Microsoft Fabric

Custom Semantic Model

Additional Security and Best Practices

Authors

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ABOUT THE AUTHORS

Prashant Atri
Strategic Advisor – Data & AI, Microsoft

He focuses on leveraging cutting-edge technologies, including AI and data analytics, to drive customer transformation and large-scale enterprise modernization. He has led multiple cloud migration and transformation projects across various clouds and with large global pharmaceutical customers in highly regulated environments.

His experience spans across multiple industries and global SI/ISV partners. He is passionate about leading ideation projects, establishing structure and framework, driving community growth and authoring content.

His ongoing knowledge sharing and contributions to the community, positions him as a trusted advisor and visionary leader. He has served as a key panelist on several webinars and round table discussions.

Outside of work, he enjoys music, dance, reading and walking.

Prabhjot Kaur - Principal Cloud Solution Architect
Partner Success Organization- Microsoft

With an in-depth understanding of industry trends and best practices, she aims to align business goals with IT capabilities by delivering scalable and sustainable solutions that encourage innovation and support long-term organizational success. Her role entails collaborating with partners and customers to comprehend their challenges and devising customized cloud strategies and solutions to enhance performance, security, and cost-efficiency.

She is passionate about writing technical blogs and whitepapers, having co-authored whitepaper and several blogs based on real-world partner engagements. In her free time, she enjoys discussing emerging technologies.

Outside of work, she enjoys cooking, kayaking, and hiking.

Changes	Date	Authors
Initial version	18-Nov-2024	Prashant Atri Prabhjot Kaur

NOTE: This material is highly advanced and customized based on various real-world use cases and challenges.

Introduction

This article presents a scenario where you are a data engineer who works for an ABC organization in the United States. You already built the lakehouse using the medallion architecture in Fabric.

You need to set up data access requirements. Specifically, you need to ensure that only authorized users, including data analysts and business users, should have access to the reports. Data access needs to be further restricted by the role of department of the user.

You will build **Customized Semantic model and apply additional security controls like** RLS and fixed identity (Service Principal). It also includes additional best practices on Auditing, Performance and overall security.

How Semantic model authentication / underlying data source communication works

Cloud connection

A Direct Lake semantic model uses a cloud connection to connect to the SQL analytics endpoint. It enables access to source data, which is either the Parquet files in OneLake (Direct Lake storage mode, which involves loading column data into memory) or the SQL analytics endpoint (when queries fall back to DirectQuery mode).

Type of Cloud Connections

Default cloud connection

When you create a Direct Lake semantic model, the default cloud connection is used. It leverages single sign-on (SSO), which means that the identity that queries the semantic model (often a report user) is used to query the SQL analytics endpoint data.

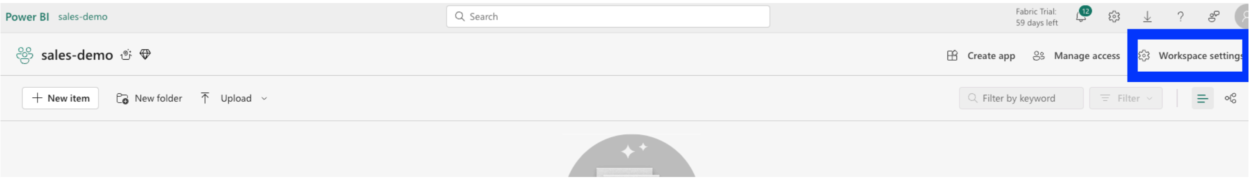
Sharable cloud connection using Fixed Identity

Optionally, you can create a sharable cloud connection (SCC) so that connections to the data source can be made with a **fixed identity**. It can help enterprise customers protect their organizational data stores. The IT department can manage credentials, create SCCs, and share them with the intended creators for centralized access management.

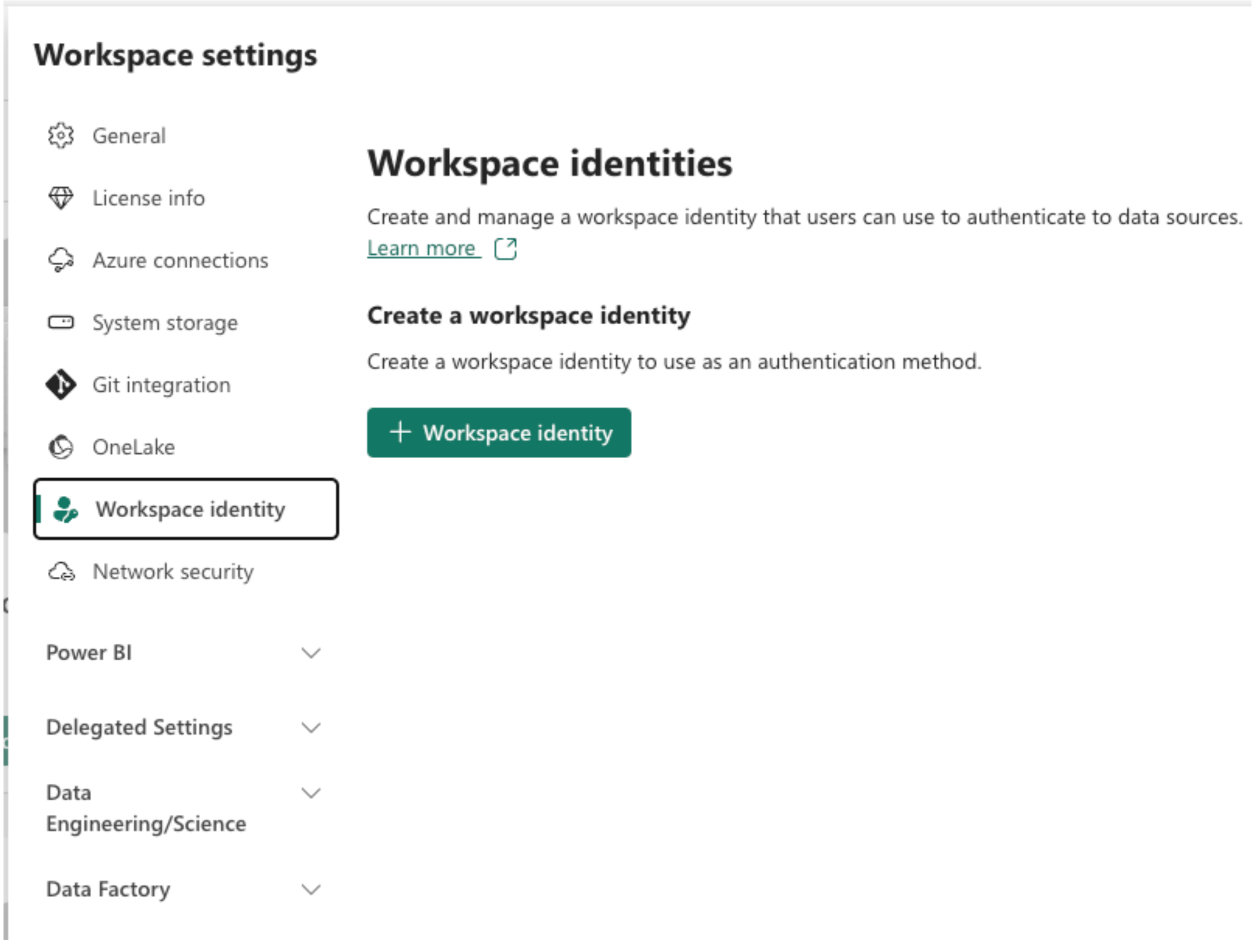
Setup Service Principal / Workspace identity

Let’s do step by step walk-through on how to setup **Fabric workspace identity – Service Principal**.

Go to Fabric **Workspace settings**



Click on **+ Workspace Identity**



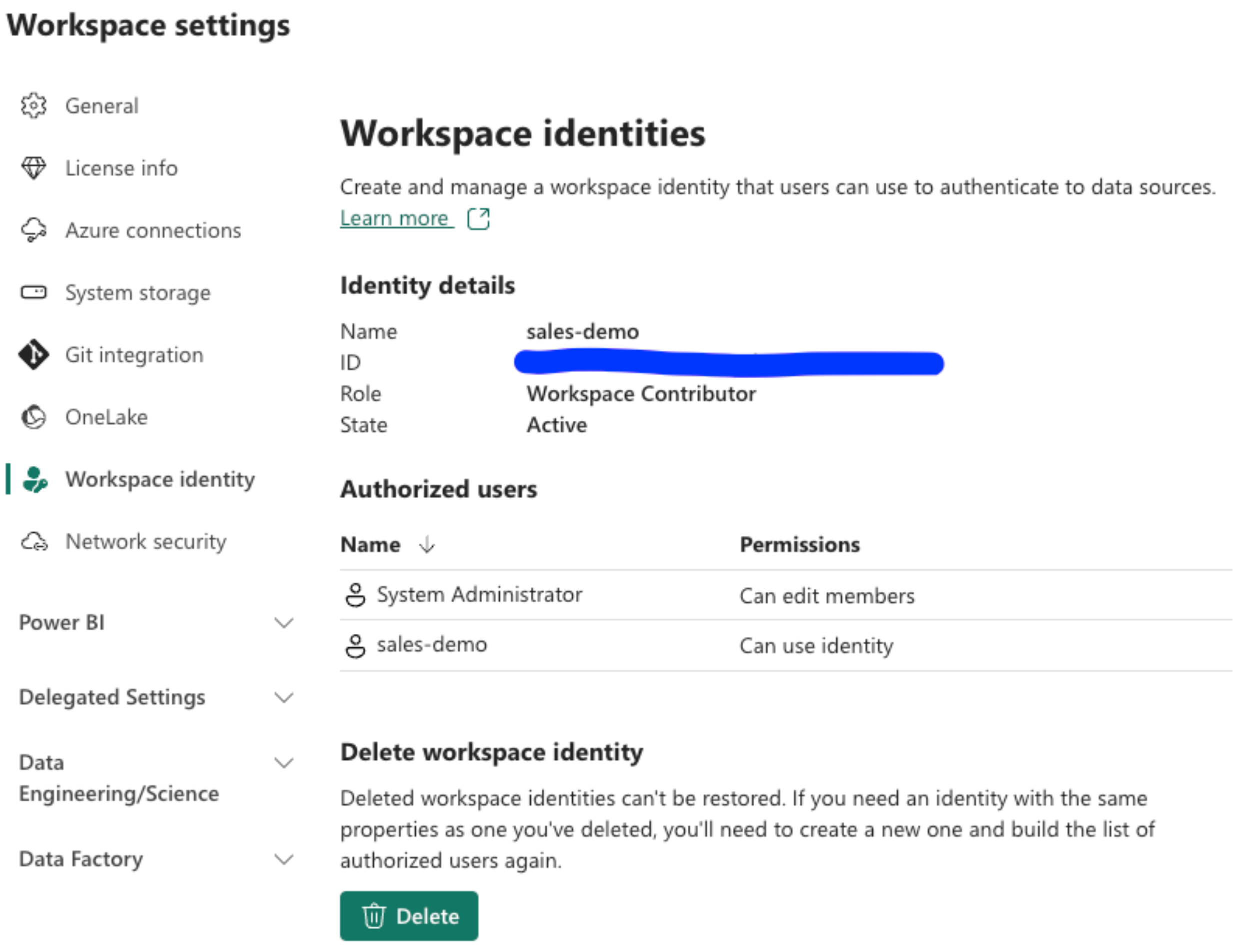
Workspace identities

Create and manage a workspace identity that users can use to authenticate to data sources.
Learn more

Create a workspace identity

Create a workspace identity to use as an authentication method.

