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Increasingly, BITNET, Internet, and other networks are being used for scholarly communication and research purposes. Computer conferences, electronic serials, online catalogs, and specialized databases are examples of network-based electronic resources. Given the decentralized nature of information provision on networks, it can be challenging to identify and access appropriate network-based electronic resources, and the long-term availability of these resources is not assured.

What roles should libraries play in creating, collecting, providing access to, and supporting network-based electronic resources? In this symposium, the editors pose five questions related to these issues.

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QUESTION 1: What role should librarians play in providing intellectual access to network-based electronic resources? Should librarians mount a collective, nationwide effort or should they primarily focus their efforts on meeting local user needs?

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Networks right now are vast uncharted territories. Networks are often compared to the wild west. Though the space of networks is mostly psychological, the dominant metaphor is still that of the new frontier. Roles for the players have yet to be defined. One of the surprising characteristics of this computer technology is its leveling influence--electronic communication is notorious for subverting the traditional hierarchical chain of communication within organizations. Therefore, it is not too late to choose our own roles. As librarians, it is possible to have an impact on several levels. Our most immediate impact will most likely arise from our role as educators. Initially, the constituencies most likely to be influenced by librarians will be friends,

colleagues, and clients within our own institutions.

The role of librarian as educator is certainly not new to us, but it will become a much more critical role as we provide intellectual access to network-based electronic resources. So much information, in so many networks, is so interconnected that there is truly an information space--Teilhard de Chardin's "noosphere" made real. Information is becoming less bound to the physical objects that carry it. And the only effective way to find out about the rich and varied pools of data, information, knowledge, and discourse on the networks is by using them. So librarians must use the network and, once they have taught themselves, they must pass on that knowledge to others. A natural role involves making people aware of the value of networks, teaching people to use networks, and providing consultation services. In other words, librarians must provide the same services they have always provided with the printed word. Still other librarians will specify and design front-ends and gateways for the networks, work toward integrating the use of networks with other information resources, and develop knowledge-based network access and awareness mechanisms.

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Involvement of librarians should be local, national, and even international. At the local level, librarians are promoting the use of networks, making networks available to local constituencies, and teaching clients to take advantage of what's out there. At the national and international levels, librarians must be involved by establishing standards as a political lobby, as a major provider of network resources, and as an advocate for the free (but not in the "free lunch" sense of the word) and open exchange of network information.

Locally, we can help to diffuse the technology within our organizations. Nationally, we must become involved in the political process. Legislation now working its way through Congress will have a major impact not only on the technical capabilities of networks, but also on network economics. Economic factors, in turn, will dictate how the networks are used and by whom. There is no doubt that there will eventually be a National Research and Education Network (NREN). What the NREN will look like and who will administer it are less certain. Libraries have already played a major role in the democratization of the Internet. Organized efforts like the Coalition for Networked Information are essential to insure a continuing role in determining the ultimate functions and capabilities of the NREN.

If we don't become involved at all levels, there is a very real possibility that resources will shift to other segments of the economy that can deliver the electronic services that academic and post-industrial organizations will need to survive. It is already happening in some places.

But not to worry, libraries have always been participants on the network and this involvement is intensifying. The fact that you are reading these pearls of electronic wisdom because they came to a machine in your home or office from a machine in Texas is evidence of our collective involvement. Already within many universities, it is library personnel who represent the greatest reservoir of knowledge about electronic information resources. And, in many cases, it is librarians who have the most experience in managing the technology. After all, managing an online library system is no trivial task. Library files and utilities are already so integrated within networks that simply being involved in their governance will insure an important role for the library profession.

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But I'm afraid that until we have a national initiative of the scope of the rural electrification program there will still be many who won't be able to benefit from the networks because they are not associated with a large or wealthy corporate, academic, or government host. The current debate over NREN highlights the fact that the full power of network potential isn't likely to come to the neighborhood branch library in most places anytime in the near future.

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There is a need for both local assistance to individuals as well as coordinated profession-wide endeavors to facilitate access. Information seekers traversing the web of local, regional, and international networks today immediately discover that this is frontier territory: roadways are undeveloped; the language is obscure to most; support services are inadequate; and there are few maps. Even for the network traveler who has knowledge of a specific resource, a personal guide is often required to locate and use the resource. On many college and university campuses, a few librarians have become the guides to network information. These few are reestablishing the librarian's traditional role in an electronic environment as well as initiating relationships of mutual benefit with the builders of the physical network and the providers and consumers of electronic information. These relationships are being established not only locally, but within nationally-based efforts such as the Coalition for Networked Information.

CNI was formed in the spring of 1990 through the mutual sponsorship of the Association of Research Libraries, EDUCOM, and CAUSE (The Association for the Management of Information Technology in Higher Education). CNI's stated goal is to promote "the creation of and access to information resources in networked environments in order to enrich scholarship and to enhance academic productivity" [1]. (See issues of EDUCOM Review for CNI-related articles, or subscribe to the BITNET list CNIDIR-L at LISTSERV@UNMB for discussion of CNI efforts to inventory Internet resources.)

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Another national effort involves the development of the Z39.50 network protocol standard. Z39.50 exists within the overall OSI protocol layers and will provide the standard network capability for search and retrieval of information between remote computers. Just as the "TELNET" and "FTP" commands of TCP/IP have enabled network access, the Z39.50 standard will hopefully enable sophisticated use of network-based information.

While national efforts such as CNI and Z39.50 seek to "tame the frontier" through the establishment of standards and the design of network access tools, individual librarians should continue to claim the role of guide, interpreter, and manager of electronic and network-based information. This will involve much exploration and continuous self-education as the environment evolves, but the endeavor is vital for our profession. As the "virtual library" becomes a reality and as network access competes with traditional ownership of information, librarians must be perceived as managers of this environment. If we are not, the "library without walls" may become the library without librarians.

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Librarianship is based upon the principles that data should be: (1) acquired for the good of the user community, (2) organized in a manner that facilitates timely retrieval, (3) preserved for future generations of users, and (4) provided to users. When accessing network resources, the user is freed of the need for physical proximity to the data. Thus, the provision of intellectual access in a globally networked environment does not hinge upon the library's ability to acquire material, but upon the library's ability to direct users to material in the network. As networks exist today, the identification and/or location of scholarly material is sometimes difficult.

Sensible organization of network resources may be the most important factor in assuring their long-term viability. It also poses the greatest challenge to the library profession, and it presents a crucial paradox: one cannot organize material that has not been identified and located, but the location of material is facilitated by, if not dependent upon, organization.

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We are viewing the dawn of a new age of communication. High-speed data networks will ultimately change the way people think about communicating with other individuals in much the same manner that the book, telephone, radio, and television have influenced preceding generations. At this time, global networking is in its infancy. The Internet is growing rapidly. However, only a fraction of the potential users in academic institutions with Internet connections are actually using it, and the majority of users simply employ the limited applications of electronic mail. The true vision of a national network, such as the proposed National Research and Education Network (NREN), is one where many institutions that are currently locked out of existing networks, such as public schools and public libraries, become connected to a global data superhighway.

In reality, even with the creation of the NREN, central administration of one global network is unlikely (and probably undesirable) in the near future. However, there is ample opportunity for organizational development of existing networks at the regional, state, and national levels. Librarians, especially academic librarians, should take leadership roles in the development of organized network resources. Since ancient times, scholars and librarians have focused on organizing data. Librarians, in particular, have much to contribute toward the organization of data in a global electronic network. A collective, nationwide effort on the part of librarians to help organize the network will ultimately serve the needs of local library users.

By approaching networked information resources with a passive, wait-and-see attitude, our profession lends a certain credibility to the viewpoint that networked resources are inherently inferior in form and content to their tangible counterparts. If there is validity in the perception that networked resources are in some way intangible, it stems from an accurate perception of a network in disarray. As reflected in current library collections that routinely incorporate audio CDs, CD-ROMs, and videotapes, librarians have already embraced data in formats other than the book. Why should network resources be treated any differently?

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Librarians daily face the obligation of balancing the needs of their local constituencies with their responsibilities to the development of information services in the profession as a whole. The financial problems that many--most?--are now facing, in the

realms of technology, training, teaching the use of new technologies, and materials acquisitions, are exacerbating this dilemma. There exists an increasing likelihood that more institutions will emphasize local needs and turn inward, either exclusively or partially. Although no one can deny that our immediate constituency takes priority, if that inward turning does take place, this retreat from national and, through networking, international commitments and obligations will work to the detriment of libraries' emerging potential for affecting network evolution and consequently information provision.

On the national level and on behalf of libraries of all sizes, ALA needs to continue to support the concept of networking (NREN or whatever emerges) with a dedicated commitment. ALA and our other professional organizations must affirm that librarians consider the importance of networking and resource access through networks in the latter years of this century and into the next comparable to the development of indexes during the last century, the evolution of the MARC format in the recent past, and the implementation of an ever increasing number of online catalogs. Without the support of our national professional organizations that serve clienteles of varying kinds and with varying degrees of technological sophistication, it is hard to imagine that a nationally sustainable network for libraries will emerge from any budgeting process.

It is important that librarians recognize that networking is not a topic just for the technological elite in automation departments in research libraries. Although my perspectives are colored by many years in an academic research library, references to networks abound at all levels.

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Barbara Wittkopf enjoins librarians to:

follow developments of the NREN as they are reported in the professional literature and the news media. BI librarians may additionally want to consider ways in which they can contribute directly to the work of the Coalition. The overriding goal of every professional librarian should be to enhance learning and ensure access to information for all [2].

Thomas R. McAnge et al. demonstrate that concepts of access to information at a distance through networking have penetrated the K-12 curriculum and have helped break down barriers of academic ability and provide a challenging and motivating curriculum [3]. An example of the spread of technology beyond the academic world is the formation of the new Consortium for School Networking, which is intended to meet K-12 needs [4]. Networking is for all; it needs national-level support of all kinds.

