Categories or Types of OLAP
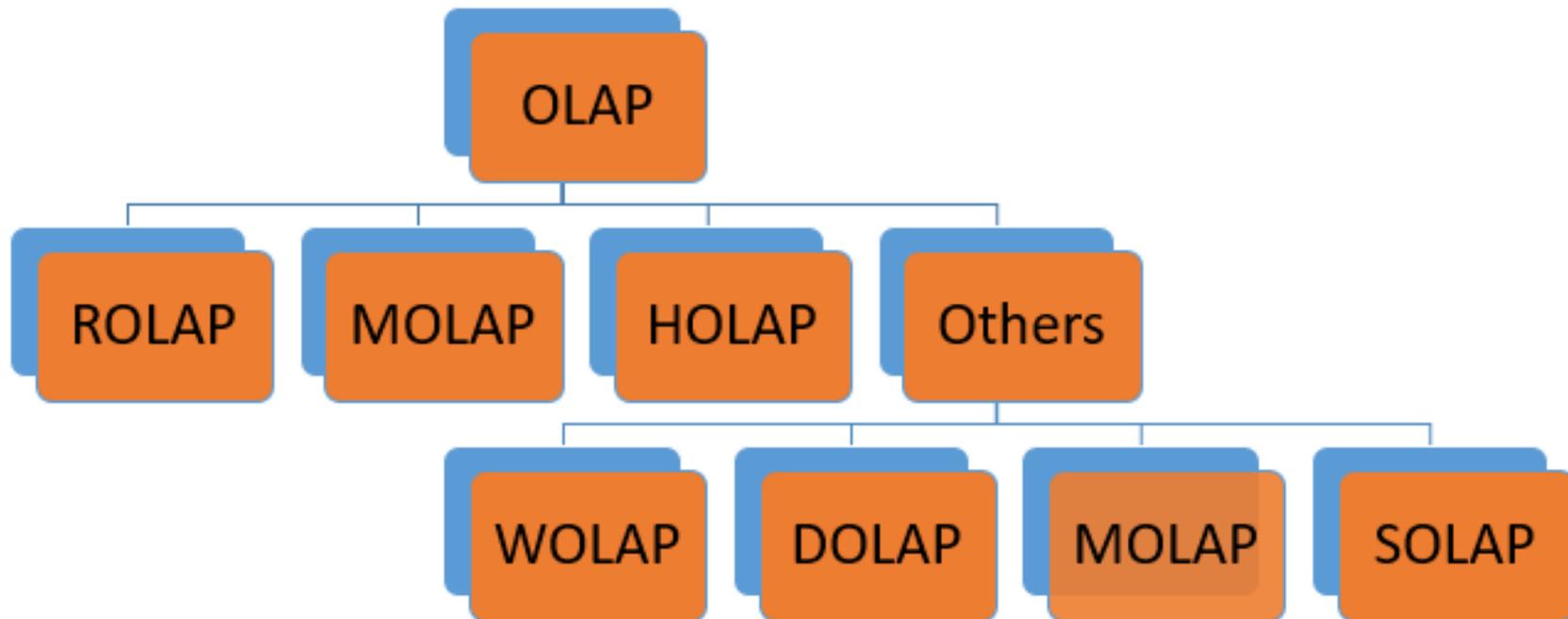
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Categories or Types of OLAP

ROLAP

- Data stored as in relational database i.e rows and columns in data warehouse.

- To display the data in multidimensional view, semantic layer called metadata is created

  - Metadata -> maps the dimension to relational tables

  - Metadata also supports aggregation

- ROLAP works with data that exist in a relational database.

ROLAP

- Do not use pre-calculated data cubes, instead pose the query to standard relational database and its tables in order to bring back the data required to question.

