

Update on Major Metadata Standards

Since 2002, a number of initiatives related to the continuing viability of the MARC format have been launched by the Library of Congress. Most of these endeavors are attempts to make the MARC format more interoperable with other metadata standards as well as more flexible in the XML environment. MODS (Metadata Object Description Schema) was only just beginning to be developed, and METS (Metadata Encoding and Transmission Standard) was just beginning to be coordinated and maintained by the Library of Congress. Since then, plenty of discussion has ensued regarding whether MARC should be seriously pursued as the metadata standard of choice for the library community.

A new XML schema for authorities, MADS (Metadata Authority Description Schema), has been developed, MARC has been translated into the XML environment as MARCXML, and work on AACR3 is now a major development in the data content standard arena. Each of these will be examined in this chapter.

General Resources

Sally H. McCallum, chief of the Network Development and MARC Standards Office, provides a very detailed description of what is happening with metadata and why at the Library of Congress in her 2003 article, "Library of Congress Metadata Landscape."¹ In the article, McCallum focuses on three major areas of development: descriptive metadata in the current operations at the Library of Congress; pathways for support and evolution into the future; and broader metadata needs with digital materials.

Under "descriptive metadata," McCallum discusses the advantages of moving MARC into the XML environment, specifically the development of the MARCXML standard.

Through the use of charts, McCallum illustrates how MARCXML is already being used to help assist in interoperability and the transferability of cataloging records between metadata standards, specifically MODS, Dublin Core, and ONIX (see p. 183 of her report). Unimarc and EAD (Encoded Archival Description) records are also included.

Future pathways for development include various validation tools and work with Functional Requirements of Bibliographic Records (FRBR) and Metadata Encoding and Transmission Standard (METS).

In summary, the Library of Congress now uses AACR, MARC 21, and EAD for primary access to its collections; XML is being employed through the MARCXML architecture and toolkit; MODS is being employed for electronic format cataloging; and for broader metadata, METS and its appropriate extension schemas are being used. For more information on all of these initiatives, see the following Web sites:

- www.loc.gov/marc
- www.loc.gov/marcxml
- www.loc.gov/mods
- www.loc.gov/mets

The Library of Congress has also developed a number of crosswalks between MARC and various other metadata standards. These crosswalks are available at www.loc.gov/marc/marcdoc.html under the heading "MARC Mappings."

In an interesting analysis and evaluation of the MARC format as a viable metadata standard for the foreseeable future, the Deutsche Bibliothek has issued the report, *Changing to International Standards*.² In this report, the German library community examines the

move from national library standards (RAK and MAB) to international cataloging standards (MARC21 and AACR2). It is a fairly unbiased and objective evaluation of the current metadata environment in libraries. The report discusses the impact of non-library standards, focusing on XML, ONIX, Dublin Core, and the Open Archives Initiative (OAI) in particular.

The stability and development of current standards is presented, and although the report concludes that the widespread use of the MARC format for the exchange of bibliographic information and for managing library operations will not change for the foreseeable future, the report does list many of the limitations of the MARC format, namely: idiosyncratic record structure and coding; inconsistent granularity; technical obsolescence; and lack of scalability to digital materials. The report does mention the Library of Congress initiatives formed to address some of these limitations. The report also mentions the FRBRization of library catalogs in the future and current metadata management services, such as OCLC's Metadata Switch Project and the RedLightGreen of the Research Library Group (RLG) project.

Roy Tennant has written some very interesting and controversial columns on MARC's viability for the future. Many of these are available in *Library Journal*.³ This topic was listed as Issue #1 in the LITA Top Technology Trends of 2003.⁴

OCLC provides much of the research and development funding and focus on MARC tools. Access to some of OCLC's current projects is available at www.oclc.org/research/announcements/2005-06-20.htm.

Even more interesting is a project called "MetaWiki" that experiments with WorldCat data in a FRBR context. MetaWiki is an online database that incorporates simple markup for browser-based, collective document writing. There are a number of projects that examine the issues surrounding data mining and customization of information.

Extensive and up-to-date articles on current initiatives related to MARC-based metadata schemas can be found in the two-volume 2004 *Library Hi Tech* issue, "MARC and Metadata: METS, MODS, and MARCXML: Current and Future Implementations."⁵

Metadata Authority Description Schema (MADS)

The interest in controlled vocabularies and ontologies in the metadata environment was part of the impetus for the development of the MADS standard. The homepage for more information at the Library of Congress is www.loc.gov/standards/mads.

The LITA Authority Control in the Online Environment Interest Group sponsored a number of presentations on

MADS at the ALA 2005 Annual meeting in Chicago. These are available at www.ala.org/ala/lita/litamembership/litaigs/authorityacts/2005annual.htm. In particular, Sally H. McCallum's PowerPoint presentation, "MADS (Metadata Authority Description Schema), A MODS Companion," is a good introduction and explanation of

Library of Congress MADS Info. Page
www.loc.gov/standards/mads

LITA Authority Control in the Online Environment Interest Group
www.ala.org/ala/lita/litamembership/litaigs/authorityacts/2005annual.htm

Ontology-Based Metadata
www-personal.umich.edu/~peterw/Ontology/Beethoven/demo.html

the standard. This Web page also provides access to other authority control case studies at various libraries, most involving use of XML.

The interest in controlled vocabularies and ontologies in future metadata standards development can also be seen in the article, "Ontology-Based Metadata: Transforming the MARC Legacy," by Peter C. Weinstein.⁶ Weinstein proposes a new catalog structure that explicitly models relationships between works. It is based on a hierarchy of five central concepts that describe the creation of a work. These concepts are loosely based on the FRBR model: conception, expression, manifestation, materialization/digitization, and instance. A working model of this catalog can be accessed at www-personal.umich.edu/~peterw/Ontology/Beethoven/demo.html.

Metadata Object Description Schema (MODS)

MODS is an XML schema for MARC 21 records. More information and current mappings are available at www.loc.gov/standards/mods. It is currently in version 3.1.

There are three excellent PowerPoint presentations related to MODS from the 2005 ALA Annual conference in Chicago. "Rich Descriptive Metadata in XML: MODS as a Metadata Schema" (available at www.loc.gov/standards/mods/presentations/ala2005-mods_files/frame.htm) was presented by Rebecca Guenther from the Network Development and MARC Standards Office at the Library of Congress.

Another presentation by Guenther, "The Metadata Object Description Schema," for the NISO Metadata workshop in 2004, is available at www.loc.gov/standards/mods/presentations/niso-mods.ppt#276,1.

