The E-Resources Management Handbook – UKSG

New resource discovery mechanisms (2)

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In the few short years since the first chapter on resource discovery was written for this publication, significant strides have been made in library discovery systems. The focus has moved to the user and the provision of services to meet the expectations of the web-savvy user of the 'Google generation'. This chapter reviews these changes as well as some exciting recent developments and looks beyond to the next steps ahead.

The original version of this chapter (published in 2006) can be accessed at http://uksg.metapress.com/openurl.asp?genre=article&id=doi:10.1629/9552448-0-3-8.1

Introduction

In the few short years since the first version of this chapter was published in UKSG's *The E-Resources Management Handbook*[1,2], the discovery landscape for scholarly materials has changed considerably.

The earlier (August 2006) chapter discussed the various methods of resource discovery and delivery for the wide range of diverse information resources for which the librarian must provide access. These include locally-managed resources such as the library catalogue, institutional repositories and digitized material as well as the growing number of remote resources including licensed databases of articles and e-books, web pages and more. These remote resources vary significantly in their target audience, their content type and coverage, and in the terms and conditions dictated by the content providers.

In 2006, the author explored different technologies for facilitating resource discovery including metasearching (searching simultaneously across heterogeneous information resources), linking from one item to related items or related services, A–Z journal lists, and the emerging new generation or 'next-gen' library discovery interfaces. Also mentioned were the up-and-coming search engine technologies of the time such as Endeca[3], FAST[4] and Lucene[5] that were being deployed in the 'next-gen' systems with the promise of transforming the user experience with their speed of retrieval and their faceted browsing capabilities. These search technologies enable the library to enrich the information for the best user experience and save precious time for the user who is looking for information; but they require that the system preprocess the data before it can be searched ('just in case'). Preprocessing is not always possible for resources that are not under the library's control and therefore such resources can only be searched following the user's query (metasearching 'just in time').

The 2006 chapter concluded with the statement, "Finding a way to combine the best of the just-in-case and just-in-time methodologies to meet changing user expectations is the current challenge for librarians and their vendors". A number of the 'next-gen' discovery interfaces aimed at library users offer a search solution for locally-managed resources integrated with metasearch for remotely-managed resources, both in a single user interface.

Google Scholar[6], first launched in November 2004 – and still in beta test, adopts a just-in-case approach to the provision of scholarly material in general. More recent initiatives in the library marketplace, leveraging new technologies, ever-increasing network speeds, and a relaxation by publishers regarding the wider dissemination of their content, now propose a just-in-case indexing of a library's complete collection including resources not directly under the library's control. Such web-scale indexing and discovery solutions for libraries have moved rapidly from theory to reality and early responses from librarians are very positive.[7]

'Not-so-new' paradigms for resource discovery

The 2006 chapter section 'New paradigms for resource discovery' listed the key recommendations for enhancing search and retrieval as taken from the December 2005 report from the bibliographic services task force of the University of California.[8] The majority of these recommendations are now commonplace in the 'next-gen' interfaces:

- alternative action for failed or suspect searches, e.g. "Did you mean?"
- the provision of easy fulfilment options, e.g. the 'I want this' button
- better navigation of large sets of results sets, e.g. faceted categorization and clustering options
- relevance-ranked results sets
- customization and personalization options.

Progress is being made on other recommendations highlighted in the report, such as the integration with commonly-used non-library tools, including institutional portals and community websites; and also on the mining of usage data in order to suggest other works of interest. Some examples of scholarly recommender services are the BibTip[9] OPAC recommender service from the University of Karlsruhe and the bX[10] article recommender service from Ex Libris.

Web 2.0 features that facilitate user contribution such as tagging and reviews have been deployed in the 'next-gen' library applications to also aid discovery. According to the 2007 OCLC report[11], these have enjoyed limited success even though such features are widely used in popular services such as Amazon[12], Netflix[13], and eBay[14].

