AZURE DATA FACTORY SECURITY & AUTHENTICATION

This whitepaper covers different security options for ADF

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Data Factory Security & Authentication

Contents

What is Azure Data Factory

More than ever before, security is one of the biggest concerns for companies. In the past, very few options existed when it came to passing credentials via code. Hardcoding credentials in configuration files or using plain text in code are some of the options. With the advent of cloud technology, we are witnessing a proliferation of generic users for application authentication. Azure addresses passing credential issue by using security features such Key vault, service principal and managed identity.
This article is a step by step documentation on how to use service principal and managed identity when implementing data pipelines using Azure Data Factory.

What is Azure Data Factory

Azure Data Factory is a fully managed data integration service in the cloud. Data Factory allows you to easily create code-free and scalable ETL/ELT processes. More details available here.

Azure Data Factory has more than 80 connectors. In this article, we'll discuss how to securely connect to the different data sources using Service principal and Managed Identity. We assume you are familiar with ADF.

What is Service principal?

Azure service principal is an identity that allows applications, automated processes and tools to access Azure resources. The role assigned to the service principal will define the level of access to the resources. It is possible to define the role at the subscription, resource group or resource level.

Authentication to your data source in ADF using Service principal

Create a Service principal

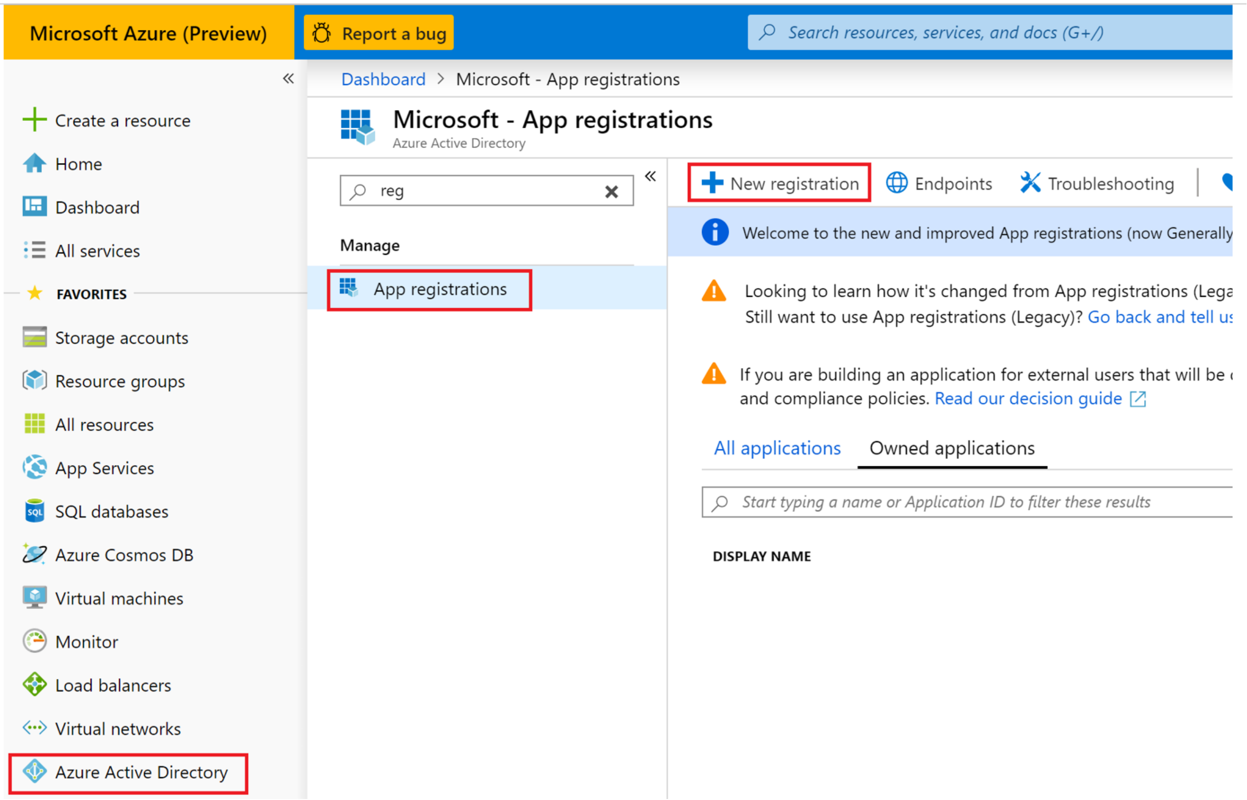
Note that it is possible to create a service principal using PowerShell and the Azure portal. In the article, we'll walk you through the creation of a Service using the Azure portal.

Grant access to Service principal

To create a service principal, you will first have to create an Azure Active Directory (AAD) Application and register the App.

Connect to the azure portal : www.portal.azure.com

Click on *Azure Active Directory* and select *new registration*



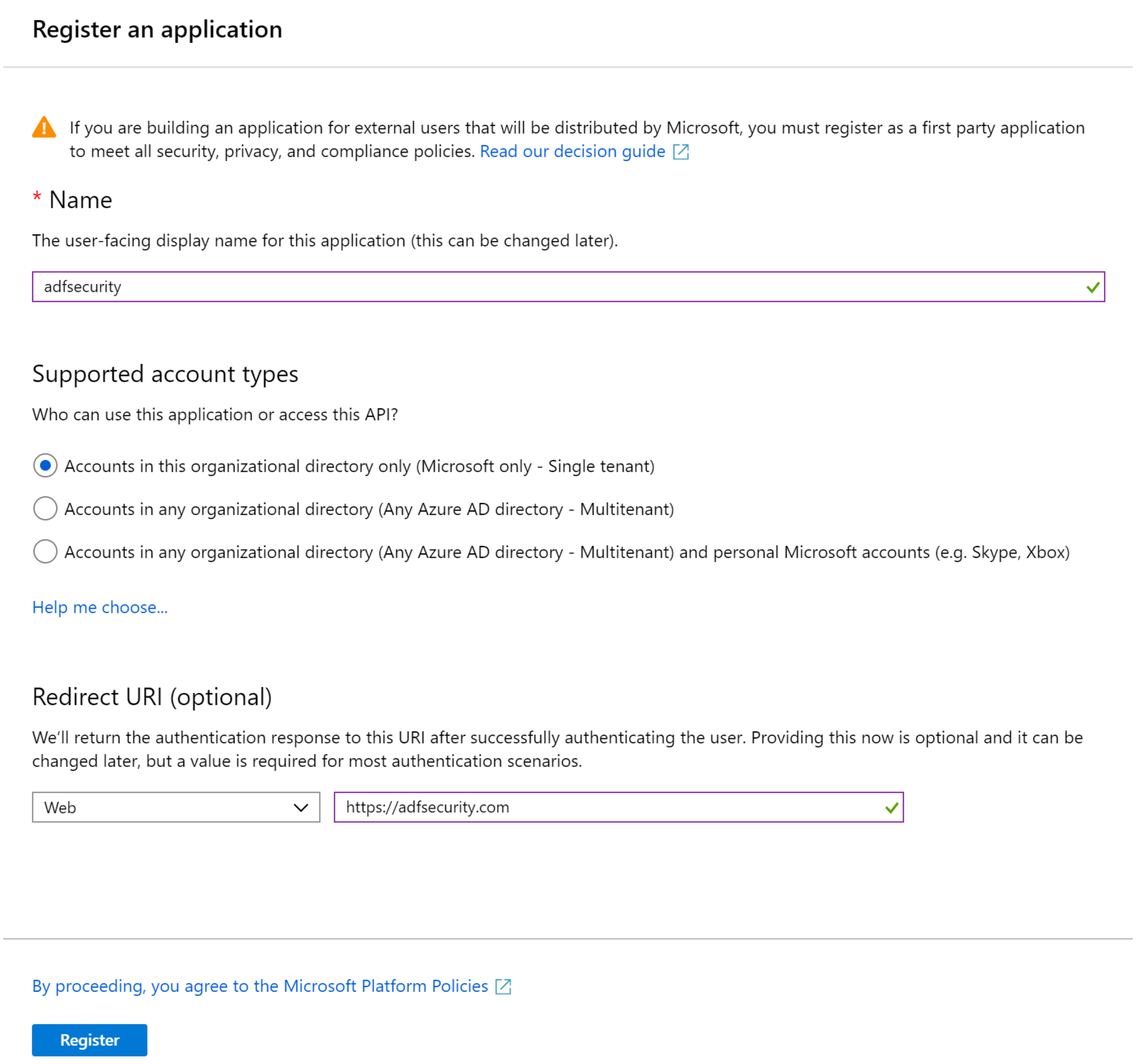
Welcome to the new and improved App registrations (now Generally

Looking to learn how it's changed from App registrations (Lega
Still want to use App registrations (Legacy)? Go back and tell us

If you are building an application for external users that will be
and compliance policies. Read our decision guide

A new blade will appear after you select *new registration*.

Enter the name of your application



Register an application

⚠ If you are building an application for external users that will be distributed by Microsoft, you must register as a first party application to meet all security, privacy, and compliance policies. Read our decision guide

* Name

The user-facing display name for this application (this can be changed later).

adfsecurity ✓

Supported account types

Who can use this application or access this API?

● Accounts in this organizational directory only (Microsoft only - Single tenant)

○ Accounts in any organizational directory (Any Azure AD directory - Multitenant)

○ Accounts in any organizational directory (Any Azure AD directory - Multitenant) and personal Microsoft accounts (e.g. Skype, Xbox)

Help me choose...

Redirect URI (optional)

We'll return the authentication response to this URI after successfully authenticating the user. Providing this now is optional and it can be changed later, but a value is required for most authentication scenarios.

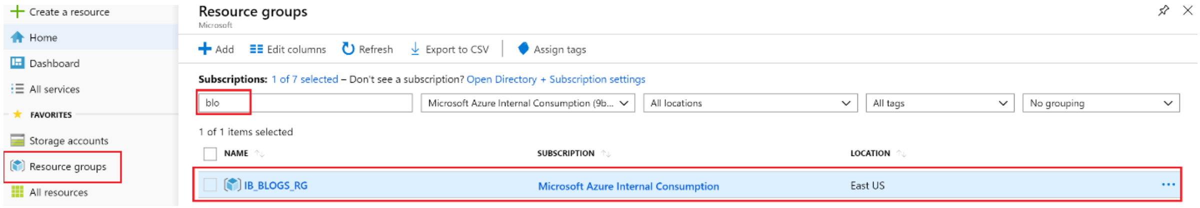
Web | https://adfsecurity.com ✓

By proceeding, you agree to the Microsoft Platform Policies

Select *register*.

As mentioned above, the role assigned to the service principal will define the level of access to the resources. In this example, we'll assign the role to the service principal at the resource group level.

Find and select your resource group.



