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No Longer Under Our Control: The Nature and Role of Standards in the 21st Century Library

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Abstract

Libraries have prospered because they developed and adopted of a wide range of standards, guidelines, and community practices to serve their needs. Broadly speaking, standards reflect vital community agreements on problems and their solution. The networked environment, however, is changing the context and use of standards in libraries. Librarians no longer create and define the terms, concepts, standards, and technologies that drive library services and practices.

This lecture examines the nature and role of standards for the emerging 21st century library. Given the dynamic character of the networked environment, when are standards appropriate and how can they be developed in a manner consistent with the volatility of information technologies and changing library services? What are the roles and responsibilities of standards developing organizations, technology vendors, content creators, and librarians for standards? Do local practices of libraries threaten standards-based resource sharing and resource access technologies? Can local needs be balanced with broader library community responsibilities, and how do standards affect this balance? The speaker's assumption is that adherence to standards has never been more critical, yet his implementation experience with Z39.50 and MARC suggests that the commitment to national and international standards by librarians, technology vendors, and content creators are often an example of good intentions rather than actual practice. This *standards disconnect* threatens the emerging 21st century library's ability to deliver fundamental services in appropriate ways to their users.

Good morning. I want to thank the Library of Congress and its Luminary Lecture series for the invitation to be here today. This is certainly an honor for me. Preparing this paper has been an interesting experience since it allowed me a chance to reflect on some of the ideas and issues that I've been grappling with over the past ten years. It has also made me realize again the extent to which I'm in debt to the ideas and work of so many different people, people such as Henriette Avram, Clifford Lynch, Pat Harris, Sally McCallum, and the many folks I've had the privilege to work with in various standards development and implementation activities. And I want to acknowledge organizations that have funded some of my research and projects that have informed my ideas including the U.S. Federal Institute of Museum and Library Services, and the Texas State Library and Archives Commission.

I hope you will find some of the ideas and issues I offer this morning worth your consideration, and I look forward to your questions, comments, and ideas at the end of the presentation.

Fifteen years ago I came to the Library of Congress as a participant in the LC Intern Program. When the nine-month intern program ended, I had the good fortune to work in the Network Development and MARC Standards Office. Although I didn't realize it was happening at the time, it turned out I was infected by two different bugs: the standards bug, and the bibliographic control bug. Certainly, NDMSO was a nexus for exposure to standards and their intersection with information organization and access. It's been my good fortune never to have recovered from those infections, and those infections have turned into affections. The issues related to standards and information organization and access have been central to my research agenda and projects in the past ten years.

The Library of Congress has been pivotal in standards development, adoption, and advocacy. It was my experience here that helped me to understand the vital roles of standards to support current and future operations and services of libraries. LC provided the leadership in the development and evolution of the MARC standards, Z39.50, standardized controlled vocabularies, classification systems, and most recently, standards for virtual reference services.

LC staff from various divisions and units participates in many different groups that operate on behalf of the broader library community These include organizations and groups that are developing standards, rules, and agreements vital to libraries such as the National Information Standards Organization (NISO), the Joint Steering Committee for Revision of Anglo-American Cataloguing Rules, the American Library Association's Machine-Readable Bibliographic Information (MARBI) Committee to name just a few.

Little of this is foreign to most of you, but I wanted to start by locating not only LC but the entire library community in the development of key standards for libraries. One of the ideas I'll be examining today is the role of a community in developing standards for its use, and the implications when a community appears to lose control over key standards that provide the foundation for its technology and services.

The title of this paper tries to capture a set of feelings that have resulted, I think, from the massive technology changes libraries have confronted in the past decade. There is a feeling that libraries – their technologies in particular – are no longer under the control of librarians. I see several aspects to this sense of losing control, and I hope to explore these in this lecture. I'm not saying all librarians everywhere have these feelings, but based on my work in several projects over the past decade, there is an issue here that needs some exploration.

Technology change can be stressful. Tried and tested ways of doing things are threatened. Assumptions about who we are and what we offer are open to question. New competitors emerge. Yet, technology change provides opportunities to rethink our core values, the services useful to our patrons, and perhaps, to find new ways of doing things. In part, the perception by some of losing control reflects the changing nature of libraries and their technologies in the networked information environment. And as the technologies change, so do the standards that are embedded in those technologies.

I think there are several aspects to this feeling of losing control.

First, the nature of the standards we must accommodate. I characterize many of the key standards of importance to libraries as "evolutionary." I remember a comment by a librarian several years ago. She was questioning how we could call something at a standard (in this case it was Z39.50) that was continually changing. In her mind, the exemplar for a standard reflected one modeled on industrial standards of the 19th century. The specifications for a ½ inch steel bolt were defined once, and the specifications remained stable forever. This is not the case with the technology and other standards that have emerged in the past 20 to 30 years. If one views standards development as a problem-solving activity, a group working on such a standard will try to get agreement on the nature of the problem, and then set out to provide a solution to that problem. The complexity of the technologies, though, usually means that we define the problems we understand, only to have new problems surface once the solution to the original problem is solved. Then it's a matter of refining the problem statement and setting about solving the new problem. So, yes, almost by their nature, information technology and related standards will not stand still, but be evolved and modified as we better understand the problems, the requirements, and the options available.

