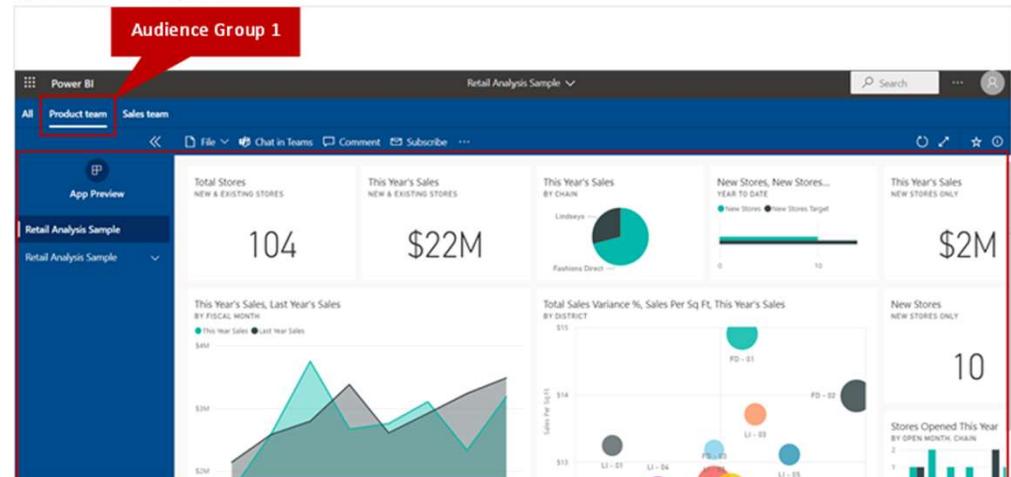
*Applicable for enterprise premium capacities but not premium users

Power BI Apps

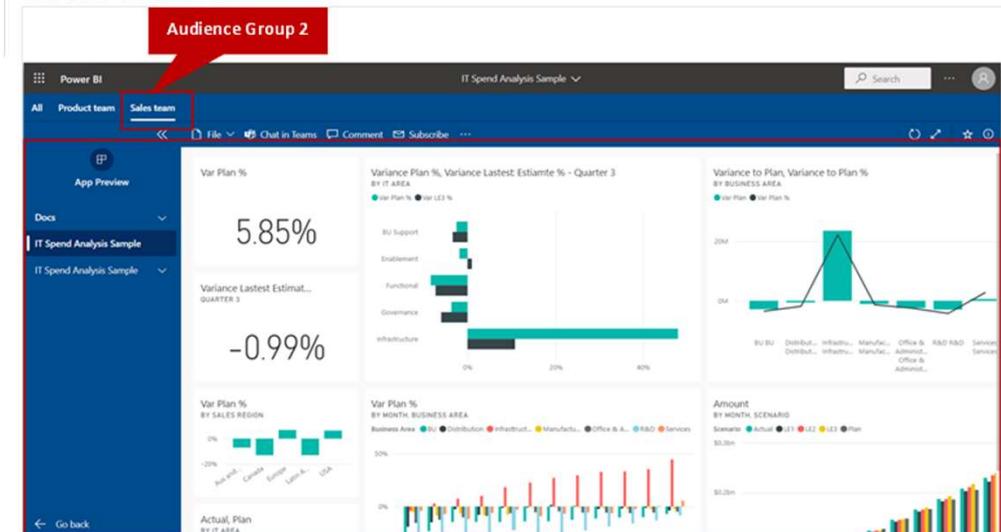
合併的 [所有檢視]



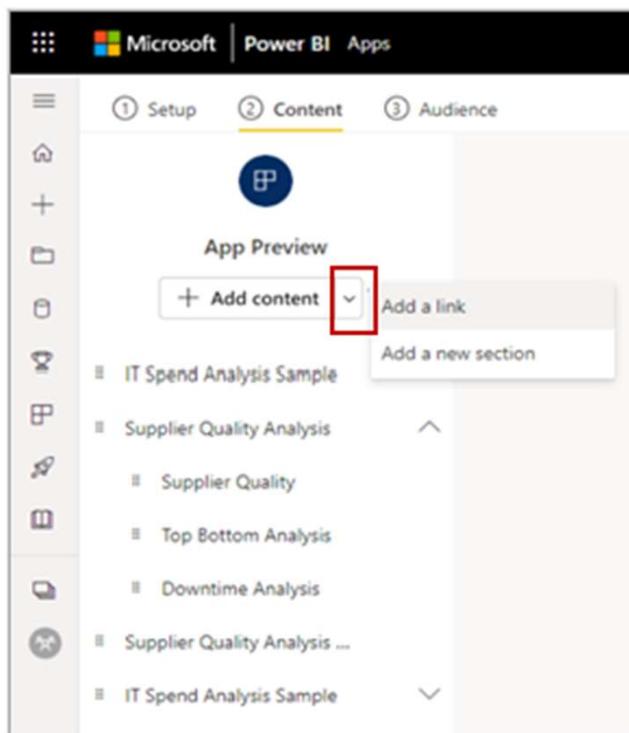
物件群組一，產品小組



物件群組二：銷售小組



Power BI Apps – Add New Links



Securely embed this report in a website or portal

Here's a link you can use to embed this content.

<https://msit.powerbi.com/reportEmbed?reportId=1a433eed-3b19-46ba-a9b2-fa22d02da23>

HTML you can paste into a website

```
<iframe title="Lab-Aggregation Table" width="1140" height="541.25" src="https://msit.powerbi.com/reportEmbed?reportId=1a433eed-3b19-46ba-a9b2-fa22d02da23"></iframe>
```

Explore more embedding options in our Power BI embedded analytics playground

[Close](#)



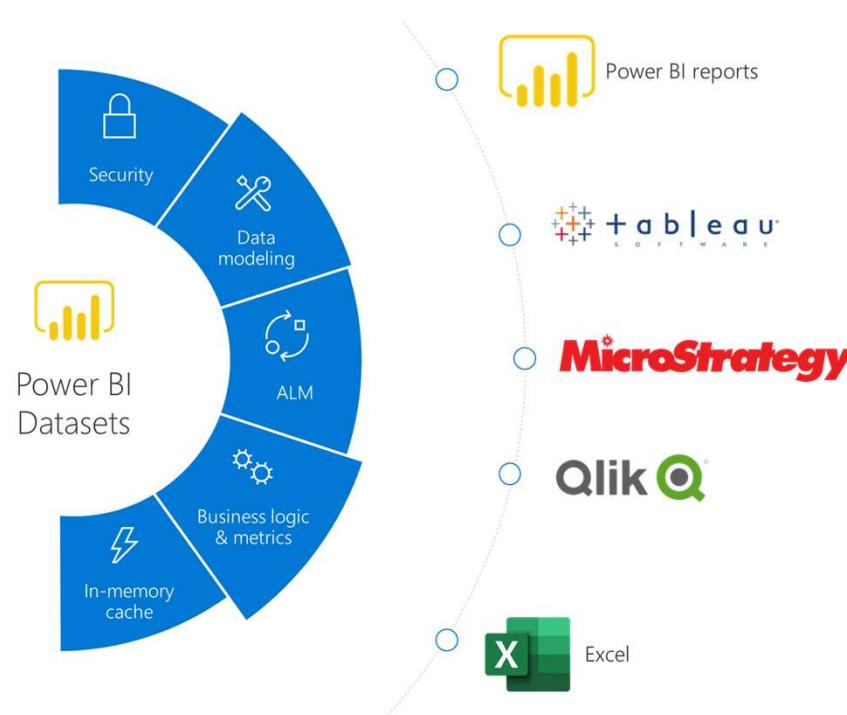
Cross Distribution - XMLA End Points

Helps building solutions with Power BI datasets

Enables Single source of truth

Value of semantic model available across 1st and 3rd party tools

Single consistent XML/A endpoint that is an industry standard



Shared Datasets – Best Practices

Use a centralized workspace for official datasets

- Only allow the required users to be members/admins/contributors
- Certify and promote datasets to enable others
- Remove duplicate copies of the dataset

Create multiple apps for different audiences

- Copy the required reports into multiple workspaces
- Customize them as required
- Publish the apps to distinct users sets, but brand them similarly

Licensing for consumption

 Can view
 Cannot view

Capacity	Content	Pro User	Free User	Notes
Shared	Workspace			
Shared	Shared Report/Dashboard			
Shared	App			
Shared	Embedded Report/Dashboard			
Shared	Dataset			
Premium	Workspace			Free users can ONLY have Viewer role
Premium	Shared Report/Dashboard			P SKU
Premium	App			P SKU
Premium	Embedded Report/Dashboard			EM or P SKU
Premium	Dataset			

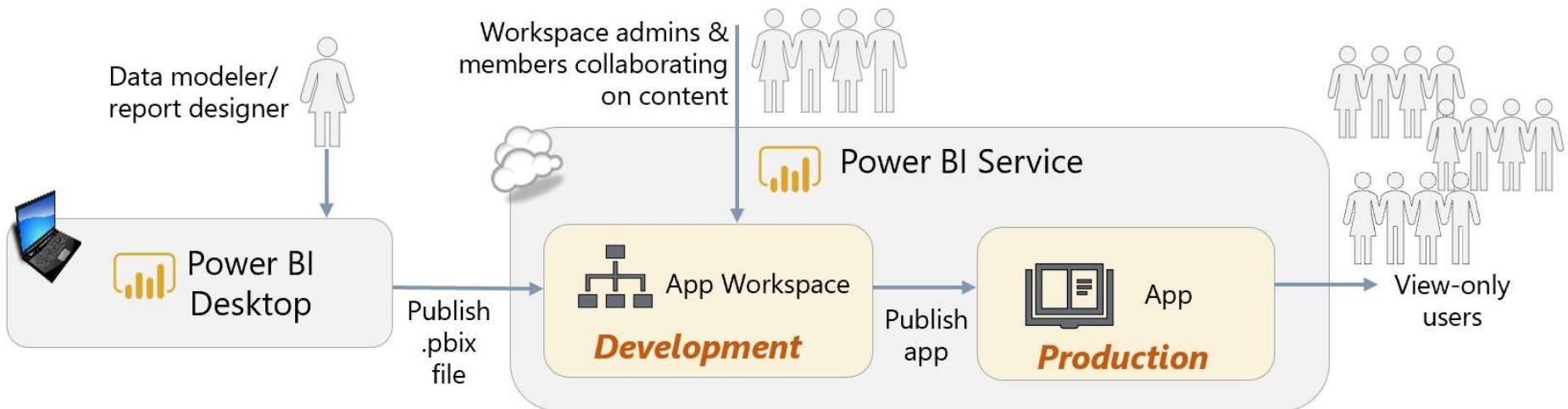
Licensing for shared datasets

 Can view
 Cannot view

Capability	Pro User	Free User		Notes
		Shared	Premium	
Consume content built on the dataset				Both the Content workspace & Dataset workspace need to be in Premium
Connect Power BI Desktop using Power BI Service dataset				
Connect 3 rd Party tools using XMLA endpoint				
Copy report to another workspace				
Save a copy of an app report				

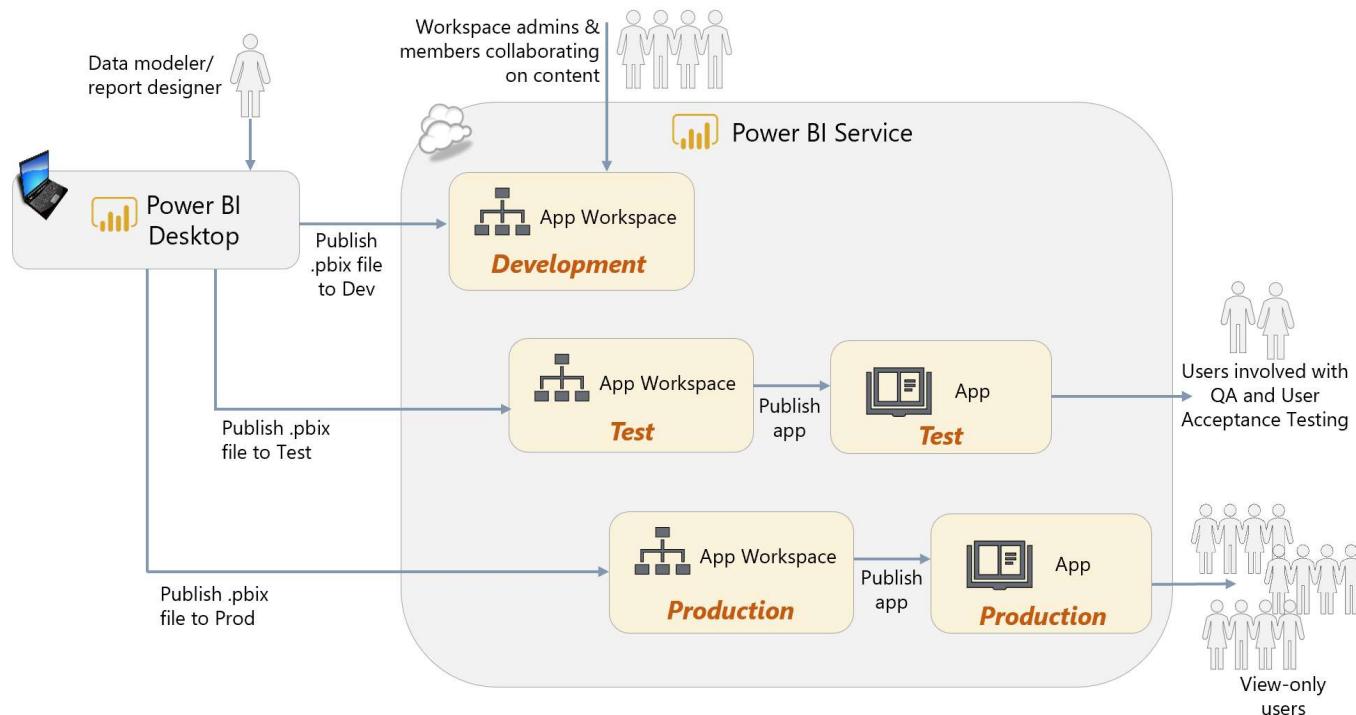
Application Life Cycle Management

Scenario 1: Using Workspace as Dev and App as Prod.



