

Empowering Users Through an Integrated, Distributed Information Services Model

Theodore A. Morris
IAIMS Computer Analyst
MORRISTA@UCMCIC.OA.UC.EDU

Ellen B. Marks
IAIMS Co-principal Investigator and
Director
Information Research and Development
MARKSEB@UCMCIC.OA.UC.EDU

University of Cincinnati Medical Center
Medical Center Information
& Communications
231 Bethesda Avenue, ML #574
Cincinnati, Ohio 45267-0574
(513) 558-6046

University of Cincinnati
29,880 undergraduates
6,304 graduate students
3,267 faculty
10,958 staff

Computing Center supports academics, library
and administration.
Staff: 175 FTEs; 100 part time

Introduction

The University of Cincinnati (UC) has implemented an approach to studying and developing information delivery systems, services and computer-mediated communications for the faculty, staff and students of its Medical Center. This approach recognizes that the future success of academic medical centers is critically dependent on the timely acquisition and use of biomedical and institutional information and efficient communication among health care providers and staff. UC and the National Library of Medicine have supported the development and testing of an integrated academic information management system (the IAIMS Project #LM04663-03).

IAIMS at UC is a model for the systematic implementation of a highly distributed computing environment which provides access to disparately located and managed information resources from an integrated workstation which presents them to the user as facets of a single resource. The main purpose of this environment is to deliver information resources and empowering tools which enable users to interact with needed information in effective and convenient ways. IAIMS is therefore one

viable model for support of end-user computing. At UC, this model has been designed and implemented to function compatibly with a traditional model of central computer support services, where a single organizational unit is responsible throughout the organization for delivering support services for all users of computing, telecommunications, etc.

In many college and university environments, the proliferation of end-user computing may be seen as a threat to the hegemony of centralized computing organizations or as a movement which can be controlled by enforcing centrally-mandated "standards." Development of a distributed model of information delivery in an academic environment, and one which is compatible and cooperative with the essential role of a central computing facility, is based on the following premises:

- Users' information needs are too diverse to support centrally;
- End-user computing, in an academic environment, is more about gaining access to information and control-

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ling one's own information than it is about computing *per se*.

- The benefits which can accrue to users from a cooperative computing model must be demonstrated concretely to assist users in "buying into" prospective products and services, both figuratively and literally.
- These benefits, in order to be viewed as incentives, must be capable of being described in the language and context of the user—which implies keen understanding of the primary tasks of the user by the developer. The developer must also "buy into" the goals and missions of the user organizations they serve.

In our current transformational environment, the success of such a computing services model will be evaluated not only by the accommodation of user needs, but also by how closely information systems remain aligned with the missions of the University and how compatible the model is with the existing central computer support services model—which itself may necessarily be in transformation. At UC, the IAIMS framework is provided by the users' primary activities—patient care and education. The system is therefore unified by a patient-centered approach to information delivery, focused on service to users, and anchored by a distributed technical model providing mainframe, mini-, and microcomputer-based information resources to the desktop.

We will first describe two key products associated with IAIMS in order to demonstrate its main concepts: the IAIMS Clinician's Workstation and the IAIMS Patient-centered Database. Secondly, we will draw attention to the development perspectives necessary to both create and implement such products, and lastly, we will describe the impacts on the systems analysis/systems design processes which occur when an information delivery perspective and a high level of user involvement are taken seriously.

Information Delivery Products

The Clinician's Workstation developed for IAIMS represents a single point of contact between users in the Internal Medicine service of the University of Cincinnati Hospital and the information resources—and the systems in which they reside—at the University and beyond. Specifically, it consists of a Macintosh II series microcomputer, with 8-bit or higher color capability, 5 Megabytes or more RAM, 40 Megabytes or more hard disk storage, and communications hardware and software to link to the University's Amdahl mainframes, Ethernet networks, and digital telephone system. IBM 3270 terminal emulation is provided by MacIRMA; Ethernet connection is provided through Apple's EtherTalk adapter card with DECnet software protocol support provided by TSSnet (which includes support for DEC's LAT protocol) and VT-240 terminal emulation provided by Mac241.