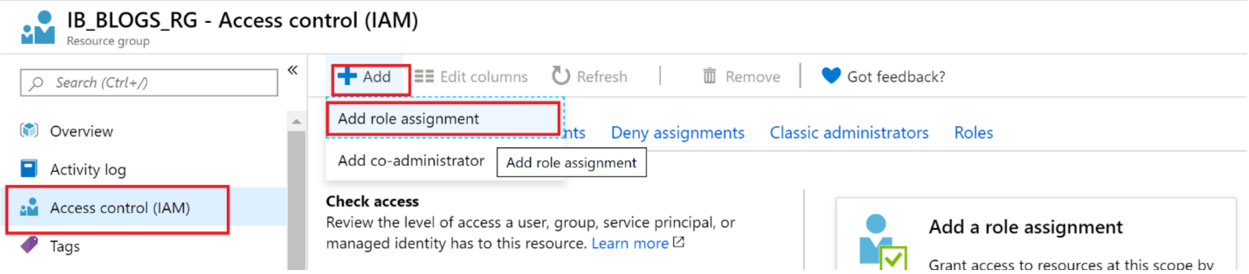
Subscriptions: 1 of 7 selected – Don't see a subscription? Open Directory + Subscription settings

blo | Microsoft Azure Internal Consumption (9b... | All locations | All tags | No grouping

1 of 1 items selected

NAME	SUBSCRIPTION	LOCATION
IB_BLOGS_RG	Microsoft Azure Internal Consumption	East US

In the new blade, under *Access Control (IAM)* select *Add* to select *Add role assignment*



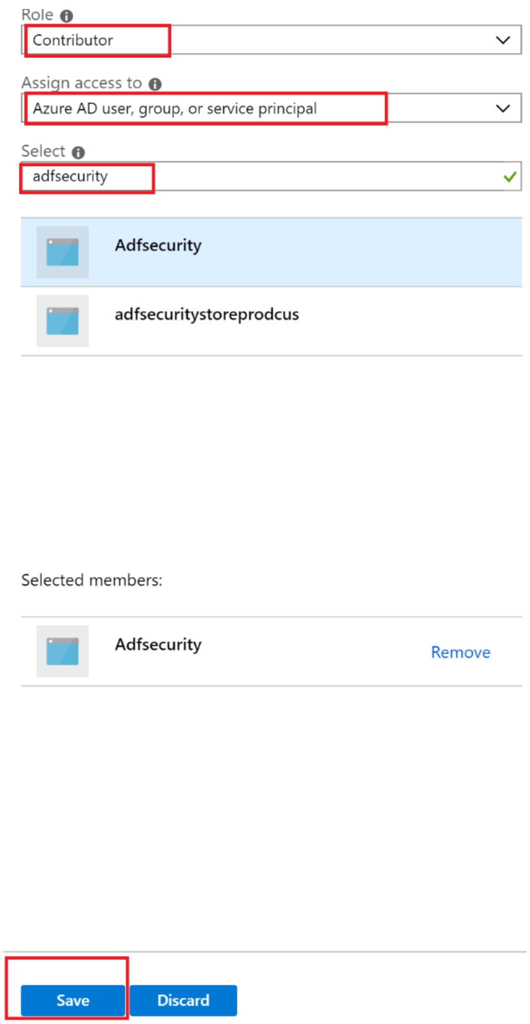
Check access
Review the level of access a user, group, service principal, or managed identity has to this resource. Learn more

Grant access to resources at this scope by

Select the role you want to assign to the service principal from the new screen.

In the assign access to dropdown list, select *Azure AD user, group, or service principal*.

In the select tab, find your application. You can enter the name of the App and, as it appears in the list, select it and click save



Role: Contributor

Assign access to: Azure AD user, group, or service principal

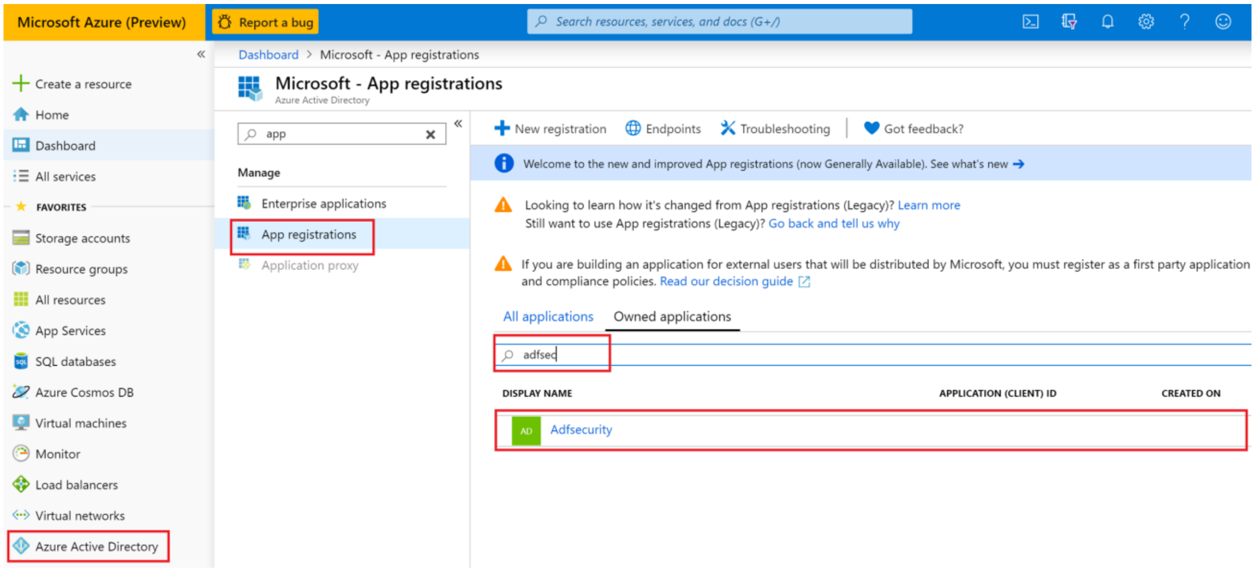
Select: adfsecurity

Selected members:

Adfsecurity

At this point, you almost are ready to start the configuration of your Data Factory. We just need to retrieve additional information to allow our Data Factory to authenticate. Not only we need the application id and the authentication key but we also need to generate a certificate and a secret.

To get the application id and authentication key, click on *Azure Active Directory* in the main menu of the portal. Select App registrations and search and select your application



Welcome to the new and improved App registrations (now Generally Available). See what's new →

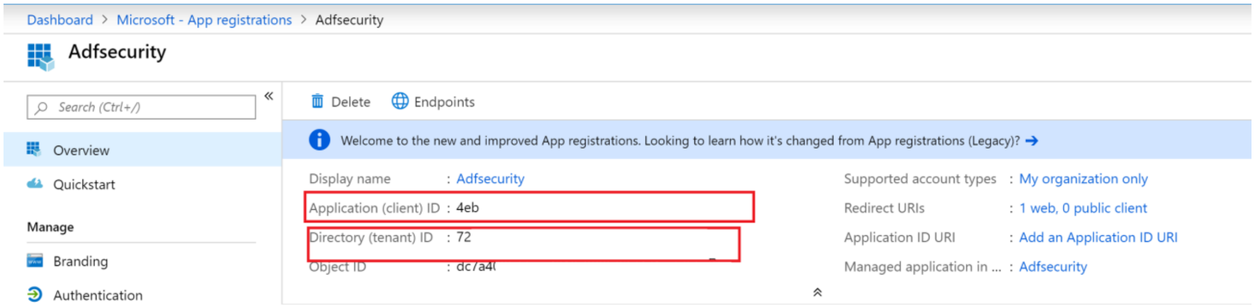
Looking to learn how it's changed from App registrations (Legacy)? Learn more
Still want to use App registrations (Legacy)? Go back and tell us why

If you are building an application for external users that will be distributed by Microsoft, you must register as a first party application and compliance policies. Read our decision guide

adfsec

DISPLAY NAME	APPLICATION (CLIENT) ID	CREATED ON
AD Adfsecurity		

In the overview page of the new blade, copy the Directory (Tenant) Id and the Application (Client) Id

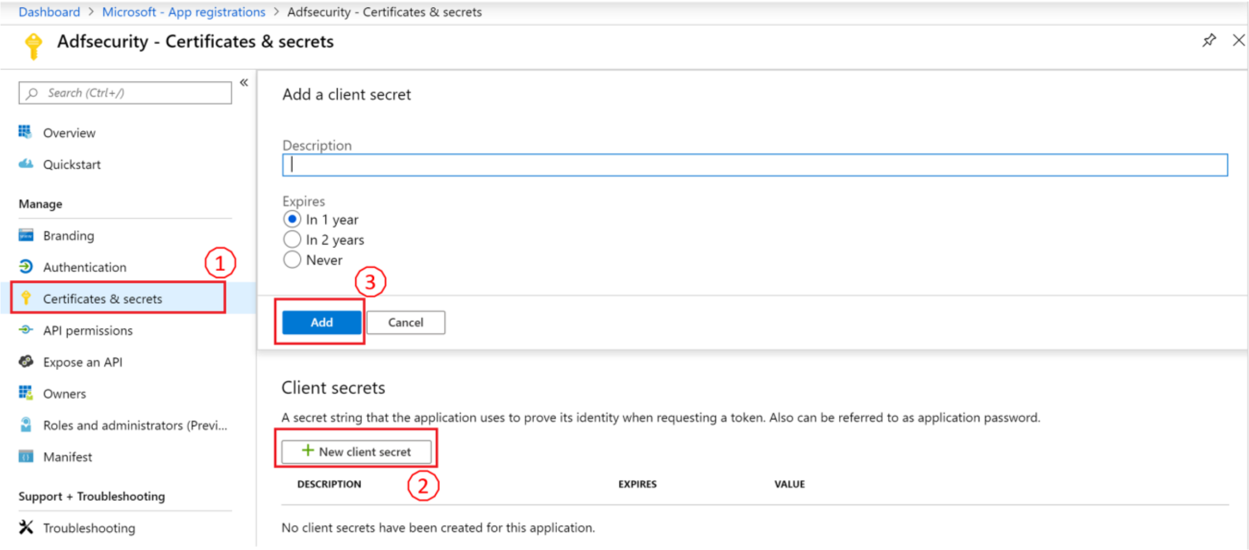


Welcome to the new and improved App registrations. Looking to learn how it's changed from App registrations (Legacy)? →

Display name : Adfsecurity
Application (client) ID : 4eb
Directory (tenant) ID : 72
Object ID : dc7a4(

Supported account types : My organization only
Redirect URIs : 1 web, 0 public client
Application ID URI : Add an Application ID URI
Managed application in ... : Adfsecurity

Let's generate the certificate that ADF will use to authenticate



Add a client secret

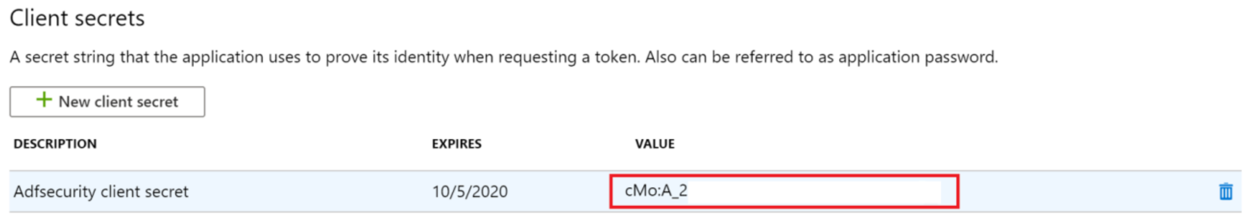
Description

Expires
● In 1 year
○ In 2 years
○ Never

Client secrets

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

No client secrets have been created for this application.



Client secrets

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
Adfsecurity client secret	10/5/2020	cMo:A_2

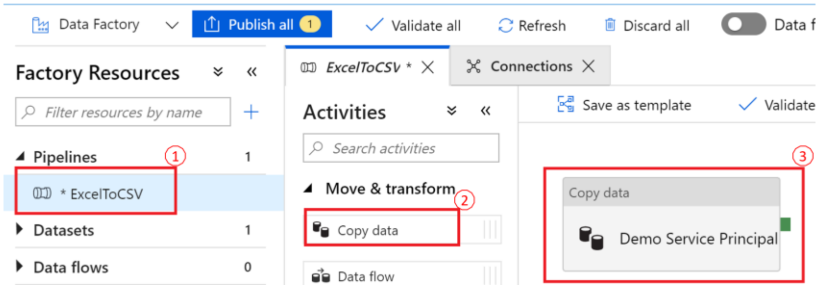
Copy and save this value as it will not be displayed going forward.

Configure your Linked Service

Once the Application created and registered, you can go back to your Data Factory and configure the linked service.

In this document, we'll show how to configure a linked service to an Azure Blob Storage, in a copy activity as an example.

