Introduction to Online Analytical Processing

- As there is a huge growth in data warehousing in the recent past, the demand for more powerful access tools that help in advanced analytical processing from historical data has increased.
- Online Analytical Processing (OLAP) and data mining are two types of access tools that have been developed to meet the demands of management users
- OLAP is a design paradigm that provides a method to extract useful information from a physical data store.
- It aggregates information from multiple systems and provides summarized information/view to the management, while data mining is used to find hidden patterns within the data.
- OLAP summarizes data and makes forecasts. For example, it answers operational questions like
- 'What are the average sales of cycles, by region and by year?'
- OLAP is 'the dynamic synthesis, analysis, and consolidation of large volumes of multi-dimensional data'.
- From this definition, it is clear that OLAP deals with multi-dimensional view of data as compared
- to a simple relational database view.
- It helps users to get a wider knowledge and understanding about different features of their corporate data through consistent, fast and interactive access to a comprehensive variety of possible views of the data.
- OLAP is used to response the complex questions shared on data warehouses.
- The queries like 'who?' and 'what?' can be answered with simple tools but there is need of special tools that can support OLAP to answer advanced queries of the nature of 'what if?' and 'why?'.
- The decisions about future actions are also supported by OLAP. A typical OLAP computation can be more difficult than simple aggregation of data,
- e.g., 'What would be the effect on property sales in different regions of Punjab if Government taxes went down by 2% and legal costs went up by 4.5% for properties over
- Rs 1,00,000?'.

OLAP applications

The various applications of OLAP in different functional areas:

Functional area	*Examples of OLAP applications*
Marketing	Market research analysis, sales forecasting, customer and promotion analysis
Finance	Budgeting, financial modeling and performance analysis
Sales	Sales forecasting and analysis
Manufacturing	Production planning and defect analysis

Features of OLAP

The important features of OLAP are given as follows.

- Multi-dimensional view of data
- Time intelligence
- Complex calculations support

Multi-dimensional view of data

A multi-dimensional view of data offers the support to process the analytical data through flexible access to corporate data.

It helps to look at data in several dimensions; for example, sales by region, sales by sales representative, sales by product category, sales by month, etc.

It provides the ability to quickly switch between one view of data and another. It allows users to analyze their information in small chunks instead of giant reports, which are confusing.

Time intelligence

Time intelligence is helpful in judging the performance of any kind of analytical application over time, e.g., current month versus last month or current month of year versus the same month of last year, and so on.

The concepts such as period-over-period and year-to-date comparisons should be straightforwardly defined in an OLAP system.

Complex calculations support

OLAP systems provide different types of powerful computational methods required to forecast sales such as percentage growth and moving averages.

OLAP Benefits

The key benefits offered by OLAP are:

- Increased productivity of end-users.
- Retention of organizational control over the integrity of corporate data.
- Reduced backlog of applications development for IT staff.
- Improved profitability and potential revenue.
- Reduced query drag and network traffic on the data warehouse or OLTP systems.

Data Cube

A Data Cube is described in terms of dimensions and facts. It represents data in different dimensions. Here, the dimensions are generally the entities which an organization preserves as records.

A cube shows data as cells in an array by relating the Total Revenue with the dimensions such as Time and Location

Suppose an organization wishes to check sales records corresponding to dimensions such as branch, time, location, and item using a sales data warehouse. These dimensions help in tracking records of monthly sales and branches where the items were sold. For example, the ‘ item’ dimension table may consist of attributes such as item_code, item_type, item_name and item_brand.