Experiment: Data Engineering Pipeline

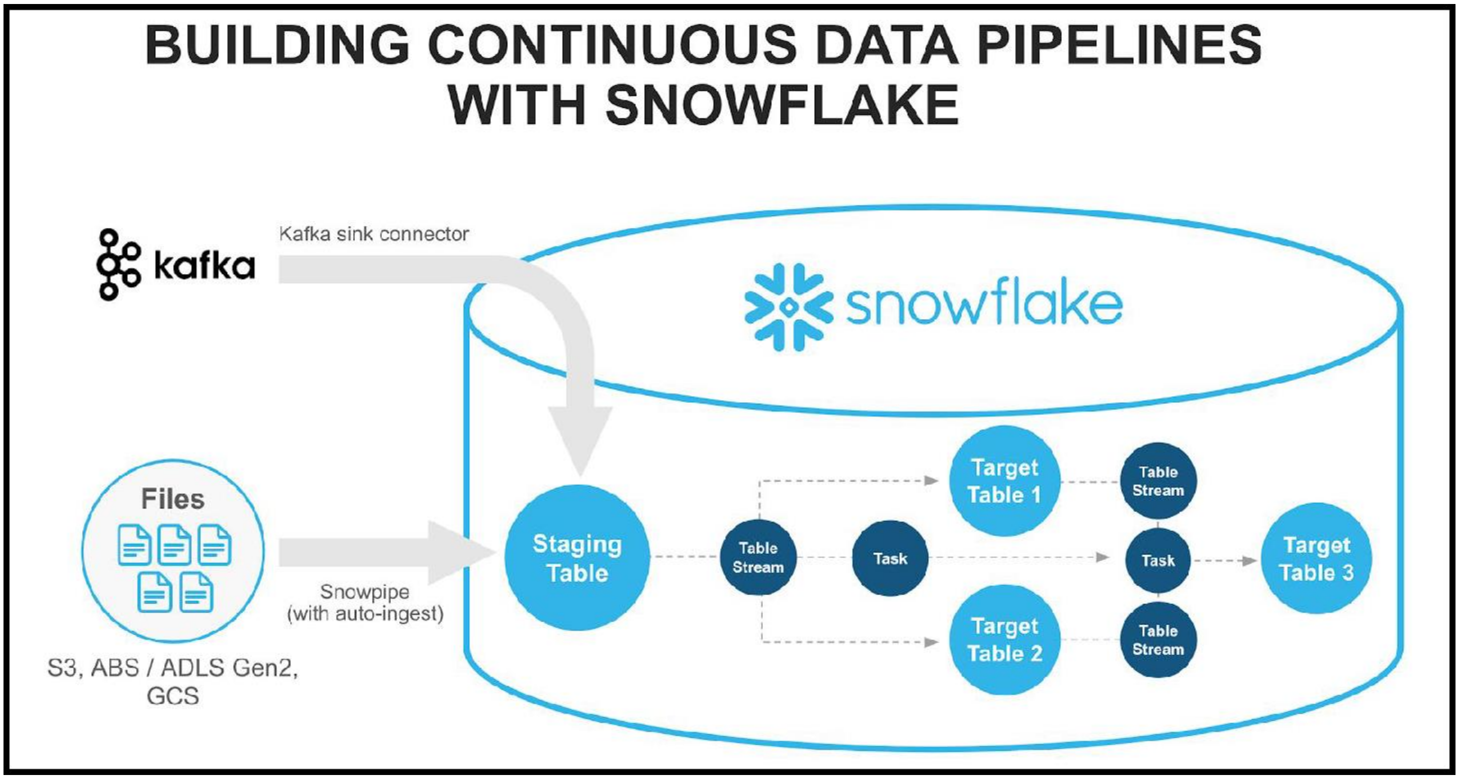
Overview

This experiment demonstrates Snowflake features specifically aligned to “Data Engineering” workload to build modern data pipelines. Data pipelines automate many of the manual steps involved in transforming and optimizing continuous data loads. Frequently, the “raw” data is firstloaded temporarily into a staging table used for interim storage and then transformed using a series of SQL statements before it is inserted into the destination reporting tables. The most efficient workflow for this process involves transforming only data that is new or modified.

Snowflake provides the following features to enable continuous data pipelines:

- Continuous data loading using Snowpipe, Snowflake Connector for Kafka, or Third-party data integration tools.
- Change data tracking using Streams.
- Recurring tasks.

The below picture illustrates how to build continuous data pipelines with Snowflake.



Snowflake Connector for Kafka makes it fast and easy to reliably publish continuous streams of records from Kafka to your Snowflake instance for storage and analysis. The Streams and Tasks features enable you to build data pipelines and turn Snowflake into a nimble data transformation engine in addition to a powerful data warehouse.

What you'll learn

This hands-on lab will demonstrate using the following features of the platform:

1. Create a Stage and configure it to automatically call **Snowpipe** using S3 event notifications. NOTE: This will require the user to create an external AWS S3 bucket in order to demonstrate.
2. **Streams** - Abstraction over staging table used by Snowpipe to allow one time processing of ingested data.
3. **Tasks** (in conjunction with Stored Procedures) - Regularly scheduled execution of transformation logic over data in the stream.

Environment

- We will use our Snowflake free 30-day trial environment.
- AWS Account provided by our session leader.

Experiment 21: Prepare Environment

21.1 Create AWS Account

21.1.1 If you were to do this lab in the future you would have to create or have access to an AWS account. Please create a new account using this link -Create AWS Account. Once logged in to your account select an AWS region closest to your Snowflake account, US-WEST-2 (Oregon), US-EAST-2 (Ohio) and US-EAST-1(N.Virginia) are good choices.

21.2 Download Snowflake SQL files to your local machine

21.2.1 SQL file **ModernDataPipelines_ExperimentDataSetup.sql** - to create database, warehouse, and data setup for the labs.

21.2.2 SQL file **ModernDataPipelines_ExperimentStoredProcedures.sql** - to create stored procedures for
(1) mimicking periodically arriving data and (2) for cleanup of files that are successfully loaded.

21.2.3 SQL file **ModernDataPipelines_Experiment.sql** - to configure/create Snowpipe, Streams, Tasks, and execute the end-to-end data pipeline.

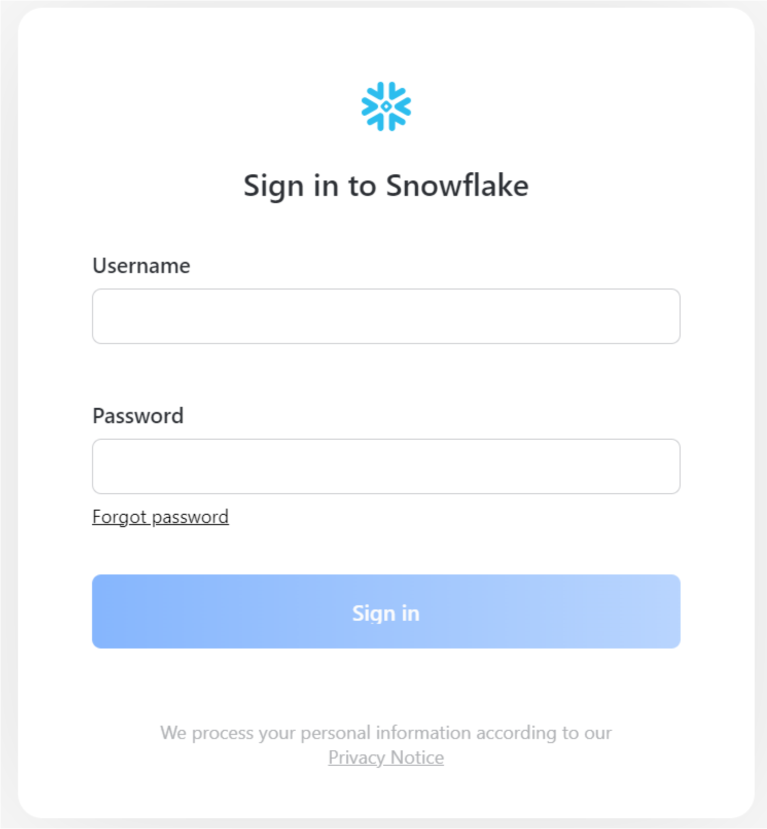
21.2.4 SQL file **ModernDataPipelines_ExperimentCleanup.sql** - to remove all the Snowflake data/objects.

21.3 Data Setup in Snowflake for the labs

About the screen captures, sample code, and environment
Screen captures in this experiment depict examples and results that may slightlyvary from what you may see when you complete the

21.3.1 Open a browser window and enter the URL of your Snowflake 30-day trial environment.

21.3.2 You should see the login screen below. Enter your unique credentials to log in.



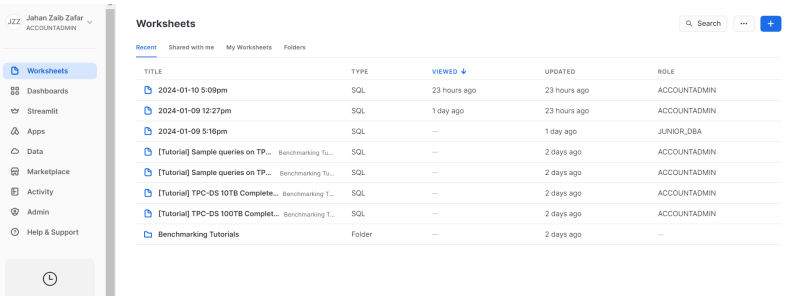
Sign in to Snowflake

Username

Password

We process your personal information according to our Privacy Notice

The top and side menu allows you to switch between the different areas of Snowflake:



Worksheets

TITLE	TYPE	VIEWED ↓	UPDATED	ROLE
2024-01-10 5:09pm	SQL	23 hours ago	23 hours ago	ACCOUNTADMIN
2024-01-09 12:27pm	SQL	1 day ago	23 hours ago	ACCOUNTADMIN
2024-01-09 5:16pm	SQL	—	1 day ago	JUNIOR_DBA
[Tutorial] Sample queries on TP... Benchmarking Tu...	SQL	—	2 days ago	ACCOUNTADMIN
[Tutorial] Sample queries on TP... Benchmarking Tu...	SQL	—	2 days ago	ACCOUNTADMIN
[Tutorial] TPC-DS 10TB Complete... Benchmarking T...	SQL	—	2 days ago	ACCOUNTADMIN
[Tutorial] TPC-DS 100TB Complet... Benchmarking T...	SQL	—	2 days ago	ACCOUNTADMIN
Benchmarking Tutorials	Folder	—	2 days ago	—

21.3.3 The **Warehouses** tab is where you set up and manage compute resources (virtual warehouses) to load or query data in Snowflake. Note a warehouse called “COMPUTE_WH (XL)” already exists in your environment.

21.3.4 If you click on the top right of the UI where your username appears, you will see that here you can do things like change your password, roles, or preferences. Snowflake has several system defined roles. You are currently in the default role of SYSADMIN and we will Switch the role to ACCOUNTADMIN for these labs.

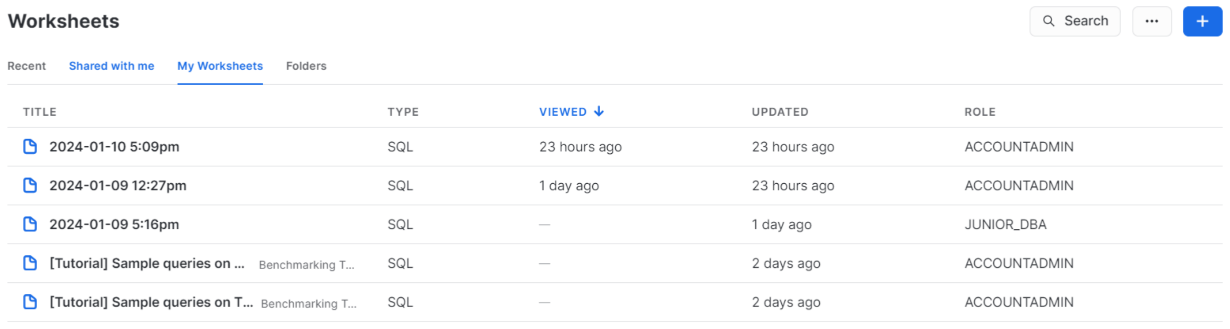
ACCOUNTADMIN
For most in these experiment you will remain in the ACCOUNTADMIN role which has privileges to create warehouses and databases and other objects in an account.

In a real-world environment, you would use different roles for the tasks in this experiment, and assign the roles to your users. More on access control in Snowflake isin towards the end of this experiment and also at https://docs.snowflake.net/manuals/user-guide/security-access-control.html

21.3.5 The **MY Worksheets** tab provides an interface for submitting SQL queries, performing DDL and DML operations and viewing results as your queries/operations complete. The default “Worksheet 1” appears.

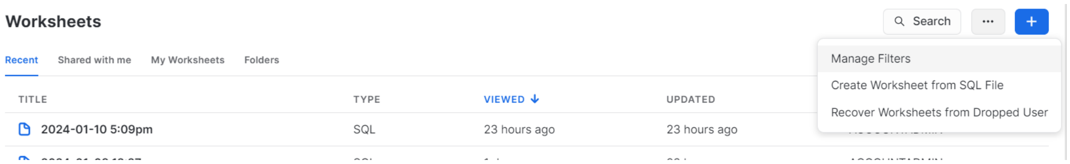
In the left pane is the database objects browser which enables users to explore all databases, schemas, tables, and views accessible by the role selected for a worksheet. The bottom pane shows results of queries and operations.

