Welcome [FIRSTNAME]

Labs

Module 1, Lesson 1, Lab 1 - Set up Azure Pass Lab

Module 1, Lesson 2, Lab 2 - Create and monitor Azure Data Factory using ARM

Module 1, Lesson 3, Lab 3 - Configure Data Factory Git integration

Module 2, Lesson 1, Lab 4 - Create and Monitor a Data Factory Pipeline

Module 2, Lesson 2, Lab 5 - Copy Data Wizard

Module 3, Lesson 1, Lab 6 - Data Transformation

Module 3, Lesson 2, Lab 7 - Control Flow

Module 5, Lesson 1, Lab 8 - Data Flow

Module 6, Lesson 1, Lab 9 - Using Azure Key Vault

Set up Azure Pass Lab

Introduction

In this lab, you will redeem Microsoft Sponsored Azure Pass for this workshop.

Estimated Time

15 minutes

Objectives

At the end of this lab, you will:

- New Azure Subscription for this workshop.
- Understand how to look for balance and consumption.

Logon Information

Use the following credentials to sign into the virtual environment.

- Username: **Admin**
- Password: **Passw0rd!**

Table of Contents

Exercise 1: Create a Microsoft Azure Pass Subscription

Reference: Checking your Azure Pass Balance and Usage details

Lab: Set up Azure Lab Pass

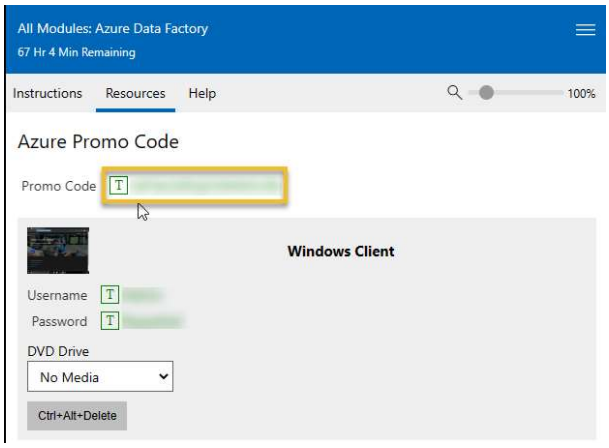
Exercise 1: Creating a Microsoft Azure Pass Subscription

This exercise shows how to create an Azure Pass subscription.

Tasks

> Redeem the Azure Pass using an **Microsoft Account**. It is not recommended, to use your corporate credentials.

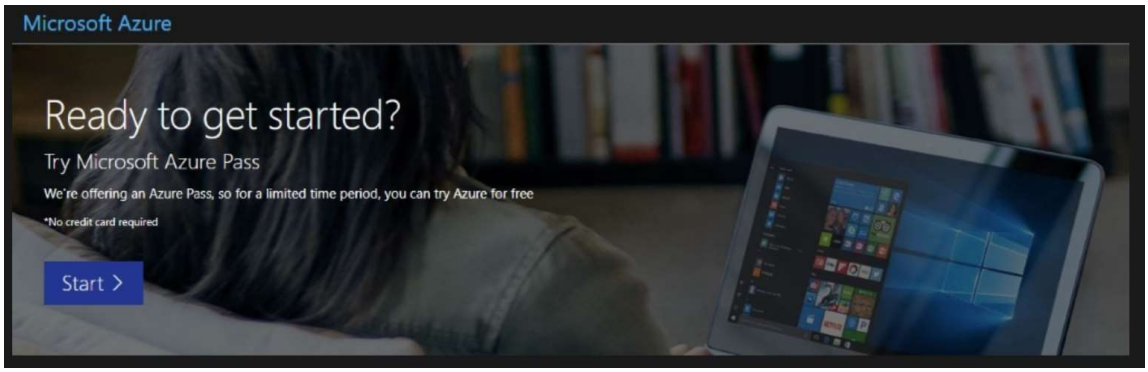
1. Retrieve Azure Pass code from the Resource Tab in your virtual machine (right window).



2. Redeem a Microsoft Azure Pass Promo Code.

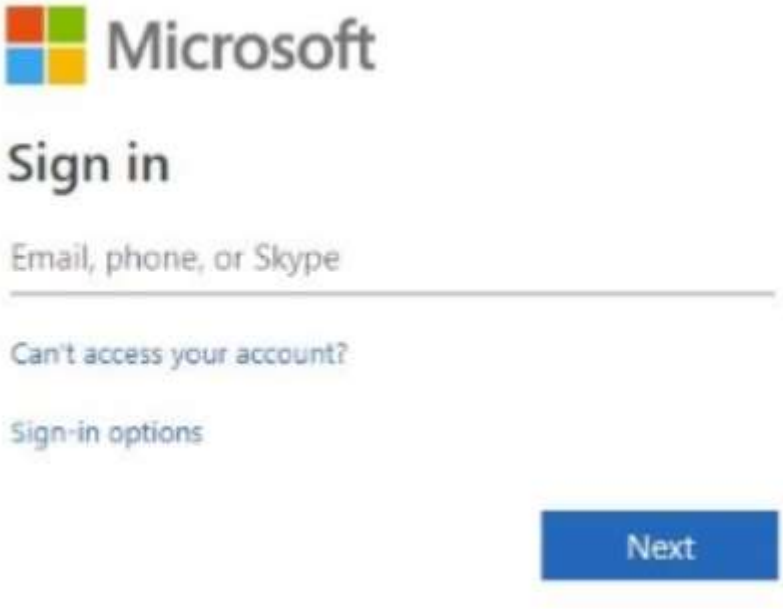
    a. From within your virtual machine, open a browser and navigate to: www.microsoftazurepass.com.

    b. Click the **start** button to **get started**.



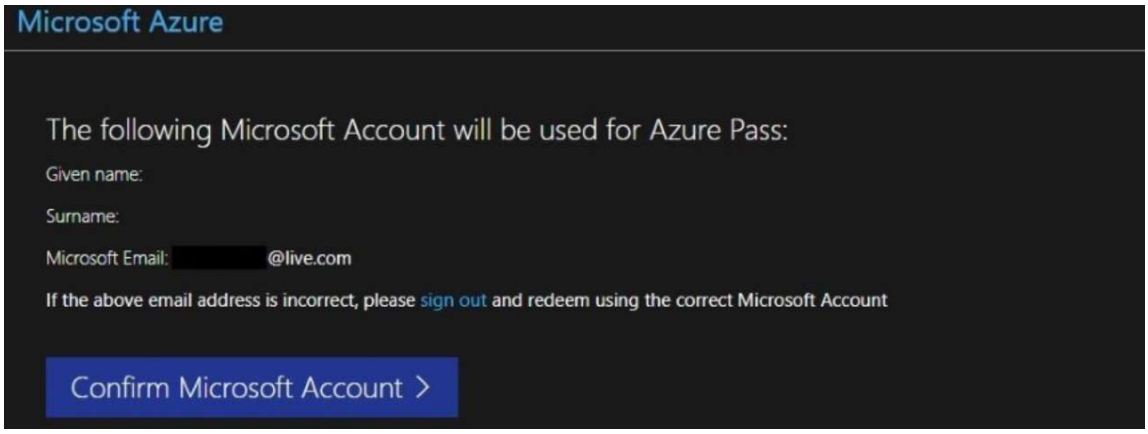
    c. Enter your account login information and select **Sign In**.

    Use your non corporate account (Microsoft Account) to login.



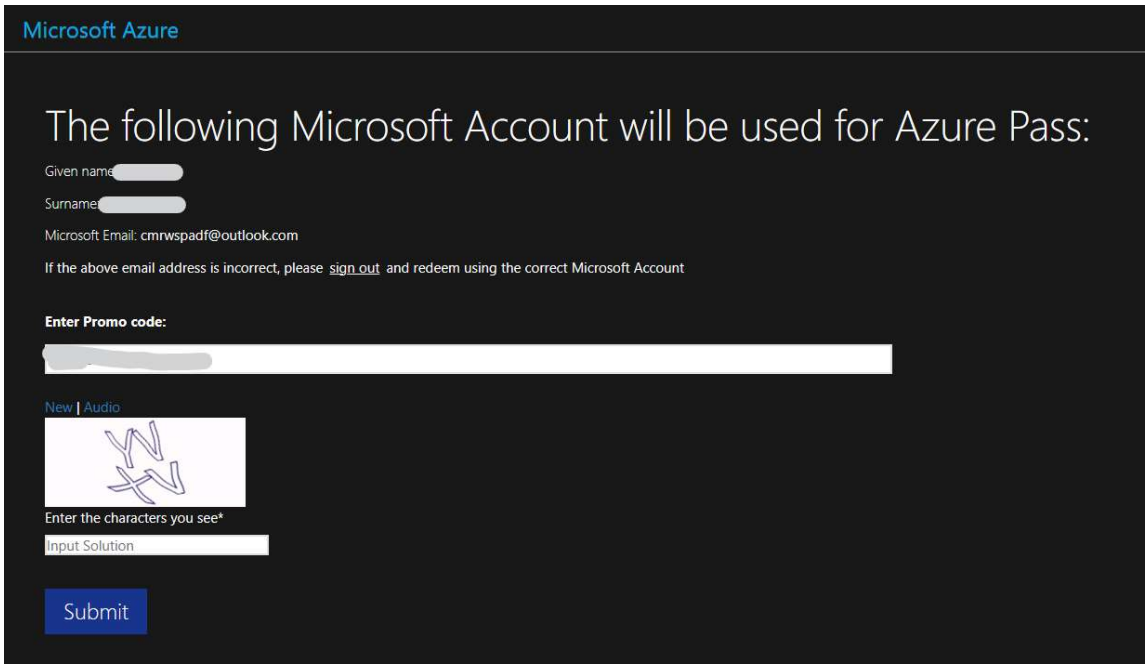
d. After making sure, that in the fourth line the correct email address is displayed, click **Confirm Microsoft Account**.

   This is going to be the email to which the subscription is going to be tied to, so make sure, it's the non corporate account.

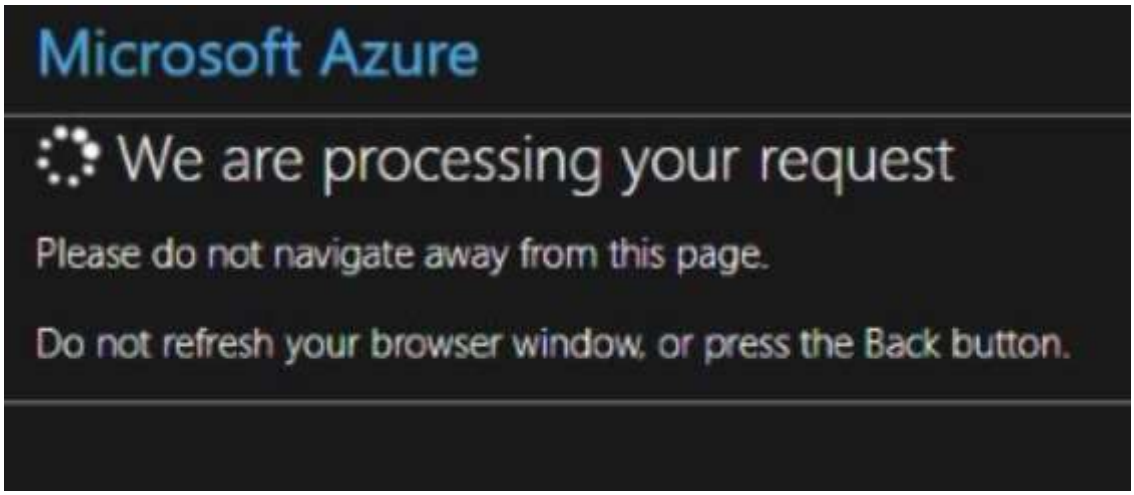


e. Enter your promo code in the Promo code box, enter the captcha characters and click **Submit**.

   The promo code can be found in the resources tab of the right window.

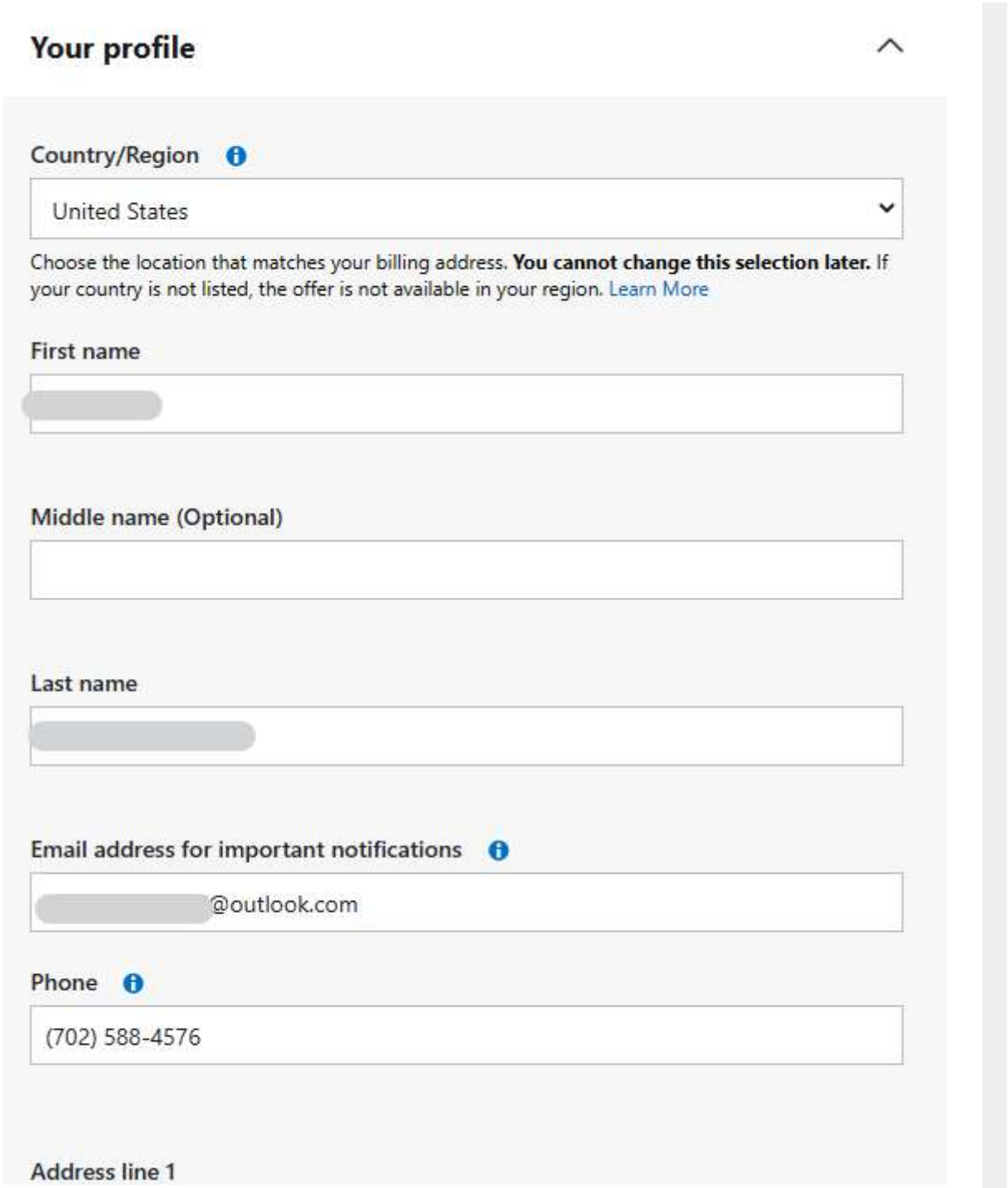


f. It may take up to 5 minutes to process the redemption.

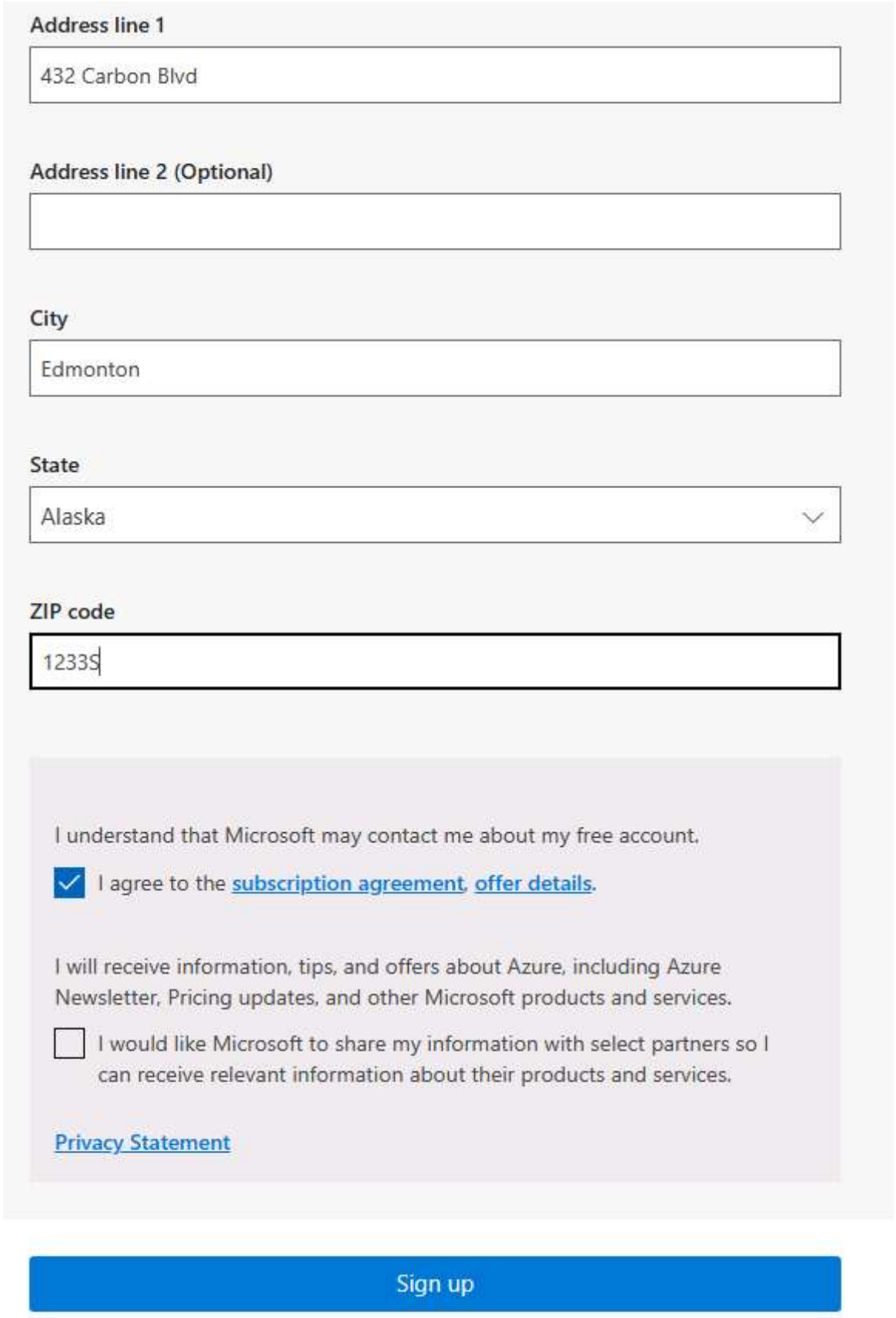


3. Activate your subscription.

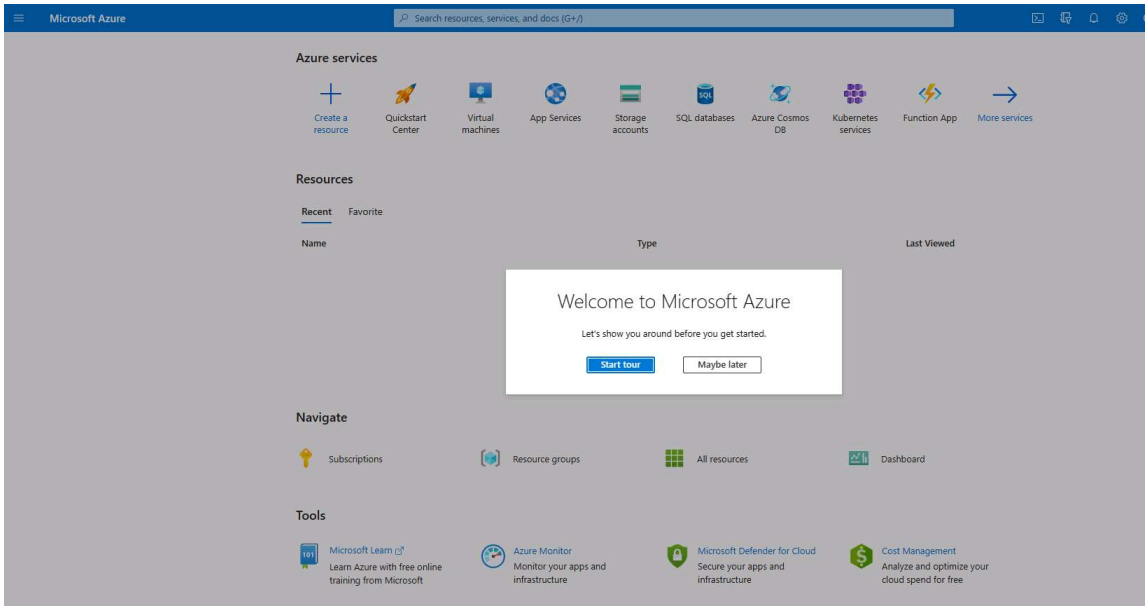
a. When the redemption process is completed, it will redirect to the **sign up** page. Enter your account information such as region, first name, last name, a valid phone number, a valid address for the region, you selected at the top. At the bottom of the page, you'll have to check the first checkbox for the subscription agreement, the second one is optional. Click **Next**.



Enter address data, check 'I agree to the subscription agreement...', the other checkbox is optional and click on **Sign Up**.



b. You might have to confirm the address. Now you just wait around 3-5 mins until you are redirected to your new Azure subscription.



Exercise has been completed.

Reference: Checking your Azure Pass Balance and Usage details

After registering for an Azure Pass subscription you will have a limited dollar amount ($100 USD) or a limited amount of time (30 days from time of registration), which ever comes first, that the subscription will be active and available to you.

1. Log in to www.microsoftazuresponsorships.com with **Microsoft Account**

    a. To check Balance details - click on **Check your Balance**

    b. To check Usage statistics - click on **Usage Details**

Create and monitor Azure Data Factory using ARM

Introduction

During this lab, you will learn how to use an ARM template to create the resources needed to complete this and future labs. You will also create and configure the services as needed to prepare for future labs.

Estimated Time

30 minutes

Objectives

At the end of this lab, you will be able to:

- Create an Azure Data Factory

Logon Information

Use the following credentials to sign into the virtual environment.

- Username: **Admin**
- Password: **Passw0rd!**

Table of Contents

Exercise 1: Provision Lab Resources using an Azure Resource Manager (ARM) Template

Exercise 2: Create the input folder and files in container

Lab: Create and Monitor Azure Data Factory using ARM

Exercise 1: Provision Lab Resources using an Azure Resource Manager (ARM) Template

Throughout this workshop's labs, you will utilize various Azure resources outside of Data Factory. To maximize your learning about Data Factory, you will provision all necessary Azure resources in one step by leveraging ARM templates.[1]

Tasks

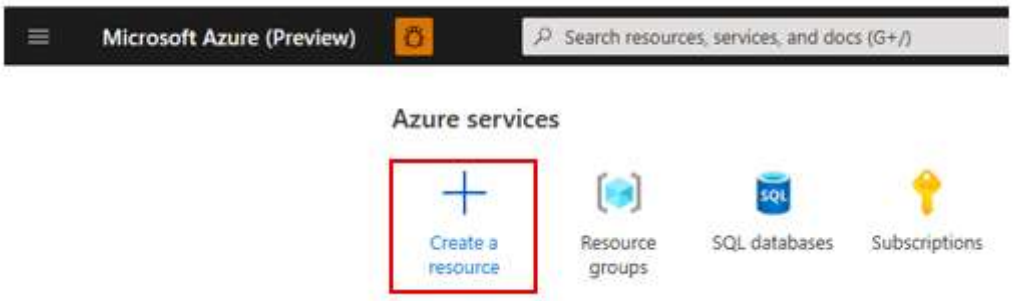
1. Connect to the Microsoft Azure Portal.

    a. Open Edge browser and navigate to http://portal.azure.com/ to connect to Microsoft Azure Portal.

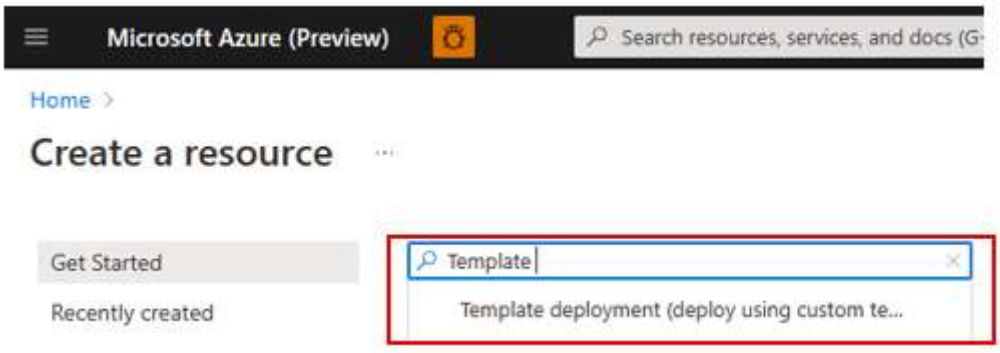
    b. Sign in with your credentials.

2. Deploy resources from an ARM template.

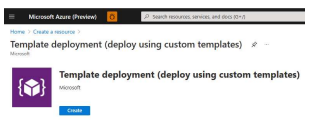
    a. To deploy a customized template through the portal, select **Create a resource**



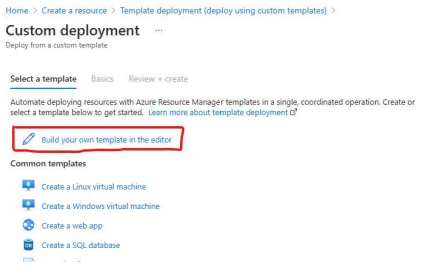
    b. Type in **template** on the search bar, then select **Template deployment (deploy using custom templates)**.



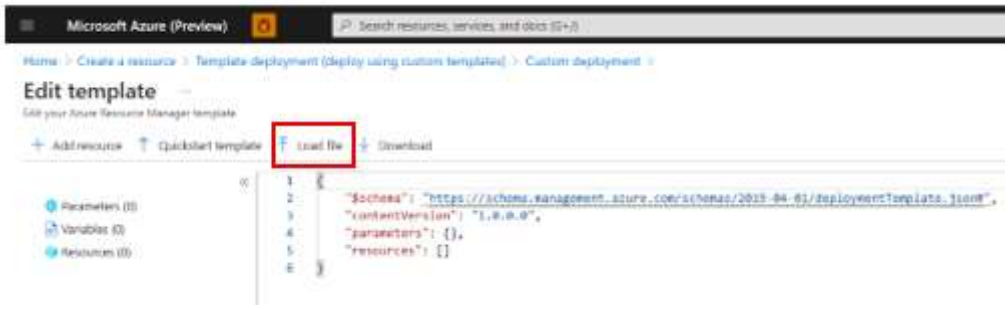
    c. Select **Create.**



    d. Select **Build your own template in the editor**.

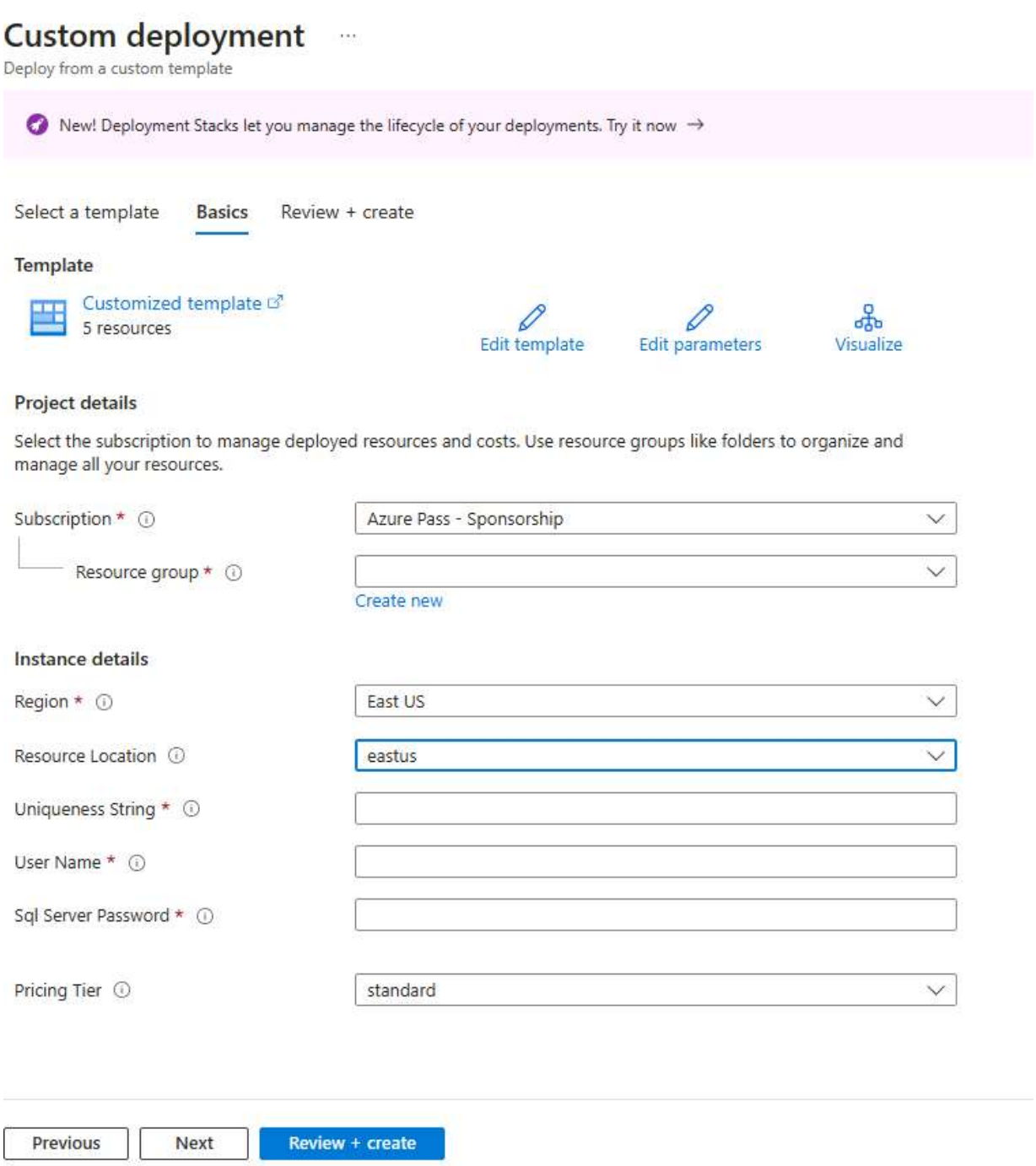


e. Click **Load file** and select file **\LabFiles\M01_L02_Lab01\ADF_Workshop_ARM_Template.json** into the editor. Review the file to see the details of the items being created.



f. Click **Save** in the bottom left of the blade.

3. The Resource Template will display a page for you to enter values into for the parameters.



a. Your subscription details should populate.

b. For Resource group, select **Create new** and enter a name for the new resource group (Ex: RG-ADFdemo).

c. For Region, select **East US** or **West US**, in which the resource group will be located. You have to choose one of these regions due to a limitation of the sponsored subscription, which only provides 10 vcores in either the WestUS or EastUS region. Since you'll be creating a Azure Databricks Cluster later on, you'll some of these vcores.

d. For Resource Location, again select either *Eastus* or *WestUs*, in which all resources will be created. If you choose another region, you may have resource issues later on.

e. Enter a Uniqueness String, which will be used as a prefix for resource names to help you identify them. Some of the resources require a name that is unique across all of Azure.

   i. Do not make the Uniqueness string too long because some resource names have a character limit.

   ii. Do not use uppercase letters or special characters because some resource names do not allow them.

f. The user name is **datafactadmin**, this will be used as the name for the admin user for the SQL Server being created.

g. For SQL Server Password, use **d@taFactSQL1**. Remember it, as you will use it later.

h. For Pricing Tier, leave this set to **standard**. This reflects the pricing tier for the Azure Databricks workspace being created.

i. Click **Review + Create**.

j. Click **Create**.

4. Verify Resources.

   a. Wait for the notification that all resources have been deployed. (this usually takes 3 - 5 mins)

   b. Select **Resource groups** in the left pane then go to your newly created resource group.

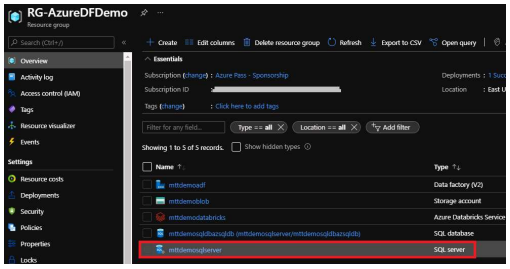
   c. Verify that the following resources were created:

      - Data Factory
      - Storage Account
      - Databricks Service
      - SQL Database
      - SQL Server

   d. If you do not see all of the resources above, it could be because your Uniqueness string was not unique enough, was too long, or included upper case or special characters. If the SQL database was not created, ensure that your password meets the rules as defined in step 2.o above.

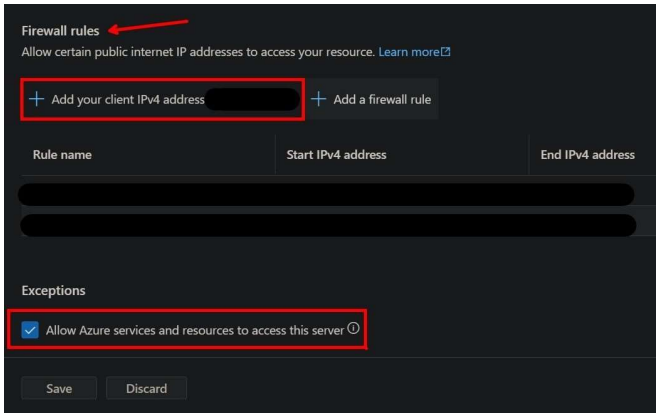
5. Add the Client IP address to the SQL Server

   a. Within your newly created resource group, click on the newly created SQL Server.



b. In the left pane, under Security, Click on Networking.

c. Under Firewall rules section, Select the **+Add client IP** option and set **Allow access to Azure services** to **ON**.



d. Then click **Save**.

Exercise 1 has been completed.

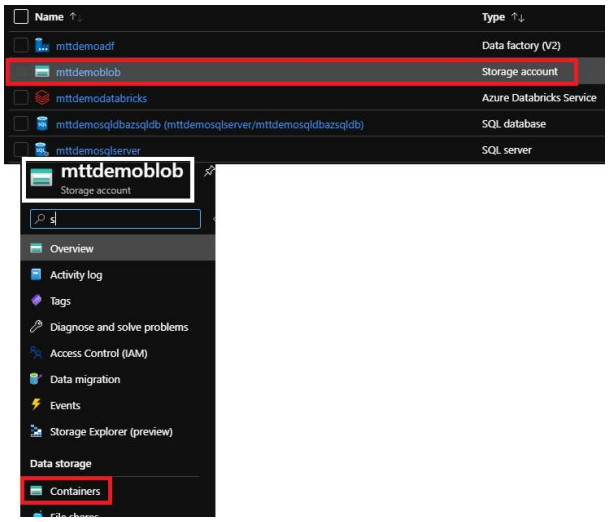
Exercise 2: Create the input folder and files in container

In this exercise, you will select the blob storage account created via the ARM template. You create a container called **adftutorial** and a folder named **input** in the container, and then upload a sample file to that input folder.

Tasks

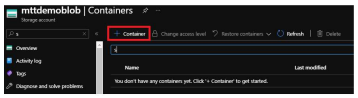
1. Select Storage account

   Select your Storage account from the Azure portal. You can use the search bar at the top and it will end in **blob** or find it in your new Resource Group. Select your storage account, then select **Containers**.

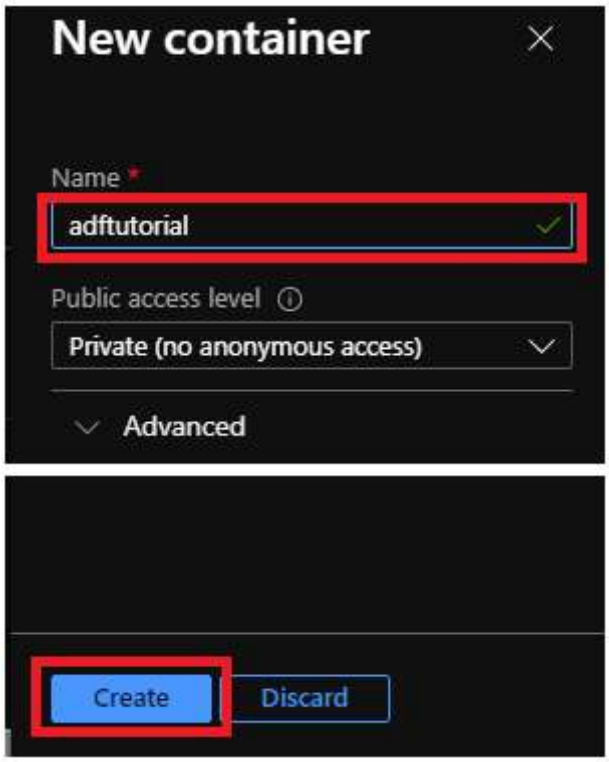


2. Create a container

   a. On Containers page, select **+Container** from the toolbar.



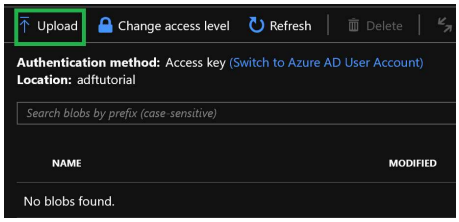
   b. In the New container dialog box, enter **adftutorial** for the name, and click the **Create** button.



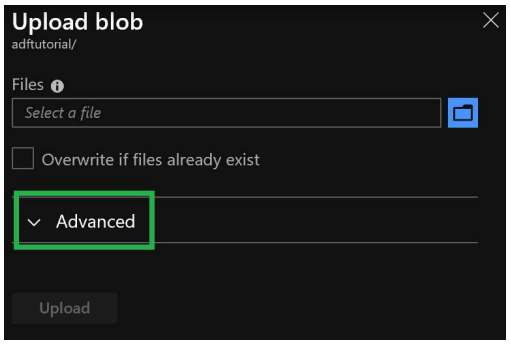
3. Once created, click on the container name, **adftutorial**.

4. Upload a file

    a. On the Container page, select **Upload** from the toolbar.

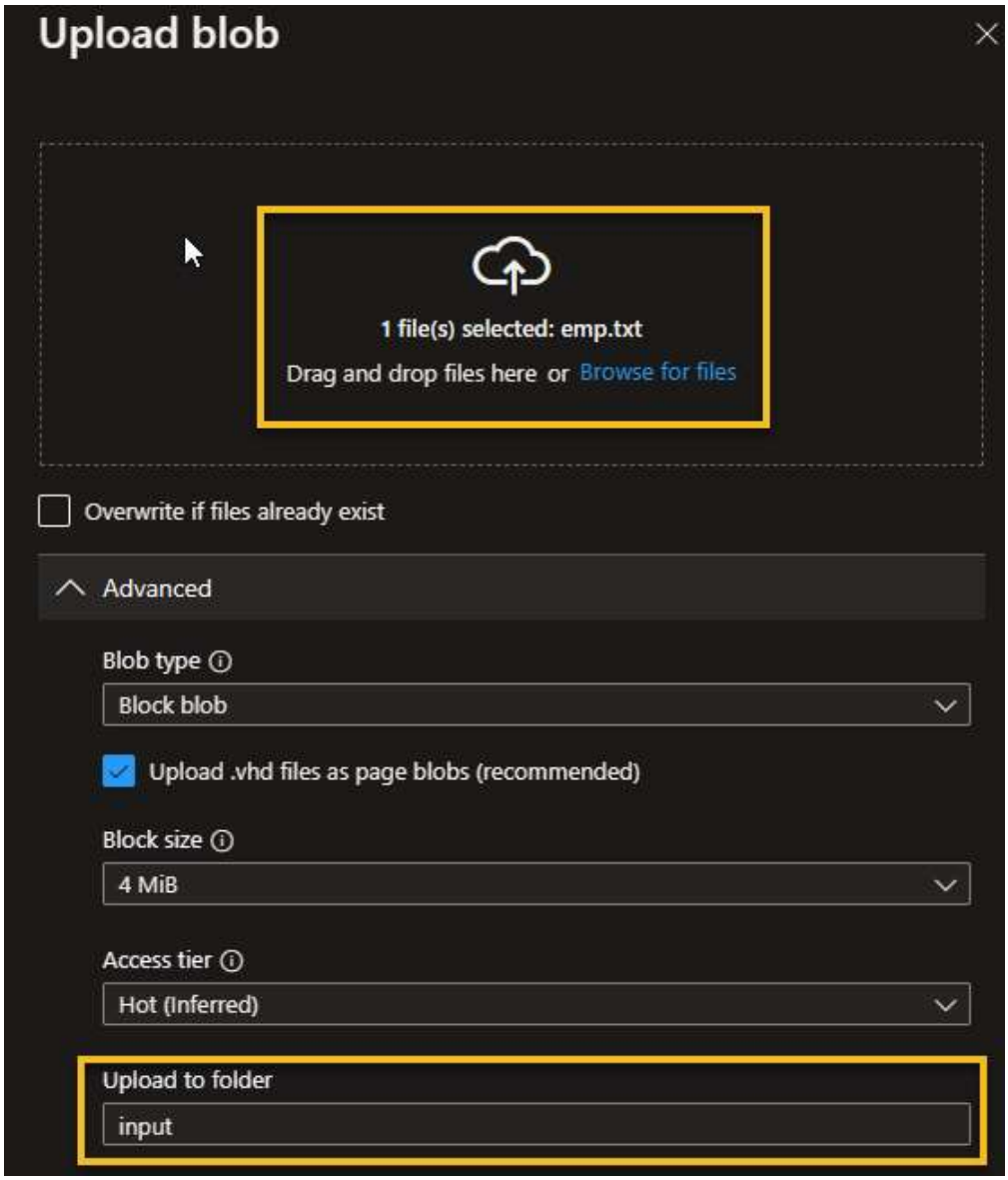


    b. On the Upload blob page, select **Advanced**.



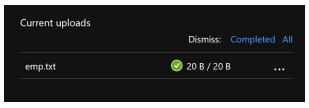
    c. In the Azure portal, on the Upload blob page, click on the **folder** icon next to the **Select a file** box and select the file **\LabFiles\M01_L02_Lab01\emp.txt** file.

    d. In the **Upload to folder** box, enter **input**.

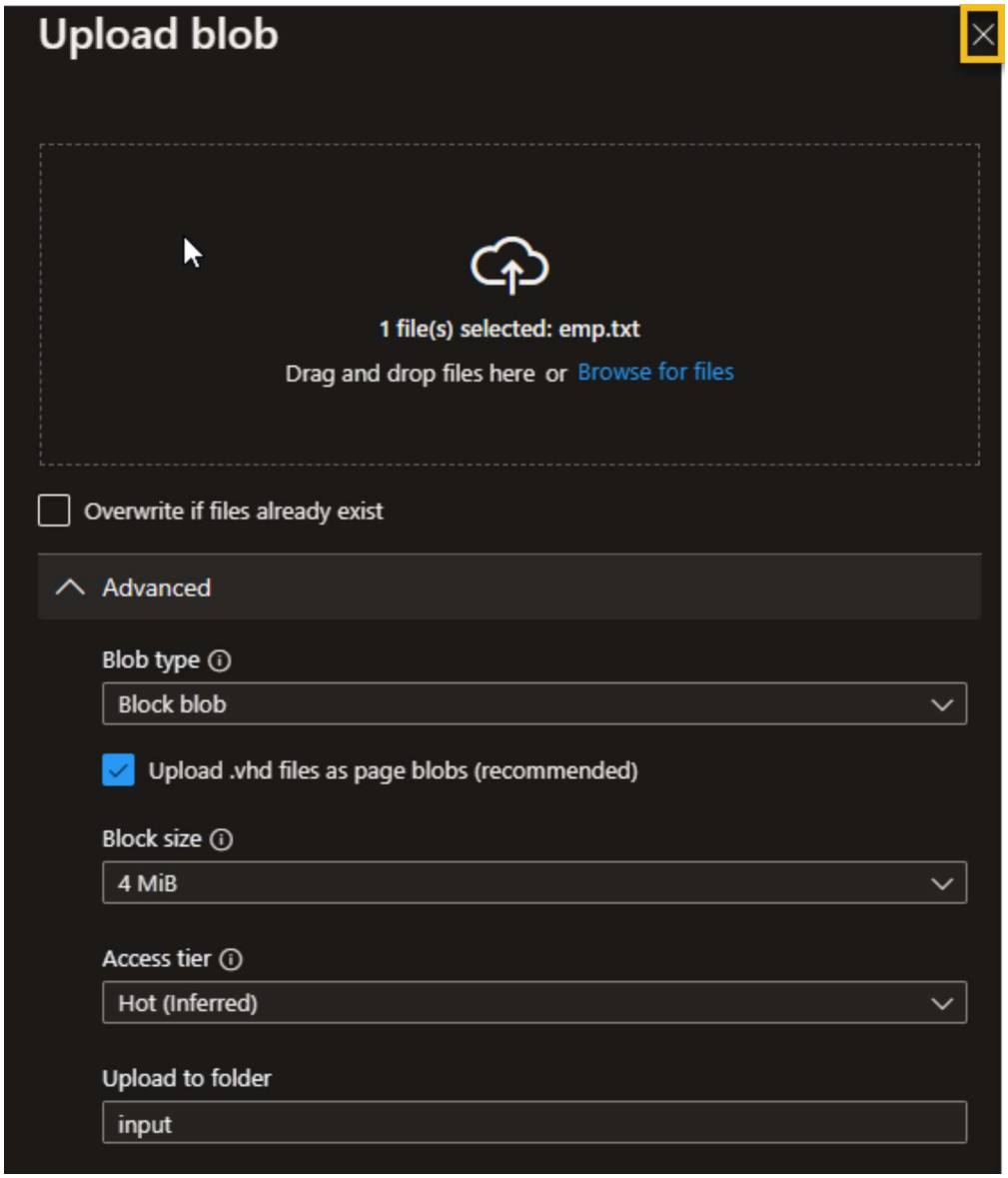


e. Click the **Upload** button.

You should see the emp.txt file and the status of the upload in the list.



f. Close the Upload blob page by clicking **X** in the corner.



Exercise 2 has been completed.

[1] *An ARM Template is a JSON file that defines one or more resources to deploy to a resource group or subscription. The template can be used to deploy the resources consistently and repeatedly.*

Configure Data Factory Git Integration

Introduction

During this lab, you will learn how to set Git Integration for Azure Data Factory.

Estimated Time

30 minutes

Objectives

At the end of this lab, you will be able to:

- Create an Azure DevOps Git Repository
- Set branches on your Repository
- Switch between Live and Git mode

Logon Information

Use the following credentials to sign into the virtual environment.

- Username: **Admin**
- Password: **Passw0rd!**

Table of Contents

Exercise 1: Set up Azure DevOps Account

Exercise 2: Setting up Azure Data Factory Source Control

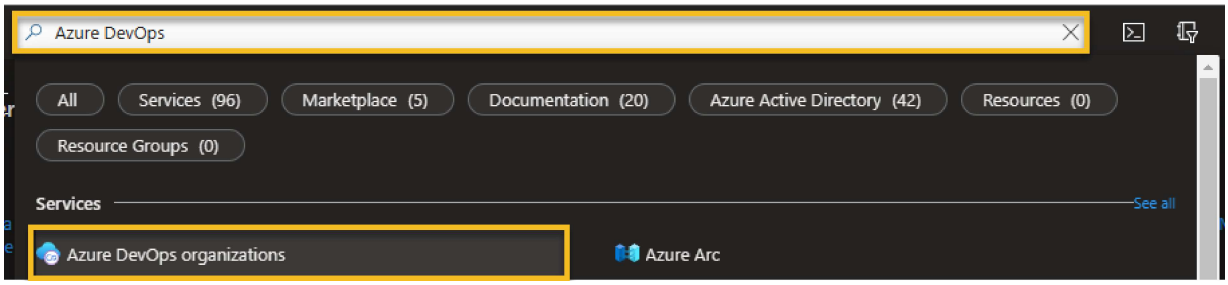
Lab: Configure Data Factory Git Integration

Exercise 1: Set up Azure DevOps Account

Tasks

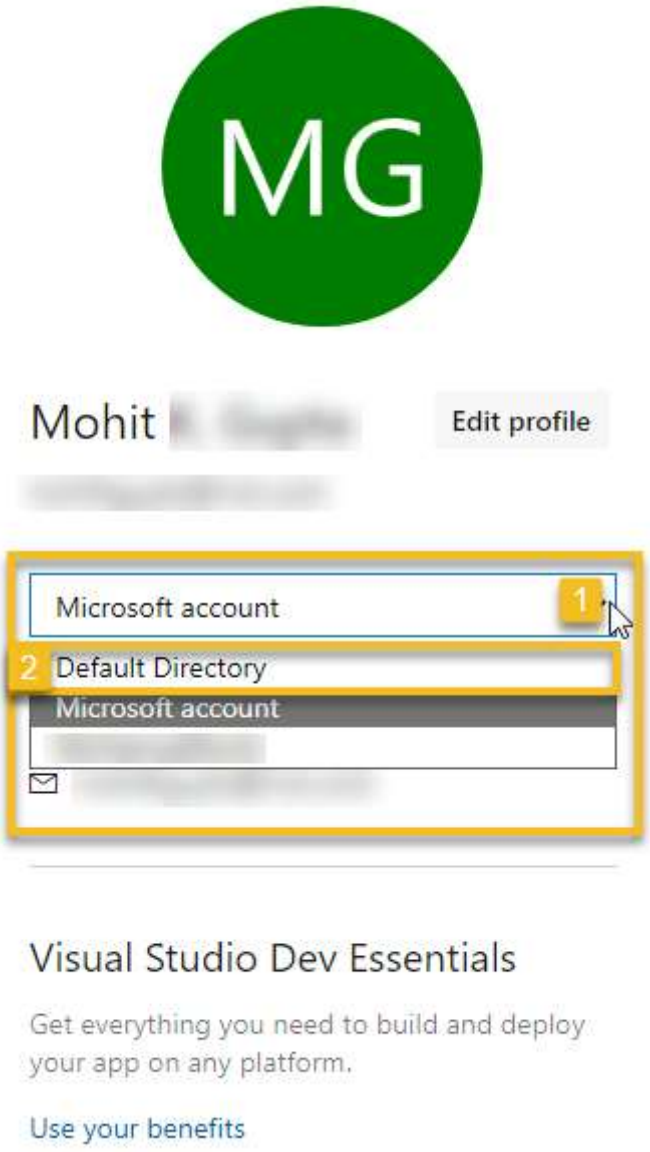
Configure a DevOps Account for the same Microsoft Account you are using for the Azure Free Pass Subscription

1. Go to https://portal.azure.com/ and sign in with your Microsoft Account.
2. Search for **Azure DevOps** on the top and select **Azure DevOps Organization**.



3. Go to My Azure DevOps Organization.

4. From the drop-down list, select **Default Directory**.



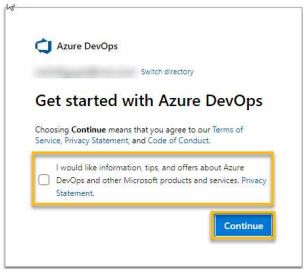
5. Select **Create new organization**.

Get started with Azure DevOps

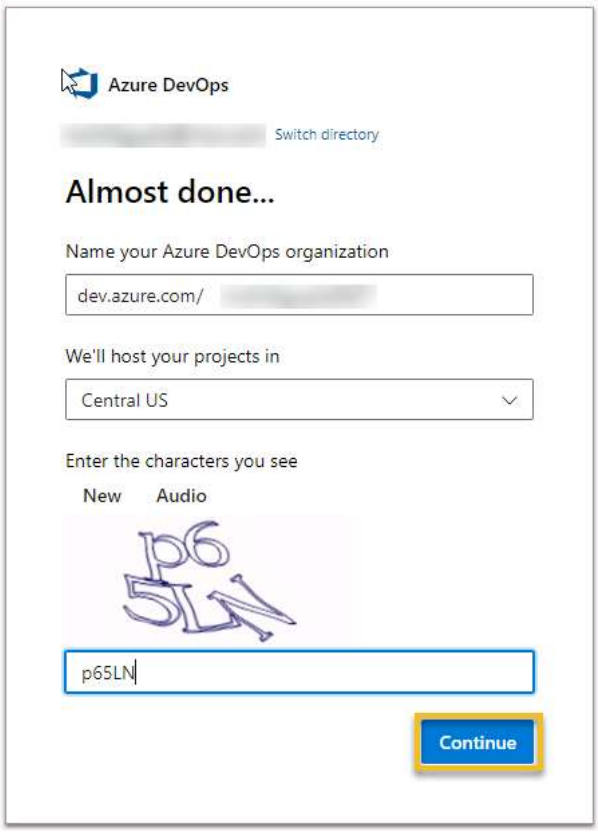
Plan better, code together, ship faster with Azure DevOps

Create new organization

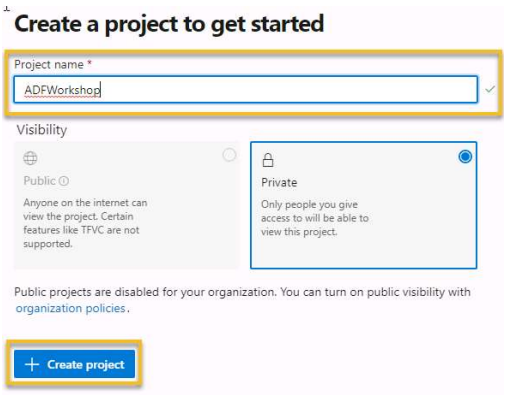
6. Select **Continue** and unselect the checkbox.



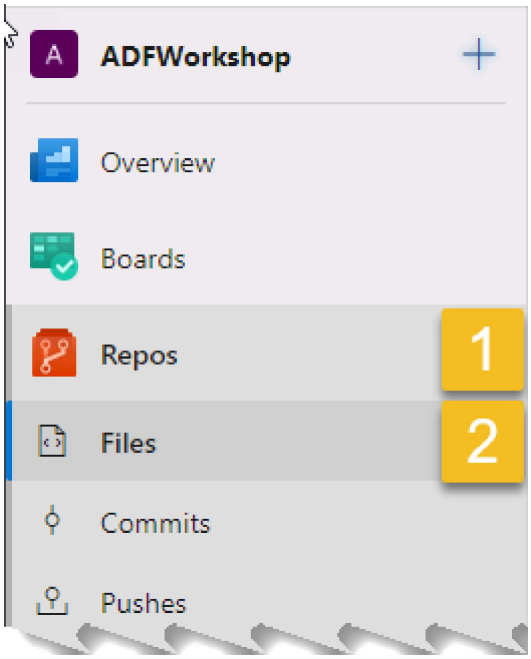
7. Update the orgnization name, region project will be hosted and enter security code. Click **Continue**.



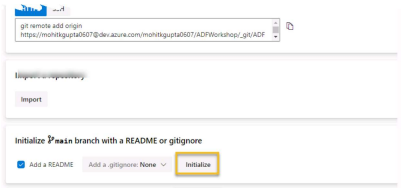
8. Enter project name, click **+ Create project**.



9. Within your Project, click on **Repos** and than **Files**.



10. Then click on Files and **Initialize**.



Exercise 1 has been completed.

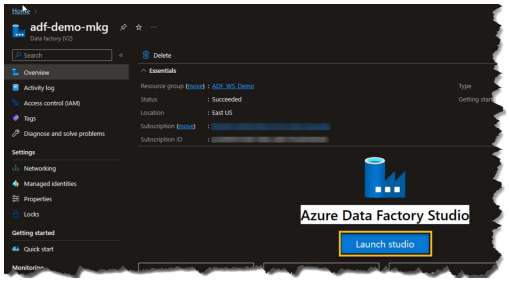
Exercise 2: Setting up Azure Data Factory Source Control

Source Control allows developers to check-in/push Azure Data Factory code and assets to a code repository. Azure DevOps source control tracks the history of who made changes and what the changes were, as well as provides a centralized source for all your code. Source control also allows for easy cross-teams collaboration..

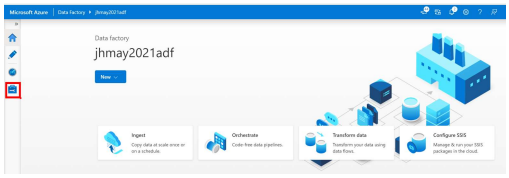
> ☐ It is **not** recommended to switch in between live mode and Git mode as the changes made into live mode may not be seen in Git mode.

Tasks

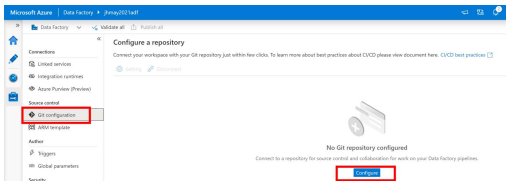
1. Login to Azure Portal, navigate to your Azure Data Factory Account and then click on Launch Studio



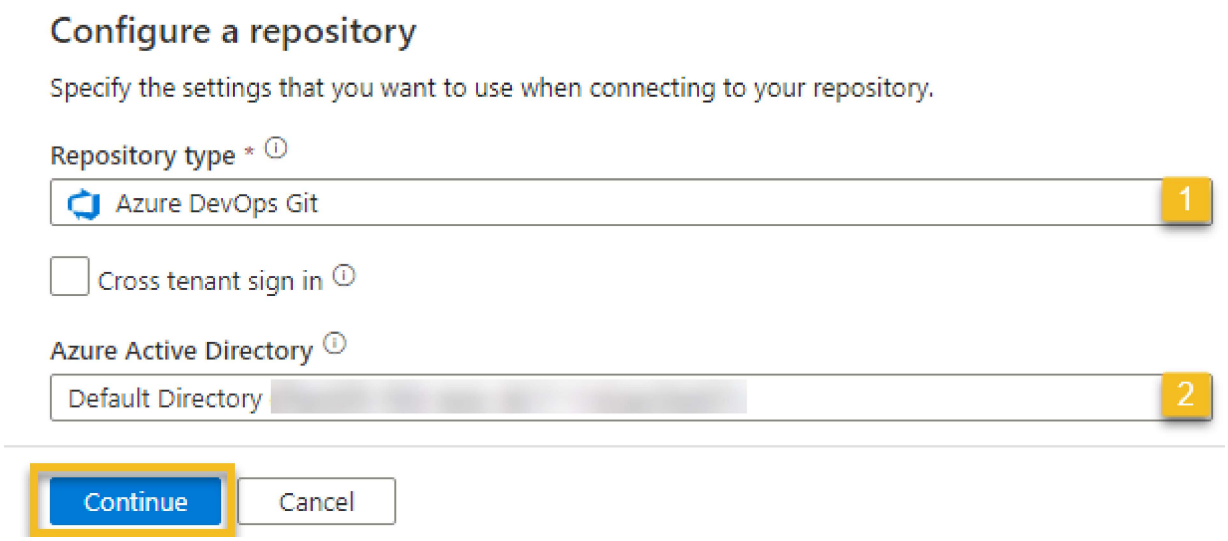
2. Select the Manage icon in the left panel



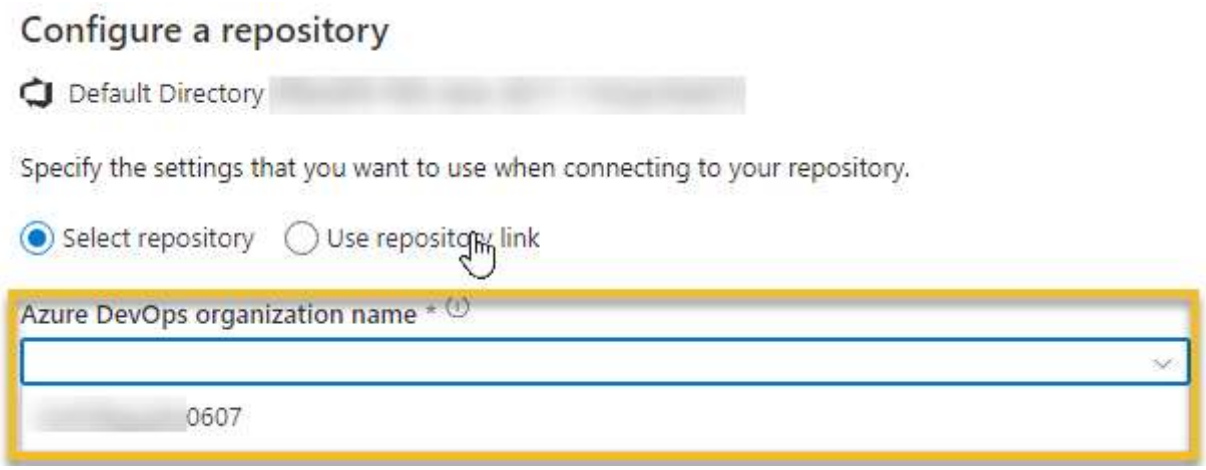
3. Select the Git configuration under Source Control heading then click Configure in the middle of the page.