On the local level, librarians could follow patterns extolled in principle but infrequently followed in practice: to become working partners in coalitions of interested faculty members, computer center staff, and others concerned with the implementation and use of network resources. This involvement is intended to include staff from many library departments, not just from a single domain. The perspectives of all librarians, whether from user education, reference, or technical services, are equally important since network technology, like death, will eventually get us all.

Participation in local processes can mean significant changes in the way librarians conduct business and their relationships with information seekers. This ability to develop coalitions with new groups that share concerns about technological innovations and to evolve resource infrastructures to deal with new needs can have a significant impact [5]. Affecting local computer center personnel who participate in making national decisions makes it

possible for librarians' viewpoints to have national impact as well. The formation of local alliances, following the former Chicago Mayor's dictum that all politics are local, and the ability to share in making decisions will be a crucial part of the future. If non-librarians make library decisions--and all networking decisions are becoming library concerns--they may be ones that, as Richard W. McCoy stated, "would not serve higher education or scholarship well" [6].

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This participation in evolving information structures on the local level also might alter the psychology of librarianship as we begin to recognize that we have the potential for being active participants in the change process rather than passive observers. With this acceptance of technology through participation, even as the impetus for new directions continues to accelerate, eventually the role of being active partners in the information transfer process becomes clearer.

Librarians also can demonstrate that they have the collective organizational skills to bring information order out of chaos. Based on information currently available about network resources, there is a significant role for librarians. I recently tried to use instructions about obtaining a file that were evidently written in some exasperation because this process was so "easy," only to discover that the instructions were wrong, only slightly wrong, but enough to puzzle the inexperienced. This experience parallels those of others who find data about information resources on the networks to be random, incomplete, and potentially misleading.

If we are willing to assume them, librarians can have other potential organizational roles. Whether the resources are in collections of electronic texts or in remote databases, which are available either through anonymous FTP or searches of list servers, mail servers, Comserve, or similar information sources that use a variety of software packages with varying search strategies, the situation is chaotic, disorganized, and wasteful of an individual's resources and time.

As a librarian who is responsible for locating resources related to specific disciplines as well as to libraries, I am faced with an increasing number of library and disciplinary list server and database resources that are difficult to find, acquire, and manage. The dispersal of information has already resulted in "cross-posting," about which so many have already complained, and an inability to even guess where information might be that deters all but the most dedicated librarian from exploring those resources.

Despite the challenges of coping with diminished resources, librarians have local and national roles to fulfill. They need to continue to support national initiatives and developments as well as participating in all kinds of local organizations concerned with information. In networking, national, and local perspectives are no longer mutually exclusive. They are, in fact, the same thing. If we do not act, others will, and we might not like the results.

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QUESTION 2: Considering the dynamic nature of the network information environment, what are the most promising technological strategies for facilitating access to network-based electronic resources? Catalog records in national bibliographic utilities and local online catalogs? Specialized resource directory databases, which would be available on the network? Microcomputer-based front-ends, possibly utilizing hypermedia or expert system technologies?

Before examining strategies for facilitating access to network resources, we first need to determine what people actually need to know to use networks intelligently. It seems that there are two problems to overcome in effectively using networks. The first is the problem of information overload. The store of digitally represented knowledge is growing exponentially. There is already more electronic information than the typical scholar can keep track of. Therefore, the first obstacle is that people need to know that a given network resource exists before they can take advantage of that resource.

Secondly, there is a cognitive overload problem. Information systems are heterogeneous. There is no single search language or data structure; it is not possible to move effortlessly from one source of digitized knowledge to another. Therefore, people will require assistance in exploiting specific network resources once connections are made.

So what are the solutions to these two problems? Certainly online directories are one way in which the network community can respond to the problem of information overload. Just as the yellow pages add value to your telephone and to the businesses that are listed, network resource directories can add value to the network itself and the resources available through it. The Internet Resource Guide is an annotated list of databases, library catalogs, and other network resources. It is available through anonymous FTP as a group of compressed files that must be decompressed once they arrive. CARL, the Colorado Alliance of Research Libraries, has added value to the Internet guide by indexing it by keyword and making it available online. This is an example of a group of libraries taking a first step in the right direction.

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There are a number of other library-based efforts to create directories of Internet resources. However, the resources on the Internet represent a moving target. As soon as a directory is created, it is likely to be out of date. Eventually, there will be servers for keeping track of the constantly changing resources on the network and linking people to resources that meet their needs. As network resources continue to proliferate, the problem of identifying and accessing them will require creative solutions. Directories are only the beginning.

Traditional catalog records are probably less useful as a way of telling people about network resources. After all, catalog records were originally designed for the purpose of generating printed cards to describe printed works. Nevertheless, cataloging and indexing will remain important activities in a networked environment, but not necessarily in their current forms. Organizationally, it will become necessary to separate the search problem from the inventory control problem.

It also is becoming increasingly apparent that the processes for describing intellectual works and for providing access to knowledge resources must become more closely associated within the organization. It also makes sense to associate all of the tasks needed to acquire, maintain, transport, and keep track of documents. Someday there may be a central repository of electronic information with a common search language, data structure, and communication protocol. On the other hand, we might never see such an information utopia.

Another area in need of a solution is how to describe entire collections. In the future, each OPAC will have gateways linking

it to other OPACs and to many other network resources. A subject search might result in a network connection being established that directs the scholar to a resource that has been tagged as being particularly strong in the subject area under investigation. The scientific resources that are already on the network present intriguing possibilities for the near future. As standardization evolves, searching across multiple files is becoming a reality. There should be some interesting projects in this area in the near future.

Currently, libraries are handling access to remote resources through their online public access catalogs (OPACs) in a variety of ways. Describing a remote electronic resource with a catalog record in a local OPAC is the simplest approach. Explaining access routes to these resources, through documentation or a systematic instruction program, requires another level of commitment. Still more commitment is required to provide gateways to other resources. However, nothing is very permanent in the world of networked information, including OPACs, which presents yet another barrier to network access.

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The knowledge-based search engine is a potential next step in accessing electronic resources. The network explorer will need a craft that is equipped with the best navigation equipment. Maps and charts will be needed. Built-in thesauri and data structures will be required for the parts of the network on which the explorer might care to roam. The navigator must incorporate a system of notation, a way of keeping track of where one has been. Rules, frames, objects, hypertext--just about every approach is being tried. Explorers will need ways of finding islands of electronic information scattered in vast seas of knowledge. Programmable navigation instruments will make it possible to store subject knowledge about specific domains on the network. For example, upon approaching MEDLINE one would provide the search engine with knowledge about the medical subject headings and tree structures in order to set a course through the specific area of medicine in which a researcher is interested.

The sheer volume of information on the network will inevitably result in attempts to represent the semantic relationships within stores of electronic text. Keyword searching will yield to knowledge-based searching. Researchers will demand ways of filtering out extraneous information. As people interact with the network, they will develop profiles that will help to guide the interaction. The ability to build the kind of links exemplified in HyperCard stacks will become routine as researchers build their personal electronic libraries.

Widespread use of the network-friendly UNIX operating system will accelerate the commercial development of front-ends and expert system shells for network access. Online catalogs and abstract databases represent some of the most highly structured data available anywhere on the networks. This contrasts with the unruly mess one finds on the lists and NetNews. Information retrieval software is almost always designed for highly structured data. In order to take advantage of the network's dynamism, reader software is designed more for interaction than retrieval. Unlike software designed to retrieve neatly organized chunks of information like as bibliographic records, reader software has to augment the researcher's ability to move around rapidly and efficiently in a complex information space. People will need something to help them reduce the amount of corrupt, spurious, and, in the case of viruses and worms, dangerous information that is out there in certain regions of the network.

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Full text presents its own set of problems. How does one extract meaning from text? Many institutions will develop their own

knowledge-based front-ends and navigation systems focusing on local needs, preferences, and clientele. The incoming generation of UNIX desktop computers will spawn micro-based toolkits. Individual scholars will develop their own modes of interaction with the networks. The library community will be involved in these efforts from R&D at one end to consulting at the other.

Currently, the R&D community is faced with two essentially different approaches to dealing with the large store of electronic information on the Net. One approach--the knowledge-based approach--seeks to represent the meaning of the electronic documents on the Net. The other approach--the brute force approach--seeks to use raw computer power to assist people with searching large electronic files. Whether one or the other will emerge as the best means of access to networked information remains to be seen. Certainly the two approaches are not mutually exclusive and, therefore, we are quite likely to see hybrid systems combining elements of each.

The knowledge-based approach improves access by imposing structure on the data. Elaborate indexes, thesauri, and expert system knowledge bases are all examples of the knowledge-based approach. This approach lends itself to domains where information is subject to systematic, hierarchical organization. Front-ends employing this approach work best with highly structured, homogeneous, and relatively unambiguous data bases. Numerous projects under way at the National Library of Medicine exemplify this approach. The medical literature seems to lend itself quite well to this approach. But the knowledge-based approach is not without problems, especially when it comes to networked information. It is less likely to work well with the kinds of unstructured, heterogeneous, and ambiguous information often found on the networks. And the knowledge-based approach, because it does require human knowledge, is labor intensive and expensive.

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The brute force approach on the other hand is not labor intensive; it is computer intensive. Where the knowledge-based approach is weak, the brute force approach is strong. The brute force approach is especially suited for dealing with large unstructured files like full-text databases. As computer capabilities increase, the brute force approach is beginning to look more promising and the ways in which it is being used extend well beyond simple keyword searching. The best example of the brute force approach in a network environment is the WAIS (Wide Area Information Server) developed by Brewster Kahle and his colleagues at Thinking Machines Corporation, a pioneer company in the production of massively parallel supercomputers.

