

Somewhere Over The Rainbow: Finding Information in the Virtual Learning Environment

Kate Roberts* and Edward Lim*

*AARLIN Office, La Trobe University, Australia
k.roberts@latrobe.edu.au, e.lim@latrobe.edu.au

How easy is it to find information at the point of need? AARLIN (Australian Academic and Research Library Network) – a consortium of Australian university libraries - sets out to explore whether it was possible to streamline user pathways from learning and research environments to information access, information resources and other relevant services at the point of need. The broad model is a library portal which can be accessed on and off campus, and which allows a range of portal features such as user customisation, more effective user access to information resources and services, uniform search interface to a range of resources, a modifiable list of "favourites", a modifiable bookmarks list, saving searches and re-running these, and saving citations.

AARLIN also sets out to explore the infrastructure and software developments necessary to achieve these, including: authentication; distance education issues; human computer interface issues; provision of context sensitive services; and tools, techniques and emerging standards which offer the potential to improve access.

1. The problem writ small

Until the e-information explosion, potential user pathways to efficiently and effectively search for and access information were somewhat cabalistic, and therefore under-utilised. The information-seeker was progressively initiated, usually by a librarian, into the secrets of turning their search strategies into gold. Pathways were also relatively few in number.

There would always have existed a subset of academic researchers who developed and maintained a high-level expertise in searching for information in their field, particularly where the genre, broad topic and scope of their information need remained constant. More typically, however, students and academics alike used the path of least resistance in searching for and accessing information, and when this failed, would either ask a librarian for assistance, or be innovative in using informal networks to fulfil the need, or change their information need. In this sense, the user pathways were relatively limited.

Traditionally, any person seeking information, has to face critical decision-making hurdles which affect the lightness of their step along the yellow brick road towards their pot of gold. These hurdles can be summarised in 4 steps:

1. what to search (tools and resources to use)
2. where to access these tools
3. how to search or interrogate them
4. how to interpret and filter the output and choose from the results

This process is sometimes (though perhaps not as often as is ideal) repeated across several tools to fulfil a user's information need. These tools might be of the same genre or heterogenous. Where the results are merely references to items that exist, a second information need arises, since the seeker now needs to identify how they might access the cited item. Therefore, the above process becomes iterative, but with a new information need driving the process. However, a user's decision-making, at each stage in the 4 steps above, is affected by how well-informed they are about each of the options available, and what those options will or won't offer.

The two tool behaviour [the cowpath syndrome]

Of all the "quick" paths across a field that cows might take towards home, cows inexplicably follow the same path home every evening.

The range of searchable and accessible resources has expanded exponentially over the past 10 years. While the information needs of users may vary, people typically will learn to use only one or two search tools with any semblance of ease, the defining

aspect of choice being that the tool has previously provided passable success. A user's judgement of what is a satisfactory search result often falls far short of what they should ideally access from a librarian's point of view. As well, user-awareness of the range of potentially searchable and relevant resources provided by the library, and what is available from these resources, is scant.

The effectiveness of an information seeker's use of a given tool is also often poor compared with the ideal, but may be deemed by the searcher to be adequate for their specific need. Comfort zones and the need for autonomy play a large role in the development of this user behaviour. Once a person has found a useful tool and a passable method to use that tool, the likelihood of a librarian successfully raising that person's awareness of other better tools, or other more effective methods to use that tool is minimised. This is because the most effective time that this awareness-raising can occur is at their point of need, but would require librarian proximity and intervention (most likely unsolicited). With the increased access to library-provided resources over the web, many staff and students who would previously have visited the library to perform their searching now perform their searching in locations external to the library. In addition, while a report¹ on a survey of users indicated that they prefer help from a person as compared with other forms of help, another study² indicated that many library users do not like to have to ask for help.

The expanding area of distance education, has coincided with on-campus students' preference for conducting their information-seeking and information access activities from locations external to the library, and often off-campus. This has reinforced the importance of providing better pathways, better and proactively offered roadsigns for users at their point-of-need, and other more accessible help that better supports primarily autonomous information-seeking and information-accessing behaviour.

Where an information-seeker's favoured search method proves unsuccessful for a specific new information need, the entire information pursuit may be suspended, or another non-library strategy (such as using informal networks) may be adopted. Thus the opportunity for the library to demonstrate alternative approaches is typically missed.

Library user behaviour analysis rarely reliably identifies potential users who actually do not engage in library transactions, where they would otherwise benefit by doing so. However, it is clear that the number of actual as compared with potential users is small. With the explosion of information sources and user-pathways, the number of potential library users has undoubtedly grown. Users' expectations that almost all information needs will be fulfilled electronically have also risen; and, simultaneously, the potential for confusion when using library resources has grown..

Containers as a signifier of content, and access protocol

To add to this matrix, during the 1980's the sources of information - beyond that information derived directly from research - were largely derived either from informal networks of experts and peers [including the 'invisible college' phenomenon], or publications that were most often library- or librarian- mediated. As well, the types of information that people reasonably expected to access using the library-mediated process was largely delineated by the commonality within the library community of :

- library collection development approaches
- collection maintenance and access approaches, and
- library service approaches (such as InterLending and Document Delivery services, Reference Services, Audiovisual Services, and Loans Services)

Any user needed to only learn once how to use a library card catalogue system, and the classification system (such as the Dewey Decimal system) to be reasonably confident of walking into almost any unfamiliar library, and be able to search for and access its books, journals and reference material, without recourse to library staff for assistance. Standardisation within the library community was the norm. As a consequence, while potential user pathways had increased, they existed within a user environment where important navigational aspects remained constant.