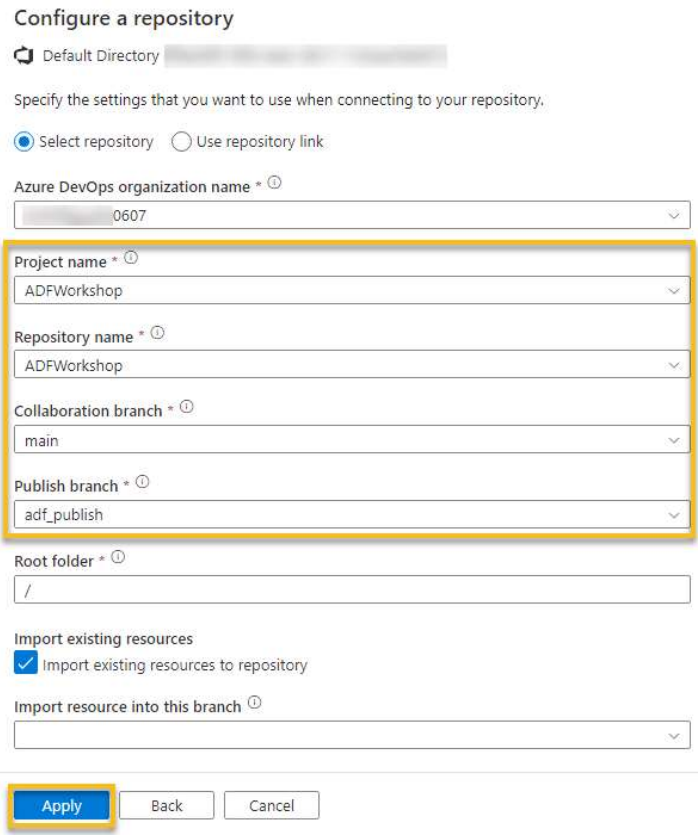
4. In the Repository settings pane to choose the repository type. Select Azure DevOps Git and your subscription then select **Continue**.



5. Select the orgnization created in Exercise 1.



6. This opens additional Git repository settings based on your repository type selection.Select your Project Name, and Repository Name. Select 'main' for both the Collaboration branch and Import resource into this branch. Click **Apply**.

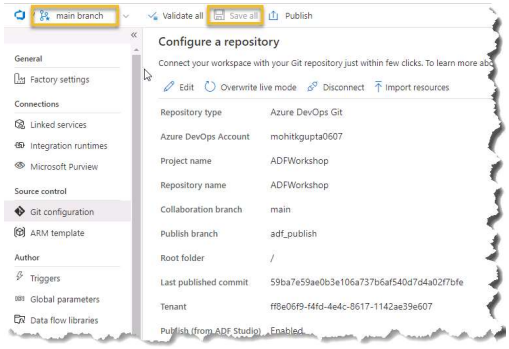


☐ If *main* branch is missing, then the repo was not initialized correctly.

7. The Set working branch to main and click **Save**.

> ℹ If you were working with multiple developers within a Data Factory, you will create a separate branches (a.k.a feature branch) to save your code to.

8. Review your Git repository settings. Note that you are now working within the main branch rather than the directly within the Data Factory service.



> ℹ The **Save all** button is available now (currently not enabled because no changes have been made within the Data Factory UI). When you make a change to your Data Factory this will be enabled.

Exercise 2 has been completed.

Create and Monitor a Data Factory Pipeline

Introduction

During this lab, you will learn how to navigate the Azure Data Factory *Author and Monitor* interfaces to create and monitor a Data Factory. In this Data Factory we will create a pipeline that copies data from one folder to another folder in Azure Blob Storage.

Estimated Time

30 minutes

Objectives

At the end of this lab, you will be able to:

- Create a linked service
- Create datasets
- Create, debug, trigger, and monitor a Pipeline.

Login Information

Use the following credentials to sign into the virtual environment:

- Username: **Admin**
- Password: **Passw0rd!**

Table of Contents

Exercise 1: Create a linked service

Exercise 2: Create datasets

Exercise 3: Create a Pipeline

Exercise 4: Debug and Trigger the Pipeline Manually

Exercise 5: Monitor the Pipeline

Lab: Create and Monitor a Data Factory on Azure Portal

During this lab, you will learn how to use the Azure Data Factory *Author & Monitor* interfaces to create and monitor a data factory pipeline.

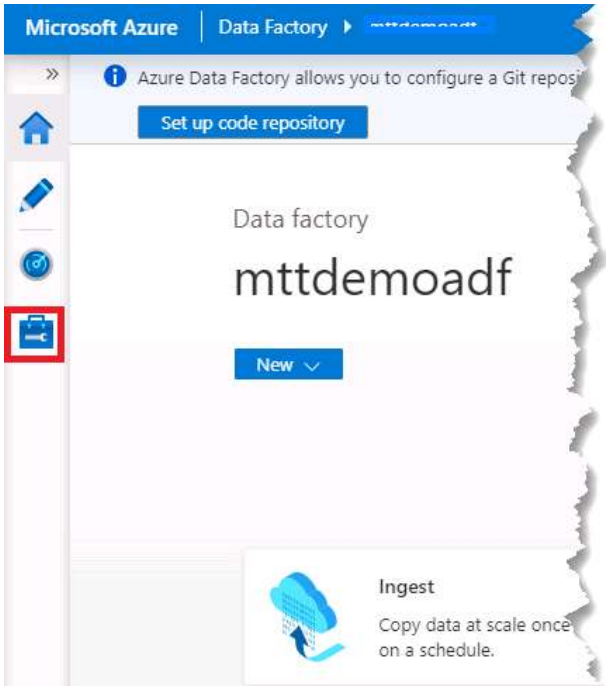
Exercise 1: Create a linked service

In this exercise, you create a linked service to link your Azure storage account to the data factory. The linked service has the connection information that the Data Factory service uses at runtime to connect to it.

Tasks

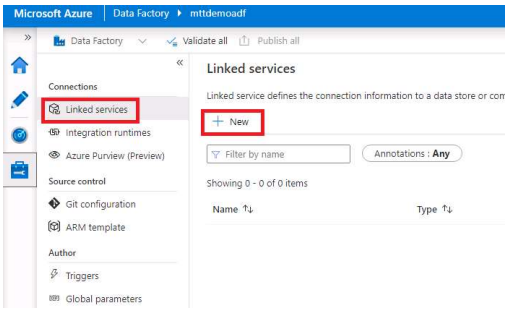
1. Select your Azure Data Factory service from the Azure portal. You can use the search bar at the top and it will end in **adf** or select from your Resource Group. Select the **Launch Studio** tile to start the Azure Data Factory user interface (UI) application on a separate tab.

2. On the Let's get started page, switch to the **Manage** tab in the left panel.

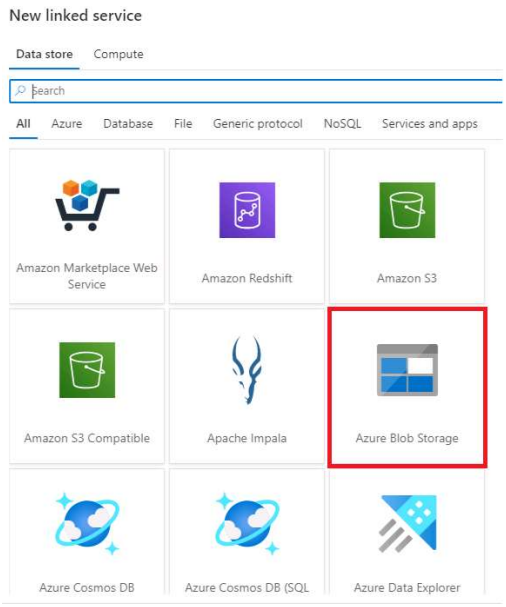


3. Create a Linked Service.

    a. Select **Linked services**, and then select the **+New** button.



b. On the New Linked Service page, select **Azure Blob Storage**, and then select **Continue**.



c. Complete the following steps:

i. For Name, enter **AzureStorageLinkedService**.

ii. For Authentication Method, ensure **Account Key** is selected.

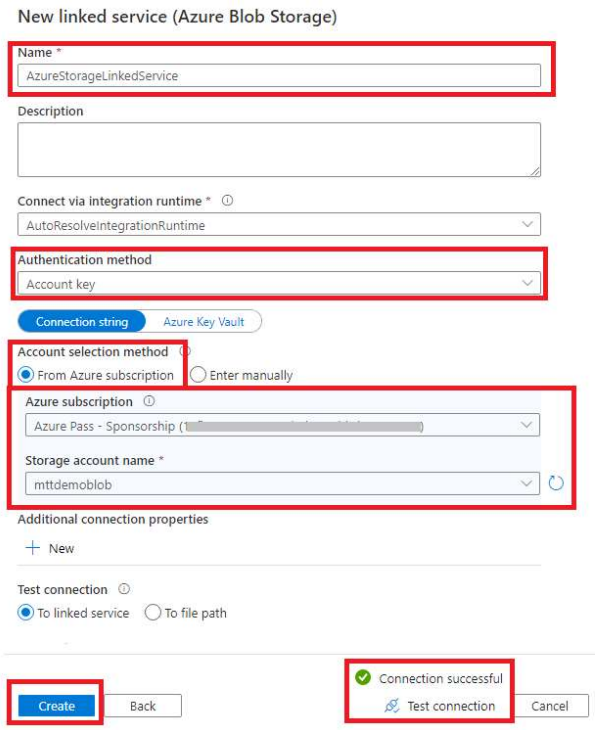
iii. For Account selection method, ensure **From Azure subscription** is selected.

iv. Select your **Azure subscription**.

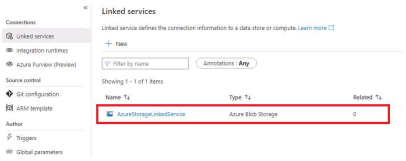
v. Select **storage account name** from the drop downs.

vi. Select **Test connection** to confirm that the Data Factory service can connect to the storage account.

vii. Select **Create** to save the linked service.



Linked service has been created.



Exercise 1 has been completed.

Exercise 2: Create datasets

In this exercise, you create two datasets: InputDataset and OutputDataset. These datasets are of type AzureBlob. They refer to the Azure Storage linked service that you created in the previous exercise.

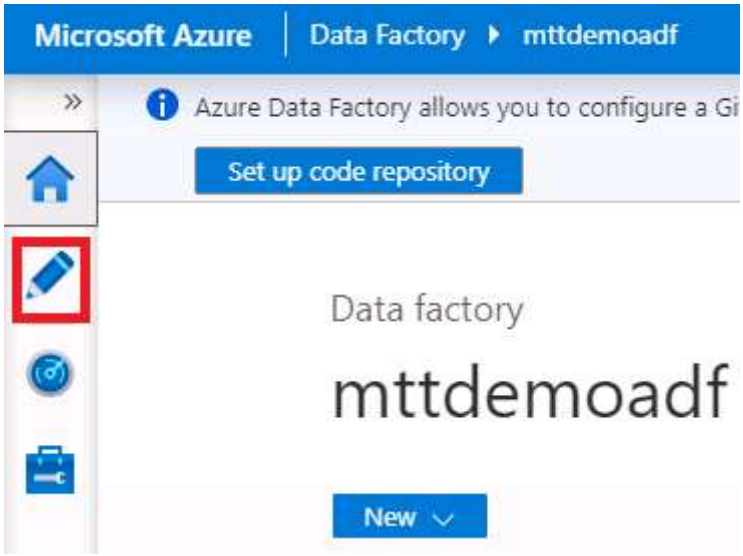
The input dataset represents the source data in the input folder. In the input dataset definition, you specify the blob container (adftutorial), the folder (input), and the file (emp.txt) that contain the source data.

The output dataset represents the data that's copied to the destination. In the output dataset definition, you specify the blob container (adftutorial), the folder (output), and the file to which the data is copied. Each run of a pipeline has a unique ID associated with it. You can access this ID by using the system variable RunId. The name of the output file is dynamically evaluated based on the run ID of the pipeline.

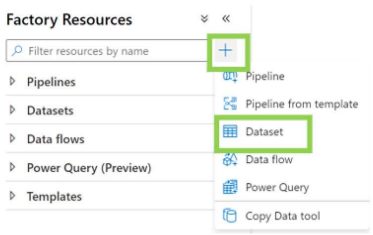
In the linked service settings, you specified the Azure storage account that contains the source data. In the source dataset settings, you specify exactly where the source data resides (blob container, folder, and file). In the sink dataset settings, you specify where the data is copied to (blob container, folder, and file).

Tasks

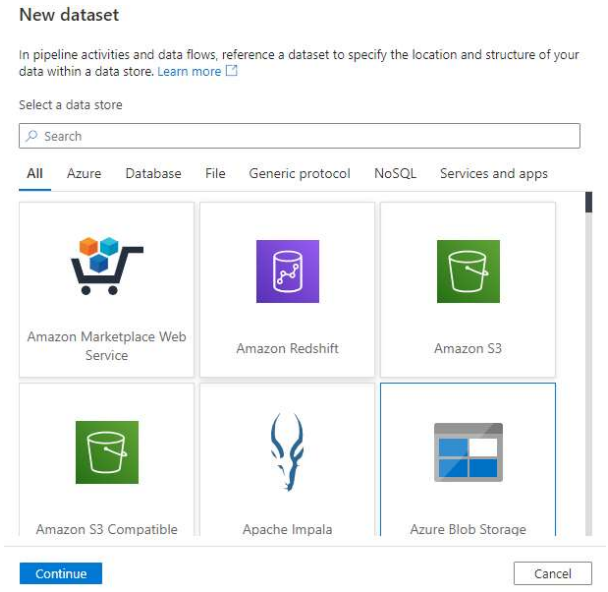
1. Click on the Pencil/Author button in the left pane.



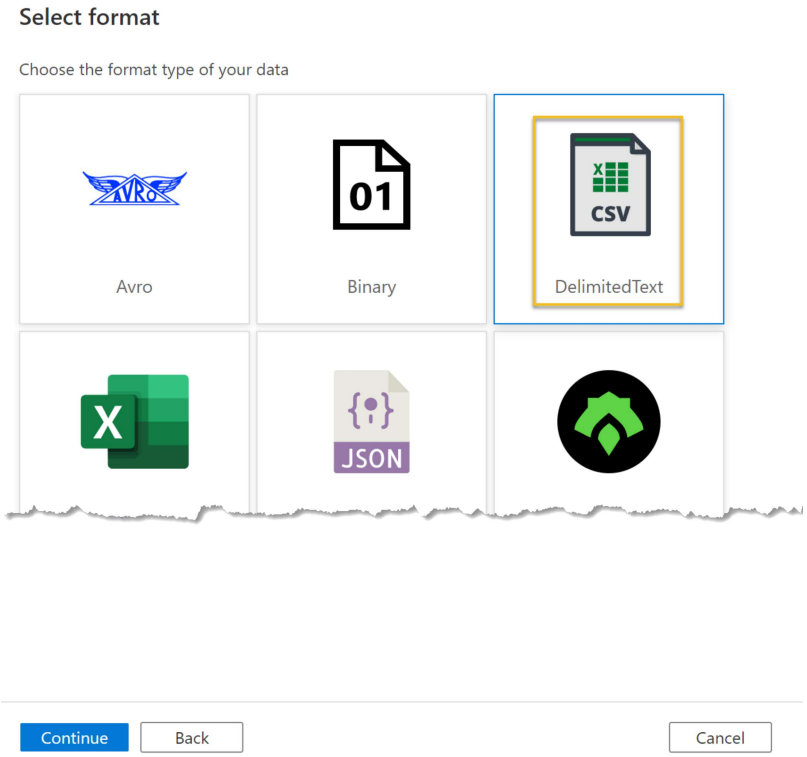
2. Select the + (plus) button and then select **Dataset**



3. On the New Dataset page, select **Azure Blob Storage**, and then select **Continue**.



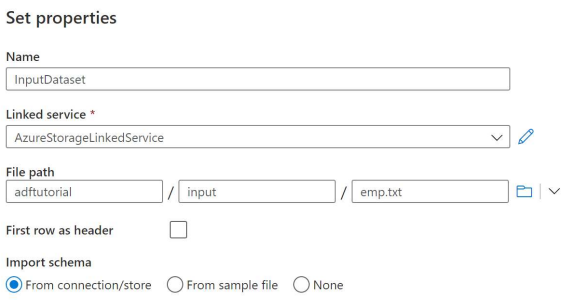
4. Since we are using a comma separated file, select **DelimitedText** and click the **Continue** button.



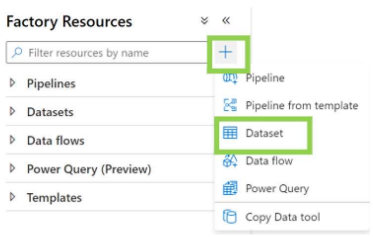
5. Give the data set a name, such as InputDataset and select the Azure Storage linked service you created in the previous exercise.

6. Select the folder button to the right of the File path.

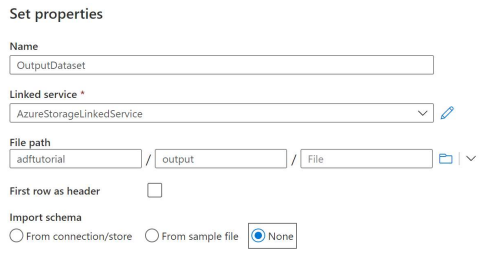
7. Then to navigate to the input file (adftutorial/input/emp.txt) and click the OK button.



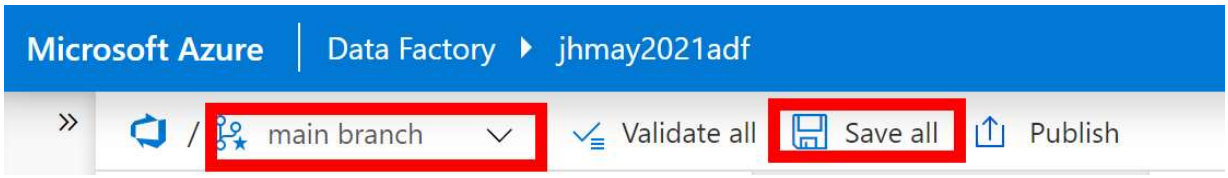
8. Next create the output dataset, Select the + (plus) button, and then select Dataset.



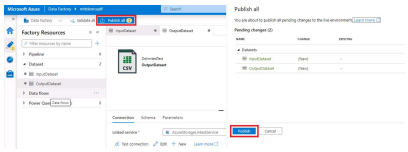
9. On the New Dataset page, select Azure Blob Storage, and click the Continue button.
10. Select DelimitedText and click the Continue button.
11. Specify OutputDataset for the name and select the Azure Linked Service created in the previous exercise.
12. Enter adftutorial as the file path container and output for directory.
13. Select None for Import Schema then select OK.



14. Click ok. Choose **Save all** from the menu bar to save your changes to your DevOps repo. If you do not see Save all, make sure you have a DevOps branch selected rather than Data Factory.



15. Select Publish All then Publish on the next screen.



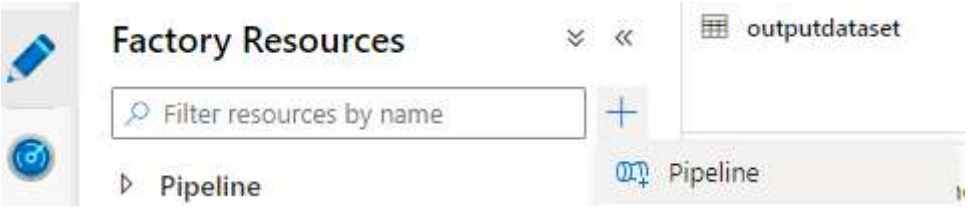
Exercise 2 has been completed.

Exercise 3: Create a Pipeline

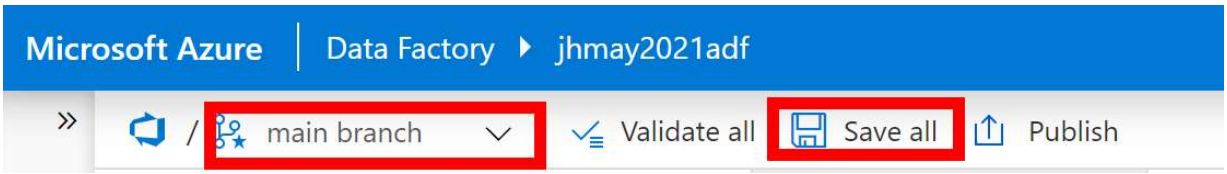
In this exercise, you create and validate a pipeline with a Copy activity that uses the input and output datasets created in a previous exercise. The copy activity copies data from the file you specified in the input dataset settings to the file you specified in the output dataset settings. If the input dataset specifies only a folder (not the file name), the copy activity copies all the files in the source folder to the destination.

Tasks

1. Select the + (plus) button under Factory Resources, and then select **Pipeline**.



2. In the Properties pane to the right, specify **CopyPipeline** for Name.
3. In the Activities toolbox, expand **Move & Transform**. Drag the **Copy Data** activity from the Activities toolbox to the pipeline designer surface. You can also search for activities in the Activities toolbox. Specify **CopyFromBlobToBlob** for Name.
4. Navigate to the Source tab in the Copy Data activity settings and select **inputdataset** for Source Dataset.
5. Navigate to the Sink tab in the Copy Data activity settings and select **outputdataset** for Sink Dataset.
6. Choose **Save all** from the menu bar to save your changes to your DevOps repo. If you do not see Save all, make sure you have a DevOps branch selected rather than Data Factory.



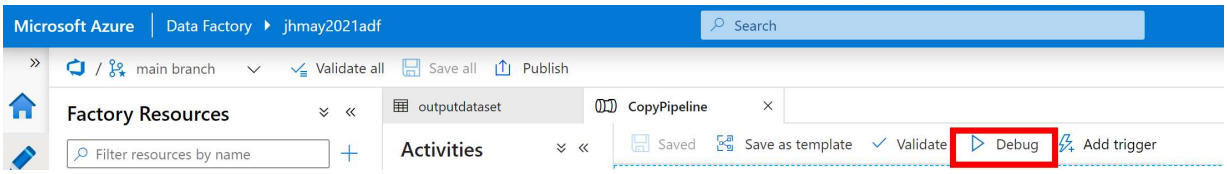
Exercise 3 has been completed.

Exercise 4: Debug and Trigger the Pipeline Manually

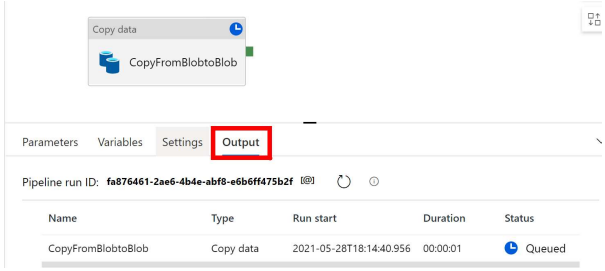
In this exercise, you will debug the pipeline before deploying entities (linked services, datasets, pipelines) to Azure Data Factory. Then, you manually trigger a pipeline run.

Tasks

1. On the pipeline toolbar above the canvas, select **Debug** to trigger a test run.

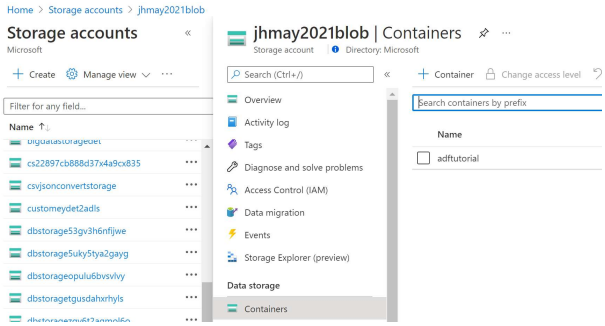


2. Confirm that you see the status of the pipeline run on the **Output** tab of the pipeline settings at the bottom.



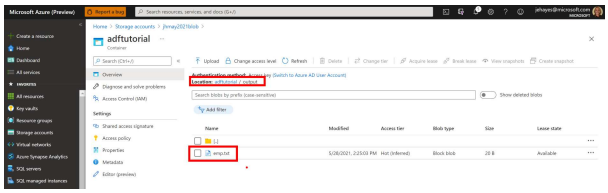
3. *In a different web browser tab,* go to your Azure Portal, navigate back to the Azure Storage account containing the **adftutorial** container.

4. From the Data storage section in the left pane, select **Containers**.



5. Select the **adftutorial** container.

6. Confirm that you see the output file, emp.txt, in the output folder.



7. Run/Trigger pipeline.

8. Go back to the Data Factory portal with your Data Factory selected.

9. Before you trigger a pipeline, you must publish entities to Data Factory. To publish, select **Publish** at the top of the portal.

10. To trigger the pipeline manually, select **Add Trigger** on the pipeline toolbar, and then select **Trigger Now.**

11. Select **OK** in the Pipeline run flyout.

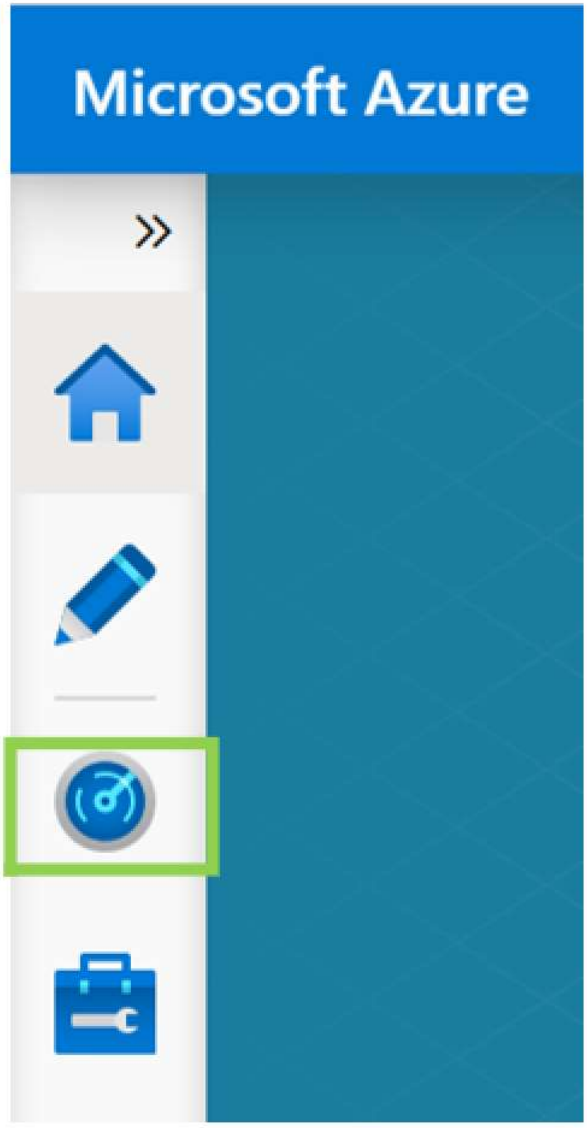
Exercise 4 has been completed.

Exercise 5: Monitor the Pipeline

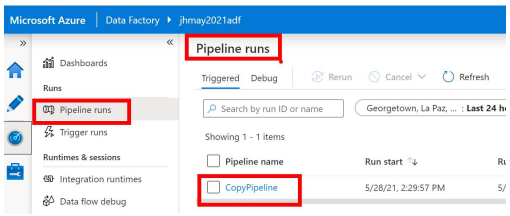
Tasks

Monitor your pipeline.

1. Switch to the **Monitor** tab on the left.



2. Under **Pipeline runs,** under **Pipeline name**, select the **CopyPipeline** hyperlink. Here you can see the status of the copy activity run on this page.



3. To view details about the copy operation, select the **Details** (eyeglasses image) link in the Actions column. For details about the properties, see Copy Activity overview.

Exercise 5 has been completed.

Copy Data Wizard

Introduction

This lab walks through the Copy Data Wizard.

In this lab we will:

- Show the graphical user interface for Copying Data

Estimated Time

20 minutes

Objectives

At the end of this lab, you will be able to:

- Use the copy data wizard

Login Information

Use the following credentials to sign into the virtual environment:

- Username: **Admin**
- Password: **Passw0rd!**

Table of Contents

Exercise 1: Upload Sample Data

Exercise 2: Copy Data via the Wizard

Lab: Azure Data Factory Copy Data Wizard

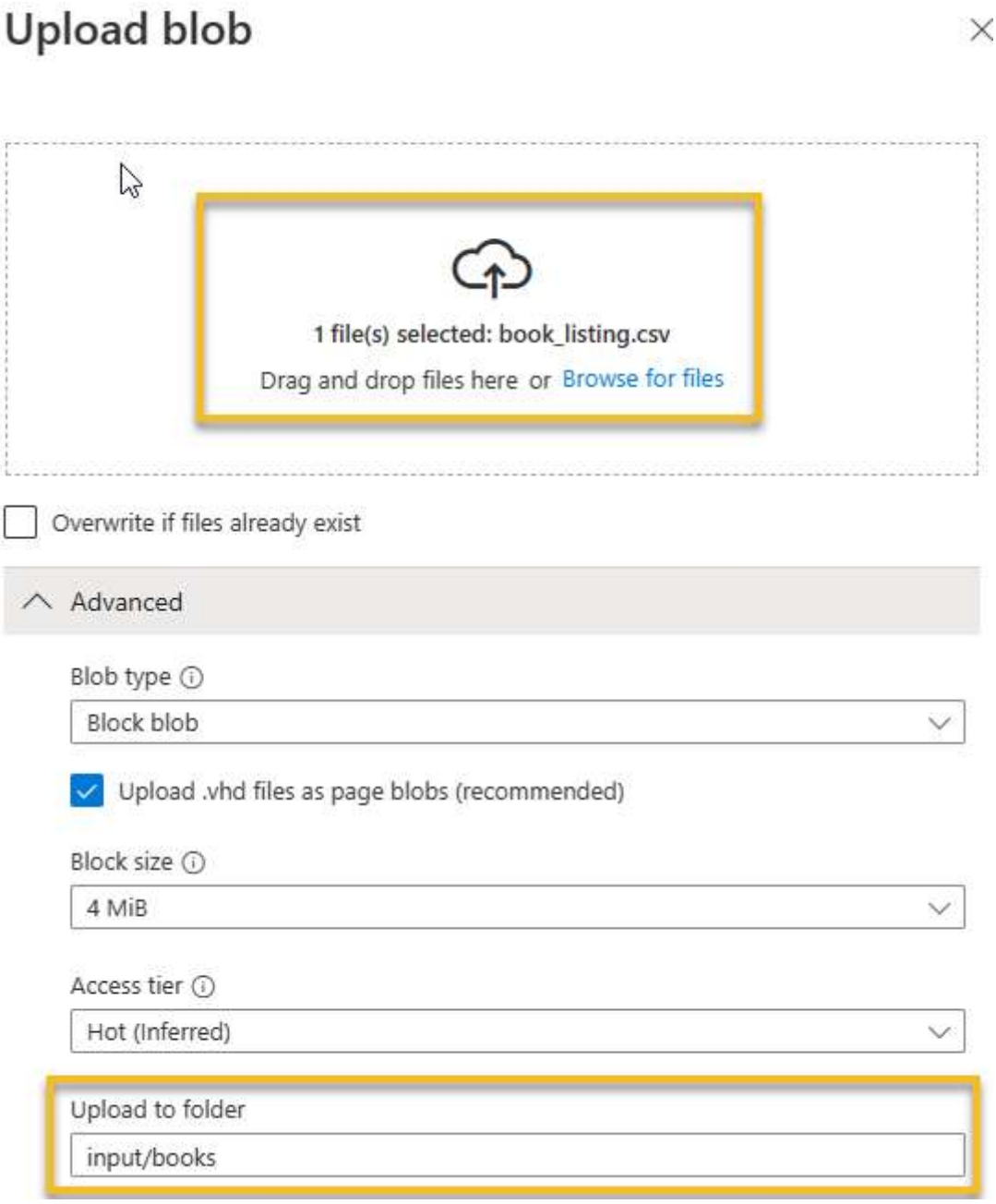
During this lab, you will learn how to copy data with the Copy Data wizard.

Exercise 1: Upload Sample Data

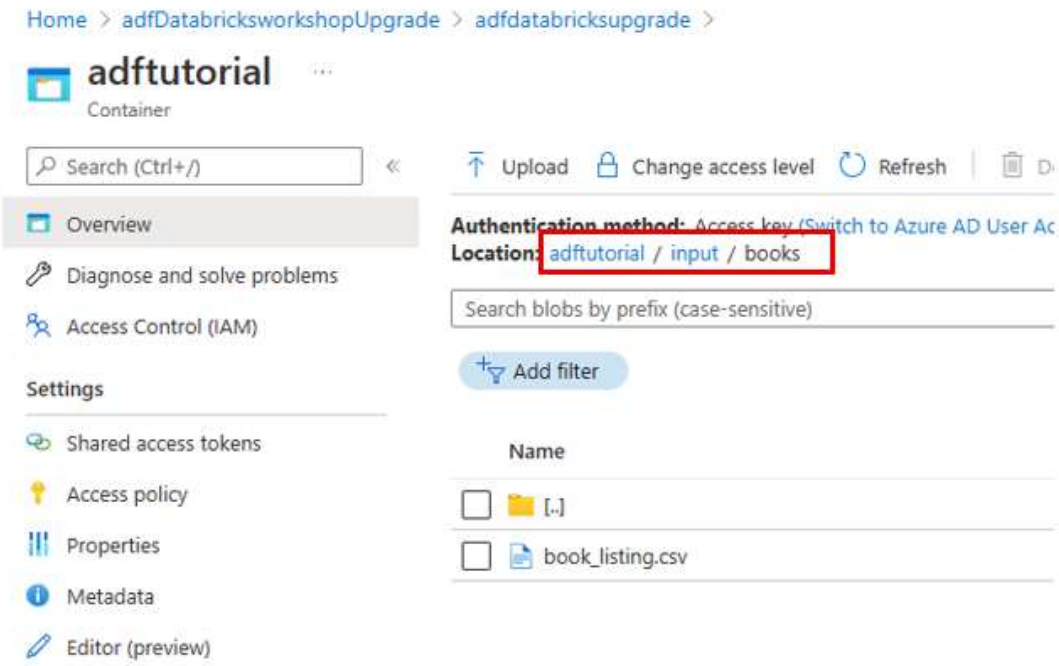
Throughout this workshop's labs, you will be utilizing various Azure resources outside of Data Factory.

Tasks

1. From the Resource Group you created in **Module 1, Lesson 1, Lab 1**, select the **Storage Account** created in the lab.
2. On the Storage account page, select **Containers** under the **Data storage** section.
3. Select the container **adftutorial**.
4. Upload sample .txt file to Container.
    a. On the Container page, select **Upload** on the toolbar.
    b. On the Files selection box, click on the **folder icon** to upload a file. Navigate to the **\LabFiles\M02_L01_Lab02** folder and select the file **book_listing.csv** and **Open** it.
    c. Select **Advanced** to show additional options.
    d. Under the **Upload to folder box** type **input/books**.
    e. Click **Upload.**



f. Confirm that the folder is input, and the file is **book_listing.csv**, and **Upload**. You should see the book_listing.csv file and the status of the upload in the list.



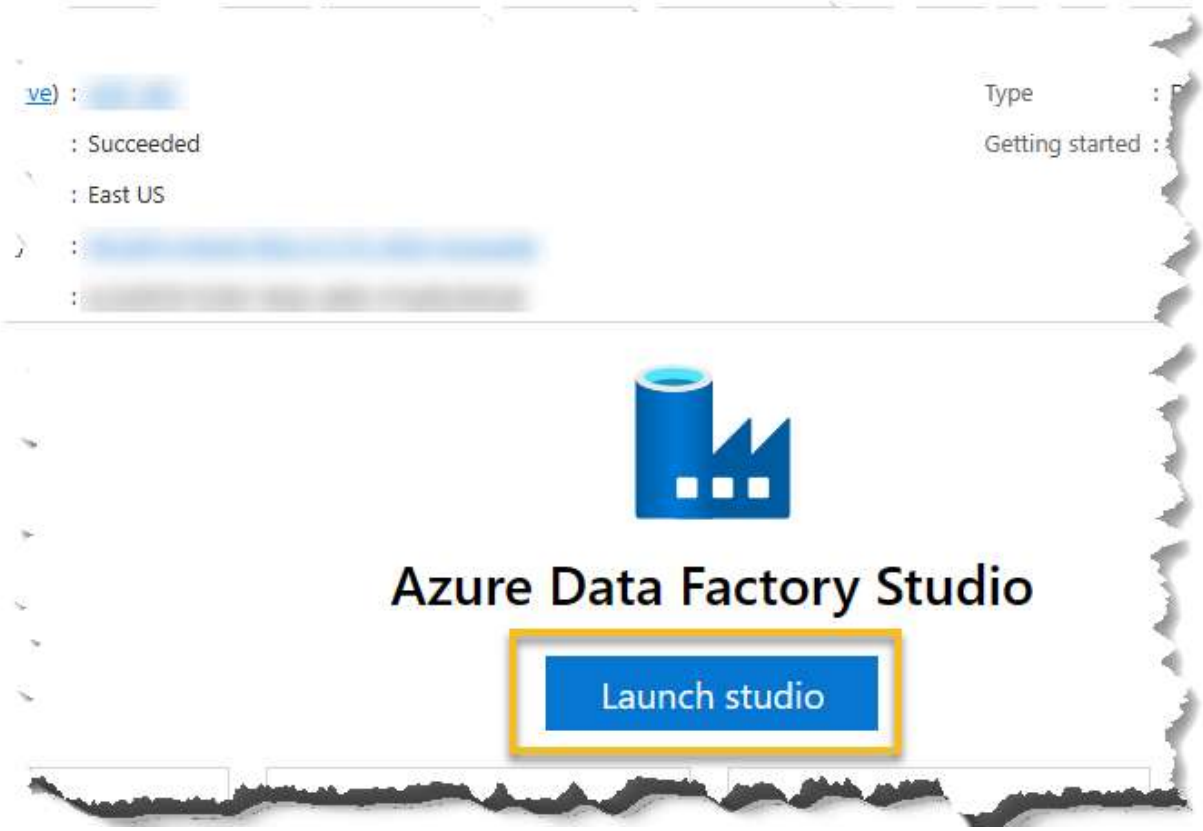
Exercise 1 has been completed.

Exercise 2: Copy Data via the Wizard

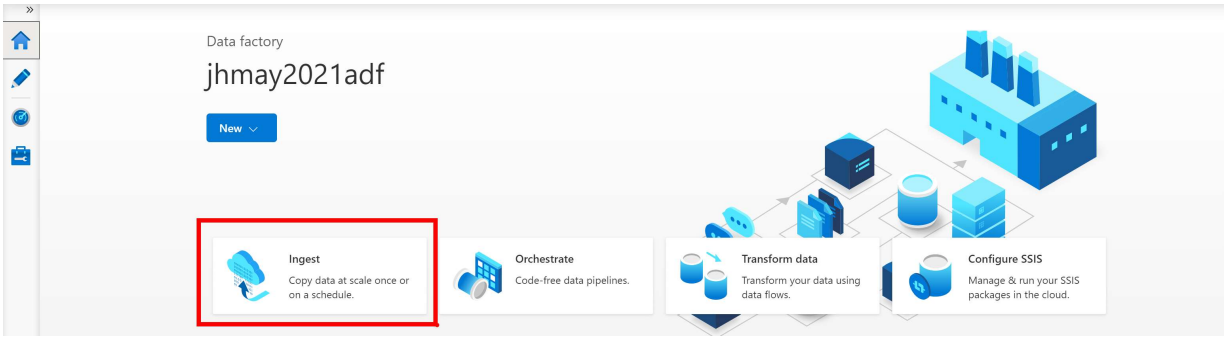
Tasks

1. Launch your Azure Data Factory in a separate browser tab.

   In the Azure portal, navigate to the ADF instance you previously provisioned, and then launch the Azure Data Factory UI by selecting Open in the ADF Overview blade.



2. On the ADF UI landing page, select Ingest.



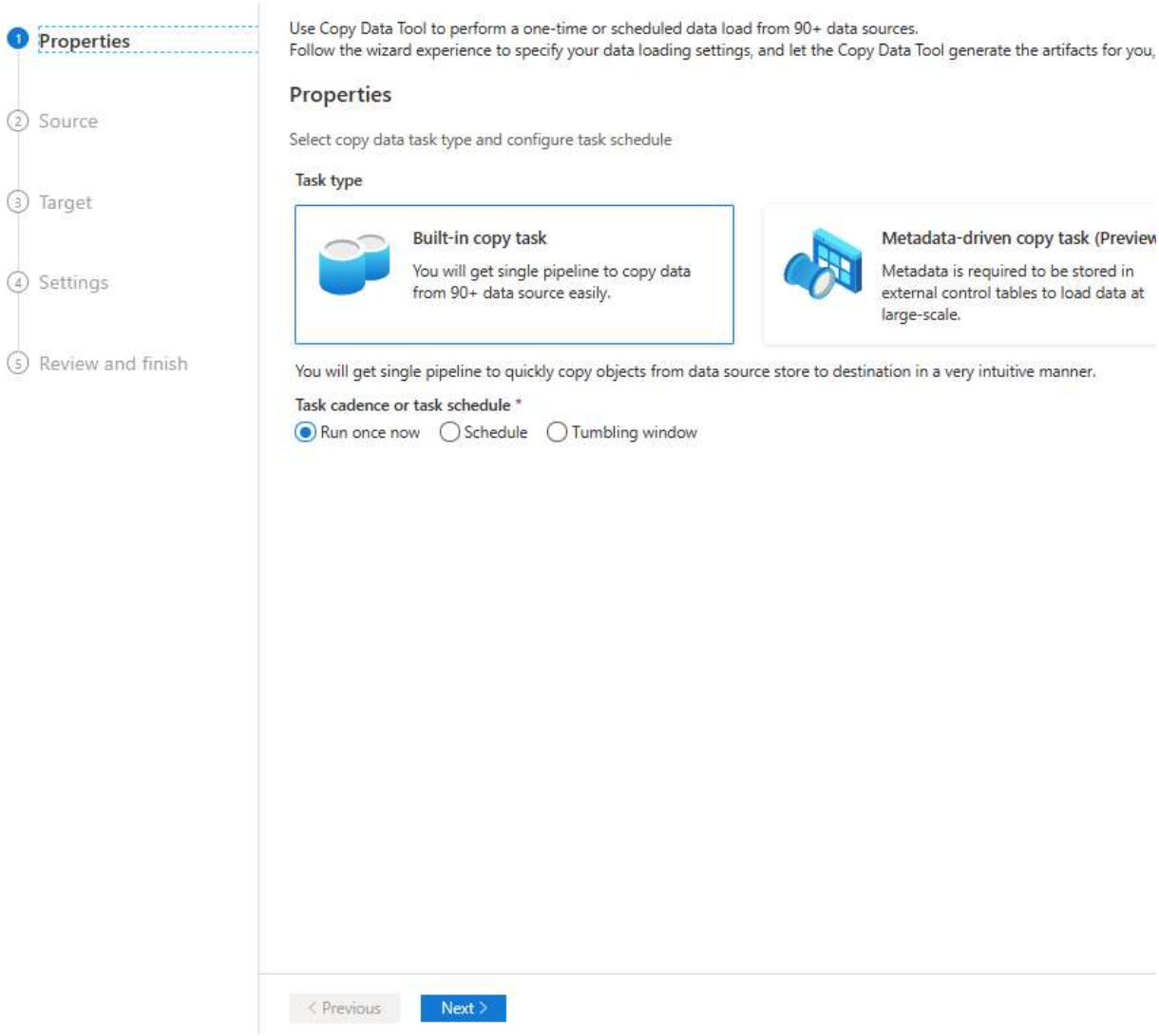
3. On the Properties Page of the Copy Data wizard

    a. Set the configurations as such:

    Task Type: Choose Built-in copy task:

    Task cadence or Task schedule: Choose Run once now.

4. Select Next.

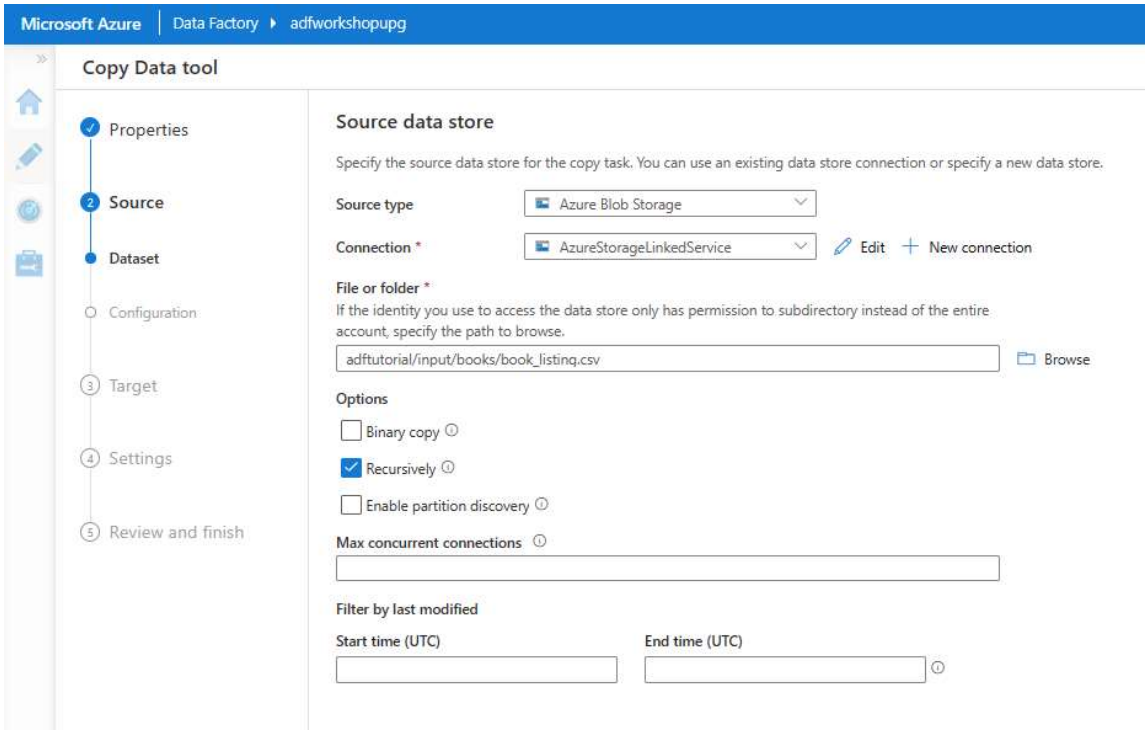


5. Configure the Source to point to the Azure Blob Storage Linked Service.

    a. On the Source dataset page, select source type Azure Blob Storage and select the AzureStorageLinkedService created in last lab

    b. Click the Folder button next to the word **Browse** to drill down to the input file **adftutorial/input/books/book_listing.csv** and select **Choose.**

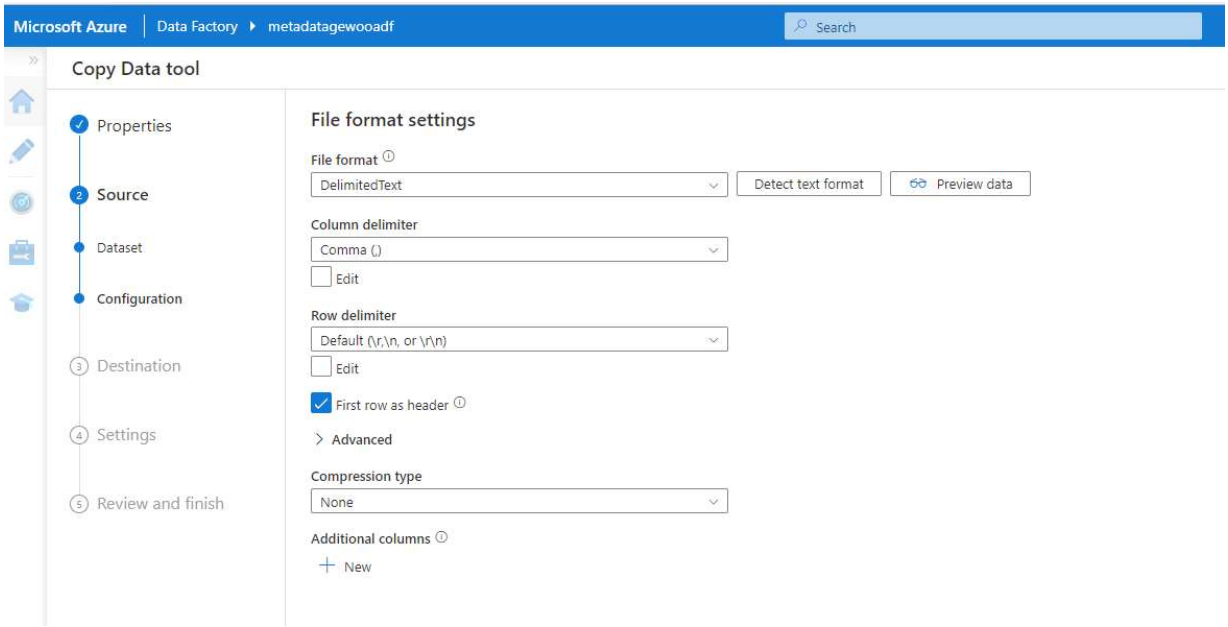
    c. Then click **Next**.



6. Validate the File Format settings

    a. Inspect the file. Notice it has the column names in the first row.

7. Select **Next** to finish the Source.



8. Configure the Destination to point to the Azure Blob Storage Linked Service.

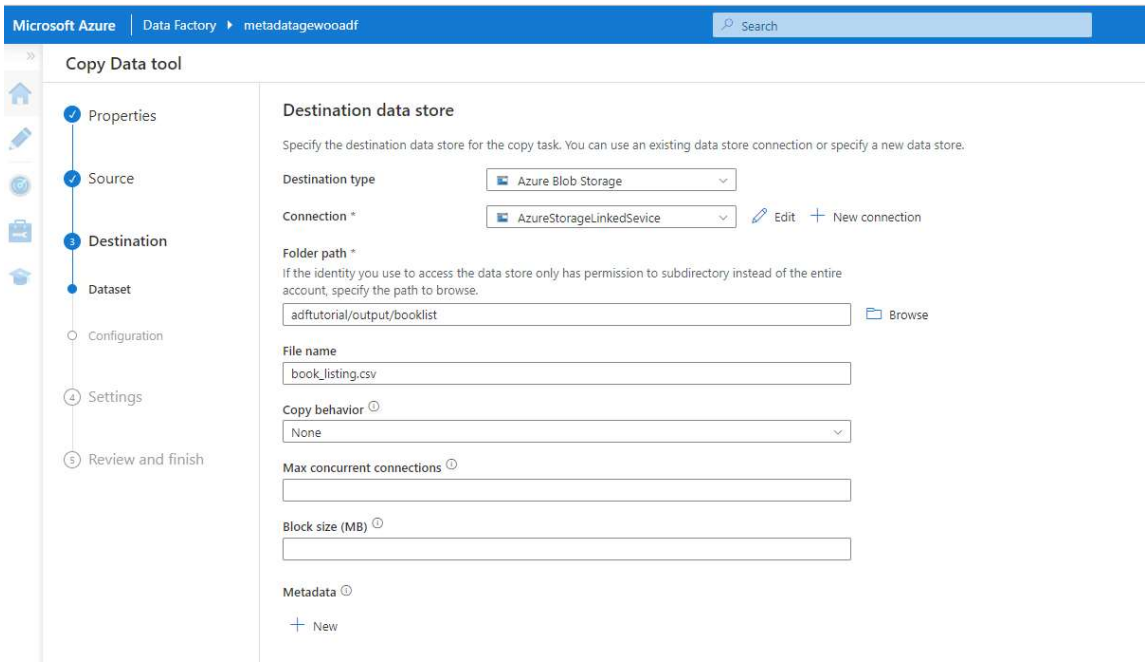
    a. On the Target dataset page, select source type Azure Blob Storage and select the AzureStorageLinkedService created in last lab

    b. In the Folder path type in adftutorial/output/booklist

    c. Enter the filename of book_listing.csv

d. Ensure Copy behavior specifies None and Max Concurrent connections is blank

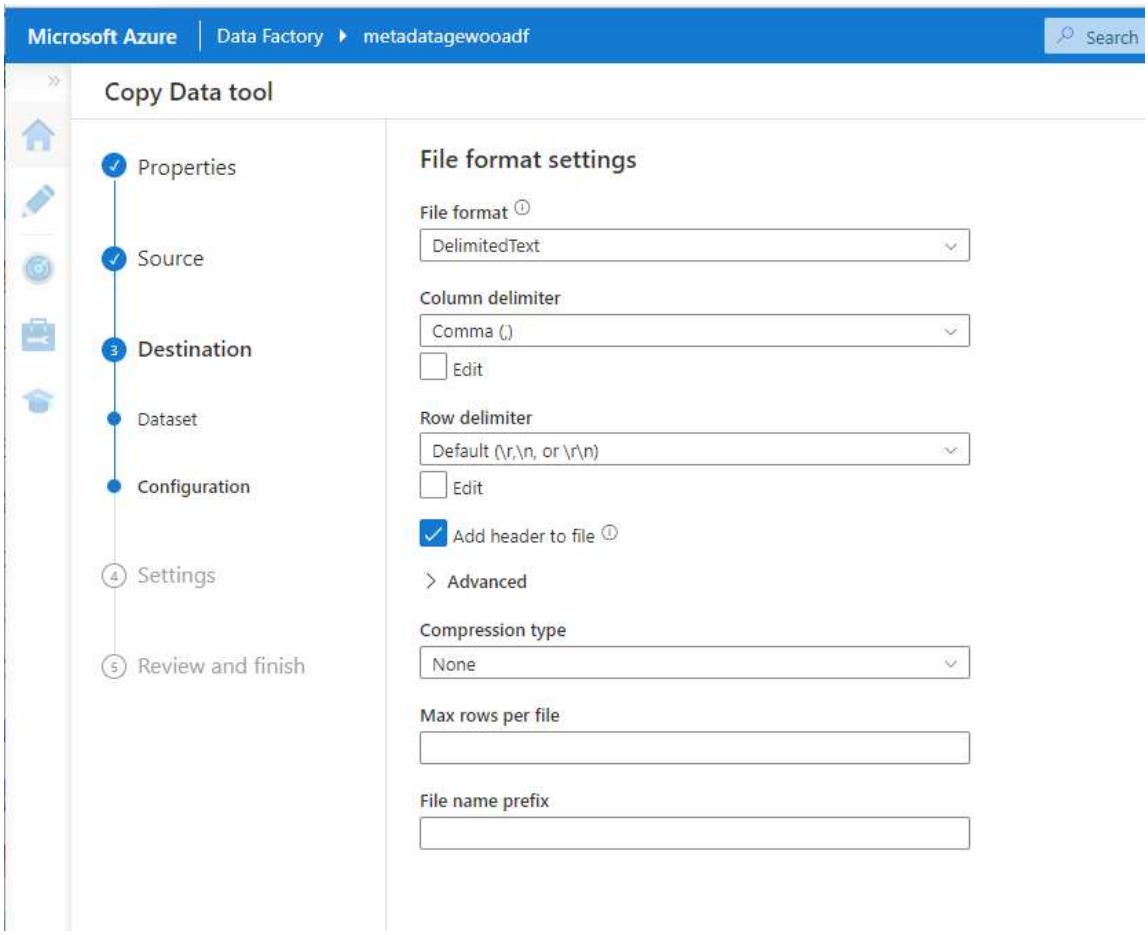
e. Click next



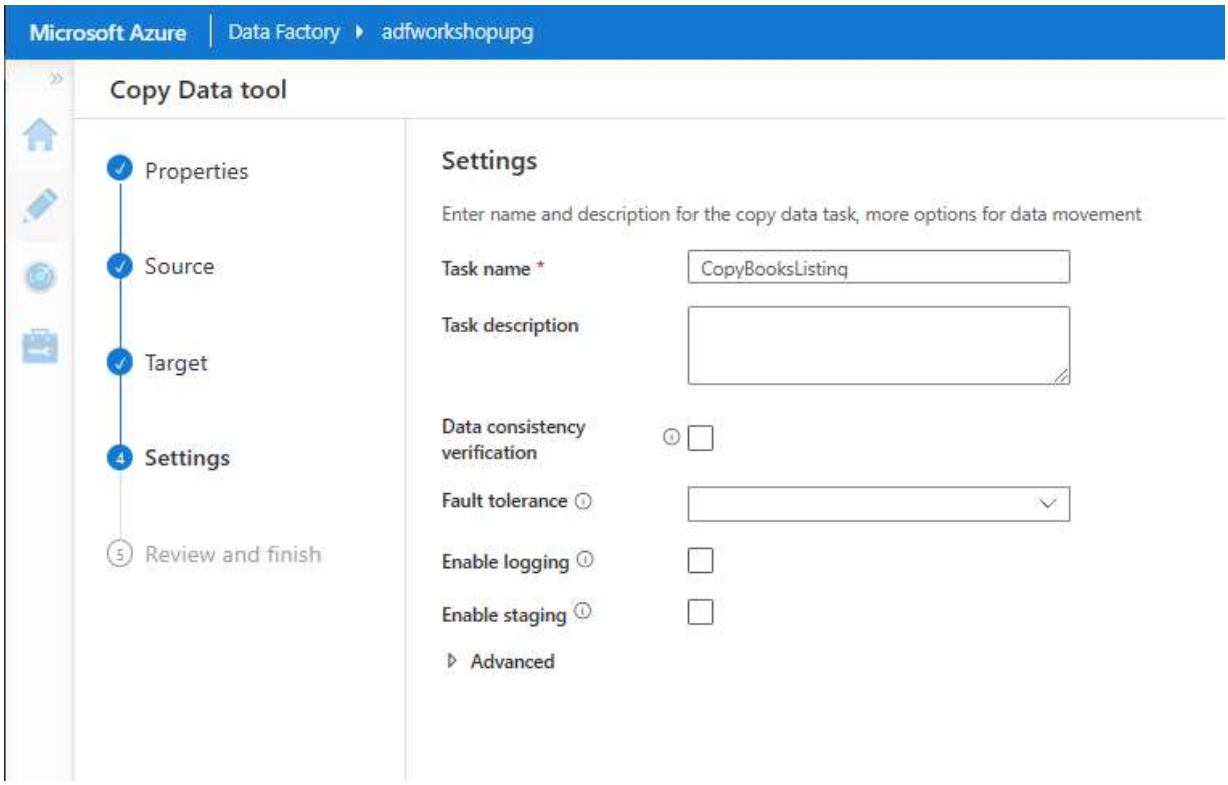
9. Validate the file format settings

a. Make sure Add header to file is chosen

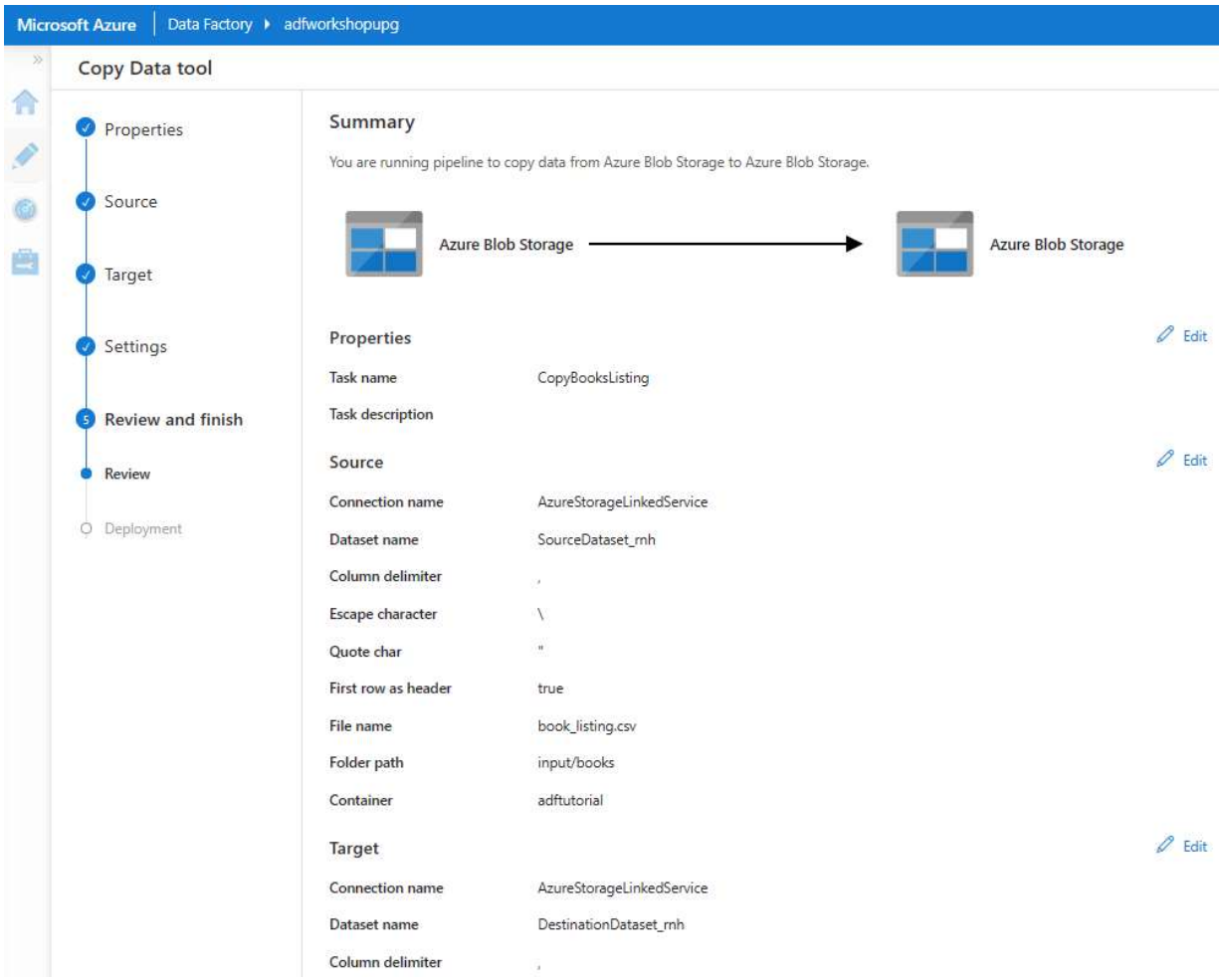
b. Click next



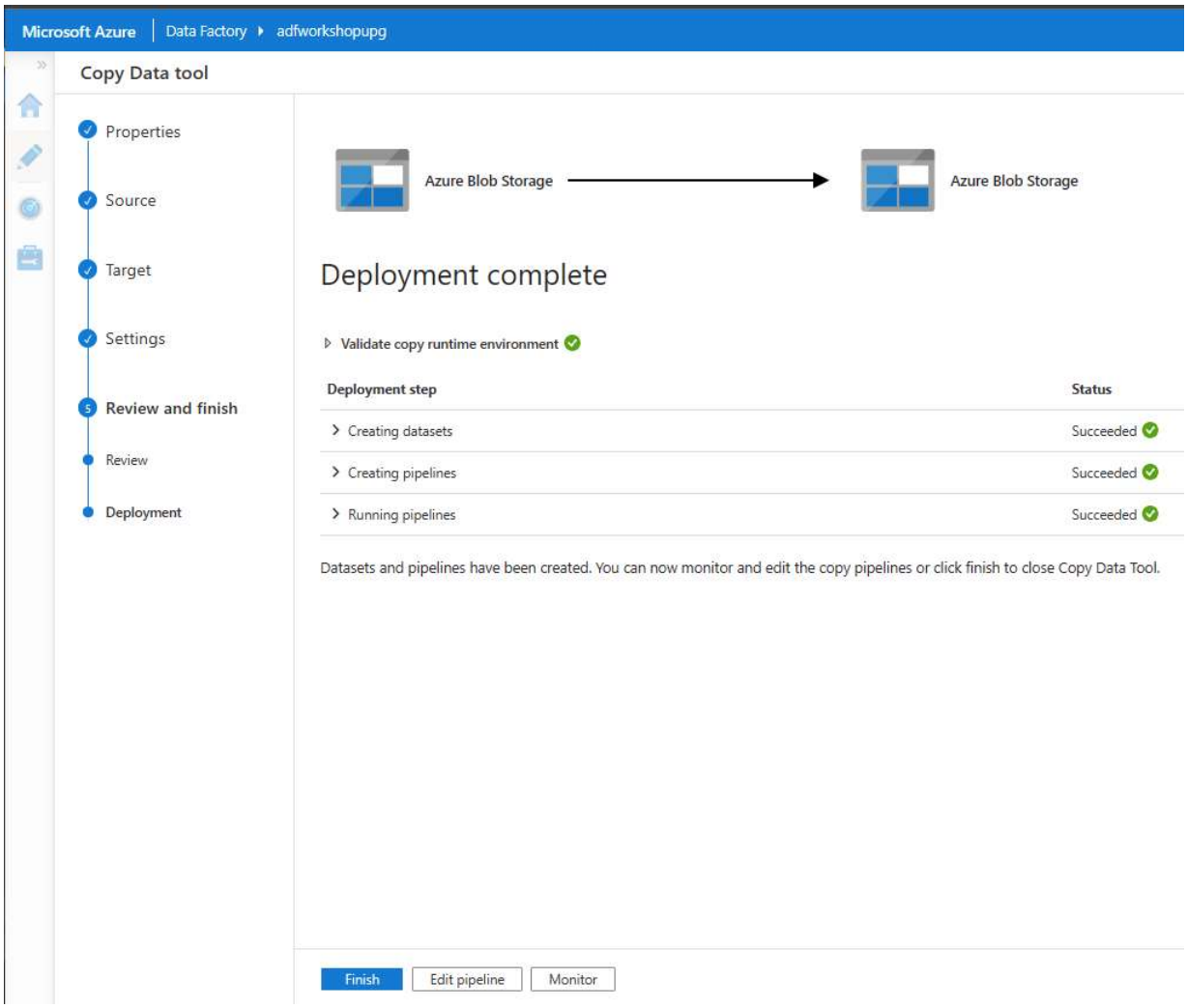
10. Name the Pipeline **CopyBooksListing** and click next.



