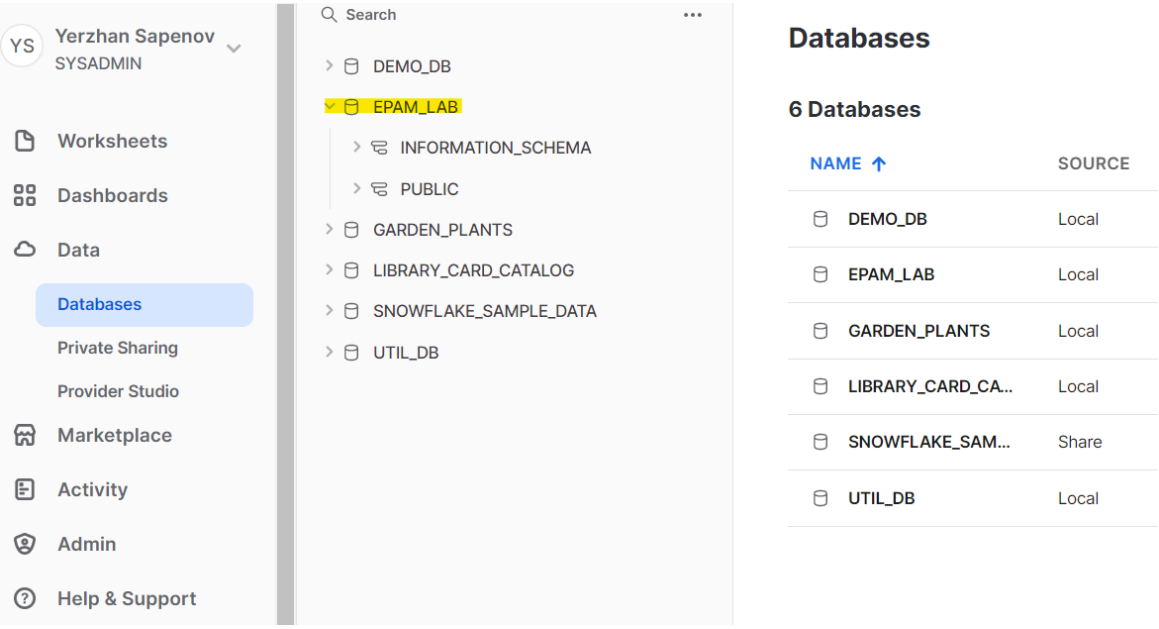
Snowflake Hands-on Lab

1. Database creation

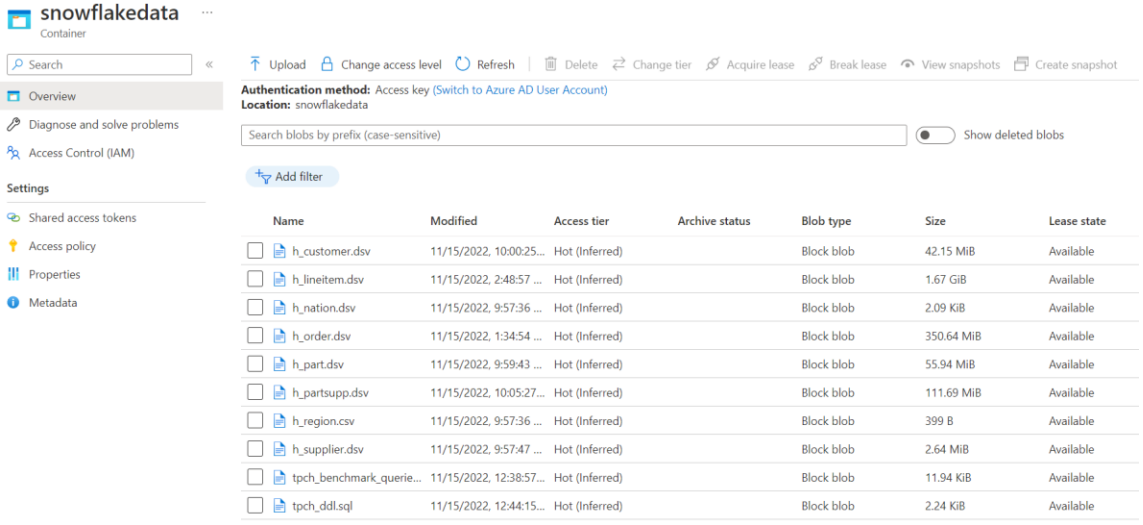
Screenshot of DB



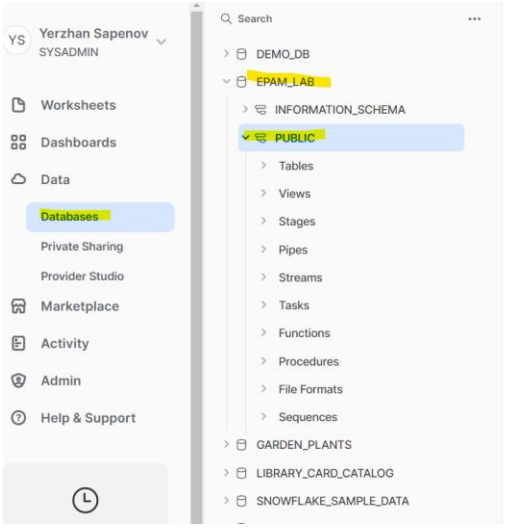
2. Data loading

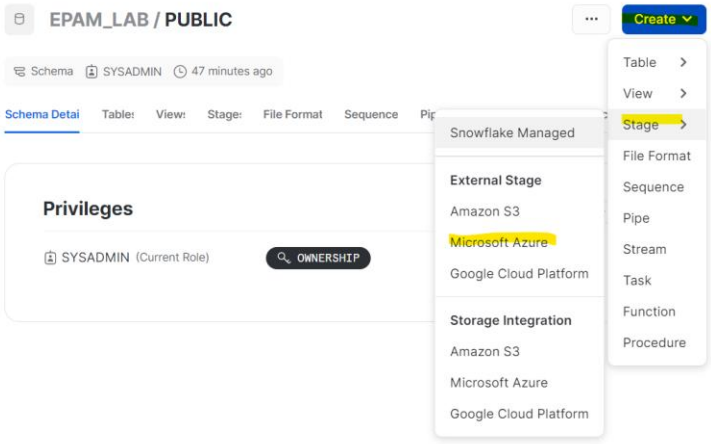
Information about storage and stage

All the data is in the Azure blob

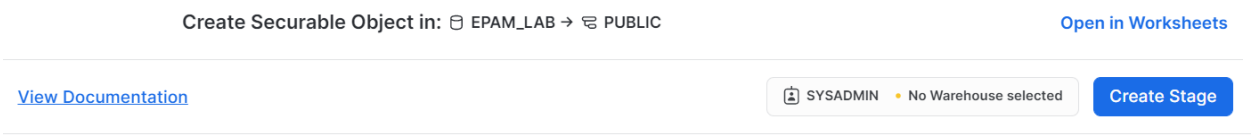


Create Stage for Azure Blob by generating SAS token in EPAM_LAB.PUBLIC schema

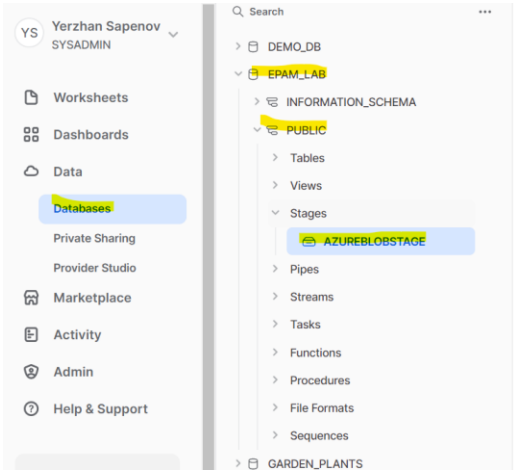


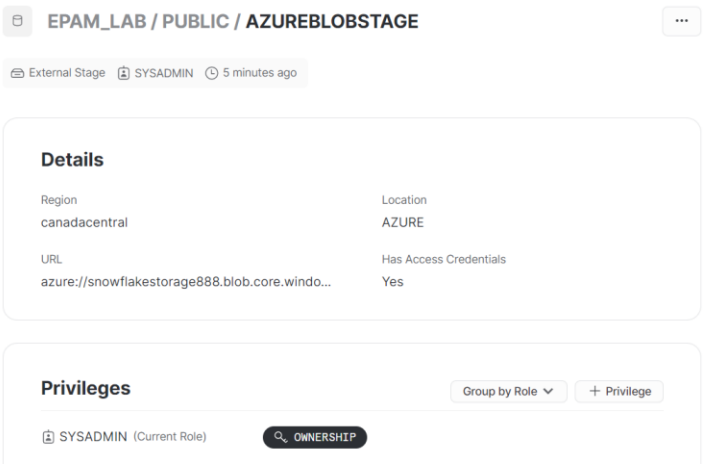


Here the SAS token is for example, used another one, forgot to make a snapshot.




```
1  create stage AZUREBLOBSTAGE
2      url = 'azure://snowflakestorage888.blob.core.windows.net/snowflakedata'