The various windows on this page can be resized by moving the small sliders on them. And if during the lab you need more room to work in the worksheet, collapse the database objects browser in the left pane. Many of the screenshots in this guide will have this database objects browser closed.

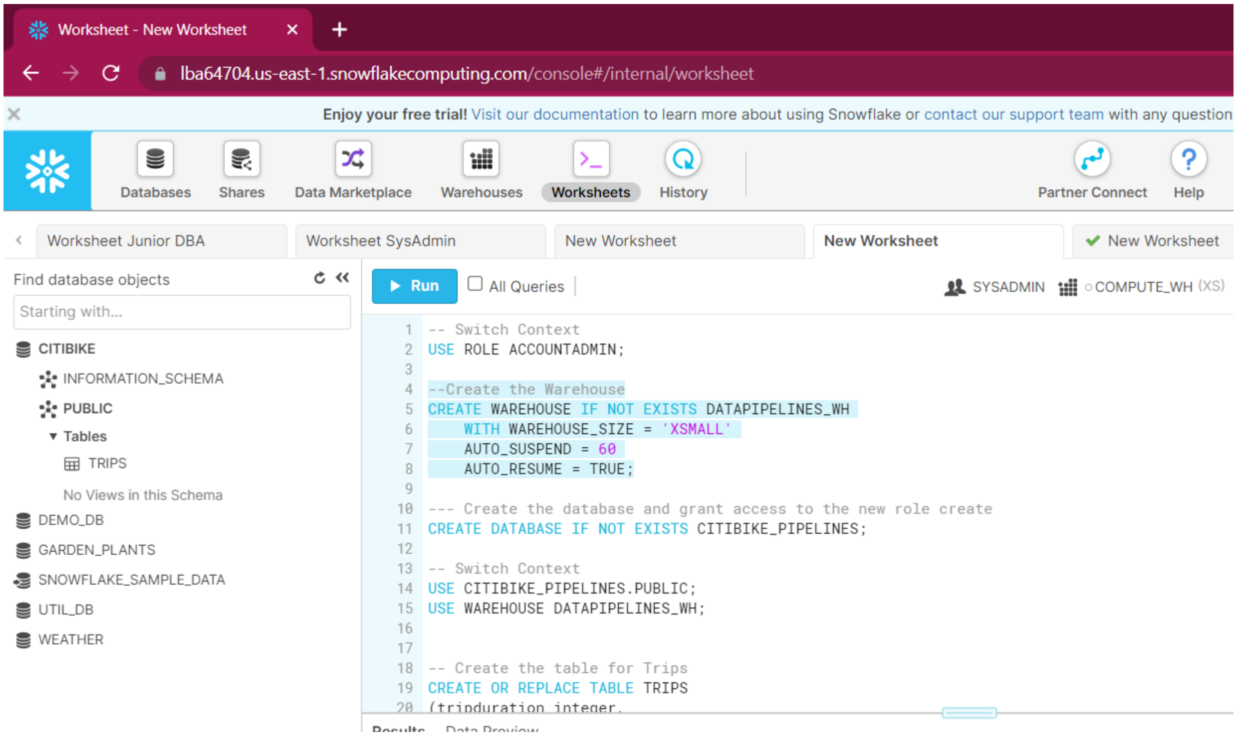


TITLE	TYPE	VIEWED ↓	UPDATED	ROLE
2024-01-10 5:09pm	SQL	23 hours ago	23 hours ago	ACCOUNTADMIN
2024-01-09 12:27pm	SQL	1 day ago	23 hours ago	ACCOUNTADMIN
2024-01-09 5:16pm	SQL	—	1 day ago	JUNIOR_DBA
[Tutorial] Sample queries on ... Benchmarking T...	SQL	—	2 days ago	ACCOUNTADMIN
[Tutorial] Sample queries on T... Benchmarking T...	SQL	—	2 days ago	ACCOUNTADMIN

21.3.6 At the top left of the default “Worksheets” just to the right of the worksheet tab, click on the three dots(...) next to Search button,select “Create Worksheet From SQL File”, then browse “**ModernDataPipelines_ExperimentDataSetup.sql**” file you downloaded in the prior section and select “Open”.



TITLE	TYPE	VIEWED	UPDATED
2024-01-10 5:09pm	SQL	23 hours ago	23 hours ago



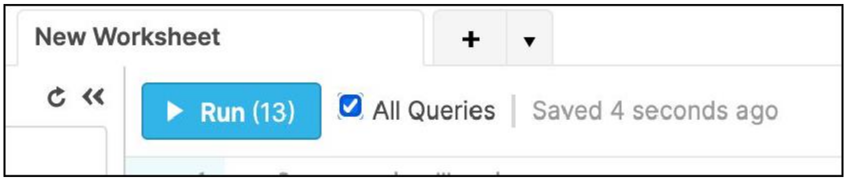
```
-- Switch Context
USE ROLE ACCOUNTADMIN;

--Create the Warehouse
CREATE WAREHOUSE IF NOT EXISTS DATAPIPELINES_WH
    WITH WAREHOUSE_SIZE = 'XSMALL'
    AUTO_SUSPEND = 60
    AUTO_RESUME = TRUE;

--- Create the database and grant access to the new role create
CREATE DATABASE IF NOT EXISTS CITIBIKE_PIPELINES;

-- Switch Context
USE CITIBIKE_PIPELINES.PUBLIC;
USE WAREHOUSE DATAPIPELINES_WH;


-- Create the table for Trips
CREATE OR REPLACE TABLE TRIPS
(tripduration integer,
```

Warning - Do Not Copy/Paste SQL From This PDF to a Worksheet
Copy-pasting the SQL code from this PDF into a Snowflake worksheet will result in formatting errors and the SQL will not run correctly. Make sure to use the “Load Script” method just covered above.

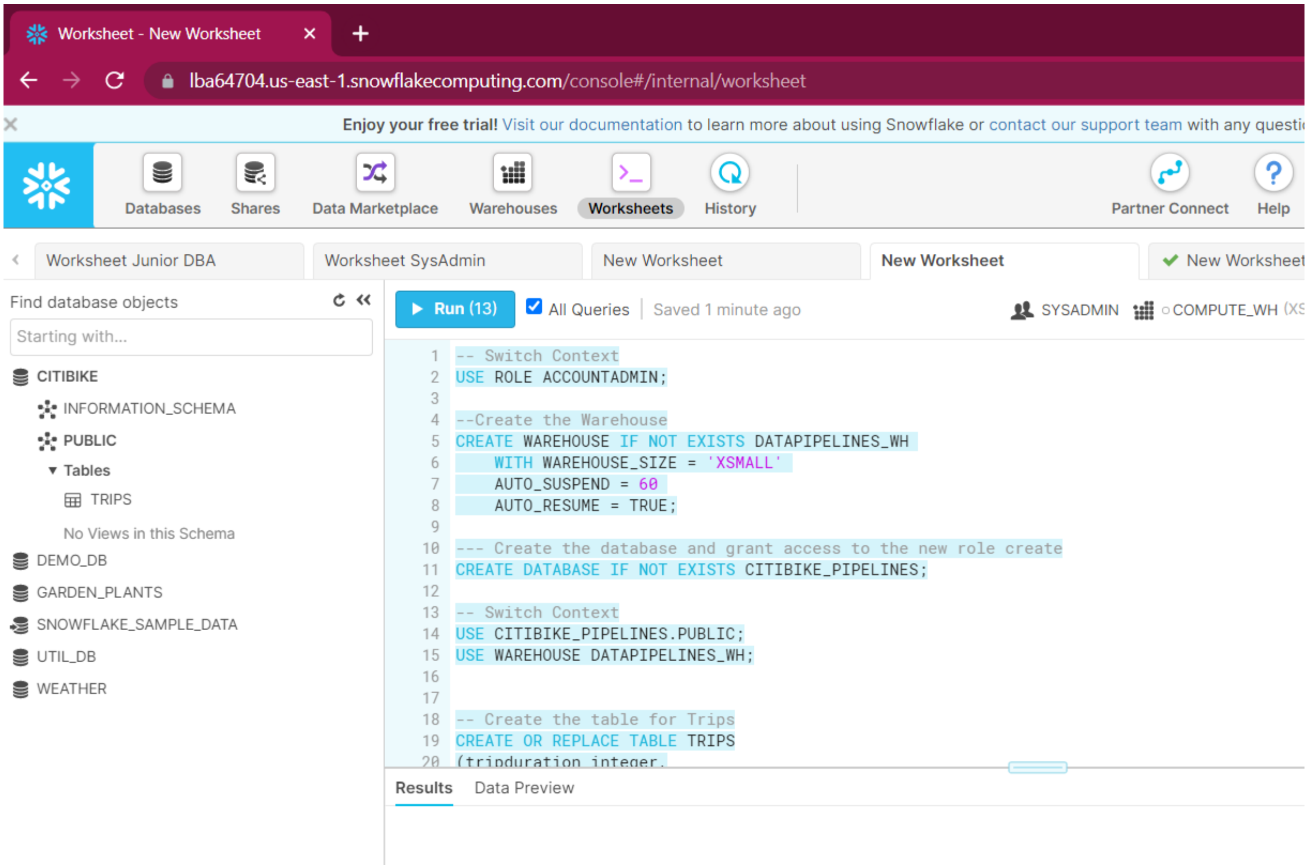
On older or locked-down browsers, this “load script” step may not work as the browser will prevent you from opening the .sql file. If this is the case, open the .sql file with a text editor and then copy/paste all the text from the .sql file to the “Worksheets”

Worksheets vs the UI
Much of the configurations in this lab will be executed via this pre-written SQL in the Worksheets in order to save time. These configurations could also be done via the UI in a less technical manner but would take more time.

21.3.7 All of the SQL commands for the lab data setup will now appear on the new worksheet. ***Click the checkbox before "All Queries"*** inside the worksheet and execute by clicking on Run.



21.3.8 Ensure the database, tables and data is loaded by reviewing the results.



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```
-- Switch Context
USE ROLE ACCOUNTADMIN;

--Create the Warehouse
CREATE WAREHOUSE IF NOT EXISTS DATAPIPELINES_WH
    WITH WAREHOUSE_SIZE = 'XSMALL'
    AUTO_SUSPEND = 60
    AUTO_RESUME = TRUE;

--- Create the database and grant access to the new role create
CREATE DATABASE IF NOT EXISTS CITIBIKE_PIPELINES;

-- Switch Context
USE CITIBIKE_PIPELINES.PUBLIC;
USE WAREHOUSE DATAPIPELINES_WH;