11. View the summary and click next

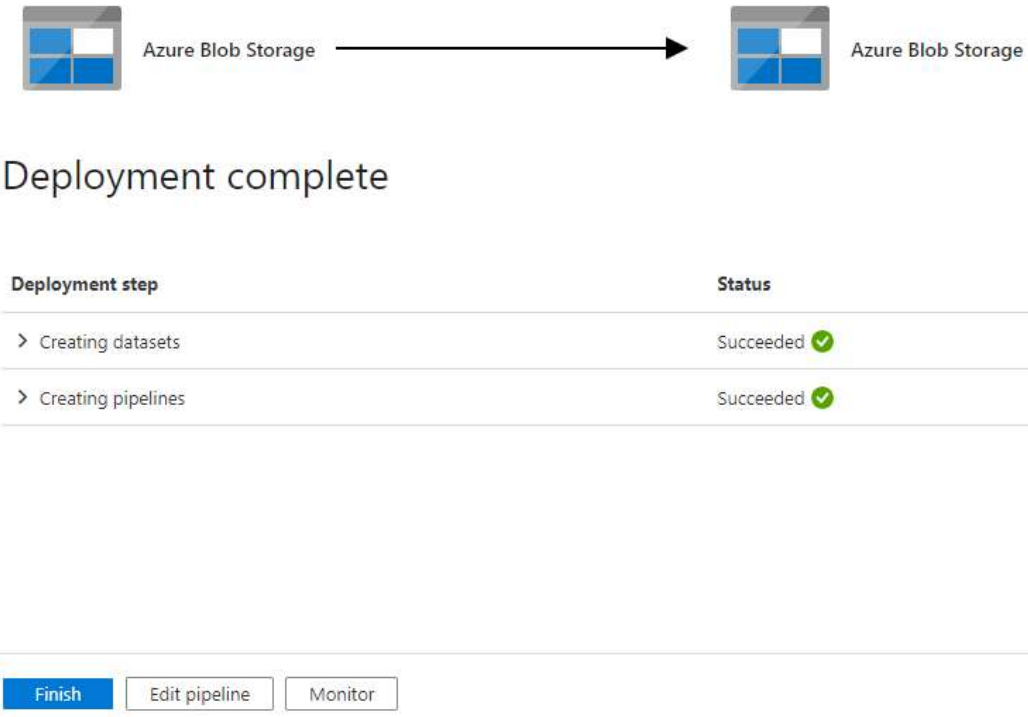


12. If you Do NOT have Git integration enabled in your Data Factory, click Finish and then go to step 14.



13. If you have Git enabled, you will need to manually Publish and Trigger the pipeline.

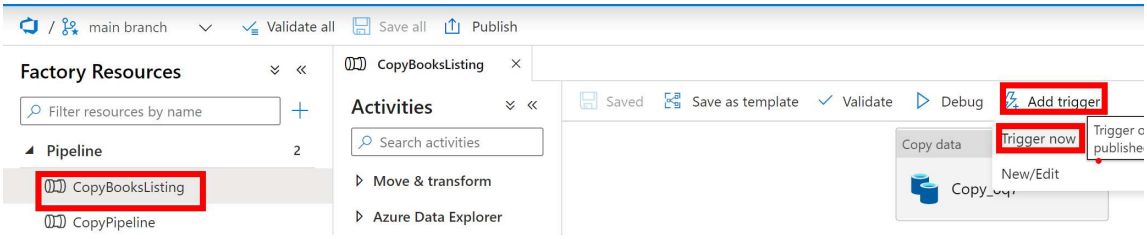
    a. Verify that your datasets and pipeline has been deployed and click **Finish**.



b. Select **Publish** from the menu bar.

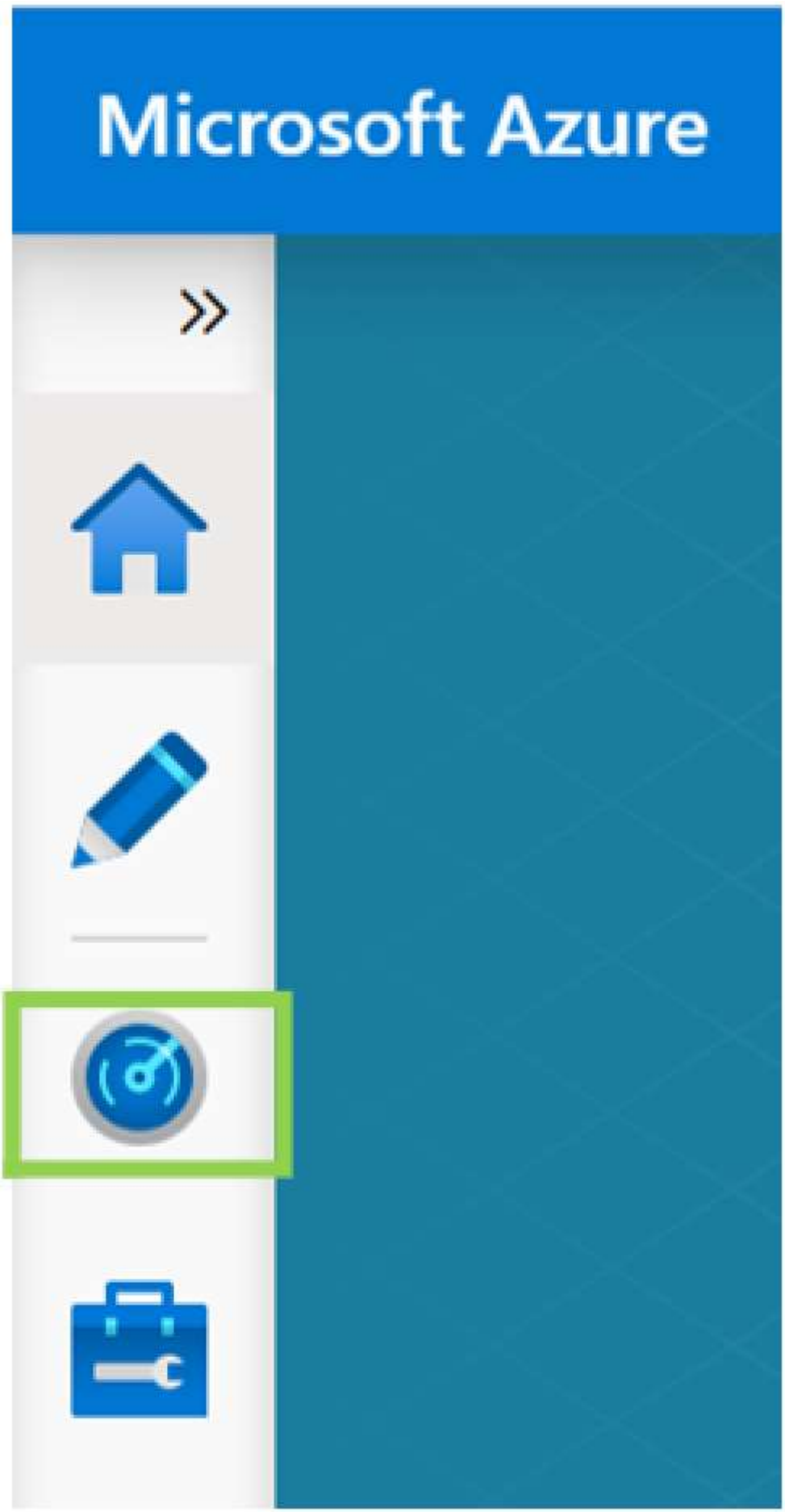
c. Review the **Pending changes** and click **OK**.

d. Navigate to your **CopyBooksListing** pipeline. Select **Add trigger** from the menu bar, choose **Trigger now** and click **OK**.

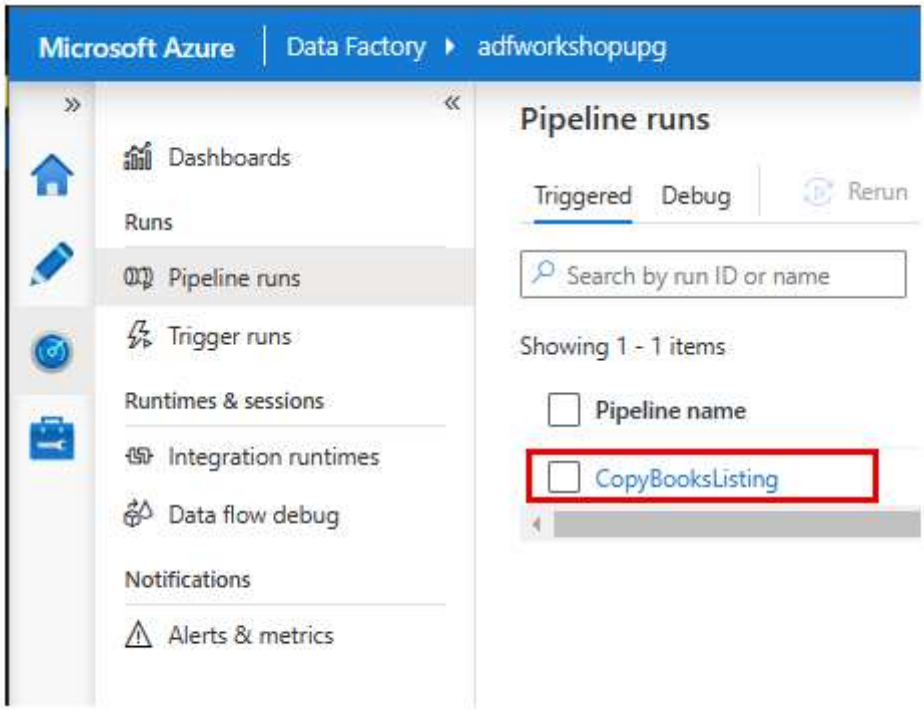


14. Monitor the pipeline run

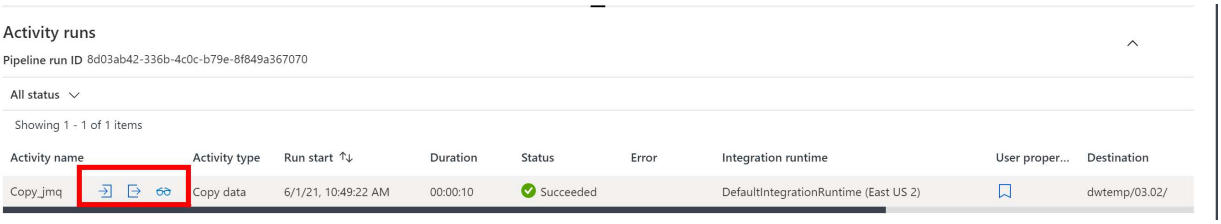
a. Click on the Monitor button to the far-left.


Microsoft Azure

15. Click the pipeline under Pipeline Name to see the progress of the individual activities that make up the pipeline.



16. Select the various inputs, outputs, and run icons under Activity runs, Activity Name.



Exercise 2 has been completed.

Data Transformation

Introduction

During this lab, you will learn how to perform data transformations using Azure Data Factory. This will cover data transformation using Azure Databricks and Azure Data Factory.

Estimated Time

45 minutes

Objectives

At the end of this lab, you will be able to:

- Configure a Data Transformation pipeline and perform ELT process

Logon Information

Use the following credentials to sign into the virtual environment

- Username: **Admin**
- Password: **Passw0rd!**

Table of Contents

Prerequisites

Exercise 1: Enable Microsoft.Compute

Exercise 2: Clone the Databricks Archive

Exercise 3: Data Ingestion using Azure Databricks

Exercise 4: Saving the Storage Account Name and Access Key

Exercise 5: Review Ingested Data in Azure Databricks

Exercise 6: Data Transformation in Azure Data Factory using Azure Databricks Notebook

Exercise 7: Review the Transformed Data using Azure Databricks

Lab: Data Transformations with Azure Data Factory

During this lab, you will learn how take a sample dataset to create a Data Factory pipeline and use sample notebooks in Azure Databricks to transform and analyze the data.

Prerequisites

You should have your storage account, databricks, and data factory resources provisioned from **Module 1, Lesson 2, Lab 2** using the Azure Resource Manager (ARM) templates. If not, please refer back to that lab.

Exercise 1: Enable Microsoft.Compute

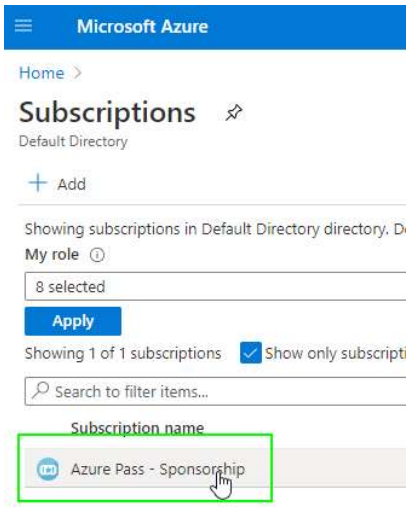
Tasks

1. Enable Microsoft.Compute

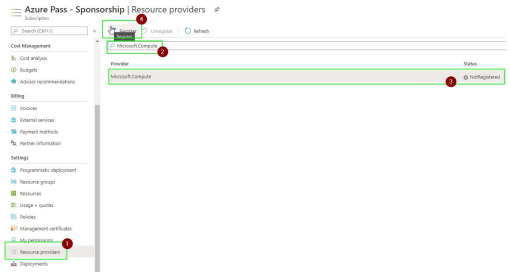
    a. In the Azure portal, select **Subscriptions**.

    b. Select **your subscription**.

    c. Select Resource providers under Settings and search for **Microsoft.Compute**. Ensure it is registered. If not registered, **register it**. (Note that it takes a few minutes for the status to change from Unregistered to Registered. Refresh your browser to get an updated status, **do not click** the refresh button beside unregister.



Exercise 1 has been completed.

Exercise 2: Clone the Databricks Archive

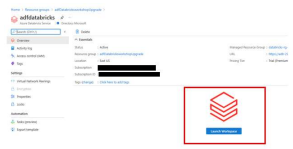
This exercise will create the Databricks notebooks for the lab.

Tasks

1. Launch the Databricks workspace

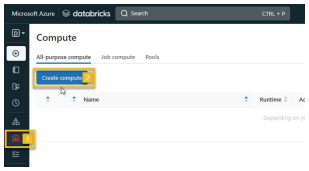
    a. In the Azure portal, go to the resource group you created in M01_L02_Lab01 and select the **Databricks service**.

    b. Select **Launch Workspace**.



2. Create your cluster.

    a. Select **Compute** on the side panel, then **+Create Compute.**

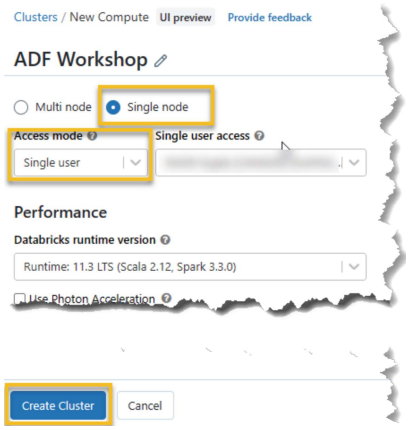


    b. Click on the pencil and Enter a Cluster Name (for example: *ADF Workshop*)

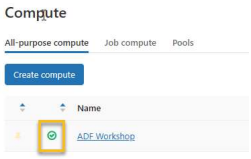
    c. Select **Single Node**.

    d. Set Access Mode to **Single user access** and it should have your email account listed

    e. Leave everything else as default and click **Create Cluster.**



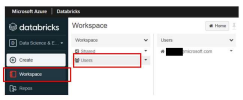
f. Wait for the cluster to be created before continuing, which may take a couple of minutes.



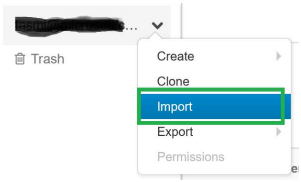
> ☐ If you get an error for number max number of IP reached. It means you might have created a multi-node cluster instead. In the sponsor tenant, you are only allowed maximum of 10 public IP addresses. Close the data bricks and delete the data bricks in your resource group to clean up everything. Create data bricks manually and start from step 2 again.

3. Import the notebook

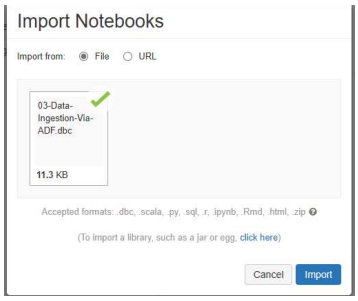
a. On the left side, select **Workspace**, then **Users**, and select your **username** (the entry with the house icon).



b. In the window that appears, select the downward arrow next to your name and select **Import**.



c. In the Import Notebooks window, select import and browse to the M03_L01_Lab01 folder, and choose the file 03-Data-Ingestion-Via-ADF.dbc



d. Click the **Import** button.

e. Select the folder named **03-Data-Ingestion-Via-ADF**.

> ℹ The folder contains 3 notebooks for this lab (two note books to be used in Databricks and one in Azure Data Factory). Run these in order, as shown below.

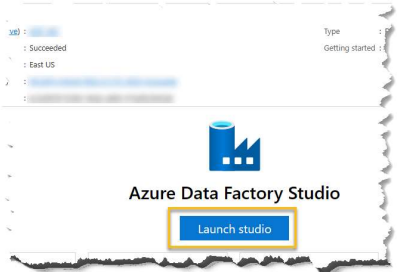
Exercise 2 has been completed.

Exercise 3: Data Ingestion using Azure Databricks

This exercise will create a Data Factory pipeline to ingest data from a public dataset into your storage account. After the data is ingested, you use a Databricks notebook function to examine the data.

Tasks

1. Launch your Azure Data Factory in a separate browser tab. In the Azure portal, navigate to the ADF instance you previously provisioned, and then launch the Azure Data Factory UI by selecting Launch Studio in the ADF Overview blade.



2. On the ADF UI landing page, select Ingest.

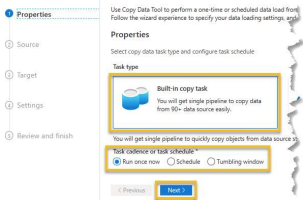
3. On the Properties Page of the Copy Data wizard

    a. Set the configurations as such:

        i. Task Type: Choose Built-in copy task:

        ii. Task cadence or Task schedule: Choose Run once now.

        iii. Select Next.



b. Configure the Source to point to the Azure Blob Storage Linked Service.

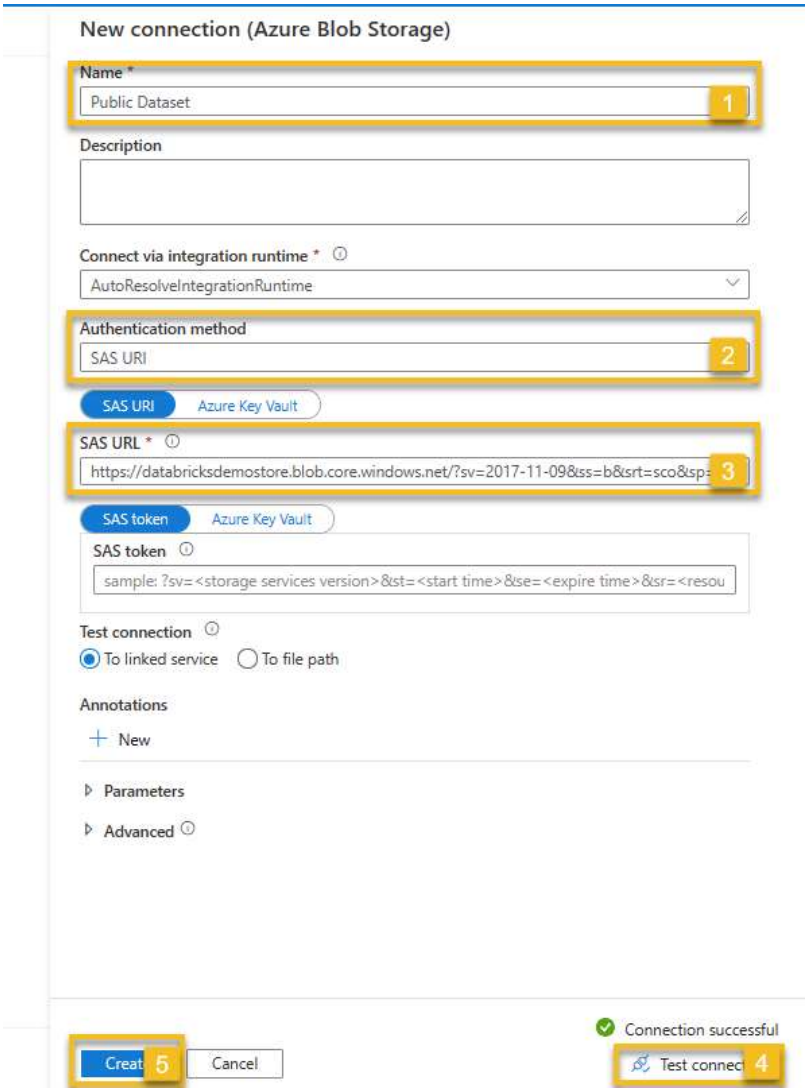
i. On the Source dataset page, select source type Azure Blob Storage and select + New connection.

ii. Configure the New Linked Service (Azure Blob Storage).

- Name: **PublicDataset**
- Authentication method: **SAS URI**
- **SAS URL**: https://databricksdemostore.blob.core.windows.net/?sv=2017-11-09&ss=b&srt=sco&sp=rl&se=2099-12-31T17:59:59Z&st=2018-09-22T15:21:51Z&spr=https&sig=LqDcqVNGNEuWILjNJoThzaXktV2N%2BFS354s716RJo

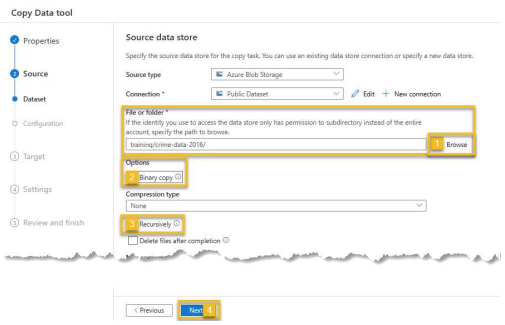
  > ☐ It will be helpful to type the URL into a notepad first. Before copying into to Azure Data Factory.

- Select **Test connection** and ensure a Connection successful message is displayed.
- Select **Create**.



c. Back on the Source data store page, Set the input folder.

- Folder: Use the Browse button to select the folder **training/crime-data-2016/**.
- Binary copy: Check this box.
- Recursively: Check this box.
- Select **Next**.

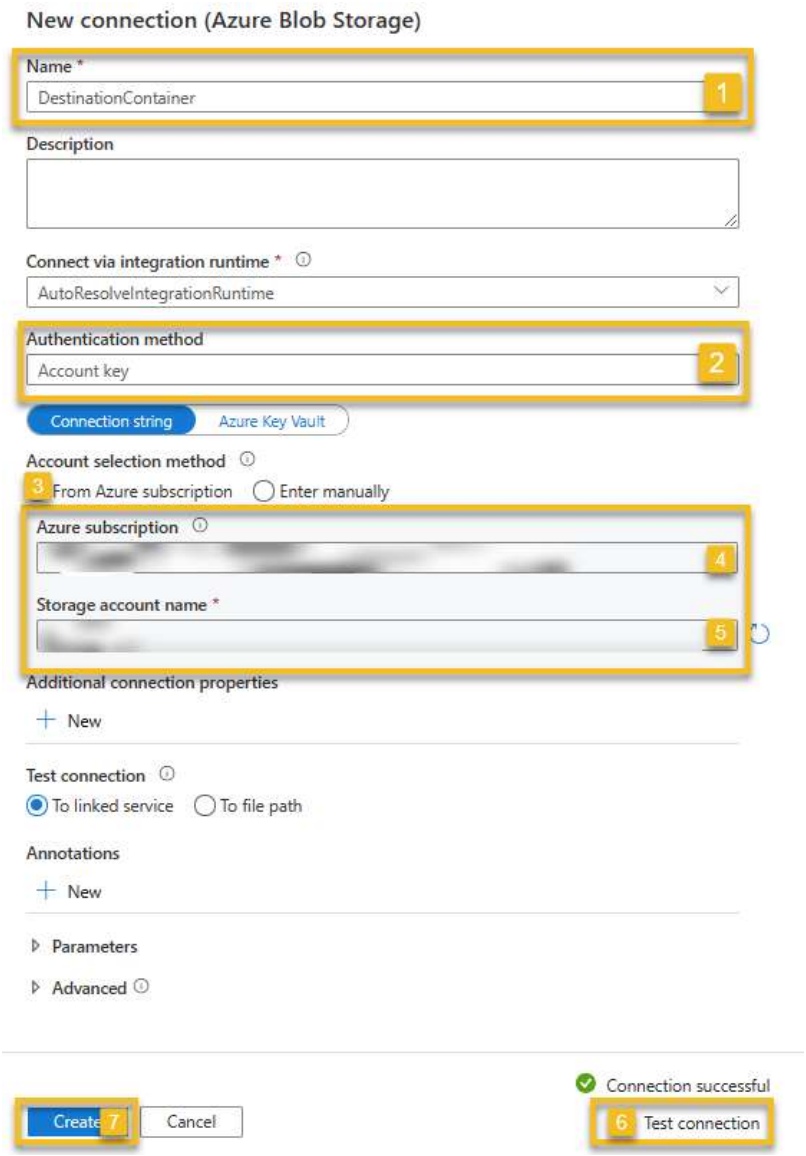


d. Configure the Target to point to Azure Blob Storage Account.

i. On the Target data store page, select source type Azure Blob Storage and select + New connection.

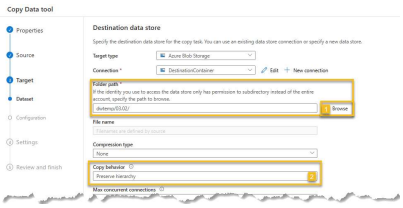
ii. Configure the New Linked Service (Azure Blob Storage).

- Name: **DestinationContainer**
- Authentication method: **Account key**
- Account selection method: **From Azure subscription**
- Azure Subscription: **Azure Pass - Sponsorship**
- Storage account name: Select the name of the Storage account you created previously from the list.
- Select **Test connection** and ensure a Connection successful message is displayed.
- Select **Create**.



e. Configure the output file or folder:

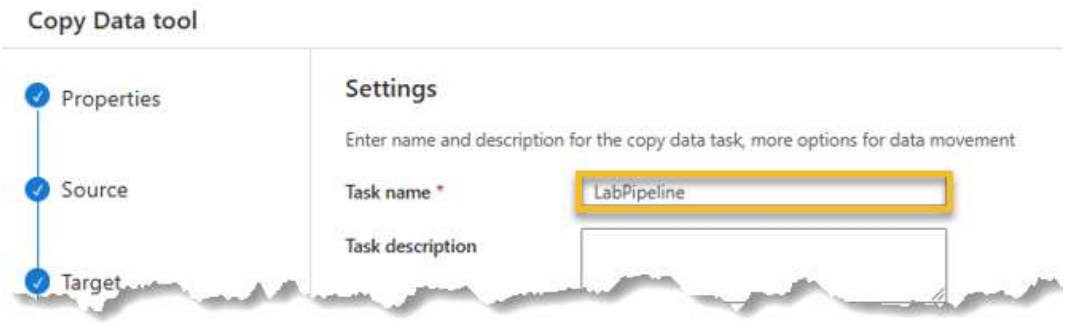
- Folder path: dwtemp/03.02/
- File name: Leave empty.
- Copy behavior: Select **Preserve hierarchy**.
- Select **Next**.



f. On the Settings page,

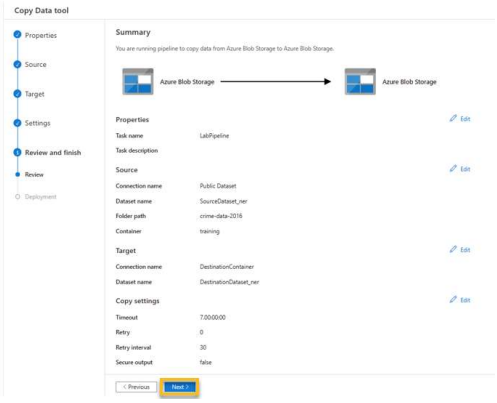
i. Enter the name **LabPipeline** and leave the other default values

ii. Select **Next**.

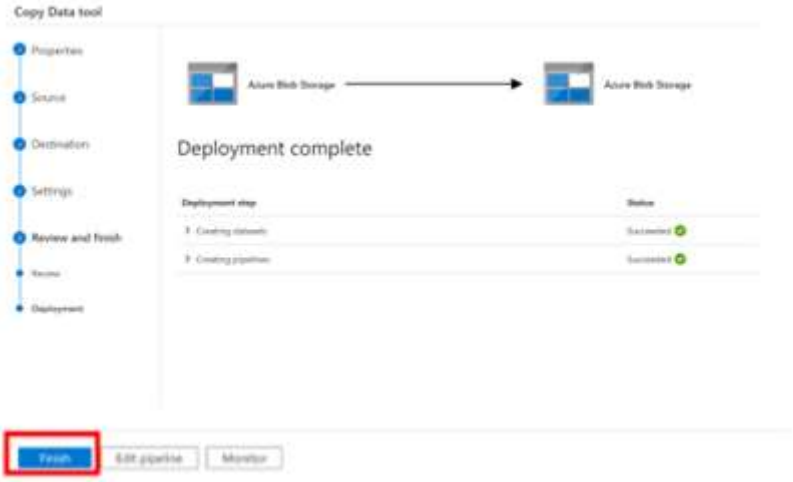


g. On the Summary page, you can review the copy pipeline settings

i. Select **Next**.



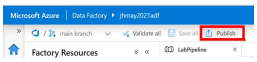
h. If you have <u>DO NOT</u> have Git integration enabled in your Data Factory, click Finish and then go to step 4.



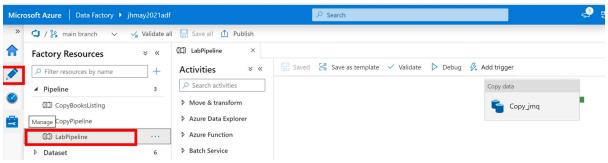
i. If you <u>HAVE</u> Git enabled, you will need to manually Publish and Trigger the pipeline.

i. Select **Finish**.

ii. Click **Publish** from the top menu bar. Review changes and click **OK**.

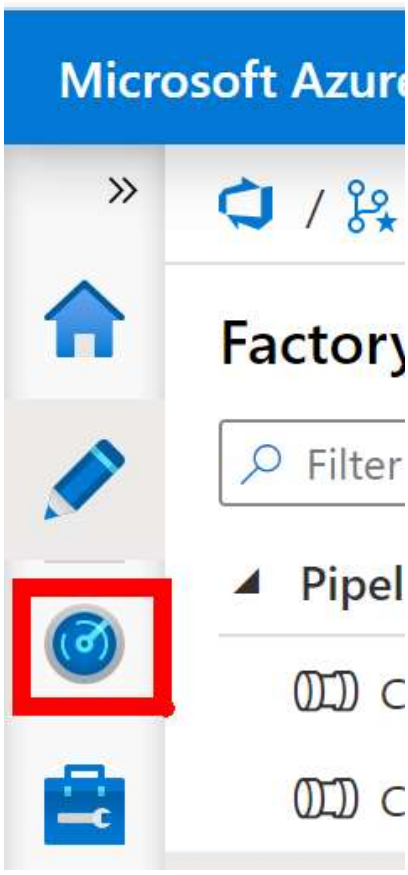


iii. Navigate and open your new pipeline, LabPipeline.

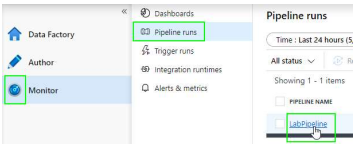


iv. Select **Add trigger** from the menu bar, choose **Trigger now** and click **OK**.

4. Click on the **Monitor** button to the far-left to monitor the pipeline run.



a. Selecting Monitor above will take you to the Pipeline Runs screen in the ADF UI, where you can monitor the status of your pipeline runs. Using the monitor dialog, you can track the completion status of pipeline runs, and access other details about the run. Click the pipeline under Pipeline Name to see the progress of the individual activities that make up the pipeline.



b. Select the various inputs, outputs, and run icons under Activity runs, Activity Name.

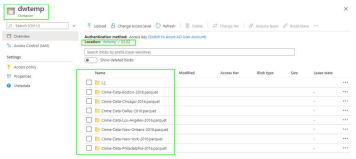
5. Verify files in blob storage.

    a. Navigate to your storage account in the Azure portal.

    b. Locate the **dwtemp** container.

    c. Locate the **03.02** folder within the dwtemp container.

    d. Confirm the files where copied via Azure Data Factory.



Exercise 3 has been completed.

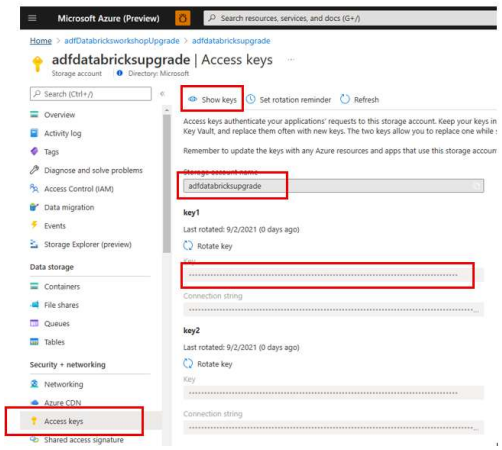
Exercise 4: Saving the Storage Account Name and Access Key

In the upcoming exercises you will need your Storage account name and the storage account key.

Tasks

1. The account name and key can be retrieved from the Access keys section in your storage account.

2. Copy your storage account name and Select show keys and copy the value under Key 1. Save these both for a future step.



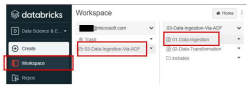
Exercise 4 has been completed.

Exercise 5: Review Ingested Data in Azure Databricks

In this exercise we will use the Python Notebook we imported in Excerise #2 to explore the ingested data.

Tasks

1. Navigate back to Databricks.
2. Select the **01-Data-Ingestion** notebook from the **03-Data-Ingestion-Via-ADF** Workspace.



3. Continue with the instructions in the **01-Data-Ingestion** notebook to Examine the ingested data in the notebook.

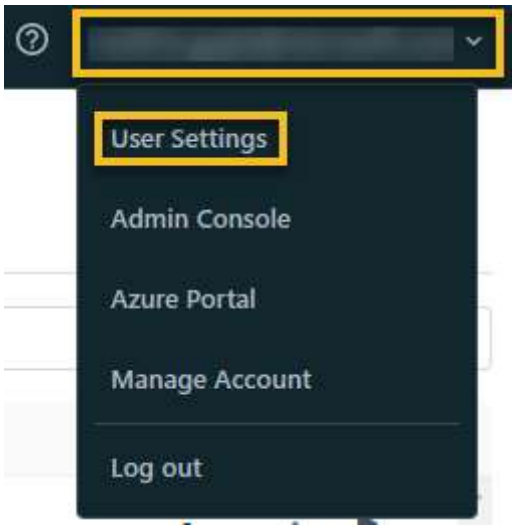
Exercise 5 has been completed.

Exercise 6: Data Transformation in Azure Data Factory using Azure Databricks Notebook

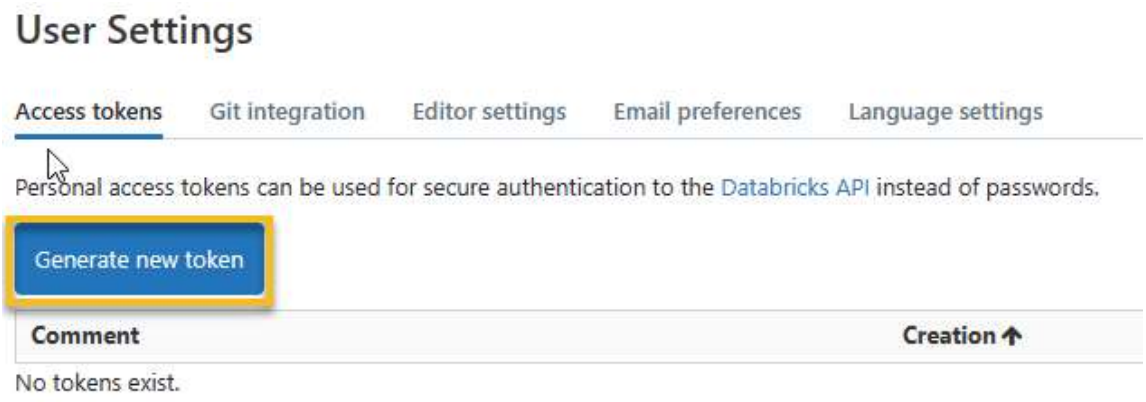
This exercise will add a Databricks Notebook activity to your ADF pipeline that runs a sample notebook to transform and restructure your data.

Tasks

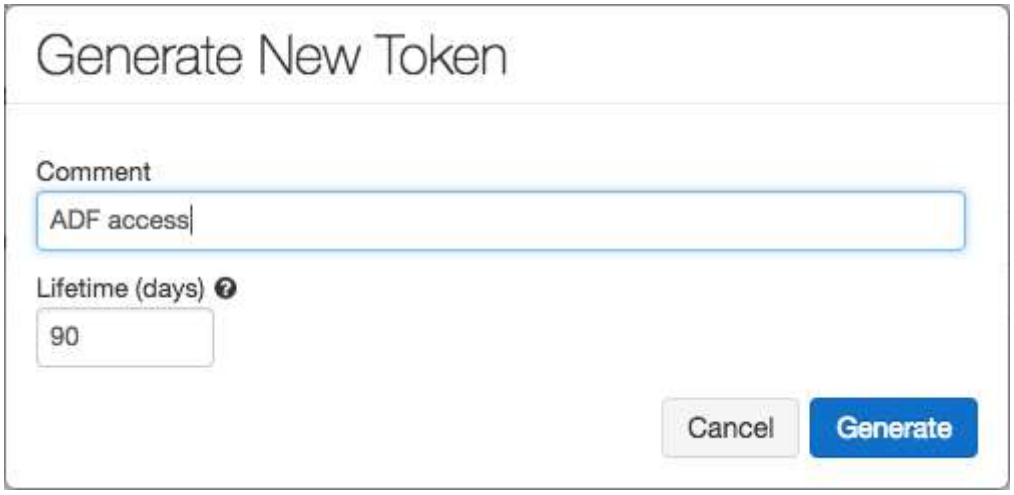
1. Create Databricks Access Token. This step will generate an access token that will be used by ADF to access the Databricks workspace.
    a. In the top right corner of your Databricks workspace (this window), select the Account icon, and then select User Settings.



    b. On the User Settings screen, select Generate New Token.

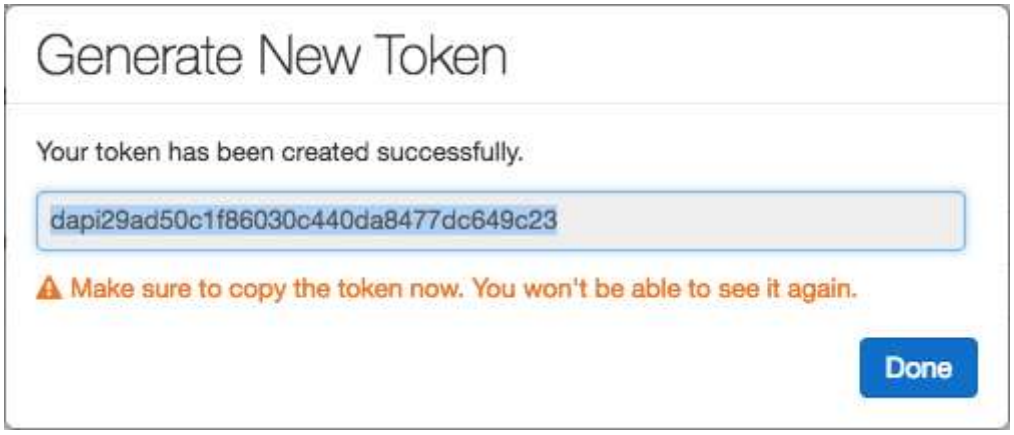


c. In the Generate New Token dialog, enter a comment, such as "ADF access", leave the Lifetime set to 90 days, and select Generate.



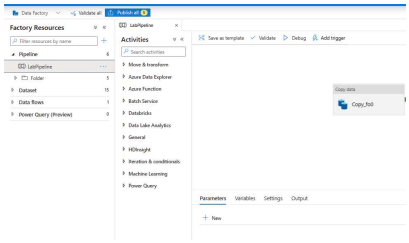
d. Copy the generated token and paste it into a text editor, such as Notepad, for use when setting up the Databricks Linked Service in ADF.

> ☐ Do not close the dialog containing the generated token until have save it in a text editor, as it will not be visible again once you close the dialog.

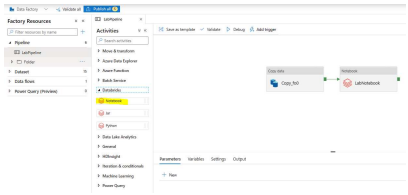


2. Add Databricks Notebook Activity to Pipeline. Navigate back to the Azure Data Factory.

a. Select the Author (pencil) icon in the left-hand menu, and select the pipeline created in Exercise 1 (LabPipeline).

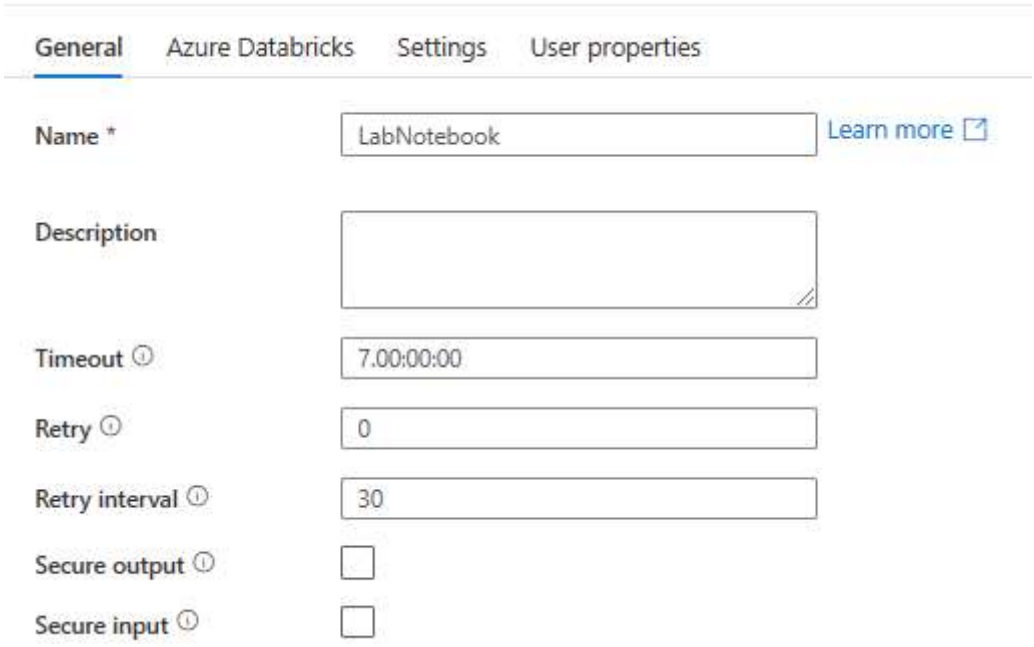


b. Expand Databricks under Activities, then drag the Notebook activity onto the design surface, and drop it to the right of the existing copy activity.



c. Select the Notebook activity on the design surface to display tabs containing its properties and settings at the bottom of the screen.

d. In the General Tab enter **LabNotebook** into the Name field.



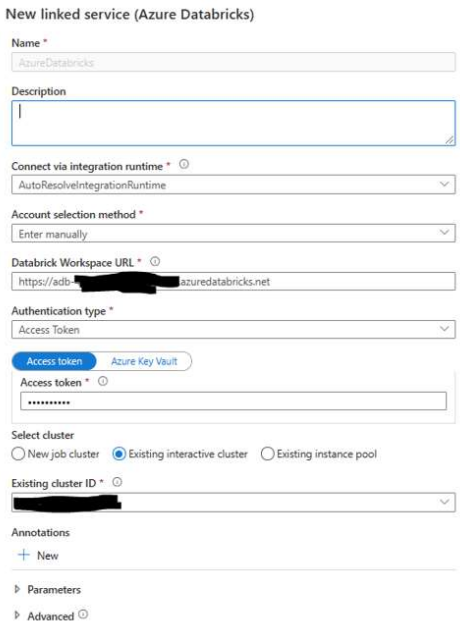
e. In the Azure Databricks Tab Select +New next to Databricks Linked Service to create a new Linked Service

f. Configure the New Linked Service.

- Name: **AzureDatabricks**
- Azure Subscription: **Azure Pass - Sponsorship**
- Databricks workspace: Select the workspace you are using for this lab.
- Select cluster: Choose Existing interactive cluster.
- Access token: Paste the token you generated in step one into this field.
- Existing cluster id: Select the Databricks cluster you are using for this lab.

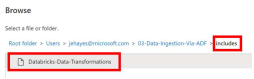
> ☐ If this drop down box does not populate, ensure that you copied your Access Token correctly into the Access token field.

- Select **Test connection** and ensure you get a Connection successful message.
- Select **Create**.



g. In the Settings Tab for Notebook, select Browse, and select the Databricks-Data-Transformations notebook from the **/Users/*[your-user-account]/*03-Data-Ingestion-Via-ADF/includes/Databricks-Data-Transformations**.

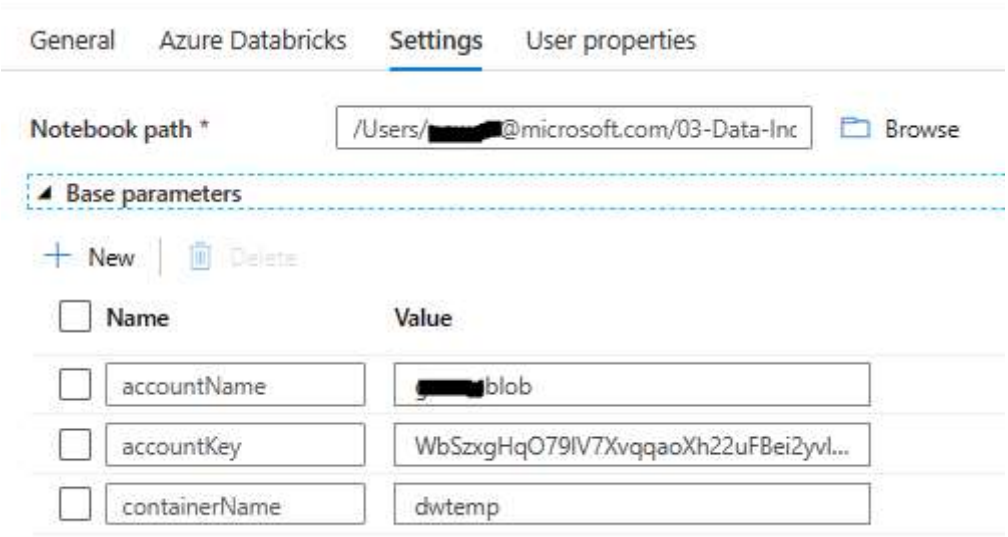
- [ ] Make sure you select the notebook in the includes folder selected. Students commonly select the notebook in the higher level folder and then they have errors or they only select the folder and not the notebook.



h. Expand Base Parameters.

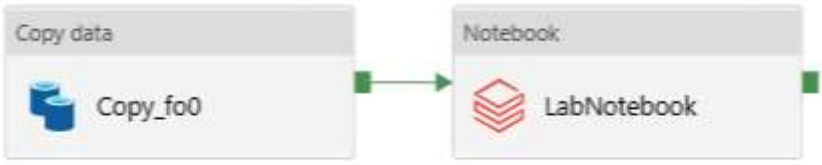
i. Select +New, three times for three parameters we need to pass to **Databricks-Data-Transformations** notebook. The values for these are copied in Exercise #4.

Name	Value Expected
accountName	Storage Account Name
accountKey	Storage Key 1
containerName	dwtemp



- [ ] The parameters names are case sensetive in Azure Databricks.

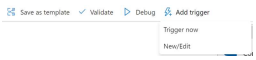
3. Connect Copy Activity to Notebook Activity. Select the small green box on the right-hand side of the copy activity and drag the arrow onto the Notebook activity on the design surface. Creating this connection sets the output from the copy activity as required input for the Databricks Notebook activity. What this means is that the copy activity has to successfully complete processing and generate its files in your storage account before the Notebook activity runs, ensuring the files required by that Notebook activity are in place at the time of execution.



4. Publish Pipeline. In the ADF UI toolbar, if you have Git configured, select **Save all** to save your changes to your Git repo. Then select **Publish** to deploy your changes to the Azure Data Factory service.

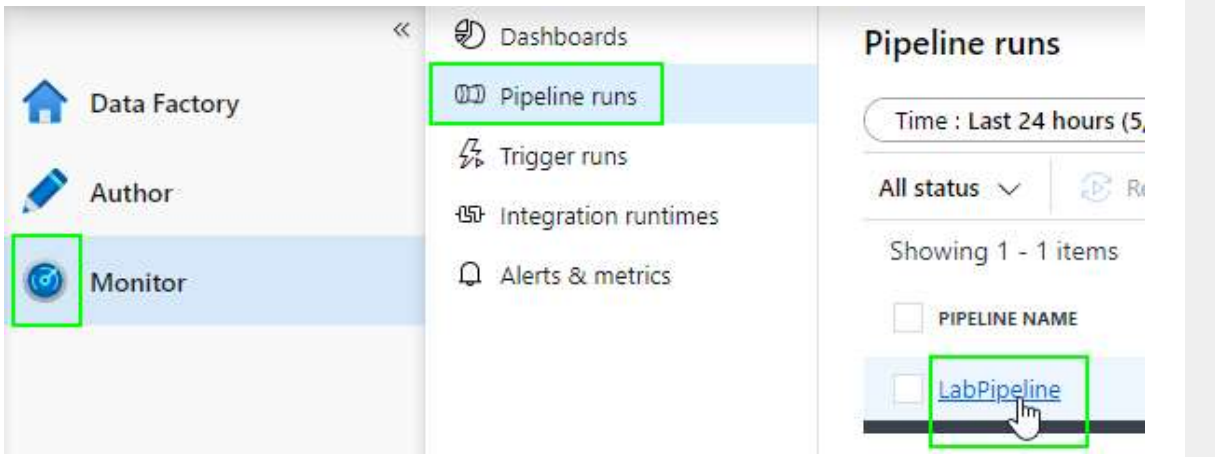
5. Trigger and Monitor the Pipeline Run

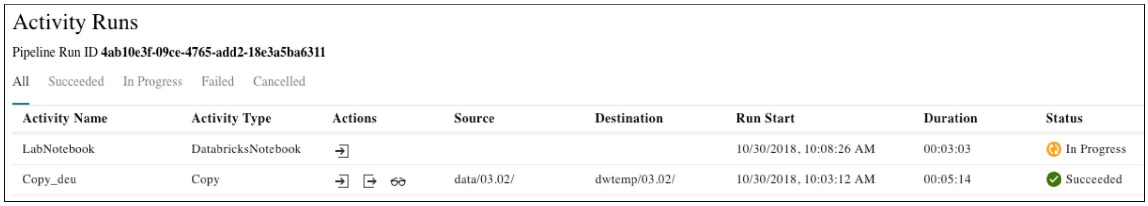
    a. Trigger the pipeline by selecting Add trigger, then Trigger Now on your pipeline.



