DOCUMENT RESUME

ED 354 004 IR 054 380

TITLE	The Role of the MELVYL System in University of California Library Automation: The Next Five Years. Technical Report No. 5.
INSTITUTION	California Univ., Oakland. Div. of Library Automation.
REPORT NO	ISBN-0-913248-09-6
PUB DATE	Oct 91
NOTE	34p.; For related reports, see IR 054 378-381.
PUB TYPE	Reports - Descriptive (141)
EDRS PRICE	MF01/PC02 Plus Postage.
DESCRIPTORS	Academic Libraries; Bibliographic Databases; Computer Networks; *Computer System Design; Futures (of Society); *Gateway Systems; Higher Education; Information Management; Information Systems; *Library Automation; *Long Range Planning; Man Machine Systems; *Online Catalogs; Users (Information)
IDENTIFIERS	Information Infrastructure; *MELVYL; *University of California

ABSTRACT

This report on options for developing the University of California (UC) MELVYL online library system discusses the system in relationship to the current environment, including national and network information resources, electronic publishing, campus libraries, and changing user expectations; and places the growth of the MELVYL system in the context of overall planning for the development of the university's automated information systems. Objectives underlying continued development of the system are proposed, including growth of the catalog and periodicals databases; loading of abstracting and indexing databases; access to electronic journals, reference sources, a directory of databases, and specialized databases; an integrated view of information resources available to the UC community; data coordination; and creation of a workstation environment. Implications of the objectives for database acquisition, computing and network resources, investment in workstation technologies, staffing, and the MELVYL system as an information utility are summarized; and an overview of the technical evolution of the MELVYL system is provided, including standards, interfaces, and hardware. Five graphs presenting 1990 and 1991 use statistics are included, and a diagram of the system is appended. (KRN)

Technical Report No. 5

THE ROLE OF THE MELVYL® SYSTEM IN UNIVERSITY OF CALIFORNIA LIBRARY AUTOMATION: THE NEXT FIVE YEARS

October 1991

Division of Library Automation
University of California
Office of the President
300 Lakeside Drive, Floor 8
Oakland, CA 94612-3550

ISBN: 0-913248-09-6

CONTENTS

Technical Report No. 5

THE ROLE OF THE MELVYL® SYSTEM IN UNIVERSITY OF CALIFORNIA LIBRARY AUTOMATION: THE NEXT FIVE YEARS

Over the last ten years, the MELVYL system has evolved into a key element in the University's plan for access to information resources. The University's strategy for library automation, as outlined in *Guidelines for Coordinating Library Automation in the University of California*,[1] stressed the need for Universitywide access through the continued development of the University network, the development of campus-integrated library automation systems, and the continuation of the MELVYL catalog under the guidance of Universitywide library policy. This document has reaffirmed the "one University, one library" objective of the *Plan for Development, 1978-1988*[2] to unify access to the library collections of the University. The rapid growth of the University networks and the creation of standard technical and bibliographic environments is increasingly making it possible for members of the University community to have access to information resources anywhere on the network. The location of information resources, once constrained by technical limitations, can now be determined by the needs of users, the quality of services, the economics of procuring information resources, and telecommunications costs. The primary goal will be a distributed model allowing use of information wherever it resides, whether in campus library or other information systems, in the MELVYL system, or in national and international systems. This new environment has increased the opportunities and the options for University automation planning.

As one of the components of the University's access plan, the MELVYL system has grown from a limited monographs catalog to include the California Academic Libraries List of Serials (CALLS), as well as resources of interest to the University from the California State Library, the California Academy of Sciences, and the Center for Research Libraries, and a growing list of abstracting and indexing databases. The MELVYL system has also played an important role in supporting the implementation of the Regional Library Facilities through its role as a union catalog. Use of the MELVYL system is expanding rapidly, with the greatest growth in the area of the abstracting and indexing databases. Indicative of the expansion of networks, use of the catalog outside of the library also shows considerable growth. In addition to these access functions, planning is underway for the MELVYL system, in cooperation with the campuses, to provide interfaces to electronic services such as document delivery, remote printing, and transmission of text and data.

---

[1] *Guidelines for Coordinating Library Automation in the University of California,* Academic Affairs and Information Systems and Administrative Services, Office of the President, University of California, March 1989.

[2] *The University of California Libraries: A Plan for Development 1978-1988*, Office of the Executive Director of Universitywide Library Planning, Systemwide Administration, University of California, Berkeley, California, July 1977.

This document describes options for further developing the role of the MELVYL system in this evolving environment. The MELVYL system is only one component of the University's effort to coordinate access to scholarly information. The relationship of the MELVYL system to other components—campus libraries, computer centers, and departments—are discussed as appropriate, although the main focus of this document is on the role of the MELVYL system. Because the MELVYL system plays a role in campus access to information, Library Automation recognizes the potential impact that changes in MELVYL system services will have on the campuses. Library Automation is committed to working jointly with the campuses to develop and coordinate MELVYL services with campus-based efforts.

First, the current environment and planning assumptions about the future are reviewed, placing the growth of the MELVYL system in the context of overall planning for the development of University automated information systems. Next, the objectives underlying the continued development of the MELVYL system are proposed. While these objectives continue the present planning priorities, they also suggest a shift of emphasis in having the MELVYL system take a more active role in mounting more databases, making more effective use of network resources, and incorporating new technologies for access and the display of information. Work on achieving these objectives will have a number of implications for the MELVYL system, campus automated systems, and the University as a whole. Finally, this paper describes the technical evolution of the MELVYL system necessary to achieve its role in the University's information structure.

1. REVIEW OF THE CURRENT ENVIRONMENT

At the University of California, users access automated information resources through a mosaic of loosely connected systems. These systems have originated from systemwide, local campus, and a combination of systemwide and campus efforts. The recognition that user access has to be integrated across systems, the rapid growth of network technology, and the move towards developing systems based on common standards, have prompted the current initiative for coordinated development of future systems.

The University's strategy for access to information differentiates where information is stored from where it is accessed. The locus of storage, whether at systemwide, the campus, or at the national level, depends on such factors as the roles and responsibilities of the various components for information storage and access, the capabilities of systems, economics, the location of database creators, and the location of the primary user community. Access to information resources, however, should be universal, depending on the level of the user's authorization, not on the location of the data. Thus, users on the MELVYL system with proper authorization should be able to access campus systems, while users on campus systems should be able to access the MELVYL system.

Within this environment, and consistent with Universitywide library policy as provided for in the *Guidelines for Coordinating Library Automation in the University of California,* the MELVYL system will continue to provide access to the monographs and periodicals holdings of the University and a broad spectrum of abstracting and indexing databases covering the major disciplines of interest to the University community. In

addition, as appropriate, the MELVYL system may also provide access to nonbibliographic information sources, such as source material in electronic form and electronic journals, selected scientific and image databases of general Universitywide interest, and local and national information resources. The MELVYL system will complement local library catalogs, campus information systems, and specialized databases mounted locally. The MELVYL system may also complement systemwide and campus administrative information systems for administrative information commonly made available to the public. The information made available through the MELVYL system may be housed centrally, at the local campus, or elsewhere on the network. Some of the information may also be available in local systems, leaving the user the option of deciding where to access and use the information.

The strategy for coordinated access to information resources maximizes the University's investment in current planning and existing systems by drawing together the various aspects of the present environment into a coordinated system. The components of the present environment include the following.

1.1 The MELVYL System

With the addition of abstracting and indexing databases, the MELVYL catalog has undergone a transition from a catalog to a system. This process recognizes the changing role of the MELVYL system as an information utility. In addition to requiring traditional catalog functions, users are expecting the MELVYL system to provide bibliographic access to the journal literature, nonbibliographic files, and source material in full text and images, and to act as a jumping-off point to other information sources on the Internet. Users are also requesting the capability from the various components of the Universitywide systems, including the MELVYL system, to connect to network-based services, such as electronic mail, current awareness, links to document delivery systems, and remote printing.

