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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 a multidimensional data model and allows the user to query 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 of 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 the city to the level of the 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.

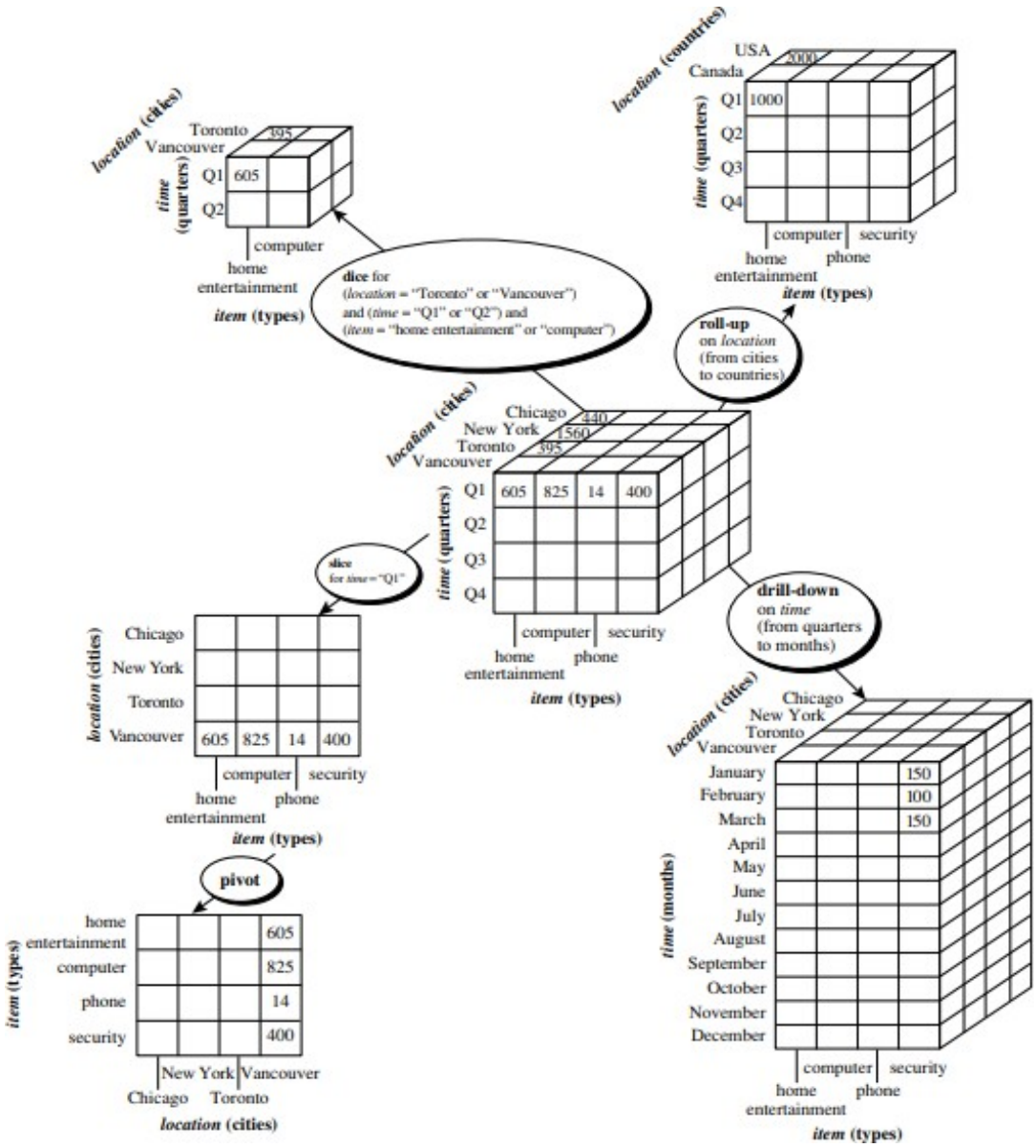

Figure 2.1: Examples of typical OLAP operations on multidimensional data.

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.

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.