3      credentials = (azure_sas_token = 'sp=r&st=2022-11-15T05:10:15Z&se=2022-11-15T13:10:15Z&spr=https&sv=2021-06-
   08&sr=c&sig=aV790mKTdrECN2GHfk38OlUokODxgXGRfw73Y009h4Y%3D');
```





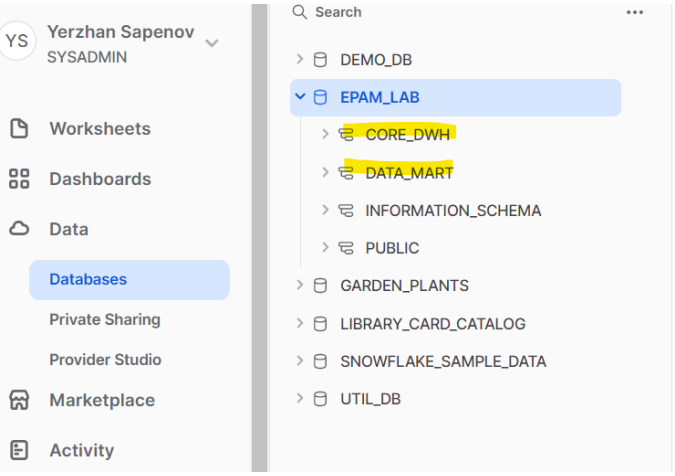
Created file formats for CSV and DSV

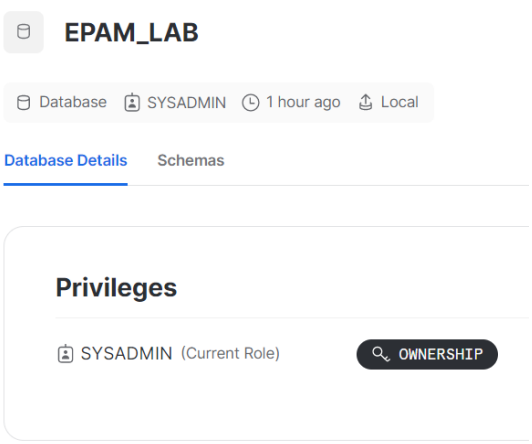
```
create file format EPAM_LAB.PUBLIC.DSVfileformat
   TYPE = 'CSV'
   FIELD_DELIMITER = '|'
   SKIP_HEADER = 1 --one header row
   FIELD_OPTIONALLY_ENCLOSED_BY = '"'
```

```
  ;
create file format EPAM_LAB.PUBLIC.CSVfileformat
  TYPE = 'CSV'--csv for comma separated files
  SKIP_HEADER = 1 --one header row
  FIELD_OPTIONALLY_ENCLOSED_BY = '"'
  ;
```