Another aspect of the MELVYL system's role as an information utility is indicated by growing use of MELVYL services by non-UC institutions such as the California State Library, the California Academy of Sciences, and Stanford University, and the ongoing discussions about use of the MELVYL system by the California State University system. While the full policy dimensions of these trends are outside the scope of this document, a few points should be made. First, it is vital that the decisions about non-UC institutional use of the MELVYL system continue to be made within the overall context of UC library policy and not in isolation; issues such as the impact on interlibrary loan and implications for use of UC library services need to be carefully considered. Secondly, we should recognize that the technical quality and flexibility of the MELVYL system and the value of the databases mounted on the system make it increasingly attractive to non-UC institutions, and that in this sense the MELVYL system can be viewed as a UC asset that might be used to leverage increased access to networked information on terms favorable both to UC and to other institutions.

Use of the MELVYL system continues to expand (Graphs 1–5). Though there has been a drop-off in the use of the MELVYL monographs database as some campuses have installed local library systems that include online catalogs, this has been more than offset by the use of the MELVYL journal articles databases. In addition, remote use of the catalog has grown dramatically. Response time, greatly improved from a couple of years

ago, has remained steady, although it still wavers on the unacceptable between 2:00 and 4:00 p.m. during the busiest times of the year. The database continues to grow—the sixth millionth book title was recorded in January, 1991—as campuses complete retrospective conversion projects. As of June 30, 1990, approximately 79 percent of the UC collection was in machine-readable form, with three campuses, Irvine, Santa Cruz, and San Diego, fully converted, and several others approaching completion.

The faculty, staff, and students of the University of California have more information options than ever before. Effective use of these resources is becoming increasingly vital to the University's missions of research and teaching. While providing a common ground for locating information, the MELVYL system is still imperfectly integrated with the information-access infrastructure on some campuses, and links between the MELVYL system and services, such as electronic mail used daily by much of the University community, are only beginning to be developed. With the guidance of campus committees, Library Automation continues to implement new databases, enhancements to the user interface, and performance improvements.

1.2 Integration of Electronic Services at the University of California

The components of the University information infrastructure—computers, information sources, networks, and electronic services—are slowly becoming integrated into a common system. On a regular basis, considerable information is accessed and transmitted among campuses across University and non-University networks. Existing systems, however, do not share compatible standards, making the display and exchange of data difficult; have quite different interfaces, causing steep learning curves; offer different levels of service; and have different access restrictions. In spite of these problems, there has been considerable success in sharing resources due to the high quality of design and technical competence of individual systems and the expanding connectivity options available to existing systems. Considerable work remains, however, before the diverse information resources can be brought together into a system that projects a single image to the user. Planning is underway to develop a conceptual framework for sharing services between the MELVYL system, campus libraries, and campus computer centers.[3]

1.3 Development of a "Single System Image" to Integrated Information Services

The "single system image" concept is intended to make diverse University of California academic and administrative information systems accessible to the end user through a variety of interfaces and hardware platforms. The development of a common end-user view of UC systems recognizes that, although the diversity of information sources and services will continue, the end user will be best served if systems are designed with compatible interfaces. Creating a "single system image" will require close cooperation between the Office of the President and the campuses to define objectives and

---

[3]*The Delivery of Electronic Library Services: Opportunities for Campus and Systemwide Cooperative Processing*, Division of Library Automation, Information Systems and Administrative Services, Office of the President, University of California, April 1991.

implementation strategies and avoid redundant efforts. The components of the "single system image" include:

- **Access to Multiple Systems**

  The "single system image" implies that users will have access to a wide range of information sources and services under University control and regionally and nationally through networks. Where these systems have compatible databases and functions, users will be able to search these databases from their home workstations using standardized protocols and common interfaces. Where systems provide different functions, users will be able to connect to remote systems to use their specialized functions.

- **Availability of Information about University Resources**

  The "single system image" provides that information about University resources be available to the end user in order to facilitate selecting needed applications. Information about each University system should include the function of the system, access restrictions, means of access, and procedures for use. Information may be gathered into a directory of databases to facilitate use. This should also be integrated with national information resource directories that provide a broader view of available resources to the extent possible.

- **Availability through Multiple Interfaces**

  The "single system image" recognizes that users will be using systems with many different kinds of interfaces, including line-by-line, command language, menu, and various kinds of graphical interfaces, or a combination of interfaces. These interfaces will reside on the MELVYL system, campus catalogs, other campus systems, and individual workstations. The user's interface should not be an impediment to using University information sources and services.

- **Interface Standards**

  The "single system image" is built upon interface standards including 1) approaches to providing information about UC systems; 2) navigation strategies to getting started in a UC system; 3) help and error-handling strategies; 4) information retrieval protocols, such as Z39.50; 5) display protocols, such as the X-Window system; and 6) common access to services such as printing.

- **Access Control**

  While UC's plans call for any resource to be accessible from any access point across the network, this does not mean that all users have access to all resources on the network. Clearly, mechanisms for access control and authentication will have to be an integral part of the implementation and the "single system image."

The "single system image" will attempt to create a universal interface to UC systems. For example, a typical scenario might go as follows. A faculty member, with a workstation at his/her office, might connect to the UC system from a remote location with a borrowed laptop, and be able to access the full range of UC systems. He/she accesses a MELVYL database, does a follow-on search in a national database without having to connect directly to that database, determines the location and circulation status of an item from a campus library system, determines the location of a faculty personnel file, is authenticated to use the file, locates a faculty member on another campus, and creates and sends mail to that faculty member, asking for follow-on information to an article located in the MELVYL system. Though the user normally would use the workstation at his/her office, the "single system image" would make it easier for users to adapt to new systems.

Of particular interest for linking diverse systems is the development of the Z39.50 protocol that will allow users on one system to search another system and have the results returned to their original system. This should be a considerable improvement over the present means of remote access, where the user must directly connect to a remote system and use that system's possibly unfamiliar interface. Acceptance of the X-Window system as the display mechanism for bitmapped display devices will also strengthen the "single system image" by combining diverse systems on a single display screen and by allowing graphical user interfaces to communicate with a wide range of access platforms. Through the "single system image," users will come to have common expectations about university systems and be able to rely on these expectations to deal with new applications and information sources. Building a familiar base to UC systems should dramatically reduce the time users need to acquaint themselves with new systems.

1.4 National and Network Information Resources

Information is a national resource. How to create and share information is a national problem. The basic goal of academic institutions has been to make information available to the widest audience at the least cost. Though this basic goal is not in dispute, there are many different approaches to achieving this end. These depend, in part, on economics, politics, entrepreneurial spirit, and the assessment of future technology, as perceived by publishers, administrators, and users. The research, education, and scientific communities are laying the groundwork for a national network based on the concept of low-cost access to information in electronic form. The private sector has been attracted to the information marketplace for profit because of the high value organizations and individuals place on locating and using information. Both as database creators and providers, the private sector has targeted and served various segments of the marketplace. The existence of these two groups, the scholarly and scientific community led by educators and librarians, and the private vendors, has created two opposing crosscurrents. One is the desire for the widest possible access to information at the lowest cost. The other is restricted access to information for a substantial fee, often on a per-use basis and with the goal of maximizing profit. At present, the common ground is system licensing to information resources for flat rates. While new relationships are being worked out in regional and national meetings, the MELVYL system has to deal with the present mix of resources, and plan for dealing with the expanding mosaic of sources and services.

The revolution in access and networking currently underway at the University of California is paralleled at other institutions and at the national level. Led by academic institutions, a large number of organizations have become linked through the Internet, a

network of networks providing access to a diverse set of information sources and to a number of electronic services, including electronic mail and file transfer of information between hosts. To maximize the potential of these capabilities, various institutional groups have formed planning alliances, of which the Coalition for Networked Information (CNI) is the most active in taking steps to build national network capabilities. One of the activities being supported is the federal legislative initiative for the National Research and Education Network (NREN), which provides funding and leadership for coordinating resources and services on a national level. The University of California is a member institution of CNI, and is playing a major role in network planning, development of standards for linking systems and transferring data between systems, and initiating cooperative projects to create and share information resources.