A Fabric workspace identity is an automatically managed **service principal** that can be associated with a Fabric workspace. Fabric items can use the identity when connecting to resources that support Microsoft Entra authentication. Fabric uses workspace identities to obtain Microsoft Entra tokens without the customer having to manage any credentials.



Workspace identities

Create and manage a workspace identity that users can use to authenticate to data sources. Learn more

Identity details

Name	sales-demo
ID	[redacted]
Role	Workspace Contributor
State	Active

Authorized users

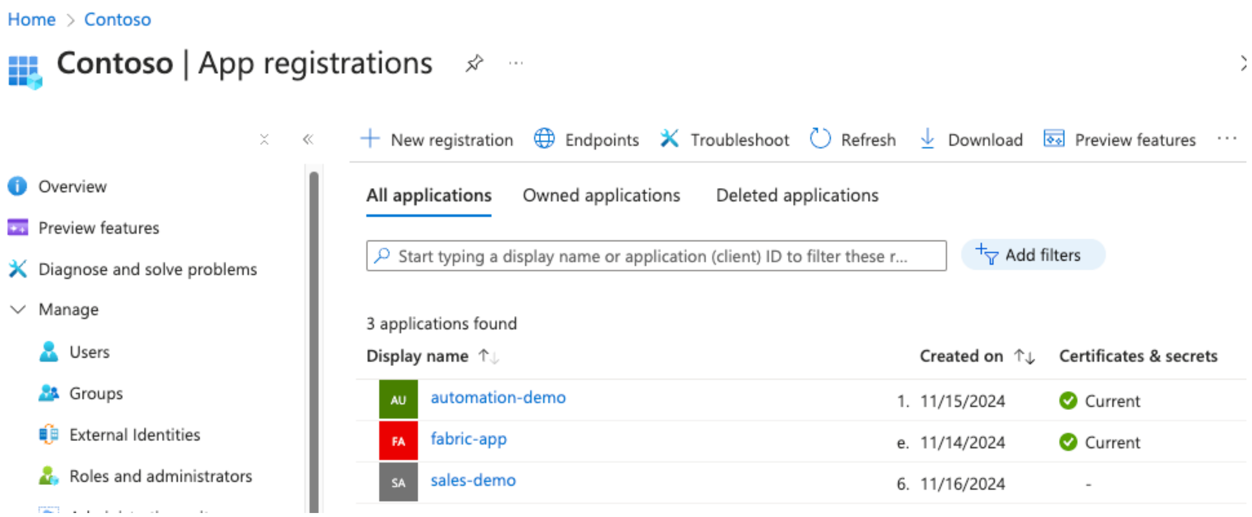
Name ↓	Permissions
System Administrator	Can edit members
sales-demo	Can use identity

Delete workspace identity

Deleted workspace identities can't be restored. If you need an identity with the same properties as one you've deleted, you'll need to create a new one and build the list of authorized users again.

When you create a workspace identity, Fabric creates a service principal in Microsoft Entra ID to represent the identity. **An accompanying app registration is also created**. Fabric automatically manages the credentials associated with workspace identities, thereby preventing credential leaks and downtime due to improper credential handling

App registration name will be same as Workspace name.



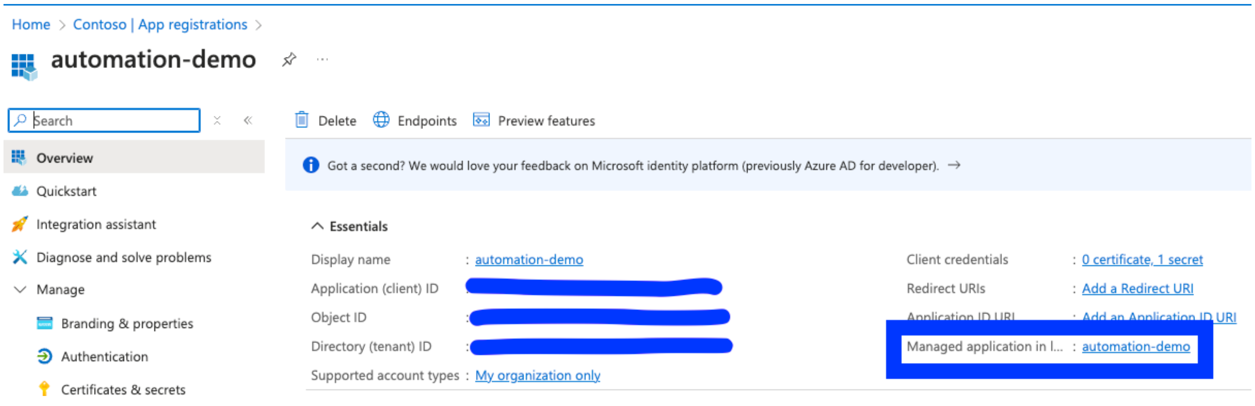
3 applications found

Display name		Created on	Certificates & secrets
AU	automation-demo	1. 11/15/2024	✓ Current
FA	fabric-app	e. 11/14/2024	✓ Current
SA	sales-demo	6. 11/16/2024	-

It generates app registration per workspace.

ObjectID - This is the unique ID of the service principal object associated with this application. This ID can be useful when performing management operations against this application using PowerShell or other programmatic interfaces.

Click on **Managed Application** to get the actual ObjectID.



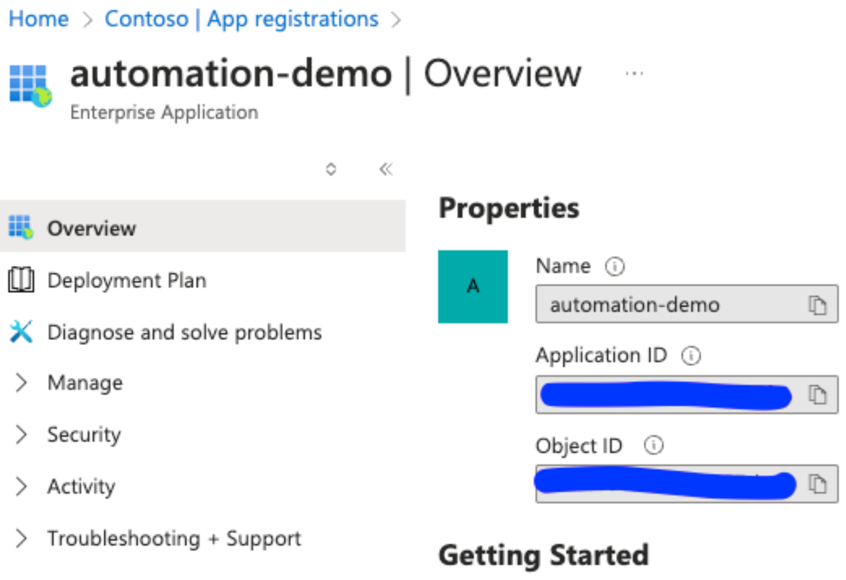
Got a second? We would love your feedback on Microsoft identity platform (previously Azure AD for developer). →

Essentials

Display name : automation-demo
Application (client) ID : [redacted]
Object ID : [redacted]
Directory (tenant) ID : [redacted]
Supported account types : My organization only

Client credentials : 0 certificate, 1 secret
Redirect URIs : Add a Redirect URI
Application ID URI : Add an Application ID URI
Managed application in l... : automation-demo

Per App registration, managed application **ObjectID** maps to the Fabric workspace ID.


Home > Contoso | App registrations >
automation-demo | Overview
Enterprise Application
Overview
Deployment Plan
Diagnose and solve problems
Manage
Security
Activity
Troubleshooting + Support
A

Properties

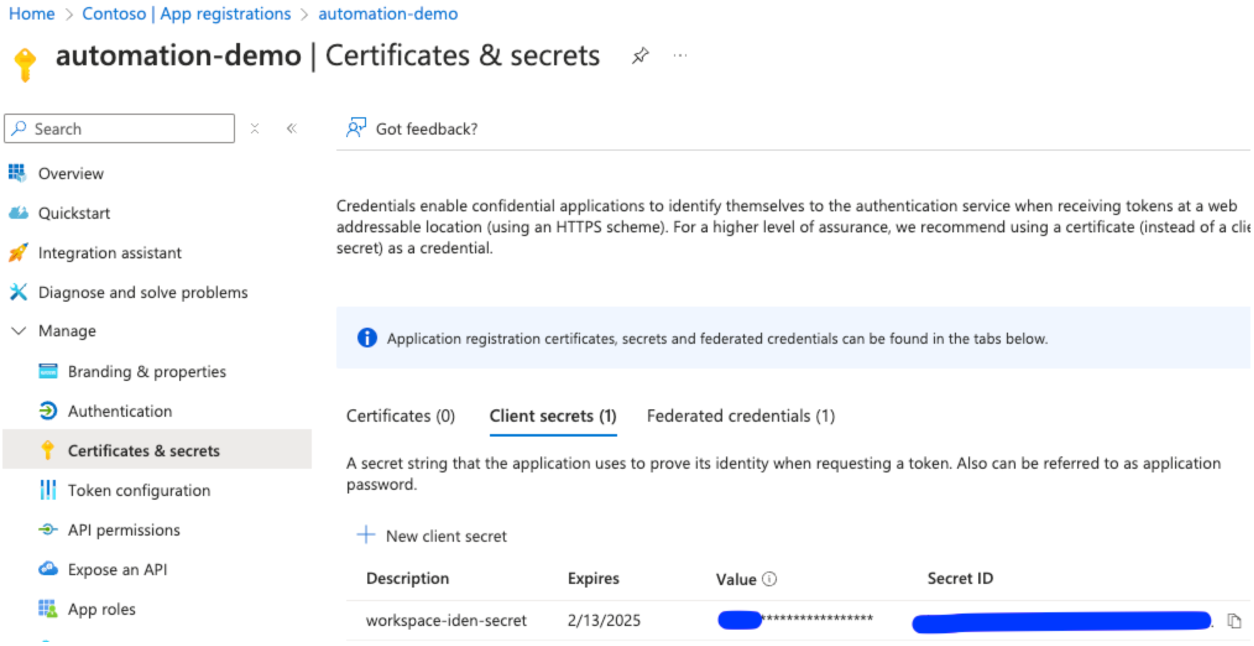
Name: automation-demo

Application ID: [redacted]

Object ID: [redacted]

Getting Started

Create secret in App registration.



Credentials enable confidential applications to identify themselves to the authentication service when receiving tokens at a web addressable location (using an HTTPS scheme). For a higher level of assurance, we recommend using a certificate (instead of a clie secret) as a credential.

Application registration certificates, secrets and federated credentials can be found in the tabs below.

