Interconnected and Innovative Libraries: Factors Tying Libraries More Closely Together

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Abstract

This article considers the many developments in technology and practice that are making libraries more connected and interdependent. It looks at new integrated online services and reviews the increasing importance of both formal and informal standards. Global centralized Web services are discussed. The relationships between information industry companies and libraries are considered. Virtual reference services and far-reaching digitization projects are explored. The article concludes that close cooperation is allowing libraries to take their services to new levels and is key to the continued innovation of those services.

Introduction

Library consortia, organized at the local, state, national, and international levels, are what we most commonly think of when we discuss library resource-sharing networks. Library consortia—for shared catalog services, interlibrary lending, document delivery, and shared electronic licensing—are growing in influence and importance. However, library communities also work together in a variety of ways, both formal and informal, that go beyond, or underpin, consortium activities. What follows is a consideration of the many different ways in which library communities are becoming more closely interconnected.

The inherent capabilities of networked technology have presented libraries with opportunities to take their services to new levels. Libraries have been affected by general trends in computer technology. Libraries also share the enormous challenges of integrating new skills and methods, facing new sources of competition, and adapting to the rapid pace of technological change. *The 2003 OCLC Environmental Scan: Pattern Recognition*

(Wilson, 2003) provides a useful consideration of the changing landscape and technology-related challenges facing libraries. *Library Networks in the New Millennium: Top Ten Trends* (Laughlin, 2000) is another valuable work that looks at the forces affecting the development of library networks. In that volume of essays Hyman (2000) addresses the rapid growth in library user expectations in a world where instant communication and high-speed mobile access to worldwide information is the norm. Both *Pattern Recognition* and Hyman (2000, p. 97) conclude that cooperation and collaboration provide libraries with essential tools for meeting the challenges of the future. *Pattern Recognition* quotes Reg Carr: "If the last few decades of library and information developments have taught us anything, then it's surely that the really significant advances, and the meaningful and lasting solutions, are cooperative ones" (Wilson, 2003, p. 83).

As technology presents libraries with many new challenges, it also provides collaborative tools to address these challenges. Shared online services in libraries have grown in step with increases in bandwidth and network reliability. We now take for granted network communication, universally available e-mail, listservs, RSS news feeds, blogs, and wikis. The use of these communication tools to focus the efforts of diverse groups is a central feature of the current advancement of library services through shared technology.

New Shared Technology Services

Integrated Library Systems (ILS) continue to be a key part of library consortium activity. New library online services are also becoming the focus of library sharing. In his article "Re-Integrating the 'Integrated' Library System" (Breeding, 2005), ILS watcher Marshal Breeding outlines the growing range of online services libraries are able to offer. Important new technologies like virtual reference, Open URL link resolving, federated searching, content management systems, and user direct document delivery services are good candidates for shared and cooperative delivery. There are important economic benefits to sharing the costs of computer infrastructure needed for such services and spreading the workload among many libraries. There is also the considerable added benefit of providing a more common experience to users from groups of libraries.

As new services are being added to the offerings of ILS vendors, existing library consortia are sharing a wider range of services. New services are also an incentive for new libraries to join consortia. For services such as user direct document delivery or virtual reference, there are great benefits to having very large groups of libraries participating. Sharing services among many libraries makes possible a level of service that could not be achievable by any single library. It is not surprising that Marshal Breeding also suggests that he is seeing renewed consolidation taking place in the ILS environment, as larger groups of libraries share centralized resources for a growing array of online services (Breeding, 2004).

Standards as a Key to Resource Sharing

Development and use of common standards is one of the most important tasks that libraries perform collectively. Libraries have a long history of standards development previous to the development of the Dewey Decimal and Library of Congress classification systems (Straw, 2003).

Through adherence to standards, worldwide networks are created that successfully share resources, with little need for discussion among the participating agencies. Libraries exchanging materials via interlibrary loan need only follow agreed protocols to do so without the need for additional communication. In the same way, adherence to the Z39.50 search standard allows libraries and their users to routinely share information between their catalogs worldwide, without the need for any direct relationship or contact other than the reliance on a shared search standard.

