PROJECT GLADIATOR

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AIRLINES CASE STUDY

Data sources: Flat files ,AWS S3 ,JSON,parquet and ORC

Scheduler : Task

Streaming : Streams / Snowpipes

Visualisation : PowerBI

Language : SQL/Javascript (Stored procedure)

Problem Statement:

Flight delay and cancellation are inevitable and they often lead to concern in passengers as well as profit loss of the airlines and airports. An accurate estimation of flight delays and cancellation is critical for airlines because the results can be applied to increase customer satisfaction and income of airline agencies. The passengers' dissatisfaction and distrust of airlines seriously damage the airlines' corporate reputation and then affect passengers' loyalty. Based on the data published by the US department of transportation, this project focuses on analysing the various reasons for flight cancellation and delays.

Dataset:

Source Dataset consists of 3 csv files(comma separated values) downloaded from kaggle website.

Flights.csv

Rows	Columns	Size
5.8M	**31**	**592MB**

Column Name	Description	Data Type
YEAR	Year of the Flight Trip (Contains only 2015 data)	Number
MONTH	Month of the Flight Trip	Number

DAY	Day of the Flight Trip	Number
DAY_OF_WEEK	Day of week of the Flight Trip	Number
AIRLINE	Airline Identifier containing two letter code of the airline.	Plain Text
FLIGHT_NUMBER	Flight Identifier	Number
TAIL_NUMBER	Aircraft Identifier containing six letter code of the aircraft. This column contains 4898 unique values.	Plain Text
ORIGIN_AIRPORT	An IATA airport code, also known as an IATA location identifier, IATA station code, or simply a location identifier, is a three-character alphanumeric geocode designating many airports.	Plain Text
DESTINATION_AIRPORT	An IATA airport code, also known as an IATA location identifier, IATA station code, or simply a location identifier, is a three-character alphanumeric geocode designating many airports.	Plain Text
SCHEDULED_DEPARTURE	Planned Departure Time	Number
DEPARTURE_TIME	Actual Departure Time	Number
DEPARTURE_DELAY	Amount of Time indicating the total delay on departure	Number
TAXI_OUT	The time duration elapsed between departure from the origin airport gate and wheels off	Number
WHEELS_OFF	The time point that the aircraft's wheels leave the ground	Number

SCHEDULED_TIME	Planned time amount needed for the flight trip	Number
ELAPSED_TIME	Total time duration containing the sum of air_time,taxi_in and taxi_out	Number
AIR_TIME	The time duration between wheels_off and wheels_on time	Number
DISTANCE	Distance between two airports	Number
WHEELS_ON	The time point that the aircraft's wheels touch on the ground	Number
TAXI_IN	The time duration elapsed between wheels-on and gate arrival at the destination airport	Number
SCHEDULED_ARRIVAL	Planned arrival time	Number
ARRIVAL_TIME	Actual arrival time	Number
ARRIVAL_DELAY	Amount of time indicating the difference between arrival_time and scheduled_arrival	Number
DIVERTED	Column indicating whether the flight was diverted (1=diverted)	Number
CANCELLED	Column indicating whether the flight was cancelled (1=cancelled)	Number
CANCELLATION_REASON	Reason for Cancellation of flight: A - Airline/Carrier; B - Weather; C - National Air System; D - Security	Plain Text
AIR_SYSTEM_DELAY	Delay caused by air system	Number

SECURITY_DELAY	Delay caused due to security issues	Number
AIRLINE_DELAY	Delay caused by the airline	Number
LATE_AIRCRAFT_DELAY	Delay caused by the aircraft	Number
WEATHER_DELAY	Delay caused due to bad weather	Number

Airports.csv

Rows	Columns	Size
323	**7**	**23KB**

Column Name	**Description**	**Data Type**
IATA_CODE	An IATA airport code, also known as an IATA location identifier, IATA station code, or simply a location identifier, is a three-character alphanumeric geocode designating many airports.	Plain text
AIRPORT	Name of the airport (Contains 322 unique values)	Plain text
CITY	Name of the city in which airport is located (Contains 308 unique values)	Plain text
STATE	State in which airport is located	Plain text
COUNTRY	Country in which airport is located (Contains only one unique value - USA)	Plain Text
LATITUDE	Latitude of the airport	Number
LONGITUDE	Longitude of the airport	Number

Airlines.csv

Rows	Columns	Size
15	**2**	**360B**

Column Name	Description	Data Type
IATA_CODE	IATA airline designators, sometimes called IATA reservation codes, are two-character codes assigned by the International Air Transport Association (IATA) to the world's airlines. (Contains 14 unique values)	Plain text
AIRLINE	Name of the airline	Plain text

Task 1: Create database airlines_db and schema airlines_schema

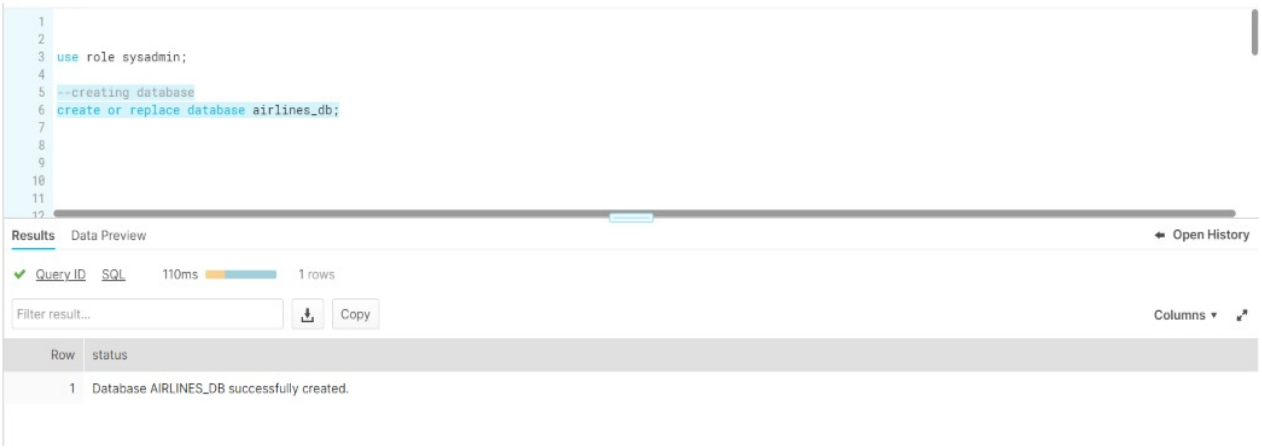
1. Creating two users and granting privileges

```
--user creation
use role useradmin;

create or replace user Abilash password = 'Abilash@123' default_role = 'sysadmin' default_namespace = 'airlines_db.airlines_schema' default_warehouse = 'compute_wh'
must_change_password = FALSE;

create or replace user sejal password = 'Sejal@123' default_role = 'sysadmin' default_namespace = 'airlines_db.airlines_schema' default_warehouse = 'compute_wh'
must_change_password = FALSE;

use role securityadmin;
grant role sysadmin to user Abilash;

grant role sysadmin to user sejal;

```

- Two users named ‘Abilash’ and ‘sejal’ were created in the team leader’s account.
- SYSADMIN role is granted to both the users.

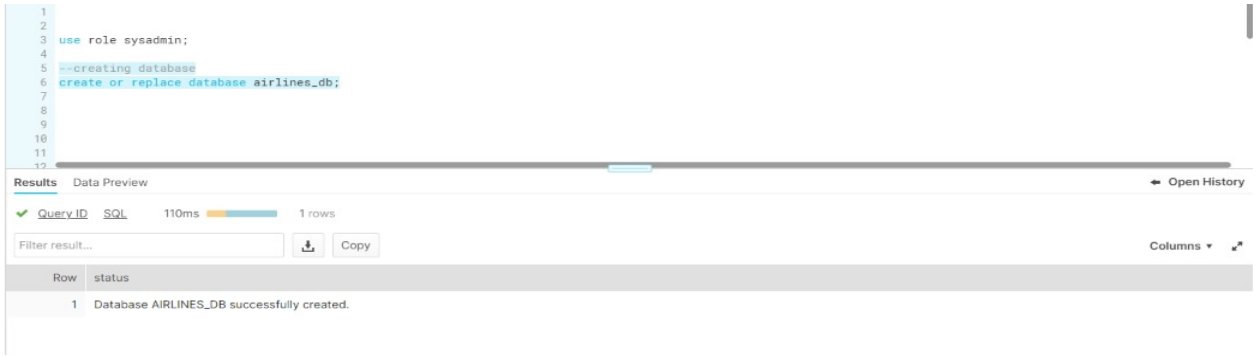
2. Creating database

A database named ‘airlines_db’ is created.



3. Creating schema

A schema named ‘airlines_schema’ is created.



Task 2: Create 3 tables airlines,airports and flights based on the given csv files and apply cluster keys on the most used column for querying.

Task 3: Add the table definition with constraints , unicode and data retention.

1. Creating CSV file format

- A CSV file format named ‘CSV’ is created.
- Data in the dataset is delimited by comma and separated by newline, therefore the ‘field_delimiter’ and ‘record_delimiter’ parameters are chosen accordingly.
- Each dataset contains a header, so it is skipped by setting the ‘skip_header’ parameter as 1.

2. Creating airlines table

```
create or replace table airlines(
    airlineId varchar(10) primary key,
    airlineName varchar(100) not null
) cluster by (airlineId)
DATA_RETENTION_TIME_IN_DAYS=90
STAGE_FILE_FORMAT=(FORMAT_NAME='CSV' ENCODING=UTF8);
```

Results | Data Preview | Open History

Query ID | SQL | 145ms | 1 rows

Filter result... | Copy | Columns

Row	status
1	Table AIRLINES successfully created.

```
alter table airlines set data_retention_time_in_days=30;
```

Results | Data Preview | Open History

Query ID | SQL | 64ms | 1 rows

Filter result... | Copy | Columns

Row	status
1	Statement executed successfully.

- A table named ‘airlines’ is created with 2 fields.
- The field ‘airlineId’ is set as the primary key because it uniquely identifies each airline and it acts as a reference to ‘airlineId’ in the ‘flights’ table.
- The table is clustered by ‘airlineId’ because it is used in join predicate.
- The retention period for the table is set as 30 days.
- ‘CSV’ file format is used for loading the table and ‘UTF8’ is set as the character set of the source data when loading data into the table.

