

DUAL DATABASE STRATEGY AND IMPLEMENTATION

Chia-hao Chang

Thomas G. Steiner

Dept. of Industrial & Systems Eng.
University of Michigan
Dearborn, Michigan

Comprehensive Computer Consulting
Northville, Michigan

ABSTRACT

In expanding from an application-oriented hierarchical database model information system to a system integrated with information-oriented relational database model, IBM offers its IMS/DB2 dual database strategy. There are also other non-IBM database technologies challenging DB2 as the only alternative for IMS installation. Automobile industries themselves are going through such a transition in developing their fourth-generation information systems. A couple major automobile corporations with IMS-based information systems are brought up as examples. These corporations have developed their design strategies and system architectures. Such an integration has influence upon the operating environment and the decision support for the end-user-driven information retrieval applications.

INTRODUCTION

Ever since database had been brought to this world, disagreements on the kinds of database model used and developed seemed never ending. CODASYL committee wanted to set a standard, and had given their recommendations to use the network model, but IBM insisted on developing their IMS/DL/1 using hierarchical models. In the 70s, Codd, based on the relational theory, founded his relational model, and constantly stressed on its sound theoretical foundation and simplicity to use, while Bachman, a pioneer in developing CODASYL model, debated on the practicality of using the traditional model (for both hierarchical and network models). The dispute led to no conclusion. As far as most industry practitioners were concerned, they only looked at the practicality. The hierarchical model reflected the structures of the assembled products (bill of material), and IBM's IMS/DL/1 was the most completed database system ever developed adopting the hierarchical models. So IMS/DL/1 became the most popularly used database system in the production lines among the major corporations. Yet time had changed, user groups began to involve more non-technical management personnel, whose needs and backgrounds were very different from the traditional information systems users. The typical application interests nowadays are answering ad hoc questions, accessing dynamic information, and processing low volume transactions. Compared to the traditional production line processing which is characterized by high volume transactions, static applications and prespecified access paths, the current trend obviously demands for a different kind of database service.

TWO DIFFERENT KINDS OF SYSTEM

The traditional application-oriented hierarchical database model information system successfully satisfies the needs of the production lines where efficiency is emphasized. The model structure allows fast processing with the prespecified access paths. To high transaction volume applications, the saving in fast processing will be significant. The model provides satisfactory performance to answer most queries, which are basically primary-key queries. Most of the reports and applications are with little or no dynamic changes. Once they are developed using third generation languages such as COBOL, they can be used repeatedly.

When non-technical management personnel becomes the user of computer technologies, their needs demand a more flexible system which will be able to respond to their changing requirements. It is quite a different situation. The transaction volume from those users is generally low, and many accesses are not prespecified. The emphasis shifts from process efficiency to effectiveness in supporting the decision making. Relational database model is found to be

very effective in searching and joining the data. Such processing is used extensively to support the end-user's demands. To enable those end-users to get information quickly and to modify the results dynamically, the system implements user-friendly languages and methods, so the users can use the system without extensive training. The direct end-users' involvement in the application development resulted in better information for decision making and greater system's responsiveness to users.

IBM'S DATABASE STRATEGY

As one can see that there are two different kinds of fundamentally incompatible needs which demand different kinds of information systems using different database models. The information system using the traditional hierarchical or network models can support high volume prespecified applications, while the information system using the relational database models can be designed to deal with more flexible and dynamic inquiries. To satisfy both objectives, IBM has a cohesive and aggressive strategy.

IBM has no intention to abandon its popularly used IMS, at least not yet. IBM wants to keep IMS as the main product and complements it with an additional information-oriented relational database system, DB2. Such migration will allow IMS continually being used to support the heavy volume operational applications, where the efficiency is very much concerned, while the end-users can also obtain their information support from the relational database system, that can provide them with more flexible and dynamic information. At the meantime, DB2 is found quite slow in processing transactions, and the overhead is higher than IMS, but since the transaction volume requesting to use DB2 is much lower than IMS, those limitations can easily be overlooked. In the long run, however, IBM's key strategic product will be DB2. The release version 2 of DB2 has already impressed many practitioners on its processing efficiency improvement of about 10 to 25%. IBM expects every new release to increase productivity by 10 to 20%, and in 10 years DB2 will be able to cover full function of IMS in performance. By then, all developments can be done under DB2.