The rise (and fall?) of metasearch

Metasearch provides users with a unified interface to the diverse and discrete information environments: 'silos' of information that constitute the library's collection. The collection can include content that the library manages and content that third parties manage; content held locally and content held remotely; content available for a fee and content that is free at the point of use. Users who are aware of the disparate systems for accessing the range of information environments that comprise the library's collection often find the distinctions between them to be arbitrary. To date, metasearch has been the most effective way to bring these together for the user in a meaningful way. Metasearch is a viable and cost-effective solution. It does not require that the library stores indexes and full data of the target resources and it offers flexibility: it enables the library and the user to tailor their search environment as they like without dependency on a single vendor.

Metasearch was greatly lauded earlier this decade and is widely adopted in both academic and public libraries. The 2008 and 2009 reviews by Marshall Breeding of the Library Journal Automated Systems Marketplace indicate that a total number of 18,000+ libraries have adopted metasearch solutions (referred to in the review by Breeding as 'federated search solutions'); and that nearly 600 new systems were added in 2009.[15,16] Common metasearch tools include Ex Libris' MetaLib[17]; Serials Solutions 360 Search[18] and WebFeat[19]; and Research Pro[20] from Innovative Interfaces. In January 2009 EBSCO announced the forthcoming release of EBSCOhost Integrated Search[21] which integrates federated search of remote databases within the EBSCOhost 2.0 interface.

Although metasearch serves the purpose of bringing disparate information resources together in a unified discovery environment, it presents a number of challenges:

1. *Search Speed*
   User expectations have been set by search engines such as Google and sub-second response times are now what is expected of library search engines. For presentation of the results set, metasearch engines are dependent on the speed of response of the target systems and typically wait for the slowest resource to respond (subject to a system timeout). Some metasearch engines address this challenge by presenting results from each target resource as soon as they receive them. However, such presentation method is not effective as it does not allow for the merging and deduplication of results.
2. *Search quality*
   In order to offer a single query interface, the search functionality is reduced to facilitate a common approach across all resources. Furthermore, relevance ranking is offered by some but not all remote resources and hence merging of results is not truly effective. For example, many abstracting and indexing databases return results with the most recent citations listed first. The problem is intensified because metasearch engines initially receive only the first 20–30 records from each target in order to optimize performance.
3. *Stability*
   Metasearching relies on the capability of the metasearch engine to adapt the user's unified query to the search protocol and syntax of each of the search targets, and then convert the results obtained from each of these targets to a unified format. A standard search and retrieval protocol such as Z39.50 or SRU/SRW provides robust means for the metasearch engine to perform this task, but in the absence of it the metasearch engine can interact with the target search through a connector based on HTML parsing. However, because information providers regularly change their interfaces, such connectors require high maintenance. The provider of the metasearch engine typically develops and maintains the connectors, but delays frequently occur in effecting such changes.

Despite these limitations, metasearch tools are, at the time of writing (October 2009), widely deployed in libraries, though it will be interesting to observe how quickly metasearch may be replaced by the emerging web-scale indexing and discovery services that promise comprehensive and integrated access to the entire library's collection.

The 'next-gen' discovery interface for library users

'Next-gen' discovery interfaces are developed to meet the expectations of the current generation of web-savvy users. With a focus on the users and their needs, the new discovery systems are intended to provide a more effective means for finding information and offering services based on it. Such services include the ability to download items, print them, save them, annotate them, review them, re-use them in mashup applications, and more.

The University of Rochester eXtensible Catalog is an example of a next-gen interface; it embraces some of the following key features:[22]

- user interface that accommodates library users at varying levels of proficiency, helping them to gain access to diverse library collections
- grouping of results consistent with the concepts of FRBR (Functional Requirements for Bibliographic Records)[23]
- support for multiple metadata schemas
- integration with metasearch applications
- integration with local ILS (integrated library system) implementations
- integration with external environments such as learning management systems (e.g. Sakai[24] and Blackboard[25]).