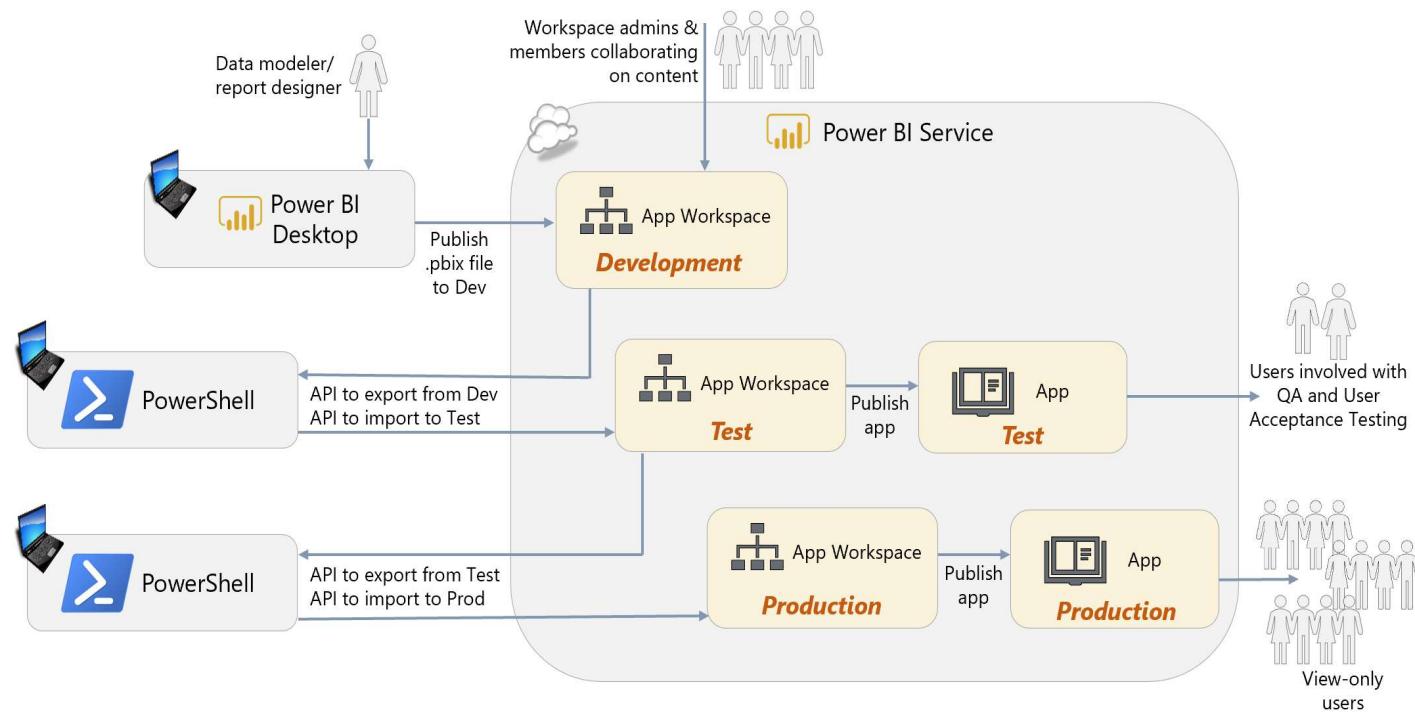
Application Life Cycle Management

Scenario 2: Different Workspaces / Apps for Dev/Test/Prod. (Manual)



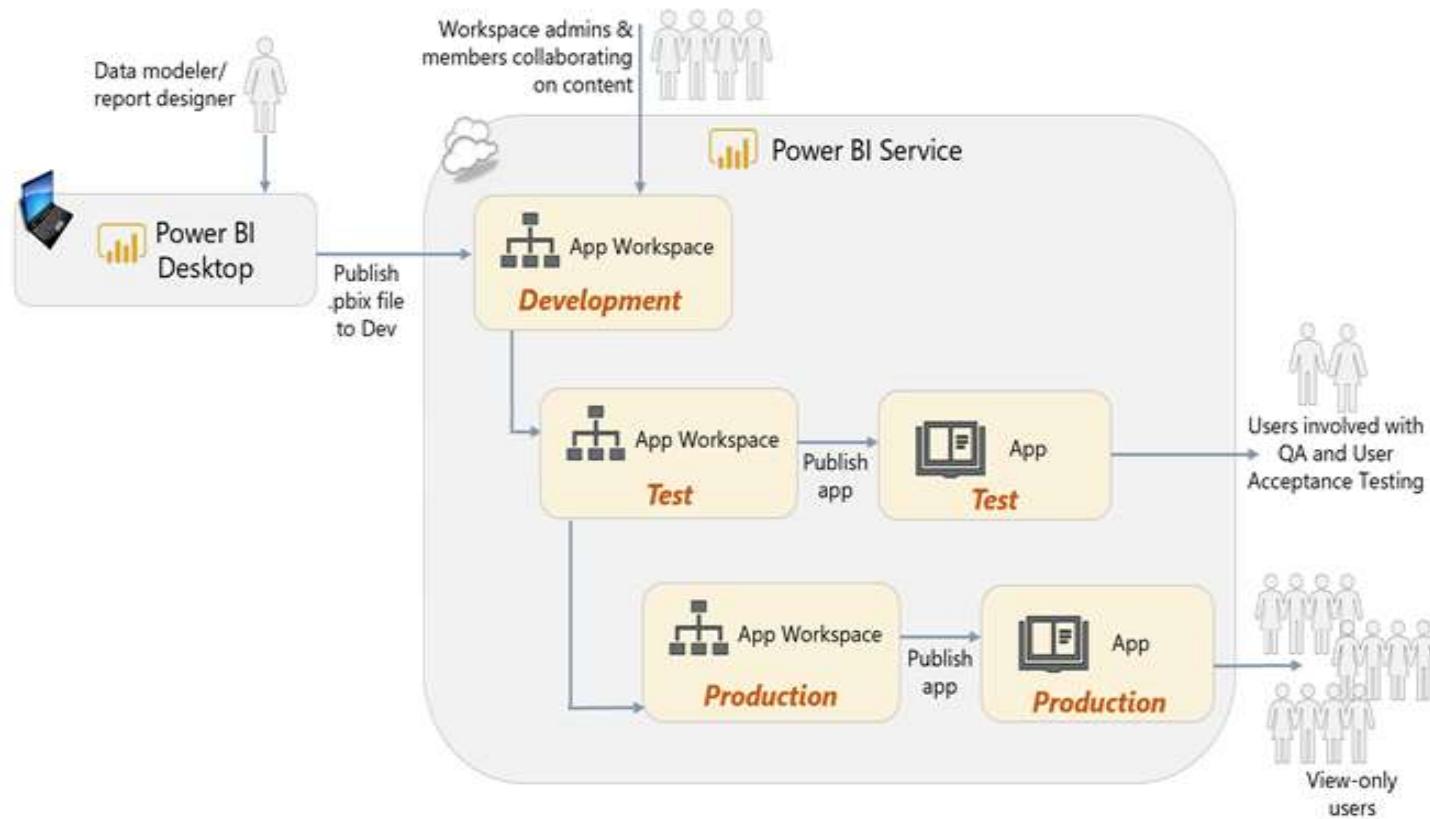
Application Life Cycle Management

Scenario 3: Different Workspaces / Apps for Dev/Test/Prod. (Custom Automation)



Application Life Cycle Management

Scenario 4: Different Workspaces / Apps for Dev/Test/Prod. (OOTB Automation through Deployment Pipelines)



Deployment Pipelines

The screenshot shows the Power BI Deployment pipelines (preview) interface. At the top, there's a navigation bar with icons for Home, Recent, My workspace, and Power BI Premium. The title is "Power BI Deployment pipelines (preview)" and the subtitle is "MyFoods full pipeline Full Production pipeline of MyFoods". The top right features a "New look on" toggle, a search bar, and various settings and help icons.

The main area displays three stages of the deployment pipeline:

- Development:** A workspace named "MyFoods.com" with 5 datasets, 5 reports, and 4 dashboards. It includes a "Deploy to test" button.
- Test:** A workspace named "MyFoods.com [Test]" with 4 datasets, 4 reports, and 3 dashboards. It includes a "Deploy to production" button.
- Production:** A workspace named "MyFoods.com [Produc...]" with 4 datasets, 4 reports, and 3 dashboards. It includes a "View app" and "Update app" button.

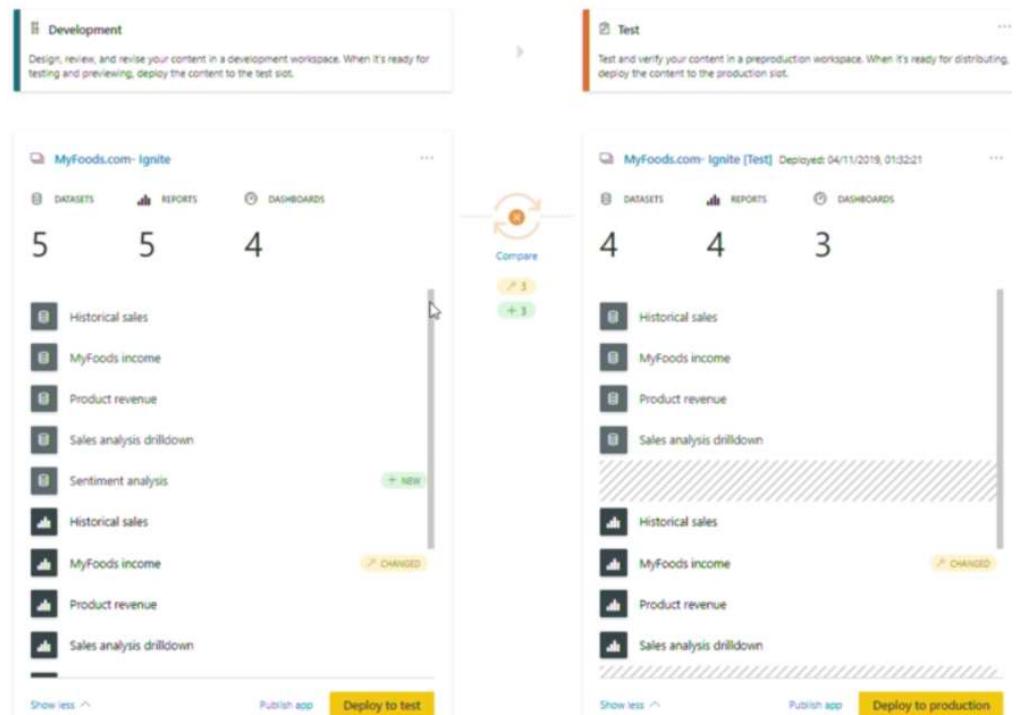
Between the Development and Test stages, there's a "Compare" button. Between the Test and Production stages, there's a green checkmark icon indicating the content has been tested and is ready for distribution. The overall interface is clean and modern, designed for managing multiple workspaces simultaneously.

Deployment Pipelines

Clone content from one stage in the pipeline to another

The connections between the copied items are kept during the copy process

Power BI will also apply configured deployment rules to the updated content in the target stage



Deployment Pipelines Automation

Leverage the deployment pipelines Power BI REST APIs to integrate Power BI into your organization's automation process

- Integrate Power BI into familiar DevOps tools like Azure DevOps or Github Actions
- Schedule pipeline deployments to happen automatically at a given time
- Deploy multiple pipelines at the same time
- Cascade depending pipeline deployments
 - If you have content that's connected across pipelines, you can make sure some pipelines are deployed before others

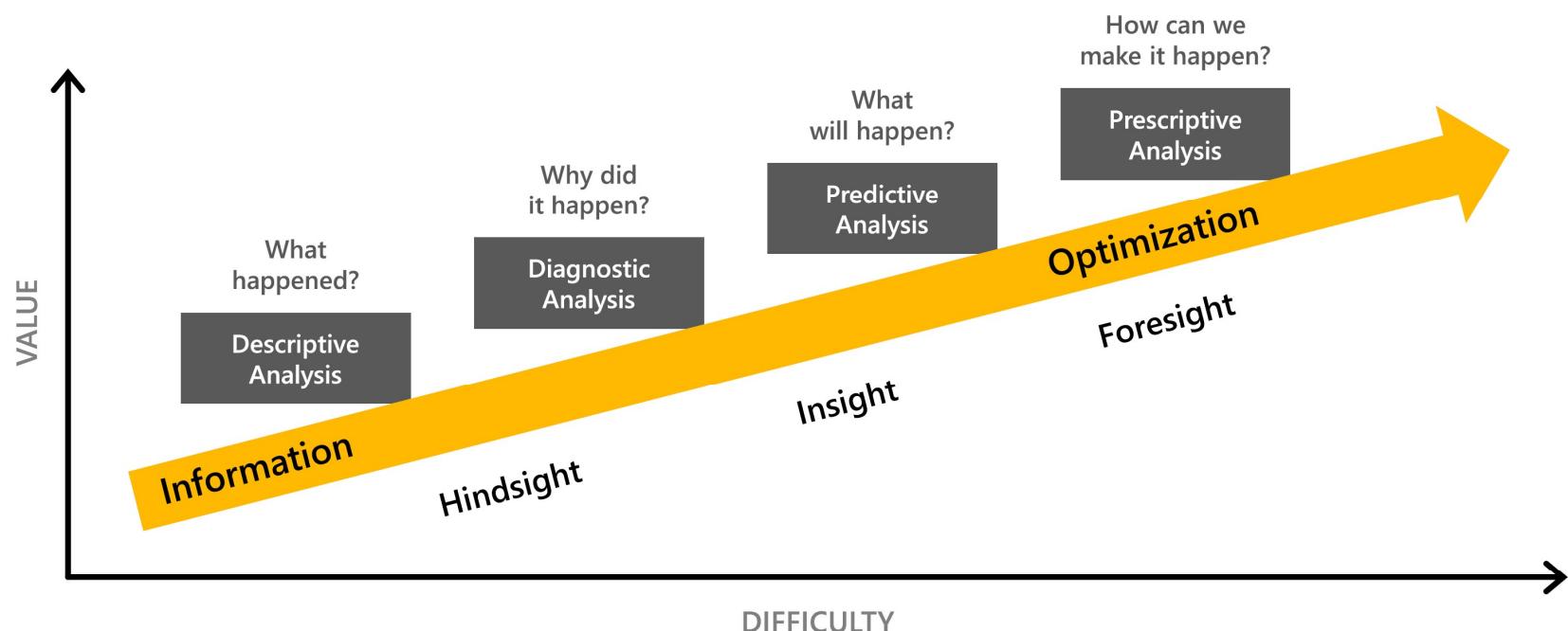
Demonstration

- Shared Datasets
- Deployment Pipelines
(preview)



Introduction to AI in Power BI

Evolution of Data Analytics



Gartner "IT Glossary_Predictive Analytics" <http://www.gartner.com/it-glossary/predictive-analysis>

Gartner®

Power BI AI Personas and Use cases



End Users

- Q&A
- Quick Insights
- Key Influencers, Decomposition Tree



Business Analysts

- In Built Visuals – Clustering, Forecasting
- Cognitive Services
- Automated ML



Data Scientists

- R / Python Integration
- Azure ML Integration

Q&A Visual – Answers to the Questions

Q&A Visual in Power BI Desktop for report authors

Consumer Experience in Power BI Service

- Report Consumers can use Q&A from Dashboards in Power BI Service
- Report Consumers can use Q&A visual from the report itself if the author has chosen to let the consumers ask questions in Desktop.