The selection of the Macintosh as the prototype Clinician's Workstation platform was made after an evaluation and review process in the Summer of 1988 which also examined the IBM PS/2 Model 70 with OS/2 and, to a lesser extent, the DEC MicroVAX 2000 with DECwindows. The evaluation was made in light of several key factors. User studies of information needs and information workstyles had revealed a need for users to work with several information resources "simultaneously." The inherent user interface at the desktop point of contact with the system should be easy to learn and manipulate. The user interface should allow users to interact with the system for long periods of use without fatigue, and should be organized to support brief contacts when speed might be essential in accessing vital information resources. A rich supporting marketplace of hardware and software would speed development efforts and insure a reproducible model for other institutions and within the Medical Center.

More specifically, during the course of the workstation evaluation and selection process, and during development of the several UCMC-created products and services, five elements were identified which represent essential elements of information systems design for our project: connectivity, compatibility, cordiality, confidentiality, and customization. Connectivity represents the lowest level of data interchange, whereby one can move data from one machine to another or one environment to another. Compatibility is a higher function than connectivity—it represents interoperability, whereby data shared between systems can be manipulated by tools and products which assist the user in performing cross-system operations.

Cordiality goes beyond simple "user-friendliness" and means that the system must be engaging; it must support the workstyle of the user and must present the user with sufficient feedback and incentive to be encouraged to work with the system. Confidentiality includes both the confidence on the part of the patients that their personal information is secure, as well as confidence on the part of the institutional users that the system will remain robust and secure from improper use or operation.

Customization implies that there is no "universal workstation" which can be all things to all users. Under an integrating framework, we will expand the number and types of user interfaces and computing platforms serving IAIMS users, typically to include both users requiring higher graphics or computational support as well as those with existing MS-DOS-dependent equipment and more modest display and computational needs.

In the IAIMS distributed information resource environment, the Clinician's Workstation allows a user to work with information on the University's mainframes, such as CGIS (University Hospital's patient accounting system), UCLID (library information database), SAS (statistical

analysis software package), and other traditional MVS and VM job-entry and database applications — plus a Teradata DBC/1022 relational database machine. The University Hospital also maintains two Stratus fault-tolerant mini-computer systems, in Laboratory Medicine and Radiology, which can be queried through an interface to CGIS.

Users can also utilize resources on the combined Student Access and Office Automation network, UCNET, which includes over 30 VAX and other minicomputers managed by the University's Computing Center, academic departments, or administrative agencies. Both the University's mainframe network and the UCNET have links to BITnet and/or the Internet. And finally, the University has invested in over 8,000 MS-DOS microcomputers as well as in hundreds of Macintoshes in student labs, research laboratories, and offices.

At the network level, the University has standardized on Ethernet as the networking strategy, and relies heavily on the DECnet protocols for the many DEC minicomputers on the UCNET. The recently accepted digital PBX offers twisted pair Ethernet along with multiplexed voice and data over twisted pair. There is also a standard list of "supported products" which the Computing Center recommends, for both minicomputer and microcomputer office automation activities.

The Patient-centered Database (PCD) developed in the IAIMS prototype phase is a focal point of user contact with the information world available at the workstation level. It utilizes an Oracle/VMS database engine and utility software, running on a MicroVAX II, and interfaces provided by Oracle/Mac and HyperCard on the Macintosh. From within the Oracle-to-Oracle interoperation, the user can view information downloaded directly into the database from CGIS on the mainframe, open a new window to another information resource on another machine, and cut-and-paste between resources for which proper authorization has been granted—for example, between the clinical notes and a reference database, or between the reference database and an electronic mail message to the library asking for a journal article.

The PCD serves as a tool, by automating access and organization of core clinical data in ways not available from existing resources. Interaction with the PCD inherently serves to increase users' computer literacy, and raises their expectations of how information services may be made even more useful and satisfying. The development of the PCD by the IAIMS staff and the user community also fostered the attitude and environment at the Medical Center of "user as partner" in information systems development.

Of course, the PCD is also an integrating platform, serving as the locus for clinical data/academic information

interactions. The connections, both physical and interpersonal, between information resources, the systems they run on, and the people who manage them, has been beneficial in furthering the efforts of professionals to work together toward the common goals of the University. It also provides access for the user to tools with which the user may make his own electronic and interpersonal connections and associations.

The PCD provides new report-generation capabilities to users of all levels, demonstrates the value in a complex organization of being able to relate information across multiple platforms, and helps clarify the difference between database management functions and reporting functions which accrue from them. Users have increased opportunities to explore situation-specific information gathering techniques and to perform *ad hoc* inquiries for information linkages which were not available before, or not easily available.

