1. Introduction: The Need for Comprehensive Electronic Resource Management Systems

A few years ago, Cornell University Libraries' strategic plan included the bold and startling prediction of a "mostly digital environment" for that library system by 2005 (Cornell Libraries 2000). Whether or not this prediction proves to be accurate for Cornell or would apply to most other libraries, it is clear from Association of Research Libraries (ARL) expenditure-trend data that spending for electronic resources (e-resources) has been growing much more rapidly than have the materials budgets of which such resources are usually a part. In the 2001–2002 academic year, at least a few ARL libraries were already spending half their materials budgets for e-resources (ARL 2002, 2003). Libraries are in the midst of a profound shift toward reliance on e-resources, and this reliance seems to have deepened within the last year or two as libraries have shed paper journal subscriptions to help pay for online access.

Meanwhile, user behavior and attitudes seem to be changing even more quickly. For example, nearly half of the undergraduates surveyed by Outsell, Inc., for a recent study of the scholarly information environment indicated that they used e-resources either exclusively or almost exclusively (Friedlander 2002). That study also showed that many faculty and graduate students would like to see more journals available to them electronically. However, as many librarians can attest, demand for expanded access to e-resources is only part of the story. Users now compare their libraries' services to such recent innovations as the Google search engine and Amazon.com, and they expect libraries to provide similar levels of simplicity, power, and convenience.

These developments provide the context for what many librarians find to be a daunting and increasingly complex challenge: successfully managing their collections of e-resources. In an earlier study of DLF-member library practices, Jewell (2001) identified some noteworthy trends in how these libraries selected and acquired licensed e-resources and presented information about them to users. Perhaps of greatest importance for the present discussion, most of the responding DLF libraries had found that their existing ILSs were incapable of supporting these functions and had begun to design and build local automated tools to fill the gaps.

One fundamental management problem that some of these systems were meant to address is the need to describe larger and larger numbers of bibliographic databases and to present that information to users. Another challenge lies in the nature and characteristics of some of the new resources. For example, most libraries now spend significant amounts of money on *aggregator* databases. Available from companies such as EBSCO, Gale, LexisNexis, and ProQuest, these databases provide access to the contents or partial contents of large numbers of periodicals. Although such collections often provide substantial benefits, reliably and routinely determining which journals they provide—for what periods of time, in what format, and with what degree of currency or completeness—has been an elusive goal. The growth of electronic journals (e-journals) and databases has heightened this problem while complicating and transforming the processes associated with acquiring and servicing library materials.

The 2001 DLF report cited above noted that users were often presented with special alphabetical or subject lists of e-resources to help meet this descriptive or resource-discovery need. Aggregator databases had become a staple within this group, and many of the libraries had begun to experiment with listing their contents along with subscribed e- journals. Since the research for the DLF report was conducted, companies such as Serials Solutions, TDNet, and EBSCO have begun to offer services aimed at filling these needs, but few ILSs that can fully support or interact with them have become available. In recent years, libraries have also begun linking their indexing and full-text resources through proprietary database vendor solutions and broader, standards-based tools Ex Libris's SFX, thus not only providing greater user convenience but also adding a layer of complexity to the management of e-resources.

Other changes that are much less visible to users have also been taking place. As e-resources have become pervasive, formal license agreements have come to supplement or supersede copyright law as the basis for defining and determining their appropriate use. Despite the welcome and promising appearance of model licenses (Cox 2000; Council on Library and Information Resources 2001) and other efforts to standardize license terms, libraries have been investing substantial time and effort in the review and negotiation of license terms. Local license negotiations may become complex and protracted, involving staff at multiple levels of both licensor and licensee organizations. As a result, some libraries had begun making special efforts to track the status of a particular negotiation, describe its important license terms, and present those terms to users and staff.

At the same time, libraries have been entering into complex, consortium-based purchasing arrangements with other libraries. These arrangements are characterized by ongoing financial commitments and new communication, evaluation, and decision-making processes. Once acquired, these resources must be supported through specialized skills and new kinds of information. Recognizing the complexity of some resources and user expectations for convenience, some libraries have begun to provide instructional and other specialized information directly to their users via their Web sites.

Another defining facet of the new electronic environment revealed in the 2001 DLF study is that large numbers of staff from disparate units of larger libraries had begun playing new and important specialized roles in the selection, support, and evaluation of e-resources. Most of these staff had needs for a wide range of specialized information. For example, staff members in different areas might need to know the status of a given resource within the local acquisition and licensing process. Others might need to know access details, whether access problems related to a particular resource had arisen, and who was involved in what specific troubleshooting activities. Several libraries were also implementing planned, cyclical reviews of their e-resources, and—with that in mind—beginning to systematically gather and report all available information on their use.

2. Current Efforts to Create Electronic Resource Management Systems

Libraries' emerging interest in ERM systems prompted Jewell and Adam Chandler at Cornell to establish in 2001 a Web *hub* to exchange information about local systems and foster communication among interested librarians. As local systems were identified, librarians involved in developing them were systematically asked about their systems' functions and data elements, and the elements were analyzed and summarized in the DLF report previously mentioned (Jewell 2001, p. 26). Seven functional areas were identified: listing and descriptive, license-related, financial and purchasing, process and status, systems and technical, contact and support, and usage. Informal discussions were also begun concerning the value of standardizing functional descriptions, element names, and definitions to support these functions.

Within a year or two, some 20 libraries and vendors had announced that they had produced or were planning to produce such systems (table 1).

Table 1. Library-Based ERM Initiatives

- California Digital Library
- Colorado Alliance (Gold Rush)
- Columbia University
- Griffith University (Australia)
- Harvard University
- Johns Hopkins University (HERMES)
- Massachusetts Institute of Technology (VERA)
- North Carolina State University
- University of Notre Dame
- Pennsylvania State University (ERLIC)
- Stanford University
- University of Texas (License Tracker)
- Tri-College Consortium (Haverford, Bryn Mawr, and Swarthmore)
- University of California, Los Angeles
- University of Georgia
- University of Michigan
- University of Minnesota
- University of Virginia
- Willamette University
- Yale University

Each system developed by a library reflects particular local requirements and development constraints, and many systems exhibit creative and noteworthy features. Rather than provide an exhaustive review of these systems, this discussion focuses on features of just a few of them. Its purpose is to begin to identify elements of an ideal, but achievable, system for managing e-resources.

The Pennsylvania State University (Penn State) Libraries' ERLIC (Electronic Resources Licensing and Information Center), established in 1999, is a good example of a system that was designed to address a fairly limited need but whose functions have been expanded substantially (Penn State Libraries 2001). Developed using Microsoft Access to track the status of orders and to anticipate renewals, ERLIC, and now ERLIC^2, have evolved into centralized sources of ordering, access, authentication, and licensing information (Stanley et al. 2000; Alan 2002). The MIT Libraries' VERA (Virtual Electronic Resource Access) system was developed about the same time as Penn State's and also exhibits a wide spectrum of functions (Duranceau 2000a; Duranceau 2000b; Hennig 2002). It offers both extensive support for "back-office" staff functions and requirements and numerous noteworthy public Web page-design features. Yale University's schematized treatment and public presentation of license terms serves as an interesting supplement to MIT's approach to the same problem.

Like ERLIC and VERA, UCLA's ERDb system was developed to provide a wide range of functionality. While its functionality and screen designs are of substantial interest and will be explored in the following pages, related working documents (Farb 2002) also articulate useful guidelines that could be generally applied to ERM-system development. Under these guidelines, a system should

- accommodate growth
- design for flexibility
- be offered "one database, but many views"
- avoid unnecessary duplication
- be capable of phased implementation

Similarly broad in scope is JHU's HERMES, which stands for Hopkins Electronic Resource Management System (Cyzyk and Robertson 2003). Based on PostgreSQL and Cold Fusion, HERMES has recently been made available on an open-source basis. While intended to support such functions as the dynamic generation of public Web pages, HERMES is of special interest because of the careful analysis of staff roles, workflows, and associated functional requirements that have gone into it. Also worthy of mention is Gold Rush, developed by the Colorado Alliance of Research Libraries (Stockton and Machovec 2001). Gold Rush was the first commercially available system to incorporate substantial functionality for e-resource subscription management. Reasonably priced and offering support both for individual libraries and library consortia, Gold Rush enables a central consortium administrator to "push" out to member libraries a record with a range of information pertaining to an e-resource.

3. Functions and Examples

3.1. A LIFE CYCLE–BASED OVERVIEW

Records management has been defined as the "systematic control of all organizational records during the various stages of their lifecycle: from their creation or receipt, through their processing, distribution, maintenance and use, to their ultimate disposition" (Robek et al. 1996). Effective management of e-resources depends on the execution of a wide range of functions that follow a slightly different life cycle. For example, while libraries at present generally do not have to deal with the creation of licensed e-resources, they do need to evaluate new products and services, and there are other fairly close parallels between a simplified records management life cycle model and one for e-resources.

Table 2 outlines many of the tasks involved in managing e-resources and the staff who may be involved in different life cycle phases. The table is based on the functions and reports available to staff users of HERMES and largely follows the DLF Electronic Resource Management Initiative (ERMI) workflow sequence (see Appendix B).The column headings refer to five roles that Hopkins staff play in the process: *selector* and *superselector, acquisitions administrator, library computing systems administrator,* and *public display administrator.* Each of these roles is described in the following paragraphs.

1. Product consideration and trial process. At JHU, a selector is responsible for identifying a resource, determining whether a trial is necessary, and gathering preliminary license information. The acquisitions administrator is responsible for negotiating a trial license, if needed. The selector recommends whether to proceed following a trial, which the superselector then approves or disapproves. Additional details, such as trial URLs, passwords, and publicity, are established and recorded during this phase.

2. Acquisition processes**.** These processes involve three fairly distinct subprocesses that may take place simultaneously. At JHU, the acquisitions administrator is responsible for license negotiation and for entry of related information into HERMES, and the computing services administrator determines technical feasibility and gives or withholds permission to proceed. Remaining tasks, also the responsibility of the acquisitions administrator, relate to funding and purchase.

3. Implementation. During this phase, authentication details are worked out and recorded, any necessary database configuration is performed, and the resource and any appropriate components are cataloged and incorporated into public Web pages. The descriptive tasks during this phase can be difficult and time-consuming, particularly if the resource in question is an e-journal or aggregator package containing large numbers of journals or other content. Public Web page presentations can be provided in a number of ways and, as will be shown later, could include the provision to staff and users of information about licensing terms. It may also be necessary to make the resource known to a link resolver or proxy server.

4. Product maintenance and review. One of the important tasks within this phase is subscription renewal, which can be triggered by date-configurable reminders to staff and could involve price or license-term renegotiation. Another task is maintenance of the holdings, or *coverage*, information encountered during the implementation phase. Additional tasks that could figure in the renewal process include acquiring and making usage data available to staff and identifying and resolving problems relating to access and other technical issues.