Ann Caldwell of Brown University provides a case study implementation with, "MODS at Brown University: Our First Three Years," available at <http://dl.lib.brown.edu/staff/caldwell/MODSatBrown.ppt>. Brown discusses the NoteTabPro tool that Brown University uses to incorporate MODS records into its institutional repository and online catalog.

Finally, Terry Reese, digital production unit head at Oregon State University, presents crosswalking challenges and tools development in his presentation "MODS for Everyone: XML Tools for Catalogers," which is accessible at http://oregonstate.edu/~reese/presentations/ala/summer2005/ala_2005_mods.ppt.

AACR3: Now Known as RDA (Resource Description and Access)

These days there's a lot of activity surrounding the next iteration of AACR. After a number of years of tweaking and nipping AACR2 by the ALCTS (Association for Library Collections and Tech Services) Committee and Cataloging: Description and Access (CC:DA), other international bodies, and the Joint Steering Committee (JSC), it was decided that an extensive revision of AACR was in order.

Given the intense interest of librarians and catalogers, there are a number of presentations available on this topic. The process for reviewing and commenting on drafts of the new document has been intense, both in regard to who should be at the table as this important document

MODS Resources

Library of Congress MODS Info. Page
www.loc.gov/standards/mods

"Rich Descriptive Metadata in XML: MODS as a Metadata Schema," by Rebecca Guenther
www.loc.gov/standards/mods/presentations/ala2005-mods_files/frame.htm

"The Metadata Object Description Schema," by Rebecca Guenther
www.loc.gov/standards/mods/presentations/niso-mods.ppt#276,1

"MODS at Brown University: Our First Three Years," by Ann Caldwell
<http://dl.lib.brown.edu/staff/caldwell/MODSatBrown.ppt>

"MODS for Everyone: XML Tools for Catalogers," by Terry Reese
http://oregonstate.edu/~reese/presentations/ala/summer2005/ala_2005_mods.ppt

especially because it will be a long-term project (projected completion/publication at this point in time is 2008).

The best place online to keep up with developments on RDA is by accessing the Joint Steering Committee for Revision of Anglo-American Cataloguing Rules (AACR) RDA Web Site, at www.collectionscanada.ca/jsc/rda.html (see the April 2005 meeting outcomes link). Links to presentations on RDA can be found at www.collectionscanada.ca/jsc/rdapresentations.html.

A recently revised (July 2005) overall introduction on RDA, originally written by Barbara Tillett, chief of CPSO at the Library of Congress, is available at www.collectionscanada.ca/jsc/docs/rdapptjuly2005.pdf.

Two presentations at the 2005 ALA Annual conference in Chicago provide insight into the current debates and problems that those involved in the process of developing RDA are enduring. Jennifer Bowen's "Changing Direction: From AACR to RDA" is available at www.ala.org/ala/alcts/alctsconted/alctsceevents/alctsannual/AACR3_Bowen.pdf, and John Attig's "Looking Under the Hood and Kicking the Tires: Some Premature Comments on RDA from an ALA Perspective" is available at www.ala.org/ala/alcts/alctsconted/alctsceevents/alctsannual/AACR3_Attig.pdf.

Metadata Encoding and Transmission Standard (METS)

The official METS Web site for this standard is www.loc.gov/standards/mets. It contains presentations, profiles,

is being revised, and who should be allowed to comment on the drafts (i.e., regular working catalogers, or just those in the loop). It is an interesting process to watch,

Anglo-American Cataloging Rules 3 (AACR3 or RDA)

Joint Steering Committee for Revision of AACR, RDA

www.collectionscanada.ca/jsc/rda.html

Recently Revised (July 2005) RDA Introduction

www.collectionscanada.ca/jsc/docs/rdapptjuly2005.pdf

"Changing Direction: From AACR to RDA"

www.ala.org/ala/alcts/alctsconted/alctsceevents/alctsannual/AACR3_Bowen.pdf

"Looking Under the Hood and Kicking the Tires: Some Premature Comments on RDA from an ALA Perspective"

www.ala.org/ala/alcts/alctsconted/alctsceevents/alctsannual/AACR3_Attig.pdf

implementation registry, example documents, extenders, and tools and utilities.

The Research Libraries Group (RLG) is one of the early and continuing innovators in the use of METS; a list

METS Resources

Library of Congress METS Info. Page
www.loc.gov/standards/mets

RLG METS Current Projects
www.rlg.org/en/page.php?Page_ID=553

IMLS Digital Collections Registry: Description of the XML Export Formats
<http://imlsdcc.grainger.uiuc.edu/registry/default.asp>

UKOLN RSLP Metadata Scheme
www.ukoln.ac.uk/metadata/rslp

of RLG's current projects is available at www.rlg.org/en/page.php?Page_ID=553.

An interesting project currently being put together at the University of Illinois at Urbana-Champaign is a formal METS profile for collection description.

An IMLS (Institute of Museum and Library Services) Digital Collections Registry based on METS, Dublin Core, and XML is available at <http://imlsdcc.grainger.uiuc.edu/registry/default.asp>. There are more than 100 digital collections featured thus far—fully described using the IMLS DCC (Digital Collections and Content) Collection Description Metadata Scheme—based on the UKOLN (U.K. Office for Library Networking) RSLP (Research Support Libraries Programme) Collection Description Metadata Scheme and the Dublin Core Collection Description Application Profile. The RSLP metadata scheme is available at www.ukoln.ac.uk/metadata/rslp.

Dublin Core (DC)

Dublin Core is now known as the Dublin Core Metadata Initiative (DCMI), and it is still regarded as the best lowest common denominator metadata standard out there. So much literature has been written about it—both in terms of futuristic applications (especially in regard to the OAI movement) and in terms of application tools and case studies—that trying to list them all would be both pointless and of little value. Almost everything having to do with Dublin Core is available at the Dublin Core Metadata Initiative homepage at <http://dublincore.org>. Some recently revised documents of interest include:

- “Understanding Dublin Core,” by Diane Hillman, <http://dublincore.org/documents/usageguide/index.shtml>;
- The DCMI Glossary, <http://dublincore.org/documents/usageguide/glossary.shtml>; and
- The DCMI Bibliography, <http://dublincore.org/documents/usageguide/bibliography.shtml>.

For a current list of projects, see <http://dublincore.org/projects/index.shtml>. DCMI also holds an annual conference that is well attended and presents state-of-the-art and current papers on DCMI initiatives and projects. Information on these conferences is available at <http://dublincore.org/workshops/index.shtml#upcoming>.

ONIX

ONIX is being incorporated more and more into Library of Congress records, given that publishers are creating and producing records using this metadata standard. ONIX for Books is currently in release 2.1 (revision 02), and more information can be found at www.editeur.org/onix.html.

