



METADATA THROUGH THE PAGES OF INFORMATION STANDARDS QUARTERLY

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This article will review the development and expansion of metadata standards, as they were reported in the pages of *Information Standards Quarterly (ISQ)*. Since its first issue in January 1989, *ISQ* has served as the journal of the National Information Standards Organization (NISO). While many library and information services standards were reported upon in the pages of *ISQ*, the lifetime of this publication has been an especially interesting time for metadata standards.

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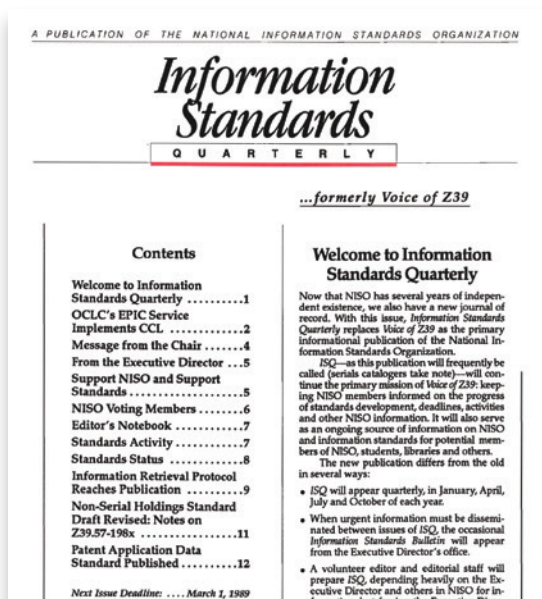
In the first issue of *ISQ*, NISO Chairperson Mary Ellen Jacob wrote, “There has been a need for some time for a newsletter or journal devoted to standards in the areas of libraries, publishing, library equipment, and information services.” She announced that *ISQ* would fill this need by providing “in-depth articles looking at various standards under development, at the standards process itself, and the application of existing standards” (Jacob 1989, 4). The fact that *ISQ* brings together a wide variety of information organizations, and examines their differing needs for metadata standards, is part of what makes it an important source of history for these standards. The articles on standards development as a process also provide interesting context.

Over the years, *ISQ* has frequently featured articles discussing the need for standards, and their uses. Although NISO was already 50 years old when the first issues of *ISQ* were published, its earlier authors often addressed the lack of awareness of NISO or its work among the organization’s

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constituents. Later in 1989, NISO Chairperson Paul Evan Peters outlined plans for NISO and its members to “advance the cause of standardization in librarianship, information services, and publishing” (Peters 1989, 2). In the same issue, Jim Michael described working with Data Research Associates (DRA) in the mid 1970s to build a library automation system that had, as its foundation, a bibliographic database that used the Library of Congress’s MARC standard. DRA believed that building on the MARC standard would be crucial to future success (Michael 1989) even though other vendors showed little interest in the standard and most libraries were primarily interested in a circulation system. Michael’s article listed the advantages he saw in following standards, including consistency, being prepared for change and the need to transport data, and interoperability among libraries and with the greater world of information. He concluded by calling on more vendors and libraries to become involved with NISO and participate in national and international standards organizations.

Michael’s points about standards enabling interoperability among local and global networks soon gained even more relevance. By 1990, *ISQ* was reporting on developments on the Internet. Its report on the 1990 NISO Annual Program and Meeting details a presentation by Dr. Vinton G. Cerf envisioning a digital library in which library resources were connected to information resources outside libraries. An article by Cerf noted that building a digital library “raises many concerns, including issues of intellectual property; the need for standard access protocols (such as Z39.50); standard object representation; and user interfaces” (Cerf 1990). While “standard object representation” isn’t otherwise addressed or defined, it seems reasonable to conclude that we would now call it “metadata.” But our first glimpse of the term in *ISQ* isn’t until 1993, when Deadra Harvey and Terry Sullivan reported on the December 1992 meeting of the Z39.50 Implementors Group, in which they use the phrase “the meta data is at the record level.” (Deadra and Sullivan 1993, 13). Later that year, Roberta Rand wrote about “metadata directories” in connection with a project to improve access to databases for tracking global change, noting, “Traditionally, [librarians and information management professionals] have developed and applied tools to assist in the storage and



JANUARY 1989

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APRIL 1995

“Metadata” as a term doesn’t appear in *ISQ* again until 1995, when it starts to become commonly used, and more frequently associated with digital objects shared online. Not surprisingly, increased use of the term begins with Bill Moen’s report on the 1995 workshop sponsored by OCLC and the National Center for Supercomputing Applications (NCSA) that led to the establishment of the Dublin Core Metadata Element Set.

Metadata for Network Information Discovery and Retrieval: Workshop Report

Fifty experts representing the related fields of librarianship, computer science, online information services, publishing, and networking participated in a three-day workshop on the topic of Metadata on March 1-3, 1995.

WHAT ARE METADATA?

Simply, metadata are data about data. In the context of the networked environment, metadata refer to a set of data elements that one can use to describe and identify information objects. The workshop’s primary goal was to develop a simple set of metadata elements that would be broadly applicable to document-like objects for network information discovery and retrieval. The result of the workshop was the Dublin Core Metadata Element Set, a preliminary set of data elements to describe and represent network information resources or network objects. Sponsored by OCLC and the National Center for Supercomputing Applications (NCSA), the workshop emphasized the critical need for solutions to assist users struggling with the increasing numbers of servers, documents, and a wide range of other network objects such as images, numeric databases, audio clips, and video archives accessible over the Internet. A recent report in *Business Week* (February 27, 1995, p. 78) indicates the power and impact of one Internet tool, the World Wide Web, on the extent of networked information: “There are now 27,000 WWW sites, and the population is doubling every 53 days, according to Sun Microsystems. And a research computer scientist at Carnegie Mellon estimates there are some five million documents stored on Web servers, a figure that is doubling every six months to a year.”

(continued on page 2)

entirely on what constitutes metadata, they were guided by a common sense understanding that metadata include a basic set of data elements that can be used to represent or describe information objects in the context of networked information retrieval and discovery.

Metadata should provide enough information about an information object to: 1) allow the object to be locatable, and 2) allow the object to be retrieved. Metadata should allow a user to discover and identify an object, and then to make some judgment as to the type of particular information objects for user’s particular information needs. The workshop organizers understood the inevitable failure if they attempted to agree on metadata of the types of network accessible information, to which they confined their attention to metadata factor and represent document-like objects (i.e., CD-ROMs analog to formerly existing forms of information such as books, journals, articles, and so on) and similar to their analog, CD-ROMs and other pictures, images, and other non-textual information.