Table 2. Johns Hopkins University's HERMES Selection/Acquisition Tasks, Roles, and Reports

Function/Role	Selector	Superselector	Acquisitions Administrator	Cataloger	Library Computing Services Administrator	Public Display Administrator
1. Product consideration and trial						
Select a resource	•					
Determine if trial required	•					
Gather preliminary license information	•					
Negotiate trial license			•			
Decide to proceed, after trial	•					
Gain approval to proceed		•				
2. Acquisition						
Receive negotiated license and approval to proceed			•			
Insert a new license			•			
Ensure project is technically feasible/Gain approval to proceed					•	
Check funding			•			
Gain approval from purchasing			•			
Generate and send purchase order			•			
Confirm final order			•			
3. Implementation						
Identify items recently imported to HERMES			•			
Identify items awaiting final review and secure approval of catalog records				•		
Hold recently imported items waiting for final review and approval of catalog records				•		
Add resource to public Web pages						•

Table 2. Continued

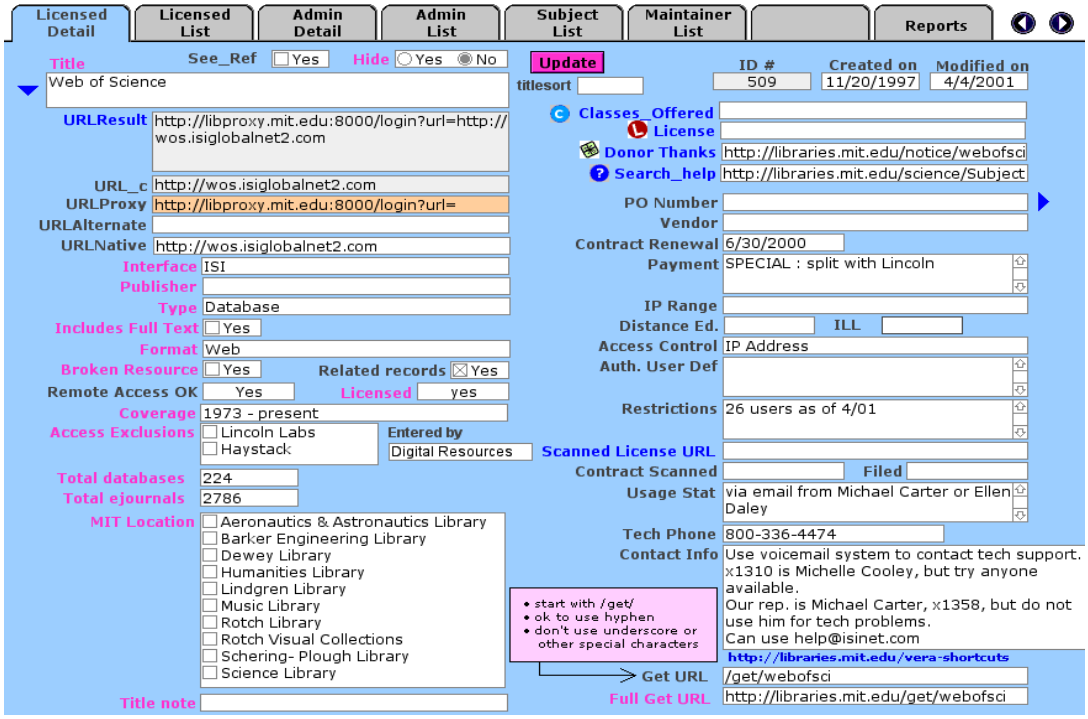
Function	Selector	Super-Selector	Acquisitions Administrator	Cataloger	Library Computing Services Administrator	Public Display Administrator
4. Product maintenance and review						
Determine whether license is up for renegotiation			•			
Reset the "days-before" expiration value			•			
Determine whether license is being renegotiated			•			
Gain response from purchasing for renegotiated license			•			
Update an existing license			•			
Attach a new resource to an existing license			•			
Attach an existing resource to an existing license			•			
View possible problem records				•		
5. Administrative functions and reports						
Check status of open items	•					
Reassign open items		•				
Assign budget codes to selectors		•				
Administer budget codes			•			
Administer provider look-up table			•			
Administer vendor look-up table			•			
Administer the subjects module				•		
Administer the Library of Congress/MESH heading mappings				•		
View workflow order	•	•	•	•		
Search e-resources and/or licenses	•	•	•	•		
Run standard reports	•	•	•	•		

3.2. SAMPLES OF ERM SYSTEM AND PUBLIC WEB PAGE SCREENS

3.2.1. Product Consideration and Trial Processes

The preceding life cycle, task, and role inventory may not correspond closely with the screen displays that staff actually see when using ERM systems or their derivatives. For example, the functions listed on table 2 could be reorganized and presented according to staff role—as they are within the HERMES. This underscores the value of one of UCLA's aforementioned design principles: "One database, many views." Another example of multiple views and an alternative organization of similar information is this screen from MIT's VERA (figure 1).

Fig. 1. MIT Libraries' VERA Staff Display Showing Range of Functions



In this view, information from different life cycle phases, such as acquisition (purchase order number and vendor), implementation (URL, location), and product maintenance and review (renewal date, technical support contact, information about usage data) is presented together, presumably because the staff who use this screen need to see it simultaneously.

Figure 2 shows a view from UCLA's ERDb system. Called a Resource Screen, it includes information relevant to multiple e-resource life cycle phases. In addition to basic identifying or descriptive information that will be useful and used throughout the resource life cycle, selection information (e.g., sponsoring unit and selector), as well as acquisitions information (e.g., vendor and purchase order number) can be seen.

Fig. 2. UCLA Resource Screen

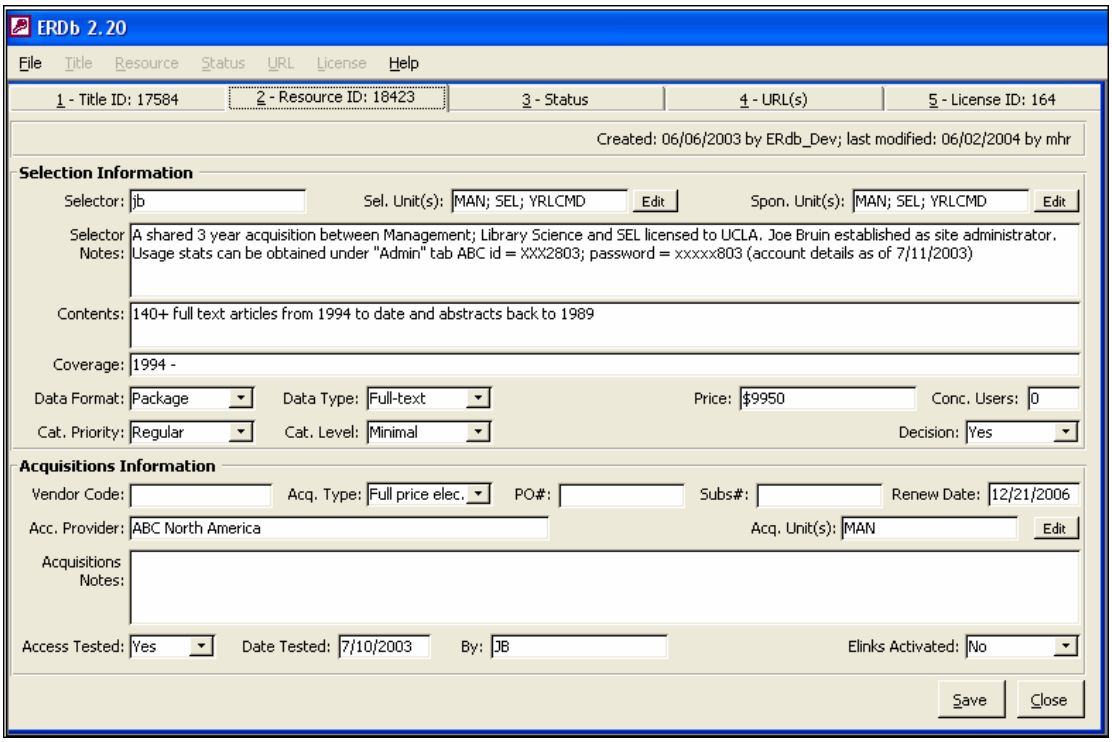
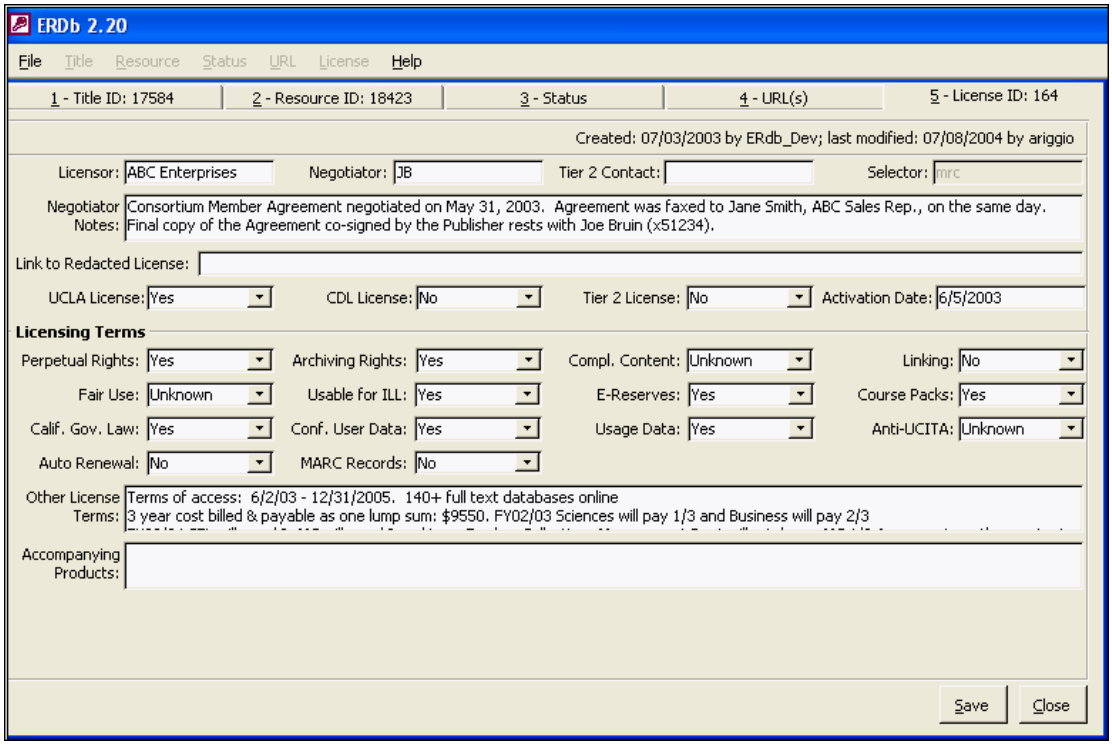


Figure 3 depicts the License Screen, another view of ERDb information related to the same resource. In addition to identifying the *licensor*, or *negotiator*, for UCLA and a link to a redacted version of the relevant license, this screen provides space for a detailed analysis of the specific rights and other details included in the license.

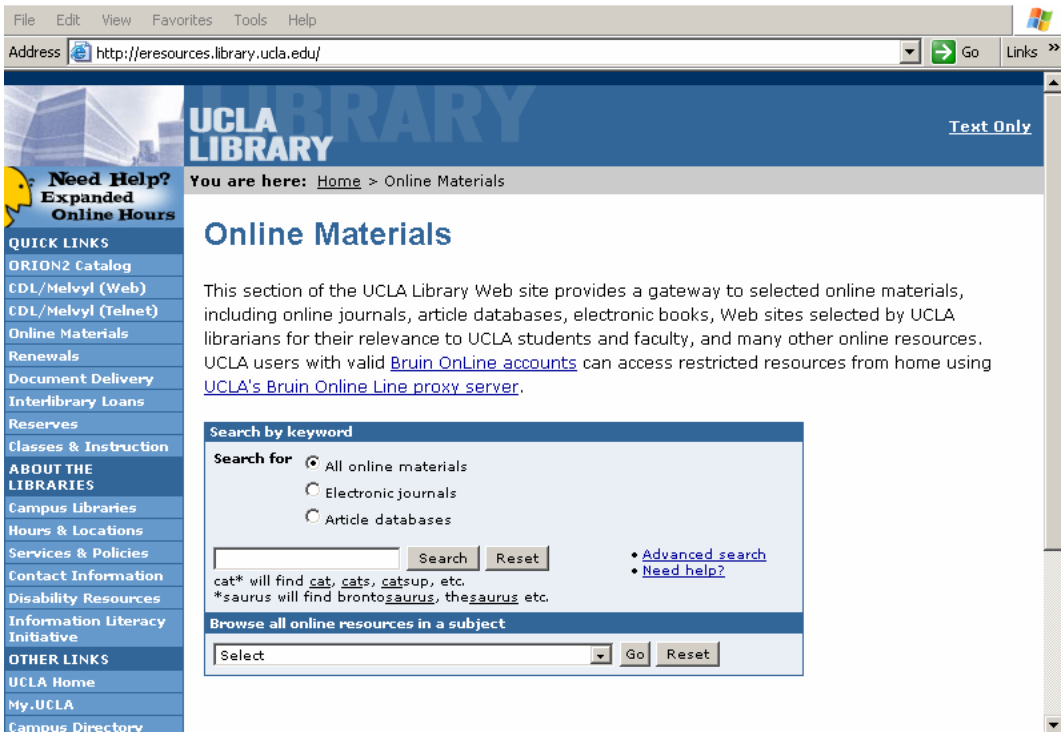
Fig. 3. UCLA License Screen



3.2.2. Implementation Processes and Public Web Pages: Alphabetical and Subject Presentations

Libraries commonly present users with multiple routes to licensed resources, including OPAC catalog entries, alphabetical and subject Web page listings, e-reserve links, and links connecting index or abstract entries to the corresponding full text. The mechanisms used to provide these presentations are generally hidden from public view. Figure 4 shows what UCLA users encounter when they follow a link from the library's gateway page to Online Materials.

