Progress towards database management standards

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ABSTRACT

The first proposals for database management standards appeared in the late 1960s. Work began on a U.S. national standard in 1978. Today there are no domestic or international database management standards, although organizations throughout the world are working toward this goal. This paper describes these various organizations and the current status of their work. It outlines recent changes in the structure and scope of American database management standardization activities that have substantially improved the outlook for timely results.
INTRODUCTION

Information processing professionals have been anticipating database management standards for over a decade. In the late 1960s and early 1970s, a flurry of reports surveyed and analyzed features of then extant database management systems (DBMS), detailed requirements for future DBMS products, and proposed specific languages for describing and manipulating databases. While the Conference on Data Systems Languages (CODASYL) candidate for a standard database management language interface was evolving, the next decade saw a proliferation of DBMS approaches, products, and applications. This increasing diversity and pervasiveness of database management software motivated renewed interest in standard approaches for database management.

Today, there are no domestic or international database management standards. Work that began in 1978 on the first American database management standard is still ongoing; but recent changes in the way DBMS standards are being developed, in their scope and in their relationships with other standards, have substantially improved the outlook for database management standardization. This paper describes the current state of DBMS standardization and updates a 1980 publication describing the various organizations addressing DBMS standards.

STANDARDIZATION BODIES

Standards for database management software, like those for other information processing components, are developed in a vast world-wide environment that includes thousands of individuals working within many organizations. The following paragraphs briefly describe the groups and committees most instrumental in developing database management standards today and the current status of their work. A more complete discussion of how EDP standards of all types are developed appears in Prigge.

International Standards Organizations

The International Standards Organization (ISO) develops standards to facilitate the international exchange of goods and services and to promote intellectual, scientific, technological, and economic cooperation. International standards are increasingly essential for world-wide trade; in the absence of international standards, differing national technical requirements rival trade tariffs as barriers to international commerce. ISO member bodies are responsible for standardization in their respective countries; for instance, the United States is represented by the American National Standards Institute (ANSI). ISO work is carried out in technical committees composed of interested member bodies with one member body serving as secretariat. The United States holds the secretariat for ISO technical committee TC 97—Computers and Information Processing.

Three groups working within the SC 5 Programming Languages subcommittee of TC 97 are currently addressing database management issues. The Conceptual Schema Working Group, WG 3, issued a report on concepts and terminology in April 1982. The DBMS Coordination Working Group is charged with evaluating, planning, and coordinating future TC 97 efforts in the area of database management. Finally, an international database experts group was convened in December 1982 to advise the ANSI X3H2 Database Committee on international standardization issues. In addition to these three bodies primarily concerned with database management, experts groups for COBOL and FORTRAN advise their ANSI counterparts on the development of international standards, including facilities for using future ISO database language standards.

National Organizations

To participate properly in international standardization activities and to develop consensus domestic standards, national bodies must provide mechanisms for coordinating diverse interests within their respective countries. Although the basic responsibilities of national standardization bodies are similar from country to country, their organizational structures and levels of participation for government, industrial, and consumer interests vary widely. Three organizations frequently associated with database management standardization in the United States; each has a distinct role in developing DBMS standards.

CODASYL

The Conference on Data Systems Languages (CODASYL) is dedicated to the development of computer languages independent of specific hardware characteristics. Participation in CODASYL committees is not limited by nationality, but CODASYL’s COBOL and network database management specifications have been the basis of major standardization efforts within the United States. CODASYL, a developmental body that produces language specifications, is not directly involved in establishing standards. Each CODASYL committee periodically publishes the results of its language development efforts in a Journal of Development (JOD). Other
organizations can use JOD specifications as a basis for implemen­tation and standardization efforts.

CODASYL bodies with database management responsibilities include the Data Description Language Committee (DDLC), the COBOL committee, and the FORTRAN Database Language Committee (FDLBC). DDLC and COBOL last published their JOD’s in 1981. Neither group has actively addressed database management standardization issues in recent months. FDLBC published its second JOD in January 1980; it has been dormant since.

ANSI

The American National Standards Institute (ANSI) is a federation of more than 180 organizations representing trade, professional, commercial, labor, and consumer interests. ANSI is the official representative of the United States in international standardization efforts, and in its capacity as secretariat it directs the work of many ISO technical committees. The Computer and Business Equipment Manufacturers Association (CBEMA) holds the secretariat for the ANSI X3 Committee on Computers and Information Processing. Work is carried out within X3 by standing and technical committees. Standing committees advise X3 on the administration, evaluation, allocation, and scheduling of standards projects. Technical committees are charged with developing draft standards on assigned topics; members representing a wide range of organizations are selected based on their individual technical expertise.