3. Creating airports table

```
12 create or replace table airports(
13     airportId varchar(10) primary key,
14     airportName varchar(100) not null,
15     city varchar(50) not null,
16     state varchar(10) not null,
17     country varchar(10) not null,
18     latitude float null,
19     longitude float null
20 ) cluster by (airportId)
21 DATA_RETENTION_TIME_IN_DAYS=90
22 STAGE_FILE_FORMAT=(FORMAT_NAME='CSV' ENCODING=UTF8);
```

Results | Data Preview | Open History

Query ID | SQL | 133ms | 1 rows

Filter result... | Copy | Columns

Row	status
1	Table AIRPORTS successfully created.

```
42
43 alter table airports set data_retention_time_in_days=30;
44
```

Results | Data Preview | Open History

Query ID | SQL | 55ms | 1 rows

Filter result... | Copy | Columns

Row	status
1	Statement executed successfully.

- A table named ‘airports’ is created with 7 fields.
- The field ‘airportsId’ is set as the primary key because it uniquely identifies each airport and it acts as a reference to ‘orgAirport’ and ‘destAirport’ in the flights table.
- The table is clustered by ‘airportId’ because it is used in join predicate.
- The retention period for the table is set as 30 days.
- ‘CSV’ file format is used for loading the table and ‘UTF8’ is set as the character set of the source data when loading data into the table.

4. Creating flights table

```
--create flights table
create or replace table flights(
    travelDate date not null, dayOfWeek number not null, airlineId varchar(10) not null, flightNumber number not null, tailNumber varchar(10) null,
    orgAirport varchar(10) not null, destAirport varchar(10) not null, scheduledDeparture time null,
    departureTime time null, departureDelay number null, taxiOut number null, wheelsOff time null, scheduledTime number null,
    elapsedTime number null, airTime number null, distance number not null, wheelsOn time null, taxiIn number null,
    scheduledArrival time null, arrivalTime time null, arrivalDelay number null, diverted number not null, cancelled number not null,
    cancellationReason varchar(10) null, airSystemDelay number null, securityDelay number null, airlineDelay number null,
    lateAircraftDelay number null, weatherDelay number null,
    constraint fk_airline_id foreign key (airlineId) references airlines(airlineId),
    constraint fk_orgportid foreign key (orgAirport) references airports(airportId),
    constraint fk_destport_id foreign key (destAirport) references airports(airportId)
) cluster by (travelDate)
DATA_RETENTION_TIME_IN_DAYS=30
STAGE_FILE_FORMAT=(FORMAT_NAME='CSV' ENCODING=UTF8);
```

Results | Data Preview | Open History

Query ID | SQL | 271ms | 1 rows

Filter result... | Copy | Columns

Row	status
1	Table FLIGHTS successfully created.

- A table named ‘flights’ is created with 29 fields.
- The field ‘airlineId’ is set as foreign key and it references ‘airportId’ in the airlines table.
- The field ‘orgAirport’ and ‘destAirport’ is set as foreign key and it references ‘airportId’ in the airports table.
- Since the data is mostly filtered by month and day, travelDate is chosen as a clustering key for the table and this improves the query performance of date-based queries.
- The retention period for the table is set as 30 days.
- ‘CSV’ file format is used for loading the table and ‘UTF8’ is set as the character set of the source data when loading data into the table.

5. Checking the clustering depth

The clustering depth for a populated table measures the average depth (1 or greater) of the overlapping micro-partitions for specified columns in a table. The smaller the average depth, the better clustered the table is with regards to the specified columns.

```
46 --checking CLUSTERING DEPTH
47 select system$clustering_depth('FLIGHTS');
```

Results | Data Preview | Open History

Query ID | SQL | 150ms | 1 rows

Filter result... | Copy | Columns

Row	SYSTEM$CLUSTERING_DEPTH('FLIGHTS')
1	2

Task 4: Create internal stage and load flights and airports

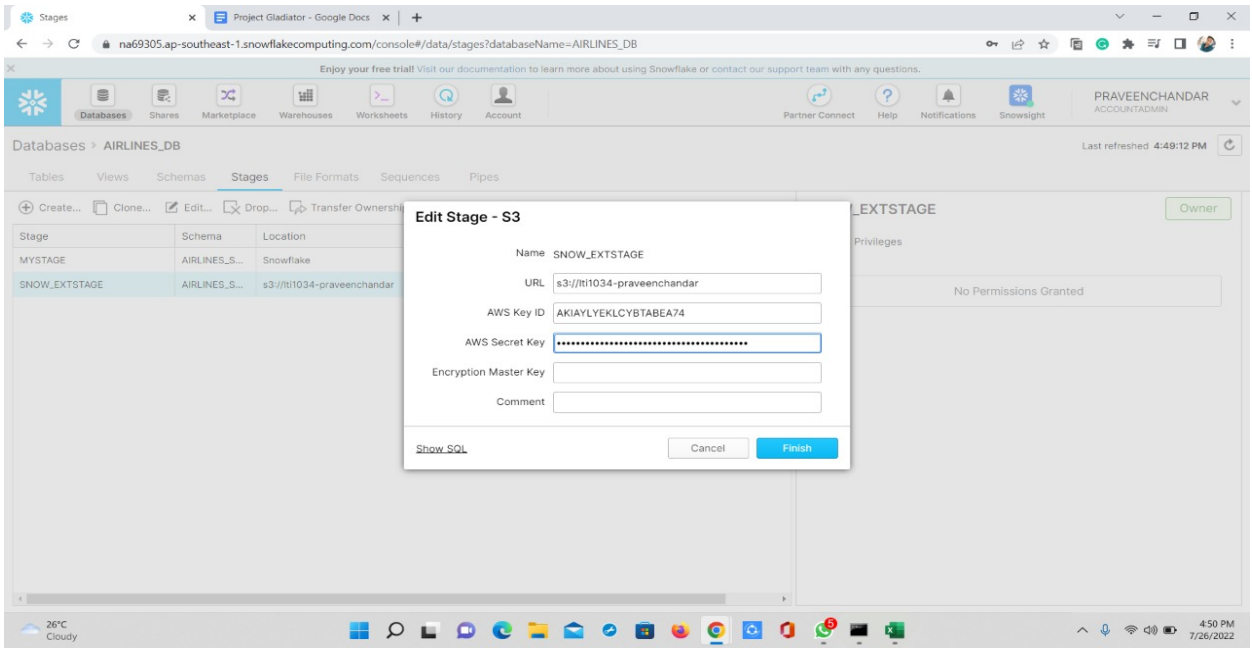
Internal stages are named database objects that provide the greatest degree of flexibility for data loading. Internal Stage stores data files internally within Snowflake.

```
sejal#COMPUTE_WH@AIRLINES_DB.AIRLINES_SCHEMA>CREATE OR REPLACE STAGE Mystage;
+-----------------------------------------+
| status                                  |
|-----------------------------------------|
| Stage area MYSTAGE successfully created. |
+-----------------------------------------+
1 Row(s) produced. Time Elapsed: 0.334s
sejal#COMPUTE_WH@AIRLINES_DB.AIRLINES_SCHEMA>PUT file:///C:\Users\rahul\Downloads\airports.csv @Mystage;
+-------------+----------------+-------------+-------------+--------------------+--------------------+----------+---------+
| source      | target         | source_size | target_size | source_compression | target_compression | status   | message |
|-------------+----------------+-------------+-------------+--------------------+--------------------+----------+---------|
| airports.csv | airports.csv.gz |       23867 |        9840 | NONE               | GZIP               | UPLOADED |         |
+-------------+----------------+-------------+-------------+--------------------+--------------------+----------+---------+
1 Row(s) produced. Time Elapsed: 2.563s
sejal#COMPUTE_WH@AIRLINES_DB.AIRLINES_SCHEMA>LIST @Mystage;
+-------------------------+------+----------------------------------+-------------------------------+
| name                    | size | md5                              | last_modified                 |
|-------------------------+------+----------------------------------+-------------------------------|
| mystage/airports.csv.gz | 9840 | 67457636361c8a6d8b1000e6661362ab | Tue, 26 Jul 2022 07:32:42 GMT |
+-------------------------+------+----------------------------------+-------------------------------+
1 Row(s) produced. Time Elapsed: 0.181s
sejal#COMPUTE_WH@AIRLINES_DB.AIRLINES_SCHEMA>COPY INTO AIRPORTS FROM @Mystage FILE_FORMAT=CSV PURGE=TRUE ON_ERROR=SKIP_FILE;
+-------------------------+--------+-------------+-------------+-------------+-------------+-------------+------------------+--------------------+--------------------------+
| file                    | status | rows_parsed | rows_loaded | error_limit | errors_seen | first_error | first_error_line | first_error_character | first_error_column_name |
|-------------------------+--------+-------------+-------------+-------------+-------------+-------------+------------------+--------------------+--------------------------|
| mystage/airports.csv.gz | LOADED |         322 |         322 |           1 |           0 | NULL        |             NULL |                 NULL | NULL                     |
+-------------------------+--------+-------------+-------------+-------------+-------------+-------------+------------------+--------------------+--------------------------+
1 Row(s) produced. Time Elapsed: 3.161s
```

- A named internal stage called ‘Mystage’ has been created using the ‘create or replace stage’ command.
- The ‘airports.csv’ file has been loaded into ‘Mystage’ using the ‘PUT’ command.
- The files staged in ‘Mystage’ are listed using the ‘LIST’ command.
- The file is loaded into the table ‘airports’ from the named internal stage ‘Mystage’ using the ‘COPY INTO’ command.
- The ‘CSV’ file format is used to load and the ‘PURGE’ parameter is set ‘TRUE’ in order to remove the file from the stage after successful load.