In the online environment, standards are taking on new importance. Networked information services are increasingly based on automated interoperability, where transactions between libraries take place with the fewest possible steps, with little human intervention, and at computer transfer speeds. Automated methods are becoming essential to reducing the cost of library services and providing the speed of service that users have come to expect. New data, format, and procedural standards have become necessary. Much more closely applied standards are proving essential to making automated interoperability work reliably and effectively.

Library classifications systems and Machine-Readable Cataloguing (MARC) are major standardization achievements for libraries. The Z39.50 search standard was the first standard that allowed libraries to achieve the automated linkages that are becoming central to our networked services today. The release of the Z39.50 standard in 1988 was an important step, but equally important for the advancement of library networking was the creation of the Bath profile in 2000 (Lunau, 2003). Divergent implementations of the standard limited its usefulness. The uniform application of Z39.50 through use of the Bath profile has been as important as the application of the standard itself. This has proven to be the case with the MARC cataloging standard as well. It is an ongoing process to make the application of MARC more uniform (Library of Congress, Network Development and MARC Standards Office, 1998).

The National Information Standards Organization (NISO) is becoming a critical resource for library integration. NISO has been instrumental in development of many of the more important standards that are allowing the closer integration of library services. The Z39.50 search standard, the International Standard Serial Number (ISSN) numbering system, and the underlying standards behind MARC are NISO standards. More recently developed standards include the Open URL linking standard and the library Circulation Interchange Protocol (NCIP) (NISO, 2005a). NISO currently has task forces working on new standards for federated searching and cross-searching of multiple databases.

NISO is the information standards organization for a more general organization, the American National Standards Institute (ANSI). NISO is also a key player in the technical standards group (T46) for the International Standards Organization (NISO, 2005b).

The standards process itself is at every stage a collective activity. The standards organizations work through a broad process of consultation, with representatives from the information industry and from libraries. The final approval of NISO standards is voted upon by the organization's membership. Libraries and other organizations volunteer to act as Maintaining Agencies for each standard. For example, the U.S. Library of Congress is the lead agency for Z39.50, and NISO ILL is maintained by the Online Computer Library Center (OCLC). In addition to the organized standards process, interest groups and research communities form around individual existing and emerging standards. These informal groups are often as important as the official process in the implementation and advancement of standards.

In addition to the ISO/NISO/ANSI international standards system, many library organizations are active in developing standards. Counting Online Usage of Networked Electronic Resources (COUNTER) is an example of a single purpose standard-setting organization. COUNTER is an international nonprofit organization formed in 1992. It represents a large group of stakeholders including libraries and information companies. The group has worked cooperatively to implement standardized usage statistics for online journal databases. COUNTER built on the existing work done in this area, including guidelines developed by the International Coalition of Library Consortia (ICOLC) and the Association of Research Libraries (ARL) (COUNTER, n.d.). The International Federation of Library Associations and Institutions (IFLA) is particularly active in developing best practices and guidelines. ALA and its divisions are among the many other library organizations that are active in advancing standards and common practices in a wide range of areas.

Informal Standards

Libraries also share important resources through the use of a wide variety of informal standards. Of course, the process of standardization is not unique to the library industry. The Windows operating system or the Intel PC computer are common examples of informal standards.

One example of an informal standard in libraries is the software product EzProxy. Useful Utilities Company's EzProxy is one of the most popular means for libraries to offer their users remote access to the journal databases and other e-content resources that they license. It is considered a standard for this purpose. The software is used by over 1,500 library agencies in more than 35 countries and has recently seen its first users in China (Chris Zagar, personal communication, April 15, 2005). It has become a standard for

providing remote access to library e-content. Another example is Infotrieve Inc.'s Ariel software, which has become a standard for online electronic document transmission. Some 6,000 library sites around the world are currently included on the Ariel site list (Infotrieve, 2005).

Just as with official standards, important communities of interest form around commonly used software, methods, and services. The users of Ariel or EzProxy communicate to solve problems and share information and best practices. In the same way, libraries using any common application or a particular ILS system, document delivery software, metasearch tool, or link resolver form informal but very valuable information- and resource-sharing networks.