One can look with fondness on the MARC record. The basic components of the record structure have not changed in over 30 years. There is the leader, the directory; tags, indicators, delimiters, field and record terminators. Yet the supporting technical specifications have evolved over 30 years. From the 1972 MARC format for bibliographic data that defined approximately 270 fields/subfields to the MARC 21 specifications that currently define nearly 2,000, the standards supporting MARC have evolved.

The second area where it's likely that librarians feel a loss of control relates to the new levels of collaboration that the networked information environment requires. Another way of framing this is in terms of the tension between the autonomy of individual libraries versus the increasing need to collaborate with more and different groups to deliver better services to our users. A new balance needs to be found between decisions related to serving the primary user groups of a library and the need to make local systems work well with the systems and information of other libraries and organizations. To support collaborative services, a library has to ensure that its systems and information interoperate with non-local applications. I put this issue in the following way: What appeared to be a beauty mark for a local system serving local users becomes a wart when that system interacts with others in the networked environment.

The third area that I want to call attention to relates to where technical standards are created. From one perspective, librarians have been masters of the key standards that underpin the technologies and business of libraries. MARC is an excellent example. The library community developed it to address problems specific to libraries – e.g., how to take variable length bibliographic data and make it machine-processible. And the resulting solution, a standard record structure, was used almost exclusively by libraries. In this area, we might want to differentiate between infrastructure standards and applications standards. Certainly, given the web as a key technology for libraries, the web infrastructure standards are not under the control of librarians. An example of such an infrastructure standard is the Extensible Markup Language (XML). But application-oriented standards of importance to libraries are developed outside of the library community, or with representatives of the library community working with representatives of many other communities. Examples of this are the Open Archives Protocol for Metadata Harvesting and the Dublin Core Metadata Initiative. Librarians may feel that they inherit tools, technologies, and standards created by others. This has the potential of those standards not addressing problems as defined by librarians.

Another factor that may lead librarians to feel a loss of control is the range and number of standards and agreements that need to be accommodated. Standards are the glue that holds the networked environment together and provide a foundation for the interoperability required. As this environment becomes more complex, we'll see the need for additional standards. For example, a key innovation that has emerged for libraries in the past two years is something that goes by the name of metasearching – an application that allows a user to search multiple databases and other resources from a single interface. NISO has taken the lead in coordinating discussions among metasearch applications vendors, content providers, and librarians to identify potential areas of standardization. It is my contention that the more we rely on machine-processing to support information organization, access, and use, the more we need more standards and agreements to ensure the applications work reliably and interoperate.

In the rest of this lecture, I'll pursue some of these ideas in the context of the emerging 21st century library. To do this with some measure of adequacy requires a look at this emerging library, the nature of standards, and the opportunities or threats we face in navigating the troubled waters of the networked information environment.

Let me begin with a short discussion of standards and standardization.

After spending several years at the Library of Congress, I went to Syracuse University to pursue a Ph.D... During my doctoral studies, I had the good fortune to participate in standards activities related to the Z39.50 protocol. That experience, and the interesting questions that were emerging about how to produce standards for the volatile networked environment, led me to my dissertation research which was a case study of standards development, and the case in question was the Z39.50 protocol. But my interest in standards didn't end with completing the dissertation and earning the Ph.D. Most recently, I served as the chair of a NISO standards committee to develop the U.S. National Z39.50 Profile for Library Applications. Standards work is nothing if not an opportunity to work with really smart people and learn the art and/or skill of developing compromises to build consensus and produce agreements all can live with!

What is a standard? Well, interestingly and ironically, there is not a standard definition of a standard. Based on a review of the standards literature and what I observed in my dissertation research, I proposed the following description:

A standard represents an agreed upon response to a recurring problem—perceived, anticipated, or "real," and codifies the response for the purpose of communication. The standard is the result of a problem–solving process. It involves agreements among stakeholders who have an interest in adopting specific responses to the problem. Conformant use of the standard leads to predictable results and a reduction of uncertainty.

This definition was intended to describe formal standards, such as those produced by the National Information Standards Organization, or other standards groups such as the World Wide Web Consortium (W3C).

In the years since my dissertation research, though, I have come to use the term "standard" much more loosely to describe a range of things. There is a commonsense notion of what a standard is that is reflected in the statement:

An agreement among people to do certain things in certain ways to achieve desired and expected ends.