1.5 Changing Patterns of Scholarly Publication and Prospects for the Electronic Library

The early stages of a revolution in scholarly publication are also underway. The main themes of this revolution are the storage of source materials in electronic form and the development of electronic journals. The result of this revolution will be the development of the electronic library. The electronic library is created when an organization takes responsibility for providing access to a body of electronic sources. This responsibility entails a combination of procuring and loading electronic sources on a system, identifying and providing access to resources loaded elsewhere on the network, and providing access to printing. In the UC situation, there is likely to develop a series of electronic libraries with distributed access. Though access will be distributed, responsibility for procuring, mounting, and preserving electronic sources may be shared between campus systems and the MELVYL system. The MELVYL system will procure electronic sources of interest to the Universitywide community and provide access to other sources on the network. Campuses may procure electronic sources of more specialized interest and also provide access to other resources on the network, including the MELVYL system, as well as other sources within UC and available on the national networks. The decision of where to locate electronic resources on the network will depend on the needs of users, quality and ease of use of resources, the economics of procuring and mounting the source material, and telecommunications costs.

The existence of full-text sources raises a number of issues that are currently under discussion at the Universitywide, national, and international level. These issues include 1) standards for the storage of electronic information; 2) techniques for indexing full-text information for end-user access; 3) formats for the distribution of source material, such as ASCII text, bitmapped images, and other applicable formats, over the network; and 4) printing with a wide range of options from simple printers to digital distributed printing. Presently, the most common access is through bibliographic indexes to full-text documents with transmission of source material via paper or fax.

1.6 Campus Library and Information Systems

Another characteristic of the current situation is the development of campus library systems and other nonbibliographic information systems. In accordance with the previously mentioned *Guidelines for Coordinating Library Automation in the University of California,* the development of campus and Universitywide systems is to be built

around a common conceptual framework of complementary systems sharing information over University networks. Campus libraries are achieving significant improvements in service, internal efficiencies, and reductions in the growth rate of library processing costs by the implementation of integrated local library automation systems. In addition to internal processing functions, these systems generally offer public access, thereby reducing the use of the MELVYL system for local catalog access. A portion of the campus needs for information is being met by the local system turning to the MELVYL system for special search functions and for access to Universitywide resources and abstracting and indexing databases. In addition, the local system has the advantage of being able to indicate the circulation status of items in its catalog, such as whether a book is checked out or on hold, plus providing document delivery services tied to detailed serials holdings.

An alternative model for integrating the local campus catalog with the MELVYL system is being developed at UC Davis, where the local automation system will primarily address internal processing functions while retaining the MELVYL system for public access. By establishing a system-to-system link based on the Z39.50 protocol, MELVYL users will be able to determine the circulation status of Davis items from the local circulation control system.

In addition to library systems, campuses are also developing local systems for access to other campus information resources, such as the Information Server Project at UC Berkeley. These resources will be available on the network and will be accessible to MELVYL users through network access.

Along with the expansion of information systems at the Universitywide and local level, the computing infrastructure is beginning to change, with UNIX workstations, personal computers, and Macintoshes connected through a wide variety of networks; these are replacing isolated personal computers on the one hand and large time-shared mainframes supporting dumb terminals on the other. Typically, the workstation or personal computer is the system of choice for faculty and staff for word processing, interfacing to computer systems, and communicating with colleagues, as well as accessing library and other information systems.

1.7 Changing Patterns of Sharing Electronic Information

The sharing of electronic information is the predominant trend in the current environment. The combination of growing collections of electronic information and the availability of networks will revolutionize how universities, libraries, and private vendors view information. The sharing of electronic information will have technical, economic, legal, and organizational manifestations. Further technical advances will be needed to develop standards and to provide the means for high-speed transmission of data over networks. The availability of databases and files of information to be shared across networks will enhance the utility of online access systems by providing an enormous wealth of information and services to help users retrieve, manipulate, save, and print bibliographic and source information. The sharing of information will make organizations less vulnerable to centralized systems because, in times of disaster, an organization may be able to rely on other organizations for access to a portion of its databases. For example, if the MELVYL system is out of commission for an extended period of time, users, without changing interfaces, may be able to open Z39.50

connections to one or more neighboring systems for access to journal article abstracting and indexing and electronic text databases.

One of the motivations for sharing information is the economics of centralized procurement and storage with distributed access. Though the economics of centralized procurement of electronic sources are still speculative, it is likely that the economics of shared information will cross organizational boundaries, requiring organizations to establish new alliances to share the costs of procurement and access relationships. Under consideration are relationships of reciprocal access, in which organizations trade access to a locally mounted database for access to a database mounted by another organization. The reciprocal sharing of access has legal implications, as often the database to be shared may be licensed from information providers. In these cases, vendor licenses will have to be broadened to allow reciprocal access, with likely increases in license costs that will be traded off against reduced costs in duplicate development, loading, and maintenance. Finally, the sharing of resources will have an organizational impact in terms of staffing to train and service increased use of diverse resources, in the realignment of collections costs to pay for procurement and access to electronic sources, and in the potential reduced rate of growth of the physical plant, as libraries rely more on electronic rather than on print sources. These impacts raise a host of policy, implementation, and budget issues that will likely take longer than the next five years to resolve; some, such as the reduced rate in physical plant growth, are long-term trends that will not likely be measurable in a five-year time frame.

1.8 Changing User Expectations

The beneficiary of coordinated Universitywide library and national planning initiatives is the end user, e.g., UC faculty, students, and staff. Information retrieval was once viewed as the purview of the librarian or information specialist, who mediated between the end user and the information source. The advent of the online catalog and the easy availability of online resources have shifted the emphasis to the end user. The online catalog has also led to increased expectations and demand for abstracting and indexing and full-text databases. Librarians and information specialists now serve a greater role in acquiring, making available, and teaching about online sources.

Users are often overwhelmed with information opportunities through online catalogs, networks, dial-up services, and CD-ROMs. The distribution of opportunities is quite uneven and depends on a number of factors, including network affiliation, hardware platform, organizational affiliation, financial resources, availability of information about resources, and individual proclivities for seeking out information and learning to use information systems. Anticipating user needs, as expressed by campus advisory committees, input directly from users, and by monitoring national trends, is a primary element in MELVYL system planning for the next five years.

2. OBJECTIVES FOR MELVYL SYSTEM DEVELOPMENT

MELVYL system objectives are proposed that extend the current system as an information utility, combining database access and electronic services through a common interface. These objectives recognize that, while there may be a common interface, the resources may be housed on the MELVYL system, local campus systems, or anywhere on the network. Specific objectives are as follows.

- **Continue Growth of the Catalog and Periodicals Databases**

  The catalog and periodicals databases will continue to grow with current acquisitions and retrospective conversion of the remaining portion of the University's collection not yet in machine-readable form. Approximately 79 percent of the University's collection has already been converted. These figures, however, do not include some specialized collections that are yet to be cataloged into formats compatible with the MARC (machine-readable cataloging) standard. In addition to monographs and periodicals titles, the MELVYL catalog also contains other publication forms, such as maps, sound recordings, music scores, government documents, manuscripts, and machine-readable data files. On a continuing basis, records in the catalog database are upgraded by matching to LC files, and could also be matched to other files, such as Dissertation Abstracts and table of contents databases. The CALLS database will continue to add non-UC California sources of interest to the academic community, to enhance records from national data sources, such as the Library of Congress supported CONSER file, and to create links between the journals listed in abstracting and indexing databases and the location of these journals.

- **Accelerate Loading of Abstracting and Indexing (A&I) Databases**

  Abstracting and indexing databases will continue to be mounted on the MELVYL system, as consistent with Universitywide library policy. It is estimated that to fully serve the core academic programs with access to the journal literature, it will be necessary to load something on the order of 1215 separate databases. A planning assumption will be to complete loading of the additional databases within the next five years, if given reasonable priority by campuses. UC will need to maintain the flexibility to respond to changes in the composition of abstracting and indexing databases by being able to add or cancel licenses as needed to maintain the best and most cost-effective available sources for UC needs.

