Moving Big Data from Snowflake to ClickHouse for Fun and Profit

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Let's make some introductions

Robert Hodges

Database geek with 30+ years on DBMS systems. Day job: Altinity CEO

Altinity Engineering

Database geeks with centuries of experience in DBMS and applications

ClickHouse support and services including Altinity.Cloud
Authors of Altinity Kubernetes Operator for ClickHouse
and other open source projects

Foundations

Snowflake is a SQL Data Warehouse

Understands SQL (completely)

Runs in public cloud

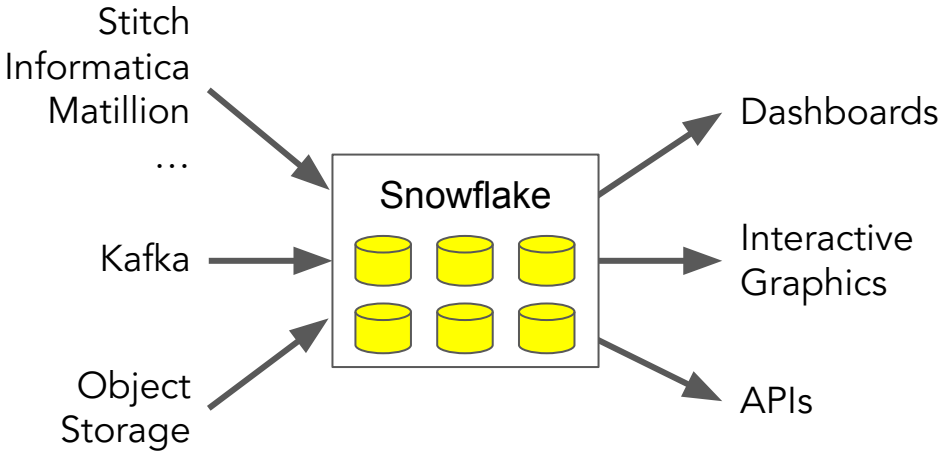
