Unit-IV

Data Warehousing

OLAP

OLAP stands for **Online Analytical Processing**. It is a technology used to help people analyze and understand large amounts of data in a fast and flexible way.
Think of OLAP like a giant spreadsheet or database, but instead of just showing numbers, it helps you see patterns, trends, and relationships in the data. It allows you to **view data from different angles** and ask different questions.

For example, if you have a lot of sales data, OLAP could help you answer questions like:

- **How much did we sell in January?**
- **Which products are selling the most in each region?**
- **What were our sales last year compared to this year?**

To make this easy, OLAP organizes data into a **cube** (like a 3D chart), where you can look at different layers of data—such as time (months, years), product categories, or sales regions—by rotating the cube and changing views.

OLAP Server

OLAP Servers

An OLAP server is a platform where data is stored, organized, and processed for analytical purposes. There are two types of OLAP servers:

•**MOLAP (Multidimensional OLAP)**: This type stores data in a multidimensional cube format. It allows for fast data retrieval and is often used for complex analyses.

- **Example**: **Microsoft SQL Server Analysis Services (SSAS)** is a MOLAP server that stores data in cubes for faster analysis.

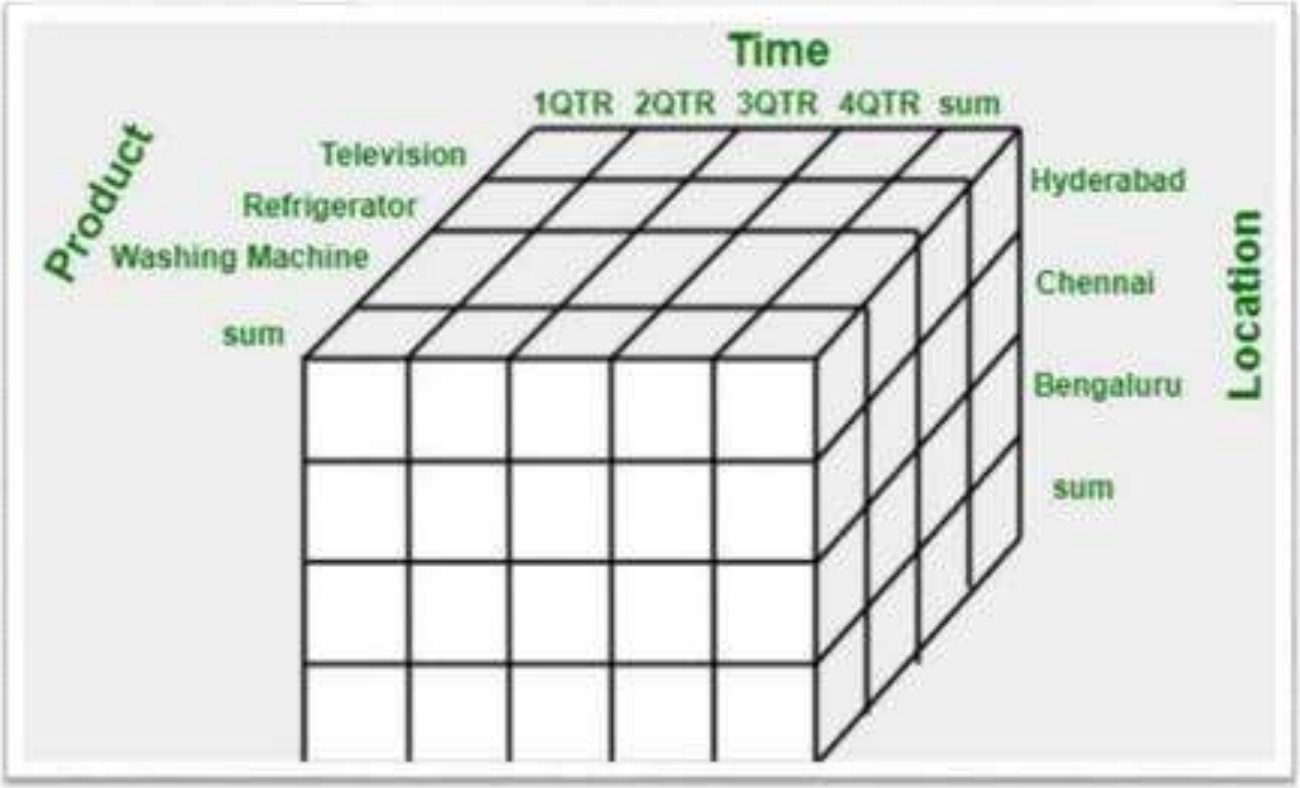
•**ROLAP (Relational OLAP)**: This type uses relational databases to store data. ROLAP doesn't create cubes, but it queries the data directly from relational databases when needed.

- **Example**: **Oracle OLAP** is an example of a ROLAP tool. It uses relational databases to perform OLAP queries.

•**HOLAP (Hybrid OLAP)**: Combines both MOLAP and ROLAP, using cubes for summary data and relational databases for detailed data.

- **Example**: **Microsoft SSAS** can operate in both MOLAP and HOLAP modes.

- OLAP (online analytical processing) and data warehousing uses multi dimensional databases. It is used to show multiple dimensions of the data to users.
- It represents data in the form of data cubes. Data cubes allow to model and view the data from many dimensions and perspectives. It is defined by dimensions and facts and is represented by a fact table. Facts are numerical measures and fact tables contain measures of the related dimensional tables or names of the facts.


Time
1QTR 2QTR 3QTR 4QTR sum
Product
Television
Refrigerator
Washing Machine
sum
Hyderabad
Chennai
Bengaluru
sum
Location

Working on a Multidimensional Data Model:

The following stages followed by every project for building a Multi Data Model :

Stage 1 : Assembling data from the client : In first stage, a Multi Dimensional Data Model collects correct data from the client. Mostly, software professionals provide simplicity to the client about the range of data which can be gained with the selected technology and collect the complete data in detail.

Stage 2 : Grouping different segments of the system : In the second stage, the Multi Dimensional Data Model recognizes and classifies all the data to the respective section they belong to and also builds it problem-free to apply step by step.

Stage 3 : Noticing the different proportions : In the third stage, it is the basis on which the design of the system is based. In this stage, the main factors are recognized according to the user's point of view. These factors are also known as "Dimensions".

Stage 4 : Preparing the actual-time factors and their respective qualities : In the fourth stage, the factors which are recognized in the previous step are used further for identifying the related qualities. These qualities are also known as "**attributes**" in the database.

Stage 5 : Finding the actuality of factors which are listed previously and their qualities : In the fifth stage, A Multi Dimensional Data Model separates and differentiates the actuality from the factors which are collected by it. These actually play a significant role in the arrangement of a Multi Dimensional Data Model.

Stage 6 : Building the Schema to place the data, with respect to the information collected from the steps above : In the sixth stage, on the basis of the data which was collected previously, a Schema is built.

OLAP Vs. OLTP

- **Online Analytical Processing (OLAP):** Online Analytical Processing consists of a type of software tools that are used for data analysis for business decisions. OLAP provides an environment to get insights from the database retrieved from multiple database systems at one time. **Examples** – Any type of Data warehouse system is an OLAP system. The uses of OLAP are as follows:
- Spotify analyzed songs by users to come up with a personalized homepage of their songs and playlist.
- Netflix movie recommendation system.