  It is important to recognize that while the implementation of abstracting and indexing databases has been extremely successful and valuable in that these databases have greatly increased access to the journal literature by the UC user community, there is a major cost associated with this success in terms of increased collection use, increased demand for interlibrary loan, and increased load on the reference and patron support services at UC libraries, as well as increased demand for terminals, printing, and computer cycles on the MELVYL system. Given these factors, we must recognize that loading these A&I databases implies a parallel commitment by the campuses to fund the resources necessary to support the increased collection use and demand for library services created by the availability of these databases, and that the ability of

the full text of approximately 40 percent of the journals indexed in Information Access Corporation's Expanded Academic Index®. Additional full-text files may be loaded on the MELVYL system or accessed through the network. Initially, access to full text will be through the bibliographic citation, with searching of the text planned for later implementation. An immediate priority will be for the MELVYL system to provide access to page image files of electronic source information for transmission across the network for high-quality access and printing; while the infrastructure on the campuses to exploit bitmapped image access is still being developed, an implementation of this type soon is important both for the information it will provide to assist in ongoing planning (including information about the network bandwidth needed to support access to bitmapped image files) and to provide a visible incentive for campuses to upgrade the existing access infrastructure by demonstrating the benefits that such an upgrade will make possible. Library Automation will work with the campuses to support different campus capabilities and approaches.

- **Provide Access to Electronic Journals**

Electronic journals are a special case of source materials, as there may be no printed edition. Electronic journals will be mounted on the MELVYL system consistent with the University's acquisition policies. The MELVYL system will also be able to provide access to electronic journals mounted at other locations on the network as these journals become available. As a potential electronic library, the MELVYL system may act as an archive for issues of electronic journals.

- **Provide Access to Reference Sources**

Considerable reference material is becoming available in electronic form, such as dictionaries, encyclopedias, handbooks, and pharmacopoeias. The MELVYL system is a candidate for providing access to a subset of these resources of scholarly interest to the academic community. A distinction may be made between reference material for research needs and reference material for quick reference. Reference material for research needs tends to be more costly and requires considerable computing resources, while quick-reference material is of lower cost and can easily fit on a user's system. For example, mounting the *Oxford English Dictionary* (*O.E.D.*) or a medical dictionary on the MELVYL system would seem to be appropriate because of the high cost and needed computer resources involved; a desk-top, quick-reference dictionary, however, might more appropriately be integrated in the user's work environment, as the user may constantly need the quick-reference dictionary as part of a word processing system.

- **Provide Access to a Directory of Databases**

The number of database sources continues to grow at an explosive rate. Except for the most common databases, users have difficulty determining what databases exist, their coverage, availability, access restrictions, and methods of use. In addition to catalogs and abstracting and indexing databases, available databases may include numerical data, images, and full text in a wide variety of fields created by commercial vendors, national organizations, and, in the public sector, by groups of institutions and individual faculty and faculty groups. At some point, there will be a critical mass

the campuses to make these resources available will be a key factor pacing the deployment of additional databases. The Office of the President will continue to work with campuses to facilitate identification and loading of new resources.

- **Provide Access to Specialized Databases**

A considerable number of specialized databases are being created by UC faculty and staff, as well as by other organizations and for-profit companies. Though there is no current project to mount a specialized database on the MELVYL system (mounting specialized databases may be more suited to campus systems), it is possible that one or more of these databases of wider interest could be loaded as part of the MELVYL system. As specialized databases are made available elsewhere on the network, Library Automation will work with database producers to provide access to these resources. Library Automation may also work, perhaps in partnership with other organizations, on the development of a "tool kit" that could be used throughout UC to assist in mounting such databases for network access.

It is probable that many specialized databases will be published on CD-ROM as time goes on; for example, the 1990 census is being distributed in this format. Today CD-ROM is being used both for high- and low-use databases; some UC libraries are installing CD-ROMs on in-library networks to provide access to abstracting and indexing databases that have not yet been mounted on the MELVYL system. The use of CD-ROM for such applications is also encouraged by the anomalous pricing policies of many information providers, who offer CD-ROM copies of data at relatively low cost, but charge very high rates for the same data on magnetic tape for mounting on mainframes, regardless of the number of concurrent users of the information in question. It seems likely that over time these pricing policies will become more rationalized. The ability to network CD-ROMs is still less than satisfactory; of course, even when these technical problems of connectivity are resolved, the fact remains that the performance characteristics of CD-ROMs are such that they can only support a handful of users at a time. As the range of abstracting and indexing databases available through the MELVYL system grows, it seems likely that use of CD-ROMs will increasingly shift to a means of providing access to low-use databases in electronic form. This may occur both centrally through the MELVYL system, which may provide access to CD-ROM databases of Universitywide interest (probably through some sort of array of CD-ROM readers and perhaps a jukebox technology), and at the campus level, to provide access to abstracting and indexing databases and other data of particular interest to the campus community. There are encouraging trends (such as the work on CD-RDX and the NISO standards committee being formed to develop application program interfaces to CD-ROM databases), which will likely lead to greatly improved network connectivity for CD-ROMs in coming years. By FY 1992–93, work in this area should be sufficiently advanced to support a prototype experiment in CD-ROM access through the MELVYL system.

- **Provide Access to Electronic Source Databases**

Providing access to full-text databases of source materials is a logical extension of the MELVYL system's role as an access system. Presently, planning is underway to load

of these databases available through the network, making it necessary to localize information about these resources in a directory of databases. Planning is underway at UC for a prototype directory. The need for such a directory is also being felt at the national level, where UC is also a participant in discussions under CNI auspices.

In the meantime, with the growth of catalogs and other reference sources on the Internet, locating databases of interest will become more difficult. To ameliorate this situation, the MELVYL system will continue to indicate, through database-specific help screens, the specific coverage and features of different databases available through the MELVYL system.

- **Build an Integrated View of Information Resources Available to the University of California Community**

  The cornerstone of the University's planning effort will be to support access to information sources regardless of their physical location. This strategy is designed to have maximum impact on the end user, who will be able to rely on University information systems for national, Universitywide, and local information resources.

- **Plan for Intersystem Standards**

  The University is committed to implementing standards to facilitate access to and the sharing of data between systems. There is already wide-scale acceptance of standards, such as MARC, TCP/IP, and, eventually, OSI. Soon, the computer-to-computer information retrieval protocol Z39.50 will be implemented to link diverse information services together. Standard Query Language (SQL) and the Remote Database Access (RDA) protocol can be used to distribute databases across multiple network hosts and to provide access to these databases. Other standards for data interchange, authentication, and printing are in the process of being discussed, developed, and implemented.

- **Facilitate Data Coordination and Data Quality**

  The records in the MELVYL union catalog and CALLS are the result of the work of campus libraries. The MELVYL system will continue to protect the integrity of these records and coordinate the MELVYL files with local campus files and the Regional Library Facilities files, as well as to upgrade and extend the value of the UC bibliographic file by incorporating information from national bibliographic sources, such as the LC MARC file and the CONSER file. Efforts should continue to extend access to UC library collections through projects such as MARCIVE, the addition of ICPSR records, and the loading of records for California State Library documents. Though the records in journal articles databases are not contributed by the campuses, the quality of campus data determines the extent to which these records can be linked to local campus location information, which is made more difficult by inaccurate data carried over from national files of serials data on which the links are based. Library Automation continues to work with the campuses to make the necessary links between the campus journal files and the abstracting and indexing database journal files.

- **Plan for Delivery of Electronic Services to the UCCommunity**

  Planning is underway to develop an operational framework to provide electronic services in the UC network environment.[4] These services will include electronic mail for transmission of requests for services, such as document delivery, various kinds of file-transfer mechanisms, and remote printing.

- **Recognize that Workstations Will Become the Common Interface Technology**

  Creating a workstation environment implies a conceptual, software, and hardware shift away from terminals to intelligent front-ends that integrate internal processing capabilities with standardized interfaces, such as the X-Window system, Z39.50, and file-transfer protocols. In this environment, access to information resources is merged with other processing functions of the faculty, staff, and student workplace. It is recognized that this shift will take a number of years, requiring that the traditional modes of access be retained while workstations take hold in the University community. It is important to recognize that workstation, in this context, is a general term, encompassing today's UNIX workstations (from vendors such as DEC, IBM, SUN, NEXT, and Hewlett-Packard), PCs, and Macintoshes, and other personal machines that may appear in the marketplace and achieve wide adoption within the University. Any strategy for workstation support must recognize the present and future diversity of the installed base of such workstations.

