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Chapter VI

Some Issues in Design of Data Warehousing Systems

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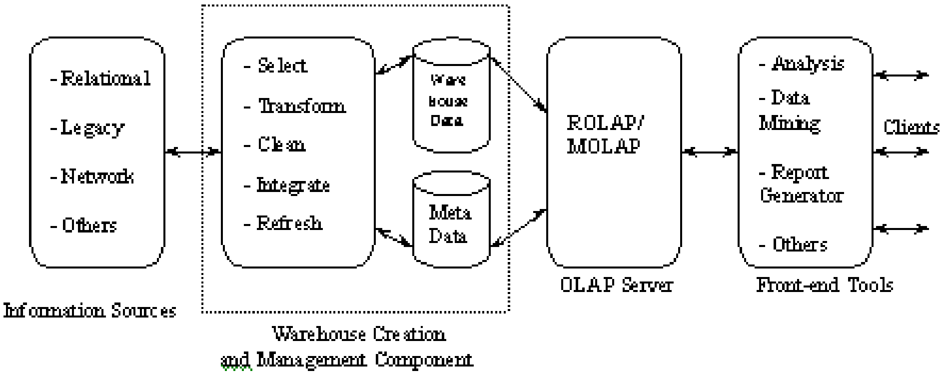
INTRODUCTION

Information is one of the most valuable assets of an organization, and when used properly can assist intelligent decision-making that can significantly improve the functioning of an organization. Data warehousing is a recent technology that allows information to be easily and efficiently accessed for decision-making activities. On-line analytical processing (OLAP) tools are well studied for complex data analysis. A data warehouse is a *set of subject-oriented, integrated, time varying and non-volatile databases used to support the decision-making activities* (Inmon, 1992).

The conceptual architecture of a data warehousing system is shown in Figure 1. The data warehouse creation and management component includes software tools for selecting data from information sources (which could be operational, legacy, external, etc., and may be distributed, autonomous and heterogeneous), cleaning, transforming, integrating and propagating data into the data warehouse. It also refreshes the warehouse data and meta-data when source data is updated. This component is also responsible for managing the warehouse data, creating indices on

Figure 1. A Conceptual data warehousing architecture



data tables, data partitioning and updating meta-data. The warehouse data contains the detail data, summary data, consolidated data and/or multidimensional data.

The meta-data is generally held in a separate repository. The meta-data contains the informational data about the creation, management and usage of the data warehouse. It serves as a bridge between the users of the warehouse and the data contained in it. The warehouse data is also accessed by the OLAP server to present the data in a multidimensional way to the front-end tools (such as analytical tools, report writers, spreadsheets and data-mining tools) for analysis and informational purposes. Basically, the OLAP server interprets client queries (the client interacts with front-end tools and passes these queries to the OLAP server) and converts them into complex SQL queries required to access the warehouse data. It might also access the data from the primary sources if the client's queries need operational data. Finally, the OLAP server passes the multidimensional views of data to the front-end tools, and these tools format the data according to the client's requirements.

There are two approaches to creating the warehouse data - bottom-up and top-down. In a bottom-up approach, the data is obtained from the primary sources based on the data warehouse applications and a profile of the likely queries which is typically known in advance. The data is then selected, transformed, and integrated by data acquisition tools. In a top-down approach, the data is obtained from the primary sources whenever a query is posed. In this case, the warehouse system determines the primary data sources in order to answer the query. These two approaches are similar to eager and lazy approaches discussed in Widom (1995). The bottom-up approach is used in data warehousing because user queries can be answered immediately and data analysis can be done efficiently, since data will always be available in the warehouse. Hence, this approach is feasible and improves the performance of the system. Another approach is a hybrid approach, which combines aspects of the bottom-up and top-down approaches. In this approach, some data is stored in a warehouse, and other data can be obtained from the primary sources on demand (Hull and Zhou, 1999).