- Has ability to drill down to the lowest level of detail in database

- Fetches data from main warehouse and dynamically creates a multi-dimensional view of data for user. But in MOLAP, static multidimensional view of data

- ROLAP deals with large volumes of data

- Processes slower compared to MOLAP

Relational OLAP Architecture

- ROLAP includes the following components –
  - Database server
  - ROLAP server
  - Front-end tool.
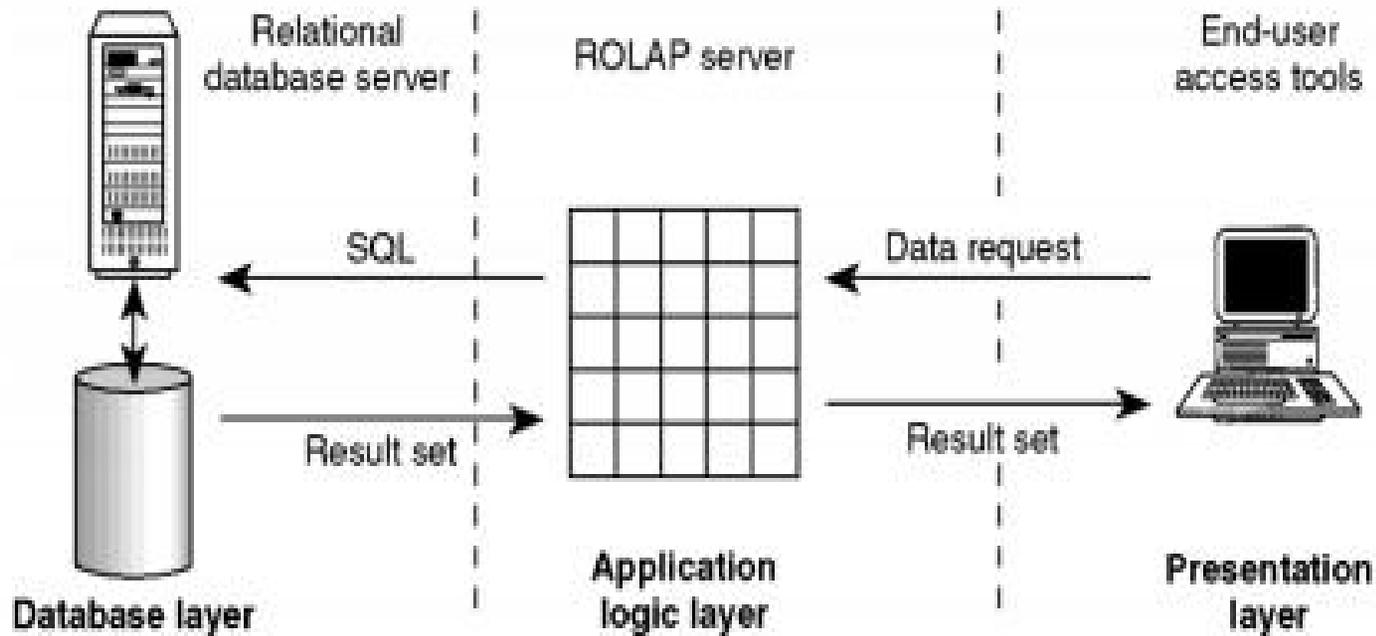
Advantages of ROLAP model

- **Scalability.** This type of OLAP system offers scalability for managing large volumes of data, and even when the data is steadily increasing.

- ROLAP servers can be easily used with existing RDBMS.

- Data can be stored efficiently, since no zero facts can be stored.

- ROLAP tools do not use pre-calculated data cubes.

Drawbacks of ROLAP model

- **Demand for higher resources:** ROLAP needs high utilization of manpower, software, and hardware resources.

- **Aggregately data limitations.** ROLAP tools use SQL for all calculation of aggregate data. However, there are no set limits to the for handling computations.

- **Slow query performance.** Query performance in this model is slow when compared with MOLAP

MOLAP

- MOLAP uses array-based multidimensional storage engines to display multidimensional views of data. Basically, they use an OLAP cube.