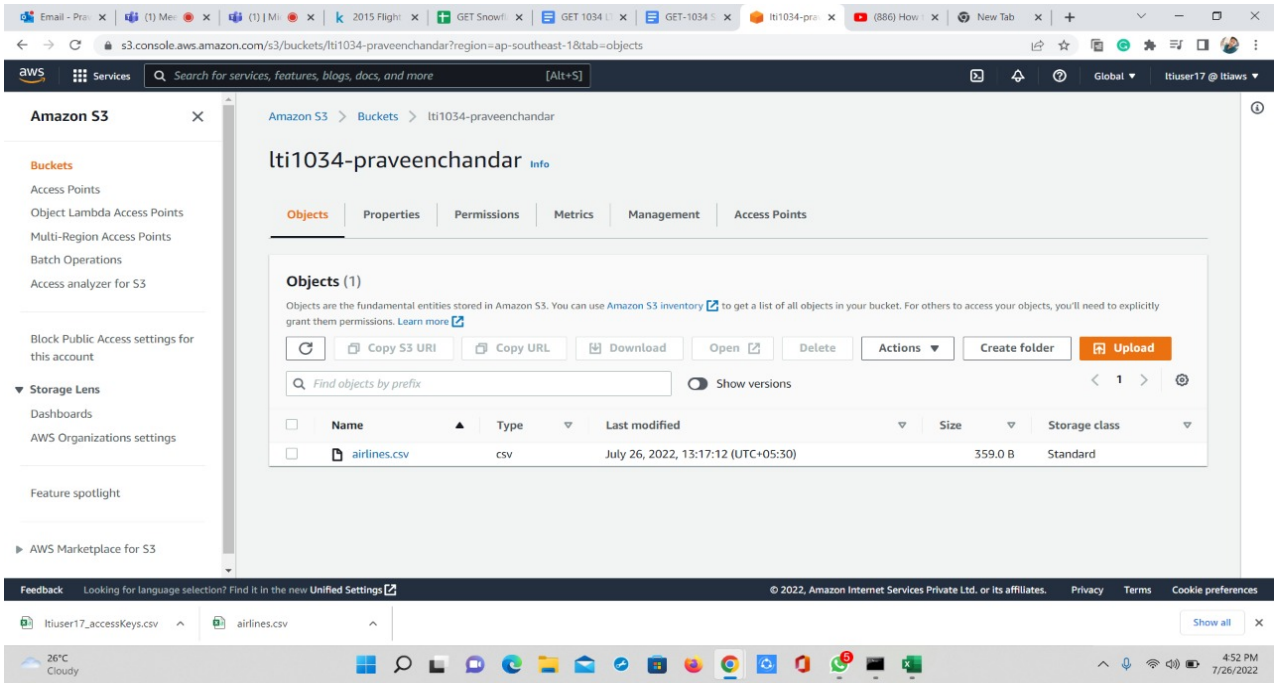
Task 5: Load airlines files into AWS s3 bucket snow_extstage

1. Creating the external stage



- An external stage named ‘snow_exstage’ is created with the appropriate credentials.

2. Uploading file in AWS S3 bucket

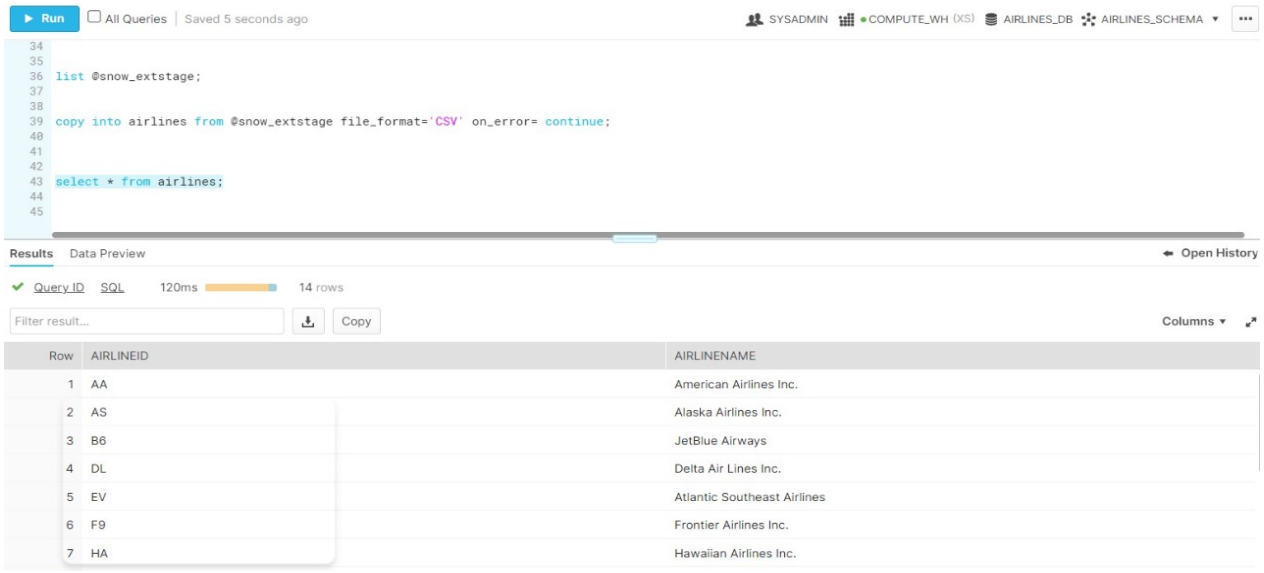


- The data file named ‘airlines.csv’ is uploaded in the AWS S3 bucket.

3. Listing the uploaded file

- The data file uploaded in the external stage is listed using the ‘LIST’ command.

Task 6: **Load the data from external stage**



- The file in the external stage ‘snow_exstage’ is loaded into the ‘airlines’ table using ‘COPY INTO’ command.
- The file is loaded with the file format ‘CSV’ and the ‘on_error’ parameter is set to ‘continue’ in order to continue the loading process if any error occurs while loading a record.

- After uploading the data from the external stage, the table is verified by querying using ‘SELECT’ command.

Task 7: **Perform bad records filtering on loading ,file format and compression**

```
copy into flights(travelDate, dayOfWeek, airlineId, flightNumber, tailNumber, orgAirport, destAirport, scheduledDeparture, departureTime,
                  departureDelay, taxiOut, wheelsOff, scheduledTime, elapsedTime, airTime, distance, wheelsOn, taxiIn,
                  scheduledArrival, arrivalTime, arrivalDelay, diverted, cancelled, cancellationReason, airSystemDelay, securityDelay, airlineDelay,
                  lateAircraftDelay, weatherDelay) from
                  (select to_date(cast($1 as varchar(4)) || '-' || cast($2 as varchar(2)) || '-' || cast($3 as varchar(2))),
                   $4,$5,$6,NVL($7,'NA'),$8,$9,to_time(cast($10 as varchar(4)),'HH24MI'),to_time(cast($11 as varchar(4)),'HH24MI'),
                   $12,$13,to_time(cast($14 as varchar(4)),'HH24MI'),$15,
                   $16,$17,$18,to_time(cast($19 as varchar(4)),'HH24MI'),$20,to_time(cast($21 as varchar(4)),'HH24MI'),to_time(cast($22 as varchar(4)),'HH24MI'),
                   $23,$24,$25,NVL($26,'NA'),
                   ZEROIFNULL($27),ZEROIFNULL($28),ZEROIFNULL($29),ZEROIFNULL($30),ZEROIFNULL($31)
                   from @mystage/flightdata/flights.csv.gz
                  ) file_format=(format_name=csv) on_error=continue;
```

Results Data Preview Open History

Query ID SQL 1m20s 1 rows

Filter result... Copy Columns

Row	file	status	rows_parsed	rows_loaded	error_limit	errors_seen	first_error	first_error_line	first_error_charact	first_error_column_
1	mystage/flightd...	PARTIALLY_LO...	5819079	5813378	5819079	5701	Time '2400' is n...	978946	69	"FLIGHTS"["WH...

- The data file ‘flights.csv’ contains year,month and day data in separate columns in ‘number’ format. The year,month and day column is merged into a single column by type casting and concatenation. Then it is converted into ‘date’ format by the ‘to_date’ function.
- The data file ‘flights.csv’ contains time data (scheduledDeparture, departureTime, wheelsOff, scheduledArrival, arrivalTime, wheelsOn) in ‘number’ format. The time data in ‘number’ format is converted into ‘time’ format by using the ‘to_time’ function.
- The ‘tailNumber’ and ‘cancellationReason’ column is filled with ‘NA’ if it contains empty values.
- Out of ‘5819079’ records, ‘5701’ records are filtered because those records contain invalid time ‘24:00’.
- This transformation and filtering is done while loading data into the table from the named internal stage ‘mystage’.

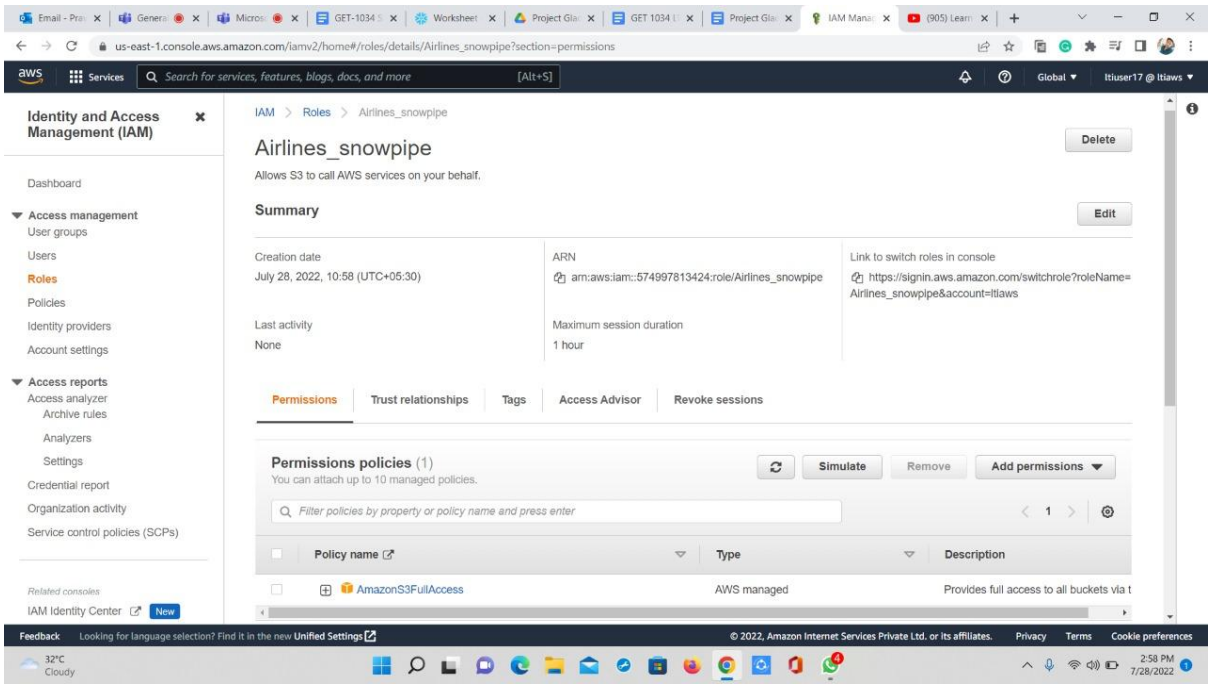
Task 8a: Create snowpipes to continuously load flights data from external stage from s3 bucket to the flight staging table

Snowpipe enables loading data from files as soon as they're available in a stage. This means you can load data from files in micro-batches, making it available to users within minutes, rather than manually executing COPY statements on a schedule to load larger batches.

Automated data loads leverage event notifications for cloud storage to inform Snowpipe of the arrival of new data files to load. Snowpipe copies the files into a queue, from which they are loaded into the target table in a continuous, serverless fashion based on parameters defined in a specified pipe object.

