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Title:	Implementation of Dimension and Fact tables and perform OLAP operations.
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Aim: Implementation of Dimension and Fact tables and perform OLAP operations.

Objective: OLAP stands for Online Analytical Processing. The objective of OLAP is to analyze information from multiple database systems at the same time. It is based on multidimensional data model and allows the user to query on multi-dimensional data.

Theory:

- Online Analytical Processing Server (OLAP) is based on the multidimensional data model.
- The main aim of OLAP is to provide multidimensional analysis to the underlying data.

Following is the list of OLAP operations:

1. Roll-up
2. Drill-down
3. Slice
4. Dice
5. Pivot (rotate)

Roll-up:

- The roll-up operation (also called the drill-up operation) performs aggregation on a data cube, either by climbing up a concept hierarchy for a dimension or by dimension reduction.
- Figure 2.1 shows the result of a roll-up operation performed on the central cube by climbing up the concept hierarchy for location.
- This hierarchy was defined as the total order "street < city < province or state < country."
- The roll-up operation aggregates the data by ascending the location hierarchy from the level of city to the level of country.
- In other words, rather than grouping the data by city, the resulting cube groups the data by country.

Drill-down:

- Drill-down is the reverse of roll-up. It navigates from less detailed data to more detailed data.
- Drill-down can be realized by either stepping down a concept hierarchy for a dimension or introducing additional dimensions.
- Figure 2.1 shows the result of a drill-down operation performed on the central cube by stepping down a concept hierarchy for time defined as "day < month < quarter < year."
- Drill-down occurs by descending the time hierarchy from the level of quarter to the more detailed level of month.
- The resulting data cube details the total sales per month rather than summarizing them by quarter.

