6-2004

A Conceptual Framework for Gateways

Jerry V. Caswell
University of Northern Iowa

A Conceptual Framework for Gateways

Jerry V. Caswell

The complexity of today's information environment is resulting in the creation of unified front ends to library resources called gateways. A gateway consists of a set of interrelated tools that enables library users to identify and locate materials relevant to their study and research. The tools are presented in a common structure or framework that facilitates the rapid identification of and navigation to the material. A gateway may include the catalog, supplemental databases to online resources, tools that link citation databases with online content, real time assistance, and help or user guidance components.

Today's electronic environment has become very complex, not only because of the sheer number of resources, but also because of the many types of resources now available. Libraries are finding that it is not enough to simply list the catalog and some electronic databases in their Web pages. There are too many resources to be easily contained in traditional Web pages and there is a need to organize the resources into meaningful categories.

Users may be confused when presented with the volume of resources currently available. They often have to page through screen after screen of resources to find what they want, if they can find it at all. Many of them cannot pick an appropriate resource tool or category that matches their current need. Thus, they spend an inordinate amount of time floundering about or pursuing the wrong pathway. They may be sifting through lists of e-journals when they should be searching an index, or they may be using a general purpose index when they should be using a discipline-specific one.

Because user expectations have been conditioned by the use of the Web and Internet-search tools such as Google, they are accustomed to using nonlinear search techniques. They are also accustomed to using tools that will turn up some information for nearly every query, even if it is not of the highest quality or reliability. The specificity and linearity of library catalogs and online databases often defeat their expectations of finding a quick and easy answer.

The use of the Web also has led users to expect that everything online is somehow connected. The essential fact that research tools are both discrete and proprietary comes to be understood by users only after considerable experience.

For all these reasons, libraries have a huge task adapting their Web sites to the often unspoken needs of library users. Somehow, libraries must harness the volumes of resources and present them in logical fashion. They need to provide users with guidance on how to make the appropriate choices for their research and study needs, and they need to integrate resources in whatever ways possible so that the information universe that users expect to find actually begins to emerge from the existing landscape. Developing a gateway is one way to start addressing these needs.

What Is a Gateway?

A gateway is a set of interrelated tools that enables users to identify and locate materials relevant to their study and research. The tools are presented in a common structure or framework that facilitates the rapid identification of and navigation to the material. A gateway may include the catalog, databases to other online resources such as e-journals, tools that link different databases together, real-time assistance, and help or user guidance components.

Nearly every library catalog will form an essential part of a gateway. Besides being the primary link to print and audio-visual materials, most catalogs provide access to electronic resources. Nearly all of them have Web interfaces, allowing for easy navigation to and from the library's Web site and other electronic resources. In addition, most catalogs can be accessed by means of predefined or canned searches, which extend their power to additional environments.

Databases also can play a major role in a gateway and can supplement the catalog by providing access to other types of material or by providing retrieval capabilities that the catalog does not have. For example, some libraries might not be ready to keep records of their rapidly expanding e-journal subscriptions in the catalog, or

Jerry V. Caswell (jerry.caswell@uni.edu) is Head of Library Information Technologies, University of Northern Iowa Library, Cedar Falls.

they might keep the regular e-journal subscriptions, but not the full-text titles contained in aggregator databases. Databases could provide this type of information while the library sorts out the issues of what should be included in the catalog on a long-term basis. Databases could provide browses by first letter of title, something that is a rising expectation from Web users. However, they are not often supported in catalogs because the retrieval engines do not allow searches on short stems of index terms.

Linking tools also can be important elements in a gateway. They are becoming increasingly important as libraries seek to improve their users' ability to navigate transparently from citations in catalogs and indexes to full-text or related databases. Older forms of proprietary linking are now giving way to linking based on the Digital Object Identifier (DOI) or OpenURL standard.

Metasearching is still another tool that gateways can provide in response to Web users' rising expectations. Like the well-known Internet search engines, Metasearching can provide searches across multiple resources, such as catalogs, Web sites, and specialized databases.

Many libraries, both academic and public, are experimenting with software that enables them to provide users with real-time assistance. Based in part on the concept of a chat room, the software makes it possible for librarian and user to engage in a dialog and to share resources in the pursuit of information. These, too, can be important in establishing a gateway.