The use of XML markup language is another case of emerging standardization. Roy Tennant's *XML in Libraries* (2002) provides an excellent survey of the many ways XML can be useful in libraries. Major library system vendors, including Ex Libris, Sirsi, and Endeavor, have developed XML interchange features in their software to be used as the means of exchanging information with other systems. E-content vendors including Elsevier and Proquest have developed XML-based search interfaces as well. The use of this informally standardized markup language is allowing libraries to share XML methods and programming expertise. It also suggests possibilities for the creation of new formal interchange standards.

It is very common for important new developments in information practice to begin as informal standards and then be taken up by standards agencies and developed into more formal standards. This was the case with the Open URL linking standard, which was first developed at Ghent University and then used by the SFX linking software (Grogg & Ferguson, 2004).

Informal software standards are often transitory. The standard software or method for performing a certain task today is likely to change within a few years. It is also common for several informal standards to compete. One piece of software may be the common standard for one group of libraries in one region, while another competing application is favored by other libraries. Each software vendor of course strives to make its application the informal standard. This sometimes confusing competitive process has been the driving force behind much of today's innovative technology. One of the keys to this process of innovation is the widespread exchange of information and expertise by groups and individuals using particular software, services, or standards.

Open Source and Libraries

Open source software is another example of collaboration at work in libraries. Eric Raymond's *The Cathedral and the Bazaar: Musings on Linux and Open Source by an Accidental Revolutionary* (Raymond, 2001) is a useful introduction to the open source community and its method of shared development and cooperative maintenance of freely available software. The

library community, with its inclination toward collaboration, has proven well suited to the shared method of software development. The open source software movement has a strong following in libraries.

Thousands of libraries around the world rely on common applications developed through the open source process, such as the Linux operating system, the Apache Web-server software, or My-SQL and PHP Web database tools. These open source applications have become the informal standard in many libraries, as elsewhere. Open source development of library-specific software is widespread as well.

The Koha ILS system is an excellent example of an open source library project (Koha Open Source Library Systems, n.d.). This application was developed in Australia in 1999 and is now used in over fifty libraries around the world. The reSearcher suite of library integration software developed by the Council of Prairie and Pacific University Libraries (COPPUL) in western Canada is one of the most ambitious and successful open source library projects (COPPUL, n.d.). The PINES network of 249 public libraries in the state of Georgia has also recently announced plans to develop a new open source integrated library system (Kenney, 2004). Eric Lease Morgan's "Possibilities for Open Source Software in Libraries" (Morgan, 2002) provides a useful introduction to the use of open source methods in libraries. The Web site of Open Source Systems for Libraries (OSS4Lib, 2005) is a prominent resource for learning about ongoing open source library activities. The open source movement in general is an important means for libraries to share software resources. Each individual open source project creates its own dynamic resource-sharing network.

Centralized Information Services

Centralized services such as bibliographic utilities and union catalogs have long been an important focus of library cooperative efforts. As some centralized services like catalog copy utilities have declined in importance, new centralized services are emerging. Increased Internet bandwidth, increasing capabilities of Web services software, and the decreasing cost of server technology are making wider sharing of library services possible. A growing capability and willingness to act collectively are also contributing to this development. In a growing number of situations, nationally or internationally centralized library services are developing.

Internet search engines, particularly Google at present, have become very important centralized information services. Google's initiatives to expand the public Internet content have received a great deal of attention. These include the Google Scholar scholarly materials search engine and Google's partnership with prominent libraries to digitize library collections (Carlson & Young, 2005). Google is partnering with a large number of e-content vendors and indexing projects to make a growing volume of journal information available via public Web search.

Google's digitization projects have generated considerable controversy. Their efforts to expand the accessible content of the Web build on long-standing earlier cooperative efforts, notably Project Gutenberg. The recent announcement of a major digitization effort by national libraries in nineteen European countries is also noteworthy, particularly for the non-English speaking world (Farrell, 2005). Other search engines including Yahoo and MSNet are also active in expanding Web content. Centralized Web services in general are an area of strong business competition (Vogelstein, 2005). New players and new content services will no doubt continue to evolve rapidly on the World Wide Web. Web search engines will continue to emerge as one of the most important centralized information resources.