In the author tab of ADF, select an existing pipeline or create a new one. In the *Activities* section, drag and drop *Copy data* under *Move & transform.*

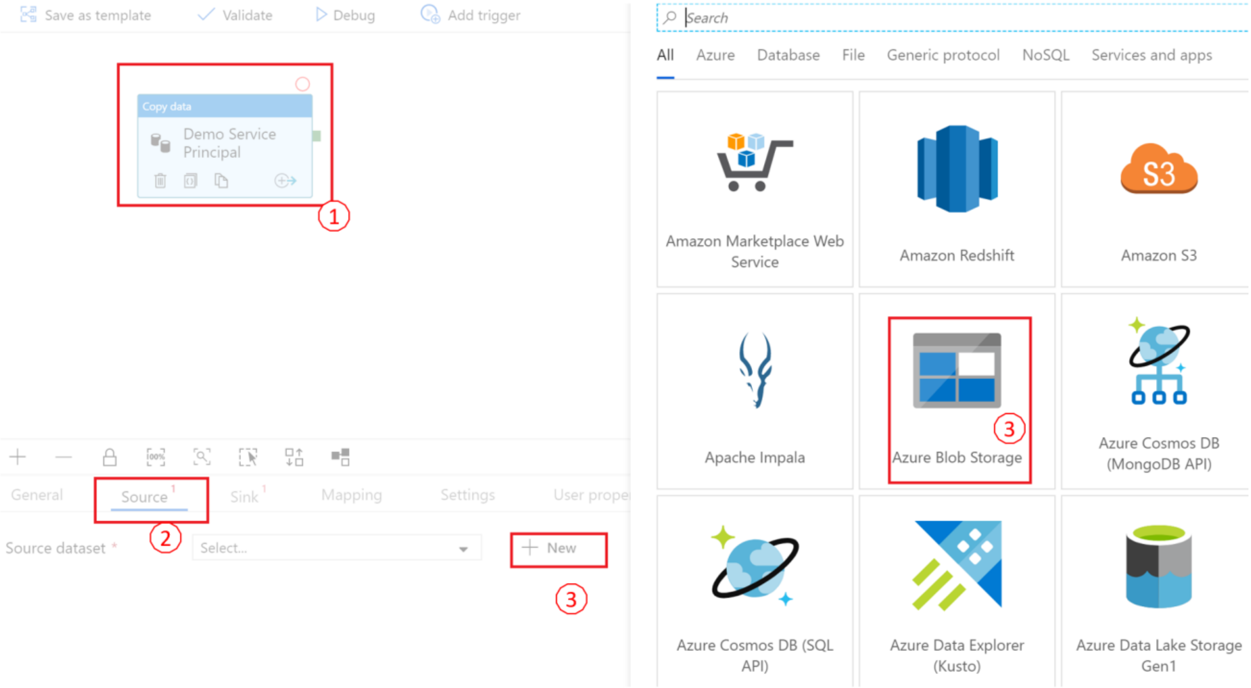


Let’s create a new dataset. While creating the dataset, we’ll be prompted to create a linked service.

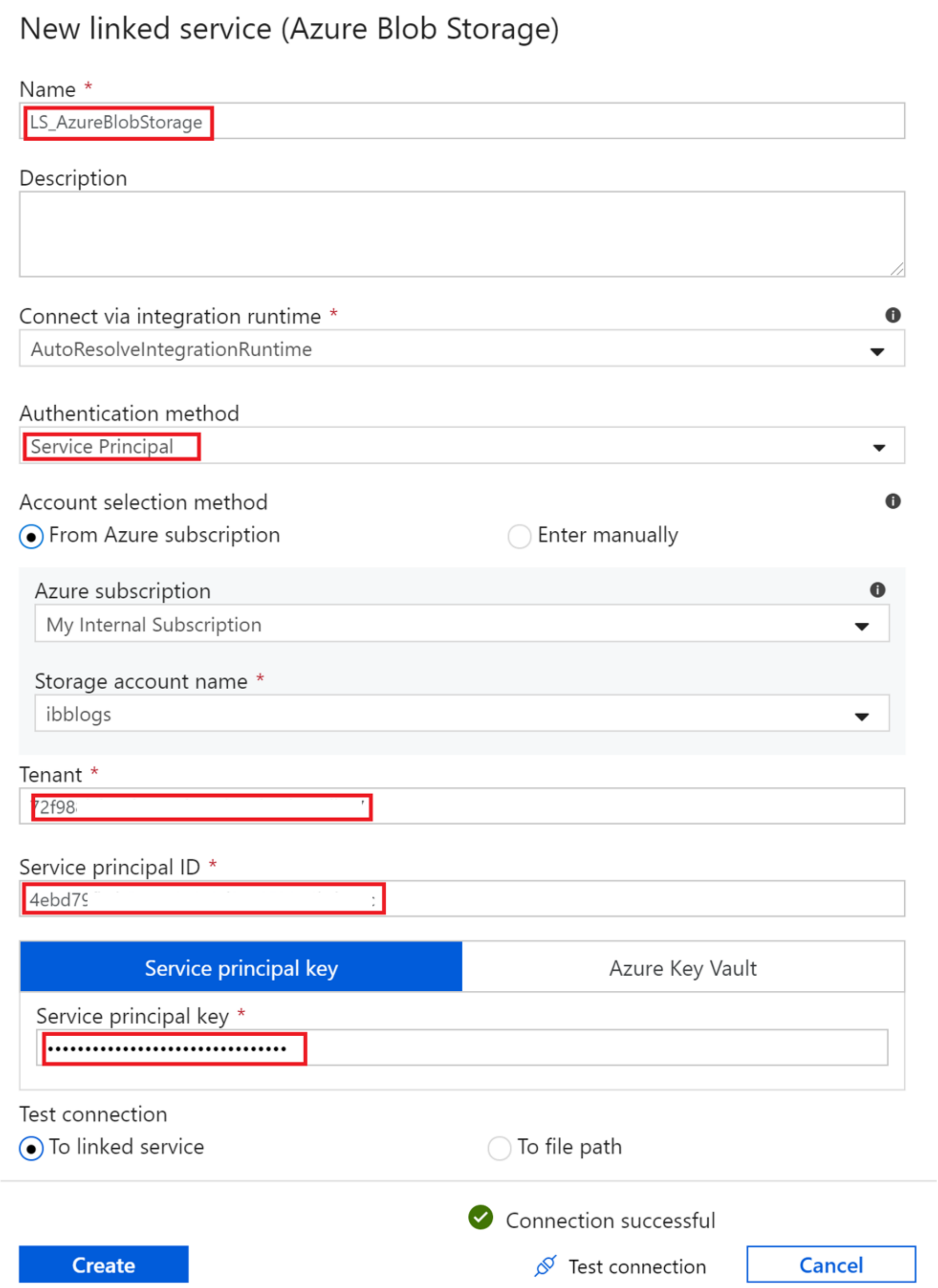
To create a dataset, select the *copy data* activity. In the properties, select *Source* and click on *New* to create a new dataset. In the new blade, select *Azure Blob Storage* as a source.

In the new Window, select *CSV DelimitedText* as format and click on continue.

Under the properties window, enter the name of the dataset and under Linked Service select N*ew*.



Provide the requested information as indicated in the screenshot below



New linked service (Azure Blob Storage)

Name *
LS_AzureBlobStorage

Description

Connect via integration runtime *
AutoResolveIntegrationRuntime

Authentication method
Service Principal

Account selection method
● From Azure subscription ○ Enter manually

Azure subscription
My Internal Subscription

Storage account name *
ibblogs

Tenant *
72f98 [redacted]

Service principal ID *
4ebd7 [redacted]

Service principal key *
••••••••••••••••••••••••••••••••

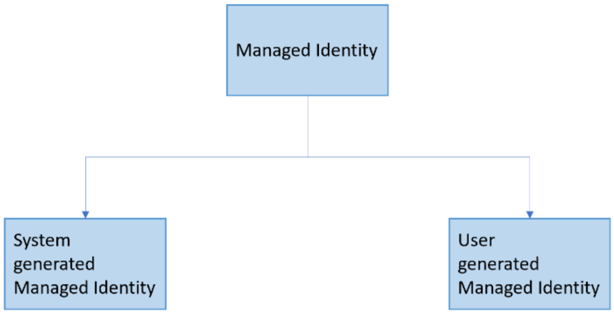
Test connection
● To linked service ○ To file path

✓ Connection successful

What is Managed Identity?

When you do not want to store credentials such as login details or keys within the code, you rely on managed identity. You can authenticate to different services in Azure without having to store credentials in services such as Azure keyVault. Managed Identity is the new name for MSI (Managed Service Identity). More details can be found here.

There are two types of managed identity

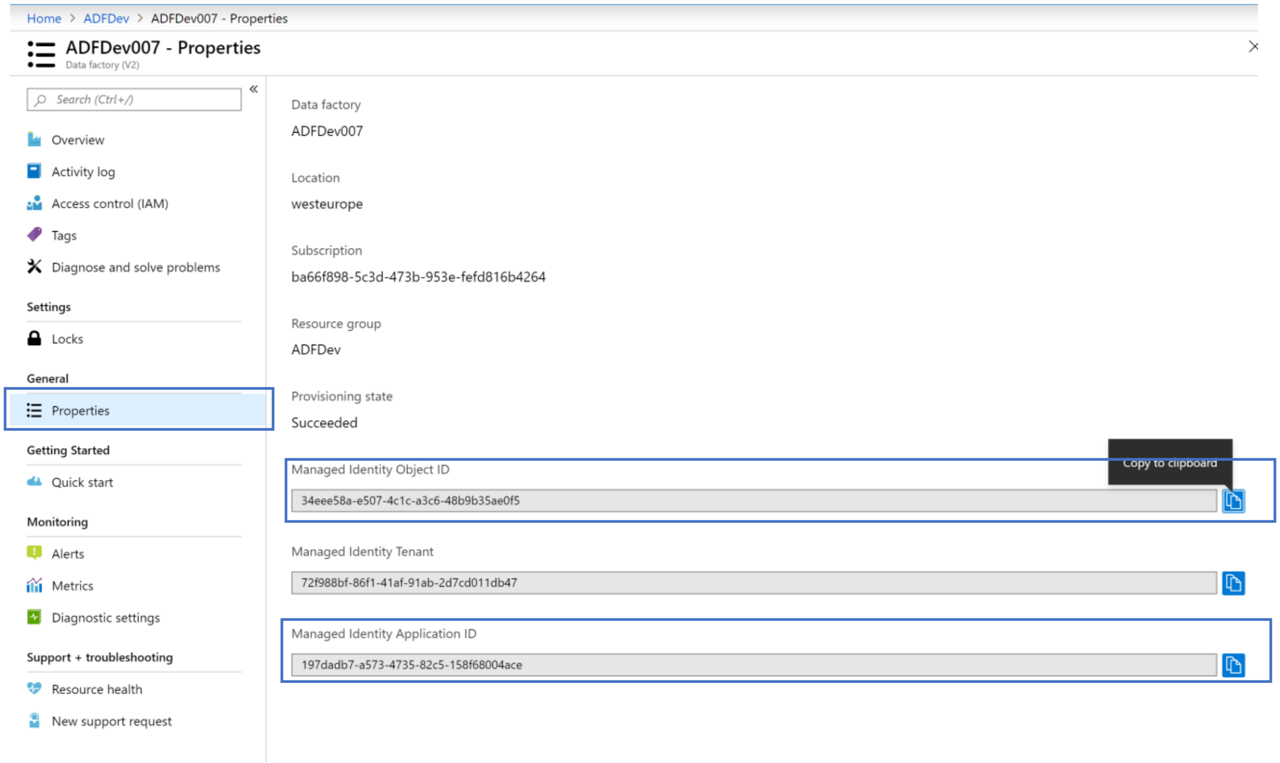

Managed Identity
System generated Managed Identity
User generated Managed Identity

Depending on the method used to create the ADF, the Managed Identity is created automatically whenever an ADF v2 is provisioned. When using SDK/REST API to create ADF, the identity session must be set to true to create MI automatically.

Authentication to your data source in ADF using Managed Identity

The scenario that we will explore is to copy data from one folder within ADLS gen2 storage to another folder within ADLS gen2 storage. We will be using managed identity to authenticate between ADLS and ADF. Let us start by creating an ADF using the portal. Once ADF has been created, you will be able to find the Managed Identity Application ID and Managed Identity Object ID by looking at the properties tab within ADF.