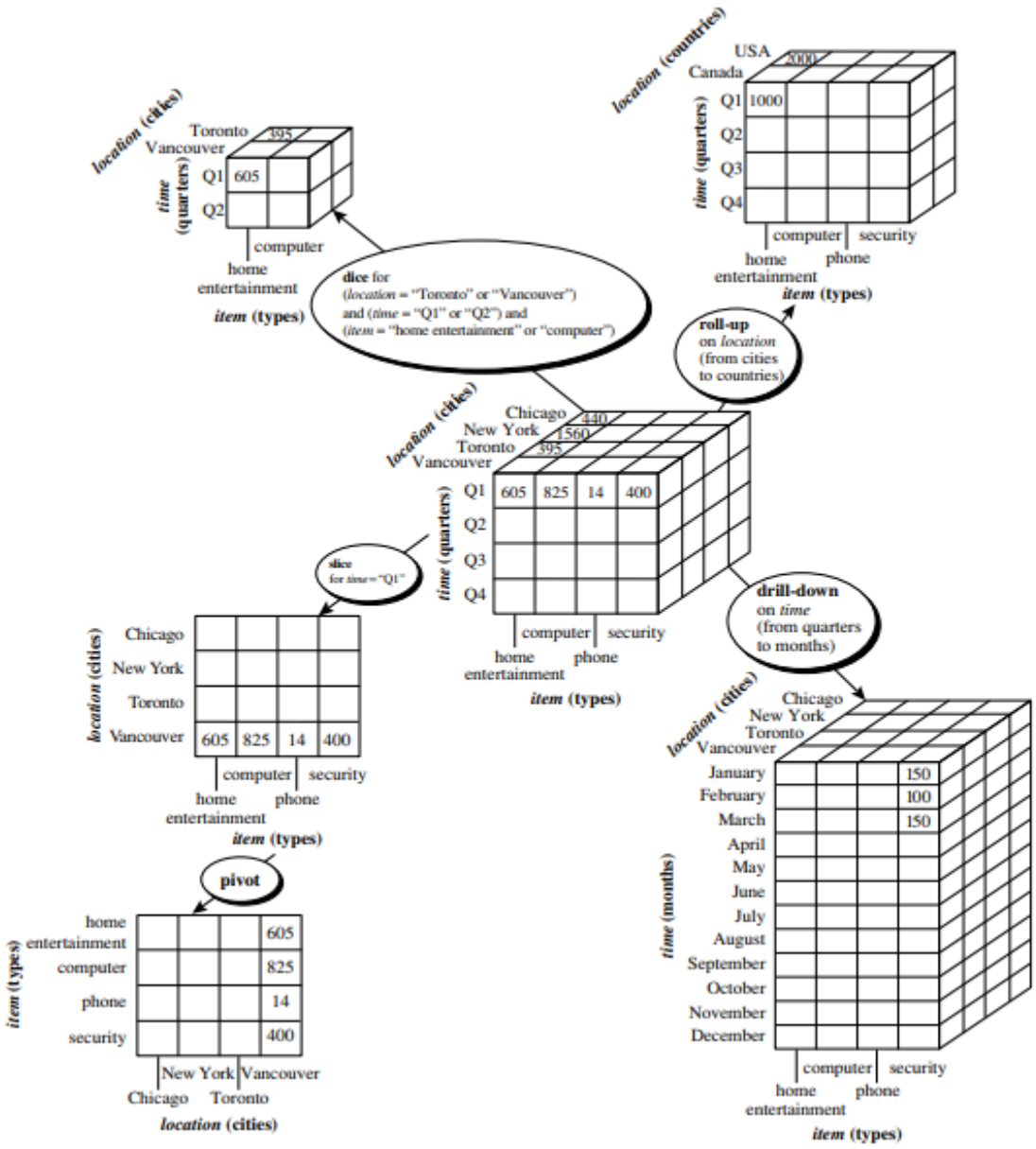


Figure 2.1: Examples of typical OLAP operations on multidimensional data.

Slice:

- The slice operation performs a selection on one dimension of the given cube, resulting in a sub cube.
- Figure 2.1 below shows a slice operation where the sales data are selected from the central cube for the dimension time using the criterion time = "Q1."

Dice:

- The dice operation defines a sub cube by performing a selection on two or more dimensions.
- Figure 2.1 shows a dice operation on the central cube based on the following selection criteria that involve three dimensions: (location = "Toronto" or "Vancouver") and (time = "Q1" or "Q2") and (item = "home entertainment" or "computer").

Pivot:

- Pivot (also called rotate) is a visualization operation that rotates the data axes in view to provide an alternative data presentation.
- Figure 2.1 shows a pivot operation where the item and location axes in a 2-D slice are rotated.

Problem Statement:

Working with a social media analytics database, you will find a Posts table with columns for Likes, Comments, Shares, PostID, PostDate, and UserID. It is your job to modify this data using the PIVOT function so that the columns show the total number of likes for each social media network (Facebook, Twitter, Instagram), and each row represents a distinct PostDate. The total number of likes on each platform for each date should be explicitly displayed in the result, with zero representing any missing platform data.

Output:

1. Creating the Dimension Tables
2. Creating the Fact Table
3. Inserting values in both dimension and fact tables
4. Displaying the tables
5. Write SQL Queries for all the above OLAP operations.

1. Roll-up

```
SELECT
    YEAR(PostDate) AS Year,
    MONTH(PostDate) AS Month,
    SUM(Likes) AS TotalLikes,
    SUM(Comments) AS TotalComments,
    SUM(Shares) AS TotalShares
FROM Posts
GROUP BY YEAR(PostDate), MONTH(PostDate)
ORDER BY Year, Month;
```