Fig. 4. UCLA Online Materials Web Page



As many other libraries do, UCLA distinguishes between e-journals and article databases. Accordingly, those distinctions need to be made within its database. UCLA's alphabetical and subject presentations (figures 5 and 6, respectively) are similar to those of many other libraries.

Fig. 5. UCLA Online Materials Web Page Title List

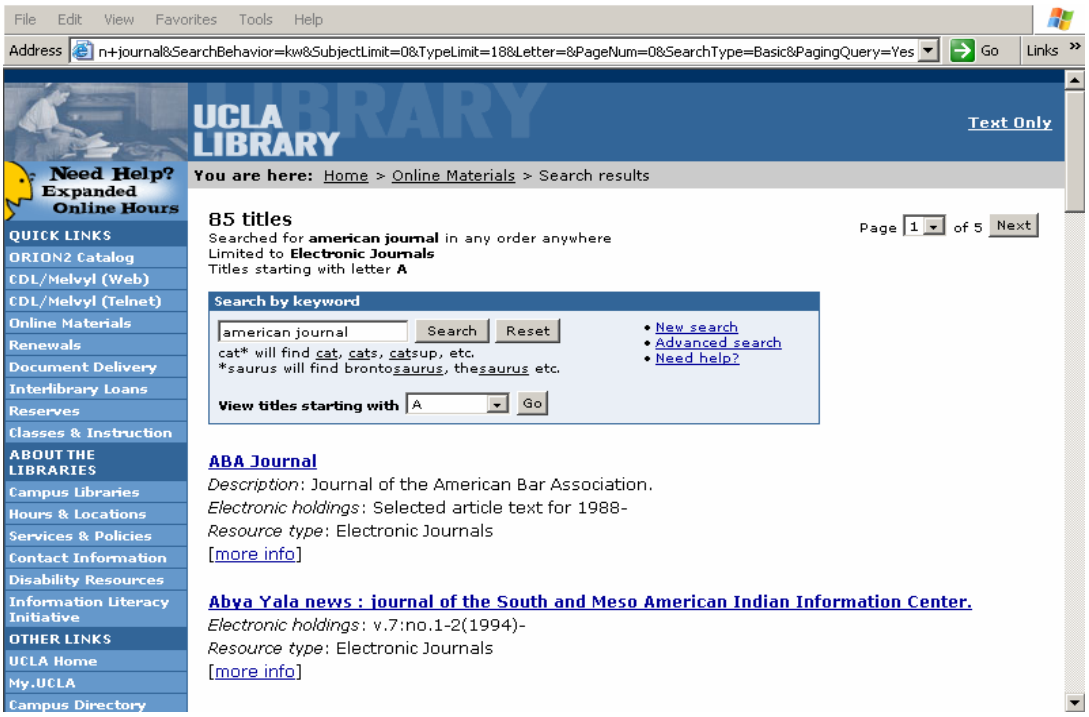
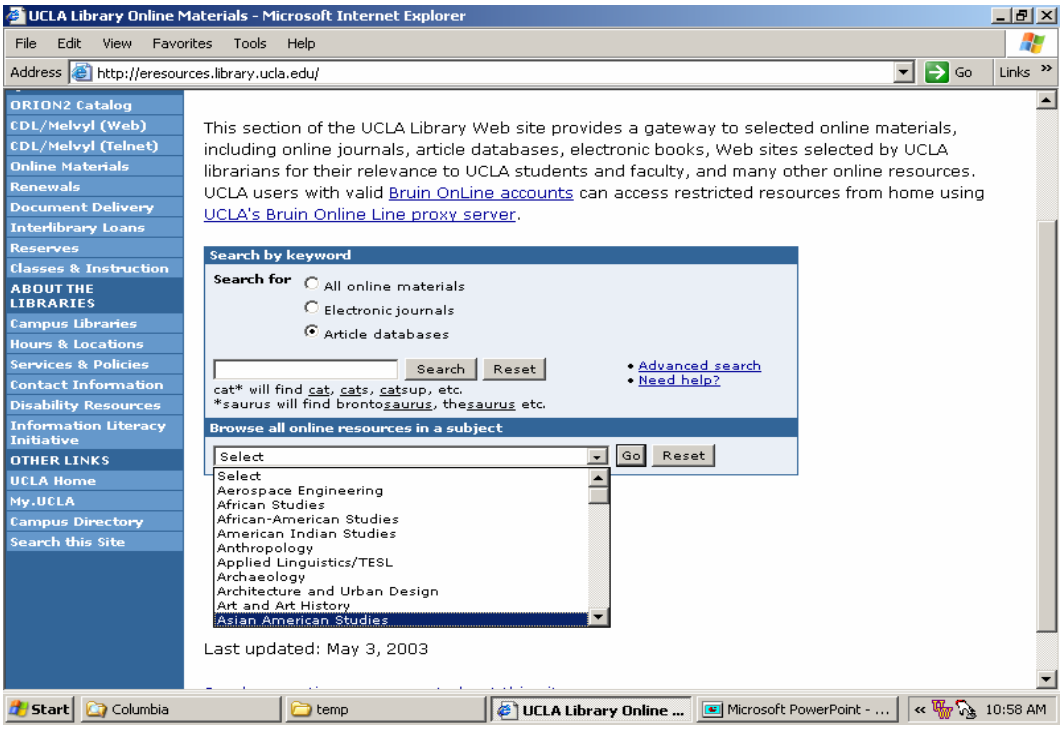


Fig. 6. UCLA Online Materials Web Page Showing Drop-Down Subject List



Helping drive and support these presentations is information gathered and maintained via the ERDb Title View (figure 7), such as the basic bibliographic data for the resource. Another view, to be released shortly, relates the component titles of a particular e-journal package to a parent record that is necessary for a number of functions, such as linking license terms to particular titles. The Title View also enables the association of a resource with both Subjects (figure 8) and Types of Resources (figure 9).

Fig. 7. UCLA Title View Screen

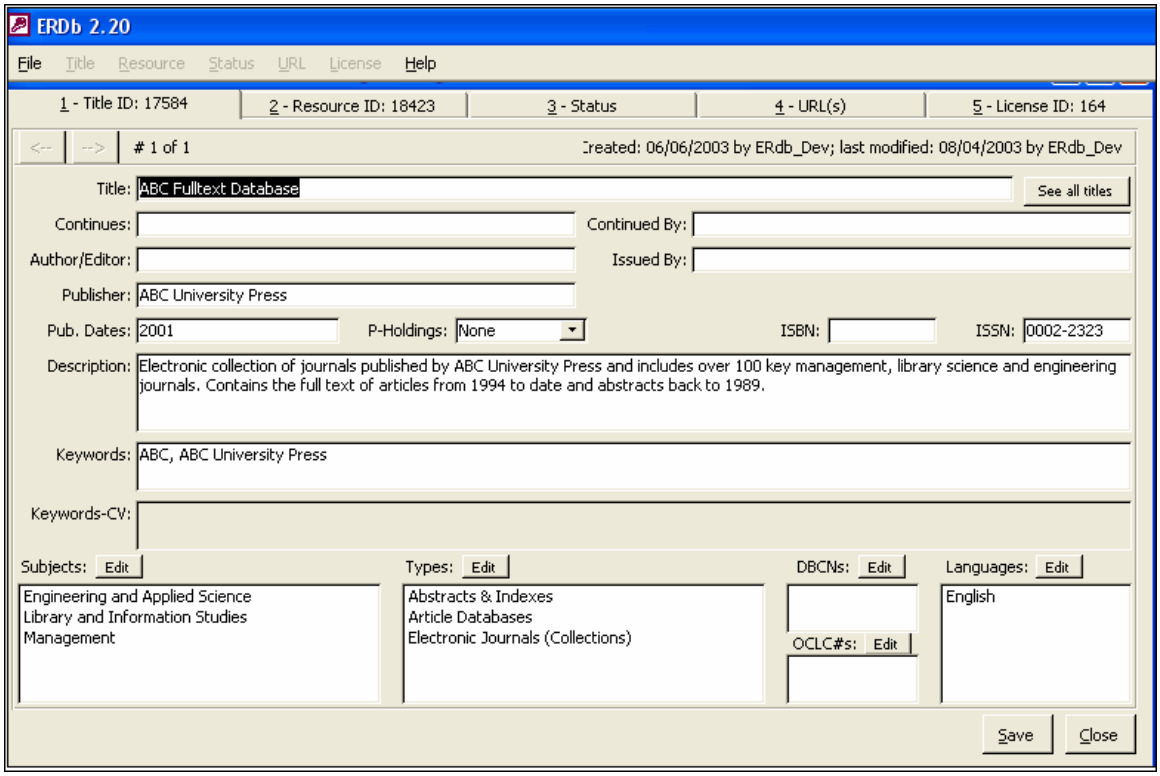


Fig. 8. UCLA Title View Screen, Showing Drop-Down Subject List

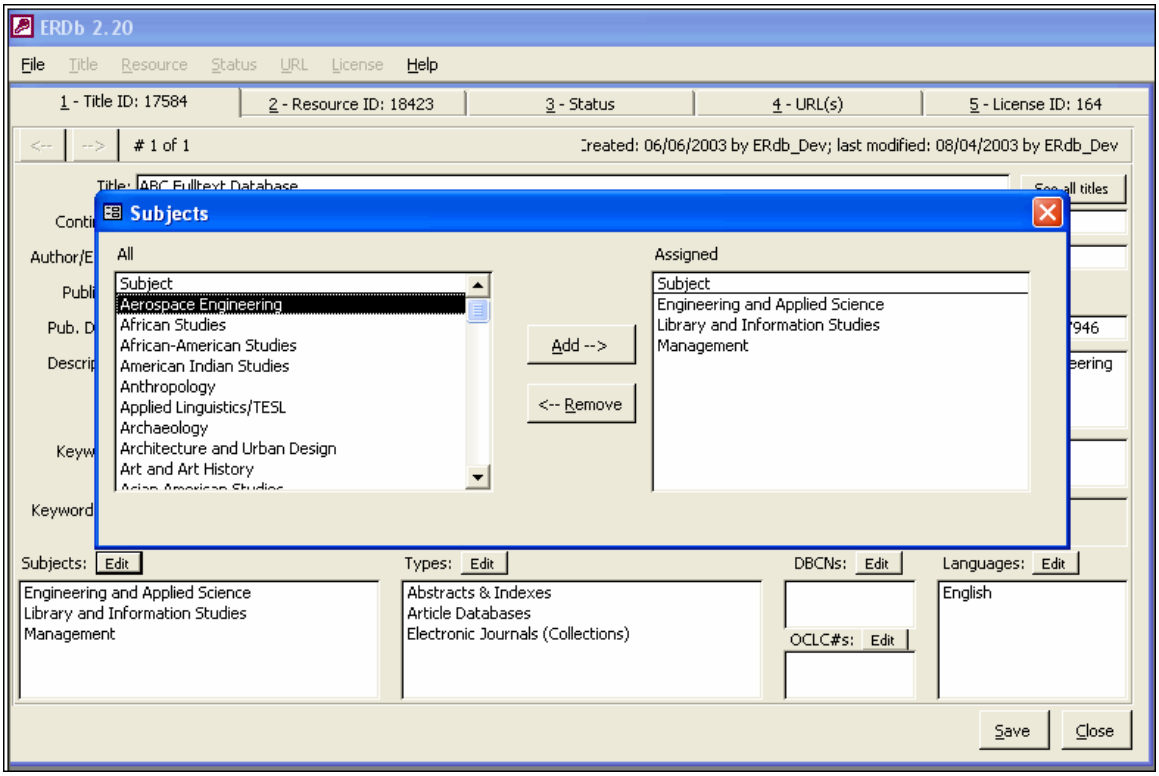
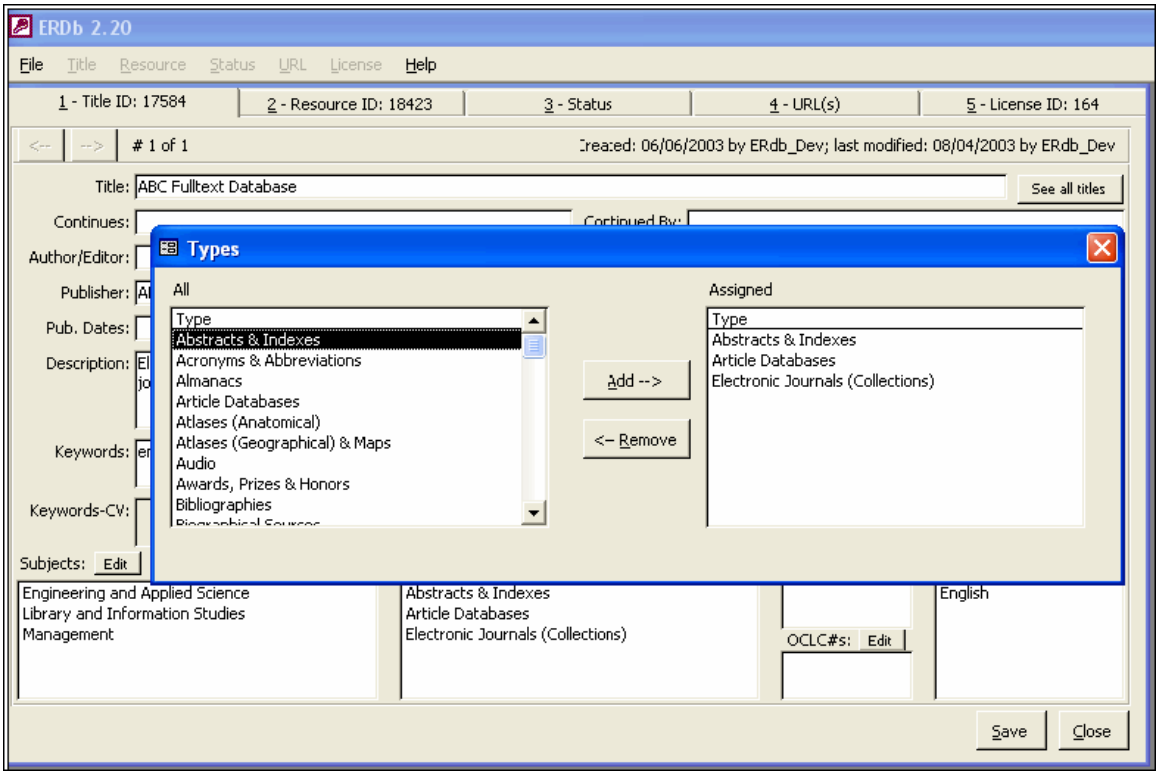


