Service providers and users discover the Internet

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Although the Internet has evolved over more than twenty years,
resources useful to health information professionals have become
available on the Internet only recently. A survey conducted by the
Regional Medical Libraries of the National Network of Libraries of
Medicine in the fall of 1993 indicates that libraries at academic
institutions are much more likely to have access to the Internet (72%)
than are libraries in hospital environments (24%). Health information
professionals who take on the challenge and exploit the Internet's
resources find rewards for themselves and their clients. The basic
electronic mail capability of the Internet allows colleagues to
collaborate, communicate, and participate in daily continuing
education. Internet terminal and file-transfer capabilities provide
improved access to traditional resources and first-time access to new
electronic resources. Through the Internet, online catalogs are
available worldwide, and document delivery is faster, cheaper, and
more reliable than ever before. Institutions can make organizational,
full-text, online, and publication information available through
Internet tools such as direct file-transfer protocol (FTP), menu-based
Gopher, and hypertext-based Mosaic. The National Library of
Medicine (NLM) is among organizations finding new ways to provide
service through the Internet. NLM now uses electronic mail to
communicate with users, FTP service to distribute publications, and
tools such as Gopher and Mosaic to distribute publications and
graphics and connect users to online services. The Internet allows
service providers and health sciences information professionals to
work in a rich, new medium whose potential is just beginning to be
explored. At the same time, its characteristics—including lack of
formal organization, standards, quality control, and permanence—
pose a challenge.

The phrase *information explosion* has never been more
appropriate than when used to refer to the growth
of information resources available on the Internet.
Although the Internet has evolved over more than
twenty years in the scientific community, it has been
fewer than five years since the first resources com-
monly used by information professionals became ac-
cessible via the Internet. A literature search using
Library Literature on Wilsondisc® from 1984 through
1993 illustrates how recently the impact of the Inter-
net has reached libraries. The search yielded 182 ci-
tations indexed to the subject term "INTERNET." Of
those, eighty-four articles were published in 1993 and
sixty-three articles in 1992, for a total of 81% pub-

lished in the last two years. Only four articles appeared before 1990.

NEW AVENUES TO TRADITIONAL DESTINATIONS

Biomedical librarians are discovering a multitude of uses for the Internet by mastering and exploiting new skills and terminology. Through tools such as electronic mail (e-mail and listservs), access to remote systems (telnet), file-transfer protocol (FTP), and menu-driven or hypertext interfaces (such as Gopher and Mosaic), the Internet provides new links to colleagues, services, and information. Before the Internet, some of these resources were available through dial-up computer connections, but most could be accessed only by telephone, the postal service, or physical travel.

E-mail and listservs allow users to collaborate with colleagues quickly without travel or "telephone tag." Through remote terminal sessions, librarians can access resources such as online catalogs all over the world. Through FTP, users can transfer documents, publications, and data files anywhere, without the delays of a modem or the postal service. And, through menu-driven or hypertext interfaces, anyone with an Internet connection can browse, search, and retrieve information in text, graphic, or multimedia formats.

Online services and catalogs

Among the first resources to become available over the Internet were the traditional online services such as DIALOG, BRS, and the National Library of Medicine's (NLM) MEDLARS®. Traditional services for searching bibliographic databases long have been accessible to libraries through direct modem dial-up or value-added networks (VANs) such as Tymnet, Telenet, and Compuserve. These established database systems now offer access via the Internet as an alternative to dialing in through a modem. A direct connection to the Internet offers advantages such as faster communications, a more reliable connection, and the elimination of any need for a phone line or modem. Providing Internet access can cost database providers less than providing VAN access, because the user institution usually pays a fixed fee for the Internet connection.

Once users establish communications through the Internet, they interact with the search system just as if they had dialed in with a modem, but the transition is not necessarily seamless. Internet access to online services usually requires that users learn to use new communications software. Technical problems may arise while the technical staff learns and supports new technologies. However, as users and institutions have gained experience with this new kind of connection, the Internet has become a popular access method. At NLM, for example, almost 20% of the traffic coming into the online systems travels through the Internet, and this percentage continues to increase.