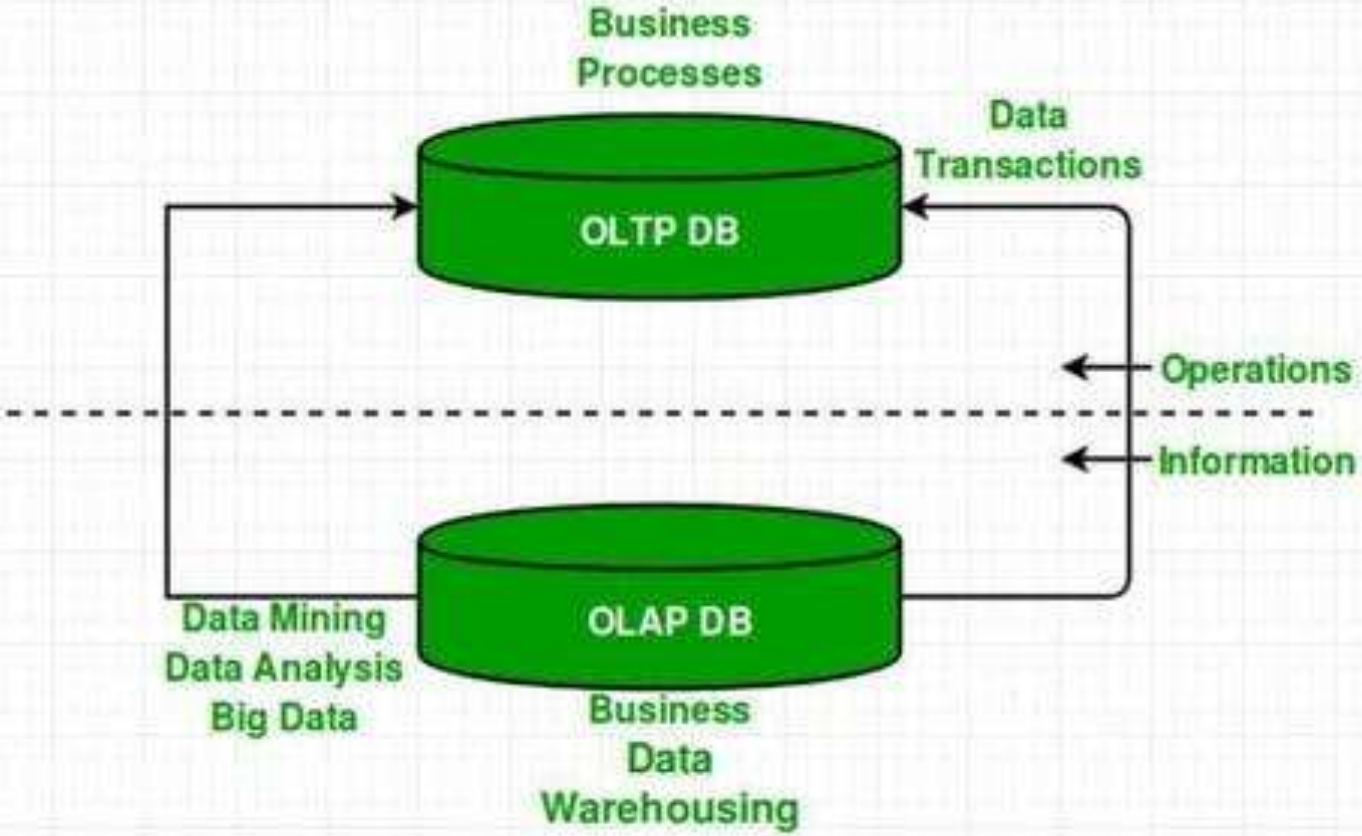
- **Online transaction processing (OLTP):** Online transaction processing provides transaction-oriented applications in a 3-tier architecture. OLTP administers the day-to-day transactions of an organization.

  Examples: Uses of OLTP are as follows:

  ATM centre is an OLTP application.

  OLTP handles the ACID properties during data transactions via the application.

  It's also used for Online banking, Online airline ticket booking, sending a text message, add a book to the shopping cart.


Business
Processes
Data
Transactions
OLTP DB
Operations
Information
Data Mining
Data Analysis
Big Data
OLAP DB
Business
Data
Warehousing

Comparisons of OLAP vs OLTP :

Sr. No.	Category	OLAP (Online analytical processing)	OLTP (Online transaction processing)
1.	Definition	It is well-known as an online database query management system.	It is well-known as an online database modifying system.
2.	Data source	Consists of historical data from various Databases.	Consists of only of operational current data.
3.	Method used	It makes use of a data warehouse.	It makes use of a standard database management system (DBMS).

Sr. No.	Category	OLAP (Online analytical processing)	OLTP (Online transaction processing)
5.	Normalized	In an OLAP database, tables are not normalized.	In an OLTP database, tables are normalized (3NF).
6.	Usage of data	The data is used in planning, problem-solving, and decision-making.	The data is used to perform day-to-day fundamental operations.
4.	Application	It is subject-oriented. Used for Data Mining, Analytics, Decisions making, etc.	It is application-oriented. Used for business tasks.

OLAP Operations

1.Roll-Up:

- The roll-up operation (**also known as drill-up or aggregation operation**) performs aggregation on a data cube, by climbing down concept hierarchies, i.e., dimension reduction. Roll-up is like **zooming-out** on the data cubes.
- Figure shows the result of roll-up operations performed on the dimension location. The hierarchy for the location is defined as the 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.

- When a roll-up is performed by dimensions reduction, one or more dimensions are removed from the cube. For example, consider a sales data cube having two dimensions, location and time. Roll-up may be performed by removing, the time dimensions, appearing in an aggregation of the total sales by location, relatively than by location and by time.

Example

Consider the following cubes illustrating temperature of certain days recorded weekly:

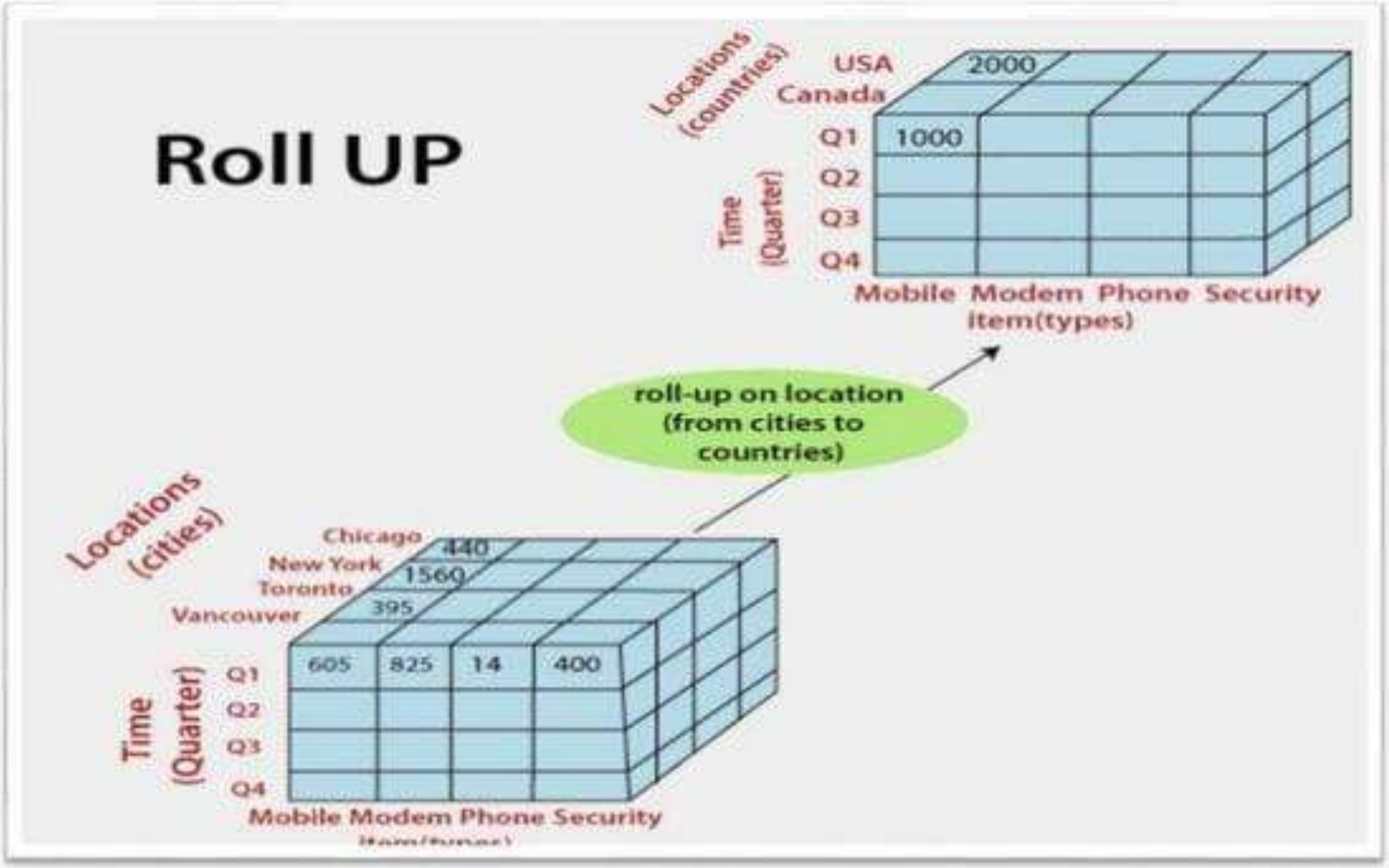
Temperature	64	65	68	69	70	71	72	75	80	81	83	85
Week1	1	0	1	0	1	0	0	0	0	0	1	0
Week2	0	0	0	1	0	0	1	2	0	1	0	0

Consider that we want to set up levels (hot (80-85), mild (70-75), cool (64-69)) in temperature from the above cubes.
To do this, we have to group column and add up the value according to the concept hierarchies. This operation is known as a roll-up.