Create a Managed Identity



ADFDev007 - Properties

Data factory (V2)

Data factory: ADFDev007

Location: westeurope

Subscription: ba66f898-5c3d-473b-953e-fefd816b4264

Resource group: ADFDev

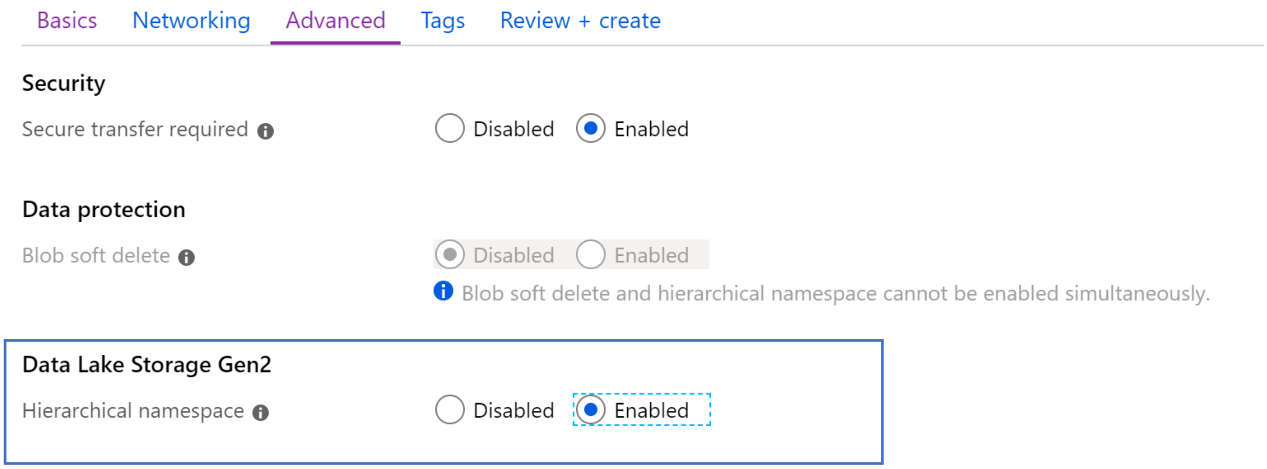
Provisioning state: Succeeded

Managed Identity Object ID: 34eee58a-e507-4c1c-a3c6-48b9b35ae0f5

Managed Identity Tenant: 72f988bf-86f1-41af-91ab-2d7cd011db47

Managed Identity Application ID: 197dadb7-a573-4735-82c5-158f68004ace

The next step is to create an ADLS gen 2 with hierarchical namespace enabled.



Security

Secure transfer required ○ Disabled ● Enabled

Data protection

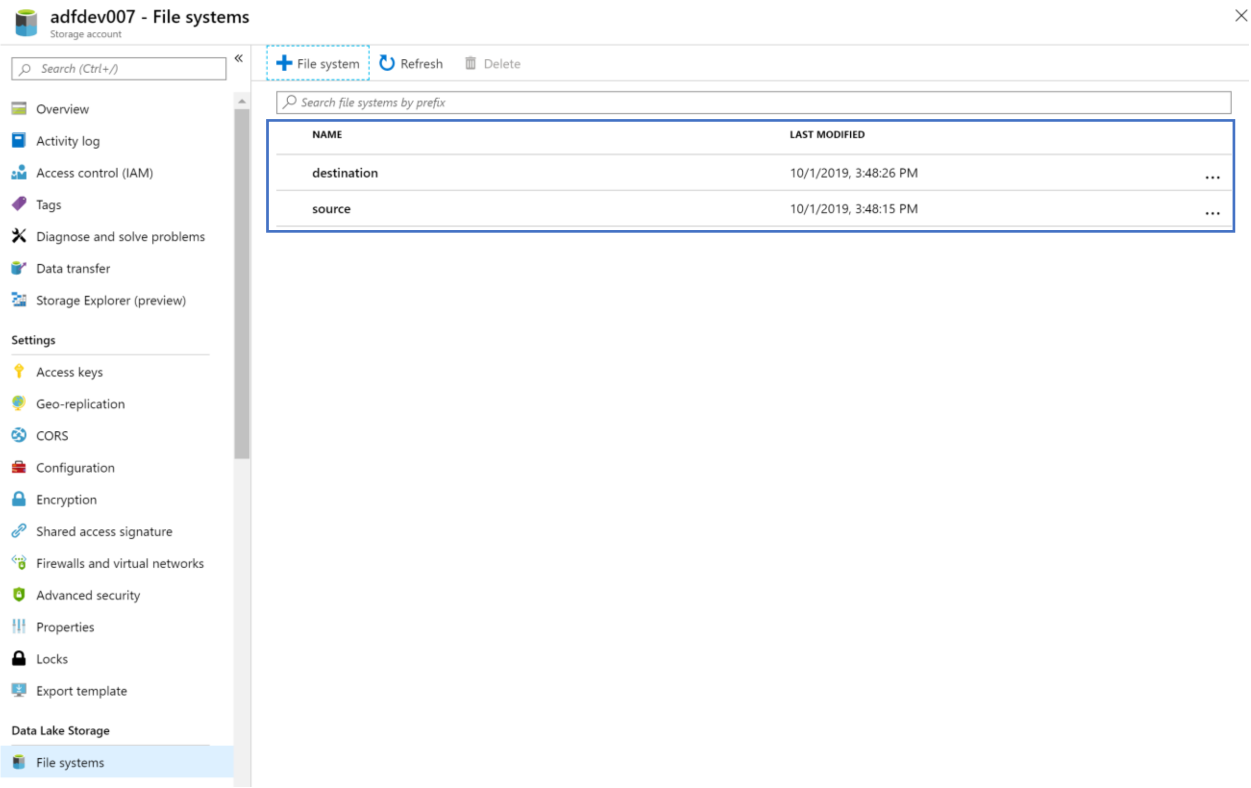
Blob soft delete ● Disabled ○ Enabled

Blob soft delete and hierarchical namespace cannot be enabled simultaneously.

Data Lake Storage Gen2

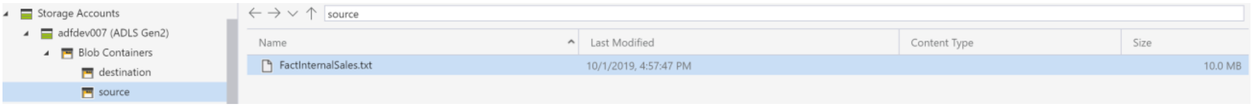
Hierarchical namespace ○ Disabled ● Enabled

Create two folders named **source** and **destination**. The folder structure for ADLS gen 2 looks like the one below



NAME	LAST MODIFIED
destination	10/1/2019, 3:48:26 PM
source	10/1/2019, 3:48:15 PM

Upload a text file into the source folder using Azure storage explorer. Azure Data Explorer is a free tool to easily manage your storage accounts. You can download it here It can be any text file.

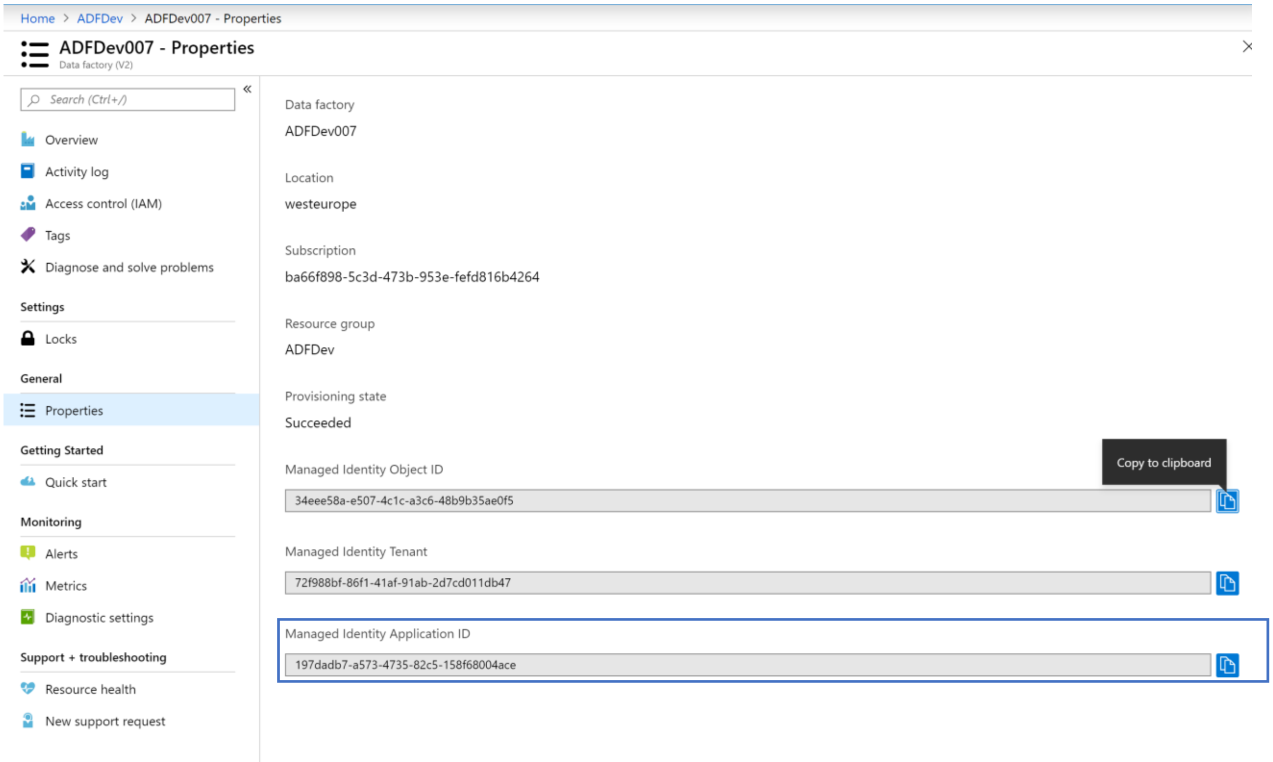


Name	Last Modified	Content Type	Size
FactInternalSales.txt	10/1/2019, 4:57:47 PM		10.0 MB

ADLS Gen2 supports both RBAC and POSIX-like access control lists (ACLs). The key thing to note is that RBAC is very coarse permission. The lowest level of permission that can be assigned is at a container level.

RBAC permission is evaluated first and if permissions are valid, ACLs are not checked, and access is granted. In short, RBAC supersedes ACLs. To provide ACL permission use **Managed Identity Object ID**. To provide RBAC permission use **Managed Identity Application ID**.

One can use this managed identity for Data Lake Storage Gen2 authentication. It allows this Azure Data factory to access and copy data to or from ADLS Gen2. Copy the Managed Identity Application ID from properties tab of Azure Data Factory.



Data factory
ADFDev007

Location
westeurope

Subscription
ba66f898-5c3d-473b-953e-fefd816b4264

Resource group
ADFDev

Provisioning state
Succeeded

Managed Identity Object ID
34eee58a-e507-4c1c-a3c6-48b9b35ae0f5

Managed Identity Tenant
72f988bf-86f1-41af-91ab-2d7cd011db47

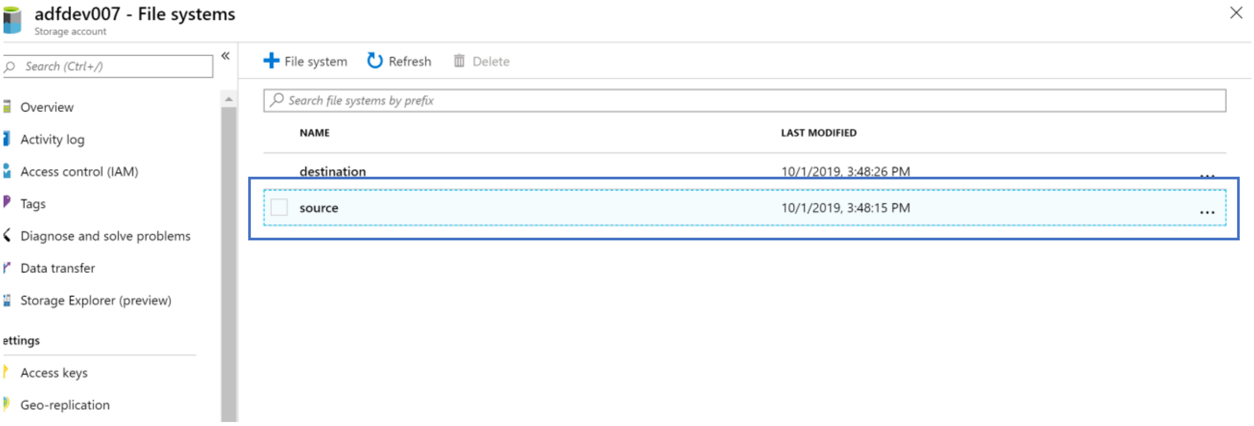
Managed Identity Application ID
197dadb7-a573-4735-82c5-158f68004ace

Grant access to Managed Identity

Now, we need to grant appropriate RBAC permission to the ADF Application ID on ADLS Gen2 folders-source and destination. Since we are copying file from source folder, the required permission is **Storage Blob Data Reader** role and for destination folder it is **Storage Blob Data Contributor** role. You will also need to grant "**Storage Blob Data Reader**" permission at account level* to be able to test connection and browse folder from ADF when setting up linked service.