And there is something special about these "people" in the above definition. They typically belong to a group, or even constitute a community. So, I've reduced the definition of a standard to simply:

A standard represents an agreement by a community to do things in a specified way to address a common problem

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In other words, standards are community agreements. In the library community, we have any number of agreements that assist us in our work and interactions. We have agreements on descriptive cataloging rules (e.g., AACR2, which is not a "formal" standard, but might be considered a *de facto* standard), MARC (which includes a formal standard, Z39.2/ISO 2709 as well as the supporting agreements as reflected in the MARC 21 documentation produced by the Library of Congress). These community agreements are responses to one or more problems faced by libraries. As mentioned earlier, many of our community agreements have been in response to problems faced by us – problems that may or may not be relevant to other communities. But in the networked environment, our community has similar problems faced by other information communities.

For many librarians, standards are things that result through some remote arcane process involving a group of people that certainly must like committee work, travel, and hotel food. They may think that we standards folks need to get a life! And they may or may not have a very positive sense of what standards

are about – “Oh no, not another NISO standard that I have to put into my RFP… can’t I just do it the way I want to?”

In fact, developing standards can be viewed as a community-centric endeavor. It is first and foremost a social process. The social aspect of standards creation is reflected in the activities that may be involved. During my research on standards development, I compiled a list of activities involved with developing and creating a standard; these include:

Brainstorming
Clarifying Requirements
Collaborative Authoring
Competitive Collaboration
Compromising
Consensus Building
Developing Proposals
Editing
Environmental Scanning
Information Sharing/Transfer
Modeling
Negotiating
Planning
Problem Defining
Problem Resolving
Problem Solving
Setting Requirements Socializing
Strategizing
Visioning
Writing

Many of these activities by their very nature imply interaction among a group of people. As a social process, it was evident to me in Z39.50 development that one of the key activities relates to the how the problem is defined. And this will depend on who is at the table doing the defining. For example, in the early years of creating the Z39.50 standard (say from 1979 through the mid-1980s), the people on the standards committee were influenced strongly by the Open Systems Interconnection (OSI) model that had come out of work by the International Organization for Standardization (ISO). There was little awareness or acknowledgement within the committee of the world of TCP/IP and the Internet that was emerging. An important implication of this was that the Internet standards community and subsequently the Web community has shown little interest in the library community’s Z39.50 protocol, which was viewed as an overly complex ISO/OSI product of value only to libraries. What happens if librarians are not at the tables and involved in the social processes of defining standards that end up critical to our services?

There are a number of venues in which these activities take place. Most familiar to many of you is NISO, the formal standards developing organization for our community. NISO is part of the voluntary standards development mechanism accredited by ANSI. Its processes for developing standards are articulated in a set of rules and guidelines. Typically, these rules provide for open participation, a balance of interests, and formal mechanisms for approval and appeal.

Community agreements, however, don’t have to be developed within such formal settings or under such formal procedures. In the early 1990s as people were discussing how to develop standards in a manner that accommodated the rapid pace of technology change, the Internet community’s processes for developing community agreements and specifications for the Internet were viewed as a new approach for standards development. The processes of ANSI and ISO were seen as too slow and resulted in complex standards that were difficult to implement. In the Internet community, the primary vehicle for reflecting community agreements was the Request for Comment (RFC). The RFCs reflected a bottom-up consensus, and there was a requirement for demonstrable interoperating implementations. In its early years, Internet standards development was done by those interested in volunteering their time and energy – basically, membership was completely open.

There are a number of models for standard development, from the ad hoc to the very formal. In the category of the more formal, one more organization deserves mention. The primary formal standards development venue for Web standards is the World Wide Web Consortium. Unlike the original Internet standards approach, the W3C is a membership organization. The standards it produces are referred to as Recommendations. As a membership organization (there are nearly 400 members), actual direct involvement in developing a Recommendation is limited in most cases to representatives of fee-paying members.

Any group of people can come together to create an agreement. For that agreement to have reach and range beyond the people directly involved, the group needs to gain some credibility from the community that is intended to benefit from the agreement. The Dublin Core Metadata Initiative provides an interesting case of a standards development effort. Starting with an invitational workshop in 1995, the Dublin Core effort has developed into a worldwide initiative to develop metadata agreements. The Dublin Core initiative is not a formal standards developing organization, but the specifications resulting from its work have been submitted to formal organizations for ratification and approval as national and international standards.

When we loosen the definition to include not only formal standards but a range of "community agreements" we can identify many venues and groups that are developing and producing rules and specifications adopted or used by libraries. We can include everything from the Joint Committee for the Revision of AACR to the Dublin Core, to the Open Archives Initiative that has created a protocol for metadata harvesting. The results of their efforts may be adopted simply because of community interest in a new technology that addresses a need or problem (e.g., OAI) or because the groups have gained authority to produce professionally-recognized rules (e.g., AACR).

Thinking of standards as community agreements can help all of us recognize we have stake. These are agreements that affect us and our services, and we have a stake in the outcome. Further, we need to recognize that libraries may have to adopt or work with agreements and standards developed outside of our community. Those agreements may or may not be informed by the needs of libraries and librarians. This library of the 21st century, in my opinion, is not going to be isolated from these other communities and their agreements. Instead, the library operating in the networked information environment is going to need to accommodate and embrace standards and specifications over which we may have little control.

