Assignment No. 6

6CS371 : Advanced Database System Lab

Name : Jay Shirgupe
PRN: 21510026
Batch: T-7
TY CSE

Introduction

In today's business landscape, efficient data management is crucial for enterprises to thrive. This report outlines the design and implementation of a data warehouse tailored for a multi-store enterprise's customer order processing system.

Objective and Scope:
The goal is to develop a data warehouse that consolidates data from various sources to facilitate comprehensive analysis and decision-making. This includes integrating customer information, store inventory, and sales records to optimize operations.

Importance of Data Warehousing:
A data warehouse enhances operational efficiency, optimizes inventory management, and improves customer satisfaction. It empowers stakeholders to make informed decisions by providing a holistic view of the enterprise's performance and enabling complex analytics through OLAP capabilities.

Business Requirements

Data Integration:
- Consolidate customer information, store inventory, and sales records from various sources.

Analysis and Decision Support:
- Enable comprehensive analysis of customer behavior, sales trends, and inventory management.
- Support informed decision-making for strategic planning and resource allocation.

Operational Efficiency:
- Streamline order processing, inventory management, and fulfillment processes to improve efficiency.
- Minimize stockouts and optimize supply chain operations.

Customer Satisfaction:
- Ensure timely order fulfillment and personalized service to enhance customer satisfaction.
- Anticipate customer needs and provide exceptional experiences.

Scalability and Flexibility:
- Design the data warehouse to scale with the enterprise's growth and adapt to evolving data needs.

User-Friendly Interface:
- Develop an intuitive interface for querying, reporting, and visualizing insights.

Security and Compliance:
- Implement robust security measures to protect sensitive data and ensure compliance with regulations.

Functional Specification

Input Requirements:
- Data sources: Operational databases containing customer information, store inventory, and sales records.
- Data formats: Structured data formats compatible with ETL (Extract, Transform, Load) processes.
- Data extraction methods: Automated processes for extracting data from source databases while ensuring data integrity and consistency.

ETL Processes:
- Extraction: Retrieve data from operational databases, including customer data, store inventory, and sales transactions.
- Transformation: Cleanse, standardize, and transform raw data into a consistent format suitable for analysis.
- Loading: Load transformed data into the data warehouse's storage structure, ensuring efficient data storage and retrieval.

Data Warehouse Design

To design the data warehouse for the customer order processing system, we will follow the star schema model, which consists of a central fact table surrounded by denormalized dimension tables. Below is the proposed design:

Dimension Tables:

Customer Dimension (Dim_Customer):
- Attributes: Customer_id (Primary Key), Customer_name, City_id (Foreign Key), First_order_date
- Description: Contains information about customers, including their unique identifier, name, city, and the date of their first order.

Store Dimension (Dim_Store):
- Attributes: Store_id (Primary Key), City_id (Foreign Key), Phone
- Description: Stores details about each store, including its unique identifier, city location, and contact phone number.

Item Dimension (Dim_Item):
- Attributes: Item_id (Primary Key), Description, Size, Weight, Unit_price
- Description: Holds information about items available in the inventory, such as item ID, description, size, weight, and unit price.

Time Dimension (Dim_Time):
- Attributes: Time_id (Primary Key), Order_date
- Description: Contains time-related information, such as order dates, for analyzing trends over time.

Fact Table:

Order Fact Table (Fact_Order):
- Attributes: Order_no (Primary Key), Customer_id (Foreign Key), Store_id (Foreign Key), Item_id (Foreign Key), Quantity_ordered, Ordered_price, Time_id (Foreign Key)
- Description: Stores detailed information about each customer order, including order number, customer ID, store ID, item ID, quantity ordered, ordered price, and time of the order.

Data Cube Implementation (in MySQL)

```sql
1   USE ads_sample;
2
3   -- Create Customer Dimension Table
4   CREATE TABLE Dim_Customer (
5       Customer_id INT PRIMARY KEY,
6       Customer_name VARCHAR(255),
7       City_id INT,
8       First_order_date DATE
9   );
10
11  -- Create Store Dimension Table
12  CREATE TABLE Dim_Store (
13      Store_id INT PRIMARY KEY,
14      City_id INT,
15      Phone VARCHAR(20)
16  );
17
18  -- Create Item Dimension Table
19  CREATE TABLE Dim_Item (
20      Item_id INT PRIMARY KEY,
21      Description VARCHAR(255),
22      Size VARCHAR(50),
23      Weight DECIMAL(10,2),
24      Unit_price DECIMAL(10,2)
25  );
26
```