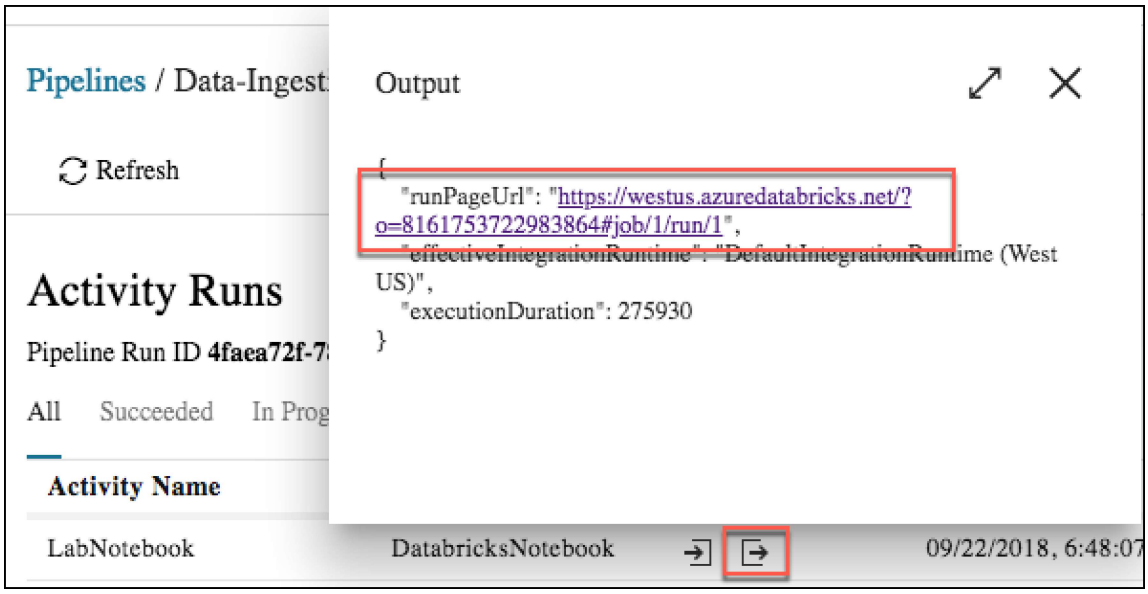
    b. Next, navigate to the Monitor screen by selecting the Monitor icon in the left-hand menu.

c. Click the pipeline under Pipeline Name to see the progress of the active pipeline run. Here you can observe the ADF pipeline activities running. Notice the Databricks Notebook activity will not run until of the copy activity has completed. Once done, you will see a Succeeded message next to each activity.





d. To view the notebook output of the run, you can select the Output Action next to the LabNotebook activity, and then select the runPageUrl value. This will open the executed notebook within Databricks, and you can view details of the run in each cell's output.



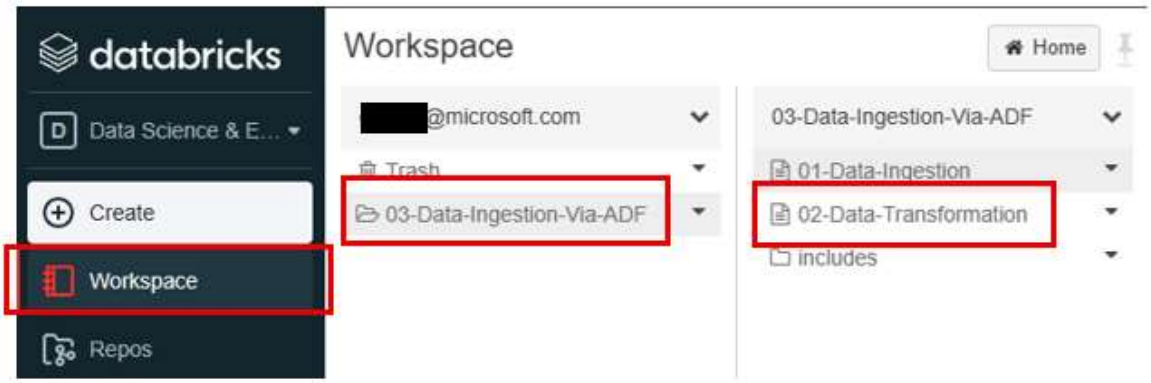
Exercise 6 has been completed.

Exercise 7: Review the Transformed Data using Azure Databricks

In the previous exercise you prepared the data and stored in table in Azure Databricks. Now you will perform some basic aggregation on the sample dataset to generate required reports using the **02-Data-Transformation** notebook.

Tasks

1. Navigate back to Databricks.
2. Select the **02-Data-Transformation** Databricks Notebook from the 03-Data-Ingestion-Via-ADF Workspace.



3. Continue with the instructions in the **02-Data-Transformation** notebook to **Verify transformations and aggregate the data** in the notebook.

Exercise 7 has been completed.

Control Flow

Introduction

During this lab, you will learn how to configure Control Flow within your Azure Data Factory pipelines.

Estimated Time

90 minutes

Objectives

At the end of this lab, you will be able to:

- Configure a Data Transformation pipeline.
- Use the Flow Control to add error handling and control the path of execution.

Logon Information

Use the following credentials to login into virtual environment:

- Username: **Admin**
- Password: **Passw0rd!**

Table of Contents

Exercise 1: Prepare your environment

Exercise 2: Implement Control Flow

Exercise 3: Extend the Control Flow with Lookup and IF Condition activities

Lab: Control Flow with Azure Data Factory

During this lab, you will learn how to do data transformations with Azure Data Factory.

Exercise 1: Prepare your environment

This step will take you through preparing your environment for the exercises which will follow.

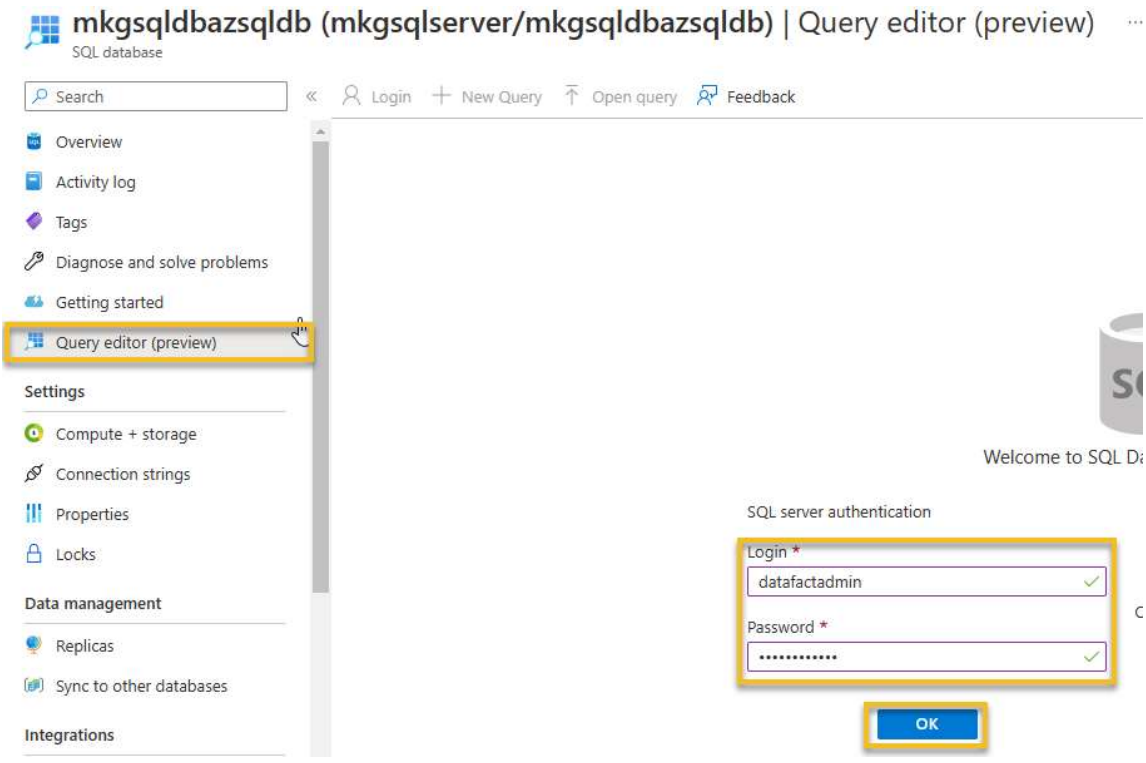
Tasks

1. Connect to the Microsoft Azure Portal. Open Edge browser and navigate to http://portal.azure.com/ to connect to Microsoft Azure Portal. Sign in with your subscriptions credentials.

2. Create database objects required for the lab.

    a. Go to SQL database created in **Module 1, Lesson 2, Lab 2**.

    b. Connect to **Query Editor (preview)**. Type in Login, **datafactadmin**, and Password, **d@taFactSQL1**. Click **OK** to login.



    c. Once connected, click on **Open Query** and execute the scripts below by clicking on **Run**.

- \LabFiles\M03_L02_Lab1\SalesLT_ProductStaging.sql
- \LabFiles\M03_L02_Lab1\SalesLT_usp_CheckProductStaging.sql
- \LabFiles\M03_L02_Lab1\SalesLT_usp_GetRowCountProductStaging.sql
- \LabFiles\M03_L02_Lab1\SalesLT_usp_PrepareProductStaging.sql
- \LabFiles\M03_L02_Lab1\SalesLT_usp_TruncateProductStaging.sql

Exercise 1 has been completed.

Exercise 2: Implement Control Flow

This exercise shows the benefits of using Control Flow within your pipeline.

Tasks

1. Prepare the Azure Blob Storage

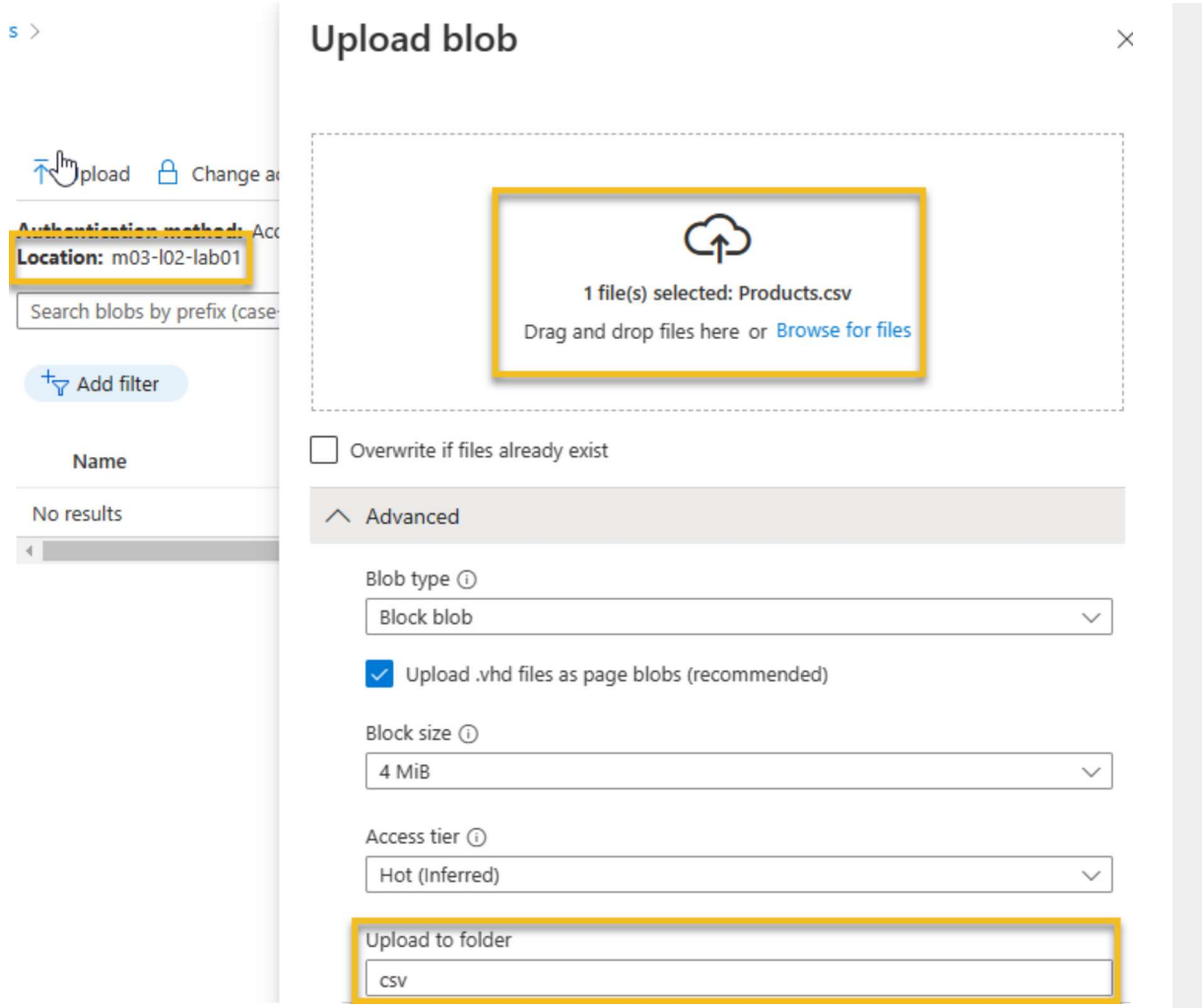
    a. Using the Azure Portal connect to the storage account created in **Module 1, Lesson 2, Lab 2**.

    b. Create a blob container called **m03-l02-lab01** in the root of the storage account.

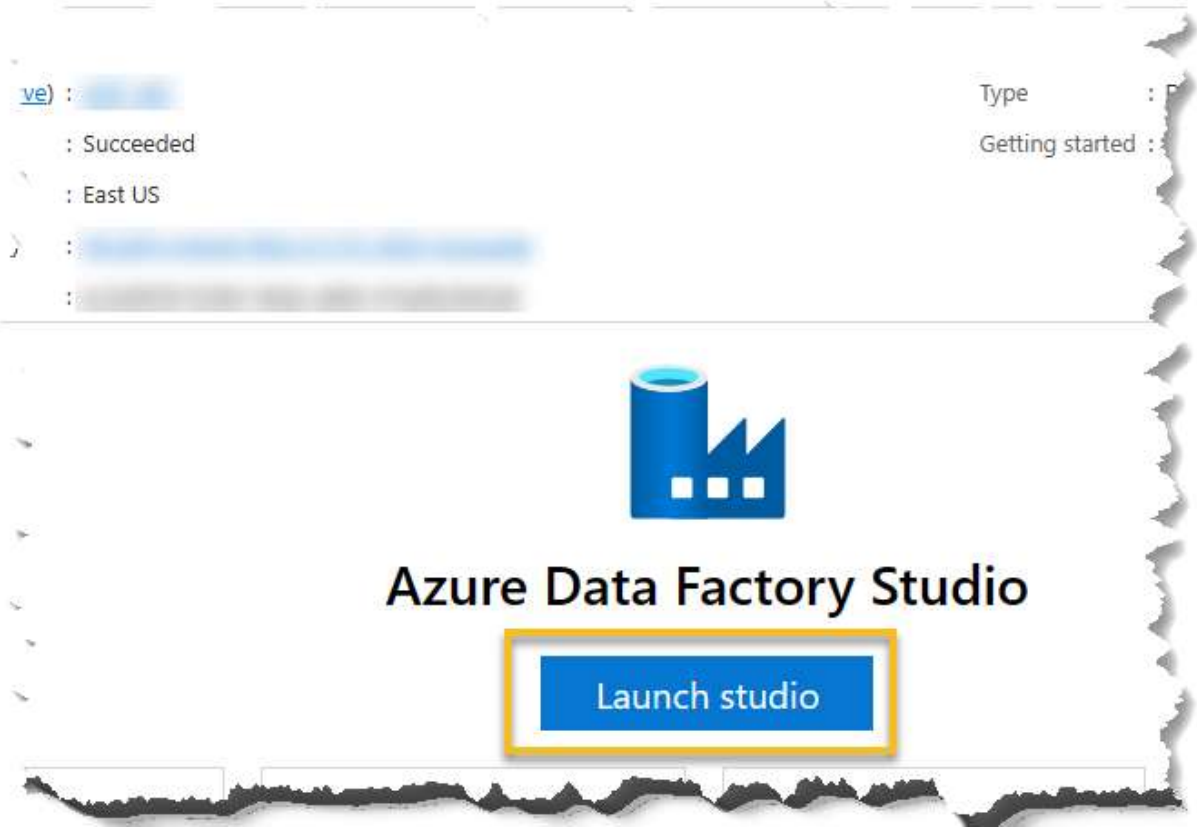
    c. Upload the input file.

    d. A sample file to use as the input has been provided for you in the lab files **\M03_L02_Lab01\products.csv**.

    e. Using the Azure Portal upload this file to the **csv** folder in the container **m03-l02-lab01**.



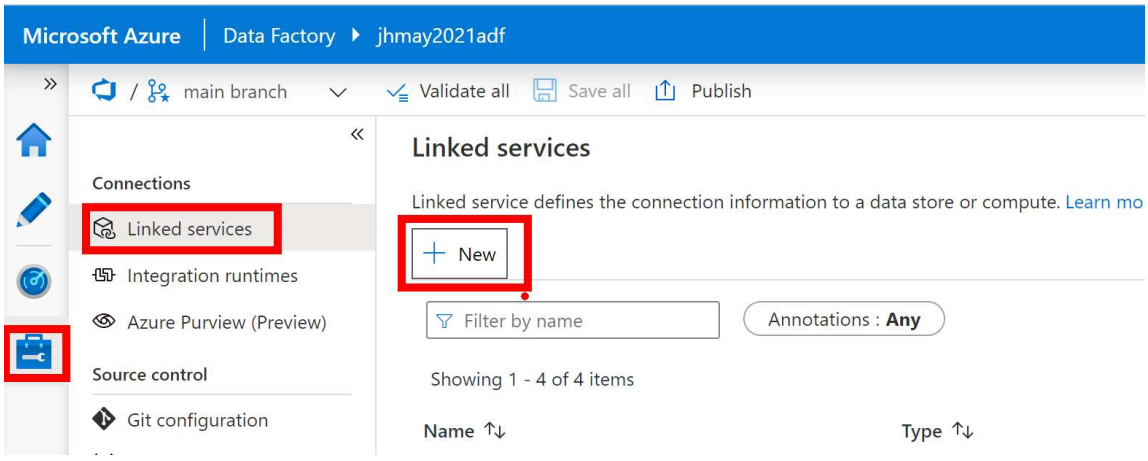
2. Log onto your Azure Data Factory by launching the **Azure Data Factory Studio**.



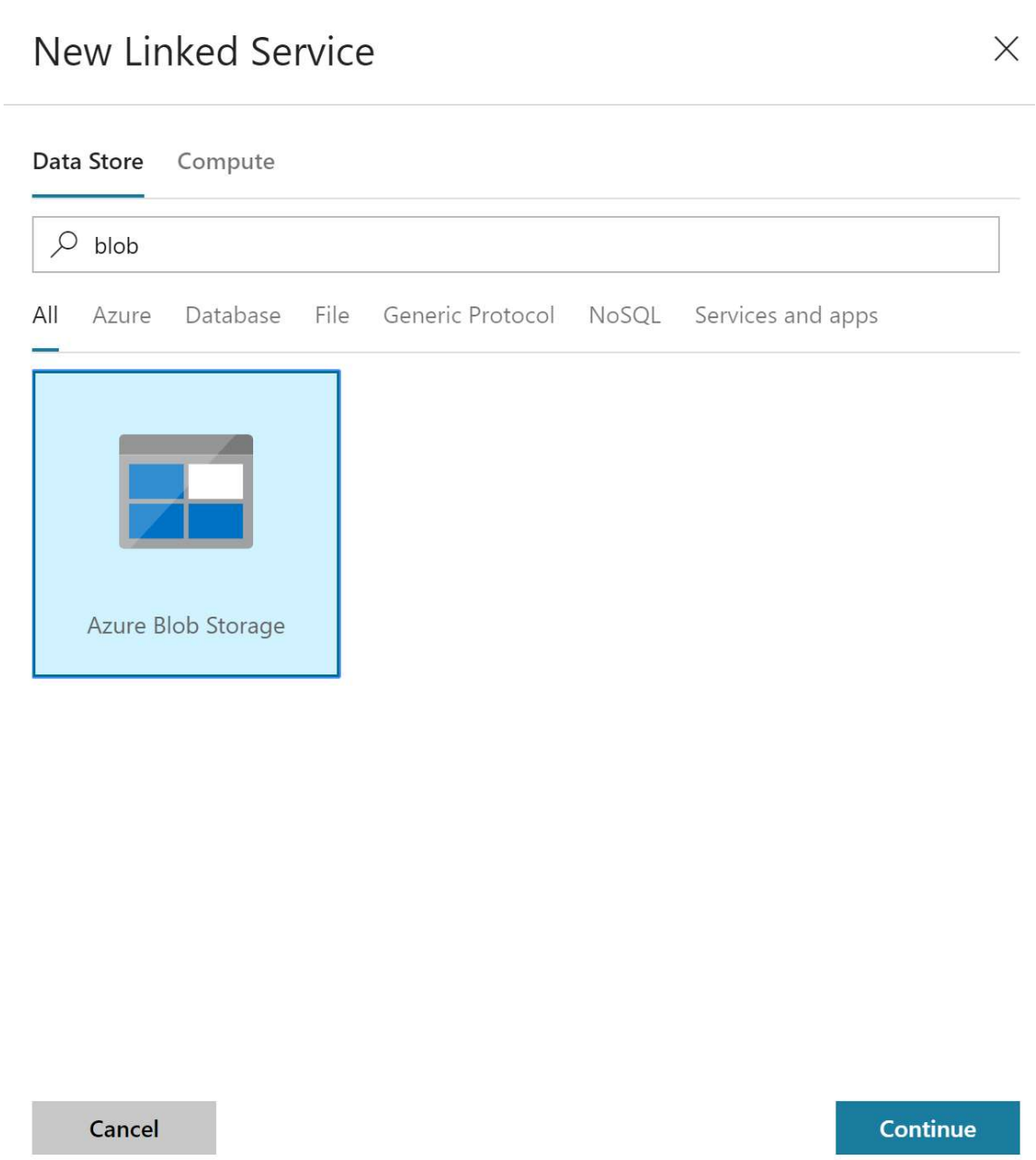
3. Verify that you have configured the Linked Service to the Azure Blob Storage account. If so, go to step 4; otherwise, continue with the instructions below:

    a. If you do not have a Linked Service already in your Data Factory to your Blob Storage account, follow the steps below to create one:

    b. Select the **Toolbox/Manage** button from the left panel. Under **Linked Service** and then select **+New**.

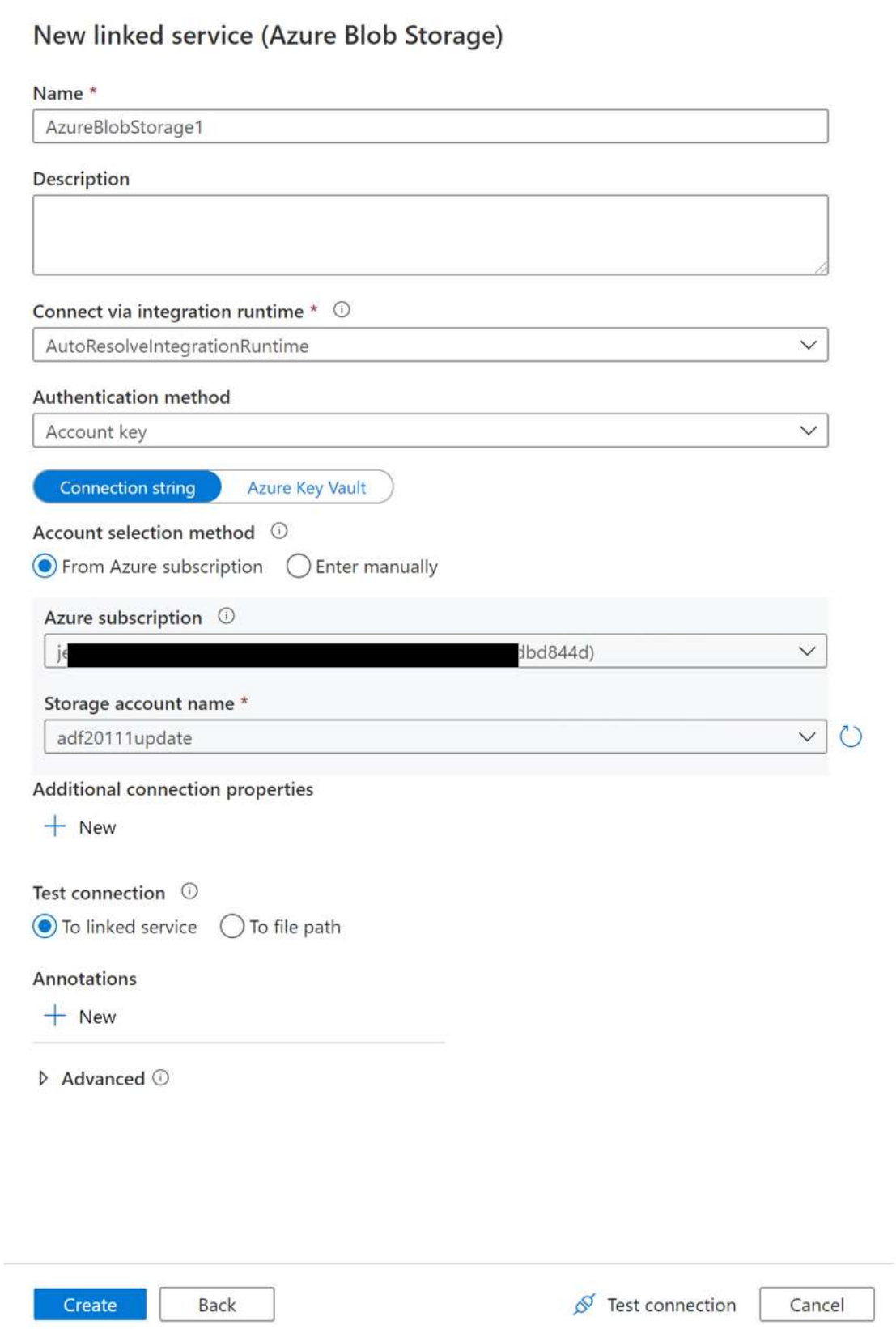


    c. Select the **Azure Blob Storage** type and click the **Continue** button.



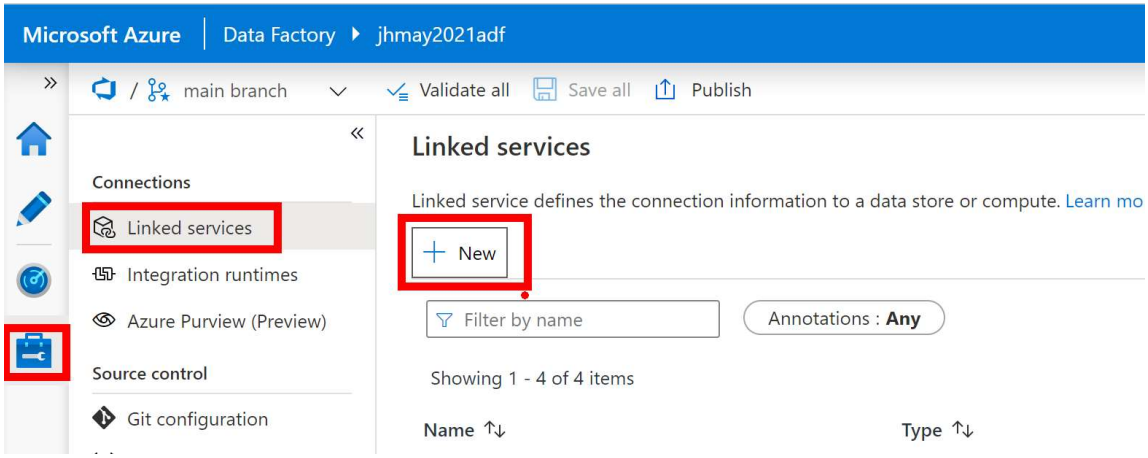
d. Change the **Linked Service name** if desired (for example: use the storage account name).

e. Select your **Subscription** then your **Azure Storage Account** from the dropdown and click the **Create** button.

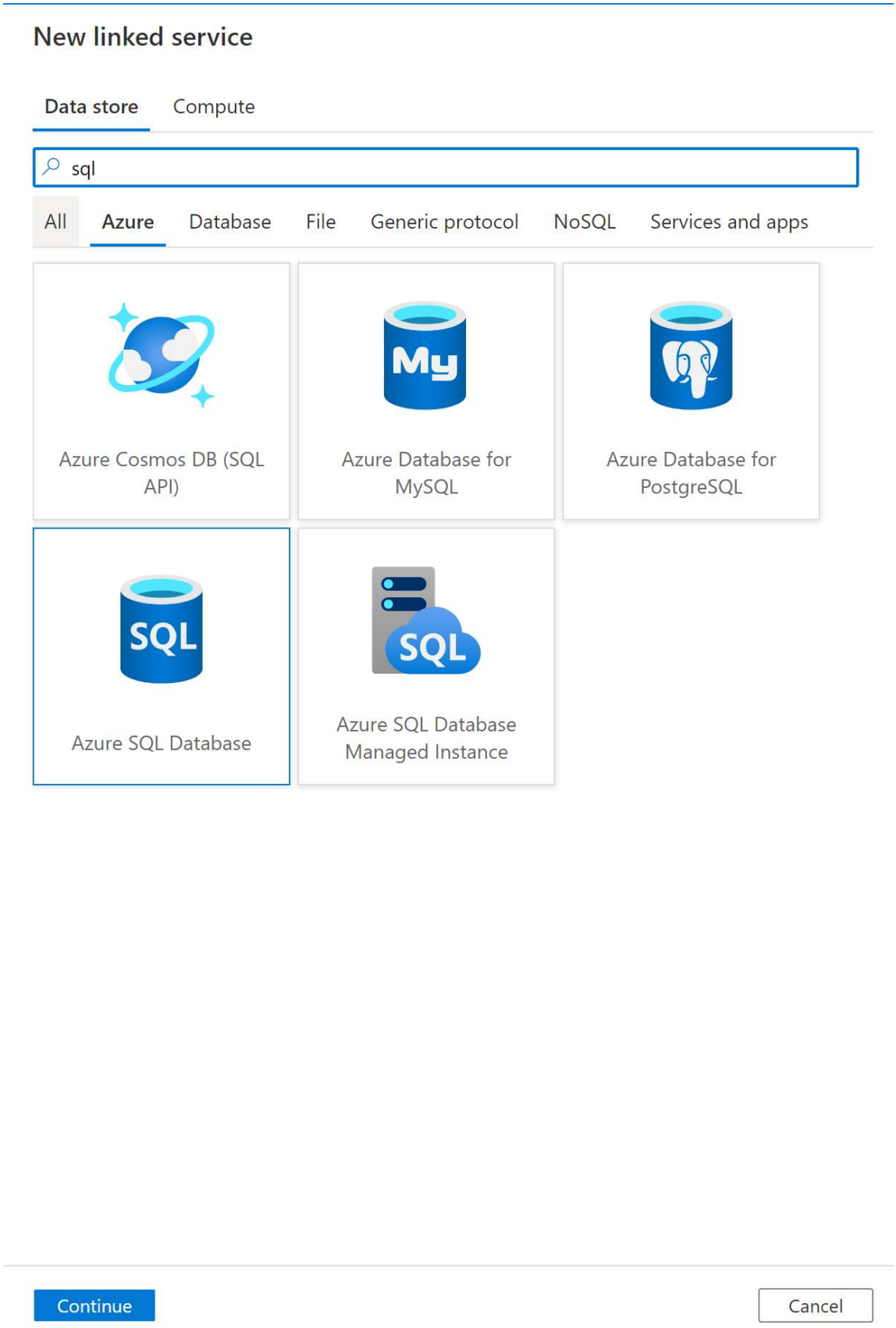


4. Configure the Azure SQL Database Linked Service in ADF.

    a. From the **Toolbox/Manage** button from the left panel. Under **Linked services**, select **+New**.



b. On the Data Store tab, select **Azure SQL Database** and click the **Continue** button.



c. Enter a name for the linked service. Something descriptive (for example: **AzureSQL_**)

d. Select **AutoResolveIntegrationRuntime**.

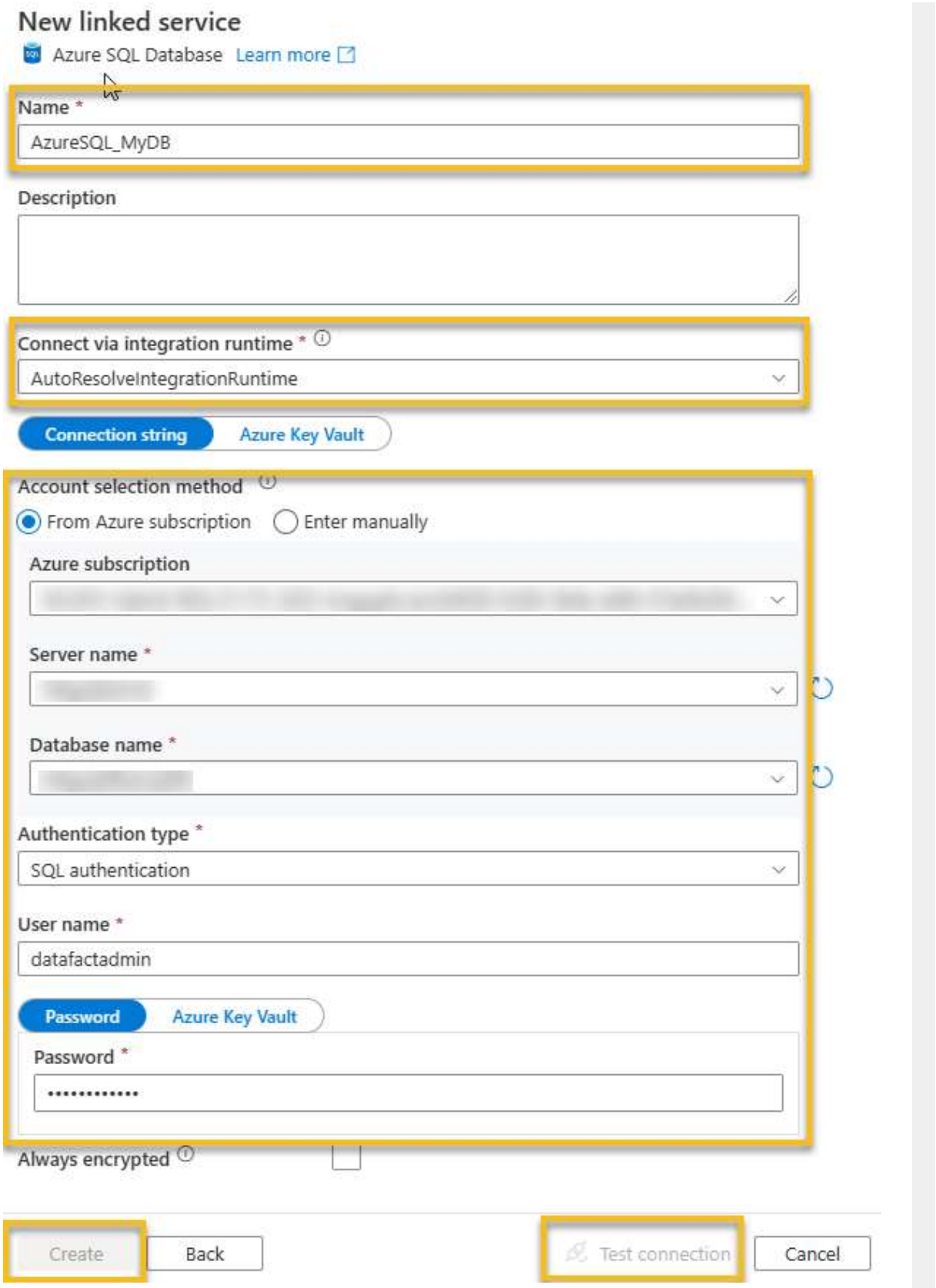
e. Select the **Subscription**, **Azure SQL Database server** and **database.**

f. Select **SQL authentication** for **Authentication Type**.

g. Enter the user name, **datafactadmin**, and password, **d@taFactSQL1**.

h. Select **Test Connection** and make sure the connection succeeds.

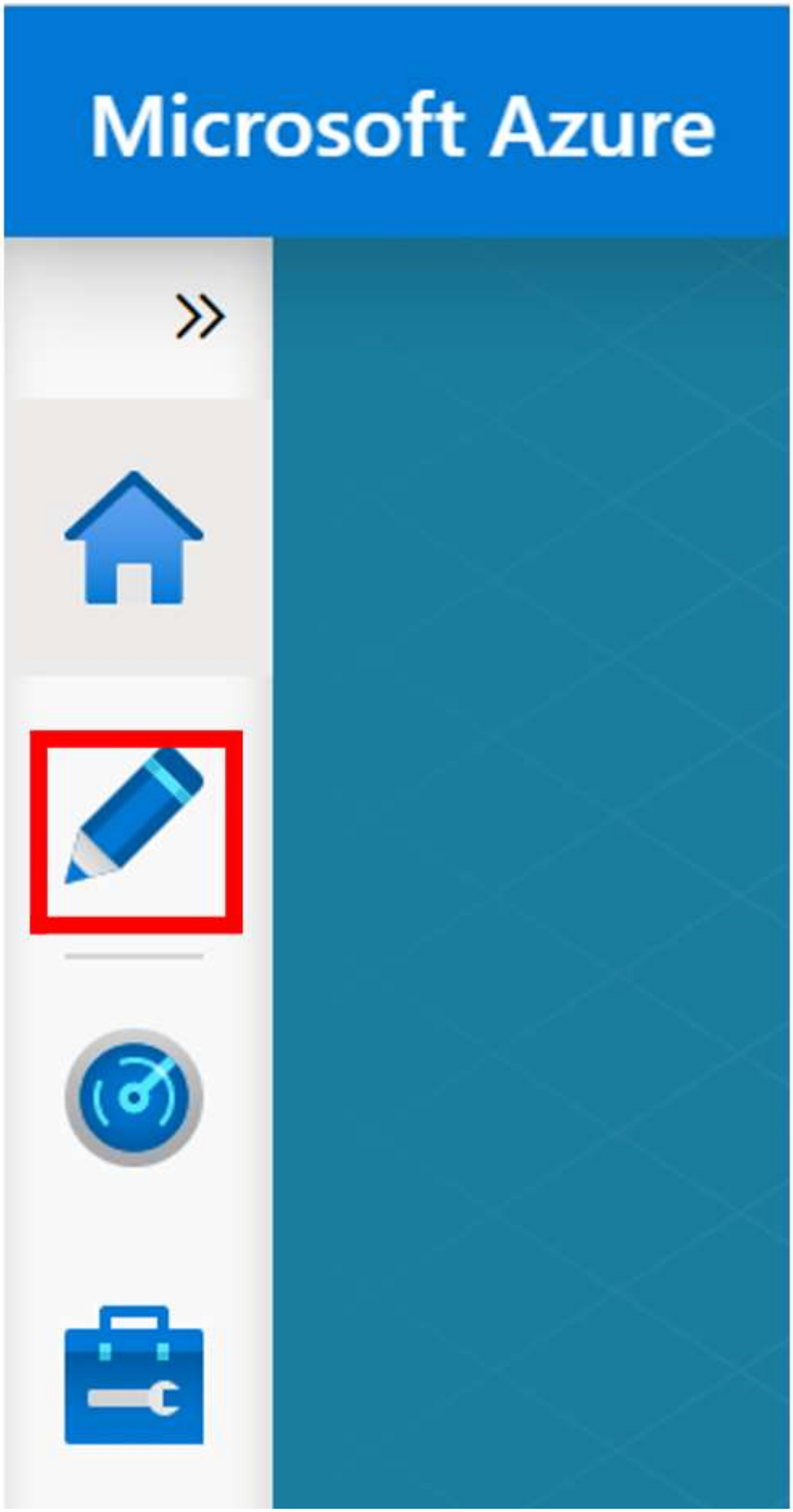
i. Then select **Create**.



5. Create a Dataset - Azure Blob Storage.

    a. We will need a dataset that points to the file uploaded earlier in this exercise.

    b. Click on the **Author/Pencil** button in the left pane.


Microsoft Azure

c. Create a new dataset by clicking the + button and selecting **Dataset**.

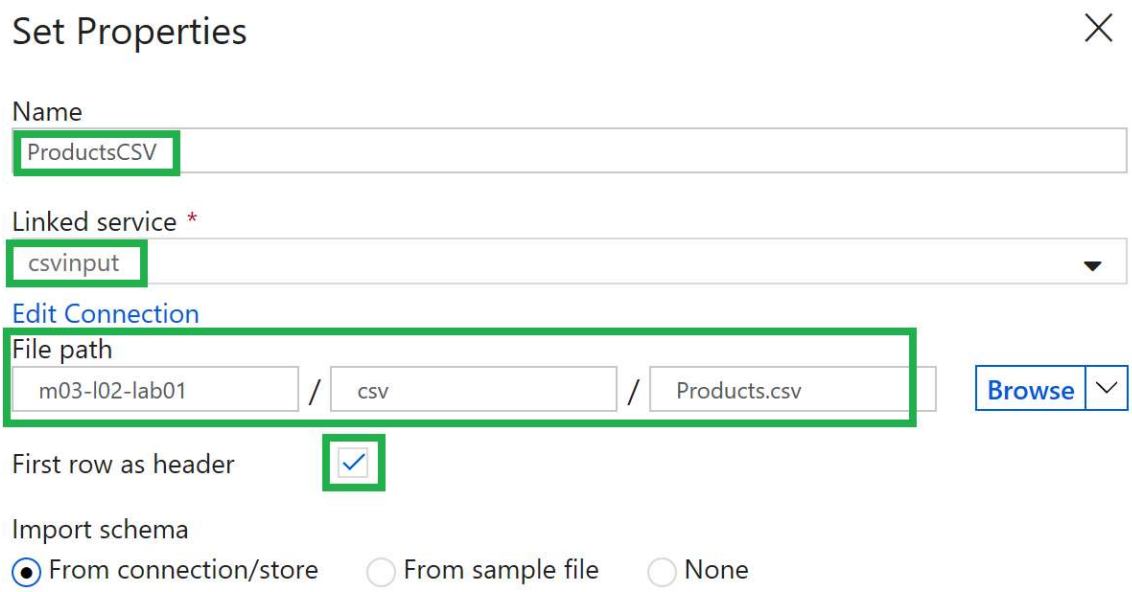
d. Select **Azure Blob Storage** and then **Continue**.

e. Select **DelimitedText** and then **Continue**.

f. Provide a name for the dataset, such as **ProductsCSV,** and select the **Linked Service** created for Blob Storage in an earlier exercise.

g. **Browse** to the csv file uploaded (m03-l02-lab01/csv/Products.csv) and check the box for **First row as header**.

h. Click the **OK** button.



6. Create a Dataset - Azure SQL Database

a. We will need a dataset that points to the Azure SQL Database so that we can use it within our activities.

b. Create a new dataset by clicking the + button and selecting **Dataset**.

c. Select the **Azure SQL Database** and then **Continue**.

d. On the Set Properties tab, change the dataset Name to **ProductStaging**.

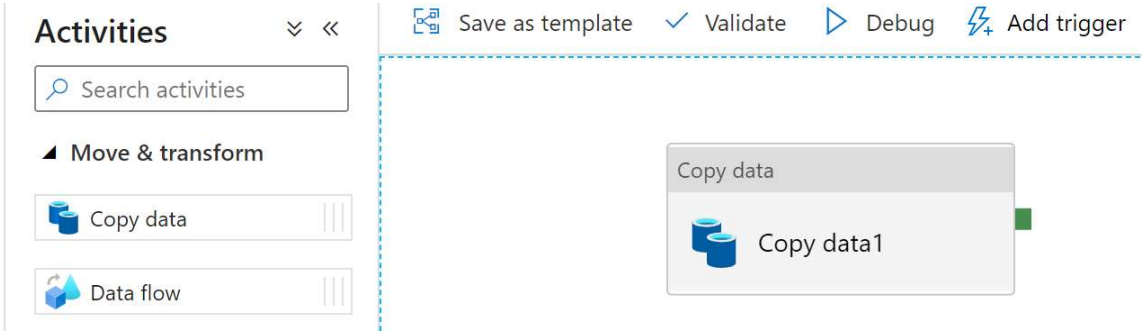
e. Select the **Linked Service** you created earlier in this exercise, and the table **[SalesLT].[ProductStaging]**.

f. Select **OK** to save the dataset.

7. Create a Pipeline and data gestation

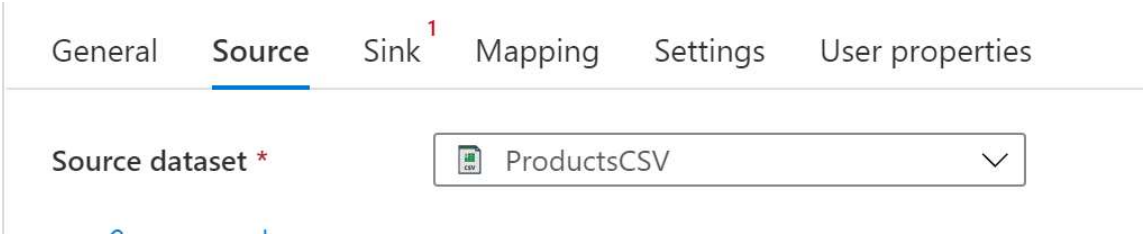
a. Create a new pipeline by clicking the **+** button and selecting **Pipeline**.

b. Under **Activities**, expand the **Move & transform** and drag the **Copy Data** activity to the designer surface.

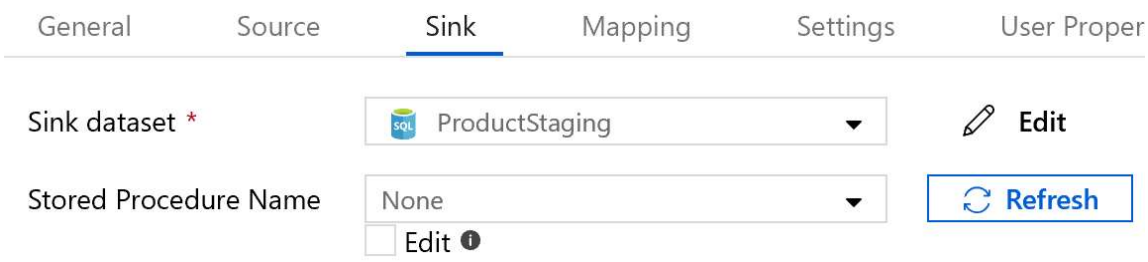


c. In the Copy Data General tab, set the Name to **Import CSV**.

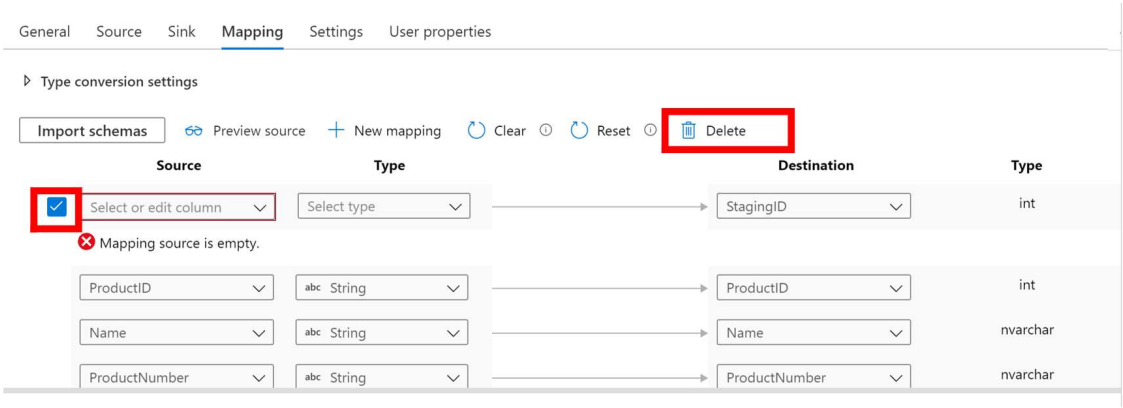
d. Switch to the **Source** tab. Select the **ProductsCSV** dataset.



e. Switch to the **Sink** tab. Select the **ProductsStaging** Linked Service for the destination we will copy to. Set the Storage Procedure Name to **None**.



f. Switch to the **Mapping** tab. Choose **Import Schemas.** Remove the **row for the StagingID column** by clicking the check box to the left and click **Delete**.

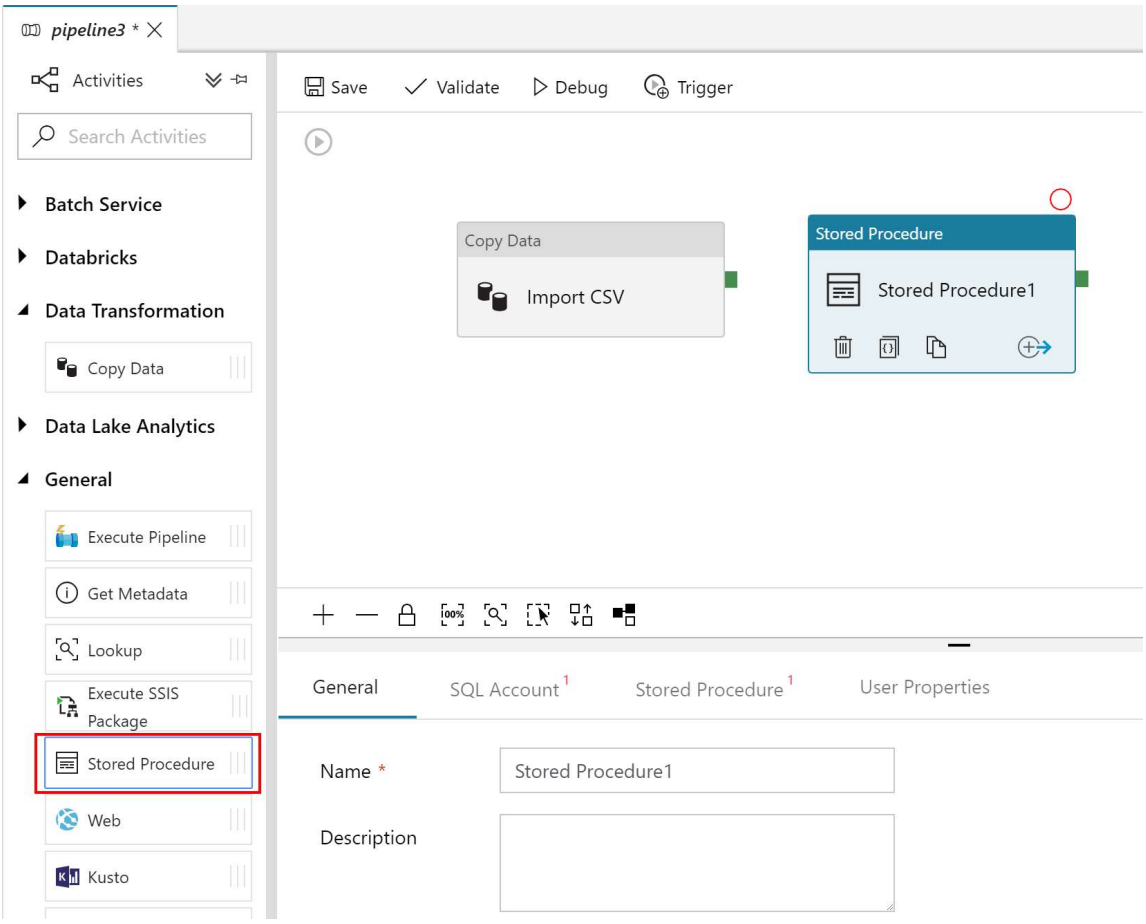


g. If you have Git configured, click the **Save all** button to save your changes.

h. Click the **Publish** button to save the changes to the Pipeline before proceeding.

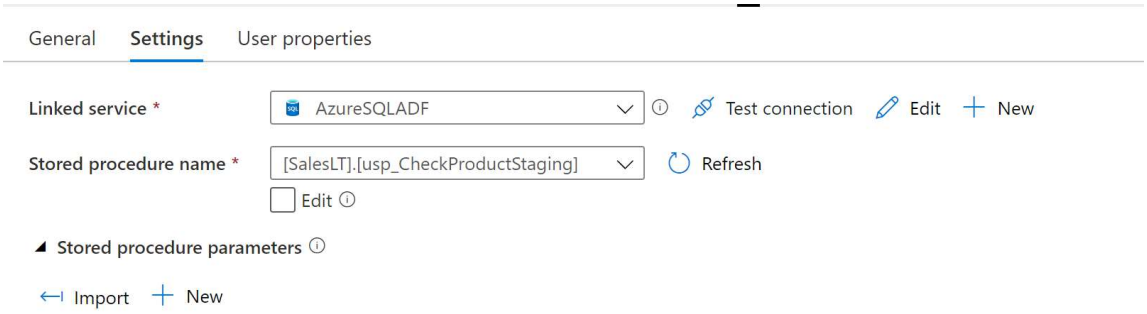
8. Add Data validation activity.

a. From the list of **General Activities**, add a **Stored Procedure** activity to the designer surface of the Pipeline you are working on.



b. Change the name of the activity to **Validate Import Rows**.

c. Switch to the **Settings** tab and select your SQL Linked Service **[SalesLT].[usp_CheckProductStaging]** from the drop-down list.



d. Select **Save all** (if Git configured) then **Publish** on the Pipeline to deploy changes.

9. Add Logic Apps for sending email notifications.

a. In the Azure Portal, enter **Logic app** in the search bar, then click Add or **Create**

b. Select the **Resource Group** you have been using for the workshop.

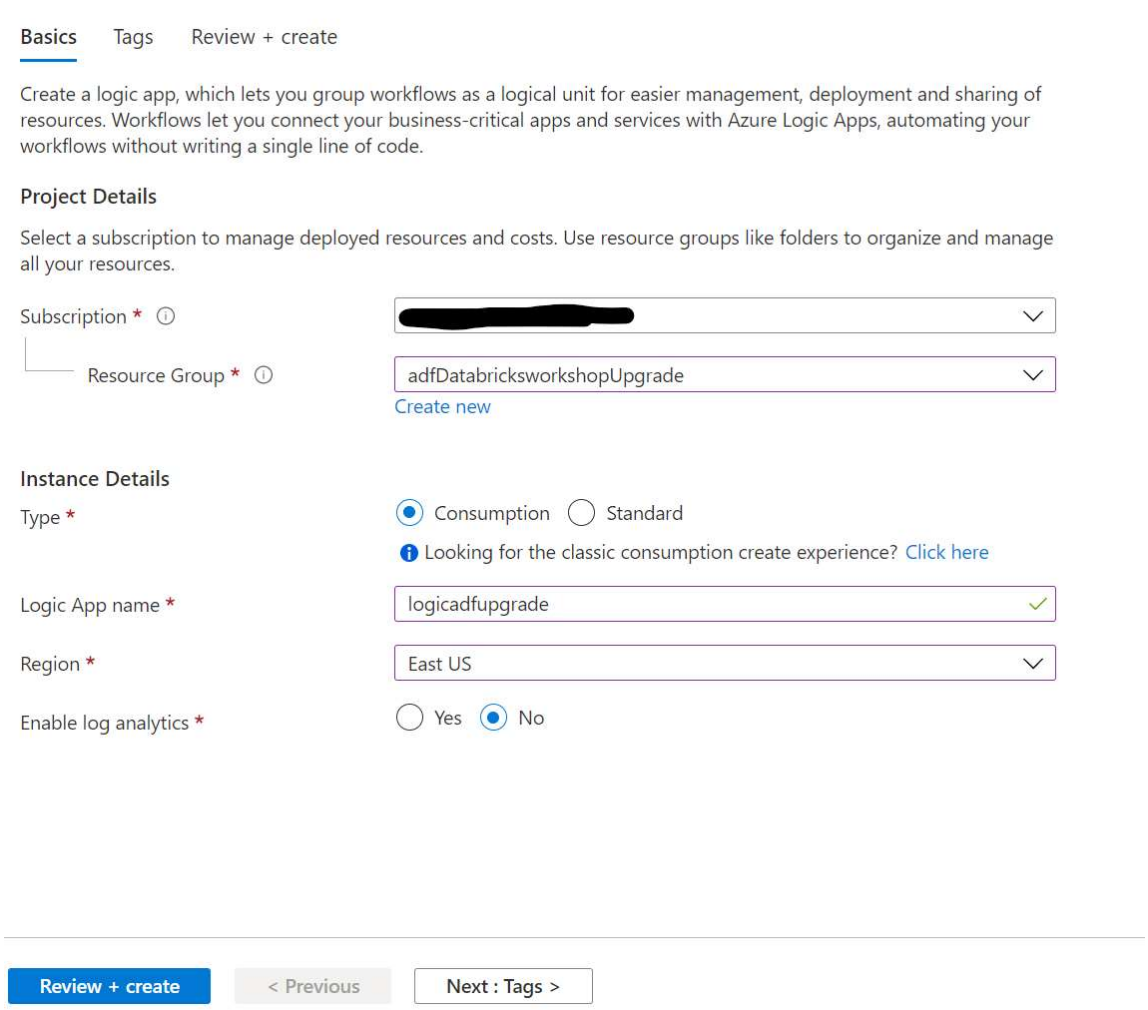
c. Change type to ***Consumption***.

> Make sure to select consumption plan, as standard plan does not have the option to send email.

d. Give the Logical app a suitable **name** (i.e. -la-pipeline-status).

e. Choose **East US** Region.

f. Check no for Enable log analytics.

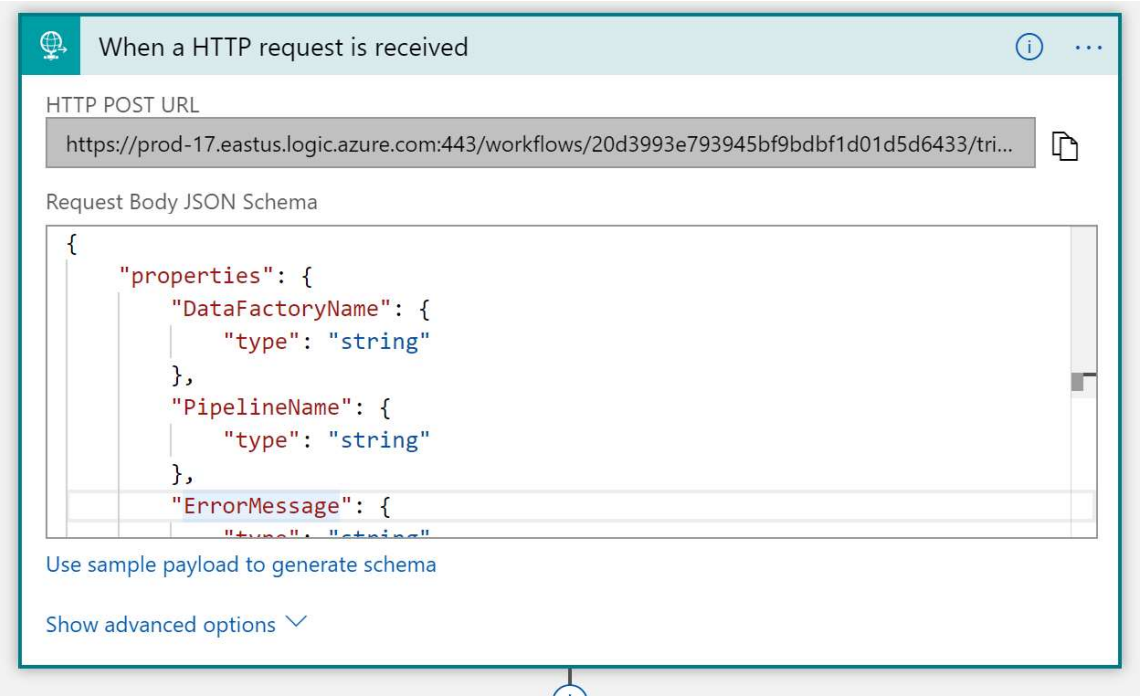


g. Click **Review and Create**, then **Create**.

h. After it has deployed, click on **Go to resource**.

i. In the Logic App Designer, select the Http Trigger (**When a HTTP request is received**).

j. Add the text from the **\LabFiles\M03-L02-Lab01\HTTPRequestBodyJSON.txt** file to the **Request Body JSON Schema** section.

