Online Analytical Processing Server (OLAP) is based on the multidimensional data model. It allows managers, and analysts to get an insight of the information through fast, consistent, and interactive access to information.

Types of OLAP

There are three main types of OLAP servers are as following:

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

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

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

Relational OLAP (ROLAP) Server

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.

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 vew.

Some products in this segment have supported reliable SQL engines to help the complexity of multidimensional analysis. This includes creating multiple SQL statements to handle user requests, being 'RDBMS' aware and also being capable of generating the SQL statements based on the optimizer of the DBMS engine.

Advantages

Can handle large amounts of information: The data size limitation of ROLAP technology is depends on the data size of the underlying RDBMS. So, ROLAP itself does not restrict the data amount.

Disadvantages

Performance can be slow: Each ROLAP report is a SQL query (or multiple SQL queries) in the relational database, the query time can be prolonged if the underlying data size is large.

Limited by SQL functionalities: ROLAP technology relies on upon developing SQL statements to query the relational database, and SQL statements do not suit all needs.

Multidimensional OLAP (MOLAP) Server

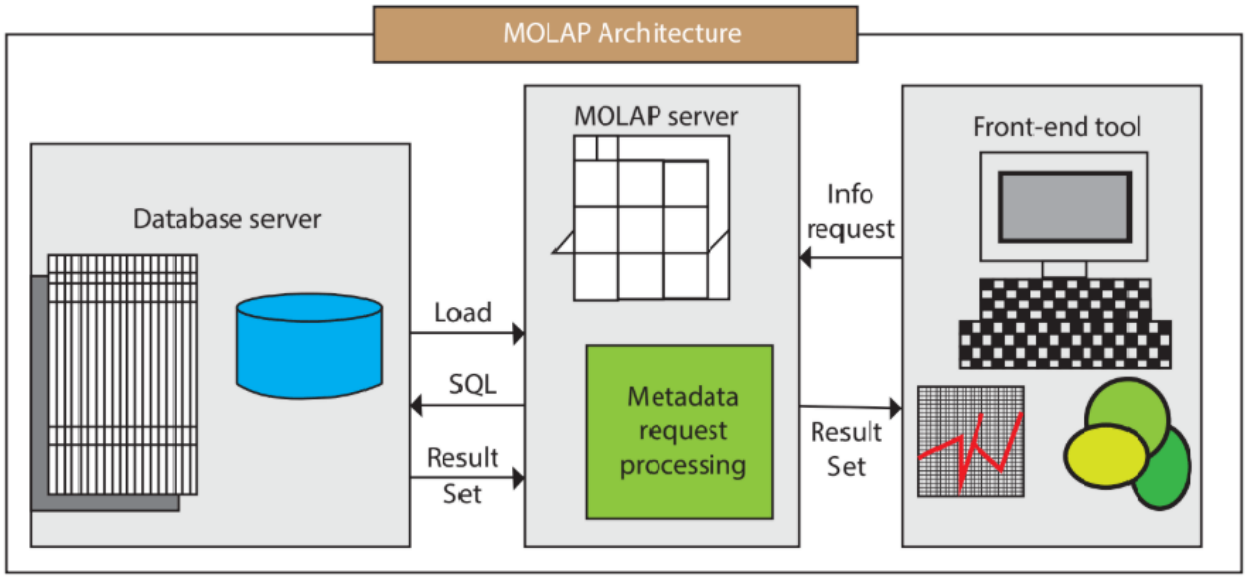
A MOLAP system is based on a native logical model that directly supports multidimensional data and operations. Data are stored physically into multidimensional arrays, and positional techniques are used to access them.

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

- •atabase server.
- •MOLAP server.
- •Front-end tool.



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.

This can be very useful for organizations with performance-sensitive multidimensional analysis requirements and that have built or are in the process of building a data warehouse architecture that contains multiple subject areas.

An example would be the creation of sales data measured by several dimensions (e.g., product and sales region) to be stored and maintained in a persistent structure. This structure would be provided to reduce the application overhead of performing calculations and building aggregation during initialization. These structures can be automatically refreshed at predetermined intervals established by an administrator.

Advantages

Excellent Performance: A MOLAP cube is built for fast information retrieval, and is optimal for slicing and dicing operations.

Can perform complex calculations: All evaluation have been pre-generated when the cube is created. Hence, complex calculations are not only possible, but they return quickly.