The eXtensible Catalog, sponsored by the Andrew W Mellon Foundation, is just one of a number of open source next-gen discovery systems. Examples of other next-gen systems include:

- AquaBrowser (from Medialab Solutions)[26]
- Encore (from Innovative Interfaces)[27]
- Primo (from Ex Libris)[28]
- WorldCat Local (from OCLC)[29]
- Visualizer (from VTLS)[30]
- SirsiDynix Enterprise (from SirsiDynix)[31]
- Summon (from Serials Solutions)[32]
- VUfind (from Villanova University)[33]
- ELIN (from University of Lund, Sweden)[34]

Although there is a considerable degree of overlap in the functionality offered by these systems, they do differ quite markedly in some areas. A series of three reviews on 'next-gen' systems in *Serials* (Nov 2008, March 2009 and July 2009) provide information on some of the above systems and offer interesting case-studies on implementations.[35,36,37] The authors of some of these articles provide an insight into the continued maintenance of the local OPAC system alongside the 'next-gen' system they have implemented, representing considerable overhead for the libraries.

The reasons for maintaining the old OPAC are various, and differ from one system to the next. But in essence not all the functionality offered in the OPAC is provided in the new systems. Some OPAC functionality, such as the ability to reserve a book or view the full MARC record, has been omitted in the quest for an uncluttered interface; some sub-modules, such as course reserves, have not yet been replicated and support for special characters in foreign languages for presentation and search is not yet fully developed in some of the new systems. Furthermore, due to the masking of metadata and searching complexity, aimed at addressing the expectations of today's users, the 'next-gen' systems are still considered immature by the librarians and have not yet garnered their full trust.

'Next-gen' system providers are making strides to enhance the systems to address these issues, but how long will this take and how much will this compromise some of the compelling features of the new systems such as the clean, simple 'Google-like' interface?

The DLF ILS Discovery Task Force[38] for standardized interoperability

In 2007 the Digital Library Federation (DLF)[39] created a task force to address interoperability between the new discovery interfaces being deployed in libraries and the ILS, to enable the discovery systems to take full advantage of the advanced data management and services in the ILS.

The ILS Discovery Interface Task Force identified four levels of increasing interoperability between the two systems while focusing on the basic areas of interoperability. In March 2008 the task force published a document, known as the 'Berkeley Accord'[40], which was adopted by the majority of ILS vendors as a statement in support of a more standardized environment in which discovery interfaces can interoperate with any given ILS. Signatories to the Berkeley Accord committed to providing the best library services for research and learning and viewed the agreement as an important step in advancing these services for the library users of today and tomorrow. Further, they agreed to support a set of essential functions through standardized open APIs (application programming interface) to enable the harvesting of bibliographic and holdings data, to enable real-time circulation status and availability information and to provide a stable URL link to the records in the ILS.

The latest recommendations (v1.1) for these functions were published in December 2008.[41] The recommendations also describe and suggest a variety of other functions to support higher levels of interoperability.

For the recommendations to be successful in promoting interoperability, they need to be implemented for the ILS systems and used in the discovery systems. The DLF actively encourages this by holding developer workshops. Further, the DLF encourages ongoing co-operation between libraries, vendors and

applications developers in building more advanced, interoperable architectures for bibliographic discovery and use.

What is the next 'next-gen' discovery system?

Dave Lankes, associate professor at Syracuse University's School of Information Studies, still sees the current next-gen search tools as catalogues. Whilst acknowledging the recent innovation, Lankes believes that many of the 'next-gen' systems are still – at heart – inventory systems and not discovery systems. According to him, inventory systems work quite well when the user conducts a search for a known item; however, they are less suited for exploring ideas and concepts. Furthermore, "they fail completely in trying to encode 'knowledge' that is the context that spans works and people". Lankes would like to see the current 'next-gen' systems as the last generation of catalogues.[42]

Lankes stresses the importance of 'connective tissue' that enables the tying together of items in a result list: "It is more important to know the logic behind a list than just the list itself". Lankes is clearly looking forward to the introduction of semantic search technologies in the library domain.

Semantic search and Web 3.0

Semantic search is intended to help users find their way around content more effectively by not only discovering materials of interest but in being able to 'understand' them and give them meaning; to deliver answers to the user's queries rather than delivering a list of results and having the user sort through these.