Q&A – Review Questions & Manage Terms

View list of Questions Asked by report consumers.

Displays unrecognized words in the questions.

Consists of 28 days of history.

Authors can define / manage the unrecognized terms in the same experience.

The screenshot displays two main sections of the Q&A interface:

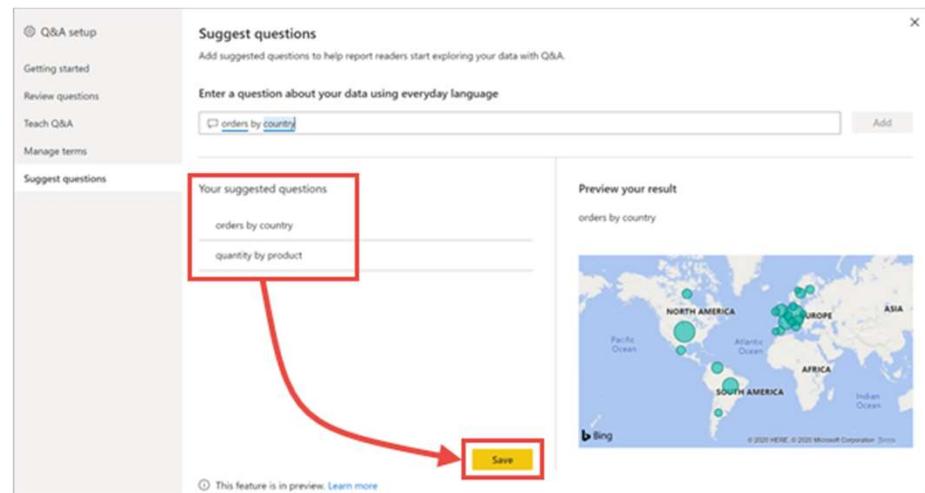
Review questions: This section shows a list of 17 questions from the "QNA Test Workspace" dataset. The questions are listed in a table with columns for "Date asked", "Fix requested", and "Fix needed". Many of the questions contain unrecognized words underlined in red, such as "awesomme games", "producer", and "genre".

Date asked	Fix requested	Fix needed
Today	Requested	
10/2/2019		
10/2/2019		
10/2/2019		
10/2/2019		
10/2/2019		
10/2/2019		
10/2/2019		
10/2/2019		
10/2/2019		
10/2/2019		
10/2/2019		
10/2/2019		
10/2/2019		
10/2/2019		

Teach Q&A: This section allows users to teach Q&A new terms. It includes a text input field for entering a question, a list of unrecognized terms, and a preview of the results. In this example, the user has entered "show total revenue for publisher" and defined "Revenue" as referring to "global sales".

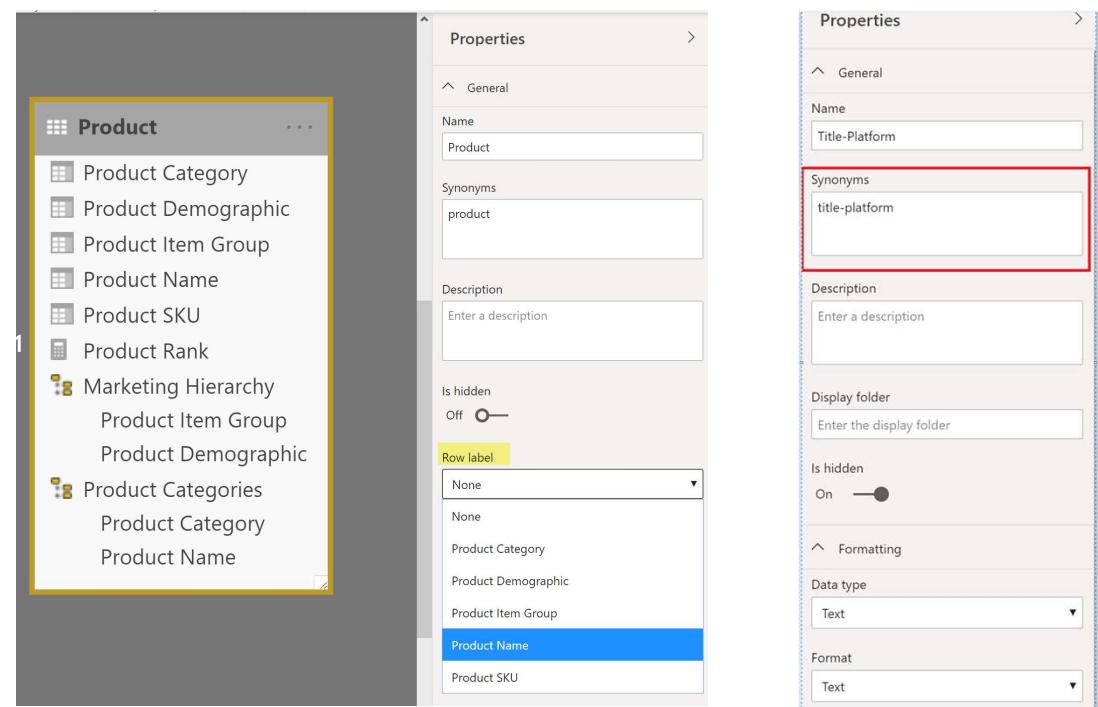
Q&A – Suggested Questions

Power BI desktop allows the Author to create their own suggested questions so that the end user can simply select from the predefined questions instead of typing it.

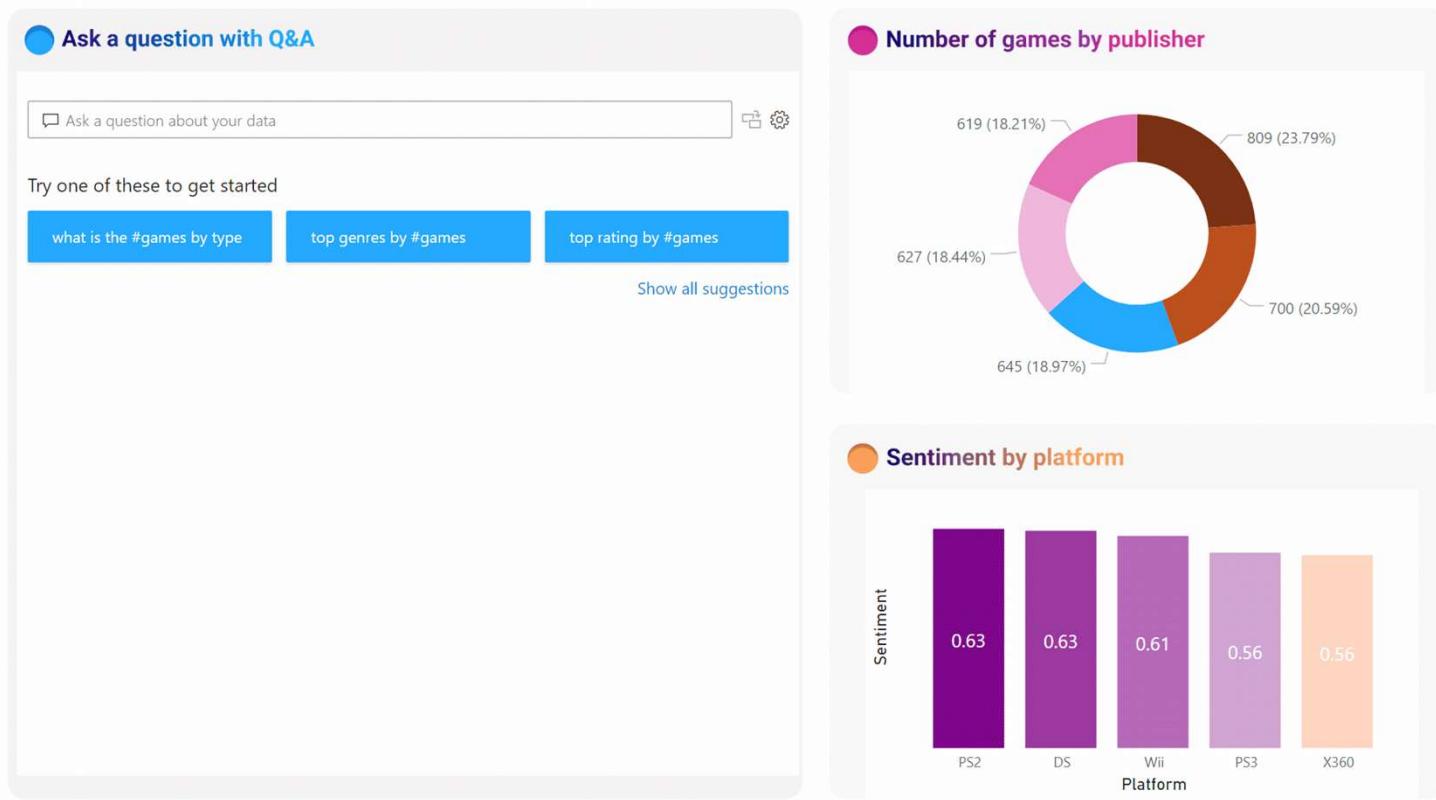


Q&A –Synonyms

- Power BI desktop can suggest Questions based on the model with ability for the author to change the suggestions.
- Report Author can define synonyms and row labels to ensure the Q&A returns the expected results.



Q&A Visual – In Action



Key Influencer Visual – Know what is influencing?

See which factors affect the metric being analyzed.

- For example: What influences employee turnover/churn?

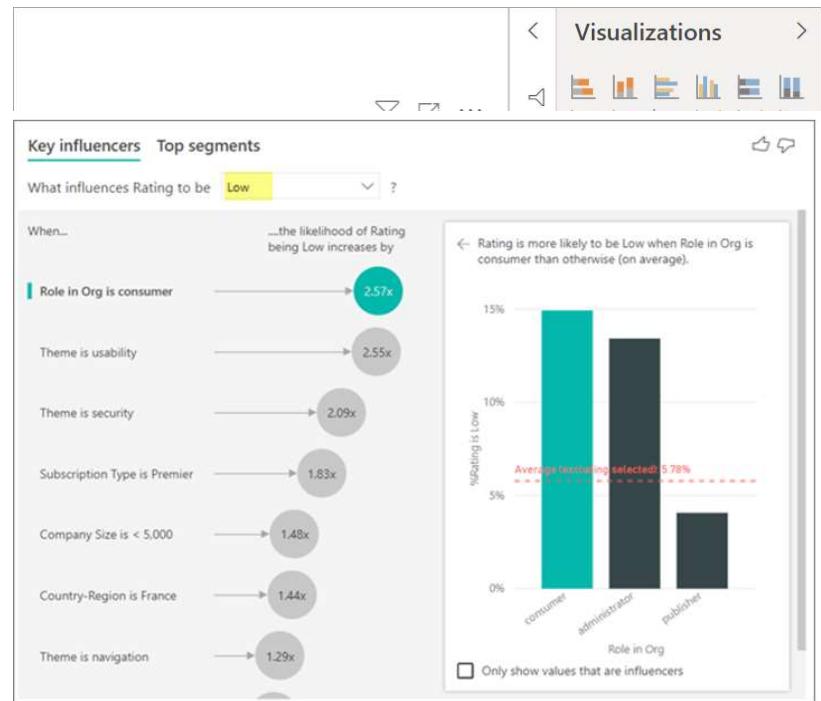
Contrast the relative importance of these factors.

- For example: Do short-term contracts have more impact on churn than long-term contracts?

Key Influencer Visual

Factors influencing the outcome are **ranked** and displayed as key influencers.

The visual also displays the average line to be able to see how a specific factor is influencing the value in question.