Following are the steps:

1. **Creating IAM roles**



2. **Creating storage integration in snowflake**

```
create or replace storage integration s3_int type=external_stage storage_provider=s3 enabled=true

storage_aws_role_arn='arn:aws:iam::574997813424:role/Airlines_snowpipe'
storage_allowed_locations=('s3://lti1034-praveenchandar');

--arn:aws:iam::574997813424:role/Airlines_snowpipe
desc integration s3_int;
```

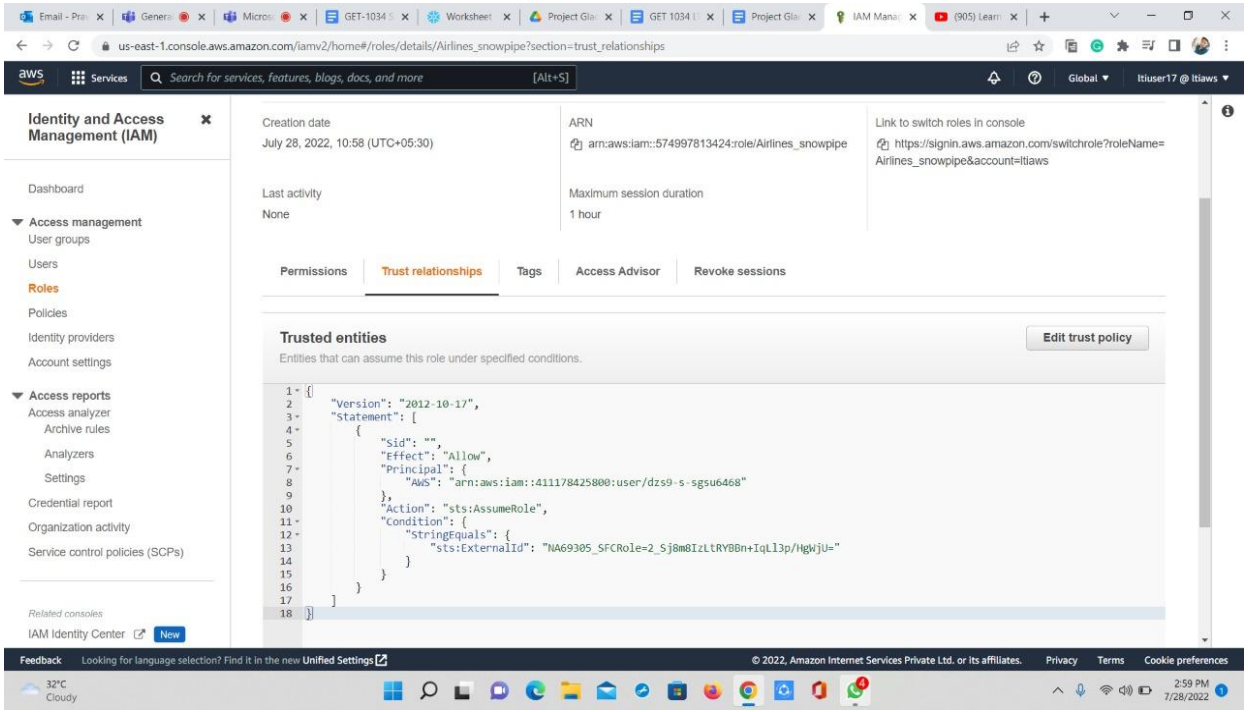
Results | Data Preview

Query ID | SQL | 52ms | 8 rows

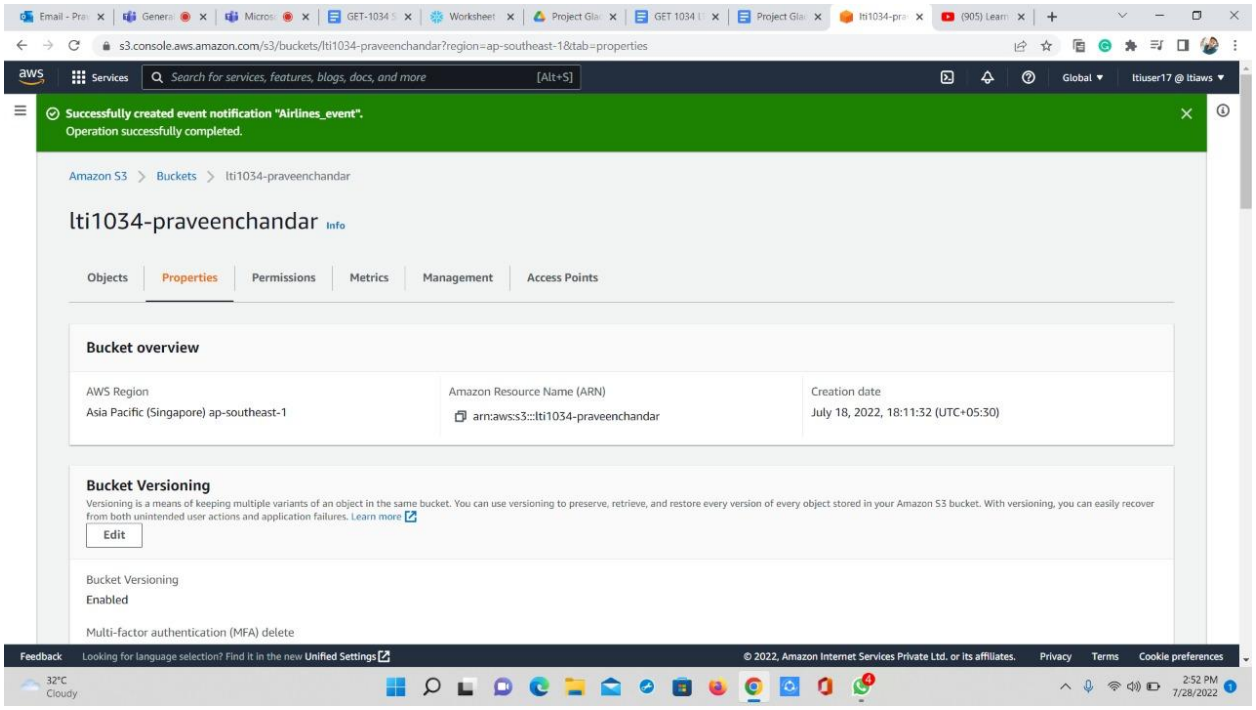
Filter result... | Copy

Row	property	property_type	property_value	property_default
1	ENABLED	Boolean	true	false
2	STORAGE_PROVIDER	String	S3	
3	STORAGE_ALLOWED_LOCATIONS	List	s3://lti1034-praveenchandar	[]
4	STORAGE_BLOCKED_LOCATIONS	List		[]
5	STORAGE_AWS_IAM_USER_ARN	String	arn:aws:iam::411178425800:user/dzs9-s-sgsu6468	
6	STORAGE_AWS_ROLE_ARN	String	arn:aws:iam::574997813424:role/Airlines_snowpipe	
7	STORAGE_AWS_EXTERNAL_ID	String	NA69305_SFCRole=2_sjuqy+Ox+5Q6wTWXuZAGaeC0sU0=	
8	COMMENT	String		

3. Editing the trust relationship



4. Creating event notification



5. Creating an external stage

```
create or replace stage snowpipe_stage storage_integration=s3_int
url='s3://lti1034-praveenchandar/' file_format='CSV';
```

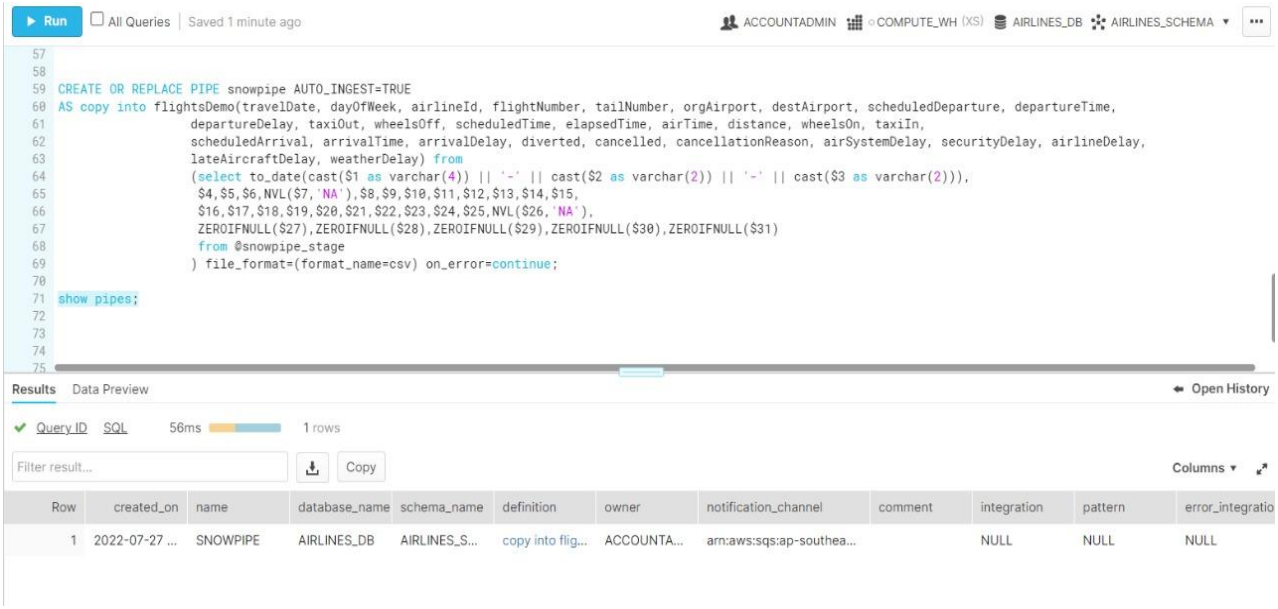
Results | Data Preview

Query ID | SQL | 3.66s | 1 rows

Filter result... | Copy

Row	status
1	Stage area SNOWPIPE_STAGE successfully created.

6. Creating a pipe with auto-ingest enabled



Task 8b: Maintain the change data capture and merge the data to the consumption table

A stream object records data manipulation language (DML) changes made to tables, including **inserts, updates, and deletes, as well as metadata** about each change, so that actions can be taken using the changed data. This process is referred to as **change data capture (CDC)**. An individual table stream tracks the changes made to rows in a source table. A stream makes a "change table" available of what changed, at the row level, between two transactional points of time in a table. This allows querying and consuming a sequence of change records in a transactional fashion.

A **Slowly Changing Dimension (SCD)** is a dimension that stores and manages both current and historical data over time in a data warehouse. It is considered one of the most **critical** ETL tasks in **tracking the history** of dimension records.

A **Type 2** SCD retains the full history of values. When the value of a chosen attribute changes, the current record is closed and a new record is created with the changed data values. This new record becomes the current record. Each record contains the effective time and expiration time to identify the time period between which the record was active.

