

# Data Warehousing for Business Intelligence

## Course 4: Business Intelligence Concepts, Tools, and Applications

### Module 2 Bonus Materials

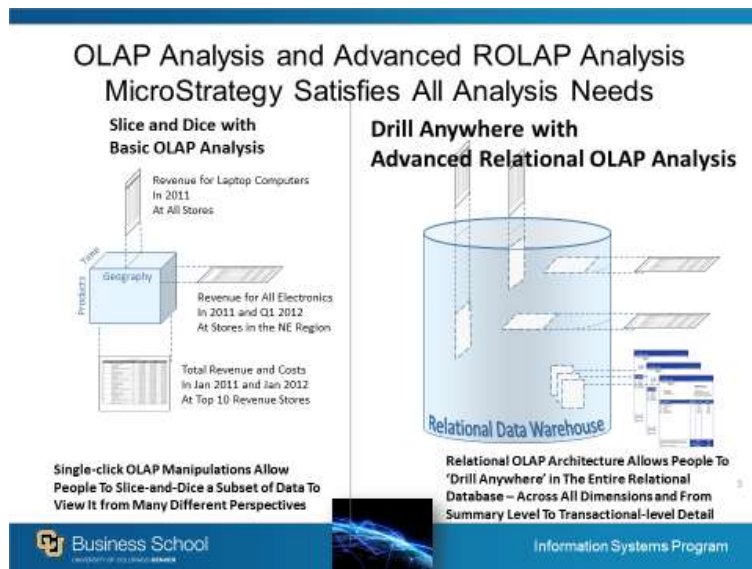
#### Lesson 4: BI OLAP Styles

We've arranged for students in this MOOC to purchase at a very low cost digital versions of chapters 1, 2, and 4 of the authoritative textbook *Business Intelligence and Analytics: Systems for Decision Support*, 10<sup>th</sup> edition, 2015 by Sharda, R., Delen, D., and Turban, E. See the optional text book link under course overview to purchase (US\$4 for one chapter, US\$10 for all three; the regular price for students is \$15 per digital chapter).

*Excerpts from SHARDA, RAMESH; DELEN, DURSUN; TURBAN, EFRAIM, BUSINESS INTELLIGENCE AND ANALYTICS: SYSTEMS FOR DECISION SUPPORT, 10th Edition, © 2015. Used by permission of Pearson Education, Inc., New York, NY. All Rights Reserved.*

OLAP fits well with mission-critical applications like budgeting and financial reporting, as well as enabling decision support solutions like EIS and Balanced Scorecards. In addition, other uses include manufacturing applications such as defect analysis and quality control. OLAP is useful for performing market analysis to determine where a company is going and where they should go. Clickstream analyses help companies determine who is doing what at their websites. Database Marketing allows you to target the right people at the right time.

- *OLAP comes in many “flavors.” The most common is ROLAP, because organizations typically prefer to use relational database technology. In this case, a star schema data model is used. For performance reasons, special purpose database technology, such as Essbase, is used. When this is the case, the data model is a multidimensional cube. Multidimensional vendors sometimes jokingly refer to ROLAP as SLOWLAP. Students are typically only familiar with relational databases and do not know that there are other technologies.*
- *ROLAP stands for Relational Online Analytical Processing. ROLAP is an alternative to the MOLAP (Multidimensional OLAP) technology.*
- *While both ROLAP and MOLAP analytic tools are designed to allow analysis of data through the use of a multidimensional data model, ROLAP differs in that it does not require the pre-computation and storage of information. Instead, ROLAP tools access the data in a relational database and generate SQL queries to calculate information at the appropriate level when an end user requests it.*
- *MOLAP is an alternative to the ROLAP technology. MOLAP differs from ROLAP significantly in that it requires the pre-computation and storage of information in the cube— the operation known as preprocessing. MOLAP stores this data in an optimized multidimensional array storage, rather than in a relational database.*
- *HOLAP (Hybrid Online Analytical Processing) is a combination of ROLAP and MOLAP. HOLAP allows storing part of the data in a MOLAP store and another part of the data in a ROLAP store. The degree of control that the cube designer has over this partitioning varies from product to product.*



Source: this slide is from MicroStrategy

OLAP stands for On Line Analytical Processing. OLAP allows business people to easily display specific slices of data by performing any of the common OLAP functions of pivoting, paging-by, sorting, filtering, and drilling. OLAP is the foundation of mainstream analysis in organizations today because it is simple for users to understand.

#### Basic OLAP - Basic OLAP

With Basic OLAP technology, people perform these functions on a limited subset of data called a cube.

With other BI technologies, these cubes are static physical databases, whereas with MicroStrategy, they are dynamically generated multidimensional caches. You can see in the diagram at left that users can view many different slices business performance: In the top slice, the user is viewing Laptop computer revenue for 2010 and for all Stores

#### Relational OLAP Analysis

Another approach to OLAP is Relational OLAP. Relational OLAP doesn't limit you to slicing and dicing within a cube. Instead you are able to access information anywhere within your data warehouse, from the highest levels of data summarization, down to the lowest layers of transactional detail. Ideally, BI vendors would offer both approaches to OLAP analysis.

#### Differentiator – Enterprise Class ROLAP Engine

The Best In Class Approach Is:

- ROLAP architecture with sophisticated caching.
- Advanced ROLAP engine which allows people to drill anywhere.
- ROLAP engine that is optimized for each relational database.