Decoupled compute/storage

Advanced cloud management

Star schemas with large table joins & complex query

Automatic performance tuning

Is proprietary



A popular engine for general purpose analytics

ClickHouse is a SQL Data Warehouse, too

Understands SQL

Runs anywhere Linux does

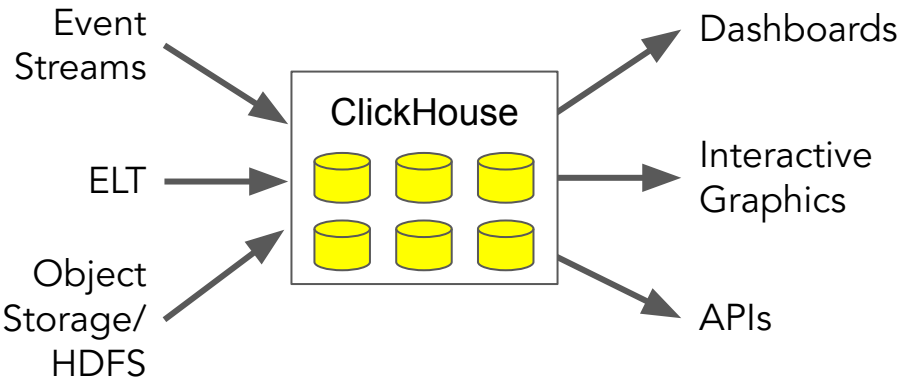
Shared nothing architecture

Extremely cost efficient

Ridiculously fast data ingest

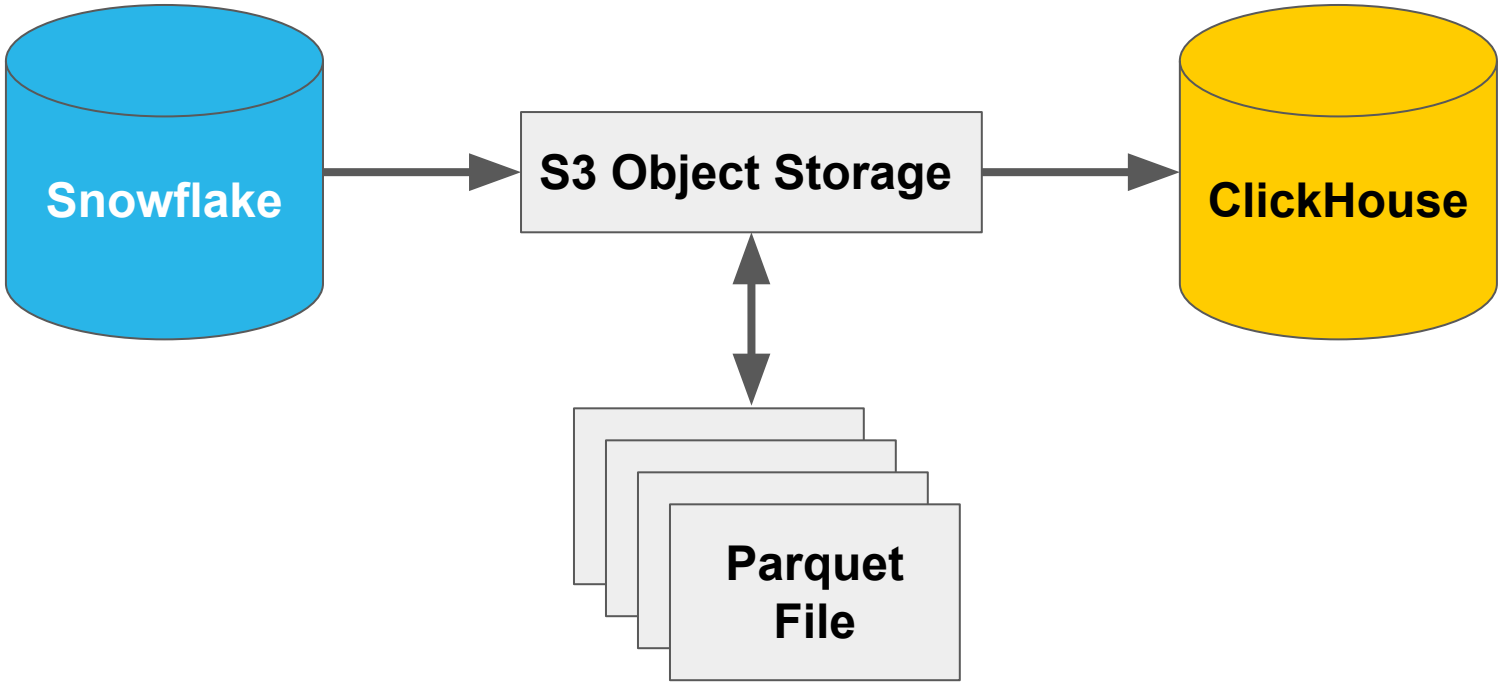
Linear scaling with fixed response

Open source (Apache 2.0)



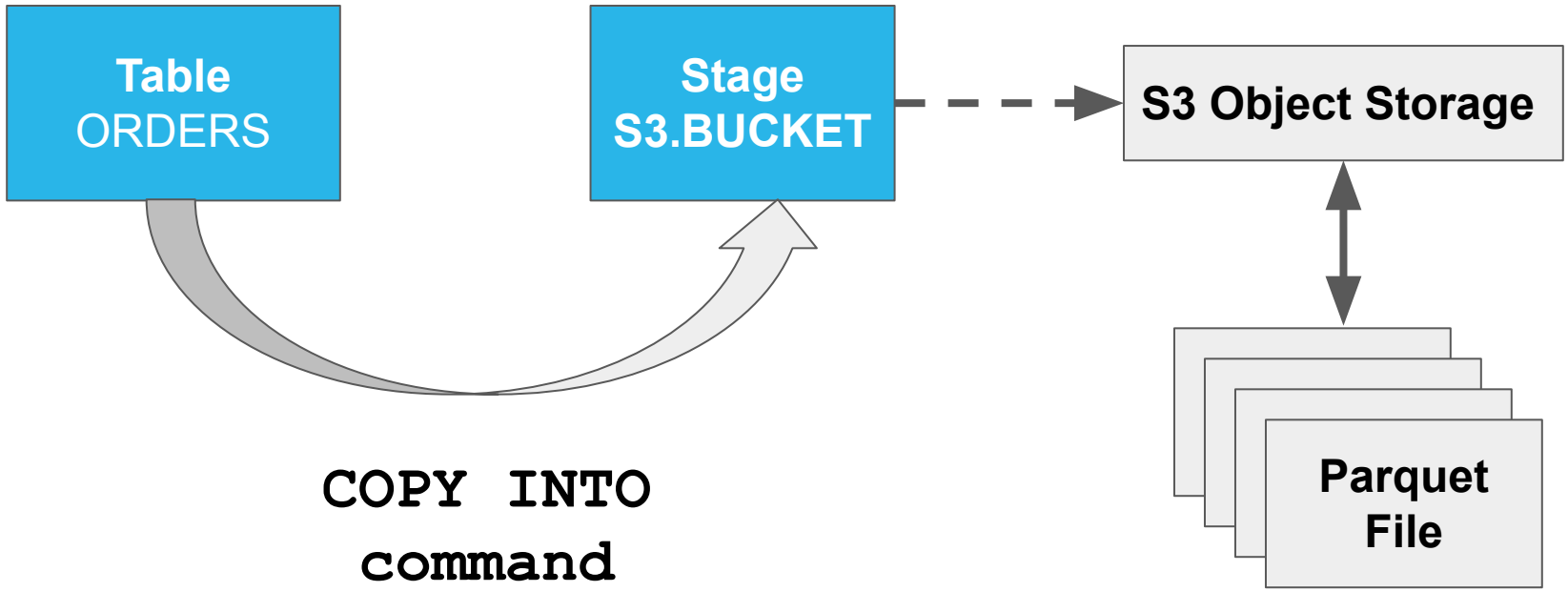
It's a popular engine for real-time analytics