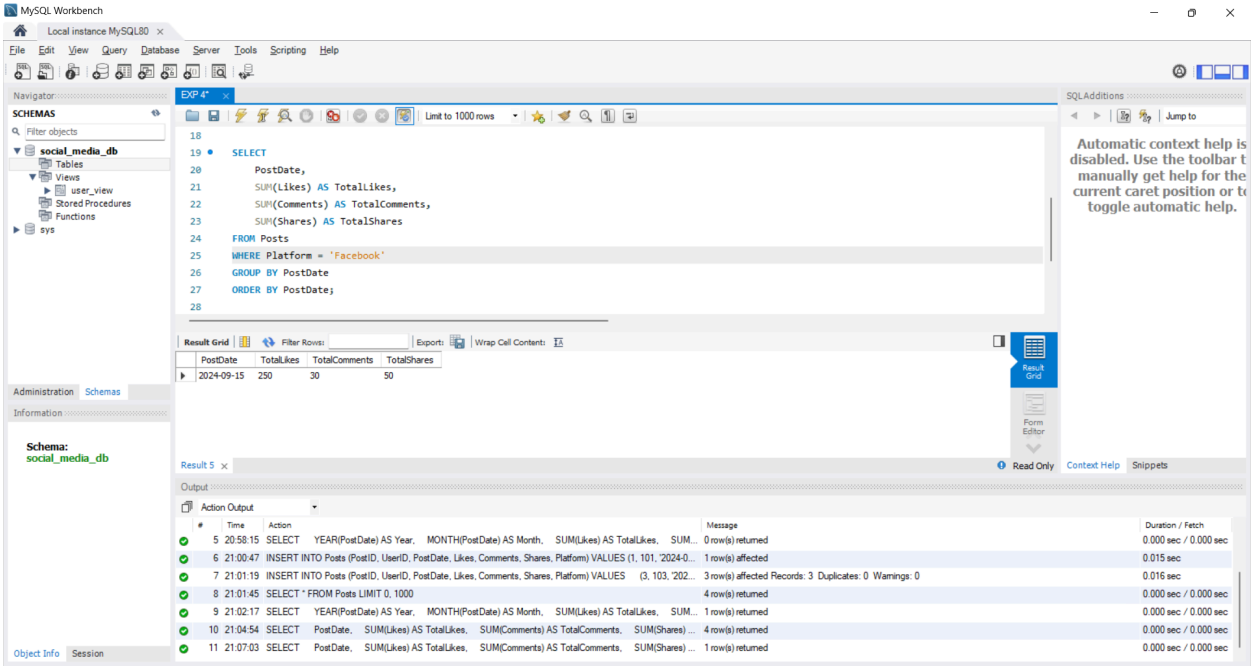
Year	Month	TotalLikes	TotalComments	TotalShares
2024	9	950	132	220