Large bibliographic utilities also have added Internet access as an alternative to dial-in modem access through a VAN. The Research Libraries Information Network (RLIN) [1], which includes a union catalog of more than fifty million items held in research and special libraries, first became available on the Internet in 1989. The Research Libraries Group (RLG) now provides access via the Internet to its newest services, Eureka®, a patron-oriented interface to RLIN and other commercial databases, and the Citadel® citation files for ordering documents associated with Eureka [2]. The Washington Library Network (WLN) offers Internet access to its eight-million-record database of the holdings of 500 northwestern libraries. The WLN user-friendly interface Easy Access is available for searching both the WLN database and several databases of University Microfilms International (UMI) and Information Access Company (IAC)[3]. Similarly, OCLC's FirstSearch®, designed for use by the public, is now available through the Internet, as is PRISM®, the interlibrary loan link to FirstSearch. OCLC now allows libraries to reach the OCLC computer via the Internet to FTP files of archived records. These three library service organizations—RLIN, RLG, and OCLC—have combined an easy-access interface with fast, low-cost Internet access and provided enhanced services for cataloging and resource sharing [4].

During the past few years, hundreds of online public access catalogs (OPACs) have become available over the Internet. More than 400 of these OPACs are in the United States. The wide availability of library OPACs has added new dimensions to the work of both information professionals and other professionals seeking resources. Information providers now can extend and enhance their services for the new open environment. Unlike the traditional commercial and resource-sharing systems, these online catalogs were created by libraries for local use. Without the Internet, these OPACs would have been made available only to the library's primary clientele through dial-up or local networks, but the Internet allows the library to make these resources searchable from anywhere.

Commercial library system vendors have encouraged this trend by providing paths to adding Internet access for institutions using their systems. Law libraries using Innovative Interfaces' INNOPAC system made their catalogs available on the Internet as early as 1991 [5]. Collections of several major public libraries, including Boston Public Library, Los Angeles Public Library, and Houston Public Library, now are accessible via the Internet through the CARL system of CARL Systems, Inc. National libraries in the United States, Canada, and other countries are making their catalogs available along with those of aca-

demic libraries and health sciences libraries through their use of commercial OPAC software from DRA, Dynix, NOTIS, and others. There are guides and lists of library catalogs, but the simplest way to access them is through the online list of Internet-accessible OPACs available on many gophers [6–7].

Document delivery and distribution

Document delivery and distribution is another area of traditional library services that Internet technology is changing. One of the most promising developments in document delivery is RLG's Ariel® software [8]. The software integrates off-the-shelf microcomputers, scanners, and laser printers to allow libraries to scan pages and send them over the Internet for printing at a receiving institution. Both institutions must have the Ariel software installed. The Internet provides less expensive, higher quality, and more reliable delivery than does fax to any destination in the world. Nearly 300 libraries in the United States and abroad use the Ariel system for interlibrary document delivery. In an example of the Internet culture, up-to-date Ariel Internet addresses for participating libraries are maintained and available for anonymous FTP from RLG.

NLM's Lister Hill Center for Biomedical Communications is developing a document delivery solution called DocView for receiving and manipulating electronic images available on the Internet. It consists of Windows-based client software, which is installed on the user's machine, as well as a remotely located Unix server that houses the documents [9]. In its prototype version, DocView can receive images transmitted from image servers, including copies sent via the Ariel system. NLM plans to incorporate DocView into its document delivery services such as LOANSOME DOC™.

Ariel and DocView both require that institutions have special software to transmit or receive documents. Research is underway to enable the use of standard Internet mail to transfer document images. The advantage to using electronic mail is that documents can be delivered to anyone with Internet access, not just sites with document delivery software. One emerging technology that may allow e-mail distribution is Multimedia Internet Mail Extensions (MIME). These developments hold promise for enabling libraries to provide copies of articles to other libraries and their users within hours, rather than days or weeks.

Full-text documents and information

Organizations quickly have taken advantage of the Internet to distribute information. Internet users can expect to find paths to current information about many organizations, including names, addresses, contact information, lists of reports, and other documents. Users can browse or search these documents by using tools such as Gopher and Mosaic. For example, a tour through the World Health Organization (WHO) gopher (gopher to "gopher.who.ch") guides users to the addresses, telephone numbers, fax numbers, telex numbers, and electronic mail addresses for WHO headquarters and the WHO regional offices. There are directories pointing to the WHO regional office for any given country and to e-mail directories of United Nations (UN) and UN-related agencies, including the Food and Agriculture Organization and Centers for Disease Control and Prevention. The WHO also provides brief descriptions of its computerized databases, along with contact information, and of its many services, such as Audiovisual Services, Health Legislation Notification System, and International Monitoring of Adverse Reactions to Drugs.