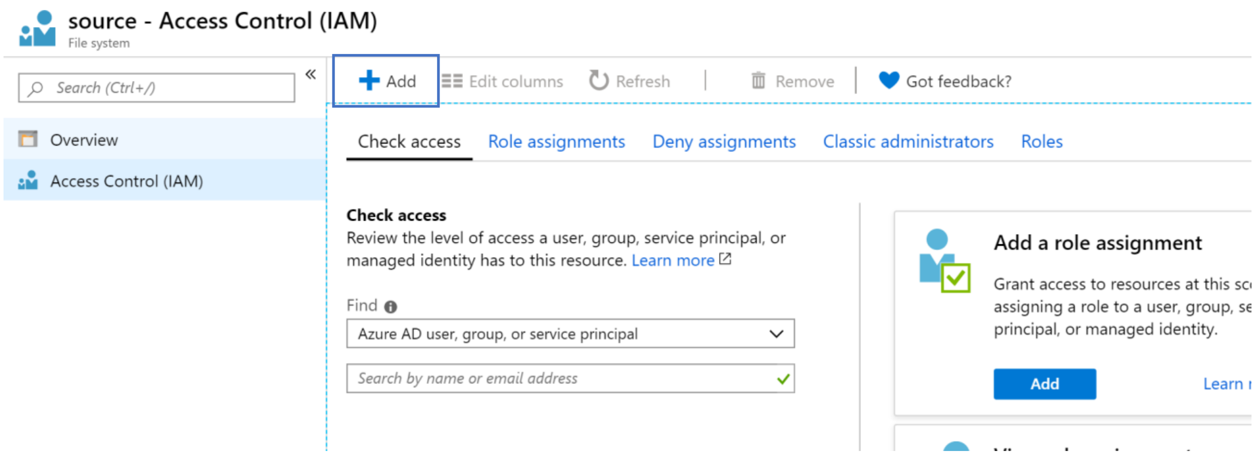
*if you do not give **Storage Blob Data Reader RBAC** permission at the account level, you **will not** be able to test connection or browse to folder. You will need to trust that it will work if the right permissions are given at the folder level. For more details refer this.

Click on the source folder



NAME	LAST MODIFIED
destination	10/1/2019, 3:48:26 PM
source	10/1/2019, 3:48:15 PM

Select the RBAC for the source folder and click add

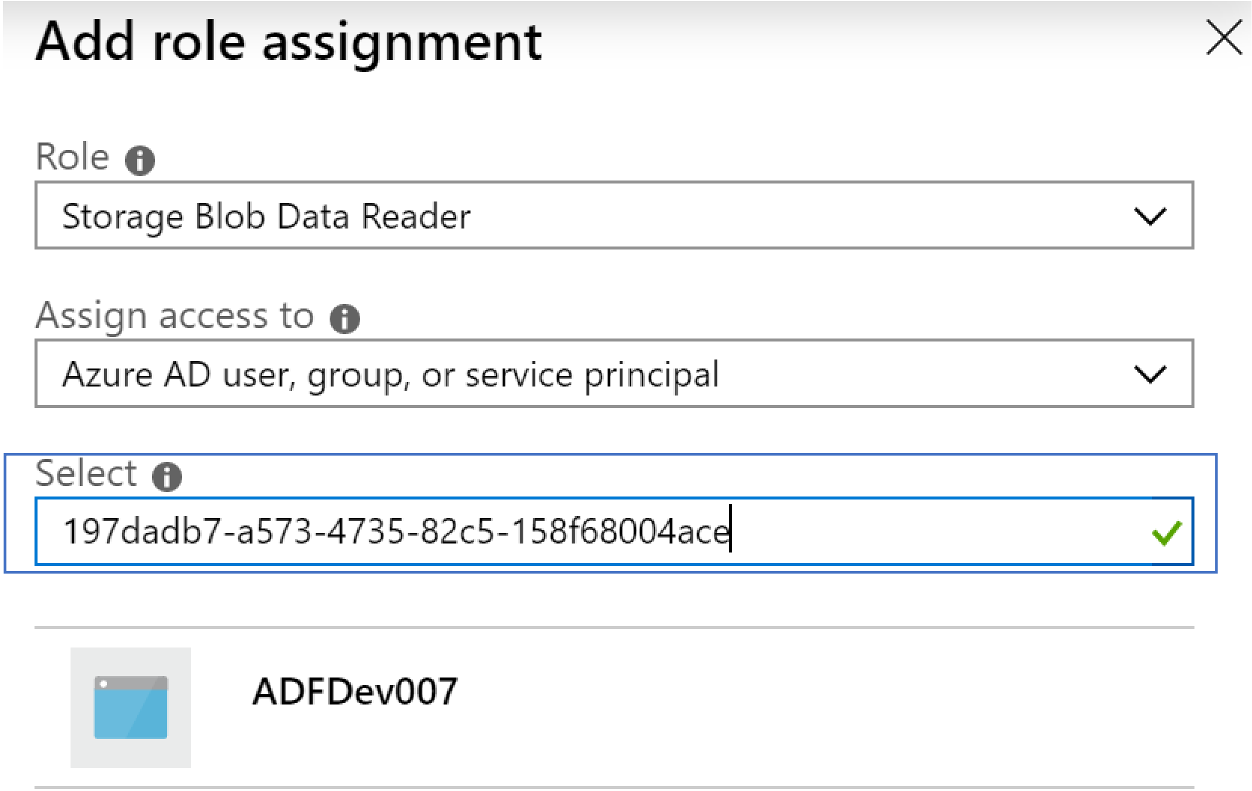


Check access
Review the level of access a user, group, service principal, or managed identity has to this resource. Learn more

Find
Azure AD user, group, or service principal
Search by name or email address

Add a role assignment
Grant access to resources at this sc
assigning a role to a user, group, se
principal, or managed identity.

Add
Learn r



Add role assignment

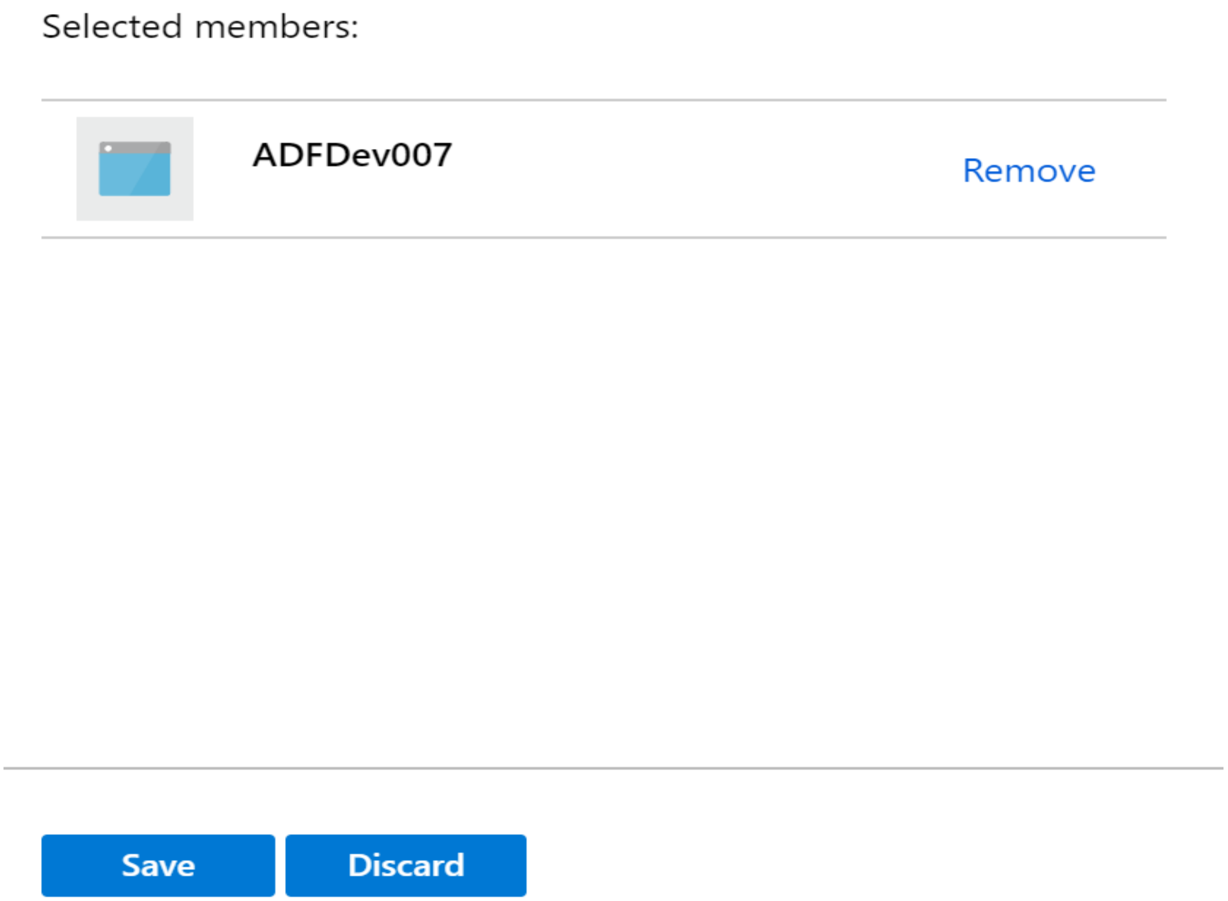
Role: Storage Blob Data Reader

Assign access to: Azure AD user, group, or service principal

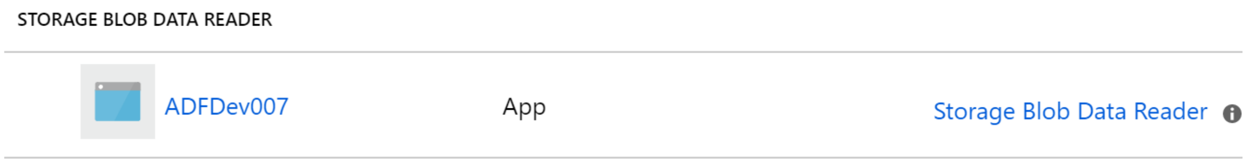
Select: 197dadb7-a573-4735-82c5-158f68004ace

ADFDev007

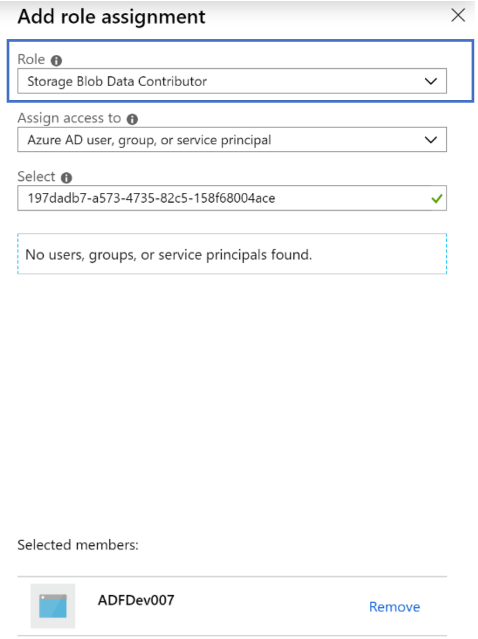
Once the ADF name is selected, you will be able to save the selection.



After saving the changes, check whether an entry is present in the Access Control (IAM) tab for the folder **source**



Do the same for the folder **destination** and the role is **Storage Blob Data Contributor**



Add role assignment

Role: Storage Blob Data Contributor

Assign access to: Azure AD user, group, or service principal

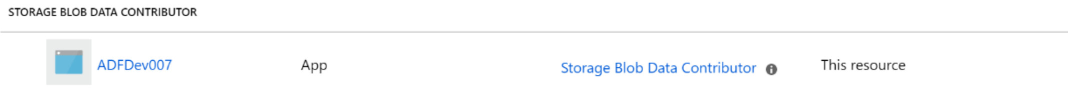
Select: 197dadb7-a573-4735-82c5-158f68004ace

No users, groups, or service principals found.