It is easy to overlook the importance of help components in a gateway. However, since the purpose of a gateway is to guide users irrespective of their skill levels, it is clear that it must be useful to users who have varying levels of familiarity with the complex electronic environment. Help and guidance can be integrated into a gateway through the careful organization and naming of components, or they can be stand-alone items such as tips and frequently asked questions (FAQs). Recent Web technology such as the use of rollovers and pop-ups has made it possible to make descriptive information and tips more readily available in places where they are needed.

The importance of help and guidance should also be a reminder to libraries that users do not think in the same way, have the same background, or make the same assumptions as other users or the librarians who created the gateway. Gateway design must take this into consideration and find a way to at least partially resolve the perpetual tension between user needs and the structural concepts and complexity that must be conveyed. One way to address this is to think in terms of the functions that a user needs to perform—for example, finding articles or finding books—and then to determine how to match those needs with the structural elements (indexes, catalogs, full text) that need to be present.

To further complicate any attempt to define what a gateway is are the many similarities between gateways and portals. In fact, it is oftentimes difficult to distinguish between them. This is because both are relatively new and still in the process of being defined. Boss's recent description of library portals has many similarities to the approach taken in this article, but differs in the amount of emphasis given to commercial portal products that provide a single-user interface.[1] Other types of library portals, such as those at North Carolina State University and the University of Washington, emphasize a one-stop approach to library services and personalization features that enable users to add, edit, or remove categories of information.[2] In this respect, they are similar to student portals created to improve access to university services such as MyUB at the University at Buffalo and MyUNIverse at the University of Northern Iowa.[3]

Catalog

A key issue for libraries building a gateway is how to position the catalog in it. To a large extent, the answer to this question will depend upon the library's view of the future of the catalog. In recent years, the catalog has been challenged to meet the expectations and needs of a generation of users who have grown up accustomed to the Web search engines. While libraries may have had reservations about the adequacy or value of these search engines as information sources, their continued growth leaves no doubt that users find them effective.

This phenomenon has put both catalogs and librarians on the defensive. While catalogs have embraced Web interfaces, broadcast searching, and methods for selectively retrieving and linking to electronic resources, the adoption of these measures has been uneven and often reactive rather than proactive. The library profession seems unable to articulate a compelling view of what the catalog should be in an electronic world. As a result, individual libraries are perplexed about the future of the catalog.

This paper will not answer those questions. The purpose of this article is to explore the potential of the catalog to provide the underlying database support for electronic resources in a gateway. To that end, the capability of the catalog to act as the database of record for electronic resources, its ability to link to full text and other networked services, and its functionality for supporting the identification and retrieval of electronic resources will be examined.[4]

In the first case, it is important to evaluate whether the catalog has special fields or records expressly for managing purchasing, licensing, and descriptive information; whether it

can manage payments and other financial details; and whether it can define relationships between providers or aggregators and the resources licensed from them. If these elements are present, then the catalog should be functionally capable of keeping track of electronic resources.

In the second case, it is necessary to evaluate whether 856 fields for hypertext links are fully supported and whether there are additional mechanisms for connecting to link servers and content-enrichment services that provide summaries, reviews, and images of book jackets. Link servers will be explored in greater detail in the section on Linking Tools.

The third case encompasses a number of points. Because client/server architecture makes it possible to separate the catalog into a front end (the interface) and a back end (the database), there can be different interfaces accessing the same database. These interfaces can be designed according to need. It is not necessary to force everyone to use the original vendor-supplied interface. Many librarians will recognize Z39.50 as the foremost example of this. If a given catalog runs a Z39.50 server, Z39.50 clients or interfaces from other vendors can access it.

A variation on this approach is to develop a local interface to the catalog for specific needs, such as a list of e-journals or newspapers. If the catalog has an application programming interface (API), and several do have this feature, a locally developed interface could be built to access it. There is a significant role for the use of eXtensible Markup Language (XML) output in this type of access, because many of the Web-development tools that are readily available today can be used for processing bibliographic records that are in an XML rather than in a MARC format.