-- Create the table for Trips
CREATE OR REPLACE TABLE TRIPS
(tripduration integer,
```

21.3.9 At this point the data setup for the labs is complete.

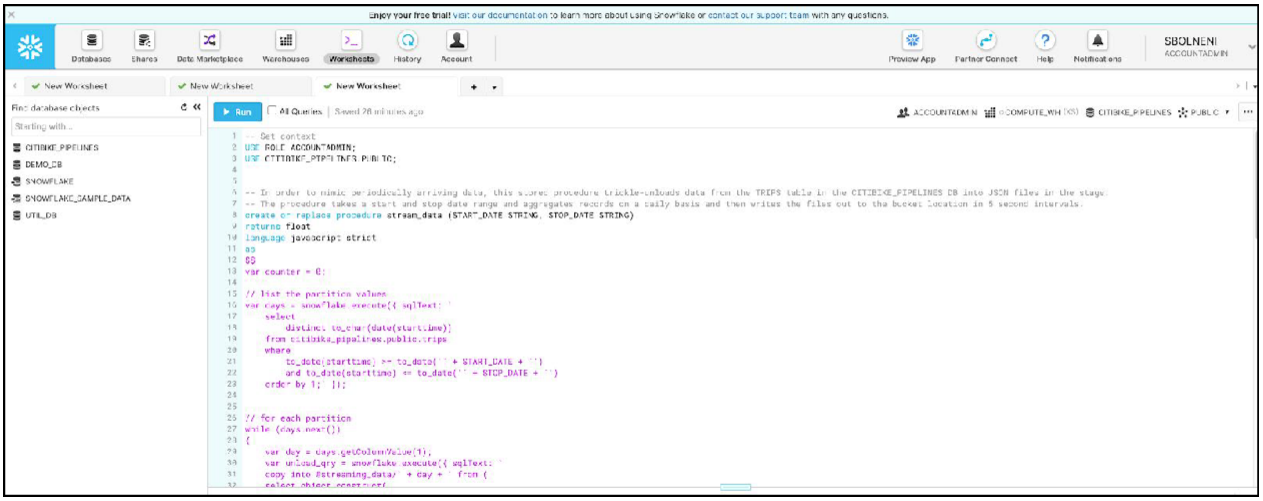
21.4 Stored Procedures for Data Generator & Cleaning Up Stage Files after Successful Load

21.4.1 In this section we will create two new stored procedures for data generation and cleaning up of stage files after successful load.

21.4.2 In order to mimic periodically arriving data, stored procedure ‘STREAM_DATA’ trickle-unloads data from the TRIPS table in the CITIBIKE_PIPELINES database into JSON files in the external stage which we will create in the next step. The procedure takes a start and stop date range and aggregates records on a daily basis and then writes the files out to the bucket location in 5 second intervals. When it is run, it will produce a steady flow of data arriving in your defined STAGE object.

21.4.3 In this lab, data being written to the External STAGE by the STREAM_DATA stored procedure will be automatically loaded into a table via Snowpipe. The ‘PURGE_FILES’ stored procedure will be used to clean up files that are successfully loaded. It will compare records entries in the information_schema.copy_history view with the file names still present in the stage. Files that were found to have been loaded are safely deleted by the procedure.

21.4.4 Similar to step 21.4.10 in the worksheets tab, click on the small, downward facing arrow,select “Load Script”, then browse to the “**ModernDataPipelines_ExperimentStoredProcedures.sql**” file you downloaded in section 21.3 and select “Open”.



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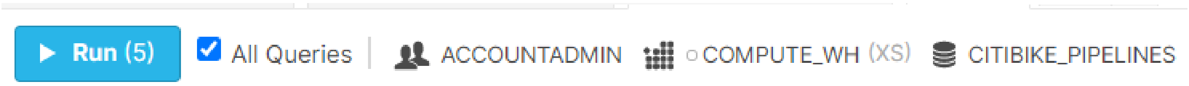
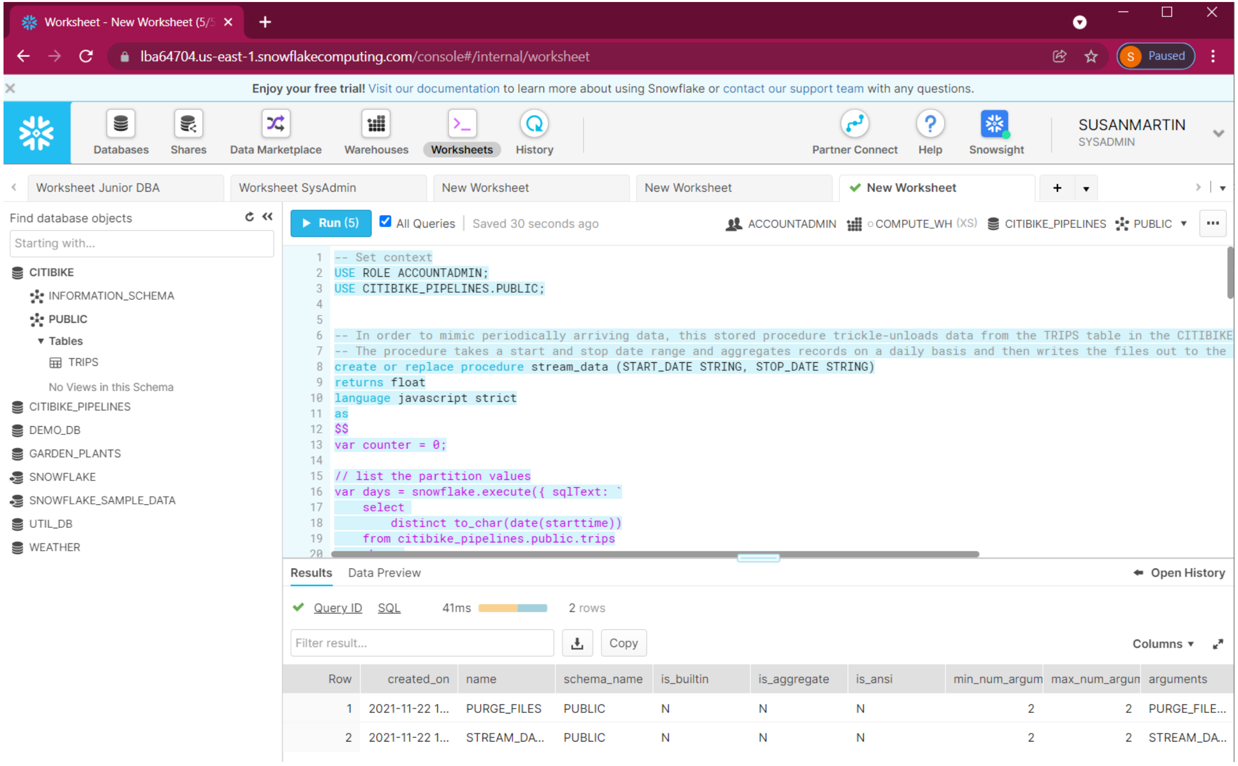
```
-- Set context
USE ROLE ACCOUNTADMIN;
USE CITIBIKE_PIPELINES.PUBLIC;


-- In order to mimic periodically arriving data, this stored procedure trickle-unloads data from the TRIPS table in the CITIBIKE_PIPELINES DB into JSON files in the stage.
-- The procedure takes a start and stop date range and aggregates records on a daily basis and then writes the files out to the bucket location in 5 second intervals.
create or replace procedure stream_data (START_DATE STRING, STOP_DATE STRING)
returns float
language javascript strict
as
$$
var counter = 0;

// list the partition values
var days = snowflake.execute({ sqlText: `
    select
        distinct to_char(date(starttime))
    from citibike_pipelines.public.trips
    where
        to_date(starttime) >= to_date('` + START_DATE + `')
        and to_date(starttime) <= to_date('` + STOP_DATE + `')
    order by 1;` });


// for each partition
while (days.next())
{
    var day = days.getColumnValue(1);
    var unload_qry = snowflake.execute({ sqlText: `
    copy into @streaming_data/` + day + ` from (
    select object_construct(
```

21.4.5 All of the SQL commands for setting the context and creating the stored procedures - ‘STREAM_DATA’, ‘PURGE_FILES’ will now appear on the new worksheet. ***Click the checkbox before “All Queries”*** inside the worksheet and execute by clicking on Run.



21.4.6 Ensure the stored procedures are created successfully by reviewing the results of ‘show procedures’ sql.



```
-- Set context
USE ROLE ACCOUNTADMIN;
USE CITIBIKE_PIPELINES.PUBLIC;


-- In order to mimic periodically arriving data, this stored procedure trickle-unloads data from the TRIPS table in the CITIBIKE
-- The procedure takes a start and stop date range and aggregates records on a daily basis and then writes the files out to the
create or replace procedure stream_data (START_DATE STRING, STOP_DATE STRING)
returns float
language javascript strict
as
$$
var counter = 0;