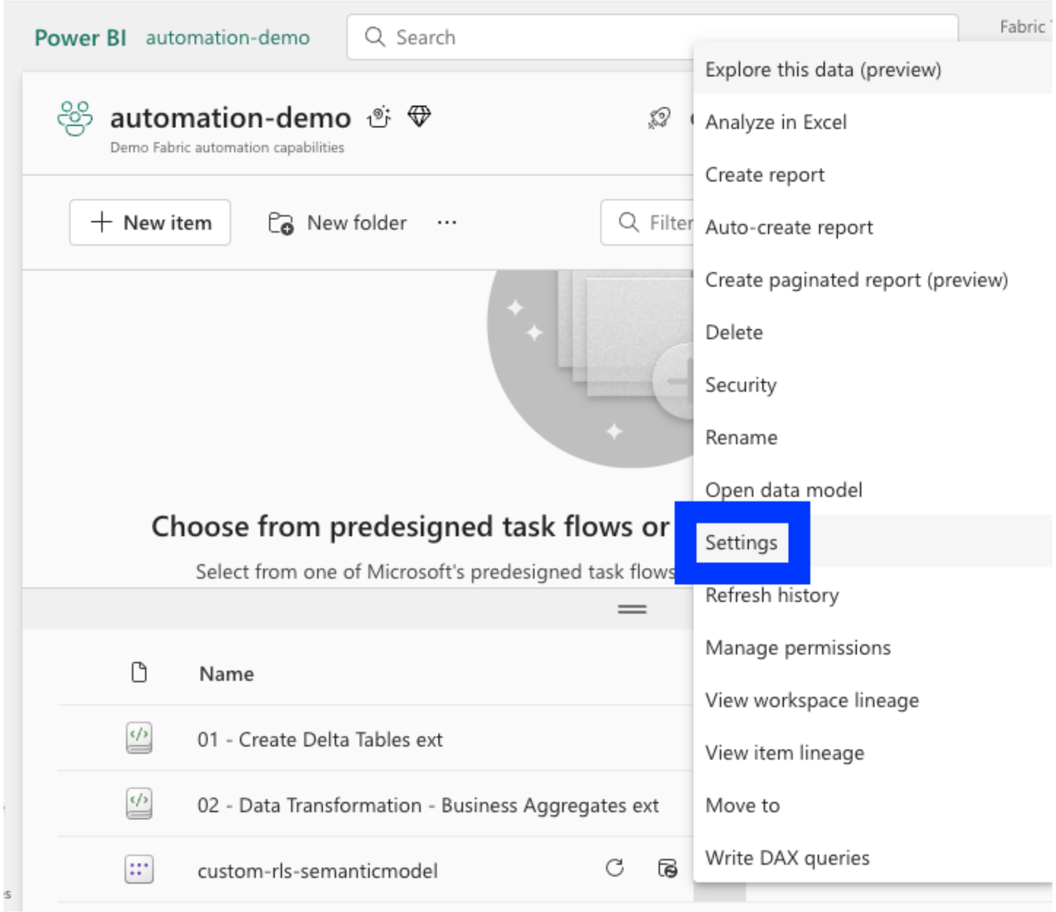
A secret string that the application uses to prove its identity when requesting a token. Also can be referred to as application password.

Description	Expires	Value	Secret ID
workspace-iden-secret	2/13/2025	[redacted]*****************	[redacted]

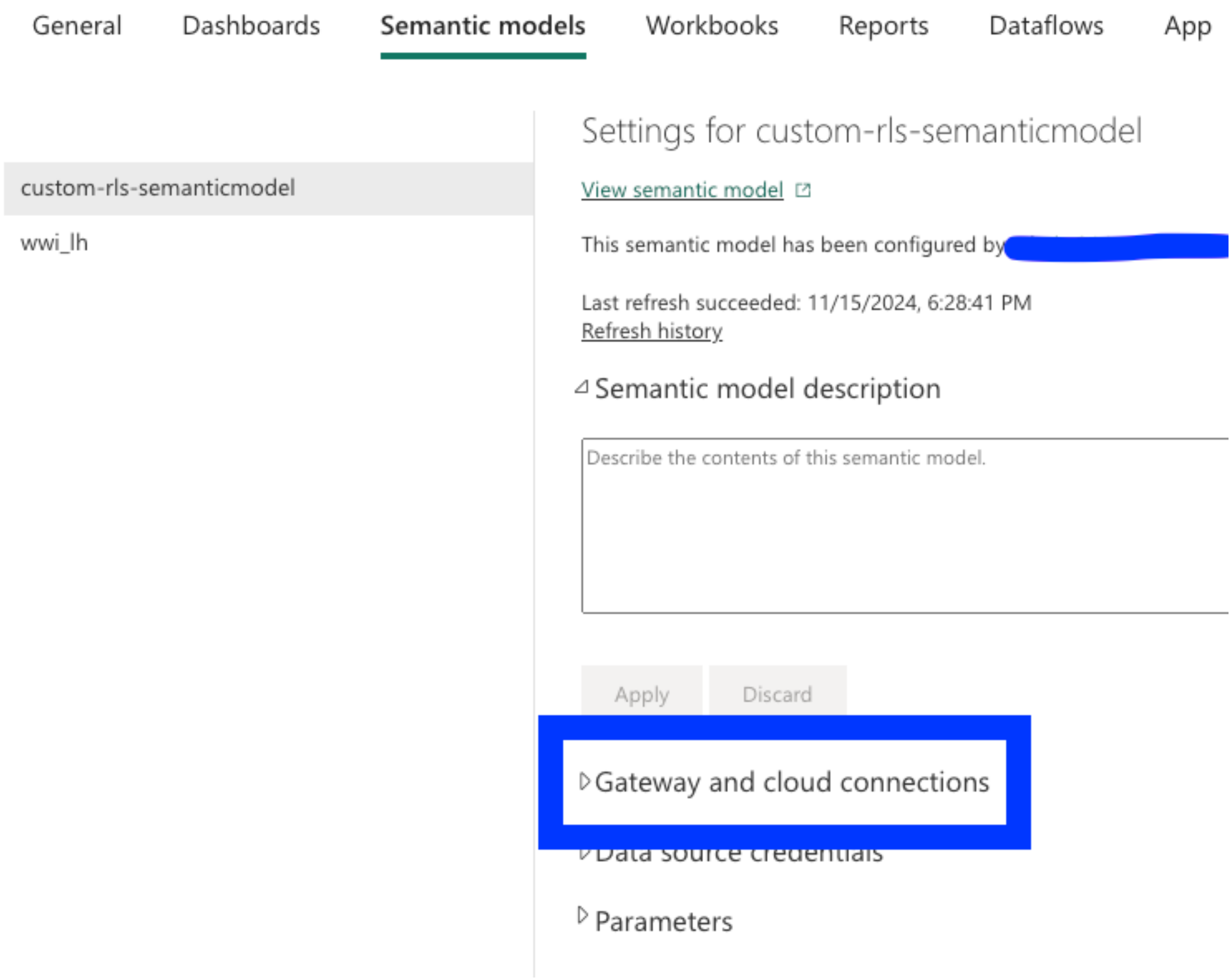
You will use above generated **Service Principal ID, Service Principal Key** in next section to create cloud connection using Fixed identity along with **Tenant ID.**

Setup Cloud connection with Fixed Identity

Click on **Semantic model → Settings**



Click on **Gateway and cloud Connections**



General Dashboards **Semantic models** Workbooks Reports Dataflows App

custom-rls-semanticmodel

wwi_lh

Settings for custom-rls-semanticmodel

View semantic model

This semantic model has been configured by [redacted]

Last refresh succeeded: 11/15/2024, 6:28:41 PM

Refresh history

◿ Semantic model description

Describe the contents of this semantic model.

Apply Discard

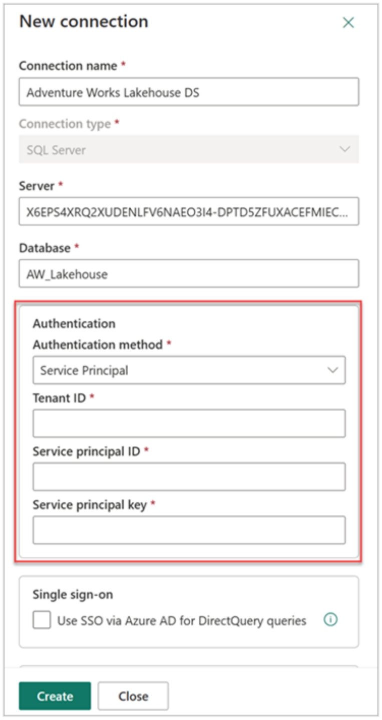
▷ Gateway and cloud connections

▷ Data source credentials

▷ Parameters

Create new connection - In **Authentication method**, select **OAuth 2.0** or **Service Principal**, and then specify credentials for the fixed identity you want to use.

Supply above created Service Principal ID, Service Principal Key here.



New connection ✕

Connection name *

Adventure Works Lakehouse DS

Connection type *

SQL Server

Server *

X6EPS4XRQ2XUDENLFV6NAEO3I4-DPTD5ZFUXACEFMIEC...

Database *

AW_Lakehouse

Authentication

Authentication method *

Service Principal

Tenant ID *

Service principal ID *

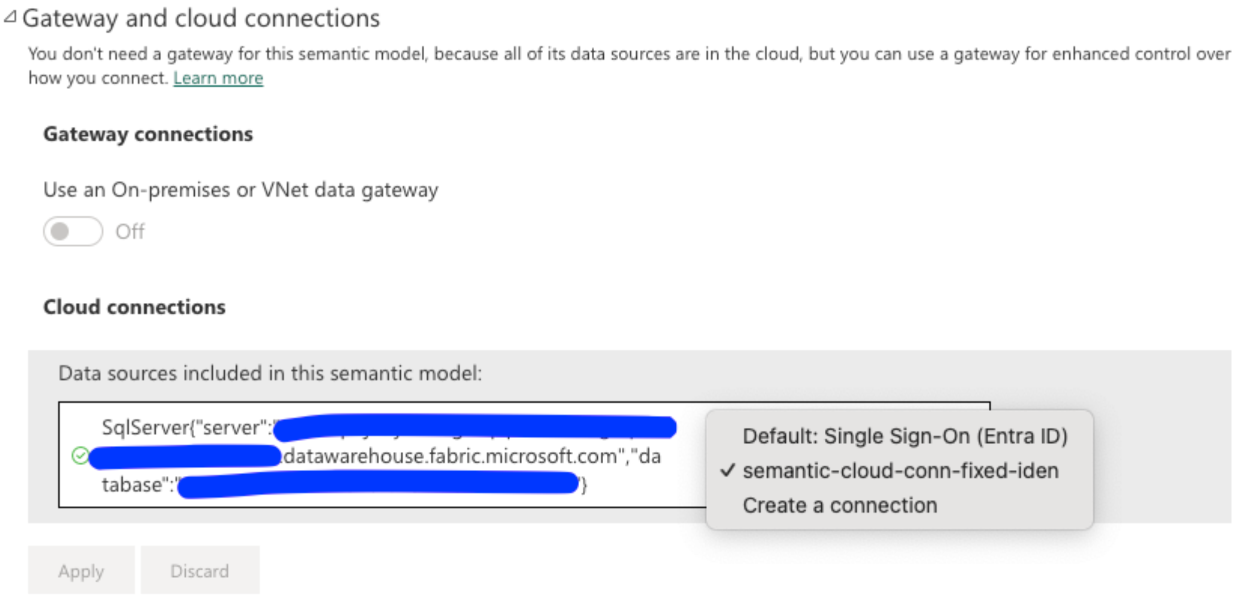
Service principal key *

Single sign-on

□ Use SSO via Azure AD for DirectQuery queries ⓘ

Create Close

After creation the fixed identity, maps to "newly created connection" and it will look like below.