Another variation is the use of predefined or canned searches. Most Web interfaces to catalogs have a search syntax that can be specified in a URL. This enables specific searches to be placed in a variety of contexts outside of the vendor-supplied Web interface—in online pathfinders, bibliographies, Web pages, and course management systems, for example. These command links, as they are sometimes called, provide fresh and up-to-date information from the catalog each time the link is used, as opposed to the rapid obsolesence of information extracted from the catalog at a given point in time and listed in a Web page. Predefined searches can make use of built-in limits by collection and material type to focus searches on particular parts of the collection. If additional types of qualification are required with electronic resources such as form or genre headings, they should be planned for in advance so that records do not have to continually be upgraded.

Partway between predefined searches and the regular search interface are what can be called guided searches. These searches use a search box into which the user enters one or more search terms. However, additional search parameters that limit the search to certain material types or collections will be embedded in the Web form or made selectable via dropdown menus or check boxes. This reduces the complexity of searching while maintaining much of its power, especially for the inexperienced user. Guided searching is especially well-suited for a gateway environment, where users will be directed to functional areas that support their research or study needs at a given point in time. For example, in a section called "Finding Books," the search forms could focus on book materials. If needed, there might be one search form for printed books and another for electronic books. A government publications search could be limited to government publications, and so on. Because guided searches are focused and context-dependent, they should provide better and more useable results than general keyword searching.

In building the catalog, librarians need to become more accustomed to using a variety of ways to move data in and out of it. In the past, bibliographic data were typically loaded into the catalog from a small number of service providers, OCLC and MARCIVE, for example. With the advent of third-party suppliers of records for electronic resources, the situation has changed. Data can be imported and loaded from a variety of sources, such as Serials Solutions and TDNet. If the data is not in MARC format, it will have to be converted with a program such as MarcEdit or MARCMaker.[5] Even if the data is relatively complete, the library may want to add fields such as local notes, locations, genres, and subject headings in order to improve retrieval. This will require a preprocessing program that often can be written locally. When considering what to add to vendor-provided records, libraries should analyze what the retrieval capabilities of the search interface are and construct records on the back end so that the desired search results can be achieved. This matching of the retrieval capabilities on the front end with the data on the back end is something at which librarians need to become more adept.

The catalog can also be used to export information to Web pages or other databases. This type of indirect use will be discussed in more detail in the Other Databases section. In this context, the catalog is a parent that feeds alternative information sources. The advantage of such an approach is that there is one master source of information and all other instantiations are derivative in nature.

Because of the everchanging nature of electronic resources, libraries are finding that database maintenance is also being transformed. For example, a service that provides two hundred e-journal titles one month may have a very different configuration of titles the next or may

be bought and merged with another service altogether. This results in the need to update records for electronic resources in the catalog frequently, something that is not a customary procedure in cataloging departments. When updates are few in number, they can be managed by cataloging staff; but when updates are large in number, the expense of staff involvement is very high and it is cheaper to update the catalog via the batch addition and deletion of records. This, too, will reflect a change in library procedures and ways of thinking that is indicative of an environment where records are less sacrosanct than they used to be and seen more as information commodities.

Finally, libraries need to work with their vendors so that catalog systems can be used in new ways. Many of the approaches discussed above make the catalog more transparent to the user, and, at the same time, leverage its functionality for more purposes and in more contexts. Given the investment that libraries have made in their catalogs, it is appropriate to extend their utility in these directions. However, vendors of library catalogs need to be made aware of these needs, so that supporting structures can be provided in both the software and database system.

Other Databases

Using databases to keep track of information resources is superior to maintaining static Web pages. Because one of the most costly parts of any library's budget is staffing, libraries are continually looking for opportunities to use technology to minimize the maintenance and upkeep of information. One way to do this is to use databases, because they allow information to be used in multiple contexts and manipulated in different ways. Information in a database typically needs to be entered or updated in one place and is then available for multiple uses. Searches of a database always return current information. Consequently, using database technology will be more effective and less costly than repeatedly entering and updating information in multiple documents or Web pages.