WAIS is designed to permit searching across multiple full-text databases without requiring the searcher to understand the search commands or data structures of any of them. Users of WAIS begin by submitting English language queries from a local client to a server on the network. Documents matching the query are then displayed for the user's evaluation. Once the user has evaluated the results of the initial query, the WAIS client reformulates the query, incorporating words derived from documents identified as relevant. The power of the computer is used to identify documents that are statistically similar to documents identified as relevant. No attempt is made to describe documents in terms of their meaning; the computer simply uses its pattern matching capabilities to identify new documents containing words found in other documents identified as relevant by the searcher.

There are already many WAIS servers distributed throughout the Net, each providing access to a different full-text file. A single interface, known as the client, provides access to files as diverse as the CIA World Factbook, the poetry of W. B. Yeats, and Billy Barron's list of OPACs. A Directory of Servers helps

researchers identify and query servers located in different places on the Internet. The directory itself is a server and users interact with it by using the same client interface that is used to interact with other servers. Interestingly enough the protocol chosen by the developers of WAIS is a modified version of the Z39.50 protocol, which is used by a growing number of automated library systems.

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The choice of the Z39.50 protocol is significant for a number of reasons. It is an open protocol and its adoption by WAIS is likely to encourage others to adopt it as well, promoting the standardization that is needed for the easy exchange of all formats of electronic information. In the future, Z39.50 has the potential to deal with audio, video, and image data in addition to text. Libraries that already employ the Z39.50 protocol have the potential to turn their OPACs into WAIS servers.

There is enough territory on the Net to warrant knowledge-based and brute force approaches to network-based information retrieval. Libraries are already playing an important role in the development of new forms of access to networked information in both areas. We don't know yet which strategy is likely to yield the best results. Most likely each strategy will work better in some situations than in others. Hybrid systems also hold promise. Libraries can and should support research and development along a number of different research fronts.

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Sophisticated network access tools that are implicit in the technology of the networks, if not in existence yet, are largely beyond the scope of development by local libraries. Again, this is a problem that ultimately must defer to coordinated national efforts, such as CNI, and cooperation with the computer science community. The narrow conceptualizations that we have of words like "catalog," "directory," "index," and "database" will not accommodate what is required in the Internet environment.

The virtual library of our future will require a "virtual catalog" or "logical index"--meaning that the information contained in such a catalog or index will not be located in one physical database. As network resources are mounted locally, a standard network data element will be used to include that resource in a logical database. If the resource is withdrawn from the network, the pointer from the virtual database to it will automatically disappear.

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The Internet's Domain Name System, which keeps track of Internet addresses, is an example of a logically connected database. Local computers maintain only local naming information, while retrieving information about the rest of the Internet from other computers. The Internet White Pages project is another example of a distributed directory [7].

While the technical details of how a distributed database works need not be apparent to all librarians, our profession must be involved in the conceptual aspects of accessing network information. In fact, as librarians and campus computing professionals compare notes at national conferences such as EDUCOM and National Net, it is apparent that it is the librarians who have the conceptual vision and service experience to understand what is required to provide network access to the average user.

The announcement by Thinking Machines, Inc. of the test release of the Wide Area Information Server (WAIS) Internet software represents an initial development of an advanced network access tool based on the Z39.50 standards [8]. Thinking Machines is the producer of the massively parallel computers that would be required to manage enormous information servers such as what might be created by the Library of Congress. Thinking Machines is offering their test software free of charge to the Internet community.

The money-making potential of information commerce is substantial. It is not hard to foresee how WAIS software, a proliferation of information servers, and ubiquitous connections from personal computers to national networks could provide the combination of technological capability and economy of scale to launch full-blown information utilities far beyond the current systems, such as CompuServe or Dow Jones. It is impossible to predict how the traditional roles of libraries may change when households are paying \$25 per month for access to a vast information network from the comfort and convenience of their homes.

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Catalog records for bibliographic materials located on the network are needed. However, placing signposts pointing to the existence of non-bibliographic resources within the databases of national bibliographic utilities and/or local library catalogs should be viewed as an interim solution to the larger issues surrounding the provision of access to network resources. Similarly, many of the problems associated with the location and utilization of network resources are only compounded by microcomputer front-ends that require frequent software revision and periodic hardware maintenance. Additionally, providing user support for numerous front-ends taxes the library's public service staff. The development of easy to use, frequently updated, and readily accessible network directories will most effectively facilitate access to other network resources in the foreseeable future.

It is ironic that technology currently exists to transport gigabytes of digital data including full-motion video, sound, and accompanying text to another user across the country, and, yet, in order to transmit that data, the sender needs to place a telephone call to a colleague in order to obtain his/her network electronic mail address. Clearly, there is a need for the establishment of centrally organized network directories encompassing: (1) machines on the network, (2) network-accessible applications residing on those machines, and (3) individual users. Although a clear imperative exists for the development of central network directories, there are several reasons why more reliable directory data is not existent on the networks at this time.

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Aside from a few pilot projects aimed at illustrating the scope of networking technology, little attention has been given to the development of network directories. One such pilot, the White Pages Project based at Portland State University, focuses on the development of a network directory of electronic mail addresses for individual users. Utilizing a software package from the United Kingdom named QUIPU and a X.500 directory implementation running on top of the lower levels of the TCP/IP protocol suite, this network directory solution has met with limited success due to the memory requirements associated with searching it. Memory caching in excess of one megabyte per user is required, and this

could quickly cripple some machines that serve numerous simultaneous users.

While technological barriers inhibiting the implementation of network directories will ultimately be overcome, other barriers are more prohibitive. Despite the successes of Art St. George and Billy Barron, who each maintain and distribute lists of online public access catalogs accessible through the Internet, the implementation and maintenance required for network directories large enough to serve a global community is beyond the ability of a single individual. As colleges and universities rewire their campuses and create the local topologies needed to accommodate the higher bandwidth associated with video, sound, and graphics, network configurations change almost daily. Therefore, when dealing with a volatile environment such as the Internet, the tasks associated with the maintenance of a network directory are particularly burdensome. The network is changing too rapidly.

However, should an individual possess the eternal vigilance and superhuman skill required to undertake such a task of organization, there needs to be a common acceptance among the user community of his or her authority to do so. This type of authority is more appropriately vested in institutions than in individuals. Currently, there is little incentive for any academic institution to undertake the establishment and maintenance of network directories. The costs associated with establishing and maintaining a network directory are prohibitive for most institutions, and tasks associated with supporting a larger global community are understandably relegated a position of lesser importance than those tasks associated with supporting local needs.

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Issues surrounding the privacy of network users on the network and copyright issues also may affect the development of network directories. For example, is it a violation of Art St. George's privacy to list his electronic mail address when citing his list of Internet-accessible OPACs? In a more traditional paper, one would not list the phone number of an individual who wrote a paper being referenced. Guidelines concerning what is required legally and ethically during the development of network directories need to be established.

Finally, while the needs of a large community of network users are better served by a distributed model of data processing, data integrity is best guaranteed when the updated data is reviewed at one central location. This model has been successfully used by some existing networks for updating the host naming tables associated with machines on the network. When changes are imminent, they are submitted to an authorized individual at each network host via a hierarchy of distribution lists.

If a central agency, or more likely a few agencies, are going to take a role in the development of network directories, which agencies will be involved? At present, three types of agencies, none of which have exclusive rights to development of network resources, seem likely. Government agencies at the state or federal level may appear and take the lead on the development of network directories. Corporations may be formed to oversee such development [9]. Finally, special interest groups such as the Coalition for Networked Information, CAUSE, and EDUCOM, may undertake the challenges presented by network directory development.

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An analogy with observed information seeking behaviors for access to printed resources at a distance, although lengthy, may help understand strategies that could be followed in a network context.

The decision to integrate the Center for Research Library's cards into Wisconsin-Madison's card catalog from the start was demonstrably and statistically proven to be one of the main reasons why Wisconsin was one of the major borrowers from the Center. Availability of information in one location, one file drawer, one alphabet, even if it was only author/title information and no subject cards where available, made a palpable difference in user access to distant resources. Whether the resources had been "owned" by Wisconsin and deposited in the Center or whether they "belonged" to some other library, our library users found them in one blended alphabetical catalog and borrowed them even though they were located at a distance. The resources were regarded as being extensions of the library's collections; they only happened to be located somewhere else.

Conversely, those resources not specifically identified by individual titles as being either here or at the Center, even though vast (e.g., local government documents), were less frequently used. Since they were not listed in the catalog, an additional reference tool was required to identify and access them. The same principle can be applied to local audiovisual, database, or other specialized resources not represented in a centralized card catalog. Without such listing they are difficult to locate and are used only by those who know they exist, usually through word of mouth or due to referrals from a knowledgeable person. Without such assistance, users could easily miss important resources.

With the implementation of an online catalog, but without full retrospective conversion, we are seeing verification of "Moore's Law"--the most convenient information systems are those most likely to be used. Students readily use the online catalog--the library Nintendo as one student called it--but are forgetting that there is a second source: the traditional card catalog. The result is an increase in the number of interlibrary loan requests for items that the library already holds, but that are represented only in the card catalog.

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This demonstrated user preference for a single source of information should guide our approach to information about network resources. Patrons prefer one access tool and, particularly if it is an electronic one, frequently assume that source to be complete and comprehensive. Flowing from this belief about user tendencies would be the "math fix" for network access: don't "multiply" sources of information; don't "divide" network or electronic information data from traditional sources; rather "add" them to information sources that our users already access, most typically online catalogs or information guides.

One far-reaching proposal, automated enhanced searching capabilities, seems ideal, although distant. A device that would automatically extend a local search of an online catalog to reach appropriate databases or other information on the networks seems to be a model for the future. (Some commercial vendors already offer ways of extending a local search on a tool such as a CD-ROM product into an online environment to search remote databases.) Extending this concept to network resources, a user would enter a search in an online catalog. If the query comes up empty, the system would automatically search the networks, local and distant databases, and other sources for related information, display it on a local terminal, and make provision for document delivery. But, given technological barriers, libraries' proclivity for utilizing non-compatible systems, and other issues of funding and

cooperation, that solution seems far away.