So far during this transition period IMS remains to be the main database system, and the operational database still is the main database. To help improve the productivity of application development, IBM introduced various application development aids such as the Application Development Facility (now ADF II). Every new release of IMS improves its performance and capabilities consistent with the new requirements for operating large transactions. While DB2 is expected to take over the majority of developments in the future, IMS is expected to become a special fast transaction processing database system. The goal is to process over 4,000 transactions per second within 10 years. The

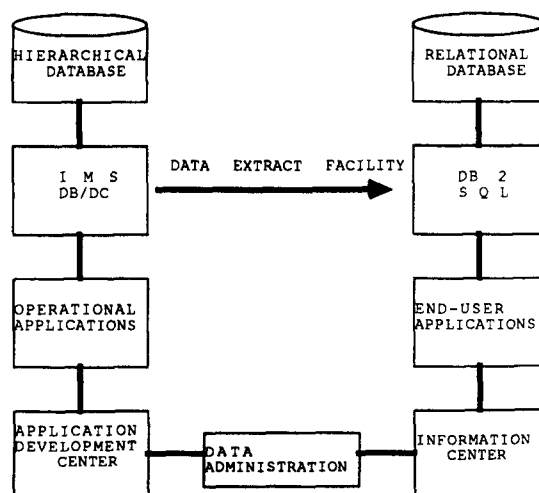


FIGURE 1. IBM'S DUAL DATABASE STRATEGY

continuing support of IMS is important. There are around thousand corporations whose processing mode is large scale and high volume. Those corporations are the main targets of IBM's dual database strategy. The "give-away" program of letting them try DB2 for six months with no obligation induces over 80% of the existing U.S. IMS users to license DB2.

At this stage the main function of DB2 is to provide information for decision support, and the main group of users of DB2 is non-technical management personnel. To help develop end-user applications, the concept of information center is suggested to implement. The user interfaces of DB2 provide nonprocedural language interface and emphasize on the relational view of database. Access methods include Query by Example (QBE), ADRS-II and Structured Query Language/Data System (SQL/DS), the key component of DB2. SQL is a set of basic commands. They act as the external interface to DB2 for data definition (such as CREATE, DROP, ALTER), data manipulation (such as SELECT, INSERT, UPDATE, DELETE) and data control (such as GRANT, REVOKE). The data definition language is initially used to create the database, and through the data manipulation language, SQL accesses the data using set operations, and the data control language grants the authority to access database. To provide an effective end-user interface, the Query Management Facility (QMF) is developed to access DB2 data through SQL and QBE. With the concept of information center being implemented, end-users can develop their own ad hoc query and reports with the help from the QMF and the assistance from the professional personnels. The integration between IMS and DB2, along with their databases, user interfaces, application development tools and information center concept, forms the blueprint of IBM's fourth-generation architecture, a dual-database strategy.

STRATEGIES ADOPTED BY AUTOMOBILE CORPORATIONS

While IBM offers its IMS/DB2 dual database strategy and considers DB2 as the emergence of IBM's fourth generation database blue print, there are also other non-IBM database technologies, such as Cullinet's IDMS/R and some fourth generation languages, challenging DB2 as the only alternative for IMS installation. Automobile corporations, the major industries of this nation, are going through such a transition in developing their own fourth-generation information systems. Most of their information systems are IMS-based. Their daily operations are usually dealt with high volume of transactions that need fast processing. In order to support the non-technical management users, the systems are under expansion to include effective decision support function. Their application-oriented hierarchical database system is to integrate the information-oriented relational database system with end-user-oriented interfaces. The following is the dual database strategies adopted by two major automobile corporations.

Corporation One

Corporation one has developed most of its production application systems under the IMS/DL/1 environment. The language interface is COBOL. Major production activities such as the shipping and receiving of specific parts, inventory control, and the packaging of parts have implemented on-line processing. There are hierarchical database, relational database and individual files using at the corporate, division and plant levels. Because of the high transaction volume of the production application systems, IMS will continue to be the principal database management system in the near future.

Decision support has recently become available to the end-users under the "information center" concept, which develops applications using fourth generation languages and relational database support. The language of choice is Information Builder's FOCUS. The relational database used by FOCUS is extracted from the online operational IMS database on the daily base. Therefore to a point, the information obtained from the relational database may not reflect up to the minute situation, but that usually is not important to the end-users. Their interests are more focused on the managerial information such as the overall trend of the transactions instead of the performance of a single transaction. The decision support information concerns much wider time zone, from past to future. That is different from the production line where the current information is most important.