Goals for these network objects would provide metadata of descriptive information. Workshop participants assumed that the process of creating metadata would be decentralized and not available to the distributed nature of the network environment and the decentralized character of information production in this environment. Metadata would be provided by the producers of network objects. Yet that metadata could be a “chief source of information” for catalogers to use who could then enhance that by doing authority work, adding additional subject headings, and other professional cataloging tasks that would add value to the description and representation.

DUBLIN CORE ELEMENT SET DEFINED

A result of the workshop was a preliminary set of data elements comprising metadata for network objects. Participants reached general consensus on thirteen basic, core elements and recognized that additional core metadata elements were needed. Each

subelement describes the type responsibility:

DATE: the date of publication. Specifically note of the content that is the actual object described.

IDENTIFIER: a character string or number used to distinguish a resource from other objects. A SCHEME subelement identifies the authority.

OBJECT-TYPE: conceptual description of the object.

FORM: physical, logical, or encoding characteristics.

RELATION: important known relationship to other objects. The TYPE subelement describes the nature of the relationship; the SCHEME subelement identifies the specific relationship; the related object’s LANGUAGE, natural language of the object content; the SCHEME element identifies the controlled vocabulary.

EDITOR: a free-text identification of the version. See function.

SOURCE: object from which this object was derived; contains a nested abstract description.

MODELS AND PROBLEMS

The diversity of workshop participants meant that no one “model” of metadata existed, and the representatives from the various communities brought their perspectives on some of the problems that metadata would have to address.

Francis Carlson, chair of ALA’s MARBI group, provided an overview of MARC. She emphasized that creating MARC records means not only using a specific record structure (i.e., ANSI/NISO Z39.50-1985) but also the content designation specified in USMARC documentation and the conventions (i.e., AACR2) for determining the content of the records. The bibliographic records in MARC provide metadata for the bibliographic entities they describe and represent.

C.M. Seaberg Moen and Juan Rodriguez presented information about the Text Encoding Initiative (TEI), a set of guidelines to assist creation of extended information about the Text Encoding Initiative (TEI). The TEI header is designed to serve as the chief source of information for a cataloger, but it is also designed to avoid redundant information from the creator of the electronic text. Filing in the basic TEI header information does not require

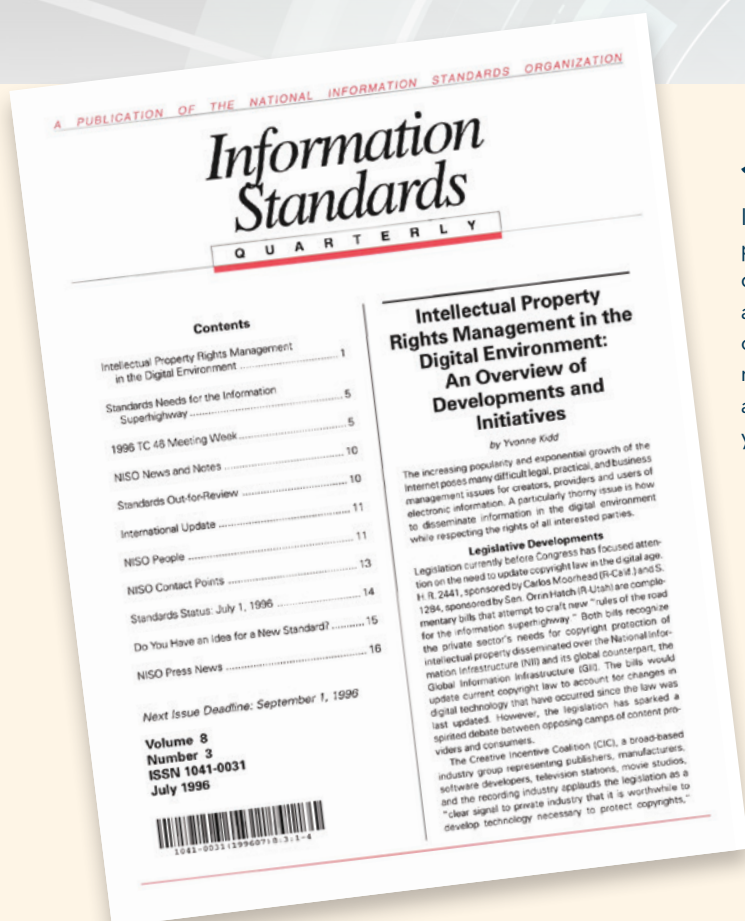
retrieval of information. In response to the vast amounts of data and information now being collected, additional retrieval tools are needed. These additional tools can be viewed as ‘meta’ tools enabling and extending the full use of existing tools” (Rand 1993, 25).

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networked environment,” as “a set of data elements that one can use to describe and represent information objects,” and states that the goal of the workshop was to “develop a simple set of metadata elements that would be broadly applicable to document-like objects for network information discovery and retrieval” (Moen 1995, 1). By 1995, the World Wide Web had already led to an explosion in networked information, making discovery increasingly difficult.

This first Dublin Core workshop brought together not only librarians, but other experts from a variety of backgrounds—computer scientists, publishers, and online service providers. The participants succeeded in not getting bogged down with disagreements about what metadata was, but focused on an area they all agreed was important—the discovery and retrieval of the most common, document-like objects. Participants also agreed that “the process of creating the metadata would be decentralized and distributed, parallel to the distributed nature of the networked environment and the decentralized character of information production in this environment” (3). They assumed that this would happen through online information producers providing basic metadata themselves. While this last assumption didn’t turn out as expected, the Dublin Core Element Set was, as Moen

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JULY 1996

In *ISQ*'s report on the 1996 NISO meeting, all three program speakers discussed work that was underway on developing new metadata standards. Clifford Lynch talked about the Warwick Framework, which "allows for packages of independently maintained and managed sets of metadata" that "lets you bound a given set of metadata for a specific purpose while recognizing that, in the real world, you'll need other sets of metadata that others can provide."

points out, "an initial, and possibly major, step forward," and while it wouldn't "get everything right the first time ... it lays out an approach that has the potential to grow into solutions for networked information discovery and retrieval" (4).