OCLC has long been a key provider of shared library services. Their Open WorldCat service is a major new development in centralized library services. OCLC has partnered with Yahoo, MSN, and Google in the Open WorldCat project, which will make over 50 million library catalog records from OCLC's WorldCat union catalog records searchable via Web search engines. OCLC also provides the means to link from a retrieved book reference to the Web searcher's local library (Mattison, 2005). In addition, both OCLC and Google are developing central services that allow individual libraries to provide links to their journal holdings. Through these services, users will be routed to the appropriate link resolver or library catalog to determine if resource references found on the Web are available in a local library (OCLC, n.d.; ResourceShelf, 2005).

Crossref is another important centralized service. Crossref is an industry organization with library membership that provides a central repository of location information to access e-journal materials available from over 1,400 publishers and societies. The service uses Open URL standard digital object identifiers to maintain up-to-date linking information for over 15 million articles in more than 11,000 journals available electronically (Crossref, 2005). Crossref can offer article- or journal-level Digital Object Identifiers (DOIs) and has recently begun offering linking to material cited by a retrieved article. Crossref is not intended to be a tool for direct patron searching. Instead it can be used in the background, by library ILS software and e-journal search software, to link from retrieved citations to available full-text content held by many different publishers. The creation of Crossref is an indication that online vendors and publishers see the benefit of working together rather than offering services independently.

RedLightGreen is the Research Libraries Group's (RLG) award-winning centralized Web accessible union catalog. This user-friendly library portal was developed with funding from the Mellon Foundation as a collaboration among RLG, Columbia University, New York University, Swarthmore College, and the University of Minnesota (Proffitt, 2004). Rather than working primarily through the Web search engines, RedLightGreen offers centralized searching of over 45 million titles from the RLG union

catalog. Through its easy-to-use portal interface, it provides links to local library holdings as well as citation assistance.

Shibboleth authentication is another example of a centralized service that will have a significant impact on libraries. Shibboleth authentication was developed as an Internet 2 project. It provides a method for vendors of e-content and institutions that license full-text content to validate authorized users in order to share information. Shibboleth ensures the security of materials traveling over the Internet while providing authorized users with easy, safe, and private access. This federated method of authentication requires content providers and users to work closely together and to share common methods of authentication and standards of security. It will provide a flexible and more secure replacement for current methods used to validate the use of content over the Internet (Needleman, 2004).

The possibilities for centralized information and library services are great. A growing number of information services can now be delivered as widely shared centralized services. Libraries worldwide are becoming more closely involved with these resources, including freely available Web resources and library consortium offerings. Greater connections are needed between freely available Web resources and individual library services and holdings.

Virtual Reference Services

Virtual Reference Services are another application where the sharing of technical resources and workload is proving to be valuable. These services have developed rapidly and received considerable attention recently. The Library of Congress worked with the "Global Reference Network" and OCLC on the early development of online reference. This work led to the development of OCLC's popular QuestionPoint virtual reference software (Quint, 2002). A range of other software products has developed as well. A recent survey showed that seven prominent virtual reference software products are now being used by over 2,800 libraries around the world (Olivares, 2004).

The Virtual Reference Desk is a promising project sponsored by the United States Department of Education. It has assisted in the creation of a network of more than 100 "Ask a"- type virtual reference services. Many of these are nonlibrary projects offering reference-type information on a wide variety of specialized topics. The Virtual Reference Desk is a wide-reaching resource-sharing project that includes both libraries and other information-providing organizations (Virtual Reference Desk, 2002).

The process of establishing standards for virtual reference services is underway. Several organizations have developed best practices in this area. IFLA began a Digital Reference Standards project in 2001 to work with a wide variety of groups, including the Reference and User Services Association (RUFA), OCLC, NISO, and the Virtual Reference Desk project (Fullerton, 2002).

Information Industry and Library Partnerships

The publishing and information services industries are changing rapidly. Business mergers and partnerships are bringing about their own sort of resource sharing through consolidation. Major publishers such as Gale, Bowker, and Academic Press have joined with larger companies. The merging of the ILS company Endeavor with the publisher Elsevier, or the e-serials service company Serials Solutions with the e-content aggregator Proquest, are examples of formerly separate information services coming together. Libraries are being offered an increasingly unified and integrated range of services.