Our goal: moving data from Snowflake to ClickHouse



Extracting data from Snowflake to Parquet

Exporting from Snowflake into Parquet files on S3



Source table on Snowflake

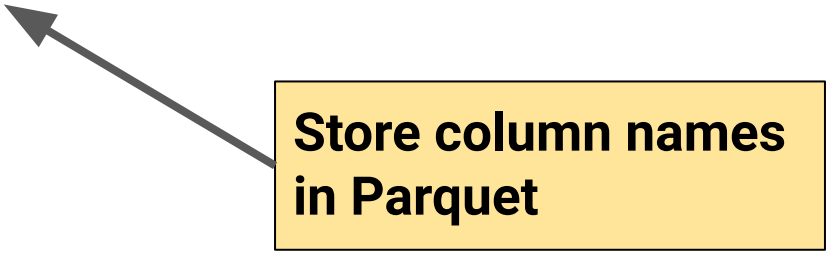
```
name              |type           |kind   |null?|
------------------|---------------|-------|-----|
O_ORDERKEY        |NUMBER(38,0)|COLUMN|N     |
O_CUSTKEY         |NUMBER(38,0)|COLUMN|N     |
O_ORDERSTATUS     |VARCHAR(1)   |COLUMN|N     |
O_TOTALPRICE      |NUMBER(12,2)|COLUMN|N     |
O_ORDERDATE       |DATE         |COLUMN|N     |
O_ORDERPRIORITY|VARCHAR(15)  |COLUMN|N     |
O_CLERK           |VARCHAR(15)  |COLUMN|N     |
O_SHIPPRIORITY    |NUMBER(38,0)|COLUMN|N     |
O_COMMENT         |VARCHAR(79)  |COLUMN|N     |
```

Create a stage on SnowFlake

```
-- Create a schema to put objects in.
CREATE SCHEMA S3

-- Create a stage connected to an S3 bucket.
CREATE OR REPLACE STAGE S3.BUCKET
URL='s3://your-migration-bucket/snowflake'
CREDENTIALS=
   (aws_key_id='aws_access_key',
    aws_secret_key='aws_secret_key')
FILE_FORMAT = (TYPE = PARQUET);
```

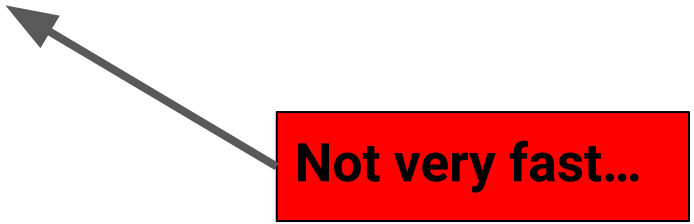
Copy from Snowflake table to stage

```
COPY INTO
@S3.BUCKET/SNOWFLAKE_SAMPLE_DATA/TPCH_SF100/ORDERS/
FROM SNOWFLAKE_SAMPLE_DATA.TPCH_SF100.ORDERS
HEADER=TRUE
```