By the following year, *ISQ* was regularly covering metadata standards, and Dublin Core in particular. In *ISQ*'s report on the 1996 NISO meeting, all three program speakers discussed work that was underway on developing new metadata standards. Clifford Lynch talked about the Warwick Framework, which "allows for packages of independently maintained and managed sets of metadata" that "lets you bound a given set of metadata for a specific purpose while recognizing that, in the real world, you'll need other sets of metadata that others can provide." (NISO 1996, 6). The meeting that led to the Warwick Framework also included discussions on the Dublin Core element set and the possibility of extending it to include metadata for images.

That topic was expanded upon by the second program speaker, Howard Besser, who reported on a workshop sponsored by OCLC and the Coalition for Networked Information (CNI). Besser saw the work to expand the scope of Dublin Core as the "first effort in what promises to be a

series of extensions and initiatives to apply the Dublin Core to other domains" (NISO 1996, 6). Consensus on how to add elements for describing images to Dublin Core was reached mainly by redefining some elements and addressing image description in usage guidelines for each element. Besser reported that "workshop participants were surprised to learn that Dublin Core could apply to image data" and "concluded that images are document-like objects that have more in common with text in the discovery process than was originally believed." This early example of efforts to expand Dublin Core, in which participants focused upon the common discovery and retrieval needs of different objects, contributed to the long-term success of Dublin Core as a metadata standard. The third program speaker, Linda Hill, talked about the Geospatial Metadata Standard developed by the Federal Geographic Data Committee (FGDC). This standard was just over two years old at that time, making it "one of the most mature efforts to develop standard metadata elements," and therefore "a good case example for other metadata development efforts." However, even though the Geospatial Metadata Standard was experiencing quick adoption, since Federal agencies were required to use it, it was

also getting mixed responses. With more than 300 fields, the standard was simultaneously criticized as too complex and not comprehensive enough. Hill stated that “the underlying problem [was] that the standard assumes that every creator and holder of a geospatial data set could catalog it” (7).

In 1998, *ISQ* reported that the Dublin Core Metadata Set was being considered as a NISO standard. By that time, Dublin Core was being used to describe not only text and images, but also audio and other objects; it also retained its focus on “facilitat[ing] cross-domain searching” (NISO 1998a, 9). In the same news section, *ISQ* announced “Issues in Crosswalking Content Metadata Standards,” by Margaret St. Pierre and William P. LaPlante, Jr., as the first in a new series of NISO White Papers (NISO 1998b, 9). This paper, originally published on NISO’s website in October 1998, was revised slightly and printed in *ISQ*’s next issue. In the version appearing in *ISQ*, St. Pierre and LaPlante noted that metadata standards are most often developed for a specific user community, and that many had already become popular, including Dublin Core, USMARC, and the Geospatial Metadata Standard developed by the FGDC (by now using the committee’s initialism for the standard). However, the authors observed that “to reach the broadest community of users, information must be made available in accordance with a number of related metadata standards” and that “to maximize [metadata’s] usefulness to the widest community of users, there is a mounting need for the metadata maintained in one standard to be accessible via alternate standards.” To this end, they outlined the work that would need to be done to make that possible. They called for harmonization, the “process of enabling consistency across metadata standards,” (St. Pierre and LaPlante 1998, 2) by simplifying “the development, implementation and deployment of related metadata standards through the use of common terminology, methods and processes” (3). Eventually, one could create crosswalks that could be fully automated because they would go beyond mere semantic mappings of one element to another; they would also include specifications converting the content of elements in ways that were compliant with the target metadata standard (e.g., conforming to repeatability requirements) (3-5).

As the 1990s neared their end, *ISQ* began to address metadata in new contexts as more information service communities realized the importance of metadata to their efforts.

NISO Members To Review Dublin Core

NISO members are considering a proposal to adopt the Dublin Core Metadata Set as a NISO standard. The Dublin Core is a set of fifteen data elements that can be used to describe text, images, sounds, and other objects and is intended to facilitate cross-domain searching. Concurrent with NISO’s review the IETF has accepted the Dublin Core as an information RFC (Request for Comment). The ballot period for the NISO review of the Dublin Core proposal is September 14-October 23, 1998.

“Metadata Crosswalking” Launches NISO White Paper Series

Issues in Crosswalking Content Metadata Standards is the title of the first paper in the NISO White Paper Series. Authored by Margaret St. Pierre (Blue Angel Technolo-

OCTOBER 1998

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As the 1990s neared their end, *ISQ* began to address metadata in new contexts as more information service communities realized the importance of metadata to their efforts. In the last issue of 1999, a report on the second Workshop on Linkage from Citations to Journal Literature, an event that brought together participants from libraries, publishers, and vendors, included several mentions of high-quality metadata as necessary to making reference databases work. Workshop action items included calling on the Dublin Core community to improve metadata that supported citation (NISO 1999, 12). In the first issue of 2000, Jessica Milstead reported on the November 1999 Electronic Thesauri workshop, where participants called for a new standard for thesauri that was “dedicated to shareability/interoperability rather than construction or display” and that “extend[ed] beyond thesauri to address controlled/managed vocabularies.” In particular, attendees expressed the need for a standard metadata schema to represent relationships among vocabularies (Milstead 1999, 1).

The year 2000 also saw Regina Reynolds speak about using embedded metadata to help libraries catalog e-journals. This metadata would be supplied by the National Serials Data Program (NSDP) to publishers when they applied for ISSN’s,



JULY 2001

As the new millennium officially began, libraries and other information organizations evaluated what it meant to be "virtual" or "digital." In her 2001 article "Taking Stock of the Virtual Library: Services and Standards," Priscilla Caplan noted that "the library community prefers the term 'digital library' and, in fact, it is uncommon for a library to call its online presence a virtual library.

and would be displayed by the publishers on the relevant e-journals' homepages (Caplan 2000, 3). At the same time, more attention was being paid to other kinds of metadata, beyond descriptive. An April 1999 workshop on image metadata led NISO to commission a team to "draft a basic data dictionary of metadata elements describing the image capture process and technical characteristics of digital images" (NISO 2000, 10). Workshop participants observed that, "work to date has [focused] on defining descriptive metadata for discovery and identification, with little attention paid to define the types of information which describe the capture process and technical characteristics of the digital images" and that such technical metadata was needed for long-term preservation of digital images (Ibid.).