Recent Outsell research indicates that approximately one out of every three searches is unsuccessful today.[43] One reason for this may be that the answer cannot be found because it does not exist in a prepackaged keyword-tagged form. Semantic analysis is unlikely to replace Google which with its speed, breadth and simplicity allows a user to find a virtual needle; yet Google rarely assists users in understanding more about the needle such as why the needle is located where it is and what other haystacks should be of concern.

Semantic search goes beyond keyword search to a better understanding of natural-language queries. For example, a possible result for the query *bank europe finance "adam jones"* is a document including the following phrase: "At its meeting last week, the board of UBS appointed A. Jones as its CFO." In this case, the system needs to know that UBS is a name of a bank; UBS is a Swiss bank, and Switzerland is a country in Europe; and CFO is Chief Financial Officer.

The Semantic Web, in which semantic search takes place, is an evolving extension of the web where machines can 'read' sites (almost) as easily as humans read and understand them. In such an environment, search engines and software agents can facilitate a better searching experience for the user, helping them find what they are looking for.

This vision of the Semantic Web has not yet been realized but efforts in this area are increasing. Semantic search and semantic technologies, such as Resource Description Framework (RDF)[44] and the Web Ontology Language (OWL)[45], intended to provide a formal description of concepts, terms and relationships within a given knowledge domain, are now being used; but mostly outside of the library environment.

Hakia[46] is an example of an emerging semantic search engine. Hakia, which emphasizes the content and context rather than the Google approach that emphasizes relevancy and popularity ranking, is one that has reached out to librarians to add credibility. Hakia has started a 'librarian's corner' where librarians can submit details of web resources that meet Hakia's criteria including peer-reviewed information, no commercial bias, currency of content, and source authenticity in terms of original material.

In the business arena, Northern Light[47] offers a free search engine that culls results from a targeted section of the open web and includes over one million articles from thousands of business news sources, leading business publications and selected industry blogs. Users can view and filter query results in a

variety of ways, for example by the underlying companies, markets, or technologies covered. Users can also view the tone or sentiment across the results for each of these extracted entities (such as a particular company). For example, the arrangement of material returned by the Northern Light search provides answers to questions about competitors and about how a company's products are perceived.

Further information on the Semantic Web can be found in Macgregor's chapter for *The E-Resources Management Handbook*[48].

Web 3.0

The Semantic Web is often equated with Web 3.0, although there are a number of characteristics for Web 3.0, the Semantic Web being just one of these. Another aspect is the 3D Web in which users can walk through the web via their desktop, interacting with content and with other users. Google Earth[49] and Second Life[50] are steps in this direction.

The library community, and in particular the 'next-gen' discovery systems, has already embraced Web 2.0 which heralds the significant move from the initial Web and the connectivity of information to user-centric design where people interact and add value to an application as they use it.

The library community eagerly awaits Web 3.0 systems that will connect data, services and applications by integrating knowledge about these systems, their content sources and their process flows. Today such connections are done manually and this does not scale to meet demand. In Web 3.0 this will be done in real time using automated and semi-automated methods. Such knowledge allows the interlinking of information about people, places, events and other concepts across different content sources and applications.

A spectrum of search options

Web 3.0 and the Semantic Web offer promise not only of a web that can understand a user's query, but also of a distributed search environment in which disparate systems can effectively communicate to provide an answer to a user's quest. Variously, estimates for the realization of the Semantic Web are at least five years hence.[51,52] In the meantime, progress continues on a number of fronts to optimize discovery processes for users and help them with the escalating problems of information overload and the distributed nature of the information.

The 'next-gen' discovery systems dramatically improve the user experience providing easy, consolidated access to a range of resources – local resources such as the catalogue and digital repositories as well as remote resources. Access to the remote resources has until recently typically been provided via metasearch. But with the constraints on metasearch as described earlier, providers and libraries themselves have continued to explore better ways to address resource discovery of multiple, disparate remote databases, typically licensed databases of journal and book content.