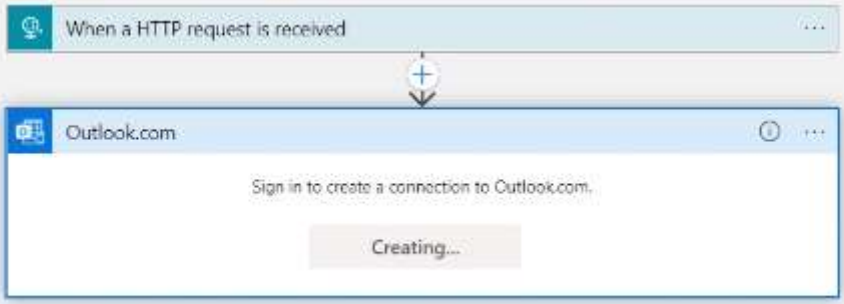


k. Select the **+New Step** use the search bar to find and select **Outlook.com - Send an email**.

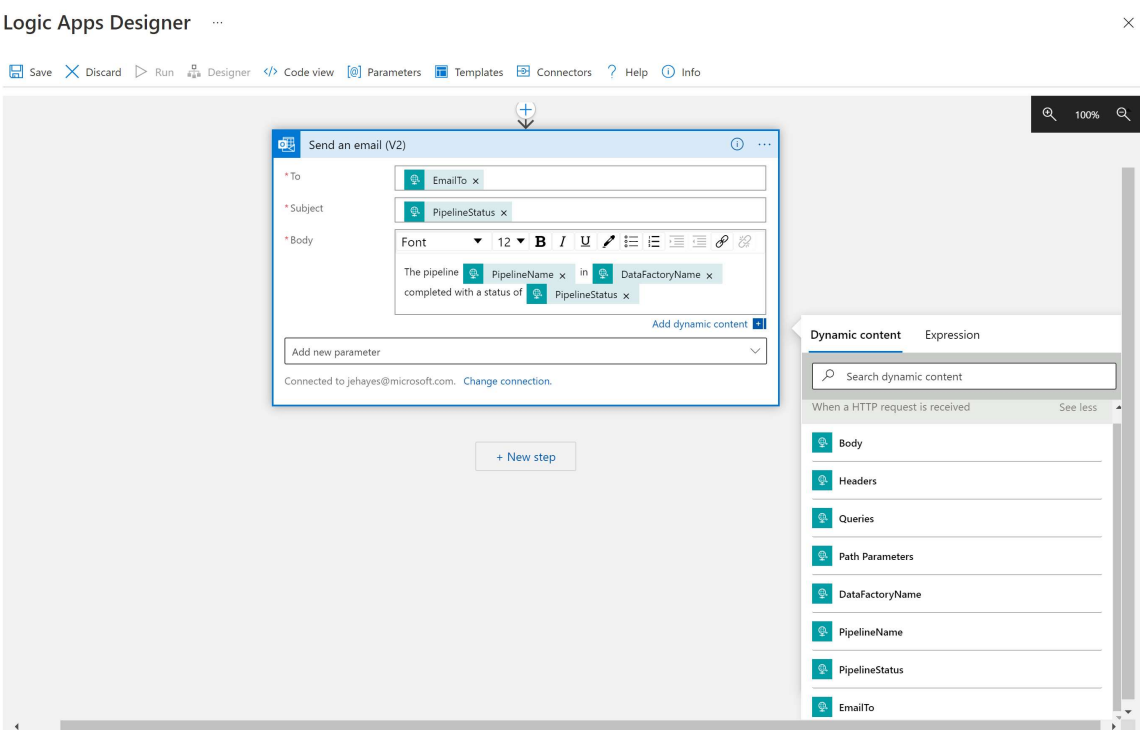
> **i** This is the provider for your email account. You can use other mail provider activities such as Office 365.com, Gmail, etc. but these may have slight variations in sign-in/authentication processes and configuration)

> ☐ Your browser cannot be in Incognito and/or InPrivate mode when signing in.

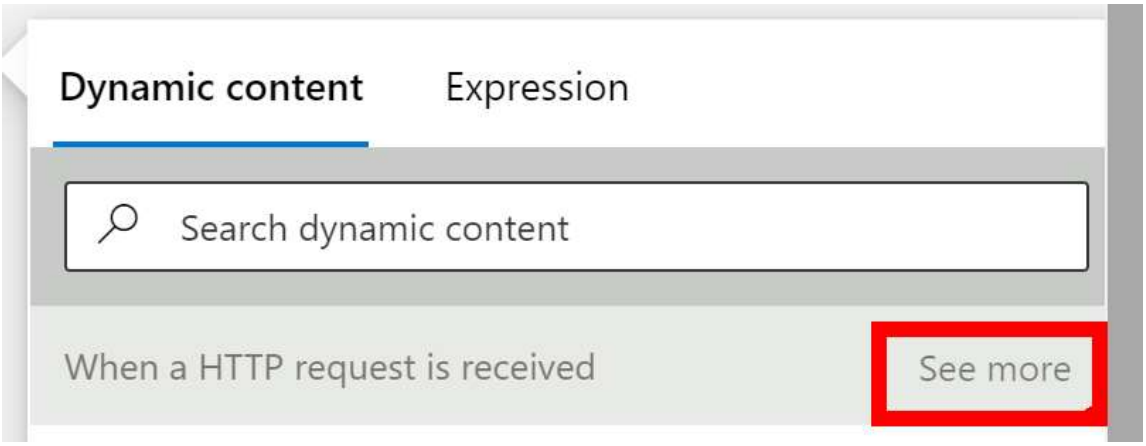
l. If you are using Outlook.com use your personal email address. If you are using Office 365, login using corporate email address.



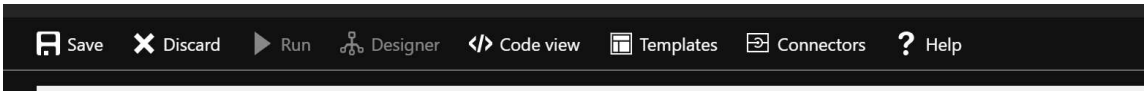
m. Enter the details of the email. You can either hard code the fields, or to make this more scalable use a combination of text and the dynamic fields selector as shown below. When you click into a field, a fly out box will appear with the available Dynamic content and Expression builder.



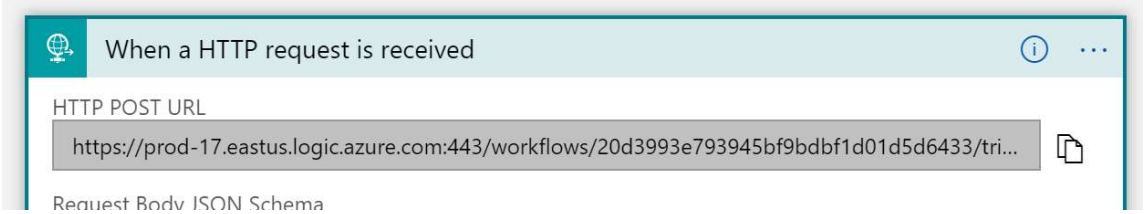
- [ ] If you do not see the json parameters when your cursor is in any of the Email required fields, click on the **See more** hyperlink in the Dynamic content section.

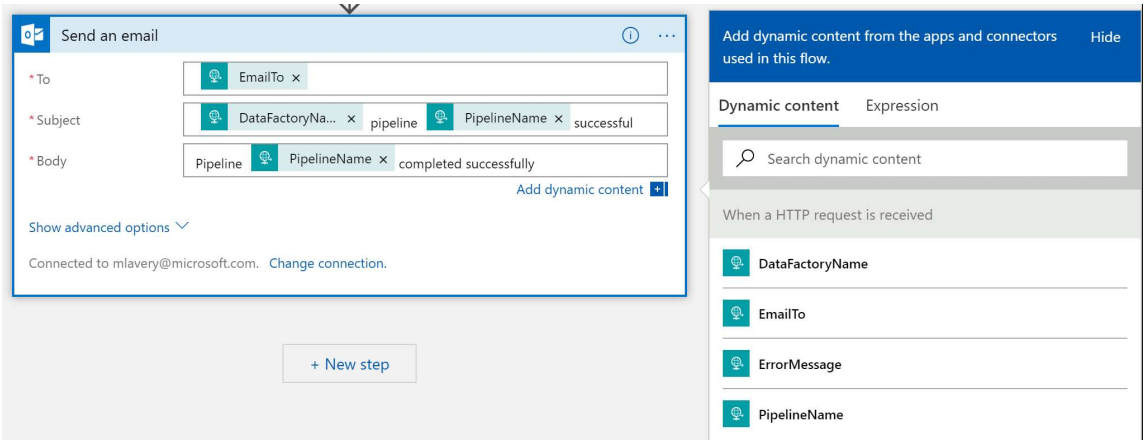


n. **Save** when ready.



o. Expand the **HTTP request** trigger and copy the **HTTP Post URL** for later reference (into Notepad or similar).

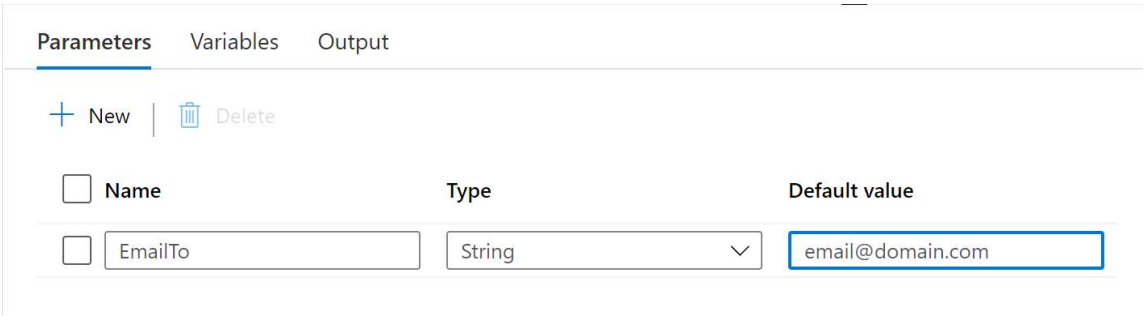




10. Configure the Pipeline Parameters

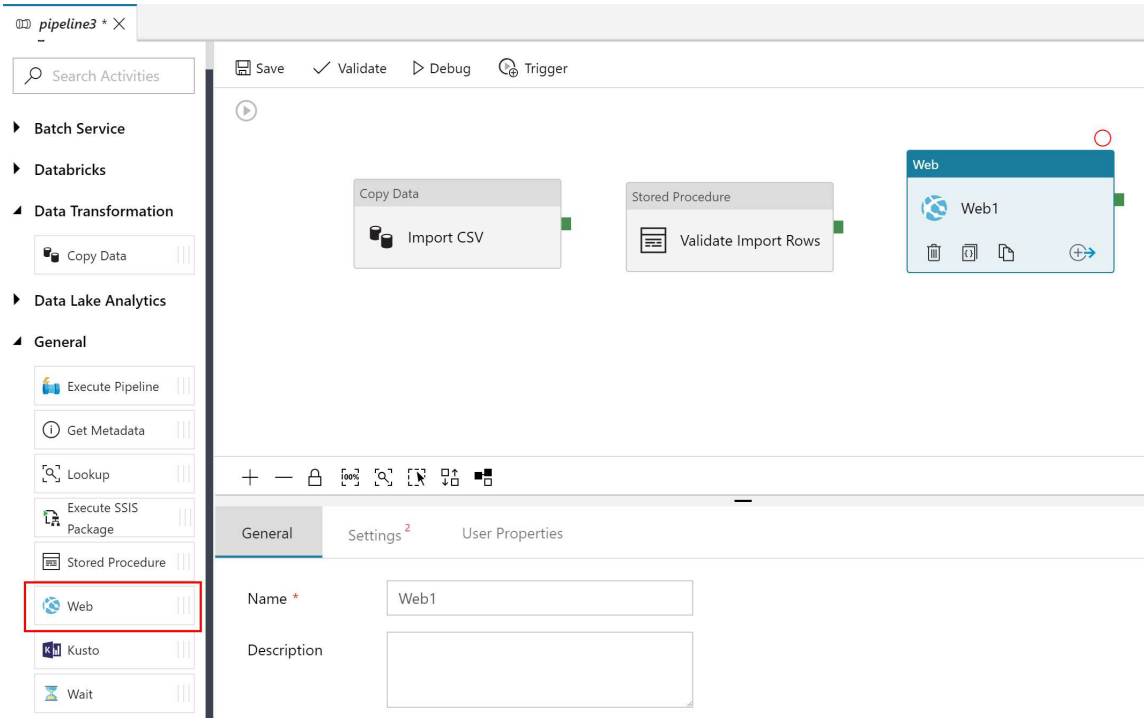
    a. In your Data Factory, click on the whitespace of the designer surface.

    b. Edit the parameters of the pipeline and add **EmailTo** of type **String** and the value of your email address.



    c. Add Web Activity to send failure notification

    d. Add a **Web** Activity to the pipeline.



e. Set the name of the Web Activity to **Send Failure Notification**.

f. On the Settings tab, enter the **URL** from the HTTP trigger of the relevant Logic App you created (previously copied in step **12.l**)

g. Set the **Method** to **POST**.

h. Click **+New** next to **Headers**.

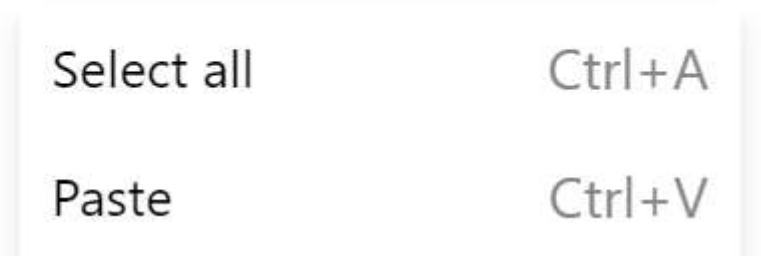
i. In this Header section, enter **Content-Type** for name and **application/json** for value.

j. In the Body field add the contents of the file **\M03-L02-Lab1\WebActivityBodyFailure.txt**.

11. Copy the Web Activity to send a success notification

a. Right click on your Send Failure Notification Web activity and select **Copy**

b. Right click on the whitespace of the pipeline canvas and choose **Paste**

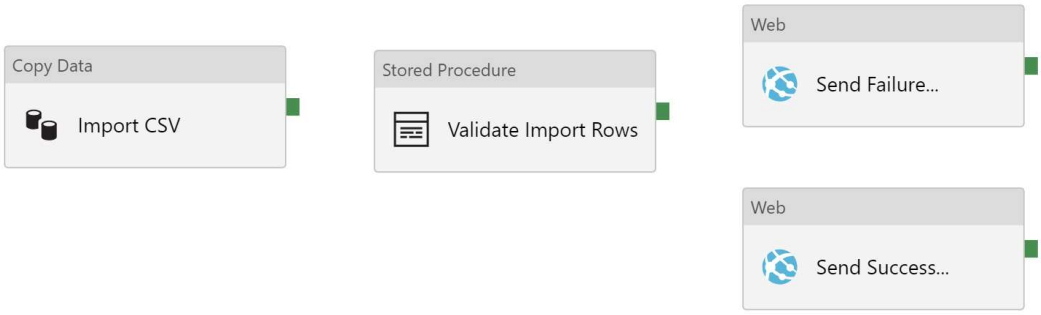


c. Rename your new Web activity to Send Success Notification

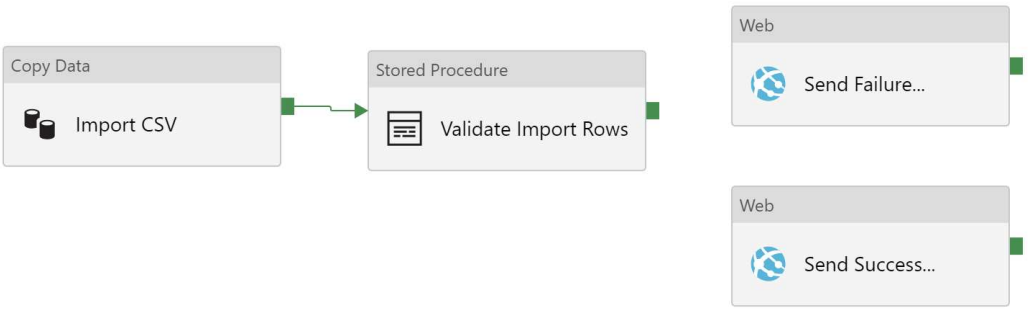
d. Go to the Settings tab and delete the code in the Body field. Replace the contents of the boody field with add the contents of the file **\M03-L02-Lab1\WebActivityBodySuccess.txt**.

12. Configure the Flow Control

a. The Pipeline should have 4 activities.



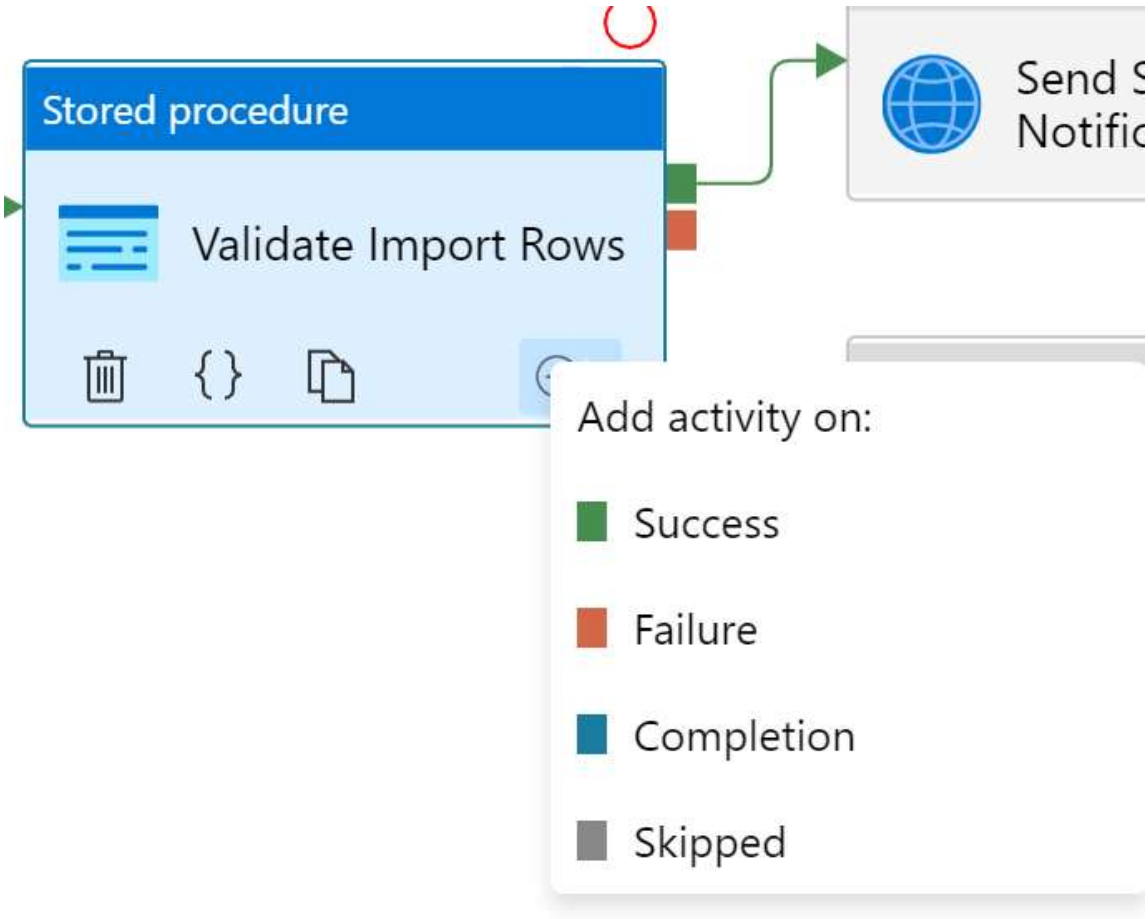
b. Select the green box next to **Import CSV** and drag it to the **Validate Import Rows** activity. This will create a success path between the two activities.



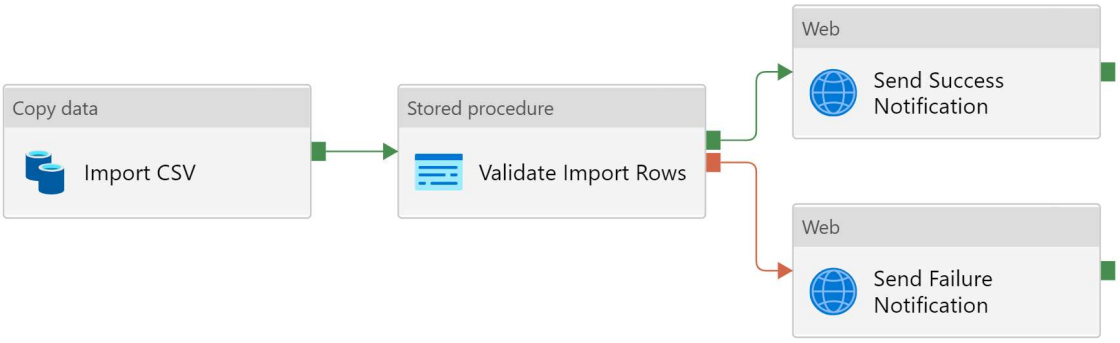
c. Select the green box next to **Validate Import Rows** and drag it to the **Send Success** activity.

d. Select the **Validate Import Rows** activity and notice the Add output icon in the lower right corner of the activity.

e. Click on the Add output icon and choose **Failure**.



f. The pipeline will look like this.

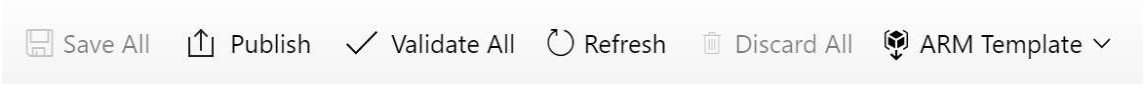


g. If you have connected your Data Factory to a Git repository, click **Save**.

13. Execute the pipeline

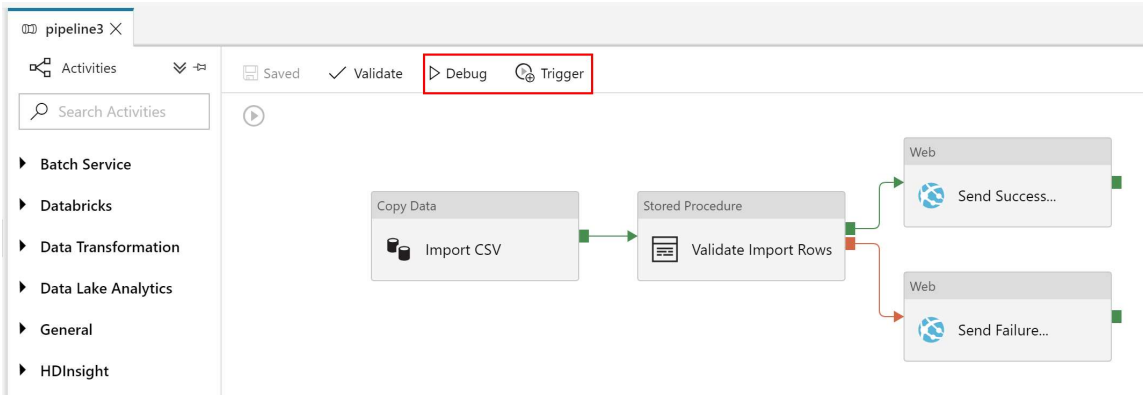
a. We are now ready to execute the pipeline. The stored procedure used in the validation phase is designed to error when there are no rows imported, as you might do in a real-world case. But it is also configured to error when there are more than 300 rows in the table, which in our case indicates that the table was not truncated before the import (we haven't implemented that step).

b. First, use the **Publish** button in the toolbar to ensure the changes are pushed to the ADF service.



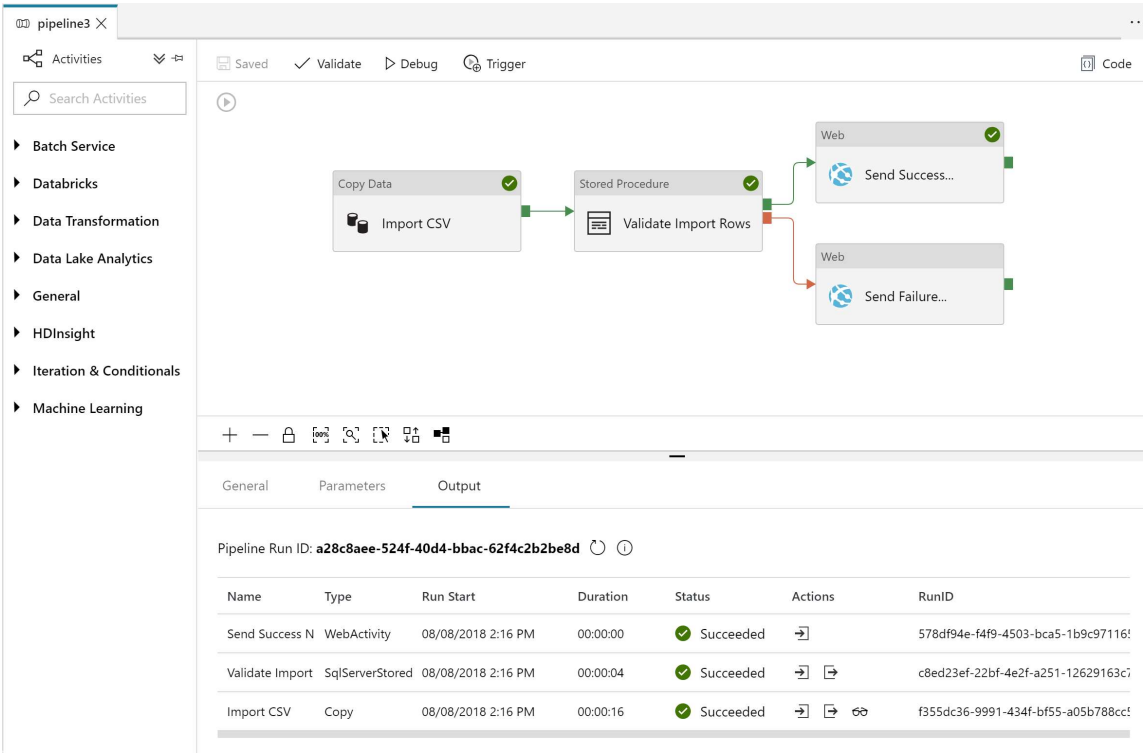
c. Make sure the publish process completes before proceeding.

d. Click either the Debug or Trigger method to execute the pipeline.

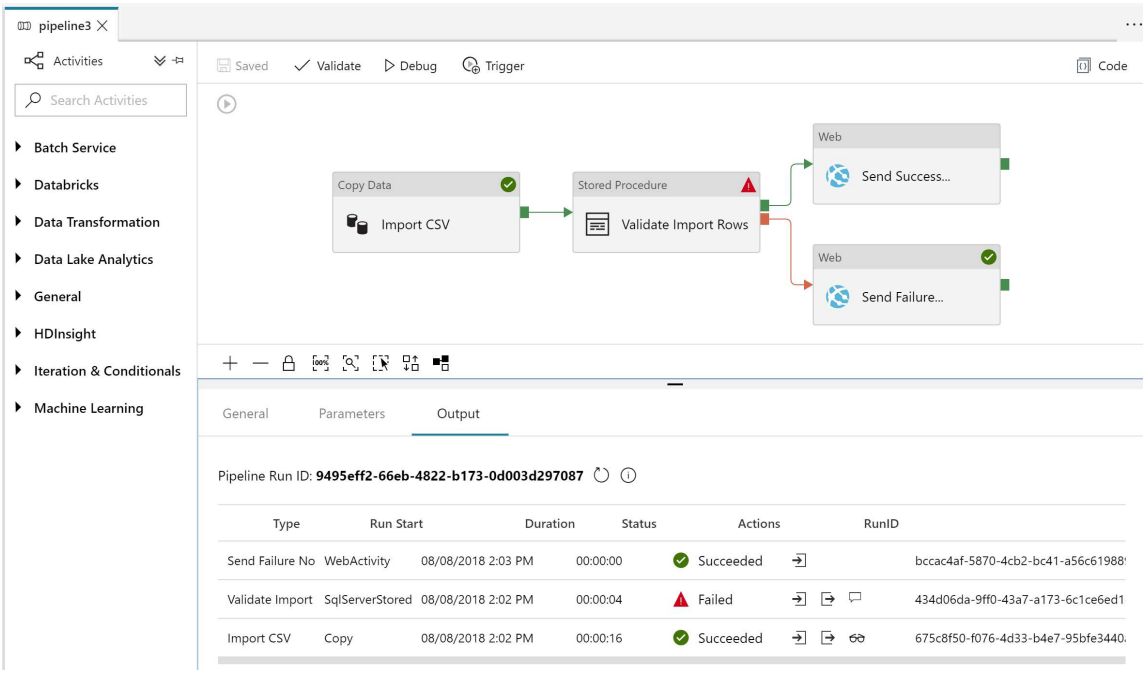


e. If using the Debug method, you should see indications in the designer as it progresses through the execution. If you used the Trigger method, then switch to the Monitoring tab and view the execution process and outcome.

f. When complete you will be able to see (in the run tasks) which pathway was taken. If using Debug method, you can also see the pathway through the icons on the designer. You should also receive an email.



g. Execute the pipeline again. This time it should follow the Failure path due to the conditions in our validation stored procedure. You should also receive an email message reporting the failure.



Exercise 2 has been completed.

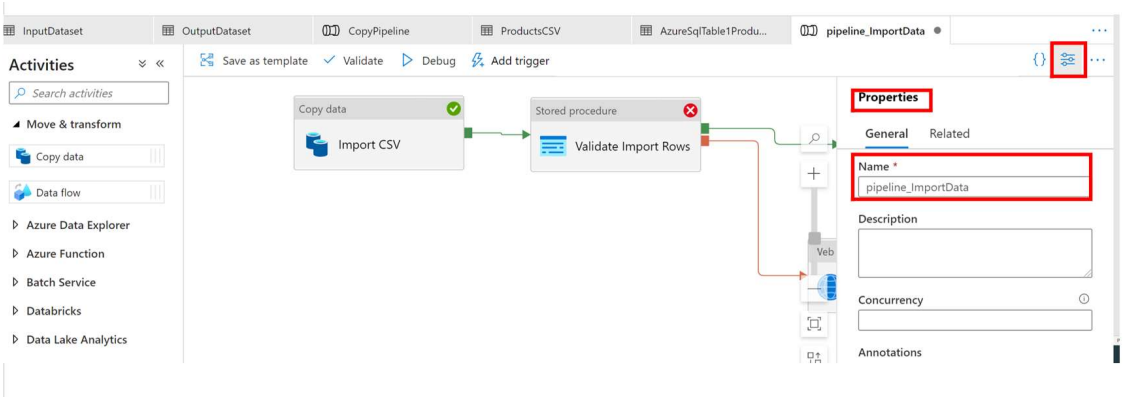
Exercise 3: Extend the Control Flow with Lookup and IF Condition activities

This exercise shows how to extend the existing pipeline with additional Flow Control using both activity output and specifically designed activities. In this scenario we need to add additional logic to check if the staging table contains data and then perform a truncation before continuing.

Tasks

1. Rename the existing pipeline

    a. We will use the existing pipeline as a child to avoid duplicating activities. Edit the existing pipeline you created in the previous exercise. On the Properties panel to the right, rename the pipeline to **pipeline_ImportData**.

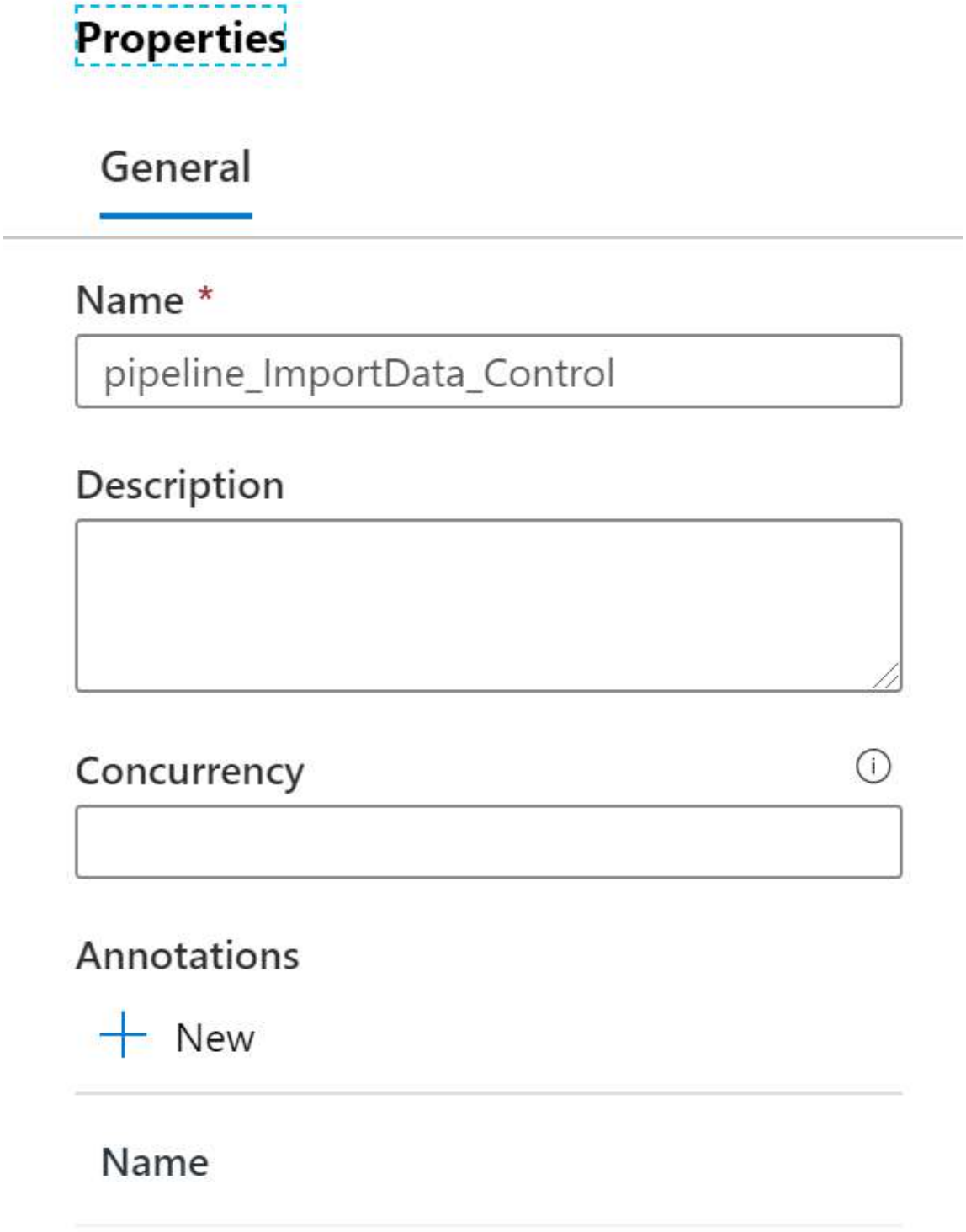


    b. If you have Git enabled, select **Save** in the pipeline toolbar. Otherwise, click **Publish**.

2. Create a new pipeline

a. Create a new pipeline by clicking the + button under Factory Resources and selecting Pipeline.

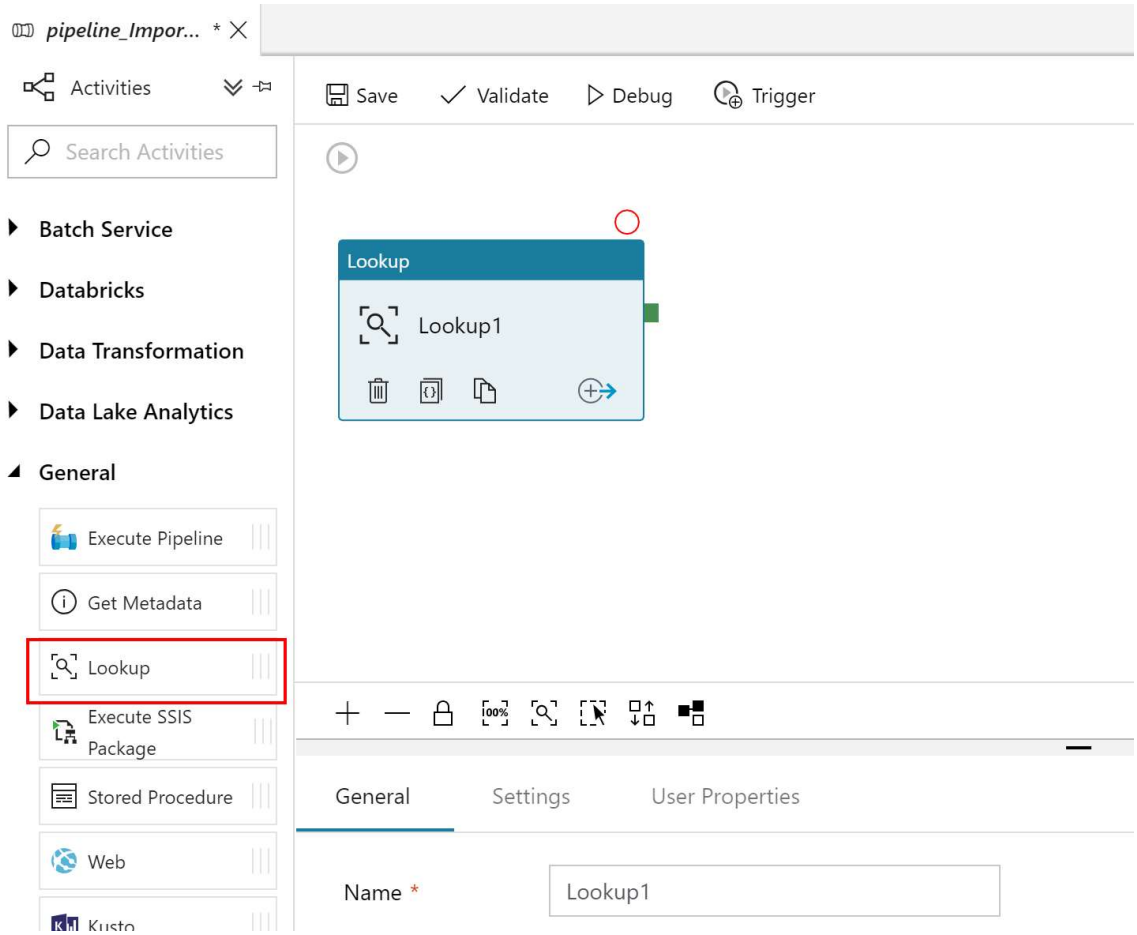
b. Rename the pipeline to **pipeline_ImportData_Control**.



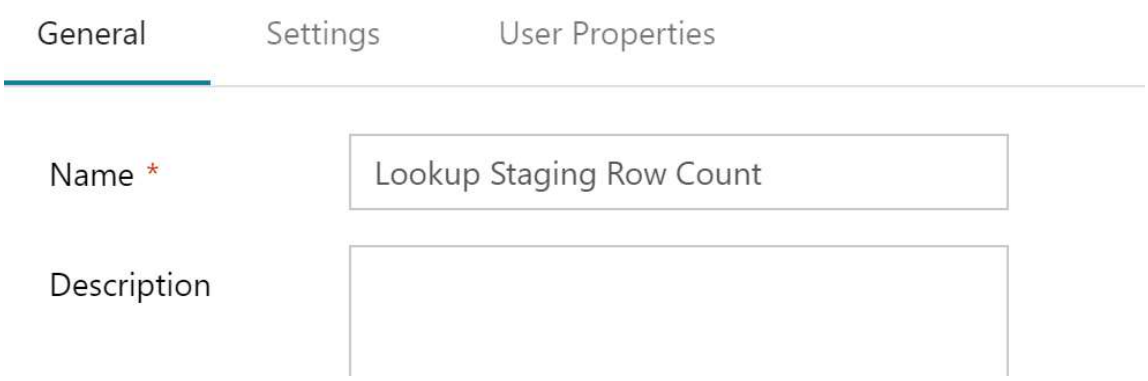
c. If you have Git enabled, select **Save** in the pipeline toolbar.

3. Add a Lookup activity to the pipeline

a. Locate the **Lookup** activity in the General section and drag it onto the designer surface.



b. Change the name of the activity to **Lookup Staging Row Count**.



c. Switch to the **Settings** tab. Select the **Source Dataset** as ProductsStaging (the Azure SQL Database dataset configured earlier).

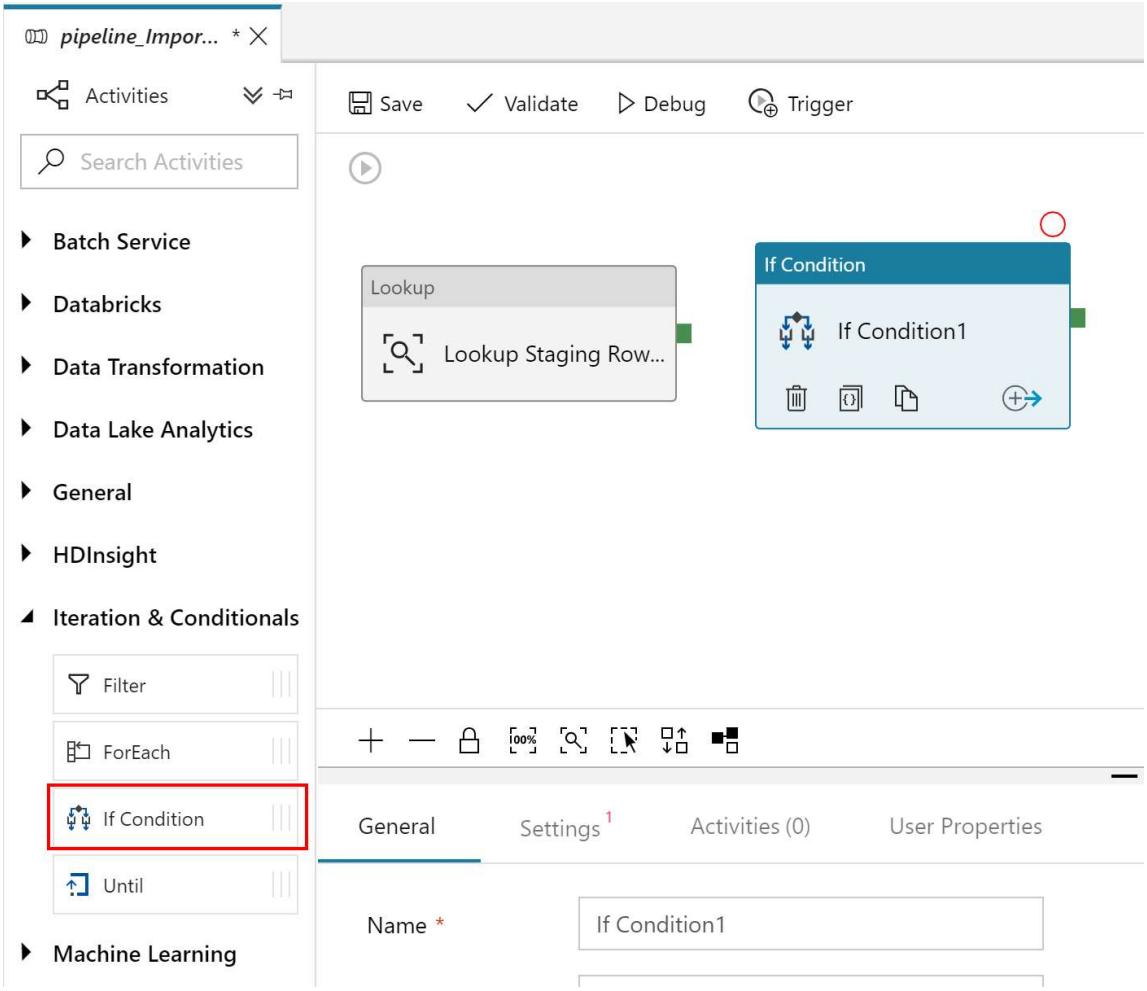
d. Set the Use Query to **Stored Procedure** and select the **[SalesLT].[usp_GetRowCountProductStaging]** stored procedure from the drop-down.

e. Take note there is a **First Row Only** check box at the bottom of settings. In this case leaving that checked is ok. Be sure to review the documentation regarding the changes to behavior with that setting and a dataset.

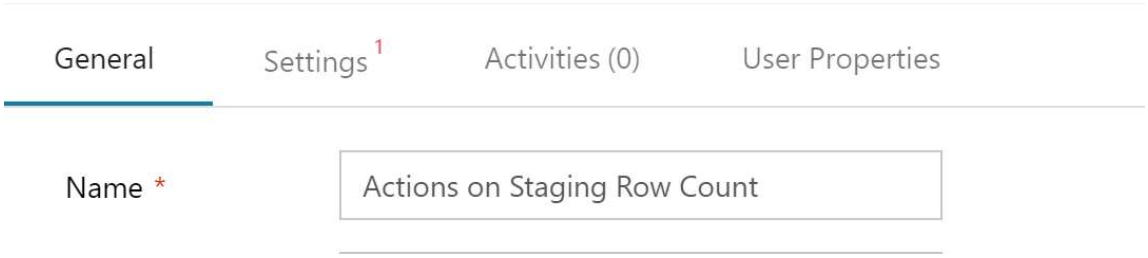
f. Select **Save** in the pipeline toolbar if you have Git enabled.

4. Add an IF Condition activity to the pipeline

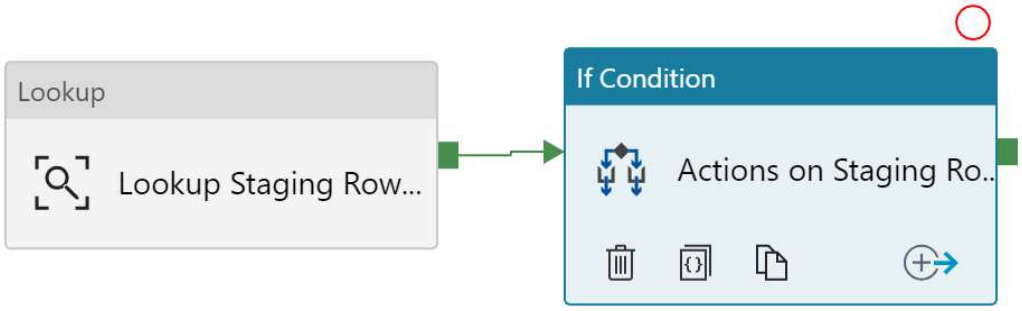
a. Locate the **IF Connection** activity in the Iteration & Conditions section and drag it onto the designer surface.



b. Change the name of the activity to **Actions on Staging Row Count**.



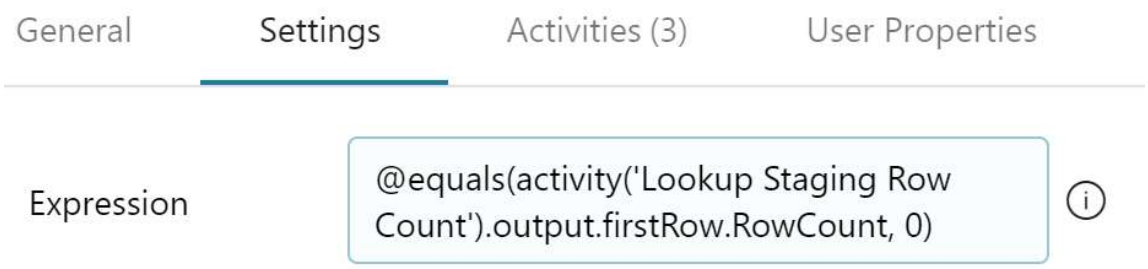
c. Create an Activity Output Condition between the **Lookup Staging Row Count** and the **Actions on Staging Row Count** for **Success**.



d. Switch to the **Activities** tab of the **Actions on Staging Row Count** activity. Place the cursor in the Expression field, then select the **Add dynamic content** link or press **Alt+P**.

e. Enter the following into the Expression field. This will use the value from the lookup activity as part of an evaluation which returns true/false.

```
@equals(activity('Lookup Staging Row Count').output.firstRow.RowCount, 0)
```

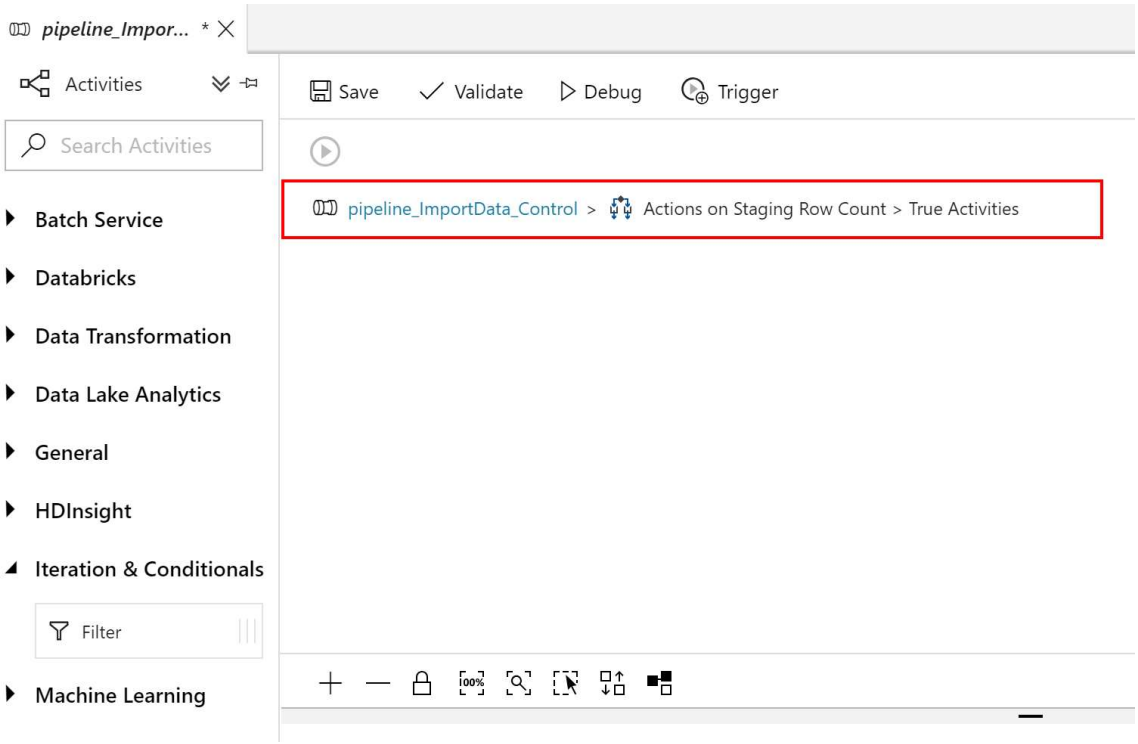


f. For more on Logical Functions see https://docs.microsoft.com/en-us/azure/data-factory/control-flow-expression-language-functions.

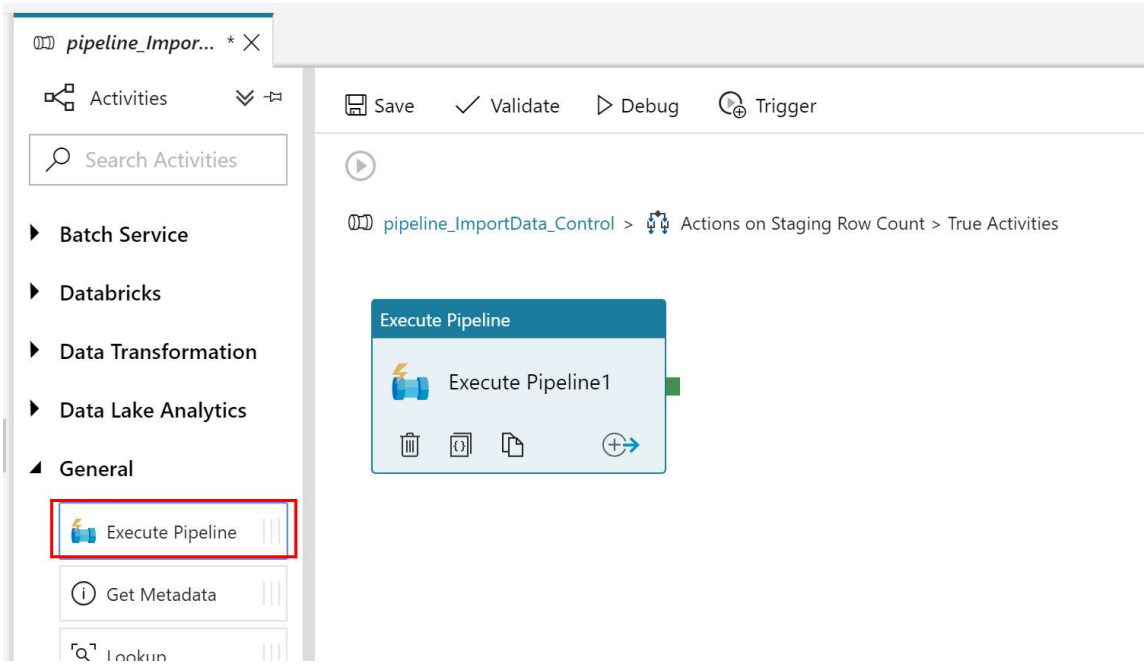
g. Click **Finish** to add the Dynamic content to the Expression field.

h. Click on the Pencil for to the Case = True.

i. This will open a new child designer surface. Notice the context path within the pipeline above the designer surface.

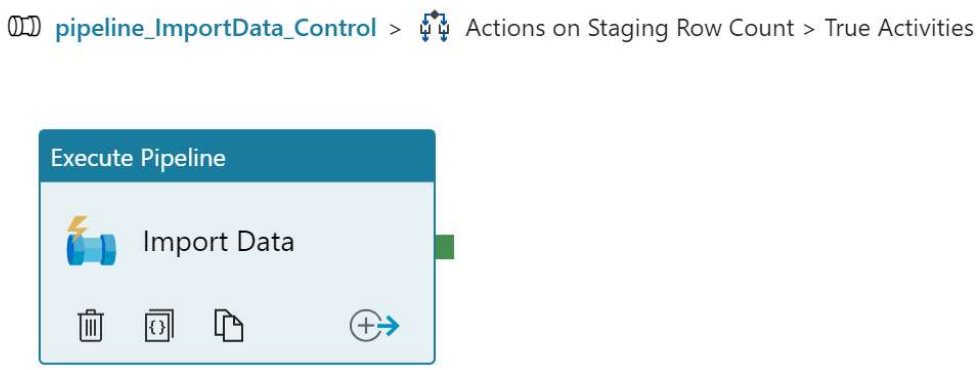


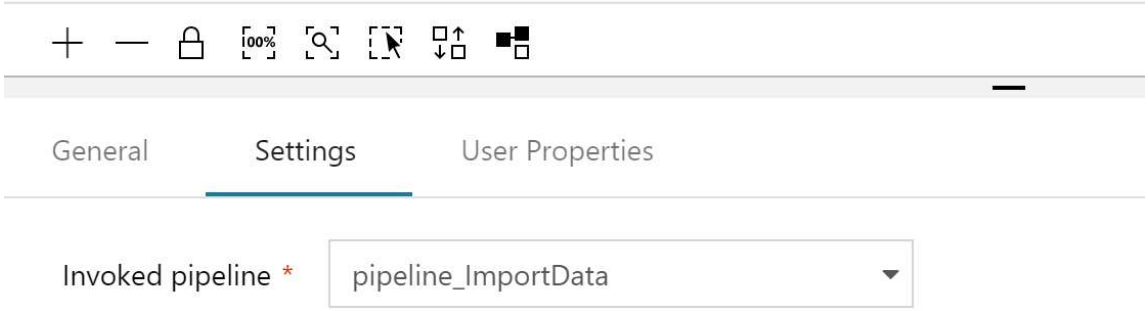
j. Here we will use the existing pipeline to avoid duplicating activities.
Locate the **Execute Pipeline** activity in the **General** section. Drag it onto the designer surface.



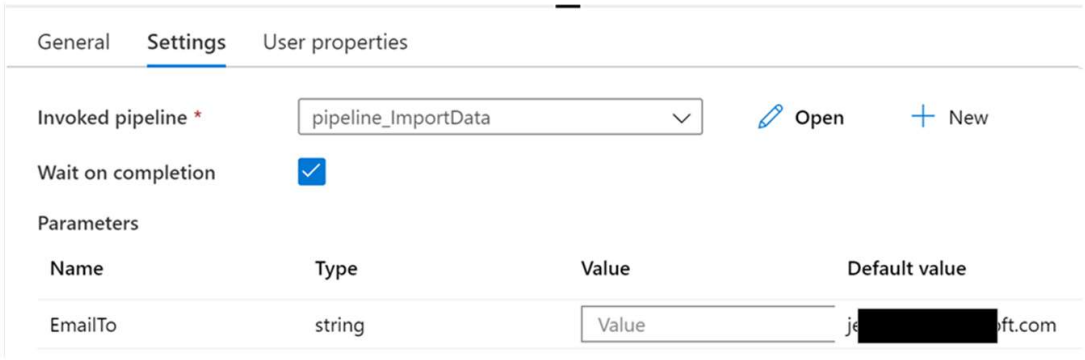
k. Rename the activity to **Import Data on True**.

l. Switch to the **Settings** tab, select **pipeline_ImportData** from the Invoked pipeline drop down.



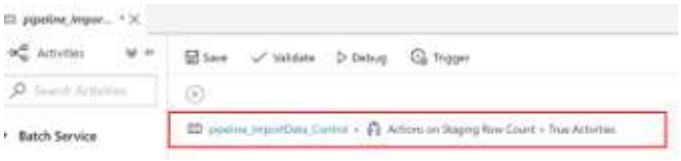


m. Notice that the **Parameters** from the Import Data pipeline are carried over. The value could be defined by a parameter on the control pipeline, or even a looked-up value from a database table or config file. In a real-world solution you would most likely configure those settings. To keep it simple for this exercise just use the default value you have already configured (for example: hard coded configuration).



n. Click **Save** if you have Git configured.

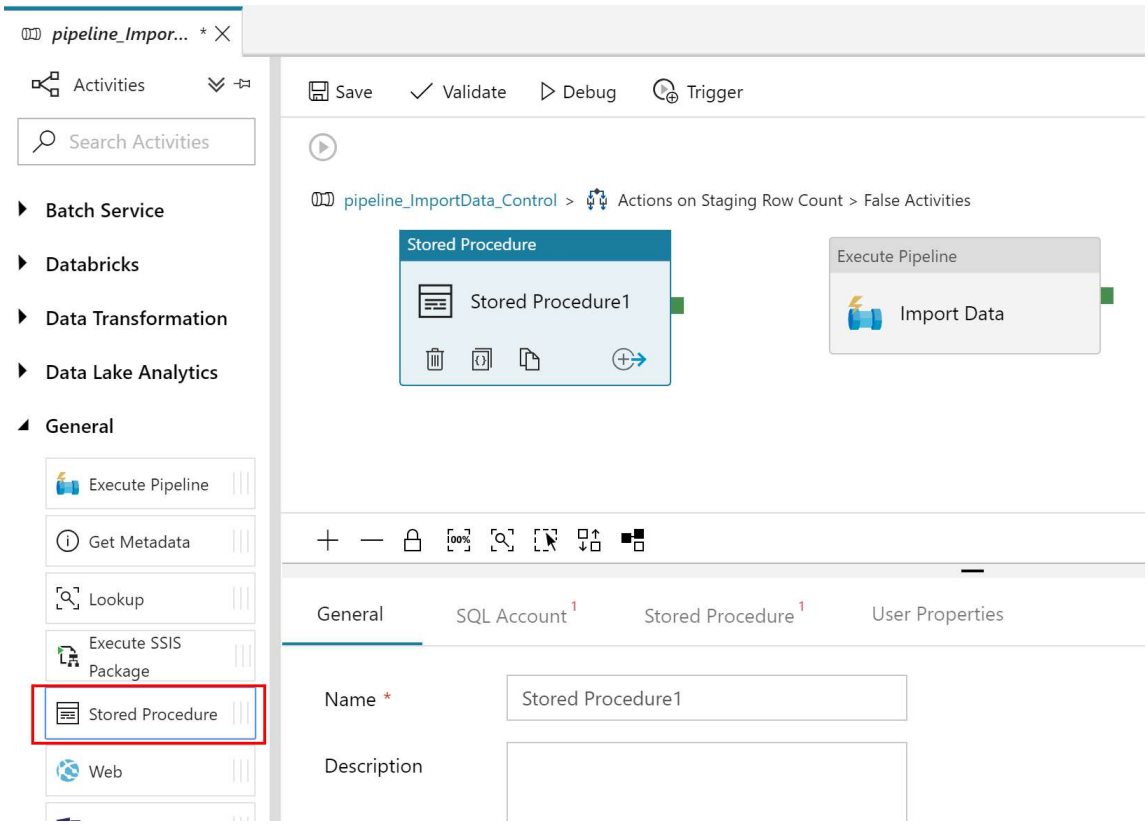
o. Navigate back to the main designer surface of the pipeline using the contextual path at the top of the designer surface. In other words, click on the **pipeline_ImportData_Control** hyperlink.



p. Click on the Pencil for to the Case = False. Again, this opens a child designer surface.

q. Here we will again call the **pipeline_ImportData** pipeline. Add an Execute Pipeline activity to this designer surface as you previously did. Since activity names must be unique within a pipeline, use the name **Import Data on False**.