Standards, rules, and agreements are developed within a context of need and use. How does the emerging library change the context for standards? First, we might ask, do libraries today differ dramatically from what we had in the 20th century? Obviously, century boundaries are arbitrary moments by which to designate the evolution of libraries, their practices, technologies, and services. But I do think there is an emergent library – a library that had its genesis in the past ten years, and in some ways the result of what might be considered a disruptive innovation, namely the Internet, and more specifically, the Web application environment of the Internet. A definition of a disruptive innovation, a concept coined by Clayton Christensen, is:

> A technology that changes the industry in such a way that previous competitive and business rules do not apply. Since the internet has had such a profound effect on the fundamental rules of business, it can be considered a disruptive technology.
> [From DefineThat: <http://www.definethat.com/define/?id=298>]

In 1993, Mosaic, the first graphical user interface browser for the World Wide Web was released. This month is the ten year anniversary of the Windows and MacIntosh releases of the browser. [From: <http://archive.ncsa.uiuc.edu/SDG/Software/XMosaic/d2-intro.html>]. We may disagree whether the Web introduced a disruptive innovation or is an enabling technology for libraries, but the impact of web applications, and the broader networked information environment, has fundamentally altered the position and possible roles of libraries in the current information world. Have Google and Amazon disrupted the business of libraries?

I'll go out on a limb here, and suggest that prior to the networked information environment, the library was primarily a late 19th century artifact, with our tools and technologies based on assumptions that were likely similar to those of librarians in the 19th century. The library catalog could almost be considered an industrial-era tool. How little has its function and content changed, even given the MARC record, since the days of Cutter, Dewey, and other leading visionaries of a previous era. To what extent were the Paris Principles really a restatement and refinement of Cutter's original objectives for the library catalog?

The library of the 21st century integrates a variety of technologies to provide new levels and types of services to its users. Looking back over the past 30 years of library development, we see the introduction of computers to support some of the technical services operations, the movement of computers out front for use by the patrons, and to the library now being a key component of the broader networked information environment. Libraries and librarians often were on leading edges in the deployment of information technology. If one thinks back to the late 1980s, many online catalogs were accessible via the Internet long before many other communities provided network access to their resources. One can credit the automation efforts of local libraries, that were themselves enabled through the widespread adoption of the MARC standard. So, an unintended consequence of the MARC standard was that it laid the information technology foundation in libraries to be early adopters of Internet technology. Yet we should also credit library visionaries such as Henriette Avram who saw computers and communications technologies working to link systems together – the work on the Z39.50 protocol was an outgrowth of this vision.

The emerging library reflects, I think, a mature understanding that the convergence of communications and computing technologies offers an opportunity for extending the reach and range of the traditional library and its users. Whether we refer to this library as a digital library, a virtual library, a hybrid library, the vision for this library acknowledges that the Internet, the Web, the networked information environment, and digital collections of information provide a context to offer broader and more instantaneous access to information. Yet the technologies merely provide a potential infrastructure to realize the visions for information access and use.

Libraries have traditionally been involved in two primary activities: 1) building and organizing collections of resources, and 2) providing services and tools for users to engage with the collections. While building collections continue to occupy the energies of librarians, I believe that the focus on services will become paramount, especially given a more competitive information marketplace.

For the past several years, I have been presenting ideas for a service-based architecture for the emerging library. A service-based architecture allows us to consider the technological infrastructure without having the technology as the starting point – namely, reclaiming our services as the driver for what we do and not technology. Another reason to focus on services is to accommodate the broad range of people involved in the preparation, collection, organization, and access to information. A technological goal of providing faster access to more information generally has the end user of the information in mind. A service-based architecture can highlight the roles, responsibilities, and interactions of the various people and organizations that will be involved in collaborative efforts to provide the services.

What is a library? Depending on which staff members of a particular library I might talk with, they are likely to emphasize different features of the *library* they consider as focal. For example, the technical services folks most likely think the primary feature of the library is the catalog and the other bibliographic tools that connect users to information. The public services folks will think of the reference and instruction services. The collection development folks focus on the collection and licensing issues for commercial resources. From the patrons' points of view, we would probably get another set of diverse descriptors of what constitutes the library that reflect their expectations.

Combining these different features probably brings us close to a common agreement of what a library is:

- A collection of resources in both analog and digital formats
- A set of services and activities designed to organize and manage the collection
- A set of tools to assist users in finding and selecting items from the collection
- A set of services to help users answer questions, learn about the collection, learn about the bibliographic tools, and generally connect users to appropriate resources
- An administrative structure that allocates resources that enable the librarians and other staff carry out their responsibilities
- A place for study, socializing, interaction.

A library's mission, goals, and objectives guide the realization of these features. Missions will differ from library to library, but there is likely some shared kernel in the mission statements such as: *developing and managing a collection of resources and deploying services to assist users in connecting with appropriate resources*.