By mid-2000 standards in general, and metadata standards in particular, were becoming increasingly important as they became necessary for interoperability. Libraries had long relied on standards to support efficiency. With the growth of the Internet, they now needed standards to support their ability to interact with the larger information environment (Gatenby 2000). As more and more research materials went online, researchers needed better ways to discover them. This need led the Digital Library Federation, among others, to seek out ways to "combine the best of library and Internet techniques to improve access to scholarly resources." One of these ways was to "develop a framework and testbeds for research metadata harvesting." Since harvesting involved "collecting descriptive metadata from many diverse sites," it required these sites to use shared standards. By agreeing to support harvesting protocols, data providers could contribute to "intellectually useful services, such as catalogs and portals to materials in multiple formats as distributed across multiple sites" (NISO 2000, 11). Not only would researchers gain valuable research tools, local repositories would gain greater visibility and reach.

As the new millennium officially began, libraries and other information organizations evaluated what it meant to be "virtual" or "digital." In her 2001 article "Taking Stock of the Virtual Library: Services and Standards," Priscilla Caplan noted that "the library community prefers the term 'digital library' and, in fact, it is uncommon for a library to call its online presence a virtual library. However, digital libraries are much more than lists of links, and are described in terms of services as well as collections" (Caplan, 2001, 1). She adds that the term "virtual library" is most often used "for projects that involve combining the assets of a number of library organizations on a state or regional level" (2) in ways that included sharing both collections and services. And, of course, what all these projects had in common was the need for "the development of technologies, software tools, norms, and standards to support these activities" (5). The need for standards to support such cooperative and

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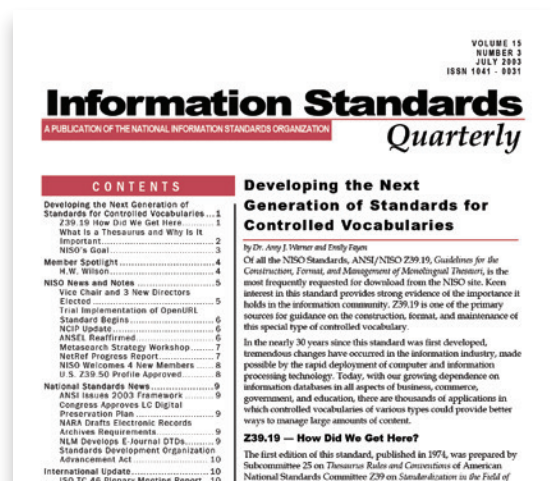
interacting projects was at least part of the reason that the NISO community voted to submit the Dublin Core Metadata Set (Z39.85) to the American National Standards Institute (ANSI) as an American National Standard in 2001 (NISO 2001). In October 2002, ANSI approved the Dublin Core Metadata Element Set (ANSI/NISO Z39.85-2001), culminating seven years of consensus building among participants “from a wide variety of information providers in the arts, sciences, education, business, and government sectors” (NISO 2002, 7).

Later in 2002, the work to establish standards for technical metadata for digital images that began at the April 1999 workshop resulted in NISO releasing ANSI/NISO Z39.87, *Data Dictionary for Technical Metadata for Digital Still Images* as a draft standard for testing. The new standard would “facilitate interoperability between systems, services, and software” and “support the long-term management of and continuing access to digital image collections” (NISO 2002, 4). The Metadata Object Description Schema (MODS) was also made available for experimentation in 2002, and revised in January 2003 based on those early experiments. MODS offered a way to create descriptive metadata in XML that was “richer than Dublin Core but simpler than full MARC” (Needleman 2003, 4), and had the potential to support a number of projects intended to make rich descriptive metadata more usable on the web. The Library of Congress’s Network Development and MARC Standards Office was also developing MARCXML, allowing round-trip conversion between MARC records and XML documents. In the publishing world, the “use of ONIX, the international standard for representing and communicating book industry product information in electronic form, continues to grow internationally as functionality and applications increase to match demand” (5).

In 2003, the term “metasearching” began to appear in many ISQ articles, though the concept had already been addressed under many other names, all “speak[ing] to a common theme of allowing search and retrieval to span multiple databases, sources, platforms, protocols, and vendors at once” (NISO 2003, 1). While long-established means of cross-database searching were still being used, including Z39.50, the new Open Archives Initiative’s Protocol for Metadata Harvesting (OAI-PMH) was gaining interest as a “standard harvesting protocol for multiple forms of metadata in any type of information repository.” Since it relied on the quality of the metadata harvested, OAI-PMH “effectively [built]

on the many metadata initiatives underway to improve description and access to electronic resources” (2). NISO held a workshop in May 2003 to address many of the questions raised about supporting metasearching. Breakout groups discussed possible recommendations for NISO to pursue, with one group discussing identifying a core set of metadata that would be needed to make sense of search results from multiple sources, and how to deliver additional metadata when available (NISO 2003b).

While it didn’t specifically address searching multiple repositories and making sense of the results, in 2004 ISQ reported on a related development that would later become increasingly relevant. In February of that year, reported ISQ, the World Wide Web Consortium (W3C) announced “its final approval of the Web Ontology Language (OWL) and the revised Resource Description Framework (RDF). RDF and OWL are critical standards for the Semantic Web, a common framework that allows data to be shared and reused across application, enterprise, and community boundaries.” They would also “provide interoperability by supporting the inclusion of multiple metadata schemas and namespaces in a single RDF description” (NISO 2004, 10).



JULY 2003

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OpenURL Now a National Standard

The OpenURL Framework for Context-Sensitive Services has been published as an American National Standard, ANSI/NISO Z39.88-2004. The standard, which defines an architecture for creating a context-sensitive networked service environment for digital resources, had been in trial use since June 2003.

OpenURL implementation provides a crucial service because Web links typically are not user-centric and by default take all users to the same target. The underlying concept of OpenURL is that links from a bibliographic reference should lead a user to the most “appropriate” copy of the resource. The selection of the appropriate copy is based on user and organizational preferences regarding the location of the copy, its cost, agreements with information suppliers, and similar considerations. This selection occurs without the knowledge of the user;

APRIL 2005

After two years of updates on NISO’s Metasearch Initiative, metasearching again featured prominently in *ISQ*’s final issue of 2005, which offered three thought pieces on the subject and a report from NISO’s OpenURL and Metasearch workshop held in September 2005.