- Use Multi-Dimensional Database Management System (MDDMS) to organize, analyze data, aggregate data -> this requires tight coupling with application layer and presentation layer.

- MOLAP tools require pre-computation and storage of derived data, like consolidation – the operation is known as procesing

- Applications requiring iterative & comprehensive time series analysis of trends uses MOLAP.

- Examples:
  - Arbor Software's Essbase
  - Oracle's Express Server
  - Pilot Software's LightShip Server

MOLAP Architecture

- MOLAP includes the following components –
  - Database server.
  - MOLAP server.
  - Front-end tool.
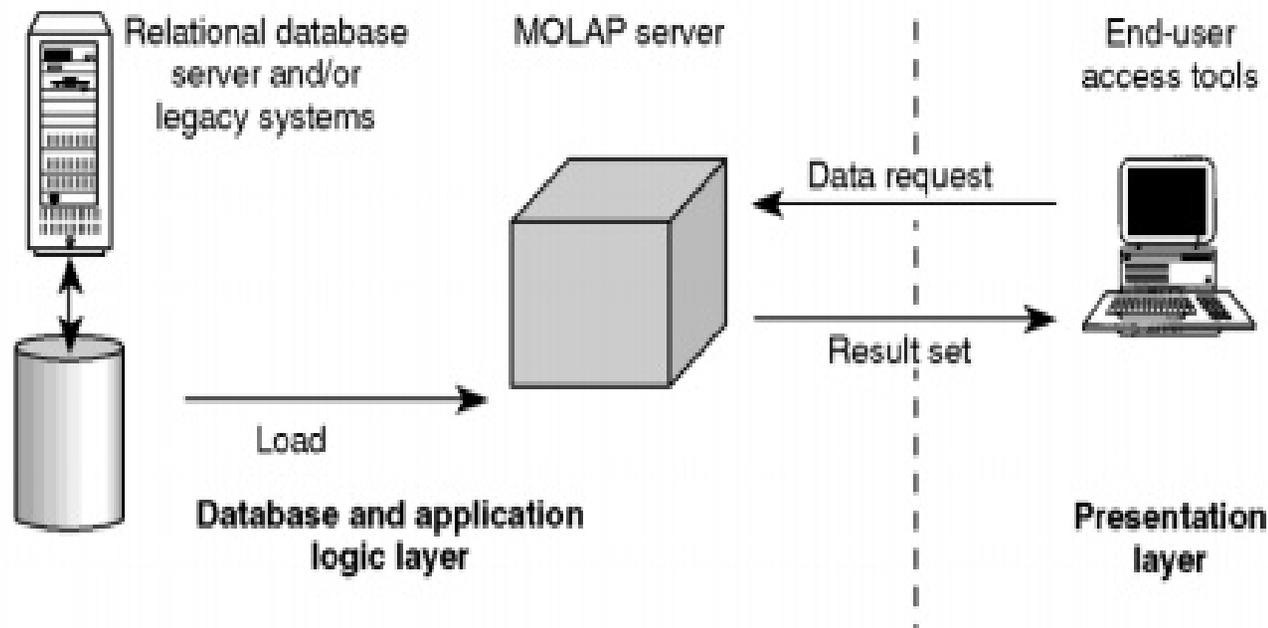
Challenges

- Limitations in ability of data structures to support multiple subject areas of data & detailed data required by many analysis.

- When dimensions change, data structure will be physically reorganized

Advantages of MOLAP

- Excellent performance
- Smaller on-disk size of data compared to data stored in relational database due to compression technique
- Effective data extraction achieved through pre-structuring of aggregated data
- MOLAP allows fastest indexing to the pre-computed summarized data.

Disadvantages of MOLAP

- Some MOLAP methodologies introduce data redundancy

- Requires additional investment
  - Human and capital resources needed

- The storage utilization may be low if the data set is sparse.