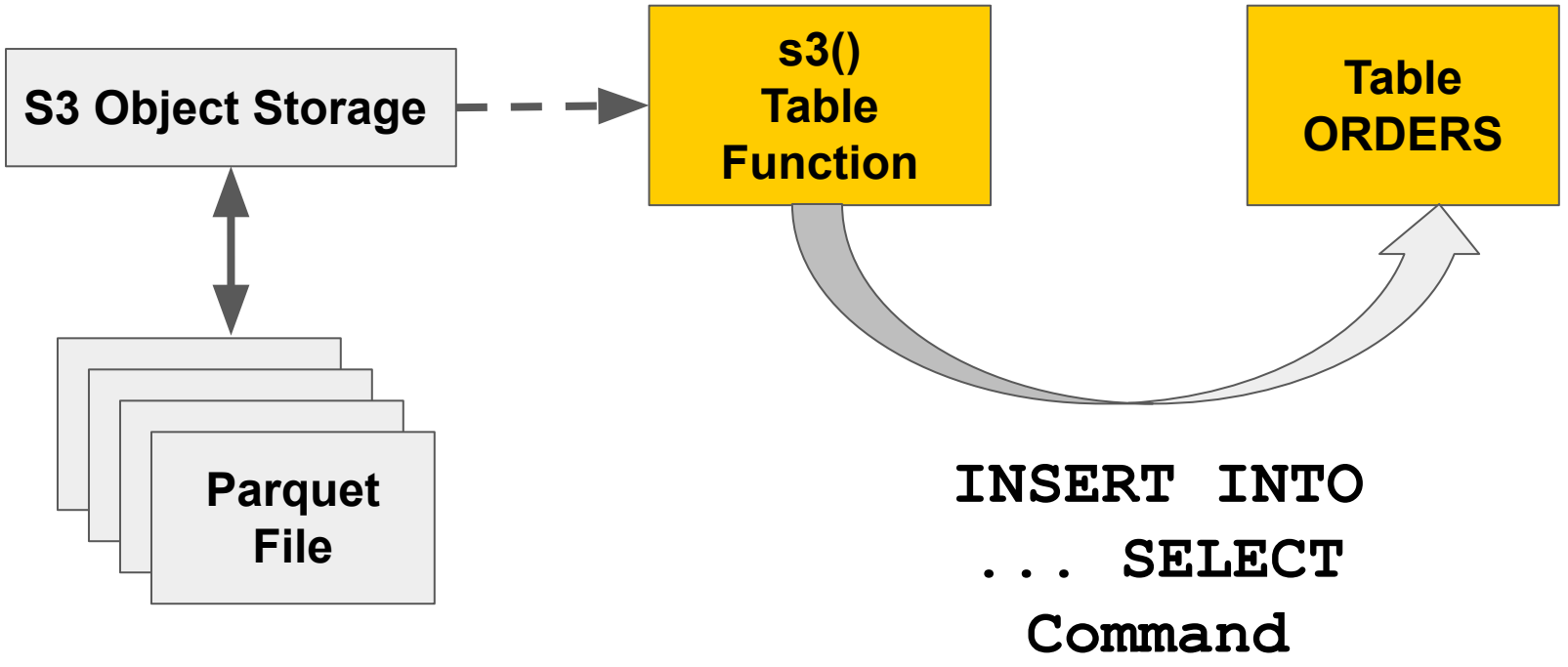
Check your work…

```
SELECT COUNT(*)
FROM SNOWFLAKE_SAMPLE_DATA.TPCH_SF100.ORDERS

SELECT COUNT(*)
FROM @S3.BUCKET/SNOWFLAKE_SAMPLE_DATA/TPCH_SF100/ORDERS/
```



Loading Parquet into ClickHouse

Exporting from Snowflake into Parquet files on S3



Create a table on ClickHouse

```
CREATE TABLE IF NOT EXISTS ORDERS (
  O_ORDERKEY Int128,
  O_CUSTKEY Int128,
  O_ORDERSTATUS String,
  O_TOTALPRICE Decimal(12, 2),
  O_ORDERDATE Date,
  O_ORDERPRIORITY String,
  O_CLERK String,
  O_SHIPPRIORITY Int128,
  O_COMMENT String
)
Engine=MergeTree()
PARTITION BY tuple() ORDER BY tuple()
```

Inefficient schema!