In 2004, MODS was given NISO registration status, allowing for faster review and accreditation, as was the Metadata Encoding & Transmission Standard (METS), the latter being “an XML-based schema for encoding metadata regarding objects within a digital library” (Harris 2005, 2). NISO’s Metasearch Initiative also continued, including the work of the Collection Description task group. That group developed two metadata element sets, one for describing collections, which was based on the Dublin Core Collection Description Application Profile, and the other for describing services for accessing collections, which was based on a new version of Z39.50. Dublin Core itself continued to mature as a metadata standard, celebrating its tenth anniversary in March 2005. That month the Dublin Core Metadata Initiative (DCMI) released the DCMI Abstract Model, which was a “specification [that] provides a reference model against which particular DC encoding guidelines can be compared.” Appendices to the model “discuss[ed] the relationship between the DCMI abstract model and the Resource Description Framework (RDF), the Guidelines for implementing Dublin Core in XML, and the expression of Dublin Core in HTML/ XHTML meta and link elements.” DCMI also worked on making Dublin Core interoperable

with digital rights and licensing systems, expressing bibliographic citation information, and clarifying when and how to refine Dublin Core elements. (NISO 2005b). The latter effort included publishing guides to help information professionals use and manage descriptive metadata. This need for guidance and organization was felt by other metadata communities as well, and in 2005 the Preservation Metadata: Implementation Strategies Working Group (PREMIS) issued its *Data Dictionary for Preservation Metadata*, which the group described as “a comprehensive guide to core metadata for supporting the long-term preservation of digital materials” (NISO 2005a).

After two years of updates on NISO’s Metasearch Initiative, metasearching again featured prominently in *ISQ*’s final issue of 2005, which offered three thought pieces on the subject and a report from NISO’s OpenURL and Metasearch workshop held in September 2005. In his thought piece, Roy Tennant advocated for centralizing and pre-processing metadata as the best option for integrated discovery, saying that “the best of all situations is where all of the metadata appropriate to a particular search service is in your control” (Tennant 2005, 2), but that when that isn’t possible, centralizing searching in one place, or metasearching, is the next best option. Lorcan Dempsey pointed out that “metasearch is not an end in itself, although we sometimes talk about it as if it were. The aim is to provide search services at the level of database combination that makes sense for the user, to provide guidance on those combinations, and to present the services in ways which make sense in user environments.” (Dempsey 2005, 3). Andrew Pace reminded readers that “ultimately the power of metasearch comes in its ability to deliver the right information in usable formats while requiring little or no underlying knowledge by the searcher of the services or content that provides that information” (Pace 2005, 4). All three authors highlighted the importance of standards to making metasearching work. The summary of NISO Metasearch Initiative recommendations included two interrelated standards from the Collection and Service Description committee, one of which was the Collection Description Specification, which was written as a Dublin Core application profile and specified “how metadata terms from the Dublin Core metadata vocabularies are used to construct a description of a collection in accordance with the DCMI Abstract Model. This metadata can be used

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NISO Framework to Direct New Committee Governance Structure

Introduction

This year will see the fruition of several key elements of NISO's new strategic direction. The major elements of the NISO Framework, an overarching model and roadmap for all of NISO's standards work, have been drawn up. A new Architecture Committee has been established to further develop and maintain the Framework and provide strategic direction, oversight, and leadership for NISO's standards development. The former Standards Development Committee has been replaced by three Topic Committees, each assigned to manage existing and new standards and recommended practices in their scope areas.

In this month's feature article, Todd Carpenter, NISO's Managing Director, describes the new NISO Framework. His article is followed by separate articles by each of the new Committee chairs, envisioning the direction that each committee will be taking. Chuck Koehler of CrossRef discusses the Architecture Committee. The three Topic Committees and their chairs are: Ted Koppel of OCLC for Discovery to Delivery, and Patricia Berenson of Thomson Scientific for Business Information.

The NISO Framework for Understanding Standards

Read on for a vision of NISO's future in standards development.

By Todd Carpenter

"The world makes way for the [person] who knows where he is going."
- Ralph Waldo Emerson

Over the past two decades, dissemination of electronic information and the widespread adoption of management systems for both print and electronic resources have resulted in shifting roles for publishers, libraries, and automation vendors. The growing significance of these changes was one of the reasons that NISO undertook a strategic assessment in 2004-2005 and began adjusting its activities to address this new and changing environment.

NISO began its strategic restructuring by gathering some of the key thought leaders in the community on to a Blue Ribbon panel. Led by Clifford Lynch, Executive Director of the Coalition for Networked Information (CNI) and funded by The Andrew W. Mellon Foundation, this panel examined NISO's role in the

JULY 2007

With Executive Director Todd Carpenter citing "shifting roles for publishers, libraries, and automation vendors," as a result of "dissemination of electronic information and the widespread adoption of management systems for both print and electronic resources," NISO implemented changes in its strategic direction and organization in 2007.

As the first years of the new millennium went on, the need for metadata that could enable discovery and use both by humans and by machines was behind increased efforts to develop standards for identifiers.

by humans to discover and select collections and also by software agents such as metasearch engines performing such tasks on behalf of human users" (NISO 2005c, 6).

As the first years of the new millennium went on, the need for metadata that could enable discovery and use both by humans and by machines was behind increased efforts to develop standards for identifiers. In response to "confusion on how best to create, implement, and support identifiers and identifier systems," NISO convened a Digital Identifiers Roundtable in March 2006. This meeting gathered experts from "libraries, government information centers, library system vendors, e-learning organizations, and content providers/aggregators" (NISO 2006, 1). Among the

complexities of creating, maintaining, and using identifiers effectively is the difficulty of discovering ones that already exist: "Opportunities are missed when service creators cannot discover applicable pre-existing identifiers and identifier systems. It can be difficult to find clear and complete information about an identifier and its associated systems," noted the meeting report (NISO 2006, 3). Both standards and metadata are needed to help meet such difficulties, and the roundtable participants made recommendations to NISO on how to contribute to both efforts (NISO 2006, 5-6).

With Executive Director Todd Carpenter citing "shifting roles for publishers, libraries, and automation vendors," as a result of "dissemination of electronic information and the widespread adoption of management systems for both print and electronic resources," NISO implemented changes in its strategic direction and organization in 2007 (Carpenter 2007, 1). In terms of what these changes meant for metadata, Carpenter observed that metadata creation was happening at an earlier stage of creating content than before, and that social tagging was also becoming part of metadata management (2). Writing for NISO's newly formed Content and Collection Management Topic Committee, Ted Koppel pointed to the movement from AACR2 to Resource Description and Access



SPRING 2008

In his editorial “Repurposing Metadata,” Jay Datema observed that “as the Open Archives Initiative Protocol for Metadata Harvesting has become a central component of digital library projects, increased attention has been paid to the way metadata can be reused.” He noted that the Dublin Core standard left a lot of choices to metadata creators, who are assumed to be professionals.