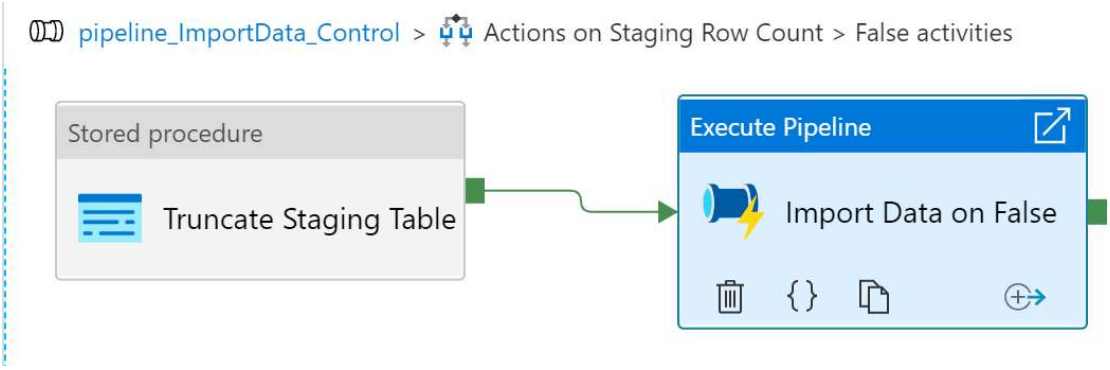
r. Based on the business requirements we need to truncate the table before importing if it already has data.
Locate the Stored Procedure activity in the **General** section and drag it onto the designer surface.



s. Change the name of the activity to **Truncate Staging Table**.

t. Switch to the **Settings** tab and select your Azure SQL Linked Service. Then select **[SalesLT].[usp_TruncateProductStaging]** from the drop-down list.

u. Add an **Activity Output Condition** between this Stored Procedure Activity and the Execute Pipeline activity **on Success**.



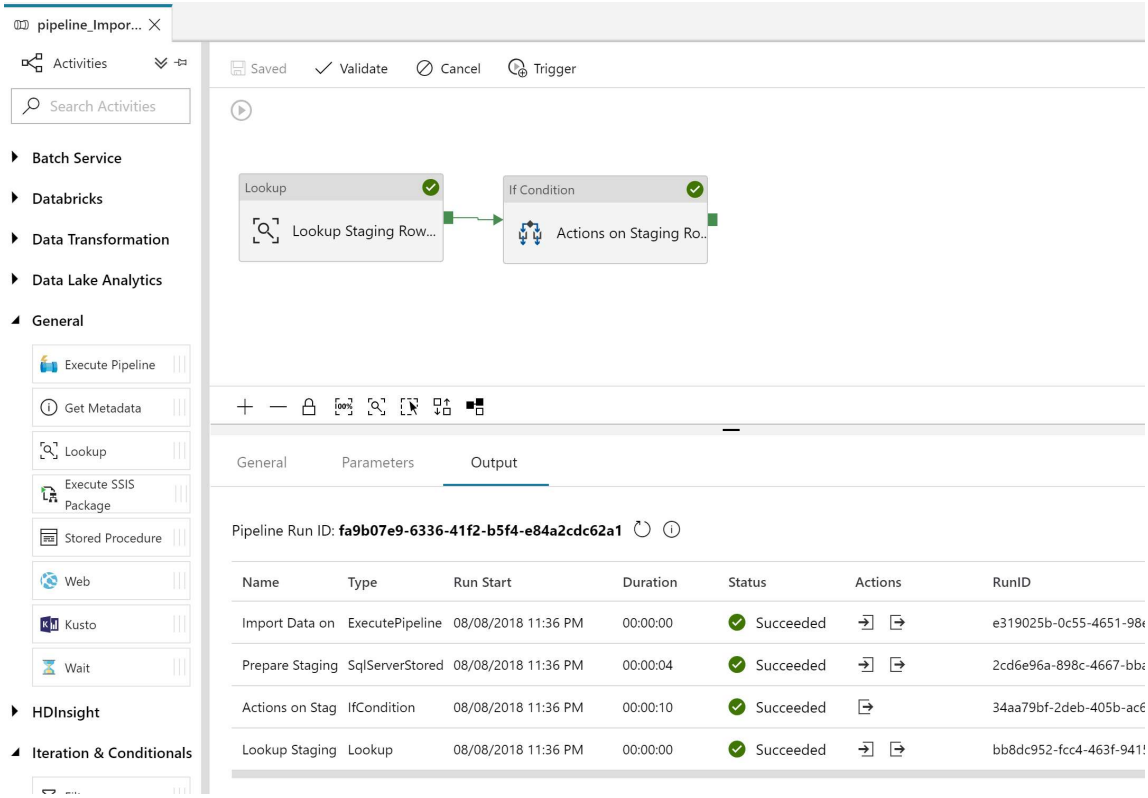
v. Navigate back to the main designer surface of the pipeline using the contextual path at the top of the designer surface.

w. Select **Save** on the Pipeline to save changes, if using Git.

x. Click **Publish** to deploy your changes to the Data Factory service.

5. Execute the Pipeline

   a. Using the same methods as in the earlier exercise execute the pipeline **pipeline_ImportData_Control** and observe the paths used. In the following screenshot the execution has followed the False conditional path.



6. You could try truncating the table manually and then executing again to force the activity to follow the true path.

   - `EXEC [SalesLT].[usp_TruncateProductStaging]`

Exercise 3 has been completed.

Data Flow

Introduction

During this lab, you will create a Data Flow task in Azure Data Factory, joining different data sources together.

Estimated Time

90 minutes

Objectives

At the end of this lab, you will be able to:

- Configure a Data Flow pipeline.
- Use debugging in Data Flow.
- Execute a Data Flow pipeline from an ADF Pipeline.

Logon Information

Use the following credentials to login into virtual environment.

- Username: **Admin**
- Password: **Passw0rd!**

Table of Contents

Setup: Prepare your environment

Exercise 1: Implement Control Flow

Exercise 2: Create Datasets

Exercise 3: Create a Data Flow Pipeline

Exercise 4: Create a Pipeline to run the Data Flow

Exercise 5: Run the Pipeline and Data Flow

Lab: Transform, Merge and Join Data in Mapping Data Flow

During this lab, you will learn how to do data transformations with Azure Data Factory Data Flow by looking at the reading history of 4 people, Keiko Brooks, Minerva Snape, Sven Dorjadt and Trixie Belden. In addition to the books these people have read, there is a file which contains information about a number of books, many (but not all) of which have been read by our readers.

We are going to learn how to join the reading history files (some of which have different columns) to each other, as well as to the list of books.

Setup: Prepare your environment

This step will take you through preparing your environment for the exercises which will follow.

Tasks

1. Open Internet Explorer and navigate to http://portal.azure.com/ to connect to Microsoft Azure Portal. Login with your subscriptions credential.
2. Create source files in new Container.
    a. Navigate to the storage account you have been using for this workshop, and create a new container named **module5**.
    b. In this container, using Storage Explorer, upload the following files from LabFiles\M05_L01_Lab01 to a folder named **originals**:
        - Books.csv
        - Keikos_History.csv
        - Minervas_History.csv
        - Svens_History.csv
        - Trixies_History.csv

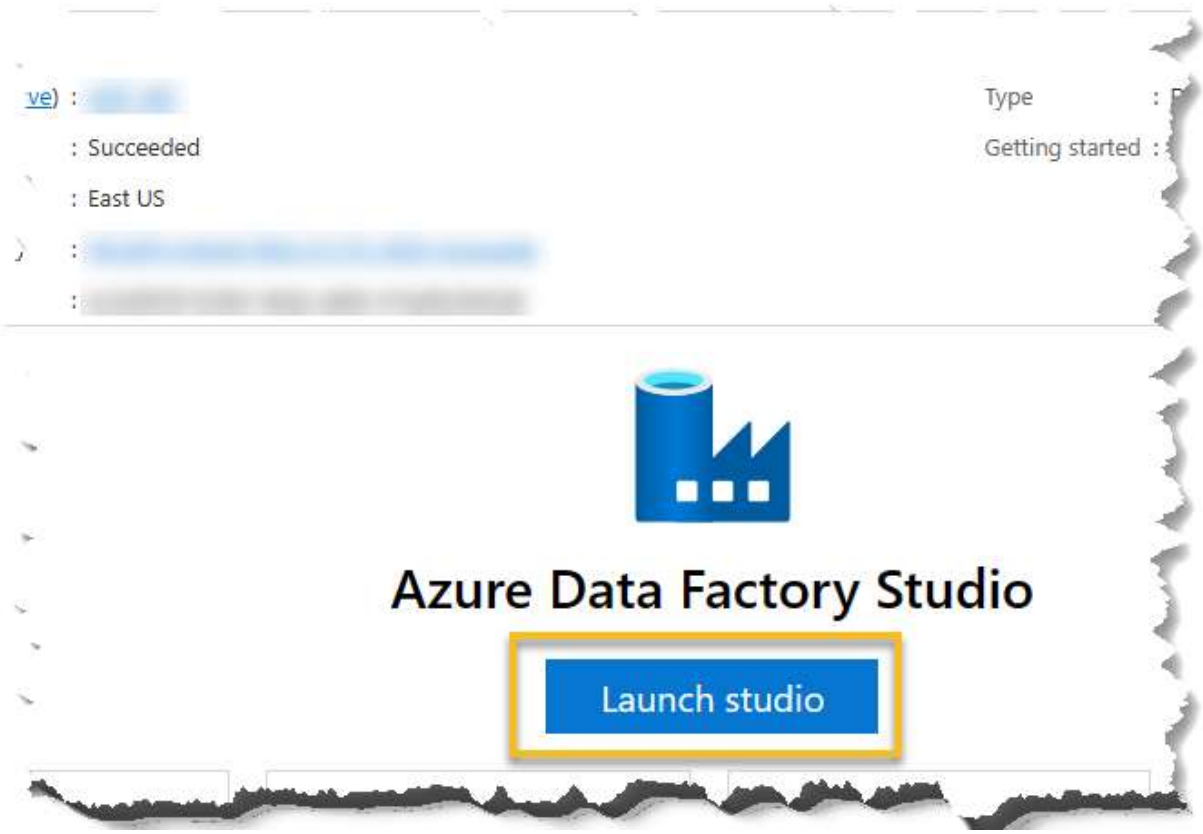
Exercise 1: Setting up Linked Service

This exercise shows the benefits of using Control Flow within your pipeline.

Tasks

1. Log into the Azure Data Factory you created earlier in this workshop.

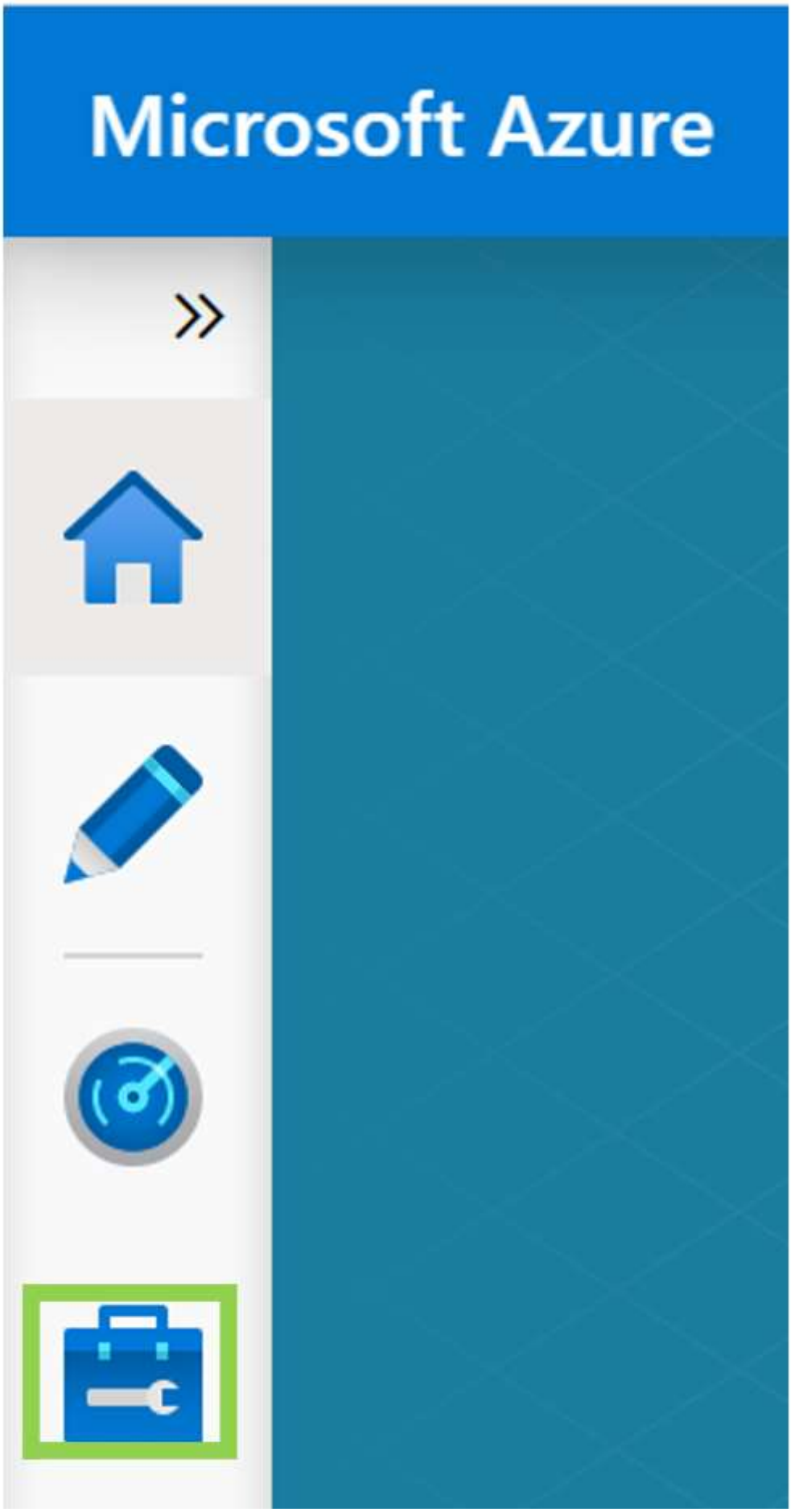
2. Select the **Launch Studio** tile to start the Azure Data Factory user interface (UI) application.



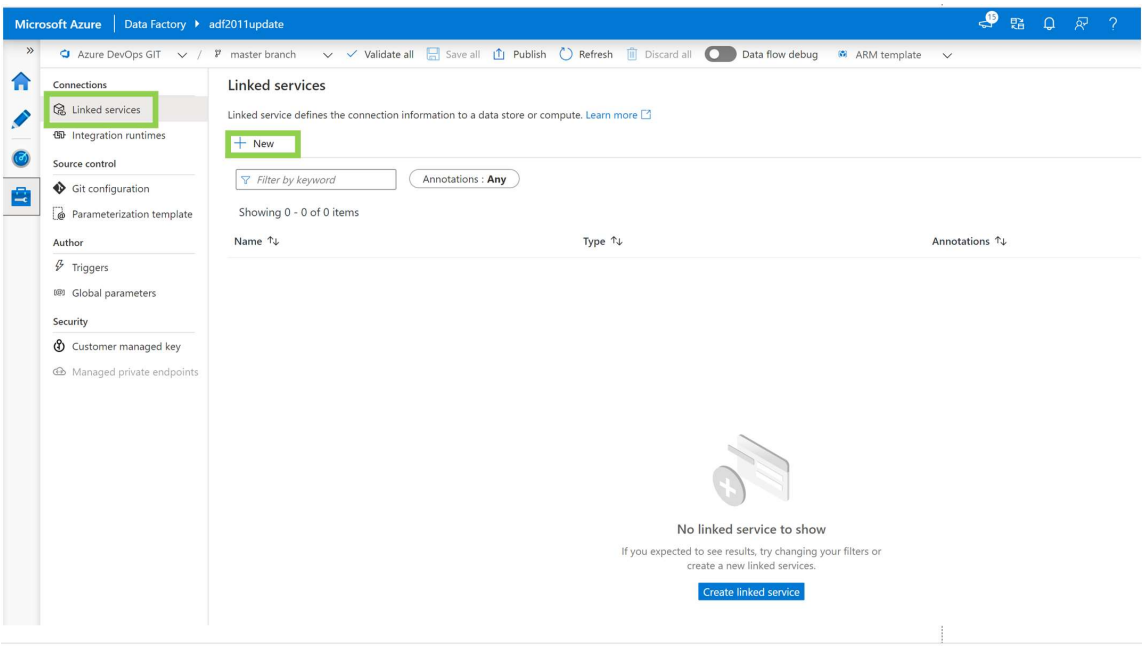
3. Configure the Azure Storage Linked Service in ADF

    a. Verify that you have configured the **Linked Service** to the **Azure Blob Storage account**. You may have an existing connection from previous lessons. If you do, skip to Exercise 2.

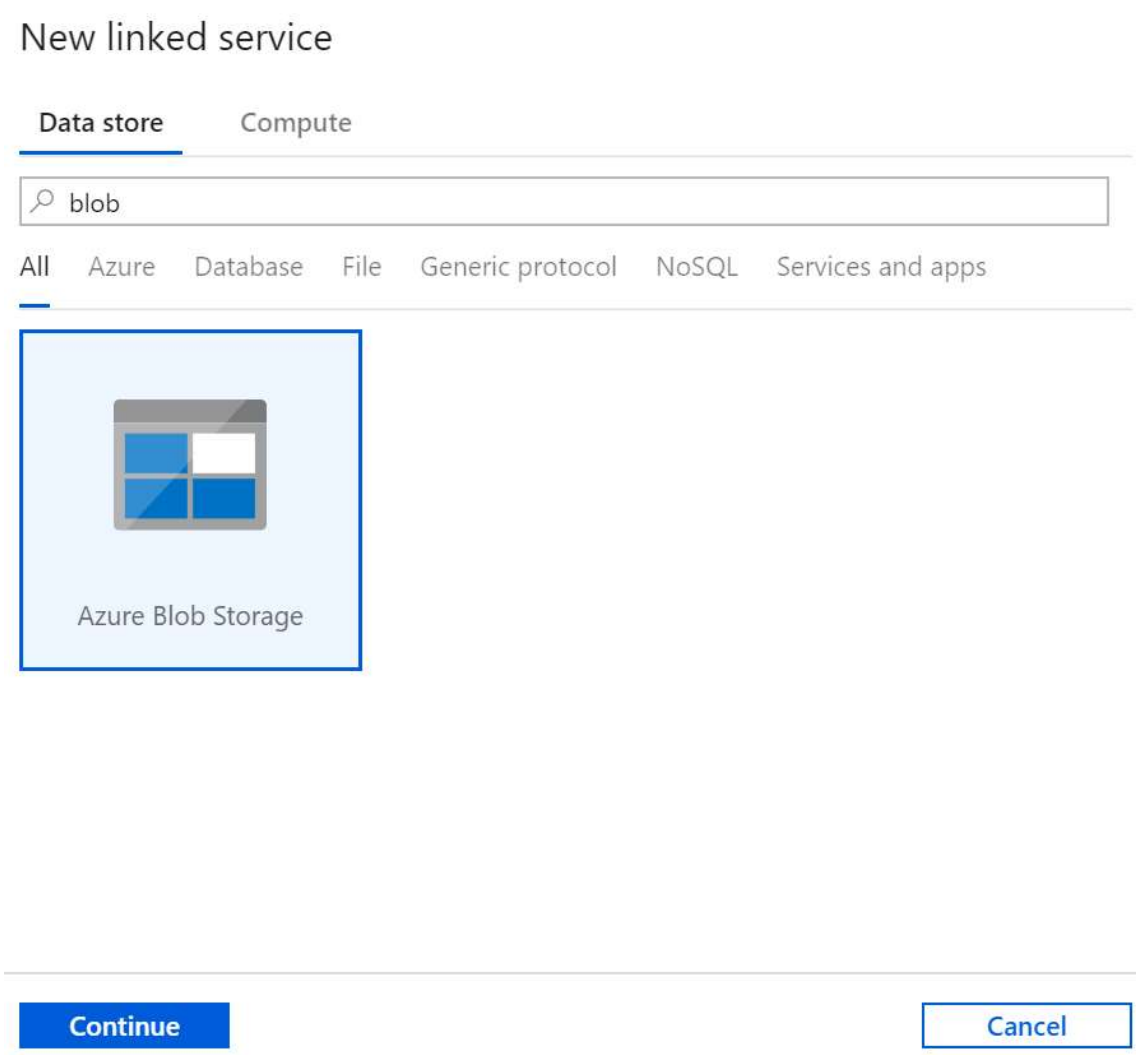
    b. Click the **Toolbox/Manage** button on the left panel.


Microsoft Azure

c. Under **Connections** in left panel, click on **Linked services**, if not already selected, and then click on **+New** in the middle pane.



d. Select the **Azure Blob Storage** type and click the **Continue** button.

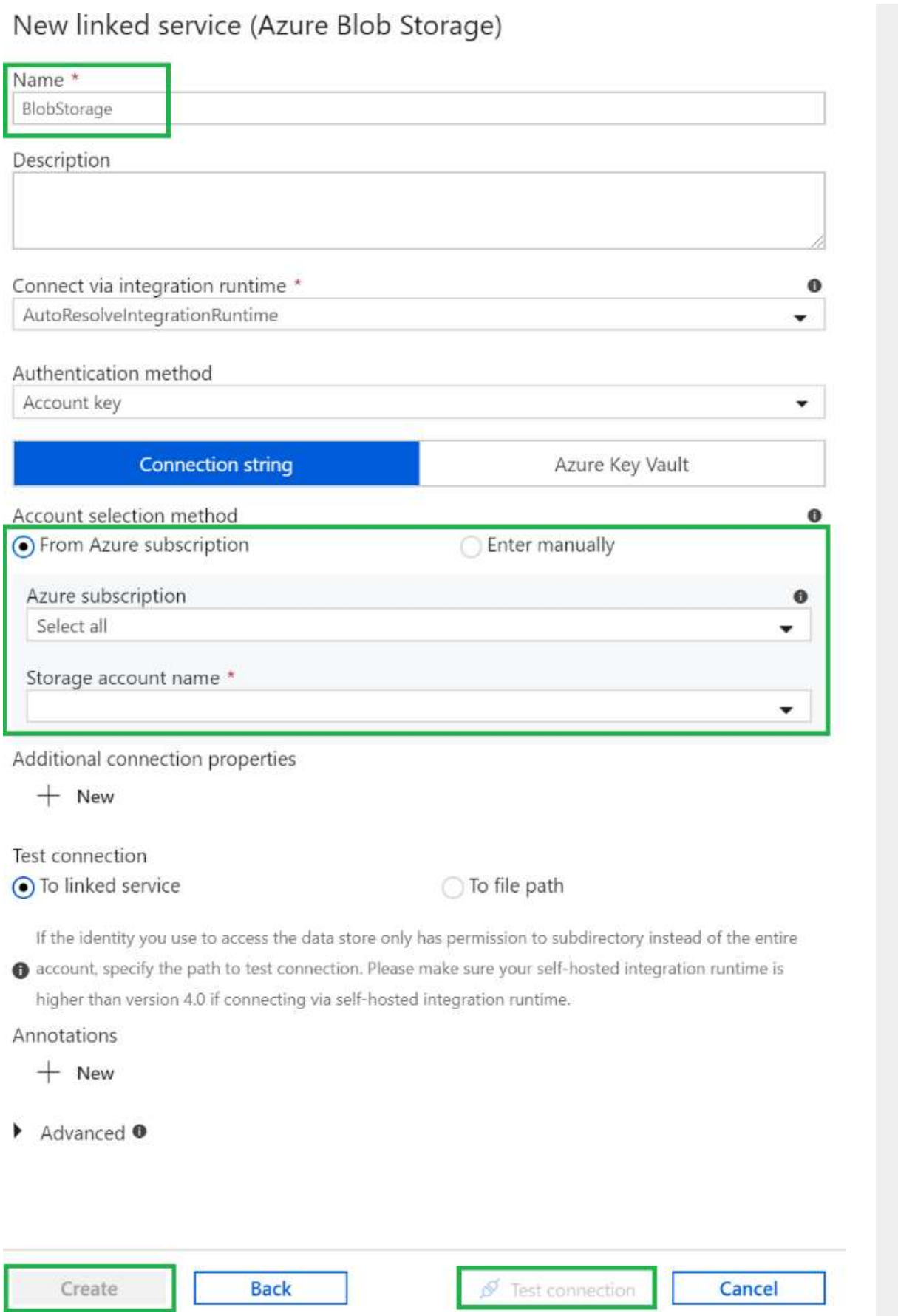


e. Change the Linked Service name if desired (for example: use the storage account name).

f. Select the **Azure subscription** from the drop-down.

g. Select the **Storage account name** from the drop-down and click on **Test Connection** test the connection.

h. Once successfully tested, select **Create**.

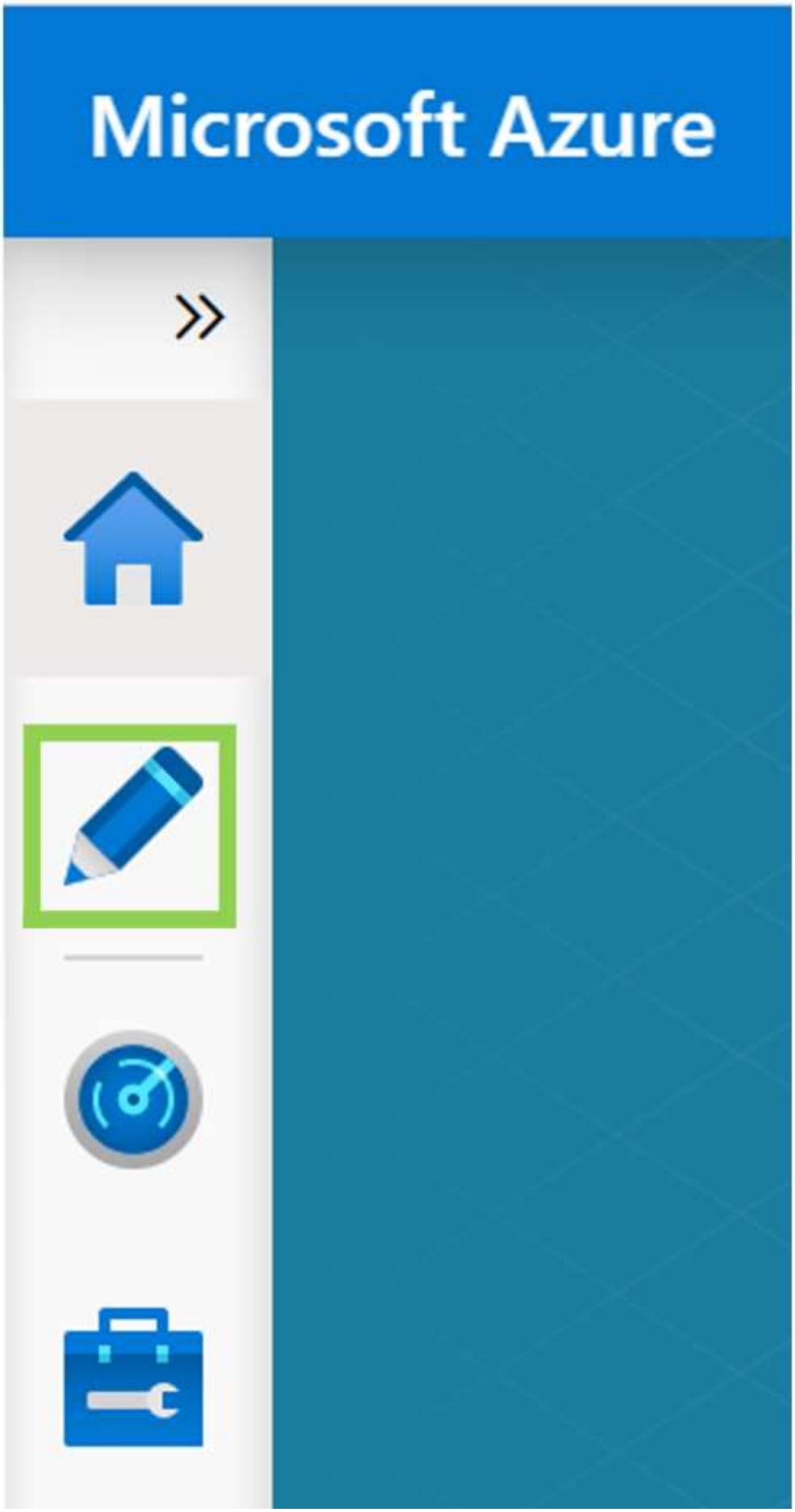


Exercise 1 has been completed.

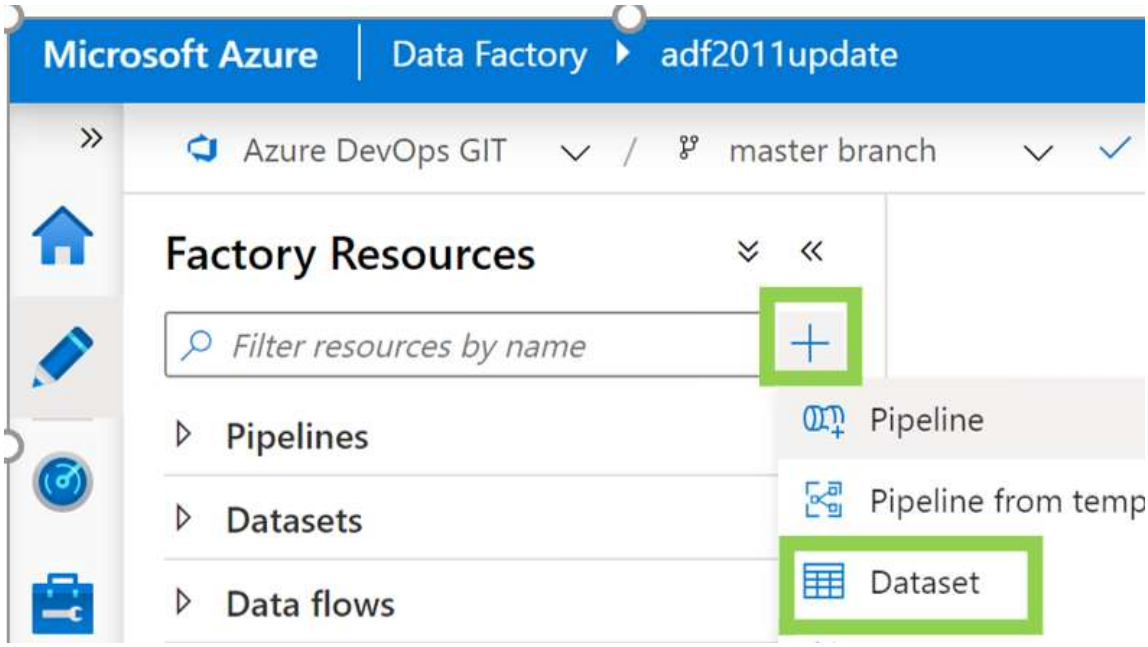
Exercise 2: Create Datasets

1. Create datasets which reference the files uploaded to Azure Storage earlier in this lab.

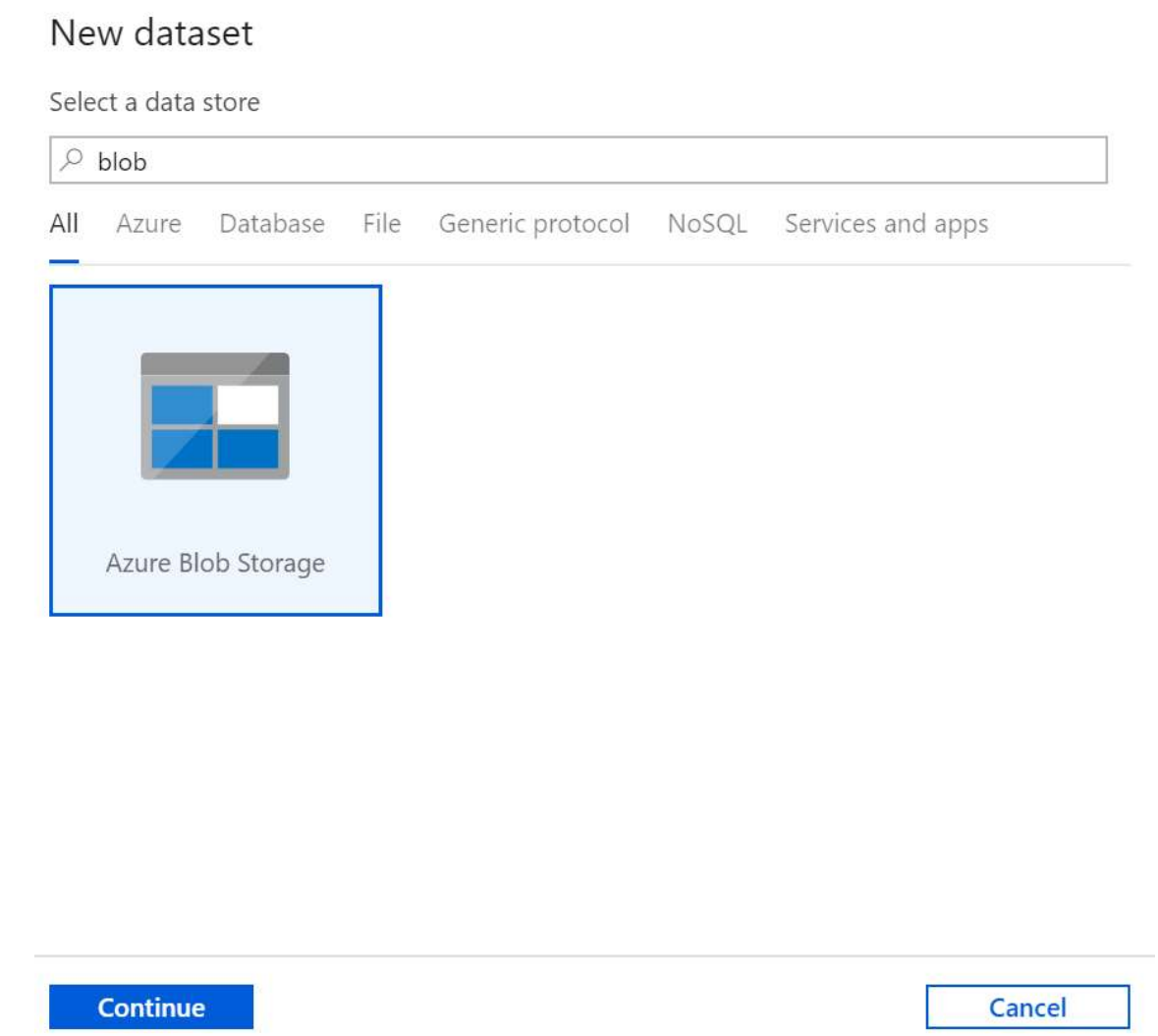
    a. Click on the **Pencil/Edit** in the left pane.


Microsoft Azure

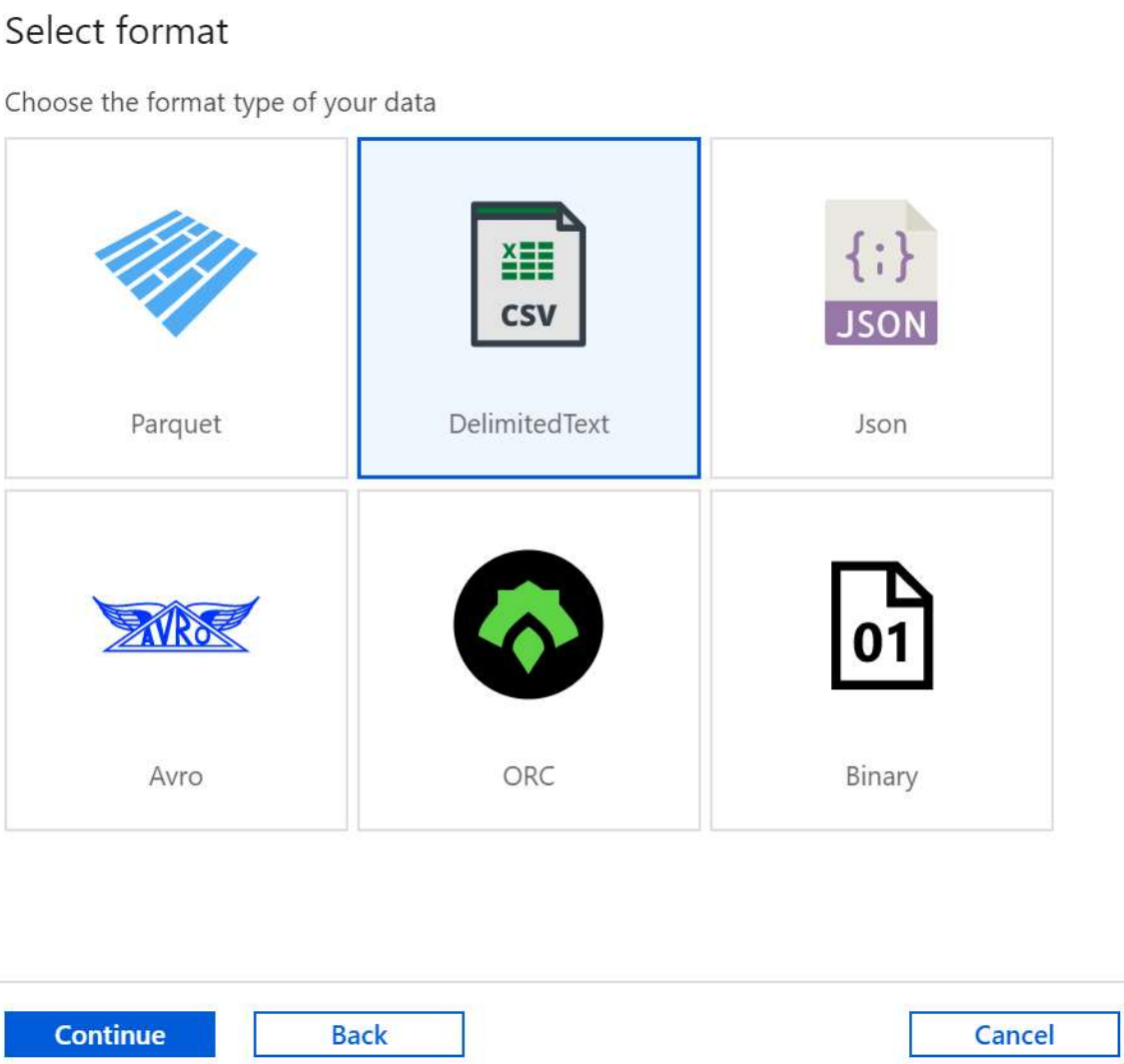
b. Create a new dataset by clicking the **+** button under **Factory Resources** and selecting **Dataset**.



c. Select **Azure Blob Storage** and click the **Continue** button.

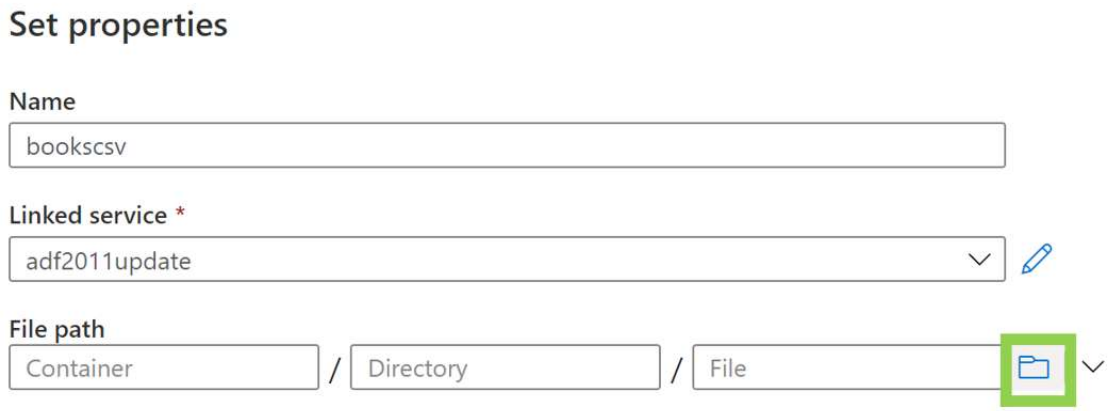


d. Select **DelimitedText** and click the **Continue** button.

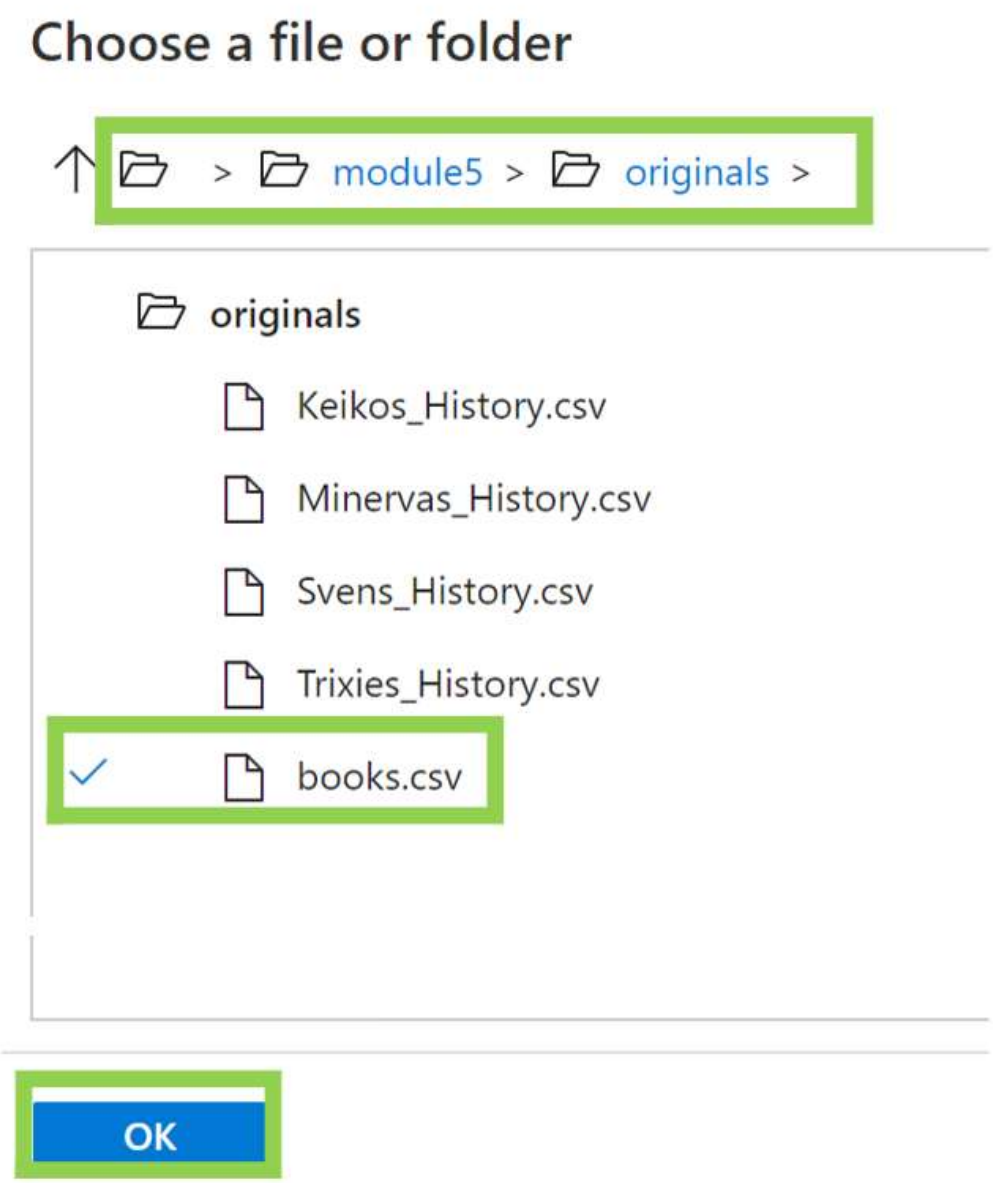


e. Enter **bookscsv** for the Name and select the **Linked Service** created for Blob Storage earlier in this exercise.

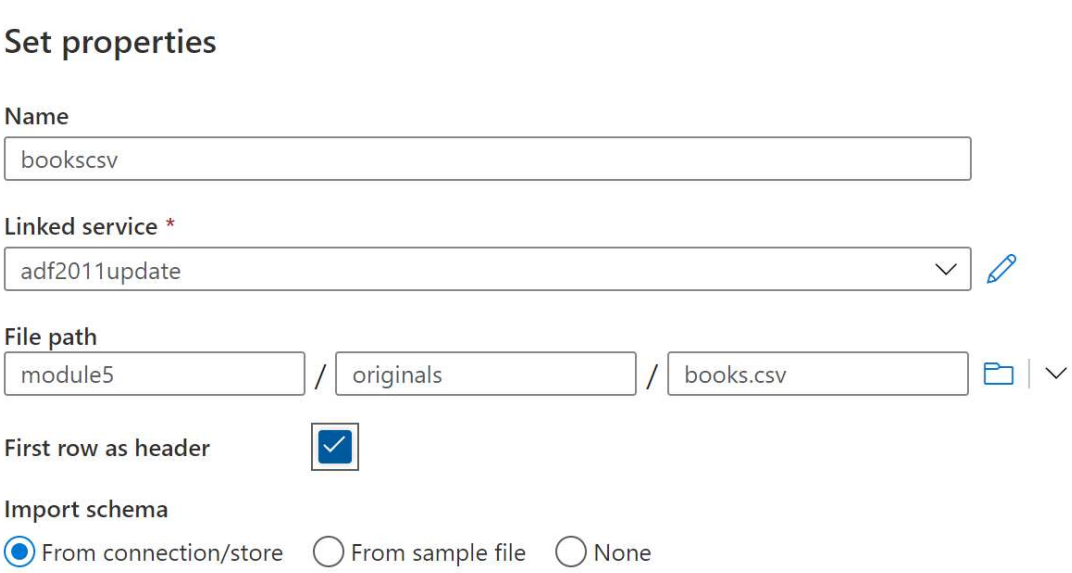
f. Click on the **Folder** button to the right of the **File path** boxes.



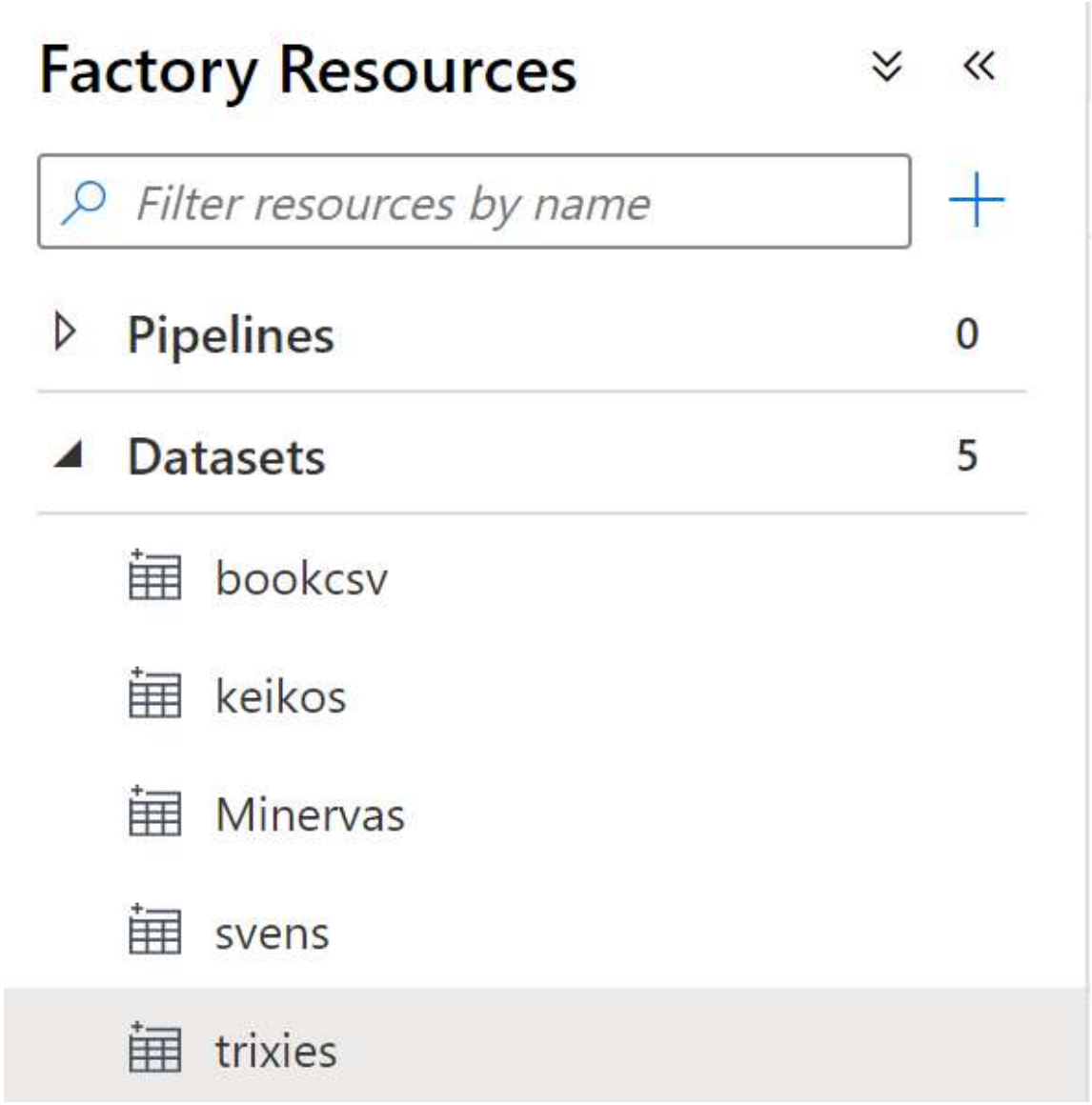
g. Drill down to the books.csv file uploaded earlier in the exercise by double clicking on the module5 container, double clicking the originals folder, and selecting the books.csv file. Click **OK**.



h. Checkmark the box for **First row as header**. Click the **OK** button.



i. Repeat steps 1 (ii) through 1 (viii) to create Datasets for the other files in your **module5/originals** folder in your Storage account. When you are done, you should have added 5 Datasets to your Data Factory.

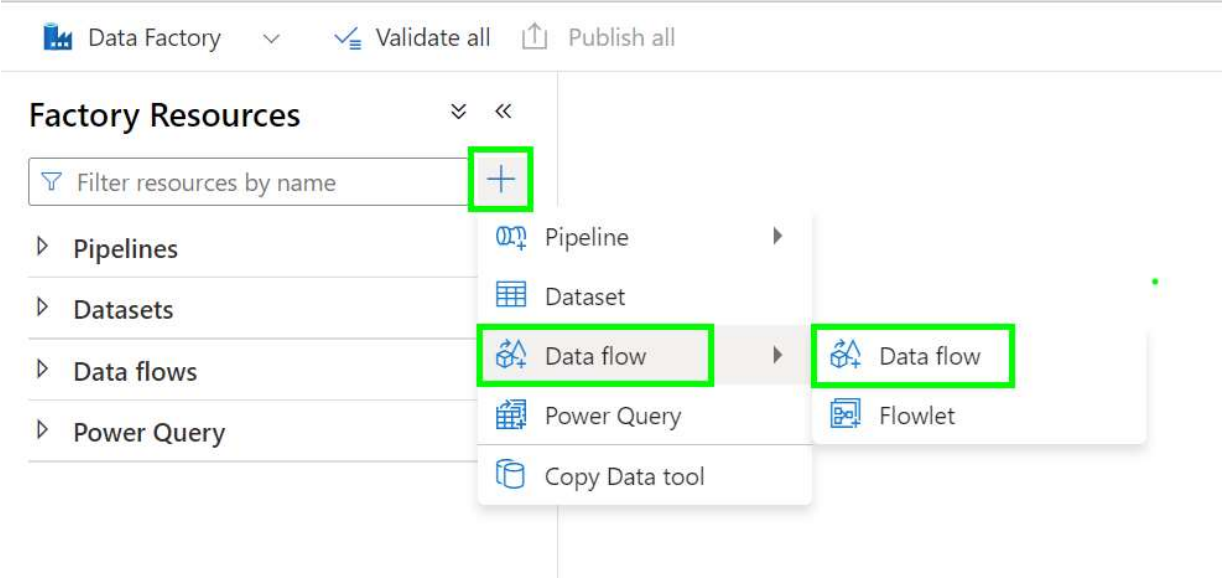


2. Now is a good time to save/publish your work.

Exercise 2 has been completed.

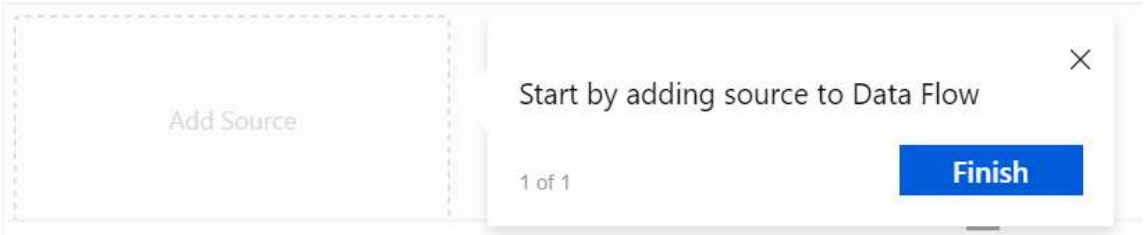
Exercise 3: Create a Data Flow Pipeline

1. Create a new data flow by clicking the **+** button, hovering over **Data Flow** and selecting **Data Flow** from subsequent list.

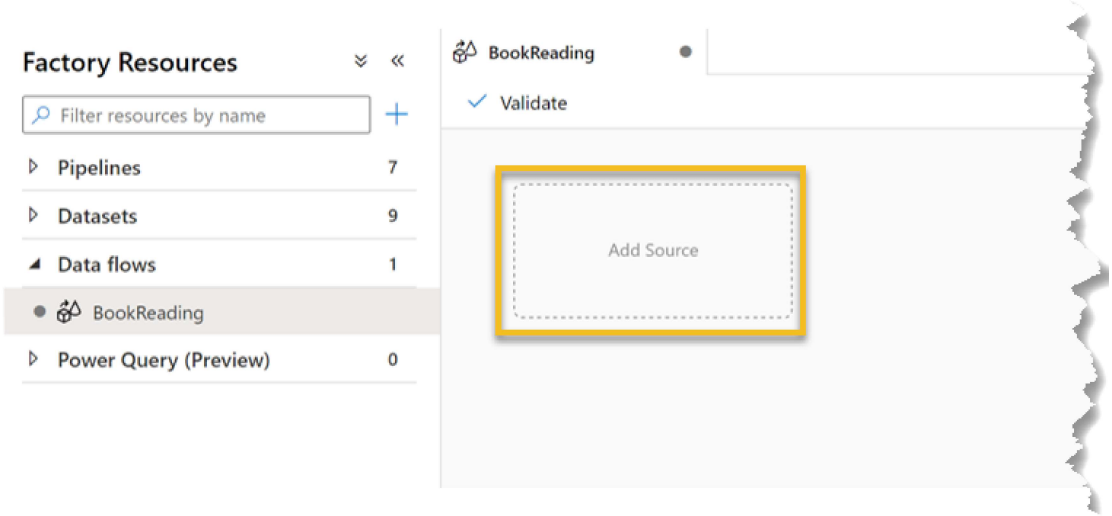


2. In the new tab, a pop-up window may show with the text **Start by adding source to Data Flow**. If so, click the **Finish** button.

    a. Similar popups will show while using Data Flow to help. Read these, including all pages if desired, and click the **Finish** button once read.



    b. In the Data Flow Properties pane to the right, enter **BookReading** for the Name.

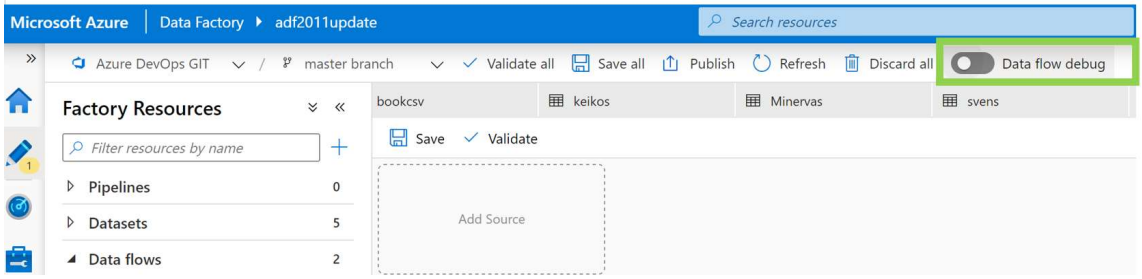


3. Enable Data flow debug

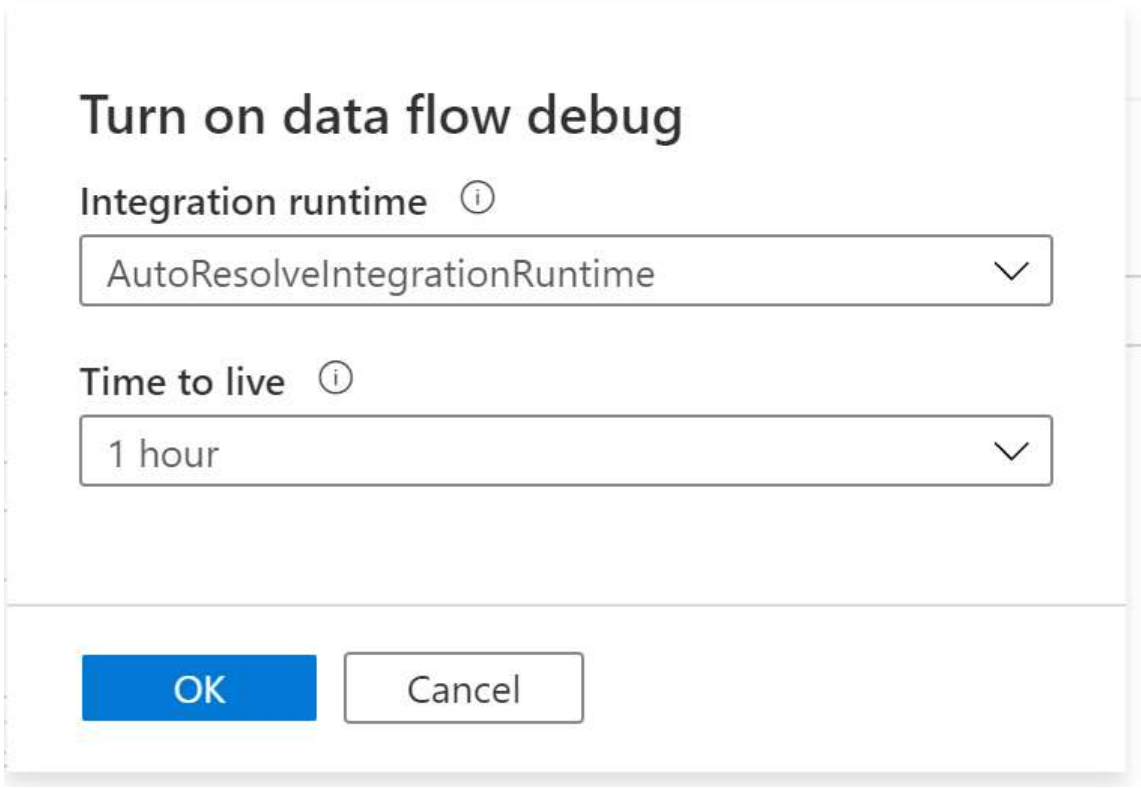
    ☐ Data flow debug allows you to preview your data while developing your Data flow. When enabled, it will start a cluster on an Azure Integration Runtime, which takes some time to

start up.

a. Click on the Data flow debug slider in the ribbon.