The long range plan for the corporation is to gradually replace the use of FOCUS by DB2 at the corporate level. There is no intention to give up IMS totally. The dual database strategy using IMS/DB2 appears to be the future plan. Down to the plant level, the relational database will be emphasized.

Corporation Two

Corporation two has also developed many of its production application systems, including its payroll system, billing system, dealer financial accounting system and executive bonuses system, under the IMS database management system, which is the principal database management system responsible for the high volume transaction processing.

The current system has been enhanced to provide additional reporting capabilities using FOCUS as the report generator. In the past, the corporation allowed its application developers try different software products, and that resulted in several "standard" systems. In the future, IMS and DB2 will be used as this corporation's main database management systems. All new applications will first be reviewed to see if they could be implemented in an IMS, DB2 or IMS/DB2 environment.

Some Observation and Comments

Both corporations seem to have the same long range plan. They are going to use IMS/DB2 dual database strategy for their future applications. IBM's plan is to improve DB2's productivity so that eventually DB2 will be the main database system complemented by the special fast processing IMS. It seems both corporations will do just that. Unless there is an indication that an application needs IMS Fast Path, or requires a substantial application base in IMS, the new application will be developed under DB2.

Both corporations are currently involved the using of fourth generation languages, especially FOCUS, in their application developments. When DB2 is to be used as the main database management system, one has to concern the future position of those languages. A good indication is that the list of fourth generation languages, including both IBM and non-IBM products, that have interfaces with structured query language (SQL) is growing. Both corporations have personnels who are experienced in FOCUS will naturally choose FOCUS as the fourth generation language interfacing with DB2 database. Since SQL can also be embedded in COBOL, that permits batch application programs written in COBOL (as well as in PL/1, FORTRAN and other languages) to access DB2 database.

The dual database strategy seems effectively provide users both the decision support and fast transaction processing capabilities. The nonprocedural end-user interface not only encourages more non-technical users utilizing the computing technology, it also allows end-users to design and develop their own applications and generate information to satisfy their own needs. At the same time, this additional component alleviates some work from the heavy-loaded IMS system. Hence IMS can be utilized mainly for operational transaction processing, while the relational database system or the fourth generation language handles the decision support applications.

CONCLUSION

The database strategy has evolved from the traditional hierarchical models to dual database models. Such a migration has resulted successfully in supporting the high volume transaction processing at the operational level and end-user-driven information retrieval at the management level. The couple major automobile corporations mentioned in the paper are the examples.

DB2 is still a new product. Its speed to process a transaction is too slow to compare to IMS at this time. Its overhead is approximately 50% higher than IMS. Besides, DB2 lacks an integrated application development system for use and has no comprehensive dictionary facility integrated with all DB/DC products. In response to these DB2's weaknesses, IBM will soon announce a centralized data dictionary that will reside in or rely on DB2, and IBM will also promote SQL-based applications. IBM will continually support IMS users while encouraging those users who do not need IMS's Fast Path to move onto DB2. According to IBM's plan, all future mainstream application products will rely on SQL/DB2.

REFERENCE

- [1] IBM Database 2 SQL Usage Guide, IBM International Systems Centers - Santa Teresa, San Jose, 1983
- [2] "IBM Powers Up," Business Software Review, February 1987
- [3] "Making the Decision: Which 4GL?," Computerworld, June 6, 1986
- [4] Babcock, C. "Answering Skeptics, DB2 Thrives in Production Systems," Computerworld, November 24, 1986
- [5] Codd, E. "Inside IBM's Relational 'Strategy'," Computerworld-Extra, December 3, 1986
- [6] Dash, J. and R. Ojala "IBM Database 2 in An information Management System Environment," IBM Systems Journal, Vol. 23, No. 2, 1984
- [7] Hessinger, P. "DB2 and IMS, The Options Doubled, and So Did The Confusion," Computerworld-Extra, December 4, 1985
- [8] Hessinger, P. "Good for What Ails You?" Computerworld, October 8, 1986
- [9] Hessinger, P. "IBM's Database Strategy for Tomorrow," Computerworld, April 9, 1984
- [10] Kaiser, M. "SQL Speaks to Databases," Computerworld, December 3, 1986
- [11] Martin, J., Managing the Database Environment, Prentice-Hall, Englewood Cliffs, 1983