Association for Information Systems
AIS Electronic Library (AISeL)

AMCIS 1998 Proceedings

Americas Conference on Information Systems (AMCIS)

December 1998

On-Line Analytical Processing Accounting: Potentials, Application, and Design Methodology

Stefan Schwarz
University of St. Gallen

Patrick Seifried
University of St. Gallen

Robert Winter
University of St. Gallen

On-Line Analytical Processing Accounting: Potentials, Application, and Design Methodology

Stefan Schwarz
Patrick Seifried
Robert Winter
Institute for Information Management
University of St. Gallen

Abstract

Most software vendors and business consultants agree that On-Line Analytical Processing (OLAP) tools are needed to derive useful decision support from accounting transaction data. But business solutions can not be created just by installing and integrating some tool(s). To support a selection from the growing number of tools, potentials and applications of OLAP for accounting must be clarified. Moreover, a methodology for designing OLAP applications is needed. Being aware that all research in this brand-new field is still in progress, we address these problems in this paper.

Positioning of OLAP

As shown in figure 1 a data warehouse integrates data from various Online Transaction Processing (OLTP) systems. The warehouse data base allows business intelligence applications to process data from different sources with consistent object and time references and over time periods much longer than those available in the OLTP systems.

Being one component of business intelligence applications, OLAP allows to navigate very easily trough complex multidimensional data, thereby exploring dependencies and causality. However, simulation or even planning are not covered by OLAP. Although the character of OLAP is retrospective, we will show how to derive support for actual or even future decisions.

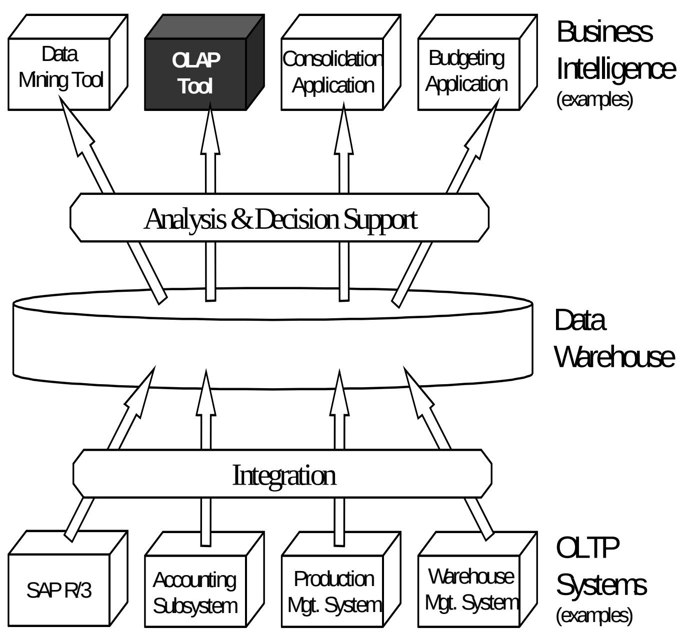

Figure 1. Positioning of OLAP

OLAP Potentials for Decision Support

OLAP is a software technology that enables analysts, managers, and executives to create and analyze useful views of business data interactively [1]. This benefit is particularly useful for the analytic evaluation of large amounts of transaction data such as accounting data.

Since OLAP tools can be used to “slice and dice”, “drill-up” and “drill-down” aggregate data (e.g. transaction figures, balances), they enable accountants and controllers to access, process and interpret financial information through different consolidation levels in real-time.

The ability to modify data granularity and aggregation rules interactively (by using Relational OLAP tools) and/or rotate data views and refine/aggregate hypercubes interactively (by using Multidimensional OLAP tools) in an end-user capable form enables accountants and controllers to work on a low level of consolidation, i.e. to combine the general information provided by aggregate data with consistent details where necessary. By allowing to analyze data interactively on an arbitrary level of detail, the flexibility of accounting evaluations is increased.

In addition to a greater flexibility, OLAP tools improve the presentation of financial information by replacing a rigid account structure and large balance columns by customizable 2D- and 3D-graphics.