As pointed out above, databases can be used to complement the catalog and to make up for what it cannot do, such as provide first-letter-of-title searches. Databases are relatively easy to set up and maintain, and interfaces to them can be developed and customized according to context. Information import and export is usually quite simple, so it is possible to load them with data from sources such as the catalog or vendors or to use them to generate additional output such as lists or small catalogs. The use of data transfer rather than reentering data already present in another system makes for greater efficiency in information management.

Databases run on both small and large systems. Databases such as MySQL and MS-Access are available for personal computer platforms, while enterprise-level databases such Oracle and SQL Server run on heavy-duty servers and can serve thousands of users at a time. Cost is usually relative to the scale of the database software, but it is surprising how much power and capability can be obtained from a system such as MySQL running on a Linux/Intel platform.

Building interfaces to databases takes some programming experience, but is becoming easier as new tools become available. Most administrative or staff interfaces to databases will require a graphical interface of the Windows or Macintosh variety, while public interfaces will be primarily Web-based and run on a Web server. Common Gateway Interface (CGI) was the first widely used Web-scripting tool, but it has been superseded in many ways by Active Server Pages (ASP), PHP, and Cold Fusion. Each of these development environments has its advantages and disadvantages and works with a different set of programming languages. What is selected for a given institution may depend as much on the skills of the available staff as on the functionality of the development system.

When a Web interface is developed, it is important to make sure that the search syntax can be represented in a URL. This enables the database system to be accessed with predefined searches from any part of the gateway or Web site, which in turn makes the information in the database system more useful since it can be accessed from a variety of contexts.

Online Content

It is the development of significant amounts of online content that has precipitated the need for gateways. Searching online databases has been available ever since the early 1970s. Early database providers such as BRS and DIALOG had a rudimentary form of gateway in the form of menus in which databases could be grouped and from which one or more could be selected for searching. However, there were no linkages between databases or linkages to the online catalogs that became generally available in the 1980s. Access was a discrete activity and users had to know in advance which search tools they needed to use.

Menuing systems developed at universities in the early 1990s were a great step forward in the integration of resources. Willow was developed at the University of Washington to provide a common interface to the library catalog and reference databases. The databases ran on BRS software and the catalog was exported from an Innovative Interfaces system to the BRS system. The Willow user interface originally ran on X-terminals and was later converted to Windows and Macintosh platforms.[6]

Sage, a menu-driven resource developed at the University of

Vermont in 1992 and early 1993, provided access to information systems that ran on different platforms by making the appropriate connection behind the scenes.[7] Some of the resources were Internet-based and others, such as CD-ROMs, resided on a local area or campus network. However, neither Willow nor Sage linked one system to another. They only provided a platform-independent menu from which linkages to individual systems could be made.

In 1994, the Web became commonly available. It enabled libraries to start listing the electronic resources to which they subscribed on Web pages, thus providing users with ready information about them. As the Web's popularity increased throughout the nineties, most vendors converted their user interfaces into a Web-based format and made their online databases Web accessible. This enabled libraries to make their catalogs and Web pages the basis for direct linking to the resources.

Just before the turn of the millennium, the types of electronic resources available proliferated dramatically. While the first databases on the Web were mostly indexes and abstracts, they were joined later by online content in the form of e-journals and newspapers, electronic books, electronic reference sources, and digital libraries of documents and images. The growing numbers and types of resources taxed the organizational skills of librarians. Which should go into the catalog? Which should be listed in databases or in Web pages? How does the catalog fit into the library's Web site? Should access to electronic resources be integrated with access to print resources? How does a user know which tool to use to find the resource that he or she needs?

The legacy of struggling with these issues is embedded in every library's Web site. Most catalogs are still in transition from being a guide to local collections to becoming a source for electronic subscriptions and selected Internet resources. Because catalogs do not provide the comprehensive access to resources they provided in the print world, they are supplemented with a variety of Web pages and local databases, which constantly challenge both users' and librarians' understanding. The purpose of a gateway is to introduce a unified front end to this amalgam of finding-tools that will guide users in the selection of the resources they need to accomplish their work.

Unlike traditional library collections, electronic collections are scattered around the Internet and most of them are licensed rather than purchased. While this facilitates their accessibility (libraries do not have to mount electronic collections locally), it makes them more subject to the mutability of the marketplace and less like the stable collections that users traditionally associate with the library.