3. ELT Data Workflow

Created 2 schemas in EPAM_LAB database.





Created tables in CORE_DWH, copied data and checked the correctness of file formats

```
CREATE OR REPLACE TABLE epam_lab.core_dwh.h_region
(
 r_regionkey INTEGER,
 r_name      CHAR(25),
 r_comment   VARCHAR(152)
);

COPY INTO epam_lab.core_dwh.h_region
FROM @epam_lab.public.azureblobstage
files = ( 'h_region.csv')
file_format = ( format_name= epam_lab.public.CSVFILEFORMAT );


CREATE OR REPLACE TABLE epam_lab.core_dwh.h_nation
(
 n_nationkey INTEGER not null,
 n_name      CHAR(27),
 n_regionkey INTEGER,
 n_comment   VARCHAR(155)
);

COPY INTO epam_lab.core_dwh.h_nation
FROM @epam_lab.public.azureblobstage
files = ( 'h_nation.dsv')
file_format = ( format_name= epam_lab.public.DSVFILEFORMAT );
```

```
CREATE OR REPLACE TABLE epam_lab.core_dwh.h_supplier
(
 s_suppkey   INTEGER not null,
 s_name      CHAR(25),
 s_address   VARCHAR(40),
 s_nationkey INTEGER,
 s_phone     CHAR(15),
 s_acctbal   FLOAT8,
 s_comment   VARCHAR(101)
);

COPY INTO epam_lab.core_dwh.h_supplier
FROM (
SELECT t.$1, t.$2, t.$3, t.$4, t.$5,
      replace(t.$6,',','.'),
      t.$7
FROM @epam_lab.public.azureblobstage/h_supplier.dsv AS t)
file_format = ( format_name= epam_lab.public.DSVFILEFORMAT );

CREATE OR REPLACE TABLE epam_lab.core_dwh.h_orders
(
 o_orderkey      INTEGER not null,
 o_custkey       INTEGER not null,
 o_orderstatus   CHAR(1),
 o_totalprice    FLOAT8,
 o_orderdate     DATE,
 o_orderpriority CHAR(15),
 o_clerk         CHAR(15),
 o_shippriority  INTEGER,
 o_comment       VARCHAR(79)
);

COPY INTO epam_lab.core_dwh.h_orders
FROM (
SELECT t.$1, t.$2, t.$3, replace(t.$4,',','.'),
   TO_DATE(t.$5,'DD.MM.YY'), t.$6, t.$7, t.$8, t.$9
FROM @epam_lab.public.azureblobstage/h_order.dsv AS t)
file_format = ( format_name= epam_lab.public.DSVFILEFORMAT );

CREATE OR REPLACE TABLE epam_lab.core_dwh.h_partsupp
(
 ps_partkey    INTEGER not null,
 ps_suppkey    INTEGER not null,
 ps_availqty   INTEGER,
 ps_supplycost FLOAT8 not null,
 ps_comment    VARCHAR(199)
);

COPY INTO epam_lab.core_dwh.h_partsupp
FROM (
SELECT t.$1, t.$2, t.$3,
      replace(t.$4,',','.'),
      t.$5
FROM @epam_lab.public.azureblobstage/h_partsupp.dsv AS t)
```

```
file_format = ( format_name= epam_lab.public.DSVFILEFORMAT );

CREATE OR REPLACE TABLE epam_lab.core_dwh.h_part
(
 p_partkey     INTEGER not null,
 p_name        VARCHAR(55),
 p_mfgr        CHAR(25),
 p_brand       CHAR(10),
 p_type        VARCHAR(25),
 p_size        INTEGER,
 p_container   CHAR(10),
 p_retailprice INTEGER,
 p_comment     VARCHAR(23)
);

COPY INTO epam_lab.core_dwh.h_part
FROM @epam_lab.public.azureblobstage
files = ( 'h_part.dsv')
file_format = ( format_name= epam_lab.public.DSVFILEFORMAT );

CREATE OR REPLACE TABLE epam_lab.core_dwh.h_customer
(
 c_custkey    INTEGER not null,
 c_name       VARCHAR(25),
 c_address    VARCHAR(40),
 c_nationkey  INTEGER,
 c_phone      CHAR(15),
 c_acctbal    FLOAT8,
 c_mktsegment CHAR(10),
 c_comment    VARCHAR(117)
);

COPY INTO epam_lab.core_dwh.h_customer
FROM (
SELECT t.$1, t.$2, t.$3, t.$4, t.$5,
      replace(t.$6,',','.'),
      t.$7, t.$8
FROM @epam_lab.public.azureblobstage/h_customer.dsv AS t)
file_format = ( format_name= epam_lab.public.DSVFILEFORMAT );

CREATE OR REPLACE TABLE epam_lab.core_dwh.h_lineitem
(
 l_orderkey      INTEGER not null,
 l_partkey       INTEGER not null,
 l_suppkey       INTEGER not null,
 l_linenumber    INTEGER not null,
 l_quantity      INTEGER not null,
 l_extendedprice FLOAT8 not null,
 l_discount      FLOAT8 not null,
 l_tax           FLOAT8 not null,
 l_returnflag    CHAR(1),
 l_linestatus    CHAR(1),
 l_shipdate      DATE,
 l_commitdate    DATE,
```

```
 l_receiptdate   DATE,
 l_shipinstruct  CHAR(25),
 l_shipmode      CHAR(10),
 l_comment       VARCHAR(44)
);

COPY INTO epam_lab.core_dwh.h_lineitem
FROM (
SELECT t.$1, t.$2, t.$3, t.$4, t.$5,
   replace(t.$6,',','.'),
   replace(t.$7,',','.'),
   replace(t.$8,',','.'),
   t.$9, t.$10,
   TO_DATE(t.$11,'DD.MM.YY'),
   TO_DATE(t.$12,'DD.MM.YY'),
   TO_DATE(t.$13,'DD.MM.YY'),
   t.$14, t.$15, t.$16
FROM @epam_lab.public.azureblobstage/h_lineitem.dsv AS t)
file_format = ( format_name= epam_lab.public.DSVFILEFORMAT );
```