Other ONIX standards (for serials and licensing, for instance) are available at www.editeur.org. The Library of

Dublin Core Resources

DCMI Homepage
<http://dublincore.org>

“Understanding Dublin Core”
<http://dublincore.org/documents/usageguide/index.shtml>

The DCMI Glossary
<http://dublincore.org/documents/usageguide/glossary.shtml>

The DCMI Bibliography
<http://dublincore.org/documents/usageguide/bibliography.shtml>

DCMI Current Projects
<http://dublincore.org/projects/index.shtml>

DCMI Conferences
<http://dublincore.org/workshops/index.shtml#upcoming>

Congress automatically generates MARC table of content records from ONIX through its Bibliographic Enrichment Advisory Team (BEAT). More information on this initiative can be found at www.loc.gov/catdir/beat and at the March

2, 2005, posting in Catalogablog at http://catalogablog.blogspot.com/2005_02_27_catalogablog_archive.html.

Text Encoding Initiative

The TEI metadata standard for literary texts in the humanities is still going strong. Everything and anything that you want to know about TEI is available at www.tei-c.org. The University of Michigan's Digital Library eXtension Service (DLXS), a content-management software, is built around the TEI metadata standard. See www.dlxs.org for more information.

VRA Core

The Visual Resources Association (VRA) Core metadata standard is just getting ready to release version 4.0. Like MARC is linked to AACR, the VRA Core is linked to the new Cataloging Cultural Objects (CCO) guidelines as a data content standard (to be discussed in more depth in Chapter 3, "New and/or Emerging Metadata Standards"). Version 3.0 is currently available at www.vraweb.org/vracore3.htm#intro. Access to version 4.0 is currently limited to the VRA Data Standards Committee only. (Although I have copies, I am not allowed to provide access to them. At the time of writing, it was unknown when Version 4.0 will be publicly available.)

TEI Homepage

www.tei-c.org

University of Michigan's Digital Library eXtension Service

www.dlxs.org

VRA Core Version 3

www.vraweb.org/vracore3.htm#intro

Version 4.0 will make the VRA Core XML-compliant, and it will redefine element qualifiers to sub-elements and attributes following XML encoding syntax. Element names that have been changed are: Record Type to Record; Type to Object Type; and Creator to Agent. Sub-elements under Agent will include: name, role, nationality, dates, and attrition. In version 3.0, Core elements can be applied to two types of records, works and images. In version 4.0, this has been expanded to works, images, and collections.

Learning Objects

Since the 2002 issue of *Library Technology Reports*, "Metadata and Its Applications" (38:5), quite a bit of activity has taken place in the area of metadata standards

for learning objects. There were two major standards back then: the Instructional Management System (IMS) and the

ONIX Resources

ONIX for Books

www.editeur.org/onix.html

Other ONIX Standards

www.editeur.org

Library of Congress BEAT Initiative

www.loc.gov/catdir/beat

Catalogablog

http://catalogablog.blogspot.com/2005_02_27_catalogablog_archive.html

Learning Object Metadata Standard (LOMS). For a while, it looked like both would be subsumed or incorporated into the Shareable Courseware Object Reference Model, or SCORM (available at www.adlnet.org/scorm/index.cfm). There seems to be some debate in the learning community, however, on whether participation and even practicality issues have been addressed in this area.

Some interesting articles on the topic are Edward Welsh's "SCORM: Clarity or Calamity?" at www.onlinelearningmag.com/onlinelearning/magazine/article_display.jsp?vnu_content_id=1526769, and Susan E. Metros's "Learning Objects: A Rose by Any Other Name . . ." at www.educause.edu/ir/library/pdf/erm05410.pdf.

Many smaller application profiles have been based on LOMS. Many of them are discussed in Carol Jean Godby's article "What Do Application Profiles Reveal about the Learning Object Metadata Standard?" (www.ariadne.ac.uk/issue41/godby).⁷ The U.K. Learning Object Metadata Core (at www.cetis.ac.uk/profiles/uklomcore) and the CELEBRATE Metadata Application Profile (at www.estandard.no/docs/celebrate_profil.pdf) are a few of these. Some competing standards with LOMS include the EDNA Metadata Standard, accessible at www.edna.edu.au/metadata, and the Dublin Core Education Working Group, accessible at <http://dublincore.org/groups/education>.

Open Archives Initiative (OAI)

The OAI, and its Protocol for Metadata Harvesting (OAI-PMH), is well established, and it is positioned as the most important tool for building and harvesting aggregations of metadata from dispersed locations and collections. It is built on the premise that data providers expose their metadata for harvesting and that service providers harvest

and present aggregated collections from numerous data providers.

Just as Dublin Core is the lowest common denominator metadata standard for metadata description and organization, OAI-PMH is technically a lowest common denominator standard for metadata harvesting. It requires only HTTP and XML, and it has been particularly

Resources on Learning Objects

SCORM

www.adlnet.org/scorm/index.cfm

"SCORM: Clarity or Calamity?", by Edward Welsch

www.onlinelearningmag.com/onlinelearning/magazine/article_display.jsp?vnu_content_id=1526769

Learning Objects: A Rose by Any Other Name..., by Susan E. Metros

www.educause.edu/ir/library/pdf/erm05410.pdf

"What Do Application Profiles Reveal about the Learning Object Metadata Standard?", by Carol Jean Godby

www.ariadne.ac.uk/issue41/godby

U.K. Learning Object Metadata Core

www.cetis.ac.uk/profiles/uklomcore

CELEBRATE Metadata Application Profile

www.estandart.no/docs/celebrate_profil.pdf

EDNA Metadata Standard

[/www.edna.edu.au/metadata](http://www.edna.edu.au/metadata)

Dublin Core Education Working Group

<http://dublincore.org/groups/education>

successful for sharing metadata of content in the so-called "deep" or "hidden" Web as well as in allowing participation by content providers who cannot technically use Z39.50 or other methods of federated searching. There is an excellent online tutorial for beginners in OAI at www.oaforum.org/tutorial.

In order to experiment with the OAI-PMH, seven metadata harvesting projects were initiated (through grants by the Andrew W. Mellon Foundation) in 2001. These groups have recently finished their projects, and many are beginning to publish their results.

One very well-written and detailed article on the University of Illinois at Urbana-Champaign's project is Sarah L. Shreeves's and Christine M. Kirkham's

"Experiences of Educators Using a Portal of Aggregated Metadata" (available at <http://jodi.tamu.edu/Articles/v05/i03/Shreeves>).⁸ Shreeves and Kirkham discuss the portal interface built to display the harvested metadata as well as examine detailed usability studies conducted to assess the effectiveness and usefulness of the interface.