⊿ Gateway and cloud connections

You don't need a gateway for this semantic model, because all of its data sources are in the cloud, but you can use a gateway for enhanced control over how you connect. Learn more

Gateway connections

Use an On-premises or VNet data gateway

○ Off

Cloud connections

Data sources included in this semantic model:

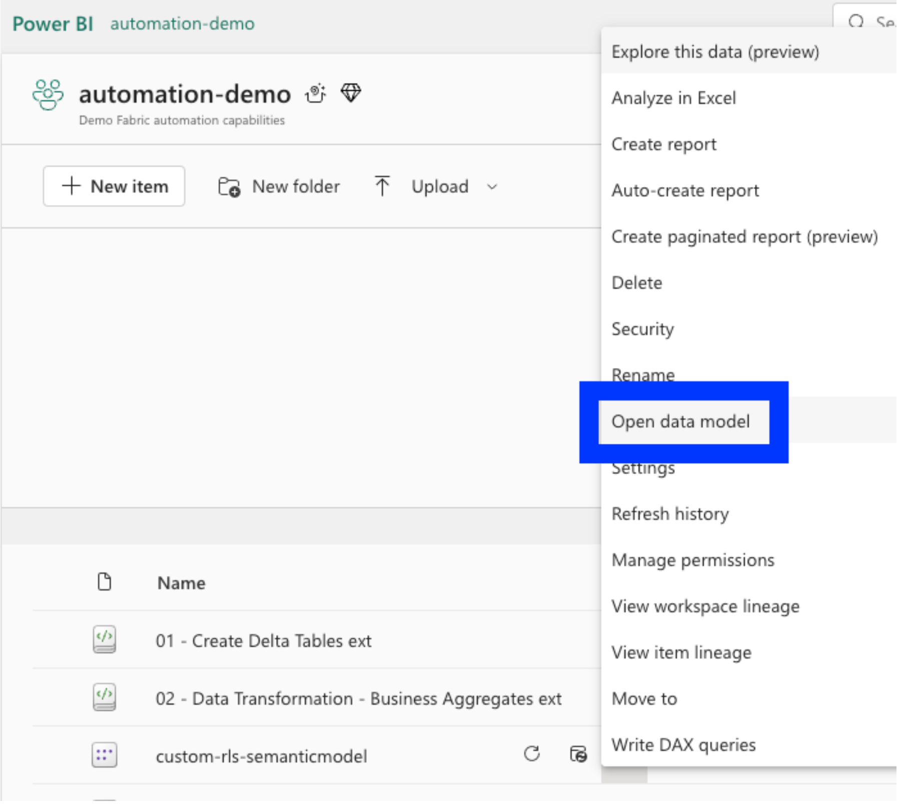
✓ SqlServer{"server":[redacted]
[redacted].datawarehouse.fabric.microsoft.com","da
tabase":[redacted]}

Default: Single Sign-On (Entra ID)
✓ semantic-cloud-conn-fixed-iden
Create a connection

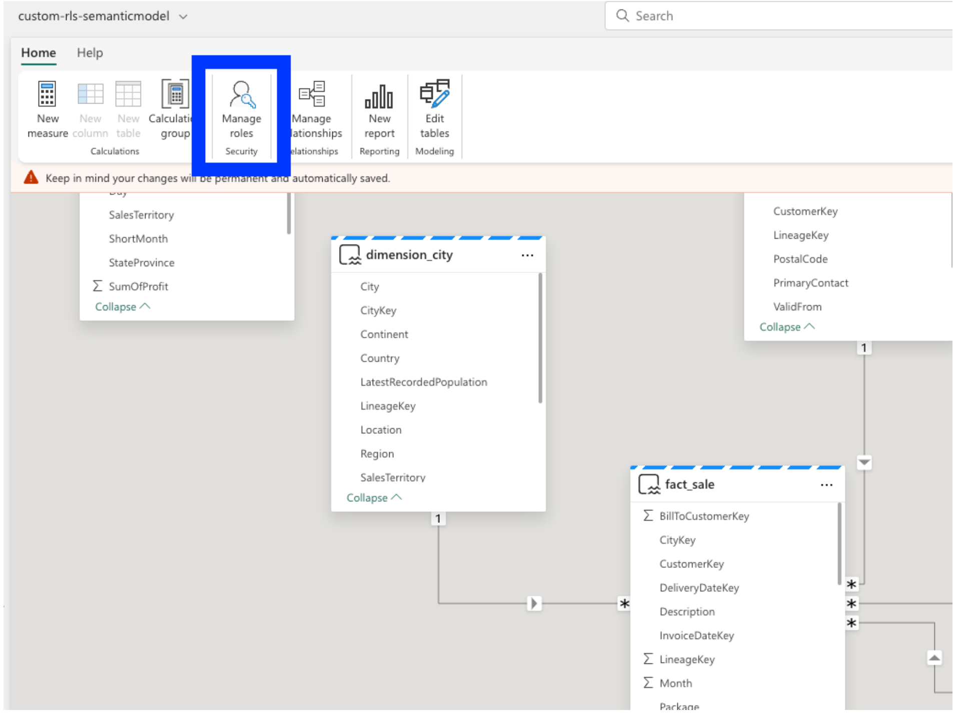
Apply Discard

Setup Semantic Model RLS and Assign Roles

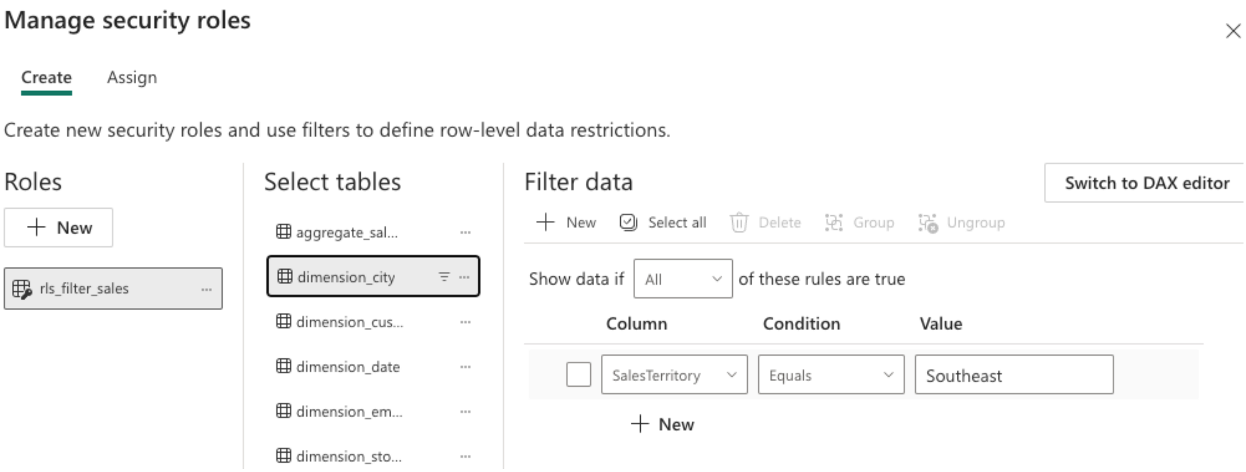
Role creation - Click on custom semantic model → Open data model to define roles definitions.



Click on **Manage Roles**



Below is the sample role,



Manage security roles

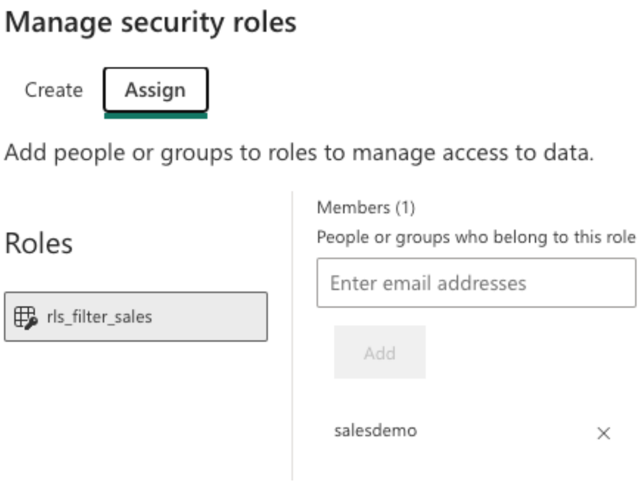
Create new security roles and use filters to define row-level data restrictions.

Role: rls_filter_sales

Show data if All of these rules are true

	Column	Condition	Value
□	SalesTerritory	Equals	Southeast

Assign role to specific set of consumers, You can **create or assign roles** using **Manage security roles OR Tabular Editor** option.



Manage security roles

Create | Assign

Add people or groups to roles to manage access to data.

Roles

rls_filter_sales

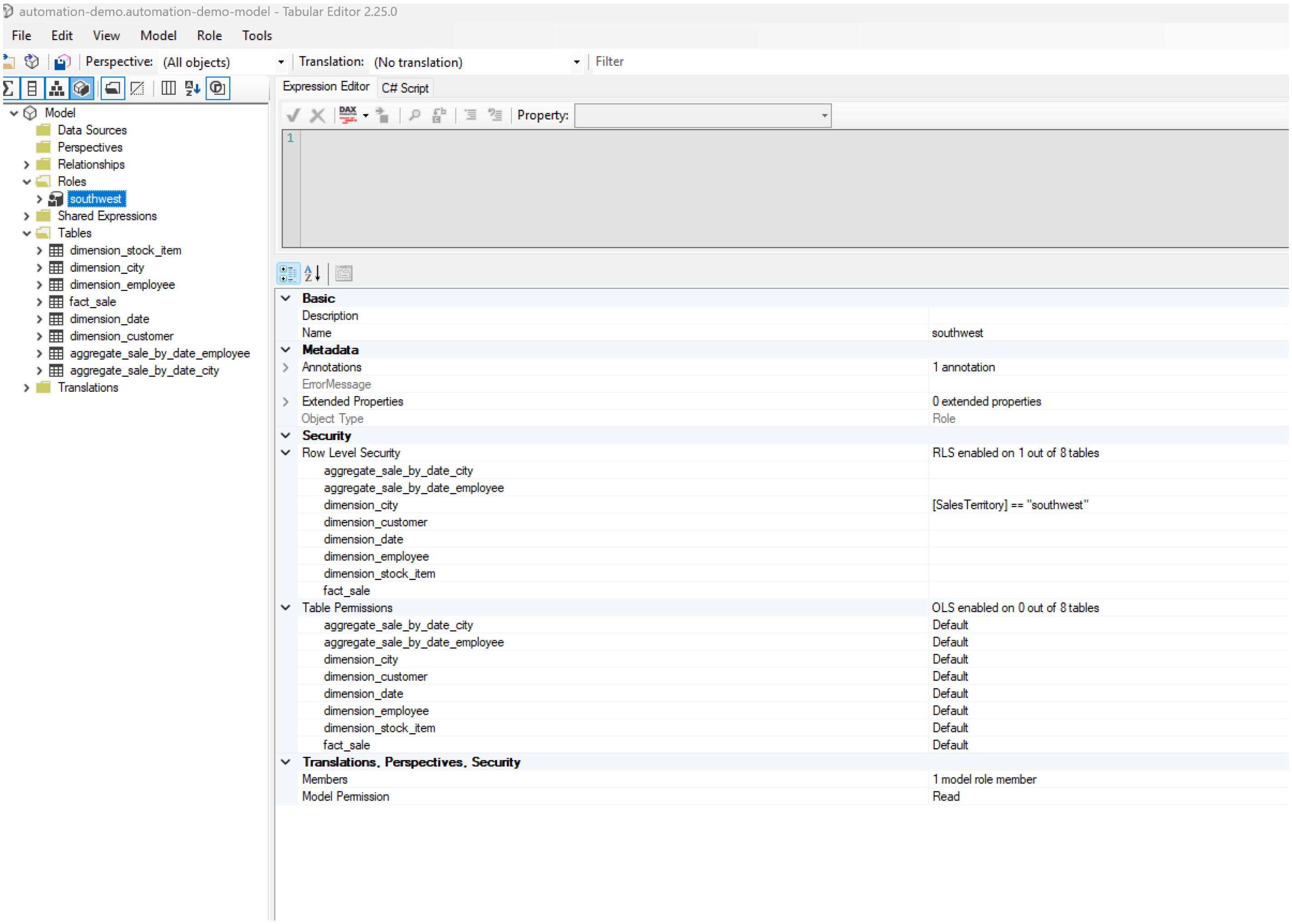
Members (1)