- **Maintain Adequate MELVYL System Performance**

  During the transition of access to new information sources and new access technologies, the MELVYL system must maintain adequate performance in terms of reliability, response time, and usability.

- **Continue Planning for Disaster Recovery and System Backup**

  Planning for disaster recovery and backup has been made more complex by the multiplication of MELVYL databases, the implementation of campus catalogs, the development of alliances between organizations whose systems may be able to provide backup during disasters, and by the development of technical standards such as Z39.50 that will facilitate sharing of resources. In addition, the declining cost of hardware provides more disaster recovery options. More options are available for developing disaster recovery plans, but these options also complicate the planning process. Campus catalogs act as an obvious backup for local access, and the implementation of the Ten Year database on the MELVYL system provides backup options when the Catalog is not available. Abstracting and indexing databases may be available from other sources, depending on the seriousness of the outages. During the next five years work will continue on developing plans and policies for disaster recovery that reflect the mosaic of databases to be backed up, identifying sites that could be used in times of emergencies, and establishing agreements with other database providers for reciprocal emergency access.

---

[4] See note 3 above.

3. IMPLICATIONS OF THE PROPOSED OBJECTIVES

Implementing the objectives for the future of the MELVYL system will have significant planning, funding, and organizational implications for both the Office of the President and the campuses. Though the general plan is consistent with current priorities, the proposed objectives will require new levels of campus cooperation, a reassessment of the technology underlying the MELVYL system and campus access, and the strict setting of funding priorities during difficult budget years. It is expected that meeting the requirement to provide bibliographic access to the literature of the major disciplines will cost approximately $1 million a year in license fees by the end of this planning period, based on current quotes from information providers. The next five years will be a transitional period, with dramatic growth in the information available to the end user, the development of a "single system image" to diverse resources, the extension of the workstation environment throughout the UC community, and the conversion of the MELVYL system to a network information server. Throughout this period, there will be a continuing need to maintain present levels of service while making changes in the delivery of information services to the University community. Specific impacts include the following:

- **Database Acquisition**

  Though a number of databases are availab ior free through the Internet, the prevalent pattern is for the University to negotiate licenses with database vendors for databases to be loaded on the MELVYL system. Because database use is high and vendors are trying to size up future markets, the University will be vulnerable to increased costs at renewal time. It is assumed that similar license agreements will be needed for full-text source materials and electronic journals. Databases accessible across the network may be available on a pay-per-view basis, as well as through license agreements, as part of reciprocal agreements between institutions.

  Funding for database acquisition, including abstracting and indexing and full-text databases, will follow a number of patterns. Licenses would continue to be supported by the UC libraries. Pay-for-view access to databases would be supported by the end user, possibly subsidized by the end user's organization. Cost sharing and reciprocal arrangements between UC and other institutions may lessen the financial impact of database acquisition.

- **Computing and Network Resources**

  The development of the MELVYL system as an information utility means continued growth in the storage capacity and computer cycles needed to maintain adequate performance. Continued investment in networks at the campus level, throughout UC as an institution and nationally, will also be vital.

- **Investment in Workstation Technologies**

The workstation model assumes a change in hardware and software technologies. Many campus systems are making significant investments in the workstation environment. End users continue to procure workstation equipment. However, some segments of the University community (for example, the humanities and libraries) are just beginning the transition to workstations. This transition will need to be accelerated to take full advantage of new information sources and services. Changes will need to be made to the MELVYL system in order to interface effectively to the workstation environment. It is important to note that the rate of deployment of workstation technologies will vary from campus to campus and from community to community on a given campus, based on campus priorities and plans, and that we must continue to support the full range of users during a long period of technology transition. In addition, not all members of the University community have easy access to automated systems. A large number of students do not have PCs, let alone workstations, and must come to the campus to do their computing.

Finally, a workstation needs to be complemented with a network connection to offer a full range of services; thus, workstation deployment must be paced by the continuing development of campus networks, and we must also consider the special problems of students and faculty accessing the system from off-campus sites (such as residences). While technology offerings for remote workstation access are improving, e.g., SLIP and perhaps ISDN at some future point, this will be much slower than direct connection to a campus network for the foreseeable future.

- **Staffing**

The MELVYL model as an information server has implications for Universitywide and campus staff. Library Automation staff will be called upon both to maintain the present system and to develop the new system, which will be a challenge at the current staffing levels. It must be recognized that as new databases are added to the MELVYL system, this increases the maintenance commitment to load, fix problems, and enhance existing systems as required by the needs of the users or by changes created by the vendor. On campuses, new databases and new services will put increasing pressure on campus library staff to plan, prepare for, and provide support for end users in the use of new databases and services.

- **The MELVYL System as an Information Utility**

The evolution of the MELVYL system toward an information utility will require changes and continued investment in the technology underlying the system, including changes in hardware, database management, and MELVYL software (changes needed both to renew the technology base and to meet growing demand). These changes, which are outlined below, will make the MELVYL system more flexible, less dependent on the ADABAS database management system (DBMS), and more able to support an advanced end-user interface.

4. TECHNICAL EVOLUTION OF THE MELVYL SYSTEM

During the next five years, the MELVYL system will evolve into a network information server based on national and international standards. In this network information server environment, the database and retrieval software will be separated from the user interface through the Z39.50 information retrieval protocol. In addition, the user interface it self will exist in multiple forms—one for older line-at-a-time devices and another for newer bitmapped display devices. The interface for bitmapped display devices will use X-Window systems, which means that it can provide service to X-Window terminals and to personal computers that can support X-Window systems, as well as operate directly on workstations. Also, the X-Window system is particularly important because it permits the system to accommodate a wide range of bitmapped display devices and is available not only for UNIX but also for the Macintosh and a variety of PC environments as well. This is consistent with the general design principle of accepting and accommodating a heterogeneous base of access platforms. There is considerable flexibility in this model for distributing the user interface, as illustrated in the attached diagram (Appendix A).

This will allow the system to more flexibly incorporate new technologies; the result will be a set of services that is far more agile than today's configuration when faced with new service demands, new technologies, and shifting cost-technology tradeoffs. The approach will be evolutionary, adding new capabilities such as workstation support, while retaining existing service interfaces for line-at-a-time terminals.

Work on developing this environment has already begun. As part of the Penn State/UC project, the restructuring of the MELVYL system on the IBM 3090 into a network information server communicating with multiple back-end databases has started. Z39.50 client routines for UNIX are being developed by UC Berkeley's Information Server Project, as part of Berkeley's participation in the Z39.50 project. In FY 1991–1992, Library Automation is scheduled to begin the design and prototyping of the user interface for workstations.

By the end of 1992, it is expected that most interface development will shift to the UNIX environment (both graphical and line-at-a-time), with the "old" IBM 3090-based line-by-line interface software moving to a pure maintenance mode. The new interface environment will facilitate more rapid prototyping and more rapid introduction of advanced user-interface features. Note that while the interface will be developed on UNIX, it can be used on PCs or Macintoshes running the X-Window system.

By early 1993, it will be feasible to reevaluate and possibly replace both the file design and/or the DBMS (ADABAS) for some existing MELVYL databases—particularly, the online catalog (the oldest file design). We can also consider at this point whether to keep all current MELVYL databases on the IBM 3090 under ADABAS or whether to move some to other hardware platform and/or DBMS environments. This is also a logical time to consider major changes in areas such as authority control for the catalog that are closely linked to the file design.