The user group indicated a number of frustrations and concerns with the portal, including frustration with redirects within search results, problems with EAD-derived records, difficulty interpreting or using search results, high incidence of null or near-null result sets, to name a few.

In their conclusion, Shreeves and Kirkham state what most service providers currently using OAI-PMH have discovered: Although the OAI-PMH is a wonderful tool that easily moves metadata from one place to another, a great deal of mediation must take place to provide a useful aggregation and portal interface for users. The bibliography at the end of the article is very useful.

Roy Tennant has described similar experiences with managing harvested metadata through the OAI-PMH, and in his article "Bitter Harvest" (accessible at www.cdlib.org/inside/projects/harvesting/bitter_harvest.html), he details some of these concerns and some possible solutions for both data providers and service providers.⁹

Some interesting uses of the OAI-PMH beyond just harvesting and aggregating metadata are detailed in the Sompel, Young, and Hickey 2003 article "Using the OAI-PMH . . . Differently" (accessible at www.dlib.org/dlib/july03/young/07young.html).¹⁰

The Digital Library Federation (DLF) maintains a list of OAI service provider institutions at www.hti.umich.edu/i/impls/viewcolls.html. This portal maintains an accurate record of major OAI service providers and the current number of records harvested. In addition to hypertext links to service providers, a short description of each service provider is provided.

One of the latest tools developed for OAI are Extensible Repository Resource Locators (ERRoLs), which is a "cool URL" to metadata, content, and services related to registered OAI repositories. More information is available at www.oclc.org/research/projects/oairesolver/default.htm and www.openarchives.org/pipermail/oai-implementers/2003-October/001087.html.

Another tool is the OCKHAM Initiative Harvest-to-Query (H2Q) software. H2Q has the ability to provide standard querying capabilities (such as Z39.50) for OAI-PMH metadata collections. It is easy to install, can harvest metadata from any OAI-PMH collection in Dublin Core, and provides Z39.50 querying to harvested collections. When it reaches version 1.0, this software also will be able to provide SRU/W querying as well as harvesting and indexing of XML-based metadata schemes. More information can be found at <http://wiki.osuosl.org/display/OCKPub/HarvestQuery>.

The National Library of Australia (NLA) is exploiting the use of the OAI-PMH to digitize its collections and host federated search services. The NLA's application of standards in the areas of national resource discovery, persistent identification of digital objects, and the generation of metadata are well documented in the article "How the Use of Standards Is Transforming Australian Digital Libraries" (accessible at www.ariadne.ac.uk/issue41/campbell).¹¹ In the area of metadata, NLA has established seven principles to follow regarding the creation of metadata:

- A digital work instantiates the metadata and provides additional information about itself, which does not need to be encoded.
- Metadata can be used to integrate access to all research output.
- The metadata schema needs to be cost-effective to encourage creation.
- If someone makes a decision to create metadata, then the work is worthy.
- The process of metadata creation is a commitment to quality.
- Enhanced metadata is required to ensure the longevity of resources, for the purpose of future resource discovery.
- Metadata creation guidelines can change to reflect the current working environment.

Metadata creation at NLA comes from three sources: automated creation, creation by document author, and creation by information specialist. In the middle phase, document authors or the information specialists, depending on the original source of the metadata, implement the enhancements. The metadata record is then created. Many of the principles indicated above are in response to the recent controversy over the use of bibliographic standards in the online environment, exemplified by the article "To Meta-Tag or Not to Meta-Tag? A Skeptical View," available at www.melcoe.mq.edu.au/documents/MD.Debate.Dalziel.ppt.

Many of the current metasearching tools being developed exploit the capabilities of the OAI-PMH protocol to assist in retrieving information from multiple resources simultaneously. In his article "Plotting a New Course for Metasearch," Marshall Breeding discusses the limitations of distributed searching and the advantages of centralized searching using the OAI-PMH.¹² In the article, Breeding examines how libraries can make the switch to centralized searching and how the emergence of Google Scholar has changed the dynamics of finding information.

There are a number of tools being developed to assist in the use of OAI-PMH. Many of these are available at www.openarchives.org/tools/tools.html. A recent development is a beta specification to convey rights expressions. It is

OAI Resources

OAI Beginners' Tutorial

www.oaforum.org/tutorial

"Experiences of Educators Using a Portal of Aggregated Metadata," by Shreeves and Kirkham

<http://jodi.tamu.edu/Articles/v05/i03/Shreeve/>

"Bitter Harvest: Problems & Suggested Solutions for OAI-PMH Data & Service Providers," by Roy Tennant

www.cdlib.org/inside/projects/harvesting/bitter_harvest.html

"Using the OAI-PMH ... Differently"

www.dlib.org/dlib/july03/young/07young.html

DLF Listing of OAI Service Providers

www.hti.umich.edu/i/impls/viewcolls.html

ERRoLs

www.oclc.org/research/projects/oairesolver/default.htm
www.openarchives.org/pipermail/oai-implementers/2003-October/001087.html

OCKHAM Initiative H2Q

<http://wiki.osuosl.org/display/OCKPub/HarvestQuery>

"How the Use of Standards Is Transforming Australian Digital Libraries"

www.ariadne.ac.uk/issue41/campbell

"To Meta-Tag or Not to Meta-Tag? A Skeptical View"

www.melcoe.mq.edu.au/documents/MD.Debate.Dalziel.ppt

OAI Tools

www.openarchives.org/tools/tools.html

Conveying Rights Expressions about Metadata in the OAI-PMH Framework

www.openarchives.org/OAI/2.0/guidelines-rights.htm

OAIster

<http://oaister.umd.umich.edu/o/oaister>

"Looking for Pearls," by Katerina Hagerdorn

www.researchinformation.info/rimarapr05oaister.html

CIC-OAI Metadata Search Portal

<http://nerval.grainger.uiuc.edu/cgi/bib/oaister>

available at www.openarchives.org/OAI/2.0/guidelines-rights.htm.

The University of Michigan Digital Library Production Service has developed a software program (OAIster) that makes it much easier for metadata to be shared among institutions. Since its development, OAIster has become the de facto digital materials union catalog for the world. For more information, see <http://oaister.umdl.umich.edu/o/oaister> and the article “Looking for Pearls,” by Katerina Hagerdorn, at www.researchinformation.info/rimarapr05oaister.html. One well-known example of an OAIster-like portal is the Committee on Institutional Cooperation (CIC) OAI Metadata Search Portal at <http://nergal.grainger.uiuc.edu/cgi/b/bib/oaister>.