(RDA), and anticipated NISO’s role in “guiding the nascent RDA initiative through the process of standards development and acceptance” (Koppel 2007, 7). He also predicted that the Dublin Core metadata standard would be affected by the changeover to RDA, and indeed, a joint task force made up of the Dublin Core Metadata Initiative (DCMI) and the RDA committee was formed to “examine the fit between RDA and models used in other metadata communities” (NISO 2007, 24).

In his 2008 *ISQ* editorial “Repurposing Metadata,” Jay Datema observed that “as the Open Archives Initiative Protocol for Metadata Harvesting has become a central component of digital library projects, increased attention has been paid to the way metadata can be reused.” He

If anything, making use of metadata supplied by content creators hearkens back to some of the original goals of Dublin Core.

noted that the Dublin Core standard left a lot of choices to metadata creators, who are assumed to be professionals. The result was that computers had difficulty processing these metadata choices, which often only made sense in their original, local context. Methods to handle such heterogeneous metadata became increasingly important, and Datema pointed to the Open Archives Initiative for Object Reuse and Exchange (OAI-ORE), which emphasized “working to extend rather than to invent.” He highlighted one ORE project in particular, a WordPress plugin developed by Michael Giarlo that generated a resource map using selected Dublin Core elements. It’s interesting to note that Datema talked about this project “turn[ing] metadata creation on its head, since the Dublin Core elements are taken directly from what the weblog author enters as the title, the name of the weblog author, subjects that were assigned, and the date and time of the entry” (Datema 2008, 9). If anything, making use of metadata supplied by content creators hearkens back to some of the original goals of Dublin Core.

Identifiers continued to gain importance in creating and managing metadata, and were featured in an article by Helen Henderson, based on a presentation given at the NISO forum “Metadata in the Digital Age: New Models of

Identifiers continued to gain importance in creating and managing metadata, and were featured in an article by Helen Henderson, based on a presentation given at the NISO forum “Metadata in the Digital Age: New Models of Creation, Discovery, and Use.”

Creation, Discovery, and Use.” Henderson reported that NISO was developing a standard for institutional identifiers that were “robust, scalable, simple to implement and to deploy in existing workflows and that can support any information workflow requiring an institutional identifier so that multiple institutional identifiers are not needed” (Henderson 2008, 13). Henderson observed that the working group would need to evaluate the metadata needed to support the new identifier standard, and come up with a “core set of metadata ... (similar to the concept of Dublin Core or the DOI core metadata set) that represents the minimal metadata needed for institutional identification, with the ability to add community specific metadata as needed” (14).

Peter Sefton returned to the issues involved in metadata harvesting and using OAI-ORE, still a fairly new standard for describing and exchanging aggregations of web resources, with his report on its use in the Australian repository ARROW. Sefton noted that “the Open Access Initiative Protocol for Metadata Harvesting is a must-have standard for repositories. It’s used for disseminating repository metadata and content to registries and indexes that aggregate content. While the interchange protocol (PMH) more or less works, in that services can connect to each other, the stuff that people interchange is very far from being standardized” (Sefton 2008, 15). He described how it became necessary for human beings to intervene, normalizing harvested metadata to make it work in aggregate.

In the first issue of 2009, 20 years after the initial publication of *ISQ*, Karen Coyle wrote about a major change in bibliographic metadata and the standards that guide them. She observed that current bibliographic metadata standards were focused on the record as the basic unit of bibliographic information, but that the future of bibliographic data was already shifting towards individual units of data and a mix of data standards. Based on her experience working with the Internet Archive’s Open Library project, Coyle pointed out the advantages of a linked data approach to metadata. The approach makes seemingly different data sources less different in practice, allowing one to draw on many data sources to create richer metadata for discovery and use (Coyle 2009, 10). Coyle added that this mix-and-match



SPRING 2009

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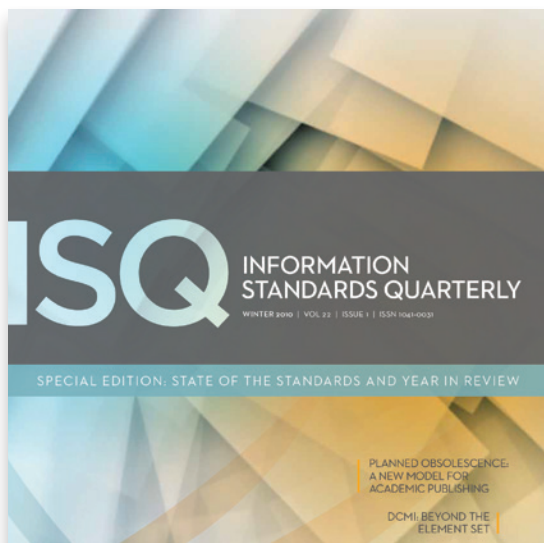
approach would make it even more important that “data elements adhere to standards so that they will be usable in a variety of contexts, or at least outside of the one context of the originating system” (11).

In March of 2009, OCLC hosted the Symposium for Publishers and Librarians on Metadata, “focusing on the challenges and opportunities facing both communities in metadata creation, enrichment, maintenance, and distribution” (Register 2009, 40). Participants examined current models of metadata workflow, especially in terms of interoperability. They discussed possibilities for increasing metadata interoperability, as well as ways to allow multiple communities to contribute to and enhance metadata over time. One of the outcomes of the symposium was the commissioning of a white paper by Judy Luther on streamlining metadata workflows for books. Luther provided an extract of her white paper in the same issue of *ISQ*, highlighting her findings after interviewing representatives throughout the book metadata supply chain. She found that, “while there has been significant development of standards,

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best practices, and systems within publishing communities and library communities, little has been done collaboratively across those communities” (Luther 2009, 34). She proposed potential solutions, which included creating crosswalks between ONIX and Cataloging in Publication (CIP) metadata, integrating the International Standard Text Code (ISTC) and the International Standard Name Identifier (ISNI) standards, and promoting further cross-community communication (35).