// list the partition values
var days = snowflake.execute({ sqlText: `
    select
        distinct to_char(date(starttime))
    from citibike_pipelines.public.trips
```

Row	created_on	name	schema_name	is_builtin	is_aggregate	is_ansi	min_num_argum	max_num_argun	arguments
1	2021-11-22 1...	PURGE_FILES	PUBLIC	N	N	N	2	2	PURGE_FILE...
2	2021-11-22 1...	STREAM_DA...	PUBLIC	N	N	N	2	2	STREAM_DA...

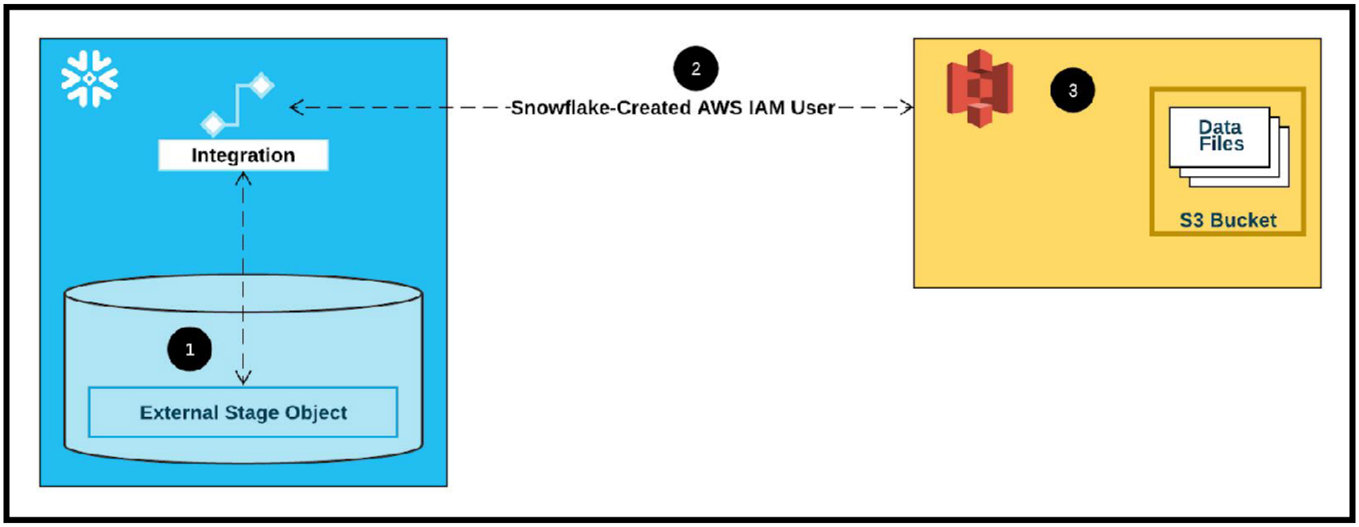
21.4.7 At this point the creation of stored procedures is complete.

21.5 Configuring Secure Access to Amazon S3

This section describes how to use storage integrations to allow Snowflake to read data from and write data to an Amazon S3 bucket referenced in an external (i.e. S3) stage. Integrations are named, first-class Snowflake objects that avoid the need for passing explicit cloud provider credentials such as secret keys or access tokens. Integration objects store an AWS identity and access management (IAM) user ID.

Note:
Completing the instructions in this section requires permissions in AWS to create and manage IAM policies and roles. If you are not an AWS administrator, ask your AWS administrator to perform these tasks.

The following diagram shows the integration flow for a S3 stage:



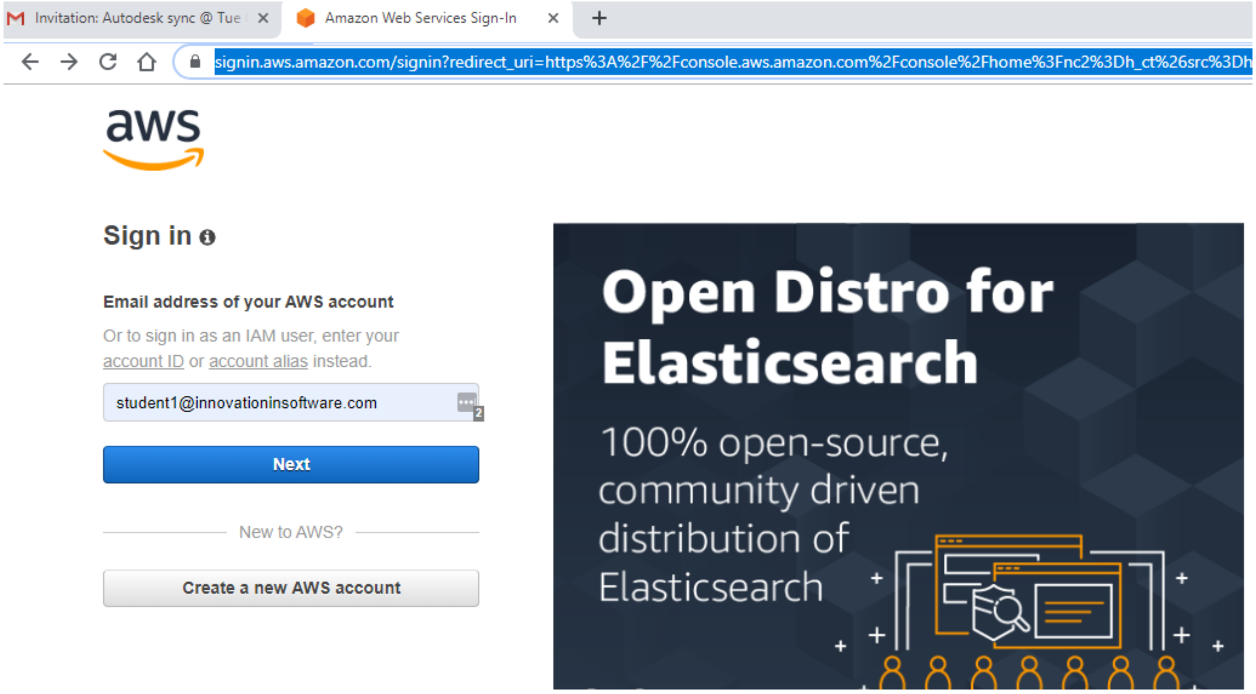
- An external (i.e. S3) stage references a storage integration object in its definition.
- Snowflake automatically associates the storage integration with a S3 IAM user created for your account. Snowflake creates a single IAM user that is referenced by all S3 storage integrations in your Snowflake account.
- An AWS administrator in your organization grants permissions to the IAM user to access the bucket referenced in the stage definition. Note that many external stage objects can reference different buckets and paths and use the same storage integration for authentication.

High level steps involved in this Section:

- Step 1: Configure Access Permissions for the S3 Bucket
  - AWS Access Control Requirements
  - Creating an IAM Policy
- Step 2: Create the IAM Role in AWS
- Step 3: Create a Cloud Storage Integration in Snowflake
- Step 4: Retrieve the AWS IAM User for your Snowflake Account
- Step 5: Grant the IAM User Permissions to Access Bucket Objects

21.5.1 Log into the AWS Management Console

https://signin.aws.amazon.com/signin?redirect_uri=https%3A%2F%2Fconsole.aws.amazon.com%2Fconsole%2Fhome%3Fnc2%3Dh_ct%26src%3Dheader-signin%26state%3DhashArgs%2523%26isauthcode%3Dtrue&client_id=arn%3Aaws%3Aiam%3A%3A015428540659%3Auser%2Fhomepage&forceMobileApp=0


Invitation: Autodesk sync @ Tue
Amazon Web Services Sign-In
aws

signin.aws.amazon.com/signin?redirect_uri=https%3A%2F%2Fconsole.aws.amazon.com%2Fconsole%2Fhome%3Fnc2%3Dh_ct%26src%3Dh

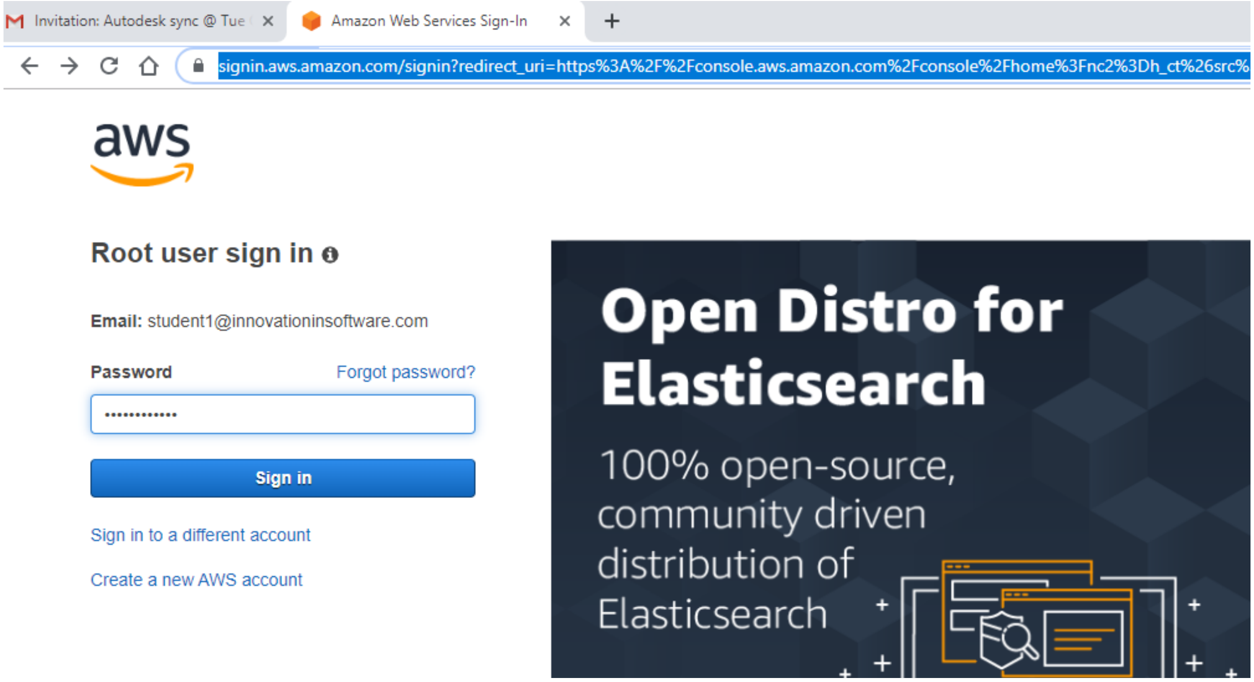
Sign in

Email address of your AWS account

Or to sign in as an IAM user, enter your account ID or account alias instead.

student1@innovationinsoftware.com

Next
New to AWS?
Create a new AWS account
Open Distro for Elasticsearch
100% open-source, community driven distribution of Elasticsearch


Invitation: Autodesk sync @ Tue
Amazon Web Services Sign-In
aws

signin.aws.amazon.com/signin?redirect_uri=https%3A%2F%2Fconsole.aws.amazon.com%2Fconsole%2Fhome%3Fnc2%3Dh_ct%26src%

Root user sign in

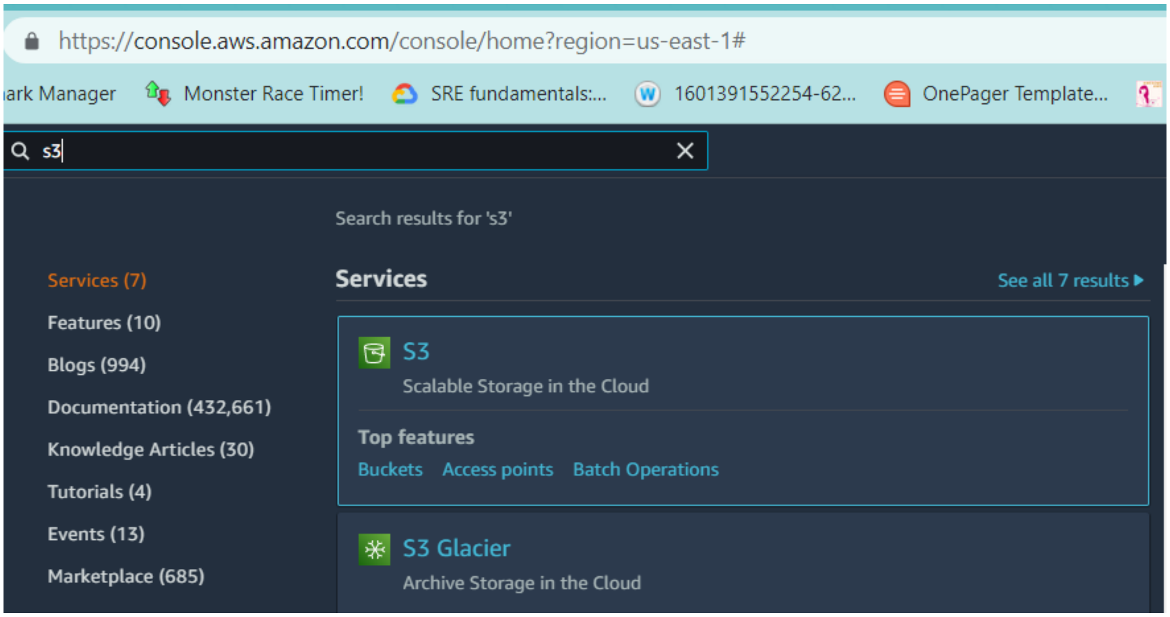
Email: student1@innovationinsoftware.com

Password

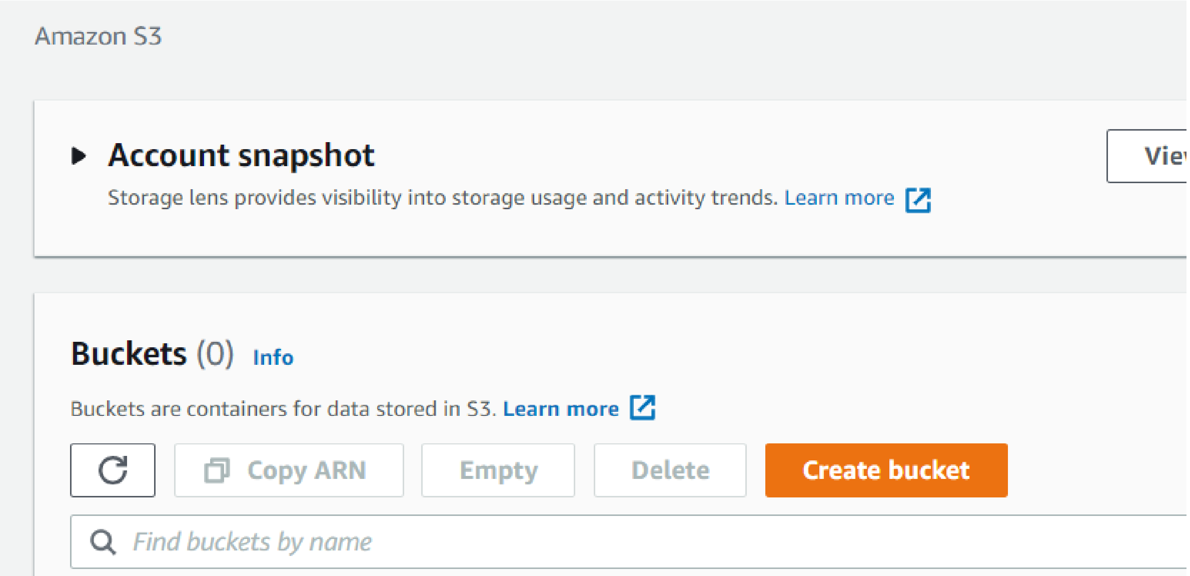
••••••••••••

Forgot password?
Sign in
Sign in to a different account
Create a new AWS account