Resource Description Framework (RDF)

RDF has gone through a number of interesting developments in the last three years. The World Wide Web Consortium (W3C) has invested quite a bit of time and money in showcasing RDF as the future of the Semantic Web, often building tools and software around it. On the other hand, there are many in the metadata and Web communities that wonder if RDF is just so much hype and are still waiting to see the applicability of RDF as a viable and robust architecture for the future.

Roy Tennant has indicated publicly a number of times that he has yet to see a compelling application of RDF, i.e., something that solves a problem or is better or more efficient than other methods (see his posting on the MODS list on July 7, 2005). This was in reaction to the Lost Boy blog, “RDF and Library Metadata Inter-operability,” available at www.ldodds.com/blog/archives/000224.html. Andy Houghton’s response to Roy’s statement also indicates that XML is much more understandable and scalable than RDF (MODS list, July 7, 2005).

There is a very thorough and factual document by Dr. Mark H. Butler of HP Labs Bristol Digital Media Systems Department, “Is the Semantic Web Hype?,” that discusses the RDF versus XML debate. It is available at www.hpl.hp.com/personal/marbut/isTheSemanticWebHype.pdf. See also Raymond Yee’s thoughts on RDF at “FiguringOutRDF,” which is accessible at <http://raymondye.net/wiki/FiguringOutRdf>.

Having stated all this, information on RDF can be found at www.w3.org/RDF, along with much of the W3C’s propaganda for RDF. Various tools and applications are also available. The RDF primer, accessible at www.w3.org/TR/rdf-primer, is the best way to start.

RDF Resources

“RDF and Library Metadata Interoperability”
www.ldodds.com/blog/archives/000224.html

“Is the Semantic Web Hype?”
www.hpl.hp.com/personal/marbut/isTheSemanticWebHype.pdf

“FiguringOutRDF”
<http://raymondye.net/wiki/FiguringOutRdf>

RDF/W3C Semantic Web Activity
www.w3.org/RDF

W3C RDF Primer
www.w3.org/TR/rdf-primer

Functional Requirements for Bibliographic Records (FRBR)

This standard was barely a blip on the horizon three years ago, and now it is the hottest thing since sliced bread! RDA will be based on FRBR, which was developed by the International Federation of Library Associations (IFLA) in 1995. It is an entity–relationship, or conceptual, model of the bibliographic universe, independent of any cataloging code or implementation. For a (somewhat) simple explanation of FRBR, see the publication *What Is FRBR? A Conceptual Model for the Bibliographic Universe*, by Barbara Tillett, at www.loc.gov/cds/downloads/FRBR.PDF.

Matthew Beacom, Metadata Librarian at Yale University, wrote a very good reply to the question “FRBR: What does it mean?” on the AUTOCAT listserv on June 3, 2005:

The thing I always emphasize about FRBR is that it is a conceptual model of the bibliographic universe. If I have time to make only one point. This is the point I try to make as clearly as I can. It is not, therefore, a set of rules or instructions. It is not a theory. It is not a specification for building a database. It is not a mark up language.

What is a conceptual model? The short answer is that a conceptual model is a useful toy that is made out of ideas. What does one do with a conceptual model? Play with it. Why play with it? For fun, of course, but as when we play with other toys—model airplane, building blocks, a telescope—we may learn something useful when we play with FRBR.

Once we learn something from playing with FRBR we can apply it to the bibliographic universe we live and work within.

There are quite a few resources that detail what is now called “FRBRization” of online public library catalogs. The best is Martha Yee’s “FRBRization: A Method for Turning Online Public Finding Lists into Online Public Catalogs,” available at <http://repositories.cdlib.org/cgi/viewcontent.cgi?article=2489&context=postprints>.

There is access to a number of fascinating papers on FRBR from the May 2–4, 2005 workshop “FRBR in 21st Century Catalogues: An Invitational Workshop,” available at www.oclc.org/research/events/frbr-workshop/program.htm.

“Using FRBR,” an article in the December 2004 issue of *High Energy Physics Libraries WebZine*, by Knut Hegna, is also well written, with good illustrations; it is accessible at <http://library.cern.ch/HEPLW/10/papers/1/>. There is also a weblog devoted to FRBR at www.frbr.org and an excellent implementation of an online catalog (Perseus Catalog) that uses the MODS metadata schema expressed in FRBR relationships available at <http://test.perseus.tufts.edu/hopper/catalog>.

There is a new document by the IFLA FRANAR Working Group, “FRAR: Extending FRBR Concepts to Authority Data,” by Glenn E. Patton at OCLC. This is available at www.ifla.org/IV/ifla71/papers/014e-Patton.pdf.

Finally, for the most updated information and research on FRBR, visit the FRBR Bibliography compiled by IFLA at http://infoserv.inist.fr/wwwsympa.fcgi/d_read/frbr/FRBR_bibliography.rtf (make sure that you access this version, as it is the most up-to-date; if you search Google, you will get previous versions). Information on FRBR is divided up into theoretical aspects, impact on current standards, application studies, implementations and research projects, relationship to other models and topics, and teaching FRBR.

Geospatial Metadata

The Federal Geographic Data Committee (FGDC) still maintains the major metadata standard for the geospatial community: the Content Standards for Digital Geospatial Metadata (CSDGM). FGDC’s Web site is accessible at www.fgdc.gov, and the group’s metadata information is available at www.fgdc.gov/metadata/metadata.html, which includes a list of successful projects, training materials, online resources, and tools. The Education and Training link (at www.fgdc.gov/metadata/education.html) contains some fantastic tutorials, presentations, and fact sheets. See especially the Metadata Quick Guide “FGDC Don’t Duck Metadata,” recently revised in March 2005 and available at www.fgdc.gov/metadata/education/MetadataQuickGuide.pdf.

“X Marks the Spot: The Role of Geographic Location in Metadata Schemas and Digital Collections” (accessible at www.rlg.org/en/page.php?Page_ID=20492&Printable=1&Article_ID=1690) is a very well written article by Stephanie C. Haas on the significance of geographic location in metadata schemes and digital collections.