What changes to these features of the library when we add the power of information technology and the network? Nothing and everything. Nothing in the sense that the library still deals with collections, bibliographic tools, services, and administration.

Yet each of these changes in subtle or radical ways. For example, the "collection" may incorporate new forms of materials (mostly in the form digital objects) and the collection of resources available to the patrons may be housed not only outside of the physical place of the library but beyond the organizational control of the library and managed by other information communities.

I'm not sure we have a good label to apply to this emerging library. For the time being, let me refer to it as the networked library. What are some of the key attributes of this library. First, I think it extends the reach and range of its users, in the same way that virtual memory in a computer provides an apparent capacity not physically installed. Second, since it is networked, it doesn't stand alone. Certainly, our libraries traditionally have not really stood alone, but the nature of our networkedness in the 21st century enables new forms of interaction and collaboration with other organizations and people not available previously.

The networked library by its nature implies new levels of collaboration. Certainly, the community agreements related to technical standards is one level of collaboration. But I suggest that the services offered by the networked library will increasingly be collaborative ventures. To give an example of this, we can look at the virtual reference services such Question Point initiated by the Library of Congress and OCLC:

> "The QuestionPoint service provides libraries with access to a growing collaborative network of reference librarians in the United States and around the world. The service will enable reference librarians to share their resources and expertise with each other and with their patrons in unprecedented ways."
>
> "With QuestionPoint, your library can broaden its reference services provided directly to your library users, including access to subject specialists around the world … At the same time, it gives you tools to expand your local reference offerings and the reach of your staff."
>
> "Cooperation and collaboration are the keys to QuestionPoint's power and success."

This initiative also reveals the connection between innovative services such as virtual reference or digital reference and standards work. To support these services, NISO has established a Standards Committee for Networked Reference Services. From the committee's charge:

> "Digital reference services constitute a new but rapidly growing extension of the traditional reference service offered to library patrons…. There is a growing interest in evolving localized network reference services into more fully interconnected, collaborative reference services."

Standards, technology, and resources can be seen as enablers for the provision of library-to-library and library-to-user services. In the case of digital reference services, we see both library-to-library and library-to-user services addressed.

A service-based architecture for the networked library has the following basic components:
Services – the focus of the architecture; the services are driven by and respond to users needs.
Users – the consumers of the services, and for whom the library should be developing these services
Resources: the human and information resources
Technology: in the form of many different tools used to create and support the delivery of services
Management: that identifies and prioritizes the services to be delivered.

Individual libraries serve many different user groups; for the networked library, identifying the user groups will be even more of a challenge. In existing libraries, user groups are often defined by their affiliation (e.g., students and faculty of a university) or geographic location (e.g., living in a city served by the public library). What defines a user of a networked library? What does it mean to have other libraries as users of our library's resources and services?

What are some of these new services or networked versions of traditional library services? Let me mention just a couple.

Resource Discovery Service

A fascinating and powerful feature of the Internet is the possibility of discovering information regardless of its physical location or format. As the networked library extends the reach and range of users across organizational, collection, and format boundaries, users face the same challenge they do with Web search engines: identifying relevant materials.

A Resource Discovery Service provides users with a variety of tools and approaches for discovering the existence of appropriate resources. Typically, a user will search one or more repositories of metadata, full text, or images to identify and select resources, and many of these resources may belong to other information communities, organized and represented through practices other than AACR2 and MARC. One example of a resource discovery service tool is a metasearch application where, through a single user interface, a user can search local and remote resources simultaneously. Different resource discovery approaches require different levels of technology integration and system interoperability.

Access Service

Once a user has discovered resources, the access service addresses getting the information to the user. Print materials found in other libraries may be delivered through traditional interlibrary loan or document delivery services. Digital resources may be available with a click of the mouse. There will frequently be licensing agreements that necessitate authentication and authorization of a user from one library prior to allowing access to digital materials owned or controlled by another library.

To what extent will the Access Service be mediated and to what extent will the patron be in control of initiating access to the materials? Patrons could initiate their own interlibrary loan or document delivery by completing an online form. Additionally, billing and payment for accessing or acquiring resources (digital or analog) must be robust enough to handle the complexity of several billing and payment schemes.

Other services include virtual reference services, instruction services, and maybe recommender services. These are just indicative of the possibilities, and as you can see, they are based on the types of services we have offered in the past. What are the standards implications because of these services? And what about local control? My sense is that a new balance needs to be struck between local decisions and the acceptance and use of broader community agreements to enable collaborative services. For example, a local library may need to implement Z39.50 and the Open Archives Initiative Protocol for Metadata Harvesting to make its local resources visible in the networked environment – not something that it does for its local users, but to support collaborative services such as resource discovery and virtual reference.

Beginning with the services, we identify what the networked library is and offers, and its intended users. The defined services determine the resource requirements, including staff and information resources. Finally, the services help determine the selection of (or identifies the need for) technology and standards in support of services. This allows us to make informed technology decisions. What technologies will be needed to support the types and levels of services users require? How do we achieve the necessary interoperability of systems to support the services? And what is the role of standards and community agreements in achieving interoperability?