One possibility will be to employ multiple database management systems, selecting one specialized for bibliographic databases, another for full-text databases, a third for image databases, and a fourth for scientific/numeric data in order to obtain maximum leverage through the use of commercially available software. However, we must carefully consider

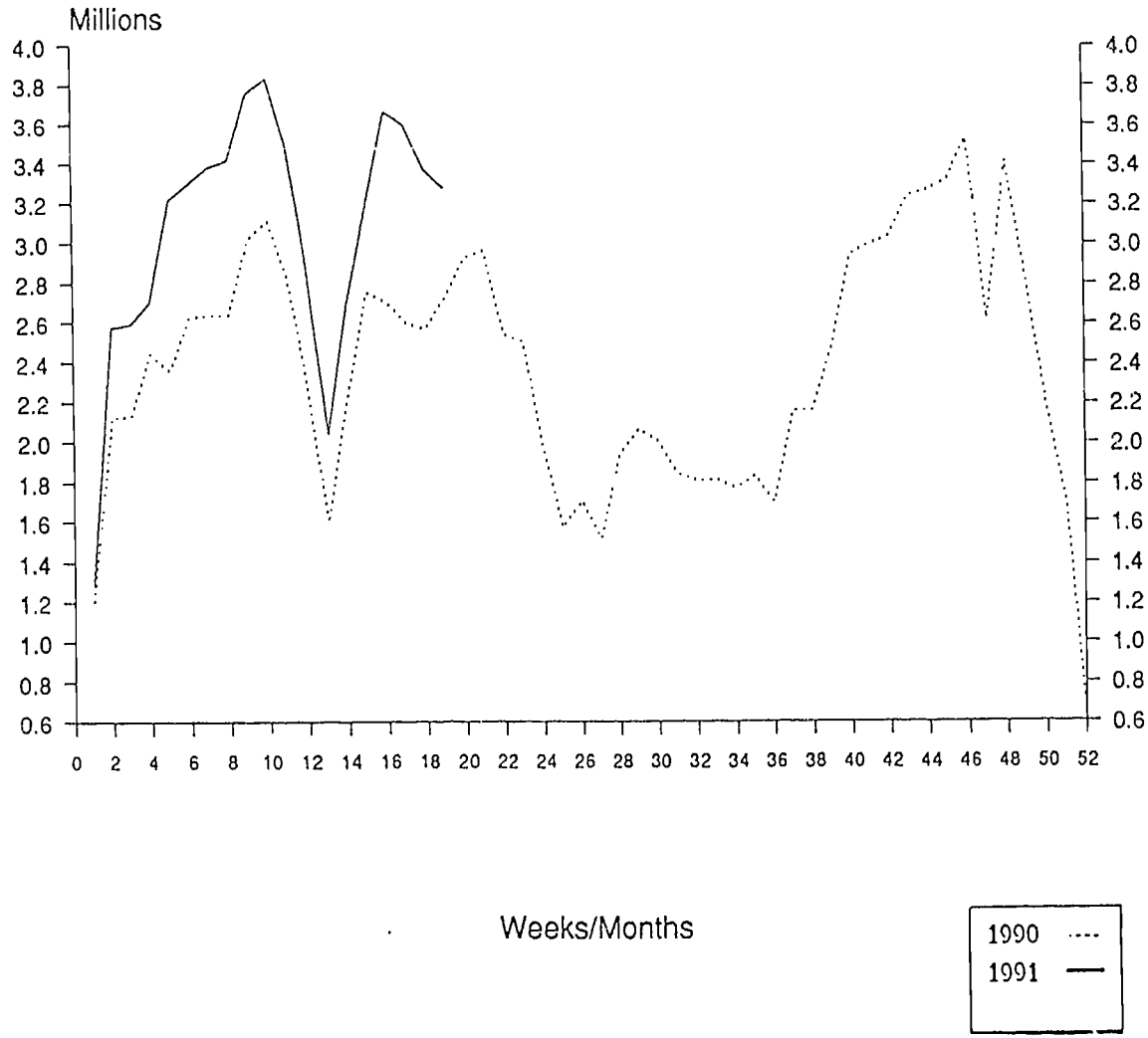
the system life cycle costs of such a decision: There is a very high cost to such diversity, not just in terms of licensing and maintaining software, but also in staff training and the development of in-depth organizational expertise similar to that which Library Automation has developed for ADABAS over the past decade. A rigorous technical and cost-benefit evaluation of database management technology available on the marketplace in the 1992–1993 time frame will be required in order to make these decisions.

It should also be noted that the goal architecture gives the MELVYL system a great deal of flexibility to continuously reconsider choices in light of new technology that comes on the marketplace; at any time when a new technology can be justified, it can be added for new information resources being mounted as part of the MELVYL system without disrupting the overall system architecture or the databases that have already been mounted.

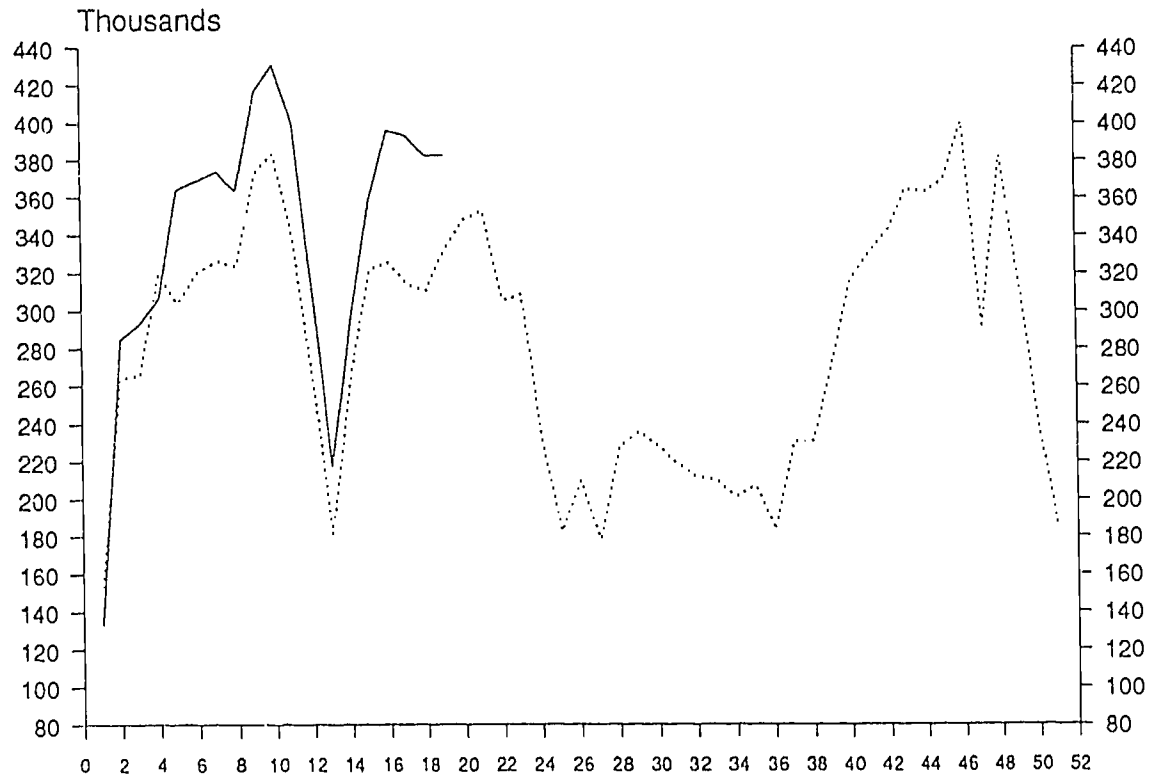
Similar considerations apply to a diversity of hardware platforms for information servers. Diversity of user-interface environments is inevitable and simply recognizes the reality of the environment into which the MELVYL system must deliver service; thus, the introduction of UNIX environments and the X-Window system as user interface platforms cannot be avoided. Adding new hardware/operating system environments into the system adds a great deal of cost and complexity over the life of the system, and demands the development of a great deal of costly organizational expertise. Thus, any such diversification in the hardware-platform base for the information servers will again require rigorous analysis of cost-benefits in the full context of the organization and the system life cycle.