In the interim, several solutions are possible. Continuously updated online guides are viable--certainly the technology exists--if someone assumes the responsibility for continuous revision and has the commitment and resources to accomplish the task. Efforts such as those of Laine Farley to provide guides to the Internet should be applauded and supported.

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Centralized cataloging, such as OCLC, has proven to be effective; the MARC format has the capabilities to handle network materials. Even though cataloging may paradoxically seem to some to be a secondary approach, a centralized, network-accessible catalog with complete network "call numbers" is preferable to the non-system that exists now. Yet with the difficulties most libraries are having keeping up with cataloging printed materials and using such devices as abbreviated records, one wonders about the source of the added labor and technical expertise to accomplish these tasks. The need for dynamic, or even batch, updating capabilities of any guide or cataloging system is a question of finances as much as it is of will or skill. Whatever system evolves, it should be viewed as one that could handle advanced information capabilities. For example, it could provide SDI services that would update information to supplement an earlier search when a user came online and, thus, becomes an active--rather than passive--participant in the information process.

One important development that needs reinforcement is working toward standards, whether in MARC or other formats, concerning the description of network text files [10]. Work on defining names and addresses for network files has been started, but based on the incomplete and inaccurate references that still exist, this area needs ongoing effort.

Some of the best efforts to organize network information have been those of dedicated individuals. Not all of them are librarians, but many of them are not affiliated with computer centers either [11].

What is needed now is an accessible union list of "network library information resources" that: (1) includes appropriate subject as well as technical information; (2) is continuously updated; and (3) is accessible to the uninitiated. Text files that are zipped, stuffed, or that otherwise require a complicated secondary step may help local computers store data more efficiently and networks transmit them, but, as messages on various servers show, they handicap beginning users, precisely the audience we should be trying to reach. As these union lists accumulate on local systems, they will themselves need to be cataloged and included in online catalogs.

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Whatever eventually evolves, it should be a system that integrates networking within the emerging comprehensive definition of library information. The belief that somehow networks and electronic information are "different," and, therefore, require special treatment is antithetical to the evolution of successful information systems. Technology and technological resources need to be integrated as closely as possible with traditional resources within a unified approach to information founded on principles derived from studies of information seeking and use. Users want to be able to identify information through one access point and not through a series of separate catalogs or information utilities with varying search strategies and command structures that complicate as much as they help. Until a search device, a dynamically updated online guide, or satisfactory resource guides are created, we will have to continue to depend on that hypermedia, intelligent (but not

artificial), semi-robotic system that is known as a "librarian."

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QUESTION 3: What kind of support services should libraries provide to their users to help them utilize network-based electronic resources? Special workstations in the library? Bibliographic instruction? User documentation? Mediated access?

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All of the above, but most emphatically systematic instruction. The ability to navigate on the networks will become a very important aspect of "information literacy" in the coming decades. It is within the purview and capability of libraries to teach clients to use complex electronic information retrieval systems. There is no reason why the same methods used to teach people to use NOTIS or MELVYL cannot also be applied to systems like rn, the software used to interact with international news networks.

Many libraries are already handling documentation for a wide range of electronic resources, including ICPSR data files, commercial online databases, and CD-ROMs from the Government Printing Office. Electronic information space is largely unmapped. Libraries should support network access by maintaining and developing network documentation. At the very least, libraries should provide access to public network information centers like LISTSERV@BITNIC and NIC.DDN.MIL. The library should evaluate, assemble, and maintain publicly available network resources like the various Internet library guides, the many useful help and FYI files from BITNIC and NIC, and "pointer" messages culled from the newsgroups and list servers. When a librarian sees something interesting described in a list message or a news posting, the librarian should try it, and, if it works, share it with colleagues who might be able to use it. The technology will only be used when people validate its use.

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Another worthwhile endeavor involves developing front-ends for access to network resources together with an instruction program to teach people to use electronic information. A front-end might be as simple as a communication script for connecting clients to specific USENET interest groups. An instruction program might center on individual consultation or group presentations. Neither of these efforts is inconsistent with the activities of libraries. Again, the best way to learn what is available from the network is to use the network. It is not possible to teach anyone to use the network unless you know how yourself. Consultation and instructional support services have the goal of requiring less mediation between the researcher and the network. There will be more emphasis on the search problem, on training clients to function independently, and on developing mechanisms to support intuitive, browser-driven interfaces.

On a practical note, we need to provide technologies for "transformation" of information from one format to another. Workstations which support network delivery, in addition to local on-demand publishing, will be needed to achieve maximum benefit from the network, but substantial benefits are also available to those working with standard microcomputers. The cost of hardware will delay the widespread use of networks outside of larger knowledge institutions. Until electronically displayed information is comparable to the resolution and convenience of the printed page, there will be a need to transform electronic texts to paper texts. Nodes on the network will need to acquire the ability to handle images and to transform information from

one medium to another.

On the other hand, electronic media are capable of simulations and animations that were never possible on the printed page. There are also many types of data that need never be transformed from their digital form, but that require intensive processing once they have been delivered. For example, providing access to numeric databases implies the provision of consultation and post-processing services. There must be support for people who want to manipulate numeric data after it has been delivered from its source on the network.

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Traditional methods of support remain appropriate for network resources. However, these methods are difficult to apply, since the networks are chaotic and information access is primitive. Patrons, faculty, and many librarians are unaware of network-based information and uninitiated in its retrieval. It is incumbent upon librarians to incorporate the network environment into their professional activities. As a first step in providing service to patrons, librarians must become network users. Also, library schools should include this new context for information provision in their curricula.

At The University of Tennessee, Knoxville, we have begun this process. A public-access workstation in the Reference Room provides connection to remote services, which are mostly OPACs. A directory of Internet-accessible resources with a short description of each service is located next to this workstation. A shareware program called AutoMenu guides the patron, prompting for the Internet address, which the patron obtains from the paper directory. Some network resources are covered in library bibliographic instruction classes, and the Graduate School of Library and Information Science includes a component on accessing network information in the "Information Technology" course.

Also, UTK reference librarians have been accessing the Harris Poll database at the University of North Carolina, Chapel Hill [12]. This database provides an online index of more than 750 Harris Poll questions and results. As with any in-library resource, librarians refer patrons to this resource or help them utilize it.

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Arguably, libraries have been providing a form of user support ever since the first reader's advisory service began operation. Unfortunately, in most libraries, providing user support for technology tends to place an additional burden upon an already overworked public services staff. Despite what some might consider the inadequacies of our nation's public schools, a reference librarian can safely assume that a patron knows the alphabet, can read, and has leafed through the pages of a book before. It is not safe to assume that s/he knows what a programmed function key is, has ever used a mouse, or understands the ramifications of searching a database using a title keyword index.

An additional factor complicates the provision of user support for technology. Technology changes! Not only is it difficult to keep the public informed of new trends, keeping staff apprised of new technologies is also difficult. Ongoing institutional

efforts to educate staff greatly contribute to the overhead associated with user support services. Maintaining a well-educated staff may be more realistic than demanding a well-educated public. Therefore, it should be considered that some types of mediated services may always be needed to fill the needs of those unable or, in some cases, unwilling to utilize the technology.

In order to minimize the havoc technological advances wreak upon library users, libraries should seek to apply technology that reduces the amount of user and staff training required to utilize it. Unfortunately, these user-friendly options are often not the least expensive ones. The development of intelligent workstations, which are intended for public use, holds great promise for meeting some user support needs. The human/machine interface provides an opportunity to automate repetitive activities and minimize training needs. For example, instead of repeatedly teaching users a series of steps required to connect to a network resource, a workstation can be programmed to execute those steps automatically. The cost associated with such interface development is ultimately offset by the savings in the provision of direct user support.

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When designing systems, achieving a balance between the differing needs of advanced users and novice users is important. Standards and network protocols play an important role in achieving this balance. Ideally, the user interface should function independently from the network. This separation of interface and network will allow each user to develop their own "personal" or "intimate" interface. The individual develops a tailor-built interface that meets his/her own research needs and can be modified to accommodate personal growth and changing research needs. Each individual interface communicates with the network via standard networking protocols. The intimate interface can travel with the user, and it can be employed wherever a network connection is possible.

Where does the final responsibility for user support services fall among the library, the campus computing center, and the agency administering the network? There may not be an ideal answer to this question--it is probably best answered at an institutional level. Generally speaking, if librarians fail to meet the challenges associated with providing user support for network resources, libraries may no longer continue to enjoy the elite position that they currently hold within society as central repositories of historical and cultural data. As data creation and dissemination becomes more closely linked to the network, the network information center (NIC), the network operations center (NOC), and/or other network administrative agencies may step in to fill this role.

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On the local level, librarians are, in many instances, on the front lines in the technological war as they and their clientele struggle to survive and thrive in an increasingly information dominated age. A comparison of the number of subscribers to PACS-L (over 3,000) and the long-established and prominent humanities list server HUMANIST (over 1,200) reveals that librarians are taking the lead in network information access and provision. As leaders, librarians bear a profound responsibility for providing access to networks through their local online workstations and instructional computing facilities. In addition, librarians must gather, organize, and offer documentation that has, in some cases, been tailored to meet the needs of users new to networking.

The issue of "special workstations" should be solved through combining network access with already existing workstations in library computer labs or those used for online catalog access. Creating yet another category of workstation is going to confuse users. Networking should be integrated within present information technologies, not considered as a special case to be set apart from other sources.

Librarians bear an even greater responsibility for information instruction, including networks. Coming from a state in which one library is going to be renamed something like "Information Technology Center," it is clear that recognition of librarians' roles in technological partnership and, in particular, their role in educating users in information access has arrived. How that instruction takes shape and what its impact will be on the user community is difficult to anticipate. Librarians are now including networking instruction in an increasing number of courses, programs, and other efforts to teach each other and their users. These have taken the form of everything from teaching classes together with computer center personnel to providing one-on-one instruction.