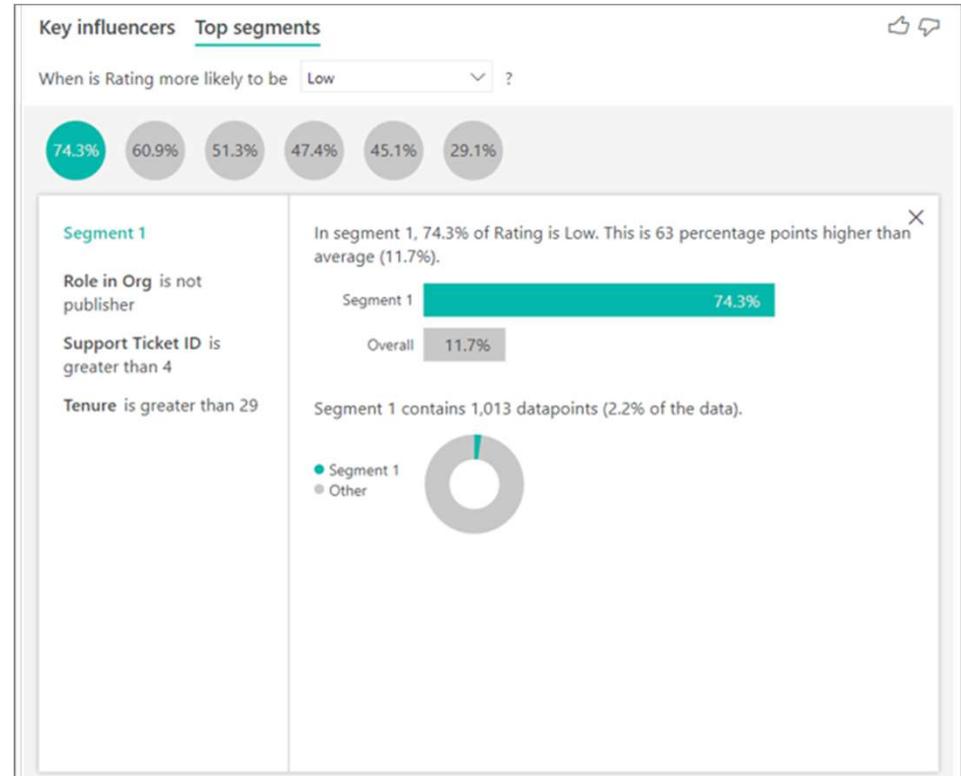


Key Influencer Visual – Top Segments

Analyze **combination of factors** affecting metric

Limitations

- Only Import Mode supported
- Publish to web not supported



Key Influencer Visual – In Action

The screenshot shows the Microsoft Power BI desktop interface. The ribbon at the top includes FILE, HOME, VIEW, MODELING, and HELP tabs. The HOME tab is selected, displaying various icons for data management, visualization creation, and publishing.

The main workspace displays a dashboard titled "GUEST ANALYTICS". The dashboard features two visualizations:

- A donut chart titled "COMMUNICATION TYPE" showing the distribution of communication methods: work phone, landline, and cellular.
- A bar chart titled "CUSTOMERS BY AGE" showing the number of customers across different age groups, with values ranging from 0K to 10K.

At the bottom of the dashboard, there are navigation tabs: PAGE 2 OF 2, Guest Reviews, Guest Analytics, and a plus sign icon.

The right side of the screen contains the "VISUALIZATIONS" and "FIELDS" panes. The VISUALIZATIONS pane lists various chart and report types. The FIELDS pane displays a hierarchical list of data fields categorized under "Customers", "Hotel Customer Co...", and "Image Classification". Fields include Age, Age Groups, Balance, Column18, Communication, Country, Days Since Last Purchase, Duration, Gender, Month, Number of Complaints, Number of Comments, Previous Campaign, Primary Interest, Purchased Sports Equipment, Rented Sports Equipment, Reservation Type, Trip Length, categories, Date, Guest Comment, Hotel Name, Index, latitude, longitude, No of comments, province, Sentiment Score, Title, and Image.

Decomposition Tree Visual – Who is contributing?



Visualize data across multiple dimensions.

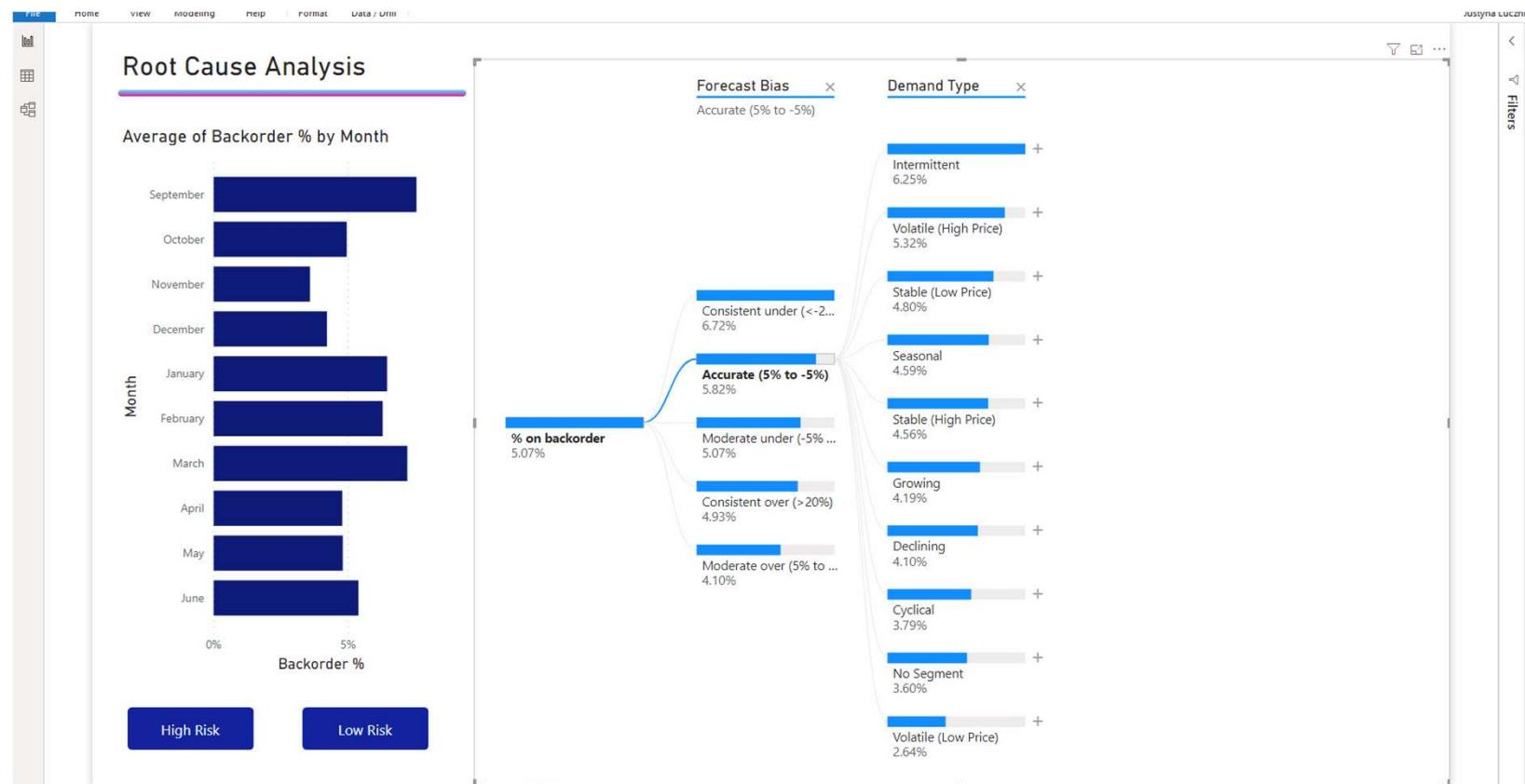


It automatically aggregates data and enables drilling down into your dimensions in any order.



It is also an artificial intelligence (AI) visualization, so you can ask it to find the next dimension to drill down into based on certain criteria. This makes it a valuable tool for ad hoc exploration and conducting root cause analysis.

Decomposition Tree Visual – In Action



Quick Insights for Report Authors

Quick Insights provide some of the internal details of the data that are hidden. These details include but not limited to:

- Explain the Increase or Decrease
- Find where the distribution is different

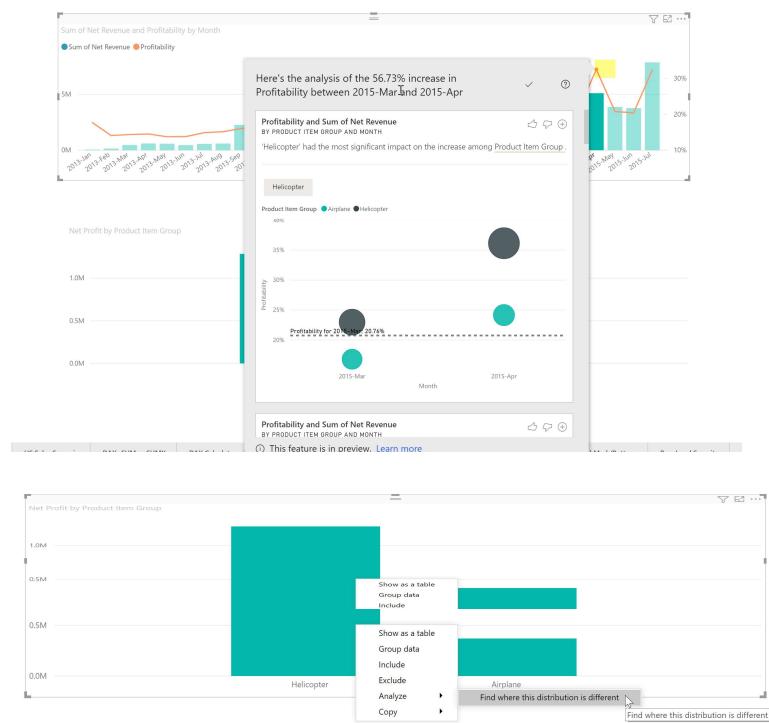
Quick Insights

Explain Increase / Decrease

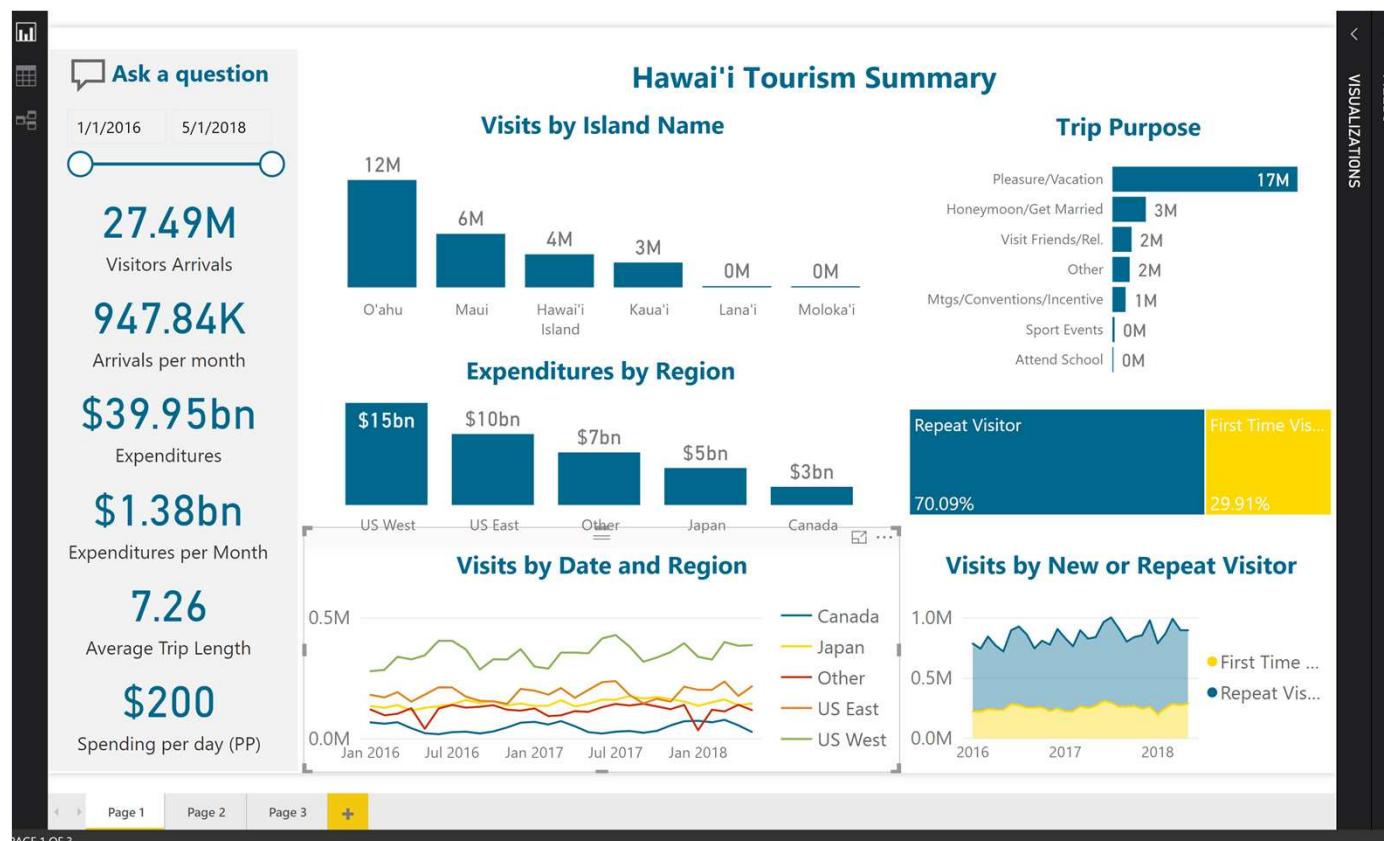
- In the existing visual you can right-click to understand why it is increased or decreased.