Since the services are likely to have a collaborative basis, the networked library increases the requirements for inter-organizational cooperation and collaboration. As cross-organizational interaction

and collaboration increase, new policy issues will emerge, in part because of new levels of technical interoperability now available.

In the networked environment, there is a fundamental operating assumption: systems and organizations will interoperate. Unfortunately, this term interoperability is problematic at best. Definitions of interoperability reveal common themes: working together, exchanging information, interacting without special effort on the part of the user.

Paul Miller of the UK Office of Library and Information Networking offers an expansive treatment of interoperability. He begins by stating that,

> one should actively be engaged in the ongoing process of ensuring that the systems, procedures and culture of an organisation are managed in such a way as to maximise opportunities for exchange and re-use of information, whether internally or externally.
>
> [From: Miller, Paul. (2000, June). Interoperability: What is it and why should I want it? *Ariadne* 24 Available: < http://www.ariadne.ac.uk/issue24/interoperability/intro.html>]

Usually, the concept of interoperability focuses on the technical aspects of information systems. For example, a systems-centric definition of interoperability might be: the ability of two or more systems or components to exchange information and use the exchanged information without special effort on the part or either system.

But Miller goes on to suggest that there are different types or levels of interoperability that needs to be accommodated within the networked information environment:

- Technical
- Semantic
- Political/ Human
- Inter-community
- Legal
- International

It's clear that some of these types of interoperability are based on agreements between organizations and among community members, not simply formal technical specifications.

In a service-based networked library, a focus on users should inform the concept of interoperability, and interoperability issues may be specific to a networked service. Interoperability for a resource discovery service can be defined, from the user's perspective, as: the user's ability to successfully search and retrieve information from two or more systems in a meaningful way and have confidence in the results. This perspective is both more appealing and more challenging than simple technical, systems interoperability.

Even if our networked library appears to provide technical interoperability among a variety of systems, users may find that organizational interoperability may be less than optimal. Searchers can reach out to many different online catalogs or other online databases to find resources. However, if the networked library does not provide effective patron-oriented access services – maybe in the form of a OpenURL service – for users to acquire materials, users may determine that there is not adequate organizational interoperability. In addition, technical interoperability raises new policy and organizational questions. The bottom line is: The fact that systems can interoperate does not mean organizations want their systems and the information residing on those systems to be accessible to everyone in the same way.

Let me give you an example of this. The issue goes by the name of "record nabbing." The Z39.50 protocol and associated profiles that were developed in the past five years are helping to realize the goal of interoperability when searching library catalogs. The Z39.50 protocol allows a client application to search a Z39.50 accessible library catalog, find appropriate records, and retrieve them in MARC format. The retrieved records end up on the client side, and can be easily moved to an import process to load into

a local library catalog (i.e., copy cataloging). But some libraries that are being used as a source for MARC records feel that this is an inappropriate use of Z39.50 and some are considering restricting Z39.50 access to their catalogs. These libraries may have paid for their MARC records or belong to a consortium or cooperative, and they view these records as valuable information assets. Without appropriate prior agreements on use of these records, the libraries feel others are stealing their information assets that are core to their services. But shutting down Z39.50 access jeopardizes other services such as metasearch applications. As our organizations are tied together more closely in the networked information environment, we may see new problems brought by increasingly robust interoperability.

Is there something different about the standards we'll need and use in the networked library? I think there may be. But as I think back to the premier technical standard for libraries, the MARC record, maybe these new standards are not going to be so foreign to us. Remember, the formal MARC standard defines an abstract record syntax. It provides the structural components that can be used to encode bibliographic data for machine-processing. But the standard did not provide semantics – Z93.2 and ISO 2709 did not state what the 245 tag meant, but only defined the structure of the tag as a component of the record. We have other supporting specifications such as the MARC 21 Format for Bibliographic Data that lays out the semantics and use of nearly 2,000 fields and subfields. These specifications reflect evolving community agreements.

More recently, we had the Z39.50 protocol standard which defined abstractly the protocol for information retrieval. Many interoperability problems surfaced in the early implementations of Z39.50 because of the options available in the standard. We needed to define application profiles such as the Bath Profile, and more recently, the U.S. National Z39.50 Profile for Library Applications that provided more detailed specification for using Z39.50 in particular applications to realize the interoperability promised by the protocol. These profiles are good examples of community agreements.

Other standards are also providing what we might call frameworks documents, which rely on profiles to more specifically direct the use of the standard for real-world applications. The NISO Circulation Interchange Protocol (NCIP) was structured from the outset as providing an abstract or framework standard that would necessitate the development of profiles to define how the protocol would be implemented for specific applications.

The same thing is happening with the Dublin Core Metadata Initiative. Originally, there were the 15 core elements, but as people realized that different information communities would use these elements in different ways, and sometimes have different semantics for the elements, there was a recognition that application profiles were needed to specify the use of the DC elements and extensions for a specific application or information community. So, we now have a DC Libraries Profile, among others.