By doing this, we contain the following cube:

Temperature	cool	mild	hot
Week1	2	1	1
Week2	2	1	1

The roll-up operation groups the information by levels of temperature.
The following diagram illustrates how roll-up works.


Roll UP
Locations (countries)
USA
Canada
2000
Q1
1000
Q2
Q3
Q4
Time (Quarter)
Mobile Modem Phone Security
item(types)
roll-up on location (from cities to countries)
Locations (cities)
Chicago
New York
Toronto
Vancouver
440
1560
395
605
825
14
400
Q1
Q2
Q3
Q4
Time (Quarter)
Mobile Modem Phone Security

2.Drill-Down

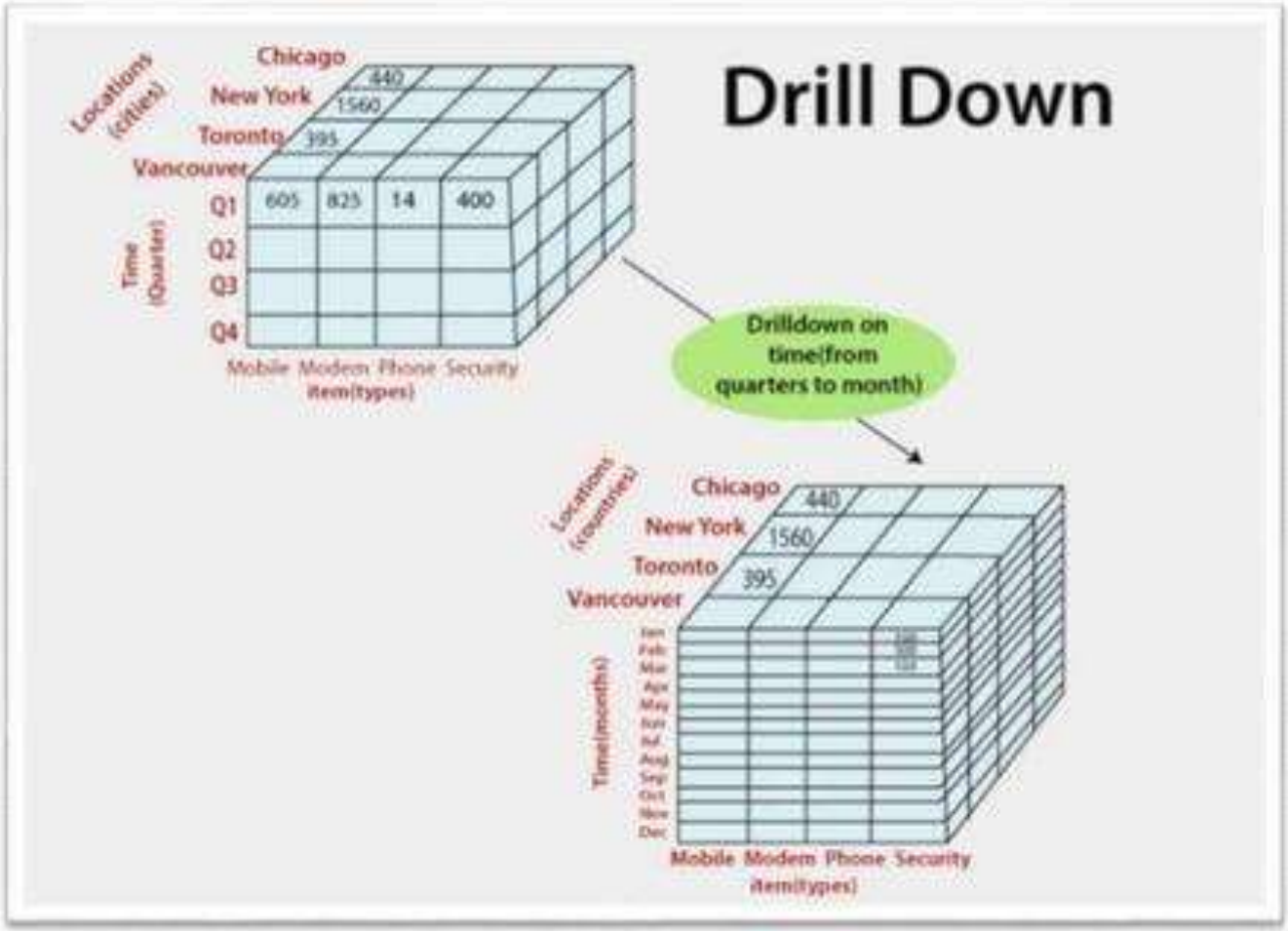
- The drill-down operation (**also called roll-down**) is the reverse operation of **roll-up**. Drill-down is like **zooming-in** on the data cube. It navigates from less detailed record to more detailed data. Drill-down can be performed by either **stepping down** a concept hierarchy for a dimension or adding additional dimensions.
- Figure shows a drill-down operation performed on the dimension time by stepping down a concept hierarchy which is defined as day, month, quarter, and year. Drill-down appears by descending the time hierarchy from the level of the quarter to a more detailed level of the month.

- Because a drill-down adds more details to the given data, it can also be performed by adding a new dimension to a cube. For example, a drill-down on the central cubes of the figure can occur by introducing an additional dimension, such as a customer group.

Example

Drill-down adds more details to the given data

Temperature	cool	mild	hot
Day 1	0	0	0
Day 2	0	0	0
Day 3	0	0	1
Day 4	0	1	0
Day 5	1	0	0
Day 6	0	0	0
Day 7	1	0	0
Day 8	0	0	0
Day 9	1	0	0
Day 10	0	1	0
Day 11	0	1	0
Day 12	0	1	0
Day 13	0	0	1
Day 14	0	0	0

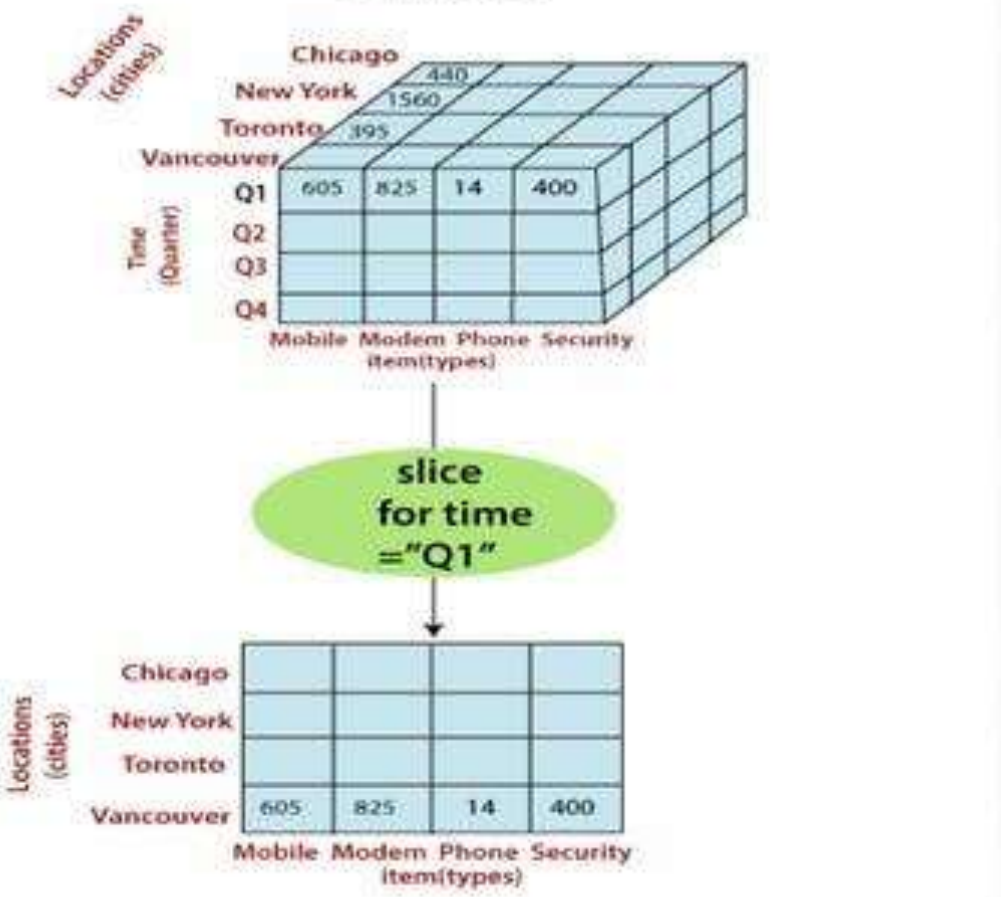

Drill Down
Locations (cities)
Chicago
New York
Toronto
Vancouver
440
1560
395
Q1
Q2
Q3
Q4
605
825
14
400
Time (Quarter)
Mobile Modem Phone Security
item(types)
Drilldown on time(from quarters to month)
Locations (countries)
Chicago
New York
Toronto
Vancouver
440
1560
395
Time(months)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Mobile Modem Phone Security
item(types)