Created denormalized tables in DATA_MART and populated with data from CORE_DWH

Table LINEITEM columns remain the same + Concatenate (PARTKEY, SUPPKEY).

```
CREATE OR REPLACE TABLE epam_lab.DATA_MART.h_lineitem AS
   SELECT l_orderkey, l_partkey, l_suppkey, l_linenumber, l_quantity, l_extendedprice, l_discount, l_tax, l_returnflag,
l_linestatus, l_shipdate, l_commitdate, l_receiptdate, l_shipinstruct, l_shipmode, l_comment, concat(l_partkey,l_suppkey) AS
l_partsuppkey
   FROM epam_lab.core_dwh.h_lineitem;
```

Table ORDERS columns:

orderkey, orderstatus, totalprice, orderdate, order-priority, clerk, ship-priority, comment, custkey, customer_name, customer_address, customer_nation_name, customer_nation_region_name, customer_nation_region_comment, customer_nation_comment, customer_phone, customer_acctbal, customer_mktsegment, customer_comment.

```
CREATE OR REPLACE TABLE epam_lab.DATA_MART.h_orders AS
SELECT o.o_orderkey, o.o_custkey, o.o_orderstatus, o.o_totalprice, o.o_orderdate, o.o_orderpriority, o.o_clerk,
o.o_shippriority, o.o_comment, c.c_name, c.c_address, n.n_name, r.r_name, r.r_comment, n.n_comment, c.c_phone,
c.c_acctbal, c.c_mktsegment, c.c_comment
   FROM epam_lab.core_dwh.h_orders AS o LEFT OUTER JOIN
   epam_lab.core_dwh.h_customer AS c ON o.o_custkey = c.c_custkey LEFT OUTER JOIN
   epam_lab.core_dwh.h_nation AS n ON c.c_nationkey = n.n_nationkey LEFT OUTER JOIN
   epam_lab.core_dwh.h_region AS r ON n.n_regionkey = r.r_regionkey;
```

Table PARTSUP columns:

partkey, part_name, part_mfgr, part_brand, part_type, part_size, part_container, part_retailprice, part_comment, suppkey, supplier_name, supplier_address, supplier_nation_name, supplier_nation_region_name, supplier_nation_region_comment, supplier_nation_comment, supplier_phone, supplier_acctbal, supplier_comment, availqty, supplycost, comment, concatenate (partkey, suppkey).

```
CREATE OR REPLACE TABLE epam_lab.DATA_MART.h_partsupp AS
SELECT ps.ps_partkey, p.p_name, p.p_mfgr, p.p_brand, p.p_type, p.p_size, p.p_container, p.p_retailprice, p.p_comment,
ps.ps_suppkey, s.s_name, s.s_address, n.n_name, r.r_name, r.r_comment, n.n_comment, s.s_phone, s.s_acctbal, s.s_comment,
ps.ps_availqty, ps.ps_supplycost, ps.ps_comment, concat(ps.ps_partkey,ps.ps_suppkey) AS ps_partsuppkey
```

```
   FROM epam_lab.core_dwh.h_partsupp AS ps LEFT OUTER JOIN
   epam_lab.core_dwh.h_part AS p ON ps.ps_partkey = p.p_partkey LEFT OUTER JOIN
   epam_lab.core_dwh.h_supplier AS s ON ps.ps_suppkey = s.s_suppkey LEFT OUTER JOIN
   epam_lab.core_dwh.h_nation AS n ON s.s_nationkey = n.n_nationkey LEFT OUTER JOIN
   epam_lab.core_dwh.h_region AS r ON n.n_regionkey = r.r_regionkey;
```