Linking Tools

The introduction of online content has also created demand for a new set of tools that provide links to it from citation databases such as catalogs, indexes, and bibliographies. These tools have their conceptual origins in the pre-Web environment of the library management system.

In the early 1990s, some library management systems supported reference databases as well as a catalog. The Northwestern Online Totally Integrated System (NOTIS) library management system, for example, had a reference database component called MDAS (multiple database access system), which provided links from citations in indexes and abstracts to catalog records for journal titles based on ISSN. Users of this system could thus determine whether the library had the journal titles referenced in the indexes. The linkage was called "hook to holdings." Later, both SilverPlatter and the Gale Group adopted similar features that linked citations in their Web-accessible databases with local catalogs via ISSN searches.

However, linkages between indexes and catalogs imply that content is still in print format. What was needed were direct links between indexes or catalogs and online content. The impetus for this came from outside traditional library circles, the digital library research conducted in the field of computer science.

One of the significant outcomes of this work was the development of DOI, which provides a persistent address for a digital object such as a journal article. The address consists of a prefix that identifes the organization that registers the object, and a unique suffix that identifies the object itself. In order to function in the context of the Web, where addresses are location dependent, DOI has to be resolved into one or more URLs. This is accomplished by means of a resolution server.[8]

Since its development, DOI has been adopted by the publishing industry as a means for cross-linking the scholarly journal literature. Citations in articles published online are given DOIs to link them to the online articles cited. The Publishers International Linking Association operates a program called CrossRef, which coordinates the process of registering participants and link resolution.[9]

Thus far, CrossRef has been focused on linking journal article to journal article. It has not been adopted by the abstracting and indexing industry. However, another recently developed linking mechanism has made considerable inroads among libraries and service providers of both indexes and online content. It is OpenURL, which is on the way to becoming a National Information Standards Organization (NISO) standard.[10] OpenURL allows the transport of object-specific information, such as the citation for an article, from an information source (a catalog or an index) to a service

provider that supplies online content. What is different about OpenURL compared to DOI—as it has been implemented by various software vendors—is that a connection is made to a specific service with which a library has a business relationship. A piece of software called a link server sits in the middle and is configured to direct connections to specific or preferred instances of an online resource.[11]

The first OpenURL link server was called SFX and is marketed by Ex Libris. Since its release, several other link servers have been developed, and increasing numbers of service providers of both indexes and online content have made their systems OpenURL compatible. Because of the importance of OpenURL for facilitating transparent access to online content, any library considering the implementation of a gateway should also consider implementing a link-server product.

Metasearching

In an effort to approximate the scope of the Internet metasearch engines, some software companies have developed metasearch engines that can be used with library resources as well as Internet resources. These tools search across multiple resources—catalogs, indexes, Web sites—and present a combined-result set to the user. Most of the products allow the user to specify which resources to include in the search.

For institutions building a gateway, there are some important issues to consider in including a metasearch tool.[12] First, is the tool flexible enough so that it can be integrated into the gateway? Some of the metasearch tools do not function except through their own interfaces. This could present a serious problem if a library wants to use the metasearch function through its own interface or to significantly modify the vendor-supplied interface.

Second, can the tool be configured to function in accordance with gateway categories? Since the categorization of resources is at the heart of a gateway, a metasearch engine should be able to be focused on different sets of resources in different contexts. For example, in the section of a gateway dealing with e-journals, the metasearch engine should be configurable to offer only choices predefined by the library for the finding of e-journals. A different set of resources would appear in a section on electronic books, and so on.

Third, can the metasearch engine handle multiple search and communication protocols? Z39.50 is a well-known protocol for the search and retrieval of information. However, only a few information services support it. An effective metasearch engine should be able to handle Z39.50, XML, and HTML output simultaneously.