An important but indirect advantage of OLAP results from the fact that OLAP base data are usually taken from a data warehouse instead of an OLTP accounting system. When being loaded into the data warehouse, transaction data are supplemented by consistent time references so that OLAP analyses can be extended to historical data, actual balances can be compared against planned balances, etc. For accounting analyses, time seems to be even the most important dimension, because only time-based comparisons allow identifying business development trends.

OLAP Utilization in Accounting

The most important OLAP application is, of course, balance control and correction by multi-stage drill-down to the transaction level.

A significant application field is the monitoring of accounts with continuously positive or negative account developments. E.g., a long-term, steadily increasing liability may indicate a potential problem. Detecting mentioned developments in retrospective analysis may help a manager to forecast future developments. A detailed example based on real life figures from Ford Motor Company will be given below.

Although often neglected, another important advantage of OLAP is the easiness of combining arbitrary dimensions. E.g., by examining the turnover in specific Strategic Business Units (SBUs, dimension 1) per country (dimension 2), marketing potentials for special products in selected countries may become apparent. By examining each dimension separately, such potentials are hardly to discover.

By monitoring account usage, rare or exorbitantly used numbers of entries can be determined. Rare account usage may indicate the account structure to be too detailed, while an exorbitant number of transactions may suggest refining the account structure.

For the creation of regular or exceptional reports, balances and/or financial transaction data can easily be complemented by derived or additional data, e.g. current ratio, quick ratio, account receivables turnover, or inventory turnover [2].

OLAP Application Development

The importance of OLAP potentials makes clear that OLAP applications need to be developed methodically instead of being created intuitively by end-users. Main advantages of using process models for application development are transparency, consistency, documentation, process control, and complexity control. Often, design methodologies (e.g. PROMET-BPR [3]) are applied only to supply chain / logistical processes, while management, product development, and customer care processes are left to an intuitive approach. We are convinced that OLAP tools and data warehousing are an excellent foundation for a management support design methodology based on Business Process Redesign (BPR) concepts.

A closer look at the PROMET-BPR method reveals that many of its core techniques and methods may be applied to management processes as well. Examples are Architectural Planning, Process Vision, and Output Analysis. Certainly, it is more difficult to define and transfer Activity Chain Diagrams because activity chains for logistic processes and management processes differ significantly. Logistic processes are dominated by the activity chain, which manages a sequence of tasks. In contrast, management processes are dominated by information objects and their dependencies / relationships. For logistic processes, information structure is derived from the workflow, while the workflow is derived from the information structure for management processes.

We conclude that the common idea of using process models for application development can be borrowed for management processes, while there is certainly significant research needed to identify all necessary adaptations.

OLAP Applied to Accounting: A Practical Example

In this section, Multidimensional OLAP is applied to accounting data. The real life system in consideration is the Ford Motor Company's annual report which comprises the company profile, a long-term vision, product descriptions, a quality report, a report of financial services, a listing of the board of directors and company officers, financial results, etc. [4].

Our system is restricted to aggregate financial data. Examples are consolidated statement of income, consolidated balance sheet, consolidated statement of cash flow and consolidated statement of stockholder's equity. All statements refer to certain company-specific definitions so that even if industry reference models (e.g. automotive) are available, individual adjustments are still necessary. From the consolidated balance sheet, all other aggregate information is derived. However, for drill-down analyses, less aggregate data like transaction figures or even detailed transactions are relevant. Furthermore, it is necessary to specify dependencies within the statements. E.g., the amount of the "cash and cash equivalents" balance sheet results from the consolidated statement of cash flows, while the "cash and cash equivalents" amount itself appears consolidated at the balance sheet.

When we build the conceptual model of our system, the most critical task is to establish correct dimensions. In the Ford Motor Company example, basic dimensions are asset structure and time line. While the abstraction hierarchy for time is obvious (fiscal year, quarter, month, ...), asset structure has to be derived from account structure: Assets are subdivided into automotive and financial services. The automotive assets are further subdivided into total cash and marketable securities, total current assets and total automotive assets. Total automotive assets can be subdivided into equity in net assets of affiliated companies, net property deferred income taxes, and other assets. The disaggregation of asset structure may continue until the level of elementary accounts has been reached.