People or groups who belong to this role

Enter email addresses

Add

salesdemo ×



automation-demo.automation-demo-model - Tabular Editor 2.25.0

File Edit View Model Role Tools

Perspective: (All objects) | Translation: (No translation) | Filter

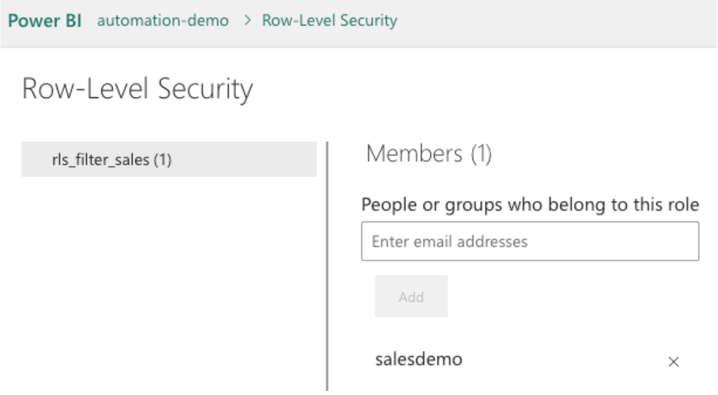
Expression Editor | C# Script

Property:

- Model
  - Data Sources
  - Perspectives
  - Relationships
  - Roles
    - southwest
  - Shared Expressions
  - Tables
    - dimension_stock_item
    - dimension_city
    - dimension_employee
    - fact_sale
    - dimension_date
    - dimension_customer
    - aggregate_sale_by_date_employee
    - aggregate_sale_by_date_city
  - Translations

Basic	
Description	
Name	southwest
Metadata	
Annotations	1 annotation
ErrorMessage	
Extended Properties	0 extended properties
Object Type	Role
Security	
Row Level Security	RLS enabled on 1 out of 8 tables
aggregate_sale_by_date_city	
aggregate_sale_by_date_employee	
dimension_city	[SalesTerritory] == "southwest"
dimension_customer	
dimension_date	
dimension_employee	
dimension_stock_item	
fact_sale	
Table Permissions	OLS enabled on 0 out of 8 tables
aggregate_sale_by_date_city	Default
aggregate_sale_by_date_employee	Default
dimension_city	Default
dimension_customer	Default
dimension_date	Default
dimension_employee	Default
dimension_stock_item	Default
fact_sale	Default
Translations, Perspectives, Security	
Members	1 model role member
Model Permission	Read

Semantic model → **Security** only works for assignment.



Power BI automation-demo > Row-Level Security

Row-Level Security

rls_filter_sales (1)

Members (1)

People or groups who belong to this role

Enter email addresses

Add

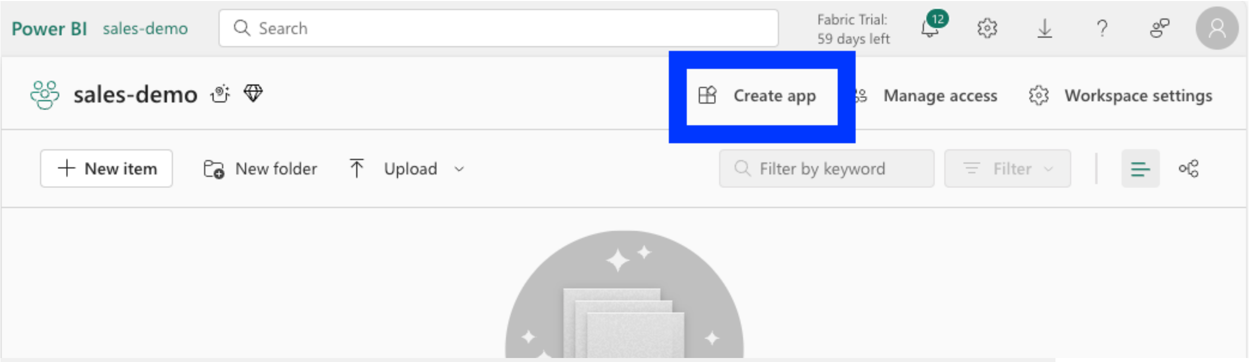
salesdemo ×

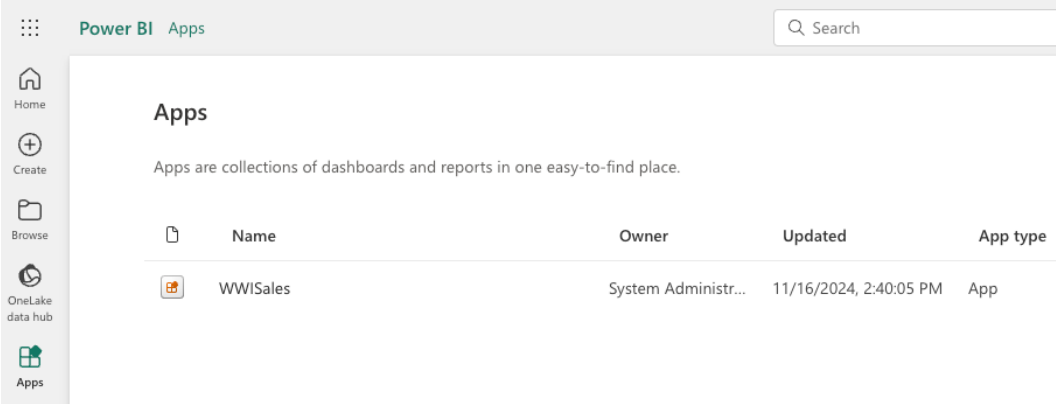
Setup PowerBI App for testing the RLS scenario

Power BI designers create official packaged content, then distribute the content to a broad audience organized as an *app*. An app can have permissions that are different than the permissions set on a workspace. This capability makes it easier for designers to manage permissions on an app. In this scenario, we have granted access to end consumers without giving access to Fabric Semantic model / Fabric items (workspace, lakehouse, warehouse etc..)

NOTE: Before creation App, create and publish a report.

Create App



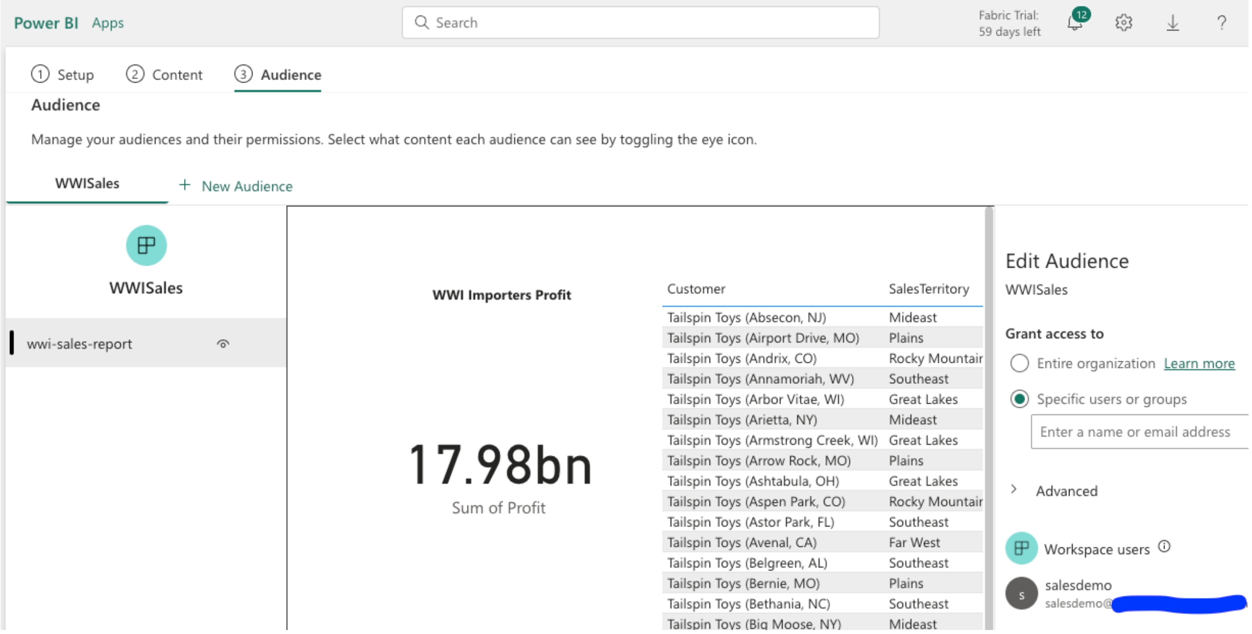


Apps

Apps are collections of dashboards and reports in one easy-to-find place.

Name	Owner	Updated	App type
WWISales	System Administr...	11/16/2024, 2:40:05 PM	App

Setup access for consumers,



① Setup ② Content ③ Audience

Audience

Manage your audiences and their permissions. Select what content each audience can see by toggling the eye icon.

WWISales + New Audience

WWISales

wwi-sales-report

WWI Importers Profit

17.98bn

Sum of Profit

Customer	SalesTerritory
Tailspin Toys (Absecon, NJ)	Mideast
Tailspin Toys (Airport Drive, MO)	Plains
Tailspin Toys (Andrix, CO)	Rocky Mountair
Tailspin Toys (Annamoriah, WV)	Southeast
Tailspin Toys (Arbor Vitae, WI)	Great Lakes
Tailspin Toys (Arietta, NY)	Mideast
Tailspin Toys (Armstrong Creek, WI)	Great Lakes
Tailspin Toys (Arrow Rock, MO)	Plains
Tailspin Toys (Ashtabula, OH)	Great Lakes
Tailspin Toys (Aspen Park, CO)	Rocky Mountair
Tailspin Toys (Astor Park, FL)	Southeast
Tailspin Toys (Avenal, CA)	Far West
Tailspin Toys (Belgreen, AL)	Southeast
Tailspin Toys (Bernie, MO)	Plains
Tailspin Toys (Bethania, NC)	Southeast
Tailspin Toys (Big Moose, NY)	Mideast

Edit Audience

WWISales

Grant access to

○ Entire organization Learn more

● Specific users or groups

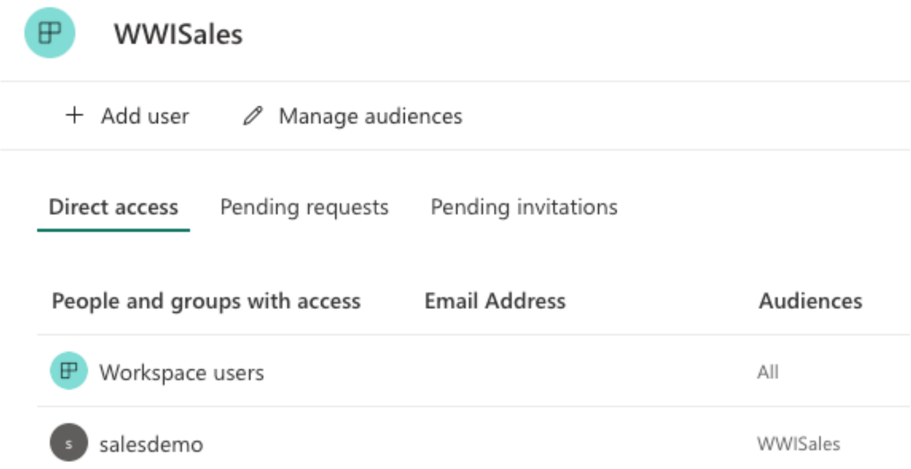
Enter a name or email address

› Advanced

Workspace users ⓘ

s salesdemo
salesdemo@[redacted]

After creating the app, use Manage Permission option to define the access.