Process automation

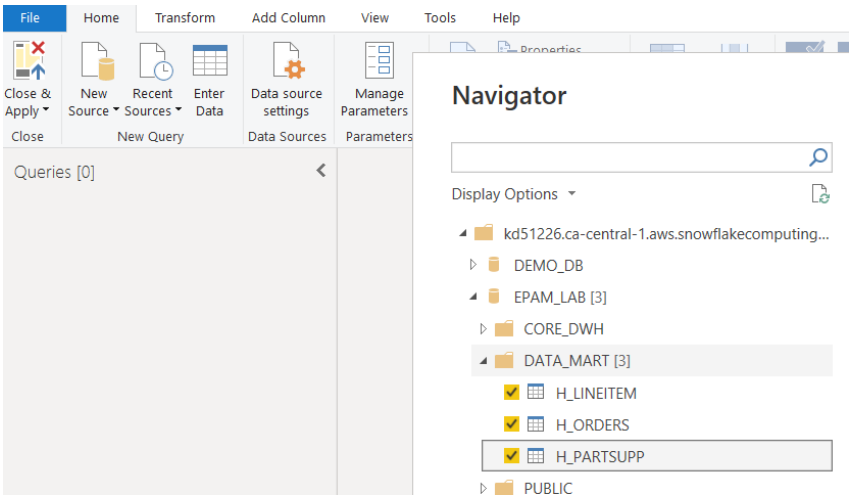
Create Stream, Procedure and Task for tables

```
CREATE OR REPLACE STREAM epam_lab.core_dwh.h_orders_stream on table epam_lab.core_dwh.h_orders;
CREATE OR REPLACE PROCEDURE epam_lab.core_dwh.DWH_TO_MART_ORDERS()
RETURNS VARCHAR
LANGUAGE SQL
AS
BEGIN
   INSERT INTO epam_lab.DATA_MART.h_orders
   SELECT o.o_orderkey, o.o_custkey, o.o_orderstatus, o.o_totalprice, o.o_orderdate, o.o_orderpriority, o.o_clerk,
o.o_shippriority, o.o_comment, c.c_name, c.c_address, n.n_name, r.r_name, r.r_comment, n.n_comment, c.c_phone,
c.c_acctbal, c.c_mktsegment, c.c_comment
   FROM epam_lab.core_dwh.h_orders_stream AS o LEFT OUTER JOIN
   epam_lab.core_dwh.h_customer AS c ON o.o_custkey = c.c_custkey LEFT OUTER JOIN
   epam_lab.core_dwh.h_nation AS n ON c.c_nationkey = n.n_nationkey LEFT OUTER JOIN
   epam_lab.core_dwh.h_region AS r ON n.n_regionkey = r.r_regionkey;
END;
CREATE OR REPLACE TASK epam_lab.core_dwh.DWH_TO_MART_ORDERS_task
warehouse = COMPUTE_WH
schedule = '30 minute'
when
 system$stream_has_data('epam_lab.core_dwh.h_ORDERS_stream')
as
CALL epam_lab.core_dwh.DWH_TO_MART_ORDERS();
ALTER TASK epam_lab.core_dwh.DWH_TO_MART_ORDERS_task RESUME;

CREATE OR REPLACE STREAM epam_lab.core_dwh.h_partsupp_stream on table epam_lab.core_dwh.h_partsupp;
CREATE OR REPLACE PROCEDURE epam_lab.core_dwh.DWH_TO_MART_PARTSUPP()
RETURNS VARCHAR
LANGUAGE SQL
AS
BEGIN
   INSERT INTO epam_lab.DATA_MART.h_PARTSUPP
   SELECT ps.ps_partkey, p.p_name, p.p_mfgr, p.p_brand, p.p_type, p.p_size, p.p_container, p.p_retailprice, p.p_comment,
ps.ps_suppkey, s.s_name, s.s_address, n.n_name, r.r_name, r.r_comment, n.n_comment, s.s_phone, s.s_acctbal, s.s_comment,
ps.ps_availqty, ps.ps_supplycost, ps.ps_comment, concat(ps.ps_partkey,ps.ps_suppkey) AS ps_partsuppkey
   FROM epam_lab.core_dwh.h_PARTSUPP_STREAM AS ps LEFT OUTER JOIN
   epam_lab.core_dwh.h_part AS p ON ps.ps_partkey = p.p_partkey LEFT OUTER JOIN
   epam_lab.core_dwh.h_supplier AS s ON ps.ps_suppkey = s.s_suppkey LEFT OUTER JOIN
   epam_lab.core_dwh.h_nation AS n ON s.s_nationkey = n.n_nationkey LEFT OUTER JOIN
   epam_lab.core_dwh.h_region AS r ON n.n_regionkey = r.r_regionkey;
END;
CREATE OR REPLACE TASK epam_lab.core_dwh.DWH_TO_MART_PARTSUPP_task
warehouse = COMPUTE_WH
schedule = '30 minute'
when
 system$stream_has_data('epam_lab.core_dwh.h_PARTSUPP_stream')
```