Fig. 9. UCLA Title View Screen, Showing Drop-Down Resource Type List



3.2.3. Implementation Processes and Public Web Pages: Extended Information

Like UCLA's ERDb system, MIT's VERA is used to generate subject (figure 10) and alphabetical (figure 11) Web pages for databases and e-journals. VERA is also used to describe e-resource availability by specific location and to manage and generate resource-specific URLs.

Fig. 10. MIT Libraries' VERA Subject Listing of Electronic Resources

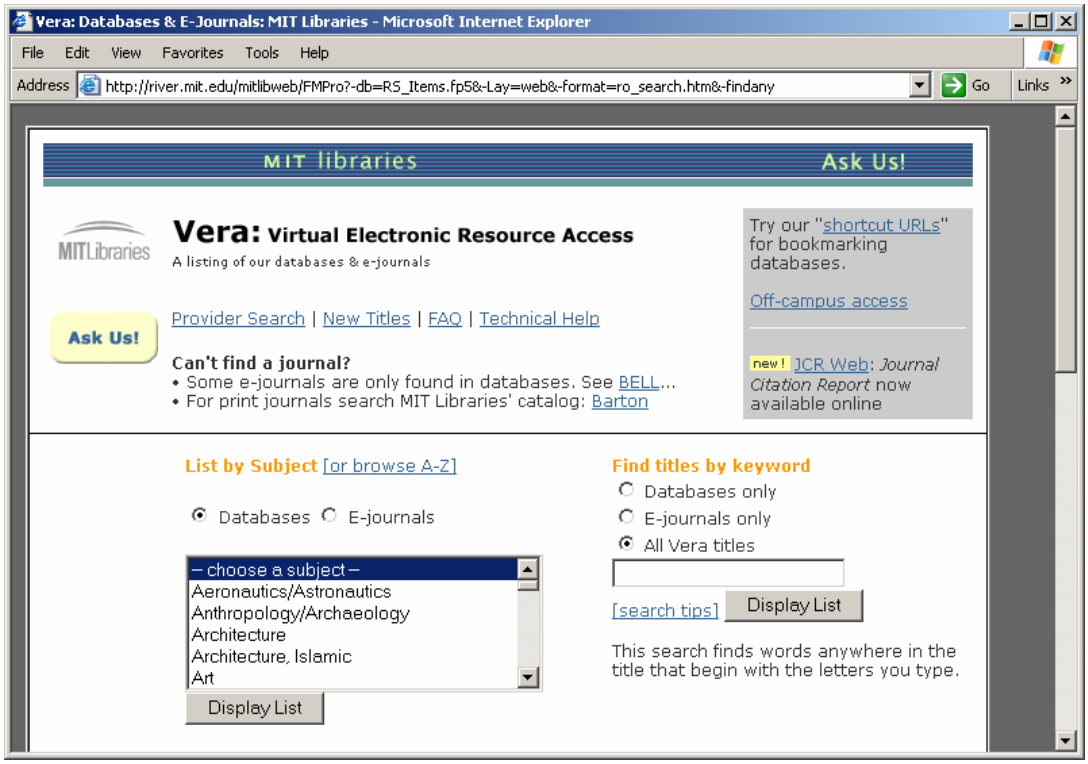
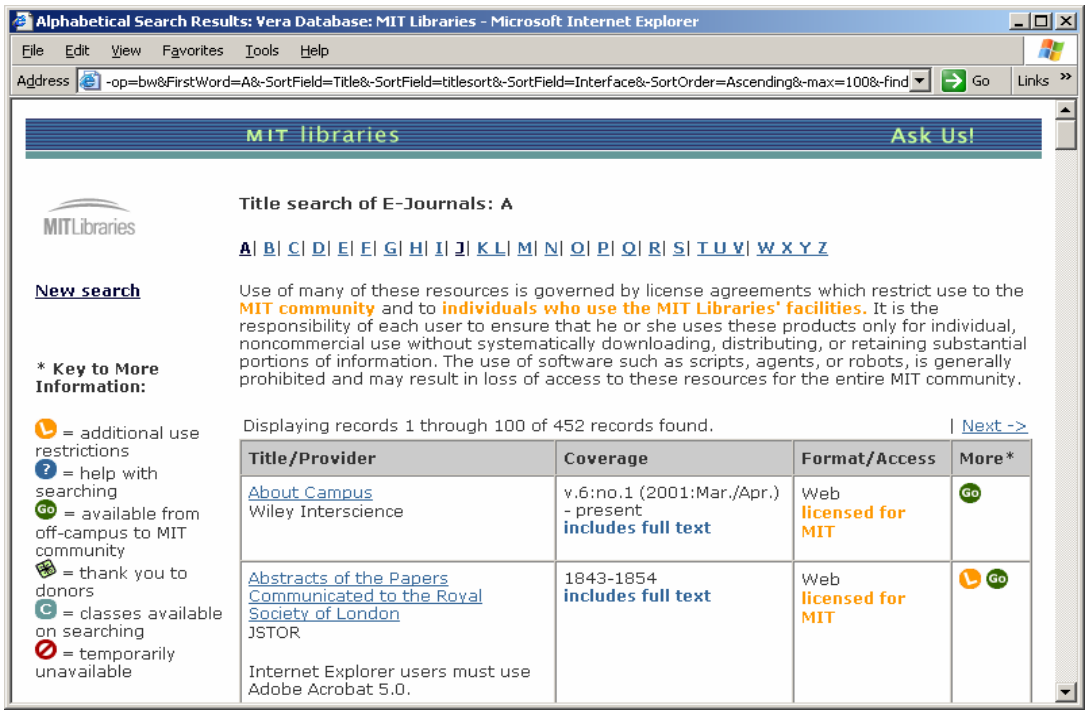
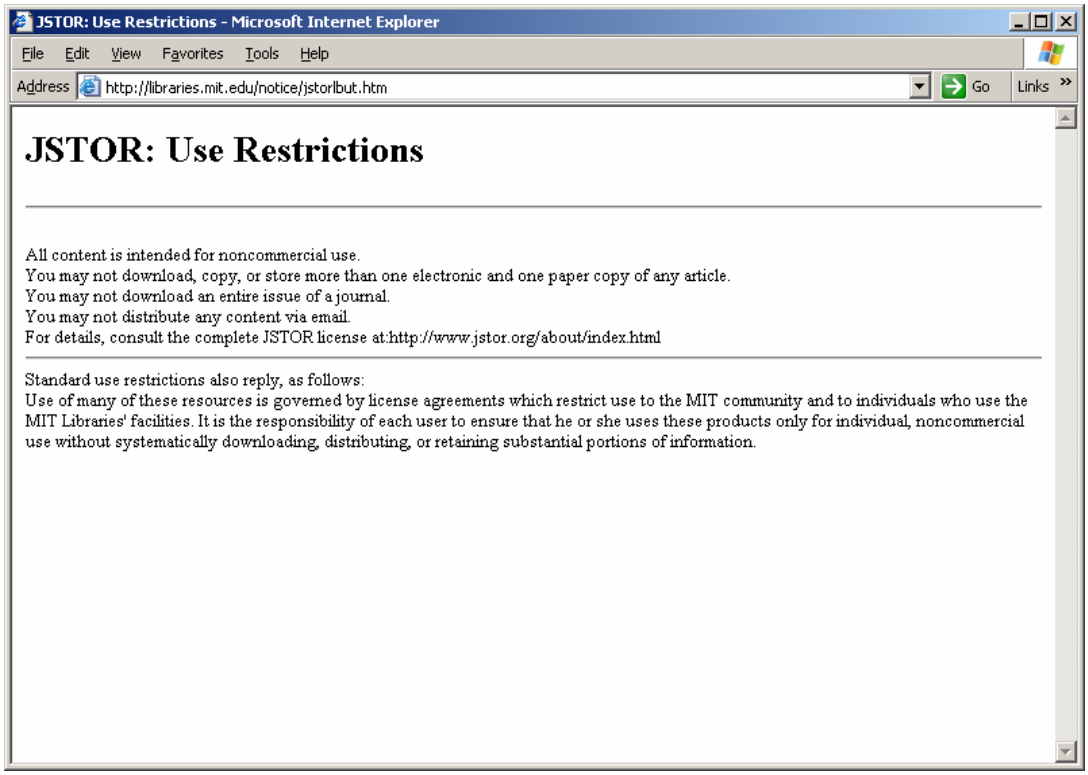


Fig. 11. MIT Libraries' VERA Alphabetical Display Showing E-Resource Details Provided and Key to More Information



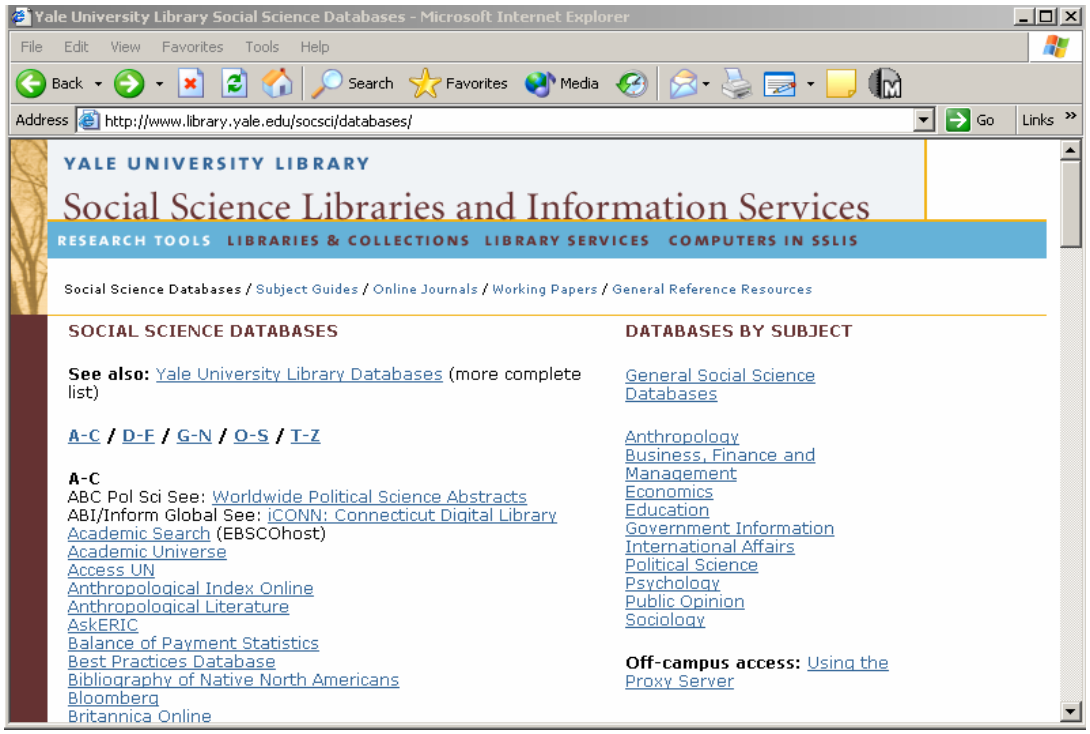
The way in which VERA incorporates and presents a wide range of other information using special-purpose icons is especially noteworthy (see the lower left corner of fig. 11). For example, the "Go" button indicates that a resource is available to the MIT community from off-campus, the "?" icon leads to search tips and other documentation, and the "C" icon leads to information about upcoming classes on using the specific resource. The universal "Not" symbol also indicates the existence of resource-specific access problems. Of even greater interest is the way in which VERA incorporates license information. In addition to the generic message about appropriate and inappropriate use of resources that precedes the resource list, the "L" icon indicates when more specific license-related information is available. For example, figure 11 shows an entry for the Abstracts of the Papers Communicated to the Royal Society of London—provided by JSTOR. The "L" icon leads the user to a summary of key provisions of the JSTOR license (fig. 12) that governs its use.