The new technical environment has many implications that must be considered. These range from a need to upgrade the MELVYL development environment and the skills of the development programming staff for the workstation (UNIX environment and the "C" programming language, as well as the evaluation of the rich set of programmer productivity tools available in this environme ` to the need for the libraries to begin investment in X-Window devices and other technologies needed to exploit the new environment. In addition, the flexibility inherent in new architecture creates options for distributed systems and questions about library, campus, and Office of the President roles and responsibilities for funding, managing, and maintaining various hardware and software components of the new environment, which will require extensive Universitywide discussion. .Appendix A attempts, in this vein, to illustrate the full range of configuration options in order to give a sense of the flexibility we wish to obtain. It is probable that not all of the possible options will be implemented. For example, it is unclear as to the extent to which Library Automation would provide software that actually resides on an end-user workstation; there are serious software release management and support issues that would have to be considered in making such a decision. There is some hope that various developments in workstation software, such as some of the MIT Athena tools, may in time alleviate the problem. The point, however, is that currently the option is open and the decision can be postponed until we are better prepared to make it. Similarly, the diagram shows how distributed networked database technology could fit in. While we have no current plans to implement this, it may be important at some point in the future as part of a load distribution or disaster contingency plan.

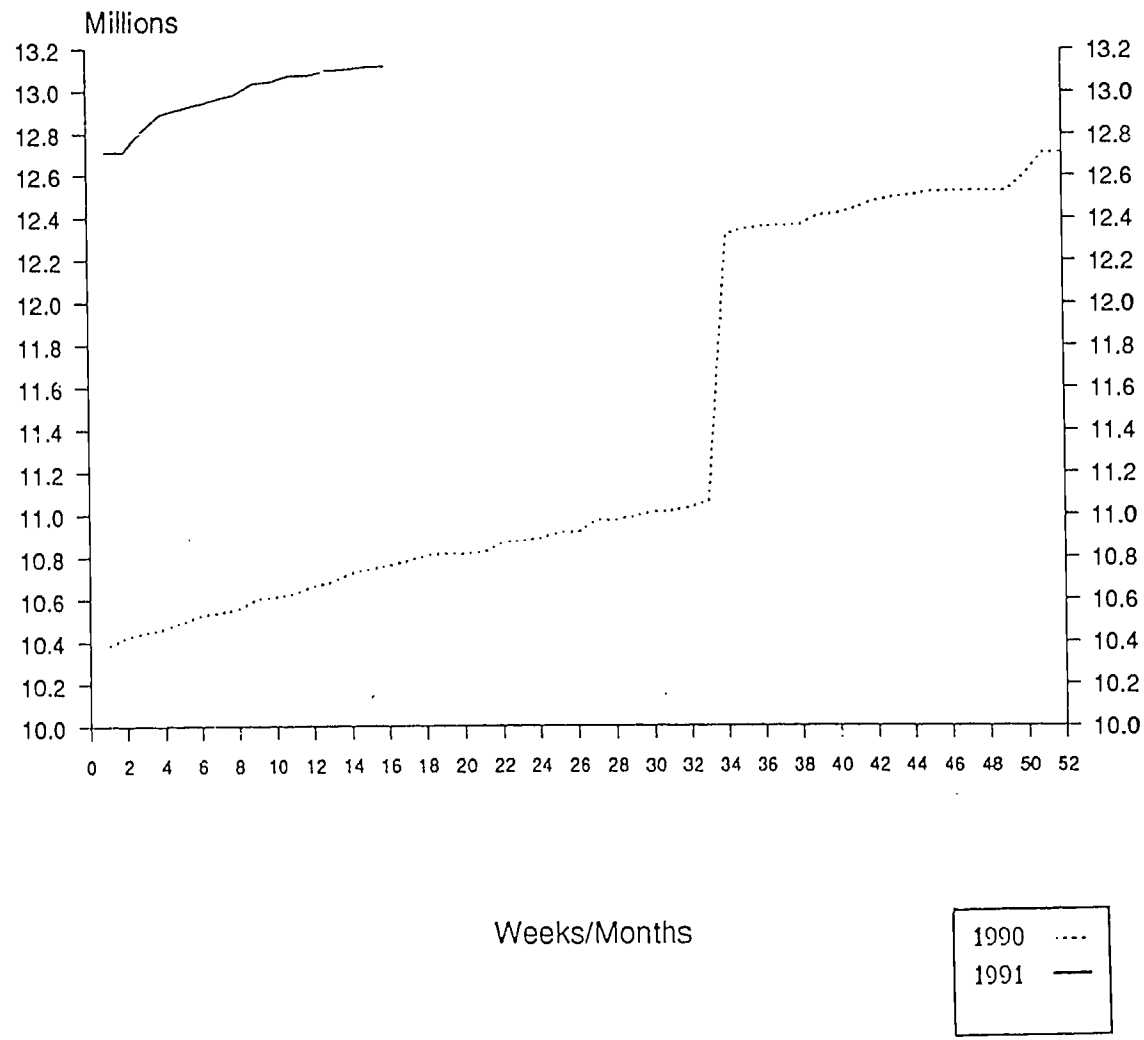
Graph 1
Number of Records Displayed



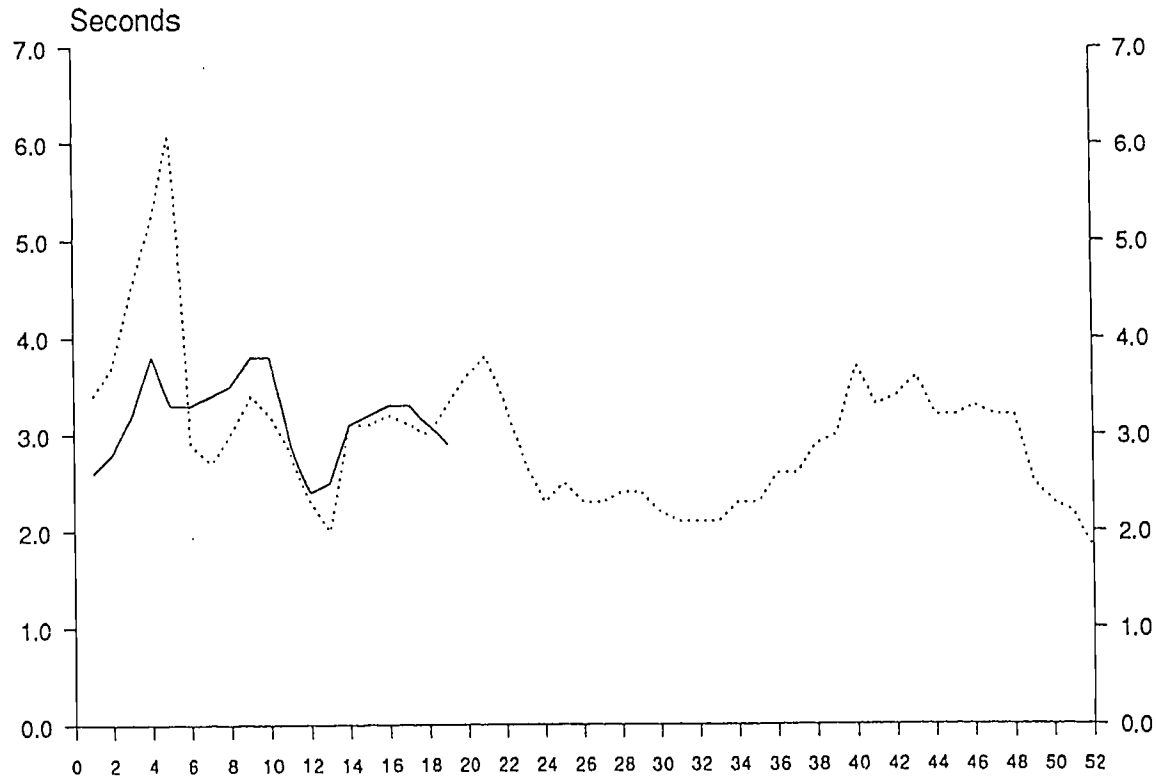
Graph 2
Number of FIND Commands Issued



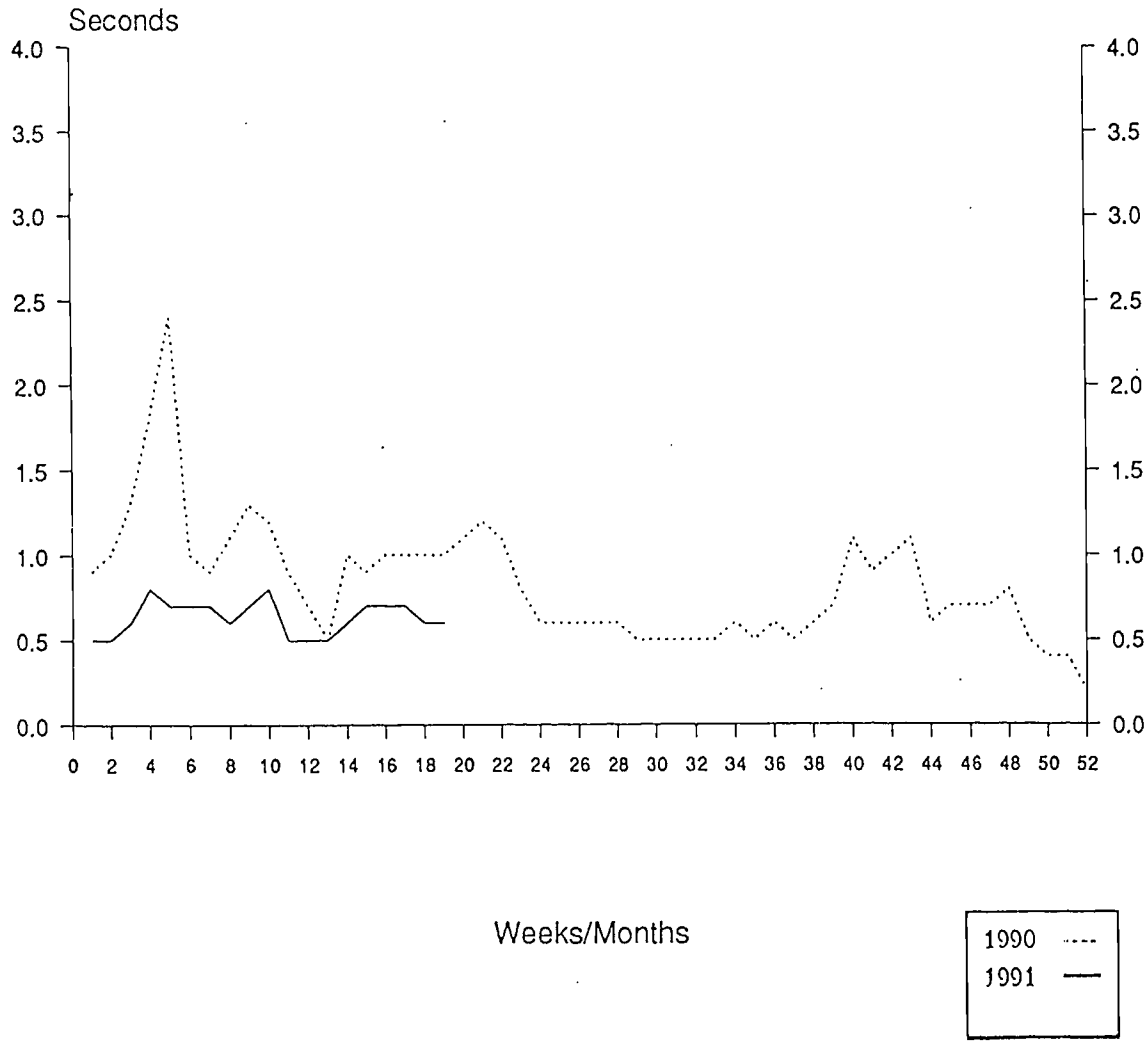
Graph 3
Database Size --- Holdings



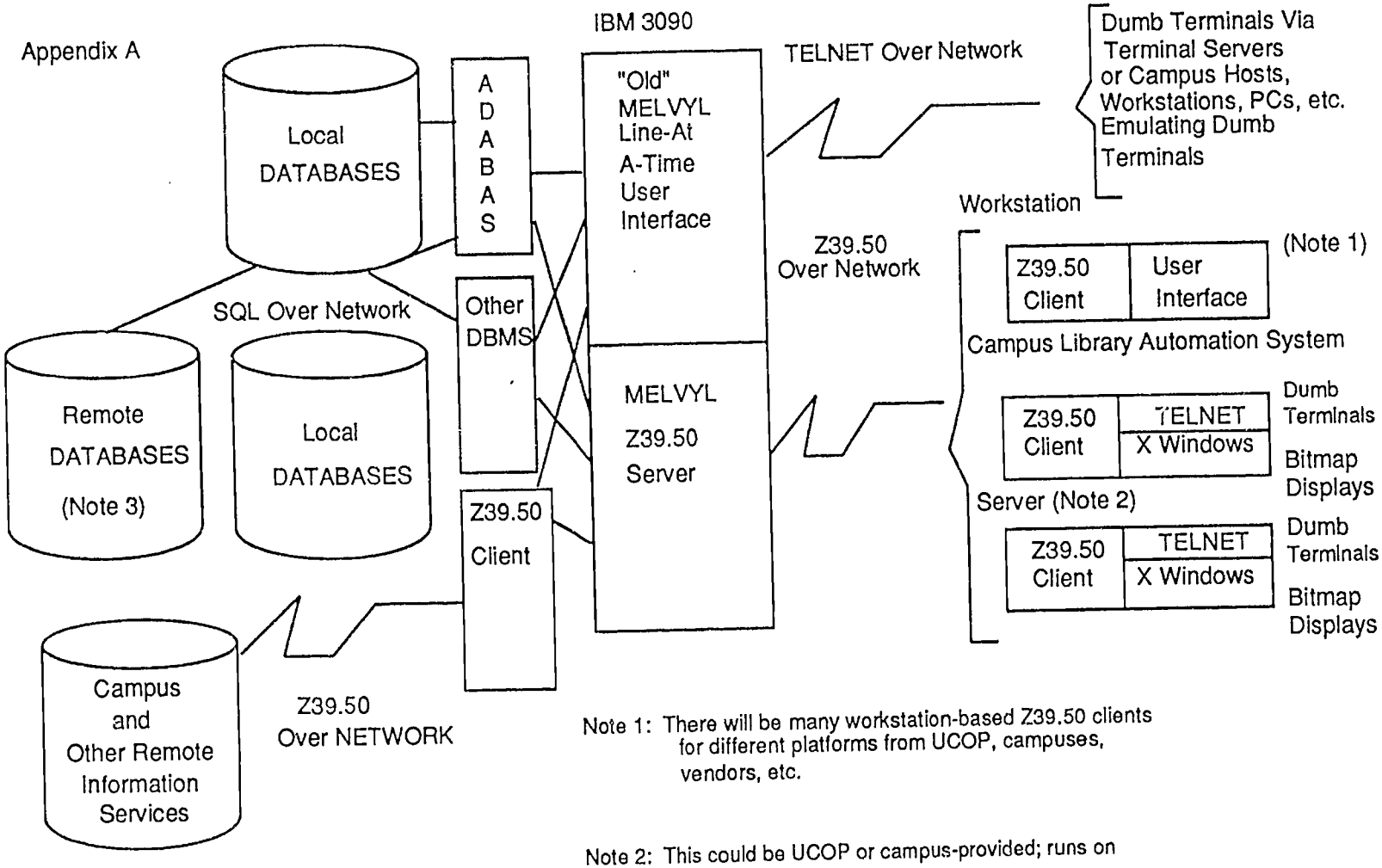
Graph 4
Search Response Time



Graph 5
Display Response Time



Appendix A



Note 1: There will be many workstation-based Z39.50 clients for different platforms from UCOP, campuses, vendors, etc.

Note 2: This could be UCOP or campus-provided; runs on UNIX platform.

Note 3: ADABAS and other DBMS systems offer networked distributed DATABASE support. This part of diagram illustrates the possibility, though there's no current plan to use.

RAW
April 4, 1992

35