Open Distro for Elasticsearch
100% open-source, community driven distribution of Elasticsearch

21.5.2 Search for the S3 service and select S3



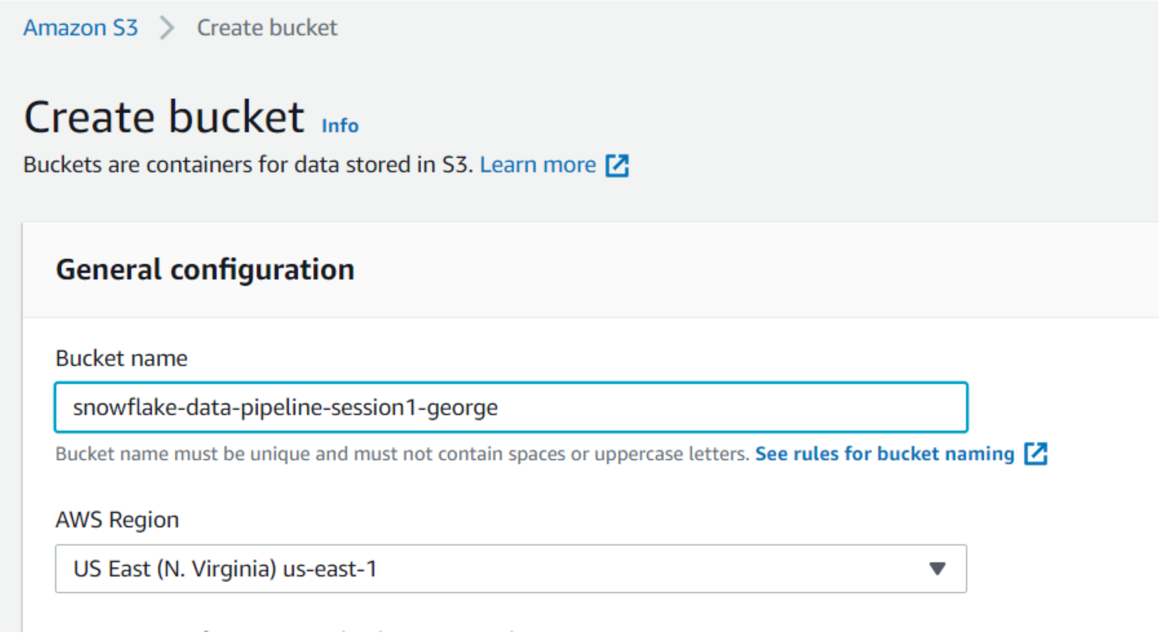
21.5.3 Create an AWS S3 bucket and a folder to be used as an external stage for Snowflake.Choose **Create bucket**.



Amazon S3
Account snapshot
Vie
Storage lens provides visibility into storage usage and activity trends. Learn more
Buckets (0)
Info
Buckets are containers for data stored in S3. Learn more
Copy ARN
Empty
Delete
Create bucket
Find buckets by name

21.5.4 Make a note of the S3 bucket/folder which will be used in the below steps. Bucket uniqueness is required globally, so we'll use a simple naming like

snowflake-data-pipeline-session1-george or similar



Buckets are containers for data stored in S3. Learn more

General configuration

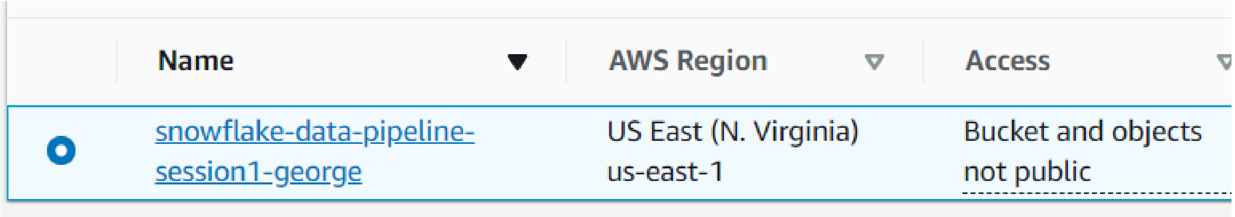
Bucket name: snowflake-data-pipeline-session1-george

Bucket name must be unique and must not contain spaces or uppercase letters. See rules for bucket naming

AWS Region: US East (N. Virginia) us-east-1

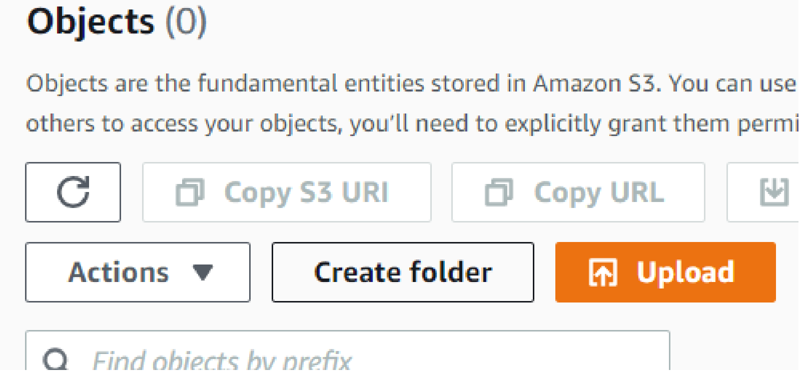
21.5.5 Scroll to the bottom, leaving the remaining options default, and choose **Create bucket**

21.5.6 Select the bucket name that you created



	Name	AWS Region	Access
●	snowflake-data-pipeline-session1-george	US East (N. Virginia) us-east-1	Bucket and objects not public

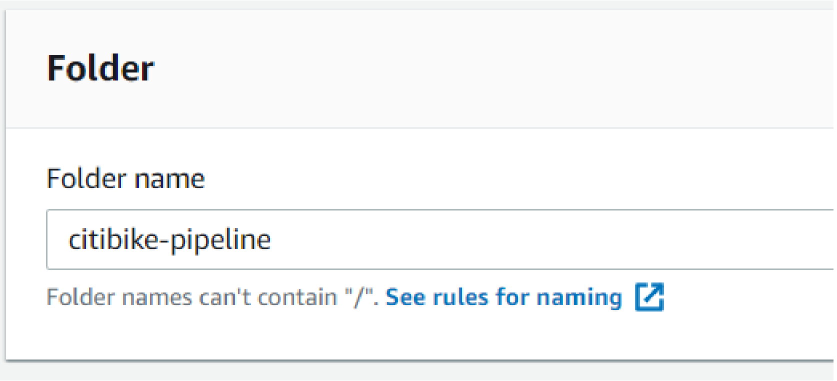
21.5.7 Choose Create folder



Objects (0)

Objects are the fundamental entities stored in Amazon S3. You can use others to access your objects, you'll need to explicitly grant them permi

21.5.8 Enter the bucket name as **citibike-pipeline**



Folder

Folder name

citibike-pipeline

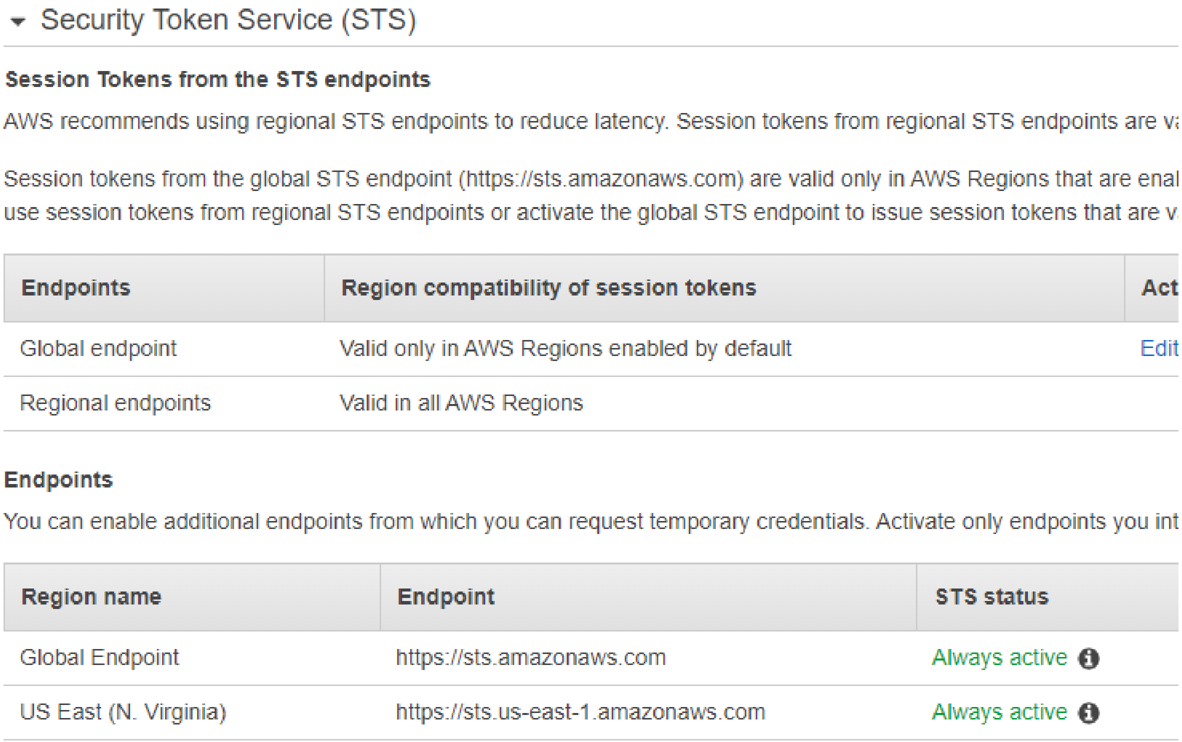
Folder names can't contain "/". See rules for naming

21.5.9 Choose **Create folder**

21.5.10 Configure Access Permissions for the S3 Bucket. From the service search enter **IAM**

21.5.11 Choose **Account settings** from the left-hand navigation pane.

21.5.12 Expand the **Security Token Service Regions** list, find the AWS region corresponding to the region where your account is located, and choose **Activate** if the status is Inactive. If we chose the US-EAST-1 region it should already be “Always Active”



▾ Security Token Service (STS)

Session Tokens from the STS endpoints

AWS recommends using regional STS endpoints to reduce latency. Session tokens from regional STS endpoints are va

Session tokens from the global STS endpoint (https://sts.amazonaws.com) are valid only in AWS Regions that are enal use session tokens from regional STS endpoints or activate the global STS endpoint to issue session tokens that are v

Endpoints	Region compatibility of session tokens	Act
Global endpoint	Valid only in AWS Regions enabled by default	Edit
Regional endpoints	Valid in all AWS Regions	

Endpoints

You can enable additional endpoints from which you can request temporary credentials. Activate only endpoints you int

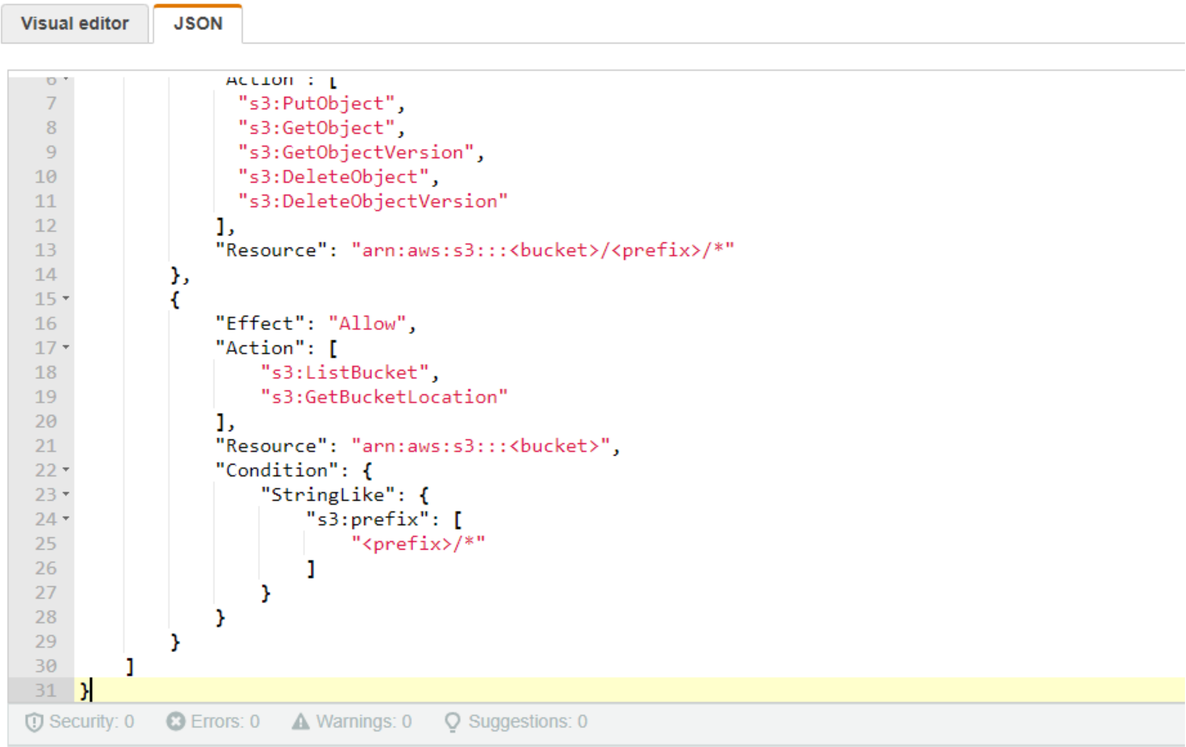
Region name	Endpoint	STS status
Global Endpoint	https://sts.amazonaws.com	Always active ℹ
US East (N. Virginia)	https://sts.us-east-1.amazonaws.com	Always active ℹ

21.5.13 Choose **Policies** from the left-hand navigation pane.

21.5.14 Choose **Create Policy**

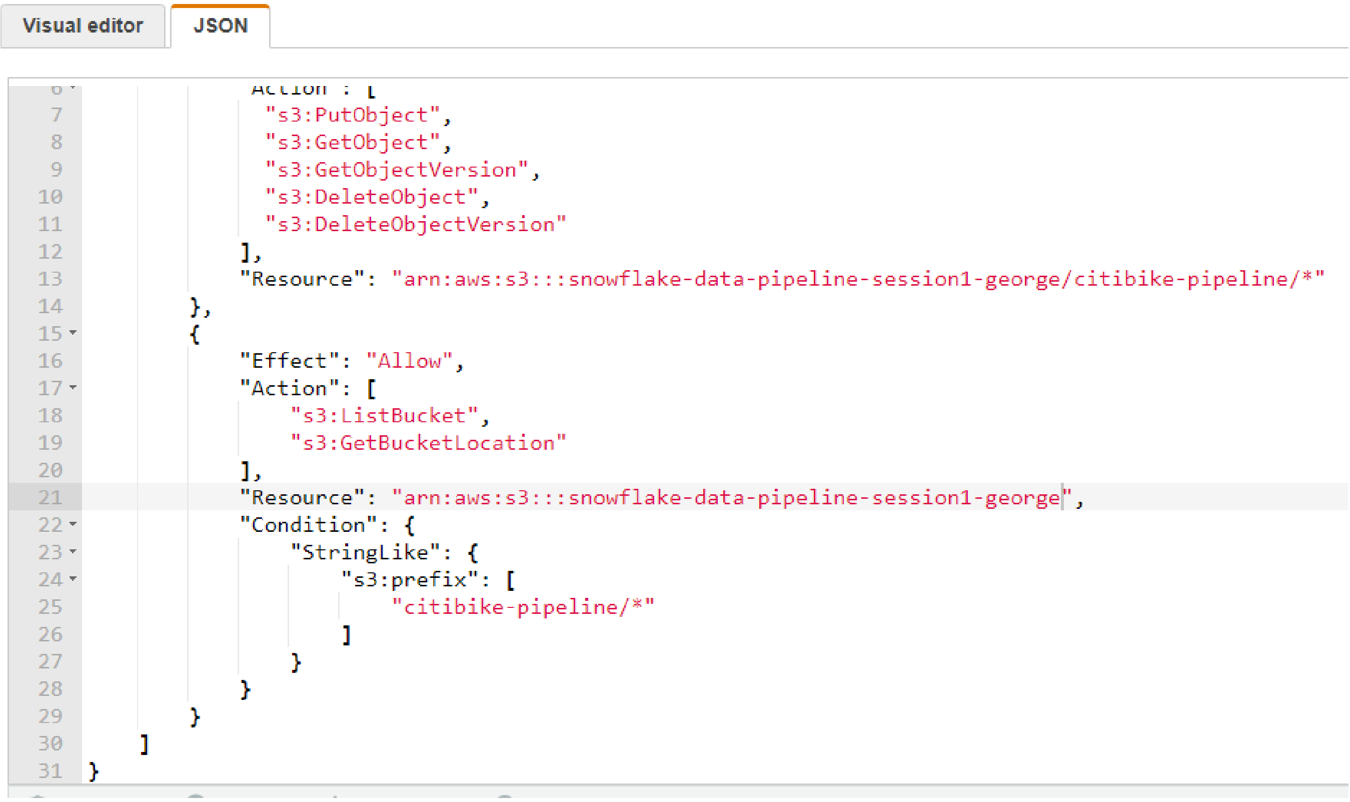
21.5.15 Select the JSON tab

21.5.16 Copy and paste the contents of **s3-iam-role.json** into the policy content area. Choose Next:Tags



