THE NBS DATA MANAGEMENT TECHNOLOGY PROGRAM

by

Helen M. Wood
Institute for Computer Sciences and Technology
National Bureau of Standards

INTRODUCTION

Computers, peripheral equipment and software comprise over $80 billion in annual U.S. industry revenues. With computer technology proving to be a major key to increased productivity in all sectors of the economy, it is essential that organizations use the technology effectively. Rapid changes in technology provide additional challenge to this task.

The Institute for Computer Sciences and Technology (ICST) at the National Bureau of Standards (NBS) manages a Government-wide program to help organizations exploit computer technology. ICST activities include the development of standards and guidelines, the provision of technical assistance to agencies, and the conduct of applied research. Major problem areas addressed include:

- computer security
- software engineering
- programming languages
- data management
- computer graphics
- micro-based systems
- computer networking
- computer storage media.

While these topics are not mutually exclusive, they provide focus and orientation for projects aimed at improving the management and use of computer technology. This paper describe activities in the NBS Data Management Technology Program.

DATA MANAGEMENT TECHNOLOGY

Rapid increases in the costs associated with software development and maintenance have caused organizations to turn to other methods of application development, including packaged software, report generators and data base management systems (DBMSs). These alternatives, however, have not always yielded expected cost savings due to such factors as:

- lack of understanding of application requirements
- ignorance of software limitations, or
- inadequate utilization of software capabilities.

The NBS Data Management Technology Program is concerned with helping agencies improve their management of data resources by promoting the educated use of data management tools and techniques. Emphasis is placed on identifying the organization's data requirements and economically capturing, maintaining and accessing those data in a machine-processible form. Program activities, products and plans will be described for the following areas:

- Data administration
- Data management software
- Database architecture
- Data transfer and conversion.

Data Administration

Data administration covers a broad span of activities which range from identifying mission critical data to assessing the adequacy of controls on highly sophisticated database technology.

Until recently, NBS activities in this area have concentrated on the development and maintenance of standard data elements and representations for common Federal applications, with particular emphasis on geographic data codes. FIPS PUB 55, for example, contains over 155,000 entries providing unique codes for populated places, primary county divisions, and other locational entities. Another product in this area, FIPS PUB 95, provides standard codes for the identification of Federal and Federally-assisted organizations.

While continuing to maintain existing standards, NBS focus in this area has shifted to providing more generic assistance to agencies in the (1) definition of their data requirements; (2) selection and use of appropriate tools, such as data dictionary software, for the control of data; and (3) identification of additional, critical requirements such as data security and integrity.

Data Management Software

The objective of activities in this area is to improve the management of valuable information resources through the development of (1) standard specifications for critical software systems, including DBMSs and Data Dictionary Systems (DDSs); and (2) guidance on choosing from among alternatives such as network or relational DBMSs, file management-type systems, and more traditional (e.g., COBOL-based) approaches. Opportunities and risks inherent in the use of micro-based DBMSs are also considered.

At present, there are no existing international, national, or Federal database standards. However, proposals are currently

under critical review within the American National Standards Institute Committee X3H2. These proposals specify structures and operations for the network and relational data models, called the Network Data Language (NDL) and Relational Data Language (RDL). The structures and operations specified are typical of existing capabilities in a wide variety of DBMS products. Thus, the proposed languages can be used for comparison purposes in DBMS selections, even before the existence of conforming products. A recent NBS report describes these data models and discusses how they might be used in the selection of DBMSs.

NBS has developed draft technical specifications for data dictionary systems. These specifications have been reviewed by a wide range of Federal agency representatives, private industry users, and software suppliers and, in addition, have been adopted by ANSI Technical Committee X3H4 as a base document for the planned standard information resource dictionary system. Preliminary cost-benefit studies estimate that the Government could realize over $120 million in benefits by the early 1990's from the use of a standard DDS.

Database Architecture

Activities in this area are aimed at (1) the selection and use of data design methods and tools, and (2) guidance for managing the performance of data management systems.

A guide to good practice in logical database design is under development. This report describes a recommended methodology for identifying and capturing critical data and relationships among those data, independent of the software and hardware environment. Emphasis is on support by a data dictionary system, graphic presentation for ease of understanding and validation, and the use of normalization for quality control.

The second project is concerned with helping users select from among such alternatives as database machines, minicomputer, and microcomputer-based DBMSs. Emphasis is on hardware, not software, with the objective being to provide guidance on making a good first-cut at hardware selection for a DBMS application. A benchmark-based approach has been used, involving records extracted from the central civilian personnel database maintained by the Office of Personnel Management. Two reports are planned: one describing a comprehensive benchmark methodology for use on database systems, and the other summarizing the methodology and presenting the results of the benchmark experiments conducted.

Data Transfer and Conversion

Transporting a database between systems is typically costly and time-consuming. Standard data models (e.g., the NDL and RDL activities described above), along with standard formats for

data interchange, can significantly reduce the expenses associated with both data transfer and conversion. Furthermore, such standards can smooth the way to truly distributed database environments.

A recent NBS report describes approaches to database translation, discusses candidate interchange forms, and recommends a method for representing the data structures of the proposed NDL and RDL specifications in a form suitable for database interchange.

CONCLUDING REMARKS

The NBS Data Management Technology Program addresses major problems encountered during the following stages of an application's lifetime: requirements analysis and database design, system selection and implementation, operations management and conversion. Products developed include standard software specifications, guides to "best practice," standard data elements and representations, and reports documenting the experiences of other organizations as they attempt to improve the management of their computing resources.

Database Laboratory facilities are maintained for the investigation and analysis of state-of-the-art database technology. These facilities support collaborative testing with researchers, vendors, users, and standards developers.

A Federal Data Management Users Group has been established by NBS to foster technical information exchange and to aid NBS in the identification of Federal needs. This users group meets quarterly at NBS.

Additional information and a list of reports, standards, and guidelines published by this program can be obtained by contacting:

NBS Data Management Technology Program
National Bureau of Standards
A255 Technology Building
Washington, D.C. 20234
(301) 921-3553