Fourth and, perhaps, most important, is the metasearch engine sufficiently advanced over Internet search engines to be consistent with the purposes of a gateway? If one thinks of a gateway as a set of reductive tools, that is, tools that progressively refine and narrow the number of choices available to the user until the desired result is arrived at, the metasearch engine must be flexible enough to do just that without submerging the user in a large quantity of useless or marginally relevant information.[13]

Real-Time Assistance

Real-time assistance is the latest in a series of technologies that enable libraries to extend reference services beyond traditional walk-ins, scheduled appointments, and telephone reference. Such services are usually gathered together under a rubric such as Ask-a-Librarian or virtual reference. For several years, libraries have responded to questions via e-mail, often by having specific e-mail addresses to which questions could be sent. However, e-mail works best for questions that are unambiguous. It does not work as well when the user and the librarian have to proceed through a series of steps to clarify the scope and nature of the question.

Consequently, adopting chat-like functions to the reference process was an excellent step to improving service, especially to remote users. Users may get the attention of a librarian by clicking on a hypertext link and entering some basic information about themselves as well as their question. A librarian will answer in real time. The interactive nature of the process encourages the clarification and refinement of the query. In addition to sending responses in the form of messages, a librarian may share online information with a user via a push feature. This enables information from Web sites and databases to be used in providing the answers.

Real-time assistance service is typically licensed from a vendor that has developed the software and maintains the site specifically for this purpose. As libraries develop gateways to improve access to their print and electronic collections, real-time assistance provides a useful online complement to traditional desk-based reference services.

Help and Guidance

The most important thing that a library can do to help its clientele use its gateway successfully is to create one that is well designed. It is known from Web-usability studies that design affects usability.[14] Where the structural elements are clearly differentiated, users should be able to make good choices about where they should be going. The use of appropriate trigger words is critical in this regard since users come to the gateway with a wide variety of backgrounds and levels of knowledge. Drawing terminology from the con-

tent of the site can be helpful in elucidating the categories, but libraries must consider how to explain terminology with which users may not be familiar. Providing multiple pathways to the same content can accommodate the fact that users think differently.

It is for these reasons that some libraries are considering a gateway that is organized into major categories such as Find Articles, Find Books, Find Reference Sources, or Find Web Sites rather than the traditional categories—Catalog, Indexes and Abstracts, E-Journals. These functional categories, together with appropriate scope notes for the various subcategories contained within them, should help users orient themselves quickly to the types of tools that are needed to carry out their study and research.

Explicit help features have their place in a gateway as well. Providing users with tips in the form of brief explanations can be very effective. However, it is important that they be brief and that they be placed strategically—that is, in places where they are most likely to be needed by users.[15] Tips placed out of context or tips that call undue attention to themselves can be seen as annoyances.

FAQs can also be helpful. However, it is important that they, too, be kept brief and to the point, both individually and collectively. There is a tendency for some FAQs to replicate much of the information on a Web site. In such cases, the effort might have been better spent reorganizing the information so that it is more accessible.

Integration with a Library Web Site

A Web site typically contains information about the library, its resources, collections, and services, while a gateway focuses on the resources used in study and research. A library's gateway may be tightly or loosely integrated with its Web site, but must be integrated in some way. Integration between the two can be made easier with features such as dropdown menus, rollover graphics, and JavaScript programming, which enable a library to include more information and more links on a given page. However, increasing the number of links does not necessarily make it clear to the user what is to be selected. Various contextual elements should be supplied to make the choices easier or clearer. For instance, if resources are deemed the most important part of a library's Web site, then they should come first or be emphasized in some fashion. User guidance should be provided to make the choices clearer. Cornell University Library (CUL), Brigham Young University Library (BYUL), and the University of Iowa Library (UIL) have developed gateways that exemplify several of these principles.

CUL's is an example of a highly integrated Web site.[16] It calls the Web site a gateway and it has integrated access to the primary research tools into the home page. The home page is divided into five major categories that cover the whole gamut of library resources and services: research tools, instruction, technical support, services, and information about the library. The research-tools category contains the links normally associated with a gateway: the Catalog, Find Articles, Find Databases, e-Journals, and Course Reserves. The Find-Articles section enables users to enter searches into a metasearch engine; it then connects users from the resulting bibliographic citations to full text via a link server. User guidance to six common types of resources is addressed by How Do I . . . ? dropdown menu selections. The information found on these pages is well written and informative. The home page also includes a catalog search form.