Solution :

```
create database olapop;
use olapop;

CREATE TABLE DimHotel2(
   HotelID INT PRIMARY KEY,
   HotelName VARCHAR(255),
   Region VARCHAR(255),
   Country VARCHAR(255),
   State VARCHAR(255),
   City VARCHAR(255),
   StarRating INT,
   HotelType VARCHAR(255)
);

INSERT INTO DimHotel2(HotelID, HotelName, Region, Country, State,
City, StarRating, HotelType) VALUES
(1, 'Edeforsvägen 2A', 'Sweden', 'Sweden', 'Harads', 'Vid väg 97', 5, 'Hotel'),
(2, 'Edeforsvägen 2 A', 'Sweden', 'Sweden', 'Harads', 'Vid väg 97', 4, 'Hotel'),
(3, 'Edeforsvägen 2', 'Sweden', 'Sweden', 'Harads', 'Vid väg 97', 3, 'Hotel'),
(4, 'Kakslauttanen', 'Finland', 'Finland', 'Saariselkä', 'Kakslauttanen', 5, 'Hotel'),
(5, 'Kakslauttanen', 'Finland', 'Finland', 'Saariselkä', 'Kakslauttanen', 4, 'Hotel'),
(6, '77 1st Ave NW', 'Canada', 'Canada', 'Alberta', 'Edmonton', 3, 'Hotel');
```

```
create table FactHotelOccupy5(
HotelId int,
RoomID int,
CustomerId int,
Date1 date,
No_of_occupied_rooms int,
No_of_vacant_rooms int,
Revenue int,
foreign key (HotelId) references DimHotel2(HotelId)
);

insert into FactHotelOccupy5 values(1,2,6,'2012-12-21',60,240,111615674),
(2,5,4,'2015-06-01',150,50,875843568),
(3,3,1,'2016-03-08',325,175,888765327),
(4,4,3,'2019-04-04',236,214,777655532),
(5,6,2,'2018-06-27',284,416,334455522),
(6,1,5,'2015-12-06',657,43,987654329);

select *from FactHotelOccupy5;
select *from DimHotel2;

-- roll up operation
select Region, Country , State , City, sum(Revenue) from DimHotel2
inner join FactHotelOccupy5 on
DimHotel2.HotelID = FactHotelOccupy5.HotelId
group by Region,Country, State , City
with Rollup;

-- drill down operation
select Country , StarRating, sum(Revenue) from DimHotel2
inner join FactHotelOccupy5 on
DimHotel2.HotelID = FactHotelOccupy5.HotelId
where Country in ('Canada','Sweden') and StarRating in (1,2,3,4,5)
```

```
group by Country , StarRating;

-- slice
select Country, HotelType, Sum(Revenue) from DimHotel2
inner join
FactHotelOccupy5 on
DimHotel2.HotelID = FactHotelOccupy5.HotelId
where HotelType='Hotel'
group by Country;

-- dice
select Country, HotelType, Sum(Revenue) from DimHotel2
inner join
FactHotelOccupy5 on
DimHotel2.HotelID = FactHotelOccupy5.HotelId
where HotelType='Hotel' and Country = 'Canada'
group by Country;
```

Conclusion:

How can the designed data warehouse and OLAP operations be applied to real-world business scenarios?

Ans. A well-designed data warehouse, combined with OLAP operations, enables businesses to make data-driven decisions. For example, in retail, a data warehouse can consolidate sales data from multiple stores, and OLAP operations like slicing and dicing can help analyze sales by product, region, or time period. A company can drill down to understand which products perform best in specific regions or roll up to view overall quarterly sales trends. In banking, OLAP can help assess customer transactions across various branches, allowing for better fraud detection and customer segmentation. These insights lead to more effective marketing strategies, optimized supply chains, and improved financial planning, ultimately boosting business performance.

Provide an example of how a retail company can use the insights gained from OLAP operations to make strategic decisions.

Ans. A retail company can leverage OLAP operations to enhance strategic decision-making by analyzing sales data across various dimensions. For example, by using slice operations to view sales data by region, the company might find that certain products are more popular in urban areas. A drill-down analysis could reveal that these products are particularly favored by specific age groups or during certain seasons. With these insights, the company can strategically increase inventory in high-performing regions, tailor marketing efforts to target demographics, and adjust pricing strategies to align with seasonal demand. This approach helps optimize sales, reduce waste, and boost overall profitability.