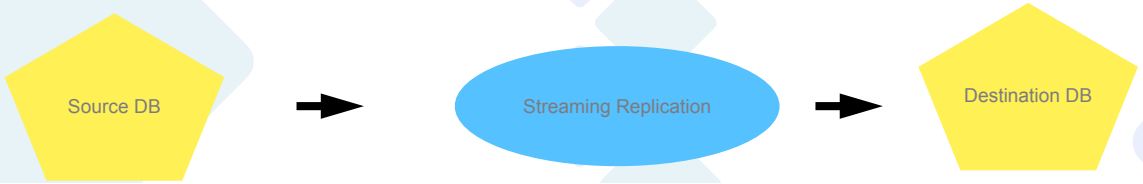
Data Engineering 0105

Kafka Project 2

Kafka Project 2: Changing Data Capture

- For this project, we will create a data tunnel to **maintain a sync** between 2 tables in two different databases.
- The stream processing would be responsible for:
  - snapshot processing => Reading all data from db1 => send asynchronously to db2
  - stream processing => Once a snapshot has been synchronized, stream processing will keep looking for the new
- Insert/Delete/Update => any changes on Emp_A should be reflected in Emp_B **< 1 sec**.



Two approaches

Polling on the tables -

With this approach we can create a python program which will start scanning the data from the head of the table till the last row, with every row being scanned will be sent to a streaming pipeline. This program would need to keep the track of the last offset/row which has been consumed, otherwise on the program crash this program would need to start all over again. The only problem with this approach is - this will take care of inserts, but not updates/deletes.

Use this approach!!!!

SQL Triggering (Postgres Triggers) -

Triggers + Functions

- Using Postgres triggers we can call an SQL function on every row insert/update/delete.
- The SQL function in this case should insert all the affected rows plus actions (insert, update or delete) into a new table. This new table will act as a CDC table.
- Producer will start scanning the data from the head of the CDC table till the last row, with every row being scanned will be sent to a streaming pipeline (Kafka). This program would need to keep the track of the last offset/row which has been consumed.
  - Otherwise we will perform full scan every time, and on the program crash this program would need to start all over again, which is very inefficient.
- Now this action should be passed as well as with the other information to the Kafka, and the consumers consuming this data will update all the syncs.

Steps

- 1, Modify the Docker compose file to have two databases, both port-forward to different ports.
- 2, Use the same schema for employee table and add this table in both databases
  - CREATE TABLE employees(emp_id SERIAL, first_name VARCHAR(100), last_name VARCHAR(100), dob DATE, city VARCHAR(100), salary INT);
- 3, Add PSQL functions and triggers on the employee_A table, which will insert the rows to the new cdc table.
  - CREATE TABLE emp_cdc(emp_id SERIAL, first_name VARCHAR(100), last_name VARCHAR(100), dob DATE, city VARCHAR(100), salary INT, action VARCHAR(100));
- 4, Modify the producer and consumer code (depending on your own configuration) to scan the employee_cdc table, and send the records to the topic; and to consume the data and update the employee_B table based on the action.

Some good practices

- There is no best solution to the problem
- Try implementing everything in an OOP manner to practice
- Always try and catch all exception you might have, especially in a production environment.
- Maintain a good coding style (ifUsingCamelToeNotation_then_do_not_switch_to_another_style)
- Some optional things you can try (absolutely no bonus)
  - Use a git repo for version control
  - Scale up/down your instances
  - Create a DLQ
  - Use Offset Explorer
  - Can use AirFlow to schedule producer.

Optional: DLQ

- Set up a DLQ topic in your docker-compose.yml file, or through admin.py (check confluent official documentations)
- You can implement your custom logic, i.e.
  - all employees should be born after 2007
  - salary should be greater than 10000
  - no negative emp id
  - …
- See if you can intentionally create some bad actions, and if you are able to get everything to work.