BYUL has taken a similar approach, but has gone further by making access to resources the primary element on the home page and by subordinating other aspects of the Web site.[17] It places the major categories of information typically found on Web sites in a lefthand sidebar and uses the main part of the home page to highlight eight categories of resources: the Catalog, Article Indexes, e-Books and e-Journals, Sound and Images, Course Reserves, e-Reference Tools, Internet Search Tools, and Subject Guides. Each category appears as a tab on a horizontal bar and has an explanation that appears on the bar whenever the pointer hovers over a tab. Several of the tab pages have search forms to the catalog or an electronic resources database built into them. They may also include predefined or guided searches. This provides for very rapid navigation to the resource components that the user needs. User guidance is provided by clear wording of the categories and headings and brief hints or descriptions about what to expect from them. The tab pages for resources are well organized and very clear. While not calling itself a gateway, this site definitely emphasizes the resources common to most gateways.

UIL provides an example of a loosely integrated gateway.[18] The gateway, which is called InfoHawk, has its own home page and is selected as a menu option from the library's main home page. The gateway has only four categories that are attractively presented as graphics: Catalogs, Indexes and Abstracts, Reference Sources, and Full Text. Descriptive statements are provided for each of the main categories to help the user make the appropriate choice. Each category is broken down into two to five subcategories for a total of fourteen. Descriptive information is obtained by moving the pointer over the subcategory names. This technique allows a considerable amount of guidance to be presented in a very compact format. Information about electronic indexes and reference sources is maintained in an electronic

resources database. Information about e-journals is maintained in Web pages derived from the SFX link server. The gateway structure is also represented in the form of dropdown menus at the top of each page with the addition of a fifth category, Library Information, which replicates most of the categories and subcategories found on the library's home page. This provides a good degree of backward integration for those who might link directly to the gateway instead of to the home page. Unfortunately, the very fine user-help pages, which cover library services as well as resources, are available only from the main home page, not from the gateway.

Conclusion

While the variations in the three gateway implementations at BYUL, CUL, and UIL suggest how open-ended the idea of a gateway still is, the common elements underscore the fact that a gateway concept is beginning to emerge. All three feature the catalog as a primary finding tool for both print and electronic resources. BYUL, in particular, has taken advantage of guided searches of the catalog for retrieving citations for e-books and audio-visual materials. All three institutions use local databases to supplement the catalog and to provide information about certain resource types—specifically, indexes, e-journals, or reference sources. All three avoid using manually maintained Web pages for lists of resources. As of May 2003, CUL and UIL use link servers and CUL has a metasearch engine, a healthy sign that libraries are putting into place the tools needed for completing the cycle of information discovery and retrieval.

Just as significant are the indications that libraries are beginning to view gateways in terms of the processes that users need to carry out. Headings such as Find Articles and Find Books, especially when complemented with various types of help, indicate that gateways are becoming mechanisms for guiding users to needed resources.

However, gateways are still very much works-in-progress and no single implementation exhibits all of the elements or the degree of integration described here. A significant amount of work remains to be done to leverage the library's investment in its catalog, to improve the flow of data from vendor-supplied information to local catalogs and databases, and to provide more unified user interfaces. Linking tools between citation databases and online content need to become more widely adopted. Help tools need to be refined so that they are more context dependent. Web-usability concepts need to be studied and applied to the organization of gateways. But, above all, the gateway itself needs to be accepted as an entity in its own right with the catalog, supplemental databases, and linking tools transparently subsumed within it.

The implications of this for the development and purchase of software and database systems are substantial. As long as libraries choose to work with products that are flexible and open-ended, they will be able to test, redesign, and adapt their gateways to ever-evolving user needs.

References and Notes

1. Richard W. Boss, "How to Plan and Implement a Library Portal," *Library Technology Reports* 38, no. 6 (Nov./Dec. 2002): 8–13. For more information see Mary E. Jackson, "The Advent of Portals," *Library Journal* 127, no. 15 (Sept. 15, 2002): 36–39, and the Library of Congress Portals Applications Issues Group Home Page. Accessed Sept. 19, 2003, www.loc.gov/catdir/lcpaig.