In 2010, Dublin Core celebrated its 15th anniversary, and *ISQ*’s first “Year in Review and State of the Standards” issue included an article by Corey Harper on DCMI and its role in developing metadata practices and research. Harper described early criticisms of the Dublin Core Metadata Element Set (DCMES), which were mainly focused on its simplicity, and observed that these criticisms were often applied to DCMI itself. He noted that DCMI had grown beyond the element set, and “provides a framework and model, as well as a set of principles for designing metadata. It is also a diverse community bound by a common interest in developing the underpinnings of rich, interoperable metadata” (Harper 2010, 22). DCMI’s commitment to interoperability led it to move towards a linked data approach to metadata, in which library metadata could interact with data on the open web, and the organization “began to shift the focus of the conversation from a metadata format to a metadata vocabulary—a collection of carefully defined properties that could be used to make descriptive statements about resources” (23). This shift in perspective was partially realized in Qualified Dublin Core, which allowed metadata creators to add specificity to qualified elements and define what values could be used to populate elements. Other developments, including the concept of metadata application profiles and the Dublin Core Abstract Model (DCAM), offered the potential for DCMI to help bridge the gap between libraries and the linked data community (24-25). Harper concluded, “DCMI recognizes the challenges of integrating myriad data formats into the linked data environment and is striving to be a central component in providing accessible and usable guidelines, specifications, and recommendations to support standards developers and metadata practitioners.” (28).



WINTER 2010

Dublin Core celebrated its 15th anniversary, and *ISQ*’s first “Year in Review and State of the Standards” issue included an article by Corey Harper on DCMI and its role in developing metadata practices and research.



SUMMER 2010

In *ISQ*'s special issue on digital preservation, guest editor Priscilla Caplan commented on the “tremendous thirst for shared specifications” in the digital preservation community, and pointed to the rapid adoption of the PREMIS *Data Dictionary for Preservation Metadata*, in spite of it not being a formalized standard, as an example of this great need (Caplan 2010, 3). In their feature article, Angela Dappert and Markus Enders confirmed the need for guidance on “which specific metadata should be collected [and] how it should be implemented in order to support preservation goals.”

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administrative, and explained that, while it made sense to reuse existing specifications for subsets of each category of metadata, doing so also presented the potential for confusion and overlap. However, metadata creators could improve interoperability, the authors noted, by “specifying best practice guidelines for combining the different metadata specifications” and “document[ing] in metadata profiles how their institution has used a metadata standard for a specific application...” (7). The rest of their article outlined how PREMIS meets these needs and “defines a common data model to encourage a shared way of thinking about and for organizing preservation metadata” (8).

A few years after Helen Henderson reported on the formation of the NISO Institutional Identifier (I2) Working Group, Jody DeRidder provided an update on its progress. The group had investigated several existing standards, looking for “the best infrastructure to support a standard institutional identifier in a scalable, extensible manner.” They decided that “the International Standard Name Identifier (ISNI) could be leveraged to meet the infrastructure needs of I2, while the needs analysis and metadata development performed by the NISO I2 working group could expand the ISNI's ability to serve institutions” (DeRidder 2011, 26). The

A few years after Helen Henderson reported on the formation of the NISO Institutional Identifier Working Group, Jody DeRidder provided an update on its progress.

same special issue of *ISQ* that contained DeRidder's report also included in-depth coverage of several other identifiers, including feature articles on ISNI and on the new Open Researcher and Contributor ID (ORCID), demonstrating the growing need to develop standards for identifiers and find ways to implement them.

ISQ expanded upon the topic of linked data in 2012, in a special double issue devoted to Linked Open Data for Libraries, Archives, and Museums (LOD-LAM). In that issue's feature article, Gordon Dunsire, Corey Harper, Diane Hillmann, and Jon Phipps wrote about the shift towards applying Semantic Web technologies to large-scale metadata management and interoperability. They highlighted several recent library initiatives, including the Library of Congress's publication of LCSH (Library of Congress Subject headings) in SKOS (Simple Knowledge Organization System), and the publication of the bibliographic catalogs of several European national libraries as linked data. Other cultural heritage-organization initiatives, such as Europeana, brought together data from a variety of sources, including archives and museums, as well as libraries. With this abundance of linked data being created and shared, the authors noted that "as more and more RDF-based metadata become available, a lack of established best practices for vocabulary development and management in a Semantic Web world is leading to a certain level of vocabulary chaos" (Dunsire 2012, 4). They outlined some possible solutions, including metadata registries and mapping semantic relationships among RDF properties. They pointed to the formation of the DCMI Vocabulary Management Community, "charged with identifying issues of best practice and intelligent implementation that could lead to better interoperability and harmonization across institutions, projects, and language communities" (11).

The special LOD-LAM issue of *ISQ* also included several "In Practice" reports on projects using linked open data. Jane Stevenson reported on Linking Lives, a project that brought together archival metadata from around the United Kingdom, with an end-user interface allowing researchers

The continuing importance of identifiers to support linked data initiatives, scholarly communication, and rights management can be seen in *ISQ*'s regular reports on the progress of standards for them.



2012 DOUBLE ISSUE

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to search across 25,000 collection descriptions (Stevenson 2012, 14). Seth van Hooland, Ruben Verborgh, and Rik Van de Walle introduced the use of general purpose tools such as Google Refine to transform existing metadata into linked data (van Hooland 2012, 24). Ted Fons, Jeff Penka, and Richard Wallis wrote about OCLC's contributions to linked data for libraries using the Schema.org ontology (Fons 2012, 29). And Antoine Isaac, Robina Clayphan, and Bernhard Haslhofer gave an update on the Europeana portal, which aggregated metadata for more than 23 million cultural heritage objects from more than 1,500 libraries, archives, and museums across Europe (Isaac 2012, 34).

The continuing importance of identifiers to support linked data initiatives, scholarly communication, and rights management can be seen in *ISQ*'s regular reports on the progress of standards for them. At the end of 2012, *ISQ* reported on the launching of the ORCID registry, where researchers could sign up for a unique identifier and then link that identifier with citation databases and full-text repositories. The ORCID ID was also designed to be compatible with ISNI identifiers (NISO 2012, 45). ISNI itself grew substantially, exceeding 6.5 million identifiers in 2013,

less than two years after the standard was published. Part of its growth could be attributed to its adoption by Wikipedia (NISO 2013a, 37). In the same year, ORCID had grown to over 160,000 identifiers and additional systems, such as those for manuscript submissions and grant applications, had started to use them (NISO 2013b, 39).

By the end of 2013, linked data was well established as the future of metadata standards in general, and of library data in particular. *ISQ*'s theme for the final issue of that year was "Evolution of Bibliographic Data Exchange." In his introduction to the issue, Guest Content Editor Ted Fons observed that libraries need to "increase our effectiveness in the exchange and management of library metadata" and that any new metadata models would have to allow for "effective exposure of library collections on the web; efficient sharing of data between libraries and library organizations; [and] promotion of data quality to enable effective library workflows." He suggested that meeting these requirements would involve "aggregating data whenever possible and using canonical identifiers to make our assets efficiently identifiable in the linked data ecosystem" (Fons 2013, 4).