1. **Creating a stream on table**

```
13 create or replace stream flights_stream on table flightsDemo;
14 show streams;
```

Results Data Preview Open History

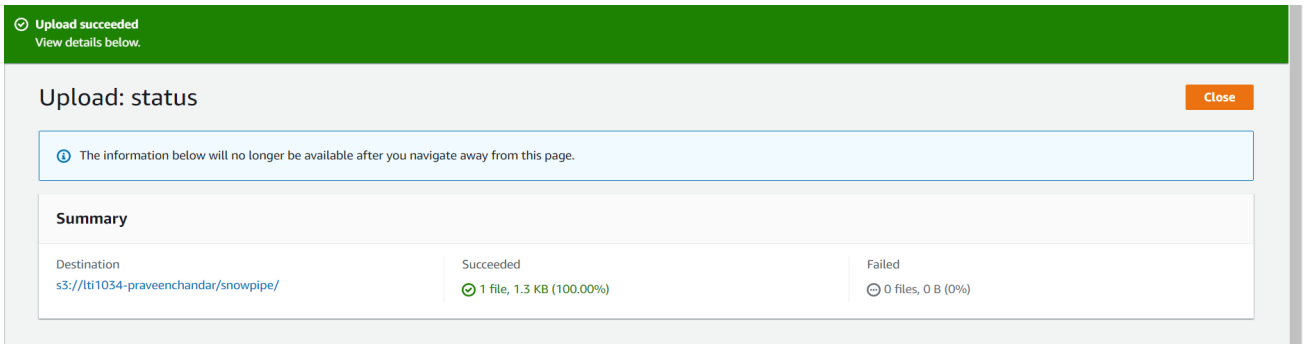
Query ID SQL 60ms 1 rows

Filter result... Copy Columns

Row	created_on	name	database_name	schema_name	owner	comment	table_name	source_type	base_tables	type	stale	mode
1	2022-07-28 ...	FLIGHTS_ST...	SNOWPIPE	PUBLIC	ACCOUNTA...		SNOWPIPE....	Table	SNOWPIPE....	DELTA	false	DEFAULT

- A stream named ‘flights_stream’ is created on the ‘flightsDemo’ table which captures any DML changes made to the table.

2. Uploading the data file to external stage



3. Table loaded through snowpipe

```
16 select * from flightsDemo;
17
```

Results Data Preview Open History

Query ID SQL 1.69s 10 rows

Filter result... Copy Columns

Row	TRAVELDATE	DAYOFWEEK	AIRLINEID	FLIGHTNUMBEF	TAILNUMBER	ORGAIRPORT	DESTAIRPORT	SCHEDULEDDEI	DEPARTURETIM	DEPARTUREDEL	TAXIOUT	WHEELS
1	2015-01-01	4	AS	98	N407AS	ANC	SEA	5	2354	-11	21	
2	2015-01-01	4	AA	2336	N3KUAA	LAX	PBI	10	2	-8	12	
3	2015-01-01	4	US	840	N171US	SFO	CLT	20	18	-2	16	
4	2015-01-01	4	AA	258	N3HYAA	LAX	MIA	20	15	-5	15	
5	2015-01-01	4	AS	135	N527AS	SEA	ANC	25	24	-1	11	

- As the file is uploaded in the external stage, data is loaded according to the ‘COPY’ statement defined in the ‘snowpipe’.

4. Data change captured in the stream

```
select * from flights_stream;
```

Results | Data Preview | Open History

Query ID | SQL | 141ms | 10 rows

Filter result... | Copy | Columns

IME	ARRIVALDELAY.	DIVERTED	CANCELLED	CANCELLATION	AIRSYSTEMDEL	SECURITYDELA	AIRLINEDELAY..	LATEAIRCRAFTI	WEATHERDELA	METADATA$ACT	METADATA$ISU	METADATA$ROV
408	-22	0	0	NA	0	0	0	0	0	INSERT	FALSE	6358a34d87...
741	-9	0	0	NA	0	0	0	0	0	INSERT	FALSE	d3a844f057...
811	5	0	0	NA	0	0	0	0	0	INSERT	FALSE	51167498a7...
756	-9	0	0	NA	0	0	0	0	0	INSERT	FALSE	495b50e6f0...
259	-21	0	0	NA	0	0	0	0	0	INSERT	FALSE	164d0a082c...
610	8	0	0	NA	0	0	0	0	0	INSERT	FALSE	ee177044ed...

- The stream ‘flights_stream’ captures the insertion data of the ‘flightDemo’ table.

5. Creation of task

```
create or replace task merge_flights_history warehouse=compute_wh schedule='1 minute'
when system$stream_has_data('flights_stream')
as
merge into "SNOWPIPE"."PUBLIC"."FLIGHTS_HISTORY" fh using flights_stream fs
on fh.travelDate=fs.travelDate when not matched and fs.metadata$action='INSERT' then
    insert(travelDate , dayOfWeek, airlineId, flightNumber, tailNumber, orgAirport, destAirport,typeOfUpdate,timeOfUpdate)
    values(fs.travelDate , fs.dayOfWeek, fs.airlineId, fs.flightNumber, fs.tailNumber, fs.orgAirport, fs.destAirport,
```

Results | Data Preview | Open History

Query ID | SQL | 76ms | 1 rows

Filter result... | Copy | Columns

Row	status
1	Task MERGE_FLIGHTS_HISTORY successfully created.

- A task named ‘merge_flights_history’ is created which merges any changes made in the ‘flightsDemo’ table into ‘flights_history’ table using the change data available in the stream ‘flights_stream’.

6. Running the task

```
alter task merge_flights_history resume;

show tasks;
```

Results | Data Preview | Open History

Query ID | SQL | 52ms | 1 rows

Filter result... | Copy | Columns

schema_name	owner	comment	warehouse	schedule	predecessors	state	definition	condition	allow_overlappir	error_integratior	last_committed_	last_su
PUBLIC	ACCOUNTA...		COMPUTE_...	1 minute	[]	started	merge into "...	system$stre...	false	null	2022-07-28 ...	

7. Merged-data

```
select * from flights_history;
```

Results | Data Preview | Open History

Query ID | SQL | 163ms | 10 rows

Filter result... | Copy | Columns

Row	TRAVELDATE	DAYOFWEEK	AIRLINEID	FLIGHTNUMBER	TAILNUMBER	ORGAIRPORT	DESTAIRPORT	TYPEOFUPDATE	TIMEOFUPDATE
1	2015-01-01	4	AS	98	N407AS	ANC	SEA	INSERT	2022-07-28 04:4...
2	2015-01-01	4	AA	2336	N3KUAA	LAX	PBI	INSERT	2022-07-28 04:4...
3	2015-01-01	4	US	840	N171US	SFO	CLT	INSERT	2022-07-28 04:4...
4	2015-01-01	4	AA	258	N3HYAA	LAX	MIA	INSERT	2022-07-28 04:4...
5	2015-01-01	4	AS	135	N527AS	SEA	ANC	INSERT	2022-07-28 04:4...
6	2015-01-01	4	DL	806	N3730B	SFO	MSP	INSERT	2022-07-28 04:4...

- After resuming the task, data gets loaded into the ‘flights_history’ table from the stream ‘flights_stream’.

8. After merge

```
select * from flights_stream;
```

Results | Data Preview | Open History

Query ID | SQL | 1.31s | 0 rows

Filter result... | Copy | Columns

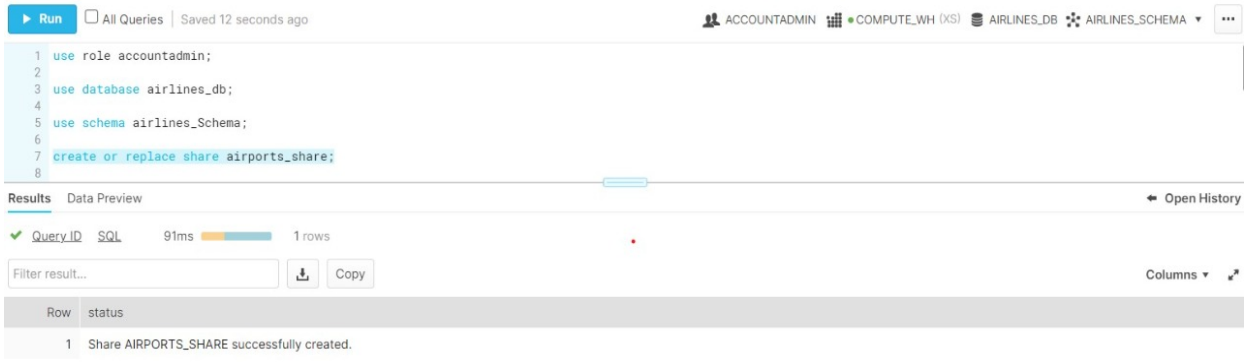
Row	TRAVELDATE	DAYOFWEEK	AIRLINEID	FLIGHTNUMBEF	TAILNUMBER	ORGAIRPORT	DESTAIRPORT	SCHEDULEDDEI	DEPARTURETIM	DEPARTUREDEL	TAXIOUT	WHEELS

- After merging the data into the ‘flights_history’ table, the change data in the stream ‘flights_stream’ gets purged.

Task 9: Share your table to new non-snowflake user

Reader accounts provide a quick, easy, and cost-effective way to share data without requiring the consumer to become a Snowflake customer.
Each reader account belongs to the provider account that created it. Similar to standard consumer accounts, the provider account uses shares to share databases with reader accounts; however, a reader account can only consume data from the provider account that created it.