Difference In Distribution

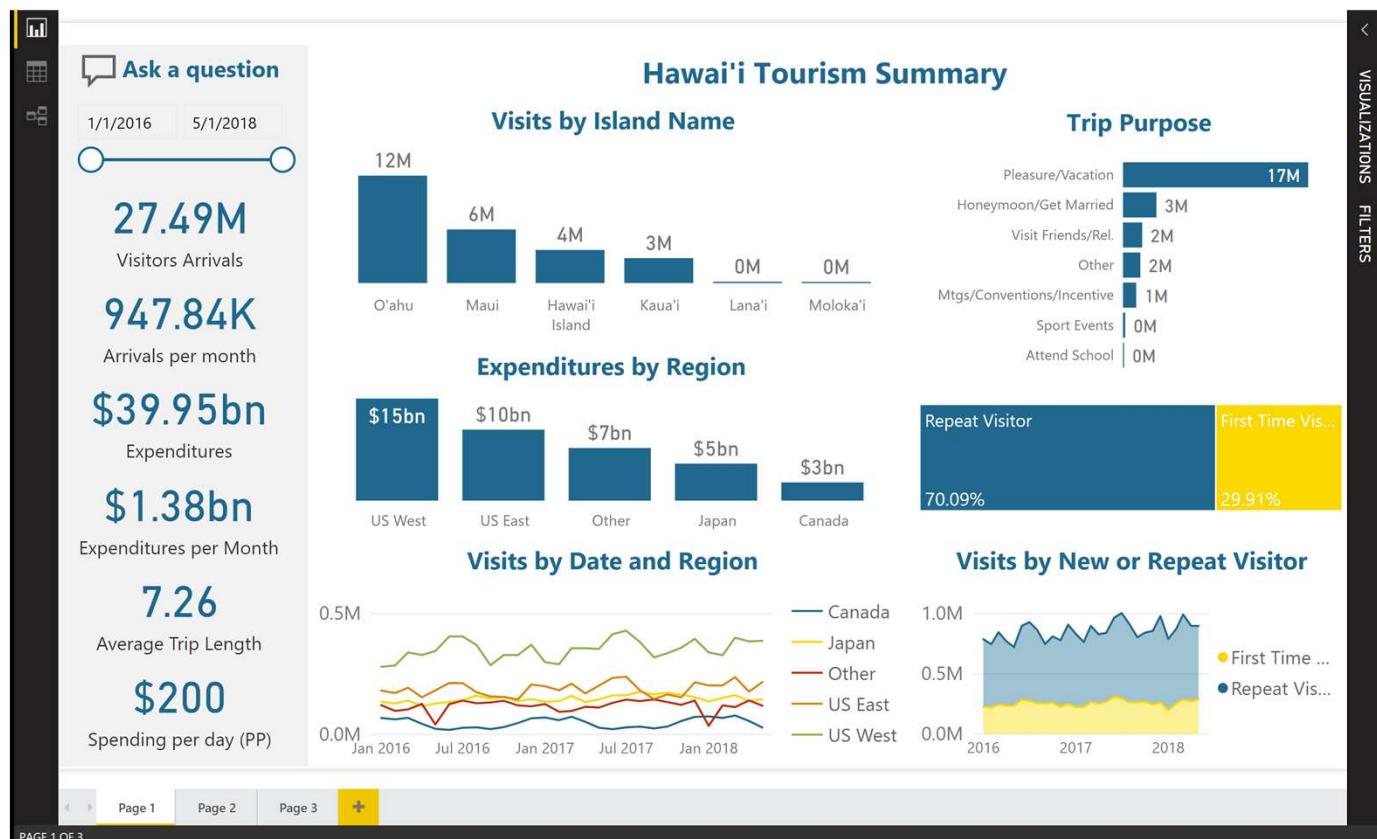
- You can also find differences in distribution.



Quick Insights – Explain Increase / Decrease – In Action



Quick Insights – Difference in Distribution – In Action



Quick Insights for Report Consumers

Quick Insights provide some specific insights on the data by running predetermined advanced algorithms. Some insights include:

- Majority
- Minority
- Time Series

Smart Narrative Visual - Key Takeaways

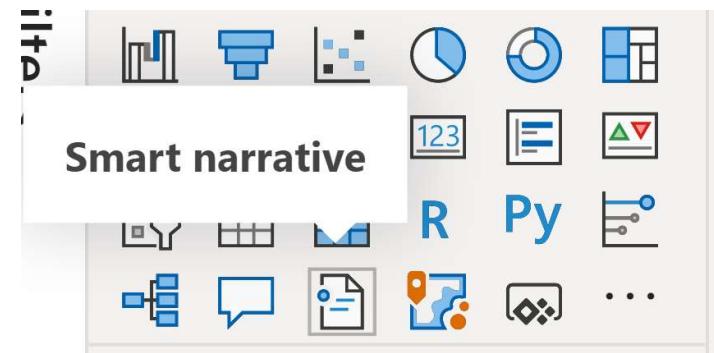
Descriptive insights that can be on

- all the visuals on the page
- specific visual

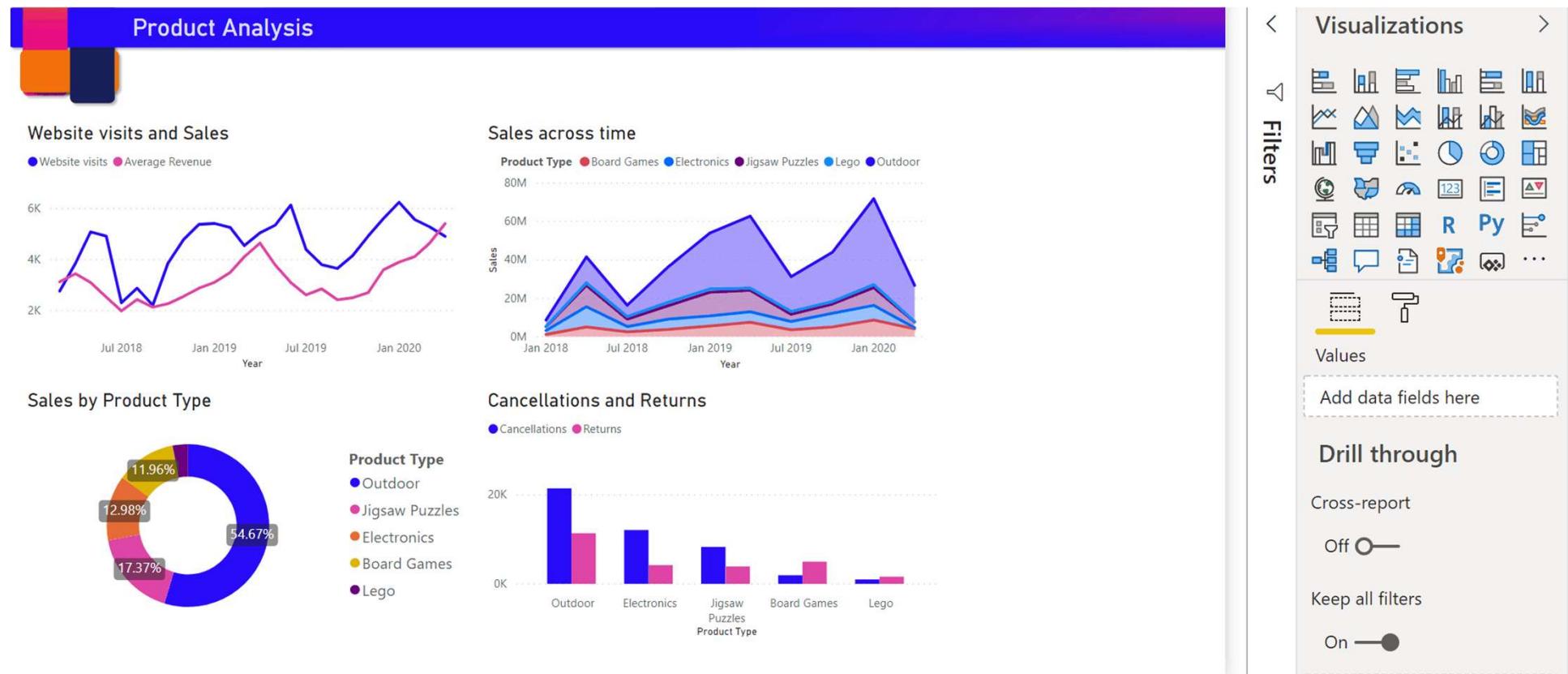
Text can be customized using the visual interface

Narratives updated with data refresh

Filtering is supported

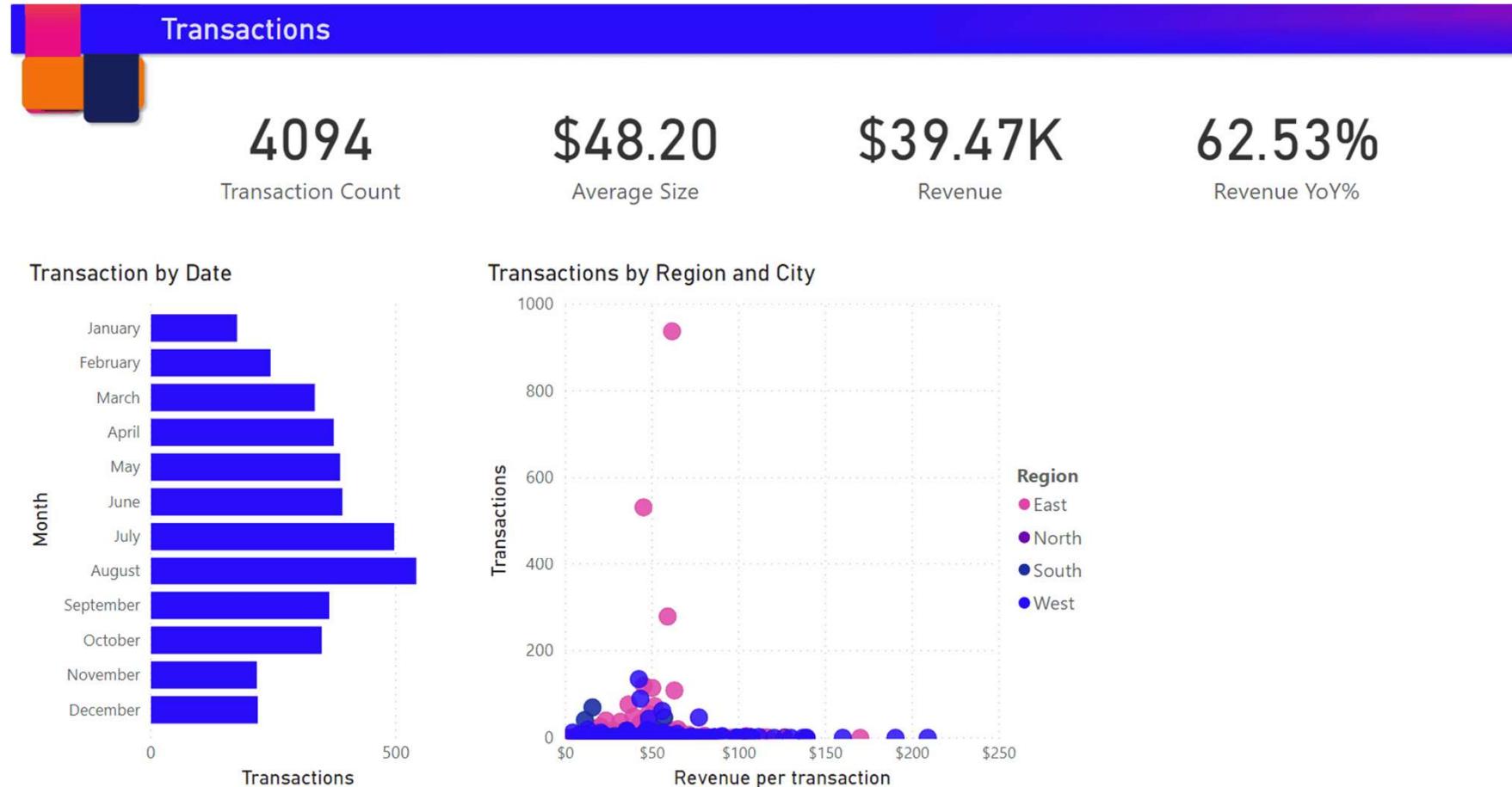


Smart Narrative Visual – based on all visuals on page



Smart Narrative Visual – based on specific visual

- right-click the visual and select '**summarize**'



Smart Narrative Visual – based on customizable Text

Product Analysis

Website visits

Segoe UI 12

A B U E E ⌂

+ Value Review

The chart displays two data series: Website_visits (blue line) and Average_Revenue (pink line). Both series show a general upward trend over the period. Website_visits starts around 3K in July 2018, peaks near 5K in January 2019, and ends around 5.5K in January 2020. Average_Revenue starts around 3K in July 2018, dips to 2K in January 2019, and then rises steadily to about 4.5K by January 2020.

Sales by Product Type

The donut chart illustrates the distribution of sales across five product categories. The largest share is Outdoor at 54.67%, followed by Jigsaw Puzzles at 17.37%, Electronics at 12.98%, Board Games at 11.96%, and Lego at 1.99%.

Product Type

- Outdoor
- Jigsaw Puzzles
- Electronics
- Board Games
- Lego

Cancellations and Returns

● Cancellations ● Returns

This bar chart compares the volume of cancellations (blue bars) and returns (pink bars) across different product types. For all categories except Lego, cancellations exceed returns. The highest divergence is seen in the Outdoor category, where cancellations are nearly double the returns.

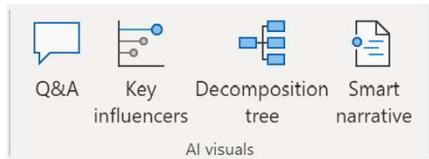
Product Type	Cancellations	Returns
Outdoor	~21K	~14K
Electronics	~15K	~5K
Jigsaw Puzzles	~8K	~5K
Board Games	~3K	~5K
Lego	~2K	~1K

Average_Revenue (72.81% increase) and Website_visits (77.33% increase) both trended up between March 2018 and April 2020.

Between March 2018 and April 2020, the average of Website_visits (4,554.08) was higher than Average_Revenue (3,214.52).