Slice

- A **slice** is a subset of the cubes corresponding to a single value for one or more members of the dimension. For example, a slice operation is executed when the customer wants a selection on one dimension of a three-dimensional cube resulting in a two-dimensional site. So, the Slice operations perform a selection on one dimension of the given cube, thus resulting in a subcube.
- For example, if we make the selection, temperature=cool we will obtain the following cube:

Temperature	cool
Day 1	0
Day 2	0
Day 3	0
Day 4	0
Day 5	1
Day 6	1
Day 7	1
Day 8	1
Day 9	1
Day 11	0
Day 12	0
Day 13	0
Day 14	0

Slice



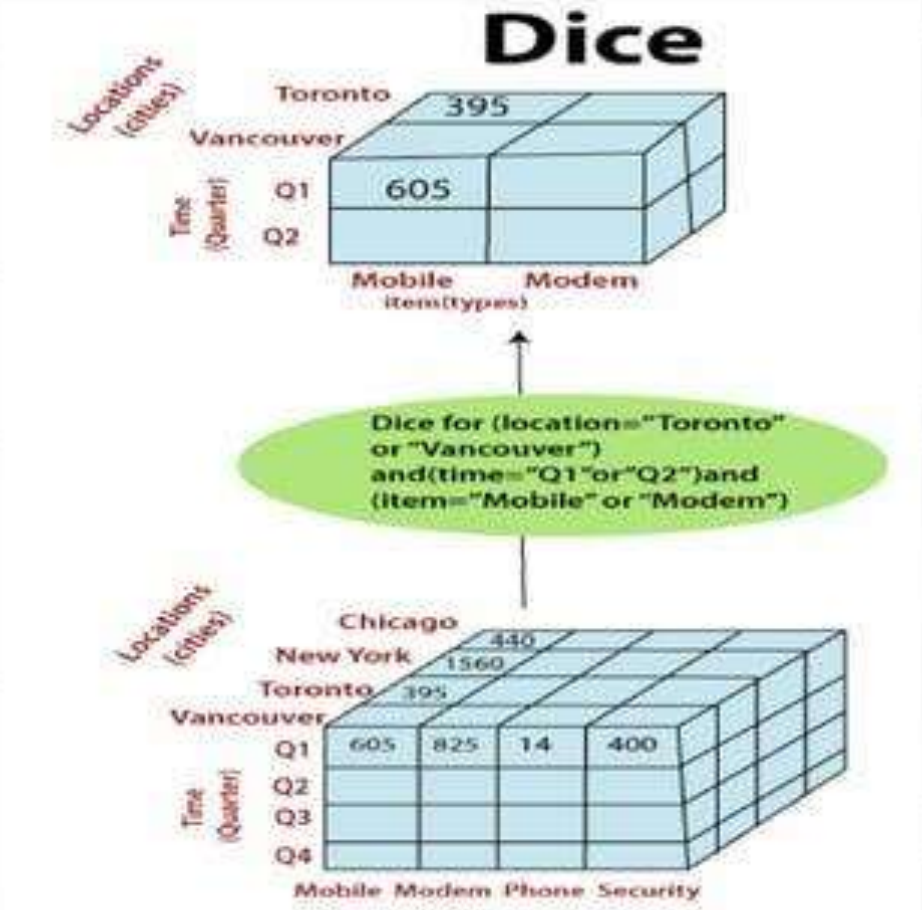
Here Slice is functioning for the dimensions "time" using the criterion time = "Q1". It will form a new sub-cubes by selecting one or more dimensions.

Dice

- The dice operation describes a subcube by operating a selection on two or more dimension.
- **For example**, Implement the selection (time = day 3 OR time = day 4) AND (temperature = cool OR temperature = hot) to the original cubes we get the following subcube (still two-dimensional)

Temperature	cool	hot
Day 3	0	1
Day 4	0	0

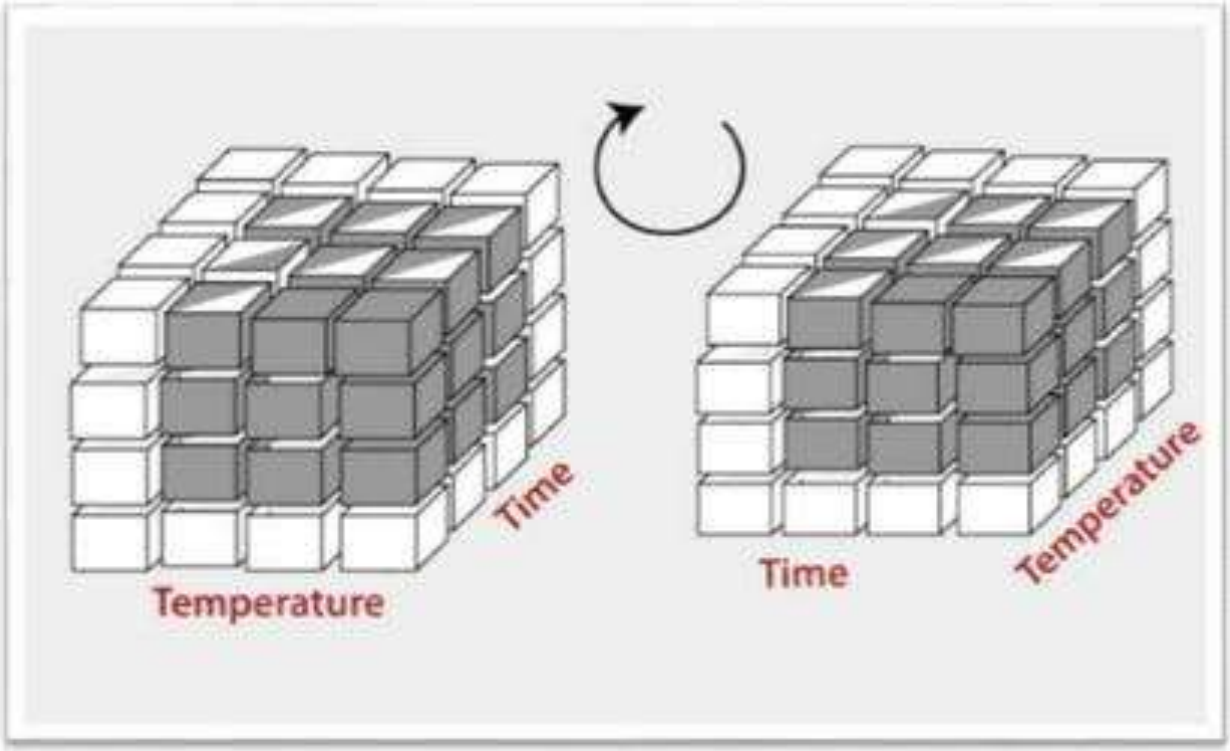
Consider the following diagram, which shows the dice operations.