1. Creating outbound share



2. Granting privileges to the share

```
--We have created db, schema and table. Now we give grant access on DB, schema, table, views
grant usage on database airlines_db to share airports_share;
grant usage on schema airlines_schema to share airports_share;
grant select on table airports to share airports_share;
grant usage on warehouse compute_wh to role public;

--https://JU23357.ap-southeast-1.snowflakecomputing.com  / Reader account


alter share airports_share add account=JU23357;
```

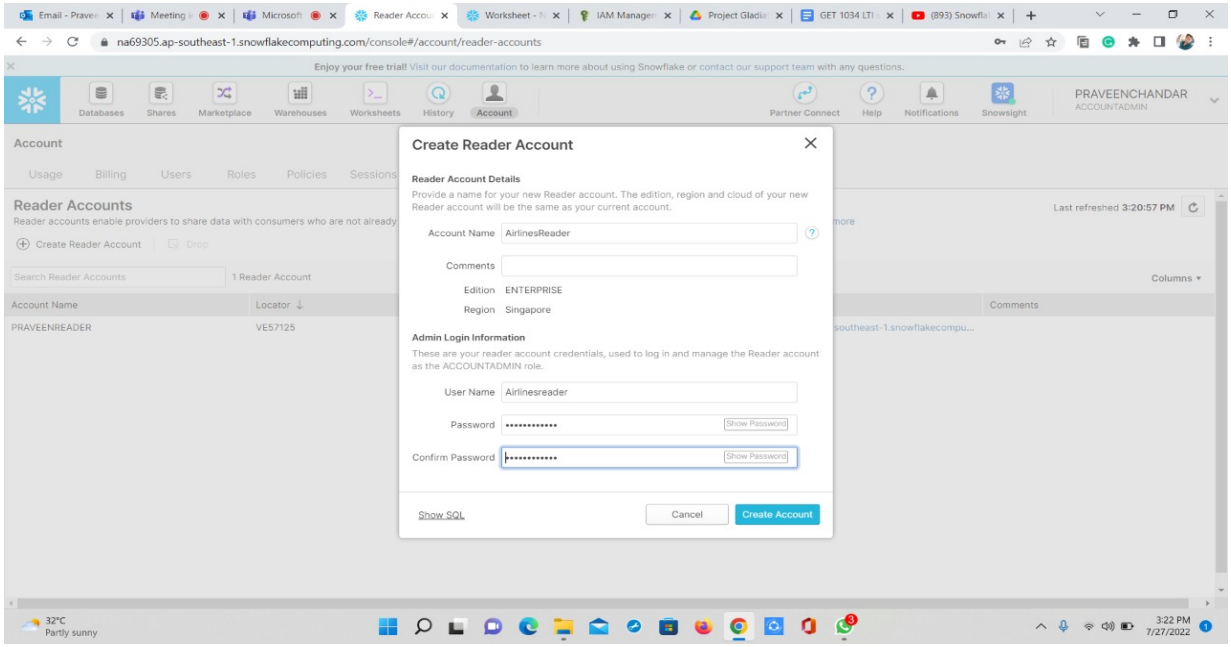
Results | Data Preview

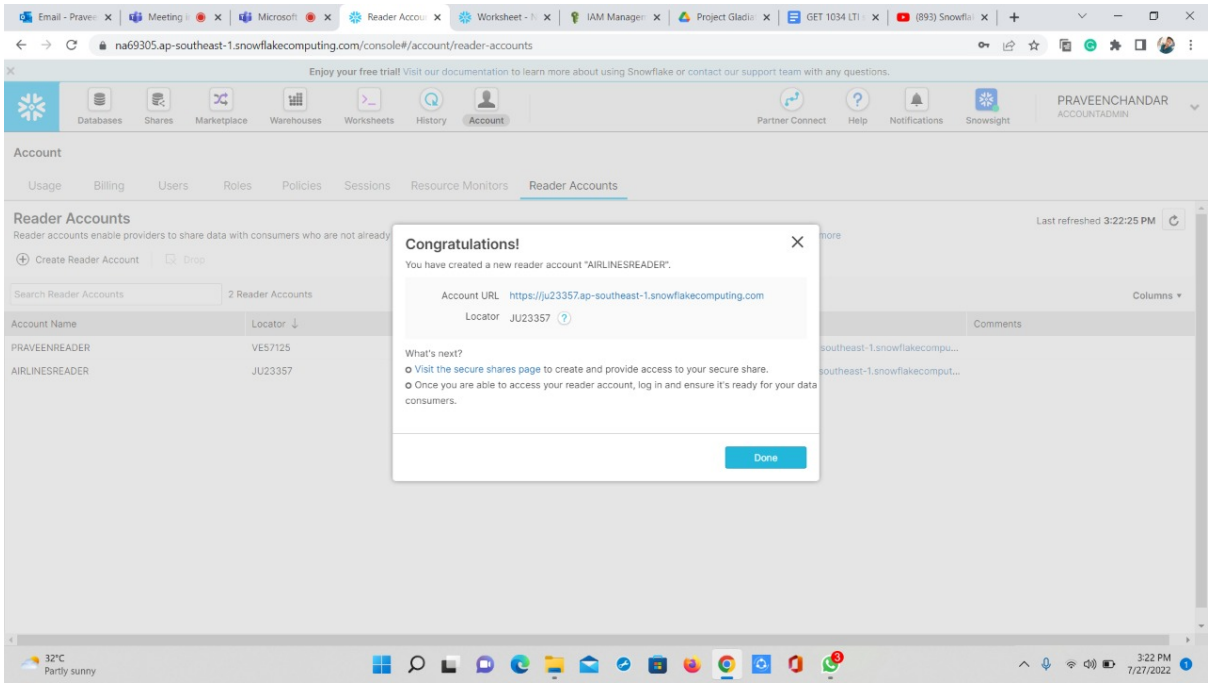
Query ID | SQL | 67ms | 1 rows

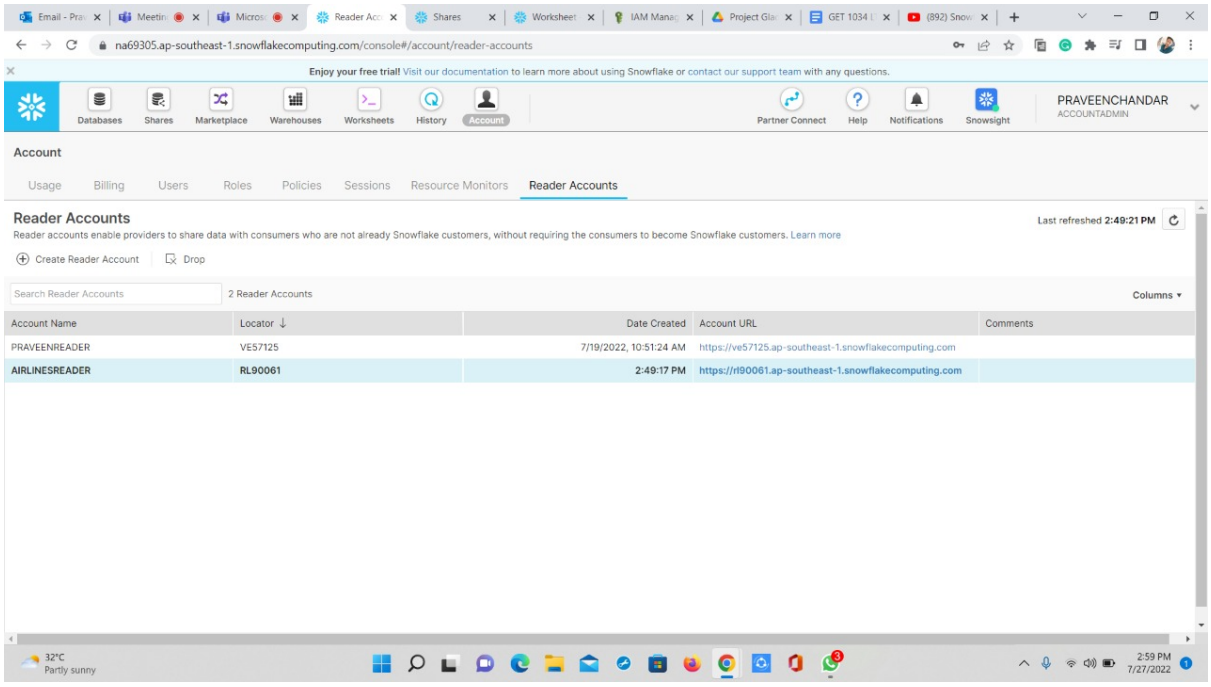
Filter result... | Copy

Row	status
1	Statement executed successfully.

