GCP BigQuery Case Study

AlphaLogistics Data Analytics

AlphaLogistics is a global logistics company specializing in transportation, warehousing, and supply chain management services. With operations spanning across continents, AlphaLogistics manages a vast amount of data related to shipments, inventory, routes, and customer interactions. To optimize its logistics operations and improve service quality, AlphaLogistics has decided to leverage Google Cloud Platform's BigQuery for advanced data analytics.

Objective

The objective of this case study is to utilize Google BigQuery to analyze AlphaLogistics' data and derive actionable insights to enhance logistics operations and customer satisfaction. By harnessing the power of BigQuery, AlphaLogistics aims to improve route planning, optimize inventory management, and identify areas for process improvement.

Dataset Description

The dataset consists of several tables storing different aspects of AlphaLogistics' operations:

1. **Shipments Table:**
    - Contains information about individual shipments, including shipment ID, origin, destination, weight, volume, and delivery status.
2. **Inventory Table:**
    - Stores details about inventory items in warehouses, including item ID, description, quantity on hand, location, and last updated timestamp.
3. **Routes Table:**
    - Stores information about transportation routes, including route ID, origin, destination, distance, estimated travel time, and transportation mode.
4. **Customers Table:**
    - Contains customer data, including customer ID, name, contact information, and shipping preferences.

Tasks

1. **Creating Tables (including partitioned tables) and Views:**
    - Create a partitioned table for the Shipments Table based on the shipment date to improve query performance and manage large datasets efficiently.
    - Develop views to abstract complex queries and simplify data access for users, such as a view to display completed shipments with delivery status.

2. **Querying with SELECT statements:**
    - Retrieve data from the Shipments Table to analyze shipment volume by origin and destination.
    - Calculate the average delivery time for completed shipments using data from the Shipments Table.
3. **Data Manipulation Language (DML) Statements:**
    - Update the delivery status of shipments using UPDATE statements based on tracking information.
4. **Arrays and Structs:**
    - Utilize arrays to represent multi-item shipments in the Shipments Table.
    - Use structs to store nested data such as address information in the Customers Table.
5. **SQL Math and Cast Functions:**
    - Calculate the total weight and volume of shipments using SUM and CAST functions.
    - Convert timestamps to date format using CAST for easier analysis.
6. **Date and Time Functions:**
    - Calculate the average delivery time for completed shipments.
    - Extract the day of the week from shipment dates to analyze delivery patterns.
7. **Statistical Aggregate Functions:**
    - Calculate the average weight and volume of shipments.
    - Determine the maximum distance traveled for routes.
8. **String Functions:**
    - Extract substrings to format addresses in the Customers Table.
    - Concatenate strings to generate unique shipment IDs.
9. **Window Functions:**
    - Calculate moving averages of shipment volumes over time using WINDOW functions.
    - Rank shipments based on delivery time within each destination using the ROW_NUMBER function.
10. **Loading Data:**
    - Load new shipment data into the Shipments Table from CSV files stored in Cloud Storage using BigQuery data import.

11. **Exporting Table Data:**
    - Export completed shipment data from the Shipments Table to Cloud Storage for further analysis or reporting.
12. **Querying External Data Sources:**
    - Query external weather data from a public API to analyze its impact on transportation routes using federated queries.
13. **bq CLI Commands:**
    - Use bq CLI commands to create datasets, and tables, and execute queries from the command line interface.

Expected Outcome

By completing the tasks outlined in this case study, AlphaLogistics expects to gain valuable insights into its logistics operations, enabling them to optimize route planning, inventory management, and customer service. These insights will drive improvements in operational efficiency, cost reduction, and overall customer satisfaction, positioning AlphaLogistics as a leader in the global logistics industry.