Here at the University of Wisconsin-Madison, a group of librarians successfully ran a program over the past academic year dealing with the availability of library catalogs over the Internet. Presented during lunch, a librarian demonstrated access to a specific catalog and compared results to others using a set script. In addition to providing data on the structure of a particular online catalog, documentation about the catalog was also distributed for future use. There have also been two state-wide conferences in which issues related to telecommunications have been the main focus. Librarians actively participated in all the programs and conferences.

Libraries and librarians are extending training beyond the staff to reach their intellectual communities as a whole. Bibliographic instruction and other librarians at the University of Wisconsin are teaching Internet access and, in a course taught by Geri Laudati on the bibliography of music, general principles of file access and transfer. It will soon be impossible to teach BI without including network information access as part of the course.

In reaching out to a library's clientele, the issue of the "teachable moment" arises. A continuing problem in doing bibliographic or other library instruction is one of timing: the library must provide programs when the users are ready for the information and will therefore accept it. That is equally true for teaching network access. Few users, outside libraries and computer centers, are interested in networks unless they relate to their information needs.

Charles Perrow's probably intentionally provocative chapter "On Not Using Libraries," in *Humanists at Work* could be subtitled, "On Not Using Networks Either" for it illustrates a common problem in reaching users [13]. He describes his unwillingness to use the library personally because he does not want additional information other than the item requested at a specific time. Nor does he advocate BITNET as an alternative medium because "there is too much communication in the world" [14]. He is going to join it, reluctantly, "Because It's There" or "Because It's Time," as one could say, but he is not enthusiastic. He does not want librarians to tell him how much he is missing either.

Perrow's restrictive approach seems characteristic of many

successful scholars who focus on the job at hand, gather the resources to meet its needs, publish the results, and then get on with the next task. It relates to what could be called the "information moment," the desire to have just the material needed at the right time. In a recent debate on the HUMANIST list server, a number of contributors, primarily faculty members, could not see the value of using the Internet to access a distant online catalog directly. They were satisfied with their local interlibrary loan services.

Fortunately, librarians who participated in the HUMANIST debate had a broader viewpoint, one that seems appropriate to our role. Whether faculty members or members of the public want network information now or not, we still have to be ahead of our audience, not behind it, and be prepared in the future to provide information on network access within a broader intellectual context. Even as librarians need to be attentive to individual learning levels and to the variance of receptivity among individuals and groups, they also need to develop the skills, sometimes with only a long-term payoff, to be ready to provide the training when the "teachable" or "information" moment for networks has arrived. Paraphrasing from a recent film: offer network information and they will come.

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Whatever training is offered might work best on a disciplinary level, avoiding a narrow "techno-librarianship" that pursues technological paths to the exclusion of the development of complementary subject and other expertise. The concept that Clyde Hendrick, an academic dean, termed a "knowledge mediator" within a disciplinary context, seems an approach that could be applied to network information as well [15]. Whether an institution or an individual, the mediator would combine technological and subject skills--neither one in isolation will be sufficient to cope with future information environments. His call for an interdisciplinary terminal degree permeated by a "research ethic" might strike some as simply trying to mimic faculty structures, but the idea of the need for multiple, not unitary, skills merits consideration as training for a new generation of librarianship, permeated by networking, begins.

This type of knowledge mediator, who is attentive to individual needs, can be seen in other efforts to provide information about networks. Some librarians already scan the networks--which may account for some overlap--and forward information to local non-subscribers who may be colleagues or faculty members. Others assume a formal responsibility for making a database of list server or other network materials, organizing it by subject, and distributing it. Yet, I have personally found this to be successful only to a limited degree. For example, I sent the same information about a new list server to two faculty members in closely related fields: one rejected it, but the other was enthusiastic. In looking for reasons why success was partial, I can see that receptivity could be related to the users state of technological development, interest in electronic information, and access to equipment. All of these factors need to be considered in trying to help users gain network access.

In these efforts to be all things to all people, to maintain print collections while incorporating and teaching about electronic data, librarians are showing the effects of battle fatigue. This could be seen in the debate over the impact of list server overload and technostress on PACS-L in January and February 1991, as librarians wrote about being in departments with individuals of widely varying skills who fear change or find it stressful. Some are "still worried about being automated out of their jobs (which could happen) while others have strong reservations about their ability to master increasingly complex systems" [16].

Steve Cisler noted: "Librarians have a sense of mild guilt and anxiety about not keeping up with new information sources (no, there's not an ANGST-L group), but we can still rely on pointers and messages from friends and colleagues" [17].

This support system is important, for as Linda Bills noted of individuals: "Redefining their job and skills, eliminating the usefulness and value of the skills they spent years (or months, or weeks) developing, and--as is often the case--throwing out physically the thing they built, can be a tremendous blow to their self-image as a valuable part of the work force and a knowledgeable expert in their own sphere" [18].

Librarians must deal with feelings of being out of control--driven by forces that they have little power over and are unable to cope with; however, they also need to recognize that they have specialized talents, knowledge, and skills. They seem especially suited to creating documentation and teaching about information, whether in a traditional or network environment. Network instruction, library workstations, and documentation are three parts of the same information solution. Librarians are equipped to provide all three.

QUESTION 4: Should libraries "collect," provide access to, and preserve network-based electronic resources? If so, what types of information (e.g., computer conference logs and electronic serials) should be collected? How should access to these locally housed electronic materials be provided? What types of barriers do you see that will hinder libraries in their attempts to accomplish this goal?

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"Collecting" electronic information is more problematic than collecting printed texts. And, as we all know, collecting printed texts is not without its own problems. Much of the information is ephemeral and not subject to any quality control. For most scholars, the printed word is still somehow more concrete than the electronic word. The publication process is an act of validation. Tenure committees tend not to look at network postings in the same way they look at publications in refereed journals. Thus collection efforts might be limited to formal efforts such as electronic journals. However, some news or list postings are as well written as some of our best printed texts. Others can be as useful for their reference value as anything in Sheehy's Guide to Reference Books. However, you also can find items like treatises on the effect of Grateful Dead music on somebody's cats. Serious collection efforts involving items beyond electronic journals are most likely to be limited to moderated newsgroups at first. There is already a loose and informal system of quality control. Eventually a more rigorous method of refereeing will emerge.

Pool has written about the canonical text [19]. The ideas in a mass publication can't be easily revised or changed once they have been set in print and loosed upon the world. The electronic word is different. Electrons are mutable. Ink on paper isn't. So, another problem is the fluidity and volatility of information itself.

For the type of information found on the list servers and news nets, access is more important than archiving. Of course, it is

desirable for someone to archive postings by individual participants in network conversations and make those archives searchable as well. Fortunately those tasks are already being handled well by services such as PACS-L. When we need to find out what people have been saying about networking CD-ROMs for example, we have access to that information. But there is no need to store much of that type of information locally. The number of libraries building archival collections of postings will remain limited. While an archive of postings may be useful, the sense of the discourse, as people and ideas interact with one another over a period of time, is difficult to capture in an archive. The network is most useful for its dynamism.

On the other hand, if there is sufficient demand for a network resource at an institution it may be computationally more efficient to maintain it locally in one central location than to encourage many separate individuals to use it on the network itself. For example, PACS-L is kept as a locally maintained bulletin board resource at the University of Texas. When they arrive from the University of Houston, PACS-L messages are stored on a local bulletin board that can be searched and browsed by people at their leisure. Everybody who needs PACS-L can use it when they want to, but some of us still insist on direct access to PACS-L, receiving the messages in our accounts as they are sent.

Archives of news group and list server postings are maintained at numerous locations and are available through anonymous FTP and from file servers. Other institutions keep a few months worth of the most recent postings from selected groups or a few megabytes worth. Right now, the problem is that it is hard to know what's out there, where it is, and how to get it.

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There are all kinds of barriers to local collection of electronic information. Hardware and software limitations are very real at many institutions. There is often a lack of financial resources to cover the additional expense of managing an electronic collection alongside a paper collection. A critical mass of skilled personnel is essential for any electronic project to work. Think about how many people it takes to maintain an online catalog. Another major impediment is the number and incompatibility of integrated library system products. In the future we will need to separate the data from the query language. One day, extending the work done with the MARC record, that may become possible. For other information packages (e.g., the serial literature) the prospects are less rosy. Our information system is heterogeneous and is likely to remain that way. But this is healthy, and we will develop ways to deal with it by using more intelligent and robust search software. Perhaps the most serious barrier is the traditional print orientation of the vast majority of educated people. The look and feel of the printed page has yet to be matched by anything in electronic format.

There are many barriers, but barriers can be overcome. In academia, a strong cooperative relationship with one's campus computing organization is essential. Cooperation is the key to successful networking. One idea that holds great appeal is the cooperative work group. One such example of a cooperative work group is the HCI Bibliography Project, a no-cost electronic bibliography on human-computer interaction maintained at Ohio State. HCI is built and maintained by the people who use it. Standards are being established along with a structure, but the database is being built by many independent agents each taking responsibility for a small part of the literature on human-computer interaction. Access is already available through anonymous FTP, with plans for an electronic mail server. Neat idea.

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Libraries should not think primarily in terms of collecting information stored on networks, but should instead pursue strategies for teaching users how to locate and retrieve this information. For example, the archives of PACS-L represent a valuable source of information for library school students. It would be an extravagant use of resources for libraries to replicate this database as a computer file or on paper, when a user only needs access to the network and the knowledge of how to search the archive and retrieve the results. Libraries need to be very careful about clinging to the traditional role of repository when it is not appropriate. The networks exist to provide direct electronic access around the globe. While the preservation issue is relevant, in the network environment electronic information needs to be preserved in one place only. The issue of "collecting" and "preserving" the PACS-L archive, for example, is primarily the concern of the University of Houston Libraries.