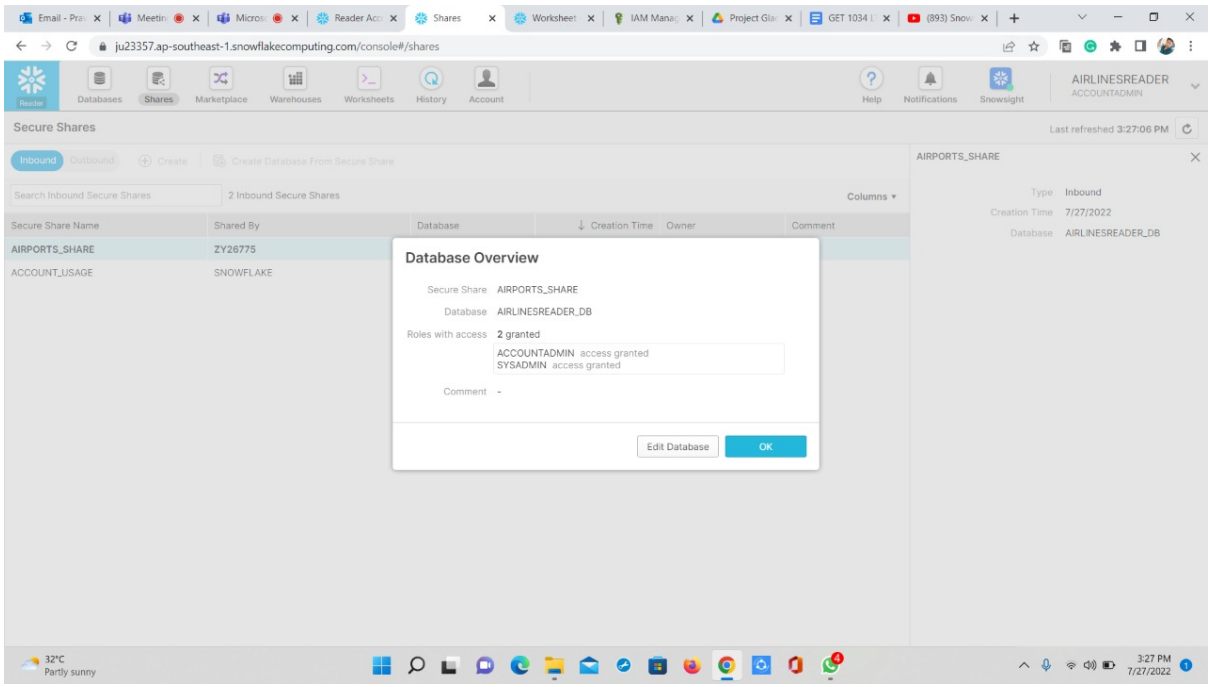
3. Creating a Reader account

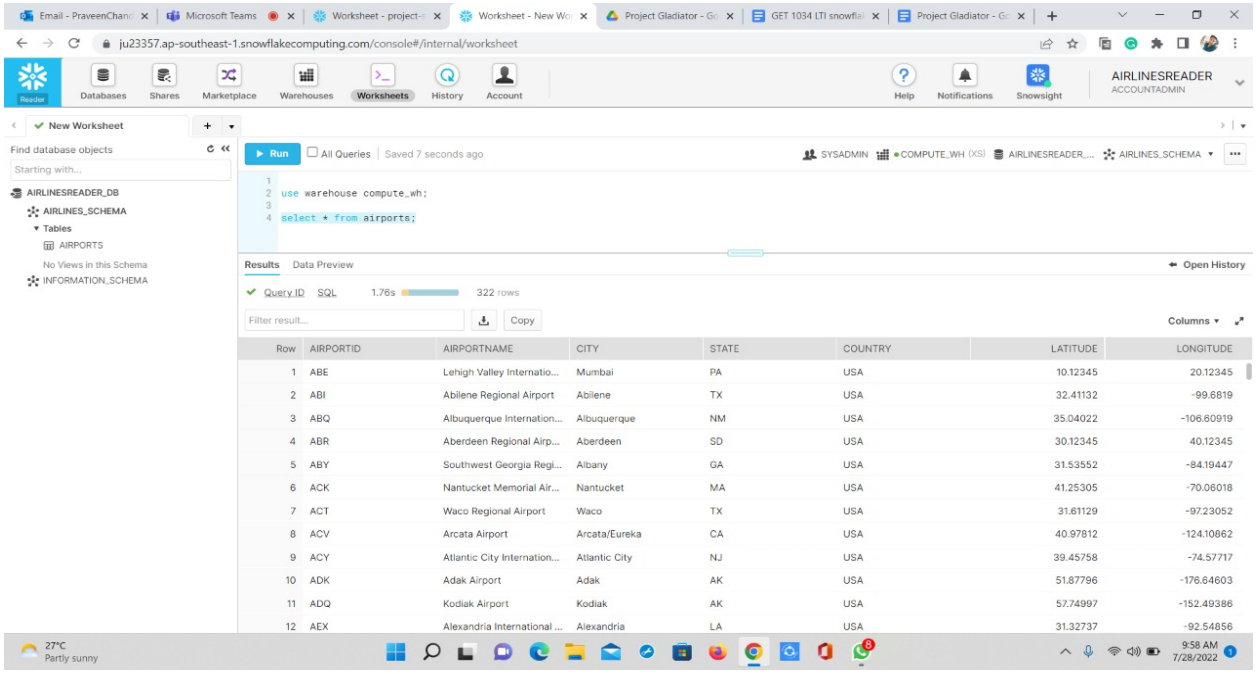






4. Reading the database from the reader account





Task 10: create clone of the table with time travel before one day and write query to get history data using particular timestamp

Cloning, also referred to as “zero-copy cloning” , creates a copy of a database, schema or table. A snapshot of data present in the source object is taken when the clone is created and is made available to the cloned object. It just updates the metadata which references the source data and prevents creation of physical copy of the data.

Snowflake Time Travel enables accessing historical data (i.e. data that has been changed or deleted) at any point within a defined period. It serves as a powerful tool for performing the following tasks:

- Restoring data-related objects (tables, schemas, and databases) that might have been accidentally or intentionally deleted.
- Duplicating and backing up data from key points in the past.
- Analysing data usage/manipulation over specified periods of time.

The steps to create cloned table is as follows:

```
select * from airports;
```

Results | Data Preview | Open History

Query ID | SQL | 1.5s | 322 rows

Filter result... | Copy | Columns

Row	AIRPORTID	AIRPORTNAME	CITY	STATE	COUNTRY	LATITUDE	LONGITUDE
1	ABE	Lehigh Valley Internatio...	Allentown	PA	USA	40.65236	-75.44040
2	ABI	Abilene Regional Airport	Abilene	TX	USA	32.41132	-99.68190
3	ABQ	Albuquerque Internation...	Albuquerque	NM	USA	35.04022	-106.60919

1. Creating a clone of the table using time-travel

```
create table restored_airport clone airports
  at(timestamp => 'Wed, 27 July 2022 12:20:24 +0300'::timestamp_tz);
```

Results | Data Preview

Query ID | SQL | 1.22s | 1 rows

Filter result... | Copy

Row	status
1	Table RESTORED_AIRPORT successfully created.

```
select * from restored_airport;
```

Results | Data Preview

Query ID | SQL | 617ms | 322 rows

Filter result... | Copy | Column

Row	AIRPORTID	AIRPORTNAME	CITY	STATE	COUNTRY	LATITUDE	LONGITUDE
1	ABE	Lehigh Valley Internatio...	Allentown	PA	USA	40.65236	-75.44040
2	ABI	Abilene Regional Airport	Abilene	TX	USA	32.41132	-99.68190
3	ABQ	Albuquerque Internation...	Albuquerque	NM	USA	35.04022	-106.60919

2. Changing the data in the table

```
update restored_airport set City='Mumbai',Latitude=10.12345, Longitude=20.12345 where airportid='ABE';
```

Results | Data Preview

Query ID | SQL | 905ms | 1 rows

Filter result... | Copy

Row	number of rows updated	
1	1	

```
select * from restored_airport;
```

Results | Data Preview | Open History

Query ID | SQL | 175ms | 322 rows

Filter result... | Copy | Columns

Row	AIRPORTID	AIRPORTNAME	CITY	STATE	COUNTRY	LATITUDE	LONGITUDE
1	ABE	Lehigh Valley Internatio...	Mumbai	PA	USA	10.12345	20.12345
2	ABI	Abilene Regional Airport	Abilene	TX	USA	32.41132	-99.68190
3	ABQ	Albuquerque Internation...	Albuquerque	NM	USA	35.04022	-106.60919

3. Retrieving the previous data using offset

```
--Time Travel using offset
select * from restored_airport at(offset => -60*15);
```

Results | Data Preview | Open History

Query ID | SQL | 88ms | 322 rows

Filter result... | Copy | Columns

Row	AIRPORTID	AIRPORTNAME	CITY	STATE	COUNTRY	LATITUDE	LONGITUDE
1	ABE	Lehigh Valley Internatio...	Allentown	PA	USA	40.65236	-75.44040
2	ABI	Abilene Regional Airport	Abilene	TX	USA	32.41132	-99.68190
3	ABQ	Albuquerque Internation...	Albuquerque	NM	USA	35.04022	-106.60919
4	ABR	Aberdeen Regional Airp...	Aberdeen	SD	USA	45.44906	-98.42183

```
delete from restored_airport where airportid='ABQ';
```

Results | Data Preview | Open History

Query ID | SQL | 1.55s | 1 rows

Filter result... | Copy | Columns

Row	number of rows deleted
1	1

```
select * from restored_airport;
```

Results | Data Preview | Open History

Query ID | SQL | 148ms | 321 rows

Filter result... | Copy | Columns

Row	AIRPORTID	AIRPORTNAME	CITY	STATE	COUNTRY	LATITUDE	LONGITUDE
1	ABE	Lehigh Valley Internatio...	Mumbai	PA	USA	10.12345	20.12345
2	ABI	Abilene Regional Airport	Abilene	TX	USA	32.41132	-99.68190
3	ABR	Aberdeen Regional Airp...	Aberdeen	SD	USA	45.44906	-98.42183

Status	Query ID	SQL Text	User	Warehouse	Clust...	Size	Session ID	Start Time	End Time	Total Duration
✔	01a5f589-0000-3299-0003-cc7200013...	delete from restored_...	SEJALJADH...	COMPUTE_...	1	X-Small	1069214928...	1:23:20 AM	1:23:21 AM	1.6s

4. Retrieving the data using QueryId

```
select * from restored_airport BEFORE (statement=>'01a5f589-0000-3299-0003-cc720001368e');
```

Results | Data Preview | Open History

Query ID | SQL | 98ms | 322 rows

Filter result... | Copy | Columns

Row	AIRPORTID	AIRPORTNAME	CITY	STATE	COUNTRY	LATITUDE	LONGITUDE
1	ABE	Lehigh Valley Internatio...	Mumbai	PA	USA	10.12345	20.12345
2	ABI	Abilene Regional Airport	Abilene	TX	USA	32.41132	-99.68190
3	ABQ	Albuquerque Internation...	Albuquerque	NM	USA	35.04022	-106.60919

Status	Query ID	SQL Text	User	Warehouse	Clust...	Size	Session ID	Start Time	End Time	Total Duration
This data was last updated at **1:29:32 AM**. Press ↻ at the top right to get the latest data. Close										
✔	01a5f581-0000-3295-0003-cc7200014...	update restored_airpo...	SEJALJADH...	COMPUTE_...	1	X-Small	1069214928...	1:15:30 AM	1:15:31 AM	905ms

```
33 select * from restored_airport BEFORE (statement=>'01a5f581-0000-3295-0003-cc72000144aa');
```

Results | Data Preview — Open History

✔ Query ID | SQL — 127ms — 322 rows

Filter result... — Copy — Columns

Row	AIRPORTID	AIRPORTNAME	CITY	STATE	COUNTRY	LATITUDE	LONGITUDE
1	ABE	Lehigh Valley Internatio...	Allentown	PA	USA	40.65236	-75.44040
2	ABI	Abilene Regional Airport	Abilene	TX	USA	32.41132	-99.68190
3	ABQ	Albuquerque Internation...	Albuquerque	NM	USA	35.04022	-106.60919
4	ABR	Aberdeen Regional Airp...	Aberdeen	SD	USA	45.44906	-98.42183

```
37 select sysdate();   --2022-07-30 20:04:39.282
38 select * from restored_airport AT (timestamp=> '2022-07-30 20:04:39' ::timestamp);
```

Results | Data Preview — Open History

✔ Query ID | SQL — 1.04s — 321 rows

Filter result... — Copy — Columns

Row	AIRPORTID	AIRPORTNAME	CITY	STATE	COUNTRY	LATITUDE	LONGITUDE
1	ABE	Lehigh Valley Internatio...	Mumbai	PA	USA	10.12345	20.12345
2	ABI	Abilene Regional Airport	Abilene	TX	USA	32.41132	-99.68190
3	ABR	Aberdeen Regional Airp...	Aberdeen	SD	USA	45.44906	-98.42183

5. Query to get history data using particular timestamp

```
41 select * from restored_airport AT (timestamp=> '2022-07-30 19:45:20.796' ::timestamp);
```

Results | Data Preview — Open History

✔ Query ID | SQL — 252ms — 322 rows

Filter result... — Copy — Columns

Row	AIRPORTID	AIRPORTNAME	CITY	STATE	COUNTRY	LATITUDE	LONGITUDE
1	ABE	Lehigh Valley Internatio...	Allentown	PA	USA	40.65236	-75.44040
2	ABI	Abilene Regional Airport	Abilene	TX	USA	32.41132	-99.68190
3	ABQ	Albuquerque Internation...	Albuquerque	NM	USA	35.04022	-106.60919
4	ABR	Aberdeen Regional Airp...	Aberdeen	SD	USA	45.44906	-98.42183

```
38
39 select * from restored_airport;
```

Results | Data Preview — Open History

✔ Query ID | SQL — 32ms — 321 rows

Filter result... — Copy — Columns

Row	AIRPORTID	AIRPORTNAME	CITY	STATE	COUNTRY	LATITUDE	LONGITUDE
1	ABE	Lehigh Valley Internatio...	Mumbai	PA	USA	10.12345	20.12345
2	ABI	Abilene Regional Airport	Abilene	TX	USA	32.41132	-99.68190
3	ABR	Aberdeen Regional Airp...	Aberdeen	SD	USA	45.44906	-98.42183
4	ABY	Southwest Georgia Regi...	Albany	GA	USA	31.53552	-84.19447

Task 11: Create stored procedure to insert the data into table after typecasting date format

Stored procedures allow you to write procedural code that executes SQL. In a stored procedure, you can use programmatic constructs to perform branching and looping.