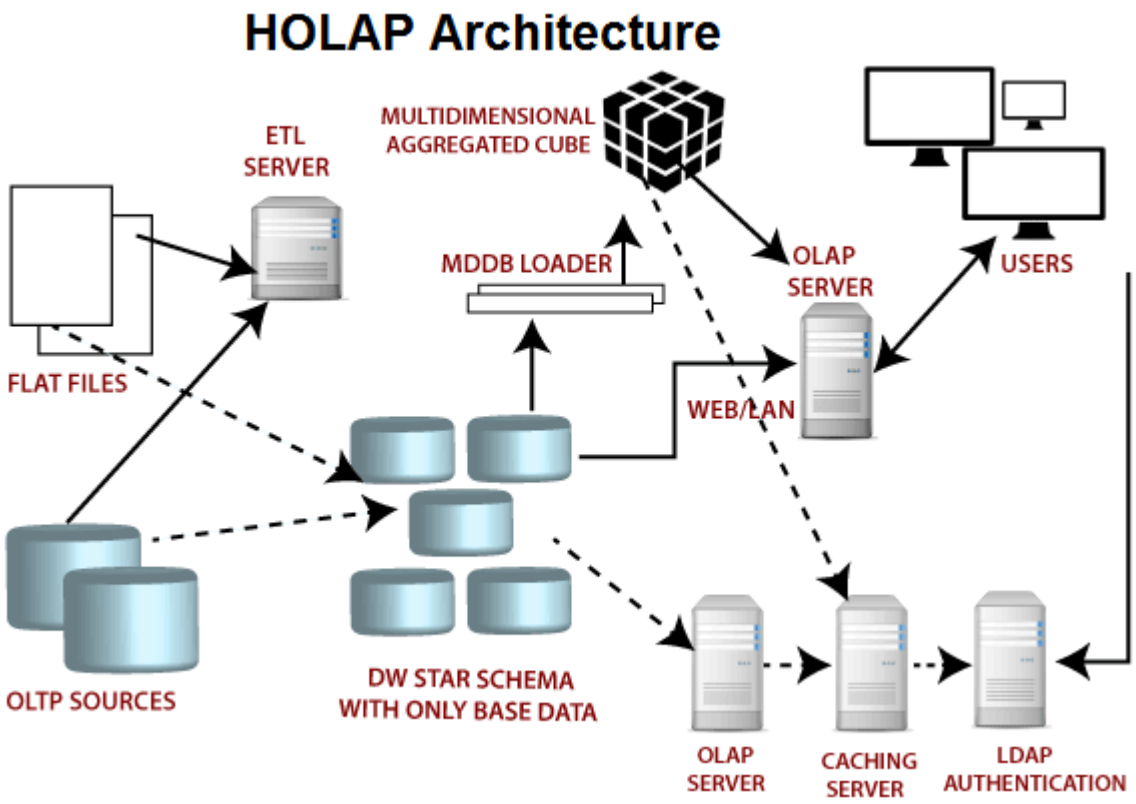
Disadvantages

Limited in the amount of information it can handle: Because all calculations are performed when the cube is built, it is not possible to contain a large amount of data in the cube itself.

Requires additional investment: Cube technology is generally proprietary and does not already exist in the organization. Therefore, to adopt MOLAP technology, chances are other investments in human and capital resources are needed.

Hybrid OLAP (HOLAP) Server

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.



Advantages of HOLAP

1.HOLAP provide benefits of both MOLAP and ROLAP.

2.It provides fast access at all levels of aggregation.

3.HOLAP balances the disk space requirement, as it only stores the aggregate information on the OLAP server and the detail record remains in the relational database. So no duplicate copy of the detail record is maintained.

Disadvantages of HOLAP

1.HOLAP architecture is very complicated because it supports both MOLAP and ROLAP servers.

Other Types

There are also less popular types of OLAP styles upon which one could stumble upon every so often. We have listed some of the less popular brands existing in the OLAP industry.

Web-Enabled OLAP (WOLAP) Server

WOLAP pertains to OLAP application which is accessible via the web browser. Unlike traditional client/server OLAP applications, WOLAP is considered to have a three-tiered architecture which consists of three components: a client, a middleware, and a database server.

Desktop OLAP (DOLAP) Server

DOLAP permits a user to download a section of the data from the database or source, and work with that dataset locally, or on their desktop.

Mobile OLAP (MOLAP) Server

Mobile OLAP enables users to access and work on OLAP data and applications remotely through the use of their mobile devices.

Spatial OLAP (SOLAP) Server

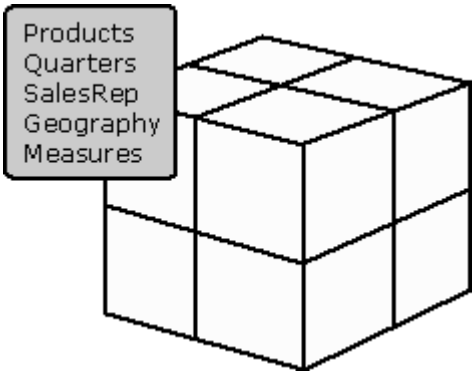
SOLAP includes the capabilities of both Geographic Information Systems (GIS) and OLAP into a single user interface. It facilitates the management of both spatial and non-spatial data.

What is Data Cube?

When data is grouped or combined in multidimensional matrices called Data Cubes. The data cube method has a few alternative names

Hypercubes and Multicubes

Multidimensional databases can present their data to an application using two types of cubes: hypercubes and multicubes. In the hypercube model, as shown in the following illustration, all data appears logically as a single cube. All parts of the manifold represented by this hypercube have identical dimensionality.



In the multicube model, data is segmented into a set of smaller cubes, each of which is composed of a subset of the available dimensions,

Hypercubes and multicubes differ in terms of available metadata. In a hypercube, each dimension belongs to one cube only. A dimension is "owned" by the hypercube. In a multicube, a dimension can be part of multiple cubes. That is, dimensions are not "owned" by any one cube; rather, they are available to all cubes. Also, there can be dimensions that do not belong to any cube.

In the OLE DB for OLAP metadata model, it is possible to browse both hypercube and multicube schemas. The CUBES rowset lists all the available cubes, whether there is a single hypercube or many multicubes. The DIMENSIONS rowset has one row for each dimension/cube combination. If there are dimensions that are not part of any cube, the CUBE_NAME field of the DIMENSIONS rowset is NULL.