Fig. 12. MIT Libraries' VERA System: Summary of JSTOR Use Restrictions



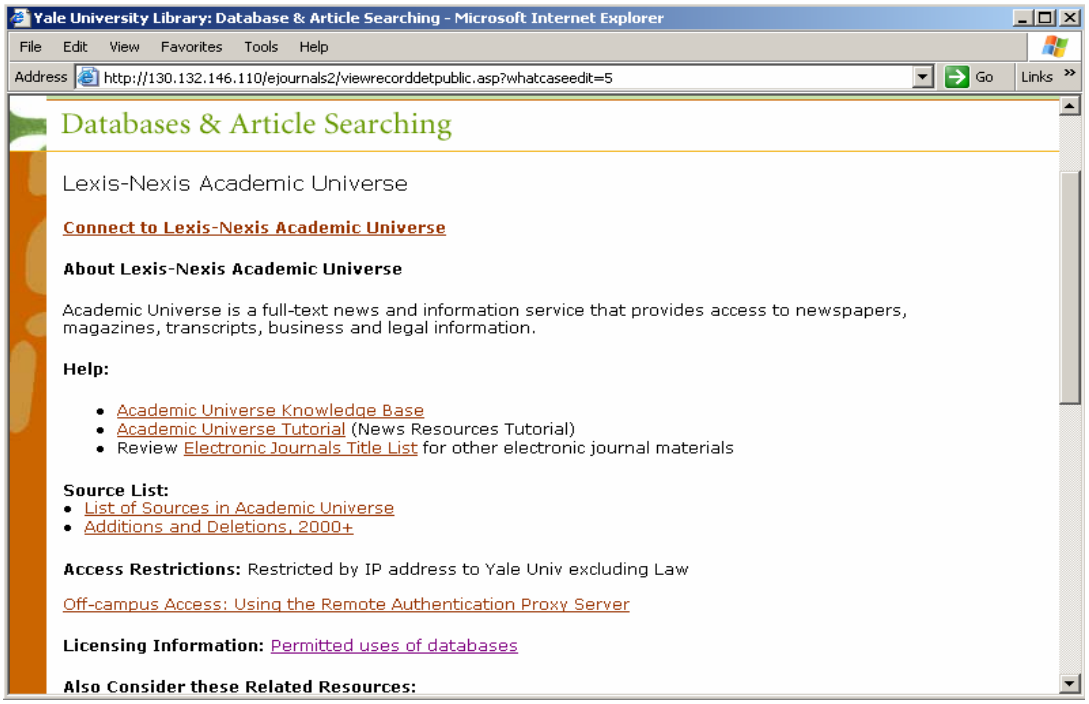
Yale University Library's public e-resource pages also integrate instructional and licensing information in clear and understandable ways. For example, figure 13 shows an alphabetical listing of databases in the social sciences, including Academic Universe.

Fig. 13. Yale University Library's Social Science E-Resource Subject List Showing Entry for Academic Universe



When users click on the Academic Universe entry, they are taken to the display of additional information shown in figure 14, which includes a group of Help tools as well as a link to Permitted Uses of Databases.

Fig. 14. Yale University Library's E-Resource List Entry for LexisNexis Academic Universe



The Permitted Uses of Databases link takes users to the appropriate section of a lengthy document summarizing permitted uses for many or most of the library's licensed resources (fig. 15).

Fig. 15. Yale University Library's License Information Summary for LexisNexis Academic Universe

Lexis Nexis Academic & Library Services

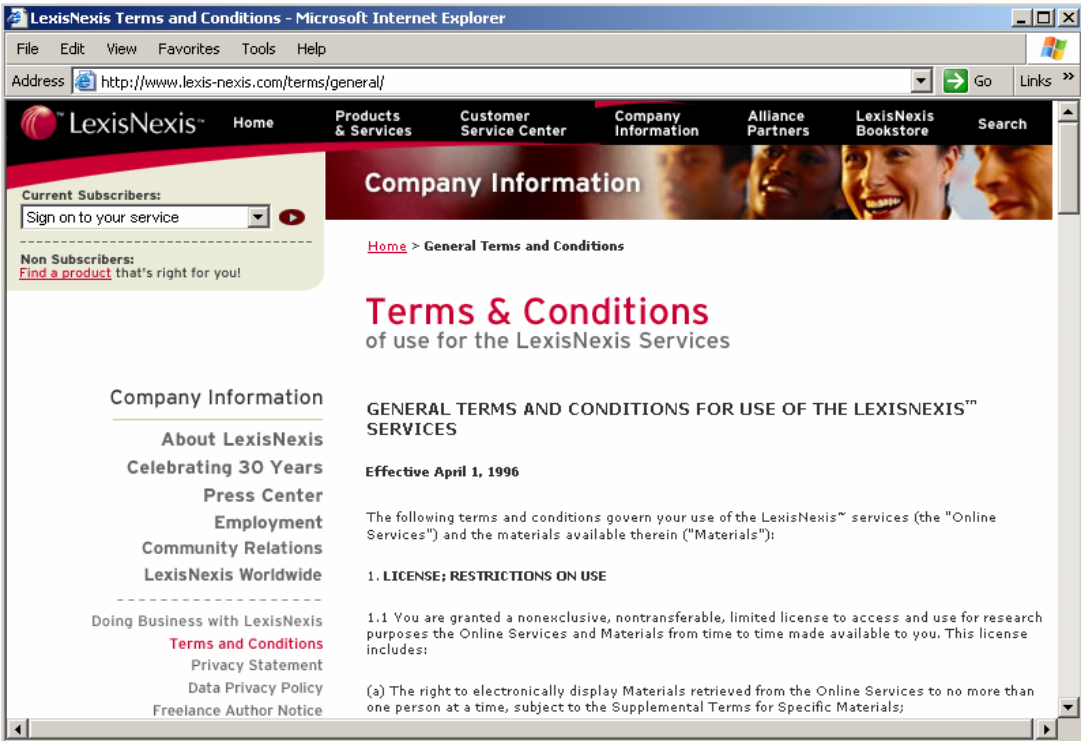
Academic UNIVerse
Congressional Universe
Statistical Universe

Licensing Information

Yes	Copy	General Terms and Conditions for Use of the Lexis-Nexis Services
Yes	Download	
No	ILL	
No	ILL (Partial)	
Yes	Limited sharing for scholarly purposes	
Yes	Course & Reserve Packs	
Yes	Print	
Yes	Use by Walk-ins	For educational use only; May not actively promote walk-in use.

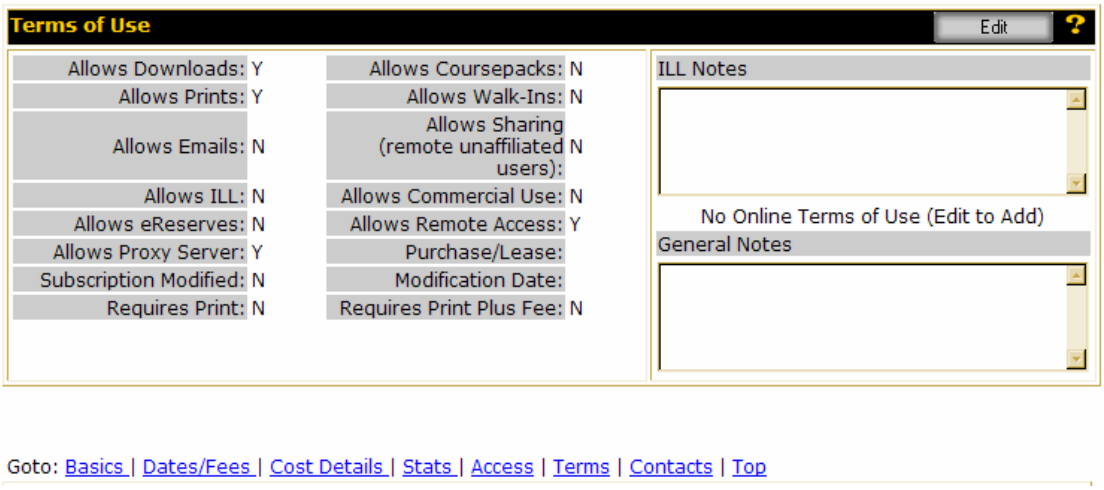
This presentation is noteworthy for at least three reasons. First, the resources' licenses have been analyzed to determine their provisions in eight key areas, with a simple "yes" or "no" indicating whether or not a particular use is permitted. Second, the summary grid provides space to expand where needed on any of the key terms. Third, the presentation allows for a link to the full Terms and Conditions. In this case, the link takes users to the LexisNexis Web page (fig. 16), but it could just as easily take them to a locally digitized version of an institution-specific license.

Fig. 16. LexisNexis Academic Terms and Conditions page (linked to from Yale University Library's Academic Universe License Information Summary Page)



An interesting contrast to the MIT and Yale license-information presentations is provided by the simple Terms of Use section from the Colorado Alliance's Gold Rush Staff Toolbox (fig. 17). Whereas MIT's and Yale's summaries are designed for use by those library systems alone, Gold Rush can provide summary license terms to all libraries sharing the system and particular resources.

Fig. 17. Terms of Use Area from Colorado Alliance's Gold Rush Staff Toolbox

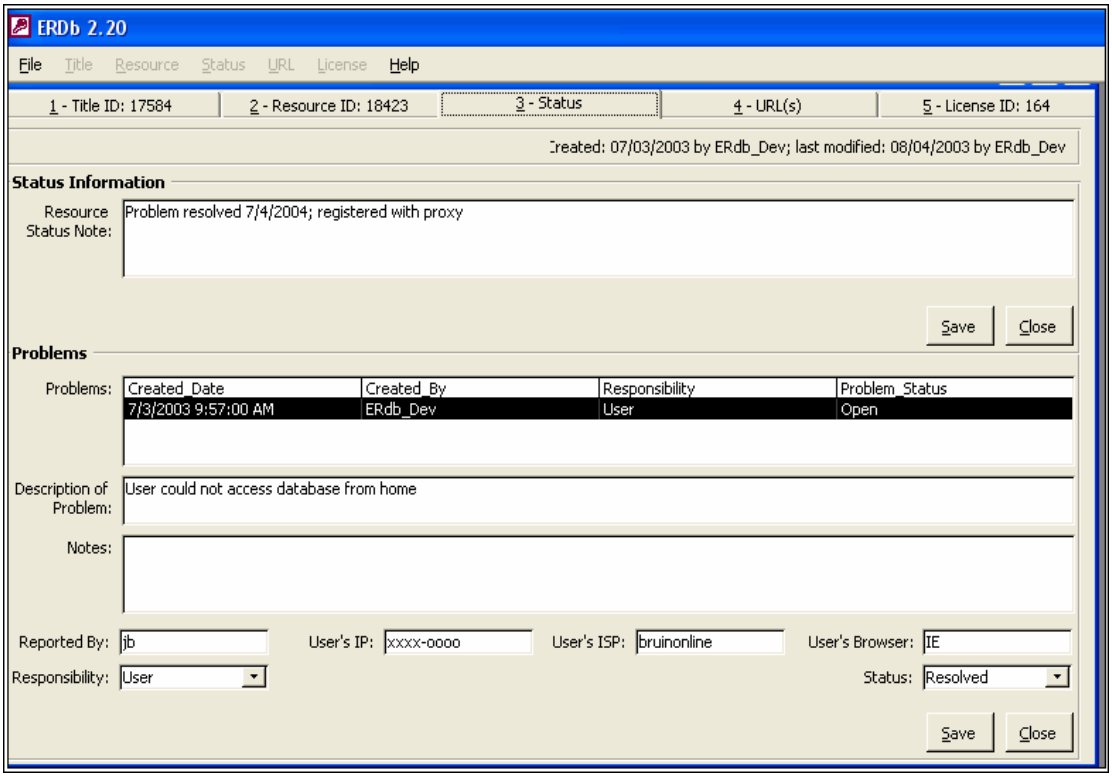


3.2.4. Product Maintenance and Review

Once access to a product has been established and its availability made known to staff and users, any number of problems may arise. For example, a vendor or another information provider may need to take a product offline for brief or extended periods for planned maintenance or to correct unanticipated technical difficulties. Occasionally, vendor files of a subscriber's IP addresses may fail to reflect recent changes or become corrupted, and this will affect access to subscribed services. Delays in product invoicing and payment may lead to outages, especially at the beginning of a month. These problems may manifest themselves in a variety of ways, such as prompts for usernames and passwords or other messages that may be difficult to understand. Still more vexing may be that an access problem related to a particular publisher's package of e- journals or an aggregator service can affect all its component journals—entries for which may be dispersed through an online catalog or Web list of journals available online.