Selected members:

ADFDev007 Remove

Once saved, check the role assigned to the Managed Identity Application ID

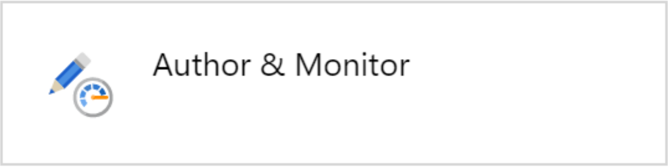


STORAGE BLOB DATA CONTRIBUTOR

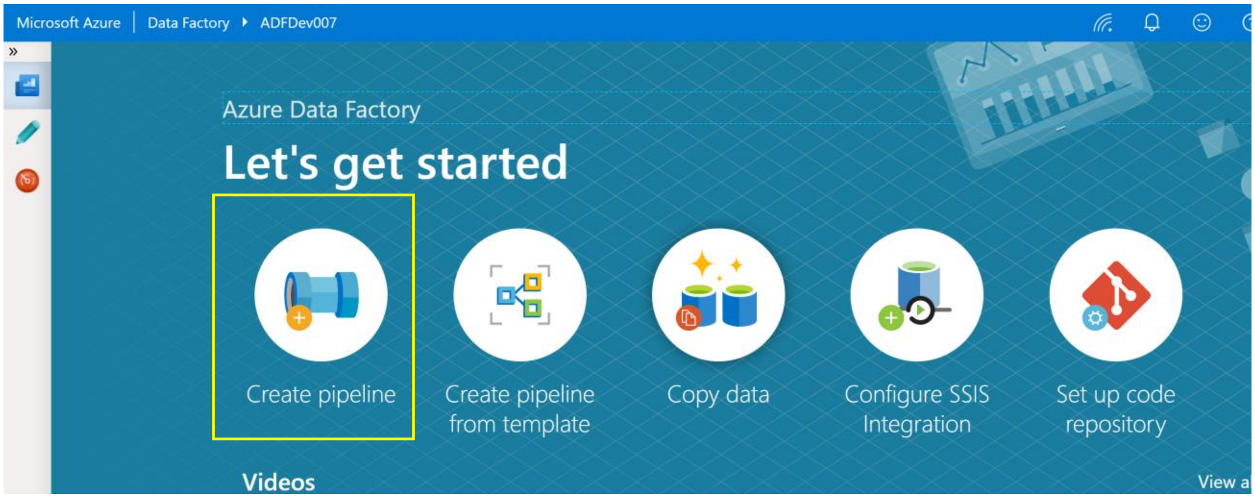
ADFDev007	App	Storage Blob Data Contributor	This resource

Create copy activity and linked service

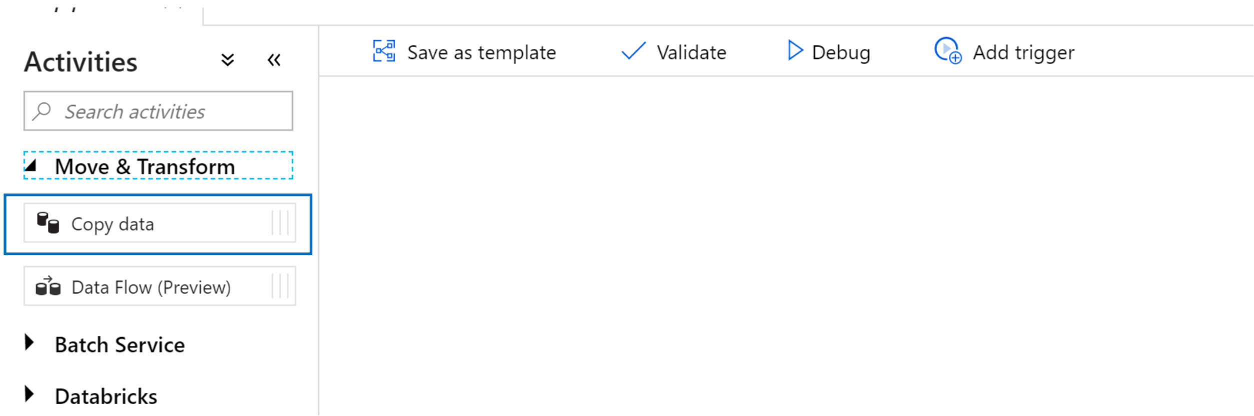
Go to the Azure Data Factory and click author & Monitor-

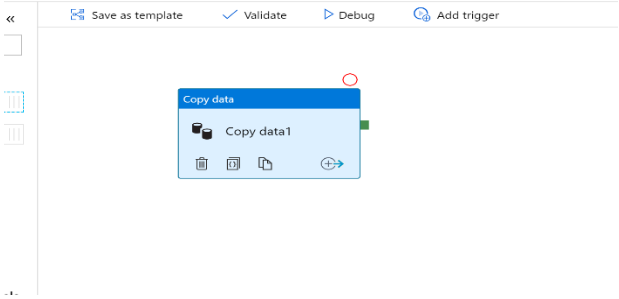


Click Create pipeline

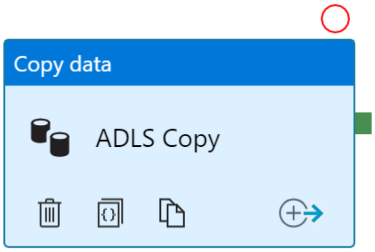


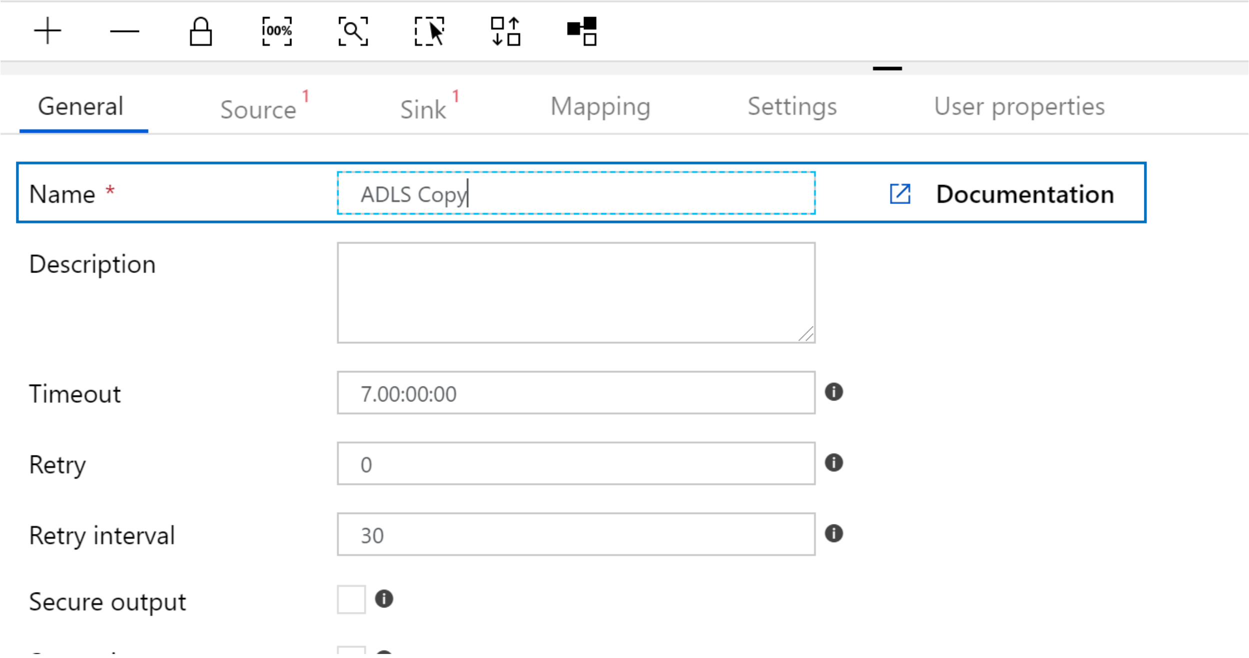
Drag and drop Copy Data activity by expanding “Move & Transform”





Rename the copy data activity to “ADLS Copy”





Name * ADLS Copy

Description

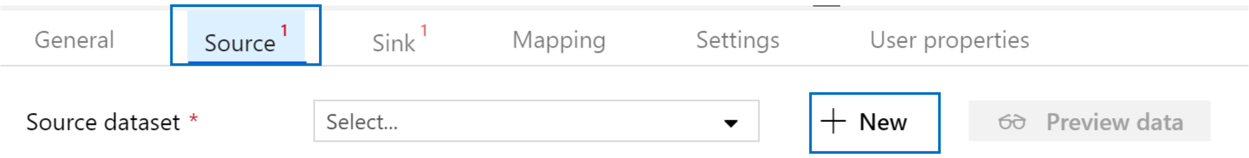
Timeout 7.00:00:00

Retry 0

Retry interval 30

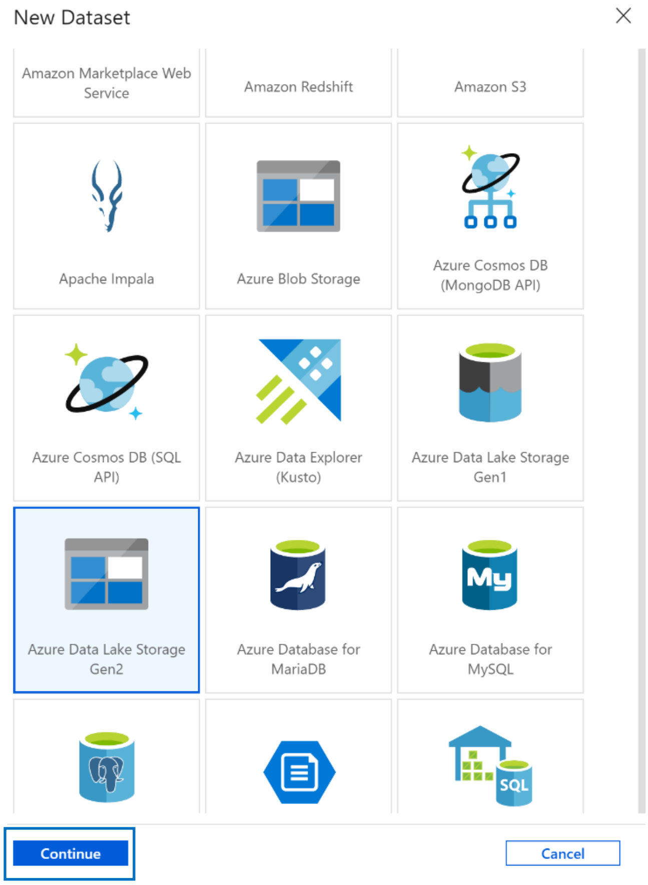
Secure output □

Now, click on the Source tab and select **NEW** set the source to be the ADLS Gen 2 folder that holds the text file

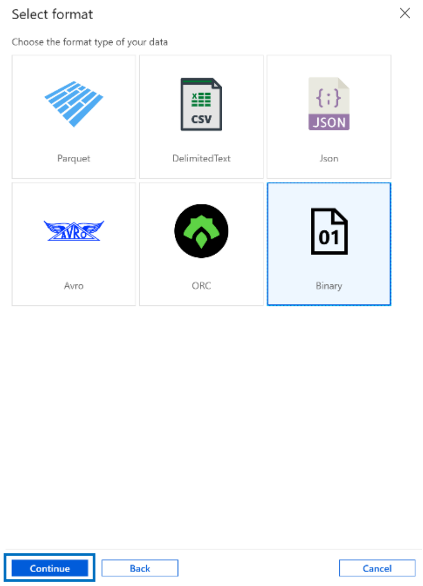


Source dataset * Select...