Several network repositories for electronic texts are being created. The Library of Congress' multi-million dollar American Memory project includes a network-accessible archive as one of its goals. Currently, Project Gutenberg and the Open Book Initiative are two network servers known to readers of PACS-L, and there are many of other projects underway [20]. The files loaded on these servers are a departure from the computer science files at most anonymous FTP sites, and are a harbinger of future network use. I envision local file servers offering archives that are locally unique, but of widespread value. At the University of Tennessee Libraries, we have made a small contribution to the universe of network resources by loading a set of HyperCard stacks related to library orientation that were produced with grant support from the U.S. Department of Education [21].

At ALA Midwinter 1991, Ann Kenny reported on a project at Cornell University that utilizes the Xerox Docutech technology to digitize a local collection of high-demand, high-research-value monographs. Electronic image files of one thousand out-of-copyright titles will reside on 12" optical disks. These disks will be accessed through a "request server" which searches a jukebox of disks. The server will eventually provide Internet access to the collection. Although the files can be downloaded and printed with more conventional hardware, the optimum method would utilize another Docutech machine, which has a built-in network connection and provides for high-speed, high-quality printing.

The Cornell project alludes to an issue related to collections of machine-readable information: print on demand. As archives of electronic files proliferate and begin to supplant paper-based collections, consumers of information may still demand a paper alternative to reading text from a computer monitor. Coupling instantaneous network access to files with the capacity to generate high quality paper output rapidly may seem at first to be paradoxical. However, joining the two technologies resolves the long-standing criticism of the delay inherent in receiving interlibrary loan requests.

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In the traditional sense, the librarian strives through acquisition to establish a central repository of similar materials by "collecting" those materials and storing them in a common location. Aided by a classification system, this process focuses on housing like materials in a single physical location. Ideal access occurs when the user is present in this same location.

This organizational model is dramatically different from the decentralized model of access that electronic data networks provide. The physical location of the material loses importance in the networked environment. Instead, the provision of access in a networked environment centers on issues such as connectivity to the network, authorized use of network resources, and network bandwidth.

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However, the advent of networked resources does not eliminate the need for a formal policy governing the acquisition of electronic resources. A single central machine, no matter how powerful, serving all the information needs of network users worldwide is more of an hallucination than a vision. Clearly, groups of local users will have an ongoing need for the proximate location of heavily used data. Thus, achieving a balance between local "collections" of heavily used electronic resources and the provision of network access to less frequently used resources should be the goal of the library acquisition process in a networked environment.

Striking the delicate balance between local ownership and network access will be aided by, if not achieved by, a formal acquisition process that accounts for network access. Librarians must shift the focus of their acquisition policies from the collection of materials by and for an individual library to policies that weigh the merit of acquiring the same resource by consortia of local libraries, regional library cooperatives, and/or state library networks. The funding agencies that back libraries must come to accept this type of cooperative venture. At the same time, vendors of commercial data products must understand the imperative facing libraries to enter cooperative collection development agreements. Accordingly, they must develop fee structures that accommodate such ventures.

This is not to say the information needs of the local user community will cease to influence decisions about the local acquisition of machine-readable data files. In much the same manner that those information needs have driven decisions regarding the appropriation of materials in more traditional formats, the librarian must continue to select electronic resources that will meet the needs of the local user community. Computer conference logs, electronic serials, even archived exchanges of electronic mail transmissions may all be appropriate for a library to acquire and preserve, given sufficient interest on the part of the user community.

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Those who doubt the suitability of personal exchanges of electronic mail might consider what value such materials would be to a historian of the twenty-first or twenty-second century faced with the task of reconstructing the correspondence of an individual (or organization) who ceased writing letters on paper late in the twentieth century. In 1989, the National Security Archives and several other organizations won a lawsuit preventing the destruction of such electronic files that were generated using an IBM Professional Office System (PROFS) during the Iran-Contra fiasco. The government is appealing the ruling, which would permit public examination of those files.

The logistics associated with establishing and operating such a

centralized computing facility prove to be the greatest barrier in the cooperative collection development of electronic resources. The needs of all libraries participating in any such venture must be realistically met. The appropriation of the hardware associated with data storage and processing must occur. Staff to operate such facilities also must be considered as well as the location of such a facility. An infrastructure which can accommodate rapid changes in technology must be maintained. And all of these factors must be met at a cost that is palatable to those providing the funding.

Given the current network landscape, the logical place for such facilities to emerge is large public universities. Universities, and their libraries, typically have the facilities already in place to begin administering these shared network resources. Again, there is an imperative for network leadership on the part of academic librarians.

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Within a network context the issues of collecting versus providing access to information resources are not necessarily incompatible, but these issues should be separated from the idea of preservation of network resources. In considering this question, I will draw on models of information access that are derived from what I know of the activities of libraries of social science and other data archives, my perceptions as a collection development librarian, and the concept of a librarian as an information broker.

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For libraries to obtain and replicate, on their local computers, much, or even large parts, of the information already available on networks seems to me to be a paradox. Although I am a collection development librarian who is primarily concerned with the need to provide adequate collections for local use and who tries to obtain what can be afforded, I am also fully conscious that collecting everything is an impossible goal. Every library, ours included, will always have to depend upon access to other collections for additional materials.

I would apply the same standards to collecting network information; however, I would be even more selective about acquisition because much of the information is temporal and is already managed by some computer somewhere. Although some network searching protocols are primitive by modern access standards, information can be accessed and retrieved as needed with accurate guides. In this sense, access is the same as ownership.

To some librarians, this might seem an abandonment of traditional library functions--the triad of obtaining, maintaining, and providing information. In looking for a model that could be used to justify this position, I turned to an article by Robert B. Reich in the Atlantic Monthly that is excerpted from his book on the world economy [22]. He notes that the distinction between goods and services--in library terms, between the housing of books and periodicals and the provision of information in digitized formats--has become meaningless. Reich divides work into slightly different categories that librarians might ponder. He recognizes the importance of "problem-identifying skills," for the development of customized products to meet individual needs [23]. In a different context that also could be applied to librarians, he sees the value of "strategic brokers," who, in business terms, bring the right pieces together to solve problems. He believes that "high-value enterprises are in the business of providing such services" as the ability to identify

and solve problems and the strategic capabilities to broker the two [24].

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This is where librarians should find their niche: identifying resources regardless of format and encouraging suppliers of network information to make their products readily and easily available. Focusing their future role not on being a warehouse of electronic or printed information, but on becoming an information utility that locates data in diverse sources seems more appropriate. Simply duplicating the collection practices we evolved for print materials in the network environment does not seem responsive to current needs or capabilities. Given high materials costs, our current collection development practices are not even working in the print environment.

There are specific areas in which libraries could profitably collect network information as a service to their users. The documentation and other files that enhance access or provide data about networks need to be locally available in the library and listed in online or other finding tools. They should be regarded in the same way as reference works, with new editions being acquired as they are produced and made accessible to the public as a whole. In a sense, this is analogous to the policies that we have pursued for online access to commercial databases. We do not, nor could we for copyright reasons, obtain all available files, but we have the documentation and can provide expert mediated assistance in accessing them. Just as online services have been integrated into traditional reference services, so should network access and resources be as well.

I would separate provision of network access to users and maintenance of documentation collections from issues of long-term network archival retention and preservation. Fortunately, there is already ample experience and context to guide decisions in the policies and procedures of machine-readable data archives in various institutions.

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For example, the University of Wisconsin-Madison has maintained, apart from the library, a Data and Program Library since 1966. It contains a rich collection of social science and other data archives, but it neither has, nor tries to retain, all available data files. Extrapolating from the experiences of such archives and casting them within a library framework, it is possible to see that libraries could acquire, catalog, and maintain some distinctive and important network materials, particularly those that are created locally or that have local interest or importance. A library could follow the pattern of data archives in providing both technical (programming) and other reference services specific to network materials, particularly those that originated from within its institution. In order to fulfill that function, it would need funding, expertise, computers, and other resources to manage the data as well as perform back up and other procedures to ensure that the data will be available when requested.

But most data archives depend upon a decentralized system akin to the membership in the Center for Research Libraries. An archive assists in identifying materials held elsewhere, obtains materials as needed, and, if they are retained elsewhere, does not permanently preserve them. Other data centers, in turn, have data acquisition, processing, dissemination, and other responsibilities that make it possible for a local archive to obtain data through this information network.

Perhaps we should aim for a similar model for network information, one based on successive local and interrelated state/regional libraries or centers that will assume retention

and preservation responsibilities for locally produced or unique materials. Such a decentralized system, that parallels state and regional organizations already in existence, seems sensible and might avoid burdening any single institution.

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Librarians responsible for deteriorating print collections have learned many lessons about the need to do preservation properly. Although preserving the historical network record is important, we should be careful before assuming another preservation task that is even more complicated than the one we have now. Reading a title page, understanding the relative importance of the book, and finding a means to preserve a title on microfilm are less complicated than making the same decisions about machine-readable data. We can learn much about storing and managing various bibliographic, non-bibliographic, or other data in electronic formats from our colleagues in data archives and benefit from their years of experience. Assuming the burden of preserving network information is a national dilemma. It requires cooperative rather than individual efforts. It raises questions that most libraries, particularly in these times, are ill-equipped to handle alone.

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QUESTION 5: As one response to the deepening crisis in the cost of library materials, colleges and universities could become publishers of network-based electronic journals, index and abstract databases, and scholarly electronic books. Should they do this? If so, what role should libraries play in this effort?

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Is it begging the question to ask if we really know what electronic publishing is? Does electronic publishing require the same set of activities required of print publishing? The ways in which electronic publications are used differ greatly from the ways books are used. Still there are similarities in the concerns of both types of publishers.