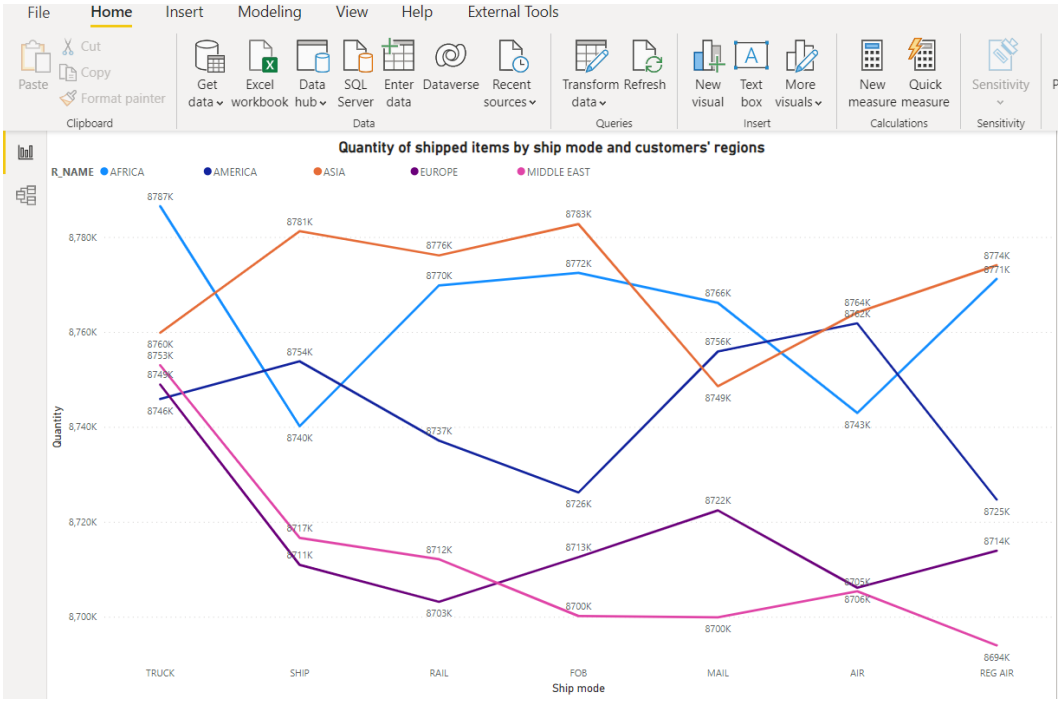
```
as
CALL epam_lab.core_dwh.DWH_TO_MART_PARTSUPP();
ALTER TASK epam_lab.core_dwh.DWH_TO_MART_PARTSUPP_task RESUME;

CREATE OR REPLACE STREAM epam_lab.core_dwh.h_lineitem_stream on table epam_lab.core_dwh.h_lineitem;
CREATE OR REPLACE PROCEDURE epam_lab.core_dwh.DWH_TO_MART_LINEITEM()
RETURNS VARCHAR
LANGUAGE SQL
AS
BEGIN
   INSERT INTO epam_lab.DATA_MART.h_LINEITEM
   SELECT l_orderkey, l_partkey, l_suppkey, l_linenumber, l_quantity, l_extendedprice, l_discount, l_tax, l_returnflag,
l_linestatus, l_shipdate, l_commitdate, l_receiptdate, l_shipinstruct, l_shipmode, l_comment, concat(l_partkey,l_suppkey) AS
l_partsuppkey
   FROM epam_lab.core_dwh.h_LINEITEM_STEAM;
END;
CREATE OR REPLACE TASK epam_lab.core_dwh.DWH_TO_MART_LINEITEM_task
warehouse = COMPUTE_WH
schedule = '30 minute'
when
 system$stream_has_data('epam_lab.core_dwh.h_LINEITEM_stream')
as
CALL epam_lab.core_dwh.DWH_TO_MART_LINEITEM();
ALTER TASK epam_lab.core_dwh.DWH_TO_MART_LINEITEM_task RESUME;

call system$wait(70);
```

4. Snowflake & 3rd party tools

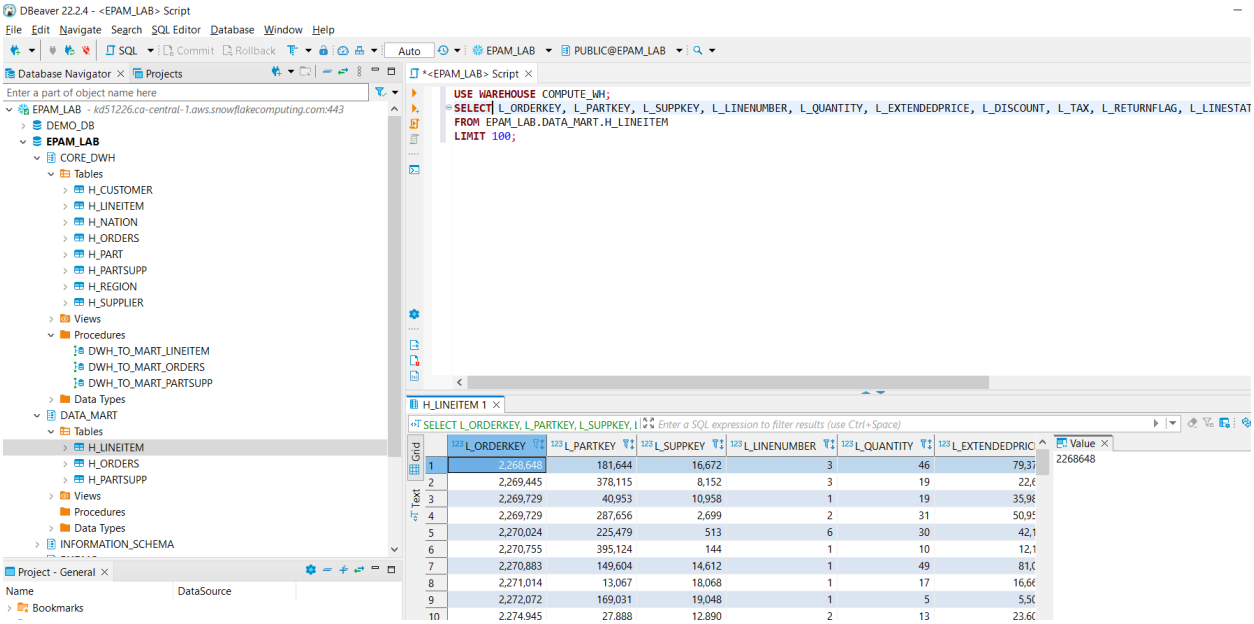
Connection from Power BI



Sample graph from the data



Connection from DBeaver



5. Snowflake SQL

Created two warehouses of different sizes

Warehouses

2 Warehouses

NAME ↑	STATUS	SIZE
COMPUTE_WH	Started	X-Small
COMPUTE_WH_XL	Started	X-Large

Used the following command to disable cache results:

```
ALTER SESSION SET USE_CACHED_RESULT=FALSE;
```

Interesting, as expected XS warehouse has longer time of execution than XL warehouse, but it has shorter time of compilation than XL.