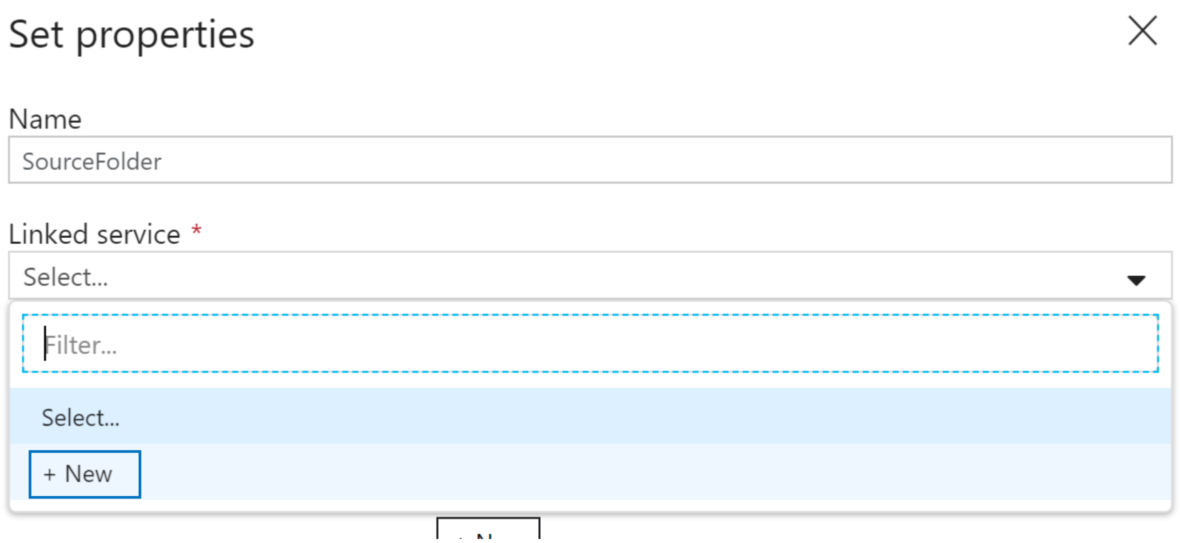
Select the ADLS gen 2 storage and click continue


New Dataset
Amazon Marketplace Web Service
Amazon Redshift
Amazon S3
Apache Impala
Azure Blob Storage
Azure Cosmos DB (MongoDB API)
Azure Cosmos DB (SQL API)
Azure Data Explorer (Kusto)
Azure Data Lake Storage Gen1
Azure Data Lake Storage Gen2
Azure Database for MariaDB
Azure Database for MySQL
SQL
Continue
Cancel

Select binary copy and click continue



Rename the activity to SourceFolder and select the **+new** in linked services



Set properties

Name

SourceFolder

Linked service *

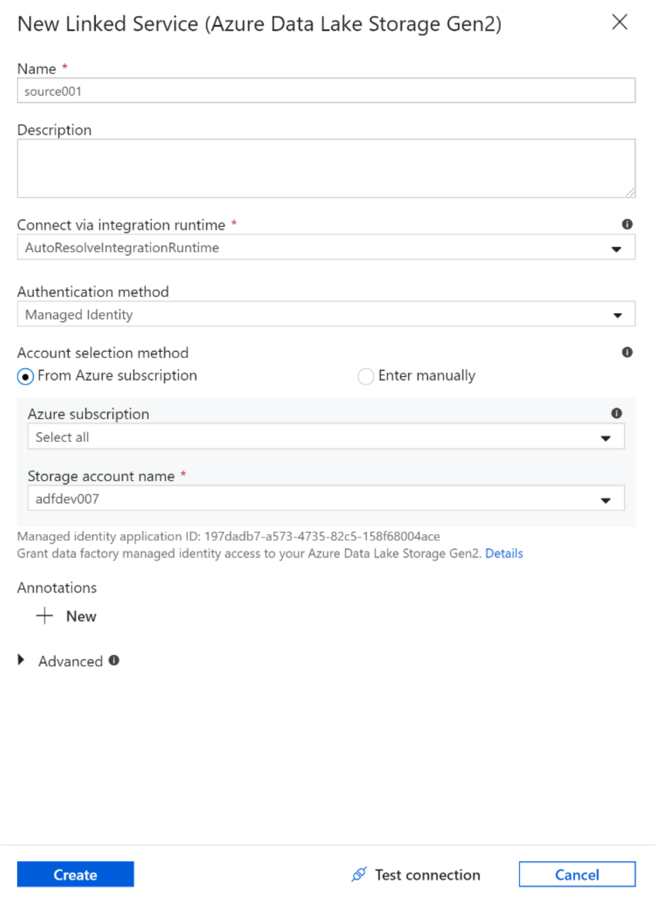
Select...

Filter...

Select...

+ New

Change Authentication method to Managed Identity and set rest of the information as appropriate



New Linked Service (Azure Data Lake Storage Gen2)

Name *

source001

Description

Connect via integration runtime *

AutoResolveIntegrationRuntime

Authentication method

Managed Identity

Account selection method

● From Azure subscription ○ Enter manually

Azure subscription

Select all

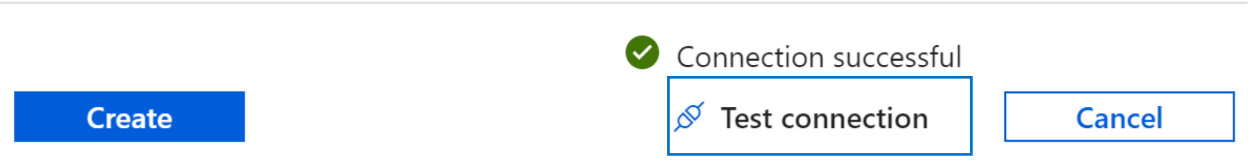
Storage account name *

adfdev007

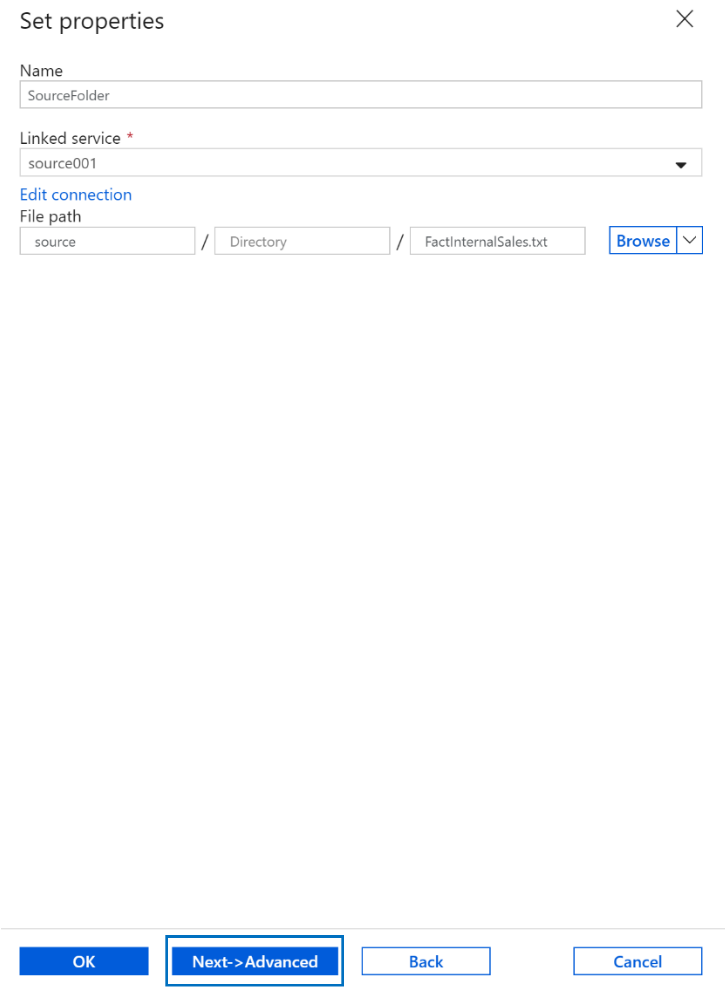
Managed identity application ID: 197dadb7-a573-4735-82c5-158f68004ace
Grant data factory managed identity access to your Azure Data Lake Storage Gen2. Details

Annotations

To test the connection, press the test connection button and “Connection successful” will come up if permissions/access is correct.



Browse to the file you want to copy and advance to the next page

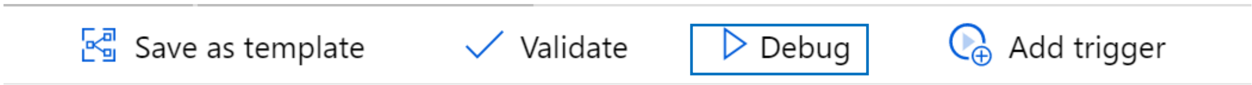

Set properties

Name
SourceFolder

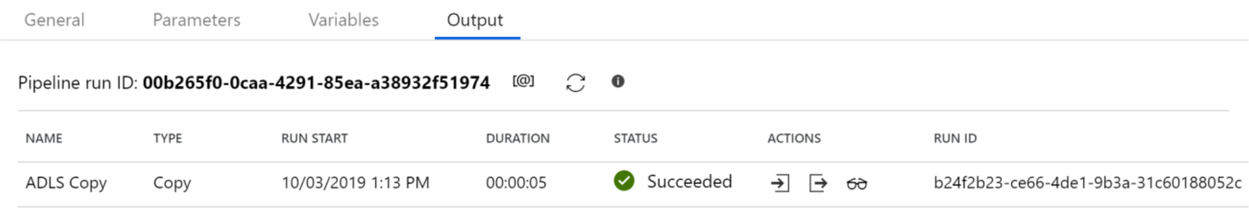
Linked service *
source001

File path
source / Directory / FactInternalSales.txt

Repeat the same for the destination folder and run the ADF in debug mode to test whether the file copy works. If all the permissions were set correctly then the files get copied.



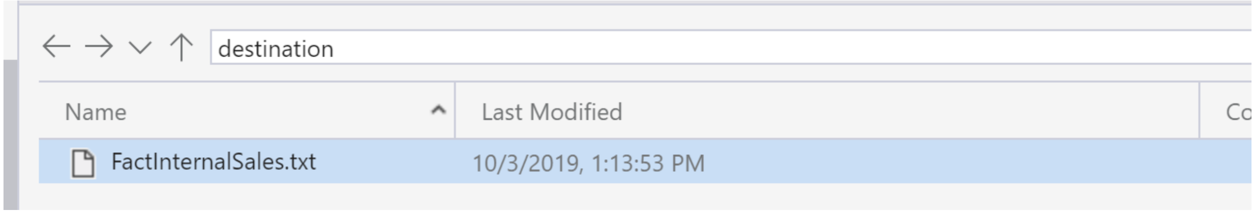
ADF execution in debug mode



Pipeline run ID: **00b265f0-0caa-4291-85ea-a38932f51974**

NAME	TYPE	RUN START	DURATION	STATUS	ACTIONS	RUN ID
ADLS Copy	Copy	10/03/2019 1:13 PM	00:00:05	✓ Succeeded		b24f2b23-ce66-4de1-9b3a-31c60188052c

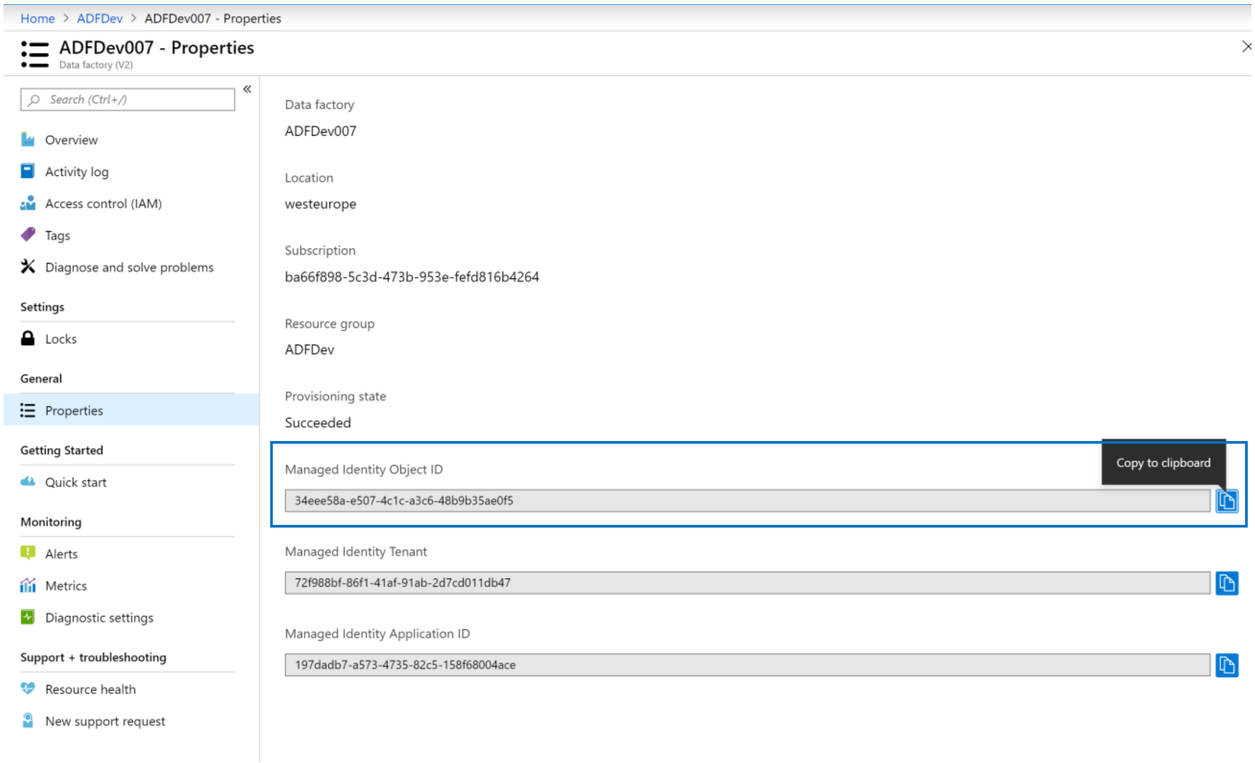
File viewed from storage explorer


destination

Name	Last Modified	Co
FactInternalSales.txt	10/3/2019, 1:13:53 PM	

Using ACLs instead of RBAC

ACL or Access Control can be done at a very granular level. You grant permission to a specific file and thereby giving you more control over the permission that is granted to service principal/Managed Identity. If you would like to have granular control, use ACL. You do not have to give any RBAC permission. We are copying file from source folder; the required permission is **execute** on the source folder and **read** permission on the file to be copied. For destination folder **execute** and **write** permission need to be granted. The permission is granted to **Managed Identity Object ID** and not **Managed Identity Application ID**.