What Is FRBR? A Conceptual Model for the Bibliographic Universe, by Barbara Tillet
www.loc.gov/cds/downloads/FRBR.PDF

“FRBRization: A Method for Turning Online Public Finding Lists into Online Public Catalogs,” by Martha Yee
<http://repositories.cdlib.org/cgi/viewcontent.cgi?article=2489&context=postprints>

“FRBR in 21st Century Catalogues: An Invitational Workshop”
www.oclc.org/research/events/frbr-workshop/program.htm

“Using FRBR,” by Knut Hegna
<http://library.cern.ch/HEPLW/10/papers/1/>

FRBR Weblog
www.frbr.org

Perseus Catalog
<http://test.perseus.tufts.edu/hopper/catalog>

“FRAR: Extending FRBR Concepts to Authority Data”
www.ifla.org/IV/ifla71/papers/014e-Patton.pdf

FRBR Bibliography
http://infoserv.inist.fr/wwwsympa.fcgi/d_read/frbr/FRBR_bibliography.rtf

Stephanie C. Haas, “X Marks the Spot: The Role of Geographic Location in Metadata Schemas and Digital Collections,” *RLG DigiNews* 8, no. 6 (December 15, 2004), www.rlg.org/en/page.php?Page_ID=20492&Printable=1&Article_ID=1690 (accessed September 28, 2005).

In her article, Haas indicates how important geographic access points are in geospatial metadata. She examines traditional library methods of providing geographic access in metadata records, discussing MARC, LCSH, and spatial coordinates. She examines how CSDGM and ISO standards provide this information. She also includes a section on breaching metadata boundaries that discusses two innovative digital projects that permit geographic searching using map interfaces and longitude/latitude searches. They are the Alexandria Digital Library

at www.alexandria.ucsb.edu and the Electronic Cultural Atlas Initiative and its TimeMap projects at www.ecai.org (see also note number 8 at the end of this chapter, p. 33, for other articles on similar projects).

A new geospatial one-stop portal has been developed by the Environmental Systems Research Institute, Inc., or ESRI (www.esri.com). ESRI won the contract from the U.S. Department of the Interior to update the department's Web site at www.geodata.gov/gos. "The Technology Behind the New Geodata.gov and the Non-Technology Challenges Ahead" is an excellent article written by Adena Schutzberg and Joe Francica on the technology that ESRI incorporated in the new metadata catalog at this site. A graphic map of how this metadata catalog works is available at www.directionsmag.com/article.php?article_id=784.¹³ It is a very futuristic catalog,

which allows users to access data through many different portals, set up alerts to their e-mail accounts, and it incorporates many different metadata standard protocols in its search and retrieval architecture.

Metadata for Music Notation

There are some new resources to add to the 2002 report ("Metadata and Its Applications, *Library Technology Reports* 38:5) in this area. There is a new metadata working group within the Music Library Association. The group maintains a Web site with links to metadata resources and guides at <http://unitproj.library.ucla.edu/music/metadata>.

Documentation on metadata and usability studies regarding the *IN Harmony: Sheet Music from Indiana* IMLS-funded digital project is available at www.dlib.indiana.edu/projects/inharmony/projectDoc/index.shtml.

Geospatial Metadata Resources

Federal Geographic Data Committee
www.fgdc.gov

FGDC Metadata Information
www.fgdc.gov/metadata/metadata.html

FGDC Education and Training Link
www.fgdc.gov/metadata/education.html

"FGDC Don't Duck Metadata"
www.fgdc.gov/metadata/education/MetadataQuickGuide.pdf

"X Marks the Spot: The Role of Geographic Location in Metadata Schemas and Digital Collections"
www.rlg.org/en/page.php?Page_ID=20492&Printable=1&Article_ID=1690

Alexandria Digital Library
www.alexandria.ucsb.edu

Electronic Cultural Atlas Initiative TimeMap Projects
www.ecai.org

Environmental Systems Research Institute, Inc.
www.esri.com

U.S. Department of the Interior
www.geodata.gov/gos

"The Technology Behind the New Geodata.gov and the Non-Technology Challenges Ahead"
www.directionsmag.com/article.php?article_id=784

Metadata for Music Notation Resources

Music Library Association Metadata Standards Working Group
<http://unitproj.library.ucla.edu/music/metadata>

IN Harmony: Sheet Music from Indiana Digital Project
www.dlib.indiana.edu/projects/inharmony/projectDoc/index.shtml

Music Encoding Initiative
www.lib.virginia.edu/digital/resndev/mei

The Music Encoding Initiative (MEI) is an XML DTD (Document Type Definition) for the representation and exchange of music information. To view more information, papers, and presentations on this standard, go to www.lib.virginia.edu/digital/resndev/mei.

Encoded Archival Description (EAD)

The Online Archive of California (OAC) has released version 2.0 of its "OAC Best Practice Guidelines for EAD," available at www.cdlib.org/inside/diglib/guidelines/bpgead/bpgead_1-2.html. RLG has also recently released an EAD Report Card, a tool that automatically checks the quality of your EAD encoding, and it is to be used as a supplement to its "RLG Best Practices Guidelines for Encoded Archival Description." The EAD Report Card is available at www.rlg.org/en/page.php?Page_ID=20513, and the Best Practices Guidelines are at www.rlg.org/en/page.php?Page_ID=450.

Rights Metadata Standards

Many of the rights management metadata standards were in flux in 2002, and the issue has become more important in the intervening three years. The Open Digital Rights Language (ODRL) Initiative (<http://odrl.net>) is working on developing and promoting an open standard for digital rights management. This initiative is working in conjunction with the DCMI (Dublin Core Metadata Initiative), and it has produced an ODRL/DCMI metadata standard to assist in this process. More information is available at <http://odrl.net/Profiles/DCMI>.

Preservation Metadata Standards

More than any other metadata standard, preservation issues have been the major focus of many initiatives and project development. A draft report, "Long-Lived Digital Data Collections: Enabling Research and Education in the 21st Century," issued by the National Science Foundation (NSF) in May 2005, details many of the issues and concerns on this topic. The report covers elements of the digital data collections universe; roles and responsibilities of individuals and institutions; perspectives on digital data collections policy by NSF; and findings and recommendations. The draft report is available at www.nsf.gov/nsb/documents/2005/LLDDC_report.pdf.

One of the newest initiatives regarding preservation metadata is the PREservation Metadata: Implementation Strategies (PREMIS) Working Group. This group has issued a number of documents, including a 237-page data dictionary for preservation metadata, and a report on implementing preservation repositories for digital materials in the cultural heritage community. All of these documents are accessible at the PREMIS official Web site at www.oclc.org/research/projects/pmwg.

The Association of Research Libraries (ARL) Preservation of Research Library Materials Committee published *Recognizing Digitization as a Preservation Reformatting Method*, available at www.arl.org/preserv/digit_final.html. The paper recognizes PREMIS, METS, and MODS as excellent metadata standards for preservation. Appendix 2 lists benefits of digitization as a preservation reformatting option, and Appendix 3 details standards and best practices in digital reformatting, with extensive links to various standards and projects.