Hybrid OLAP or Managed Query Environment

- Hybrid OLAP is a mixture of both ROLAP and MOLAP.
- It offers fast computation of MOLAP and higher scalability of ROLAP.
- HOLAP uses two databases.
- Aggregated or computed data is stored in a multidimensional OLAP cube
- Detailed information is stored in a relational database.
- HOLAP tools use both pre-calculated cubes and relational data stores

Benefits of Hybrid OLAP

- Helps to economize the disk space, and it also remains compact which helps to avoid issues related to access speed and convenience.

- Hybrid HOLAP's uses cube technology which allows faster performance for all types of data.

- ROLAP are instantly updated and HOLAP users have access to this real-time instantly updated data.

- MOLAP brings cleaning and conversion of data thereby improving data relevance.

Drawbacks of Hybrid OLAP

- Greater complexity level: The major drawback in HOLAP systems is that it supports both ROLAP and MOLAP tools and applications. Thus, it is very complicated.

- Potential overlaps: There are higher chances of overlapping especially into their functionalities.

Advantages of OLAP

- OLAP is a platform for all type of business includes planning, budgeting, reporting, and analysis.
- Information and calculations are consistent in an OLAP cube. This is a crucial benefit.
- Quickly create and analyze "What if" scenarios
- Easily search OLAP database for broad or specific terms.
- OLAP provides the building blocks for business modeling tools, Data mining tools, performance reporting tools.
- Allows users to do slice and dice cube data all by various dimensions, measures, and filters.
- It is good for analyzing time series.
- Finding some clusters and outliers is easy with OLAP.
- It is a powerful visualization online analytical process system which provides faster response times

Disadvantages of OLAP

- OLAP requires organizing data into a star or snowflake schema. These schemas are complicated to implement and administer

- You cannot have large number of dimensions in a single OLAP cube

- Transactional data cannot be accessed with OLAP system.

- Any modification in an OLAP cube needs a full update of the cube. This is a time-consuming process

Types of OLAP

Type of OLAP	Explanation
Relational OLAP(ROLAP):	ROLAP is an extended RDBMS along with multidimensional data mapping to perform the standard relational operation.
Multidimensional OLAP (MOLAP)	MOLAP Implementes operation in multidimensional data.
Hybrid OnlineAnalytical Processing (HOLAP)	In HOLAP approach the aggregated totals are stored in a multidimensional database while the detailed data is stored in the relational database. This offers both data efficiency of the ROLAP model and the performance of the MOLAP model.
Desktop OLAP (DOLAP)	In Desktop OLAP, a user downloads a part of the data from the database locally, or on their desktop and analyze it. DOLAP is relatively cheaper to deploy as it offers very few functionalities compares to other OLAP systems.
Web OLAP (WOLAP)	Web OLAP which is OLAP system accessible via the web browser. WOLAP is a three-tiered architecture. It consists of three components: client, middleware, and a database server.
Mobile OLAP:	Mobile OLAP helps users to access and analyze OLAP data using their mobile devices
Spatial OLAP :	SOLAP is created to facilitate management of both spatial and non-spatial data in a Geographic Information system (GIS)

BASIS FOR COMPARISON	ROLAP	MOLAP
Full Form	ROLAP stands for Relational Online Analytical Processing.	MOLAP stands for Multidimensional Online Analytical Processing.
Storage & Fetched	Data is stored and fetched from the main data warehouse.	Data is Stored and fetched from the Proprietary database MDDBs.
Data Form	Data is stored in the form of relational tables.	Data is Stored in the large multidimensional array made of data cubes.
Data volumes	Large data volumes.	Limited summaries data is kept in MDDBs.
Technology	Uses Complex SQL queries to fetch data from the main warehouse.	MOLAP engine created a precalculated and prefabricated data cubes for multidimensional data views. Sparse matrix technology is used to manage data sparsity.
View	ROLAP creates a multidimensional view of data dynamically.	MOLAP already stores the static multidimensional view of data in MDDBs.
Access	Slow access.	Faster access.