Four technical committees and an advisory body within X3 are working on database management. They are X3H2, X3H4, X3J3, X3J4, and the SPARC Database Systems Study Group.

X3H2. The X3H2 Database Committee is charged with developing American national standards (ANS) for database management facilities based on the network and relational data models, including both data definition languages and generic operations on DDL-defined structures. The X3H2 network database language (NDL) specification is derived from the CODASYL COBOL and DDLC JOD’s of January 1978. X3H2 adopted a formal specification for SQL as its base document for a relational database language (RDL) standardization effort initiated in October 1982. Originally charged with developing a draft standard for a network data description language (with access languages to be provided by the COBOL and FORTRAN committees), X3H2’s charter was expanded in the past 18 months to include generic operations and the relational model. This broadening of scope and elimination of dependency on multiple technical committees greatly improves the prognosis for an early ANSI database language.

X3H4. Established in 1980, this committee is charged with developing an ANSI standard for an information resource directory system (IRDS). To date, X3H4 has produced a dynamic requirements document and a skeletal functional specification for an IRDS standard. It is working to evolve a draft proposed standard for review by X3 within the next year.

X3J3. This committee is developing a revision for the current ANSI FORTRAN standard. The X3J3.1 Database Task Group, established in 1979 to consider DML and subschema languages for the next FORTRAN standard, has not met in more than two years. This recent lack of progress in the database area reflects X3J3’s belief that it is premature to consider incorporation of specific database capabilities in FORTRAN. However, recognition of the potential impact from the incorporation of database functionality in FORTRAN motivated much of the restructuring and enhancing of the language for the revised standard currently being developed.

X3J4. The COBOL committee is working to revise the current ANSI standard; COBOL 198X will not include subschema and data manipulation language (DML) facilities as once planned. Instead, X3J4 is considering X3H2 database specifications for possible inclusion in future revisions of ANSI COBOL. A newly established task group, X3J4.1, is responsible for defining the COBOL syntax to interface with the X3H2 NDL. X3J4 will not delay release of a revised standard until mechanisms have been defined for integrating the X3H2 database facility into COBOL. The recent decoupling of programming language syntax from DBMS operators (now being defined generically by X3H2) means that interfaces to COBOL and other programming languages can be specified whenever programming language committees so desire; the timely availability of a database language standard is not dependent on their action.

Database Systems Study Group. Acting as an advisor to the X3 Standards Planning and Requirements Committee (SPARC), the Database Systems Study Group (DBSSG) is charged with planning and coordinating future ANSI database standardization efforts. Prior to 1980, X3 was considering standards for CODASYL-network database languages only; X3H2 was charged with developing a DDL, with X3J3 and X3J4 responsible for defining DML and subschema languages for FORTRAN and COBOL, respectively. In the past three years, ANSI restructured and broadened its database standards development effort in response to DBSSG suggestions. Today, ANSI is addressing relational database management as well as the CODASYL-network approach. X3 has clearly defined and separated responsibilities for programming language syntax and generic DBMS operators. A single committee, X3H2, has responsibility for defining both structure definition languages and operations on those structures, while programming language committees are charged with defining the specific syntax for accessing databases. Finally, data dictionary/directory standardization is well underway within X3H4.

United States Government

The U.S. Government depends on standards for competitive procurement of computer hardware, software, and services. The Institute for Computer Sciences and Technology (ICST) of the National Bureau of Standards (NBS) develops federal standards and guidelines for effectively using computers in the government. Federal Information Processing Stan
dards (FIPS) cover all aspects of computer use; FIPS standards and guidelines issued by NBS apply to procurement and management practices of federal agencies. To facilitate development of industry standards for database management systems that can be applied to government problems, NBS participates along with other federal agencies in many of the database standardization bodies previously described.

Other Organizations

The European Computer Manufacturers Association (ECMA) is a nonprofit association of computer manufacturers whose purpose is to develop standards for European data-processing systems. Over the past several years, ECMA's database technical committee, TC22, has actively followed the work of CODASYL and ANSI, publishing constructive critiques and enumerating incompatibilities among related specifications.

The International Federation for Information Processing (IFIP) is not a standards development body per se, but it sponsors studies that can form the basis for international standards. IFIP is a federation of technical societies concerned with information processing. More than 30 countries are represented in IFIP. The American Federation of Information Processing Societies (AFIPS) represents the United States; the ACM, the IEEE, and other professional organizations are members of AFIPS.

CONCLUSION

Although there are no existing domestic or international database management standards, recent changes in the structure and scope of American DBMS standardization activities have improved the prognosis for timely results. The preceding paragraphs briefly surveyed the international and American groups most often associated with DBMS standardization.

REFERENCES

2. CODASYL Database Task Group Report, Association for Computing Machinery, April 1971.