Snowflake leverages cache, here are the same query with and without cache.

The duration is around 15 times smaller.

SQL TEXT	QUERY ID	STATUS	USER	WAREHOUSE	DURATION
select l_orderkey, sum(l_extendedprice * (…	01a86e64-320…	Success	YERZHAN	COMPUTE_WH	116ms
select l_orderkey, sum(l_extendedprice * (…	01a86e63-320…	Success	YERZHAN	COMPUTE_WH	1.7s

Performance comparison 3NF vs Star Schema

```
SELECT epam_lab.core_dwh.h_nation.n_name,
      sum(l_extendedprice * (1 - l_discount)) as revenue
FROM epam_lab.core_dwh.h_lineitem,
     epam_lab.core_dwh.h_orders,
     epam_lab.core_dwh.h_customer,
     epam_lab.core_dwh.h_nation
WHERE l_orderkey = o_orderkey
      and l_orderkey = o_orderkey
      and l_shipdate <= date '1998-12-01'
      and o_custkey = c_custkey
      and c_nationkey = n_nationkey
group by
            n_name
```

```
order by
        revenue desc;

SELECT epam_lab.data_mart.h_orders.n_name,
    sum(l_extendedprice * (1 - l_discount)) as revenue
FROM epam_lab.data_mart.h_lineitem,
    epam_lab.data_mart.h_orders
WHERE l_orderkey = o_orderkey
    and l_orderkey = o_orderkey
    and l_shipdate <= date '1998-12-01'
group by
        n_name
order by
        revenue desc;
```

The execution duration of query is faster for the star schema, 1.2s versus 1.6s.

SQL TEXT	QUERY ID	STATUS	USER	Query Duration	DURATION
SELECT epam_lab.core_dwh.h_nation.n_name, …	01a86e99-320…	Success	YERZHAN	Compilation 388ms	2.2s
SELECT epam_lab.data_mart.h_orders.n_name,…	01a86e96-320…	Success	YERZHAN	Queued provisioning 73ms	1.6s
SELECT epam_lab.data_mart.h_orders.n_name,…	01a86e95-320…	Failed	YERZHAN	Execution 1.2s	35ms
SELECT epam_lab.data_mart.h_orders.n_name,…	01a86e90-320…	Failed	YERZHAN	Total 1.6s	23ms

6. Other SnowFlake Features

Object Cloning

```
CREATE TABLE epam_lab.data_mart.h_orders_dev CLONE epam_lab.data_mart.h_orders;
```

It is very fast, less than 1 second.

Time Travel

```
DROP TABLE epam_lab.data_mart.h_orders_dev;
SELECT * FROM epam_lab.data_mart.h_orders_dev LIMIT 10;
```

002003 (42S02): SQL compilation error:

```
Object 'EPAM_LAB.DATA_MART.H_ORDERS_DEV' does not exist or not
authorized.
```

```
UNDROP TABLE epam_lab.data_mart.h_orders_dev;
```

	status
1	Table H_ORDERS_DEV successfully restored.

```
SELECT * FROM epam_lab.data_mart.h_orders_dev LIMIT 10;
```

	O_ORDERKEY	O_CUSTKEY	O_ORDERSTATUS	O_TOTALPRICE	O_ORDERDATE
1	10,702,467	114,445	F	197,071.8303	1993-06-25
2	10,702,469	185,380	F	192,008.179	1993-06-25
3	10,702,470	160,526	F	325,258.8345	1993-06-26
4	10,702,471	57,496	F	6,239.751	1993-06-26
5	10,702,500	168,340	F	277,266.9072	1993-06-27
6	10,702,504	185,531	F	231,749.9791	1993-06-28
7	10,702,533	13,877	F	74,401.1625	1993-06-29

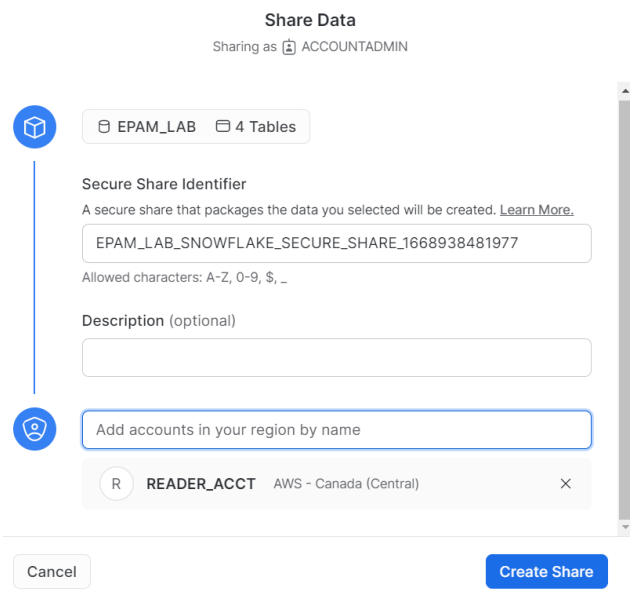
Data Sharing

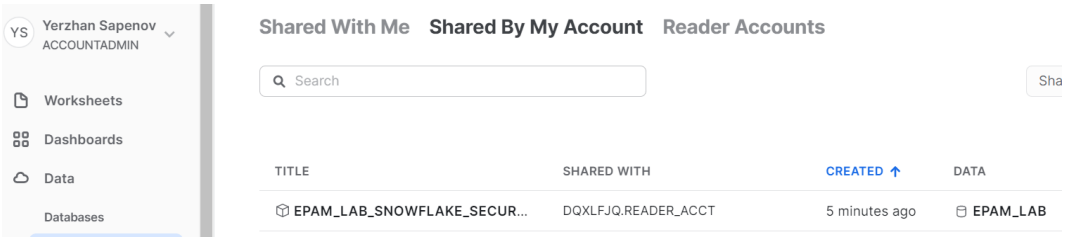
Created reader account

```
create managed account reader_acct
   admin_name = Yerzhan , admin_password = '****' ,
   type = reader;
```

status
{"accountName":"AH56885","loginUrl":"https://ah56885.ca-central-1.aws.snowflakecomputing.com"}