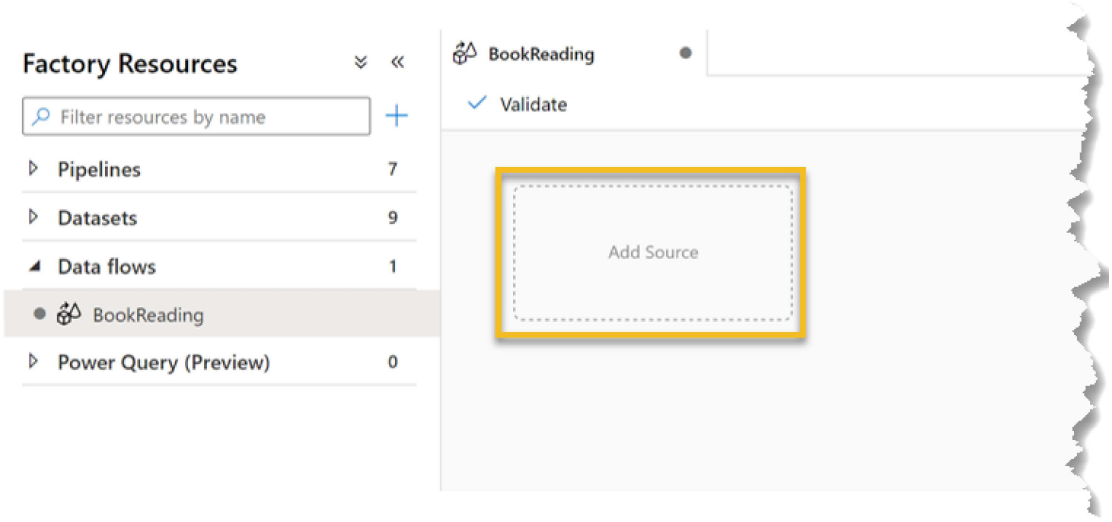


b. When prompted for **Turn on data flow debug**, click **OK**.

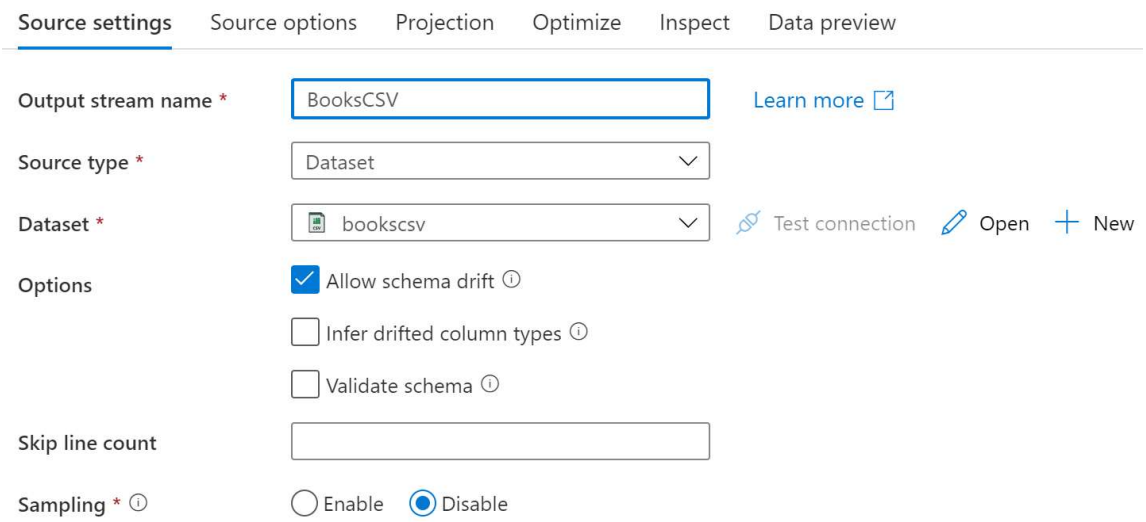


4. Add source data to the Data Flow

a. Select the **Add Source** rectangle in the center pane.



b. Click on the Dataset dropdown box and select the **bookscsv dataset** created in Step 3 for the books.csv file. Enter **BooksCSV** for the Output stream name.



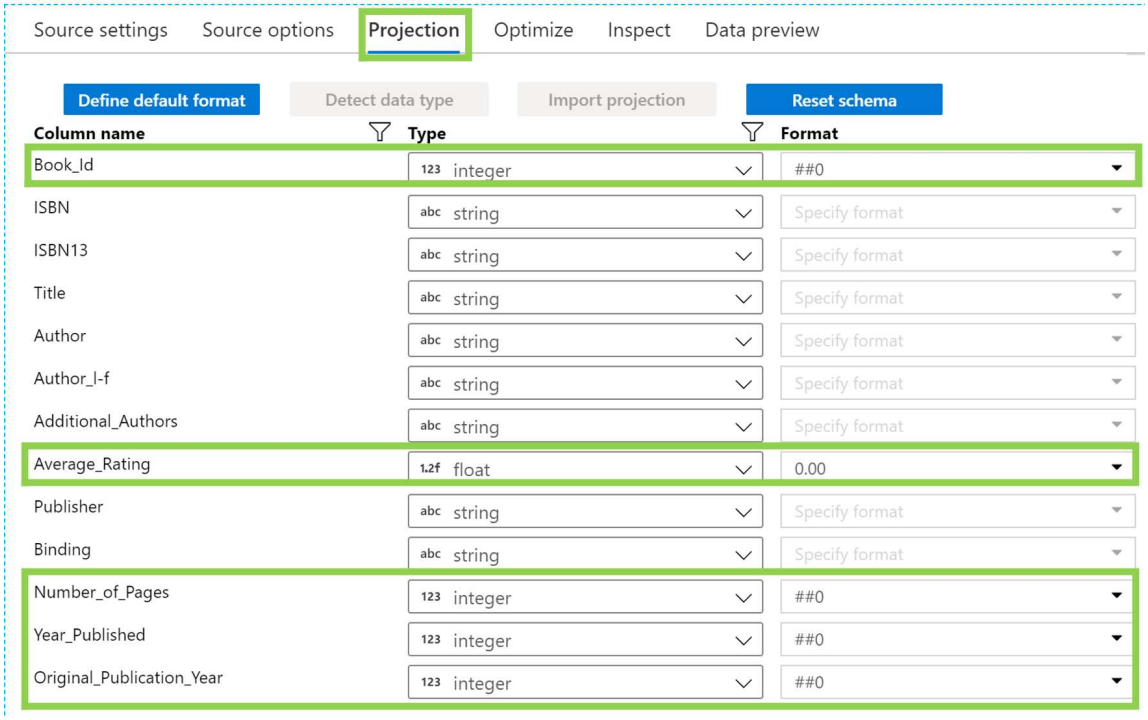
c. Select the **Projection** tab and set the following columns to integer type, with a format of ##0:

- Book_ID
- Number_of_Pages
- Year_Published
- Original_Publication_Year

d. Set the following columns to float, and type 0.00 in the format box. (0.00 is not shown as an option in the dropdown list. You can manually enter your own format strings).

- Average_Rating

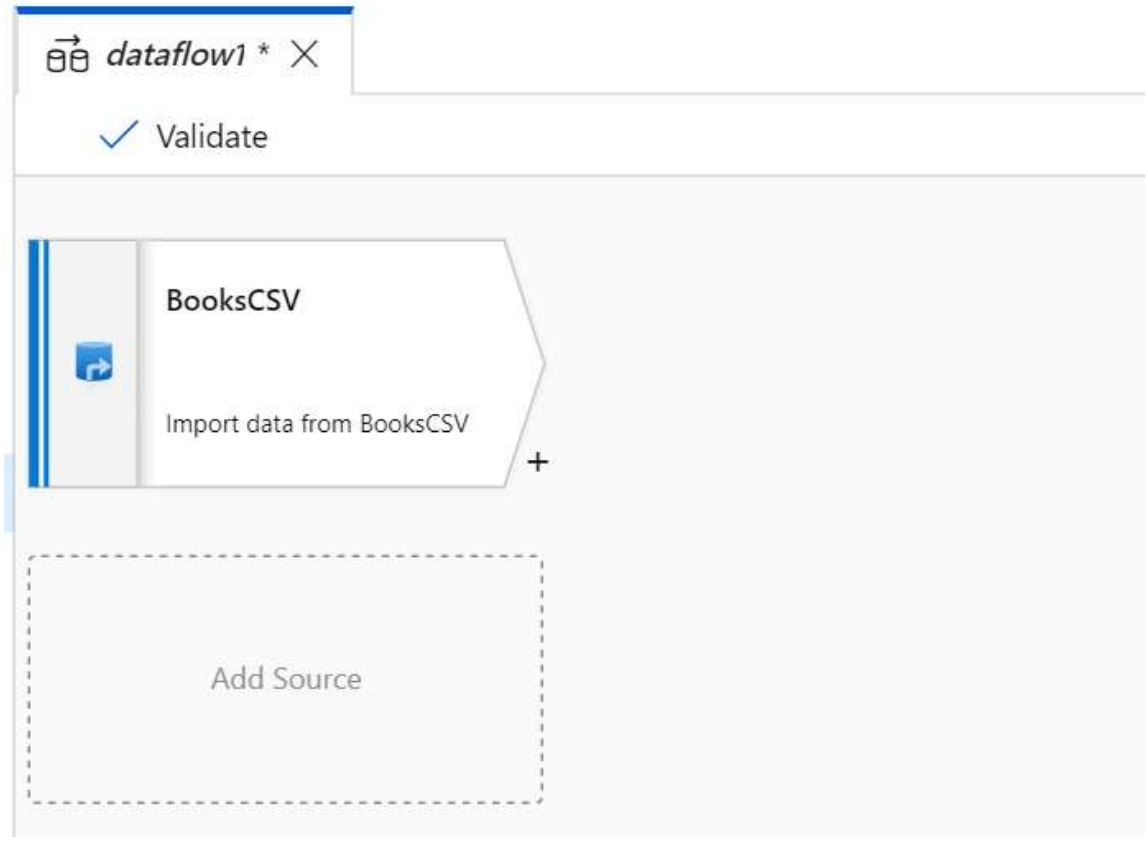
e. Leave the remaining columns as string.



f. Select the **Data Preview** tab and click **Refresh** to preview the data.

> ☐ If your Debug cluster is still starting, you will see a "Please wait.." message. Click **Refresh** to display the data after the cluster has started.)

g. Select the **Add Source** area under the last source you created.



h. Under Source Settings, name the **Output Stream** TrixiesHistory and select the **dataset Trixies_History** created earlier in this lab.

i. Select the Projection tab and set the following columns to integer type, with a format of ##0:

- Book_ID
- My_Rating
- Read_Count

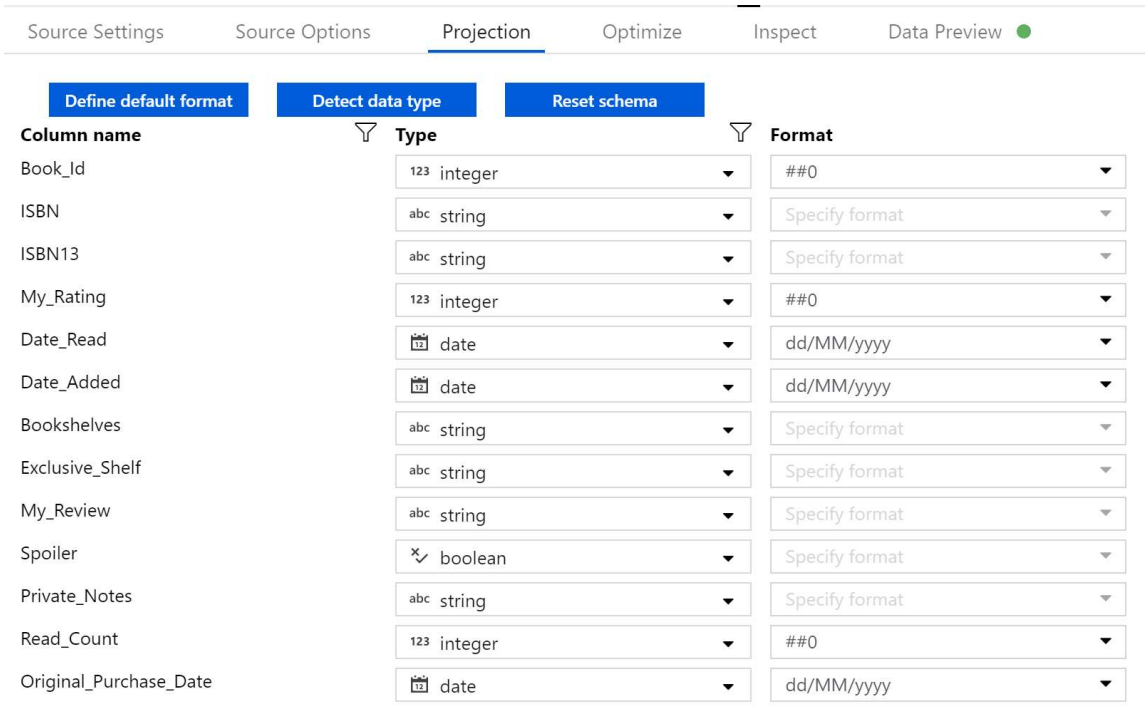
j. Set the following columns to **date**, and set the format to **dd/MM/yyyy** (this is a result of the format of the dates in the files):

- Date_Read
- Date_Added
- Original_Purchase_Date

k. Set the following columns to boolean:

- Spoiler

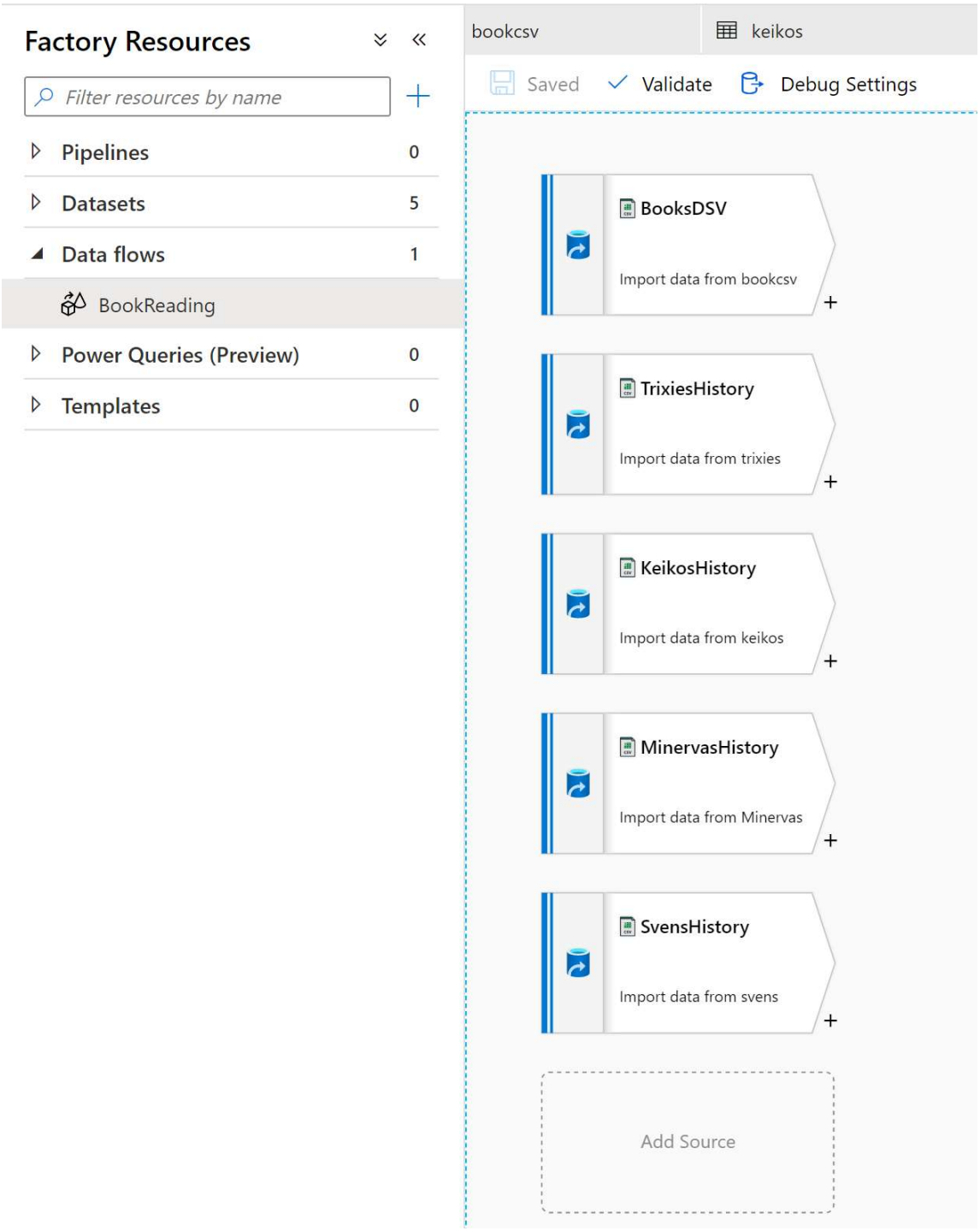
l. Leave the remaining columns as string.



m. Go to the **Data Preview** tab and click Refresh to preview the data.

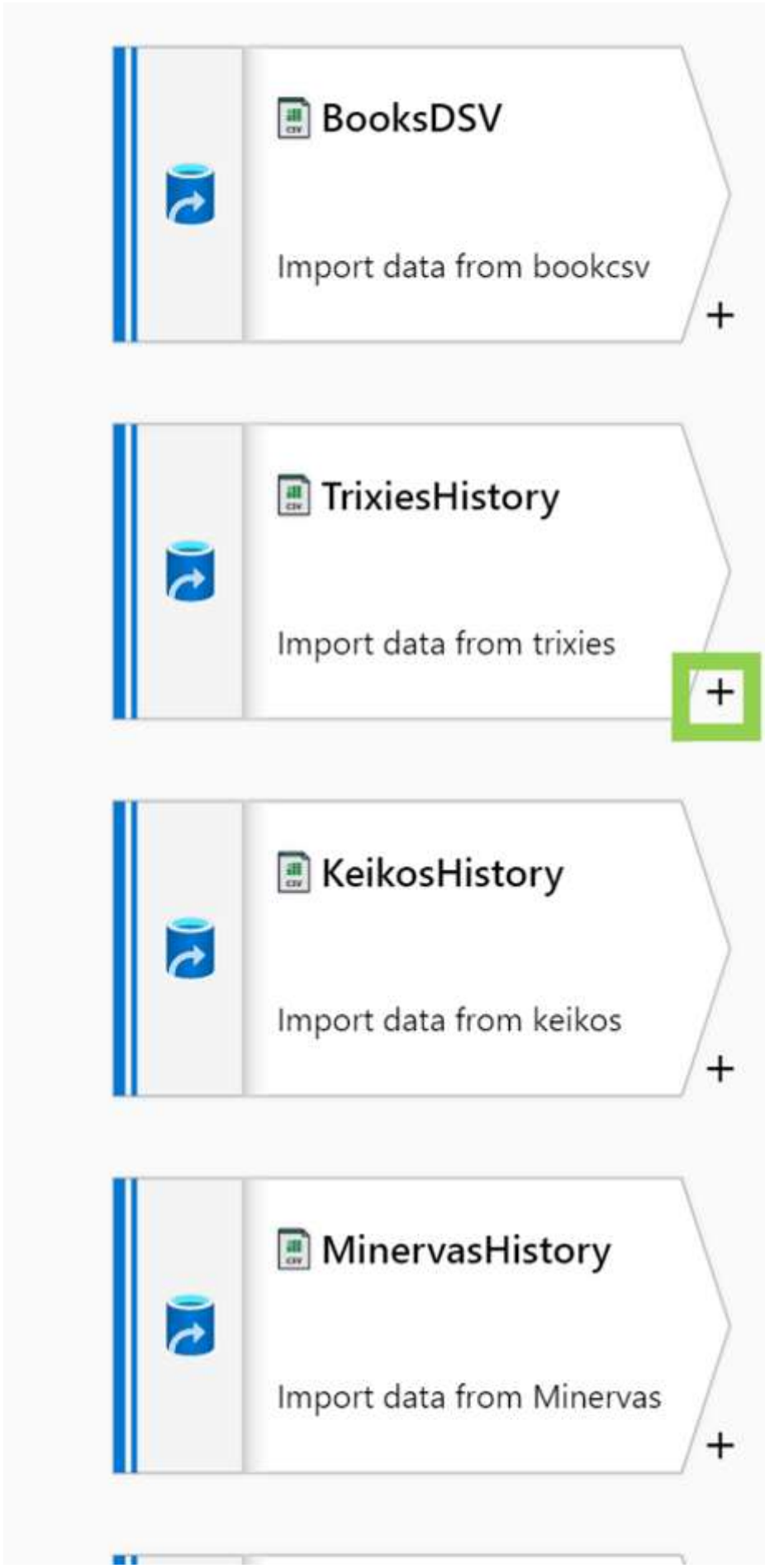
n. Repeat steps 4 (viii) through 4 (xiii) for the other svens, minervas and keikos reader history files, changing names as appropriate.

o. You should now have 5 data sources on your canvas.



5. Prepare reading history data to be joined. The intent is to join the four reading history files together, along with the books.csv file, to output the data in a single file. The four readers are not identified in their files, so we need to create a column to identify them.

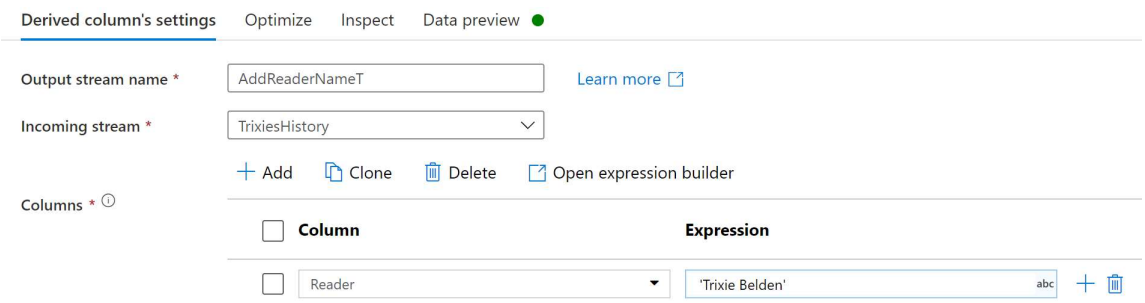
    a. Click the + plus sign next to TrixiesHistory on the pipeline canvas.


BooksDSV
Import data from bookcsv
TrixiesHistory
Import data from trixies
KeikosHistory
Import data from keikos
MinervasHistory
Import data from Minervas

b. From the popup list, select **Derived Column**.

c. Name the output stream **AddReaderNameT**.

d. For Columns type, enter the column name **Reader** and for the expression enter **Trixie Belden**, enclosed in single quotes.

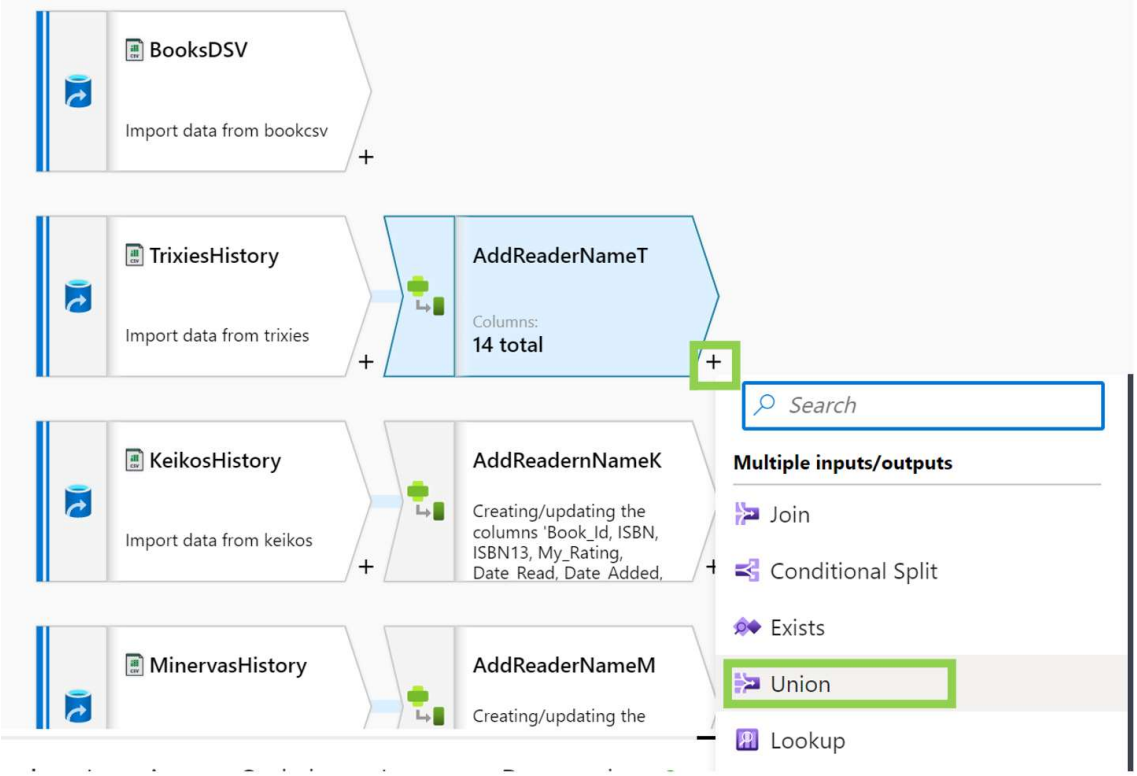


e. Repeat step 5 (i) through 5 (iv) to create a Derived Column called Reader for the other Reader History data sources, entering their full names as shown below:

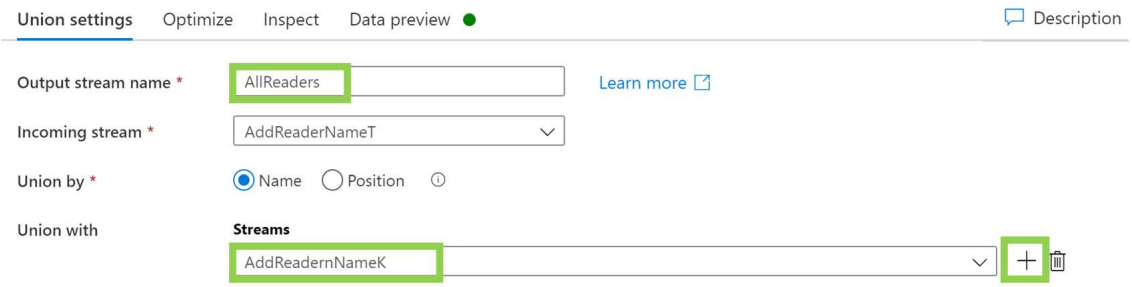
Source	Output stream Name	Reader column Expression
Minerva	AddReaderNameM	Minerva Snape
Sven	AddReaderNameS	Sven Dorjadt
Keiko	AddReaderNameK	Keiko Brooks

6. Join all the reader history data into a single stream.

a. Select the **+ plus** sign next to **AddReaderNameT** and select **Union**.



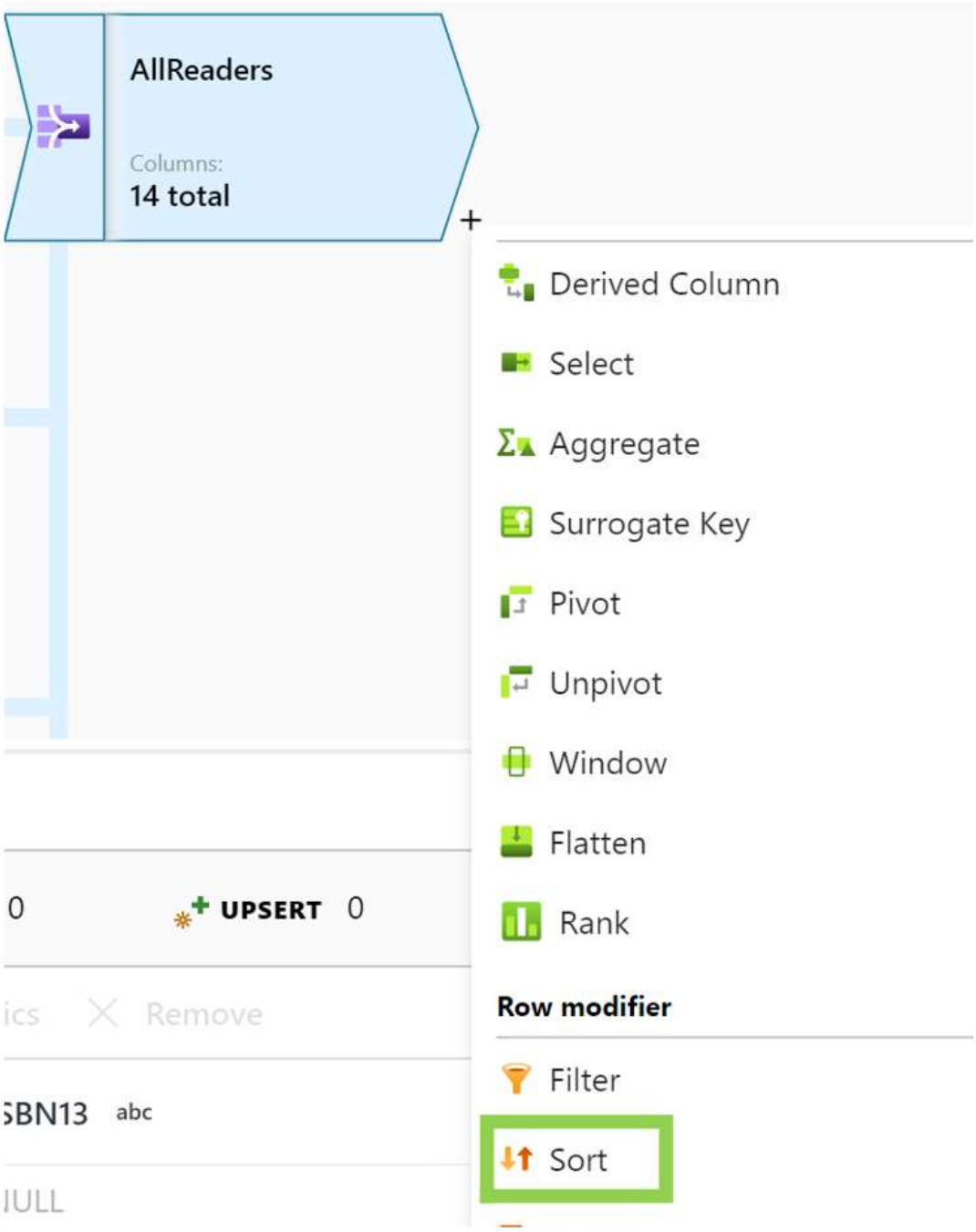
b. Name the output stream **AllReaders**. In the **Union with** field select **AddReaderNameK**. Click the plus sign and add rows for **AddReaderNameS** and **AddReaderNameM**, so all readers have their reading history in one stream.



c. Under the Inspect tab, you can see how the columns have been aligned for the join, including the blanks from the columns missing from the files for KeikosHistory and MinervasHistory. Also note that the out of order columns are now aligned.

7. Inspect the data to be sure all 4 datasets have been joined.

a. Select the **Plus + sign** next to AllReaders and select **Sort** under the **Row modifier** heading from the popup list of transformations.



b. Name the output stream **SortReadingHistory**. In **Sort conditions** and select the column **Book_Id** and **Order** ascending.

> ℹ This isn't strictly necessary but provides an easy way within the debug mode to show that data is flowing in from different source files, given our data set.

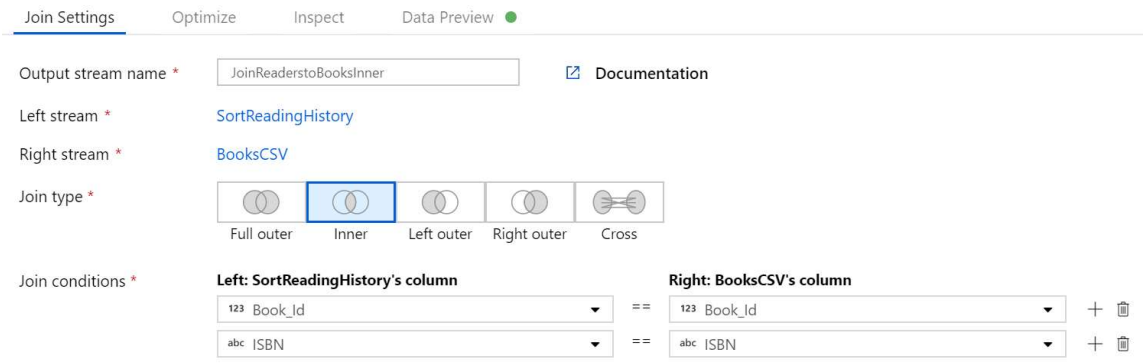
c. Go to the **Data Preview** tab to review the data, and you should be able to find records from all 4 of our readers.

8. Join the reader and book data together.

a. Select the **Plus + sign** next to the **SortReadingHistory** Output stream and select **Join**.

b. Name the output stream **JoinReaderstoBooks** and select **BooksCSV** from the **Right stream** dropdown.

c. Set the Join type to **Inner** and add 2 columns to the Join conditions: **Book_Id** and **ISBN**.

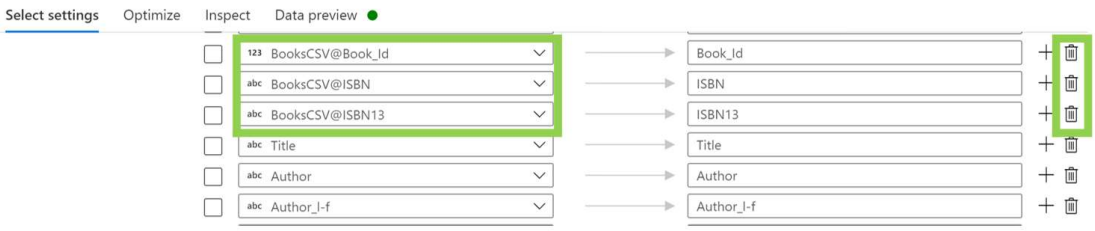


d. Go to the **Data Preview** tab which now shows duplicate columns in the dataset, Book_Id, ISBN and ISBN13. We should remove them to avoid any confusion for the users of our data.

9. Remove resulting duplicate columns.

a. Select the **Plus + sign** next to the **JoinReaderstoBooks** output stream and choose the **Select** transformation under the **Schema Modifier** heading.

b. Name the Output stream **RemoveDuplicateColumns.** Scroll down through the Input column list until you see the duplicate column names from the BooksCSV output stream. Remove these duplicated columns (BooksCSV@Book_Id, BooksCSV@ISBN and BooksCSV ISBN13) from the input columns by clicking on the delete buttons at the end of each row.



10. Output the joined books and reader data

    a. Select the **Plus + sign** next to the **RemoveDuplicateColumns** Output stream, select the **Sink** transformation under the **Destination** heading and name it **ReadersBooksInnerJoin**.

    b. Select **+New** next to the **Dataset** field to create a new dataset.

    c. Choose **Azure Blob Storage** for the data store type.

    d. Select **DelimitedText** for the format. Click **Continue**.

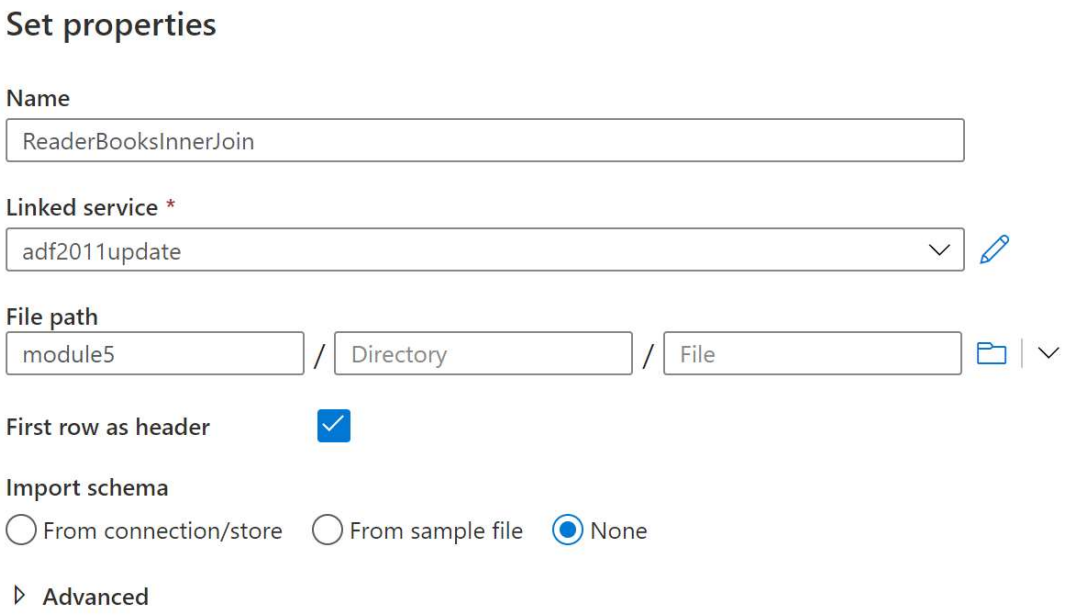
    e. Enter **ReadersBooksInnerJoin**, for the name.

    f. Select the same Linked service used throughout this lab. Browse to your container name or manually enter module5 as the container name. (If you named your container something else, use this name instead.)

    g. Check **First row as header** box

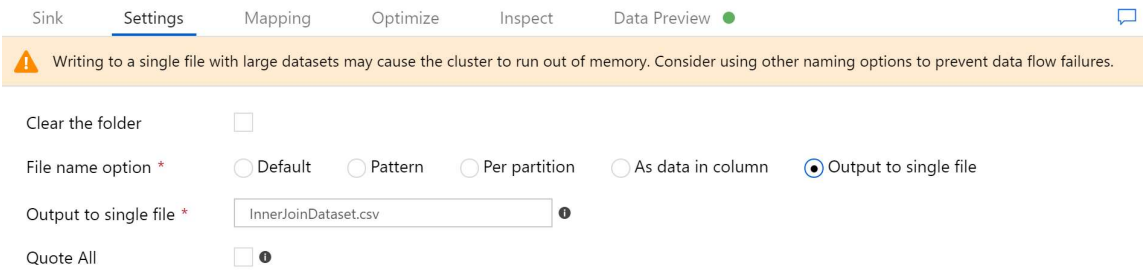
    h. Select **None** for **Import Schema**

    i. Select **OK**.



    j. Click on the **Settings** next to Sink, select **Output to single file** and enter the filename of **InnerJoinDataset.csv**.

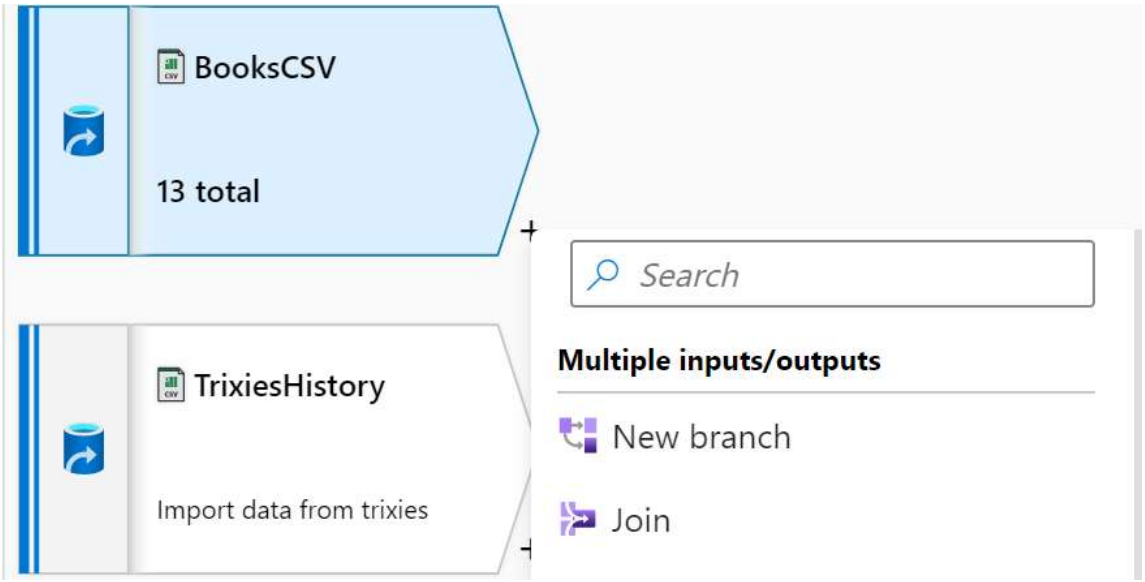
> ℹ The warning about writing large datasets to a single file. This is not a concern with our dataset.



k. On **Optimize** tab, set partition option to be **Single partition**.

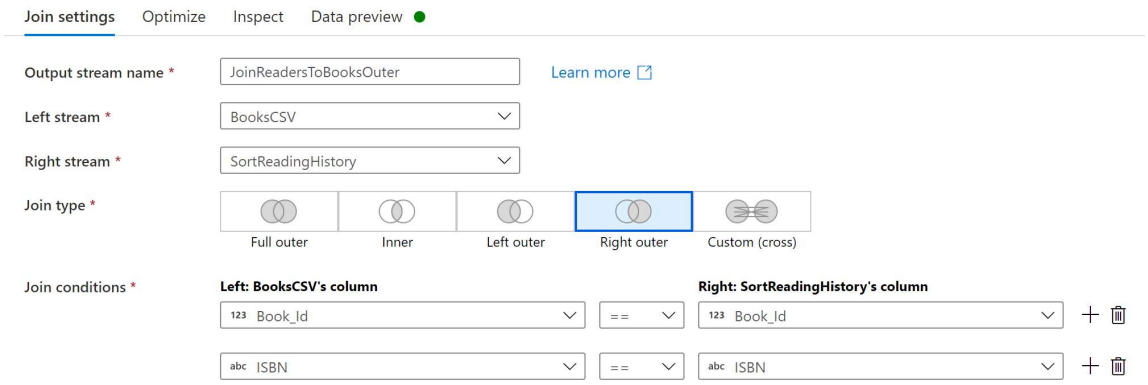
11. Second join of the books and reader data

    a. Select the **Plus + sign** next to the **BooksCSV** Source and select **Join**.



    b. Name this output stream **JoinReadersToBooksOuter**.

    c. Select **SortReaderHistory** as the **Right stream** and Right outer as the **Join Type** and add 2 columns to the Join conditions: **Book_Id** and **ISBN**. This output stream will include all reader history records even if there is no matching record in the BooksCSV source.



12. Second removal of duplicate columns

    a. Select the **Plus + sign** next to the **JoinReadersToBooksOuter** Output stream and choose **Select**.

    b. Name this Output stream **RemoveDuplicateColumns**, and observe the error from Data Flow, which does not allow multiple transformations to have the same names. Add a **2** to the end of the name.

13. Again, remove the duplicated columns (Book_Id, ISBN and ISBN13) from the Books file.

    a. Select the **Plus + sign** next to the **RemoveDuplicateColumns2** Output stream and choose **Sink.**

    b. Name this Output stream **ReadersBooksOuterJoin.**

14. Select **+New** next to the **Dataset** field to create a new dataset.

    a. Choose **Azure Blob Storage** for the data store type.

    b. Select **DelimitedText** for the format. Click **Continue**.

    c. Enter **ReadersBooksOuterJoin**, for the name.

    d. Select the same Linked service used throughout this lab. Browse to your container name or manually enter module5 as the container name. (If you named your container something else, use this name instead.)

    e. Check **First row as header** box

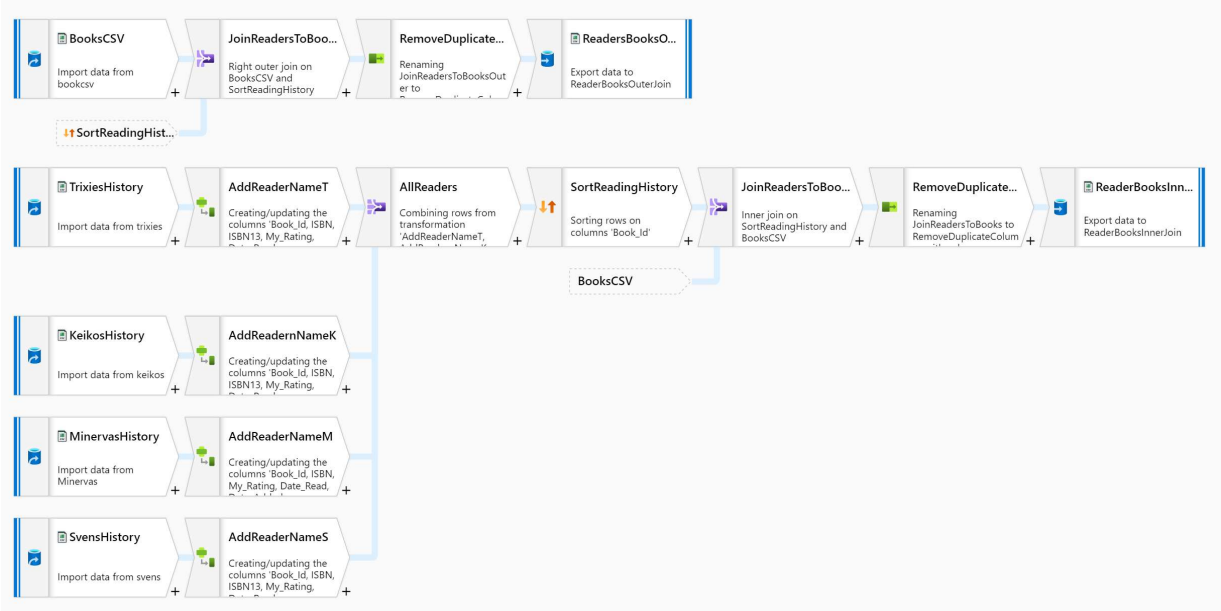
    f. Select **None** for **Import Schema**

    g. Select **OK**.

    h. Click on the **Settings** next to Sink, select **Output to single file** and enter the filename of **ReadersBooksOuterJoin.csv**. and select **Output to single file** name.

    i. Make sure to select **Single partition** on the **Optimize** tab.

15. Your Data Flow should look similar to the screenshot below.

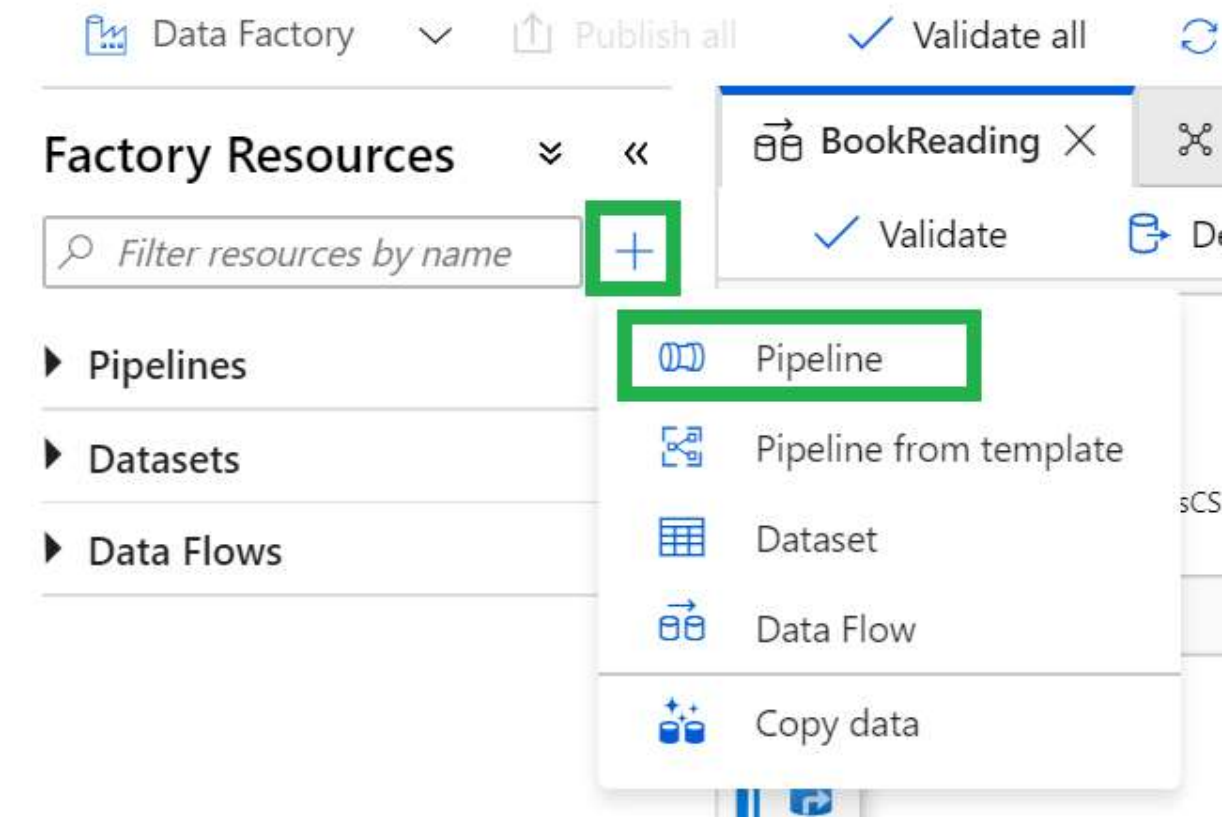


16. Save and Publish the Data Flow.

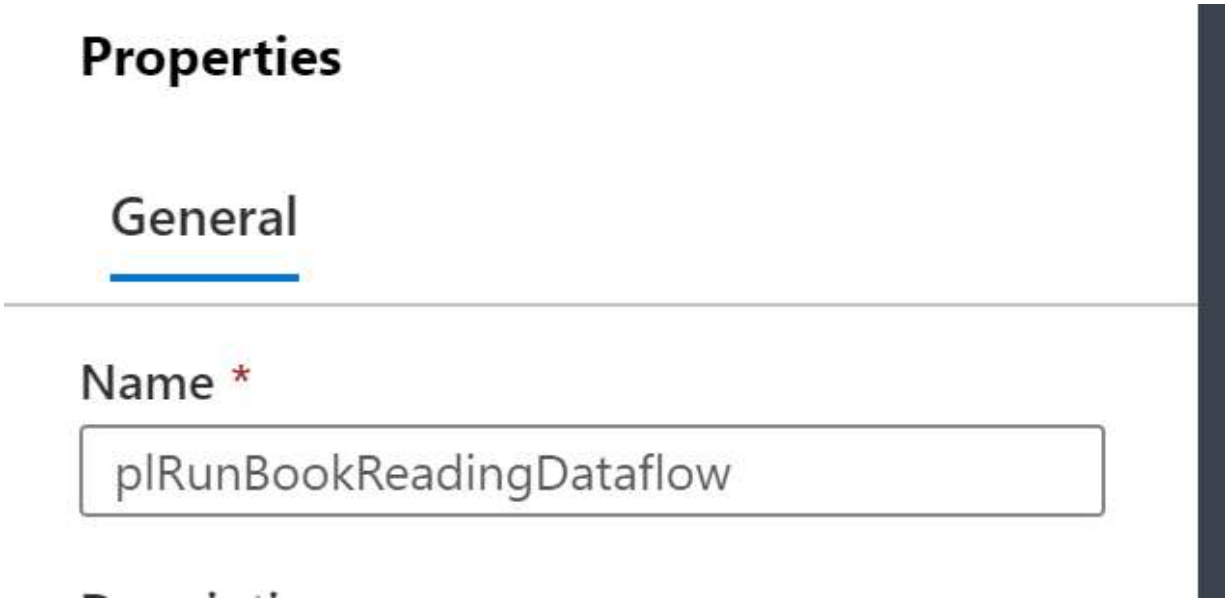
Exercise 3 has been completed.

Exercise 4: Create a Pipeline to run the Data Flow

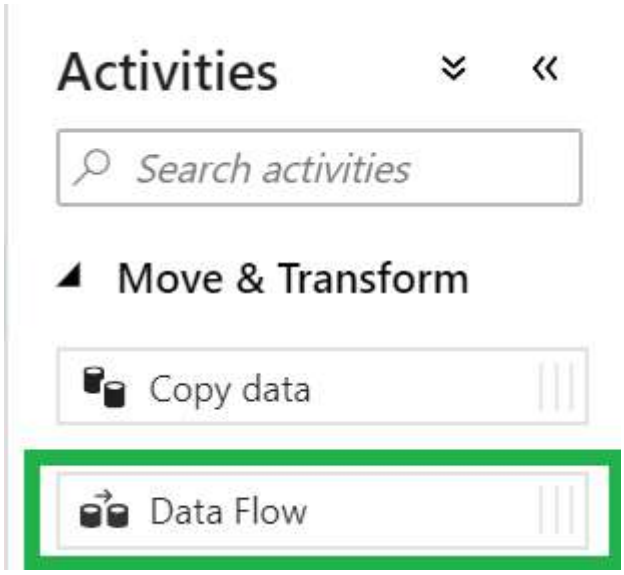
1. Select the **Plus Sign +** next to the Filter resources by name box and select **Pipeline** to create a new pipeline.



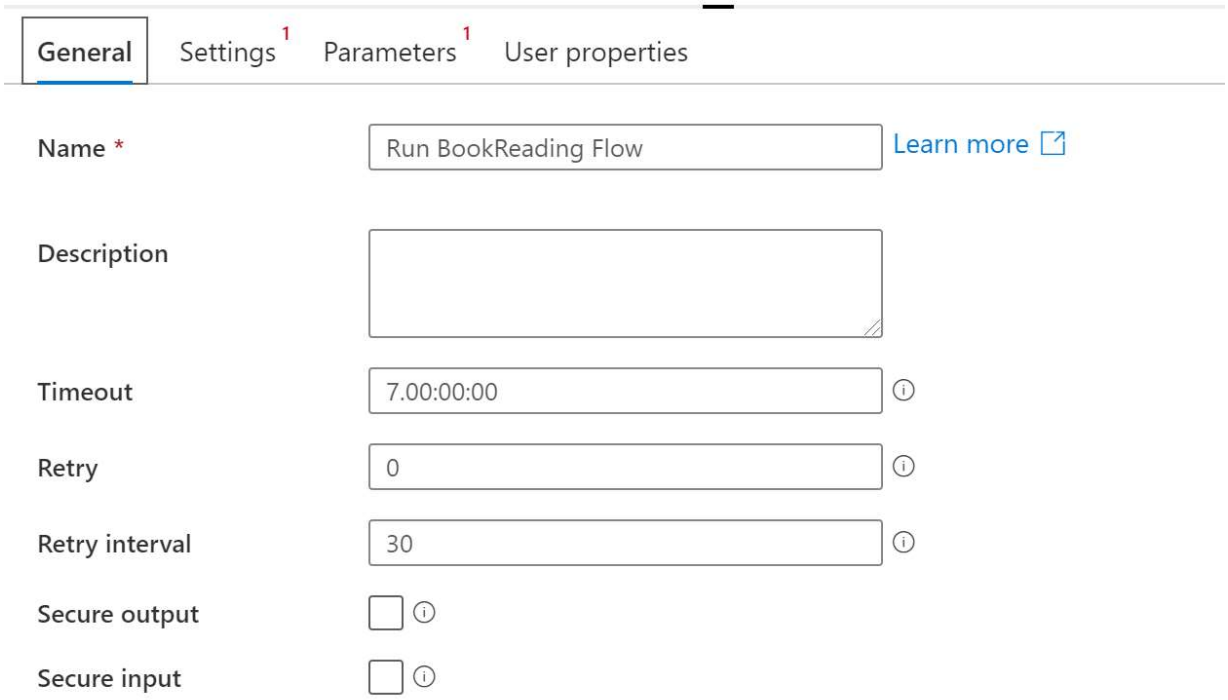
2. Rename the pipeline **plRunBookReadingDataflow**



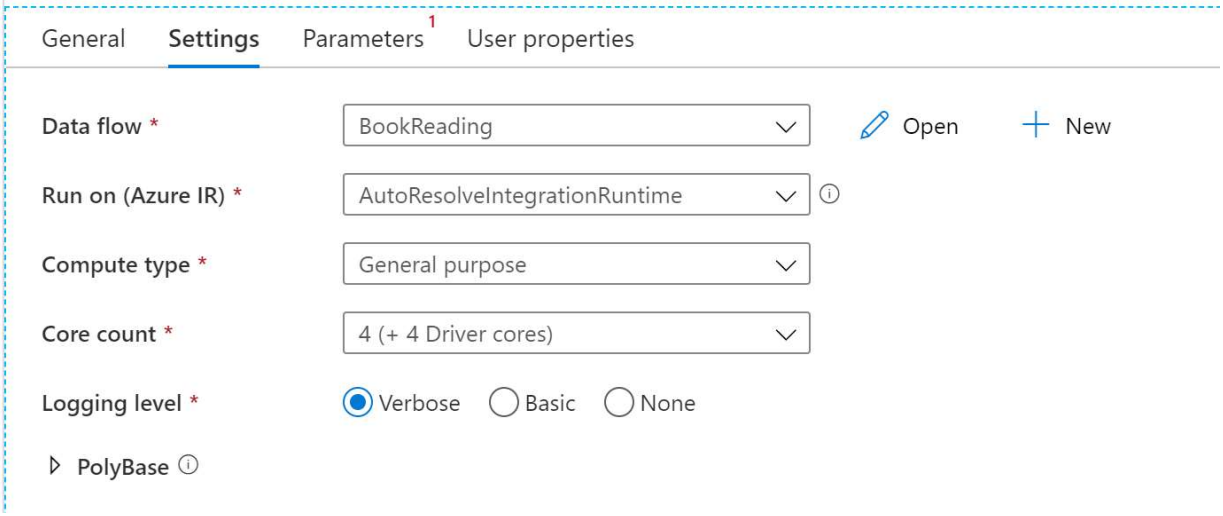
3. Expand **Move & Transform** and drag the **Data Flow** activity onto the canvas.



4. Under General, name the activity **Run BookReading Flow**.



5. Click on the **Settings** tab. Select the **BookReading** data flow from the Data flow drop down. Leave the Integration Runtime default values.