The National Institutes of Health (NIH) gopher (gopher to "gopher.nih.gov") illustrates the breadth of information available for physicians and other health professionals, researchers, and information professionals. Similar to the WHO gopher, the NIH gopher provides information about NIH organization, addresses and telephone numbers of NIH staff, and other general announcements. Gopher has provided an easy-to-use interface to much of the information in the National Cancer Institute's Physicians Data Query (PDQ) database. For example, detailed descriptive information on the purpose and design of clinical trials is given, along with specific information for both physicians and patients on current treatments for most cancers. Telephone contact lists, organized by state, also are included. Announcements of forthcoming NIH consensus-development conferences and the full text of the NIH conference statements are among the publications that may be read online or captured electronically. The National Institute of Allergy and Infectious Diseases (NIAID) gopher (gopher to "gopher.niaid.nih.gov") offers an AIDS information directory concentrating on reference and research tools, including press releases and the Center for Disease Control's (CDC) *Daily AIDS Summaries.* The full text of numerous related reports, such as the *1993 Surgeon General's Report to the American Public on HIV Infection and AIDS,* the Agency for Health Care Policy and Research clinical guidelines related to AIDS [10], and publications for caregivers, such as *Caring for Someone with AIDS,* are also available. The NIH gopher points to gophers of other institutions offering health resources.

In 1993, the Library of Congress (LC) made its online catalog LOCIS (telnet to "locis.loc.gov") available for searching through the Internet [11]. The Reference Manual and Quick SearchGuide for searching LOCIS are available for file transfer using FTP. With the appearance of the Machine-Assisted Realization

of the Virtual Electronic Library (MARVEL) gopher (gopher to "marvel.loc.gov"), LC introduced a Gopher interface to many full-text, factual, and secondary information sources. Besides providing access to the treasure of information held by LC, MARVEL points users to other government services, such as FedWorld, the National Technical Information Service (NTIS) Gateway to Federal Information Resources (telnet to "fedworld.gov"), and other guides to government services. Federal publications usually are not copyrighted, so both federal agencies and other organizations have moved quickly to make this material available electronically.

Examples of factual and full-text documents available through MARVEL are the congressional directories, U.S. Congress committee assignments, the Freedom of Information Act, the current and proposed federal budgets, and the Americans with Disabilities Act and related publications. Important documents from other countries are also available, such as the Canadian Constitution Act and the Meech Lake Accord and the Maastricht Treaty on European Union. MARVEL also points users to resources in health, such as the NIH gopher and the full-text of the CDC journal *Morbidity and Mortality Weekly Report*. LC MARVEL is heavily used. During one week in March 1994, more than 186,000 files were accessed [12].

Although most of the information currently is offered at no cost, some services will institute fees in the future. MARVEL points to a prototype gopher service from LEGI-SLATE, which permits the searching of documents from the *Federal Register*. LEGI-SLATE anticipates some level of free access in the final version, but an annual subscription will allow users to have unlimited access to information about all congressional bills and resolutions in addition to the *Federal Register*.

E-MAIL, LISTSERVS, AND OTHER ELECTRONIC COMMUNICATIONS

The Internet allows biomedical library professionals to communicate and collaborate more frequently and quickly than was previously possible. Listservs, mailing lists, electronic mail, and Usenet (a U.S.-based international network) also have changed the way library professionals communicate. For example, they are using listservs (mailing lists where subscribers each receive a copy of all messages) to keep up-to-date on current events in the field, ask questions of colleagues, and offer duplicate journal issues to anyone willing to pay postage.

MEDLIB-L serves these purposes, among others, for biomedical librarians. The statistics for MEDLIB-L show that more librarians are joining the electronic community. At the close of its first year, 1991, the MEDLIB-L listserv had 604 subscribers. By the end of

1993, there were 1,821 subscribing addresses, which reflects even more participants, because some addresses serve multiple readers. The average number of messages per day increased from two to fourteen during the same period. Although it is located in the United States, subscribership is international, with participants from thirty-five countries [13].