1. Creating a stored procedure

```
create or replace procedure date_format(newdate varchar)
returns varchar as
$$
begin
    insert into flightsDemo values(to_date(:newdate,'YYYY-MM-DD'),1,'WN',7070,'N255WN','MAA','LAX',1615,1613,-2,7,1620,115,106,94,616,1654,5,1710,1659,-11,
    0,0,'NA',0,0,0,0,0);
    return 'success';
end
$$;
```

Results | Data Preview | Open History

Query ID | SQL | 84ms | 1 rows

Filter result... | Copy | Columns

Row	status
1	Function DATE_FORMAT successfully created.

- A stored procedure named ‘date_format’ is created which takes a date in varchar format as an argument.
- This procedure uses Snowflake scripting to insert a record into the ‘flightsDemo’ table by typecasting the argument into date format using the ‘to_date’ function.

2. Calling the stored procedure

```
call date_format('2015-05-01');

select * from flightsDemo;
```

Results | Data Preview | Open History

Query ID | SQL | 174ms | 1 rows

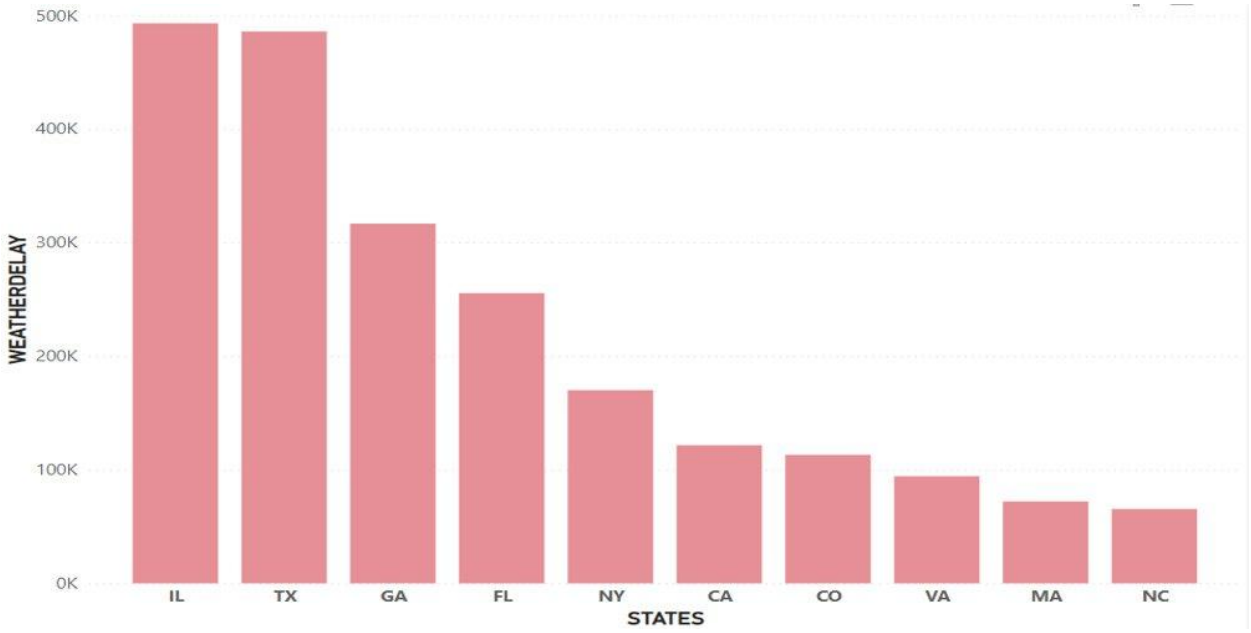
Filter result... | Copy | Columns

Row	TRAVELDATE	DAYOFWEEK	AIRLINEID	FLIGHTNUMBEI	TAILNUMBER	ORGAIRPORT	DESTAIRPORT	SCHEDULEDDEI	DEPARTURETIM	DEPARTUREDEL	TAXIOUT	WHEELS
1	2015-05-01	1	WN	7070	N255WN	MAA	LAX	1615	1613	-2	7	

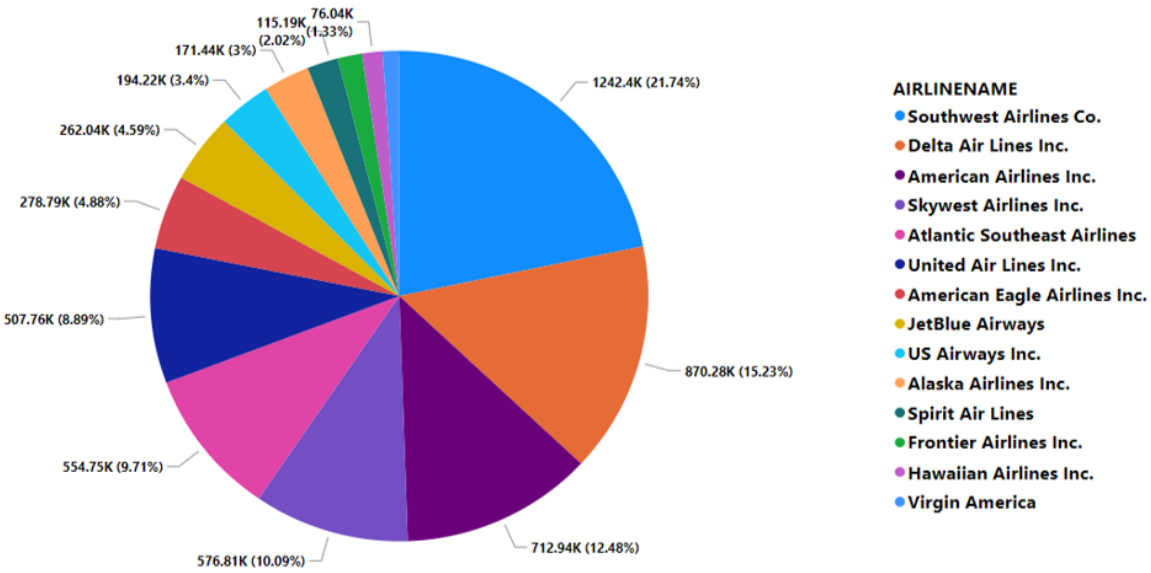
- After the stored procedure is called, a record is inserted into the ‘flightsDemo’ table.

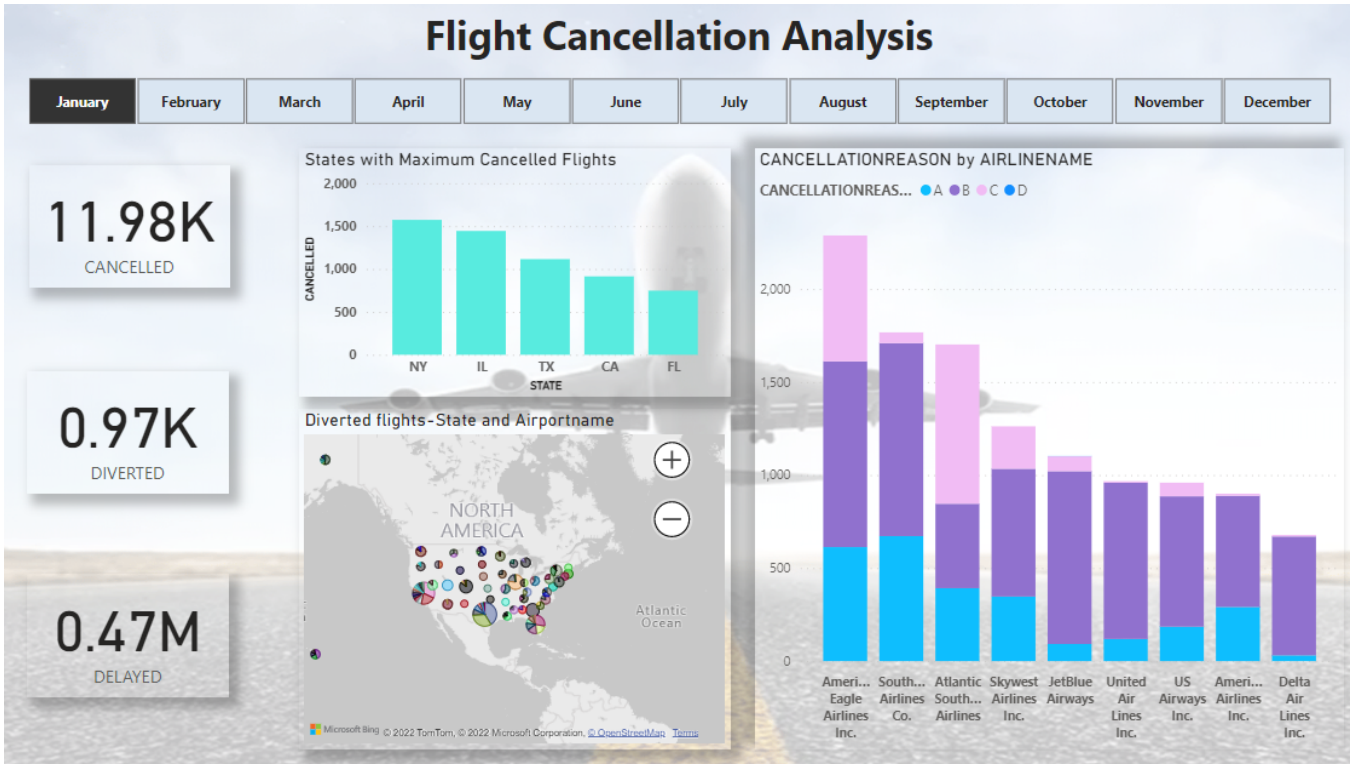
Task 12: Create a visualisation for flight delay analysis using powerBI and prepare reports /dashboard for business queries

Top 10 States with weather delay



Arrival Delay by Airline Name





Flight Delay Analysis