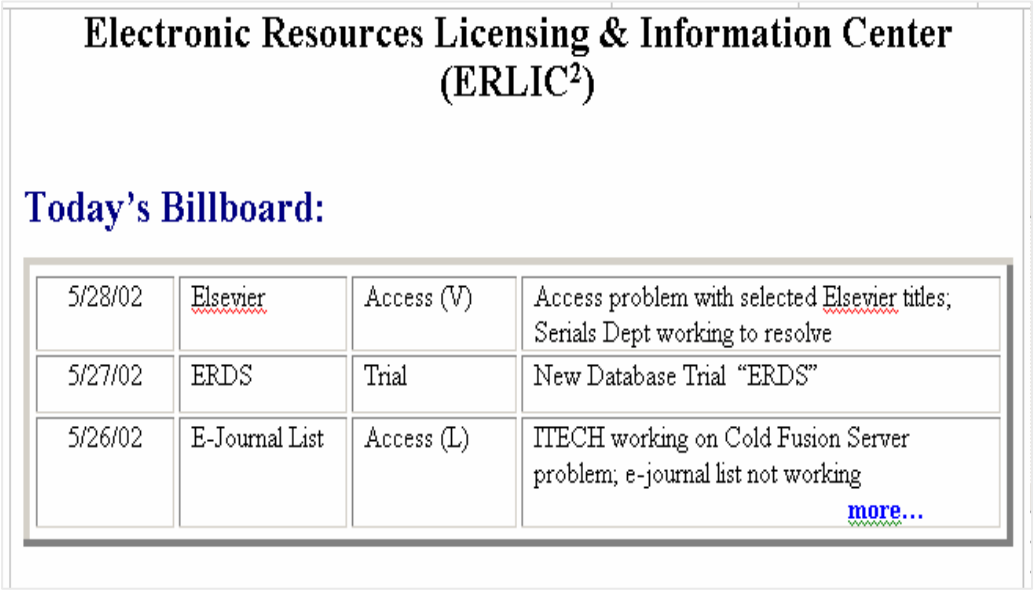
When any of these circumstances arise, it may be difficult or impossible for a library to effectively manage communication with staff and affected users. One promising approach to staff communication is shown in figure 18, which depicts a Status screen from UCLA's ERDb system. The upper half of this screen displays basic information about the resource in question, while the lower half provides space to record information about a reported incident, such as a user's name, IP address, Internet service provider, and browser; a description of the problem; the action required; and the present status of the problem.

Fig. 18. UCLA Library's Status Screen



Another approach to communicating problems such as some of those mentioned above is shown in figure 19, which is a mock-up of a Billboard function envisioned for Penn State's ERLIC[2]. This feature would allow users or staff to quickly identify any resources to which access was likely to be a problem at a particular time.

Fig. 19. Penn State University Libraries ERLIC^2 System Prototype of E-Resource Billboard Function



4. The DLF ERM Initiative

4.1. BACKGROUND: EVOLUTION AND ORGANIZATION OF THE PROJECT

The project that eventually became the DLF ERMI began with the Web hub developed by Jewell and Chandler. At the time the hub was created, the ALCTS Technical Services Directors of Large Research Libraries Discussion Group developed an interest in ERM and agreed to sponsor an informal meeting on the topic at the June 2001 American Library Association (ALA) annual conference. That meeting attracted some 40 librarians and led to further discussions of functions and data elements. Shortly thereafter, an informal steering group was formed that included Jewell, Chandler, Sharon Farb and Angela Riggio from UCLA, Nathan Robertson from JHU, Ivy Anderson from Harvard, and Kimberly Parker from Yale. This group worked with Patricia Harris and Priscilla Caplan at NISO and Daniel Greenstein (then at the DLF). These individuals undertook discussions of possible standards that ultimately led to the presentation of a NISO/DLF Workshop on Standards for Electronic Resource Management in May 2002. The workshop was attended by approximately 50 librarians and representatives from a number of vendors and publishers, including EBSCO, Endeavor, Ex Libris, Fretwell-Downing, Innovative Interfaces, SIRSI, and Serials Solutions.

At the workshop, in addition to presentations and discussions concerning the nature and extent of ERM, a proposed entity relationship diagram (ERD) and several lists of data elements were presented and discussed. One important outcome of this meeting was the formation of a consensus that standards to help guide the development of ERM systems were indeed desirable. This affirmation led the workshop steering group to consider a

more formal, collaborative approach to the establishment of related best practices and standards. Such an effort, the steering group members maintained, might reduce unnecessary costs and duplication at the institutional level, support interoperability and data sharing among diverse systems and organizations, and provide extended benefits to the wider library community.

Accordingly, the steering group developed and submitted to the DLF a proposal for an ERMI. The aim of this project was to formalize and provide further shape and direction for efforts that had previously been very informal and ad hoc. Its primary goal was to foster the rapid development of systems and tools for managing e-resources—whether by individual libraries, consortia, or vendors—and, more specifically, to

- describe the functions and architectures needed to enable systems to effectively manage large collections of licensed e-resources;
- establish lists of appropriate supporting data elements and common definitions;
- write and publish experimental XML Schemas/DTDs for local testing;
- identify and promote appropriate best practices; and
- identify and promote appropriate standards to support data interchange.

The DLF accepted the proposal in October 2002. The seven librarians who organized the May 2002 NISO/DLF workshop became the steering group for the new initiative. The steering group's task has been to continue the efforts already begun and produce the documents, or deliverables, described below.

The steering group held weekly conference calls for two years. In addition, to provide for ongoing expert advice, two reactor panels, or advisory groups, were formed. One panel (table 3) consisted of librarians deemed specially qualified by their experience and interest in ERM systems to provide the kinds of feedback needed.

Table 3. DLF ERMI Librarian Reactor Panel

- Bob Alan (Penn State)
- Angela Carreno (New York University)
- Trisha Davis (Ohio State University)
- Ellen Duranceau (MIT)
- Christa Easton (Stanford University)
- Laine Farley (California Digital Library)
- Diane Grover (University of Washington)
- Nancy Hoebelheinreich (Stanford University)
- Norm Medeiros (Haverford College)
- Linda Miller (Library of Congress)
- Jim Mouw (University of Chicago)
- Andrew Pace (North Carolina State University)
- Ronda Rowe (University of Texas)
- Jim Stemper (University of Minnesota)
- Paula Watson (University of Illinois)
- Robin Wendler (Harvard University)

Members of the steering group and the librarian reactor panel communicated in a number of ways. First, several members of the panel and of the steering group attended a special meeting held in conjunction with the DLF Spring 2003 Forum in New York City. Steering group members established a groupware site at UCLA using Microsoft's SharePoint software. This facilitated sharing of draft documents, task lists, and information on upcoming meetings and deadlines. The site was also used to post questions for the panel members and to provide space for responses and replies. Since not all members of the reactor panel were able to use the SharePoint site, questions and responses were also distributed via e-mail. As needed, the steering group invited panel members who posted comments and questions to participate in the conference calls. The steering group members found that the discussions and feedback substantially enhanced their understanding of the problem, and many comments and questions led to refinements of the deliverables.

The second panel, the vendor reactor panel, consisted of representatives from a range of other organizations with interests in the problems to be addressed by the initiative. This group comprised representatives from a number of integrated ILS providers and other companies serving the library market (table 4).

Table 4. DLF ERMI Vendor Reactor Panel

- Tina Feick (SWETS Blackwell)
- Ted Fons (Innovative Interfaces, Inc.)
- David Fritsch (TDNet)
- Kathy Klemperer (Harrassowitz)
- George Machovec (Colorado Alliance)
- Mark Needleman (SIRSI)
- Oliver Pesch (EBSCO)
- Chris Pierard (Serials Solutions)
- Kathleen Quinton (OCLC Online Computer Library Center, Inc.)
- Sara Randall (Endeavor)
- Ed Riding (Dynix)
- Jenny Walker (Ex Libris)

Communication patterns between the steering group and the vendor panel differed from those used with the librarian panel. While the vendor group was provided with versions of the draft documents and the questions being posted to the librarians, there was relatively little further communication about those documents at the time. Nevertheless, many of the companies represented on the vendor panel have continued to express strong interest in the project. ILS vendors have been especially responsive. Many discussions have involved steering group members. For instance, Innovative Interfaces, Inc. (III) has pursued development of an ERM module since spring 2002. Tim Jewell has been involved in related discussions and has kept the company informed of ongoing work on data elements (see below) so that III's elements could be as consistent with them as possible. Ex Libris has also performed substantial analytical work preparatory to product development; Ivy Anderson has contributed heavily to those efforts, especially to the statement of functional requirements that has helped guide it. More recently, Dynix held predevelopment meetings in which Nathan Robertson was involved, and the company has now developed an internal white paper describing the architecture of a future system that references the steering group's work.

4.2. PROJECT DELIVERABLES AND USE SCENARIOS

The ERMI has developed and made available a number of deliverables. An overarching goal has been to control costs and save time by providing a series of interrelated documents on which libraries and vendors could base their efforts. It was expected that the documents might be put to a variety of other uses as well. The documents and some of their anticipated uses are as follows:

- Problem Definition and Road Map. The purpose of the road map was to offer an overview of the ERM problem, provide examples of the creative approaches some libraries have taken to solving it, and highlight problems needing resolution.

- Workflow Diagram. Devising a detailed but generic workflow diagram was expected to help the steering group understand work processes and thereby help ensure that other documents would be developed appropriately and completely. A workflow diagram could provide a reference point for analyzing local workflows, which could lead to improved internal communication and more streamlined processes.

- Functional Specifications. This document was intended to clearly and comprehensively identify the functions that an ERM system would serve. Libraries could use it to support discussions of the features they might wish to purchase or incorporate into a locally developed ERM system or use the specifications in a draft request for proposals from vendors.

- Entity Relationship Diagram. An ERD is a standard system-development tool that can help designers conceptualize and present groups of data elements, or entities, and their interrelationships. As noted earlier, a draft ERD was presented during the DLF/NISO workshop, and a revised version was expected to help clarify discussions during the initiative and to assist future system designers.

- Data Elements and Definitions. Providing a standardized list of entities and data elements was projected to save developers substantial time. Such a list could also be helpful in the development of data standards. Draft lists of data elements were discussed at the NISO/DLF workshop, and it was intended that the final, single list would be keyed to, and organized to reflect, the ERD. To invoke a naturalistic comparison, the ERD (as a sketch of a whole system), could be likened to a tree, while the data elements could be compared to its leaves.

- XML Schema. The XML schema was intended to extend the value of a standardized list of entities and elements by providing a means for exchanging data. Such a schema could provide partners a platform upon which to test the sharing of license information across different systems while giving an additional boost to local library and vendor development efforts.

- Final Report. A final report would integrate these documents and present them as a whole.