Default compression!

No partitioning or sorting!

Load data from open S3 bucket when there are no nulls…

```
-- Set to number of vCPUs.
SET max_insert_threads=16

INSERT INTO ORDERS
SELECT * FROM
s3('https://s3.us-east-1.amazonaws.com/your-migration-bucket/snowflake/SNOWFLAKE_SAMPLE_DATA/TPCH_SF100/ORDERS/*.parquet',
'aws_access_key', 'aws_secret_key', Parquet)
```

AWS credentials included

Load from S3 bucket when data have nulls

```
-- Set to number of vCPUs.
SET max_insert_threads=16

INSERT INTO ORDERS
SELECT * FROM
s3('https://s3.us-east-1.amazonaws.com/your-migration-bucket/snowflake/SNOWFLAKE_SAMPLE_DATA/TPCH_SF100/ORDERS/*.parquet',
'aws_access_key', 'aws_secret_key', Parquet,
'O_ORDERKEY Int128, O_CUSTKEY Int128, O_ORDERSTATUS String,
O_TOTALPRICE Decimal(12, 2), O_ORDERDATE Date, O_ORDERPRIORITY
String, O_CLERK String, O_SHIPPRIORITY Int128, O_COMMENT
String')
```

AWS credentials included

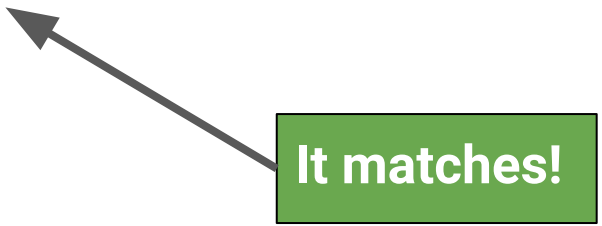
Schema required due to missing cast*

* https://github.com/ClickHouse/ClickHouse/issues/35346

Check your work…

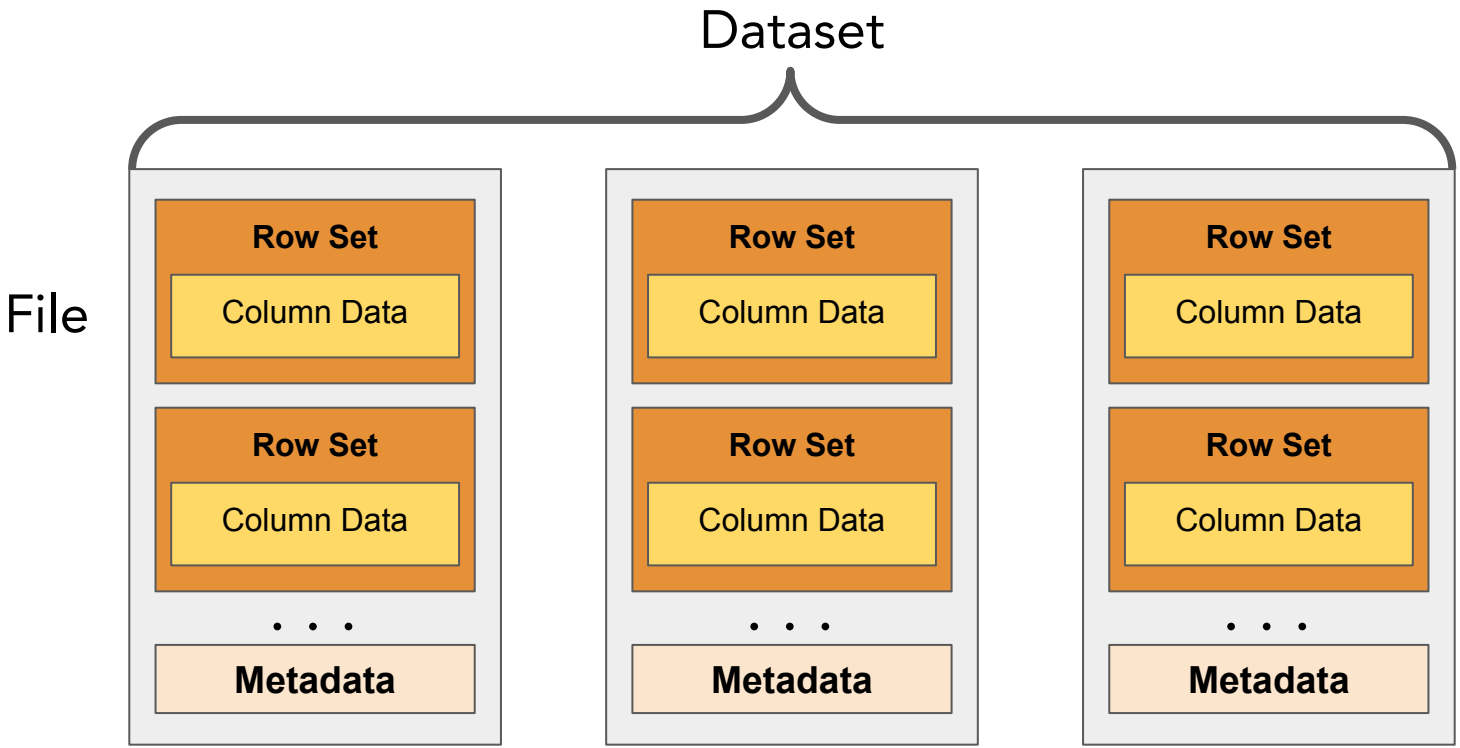
```
SELECT count() FROM ORDERS
```

```
┌─count()─┐
│ 150000000 │
└─────────┘
```