Think about XML for a minute. It provides a framework and general specifications for the structural elements of XML documents. It provides a "language" for marking up documents, but its power is that it allows information communities to define document type definitions (DTDs) or schemas that provide the semantics and other rules for different types of XML documents. In this way, it seems very much like the MARC syntax, which relies on additional specifications to utilize the syntax for different types of bibliographic and related data.

This means that librarians are going to need to understand in more sophisticated ways a complex set of standards, agreements and specifications. It has long been clear that simply specifying in a RFP that a system must support the Z39.50 standard is not sufficient to realize the desired interoperability. Instead, the RFP must be written more precisely to state not only which standard must be supported, but indicate which application profiles, levels of conformance, and other specifications need to be addressed. Just as it's not sufficient to say that an integrated library system must support Z39.2 or ISO 2709; the RFP writer must specify support for MARC 21 bibliographic format, holdings format, etc.

It's not that the standards warriors are trying to make life difficult for librarians. Rather the new expectations for reliable interaction, interconnection, interoperability, and interchange of information require more use and conformance to standards, and a broader range of standards.

Given changing information technology landscape, the new service environments for the networked library, and the increasing number and type of standards, where do we, as librarians, stand in all of this?

I have used the term “community” throughout my lecture. At points, I qualified that term by referring to information communities. I think different information communities can be characterized by the data and information they deal with, their processes and practices, their metadata – in other words, their community agreements. I think libraries constitute an information community. Further, this community is one information community among many. Museums constitute another. So do archives. The geospatial data folks may comprise another. Prior to the networked information environment that make these separate information communities visible in new ways, users would go to the library to find books and journal articles, to the museum to find art objects and supporting documentation, to archives to find papers, records, and objects associated with an individual or organization. Information communities were often separated physically (in separate buildings) as well as by their practices. The networked information environment now allows users to do what they have always wanted to do – find information to resolve a problem or question without regard to the format, organization holding the object, or physical location. What is the role and responsibility of the library to help provide the services to integrate access to information belonging to these different communities? What will it mean to our own practices, standards, and agreements?

As a community, librarians have worked together over the years to define and solve problems in a collaborative manner that resulted in community agreements and formal standards. In many cases, our tools and technologies were developed expressly to solve the problems as we defined them. My assertion is that this level of autonomy and control is changing. One of the main catalysts for this change is the emergence of the networked information environment in which and through which we carry out our work and deliver our services.

I don’t have the time to detail the important milestones in the development and deployment of our community’s standards and agreements. But the library community – often with academic and research libraries leading the way -- developed its own standards that reflected the problems it needed to solve and solutions that the community could live with. Whether developed under the auspices of NISO (e.g., the MARC record standard, Z39.2), or by the Library of Congress (e.g., Library of Congress Classification System), or joint library association efforts (e.g., AACR2), community members developed key community standards.

The networked environment that is the current context for information organization, access, retrieval, and sharing is founded on technical standards developed both within and outside of the library community. It is clear that many of the key infrastructure standards and technologies will be developed outside of the library community – in venues such as the W3C, the Internet Society, and elsewhere. If we look at some technical standards key to the networked library (and this is only a list to illustrate!), we see:

- Z39.50 Protocol
- Interlibrary Loan Protocol
- Circulation Interchange Protocol
- OpenURL
- Dublin Core Metadata (and other metadata standards)
- Digital Object Identifiers
- ONIX Metadata standard
- HTTP
- HTML
- The suite of XML standards
- Simple Object Access Protocol (SOAP)

As we move down the list, the venues for developing these standards move outside of the libraries’ sphere of influence and control.

On the other hand, some of our new community agreements are integrating technologies and standards developed by other communities. We are also providing tools and standards of use to others beyond the library community. The NCIP protocol, for example, adopted XML as the encoding mechanism for its protocol. A new effort within the Z39.50 community called Search and Retrieve for the Web uses the

concept of web services and the associated W3C standards such as XML, SOAP, and Dublin Core. And one of the key architects of the recently completed OpenURL standard, Herbert Van De Sompel, sees this linking mechanism as useful beyond its initial focus in libraries, which was reference linking. And we are seeing that our MARC record, our community's defining machine-based structure, may need to be reconsidered in the light of XML if the metadata produced by our librarians is to be more broadly and more effectively used by folks outside of our immediate community.

My belief is that the networked library will require more standards rather than fewer. One of the key challenges will be to ensure that these standards work together. And I think the starting point for considering all of this will be our understanding of the services we need to offer our users – both patrons and other libraries.