The importance and potential value of standards to ERM systems is fundamental. A primary motivation for establishing standards in this case is to lessen vendor development costs and risks and thereby accelerate the development process. In addition, although it is conceivable that ERM systems might be developed and marketed as standalone systems, it seems likely that they will need to be overlaid on or otherwise linked to existing tools, such as serials or acquisitions systems, online catalogs, and e-resource gateways (Warner 2003). It is therefore critical to establish predictable pathways among variant data streams. Libraries that have developed their own systems or that wish to do so in the short term, might hope ultimately to transfer their data to a vendor system. If agreement on standards could be reached, those libraries could develop, modify, or align their

systems with the standards, thus paving the way toward data and system migration. Finally, it is conceivable that, provided they had standard ways of doing so, libraries could exchange license information with trading partners or create systems that would describe the availability of specific e-resources for specified uses such as interlibrary loan.

These considerations led the steering group to survey and monitor the status and development of standards that might dovetail with or otherwise have relevance for its work. Farb and Riggio (2004) summarized the results of that investigation as follows:

> Increasingly, we are learning about new metadata schemata, structures, and standards designed to address various communities and constituencies. To date, however, none exist that address the dynamic, multidimensional, and legal aspects of acquiring and managing licensed e-resources over time.

Table 5 provides a rough mapping of the planned DLF ERMI metadata schema coverage against several others designed to address specific aspects of ERM. The first seven column labels indicate general functional areas that need to be addressed by standards, and the right-hand column shows whether or not a particular effort is proprietary, which the steering group regarded as an important determinant of potential value to libraries and other interested parties. The row labeled "DLF ERMI" indicates the steering group's assessment that its work addressed all seven functional areas in a significant way, although attention to the "Usage" category was less extensive than for the others. While related standards efforts are shown as having focused on fewer areas—such as identification and description—it should not be assumed that the steering group expected its work to take the place of other efforts. Instead, the intent was to identify areas of common interest and avoid duplication of effort.

Table 5. Metadata Standards Comparison: E-Resource Management

Metadata Standards Comparison: E-Resource Management

	ID/ Description	Acquisition	Licensing	Access/ Trouble	Usage	Preservation	Authenti-cation	Non-Proprietary
DLF ERMI	●	●	●	●	○	●	●	●
Dublin Core	●	○	○					●
A-Core	●					●		●
ONIX	●	○	○					●
ONIX for Serials	●	●						●
<indecs>	●	●	●					●
METS	●		●	●		●		●
COUNTER	●		○		●		○	●
Shibboleth							●	●
ODRL	○	○	●	●				●
XrML	○	○	●					

● Substantial coverage
○ Some coverage

4.3. PROJECT RESULTS

This section reviews what has been learned in the process of developing the various ERMI documents and the results of the XML investigation. The documents themselves may be found in the appendixes.

4.3.1. Functional Requirements (Appendix A)

In spring 2003, staff from Harvard's and MIT's libraries met with staff from Ex Libris to discuss possible work on an ERM tool. While lists of likely data elements were available and discussed, attention quickly turned to the question "But what is the functionality?" To answer that question, Harvard and MIT libraries' staff, led by steering group member Ivy Anderson and MIT's Ellen Duranceau, collaborated to write a description of the functionality needed in an ERM system. This document was subsequently broadened for use as a DLF ERMI deliverable.

The functional requirements identify and describe the functions needed to support e-resources throughout their life cycles, including selection and acquisition, access provision, resource administration, staff and end-user support, and renewal and retention decisions. The requirements are based on the following guiding principles:

- Print and e-resource management and access should be through an integrated environment.
- Information provided should be consistent, regardless of the path taken.
- Each data element should have a single point of maintenance.
- ERM systems should be sufficiently flexible to make it possible to easily add new or additional fields and data elements.

In addition, a few core requirements for ERM systems were identified. For example, systems should be able to represent the relationships among individual e-resources, packages, licenses, and online interfaces; associate the characteristics of a given license, interface, or package with the resources to which it applies; and provide robust reporting and data-export capabilities.

This document encompasses 47 requirements, more than half of which discuss functionality needed to support staff. The scope of the requirements can be seen from the following category summary.

- General (4 requirements). These include the three core requirements in more precise language, and state that "security features to control staff views and maintenance rights" are also required.

- Resource Discovery (7 requirements). These requirements address the need for making resources available through, or pass information about them to, OPACs and Web presentation services and for contextual presentation of license information at the point of access.

- Bibliographic Management (2 requirements). These address the need for a single point of data entry, maintenance for bibliographic information, and the ability to import aggregator holdings and subscription-management data.

- Access Management (5 requirements). This group covers the management of basic access-related information such as Uniform Resource Identifiers (URIs), User IDs and passwords, and lists of institutional IP addresses, as well as the requirement to interoperate with or submit data to related technical systems such as proxy servers and persistent naming services.

- Staff Requirements (29 requirements)

    - General Interface Requirements (4 requirements). The staff interface should be organized into views that are optimized for particular areas of staff activity or interest such as resource acquisition, troubleshooting, license administration, or administration and statistics.

    - Selection and Evaluation Processes (9 requirements). An ERM system should support the recording of actions and other information at various steps in what may be decentralized processes. It also must have the capability to perform specified actions or to send alerts in defined circumstances. The library should be able to customize actions and triggers to support a site-specific workflow.

    - Resource Administration and Management (11 requirements). This group describes functionality related to administrative user names and passwords, local configuration options, hardware and software requirements, problem-solving and troubleshooting support, the ability to flag resources as unavailable, and the ability to store information about usage data.

    - Business Functions (5 requirements). This group covers pricing models, cancellation restrictions, renewal and termination activities, and cost-sharing and consortial-relationship information.

To help make the functional requirements as universally applicable as possible, the steering group reviewed and discussed them with members of the librarian reactor panel, who were asked to distinguish between the requirements they saw as core or essential, and those that were not. The steering group found it gratifying (although vendors may find it dismaying) that every requirement was considered core by at least one member of the reactor group. Nevertheless, it is possible to identify some of the functions that this group viewed as most critical.

One of the most important requirements was the ability to manage the relationships among bibliographic entities (i.e., individual titles) and the packages, licenses, and interfaces through which they are made available. Another important requirement was the ability to store access-related information such as URLs, user IDs and passwords, and institutional IP addresses. The ability to record authorized-user categories and other license permissions, restrictions, and metadata about the agreement itself was viewed as equally important. Not surprisingly, the ability to store license permissions and associated metadata was one of the most frequently cited requirements, and the ability to link to an online version of a redacted license was also desired by most panelists. Offering a single point of maintenance for bibliographic and other descriptive data and facilitating electronic transfer of holdings and other subscription data from external providers were also identified as essential, as was supporting institutional workflows via customized routing and notification tools.

Other core or essential features included the ability to store information about administrative IDs and passwords and information about and access to usage statistics.

The following themes also emerged in the reactor panel discussions:

- Most libraries want to be able to use their existing ILSs for core acquisitions functions such as ordering, budgeting, and fund accounting. However, these systems must be enhanced to accommodate the additional functionality required by e-resources. If ERM is implemented in a stand-alone application, libraries will generally choose to continue to perform core acquisitions activities in their ILSs but may want to export some data to the ERM system for analysis and reporting.

- The relationship of the descriptive data in an ERM system to other descriptive systems such as the OPAC, federated search tools, and link resolution services is a matter of concern for many libraries. All agreed that minimizing duplicative data and enabling these systems to "talk to" one another was important. As one reactor said, the OPAC should be recognized as the home of MARC bibliographic data.

- Usage statistics are an increasing focus of interest for many libraries. In addition to relying on vendor-provided usage data, many libraries collect such data locally. The steering group asked the panel members whether an ERM system should store usage data or merely point users to external data sources. Although most respondents found pointers to be adequate, a number felt that a common framework for storing and presenting statistics from disparate sources should be provided.

- Many large libraries use persistent URIs. Support for them can be critical to the library's operation. In general, libraries that assign persistent URIs want to be able to record them in the ERM system. Many agreed that being able to generate persistent URIs was both desirable and feasible since the algorithms by which they are assigned tend to be highly formulaic.

4.3.2. Workflow Diagram (Appendix B)

The purpose of the workflow diagram was to provide a detailed overview of the activities associated with managing the life cycle of electronic products (e-products). A starting point was the realization that while there are some similarities between the acquisition and management processes for traditional, physical library materials and those for e-products, many issues are unique to e-products.

Some of these differences are obvious from the overview flowcharts in Appendix B. For example, e-products routinely require a licensing process and may pose technological challenges for implementation. Activities associated with acquiring and activating a networked product are substantially different from those associated with the receipt and processing procedures for physical items. Maintenance, troubleshooting, and license renewal for e-products are quite unlike the circulation, physical storage, and repair issues for physical objects.

The flowchart for the project, developed primarily by Kimberly Parker and Nathan Robertson, reflects these complex realities by breaking down a model workflow into the four main subprocesses identified for HERMES in section 3.1. Each subprocess is depicted through its own diagram. The first subprocess, Product Consideration and Trial Processes, traces typical steps from the point at which library staff become aware of the availability of an e-resource of interest, through trial and evaluation steps, to the "Proceed/Don't proceed" decision point. A decision to proceed would trigger three other processes shown in the diagram (since they typically occur concurrently)—License Negotiation, Technical Evaluation, and Business Negotiation.

Once all these processes reach the "approval to proceed" point, the third major set of processes is triggered. These are labeled Implementation Processes and encompass such disparate steps as product registration and configuration, cataloging and inclusion in appropriate Web pages, and activities related to availability and handling of usage data. The final set of processes is Product Maintenance and Review. Among the functions included in the routine maintenance category are the capture of usage statistics, troubleshooting and problem resolution, routine product changes from the vendor (e.g., URL revisions), and revisions to public documentation.

4.3.3. Data Entities, Elements, and Structure (Appendixes C, D, and E)

Three of the deliverables are tied especially closely to one another: the ERD, the data element dictionary, and the data structure. The ERD is a visual representation of ERM concepts and the relationships between them. The data element dictionary identifies and defines the individual data elements that an ERM system must contain and manage, but leaves the relationship between the elements to be inferred by the reader. The data structure associates each data element with the entities and relationships defined in the ERD. Together, the three documents form a complete conceptual data model for ERM.

An ERD is often used as a way to visualize a relational database. Each entity represents a database table, and relationship lines represent the keys in one table that point to specific records in related tables. ERDs may also be more abstract, not necessarily capturing every table needed within a database but simply diagramming the major concepts and relationships. The ERD developed for the ERMI is of the latter type. It is intended to present an abstract, theoretical view of the major entities and relationships needed for management of e-resources, but does not identify every table that would be necessary for an ERM database.

The data element dictionary, which now includes roughly 300 elements, grew out of a data dictionary developed for UCLA's ERDb. It lists the elements alphabetically by data element name and includes an identifier, definition, and, where deemed necessary, comments. To the extent possible, element naming and definitions were based on guidelines provided by International Standards Office (ISO) 11179. In addition, an effort was made to identify and use element names already included in other relevant metadata schemas such as Dublin Core, ONIX, ONIX for Serials, and METS. A more detailed discussion of these standards and schemas and of how the work of the initiative relates to them is provided in Appendix F.

The data structure document integrates the ERD and the data element dictionary by mapping the data elements from the dictionary to the approximately two dozen entities depicted in the ERD. In addition to the names and definitions, the data structure indicates element type (e.g., logical, pointer, text), use or functionality (including references to specific points in the functional requirements document), suggested values, optionality (whether optional or mandatory), repeatability (whether the element carries a unique value or can be repeated), and selected notes or examples for additional clarity.

Some of the two dozen defined entities, such as the entities for Electronic Resource and for Interface, could be characterized as serving a primarily descriptive function. A large number of data elements are required to summarize license terms. For example, a Terms Defined entity includes groups for identification, user group, and terms of use—which itself contains some 30 elements covering such license provisions as fair use, scholarly sharing, interlibrary loan, and course packs.

There are also entities for Acquisition and Processing Workflow, and for Access Information and Administrative Information. Some entities can be used for a variety of purposes. For example, the Organization entity can be used to record information about any business, vendor, provider, publisher, licensor, etc., with which a library does business related to e-products.

Since the elements identified, named, and defined for this part of the project were seen as possibly forming the core for an emerging data exchange standard, the lists have been available via the Web hub for some time. Communication with two ILS vendors (Innovative Interfaces and Ex Libris) that have been actively working on ERM systems has been especially close, and both have undertaken substantial work to see that their data elements are consistent with those of the initiative.