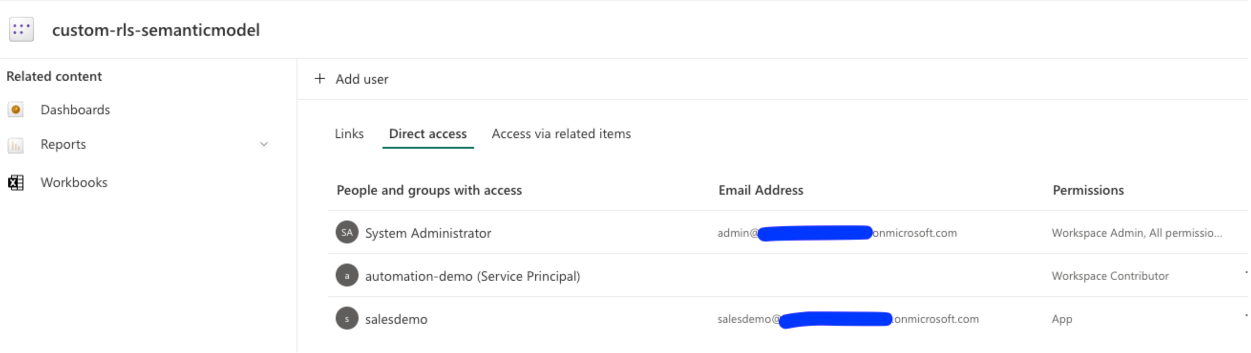
WWISales

+ Add user ✎ Manage audiences

Direct access Pending requests Pending invitations

People and groups with access	Email Address	Audiences
Workspace users		All
s salesdemo		WWISales

While granting access to user(salesdemo) on App, internally it assigns the **READ permission to semantic model** too. (We are not giving workspace level roles, it’s a **direct access** to Semantic model).



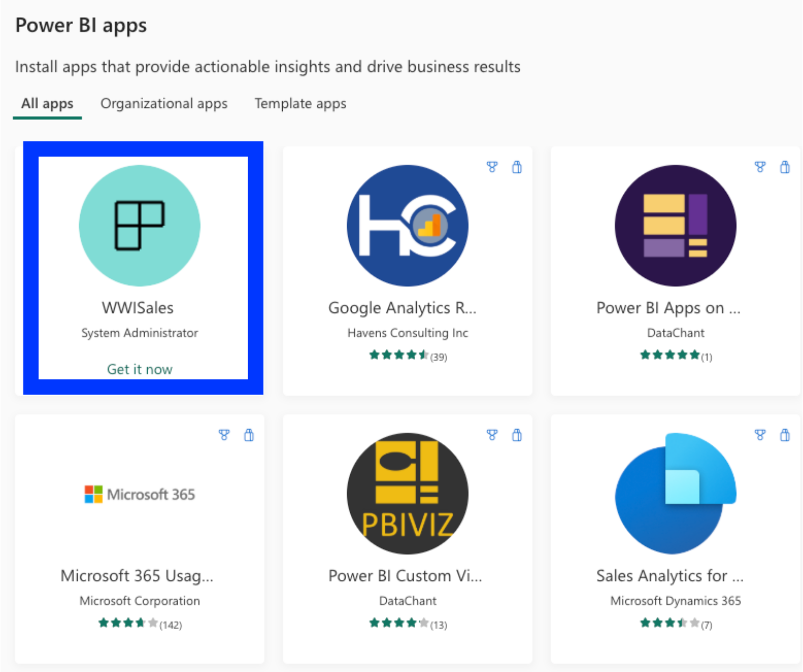
custom-rls-semanticmodel

People and groups with access	Email Address	Permissions
System Administrator	admin@[redacted]onmicrosoft.com	Workspace Admin, All permissio...
automation-demo (Service Principal)		Workspace Contributor
salesdemo	salesdemo@[redacted]onmicrosoft.com	App

Login as Test user and test the RLS scenario.

Note: End user only having access to App, not the underlying Fabric workspace or data sources.

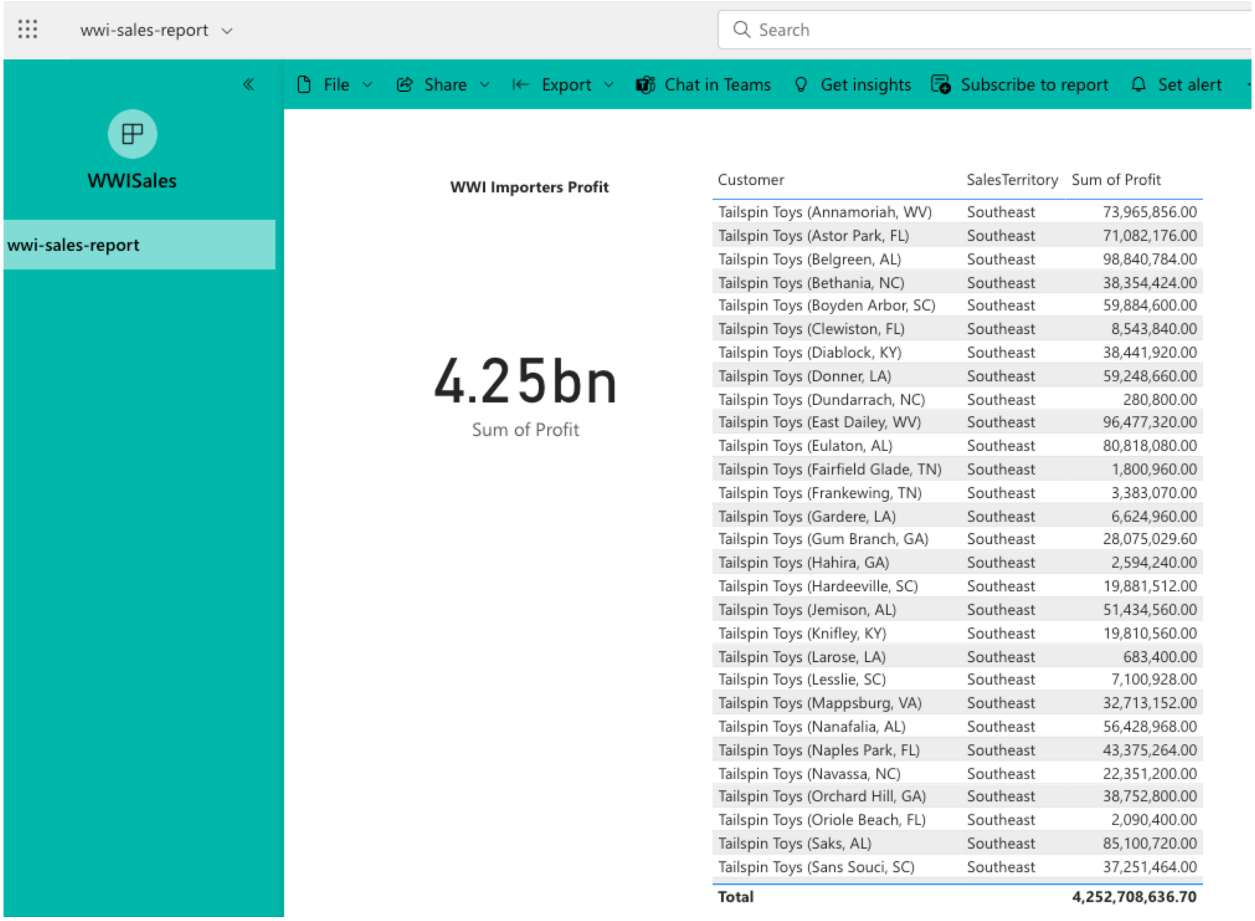
When you log in as test user, go to **Apps > Get Apps** in the PowerBI Service.



Power BI apps

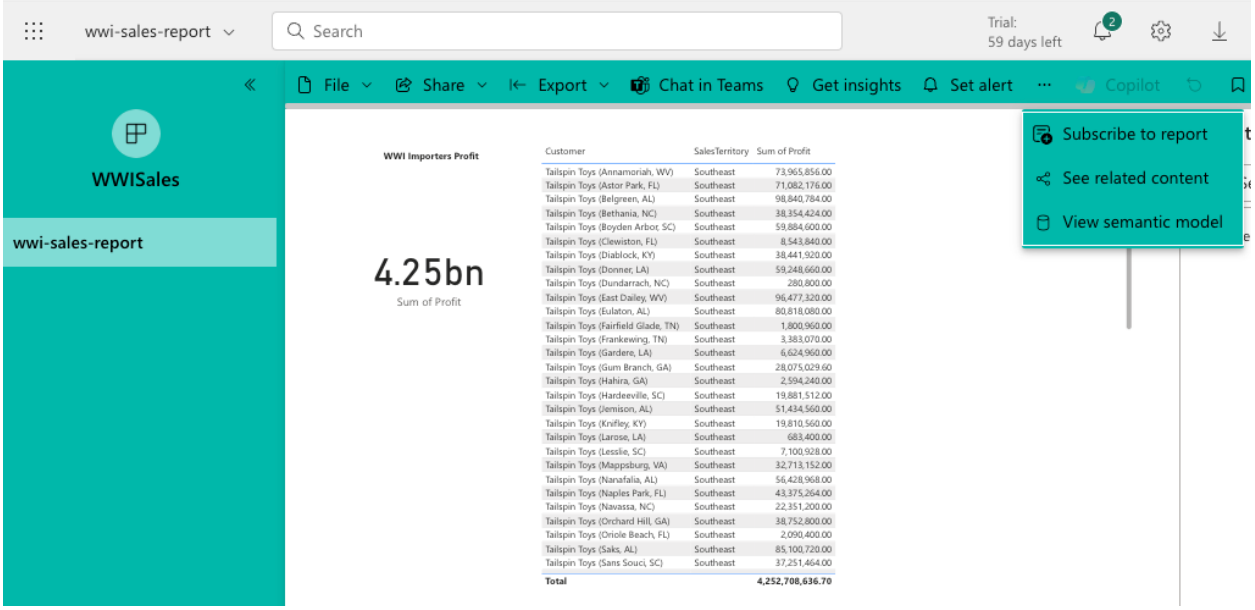
Install apps that provide actionable insights and drive business results

Based on **RLS filter criteria**, its only showing specific Sales Territory.



Customer	SalesTerritory	Sum of Profit
Tailspin Toys (Annamoriah, WV)	Southeast	73,965,856.00
Tailspin Toys (Astor Park, FL)	Southeast	71,082,176.00
Tailspin Toys (Belgreen, AL)	Southeast	98,840,784.00
Tailspin Toys (Bethania, NC)	Southeast	38,354,424.00
Tailspin Toys (Boyden Arbor, SC)	Southeast	59,884,600.00
Tailspin Toys (Clewiston, FL)	Southeast	8,543,840.00
Tailspin Toys (Diablock, KY)	Southeast	38,441,920.00
Tailspin Toys (Donner, LA)	Southeast	59,248,660.00
Tailspin Toys (Dundarrach, NC)	Southeast	280,800.00
Tailspin Toys (East Dailey, WV)	Southeast	96,477,320.00
Tailspin Toys (Eulaton, AL)	Southeast	80,818,080.00
Tailspin Toys (Fairfield Glade, TN)	Southeast	1,800,960.00
Tailspin Toys (Frankewing, TN)	Southeast	3,383,070.00
Tailspin Toys (Gardere, LA)	Southeast	6,624,960.00
Tailspin Toys (Gum Branch, GA)	Southeast	28,075,029.60
Tailspin Toys (Hahira, GA)	Southeast	2,594,240.00
Tailspin Toys (Hardeeville, SC)	Southeast	19,881,512.00
Tailspin Toys (Jemison, AL)	Southeast	51,434,560.00
Tailspin Toys (Knifley, KY)	Southeast	19,810,560.00
Tailspin Toys (Larose, LA)	Southeast	683,400.00
Tailspin Toys (Lesslie, SC)	Southeast	7,100,928.00
Tailspin Toys (Mappsburg, VA)	Southeast	32,713,152.00
Tailspin Toys (Nanafalia, AL)	Southeast	56,428,968.00
Tailspin Toys (Naples Park, FL)	Southeast	43,375,264.00
Tailspin Toys (Navassa, NC)	Southeast	22,351,200.00
Tailspin Toys (Orchard Hill, GA)	Southeast	38,752,800.00
Tailspin Toys (Oriole Beach, FL)	Southeast	2,090,400.00
Tailspin Toys (Saks, AL)	Southeast	85,100,720.00
Tailspin Toys (Sans Souci, SC)	Southeast	37,251,464.00
Total		**4,252,708,636.70**