```
                "Action": [
                 "s3:PutObject",
                 "s3:GetObject",
                 "s3:GetObjectVersion",
                 "s3:DeleteObject",
                 "s3:DeleteObjectVersion"
                ],
                "Resource": "arn:aws:s3:::<bucket>/<prefix>/*"
            },
            {
                "Effect": "Allow",
                "Action": [
                    "s3:ListBucket",
                    "s3:GetBucketLocation"
                ],
                "Resource": "arn:aws:s3:::<bucket>",
                "Condition": {
                    "StringLike": {
                        "s3:prefix": [
                            "<prefix>/*"
                        ]
                    }
                }
            }
        ]
}
```

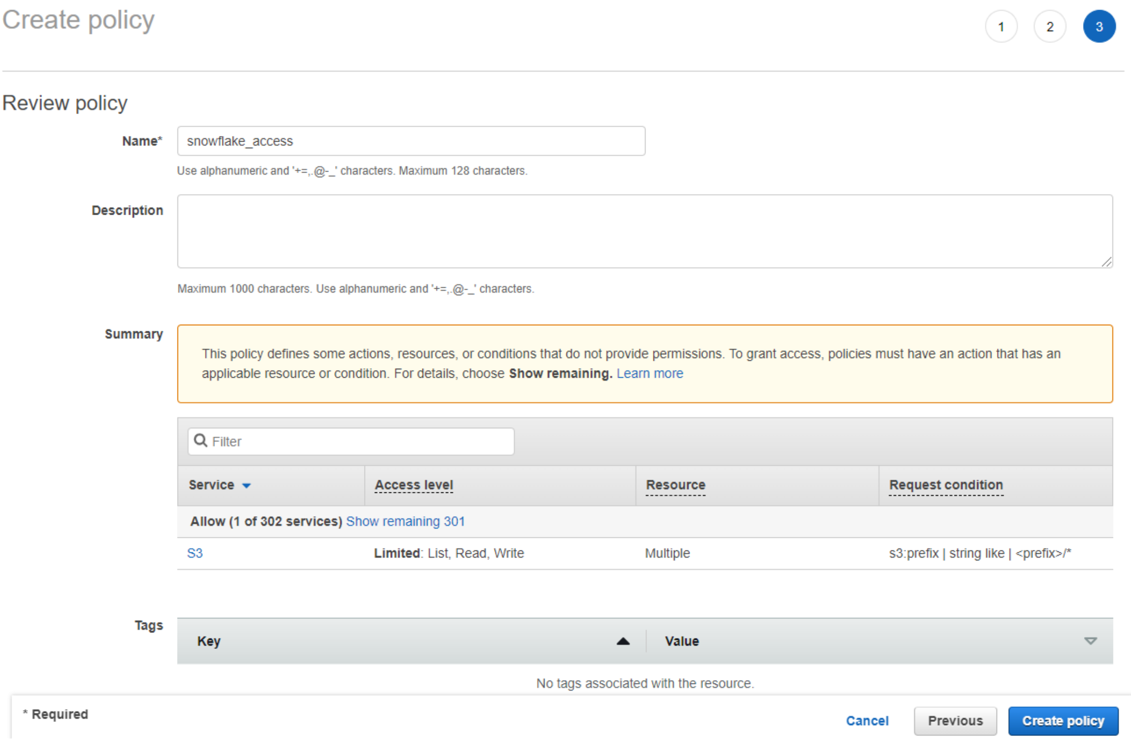
Make sure to replace bucket and prefix with your actual bucket name and folder path prefix. For the example bucket = snowflake-data-pipeline-session1-george and the prefix = citibike-pipeline



