INTERNATIONAL JOURNAL OF RESEARCH IN COMPUTER APPLICATION & MANAGEMENT

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AN OVERVIEW OF DATA WAREHOUSING AND OLAP TECHNOLOGY FOR DECISION MAKING

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ABSTRACT

Operational databases (OLTP) are not optimized for data access only they have to balance the requirement of data access with the need to ensure integrity of data. OLTP is customer-oriented and is used for transaction and query processing by clerks, clients and information technology professionals. Most of the times the users need to read data fast, over a large volumes of data. There is a great need for tools that provide decision makers with information to make decisions quickly and reliably based on historical data. The above functionality is achieved by Data Warehousing and Online analytical processing (OLAP). An OLAP system is market-oriented and is used for data analysis by knowledge workers, including managers, executives and analysts. OLAP and Data Warehouses are complementary. A Data Warehouse stores and manages data. OLAP transforms Data Warehouse data into strategic information. OLAP ranges from basic navigation and browsing (often known as "slice and dice"), to calculations, to more serious analyses such as time series and complex modeling. As decision-makers exercise more advanced OLAP capabilities, they move from data access to information to knowledge. This paper overviews the functionality provided by Data warehouse to make decisions. Also, how OLAP in data warehouse are beneficial than OLTP are discussed in this paper.

KEYWORDS
OLAP, OLTP, data warehousing, data mining, decision making.

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INTRODUCTION

A data warehouse is a relational database that is designed for query and analysis rather than for transaction processing. It usually contains historical data derived from transaction data, but can include data from other sources. Data warehouses separate analysis workload from transaction workload and enable an organization to consolidate data from several sources. In addition to a relational database, a data warehouse environment can include an extraction, transportation, transformation, and loading (ETL) solution, online analytical processing (OLAP) and data mining capabilities, client analysis tools, and other applications that manage the process of gathering data and delivering it to business user. A data warehouse is based on a multidimensional data model which views data in the form of a data cube.

OBJECTIVES OF THE STUDY

1. To get understand data warehouse fundamentals.
2. To study architecture of data warehouse.
3. To know difference between data warehouse and operational data.
4. To understand need of data warehouse and OLTP in decision making.
5. To know applications of data warehouse.

RESEARCH METHODOLOGY

In this research, researcher has used secondary data. the information is collected from various books, websites, articles, ppts as well as from pdfs etc.

DATA WAREHOUSE FUNDAMENTALS

"A data warehouse is a subject-oriented, integrated, time variant, and nonvolatile collection of data in support of management's decision-making process."—W. H. Inmon

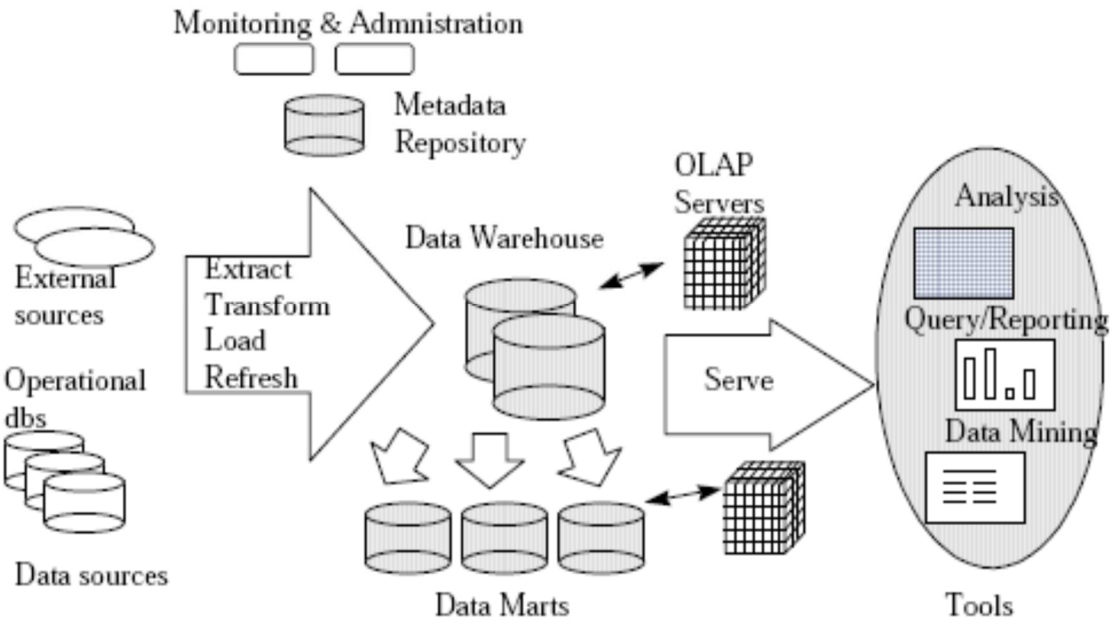
Explanation of definition is as follows:

- Subject-Oriented:
  - Designed around subject such as customer, vendor, product and activity
  - Does not includes data that are not needed for Decision support system (DSS)
- Integrated:
  - Most important feature
  - Consistent naming convention, measurement of variables and so forth
  - The data should be stored in single globally acceptable fashion
- Time Varying:
  - All data in the warehouse should be accurate as of some moment in time
  - Data stored over a long time horizon (5 –10 years)
  - Key structure contains element of time (implicitly or explicitly)
  - Data once correctly recorded can't be updated
- Non Volatile:
  - No Update of data allowed
  - only loading and access of data operations

ARCHITECTURE OF DATA WAREHOUSE

Following figure shows a typical data warehousing architecture:

FIGURE 1: DATA WAREHOUSING ARCHITECTURE



It includes tools for extracting data from multiple operational databases and external sources; for cleaning, transforming and integrating this data; for loading data into the data warehouse; and for periodically refreshing the warehouse to reflect updates at the sources and to purge data from the warehouse, perhaps onto slower archival storage. In addition to the main warehouse, there may be several departmental data marts. Data in the warehouse and data marts is stored and managed by one or more warehouse servers, which present multidimensional views of data to a variety of front end tools: query tools, report writers, analysis tools, and data mining tools. Finally, there is a repository for storing and managing metadata, and tools for monitoring and administering the warehousing system.