Notable cases have existed for a few years where journal articles are harvested and indexed locally for a targeted community. These include DADS[53] from DTV[54] (Technical Knowledge Center of Denmark), ELIN[55] from Lund, Summa[56] from the University of Aarhus in Denmark, and OhioLINK[57] in the United States. In January 2009 Serials Solutions announced the release later in the year of their Summon[58] service and this announcement was quickly followed by announcements of similar services from Ex Libris, OCLC and EBSCO. To enable such services, the vendors have negotiated with the information providers on behalf of their customers to collect the data and metadata into a single database where the results are deduplicated, rationalized, and indexed ready for user discovery. A single search box is offered to the user and results are returned quickly in one relevance-ranked list. As with Google Scholar, the aggregation of data is for discovery purposes only and delivery of the item including authorization is done by the original information provider: typically these systems link the user back to the local library catalogue entry for a printed book, or use an OpenURL resolver to take the user directly to a journal article on a publisher's website. Although these services offer hundreds of millions of items (journal articles,

newspaper articles, books and book chapters) – and growing – not all providers are yet contributing their data to this centralized pool and some may be reluctant to do so.

Pending widespread adoption of semantic search services, local indexing for a targeted community or centralized indexing on behalf of a broader community is likely to be the norm for a growing proportion of a library's collection; even Google Scholar does not manage to harvest, index and make available all items in a library's collection. A spectrum of search options is needed to fulfil a user's wish to search a library's collection, and in this distributed information world in which we live, metasearch – and navigational linking – will continue to be important for those remote resources that cannot be indexed because of business policies or technical constraints. How to merge effectively the results retrieved from multiple resources into a single list that makes sense to the user is a big challenge. Another important challenge for discovery systems is the need to move beyond 'traditional' textual content to address datasets and other data types which are critical to research. In addressing all such issues, closer attention should be paid to truly understanding the user.

Understanding the user

In this handbook, David Nicholas, Director of the School of Library, Archive and Information Studies and of the UCL Centre for Publishing at University College London, offers important insights into the information-seeking behaviour of virtual users in the scholarly domain and stresses the importance of understanding these users. In his chapter 'If we do not understand our users, we will certainly fail'[59] Nicholas describes the findings from his research, which uses deep log analysis techniques and clearly indicates that when it comes to information-seeking behaviour 'one size does not fit all'. Further, Nicholas identifies very significant differences between various types of users, particularly with respect to their subject field but also with regard to academic status, geographical location, gender, type of institution and attitudes towards scholarly communication.

Another report on the information-seeking behaviour of users, 'The Behaviour of the Researcher of the Future (Google Generation)'[60] explodes some of the myths of the 'Google generation' (youth born after 1993 and brought up in the internet age). This report was commissioned by the Joint Information Systems Committee (JISC)[61] and the British Library[62] and was conducted by CIBER[63], the Centre for Information Behaviour and the Evaluation of Research at University College London.

Research findings in the report indicate that the Google generation "is not particularly Web-literate, and their research traits – impatience in search and navigation and zero tolerance for any delay in satisfying their information needs – are becoming the norm for all age-groups". These findings emphasize the need for libraries to increase their efforts to promote the expensive and valuable content they license to all their users including faculty and to make the discovery interfaces easier to use.

Conclusion

Ten years ago resources in general – and e-resources in particular – were relatively scarce in the scholarly environment and the user took a more exploratory approach to their search activities. Today we see dramatic growth in the amount of available information and users with a short attention span, who are results-oriented and expect convenience of use. Users gravitate increasingly to the large aggregations of data available through a single interface, although a single resource, vast as it can be, does not fit all needs and most users rely on more than one resource to deal with all their research enquiries.

Discovery systems must be optimized in terms of coverage, performance and functionality, and tools are needed to help the user to explore the information landscape most effectively and to distil quickly the items of interest. Libraries, library vendors and information providers are all engaged in the creation and delivery of suitable solutions, while the large search engines such as Google continue to adapt and develop their services to address the changing needs of scholars.

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