Certainly, some of us enjoy the challenges involved in developing standards. We want to develop standards that are useful and provide a specific functionality. Examples of useful standards to be sure include Z39.50, the ILL protocol, and the Circulation Interchange Protocol. But in some ways these were developed as stovepipes – addressing a particular problem, and developed by different groups within our community. Yet think of the possibility for services that can be created using these three standards – discovering resources via Z39.50, checking patron permissions and availability via the Circulation Interchange Protocol, and getting the item via the ILL protocol. But at the time of their development, there was not a clear sense of how these would work together, and in some cases, there are areas in which the three protocols overlap in the functions provided (e.g., one can actually order an item via Z39.50 instead of using the ILL protocol).

As an example of how we can look at new approaches for standardization, the NISO metasearch initiative may point the way forward. Metasearch is not just about searching, but rather involves several things:

- Access Management – Authorization and authentication
- Resource Identification – How to describe resources to make them visible and to help users find them
- Search and Retrieval – How to express searches, manage search sessions, and present results from distributed resources in usable ways for users
- Statistics – How to provide meaningful usage reports for decision support to evaluate and compare services, etc.

By defining the problems to be addressed by the standards within the context of a specific service, we have a better starting point to avoid the stovepiping of standards. This approach has as a starting point the service to be offered (a metasearch or resource discovery service), identifies relevant aspects, and recommends areas for standardization that can support the service. Further, the metasearch approach will identify potentially useful standards that are available or emerging from other communities to address some of these problems. For example, Access Management might involve the use of Shibboleth, a technology for distributed authentication and authorization of users. The Resource Identification may build on the Collections Description and Directory Services work of others. The Search and Retrieval may use or provide new requirements for the Search and Retrieve for the Web efforts by members of the Z39.50 community. And Statistics will look at the work of Counter, the NISO E-Metrics, and other existing work. The point here is that we need to forego the "not invented here" reaction that would isolate our information community from others in the networked information environment. We cannot afford that isolation.

The world of the networked library may be discomforting, yet it offers exciting opportunities to develop services never before possible. To conclude, let me highlight some of the ideas I've tried to explore this morning.

- **The networked library will require the use of more and different kinds of standards, only some of which are developed by our information community.** While we will continue to develop community agreements and standards appropriate for the problems we define, we will have to rely on, adapt to, and integrate standards developed by other information communities.

Accommodating standards from other communities may seem as disruptive, yet if they help us to build the services of the 21st century library, we all will benefit, especially our users

- **Libraries are one information community among many in the networked information environment.** We are part of a complex, distributed information landscape, and we have the responsibility to provide premier services to our users that help them make sense of this landscape and connect them with information wherever it is located and whatever format it is in..
- **Standards are community agreements.** If you can think of standards as community agreements, you can feel more ownership in them. They will feel less like impositions from without and more as supporting devices you need to provide services to your users and carry out your work. We have a long tradition of working together for the benefit of the community and our users. We can build on that collaborative spirit as we move to realize the opportunities of the networked library. This includes owning the responsibility for supporting the development of standards and adopting them.
- **The standards developing organizations need your support.** We are very fortunate to have NISO, a venue for coordinating the development and use of standards within our community. Standards development is not cheap. Standards committees consist of volunteers, and organizations must allocate resources to ensure participation on the committees. Development is only one aspect of the standards process – NISO is involved in publication, education, and outreach, and it provides logistical support for standards development. It does all of this with a staff that is likely too small for these critical responsibilities. If NISO were to disappear, our community would suffer. And likely we would need to set up a similar structure to ensure that the need for our community's standards is met.
- **A single institution is not likely to emerge to be the advocate or enforce standards.** The Library of Congress has long played a critical role in supporting standards by its adoption of those standards. Would MARC have succeeded in the way it did without the leadership of Henriette Avram and the Library of Congress? But it's not clear that single institutions can have the same influence in the networked environment. Therefore, it is incumbent on the community to embrace the standards.
- **Envision the services and develop, adopt, and integrate standards to support those services.** Services are what libraries offer. What standards do we need to enable these services? Which of those will be developed by our community and which we will inherit and integrate from others? We need to move from functional requirements to service requirements when thinking about standards to service requirements.
- **The networked library implies a new balance between local needs and community-wide and network-wide responsibilities.** In the 20th century, few libraries have been islands unto themselves. Whether they were recipients of catalog cards from the Library of Congress, participants in shared online cataloging cooperatives, or borrowers or lenders in interlibrary loan transactions, the U.S. library community has worked together. The networked environment doesn't call these arrangements into question, but I do think it will require a new equilibrium between serving local needs and participating in collaborative services. Individual libraries have much to gain – whether as a participant in a global reference network or as a search target for resource discovery service. Yet, such collaborative services are likely to mean revising local practices, implementing systems that support standards in consistent ways, and understanding that the networked library's services bring a new responsibility for reciprocity.

I do not think that we have to succumb to feelings of not being in control. We will benefit not from isolating ourselves. We can recognize the special nature of our information community while also recognizing we are one information community among others. We can address our own needs and pursue appropriate community agreements while accommodating the separate practices and agreements of other communities in the networked environment. And we will do this because of our desire to provide services commensurate with our users' needs and expectations.

Thank you.