Data factory
ADFDev007

Location
westeurope

Subscription
ba66f898-5c3d-473b-953e-fefd816b4264

Resource group
ADFDev

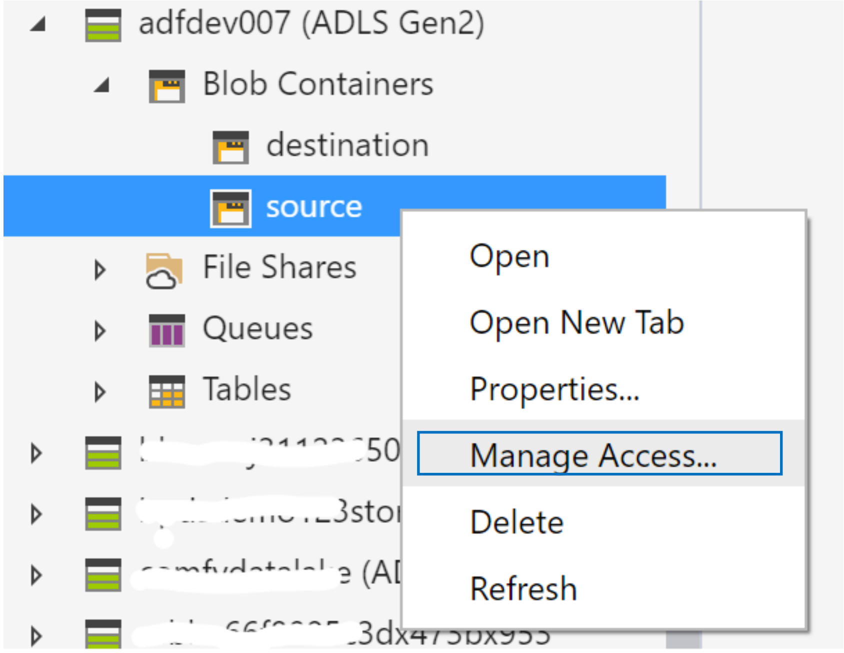
Provisioning state
Succeeded

Managed Identity Object ID
34eee58a-e507-4c1c-a3c6-48b9b35ae0f5

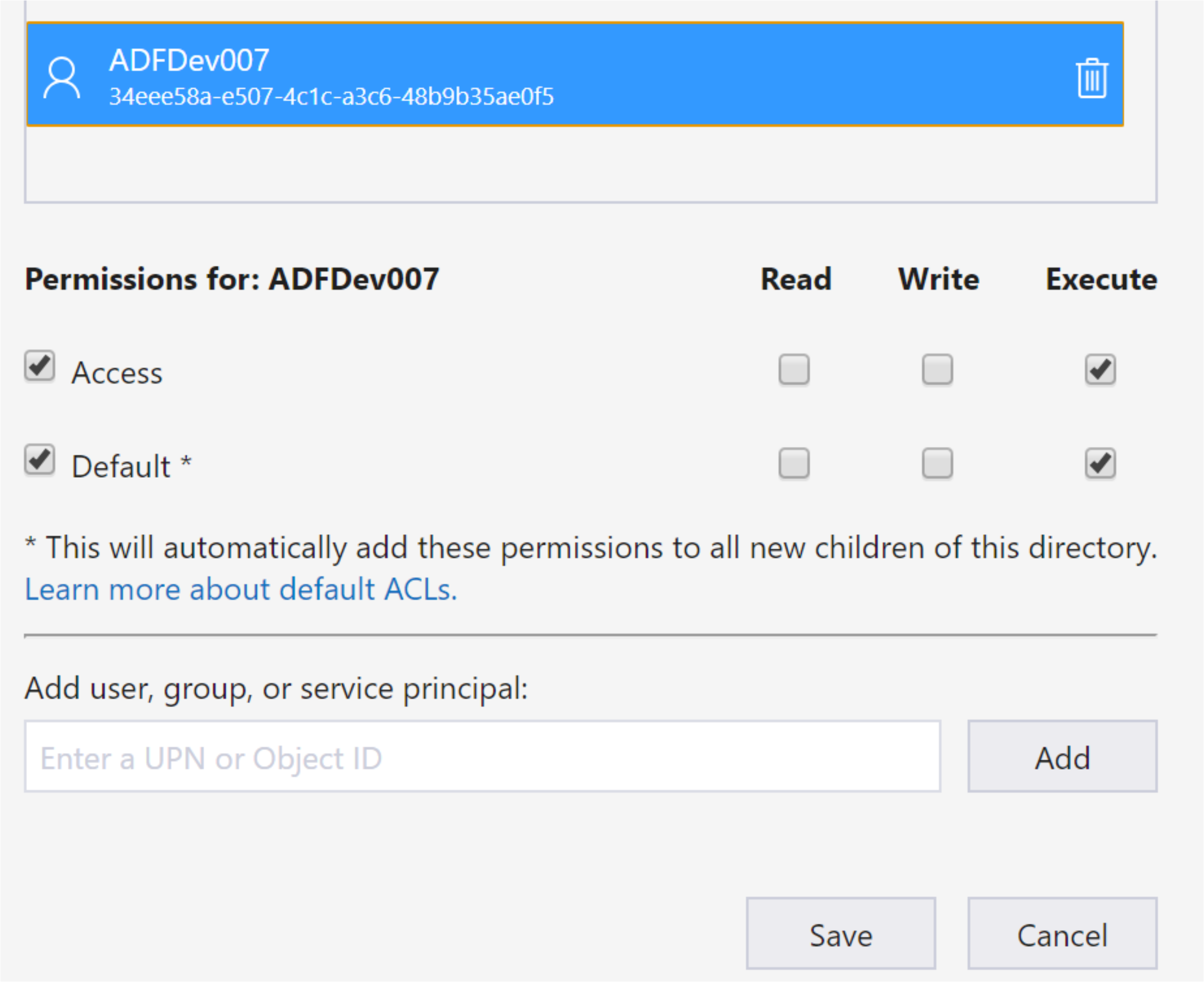
Managed Identity Tenant
72f988bf-86f1-41af-91ab-2d7cd011db47

Managed Identity Application ID
197dadb7-a573-4735-82c5-158f68004ace

Open storage explorer and right click the folder for which the access needs to be managed



Add the **Managed Identity Object ID** and grant the execute permission



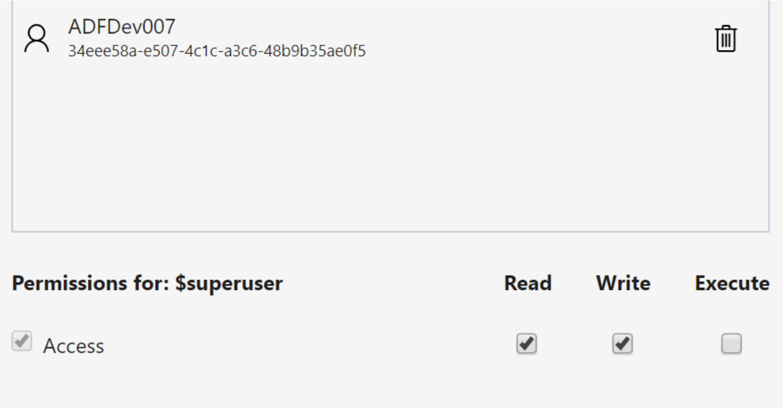
ADFDev007
34eee58a-e507-4c1c-a3c6-48b9b35ae0f5

Permissions for: ADFDev007	Read	Write	Execute
☑ Access	□	□	☑
☑ Default *	□	□	☑

* This will automatically add these permissions to all new children of this directory. Learn more about default ACLs.

Add user, group, or service principal:

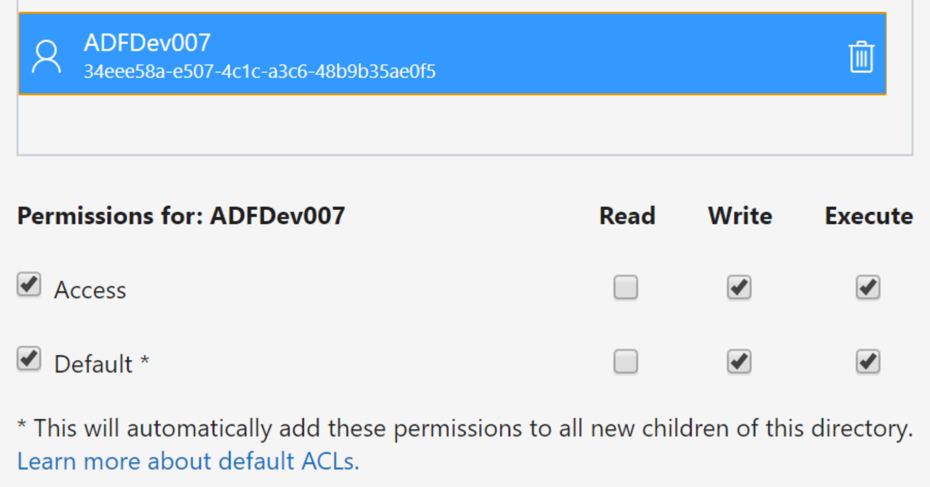
You need to grant read permission on the file to be copied



ADFDev007
34eee58a-e507-4c1c-a3c6-48b9b35ae0f5

Permissions for: $superuser	Read	Write	Execute
☑ Access	☑	☑	□

Finally, on the destination folder grant **execute** and **write** permission.



ADFDev007
34eee58a-e507-4c1c-a3c6-48b9b35ae0f5

Permissions for: ADFDev007	Read	Write	Execute
☑ Access	☐	☑	☑
☑ Default *	☐	☑	☑

* This will automatically add these permissions to all new children of this directory.
Learn more about default ACLs.

You will also need to grant "**Storage Blob Data Reader**" permission at account level* to be able to test connection and browse folder from ADF when setting up linked service.

*if you do not give **Storage Blob Data Reader RBAC** permission at the account level, you **will not** be able to test connection or browse to folder. You will need to trust that it will work if the right permissions are given at the folder level. For more details refer this.

Once all the above activities are complete, you can follow the steps provided in "Create copy activity and linked service" session.

Service principal vs Managed Identity

We worked our way through this document to see how we can use each service principal and managed identity. Both are secure and serve the customers well. Managed Identity is fully managed. This gives Managed Identity an edge in organizations were fully managed service is a priority. Hence, our recommendation is to use Managed Identity whenever it is supported by the service you are using. For the services not supporting managed identity, use service principal.

For a list of Azure services that support the managed identities for Azure resources feature, see Services that support managed identities for Azure resources.