There are many listservs in subjects of interest to library and information professionals, and most professionals find themselves subscribing to a handful to keep up on several subject areas, from reference questions to copyright. For example, one helpful directory of scholarly electronic conferences is edited by Diane Kovacs and is available electronically through FTP or Gopher [14].

Outside the public view of the listservs, electronic mail also provides a new way for colleagues to communicate among themselves and with information providers. Many authors now include in their publications an e-mail address in addition to the traditional institutional postal address. Professional directories, such as that of the Medical Library Association, include e-mail addresses. For some professionals, e-mail has become as important as the telephone, especially for bridging long distances. E-mail eliminates the cost of long-distance telephone calls, the problems related to time-zone differences, and the difficulty of finding people "at their desk." Electronic mail can be very efficient, with answers crossing continents in minutes.

Information providers have begun to exploit the potential for electronic mail in user support. Before the Internet, user questions would have been asked by telephone or written correspondence. E-mail assists information providers that serve large numbers of users by allowing quick response to questions, eliminating the problems of contacting busy users by telephone across time zones. Many customer support staffs now provide answers by electronic mail and find it allows them to respond quickly, send a copy of a previously composed message, and often receive a "thank you" in response.

NLM EMBRACES THE INTERNET

NLM has made many of its existing services available over the Internet, developed new Internet services, and used the Internet as another way to communicate with users. For example, NLM is using the Internet to offer many publications free of charge. Introduced in May 1993, NLM's anonymous FTP server (FTP to "nlmpubs.nlm.nih.gov") provides access to more than 200 NLM publications, including fact sheets, biomedical subject bibliographies, AIDS information, system manuals, and newsletters. The publications server provides most documents in both plain text and PostScript® formats; users may select either the

basic textual information or a PostScript file that permits the printing of the publication in its original format.

The *NLM Fact Sheets*, the *PDQ Manual*, and *Health Services: Sources of Information for Research* are among the most popular documents on the server. Most of the publications were available through government sales programs, directly from NLM, or from the Regional Medical Libraries, but the Internet allows NLM to distribute electronically the most current versions of its publications to anyone in the world, instantaneously. From November 1993 through February 1994, more than 2,000 unique users FTP'd a total of 11,400 files from NLM. The server has allowed NLM to increase access to its information.

As have other major libraries, NLM has made its online catalog available over the Internet. The NLM Locator (telnet to "locator.nlm.nih.gov") interface was introduced for on-site patrons in February 1993 and for Internet users that May. NLM Locator allows menu-driven Internet access to NLM's CATLINE® (cataloged records of monographs and serials), AV-LINE® (audiovisuals), and SERLINE® (serials owned by NLM and by member libraries of the National Network of Libraries of Medicine [NN/LM]). Together, these databases represent the NLM collection, which has been available online for many years to MEDLARS users. NLM designed Locator so that these files could be searched easily by librarians, researchers, and the public and provides them free of charge for Internet users. The Internet allowed NLM to provide this access more quickly and easily than was possible with earlier technology. Locator use grows at a monthly rate of 700 to 800 new users, who conduct between 3,000 and 4,000 search sessions each month.

NLM Locator enables NLM staff to interact with users of its services through an electronic suggestion box, which attracts questions and comments daily on a variety of programs. NLM users have used this online suggestion box to ask for assistance in structuring queries, to let NLM know of problems with cataloging or serial records in the databases, to suggest new Medical Subject Headings (MeSH) and so on. Questions and comments come from librarians and other users all over the world, are forwarded internally by NLM to the appropriate responder, and can be answered quickly and efficiently using the Internet. This comment-box feature enables NLM to respond to questions from users that otherwise might have gone unasked and therefore unanswered. Direct e-mail address links to information and support staffs provide a popular alternative to the telephone and traditional mail for users, and a useful customer support tool for information providers. For example, NLM now receives twice the number of inquiries to its Reference Section via Internet e-mail (REF@NLM.NIH.GOV) than by regular mail.