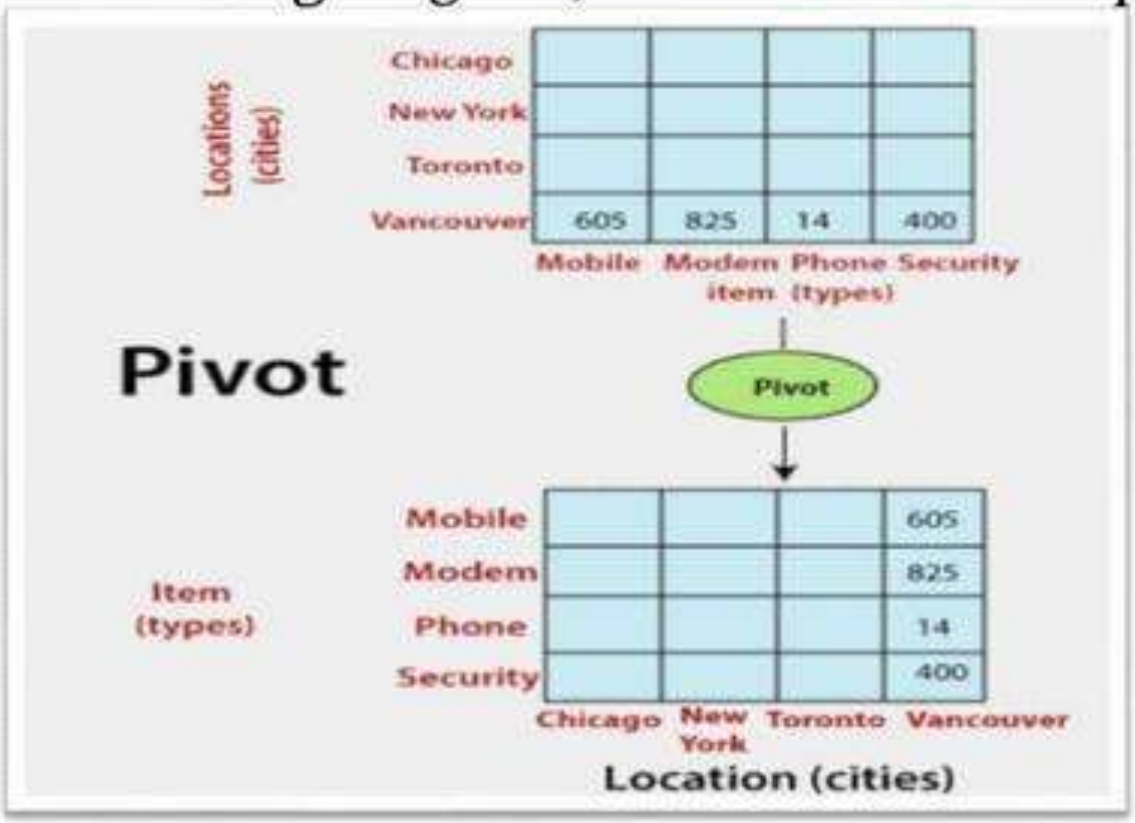
- The dice operation on the cubes based on the following selection criteria involves three dimensions.
- (location = "Toronto" or "Vancouver")
- (time = "Q1" or "Q2")
- (item =" Mobile" or "Modem")

Pivot

- The pivot operation is also called a rotation. Pivot is a visualization operations which rotates the data axes in view to provide an alternative presentation of the data. It may contain swapping the rows and columns or moving one of the row-dimensions into the column dimensions.

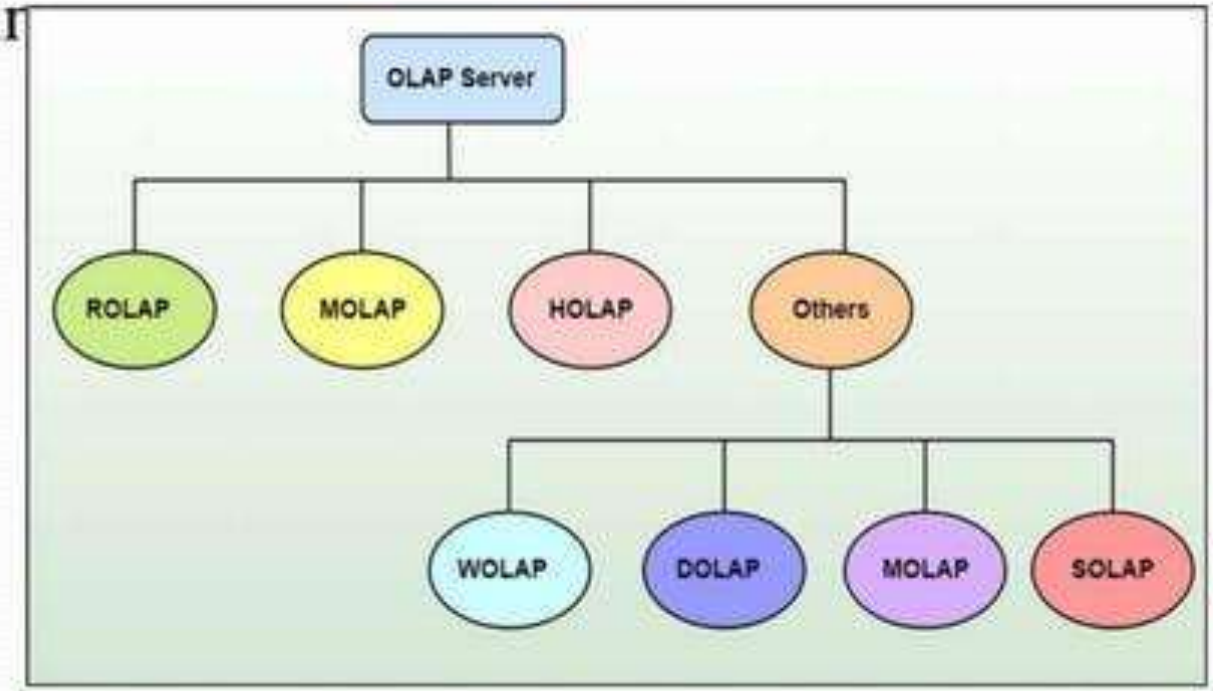

Time
Temperature
Time
Temperature

- Consider the following diagram, which shows the pivot operation.



Types of OLAP Servers:

There are three main types of OLAP servers are as followi



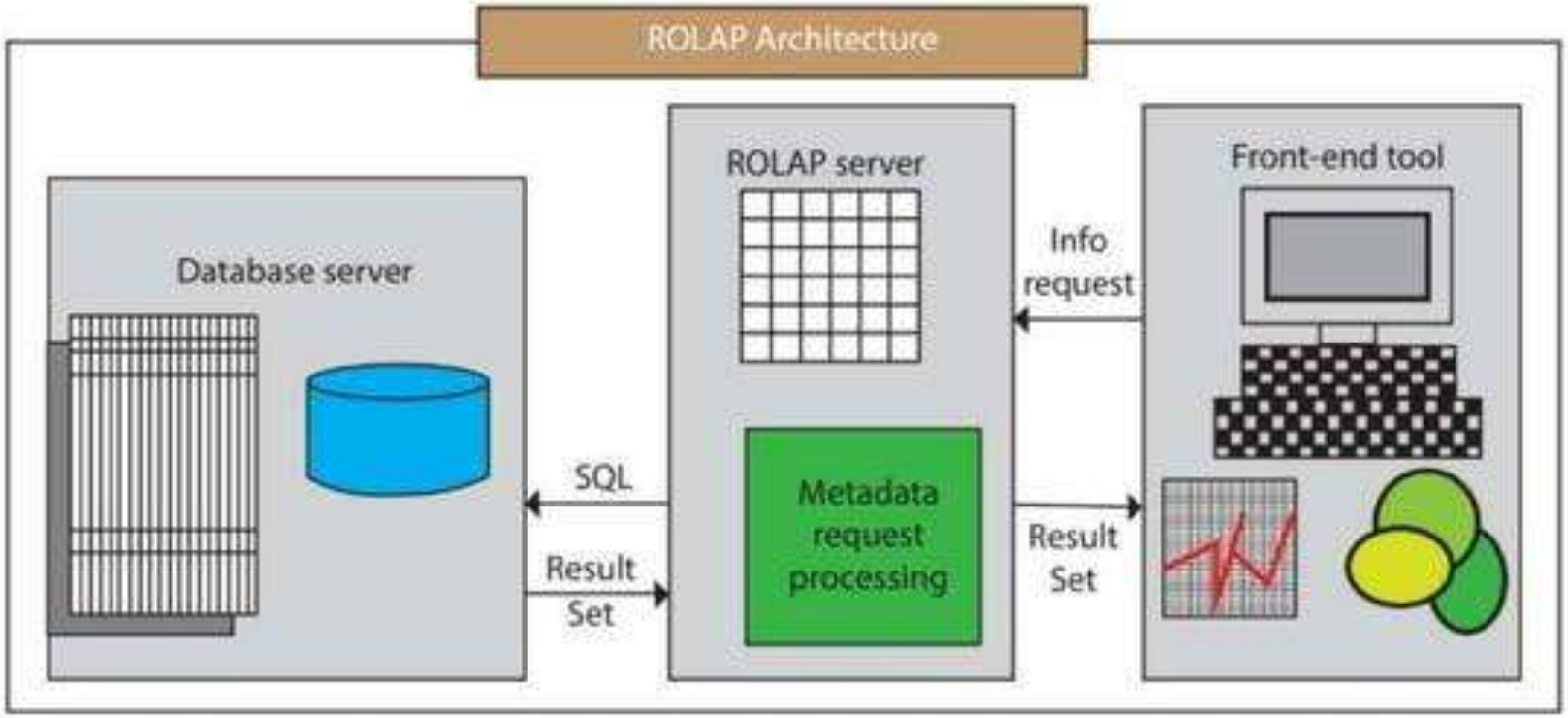
1. **ROLAP** - stands for Relational OLAP, an application based on relational DBMSs.