More about Parquet and ClickHouse

Apache Parquet file layout



Grab script to read Parquet and generate ClickHouse SQL

```
git clone \
  https://github.com/Altinity/clickhouse-sql-examples.git

cd clickhouse-sql-examples/parquet
python3 -m venv .venv
. .venv/bin/activate
python3 -m pip install --upgrade pip
pip install -r requirements.txt
```

Set environmental variables

```
# Region and keys for S3 access.
export AWS_S3_REGION="us-east-1"
export AWS_ACCESS_KEY_ID="aws_access_key"
export AWS_SECRET_ACCESS_KEY="aws_secret_key"

# Parquet dataset path: bucket_name/dir1/.../dirN/table_name/
export
S3_DATASET_PATH="your-migration-bucket/snowflake/SNOWFLAKE_SAM
PLE_DATA/TPCH_SF100/ORDERS/"
```

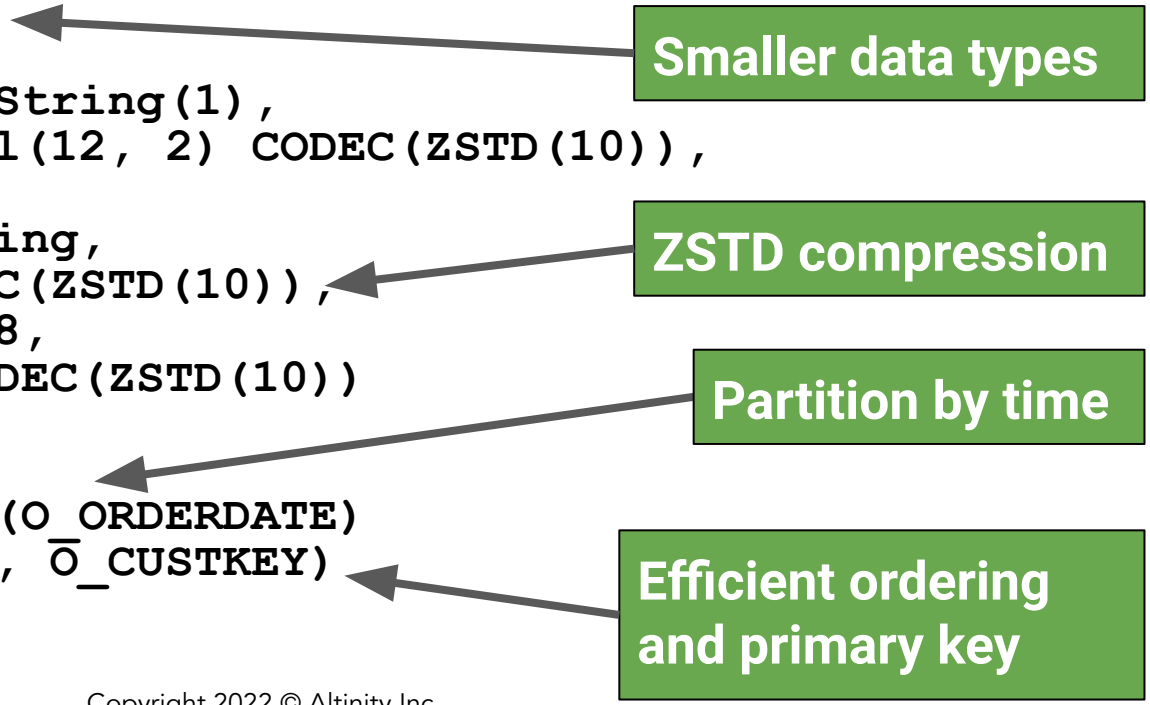
Run script to generate CREATE TABLE and INSERT

```
$ python generate-ch-schema.py
-- Automatically generated DDL and INSERT for Parquet data
-- AWS REGION: us-east-1
-- S3 DATASET PATH:
your-migration-bucket/snowflake/SNOWFLAKE_SAMPLE_DATA/TPCH_SF1
00/ORDERS/
-- Table name: ORDERS
CREATE TABLE IF NOT EXISTS ORDERS (
  O ORDERKEY Int128,
  O CUSTKEY Int128,
  O ORDERSTATUS String,
  O_TOTALPRICE Decimal(12, 2),
...
```