The Internet discovery tools Gopher and the World Wide Web (known as WWW or the Web) Mosaic are described elsewhere in this symposium [15]. With Internet access to existing services and basic anonymous FTP established, NLM began to exploit these discovery tools. The NLM gopher (gopher to "gopher.nlm.nih.gov") became operational in November of 1993 and offers NLM publications, telnet sessions to online services, and links to specialized NLM gophers. The gopher menu makes it simple for users to browse publications, search for text words, and transfer the publication over the Internet for local use. The gopher also enables users to connect via telnet to NLM online services, including MEDLARS, Locator, and DOCLINE®. Specialized NLM gophers include the Toxicological Information Gopher. This specialized gopher provides a new mechanism for NLM to gather and distribute information resources in a particular subject for a specialized user group.

The most versatile Internet tools used by NLM are WWW servers, which can be accessed by clients such as Mosaic. Mosaic and other Web clients allow NLM to distribute information in a graphical publication format and include hypertext links to documents, photographs, sound files, video clips, and online telnet sessions. NLM has several "home pages" available, including one for general information, Hyperdoc (http://www.nlm.nih.gov/); a National Center for Biomedical Information (NCBI) home page (http://www.ncbi.nlm.nih.gov/), designed to serve the biotechnology community; and another maintained by the Educational Technology Branch (http://wwwetb.nlm.nih.gov). Mosaic allows NLM to provide information in a rich multimedia environment, which would have been more difficult to provide with previous technologies.

To reach all users who need health-related information, NLM makes use of several complementary approaches to distribute the same information. For example, the Health Services/Technology Assessment Text (HSTAT) service, consisting of full-text documents useful in health care decision making is accessible by dial-up or telnet for character-based terminals (telnet to "text.nlm.nih.gov", log in as "hstat") and through GRATEFUL MED, the NLM gopher, and the NLM Mosaic server. Users may choose from these interfaces to access and search the full text of NIH and Agency for Health Care Policy and Research practice guidelines and technology assessment reports.

INTERNET ACCESS AND HEALTH SCIENCES LIBRARIES

To determine the level of health sciences library access to the Internet, the Regional Medical Libraries of NN/LM conducted a brief survey in the fall of

1993 (Table 1). All 4,037 libraries that were members of NN/LM at the time were sent questionnaires. Thirty-three hundred thirty-one (3,331) usable responses were analyzed, for an 83% response rate. Health sciences libraries in academic institutions represented only 16% of total responses, but it was not surprising to find that 72% had access to the Internet. Hospital libraries made up 63% of responding institutions, but only 24% had access to the Internet. Overall, 34% of responding libraries reported that they had access to the Internet.

The survey also asked whether the library's parent institution planned to obtain access in the near future. Of the 2,089 hospital libraries that responded to the question, 16% reported that their institution already had access, while 9% (180) indicated that their institution would obtain access in the future. The majority, 75%, simply reported that their institution did not have access. In academic institutions, 66% already had access, and 11% planned to obtain it. The survey shows that academic institutions are well on their way to having 100% access to the Internet. Hospital libraries do not have the same level of Internet access as do academic institutions but also are moving toward becoming part of the electronic community. At the time of this survey, hospital libraries were ahead of their institutions in connecting to the Internet.

Responses to questions about what Internet services were available and which services were used indicated that many libraries are still in an "exploratory" stage. Only one third of the responding libraries (1,105) answered these questions. E-mail and listservs were the tools used most often by respondents (81%). The next most widely used capability was telnet for searching remote databases (63%). Fewer than half the health sciences libraries indicated that they used FTP or Gopher, and fewer than 200 libraries used Wide Area Information Server (WAIS), WWW, or Mosaic. Despite its rapid growth and the variety of services available, the Internet was used by the libraries surveyed primarily for e-mail and then for other information services.