(++) Which Is Important Because:

**Systems don't fail or slow down even during peak usage.**

Any question can be answered at any time.

◇ Other Alternatives In the Market Are:

Some other tools store data in proprietary data storage mechanisms.

**Other ROLAP tools don't have database-optimized ROLAP engines or caching engines.**

Other tools only allow you to drill within pre-defined subsets of your data warehouse, or along pre-defined drill paths.

(--) Which Are Less Optimal Because:

Proprietary data storage mechanisms tend to not scale as well as relational databases.

Non-optimized ROLAP engines require more resources (CPU, memory, network).

Not all questions can be answered at any time by the business user.  
Additional Notes for Reference:

The advantages of Relational OLAP are mostly obvious:

*People can investigate the data freely... without being constrained to just the data contained within a cube. ...People can “surf” anywhere in the data warehouse... without the need to create new ad-hoc reports Normal business people can serve themselves with data ... without requiring assistance from IT*

#### Summary

*Having heard this, it should probably make you wonder why other vendors’ technology is not also based on Relational OLAP. The simple reason is that Relational OLAP technology proved to be very difficult for software vendors to perfect. It took MicroStrategy a decade of concerted work with customers, theoretical work, and many patents to produce a highly scalable, high performance Relational OLAP technology. Other companies spent this past decade investing in the easier cube-centered technology instead, and are just now realizing that customers’ requirements are rapidly evolving to need Relational OLAP capabilities.*

#### MICROSTRATEGY BROCHURE TEXT

MicroStrategy provides both Basic OLAP analyses for simple analytical needs, as well as full Relational OLAP for more freeform analysis and more extensive investigation. Both forms of OLAP allow business people to easily display specific slices of data by performing any of the common OLAP functions of pivoting, paging-by, sorting, filtering, and drilling.

#### MICROSTRATEGY DELIVERS ALL ANALYSIS REQUIREMENTS – FROM SLICE-AND-DICE TO INVESTIGATIVE ANALYSIS

- Providing Simple Speed-of-Thought OLAP Analysis to Business Users | MicroStrategy delivers quick insights to business users via Online Analytical Processing (OLAP). OLAP is the means by which a user examines data across various dimensions and hierarchies. With MicroStrategy, business users look for patterns, trends, and exceptions and intuitively change their views of the data through simple slice-and-dice analysis. **MicroStrategy’s OLAP functions allow business users to understand and predict business events without being trained on analytic techniques.**
- Open Up the Entire Data Warehouse with Relational OLAP Analysis | MicroStrategy uniquely delivers complete investigative analysis. **MicroStrategy’s renowned relational OLAP (ROLAP) capabilities open up the entire depth and breadth of the data warehouse for full investigative drilling, down to the transaction-level of detail as necessary. With MicroStrategy’s “drill anywhere” capability, business users can surf anywhere in the data warehouse to see new sets of data, reducing the need for formal report creation or the help of IT personnel, and improving user comprehension of data.**

## OLTP versus OLAP

	OLTP	OLAP
User	■ Clerk, IT Professional	■ Knowledge Worker
Function	■ Day-to-day Operations	■ Decision Support
Database Design	■ Application-oriented (E-R based)	■ Subject-oriented (Star, Snowflake)
Data	■ Current, Isolated	■ Historical, Consolidated
View	■ Detailed, Flat Relational	■ Summarized, Multidimensional
Usage	■ Structured, Repetitive	■ Ad-Hoc
Unit of Work	■ Short, Simple Transaction	■ Complex Query
Access	■ Read / Write	■ Read Mostly
Operations	■ Index/Hash on Prim. Key	■ Lots of Scans
# Records Accessed	■ Tens	■ Millions
# Users	■ Thousands	■ Hundreds
Database Size	■ 100s MB-GB	■ 100s GB-TB
Performance Metric	■ Transaction Throughput	■ Query Throughput, Response

Adopted from Teradata University Network presentation on OLAP

Business School  
University of California, Irvine

Information Systems Program

This slide shows the differences between OLAP (Online Analytical Processing) systems and OLTP (Online Transaction Processing) systems which are online transaction processors. OLTP's are basically used for day to day functions such as online bill pays and money exchanges, while OLAP is used for more long term decision support requirements. OLTP's are made up of current, isolated data, while OLAP users view historical and consolidated data. And as you can see, the size difference can also be fairly significant, given that OLTP's maximum size is in the Gigabyte range, while an OLAP is usually in the Terabyte range.

- OLTP (On-line Transaction Processing) is characterized by a large number of short on-line transactions (INSERT, UPDATE, DELETE). 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 OLTP database there is detailed and current data, and schema used to store transactional databases is the entity model (usually 3NF).
- OLAP (On-line Analytical Processing) is characterized by relatively low volume of transactions. Queries are often very complex and involve aggregations. For OLAP systems a response time is an effectiveness measure. OLAP applications are widely used by Data Mining techniques. In OLAP database there is aggregated, historical data, stored in multi-dimensional schemas (usually star schema).

See more information

[OLAP Analysis](#)

[OLAP & its Hybrids](#)

[OLAP Database- Multidimensional](#)

Also See the following Video by Minder Chen, Professor at Martin V. Smith School of Business and Economics, CSU Channel Islands, on "Data Warehouse and Business Intelligence: Systems Architecture and OLTP vs. OLAP", (<https://www.youtube.com/watch?v=DffOEbXr9fI>) Published on November 10, 2013.