Average_Revenue experienced the longest period of decline (-1,684.96) between 3/1/2019 and 9/1/2019.

Outdoor accounted for 54.67% of Sales. Between January 2018 and April 2020, Outdoor had the largest increase in Sales (466.05%) while Electronics had the largest decrease (70.30%). Cancellations and Returns diverged the most when the Product Type was Outdoor, when Cancellations were 10079 higher than Returns.



End User AI Features

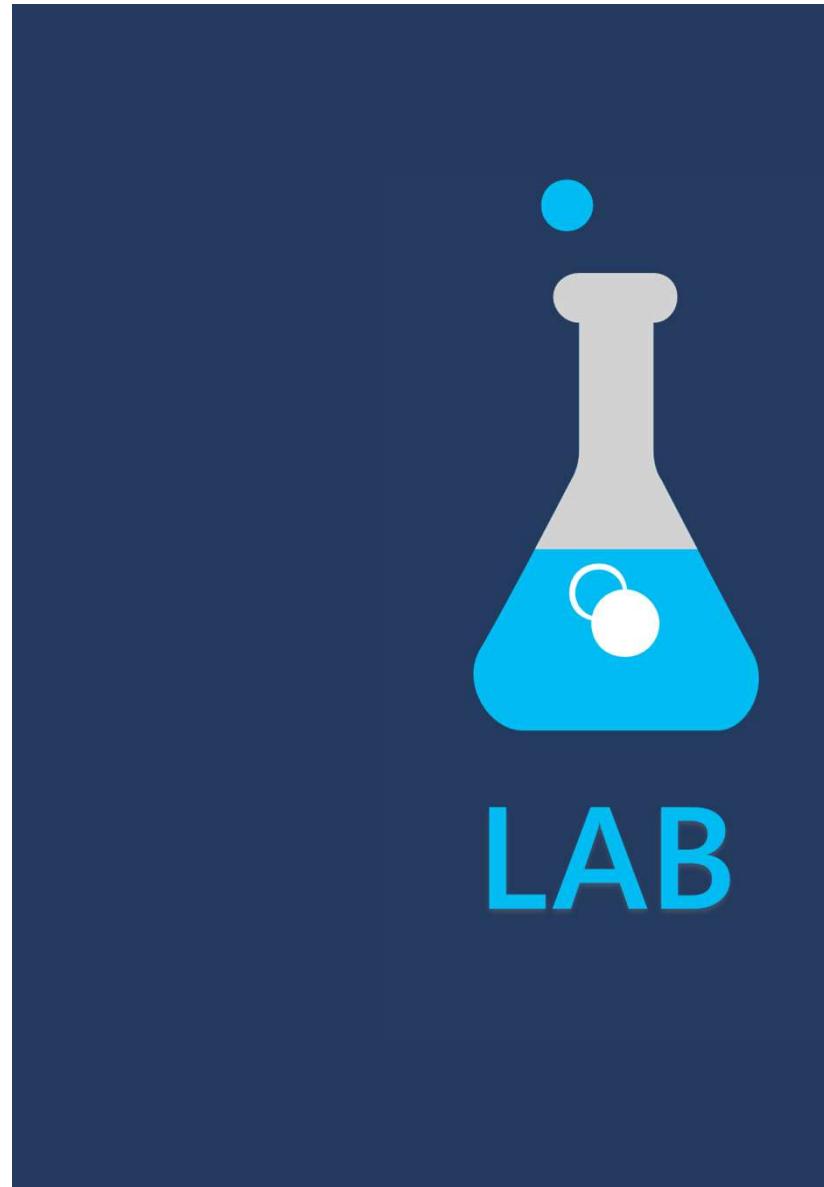
Ex 1: Q&A Visuals

Ex 2: Key Influencer Visuals

Ex 3: Decomposition Tree

Ex 4: Smart Narratives Visual

Dataset : customerfeedback.xlsx



Key Influencer Visuals

Lab-AI Visual - Power BI Desktop

File Home Insert Modeling View Optimize Help External tools Format Data / Drill

Cut Copy Format painter Paste Get data workbook OneLake data hub SQL Server Data Enter Data Refresh recent sources Transform data New visual Text box More visuals New measure Quick measure Calculations Sensitivity Sensitivity Publish Share

Rating Role in Org Count of Rating

Rating	Role in Org	Count of Rating
High	administrator	2516
Low	administrator	390
High	consumer	24919
Low	consumer	4373
High	publisher	12400
Low	publisher	530
Total		45218

Company Size

- < 5,000
- > 50,000
- 5,000 - 50,000

Key influencers Top segments

What influences Rating to be Low ?

When... ...the likelihood of Rating being Low increases by

- Support Ticket ID goes up 2.53 → 4.08x
- Tenure is more than 29 → 2.86x
- Role in Org is consumer → 2.57x
- Theme is usability → 2.55x
- Theme is security → 2.09x
- Subscription Type is Premier → 1.83x
- Company Size is < 5,000 → 1.46x
- Country-Region is France → 1.44x

Average: 3.63

Rating

On average when Support Ticket ID increases, the likelihood of Rating being Low increases.

Average of Support Ticket ID over Customer Table

Visualizations

Build visual

Filters

Analyze

Rating

Explain by

- Country-Region
- Support Ticket ID
- Role in Org
- Theme
- Tenure
- Company Size
- Subscription Type

Expand by

Add data fields here

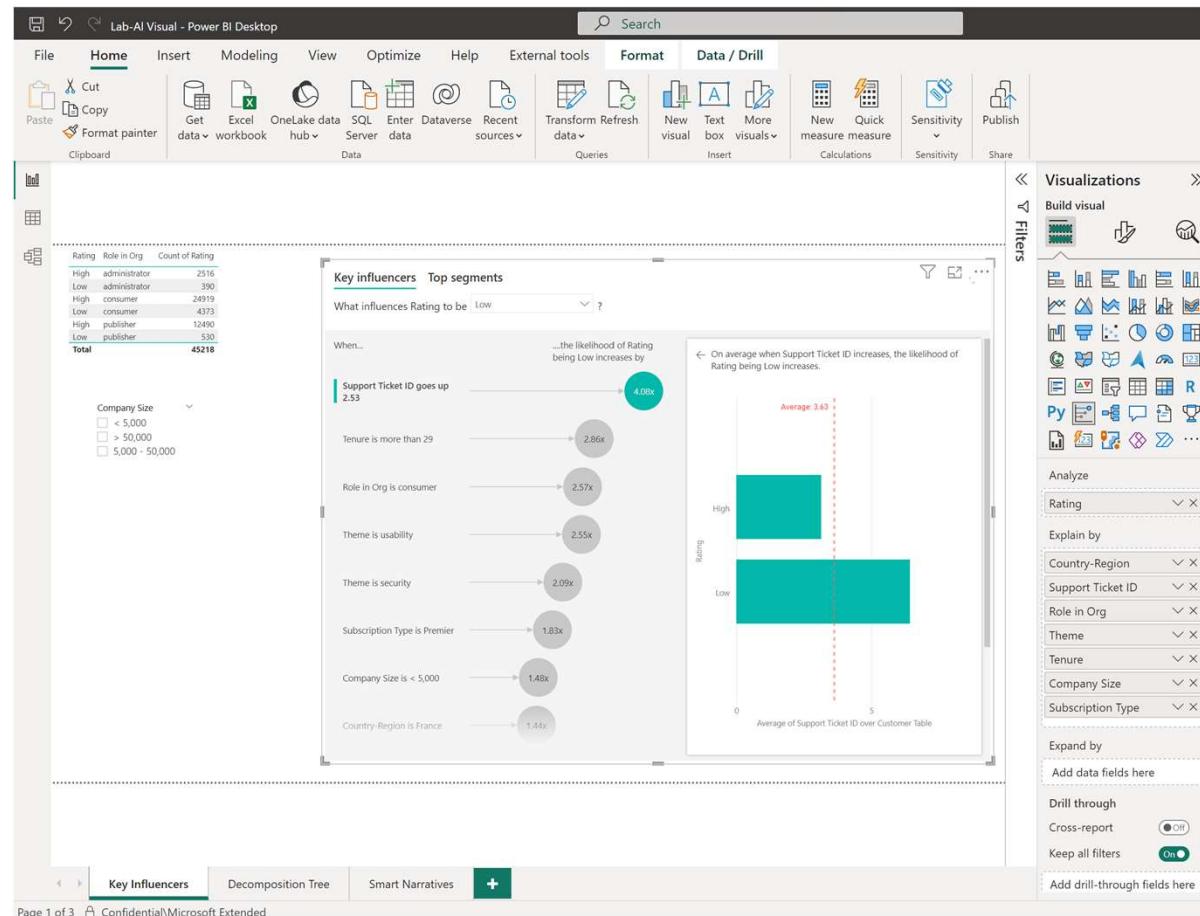
Drill through

- Cross-report
- Keep all filters

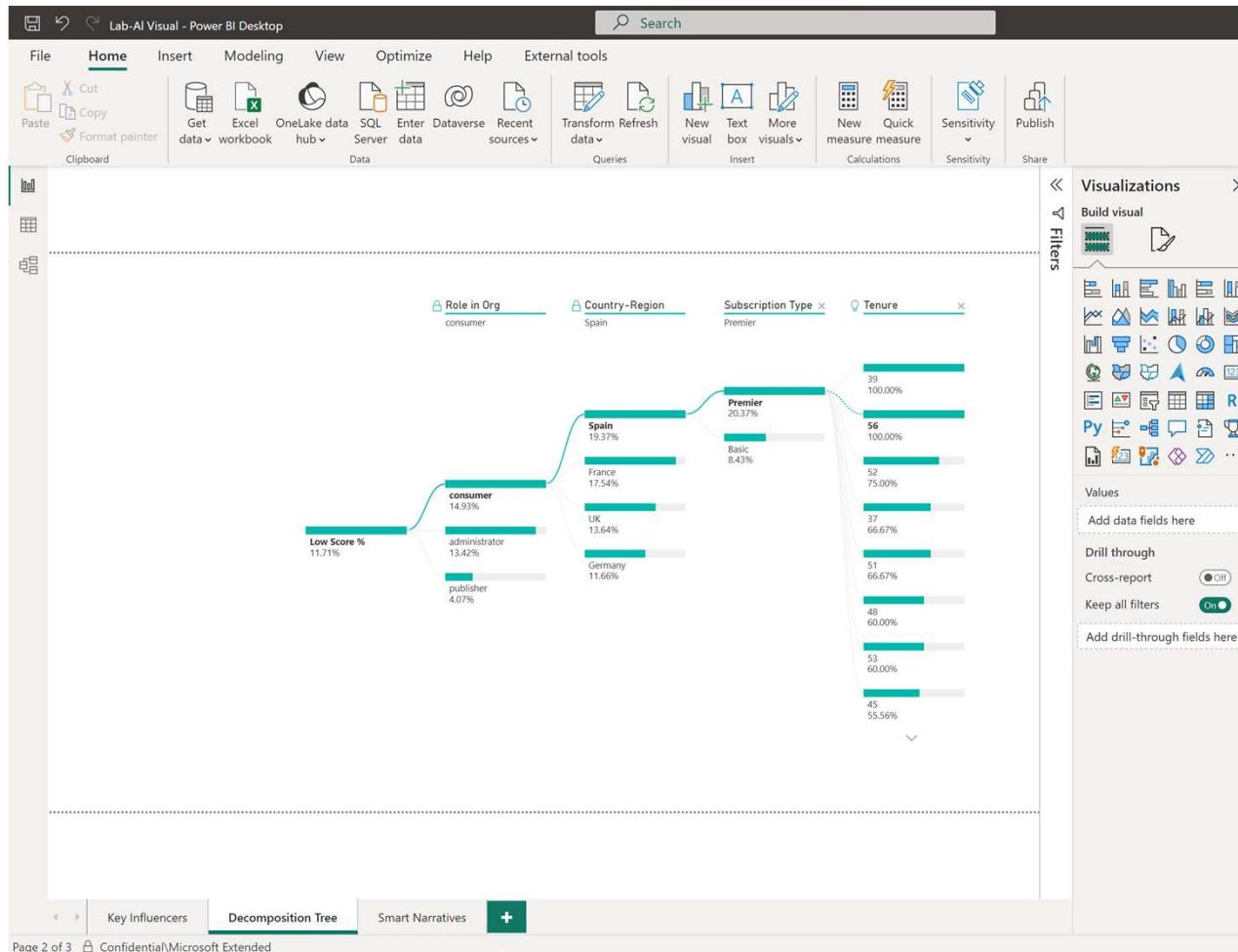
Add drill-through fields here

Key Influencers Decomposition Tree Smart Narratives +

Page 1 of 3 Confidential\Microsoft Extended



Decomposition Tree



Smart Narratives Visual

Lab-AI Visual - Power BI Desktop

File Home Insert Modeling View Optimize Help External tools

Cut Copy Format painter Paste Get data workbook OneLake data hub SQL Server Enter data Dataverse Recent sources Transform data New visual Text box Insert More visuals New measure Quick measure Calculations Sensitivity Publish Share

Clipboard Data Queries

Low Score % and Low Score % by Role in Org

Role	Low Score %
consumer	~14.5%
administrator	~13.5%
publisher	~4%

Low Score % by Country-Region

Country-Region	Low Score %
France	~12.5%
Spain	~8.5%
UK	~5.5%
Germany	~4.5%

Subscription Type Company Size Duration Low Score % Count of Rating

Subscription Type	Company Size	Duration	Low Score %	Count of Rating
Premier	< 5,000	23944	5.58%	2938
Premier	> 50,000	11245	5.54%	1353
Basic	> 50,000	2116	4.28%	257
Basic	5,000 - 50,000	10302	3.37%	1334
Premier	5,000 - 50,000	50192	3.30%	6697
Basic	< 5,000	3050	3.17%	441
Total		100889	4.07%	13020

At 5.09%, France had the highest Low Score % and was 64.07% higher than Spain, which had the lowest Low Score % at 3.10%.