An interesting preservation endeavor in the digital media area is Archiving the Avant-Garde: Documenting and Preserving Digital/Variable Media Art. This Web site (accessible at www.bampfa.berkeley.edu/about_bampfa/avantgarde.html) examines the issues related to preserving digital and Internet art and performance that are often ephemeral and variable in nature. The site also contains project partners and various documents related to this topic.

The National Library of Australia's Web Site, Preserving Access to Digital Information (PADI), accessible at www.nla.gov.au/padi/about.html, is devoted to preservation issues. Available through the site are several "trails," including a Removable Storage Media Trail, a Metadata and Preservation Metadata Trail, a Digital Preservation Management Trail, a Digital Preservation Methods Trail, and a Web Archiving Trail. There's a Beginner's Trail for general resources related to broad digital preservation issues. This is a very good portal for preservation metadata links.

Another good portal is the DCMI Preservation Working Group Web site at <http://dublincore.org/groups/preservation>, which also provides links to major preservation metadata standards under "Related Work."

"OAC Best Practice Guidelines for EAD"

www.cdlib.org/inside/diglib/guidelines/bpgead/bpgead_1-2.html

RLG EAD Report Card

www.rlg.org/en/page.php?Page_ID=20513

"RLG Best Practices Guidelines for Encoded Archival Description"

www.rlg.org/en/page.php?Page_ID=450

Open Digital Rights Language

<http://odrl.net>

ODRL/DCMI Metadata Standard

<http://odrl.net/Profiles/DCMI>

An excellent discussion of the topic of technical metadata, especially in relation to the preservation of digital still images, is *Automatic Exposure: Capturing Technical Metadata for Digital Still Images*, available at www.rlg.org/longterm/ae_whitepaper_2003.pdf. This RLG Initiative document provides the best history of technical metadata that I have seen thus far; it also discusses why technical metadata is important to capture for the management and preservation of digital images throughout the different stages of their lifecycles.

The NISO standard Z39.87 Technical Metadata for Digital Still Images, at www.niso.org/standards/resources/Z39-87-200x-forballot.pdf?CFID=6566808&CF_TOKEN=14429374, at the time of writing, was in a ballot period (for comment until August 26, 2005). To keep track of its acceptance, check www.niso.org/committees/committee_au.html. The NISO Metadata for Images in XML Schema (MIX) is also detailed in the RLG paper (see www.loc.gov/standards/mix for more information on this metadata standard). The Open Archival Information

Preservation Metadata Standards Resources

“Long-Lived Digital Data Collections: Enabling Research and Education in the 21st Century”
www.nsf.gov/nsb/documents/2005/LLDDC_report.pdf

PREMIS Working Group
www.oclc.org/research/projects/pmwg

Recognizing Digitization as a Preservation Reformatting Method (*Prepared for the ARL Preservation of Research Library Materials Committee*)
www.arl.org/preserv/digit_final.html

Archiving the Avant-Garde: Documenting and Preserving Digital/Variable Media Art
www.bampfa.berkeley.edu/about_bampfa/avantgarde.html

NLA’s Preserving Access to Digital Information (PADI)
www.nla.gov.au/padi/about.html

DCMI Preservation Working Group
<http://dublincore.org/groups/preservation>

RLG’s Automatic Exposure: Capturing Technical Metadata for Digital Still Images
www.rlg.org/longterm/ae_whitepaper_2003.pdf

NISO Standard Z39.87 Technical Metadata for Digital Still Images
www.niso.org/standards/resources/Z39-87-200x-forballot.pdf?CFID=6566808&CFTOKEN=14429374
www.niso.org/committees/committee_au.html

NISO Metadata for Images in XML Schema
www.loc.gov/standards/mix

Report on the Open Archival Information System
www.oclc.org/research/projects/pmwg/pm_framework.pdf

Moving Image Collections
<http://mic.imtc.gatech.edu/index.php>

MIC’s Cataloging and Metadata Portal
http://mic.imtc.gatech.edu/catalogers_portal/cat_index.htm

DigiCULT
www.digicult.info/pages/index.php

DigiCULT Newsletters
www.digicult.info/pages/newsletter.php

DigiCULT Technology Watch Reports
www.digicult.info/pages/techwatch.php

DigiCULT Thematic Issues
www.digicult.info/pages/themiss.php

InterPARES Project
www.interpares.org

PRISM Project
www.library.cornell.edu/iris/research/prism

“Preservation Risk Management for Web Resources” in D-Lib Magazine
www.dlib.org/dlib/january02/kenney/01kenney.html

USGPO, “Report on the Meeting of Experts on Digital Preservation”
www.gpoaccess.gov/about/reports/preservation2.pdf

USGPO, “Report on the Meeting of Experts on Digital Preservation: Metadata Specs”
www.gpoaccess.gov/about/reports/metadata_report_final.pdf

NARA’s “Technical Guidelines for Digitizing Archival Materials for Electronic Access”
www.archives.gov/research/arc/digitizing-archival-materials.html

System (OAIS) is also discussed, in relation to technical metadata standards for preservation, in *Preservation Metadata and the OAIS Information Model: A Metadata Framework to Support the Preservation of Digital Objects* (see www.oclc.org/research/projects/pmwg/pm_framework.pdf). Pages seven and eight of RLG’s *Automatic Exposure* white paper (available at www.rlg.org/longterm/ae_whitepaper_2003.pdf) include discussion about tools currently under development or in

an experimentation phase to harvest technical metadata. In its conclusion, *Automatic Exposure* recommends the NISO MIX standard for the preservation of technical metadata for digital still images.

An interesting resource devoted to moving images’ metadata and preservation is the Moving Image Collections (MIC) Web site, which is accessible at <http://mic.imtc.gatech.edu/index.php>. MIC’s Cataloging and Metadata Portal, at http://mic.imtc.gatech.edu/catalogers_portal/

cat_index.htm, provides access to resources in content standards, descriptive metadata schema, related metadata standards, controlled vocabularies, classification schemes, other standards, and cataloging tools. The MIC metadata schema serves as a mapping registry for any metadata supplied by MIC participants and for import, display, and export of various standards, including MARC, Dublin Core, and MPEG-7, among others. MIC has developed an innovative ingest utility—currently being tested by seven archives—by which the archives supply sample records, map their data elements to MIC data elements via a Web form, view their data in MIC format, tweak the Web form, review the data through as many iterations as they want, and then send their complete data via FTP to MIC for automatic ingest. The metadata is then mapped automatically to MARC, Dublin Core, and MPEG-7. MIC is currently working on an export facility that will allow data sharing in various other standards and via OAI. The union catalog utilizes some of these innovations.