```
                "Action": [
                 "s3:PutObject",
                 "s3:GetObject",
                 "s3:GetObjectVersion",
                 "s3:DeleteObject",
                 "s3:DeleteObjectVersion"
                ],
                "Resource": "arn:aws:s3:::snowflake-data-pipeline-session1-george/citibike-pipeline/*"
            },
            {
                "Effect": "Allow",
                "Action": [
                    "s3:ListBucket",
                    "s3:GetBucketLocation"
                ],
                "Resource": "arn:aws:s3:::snowflake-data-pipeline-session1-george",
                "Condition": {
                    "StringLike": {
                        "s3:prefix": [
                            "citibike-pipeline/*"
                        ]
                    }
                }
            }
        ]
}
```

21.5.17 Choose **Next: Review**

21.5.18 Enter **snowflake_access** as the Policy Name and choose **Create policy**



Create policy

Review policy

Name* snowflake_access

Use alphanumeric and '+=,.@-_' characters. Maximum 128 characters.

Description

Maximum 1000 characters. Use alphanumeric and '+=,.@-_' characters.

Summary

This policy defines some actions, resources, or conditions that do not provide permissions. To grant access, policies must have an action that has an applicable resource or condition. For details, choose **Show remaining.** Learn more

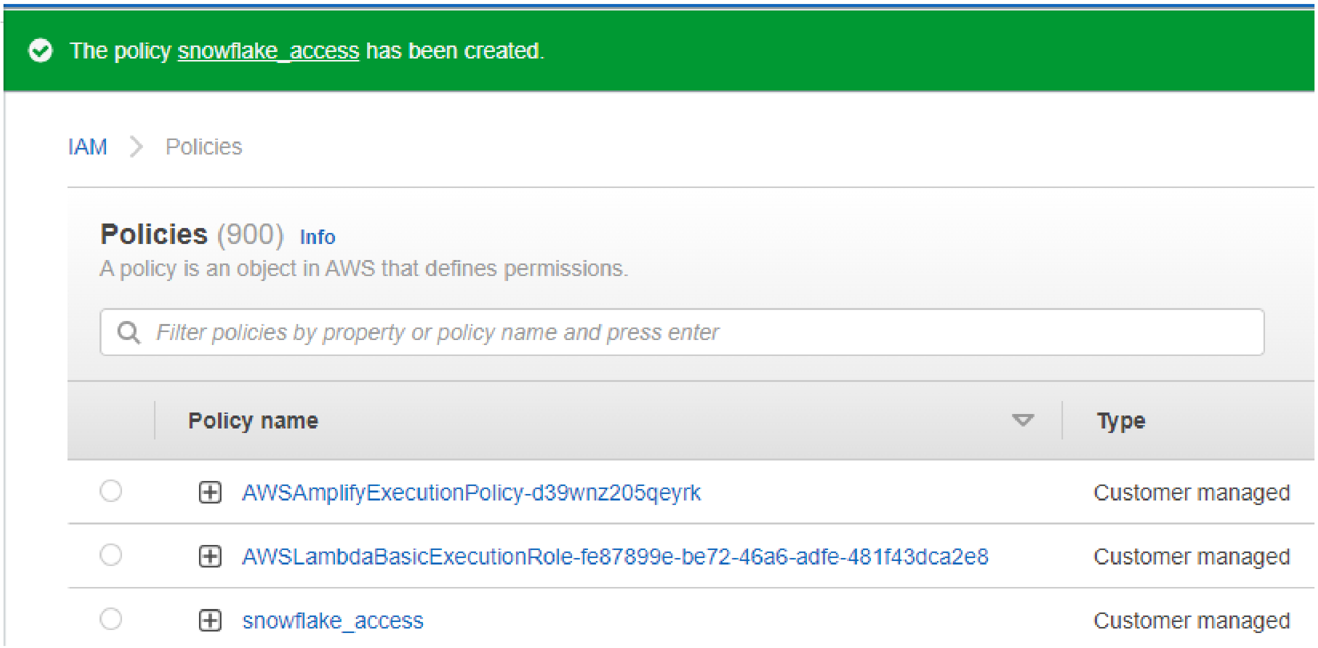
Service	Access level	Resource	Request condition
Allow (1 of 302 services) Show remaining 301			
S3	**Limited**: List, Read, Write	Multiple	s3:prefix | string like | <prefix>/*

Tags

Key	Value

No tags associated with the resource.

* Required



The policy snowflake_access has been created.

IAM > Policies

Policies (900) Info

A policy is an object in AWS that defines permissions.

	Policy name	Type
○	⊞ AWSAmplifyExecutionPolicy-d39wnz205qeyrk	Customer managed
○	⊞ AWSLambdaBasicExecutionRole-fe87899e-be72-46a6-adfe-481f43dca2e8	Customer managed
○	⊞ snowflake_access	Customer managed

Make sure to replace `bucket` and `prefix` with your actual bucket name and folder path prefix. For the example bucket = snowflake-data-pipeline-session1-george and the prefix = citibike-pipeline

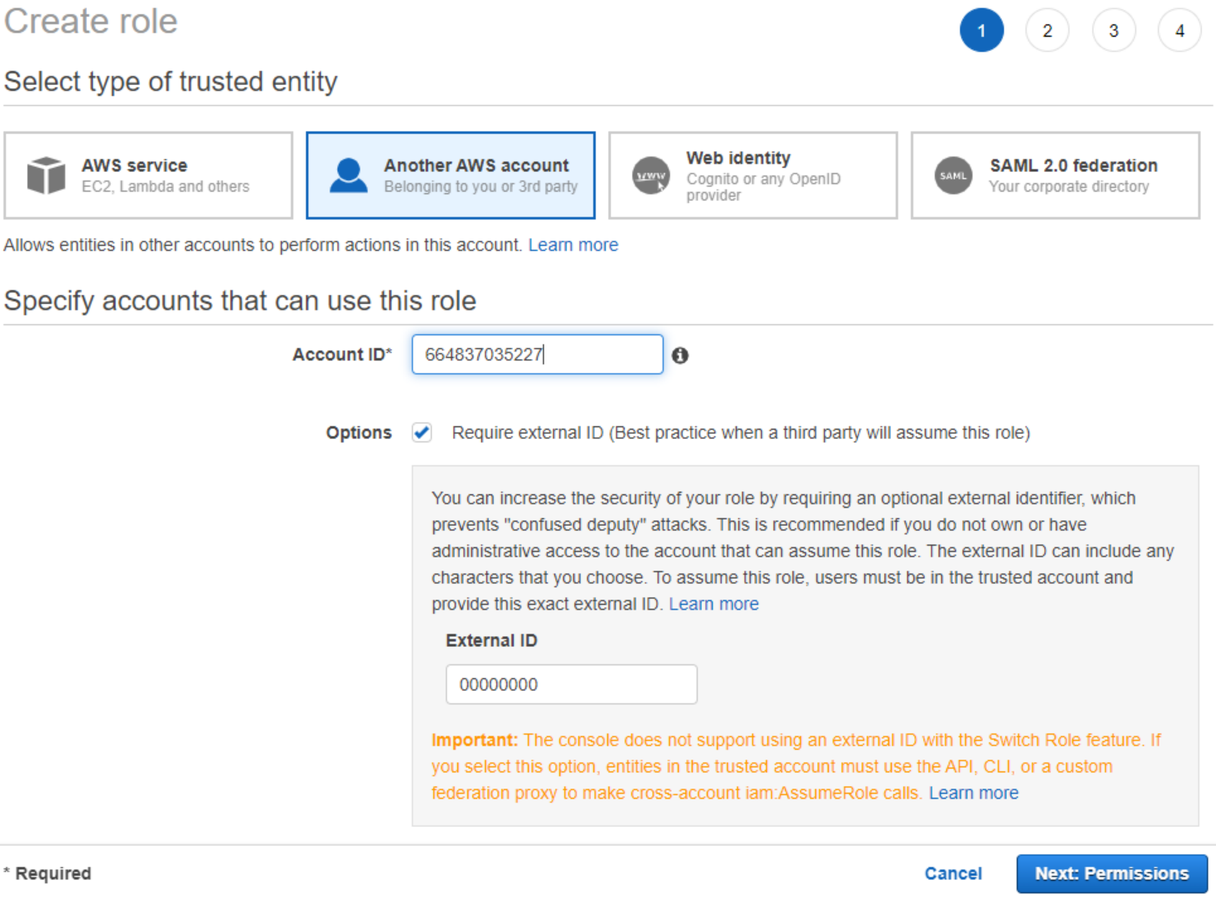
21.5.19 Choose Roles from the left-hand navigation pane.

21.5.20 Click the **Create role** button.

21.5.21 Select **Trusted Entity** Page in AWS Management Console

21.5.22 Select **Another AWS account** as the trusted entity type.

In the Account ID field, enter your own AWS account ID temporarily. Later, you will modify the trusted relationship and grant access to Snowflake.


Create role
1
2
3
4
Select type of trusted entity
AWS service
EC2, Lambda and others
Another AWS account
Belonging to you or 3rd party
Web identity
Cognito or any OpenID provider
SAML 2.0 federation
Your corporate directory
Allows entities in other accounts to perform actions in this account. Learn more
Specify accounts that can use this role

Account ID* 664837035227

Options ☑ Require external ID (Best practice when a third party will assume this role)

You can increase the security of your role by requiring an optional external identifier, which prevents "confused deputy" attacks. This is recommended if you do not own or have administrative access to the account that can assume this role. The external ID can include any characters that you choose. To assume this role, users must be in the trusted account and provide this exact external ID. Learn more

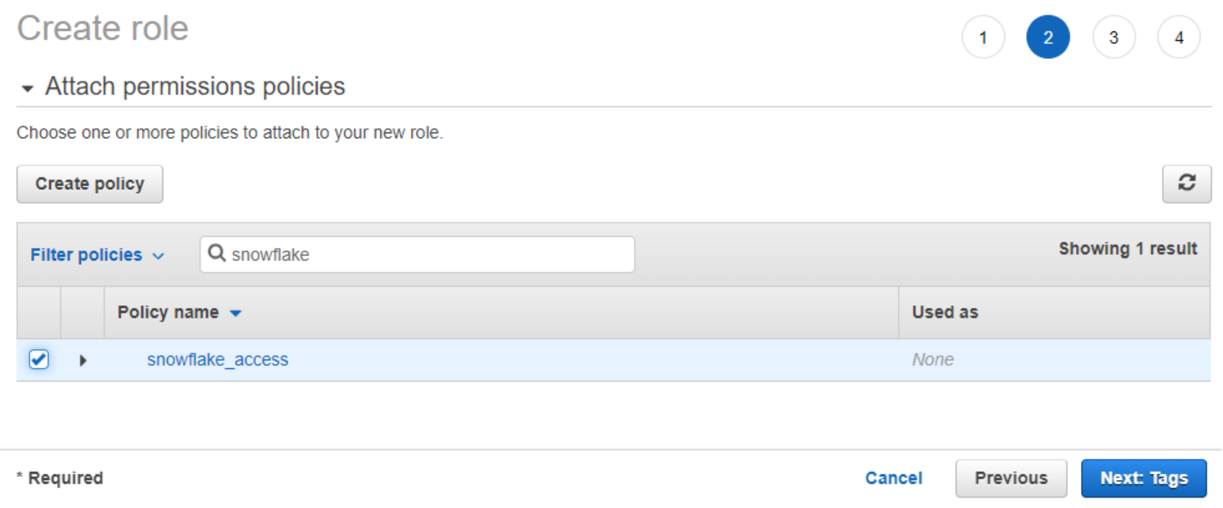
External ID 00000000

Important: The console does not support using an external ID with the Switch Role feature. If you select this option, entities in the trusted account must use the API, CLI, or a custom federation proxy to make cross-account iam:AssumeRole calls. Learn more

21.5.23 Enter a dummy ID such as **0000**. Later, you will modify the trusted relationship and specify the external ID for your Snowflake stage. An external ID is required to grant access to your AWS resources (i.e. S3) to a third party (i.e. Snowflake).

21.5.24 Click the **Next** button.

21.5.25 Locate the policy you created in Step 1: Configure Access Permissions for the S3 Bucket (in this topic), and select this policy.



Create role

Attach permissions policies

Choose one or more policies to attach to your new role.

Filter policies: snowflake

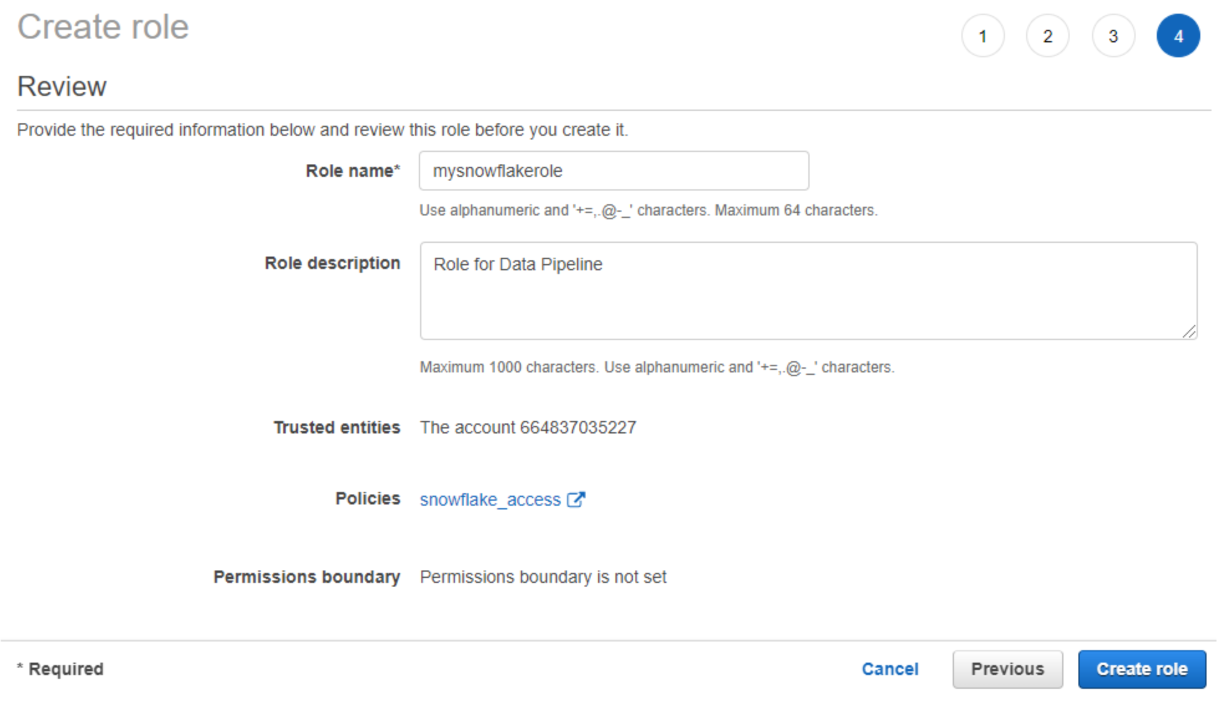
Showing 1 result

	Policy name	Used as
☑	snowflake_access	None

* Required

21.5.26 Click the **Next:Tags** button. Choose **Next: Review**

21.5.27 Review Page in AWS Management Console



Create role

Review

Provide the required information below and review this role before you create it.

Role name*: mysnowflakerole

Use alphanumeric and '+=,.@-_' characters. Maximum 64 characters.

Role description: Role for Data Pipeline

Maximum 1000 characters. Use alphanumeric and '+=,.@-_' characters.

Trusted entities: The account 664837035227

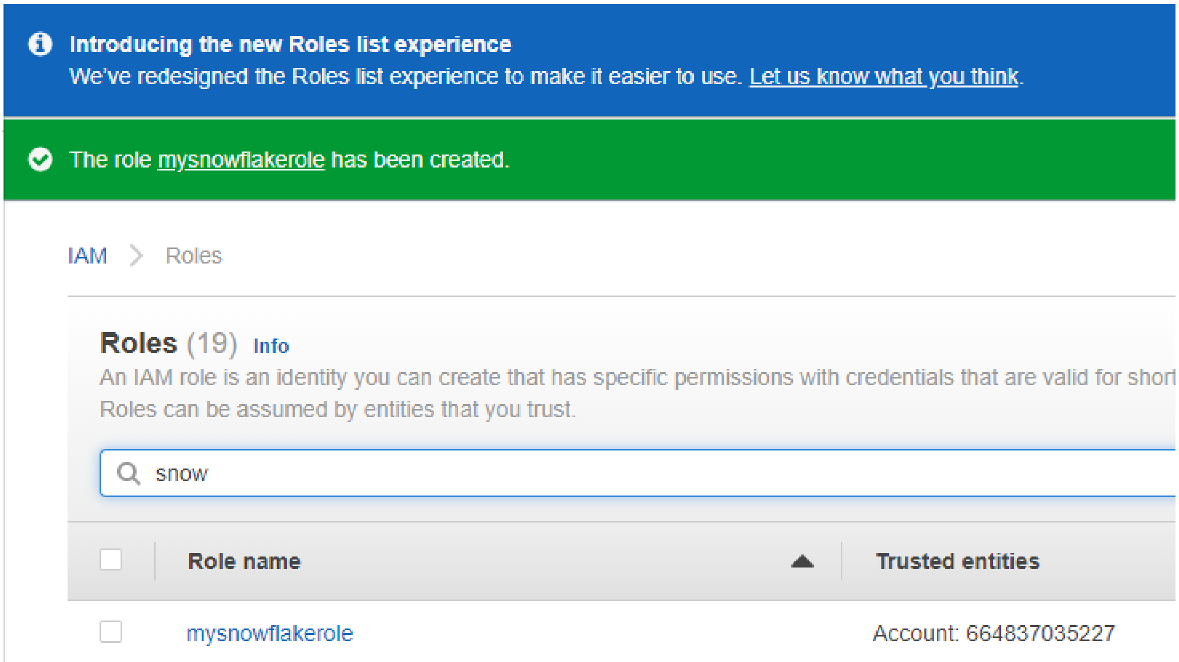
Policies: snowflake_access

Permissions boundary: Permissions boundary is not set

* Required

21.5.28 Enter a name **mysnowflakerole** and description for the role, and click the **Create role** button.

You have now created an IAM policy for a bucket, created an IAM role, and attached the policy to the role.



Introducing the new Roles list experience
We've redesigned the Roles list experience to make it easier to use. Let us know what you think.

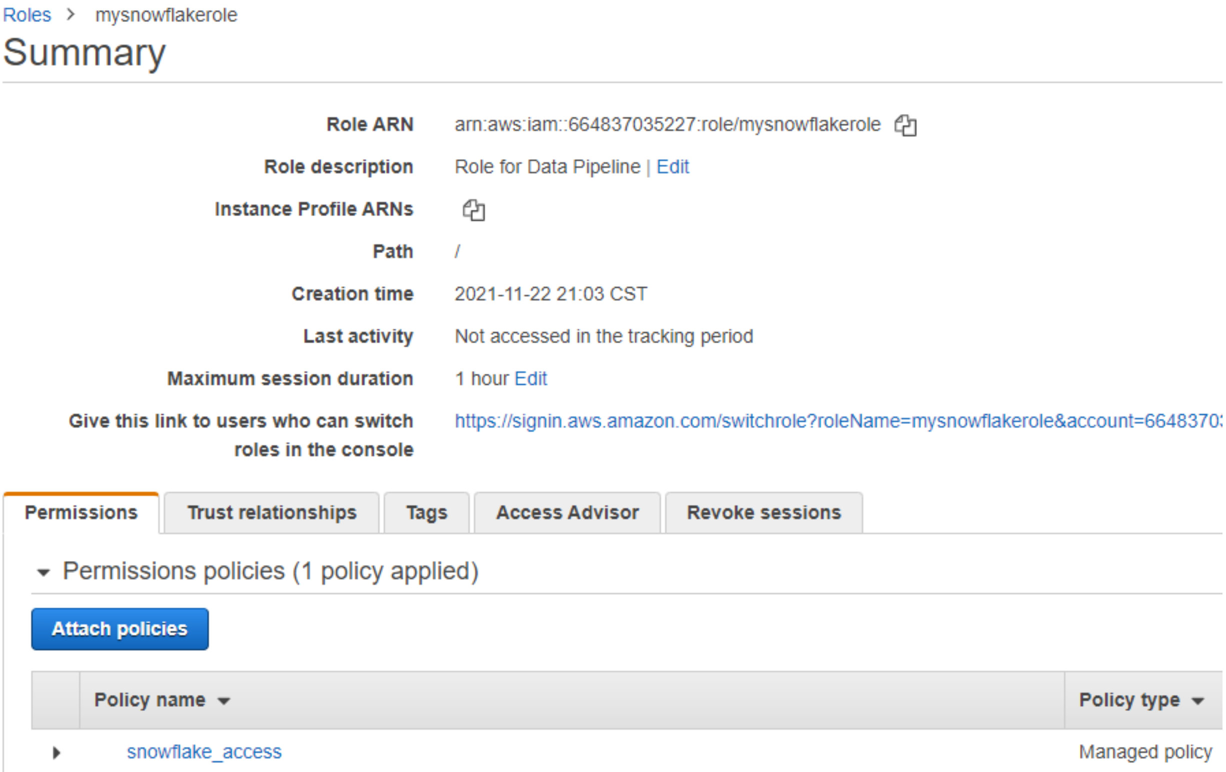
The role mysnowflakerole has been created.

IAM > Roles

Roles (19) Info
An IAM role is an identity you can create that has specific permissions with credentials that are valid for short
Roles can be assumed by entities that you trust.

snow

□	Role name	Trusted entities
□	mysnowflakerole	Account: 664837035227



Roles > mysnowflakerole

Summary

Role ARN	arn:aws:iam::664837035227:role/mysnowflakerole
Role description	Role for Data Pipeline | Edit
Instance Profile ARNs	
Path	/
Creation time	2021-11-22 21:03 CST
Last activity	Not accessed in the tracking period
Maximum session duration	1 hour Edit
Give this link to users who can switch roles in the console	https://signin.aws.amazon.com/switchrole?roleName=mysnowflakerole&account=6648370

Permissions policies (1 policy applied)

Policy name	Policy type
snowflake_access	Managed policy

Record the Role ARN value located on the role summary page. In the next step, you will create a Snowflake integration that references this role.

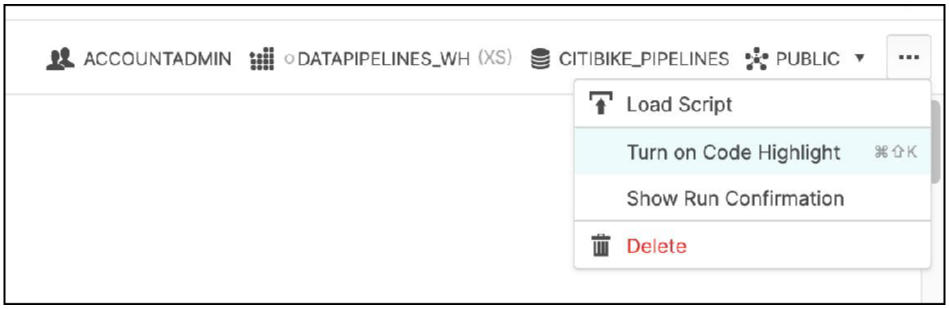
For example: **arn:aws:iam::664837035227:role/mysnowflakerole**

Make a note of the **ARN** for the IAM Role. You will need this in the next step.

21.5.29 Create a Cloud Storage Integration in Snowflake. **[SNOWFLAKE]**

Similar to step 21.4.10 in the worksheets tab, click on the small, downward facing arrow,select "Load Script", then browse to the "**ModernDataPipelines_Experiment.sql**" file you downloaded in section 21.3 and select "Open".

Before we start using SQL in Worksheets we will turn on Code Highlight by clicking on the 3 dots on the top right hand corner of the worksheet, and then clicking on **Turn on Code Highlight**. This will make it easier to identify the SQL that will be executed.



Set the context for the worksheet by executing the below sql.