Online information vendors are involved in a growing array of partnerships, of which Crossref is just one example. The new services that are becoming available—federated searching, Open URL linking, and virtual reference—all depend on the use of common standards and methods and on close cooperation among e-content vendors. Both Proquest's director of platform management, John Law, and EBSCO's chief systems architect, Oliver Pesch, agree that even more standardization and cooperation between online information companies is needed (Grogg & Ferguson, 2004). It is not surprising that the metasearch company MuseGlobal prominently "showcases" its partnerships with major ILS vendors and e-content providers (MuseGlobal, 2005). In the same way, ILS vendor Sirsi lists eighty corporate partners on their Web site (Sirsi, 2005). The successful functioning of online products is increasingly dependant on cooperation.

Publishers and information services vendors are also partnering with libraries in a growing variety of ways. As vendors rapidly develop new services, partnerships between software vendors and the library community for testing and evaluating new products are essential. The Endeavor company promotes the collaborative approach taken to develop its software in partnership with library users. It lists over sixty libraries involved in "task forces" (Endeavor Information Systems, n.d.) working to enhance aspects of Endeavor services. Wide consultation and collaborative interaction with libraries have become the norm for information services companies. It is important to build communities of interest for their products. Online information, product-specific publications, user groups, and mail lists are common methods for training users and providing information. They are also important for allowing users to share knowledge and join in discussions, which result in innovations and enhancement of the vendor's products. Informal networks grow around both commercial and public domain software. The product's listserv often becomes a critical resource. The user community becomes an important force in application development.

The range of library-related partnerships and network relationships is diverse and far reaching. The relationships among nonprofit organizations, information vendors, and libraries have been instrumental in developing online information infrastructure in many parts of the world. Electronic

Information for Libraries (eIFL) is a particularly good example. eIFL was formed in 1999 as a joint project of the Sorus Foundation's Open Society Institute and EBSCO publishing, with the aim of fostering library consortia and e-content services in countries with limited online information infrastructure. eIFL has developed into an independent consortium providing e-content services in forty developing countries, particularly in Eastern Europe and Africa (Electronic Information for Libraries, n.d.).

PRESERVATION AND CONSERVATION PARTNERSHIPS

Another area where information industry and library partnerships have been particularly active is in digitization of print collections. A major example of such partnering is the Elsevier company's collaborative effort to locate, digitize, and preserve the complete archive of its print journals. Elsevier partnered with the National Library of the Netherlands and Yale University, in addition to many content-providing libraries, over a three-year period on this project (Elsevier Corporation, 2002).

Thomson Web of Science has undergone a similar process to identify and index 100 years of historical journal materials for their Century of Science project (Thomson Scientific, 2004). Thomson credits partners Trinity College Dublin and University College Cork and lists eight other major libraries and institutions for providing materials for this project. Another interesting text conversion project is the Early English Books Online Text Creation Partnership (EEBOTCP), which involves Proquest and Chadwyck-Healey, partnered with over 130 universities, in the digitization of early works in English (EEBOTCP, 2005). Both business and nonprofit partnerships are involved in digitization efforts. These partnerships are making it possible to preserve and manage worldwide collections, both paper and electronic, in ways that have never been possible before.

CONCLUSION

Libraries are working ever more closely with one another, with online information companies, and with other cultural agencies. They increasingly share infrastructure and human resources to offer a range of common services. They are participating in widely available Web-accessible centralized services. Libraries collaborate and exchange resources by sharing both formal and informal standards. They participate in the cooperative process for developing those standards. Libraries participate collectively in the continuing innovation of information software and services, both commercial and open source. They routinely share information on the use of common software applications, large and small. The sharing of ideas, expertise, and resources by wide-reaching, often voluntary and informal, communities of interest is central to the way libraries offer and further develop online services.

These activities have made libraries more interconnected and interdependent than ever before. Through this interdependence, libraries are moving well beyond organizing and offering user access to local bodies of material within their own buildings to ordering and providing access to ever larger, increasingly comprehensive, ultimately global bodies of shared material. As the number, type, and complexity of sharing relationships grow, libraries will need to draw the threads together to better focus the many important ways in which they work together to share resources.

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