View **Semantic model** in the App,



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Tailspin Toys (Knifley, KY)	Southeast	19,810,560.00
Tailspin Toys (Larose, LA)	Southeast	683,400.00
Tailspin Toys (Lesslie, SC)	Southeast	7,100,928.00
Tailspin Toys (Mappsburg, VA)	Southeast	32,713,152.00
Tailspin Toys (Nanafalia, AL)	Southeast	56,428,968.00
Tailspin Toys (Naples Park, FL)	Southeast	43,375,264.00
Tailspin Toys (Navassa, NC)	Southeast	22,351,200.00
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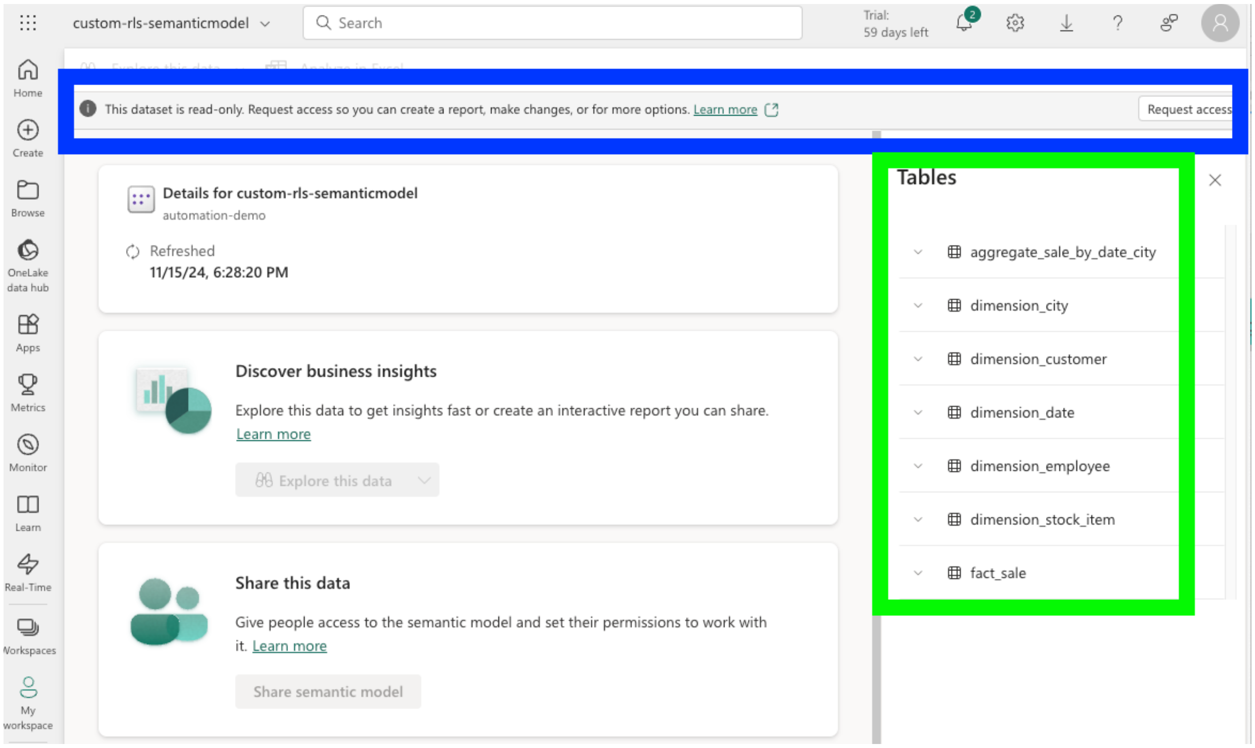
Tailspin Toys (Sans Souci, SC)	Southeast	37,251,464.00
Total		4,252,708,636.70



custom-rls-semanticmodel

Search

Trial: 59 days left

This dataset is read-only. Request access so you can create a report, make changes, or for more options. Learn more

Request access

Details for custom-rls-semanticmodel
automation-demo

Refreshed
11/15/24, 6:28:20 PM

Discover business insights

Explore this data to get insights fast or create an interactive report you can share. Learn more

Explore this data

Share this data

Give people access to the semantic model and set their permissions to work with it. Learn more

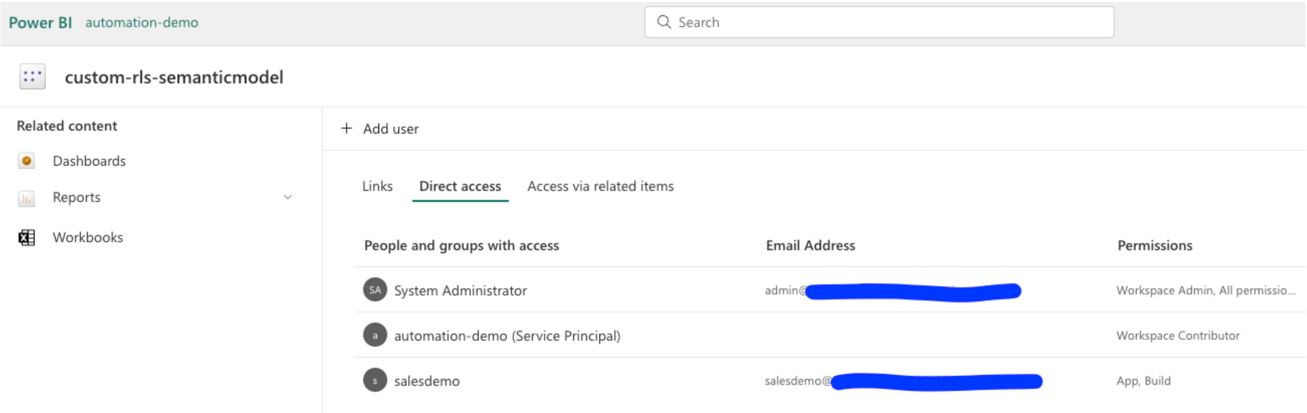
Share semantic model

Tables

- aggregate_sale_by_date_city
- dimension_city
- dimension_customer
- dimension_date
- dimension_employee
- dimension_stock_item
- fact_sale

Now, let's walk through on how a user can view semantic model and build report as well.

Added **"build"** permission as mentioned below.



Power BI automation-demo

Search

custom-rls-semanticmodel

Related content

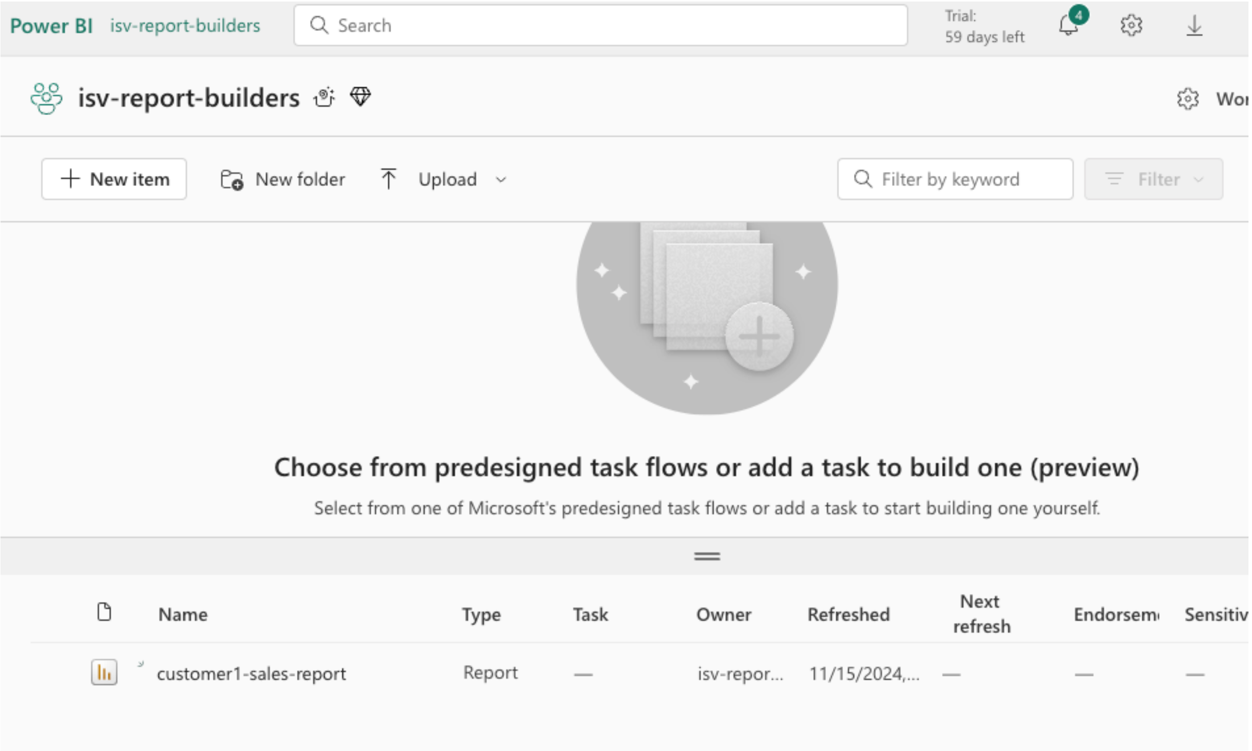
- Dashboards
- Reports
- Workbooks

+ Add user

Links | Direct access | Access via related items

People and groups with access	Email Address	Permissions
System Administrator	admin@[redacted]	Workspace Admin, All permissio...
automation-demo (Service Principal)		Workspace Contributor
salesdemo	salesdemo@[redacted]	App, Build

Workspace	**Permissions**
Workspace1 (automation-demo) Lakehouse, semantic-model hosted here.	• Read Access granted to salesdemo user on **semantic model** via APP • Added Build permission on APP (This only allows to develop a report, it doesn't give any additional access to this workspace)
Workspace2 (isv-report-builders)	Contributor access granted to salesdemo user, to create and store report.



Choose from predesigned task flows or add a task to build one (preview)

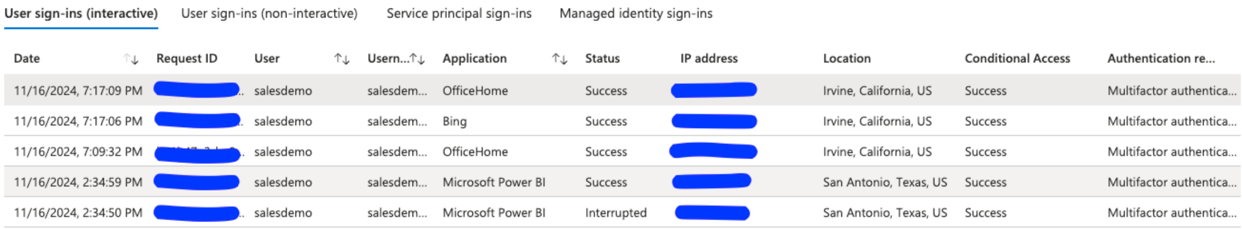
Select from one of Microsoft's predesigned task flows or add a task to start building one yourself.