- These are intermediate servers which stand in between a relational back-end server and user frontend tools.
- They use a relational or extended-relational DBMS to save and handle warehouse data, and OLAP middleware to provide missing pieces.
- ROLAP servers contain optimization for each DBMS back end, implementation of aggregation navigation logic, and additional tools and services.
- ROLAP technology tends to have higher scalability than MOLAP technology.

- ROLAP systems work primarily from the data that resides in a relational database, where the base data and dimension tables are stored as relational tables. This model permits the multidimensional analysis of data.
- This technique relies on manipulating the data stored in the relational database to give the presence of traditional OLAP's slicing and dicing functionality. In essence, each method of slicing and dicing is equivalent to adding a "WHERE" clause in the SQL statement.

Relational OLAP Architecture

- ROLAP Architecture includes the following components.
- Database server.
- ROLAP server.
- Front-end tool.


ROLAP Architecture
Database server
ROLAP server
Front-end tool
Info request
SQL
Result Set
Metadata request processing
Result Set

- **Relational OLAP (ROLAP)** is the latest and fastest-growing OLAP technology segment in the market. This method allows multiple multidimensional views of two-dimensional relational tables to be created, avoiding structuring record around the desired view.

2. **MOLAP** stands for Multidimensional OLAP, an application based on multidimensional DBMSs.

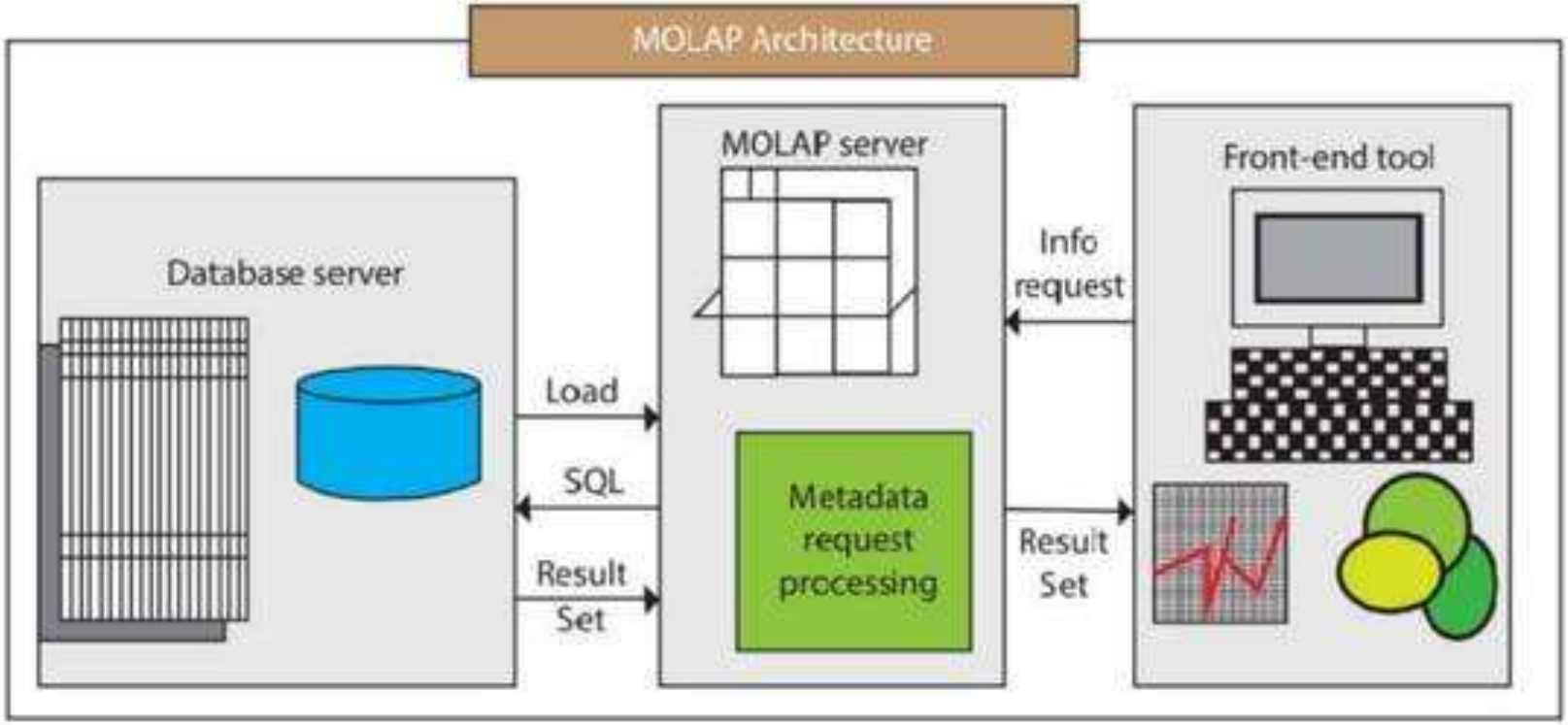
   A MOLAP system is based on a native logical model that directly supports multidimensional data and operations. Data are stored physically into multidimensional arrays, and positional techniques are used to access them.

- One of the significant distinctions of **MOLAP** against a **ROLAP** is that data are summarized and are stored in an optimized format in a multidimensional cube, instead of in a relational database. In MOLAP model, data are structured into proprietary formats by client's reporting requirements with the calculations pre-generated on the cubes.

MOLAP Architecture

MOLAP Architecture includes the following components

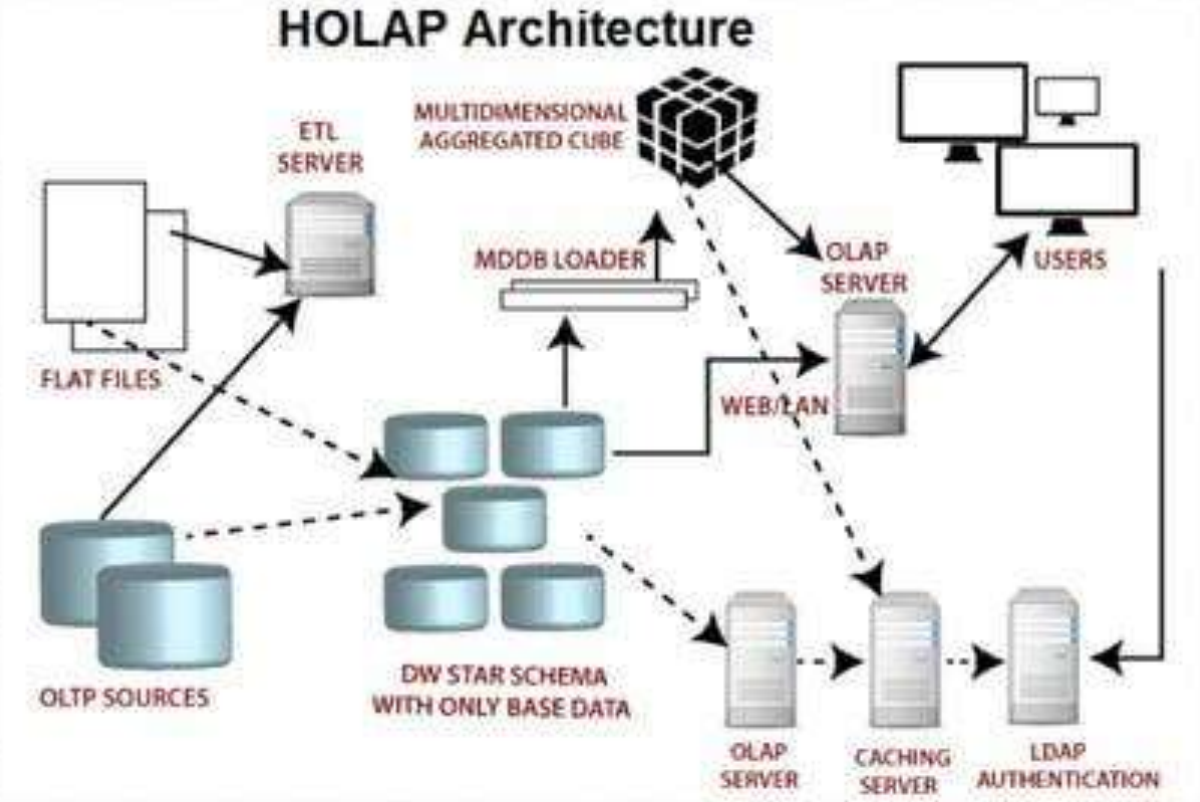
- Database server.
- MOLAP server.
- Front-end tool.