2. "Library Portals," *Provosts on Portals*, a project of the American Association of State Colleges and Universities and the Teaching Learning Technology Group of the American Association of Higher Education. Accessed May 23, 2003, http://faculty.weber.edu/portals/library_portals.htm; "Other My Library Projects." Accessed May 23, 2003, www.library.vcu.edu/mylibrary/cil99.html; Elizabeth Buchanan, "Ready or Not, They're Here: Library Portals," *Syllabus* (July 2001). Accessed May 23, 2003, www.syllabus.com/article.asp?id=4138.

3. "What Is MyUB?" Accessed May 23, 2003, www.buffalo.edu/aboutmyub; "UNI unveils new Online Student Portal," *Campus News Network* 11, no. 12 (Jan. 23, 2001). Accessed May 23, 2003, www.uni.edu/pubrel/cnn/issues/012301/story07.html.

4. This discussion builds upon and extends some of the concepts discussed at the MARS Hot Topics meetings in 1999 and 2000 and in Jerry Caswell's report on leveraging the catalog; MARS Hot Topics Annual 1999 Summary, "Electronic Resources Gateway: Why and How!" Accessed May 23, 2003, www.nd.edu/~crichter/mars/hot_ann99sum.htm; MARS Hot Topics Midwinter 2000 Summary, "Coordinating/Integrating Electronic Resources Gateways and OPACs." Accessed May 23, 2003, www.nd.edu/~crichter/mars/hot_topicsum_midw00.htm; Jerry V. Caswell, "Leveraging the Online Catalog: Exhibits and Demonstrations." Accessed May 23, 2003, www.uni.edu/~caswell/cat.

5. Terry Reese, "About MARCEdit." Accessed May 23, 2003, http://oregonstate.edu/~reeset/marcedit/html/about.html; Library of Congress, "MARCMaker and MARCBreaker Users' Manual." Accessed May 23, 2003, www.loc.gov/marc/makrbrkr.html.

6. Alex Wade, "Tying Distributed Systems Together: Going beyond the Digital Registry." Accessed May 23, 2003, www.lib.washington.edu/about/registry/ala.

7. Lyman Ross et al., "The Role of Academic Libraries in the Dissemination of Scholarly Information in the Electronic Environment," in *Computer Networking and Scholarly Communication in the Twenty-First-Century University*, eds. Teresa M. Harrison and Timothy Stephen (Albany: SUNY Pr., c1996), 374–82.

8. "DOI Overview: The Digital Object Identifier (DOI) System." Accessed May 23, 2003, www.doi.org/overview/sys_overview_021601.html.

9. "About CrossRef: History/Mission." Accessed May 23, 2003, www.crossref.org/01company/02history.html.

10. "The OpenURL Framework for Context-Sensitive Services: Standards Committee AX." Accessed May 23, 2003, www.niso.org/committees/committee_ax.html.

11. "OpenURL Overview." Accessed May 23, 2003, www.sfxit.com/open/index.html.

12. A useful summary of metasearch issues is to be found in Judy Luther, "Trumping Google: Metasearching's Promise," *Library Journal* 128, no. 16 (Oct.1, 2003): 36–39.

13. Using an Internet search engine is roughly analogous to using the search function on a Web site. As Web-usability experts have reported, "users that found content were far more successful when they navigated by using categories than by using Search." Erik Ojakaar and Jared M. Spool, *Getting Them to What They Want*, UIE Reports: Best Practices Series (Bradford, Mass.: User Interface Engineering, 2001), 4.

14. Ibid., 7–8, 11–13, 15.

15. User Interface Engineering, "Making Tips Work," Accessed May 23, 2003, http://world.std.com/~uieweb/tips.htm.

16. "Gateway to Cornell University Library." Accessed May 23, 2003, http://campusgw.library.cornell.edu. Note that this is a successor to the gateway described in Karen Calhoun, Zsuzsa Koltay, and Edward Weissman, "Library Gateway: Project Design, Teams, and Cycle Time," *Library Resources & Technical Services* 43, no. 2 (Apr. 1999): 114–122.

17. "Brigham Young University, Harold B. Lee Library." Accessed May 23, 2003, www.lib.byu.edu/hbll.

18. The University of Iowa InfoHawk, "Welcome to the InfoHawk Gateway." Accessed May 23, 2003, http://infohawk.uiowa.edu.