4.3.4. XML Investigation (Appendix F)

The final proposed deliverable was an XML schema that would foster the development of metadata standards for the exchange of information about e-resources, e-resource packages, and licenses. During fall 2003, a group was formed to pursue this work. Coordinated by Adam Chandler, it included fellow steering group members Sharon Farb, Angela Riggio, and Nathan Robertson, plus Robin Wendler (Harvard), Nancy Hoebelheinrich (Stanford), and Simon St. Laurent (O'Reilly & Associates). Rick Silterra (Cornell) joined the effort later. Because this part of the project depended on finalizing work on the data entities, elements, and structure, it was impractical to get very far ahead of that part of the project. The desire to complete the project in a timely way and make it available for comment and use also meant that time available for this part of the project was fairly limited. The data element work was informed and affected by what the steering group knew of emerging work elsewhere on standards, including the work of the NISO/EDItEUR Joint Working Party for the Exchange of Serials Subscription Information.

The XML investigation began with a consideration of the uses to which an ERM schema might be put. These possible uses included

- exchange among vendors and libraries of data for use in link resolvers, including user group license terms;
- publisher e-resource title lists;
- packaging actionable license terms with associated objects in a preservation archive (e.g., using METS);
- dissemination of license and administrative data to members of a consortium; and

- exchange of license data with a contracting partner.

With these many possibilities in mind, XML group member Wendler developed a draft schema for general use that included Dublin Core and MODS name space and schemas, and a slot or placeholder for rights expression. As the group discussed the draft and as the NISO/EDItEUR and XrML/ODRL dynamics further unfolded, it became clear that a more fruitful approach would be to concentrate on a limited number of practical scenarios. Since license terms have been of substantial concern to libraries for several years, but no directly related, known XML work had yet taken place within that community, it was decided to focus on license terms. The group focused on two sets of elements:

- a short *quick-fix* set that would best describe license terms that staff and users would most need to know; and

- a broader *license* set of elements that could be most usefully shared by two libraries or other entities such as a publisher or consortium and a library.

Members of the group selected the required elements from the DLF ERM system data structure document and created instance documents with data that were then used to develop a schema optimized to these narrow uses.

Because of the many potential advantages of relying on existing schemas, the group looked for work that was closely related or that might be adapted to the purposes it had in mind. Apparent similarities led to investigation of work on digital rights management (DRM), and rights expression languages (RELs). As Karen Coyle has described in her recent report for the Library of Congress (Coyle 2004), two well-established RELs currently vie for recognition as the standard for media products such as movies in DVD format. The first of these, now referred to as MPEG-21/5, grew out of the XrML language developed by a company named ContentGuard. The second is called the Open Digital Rights Language, or ODRL. These initiatives are intended not only to enable a rights holder to describe what a user may do with a particular resource but also to confer substantial control of user behavior on the implementing party. The XML group learned of the existence of extensive patent claims related to MPEG-21/5, and its strong preference for open standards led it to focus on ODRL.

A third initiative that sparked interest is from Creative Commons and is based on the resource description framework (RDF). The intent of the Creative Commons approach, unlike that of the MPEG-21/5 and ODRL, is to provide a means for authors to declare the terms on which they are making works available free of charge via the Internet, rather than to exert control. The group elected to focus some of its attention on the Creative Commons schema, and four schemas (corresponding to the two use cases described above) were developed: one for ODRL, another based on the Creative Commons RDF, and two for native ERMI, which were based on ERMI project elements and values.

The attempt to use ODRL met with mixed results. While ODRL proved to be extensible and flexible, learning to use it effectively was time-consuming and would have taken much longer without the generous assistance of Renato Iannella and Susanne Guth of the ODRL initiative. For example, the group found that only the form of the XML documents could be validated in the ODRL schema that the group developed, meaning that any value (including invalid ones) would be accepted. (Iannella told us subsequently that it is possible to validate a document more completely, but time did not allow us to alter our demonstration ODRL schema to incorporate that feature.) In addition, it is necessary to describe all permitted uses under ODRL; this is clearly inconsistent with libraries' expectations that they should be able to make reasonable uses of resources that are not prohibited by licenses.

A greater degree of success was hoped for with the Creative Commons RDF, because it was not designed to support direct control of use and its ethos is consistent with open access and fair use. While less constraining and more extensible than the ODRL, it unfortunately also lacks provision for validating structure and data types. The group consequently concluded that the Creative Commons RDF could not provide a basis for license description and communication.

These discoveries led to work on the third alternative, the aforementioned native ERMI license-expression development. In essence, this would entail establishing a name space for license expression on the basis of elements and values from the ERMI data dictionary and data structure documents. Its benefits include the ability to simply use any of those elements and values, to avoid time required to adapt other existing RELs to purposes for which they may be ill suited, and to have greater syntax and value validation. One added benefit that was found in the process of creating the two test native ERMI schemas is that they were more compact than those created using either ODRL or the Creative Commons RDF. Because of this "best fit," the group believes that discussion of standardized license expression within the library and scholarly publishing communities should focus on the native ERMI alternative in the near term.

5. Response to the Initiative and Future Considerations

Now that the results of the DLF ERMI have been fully described, it is time to briefly consider responses to the work from the library and vendor communities and to review selected areas where members of the steering group feel that additional work is most needed.

5.1. LIBRARIAN AND VENDOR RESPONSE

The main reason behind the development of the ERMI was the realization that few libraries had the tools needed for successful management of e-resources and that developing such systems would be time-consuming and complex. From the beginning, the members of the ERMI steering group felt that solving such a problem would require extensive collaboration and investment. It is consequently very satisfying to report that librarians and vendors have had very positive reactions to the initiative.

Most important, at this writing, several vendors either have already begun developing ERM systems or services or have announced plans to do so, and most of this work has drawn heavily from the project's draft functional requirements and data elements. These organizations and their ERM-related products and services include the following:

- The Colorado Alliance plans to improve and enhance the Gold Rush product in 2004.
- Dynix announced development of an electronic management module during the 2004 ALA annual conference.
- EBSCO has developed an electronic journal service that incorporates significant ERM functionality and uses an e-resource life cycle diagram in its literature.
- Endeavor has announced plans to develop a full-function ERM product named Meridian for release in 2005.
- Ex Libris has announced development of a product named Verde that will draw upon the SFX knowledge base. Initial release is planned by the end of 2004.
- Harrassowitz has announced plans for HERMES 2.0, a service that will incorporate ERM features.
- Innovative Interfaces, Inc. has developed an ERM module that is moving from development and beta testing into production.
- Serials Solutions has an ERM product in its near-term plans.
- SIRSI has developed a prototype system that was shown at the 2004 ALA annual conference.
- VTLS announced plans this spring to develop an ERM product called Verify (VTLS 2004).

5.2. OUTSTANDING ISSUES

As these vendors develop their products and services, they and the libraries they serve inevitably will find places where the ERMI products will seem lacking or incomplete. Accordingly, they will devise new and helpful approaches to solving some of the problems sketched out in this report or to problems not yet identified. In that spirit, we would like to identify some problems that we were unable to solve within our time constraints, but that merit further work.

5.2.1. Consortium Support and Functionality

The ERMI has focused on the needs of individual libraries rather than on those of the library consortia to which so many libraries now belong. That has allowed rapid headway to be made, but a broader view that takes consortial support functions into account is highly desirable. Doing so is complicated by the fact that library consortia differ substantially from one another. Some, such as Ohiolink and CDL have significant amounts of central funding and a broad service mandate, while others function more as buying clubs and have correspondingly more limited missions, staffing, and goals. Nevertheless, some steps in this direction have been taken within the last several months. The extent of consortial support desired at the "central funding/broad mandate" end of this continuum was suggested in an assessment conducted for CDL (Wright 2003), which referenced the work of the ERMI. In March 2004, the University of California (UC) system libraries' System-Wide Operations and Planning Advisory Group (SOPAG) followed up on this assessment with a retreat to discuss ERM needs. Each library in the UC system sent representatives to this meeting. Although the functionality and architecture described in the ERMI documents was discussed and endorsed, attention was also given to SOPAG requirements seen needing a higher profile or not addressed in the DLF initiative. For example, CDL expends significant effort tracking which member libraries participate in which voluntary buy-in purchases and what cost shares apply. Additionally, evaluation and negotiation of e-journal packages requires the ability to track current print and e-journal subscription information at both the individual campus and consortial levels and to link to it other information such as cost, usage and Thompson ISI (Institute for Scientific Information) "impact factor." Given the likelihood that CDL libraries will continue to use different ILSs and ERM systems, the need for data standards and interoperability noted above is especially acute.

Following the SOPAG ERM retreat, two relevant sessions were held at the International Coalition of Library Consortia (ICOLC) meeting. The first session focused on consortial *administrivia* and offered an opportunity for consortium managers to discuss the kinds of information they must track and communicate to vendors and member libraries and related support tools they have devised. Librarians who have followed the ERM discussions would have recognized many themes, including the diversity of data needed (such as library and vendor contacts IP ranges, and renewal dates, and reliance on various spreadsheets and databases to do that work). The second session was on managing e-resources across the consortium. It featured descriptions of the work of the DLF, the UC system, and the Gold Rush product. Attendees expressed substantial interest in vendor developments, their support of consortia, and data standards. A subsequent ERMI steering group discussion of points raised during these ICOLC sessions concluded that the ERMI data model supports, or can be extended to address, key consortial requirements, but that a more careful review was needed. Since CDL is engaged in analyzing its requirements, it is conceivable that a document resulting from that process could be developed into a more generic statement of consortial ERM requirements and released under ICOLC auspices.

5.2.2. Usage Data

Although there is some provision for usage data within the ERMI data model, it would be desirable to better describe both the analyses libraries will perform on the data available to them and how such data might be passed more easily to libraries for incorporation into their ERM systems. Important sources for analyses of functionality are model usage-data programs such as the Data Farm developed at the University of Pennsylvania (Zucca 2003; University of Pennsylvania Libraries 2004) and ARL's E-metrics initiative (Association of Research Libraries 2004). Project COUNTER's code of practice for the "recording and exchange of online usage data" will undoubtedly become an increasingly important standard in this area, and the recently announced availability of an XML DTD for COUNTER usage reports is particularly welcome, as it will pave the way for smoother and more effortless transport of usage data.

5.2.3. Resource Succession

One issue related to the ERMI data model is that individual journals frequently pass from one publisher to another, or from platform to platform. As this happens, it may be difficult to keep track of the particular license terms, archival rights, and access information related to each change.

5.2.4. Data Standards

As important as these efforts are, they seem unlikely to succeed in the long run unless work to develop and maintain relevant data standards continues along with them.

- Serials Description and Holdings**.** Knowing that the NISO/EDItEUR Joint Working Party for the Exchange of Serials Subscription Information was working to develop a standard exchange format for serials subscription data, the ERMI steering group decided to rely on that group's work rather than to develop a competing standard. The steering group regards the work of the joint working party as fundamentally important and looks forward to further developments.

- Standard Identifiers. The steering group concluded that a single global e-resource identification system or registry for packages, providers, and interfaces could make it possible to exchange certain kinds of information far more reliably and precisely than at present.

- License Term Expression**.** Resolving issues related to standardized communication about intellectual property, licensing, and permitted use will also require additional work. Luckily, there is evidence of interest in this problem. For example, discussions at the recent CONSER Summit on Serials in the Electronic Environment suggested that some publishers may be ready to experiment with providing public versions of their licenses to libraries, and there was interest in establishing a test-bed of licenses marked up in XML for

importing into local ERM systems. There have also been discussions of the possibility of establishing a standard data dictionary for publisher licensing and rights expression, using the ERMI data dictionary as a starting point.

- Interoperability. It seems reasonable to question whether or not stand-alone ERM applications can be developed that are truly capable of integration into ILSs from other vendors. While the steering group believes that standardizing data elements is an important step in this direction, it is possible that a new initiative called VIEWS, which is aimed at "enabling web services between disparate applications used in libraries," may be another (Dynix 2004).

Resolving these issues will require organized, cooperative efforts from libraries, consortia, publishers, serial agents and support companies, and library system vendors, as well as effective structures for communicating about them.

6. Conclusion

The new electronic environment in which libraries, publishers, and vendors operate has evolved quickly and become quite complex in relatively short order, but the complexities we now recognize could pale in comparison to those that may be just around the corner—as investments in e-resources grow, technical innovation continues, and business models evolve. No matter how the environment evolves, new tools, standards, smart choices, and collaboration will be needed. We hope that the DLF ERMI has enabled all these activities to happen more quickly and to be more efficient and effective.

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