Finally, the PCD provides a design model or template whereby other departments and organizations can take advantage of the IAIMS experience and model in their own environments. The current interface was developed in conjunction with the Internal Medicine department, but as a prototype for the future Medical Center-wide clinical information system, the PCD provides a tangible foundation for planning and design discussions of other departmental and institutional information systems. It also serves as a concrete example of the value of supporting users' information needs with distributed computing resources.

The PCD development effort at UC also helped further the establishment of standards for many areas of University research and administrative computing, including the acquisition of the Teradata, the selection of a 4GL reporting language, increased use of data dictionaries, etc.

Information Delivery Perspective

The creation of a new information system such as the IAIMS highlights the need for an alignment of organizational, technological, and social factors, and the need for all parties involved in IAIMS development and implementation to share common goals. However, there are often divergent orientations toward delivering computing services to users which compete in a university setting. Personnel and organizations representing what we call "data processing" and "information delivery" perspectives are both crucial to the development of IAIMS, and a "dynamic balance" must be maintained between them.¹ Without an environment which can foster mutual understandings, a competition for scarce resources can emerge which will not only impede the progress of systems development but which is also a disservice to the users.

The "data processing" perspective can be said to be shaped by the possibilities and limitations of technologies. The "information delivery" perspective places the needs of the information system user at the center of information systems development. Providing data and tools, where and when they are needed, is the goal of the information delivery perspective. This is why it is so valuable to a distributed computing service support model.

In the case of the IAIMS development, in the earliest planning processes six task forces were established, chaired by Medical Center faculty (and as chair of the Technology Taskforce, a director of the University's computing center who was also director of the University Hospital information systems group). Within the context of the planning process, three major groups—clinical faculty from the College of Medicine, information professionals from the Health Sciences Library, and data processing professionals from the Computing Center—shared power in the design of the IAIMS and helped determine its goals and direction. This has led to a high degree of alignment of the IAIMS with the various involved parties, in both trivial and profound ways, from the adherence to established DECnet and Ethernet standards to the delivery of laboratory information and X-ray image representations directly to user workstations.

The information delivery perspective brought notable impact on the guidance of systems analysis and systems design efforts for the IAIMS. Within a distributed computing service support model, it pointed out the need for flexibility in development. It also showed the value of shortening the development life cycle, involving users fully and tools heavily to allow programmers and analyst on the project to interact with users to produce more accurate task analyses and to base their development questions in the language and context of the users' environment.

In a similar fashion, a high degree of involvement with the practitioners of the existing computer service support model led, through cooperative and collaborative efforts, to Computing Center acceptance of technical plans, to acceptance of standards on the part of the IAIMS developers, to modification of standards on the part of the Computing Center, and to the opportunity to draw expertise from existing personnel resources and to "feed back" new knowledge. For example, the IAIMS staff participate in a new UC Network Users Group, led by the Computing Center, and the IAIMS effort was the impetus behind the establishment of the UC Macintosh Developers' Group, an organization founded to facilitate the flow of information among persons interested in using Macintosh computers to perform the work for which they are responsible at the University.

Establishment of distributed computing support services in an institution currently served primarily by centralized support services requires a careful application of "win-win" strategies to succeed. Information delivery perspective proponents will not be able to persuade data processing perspective proponents across the conference table—the potential of the differing perspectives must be energized productively through cooperative projects and collaborations. At UC, these took shape in such diverse ways as the establishment of a Computing Center-sponsored Microcomputer Information Center in a highly visible location inside the Health Sciences Library, in the development and delivery of a public access MEDLINE subset to Medical Center users, and other projects. Each of the several projects provided opportunities for representatives of each perspective to work together toward common goals.

The establishment of a distributed model of information delivery affects the character of information systems products, the service perspectives of the systems designers, and the essential development processes themselves. By concentrating central computing support services where they are appropriate, facilitating user computing support services and user system design services at the user level, and coordinating the two in an atmosphere of cooperation and mutual benefit, the institution can provide a stable core of utility-like services, a flexible and responsive design and support cadre, and a productive, effective, and efficient delivery of computing support for all users.

References

- ¹Marks, EB, Morris, TA, Myatt, AE, and Lorenzi, NM, "Information and Technology, the IAIMS Dynamic Balance," presented at the Medical Library Association Annual Conference, Boston, Massachusetts, May, 1989.
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