Action Output ▾

	#	Time	Action	Message	Duration / Fetch
❌	1	13:39:22	CREATE TABLE Dim_Customer (Customer_id INT PRIMA...	Error Code: 1046. No database selected Select the default DB to be used by double-clickin...	0.0013 sec
❌	2	13:39:25	CREATE TABLE Dim_Store (Store_id INT PRIMARY KEY, ...	Error Code: 1046. No database selected Select the default DB to be used by double-clickin...	0.00019 sec
✅	3	13:39:37	USE ads_sample	0 row(s) affected	0.00024 sec

```sql
22      Size VARCHAR(50),
23      Weight DECIMAL(10,2),
24      Unit_price DECIMAL(10,2)
25  );
26
27  -- Create Time Dimension Table
28  CREATE TABLE Dim_Time (
29      Time_id INT PRIMARY KEY,
30      Order_date DATE
31  );
32
33  -- Create Order Fact Table
34  CREATE TABLE Fact_Order (
35      Order_no INT PRIMARY KEY,
36      Customer_id INT,
37      Store_id INT,
38      Item_id INT,
39      Quantity_ordered INT,
40      Ordered_price DECIMAL(10,2),
41      Time_id INT
42  );
43
44  -- Add Foreign Key Constraints
45  ALTER TABLE Dim_Customer ADD CONSTRAINT fk_customer_city FOREIGN KEY (City_id) REFERENCES Dim_Store(City_id);
46  ALTER TABLE Dim_Store ADD CONSTRAINT fk_store_city FOREIGN KEY (City_id) REFERENCES Dim_Customer(City_id);
47  ALTER TABLE Fact_Order ADD CONSTRAINT fk_order_customer FOREIGN KEY (Customer_id) REFERENCES Dim_Customer(Customer_id);
```

Action Output ▾

	#	Time	Action	Message	Duration / Fetch
❌	1	13:39:22	CREATE TABLE Dim_Customer (Customer_id INT PRIMA...	Error Code: 1046. No database selected Select the default DB to be used by double-clickin...	0.0013 sec
❌	2	13:39:25	CREATE TABLE Dim_Store (Store_id INT PRIMARY KEY, ...	Error Code: 1046. No database selected Select the default DB to be used by double-clickin...	0.00019 sec
✅	3	13:39:37	USE ads_sample	0 row(s) affected	0.00024 sec

```
26
27    -- Create Time Dimension Table
28  ●⊖ CREATE TABLE Dim_Time (
29        Time_id INT PRIMARY KEY,
30        Order_date DATE
31    );
32
33    -- Create Order Fact Table
34  ●⊖ CREATE TABLE Fact_Order (
35        Order_no INT PRIMARY KEY,
36        Customer_id INT,
37        Store_id INT,
38        Item_id INT,
39        Quantity_ordered INT,
40        Ordered_price DECIMAL(10,2),
41        Time_id INT
42    );
43
44    -- Add Foreign Key Constraints
45  ● ALTER TABLE Dim_Customer ADD CONSTRAINT fk_customer_city FOREIGN KEY (City_id) REFERENCES Dim_Store(City_id);
46  ● ALTER TABLE Dim_Store ADD CONSTRAINT fk_store_city FOREIGN KEY (City_id) REFERENCES Dim_Customer(City_id);
47  ● ALTER TABLE Fact_Order ADD CONSTRAINT fk_order_customer FOREIGN KEY (Customer_id) REFERENCES Dim_Customer(Customer_id);
48  ● ALTER TABLE Fact_Order ADD CONSTRAINT fk_order_store FOREIGN KEY (Store_id) REFERENCES Dim_Store(Store_id);
49  ● ALTER TABLE Fact_Order ADD CONSTRAINT fk_order_item FOREIGN KEY (Item_id) REFERENCES Dim_Item(Item_id);
50  ● ALTER TABLE Fact_Order ADD CONSTRAINT fk_order_time FOREIGN KEY (Time_id) REFERENCES Dim_Time(Time_id);
51
```

Action Output ▾

	#	Time	Action	Message	Duration / Fetch
⊗	1	13:39:22	CREATE TABLE Dim_Customer (Customer_id INT PRIMA...	Error Code: 1046. No database selected Select the default DB to be used by double-clickin...	0.0013 sec
⊗	2	13:39:25	CREATE TABLE Dim_Store (Store_id INT PRIMARY KEY, ...	Error Code: 1046. No database selected Select the default DB to be used by double-clickin...	0.00019 sec
✓	3	13:39:37	USE ads_sample	0 row(s) affected	0.00024 sec

Result Grid | Filter Rows: | Export: | Wrap Cell Content:

#	Customer_name	Total_sales_amount
1	Rajesh Sharma	999.98
2	Priya Patel	399.99
3	Amit Singh	799.99
4	Deepika Gupta	899.97

Result Grid | Filter Rows: | Export: | Wrap Cell Content:

#	Description	Total_sales_amount
1	Saree	999.98
2	Kurta	399.99
3	Jeans	799.99
4	T-Shirt	899.97

Result Grid | Filter Rows: | Export: | Wrap Cell Content:

#	Store_id	Total_sales_amount
1	1	999.98
2	2	1199.98
3	3	899.97