There are a number of metadata and preservation metadata initiatives in Europe. The most important one is the DigiCULT group (at www.digicult.info/pages/index.php). The mission of this group is to benefit the cultural heritage sector, particularly in Europe, by assessing and monitoring emerging and existing technologies to help optimize the development, preservation, and access to Europe's cultural and scientific heritage, especially within the emerging digital cultural economy.

As such, this group has issued a number of groundbreaking and informative reports that list many of the digital projects currently underway throughout Europe as well as a number of locally and regionally developed metadata standards. Thus far, this group has produced nine newsletters (between 2002 through 2004, available at www.digicult.info/pages/newsletter.php); three Technology Watch Reports, focused on presenting six technologies in depth and their current and future impacts on cultural heritage projects (available at www.digicult.info/pages/techwatch.php); and seven Thematic Issues, which detail news, software products, current projects, and digital initiatives of interest to the cultural heritage community (available at www.digicult.info/pages/themiss.php). It is impossible for this report to detail all of the metadata standards detailed throughout the publications of this group, which is why this general annotation with specific links is provided.

Specifically, Thematic Issue #1 (August 2002), on “Integrity and Authenticity of Digital Cultural Heritage Objects,” details many preservation metadata standards, including the International Research on Permanent Authentic Records in Electronic Systems (InterPARES) project at www.interpares.org; and the Preservation, Reliability, Interoperability, Security, and Metadata (PRISM) Project at www.library.cornell.edu/iris/research/prism (see also “Preservation Risk Management

for Web Resources,” in *D-Lib Magazine*, January 2002 at www.dlib.org/dlib/january02/kenney/01kenney.html).

Finally, in order to focus on digital specifications for digital preservation masters and metadata issues, the United States Government Printing Office (GPO) recently held the second of a series of meetings with a group of experts on digital preservation. The goal of this second meeting was to examine a plan for the development of metadata specifications for descriptive and preservation metadata for the digitization of the historical Federal Depository Library Program (FDLP) collection. The “Report on the Meeting of Experts on Digital Preservation” is available at www.gpoaccess.gov/about/reports/preservation2.pdf, and the report on metadata is at www.gpoaccess.gov/about/reports/metadata_report_final.pdf (“Report on the Meeting of Experts on Digital Preservation: Metadata Specifications”).

The conclusion of the group in relation to metadata was that wrapping the metadata around the digital object, rather than maintaining the metadata in a separate database, was endorsed. METS was viewed as a favorable solution, because its wrapper format allows diversity of schema at different levels (MARC at the top level; and Dublin Core, FGDC, and DDI at lower levels). They developed a model metadata package containing eleven high-level elements. Appendix B also lists some interesting case studies and reviews of other possible metadata standards, such as The National Archive and Records Administration (NARA) report “Technical Guidelines for Digitizing Archival Materials for Electronic Access” (accessible at www.archives.gov/research/arc/digitizing-archival-materials.html) as well as metadata models from the National Library of Australia and the National Library of New Zealand.

Notes

1. Sally H. McCallum, “Library of Congress Metadata Landscape,” *Zeitschrift für Bibliotheks- und Bibliographie* 50, no. 4 (July/August 2003): 182–87.
2. Patricia Burch, *Changing to International Standards*. Stillwater, NJ: Die Deutsche Bibliothek & The Stillwater Group, March 8, 2005, www2.bibliothek.uni-augsburg.de/kfe/mat/final_report.pdf (accessed September 28, 2005).
3. Roy Tennant, “MARC Must Die,” *Library Journal* (October 15, 2005), www.libraryjournal.com/article/CA250046.html (accessed September 28, 2005); *Ibid.*, “MARC Exit Strategies,” *Library Journal* (November 15, 2005), www.libraryjournal.com/article/CA256611.html (accessed September 28, 2005); *Ibid.*, “Doing Data Differently,” *Library Journal* (June 15, 2005), <http://www.libraryjournal.com/article/CA606393.html> (accessed September 28, 2005); *Ibid.*, “A Bibliographic Metadata Infrastructure for the 21st Century,” *Library Hi Tech* 22, no. 2 (2004): 175–181, <http://roytennant.com/metadata.pdf> (accessed September 28, 2005).

4. The Top Trends, Library and Information Technology Association (LITA), "Technology and Library Users, An Ongoing Discussion," LITA, June 22, 2003, www.ala.org/ala/lita/litaresources/toptechtrends/annual2003.htm (accessed September 28, 2005).
5. Bradford Lee Eden, theme ed., "MARC and Metadata: METS, MODS, and MARCXML: Current and Future Implementations," *Library Hi Tech* 22, nos. 1-2 (2004).
6. Peter C. Weinstein, "Ontology-Based Metadata: Transforming the MARC Legacy." Proceedings of the Third ACM Conference on Digital Libraries, Pittsburgh, PA, June 23-26, 1998: 254-63
7. Carol Jean Godby, "What Do Application Profiles Reveal about the Learning Object Metadata Standard?" *ARIADNE* 41 (October 2004), www.ariadne.ac.uk/issue41/godby (accessed September 27, 2005).
8. Sarah L. Shreeves and Christine M. Kirkham, "Experiences of Educators Using a Portal of Aggregated Metadata," *Journal of Digital Information* 5, no. 3 (2004), <http://jodi.tamu.edu/Articles/v05/i03/Shreeves> (accessed September 27, 2005).
9. Roy Tennant, "Bitter Harvest: Problems & Suggested Solutions for OAI-PMH Data & Service Providers," California Digital Library Association (2004), www.cdlib.org/inside/projects/harvesting/bitter_harvest.html (accessed September 27, 2005).
10. Herbert Van de Sompel, Jeffrey A. Young, and Thomas B. Hickey, "Using the OAI-PMH . . . Differently," *D-Lib Magazine* 9, no. 7/8 (July/August 2003), www.dlib.org/dlib/july03/young/07young.html (accessed on September 28, 2005).
11. Debbie Campbell, "How the Use of Standards Is Transforming Australian Digital Libraries," *ARIADNE* 41 (October 2004), www.ariadne.ac.uk/issue41/campbell (accessed September 27, 2005).
12. Marshall Breeding, "Plotting a New Course for Metasearch," *Computers in Libraries* 25, no. 2 (February 2005): 27-29.
13. Joe Francica and Adena Schutzberg, "The Technology Behind the New Geodata.gov and the Non-Technology Challenges Ahead," *Directions Magazine* (March 8, 2005), www.directionsmag.com/article.php?article_id=784 (accessed on September 28, 2005).