France had the highest Low Score % at 5.09%, followed by UK, Germany, and Spain.

Across all 4 Country-Region, Low Score % ranged from 3.10% to 5.09%.

Sum of Score is 101604

Visualizations

Build visual

Filters

Values

Add data fields here

Drill through

Cross-report

Keep all filters

Add drill-through fields here

Key Influencers Decomposition Tree Smart Narratives +

Page 2 of 3 Confidential Microsoft Extended

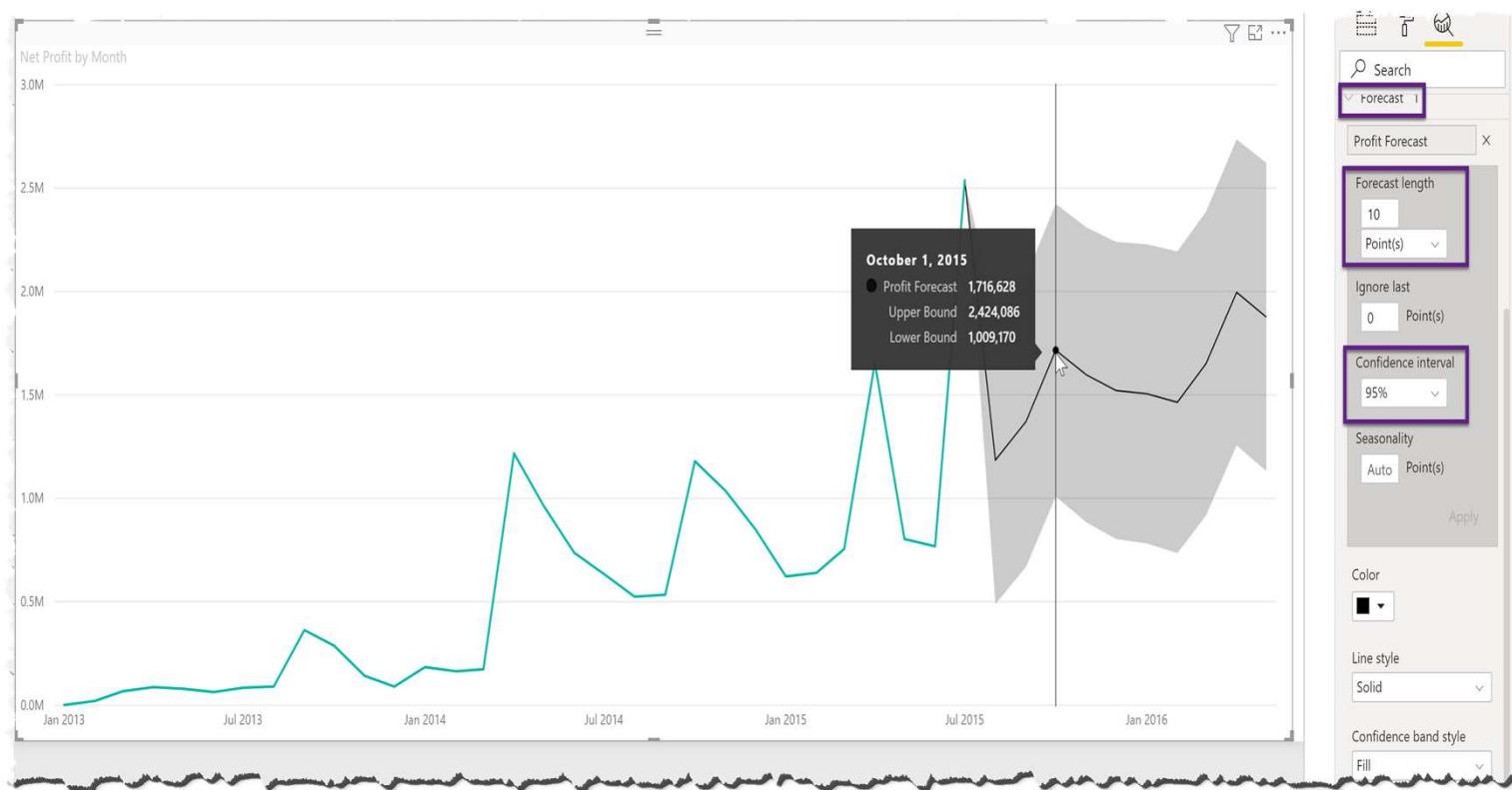
Support for AI in Visuals – Forecasting with Line Graph

Forecasting support in
Line graph

Date/Time data type
required

Forecasting only available
for line chart visuals

Support for AI in Visuals – Line Graph



Support for AI in Visuals

Some visuals in Power BI support embedding AI into them automatically:

- Forecasting support in Line graph
- Clustering support in Scatter graph

This would enable the analyst to show some of the insights quickly to the end users.

Support for AI in Visuals – Line Graph – In Action

The screenshot displays a Microsoft Power BI dashboard titled "SALES SUMMARY". The dashboard is divided into two main sections: "PREVIOUS FISCAL YEAR" and "CURRENT FISCAL YEAR".

PREVIOUS FISCAL YEAR: This section features a line graph showing revenue growth from April 2017 to Jun 2017. The graph has three data points labeled \$125M, 12K, and \$13K. The Y-axis ranges from \$0.1bn to \$0.2bn.

CURRENT FISCAL YEAR: This section includes three key metrics: Estimated Revenue (\$196M), Open Opportunities (7,592), and Average Deal Size (\$26K). Below these metrics is a bar chart showing daily open opportunities from Apr 2018 to Jun 2018.

Data Tables: Below the graphs are two data tables. The first table shows opportunities by name, account, owner, and close date. The second table shows opportunities by name, account, owner, estimated revenue, estimated close date, and open days.

Visualizations Panel: On the right side, there is a "VISUALIZATIONS" panel with a "FIELDS" tab. It lists various visualization types such as Percentile Line, Forecast, and Add. A "Forecast" section is currently expanded, showing settings for "Forecast length" (10), "Ignore last" (0 Point(s)), "Confidence interval" (Auto), and "Seasonality" (Auto).

Bottom Navigation: At the bottom of the dashboard, there is a navigation bar with tabs: Sales Summary (selected), Pipeline Risk, Sales History, Pipeline, Leads, Actual Revenue by day, Funnel, Workload, Pipeline Risk, and Product. There is also a "+" button to add new visualizations.

PAGE 2 OF 11

Support for AI in Visuals – Anomaly Detection with Line Graph

Date/Time data type
required

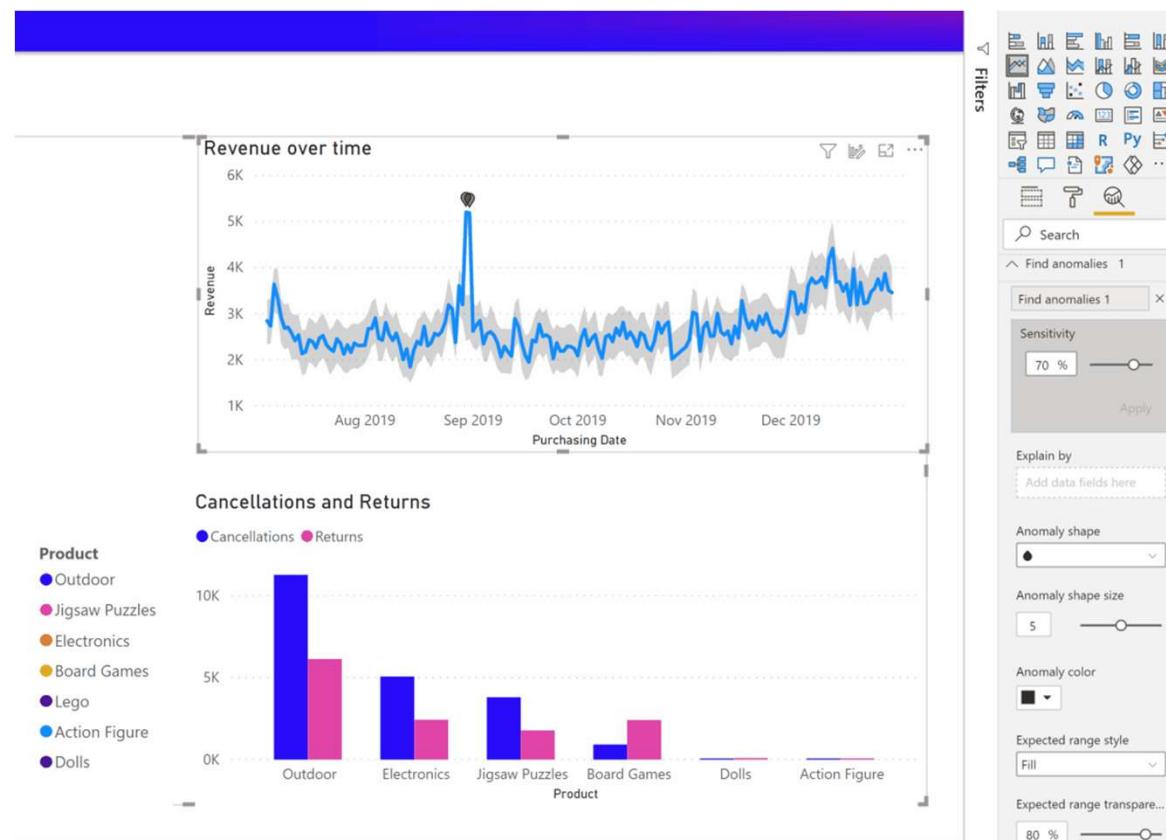
Anomaly Detection only
available for line chart
visual

Explanations provided
for the anomalies to help
with root cause analysis

Support for AI in Visuals – Anomaly Detection with Line Graph



Support for AI in Visuals – Explanations for anomaly detection



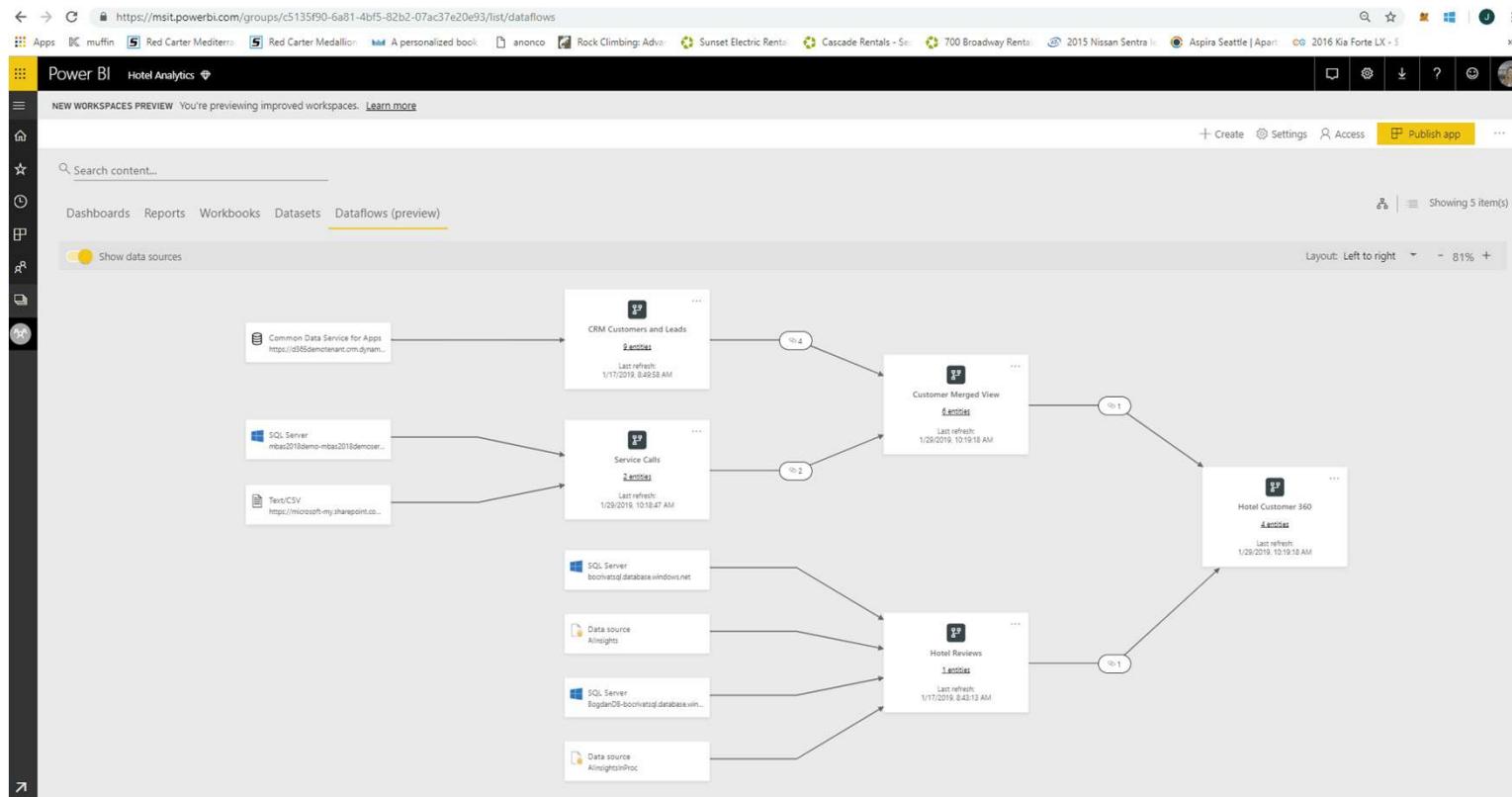
Support for Cognitive Services

Dataflows in Power BI support cloud powered ETL combined with cognitive functions, such as:

- Sentiment Analysis
- Key Phrase Extraction
- Language Detection
- Image Tagging

Which can further be used in Power BI Desktop to present to the end users.