Quality control is a key issue. For any electronic publisher, it will be important to acquire worthwhile materials for publication and to assure the integrity of the electronic publication, whether it is an abstract database or an electronic book. Production is not as great a problem for the electronic publisher as it is for print publishers. Editing will be easier because it is possible to exchange drafts directly with the author(s) of an electronic publication. But editing will still be necessary. Distribution will be a piece of cake for the electronic publisher compared to the expense of distributing printed items. The trick will be identifying markets for the electronic publication--determining the channels of distribution. Marketing may or may not be easier in an electronic environment. Finance and accounting will be more difficult. The traditional publishing industry provides us with no point of reference here. For example, how does one factor the cost of maintaining the network into the cost of electronic publishing? We also must recognize that it is possible to vary the size of electronic units of information. Is our unit of accounting the volume, the issue, the article, the citation, or the word?

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There are a number of players in a position to influence the future of electronic publishing. Almost all of them, including libraries, have some stake in the traditional publishing

industry. Universities, the government, computer companies, phone companies, utilities like OCLC, even cable companies join the library community as major players in the nascent electronic publishing industry. The number of old line publishing houses joining the electronic game has increased dramatically of late. The industry is far from maturity; it is in its infancy at best.

What you are reading right now is an example of electronic publishing in its infancy, and the fact that it is published by a library is evidence that libraries can become electronic publishers. So yes, libraries should become electronic publishers, but this is not something to be considered lightly. Managing an electronic publishing enterprise of any substance would require a strong administrative commitment over the long term and a willingness to subsidize the service in some way. Participation in a cooperative publishing enterprise would require a lesser commitment and is more feasible for all but the most ambitious libraries. No matter who publishes something, somebody has to pay for it, although the costs of electronic publishing are lower than the cost of traditional publishing and distribution. Putting an OPAC on the network is less costly than publishing and distributing printed catalogs.

Republishing texts in electronic formats is one area where we're already seeing a lot of activity. The Freedom Shrine collection of historic documents on the Cleveland Free-Net and Shakespeare on Dartmouth's OPAC are two of many examples of this activity. Project Gutenberg is another example of a concerted effort to republish texts in electronic form. Public file directories on the network are also a useful form of publishing. It's possible to FTP just about anything today. I was pleasantly surprised by the number and quality of bibliographies I have found on the network and also by the many thought provoking essays on the network's potential and future.

Cornell and Xerox are conducting an experiment that may add a new dimension to the idea of libraries as publishers. Images of brittle books are scanned, sent across a network, and printed in high resolution on a Xerox Docutech machine. With the proper infrastructure in place one could use the network to deliver images of brittle books across the world almost as easily as they are delivered across Cornell's campus.

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Others are sending graphic images across the networks in addition to images of text. However, graphics require large amounts of network bandwidth. Yet, as network capacity increases, video will become more common. As it becomes easier to combine different types of information, libraries may publish new forms of information. Beyond text-based "electronic books" there will be multimedia electronic documents. The "electronic book" of the future is as likely to be a composite as it is to be a single coherent entity. Scholars will compile their own electronic books by gathering separate pieces of information from different parts of the network. Libraries may become publishers simply by using the network to build customized multimedia documents for clients or by providing the technology, training, and facilities to allow clients to build their own composite documents.

Libraries have been publishers of printed works for centuries and have achieved a reputation for high quality. When it comes to publishing original material, whether it is a bibliographic file, a numeric database, or an electronic journal, quality control is definitely the major challenge of electronic publishing.

Indiscriminately making files available on the network is not publishing. The quality control system for the printed word is much more firmly established and highly evolved than that for the electronic word and image. Technology has advanced to the point where we need to start considering how to develop a system of

quality control. There is no doubt that we are on the verge of profound changes in the way we produce and communicate knowledge.

Postscript

When I set out to write this piece, I wondered whether it would be possible to explore the ideas I was being asked to treat by doing all of the research from the computers in my office and my home, without connecting to any commercial services. In other words, I wondered if the network would reveal its secrets to me without my having to consult any printed works or commercial online sources. I can now say that it is possible to use the network to find out about the network. In fact much of the subject matter now being carried by the network is about the network.

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However, it does help to start with a good printed guide. If I hadn't been introduced to the secrets of the network by a few good articles and books and by reading PACS-L every day, I'm sure my task would have been much more difficult. Beginners on BITNET are advised to get some of the files available from the server `LISTSERV@BITNIC`. The file `BITNET USERHELP` is a good one to start with. Internet novices face a more formidable task, but the FYI series of RFC's that are available from `NIC.DDN.MIL` are a good start. RFC 1175 is an excellent bibliography that can lead the network beginner to many valuable sources. The many other network sources I consulted via BITNET and the Internet are too numerous to even mention, much less describe, in the amount of space allotted for this contribution. Maybe that is the point.

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Virtually every college and university requires publication as evidence of scholarly achievement and the advancement of knowledge. Sustaining the publishing process is not only in the self-interest of academic institutions, but is also their obligation. In the current publish-or-perish model, the academic community has hired the commercial sector to provide editorial review, indexing and abstracting, printing, and distribution of faculty publications. However, the continuing trend toward cancellation of journal subscriptions indicates that the costs of the publishing process are too high. Many have commented that the practice of paying scholars to produce knowledge and then paying a second time to acquire it from publishers needs reevaluation.

If the current paradigm for scholarly publication continues to break down, the university community will likely examine options for self-publication. It is also likely that the computing and network infrastructure in place on most university and college campuses would be an attractive option for the storage and distribution of scholarly information, especially since most publications are now created initially in machine-readable form. The implications for such a change are beyond the scope of this question, but electronic publishing should and will continue to expand.

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Other probable partners in this scenario are the university presses, professional associations, and libraries. Librarians offer an obvious pool of expertise for the indexing, abstracting, and cataloging needs of self-publishing. Also, libraries are a natural location for a locate-and-print-on-demand service from network files. Of course, this scenario assumes that buying

electronic articles on demand, even for multiple users, would be less costly than current subscriptions to paper journals.

There continues to be great pressure on libraries to develop collections. This is in part due to the tangible security of ranges of books and periodicals and the need to purchase before a title goes out of print, but it also reflects dissatisfaction with the time it currently takes libraries to deliver a remotely held item through interlibrary loan. However, the advances taking place in high-speed network file transfer and print-on-demand technology might make requesting a remotely held electronic file more attractive than physically searching for it in the stacks and photocopying the needed information.

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"History is on our side. We will bury you."
Nikita Khrushchev to Western ambassadors
at a reception in the Kremlin, November 17, 1956.

It will take more than the rhetoric of a few academic librarians and computing administrators pounding their shoes on a table to displace the foothold a journal such as the Journal of the American Medical Association has within the medical community. There needs to be an acceptance among a wider audience that a fundamental change in the nature of scholarly publishing, namely--a headlong charge toward electronic publishing led by academic librarians--is worthwhile before even journals of lesser stature than JAMA will be widely replaced by electronic counterparts. Whether this widespread acceptance currently exists in the academic community is uncertain, although it is clearly growing.

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Should colleges and universities become publishers? There is a clear precedent for such an activity in the many university presses that already operate. Although these small presses account for only a tiny fraction of all published material, it is an important fraction when the quality of scholarship is considered. The extension of these publishing activities into a networked environment is a logical step in network evolution. However, it is one that will not be achieved without the investment of considerable resources by academic institutions.

Certainly, the enabling technology exists. Electronic publishing can occur in academia, but on what scale? Can one reasonably expect home-grown publications to supplant the entire book-trade industry overnight? Visions of a paperless society are hardly new. The barriers that have prevented the achievement of such a vision are many and varied. While some are vanishing, others linger. Providing academic libraries and, ultimately, the users of academic libraries with the enabling technology remains one such barrier. This barrier can be overcome only with the investment of sufficient fiscal resources to provide the needed hardware and to develop the appropriate software.

Meeting user expectations and achieving user acceptance may prove the more difficult tasks. People are reluctant to change. In order to satisfy user expectations, reading electronic materials must be a pleasant experience, more pleasant than the experience offered by the commonplace 25 x 80 character monochrome terminal. The user will expect utility from an electronic publication similar to that found in the print counterpart. The incorporation of graphic images and photographs similar to those already found in print publications will be mandatory in order to meet this challenge. The user will want the ability to vary a display to suit individual needs, to manipulate the text, to

download the text, and to print the text.

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Rather than attempt to undermine the financial viability of existing publishers, the academic community should cooperate with publishers to develop alternative network solutions for access and ownership problems. Publishers surely recognize that the nature of scholarly communication is changing, and they will not jeopardize their businesses by resisting that change. Dialog between the academic community and publishers does not obviate the need for continued development of electronic publications within the academic community. Colleges and universities should, by whatever means possible, strive to publish electronic publications that meet high standards of scholarship. However, such dialog does reflect a deeper understanding among those in the academic community of an intricate set of intertwined problems that permeate scholarly publishing and a recognition that the current publication practices are not likely to be displaced overnight even if such an occurrence was beneficial to the academic community.

Until libraries and computing centers have proven the scope of networking technology to the satisfaction of the user community, they can expect some stiff resistance to electronic publications. Similar resistance in the user community has already been experienced as libraries began facing massive cuts in serials acquisition budgets. Pilot publications, particularly within disciplines outside the realm of library science, need to demonstrate the feasibility of electronic publication to the satisfaction of the user community. But it is probably a little premature to cancel all your journal subscriptions.

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Unfortunately, the image that emerges for me when I think of scholarly societies, universities, and libraries and their roles in the creation of information systems of all kinds is, with rare exception, one of passivity. Few organizations have assumed responsibilities for adequately providing access to the information they produce; few institutions adequately index what they acquire.

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Librarians have perceived themselves as passive observers of the information development process, as opposed to active shapers of an information future. Although we can point with pride to our achievements in managing and providing existing information, we have been secondary players in many other respects and did not participate, except as consumers, in the explosion of information management systems that characterized the mid-1970s. We do not index our periodical collections, but count on others to do it for us. We do not buy information from other libraries, but from vendors. We do not publish, we purchase.