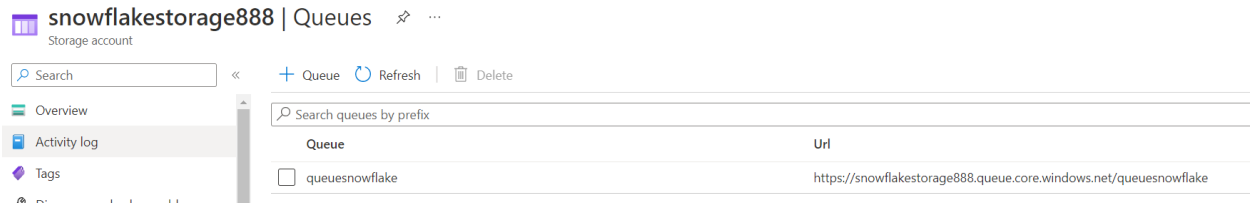
Shared data with reader account





7. Snowpipe

Created Storage Queue



Registered Microsoft.EventGrid for subscription

Created Event Subscription

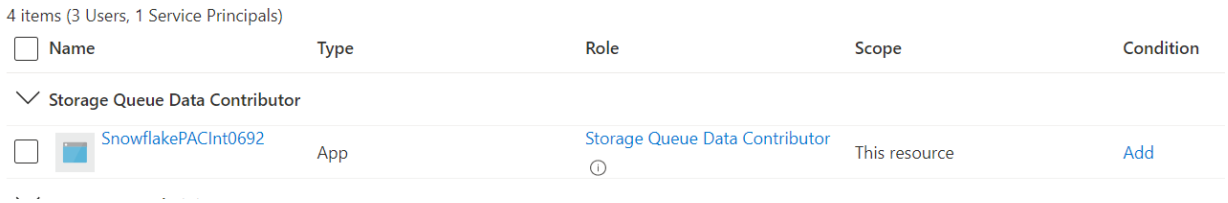
Created an Integration in Snowflake

```
create notification integration SNOWPIPE_DEMO_EVENT
 enabled = true
 type = queue
 notification_provider = azure_storage_queue
 azure_storage_queue_primary_uri = 'https://snowflakestorage888.queue.core.windows.net/queuesnowflake'
 azure_tenant_id = 'b41b72d0-4e9f-4c26-8a69-f949f367c91d';
```

Permission granted for Snowflake by Azure through URL from command

DESC notification integration SNOWPIPE_DEMO_EVENT;

Granted Snowflake access to the Storage Queue



Created Snowpipe

```
CREATE OR REPLACE pipe EPAM_LAB.PUBLIC.SNOWPIPE_ORDERS
auto_ingest = true
integration = 'SNOWPIPE_DEMO_EVENT'
as
COPY INTO
FROM (
```

```
SELECT t.$1, t.$2, t.$3, replace(t.$4,',','.'),
   TO_DATE(t.$5,'DD.MM.YY'), t.$6, t.$7, t.$8, t.$9
FROM @epam_lab.public.azureblobstage AS t)
file_format = ( format_name= epam_lab.public.DSVFILEFORMAT );
```

Counted amount of rows in epam_lab.core_dwh.h_orders

COUNT(*)
3,000,000

Uploaded file to Azure Blob Storage with 5 lines.

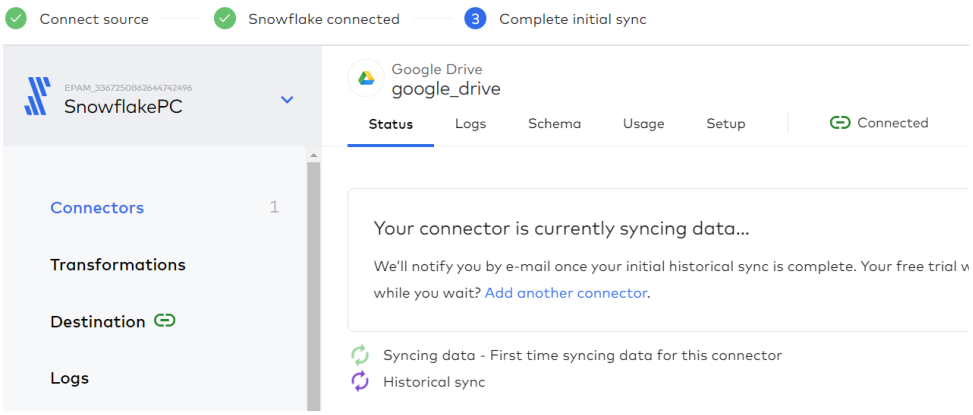
COUNT(*)
3,000,005

Good step-by-step tutorial [link]

8. Additional tasks

In Partner Connect it is possible to use partner applications

Connected to Google drive folder and started sync through Fivetran



Explored Matillion