Name	Type	Task	Owner	Refreshed	Next refresh	Endorsem	Sensitiv
customer1-sales-report	Report	—	isv-repor...	11/15/2024,...	—	—	—

Audit logging

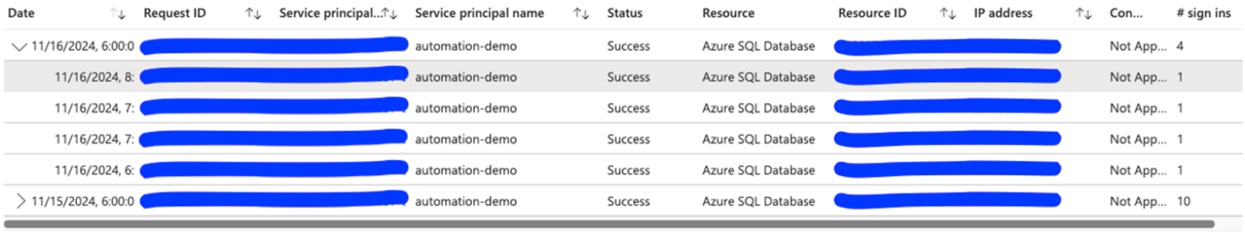
Microsoft Entra ID Audit logging

Sing-in logs


User sign-ins (interactive)
User sign-ins (non-interactive)
Service principal sign-ins
Managed identity sign-ins

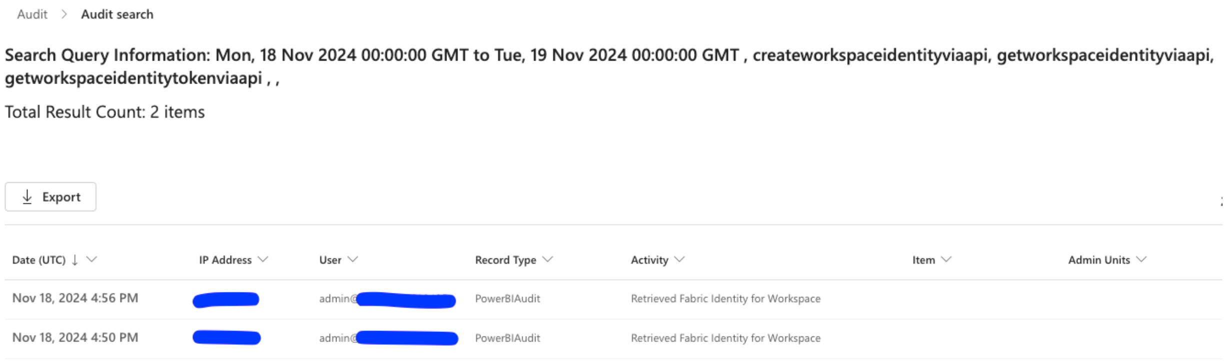
Date	Request ID	User	Usern...	Application	Status	IP address	Location	Conditional Access	Authentication re...
11/16/2024, 7:17:09 PM	[redacted]	salesdemo	salesdem...	OfficeHome	Success	[redacted]	Irvine, California, US	Success	Multifactor authentica...
11/16/2024, 7:17:06 PM	[redacted]	salesdemo	salesdem...	Bing	Success	[redacted]	Irvine, California, US	Success	Multifactor authentica...
11/16/2024, 7:09:32 PM	[redacted]	salesdemo	salesdem...	OfficeHome	Success	[redacted]	Irvine, California, US	Success	Multifactor authentica...
11/16/2024, 2:34:59 PM	[redacted]	salesdemo	salesdem...	Microsoft Power BI	Success	[redacted]	San Antonio, Texas, US	Success	Multifactor authentica...
11/16/2024, 2:34:50 PM	[redacted]	salesdemo	salesdem...	Microsoft Power BI	Interrupted	[redacted]	San Antonio, Texas, US	Success	Multifactor authentica...

Logs about Fabric service principal talking to Fabric items



Date	Request ID	Service principal...	Service principal name	Status	Resource	Resource ID	IP address	Con...	# sign ins
11/16/2024, 6:00:0	[redacted]	[redacted]	automation-demo	Success	Azure SQL Database	[redacted]	[redacted]	Not App...	4
11/16/2024, 8:	[redacted]	[redacted]	automation-demo	Success	Azure SQL Database	[redacted]	[redacted]	Not App...	1
11/16/2024, 7:	[redacted]	[redacted]	automation-demo	Success	Azure SQL Database	[redacted]	[redacted]	Not App...	1
11/16/2024, 7:	[redacted]	[redacted]	automation-demo	Success	Azure SQL Database	[redacted]	[redacted]	Not App...	1
11/16/2024, 6:	[redacted]	[redacted]	automation-demo	Success	Azure SQL Database	[redacted]	[redacted]	Not App...	1
11/15/2024, 6:00:0	[redacted]	[redacted]	automation-demo	Success	Azure SQL Database	[redacted]	[redacted]	Not App...	10

Microsoft Purview Auditing



Search Query Information: Mon, 18 Nov 2024 00:00:00 GMT to Tue, 19 Nov 2024 00:00:00 GMT , createworkspaceidentityviaapi, getworkspaceidentityviaapi, getworkspaceidentitytokenviaapi , ,

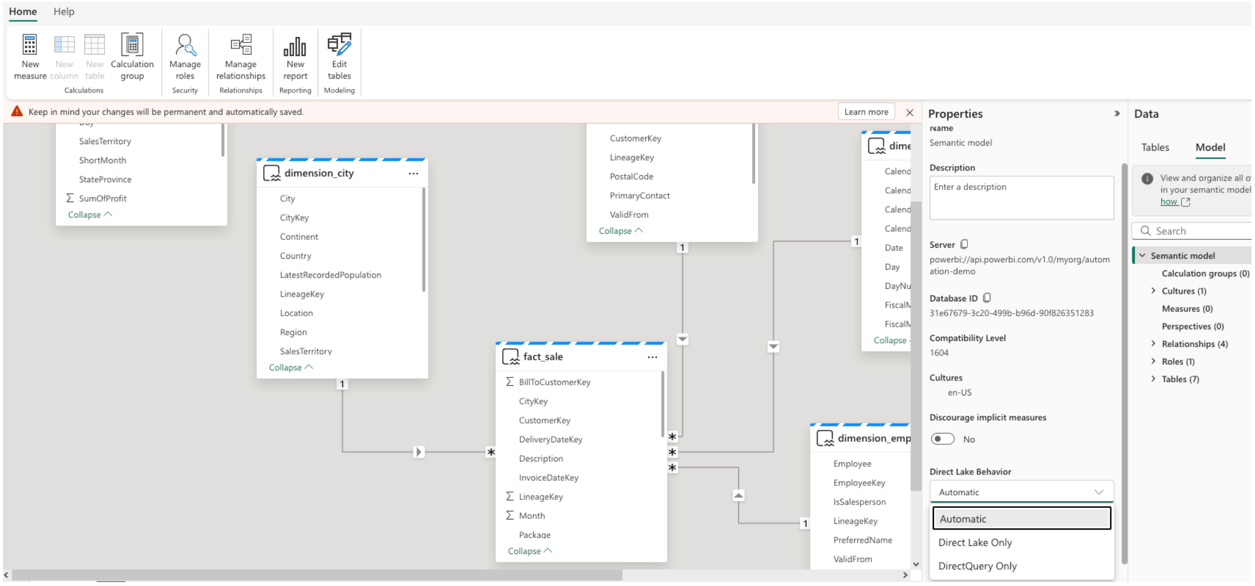
Total Result Count: 2 items

Date (UTC)	IP Address	User	Record Type	Activity	Item	Admin Units
Nov 18, 2024 4:56 PM	[redacted]	admin@[redacted]	PowerBIAudit	Retrieved Fabric Identity for Workspace		
Nov 18, 2024 4:50 PM	[redacted]	admin@[redacted]	PowerBIAudit	Retrieved Fabric Identity for Workspace		

Direct Lake behavior

You can control fallback of your Direct Lake semantic models by setting its DirectLakeBehavior property. It can be set to:

- **Automatic**: (Default) Queries fall back to DirectQuery mode if the required data can't be efficiently loaded into memory.
- **DirectLakeOnly**: All queries use Direct Lake storage mode only. Fall back to DirectQuery mode is disabled. If data can't be loaded into memory, an error is returned.
- **DirectQueryOnly**: All queries use DirectQuery mode only. Use this setting to test fallback performance, where, for instance, you can observe the query performance in connected reports.



Keep in mind your changes will be permanent and automatically saved.

Properties

Name: Semantic model

Description: Enter a description

Server: powerbi://api.powerbi.com/v1.0/myorg/automation-demo

Database ID: 31e67679-3c20-499b-b96d-90f826351283

Compatibility Level: 1604

Cultures: en-US

Discourage implicit measures: No

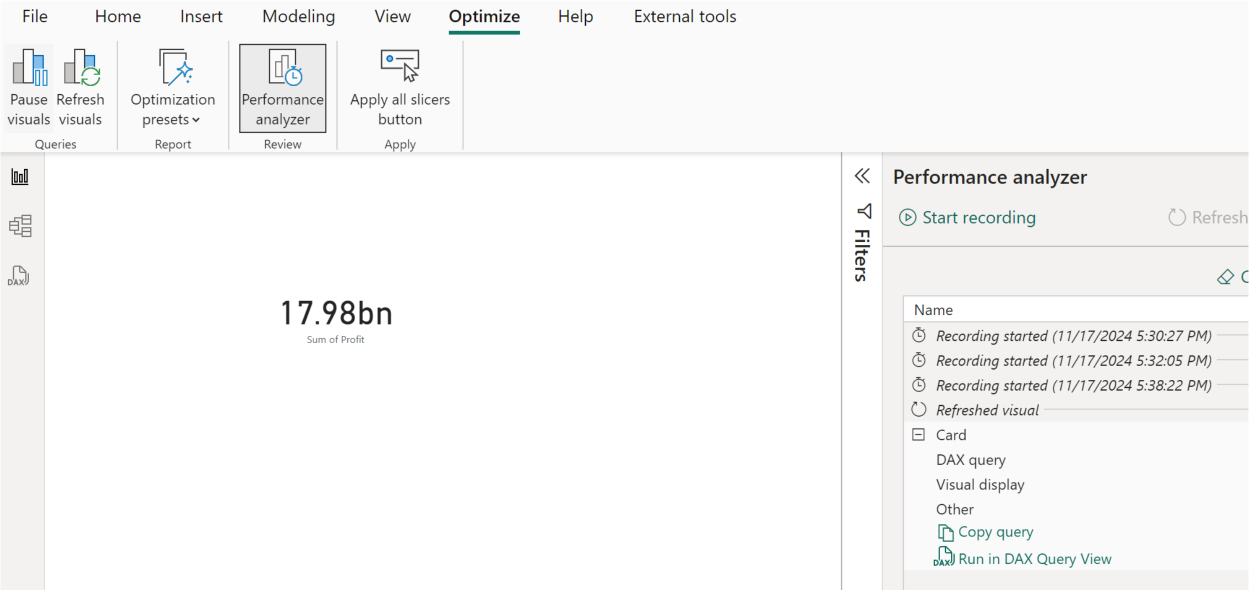
Direct Lake Behavior: Automatic

- Automatic
- Direct Lake Only
- DirectQuery Only

Direct Lake – analyzer (trace)

Validate the report mode using Performance analyzer. https://learn.microsoft.com/en-us/fabric/get-started/direct-lake-analyze-query-processing

Below picture shows that semantic model was able to process the visual’s in **Direct Lake** mode.



Recording started (11/17/2024 5:30:27 PM)
Recording started (11/17/2024 5:32:05 PM)
Recording started (11/17/2024 5:38:22 PM)
Refreshed visual
Card
DAX query
Visual display
Other