```
-- Set the context for the worksheet.

USE ROLE ACCOUNTADMIN;
USE CITIBIKE_PIPELINES.PUBLIC;
USE WAREHOUSE DATAPIPELINES_WH;
```

Run the queries by placing your cursor anywhere in the command and clicking the blue “Run” button at the top of the page or by hitting Ctrl/Cmd+Enter on your keyboard

Warning
From here on in the labs, never check the “All Queries” box at the top of the worksheet. We want to run SQL queries one at a time in a specific order; not all at once.

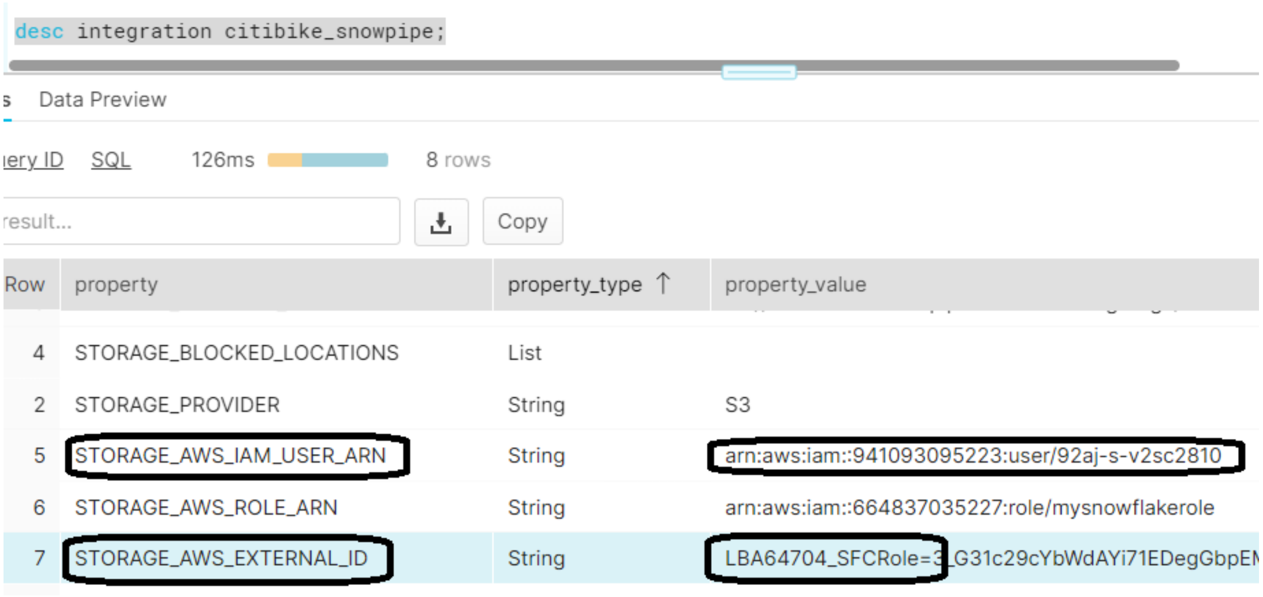
Create Cloud Storage Integration in Snowflake using the below sql. Use the ARN of the IAM role created in step 1.6.3

```
-- Create Cloud Storage Integration.
create or replace storage integration
citibike_snowpipe type = external_stage
storage_provider
= s3 enabled =
true
storage_aws_role_arn =
'arn:aws:iam::664837035227:role/mysnowflakerole'
storage_allowed_locations = ('s3://snowflake-
data-pipeline-session1-george/citibike-
pipeline');
```

Note the Storage Integration name created in Snowflake. We need the name in the following sections.

21.5.30 Retrieve the AWS IAM User for your Snowflake Account. **[SNOWFLAKE]**
Follow the instructions outlined in the Snowflake documentation using the link below.
https://docs.snowflake.com/en/user-guide/data-load-s3-config-storage-integration.html#step-4-retrieve-the-aws-iam-user-for-your-snowflake-account

```
desc integration citibike_snowpipe;
```



```
desc integration citibike_snowpipe;
```

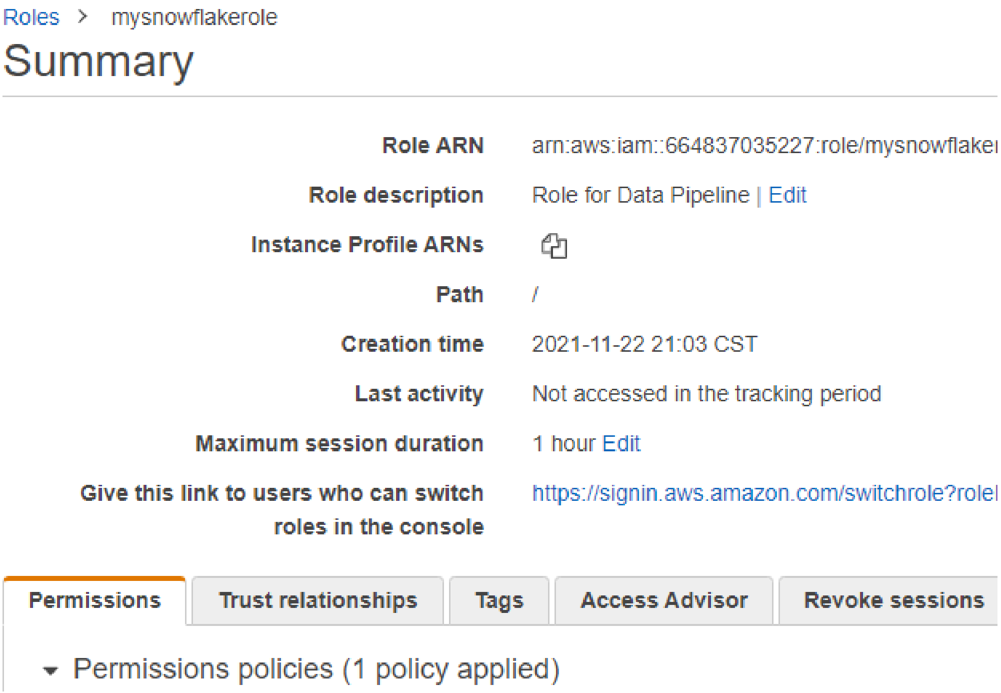
Row	property	property_type ↑	property_value
4	STORAGE_BLOCKED_LOCATIONS	List	
2	STORAGE_PROVIDER	String	S3
5	STORAGE_AWS_IAM_USER_ARN	String	arn:aws:iam::941093095223:user/92aj-s-v2sc2810
6	STORAGE_AWS_ROLE_ARN	String	arn:aws:iam::664837035227:role/mysnowflakerole
7	STORAGE_AWS_EXTERNAL_ID	String	LBA64704_SFCRole=3_G31c29cYbWdAYi71EDegGbpE

Record the following values from the output of the above sql statement:
STORAGE_AWS_IAM_USER_ARN = arn:aws:iam::941093095223:user/92aj-s-v2sc2810
STORAGE_AWS_EXTERNAL_ID =
LBA64704_SFCRole=3_G31c29cYbWdAYi71EDegGbpEMvM=

21.5.31 Grant the IAM User Permissions to Access Bucket Objects **[AWS]**

Follow the instructions outlined in the Snowflake documentation using the link below.
https://docs.snowflake.com/en/user-guide/data-load-s3-config-storage-integration.html#step-5-grant-the-iam-user-permissions-to-access-bucket-objects
Complete only the instructions for Step5 in the documentation link. After completing step 5, come back to this guide.

Edit the role that we created **mysnowflakerole**. Choose **Trust relationships**



Roles > mysnowflakerole

Summary

Role ARN arn:aws:iam::664837035227:role/mysnowflaker

Role description Role for Data Pipeline | Edit

Instance Profile ARNs

Path /

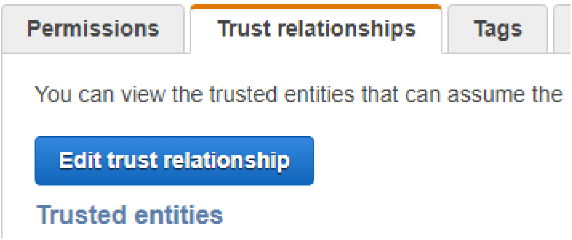
Creation time 2021-11-22 21:03 CST

Last activity Not accessed in the tracking period

Maximum session duration 1 hour Edit

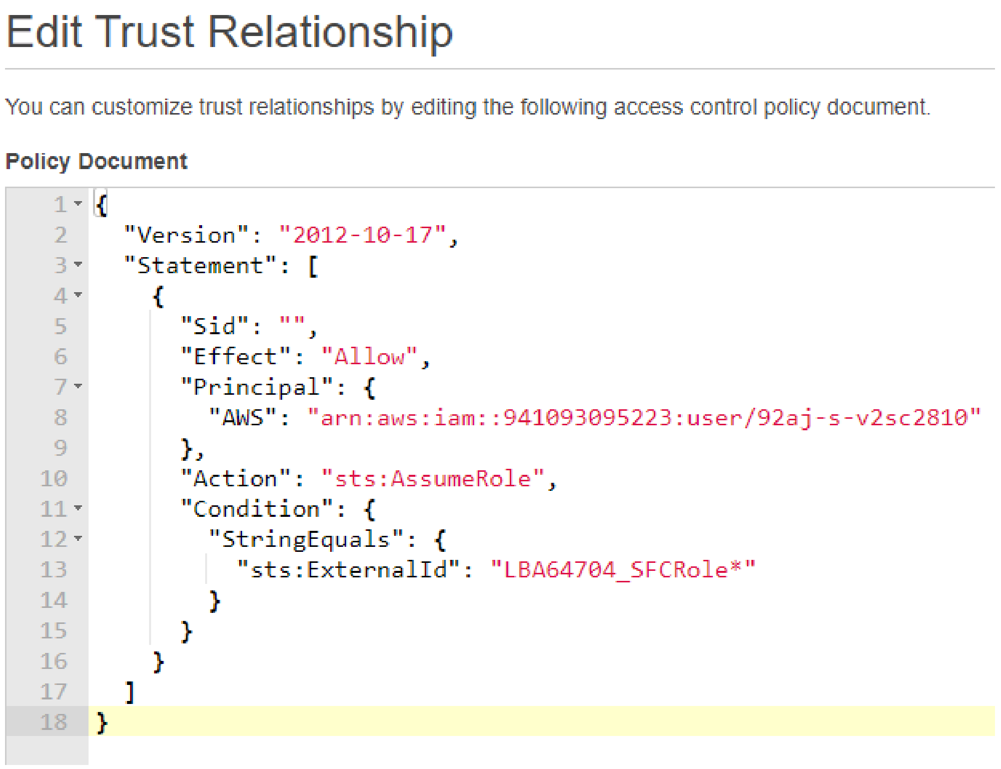
Give this link to users who can switch roles in the console https://signin.aws.amazon.com/switchrole?roleI

21.5.32 Choose **Edit trust relationship**



You can view the trusted entities that can assume the

21.5.33 Paste the updated policy replacing the JSON



Edit Trust Relationship

You can customize trust relationships by editing the following access control policy document.

Policy Document

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Sid": "",
      "Effect": "Allow",
      "Principal": {
        "AWS": "arn:aws:iam::941093095223:user/92aj-s-v2sc2810"
      },
      "Action": "sts:AssumeRole",
      "Condition": {
        "StringEquals": {
          "sts:ExternalId": "LBA64704_SFCRole*"
        }
      }
    }
  ]
}
```

21.5.34 Choose **Update Trust Policy**

We just completed configuring a Snowflake storage integration object to delegate authentication responsibility for cloud storage to a Snowflake identity and access management (IAM) entity.

21.6 Creating an External Stage for Snowpipe

21.6.1 Create the streaming_data EXTERNAL STAGE object where the data will land. In the worksheet, execute the below sql statement to create the External Stage object.

```
-- Creating an External Stage.
-- Replace the s3 bucketname and the folder name as highlighted
below.

create or replace stage
  streaming_data url =
  's3://<s3bucketname>/<folder>/'
  storage_integration =
  citibike_snowpipe
  file_format=(type=json);
```

21.7 Finalizing Setup

21.7.1 Pause to take stock for what has been built so far. An external stage pointing to an S3 bucket was created.

```
 show stages like '%STREAMING%';
```