The issue now is whether there are other options that networks make possible. In reviewing those choices, the barriers to implementing any of them need to be considered. First among them is the issue of information ownership. The privatization of information and publishers' recognition of its extraordinary commercial value have led to significant price increases. Librarians have limited potential now to convince publishers to surrender rights to information of whose value they have just recently become aware. If they did, libraries would become competitors with a private sector that has proven its ability to pay for access to technology, to provide rapid information dissemination (even if it is at a substantial price), and to

influence political leaders at all strata of government that interference with the private sector is inimicable to quality information access and provision.

There are also limiting factors among libraries themselves, which are rooted in tradition and relate to political and social factors. Cooperation, or the lack of it, is one. Morten Hein's comment that "Even if everyone agrees on the benefits of cooperation, we have little practical experience in cooperating with one another" has broad applicability to libraries everywhere [25]. Although there are encouraging signs that this situation is changing both in Europe (through activities of the European Economic Community) and in the United States (through agreements among member institutions of the Research Libraries Group, the Committee for Institutional Cooperation, and other associations), the surrender of local autonomy and privilege for the sake of regional or national benefit is still a rarity. The failure of the Farmington Plan to gather all foreign publications was one proof of that incapability. The idea that an institution would cooperate in a joint venture to publish an index of some kind, if it had to spend staff time on titles of little interest to the local community, might be foreign to those agencies that provide library funding.

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Yet, the concept of individuals and organizations, including libraries, as self-publishers of new information, who would then make it available through networks, is so tantalizing that I am reluctant, despite obstacles, to surrender it. I can see the potential in library list servers as well as discipline-oriented titles such as the Bryn Mawr Classical Review [26]. The Review, an example of what can be done in providing scholarly analyses of the literature, has been going through a period of experimental "e-distribution" with a table of contents and other features that make it resemble a printed work. Its editor is learning to cope with the problems inherent in publishing a journal of classical studies when our systems cannot display Greek adequately. (The editor offers "e-readers" the opportunity to get a hard copy through "snail-mail.") His experiences can serve as a guide to future information provision in fields with similar difficulties. This example encourages me to believe that there are similar opportunities for other individuals and organizations, including libraries, to provide similar tools and aids not now being provided by current systems.

Libraries collecting and making available to their patrons network publications and electronic journals of this kind will find that it may require a commitment of additional equipment and storage space, which means that long-term provision of access may be difficult. Two issues of the Review, which were delivered in April, take about 400 KB. Adding other titles to this one will soon fill up even the largest hard drive. Since indexing to various network e-journals is not common, libraries also will have to address this issue as these journals proliferate. Still, the Review is a worthwhile example of what can be accomplished in adding network knowledge tools at little cost, despite subsequent problems for library information management.

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Perhaps libraries have the opportunity to fulfill other information needs while still serving their local communities. Entering the complex scientific or technological information scene, even though this would be the area that would presumably attract many users, seems difficult. There are simply too many well-funded players eager to serve a private sector able to pay. Yet, this may be an area where libraries could function as publishers of indexes, because costs are so high for basic tools. As the Review shows, unmet needs for the humanities are also prevalent. Considering the collective store of technical and

subject expertise that is available, libraries could consider creating and sharing network humanities indexes or other information access tools. Variants of desktop publishing and the adoption of a standard page mark-up language could lead to publications such as library bibliographies and finding aids being distributed electronically as well as in a printed format. Networks are an ideal way to disseminate this information.

In order to remain in the game, libraries may have to become information producers and mediators as well as consumers. Demand for immediacy of information access in an increasingly competitive world means that individuals will access the fastest form of information and bypass the library if it does not meet their needs. Yet this new information environment also creates a role for libraries in creating and disseminating, at the least, indexes and other aids for accessing network information. Indexes to e-journals are one example; if libraries don't provide them, someone else will. There are already good examples of guides being created: a list of electronic journals has been compiled by Michael Strangelove of the University of Ottawa and a HyperCard-based Internet Tour has been developed [27]. While Elizabeth Lane admired such efforts in a PACS-L message, she correctly noted that "this is happening in such a scattered way," and she saw the "need for libraries to take an institutional role in seeking out, and even creating, these resources" [28]. Dewey Bayer has noted that libraries should work to facilitate the potentials of network technologies and help the beginners who otherwise have to "search for months in order to haphazardly build a knowledge base" [29].

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The intensification of the struggle for resources that has characterized the first two periods of Daniel Bell's vision of the post-industrial society may be extended to disputes about information access in traditional, electronic, or network formats. The development of international multimedia giants that dominate knowledge fields imperils access at reasonable cost. As information in electronic formats exists and is propagated now, those that have the funding get the information, whether on a campus or among nations. Whether--and how--that issue is resolved will have long-term impacts on even those libraries that consider themselves to be information rich now. Networks and new methods of information distribution through networks have the capacity for smoothing out issues of equitable and free access to information. Unlike the mid-1970s when many of the currently used commercial systems evolved, libraries have enhanced technological capabilities that make it possible for them to use networks to take advantage of publishing and other information dissemination capabilities. Joining with scholarly organizations and institutions, they should do so--now.

Notes

1. Richard P. West and Richard N. Katz, "Implementing the Vision: A Framework and Agenda for Investing in Academic Computing," EDUCOM Review 25 (Winter 1990): 33.
2. Barbara Wittkopf, "BI Librarian Involvement in the NREN," Research Strategies 9 (Winter 1991): 2-3.
3. Thomas R. McAnge, Marcia Harrington, and Mary Ellen Pierson, Survey of Educational Computer Networks (Blacksburg, VA: Virginia Polytechnic Institute and State University, 1990).
4. Dr. Art St. George, e-mail message to PACS-L@UHUPVM1, 21 July 1991.
5. Robert M Rosenzweig, "Research Universities in the Next Decade," College and Research Libraries 43 (March 1982): 102-109.

6. Richard W. McCoy, "The Electronic Scholar: Essential Tasks for the Scholarly Community," *Library Journal* 110, no. 16 (1 October 1985): 39.

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7. Send the message "GET WHITEPAG KNOPPE_M" to LISTSERV@BITNIC to receive an article discussing the Internet White Pages project.

8. To subscribe to the WAIS-DISCUSSION list, send the message "ADD your e-mail address WAIS-DISCUSSION" to LISTSERV@THINK.COM. To subscribe to the WAIS-INTEREST list, send the message "ADD your e-mail address WAIS-INTEREST" to LISTSERV@THINK.COM. If you have trouble, send the message "HELP" to the above address.

9. John Markoff, "High-Speed Data System is Discussed," *New York Times*, 16 July 1990, section D, 1.

10. A electronic document by Sue A. Dodd provides information about formatting bibliographic references to computer files. To obtain this document, send the message "SEND COMPFILE BIBREF" to COMSERVE@RPIECS.

11. Diane Kovacs has produced a good directory of academic lists. This multiple-file directory can be obtained via FTP from [KSUVXA.KENT.EDU](ftp://KSUVXA.KENT.EDU). Dr. Art St. George has produced a list of network-accessible library catalogs. To obtain this list, send the following message to LISTSERV@UNMVM: GET LIBRARY PACKAGE. A useful bibliography on computer networking by Elliott Parker illustrates the evolving type of information needed to identify and obtain network resources that are not typically included in bibliographic references. To obtain this bibliography, send the message "SEND COMPUNET BIBLIO" to COMSERVE@RPIECS. K. L. Bowers et al. have produced another useful bibliography on networks. To obtain this bibliography, send an e-mail message to SERVICE@NIC.DDN.MIL that says "RFC 1175" in the subject line of the message.

12. To access the Harris Poll database, TELNET [UNCVML.ACS.UNC.EDU](telnet://UNCVML.ACS.UNC.EDU). At the user prompt, type "IRSS1"; at the password prompt, type "IRSS."

13. Charles Perrow, "On Not Using Libraries," in *Humanists at Work: Disciplinary Perspectives and Personal Reflections* (Chicago: University Library, University of Illinois at Chicago, 1989), 29-42.

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14. Ibid, 37.

15. Clyde Hendrick, "The University Library in the Twenty-First Century," *College and Research Libraries* 47 (March 1986): 127-31.

16. Thomas Sanders, e-mail message to PACS-L@UHUPVM1, 10 February 1991.

17. Steve Cisler, e-mail message to PACS-L@UHUPVM1, 7 February 1991.

18. Linda Bills, e-mail message to PACS-L@UHUPVM1, 20 February 1991.

19. Ithiel De Sola Pool, "The Culture of Electronic Print," *Daedalus* 111 (Fall 1982): 17-31.

20. The FTP address for Project Gutenberg is [MRCNEXT.CSO.UIUC.EDU](ftp://MRCNEXT.CSO.UIUC.EDU) (look in directory /etext). The FTP address for the Open Book Initiative is [WORLD.STD.COM](ftp://WORLD.STD.COM).

21. The FTP address for the University of Tennessee Libraries HyperCard stacks is UTKLIB.LIB.UTK.EDU.

22. Robert B. Reich, "The Real Economy", Atlantic Monthly 267 (February 1991): 35-52.

23. Ibid, 37.

24. Ibid.

25. Morten Hein, "Library Cooperation Based on Information Technology Networks--A Vision for a European Library Future," IFLA Journal 17, no. 1 (1991): 39-44.

26. To subscribe to the Bryn Mawr Classical Review, send the message "SUB BMCR-L first name last name" to MAILSERV@BRYNMAWR.EDU. The editor's e-mail address is JODONNEL@PENNSAS.

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27. Steve Cavrak, e-mail message to PACS-L@UHUPVM1, 25 April 1991.

28. Elizabeth Lane, e-mail message to PACS-L@UHUPVM1, 25 April 1991.

29. Dewey J. Bayer, e-mail message to PACS-L@UHUPVM1, 25 April 1991.

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