CHALLENGES FOR INFORMATION PROFESSIONALS

Although it is generating positive changes in the provision of health information, the Internet also can be frustrating. Conquering the Internet requires constant searching, sifting, and selecting. Health sciences librarians always have used these skills with print and electronic materials, but the Internet, with its lack of formal organization, provides a new challenge. Finding specific information can be difficult because there is no standard vocabulary, no comprehensive catalog, and no quality filter. Information can originate in an established research institution or an en-

Table 1
NN/LM survey of health sciences libraries, October 1993

	All respon-dents	Library had Internet (%)	Institution has Internet (%)	Institution planning Internet access (%)
Academic libraries	529	383 (72)	348 (66)	57 (11)
Hospital libraries	2,101	500 (24)	326 (16)	180 (9)
Other	701	259 (37)	237 (34)	74 (11)
All libraries	3,331	1,142 (34)	911 (27)	311 (9)

trepreneur's basement. The same information may be available in multiple formats through multiple Internet tools, but it may not always carry the same name. Some sources of information may appear identical, but close scrutiny will uncover differences. Finally, there is little permanence on the Internet, so flexibility, persistence, and judgment on the part of the information professional are critical.

As the Internet matures and the navigational tools improve, health sciences librarians will find it easier to select and use the best tools and sources to meet the need of their clients. The Internet is a rich source of information, much of which has not been easily accessible until recently. It provides tools that enable professionals to communicate more effectively and provide improved access to new and existing services for their clients. The distributed nature of this "network of networks" fosters rapid growth in the number and variety of resources appearing daily. The size and variety of resources challenge health information professionals to build on traditional skills and apply them to this new information environment. The Internet offers information professionals an opportunity to develop and organize a growing wealth of information.

REFERENCES

1. RLIN databases accessible to individuals on national Internet. Libr J 1989;114:15.
2. RLIN Info. Ctr.—DFH. RLIN search access. Message to: Eve-Marie Lacroix. In: Internet [electronic mail system]. 1994 Feb 24, 16:27:55 PST; cited 1994 Feb 24, 19:27:41 EST [235 lines].
3. WAKEFIELD K. Re [3]: WLN/Internet. Message to: Eve-Marie Lacroix. In: Internet [electronic mail system]. 1994 Feb 25, 13:13:46 PST; cited 1994 Feb, 13:14:54 [139 lines].
4. DEAN N. OCLC/Internet. Message to: Eve-Marie Lacroix. In: Internet [electronic mail system]. 1994 Mar 3, 17:22:56 EST; cited 1994 Mar 3, 17:24:02 EST [38 lines].
5. ROGERS M. Innovative Interfaces gets its law degree; ten installations and sharing of INNOPAC via Internet mark firm position in law libraries nationwide. Libr J 1991;116: 30.
6. HANCOCK L. Internet/Bitnet health sciences resources.

Version 3-94. [monograph online]. Kansas City, KS: University of Kansas Medical Center, 1994. Available via ftp from: ftp2.cc.ukans.edu:/pub/hmatrix/medlst03.txt or medlst03.zip.

7. BARON B, MAHE M-C, EDS. Accessing online bibliographic databases [monograph online]. New Haven (CT): Yale University, 1993. Available via ftp from: ftp.utdallas.edu:/pub/staff/billy/libguide.

8. JACKSON ME. Using Ariel, RLG's document transmission system to improve document delivery in the United States. Interlending Doc Supply 1993;20(2):49–52.

9. WALKER FL, THOMA GR. Access to document images over the Internet. In: Conference Proceedings of IOLS 94. In press.

10. AGENCY FOR HEALTH CARE POLICY AND RESEARCH. Evaluation and management of early HIV infection: clinical practice guideline no. 7. Rockville, MD: The Agency, Public Health Service, U.S. Department of Health and Human Services, 1994. AHCPR Publication No. 94-0572.

11. Libr Cong Info Bull 1993 Sep;52(16):319.

12. LC Marvel usage statistics. In: LC Marvel [gopher]. [Washington, DC]: Library of Congress; cited 1994 Mar 23.

13. START N. 1993 MEDLIB-L statistics. In: MEDLIB-L [listserv]. Nancy Start, list owner. [Buffalo]: State University of New York at Buffalo, Health Sciences Library, 1994 Feb 23, 13:38:47 EST; cited 1994 Feb 24, 8:24 EST [73 lines].

14. KOVACS DK, ED. Directory of scholarly electronic conferences. 7th revision. [online monograph]. Kent, OH: Kent State University Libraries, 1993. Available via ftp from: ksuvxa.kent.edu:/library.

15. POWSNER SM, RODERER NK. Navigating the Internet. Bull Med Libr Assoc 1994 Oct;82(4):419–25.