Optimizing imported table in ClickHouse

Create a better table in ClickHouse

```
CREATE TABLE IF NOT EXISTS ORDERS_OPTIMIZED (
  O_ORDERKEY UInt64,
  O_CUSTKEY UInt64,
  O_ORDERSTATUS FixedString(1),
  O_TOTALPRICE Decimal(12, 2) CODEC(ZSTD(10)),
  O_ORDERDATE Date,
  O_ORDERPRIORITY String,
  O_CLERK String CODEC(ZSTD(10)),
  O_SHIPPRIORITY UInt8,
  O_COMMENT String CODEC(ZSTD(10))
)
Engine=MergeTree()
PARTITION BY toYYYYMM(O_ORDERDATE)
ORDER BY (O_ORDERDATE, O_CUSTKEY)
```



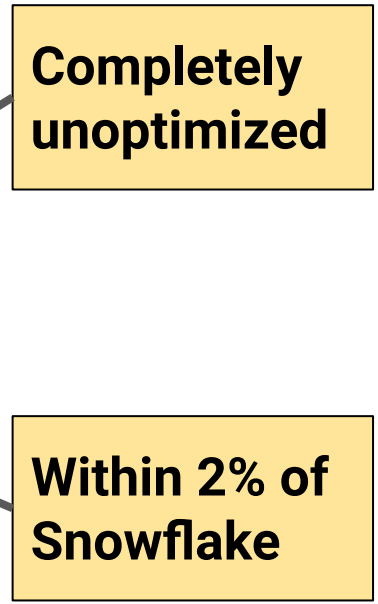
Move data into the optimized table

```
-- Set to number of vCPUs.
SET max_insert_threads=16

INSERT INTO ORDERS_OPTIMIZED SELECT * FROM ORDERS

OPTIMIZE TABLE ORDERS_OPTIMIZED FINAL
```

Check the table size before and after optimization

```
SELECT
  name, total_rows AS rows,
  formatReadableSize(total_bytes) AS size
FROM system.tables
WHERE name LIKE 'ORDERS%' ORDER BY name
```

```
┌─name─────────────┬──────rows─┬─size─────┐
│ ORDERS           │ 150000000 │ 6.06 GiB │
│ ORDERS_OPTIMIZED │ 150000000 │ 4.37 GiB │
└──────────────────┴───────────┴──────────┘
```



Conclusion and where to learn more

Moving a table from Snowflake to ClickHouse

1. Set up S3 bucket.
2. Snowflake: COPY data from Snowflake table to S3 via stage.
3. ClickHouse:
    a. Create working table definition.
    b. Load data from S3 using s3() function.
    c. Optimize the schema and reload.

Where is the documentation?

Altinity Blog – Migrating Data from Snowflaw to ClickHouse using S3 and Parquet

ClickHouse SQL Examples – https://github.com/Altinity/clickhouse-sql-examples

Apache Parquet Documentation – https://parquet.apache.org/docs/

Apache Arrow Documentation – https://arrow.apache.org/docs/

Thank you!
Questions?

https://altinity.com

rhodges at altinity.com

Altinity.Cloud

Software and Support for ClickHouse

We're hiring!