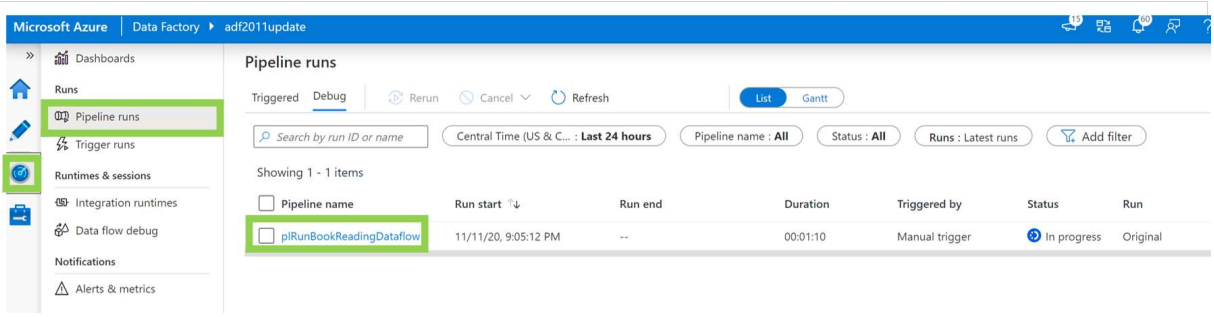


6. Select **Publish all**.

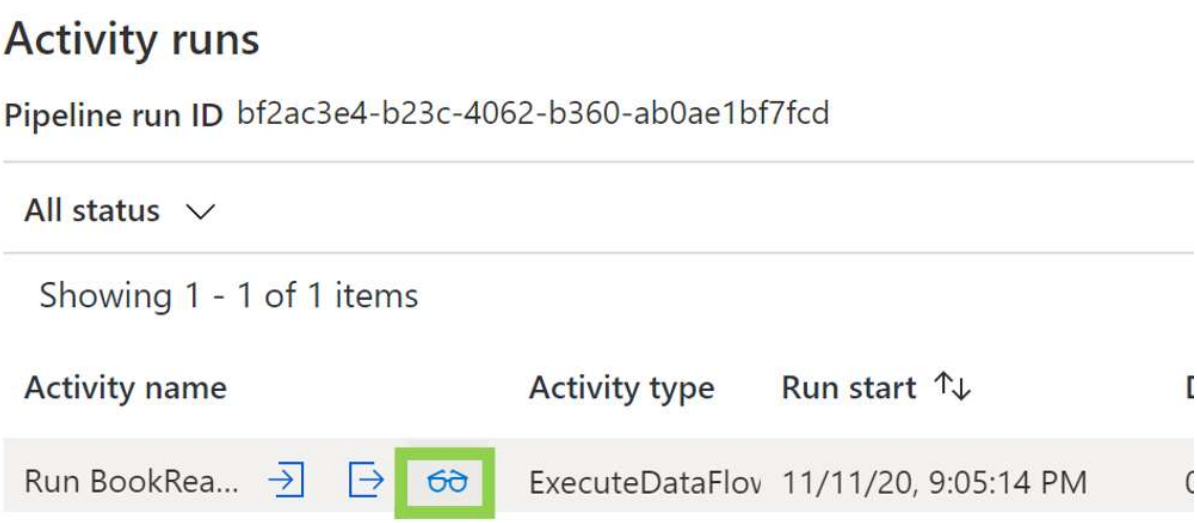
Exercise 4 has been completed.

Exercise 5: Run the Pipeline and Data Flow

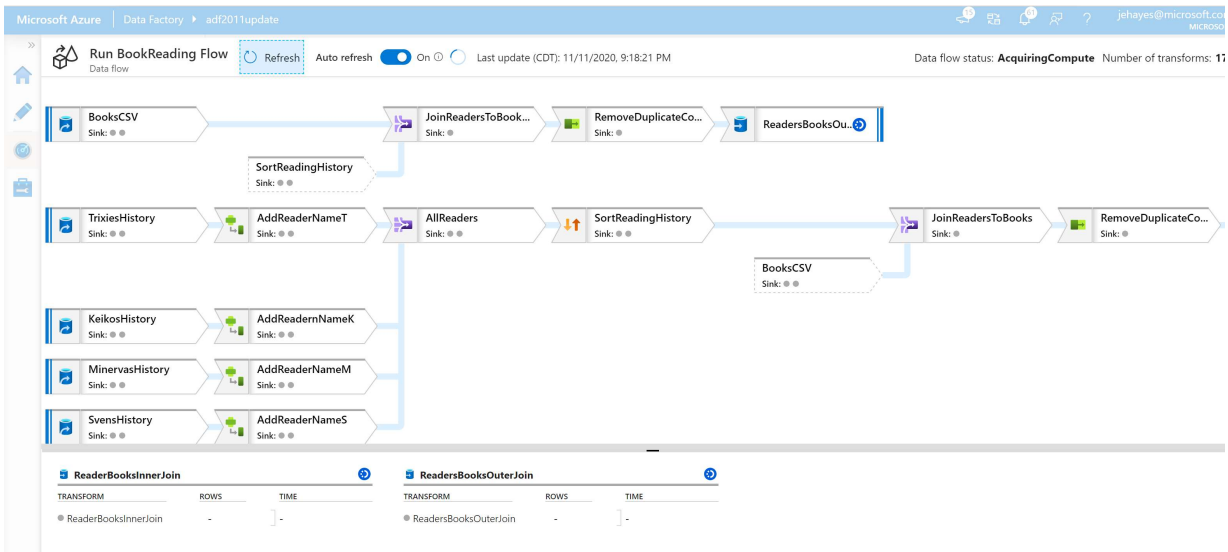
1. Once publishing has completed successfully, choose **Trigger,** select **Trigger now** and press **Ok**.
2. Select Monitor on the left side of the portal, and see the pipeline running. Click on the **Pipeline name**.



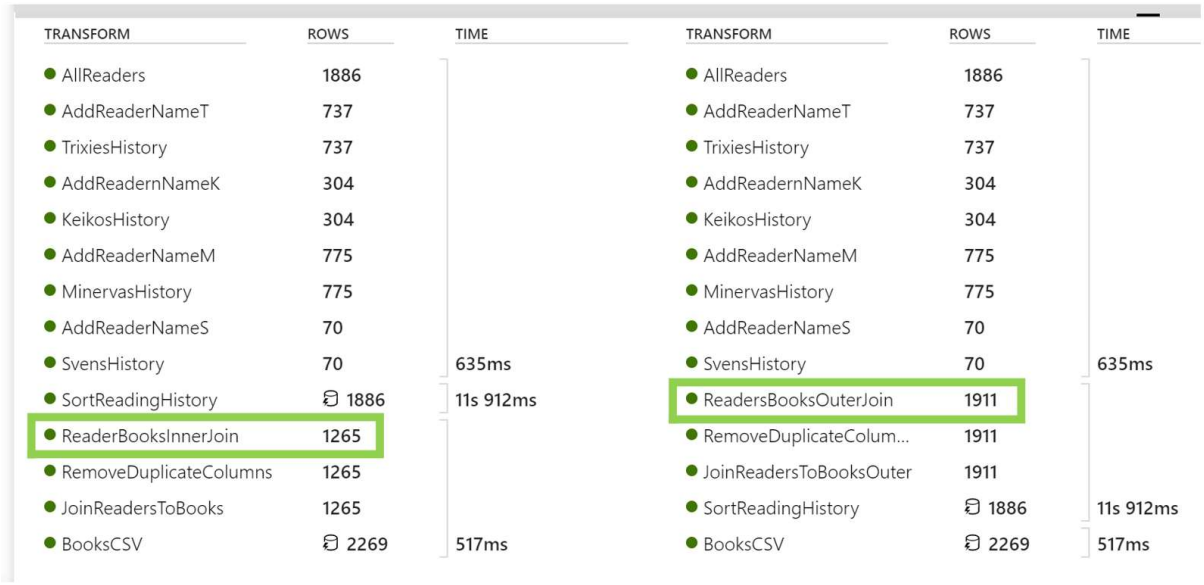
3. Select the glasses icon to see the **details** of the activity.



4. The screenshot below shows the transformation activities being run. The screen will refresh every 60 seconds until the run is complete if Auto refresh is on (as shown below.) Note the time AcquiringCompute in the upper right corner - this will take approximately 6 minutes.



5. After the Data flow is complete, you can see the statistics for the time and number of rows processed. Compare the outputs from the two csv files, ReadBooksInnerJoin and ReadBooksOuterJoin . Why were there differences in the rows returned in each of the csv files?



TRANSFORM	ROWS	TIME
AllReaders	1886	
AddReaderNameT	737	
TrixiesHistory	737	
AddReadernNameK	304	
KeikosHistory	304	
AddReaderNameM	775	
MinervasHistory	775	
AddReaderNameS	70	
SvensHistory	70	635ms
SortReadingHistory	1886	11s 912ms
ReaderBooksInnerJoin	1265	
RemoveDuplicateColumns	1265	
JoinReadersToBooks	1265	
BooksCSV	2269	517ms

TRANSFORM	ROWS	TIME
AllReaders	1886	
AddReaderNameT	737	
TrixiesHistory	737	
AddReadernNameK	304	
KeikosHistory	304	
AddReaderNameM	775	
MinervasHistory	775	
AddReaderNameS	70	
SvensHistory	70	635ms
ReadersBooksOuterJoin	1911	
RemoveDuplicateColum...	1911	
JoinReadersToBooksOuter	1911	
SortReadingHistory	1886	11s 912ms
BooksCSV	2269	517ms

Exercise 5 has been completed.

Using Azure Key Vault

Introduction

During this lab, you will learn how to store and retrieve credentials used by Azure Data Factory linked services in Azure Key Vault, improving the security of your environment.

Estimated Time

20 minutes

Objectives

At the end of this lab, you will be able to:

- Configure Data Factory to communicate with Azure Key Vault.
- Retrieve secrets from Azure Key Vault in Azure Data Factory.

Logon Information

Use the following credentials to sign into virtual environment.

- Username: **Admin**
- Password: **Passw0rd!**

Table of Contents

Exercise 1: Create the Data Factory Service Identity

Exercise 2: Store and Retrieve secrets in Azure Key Vault

Lab: Azure Data Factory Security

During this lab, you will learn how to securely store secrets in Azure Key Vault for use with Azure Data Factory.

Exercise 1: Create the Data Factory Service Identity

This exercise shows how to create the Azure Data Factory Service Identity.

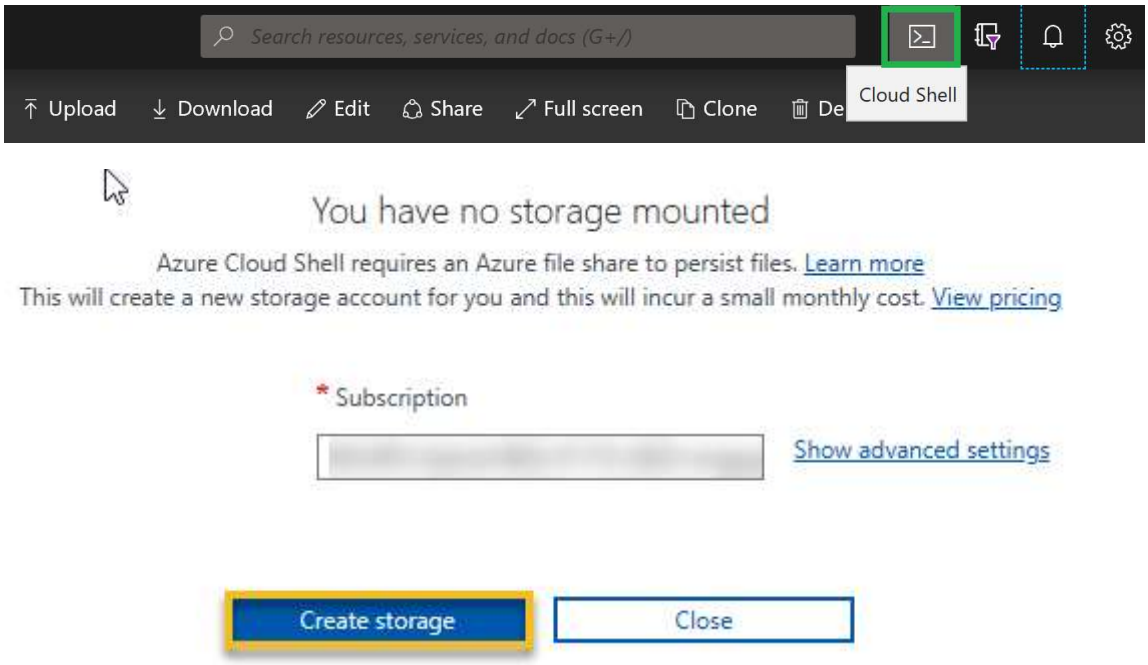
Tasks

1. Open Edge and navigate to http://portal.azure.com/ to connect to the Microsoft Azure Portal. Sign in with your subscription's credentials.

2. Create Managed Identity using PowerShell.

> ℹ A Managed Identity is automatically created when you create the Data Factory in the Azure Portal or with PowerShell. If you create the Data Factory from an ARM template (like we did in a previous lab), you will need to run a PowerShell command which will create the Managed Identity in the existing Data Factory.

   a. Open the Cloud Shell from the Azure Portal. Launching **Cloud Shell** and select **PowerShell**, it will ask you to create a storage account.



   b. Modify and run the following command:

```
Set-AzDataFactoryV2 -ResourceGroupName resource_group_name -Name ADF_name -Location eastus
```

   c. You may get a warning that says the Data Factory already exists. If you do, just select Y since this will just create the Managed Identity for the Data Factory.

> ℹ You will not lose your Data Factory assets (pipelines, linked services, etc.).

```
PS /home/jean> Set-AzDataFactoryV2 -ResourceGroupName adf2011update -Name adf2011adf  -Location eastus2

Confirm
A data factory with the name adf2011adf in the resource group adf2011update exists.
Continuing execution may overwrite the existing one.
Are you sure you want to continue?
[Y] Yes  [N] No  [S] Suspend  [?] Help (default is "Y"): Y
```

Exercise 1 has been completed.

Exercise 2: Store and Retrieve secrets in Azure Key Vault

This exercise shows how to configure Azure Data Factory to securely store secrets in Azure Key Vault. To configure the trust between the two services you will need to have completed **Module 01, Lesson 02, Lab 02**.

The method shown in this lab, using the SQL Database created in **Module 01, Lesson 02, Lab 02**, can be used with many other services where connection strings and credentials are required, such as Azure Storage, CosmosDB, etc.

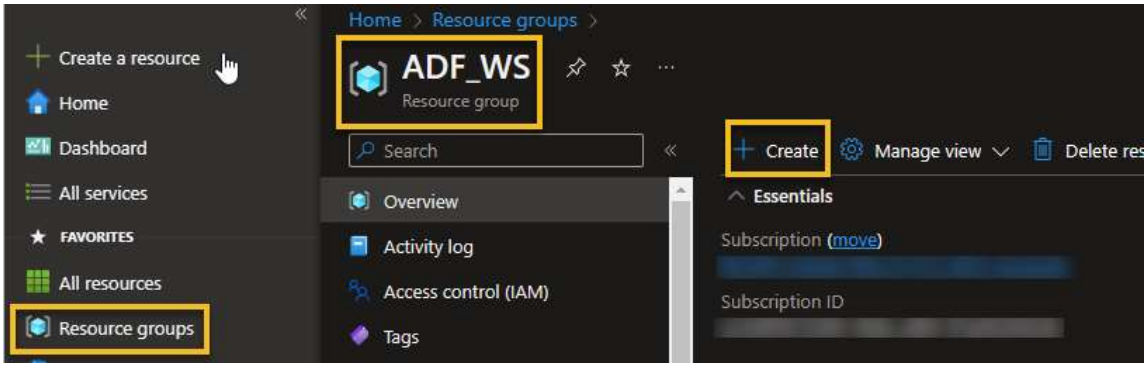
Tasks

1. Create an Azure Key Vault resource.

    a. Go to **Resource Groups**.

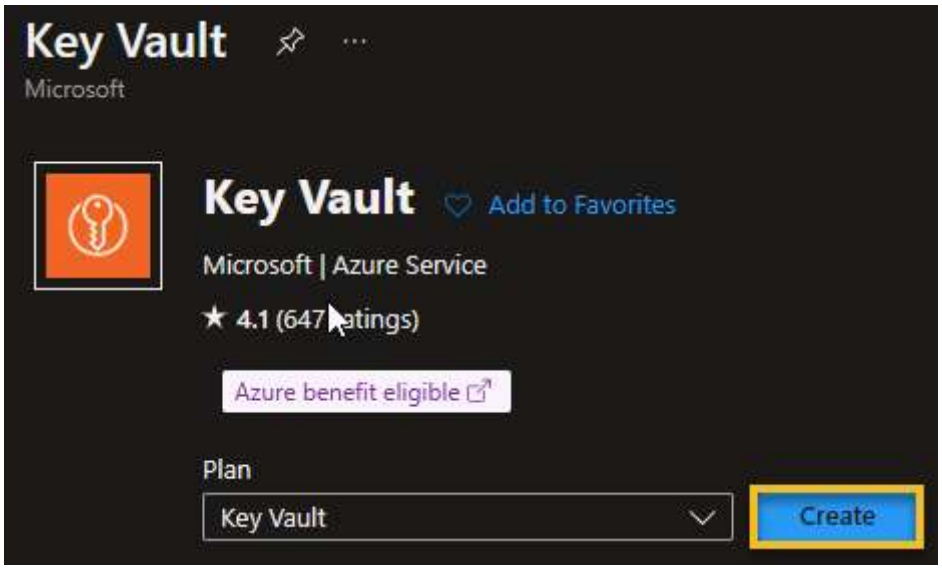
    b. Go to your resource group.

    c. Click on **+ Create** to create a new Azure Key Vault.

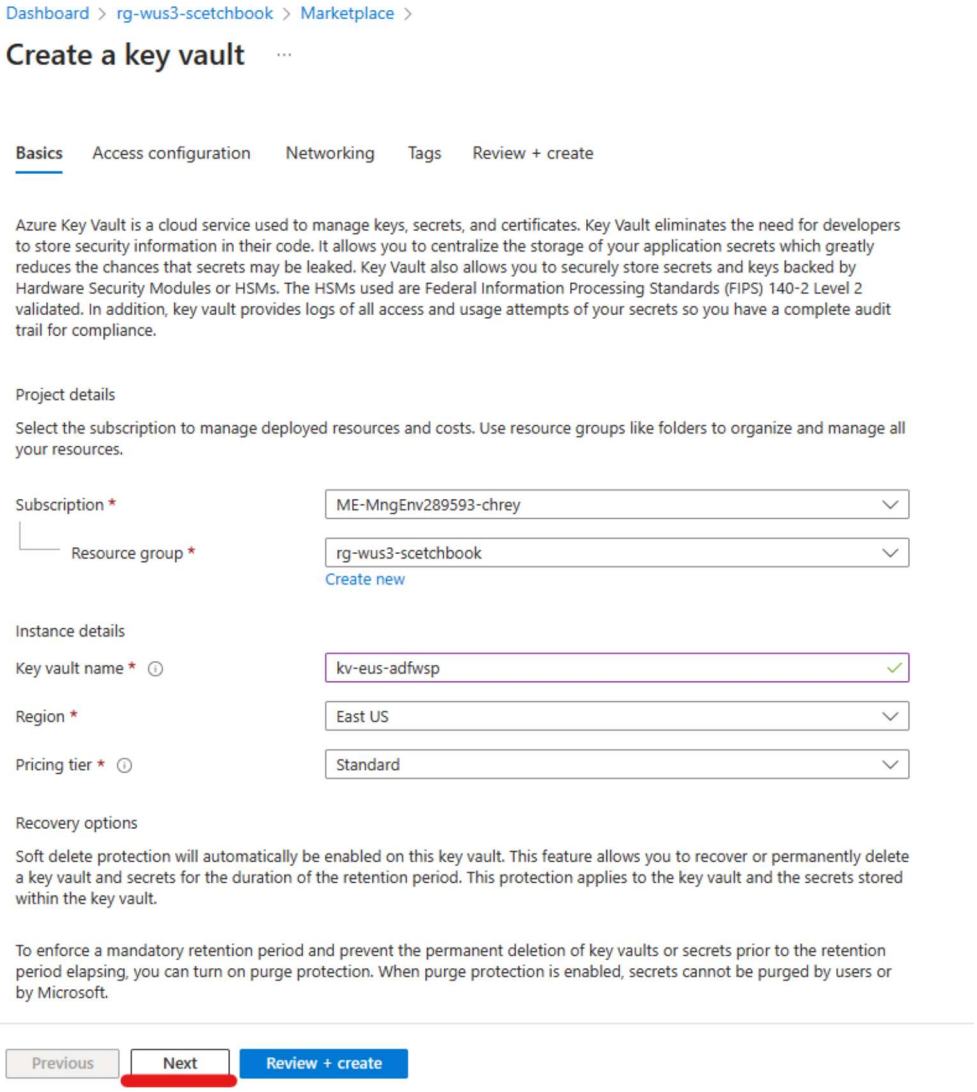


    d. Search for **Key Vault** and select the resource.

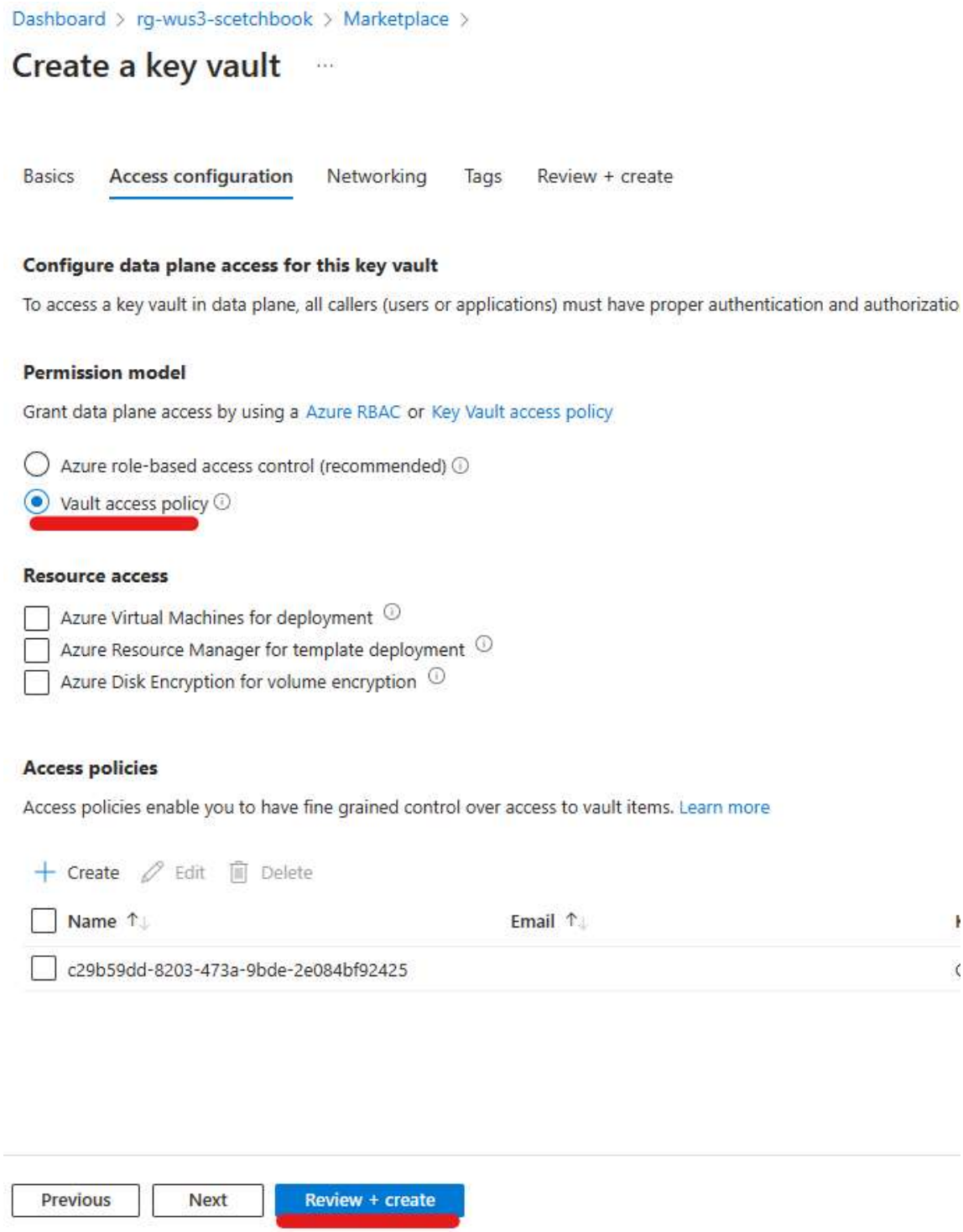
e. Click **Create**.



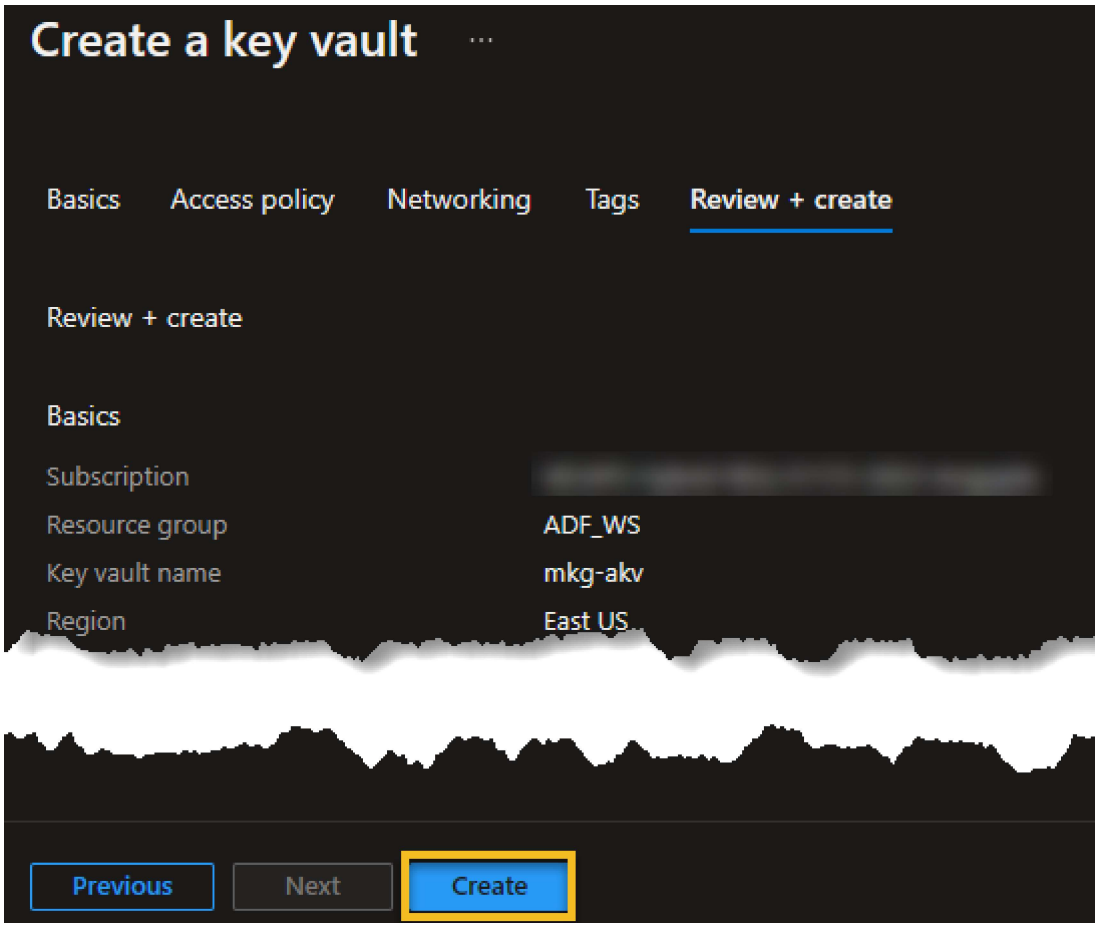
f. Confirm your resource group name, enter in unique Key Vault Name and click **Next**.



g. In **Permission Model** change radio to **Vault Access Policy**



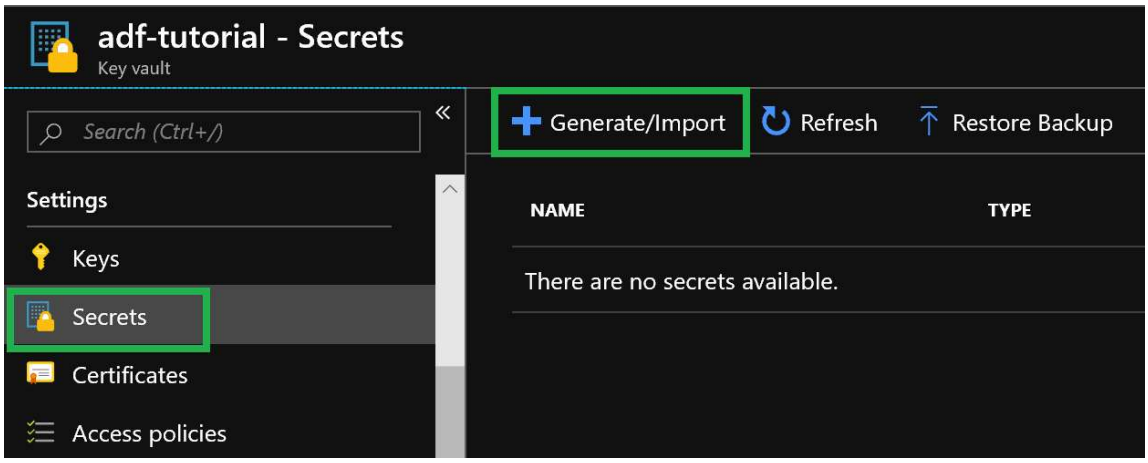
h. Click **Review and Create** and then **Create**



2. Once the Key Vault is provisioned, navigate to it in the Azure Portal and select Settings > **Secrets**.

3. Create a new secret to save SQL Server connection strings.

    a. Select **+Generate/Import** to create a new secret.



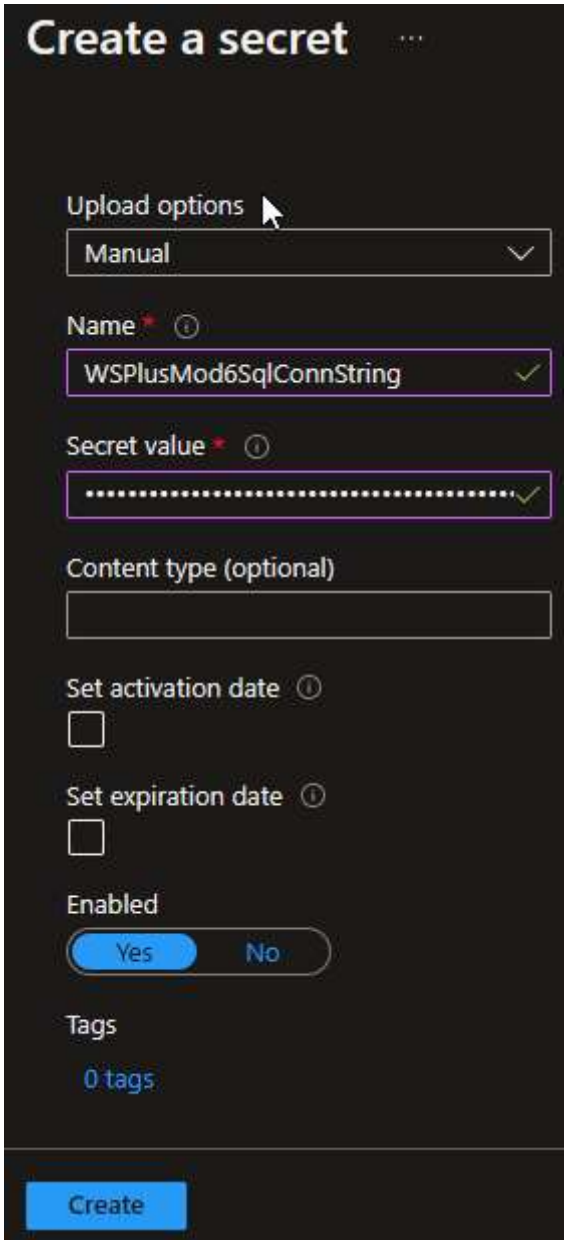
    b. Ensure that Upload options is set to **Manual**.

    c. Give the secret a meaningful name (for example: WSPlusMod6SqlConnString). Use the following text as the **Value** after you modify the parameter values to reference your Azure SQL Server, Azure SQL Database, User ID and Password.

T Server=tcp:<*serverName*>.database.windows.net; Database=<*dbName*>; User ID=<*loginName*>; Password=<*password*>; Trusted_Connection=False; Encrypt=True;

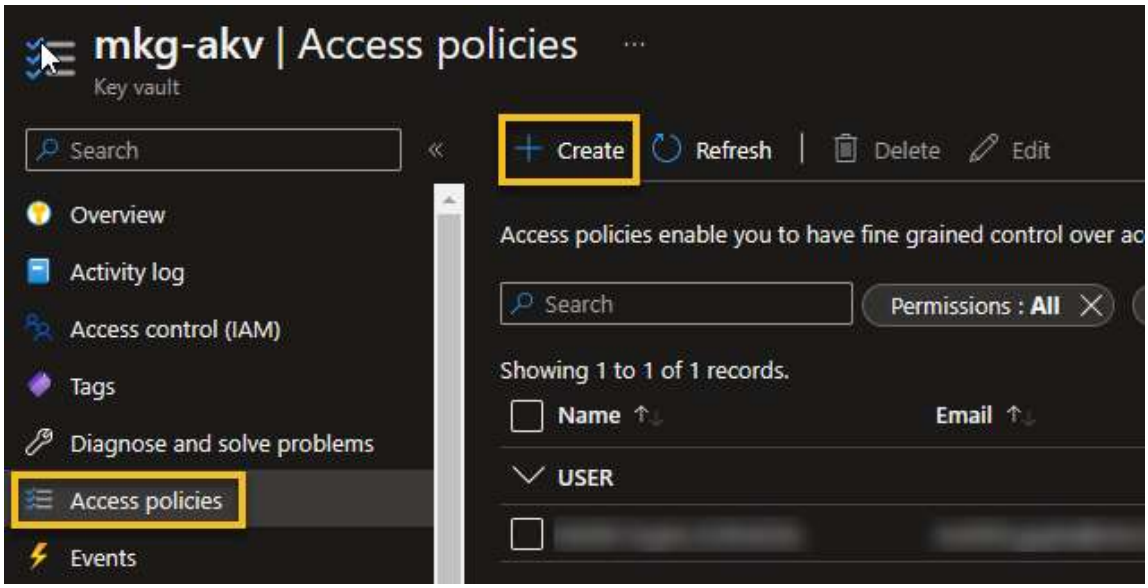
> ☐ Paste the above text to notepad and update the values in the <> brackets (remove the brackets) before copying to ADF.

d. Click the **Create** button.



4. Grant the Azure Data Factory access to Azure Key Vault.

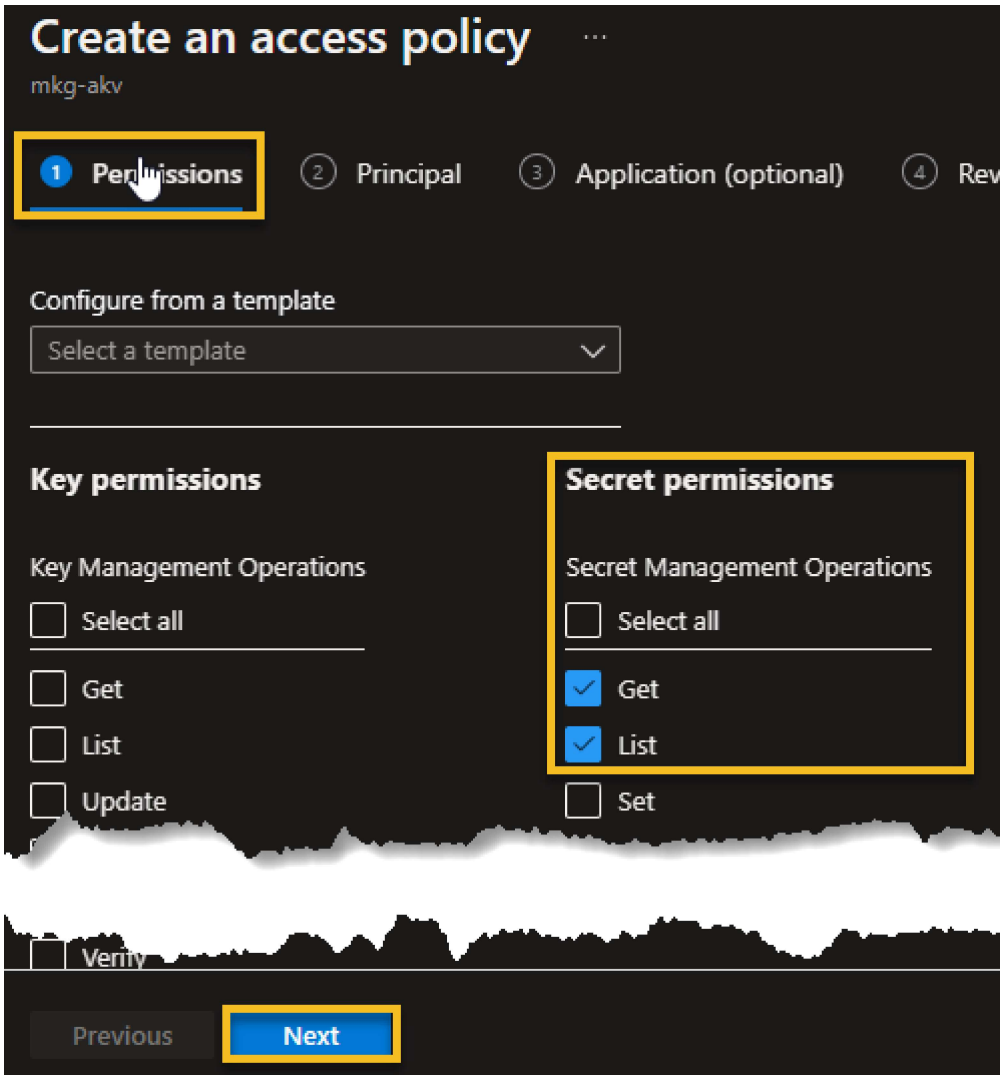
   a. In the Azure Key Vault resource. Select Access Policies and click on **+ Create**.



b. Azure Key Vault allows you define permissions on each of the object types that can be saved in the Key Vault. Keys, Secrets, and Certificates. We only created a Secret. Therefore, we will grant the Azure Data Factory **Managed Identity** acount permission to read the contents of the secret. From **Permission** list, select **Get** and **List**. Click **Next** to select the principal account.

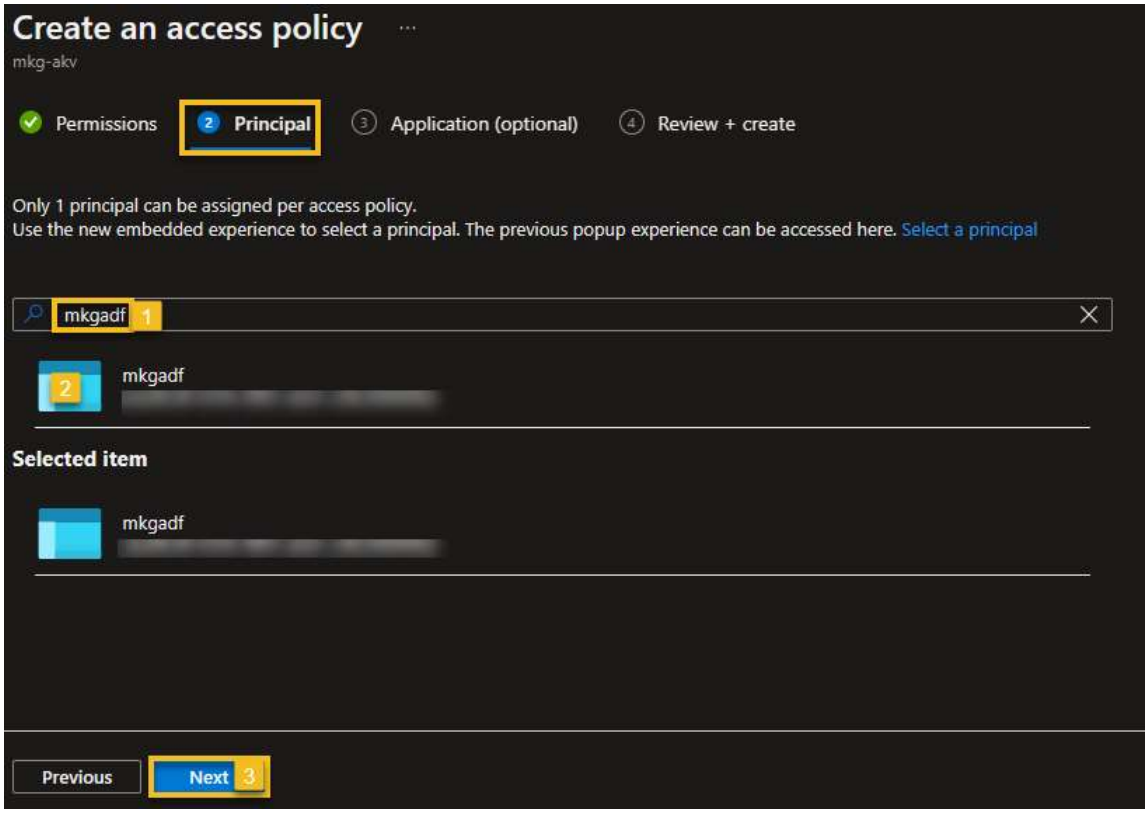
> ☐ In production you will only grant **Get** permission (read). You will not expose all the screats in the key vault with **List**.

> ℹ Do not use a template option, as it grants more permissions then needed.



c. Search for your Azure Data Factory name, select and click **Next**.

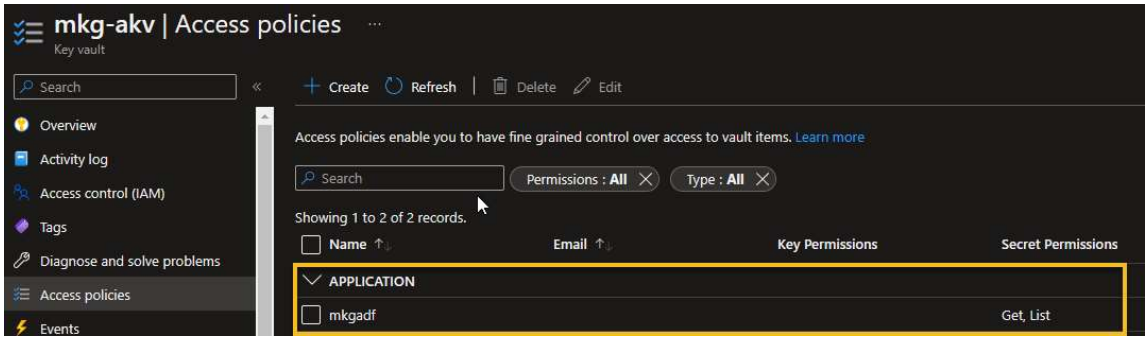
> ☐ If your ADF does not show up in the list, then the managed identity account is missing. Review Exercise 1.



d. Click **Next** on Step 3.

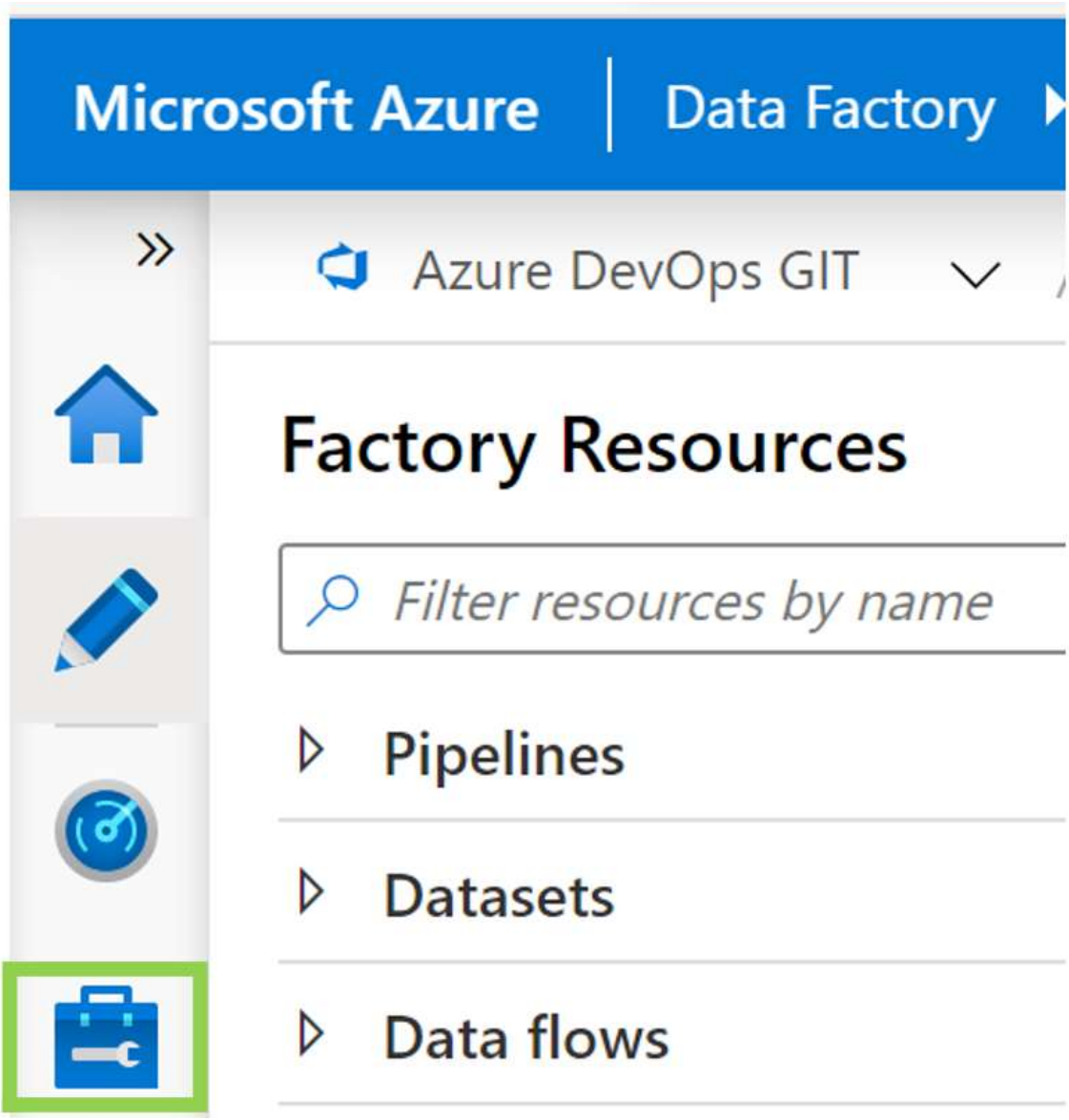
e. Click **Create** on Step 4.

f. You should see your ADF listed as an application after creation.

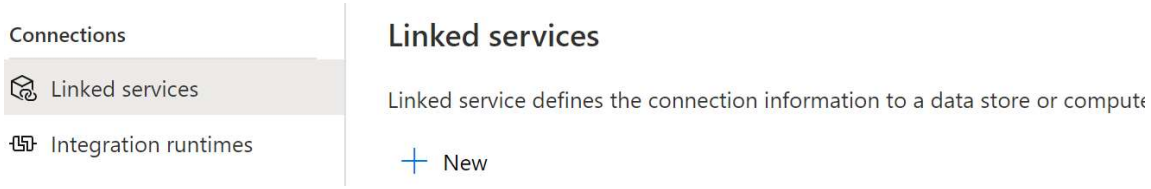


5. Create a Key Vault Linked Services pipeline

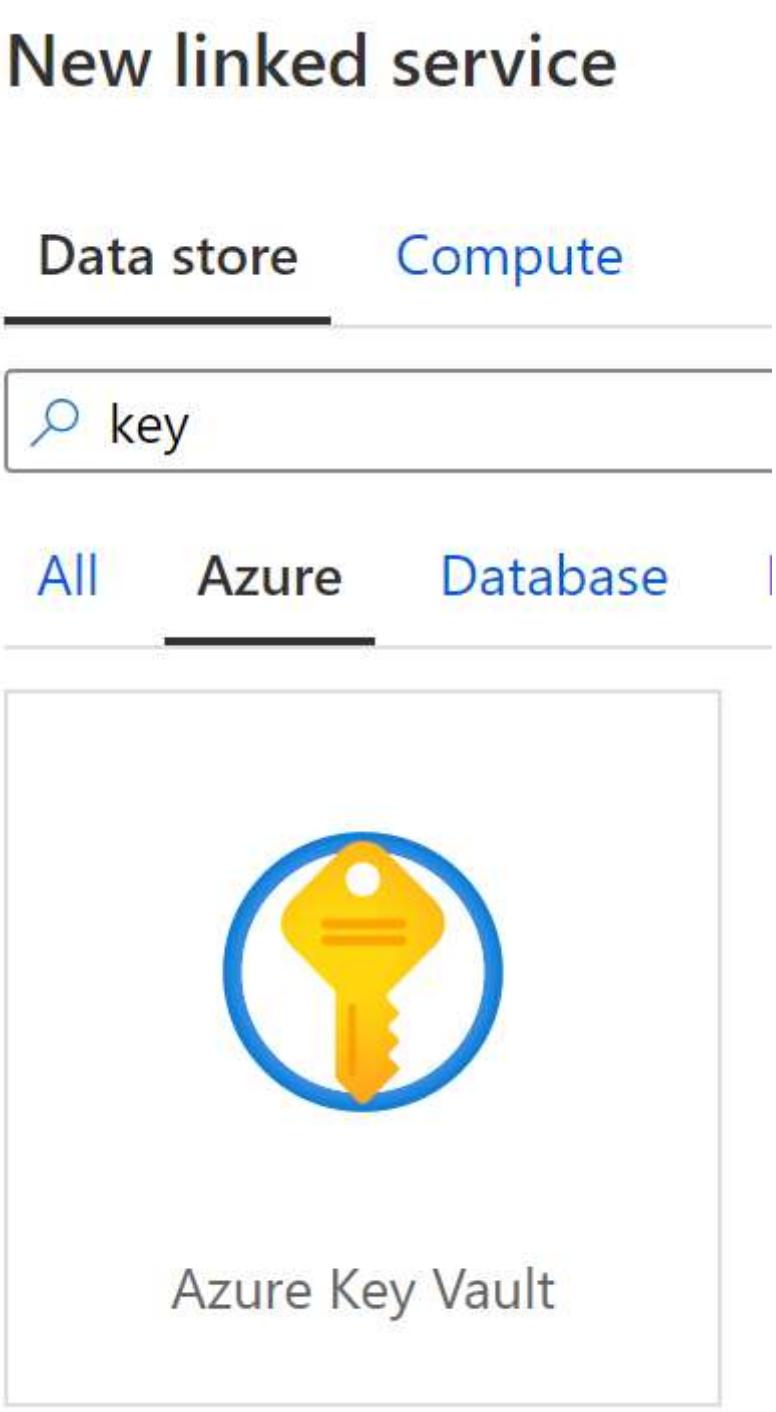
a. In your Data Factory portal, select the **Manage/Toolbox** link.



b. Choose **+New** under the Linked Services tab.



c. Select the **Azure Key Vault** linked service type and **Continue**.



d. Give the linked service a suitable name and locate the Key Vault within your Azure subscription.

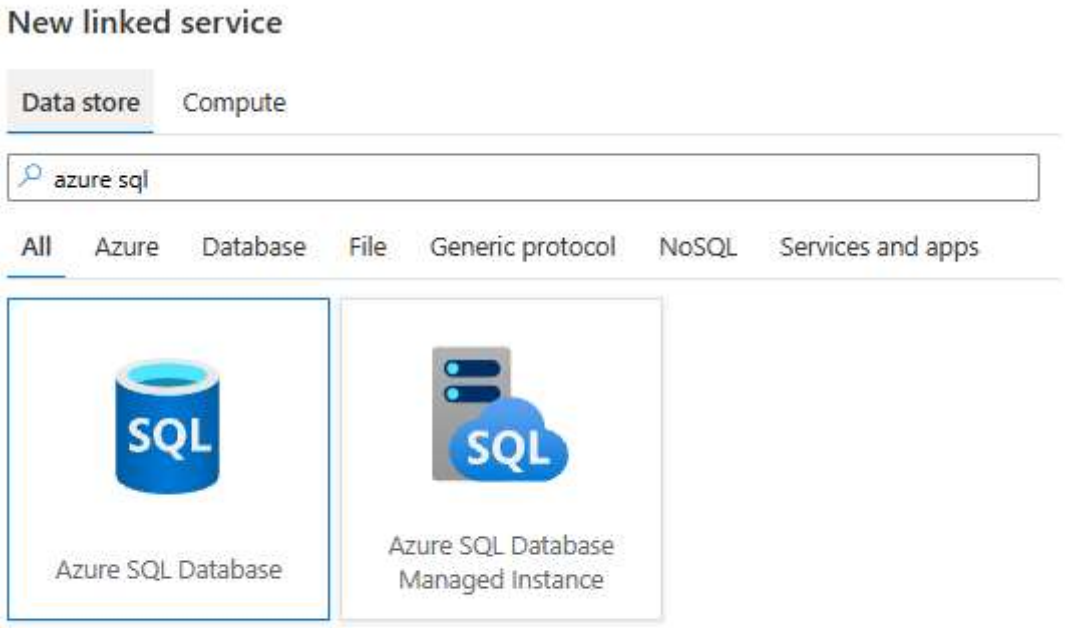
e. Select **Test Connection** and make sure the connection succeeds. If it doesn't succeed then you need to check the Key Vault access policies for the Service Identity.

f. Click **Create**.

6. Reference secrets stored in key vault

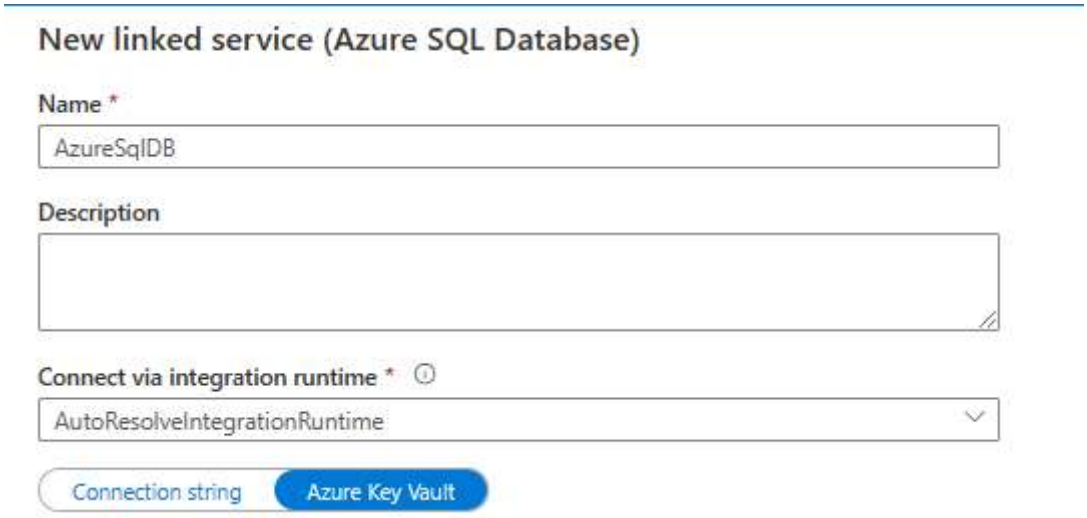
a. We will use an Azure SQL Database to demonstrate this functionality. You should already have an Azure SQL Database from earlier labs and the pre-requisites, if not go to the Azure Portal and provision a database.

b. From Linked services select **+New** and create a new connection to the **Azure SQL Database**.



c. Give the connection a meaningful name.

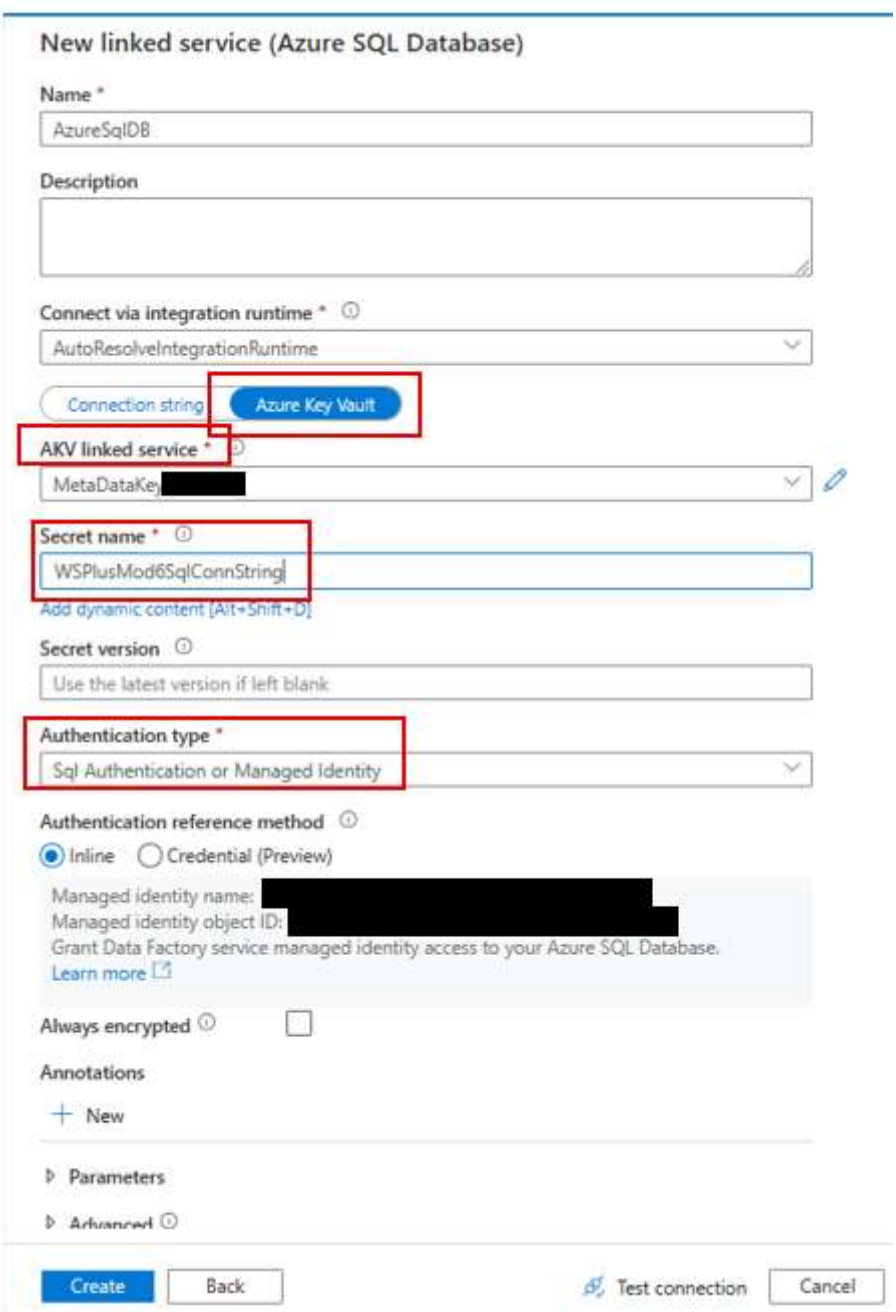
d. Change the selection from Connection String to **Azure Key Vault**.



e. Select the **AKV** linked service from the drop-down below.

f. Enter the name of the secret which you created earlier in this lesson (for example: WSPlusMod6SqlConnString).

g. Optionally enter the version you wish to use; best practice is to leave blank, which uses the latest version. This allows Data Factory to always use the most recent version of the secret without any changes needing to be made.



h. Select **Test connection** next to the Cancel button above and make sure that the connection succeeds. It may take a little longer to connect as the connection string needs to be retrieved from the Key Vault.

i. Then click on the **Create** button.

Congratulations you have now configured Data Factory to retrieve secrets from Key Vault. From here you could configure a Dataset and Pipeline to use the connection. With the test connection success, we have demonstrated the configuration to satisfy the purpose of this lab.

Exercise 2 has been completed.