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Cooperation Between a Radiology Computer Consortium and a Computer Manufacturer in the Development of a Radiology Information System

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This article reports on the formation of a Radiology Information System Consortium (RISC) by 13 hospitals and medical centers in the United States, including Henry Ford Hospital in Detroit, and the cooperation between this consortium and a major manufacturer of computers and software, Digital Equipment Corporation (DEC), for the common goal of developing a state-of-the-art radiology information system.

Since the advent of the digital computer, many hospital radiology departments have designed and implemented computer-based information management systems. Similar systems have also been commercially developed. Many early systems employed large mainframe computers which were also responsible for other hospital computing needs, primarily billing. These systems were expensive and ran slowly; later, disadvantages were overcome by using dedicated minicomputers (1). Each system was different, its design based on the capabilities of specific computer hardware and software, and on the needs and desires of a specific department (2-5). Radiology information management systems have continued to evolve because of improvements in computer hardware and software, stimulated by the growing expectations of those using them or anticipating their installation.

A major goal of many of these systems is the rapid distribution of diagnostic radiology reports (5-8). Other functions have included film library management, patient scheduling and tracking, billing, management reporting, inventory control, and teaching file management (4,9-11). Individual systems have been able to perform these functions to varying degrees, according to the needs of specific hospitals and radiology departments. However, a system that functions well in one radiology department might not be adequate for another facility because of different needs or different physical resources (2). Most systems have not been general enough to satisfy the needs of many, different departments and have not contained all the functions essential to comprehensive radiology management. Moreover, improving functional capacity has not been possible for most systems because of initial design inadequacies. A completely new start was therefore needed.

Development of a Radiology Information System Consortium (RISC)

A few years ago, Dr. Ronald Arenson developed a radiology management system at Massachusetts General Hospital and, later, at the Hospital of the University of Pennsylvania that was widely acknowledged as representing the state of the art in radiology management systems at that time (12). However, Arenson soon realized that design inadequacies in his system would make it necessary to develop a second generation system.

In 1980, Dr. Arenson invited hospitals and companies with experience or interest in radiology computing to discuss the possibility of a comprehensive, unified information management system (13). His intention was to form a consortium of hospitals that would pool experiences, needs, and expertise in order to adopt a standard for the development of a radiology information management system. The consortium would then commission a manufacturer to produce a system utilizing those standards. The consortium would benefit from the development of a state-of-the-art radiology information management system, while the manufacturer would profit from marketing a system with such backing. The Radiology Information System Consortium (RISC) was formed as a nonprofit group within the Pennsylvania Hospital Services Association of the Hospital Association of Pennsylvania, its members limited to nonprofit hospitals or other health care facilities in the United States (Table). Our institution, Henry Ford Hospital, was one of the 13 founding members of the

Consortium. The Bureau of Radiologic Health (FDA, HEW) gives technical support to RISC.

RISC and the Digital Equipment Corporation (DEC)

After the RISC developed specifications for a radiology management system, a request for proposal (RFP) was sent to likely manufacturers throughout the country, and meetings were held with manufacturers to clarify the proposal. Of the formal proposals received from vendors, three were chosen for final consideration, and the contract for the development of the radiology information system was awarded to Digital Equipment Corporation (DEC) in early 1982 (14). DEC was selected for two reasons. One was the financial status of RISC, which had limited capital and therefore needed to choose a manufacturer which could itself support the development of the information system. The other was the fortunate coincidence that DEC's Medical Systems Group had a radiology project group in the process of developing a radiology management information system, called DECrad. Serendipitously, DEC was seeking a hospital or group of radiologists to help develop DECrad, and RISC's RFP was therefore quite timely.

Communication Between RISC and DEC

The design of DECrad required much communication between members of RISC and DEC, and DEC extensively promoted the exchange of ideas. Although RISC and DEC periodically held large group meetings, frequent regular meetings were needed to discuss the content and progress of DECrad. Therefore, DEC facilitated long distance communication by supplying members of RISC with terminals and modems as well as passwords to a national computer network. Members

could "talk" with the computer at DEC headquarters in Maynard, Massachusetts, where a test version of DECrad was operating. In addition they could test new versions of DECrad, demonstrate DECrad to others, and send mail electronically to other members of RISC. One person at DEC was responsible for coordinating responses for RISC members. While this method of communication helped, it was unable to replace actual meetings of the entire group.

The Design of DECrad

RISC and DEC agreed to make DECrad powerful, versatile, and state of the art. The system contains seven major functions or modules: patient registration, examination scheduling, patient tracking, film library management, diagnostic reporting, accounting, and management reports on system activities. The basic philosophy in its development was to create a system that incorporates as many functions as possible and that includes tables of information able to describe as many user-defined variables as possible. In other words, DECrad was designed to include greater capability than needed by any individual user, since it is easier to remove nonessential functions than to add new functions. Tables of values were used as much as possible to assure that any changes needed, such as changes in billing codes, would not require that the entire software code be redesigned.

RISC raised an important concern in the early discussions about DECrad. Because DEC's Medical Systems Group was committed to using the language MUMPS (Massachusetts General Hospital Utility Multi-Programming System) for its software development, it was designing DECrad to use DEC's VAX 11 computers under DEC's VMS operating system. Up to that time, no one had managed a system of DECrad's size and complexity on the VAX computers using MUMPS. Whether MUMPS would be fast and efficient enough to satisfy the demands of busy radiology departments was not known.

Testing DECrad

Version 1.0 of DECrad was tested at two RISC-member hospitals, the University of Massachusetts Medical Center and the Yale-New Haven Hospital, in order to discover and resolve software and design problems before releasing DECrad to the market. The initial testing revealed significant problems in the system. The early version functioned slowly and was easily overloaded. Only a portion of the modules were implemented. As a result, DEC rewrote most of the modules in DECrad to increase their functionality. The implementation of MUMPS on the VAX was improved to significantly increase the speed at which MUMPS ran,

thereby increasing DECrad's speed. As software development continues, improvements made at each test center have produced more advanced versions of DECrad than version 1.0. At this time, DECrad is in its final stage of implementation at Yale-New Haven Hospital, and installation of advanced versions are planned at other RISC-member hospitals.

While version 1.0 of DECrad was being tested, RISC and DEC continued to meet and design an enhanced version. DEC has been writing the software for this version and plans to announce it soon. On the basis of the experience with DECrad at the RISC test sites, DEC has produced a commercial version now installed at two non-RISC hospitals, Winter Haven Hospital in Florida and Boston City Hospital in Boston. Three more commercial installations of DECrad are planned in the near future.

Significance of DECrad

Cooperation between RISC and DEC in the production of DECrad has been important for several reasons. First, many hospitals and clinics have shared their experience and expertise to design a unique product for the radiology community. Second, this product has great flexibility and should fit the needs of almost any radiology department. Third, the manufacturer has a product that should be profitable. Finally, the cooperation between RISC and DEC can serve as a model for producing other medical administrative systems characterized by flexibility and comprehensiveness. Such products are of obvious importance to the medical consumer as well as the manufacturer seeking to produce products with broad appeal in the marketplace.

The Future of RISC, DEC, and DECrad

Members of the RISC and DEC have worked well together to develop a good product. Although RISC and DEC are trying to negotiate another contract for further development of DECrad, their continued interaction is not certain. Moreover, as an organization fundamentally concerned with computer application problems in radiology, RISC is now considering other areas of involvement (13). Among these are the evolution of the Picture Archive and Communication Systems (PACS) and the development of information network standards within a radiology department. The principal function of RISC is to define information standards and promote their development by commercial organizations. RISC apparently has achieved this goal with DECrad.

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