Support for Cognitive Services – In Action



Support for Cognitive Services – In Action

The screenshot displays a Microsoft Power BI interface with several components:

- Top Bar:** Shows the ribbon menu with options like File, Home, View, Modeling, Help, Format, Data / Unit, Insert, and Publish.
- Left Sidebar:** Contains icons for Paste, Cut, Copy, Format Painter, Get Data, Recent Sources, Enter Data, Refresh, New Page, New Visual, Ask A Question, Buttons, Shapes, From Marketplace, From File, Switch Themes, Manage Relationships, New Measure, New Column, New Quick Measure, Calculations, Publish, and Share.
- Visualizations:** A large card titled "GUEST REVIEWS" displays a grid of 8 guest reviews, each with a small image and a snippet of text. The reviews are:
 - Our room was on the ground floor, facing the ocean. Great view. The lobby was beautiful - no walls. Breakfast...
 - The accommodation is basic but will have money left over for shopping and sightseeing.
 - Great beach park next to the hotel. Worth it if travelling with kids due to the large playground. Very quiet.
 - I would expect that the Jacuzzi would be hot (or at least warm) - it was not. Very disappointed with my stay...
 - Incredible hotel. Loved the view. Very friendly staff.
 - Amazing Japanese restaurant downstairs. The hotel is walking distance to all the necessary amenities.
 - Reserved a king room with ocean view. Was given a queen bed with a view. Noticed desk was given a king.
 - Clean, good location, fast WiFi, a very comfortable king bed. Ended up with a great view which was a nice...
- Visualizations:** Two smaller cards titled "SENTIMENT SCORE BY HOTEL" and "SENTIMENT SCORE BY IMAGE TAG".
- Fields:** A sidebar titled "FIELDS" containing a search bar and a list of fields categorized by type (e.g., Customers, Hotel Customer Co..., categories, Date, Guest Comment, Hotel Name, Index, latitude, longitude, No of comme..., province, Sentiment Sc..., Title, Image Classification, Key Phrases). Fields listed include: Document Id, Index, Title, Content, Guest Comment, Title Image (URL), Image, Subtitle Fields, Badge (Image URL), MetaData Fields, Top Bar Color, and Sorting Field.

Cognitive Services in Power BI

Dataset :

[https://pbaitutorials.blob.core.windows.net/text
analytics/](https://pbaitutorials.blob.core.windows.net/textanalytics/)



Support for Machine Learning Services

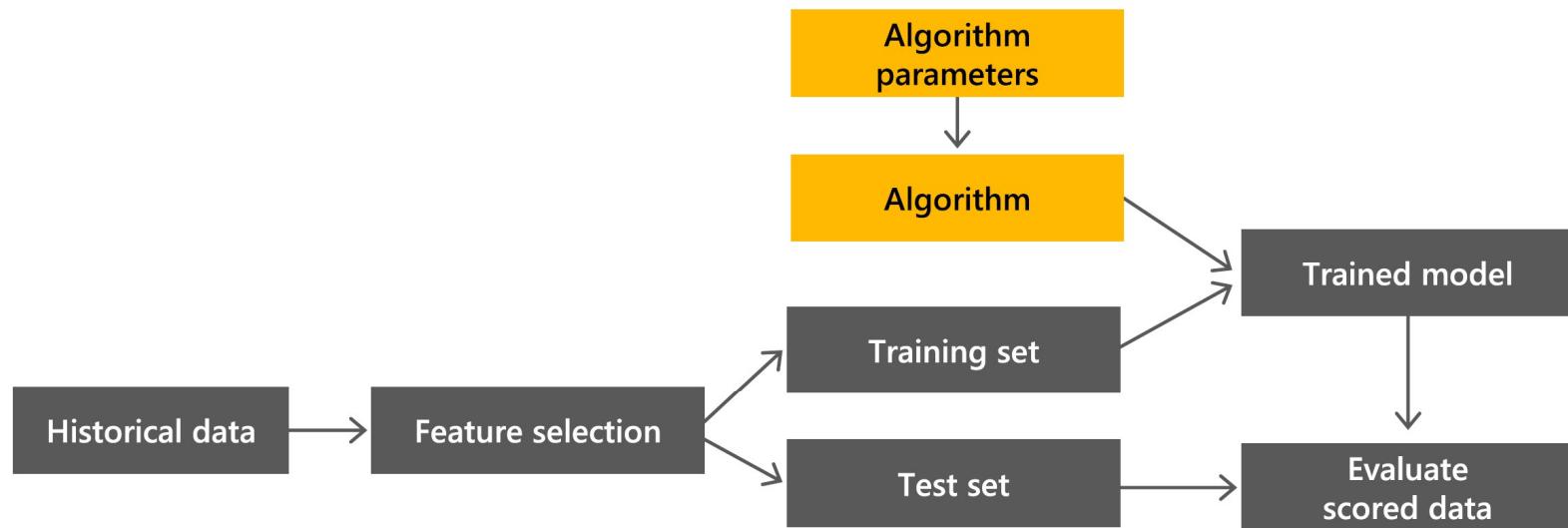
Dataflows in Power BI support cloud powered ETL combined with AutoML.

Dataflows in Power BI support cloud powered ETL integrated with existing Azure Machine Learning models

Various ML algorithms can be applied on the data to analyze the data in hand.

Which can further be used in Power BI Desktop to present to the end users.

Typical ML Model



AutoML in Power BI

The screenshot shows the Power BI Entities screen. At the top, there is a navigation bar with icons for Home, Recent, and Favorites, followed by the text "Power BI AI test > SalesOpportunities". To the right of the navigation bar are icons for Chat, Settings, Download, Help, and Close. Below the navigation bar, there are two tabs: "Entities" (which is selected) and "Machine learning models". On the far left, there is a vertical sidebar with icons for Home, Recent, Favorites, and a search bar.

ENTITY NAME	ENTITY TYPE	ACTIONS
Account	Custom	
Contact	Custom	
Lead	Custom	
Opportunity	Custom	
OpportunityProduct	Custom	
Product	Custom	
SystemUser	Custom	

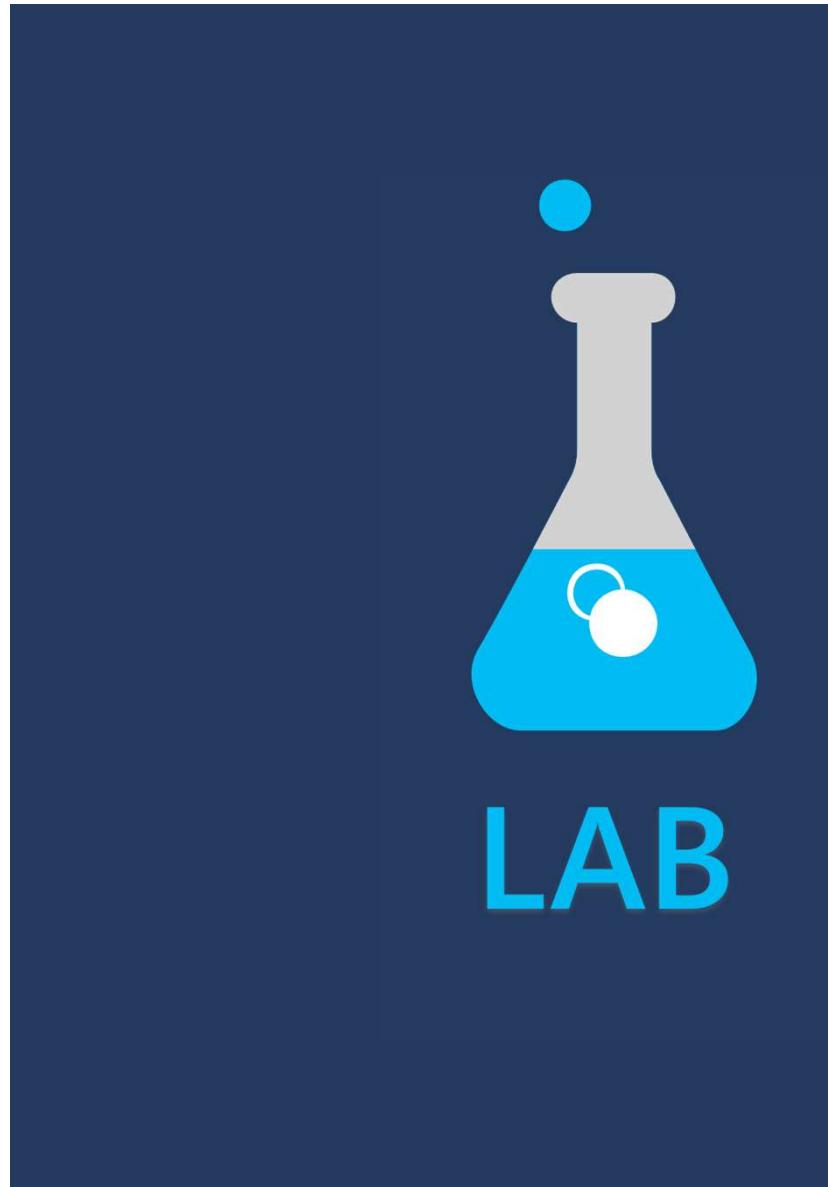
AutoML models can be applied to any entity in the same workspace

Auto ML in Power BI

Create a Auto ML pipeline in Power BI

Dataset :

https://raw.githubusercontent.com/santoshc1/PowerBI-AI-samples/master/Tutorial_AutomatedML/online_shoppers_intention.csv



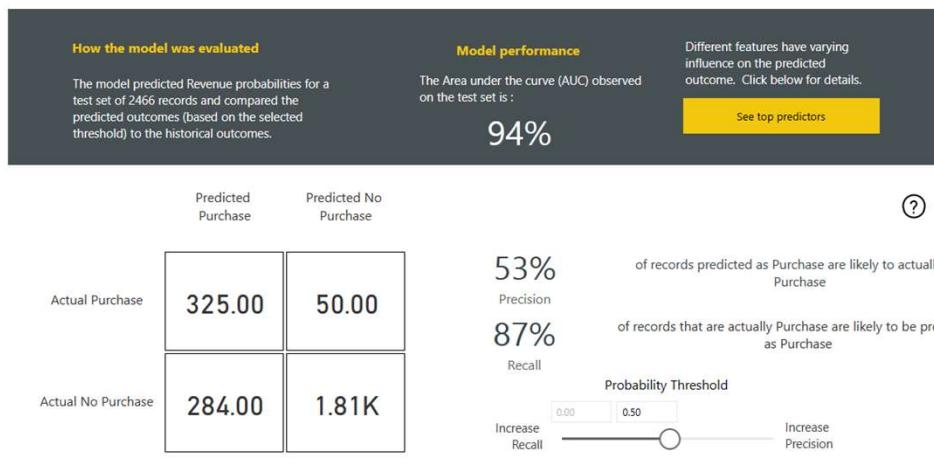
Auto ML in Power BI

The screenshot shows the Microsoft Power BI Data Editor interface. On the left is a navigation pane with options like '首页', '我的最爱', '最近', '工作区', and 'Power BI AI 助手...'. The main area is titled '编辑查询' (Edit Query) and shows a table named 'f_0' with several columns: 'id', 'Adhesive', 'Adhesive_Score', 'Online visitors', 'Information_Driver', 'ProductAdhesive', 'ProductAdhesive_Score', and 'Revenue'. A search bar at the top right contains the text 'Online visitors'. A tooltip '正在输入' (Typing) is shown over the search bar.

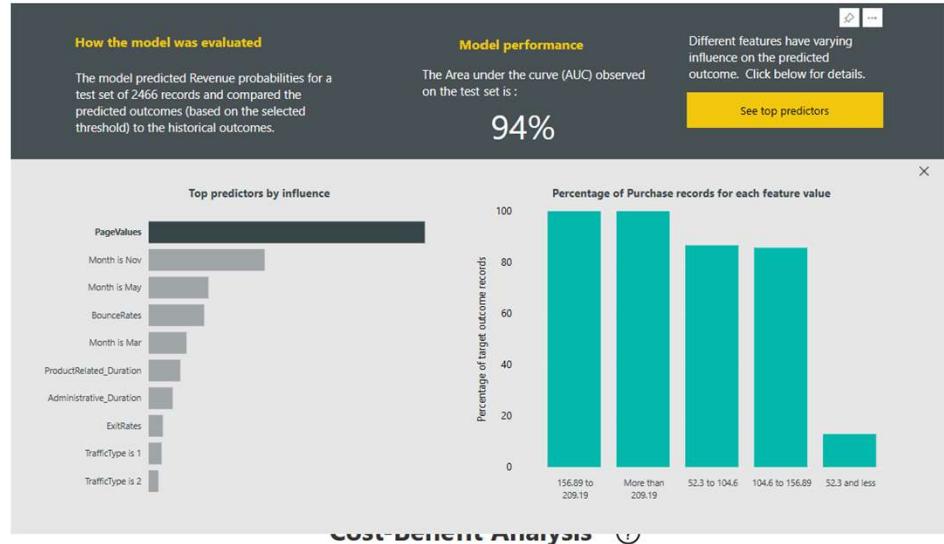
The screenshot shows the 'Purchase Intent Predictor' model creation wizard in the Power BI AI Assistant. The top navigation bar includes '新数据集', '取消', '保存', '继续到模型', and '取消'. The main steps are: '选取要预测的属性' (Select prediction properties), '选择模型' (Select model), '选取要研究的资料' (Select research data), and '命名及定义' (Name and define). Step 1 is currently active. Below the steps, there's a section for '定制模型' (Customize model) with a progress bar at 5分钟 (5 minutes). It lists '模型类型' (Model type) as '二元逻辑', '基底算术' (Base algorithm) as 'Online visitors', '基底精度' (Base precision) as 'Revenue', and '输入维度' (Input dimension) as '18'. A note says: '模型会使用上锁的数据集中的特征性的样本，并以 50% 左右的样本被抽选进行建模。模型将尝试以其特征样本数据对其进行训练，从而提高预测精度。'

Auto ML in Power BI

MODEL PERFORMANCE



MODEL PERFORMANCE



Questions?