Of course, additional dimensions like group of company, planned vs. realized amount, product line, sales region, or currency could easily be taken into consideration. While OLAP (and in particular Multidimensional OLAP) tools support large numbers

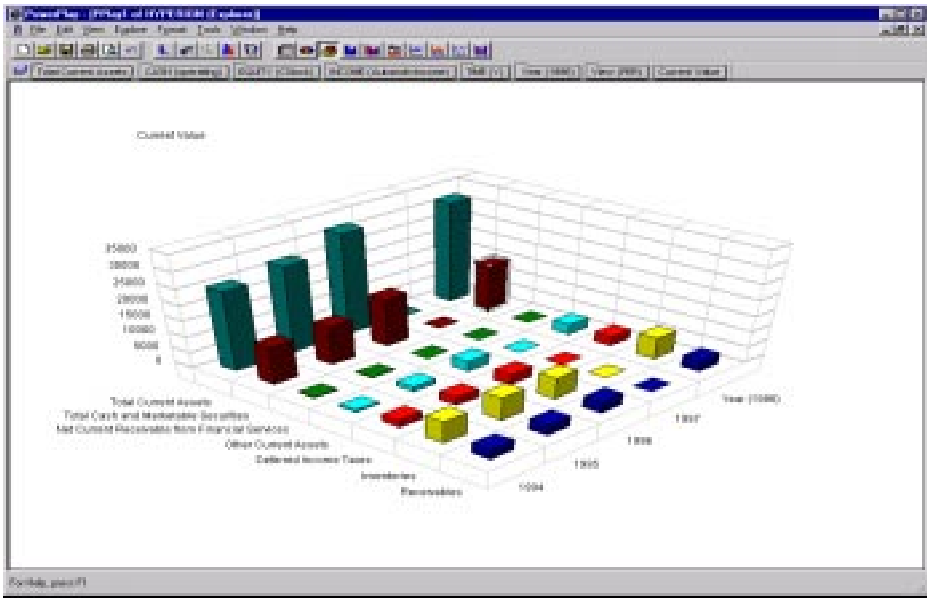

Figure 2. Ford Automotive Assets Development 1994-1996

of dimensions, however, transactional data sources often make only few of them available for analysis. As a consequence, additional dimensions must be derived from uni-dimensional base data (e.g. region from account structure) when the data are loaded into the data warehouse or into the OLAP tool database.

Figure 2 illustrates an aggregate, consolidated view of Ford Motor Company's automotive assets along the dimensions "account structure" and "time". This view could be refined with regard to asset and time granularity (e.g. quarters instead of years, inventory structure instead of total assets structure) in order to identify asset development trends or to locate problem sources. In addition, "time" could easily be replaced by "region" or "currency" in order to support regional analyses instead of longitudinal analyses.

Summary

By means of analysis applications based on OLAP tools (and data ware-houses/marts), accountants and controllers can exploit a powerful decision support potential. But like opera-tional applications, OLAP applications require a care-ful design based on a speci-fic methodology. Due to the dynamics of the OLAP tool market and the fact that many companies just started to utilize these concepts, much research is needed to identify e.g. a taxonomy of supportable analyses and business rules, a sound methodology for OLAP design, and reference hierarchies for important analysis dimensions.

Selected References

[1] OLAP Council: OLAP and OLAP Server Definitions, WWW, 1998, http://www.olapcouncil.org/glossary.html.

[2] Needles, B. / Anderson, H. / Caldwell, J.: Principles of Accounting, Houghton Mifflin, 6th Edition, 1996.

[3] Bach, V. / Brecht, L. / Hess, T. / Österle, H.: Enabling Systematic Business Change, Vieweg, 1996.

[4] Ford Motor Company and Subsidiaries: Financial Results, WWW, 1997, http://www.ford.com/finaninvest/stockholder/stock96/results/.