MOLAP Architecture
MOLAP server
Front-end tool
Database server
Info request
Load
SQL
Result Set
Metadata request processing
Result Set

- **MOLAP** structure primarily reads the precompiled data. MOLAP structure has limited capabilities to dynamically create aggregations or to evaluate results which have not been pre-calculated and stored.
- Applications requiring iterative and comprehensive time-series analysis of trends are well suited for MOLAP technology (e.g., financial analysis and budgeting).
- Examples include Arbor Software's Essbase. Oracle's Express Server, Pilot Software's Lightship Server, Sniper's TM/1. Planning Science's Gentium and Kenan Technology's Multiway.
- Some of the problems faced by clients are related to maintaining support to multiple subject areas in an RDBMS. Some vendors can solve these problems by continuing access from MOLAP tools to detailed data in and RDBMS.

HOLAP stands for Hybrid OLAP, an application using both relational and multidimensional techniques.

- HOLAP incorporates the best features of **MOLAP** and **ROLAP** into a single architecture. HOLAP systems save more substantial quantities of detailed data in the relational tables while the aggregations are stored in the pre-calculated cubes. HOLAP also can drill through from the cube down to the relational tables for delineated data. The **Microsoft SQL Server 2000** provides a hybrid OLAP server.


HOLAP Architecture
MULTIDIMENSIONAL AGGREGATED CUBE
ETL SERVER
MDDB LOADER
OLAP SERVER
USERS
FLAT FILES
WEB/LAN
OLTP SOURCES
DW STAR SCHEMA WITH ONLY BASE DATA
OLAP SERVER
CACHING SERVER
LDAP AUTHENTICATION

ROLAP	MOLAP	HOLAP
ROLAP stands for Relational Online Analytical Processing.	MOLAP stands for Multidimensional Online Analytical Processing.	HOLAP stands for Hybrid Online Analytical Processing.
The ROLAP storage mode causes the aggregation of the division to be stored in indexed views in the relational database that was specified in the partition's data source.	The MOLAP storage mode principle the aggregations of the division and a copy of its source information to be saved in a multidimensional operation in analysis services when the separation is processed.	The HOLAP storage mode connects attributes of both MOLAP and ROLAP. Like MOLAP, HOLAP causes the aggregation of the division to be stored in a multidimensional operation in an SQL Server analysis services instance.

ROLAP	MOLAP	HOLAP
ROLAP does not because a copy of the source information to be stored in the Analysis services data folders. Instead, when the outcome cannot be derived from the query cache, the indexed views in the record source are accessed to answer queries.	This MOLAP operation is highly optimize to maximize query performance. The storage area can be on the computer where the partition is described or on another computer running Analysis services. Because a copy of the source information resides in the multidimensional operation, queries can be resolved without accessing the partition's source record.	HOLAP does not causes a copy of the source information to be stored. For queries that access the only summary record in the aggregations of a division, HOLAP is the equivalent of MOLAP.

OLAP Tools and Technologies

OLAP Tools

These are software applications that help users interact with OLAP servers and perform data analysis. OLAP tools provide an easy interface for creating reports, visualizing trends, and answering business questions.

1. Microsoft Power BI: A popular BI tool that allows users to analyze data and create interactive reports. Power BI can connect to various data sources, including OLAP cubes, and provides a simple drag-and-drop interface.

- **Example**: A retail company can use Power BI to analyze sales data stored in an OLAP cube and create dashboards showing sales trends by region, product, or time.

OLAP Tools and Technologies

2. Tableau: Another powerful data visualization tool that allows users to connect to OLAP data sources. Tableau makes it easy to create interactive charts, graphs, and dashboards.

- **Example**: A company can use Tableau to visualize customer behavior trends across different product categories using data from OLAP cubes.

3.QlikView: This tool helps users to visualize and explore data by connecting to OLAP and relational databases. It offers a unique associative data model that enables users to explore data from different angles.

- **Example**: A manufacturing company can use QlikView to explore production performance data stored in an OLAP system and quickly identify bottlenecks or inefficiencies.

OLAP Tools and Technologies

What is Microsoft Power BI?

Microsoft Power BI is a tool that helps people look at and understand data in a simple way. It turns your raw data into interactive charts, graphs, and reports so that anyone can make smart decisions quickly. Power BI allows you to connect to different data sources (like databases or Excel files) and analyze that data visually.

Key Features of Power BI:

- **Interactive Dashboards**: You can create dashboards where you can click and explore your data in real-time.
- **Easy Visualization**: You can create charts, graphs, maps, and more without needing to know complex programming.
- **Data Sharing**: You can share reports with others, so teams can collaborate and make better decisions.
- **Real-Time Analysis**: Power BI allows you to track and monitor your data live as it changes.

OLAP Tools and Technologies

How Power BI Works:

1.Connect to Data: You connect Power BI to your data source (like an Excel file, a database, or an OLAP cube).

2.Transform Data: Power BI has tools to clean and prepare the data for analysis.

3.Visualize Data: You can then create reports and dashboards using various charts like bar charts, pie charts, and line graphs.

4.Publish and Share: Once you create your report, you can publish it and share it with others.

Example of OLAP Analysis Using Power BI

Let's say you have sales data stored in an **OLAP cube**, and you want to visualize it using Power BI. Here's how you might set it up in very simple steps:

OLAP Tools and Technologies

Steps:

1.Connect Power BI to Your OLAP Cube:

1. Open Power BI.
2. Click on **Get Data**.
3. Select **Analysis Services** (for connecting to OLAP cubes).
4. Enter the server name and database to connect to your OLAP cube.

2.Create a Simple OLAP Query:

1. After connecting, you can see your data model in Power BI.
2. Let's say you want to analyze **Sales by Region** and **Product**.

3.Here’s a simple example of how to do it with **DAX (Data Analysis Expressions)**, the language used in Power BI for creating calculations:

OLAP Tools and Technologies

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```
Total Sales = SUM('Sales'[SalesAmount])
```

OLAP Tools and Technologies

This formula calculates the total sales amount from your sales data.

3.Add Visualizations:

3. Drag and drop fields like **Region**, **Product**, and **Sales Amount** into a report.
4. Choose a **bar chart** or **pie chart** to visualize sales by region.

4.Slice and Dice the Data:

3. You can use **slicers** to filter the data by time periods (like months or years) or other categories (like product types).

5.Publish and Share:

3. Once you have your report set up, you can **publish it** to the Power BI service, where others in your organization can view and interact with it.

OLAP Tools and Technologies

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OLAP Tools and Technologies

Sample Code (DAX Example):
Let's say we have an OLAP cube that stores **SalesData** with columns like Region, Product, and SalesAmount.

Now, you want to calculate the total sales by **Region** and **Product**. Here's how you can write a simple DAX formula to calculate the total sales:

```
Total Sales = SUM('SalesData'[SalesAmount])
```

You could then create a **bar chart** in Power BI:

- Drag **Region** to the Axis field.
- Drag **Total Sales** to the Values field.
- You'll see the total sales for each region.

OLAP Tools and Technologies

Example of an OLAP Query in Power BI (using MDX):

If you're working with an OLAP cube, you might use **MDX (Multidimensional Expressions)** queries to extract data. However, in Power BI, you often don't need to write MDX directly, because Power BI automatically translates your actions into the necessary queries. But if you're querying an OLAP cube, it would look something like this:

```
SELECT
  [Measures].[SalesAmount] ON COLUMNS,
  [Product].[Category] ON ROWS
FROM [SalesCube]
WHERE ([Region].[North America])
```

OLAP Tools and Technologies

This MDX query asks for the **SalesAmount** for different **Product Categories** in the **North America** region.

Conclusion:

Power BI is a great tool for exploring and visualizing data. It connects easily to OLAP cubes and allows you to create interactive dashboards with just a few clicks. You don't need to be an expert in coding or data science to use Power BI — it’s designed to be user-friendly and accessible for anyone.

Key Takeaways:

- **Power BI** helps you analyze and visualize your data.
- You can connect Power BI to **OLAP cubes**, **databases**, or **Excel files**.
- It provides easy-to-use tools for creating interactive charts and reports.
- **DAX** and **MDX** are languages used for advanced calculations and queries in Power BI, but you don't need to know them to get started.

OLAP Tools and Technologies

What is OLAP?

OLAP stands for **Online Analytical Processing**, a technique used in **data analysis** to quickly answer complex queries involving large datasets. It allows users to:

- Summarize data into **cubes**.
- Perform **multi-dimensional analysis** (slicing, dicing, rolling up, and drilling down).
- Aggregate data efficiently.

How Tableau Uses OLAP

Tableau uses OLAP concepts for:

- **Data visualization and exploration**: Connecting to OLAP cubes (like Microsoft SQL Server Analysis Services).
- **Multi-dimensional analysis**: Allows users to slice and dice data with drag-and-drop features.
- **Aggregation and filtering**: Easy aggregation (SUM, AVG, MIN, MAX) across multiple dimensions.

OLAP Tools and Technologies

OLAP Cube Example – Python Simulation

Since Tableau itself doesn't involve direct coding, I'll show how OLAP-like data analysis works using **Python with Pandas and NumPy**. You can load similar data into Tableau for visualization.

1. OLAP Simulation with Python

We'll create a small **OLAP cube** with sales data and perform slicing, dicing, and aggregation.

OLAP Tools and Technologies

```
import pandas as pd
import numpy as np

# Sample data
data = {
   "Region": ["North", "North", "South", "South", "East", "East", "West", "West"],
   "Product": ["A", "B", "A", "B", "A", "B", "A", "B"],
   "Month": ["Jan", "Jan", "Feb", "Feb", "Mar", "Mar", "Apr", "Apr"],
   "Sales": [100, 200, 150, 250, 130, 220, 170, 300]
}

# Create DataFrame
df = pd.DataFrame(data)

# Simulate OLAP operations:
# 1. Slice: Filter for 'North' region
slice_north = df[df['Region'] == 'North']

# 2. Dice: Filter for 'North' and 'Product A'
dice = df[(df['Region'] == 'North') & (df['Product'] == 'A')]

# 3. Roll-up (aggregate): Group by region and sum sales
rollup = df.groupby('Region')['Sales'].sum().reset_index()

# 4. Drill-down: Group by region and product
drilldown = df.groupby(['Region',
'Product'])['Sales'].sum().reset_index()
```

```
# Print results
print("\nSlice (North region):")
print(slice_north)

print("\nDice (North region, Product A):")
print(dice)

print("\nRoll-up (Total Sales by Region):")
print(rollup)

print("\nDrill-down (Sales by Region and Product):")
print(drilldown)
```

OLAP Tools and Technologies

📈 **2. Tableau Visualization**

If you were to visualize this in Tableau:

- **Slice:** Filter by Region = North.
- **Dice:** Filter by Region = North and Product = A.
- **Roll-up:** Create a SUM aggregation by region.
- **Drill-down:** Add a hierarchical view by Region → Product.

🚀 **Key Takeaway**

- **OLAP cubes** in Tableau allow for complex, multi-dimensional data analysis.
- Using Python, you can simulate basic OLAP operations before loading the data into Tableau for rich visualizations.
- **Tableau's OLAP capabilities** make it easy to slice, dice, roll up, and drill down data visually without coding.

OLAP Tools and Technologies

What is QlikView?

QlikView is a **Business Intelligence (BI)** tool used for **data visualization and analysis**. It allows you to:

- Load and manipulate large datasets.
- Perform **OLAP-style multi-dimensional analysis**.
- Use **Associative Data Modeling**, which links data dynamically for easy exploration.

How QlikView Uses OLAP

QlikView offers OLAP functionalities through:

- **Associative Data Model:** Automatically connects related data fields.
- **Drill-down and Roll-up:** Users can zoom in and out on hierarchical data.
- **Slicing and Dicing:** Filter and explore subsets of data interactively.
- **Aggregation:** Sum, Average, Min, Max, etc., across dimensions.

OLAP Tools and Technologies

OLAP Example with QlikView – Simple Code

In QlikView, you define the data model using **scripts**, then build visualizations on top of it.

1. Sample Data and OLAP Script

Imagine you have sales data stored in a CSV file (sales_data.csv) with the following columns:

```
Region, Product, Month, Sales
North, A, Jan, 100
North, B, Jan, 200
South, A, Feb, 150
South, B, Feb, 250
East, A, Mar, 130
East, B, Mar, 220
West, A, Apr, 170
West, B, Apr, 300
```

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🔍 2. QlikView Script to Load and Perform OLAP Operations

Here's how you can load and analyze the data using QlikView's **Script Editor**:

✅ **Step 1:** Open QlikView → Go to **Edit Script** → Paste the following code.

```
// Load data from CSV file
SalesData:
LOAD
   Region,
   Product,
   Month,
   Sales
FROM
   sales_data.csv
(txt, codepage is 1252, embedded labels, delimiter is ',', msq);

// Slicing: Filter North region (Create a filter in the dashboard)
NorthSales:
LOAD
   Region,
   Product,
   Month,
   Sales
RESIDENT SalesData
WHERE Region = 'North';
```

```
// Dicing: Filter North region and Product A
NorthProductA:
LOAD
   Region,
   Product,
   Month,
   Sales
RESIDENT SalesData
WHERE Region = 'North' AND Product = 'A';

// Roll-up: Sum Sales by Region
Rollup:
LOAD
   Region,
   SUM(Sales) AS TotalSales
RESIDENT SalesData
GROUP BY Region;

// Drill-down: Sales by Region and Product
Drilldown:
LOAD
   Region,
   Product,
   SUM(Sales) AS SalesByProduct
RESIDENT SalesData
GROUP BY Region, Product;
```

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📈 **3. OLAP Operations in QlikView**

Once the script is loaded:

•Go to **Sheet Editor**.

•Create charts to visualize OLAP operations:

- •**Slice:** Use a filter pane to show only North region data.
- •**Dice:** Use multiple filters (Region = North and Product = A).
- •**Roll-up:** Create a bar chart with Region on the X-axis and SUM(Sales) as the mea
- •**Drill-down:** Use a hierarchical dimension (Region → Product) for detailed explor

🚀 **Key Takeaway**

•**QlikView** provides **OLAP capabilities** by allowing slicing, dicing, roll-up, and drill-down operations on large datasets.

•**Script-based data loading** and filtering enables multi-dimensional analysis.

•**Associative data model** makes filtering and exploring data highly intuitive and fast.

OLAP Tools and Technologies

📈✓ **Applications of OLAP in Business Decision-Making (Easy Language)**
OLAP (**Online Analytical Processing**) helps businesses make **better decisions** by analyzing large amounts of data quickly and efficiently. Here are some common **real-life applications**:

📊 **1. Sales and Marketing Analysis**
•**Track sales performance** by region, product, or time period.
•Identify **top-selling products** and underperforming ones.
•Plan marketing campaigns by analyzing **customer behavior patterns**.
✓ *Example:* A company uses OLAP to check which product sells the most in different regions, helping them target promotions effectively.

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💰 **2. Financial Reporting and Budgeting**
•Summarize and analyze **revenue, expenses, and profit** across departments.
•Create **financial forecasts** by observing trends.
•Identify areas of **unnecessary spending**.
✓ *Example:* A finance team uses OLAP to compare monthly expenses across branches and adjust the budget accordingly.

🛒 **3. Inventory and Supply Chain Management**
•Monitor **stock levels** in different locations.
•Analyze **supply and demand patterns**.
•Optimize **inventory levels** by predicting future needs.
✓ *Example:* A retail company uses OLAP to see which products are running low and orders more before they run out.

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4. Customer Relationship Management (CRM)
•Analyze **customer preferences** and buying habits.
•Identify **loyal customers** and create personalized offers.
•Improve **customer retention** by addressing issues early.
✓ *Example:* An e-commerce company uses OLAP to find customers who frequently abandon their carts and sends them discount offers.

5. Human Resources (HR) Analysis
•Monitor **employee performance** and productivity.
•Analyze **absenteeism trends**.
•Plan for **workforce expansion** or downsizing based on data.
✓ *Example:* A company uses OLAP to check which departments have the highest turnover rate and take corrective actions.

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🌐 **6. Healthcare and Insurance**
•Analyze **patient records** for treatment effectiveness.
•Detect **fraudulent claims** in insurance.
•Identify **trends in diseases** and plan resources accordingly.
✓ *Example:* A hospital uses OLAP to track which treatments have the highest success rates.

🚀 **Key Takeaway**
OLAP helps businesses:
•**Make faster, data-driven decisions**.
•**Identify trends and patterns** to gain insights.
•**Improve efficiency** by analyzing multi-dimensional data effectively.

Thanks !!!