In the feature article, Lars Svensson looked closely at publishing library data as linked data, and described the difficulty of translating bibliographic metadata because it "lacks an agreed-upon model" that would help "[explain] the structure and the value of this information to non-librarians and would also simplify interoperability with data adhering to other models." However, the library community has been more focused on formats (i.e., replacing MARC) than on data models, which Svensson called "counter-productive." (Svensson 2013, 8). Svensson outlined various attempts at developing a model for bibliographic information, including the Functional Requirements for Bibliographic Records (FRBR) and the Europeana Data Model (EDM), and described current work on BIBFRAME, which conflated data models and exchange formats (9). He concluded that "there is no one-size-fits-all model for bibliographic information," but in order to allow libraries to integrate their data with that of the wider world, "it is necessary to agree on a common model that reduces the complexity of that data integration. To build such a model, librarians—as the domain experts—need to cooperate with potential data consumers from industry and from other cultural heritage institutions." (12).

In an opinion piece, Paul Moss also addressed the conflation of multiple functions as a complication in replacing MARC, and proposed that the library community "[remove] the requirement to be the future of bibliographic description for every purpose and [focus] simply on the problem of moving metadata around..." By doing so "we may achieve a state which allows us to transition away from MARC as a

By 2014, the growing emphasis on Open Access (OA) prompted *ISQ* to devote a themed issue to supporting it. *ISQ* Managing Editor Cynthia Hodgson's feature article provided an overview of the movement, including its history and basic concepts.

representation of bibliographic data." He suggested that such a decoupling of functions "could allow a new data model, such as proposed by the current state of BIBFRAME, to be adopted in parallel to existing models for transmitting MARC records," while allowing new models for data exchange to exist alongside the old (Moss 2013, 16). Meanwhile, work on BIBFRAME continued, and Jackie Shieh described George Washington University's experiences as an early experimenter in late 2012 through early 2013. She pointed out that being an early experimenter offered "a unique opportunity to contribute and establish a new standard that would benefit researchers navigating the information sphere" (Shieh 2013, 19). Shieh concluded that the George Washington University Library benefited from the learning experience and the opportunity to collaborate with other early experimenters. The library also felt that "the investment of resources—staff, equipment, time, and skills—will eventually pay off, if not in this direction, then in another venue" (20).

By 2014, the growing emphasis on Open Access (OA) prompted *ISQ* to devote a themed issue to supporting it. *ISQ* Managing Editor Cynthia Hodgson's feature article provided an overview of the movement, including its history and basic concepts. She outlined the importance of identifiers and metadata standards to building an infrastructure to support OA, noting that "systems and services are in early stages of adoption with little interoperability between them" (Hodgson 2014, 6). Building OA repositories is dependent on reliable identifiers and metadata that can be harvested from multiple sources and aggregated, and "community- or discipline-specific metadata vocabularies that are more robust than Dublin Core would eliminate or reduce the manual classification of article deposits" (8). Hodgson also pointed out the need for license metadata, which "isn't always included at the article level or done in a consistent way" (9). To this end, Cameron Neylon, Ed Pentz, and Greg Tananbaum presented the outcomes of NISO's "Recommended Practice on Open Access Metadata and Indicators (later re-named Access and Licensing Indicators)" (Neylon 2014, 35). The draft proposal

included machine-readable metadata tags that indicated when an object was freely accessible online, or a link to a URI specifying the object's license terms (36).

Later in 2014, Todd Carpenter reported on additional developments in rights-related metadata. He noted that, for the most part, rights metadata was still managed manually, and information on rights was difficult to find and to use. To address this problem, multiple industries involved in providing content formed the Linked Content Coalition (LCC) "to develop a framework for well-structured, machine-interpretable rights data that can flow in an automated way" (Carpenter 2014, 13). The resulting LCC Framework included a data model for rights, details on how to use existing identifiers, and an analysis of information flow and exchange within the network. It also issued "ten targets for developments in identifier and metadata interoperability" to make the rights data network more effective in the future (14).

The Spring 2015 issue of *ISQ* gave an update on the work of the Access and Licensing Indicators working group that Neylon, Pentz, and Tananbaum reported on the previous

year. NISO published the group's proposal as a formal recommended practice on Access License and Indicators, and noted that "the recommended metadata tags can easily be incorporated into existing metadata distribution channels, encoded in XML, and added to existing schemas and workflow" (NISO 2015, 31).

The same 2015 issue included a NISO Report from Marshall Breeding, summarizing his white paper for NISO's Discovery to Delivery Topic Committee. He described the current discovery services landscape, including systems and existing standards and recommended practices. He stated that "indexing and relevancy is currently accomplished through entirely proprietary methods" and that "how an index-based discovery service interacts with discovery interfaces also lacks standardization" (Breeding 2015, 26). The author outlined the challenges involved in creating open access alternatives, features that are missing or underdeveloped in current discovery services, and the most important opportunities for their enhancement. This last section in particular relied on further developments in metadata standards. Integrating social interactions "would depend on standardized mechanisms that enable interoperability between the ecosystems of discovery services and those of external social networks" (29). Providing better access to special collections and archives would require "further development in supporting their metadata structures and hierarchical organizational concepts" (30). One of Breeding's recommended action items for NISO was to study "open linked data and opportunities to facilitate the exposure of metadata in index-based discovery services" (Ibid.).

Over the course of its 27 years, *ISQ* has documented the tremendous growth in metadata standards that occurred over the same time period. Since 1989, metadata standards have not only increased in terms of their quantity and complexity, they have also broadened their scope and community. In the early issues of *ISQ*, metadata coverage was mainly limited to descriptive bibliographic data, albeit from a wide variety of perspectives. Early discussions of the importance of metadata consistency and interoperability became increasingly relevant as the Internet became a driving force for change in every aspect of the information environment. As more content, workflows, and services went online, more communities recognized the need for metadata standards to help them manage it all. And as the quantity of content and the demand for information services increased, they also recognized the value of metadata that could be shared and reused in multiple contexts and across communities. As a result, NISO, through the pages of *ISQ*, became an increasingly important resource for communicating and discussing developments in creating, standardizing, and implementing metadata.



SPRING 2015

The Spring 2015 issue of *ISQ* gave an update on the work of the Access and Licensing Indicators working group that Neylon, Pentz, and Tananbaum reported on the previous year.

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