COMPARISON OF DATA WAREHOUSE AND OPERATIONAL DATA

Data warehousing developed is advantageous over operational databases due to following reasons:

TABLE 1

	OLTP (Operational Database)	**OLAP (Data Warehouse)**
Source of data	Operational data; OLTPs are the original source of the data	Consolidation data; OLAP data comes from the various OLTP Databases
Purpose of data	To control and run fundamental business tasks	To help with planning, problem solving, and decision support
What the data	Reveals a snapshot of ongoing business processes	Multi-dimensional views of various kinds of business activities
Inserts and Updates	Short and fast inserts and updates initiated by end users	Periodic long-running batch jobs refresh the data
Processing Speed	Typically very fast	Depends on the amount of data involved; batch data refreshes and complex queries may take many hours; query speed can be improved by creating indexes
Queries	Relatively standardized and simple queries Returning relatively few records	Often complex queries involving aggregations
Space Requirements	Can be relatively small if historical data is archived	Larger due to the existence of aggregation structures and history data; requires more indexes than OLTP
Database Design	Highly normalized with many tables	Typically de-normalized with fewer tables; use of star and/or snowflake schemas
Backup and Recovery	Backup religiously; operational data is critical to run the business, data loss is likely to entail significant monetary loss and legal liability	Instead of regular backups, some environments may consider simply reloading the OLTP data as a recovery method.

NEED OF DATA WAREHOUSE IN DECISION MAKING

Being a new branch of the database community developed in recent years, the 'data warehouse' is a read -only analytical database that is used as the foundation of a decision support system. The purpose of a data warehouse is to ensure the appropriate data is available to the appropriate end user at the appropriate time. A data warehouse is a global repository that stores pre-processed queries on data, which reside in multiple, possibly heterogeneous, operational query base for making effective decisions. The contents of a data warehouse may be a replica of part of some source data or they may be the results of preprocessed queries or both. This method of data storage provides a powerful tool helping project organizations in making decisions. The architecture of a data warehousing system allows a number of alternative ways to integrate and query (such as previous or projected) information stored in it. Thus, a data warehouse coupled with OLAP enables project managers to creatively approach, analyze and understand project problems. The data warehouse system is used to provide solutions for organization problems since it transforms operational data into strategic decision-making information. The data warehouse stores summarized information instead of operational data. This summarized information is time-variant and provides effective answers to queries,

Finance departments use OLAP for applications such as budgeting, activity-based costing (allocations), financial performance analysis, and financial modeling. Sales analysis and forecasting are two of the OLAP applications found in sales departments. Among other applications, marketing departments use OLAP for market research analysis, sales forecasting, promotions analysis, customer analysis, and market/customer segmentation. Typical manufacturing OLAP applications include production planning and defect analysis.

WHY OLAP IN DATA WAREHOUSE?

Simply told, a data warehouse stores tactical information that answers "who?" and "what?" questions about past events. While OLAP systems have the ability to answer "who?" and "what?" questions, it is their ability to answer "what if?" and "why?" that sets them different from Data warehouses.

OLAP enables decision making about future actions. In contrast to Data warehouse, this is usually based on relational technology. OLAP uses a multidimensional view of aggregate data to provide quick access to strategic information for further analysis. OLAP and data warehouses are complementary. A data warehouse manages and stores data. OLAP transforms data warehouse "data" into "strategic information". It ranges from basic navigation and browsing (often known as 'slice and dice') to calculations, to more serious analysis such as time series and complex modeling.

APPLICATIONS OF DATA WAREHOUSE

Applications that data warehouse supports are:

- **OLAP** (Online Analytical Processing) is a term used to describe the analysis of complex data from the data warehouse.
- **DSS** (Decision Support Systems) also known as EIS (Executive Information Systems) supports organization's leading decision makers for making complex and important decisions.
- **Data Mining** is used for knowledge discovery, the process of searching data for unanticipated new knowledge.

CONCLUSION

Data warehouse is the essential element of the Decision Making Process. Data warehouse is the technology for the future. Data warehouse enables knowledge worker to make faster and better decisions.

The main emphasis for OLTP systems is put on very fast query processing, maintaining data integrity in multi-access environments and an effectiveness measured by number of transactions per second.

In addition, in an OLTP system, the data is frequently updated and queried and to prevent data redundancy and to prevent update anomalies the database tables are normalized, which makes the write operation in the database tables more efficient.

An OLAP (On-line Analytical Processing) deal with Historical Data or Archival Data, and it is characterized by relatively low volume of transactions. In addition, the Queries needed for these systems are often very complex and involve aggregations as for OLAP systems the response time is an effectiveness measure.

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