2. Drill-down

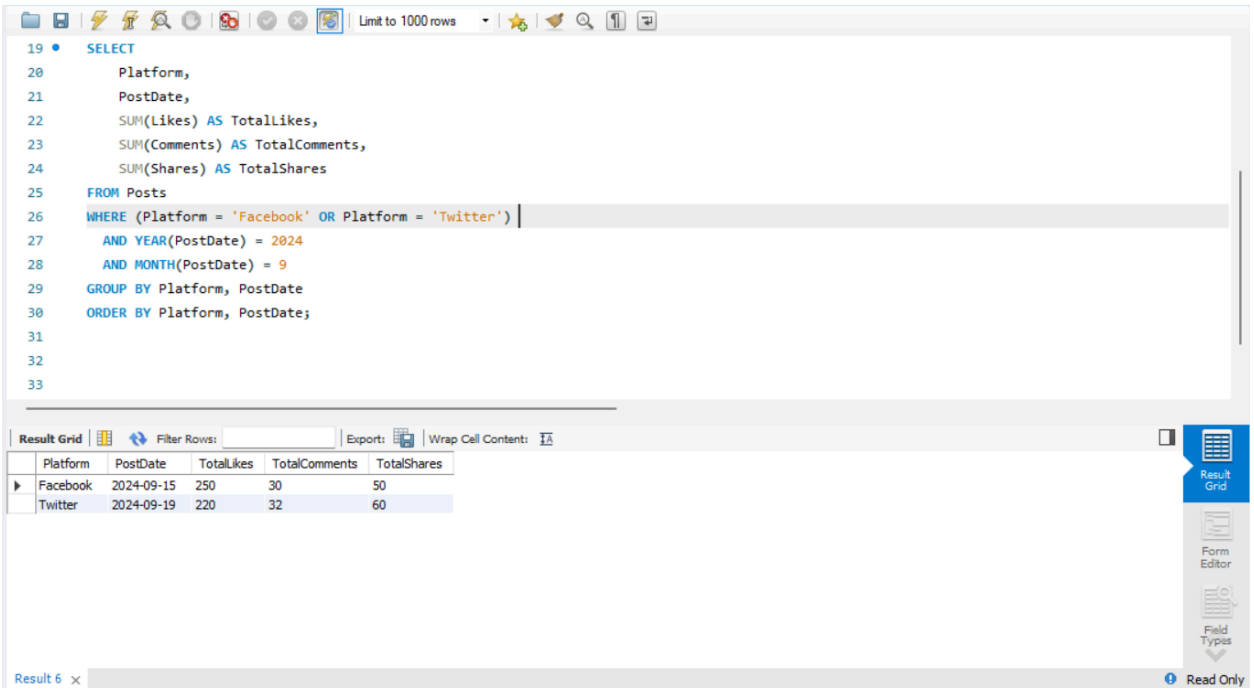
```
SELECT
    PostDate,
    SUM(Likes) AS TotalLikes,
    SUM(Comments) AS TotalComments,
    SUM(Shares) AS TotalShares
FROM Posts
WHERE YEAR(PostDate) = 2024 AND MONTH(PostDate) = 9
GROUP BY PostDate
ORDER BY PostDate;
```

PostDate	TotalLikes	TotalComments	TotalShares
2024-09-15	250	30	50
2024-09-17	300	45	70
2024-09-18	180	25	40
2024-09-19	220	32	60

3. Slice



4. Dice



5. Pivot (rotate)

```
        (6, 106, '2024-09-20', 200, 35, 55, 'Instagram');

SELECT
    PostDate,
    COALESCE(SUM(CASE WHEN Platform = 'Facebook' THEN Likes ELSE 0 END), 0) AS Facebook,
    COALESCE(SUM(CASE WHEN Platform = 'Twitter' THEN Likes ELSE 0 END), 0) AS Twitter,
    COALESCE(SUM(CASE WHEN Platform = 'Instagram' THEN Likes ELSE 0 END), 0) AS Instagram
FROM Posts
GROUP BY PostDate
ORDER BY PostDate;
```

Result Grid

PostDate	Facebook	Twitter	Instagram
2024-09-15	500	0	0
2024-09-16	0	150	0
2024-09-17	0	0	600
2024-09-18	180	0	0
2024-09-19	0	440	0
2024-09-20	0	0	200

Conclusion:

Q1. What is the importance of OLAP operations?
Ans :
OLAP (Online Analytical Processing) operations are crucial for analyzing multidimensional data efficiently. They allow users to perform complex queries and gain insights into data from various perspectives. OLAP operations like roll-up, drill-down, slice, dice, and pivot enable detailed data exploration, trend analysis, and strategic decision-making by summarizing and presenting data in a user-friendly format.

Q2. What are the key features of OLAP?
Ans :
Key Features of OLAP:

1. **Multidimensional Analysis:** OLAP allows users to view data from multiple dimensions, such as time, geography, and product categories.
2. **Interactive Data Exploration:** Users can easily navigate through different levels of data granularity and perform operations like drill-down and roll-up.
3. **Fast Query Performance:** OLAP systems are optimized for quick retrieval of complex queries and aggregations.
4. **Dynamic Data Views:** The ability to slice, dice, and pivot data helps in generating customized reports and visualizations.
5. **Support for Complex Calculations:** OLAP tools handle complex calculations and aggregations, providing detailed insights into business metrics.