2. The problem writ large

The library information "environment" is in great and continual flux. At a time when it is becoming easier to effectively find information on the web without recourse to library-provided resources and tools, the library information environment has become increasingly confusing and non-standard.

The advent of the web has brought with it a profusion of electronically published material available freely on the web, some of which is of high quality, and is increasingly searchable by search engines. The items indexed by a search engine range from drab and trivia to fraudulent information, amidst which are gems. The profusion of official information now on the web lends credence to the Internet (in its own right) as a credible source of good information.

While search engines generally have proven to be quite effective in indexing selected parts of the Web, they are not wholly satisfactory for effective information retrieval for a variety of reasons.

- The very large information space of the Internet has made the problem of finding and retrieving information very difficult. The major search engines only index a fraction of the total number of documents available on the Web, and their individual coverage varies widely. A study³ reported in *Edupage*, 28 July 2000 states that the Web "is expanding so rapidly that today's search engines only cover a fraction of the existing pages." This study estimates that the Web is 500 times larger than the segment covered by standard search engines such as Yahoo! and AltaVista. It claims that the Web holds about 550 billion documents, but that search engines index a combined total of 1 billion pages. "One reason that search engines have not kept up with the number of pages on the Web is that data is increasingly stored in large databases maintained by government agencies, universities, and companies. The dynamic information housed in databases is difficult for traditional search engines to access, because the search software is designed to locate static pages."
- Because no single search service is comprehensive, more than one search engine must be used for retrieval if high precision is required.
- Many studies have shown that the quality of the search results using different search engines vary greatly..
- Most of the search engines undertake full text indexing, and since there is a lack of vocabulary control, keyword searches can result in hundreds if not thousands of items being retrieved - much of which may not be relevant.
- Most of the search engines are almost useless for searching and retrieving non-textual documents and objects like audio, video and executable programs. Furthermore, search engines cannot search and retrieve password controlled sites, because these are not indexed.
- Because many Web publications do not undergo the authoritative accreditation process, which is usually found in the print environment in peer reviewed journals or in the monographs published by prestigious publishers, it is frequently difficult to separate the wheat from the chaff. Thus the problem is not only one of retrieving relevant information but also one of retrieving quality information.

However, it is argued that with increased use of a tool that is commonly used across all spectrums of society, there is a greater chance that searching proficiency will increase.

Many search engines offer search syntax and field searching options that allow a searcher to refine their search for more effective results. Bailey⁴ notes that some recent studies support the view that people using search engines construct and perform only very simplistic searches, and use one or two words at most, rarely using synonyms, field-searching or Boolean operators. A study by Culbertson¹ in 1992, focussing on library-users searching CD-Rom databases, also noted that library-users rarely use advanced searching options. Other research, however, argues that a common behaviour is now the "successive search" process⁵, where a user repeats (and modifies) their searching across several sessions (though probably against the same resources or search engine). It is unclear how many people actively use the advanced options. Nonetheless, a person attempting to refine their search on a search engine, and wanting assistance to do this, is far more likely to be able to find someone nearby who can advise them on strategies to do this (such as a colleague in the office, a family member in the home, a person sitting at the next PC in the internet café, etc), as compared with when they are sitting in the same environment attempting to search an indexing tool that the library subscribes to and offers to that user.

While the literature gives varying reports about user heuristics, observation of and interviews with people searching library databases indicates that they tend to only use 1 or 2 databases, and that they prefer to spend extensive time browsing large results sets than invest time identifying whether their search has been effective, and how it might be improved. This may be because of lack of awareness of where help can be accessed, a reluctance to ask for help, or other barriers to accessing help.

As with the two-tool behaviour (the cowpath syndrome) manifested by information seekers even pre the e-revolution, the literature tends to indicate that users are generally still electing to just use one or two tools regardless of their information need, and are making their preferred tool an internet search engine even when searching for academic-related material. A recent study⁶, which surveyed incoming tertiary students about their internet use, found that 73% claimed that they accessed the internet daily, and an additional 25% access the internet once a week. Furthermore, 77% claimed that they commence their research using the web, and 67% reported that they find most information for their papers through the internet.

E-journal subscriptions, and loss of standardisation

The emergence of subscription e-journals provides a classic example of the challenges that an information seeker now faces, when trying to track down a cited article.

A user's pathway to identify the ownership and availability of a journal in paper format, in a given library, was previously as follows:

- check the library's catalogue
- if there is a record, check whether the required year, volume and issue is included in holdings, and has been received by the library
- if so, write down the call number and other location details, and
- go to the appropriate shelf in the library

In the initial years of e-journal subscriptions, especially when the subscription came as part of an aggregator package (where the journals that were included varied frequently), most libraries resiled from creating a catalogue record for each of these e-journals. Over time, libraries eventually opted to create an online list of their e-journals – quite distinct from their catalogue, even though the catalogue had typically been promoted as the mechanism for identifying whether the library offered access to a resource. Thus, if the library subscribed to a paper version and an electronic version of a journal, the catalogue would contain a record to indicate the availability of the paper version, but the user would need to also know that they had to check an additional list: the e-journals list.

More recently, most libraries have chosen to create catalogue records for their e-journals. However, these catalogue records are often minimal records, and lack useful "holdings" information such as the starting and ending year, and details of volume and issues. These records usually contain a URL which promises to take the user to the full-text for that journal. However, that URL might sometimes take the user to a webpage listing issues for that journal; or it might take the user to the publisher's or vendor's homepage from which a user would then have to drill down to the journal, the volume, the issue, and the article. Where the user sees a list of issues, they will often find that some of the listed issues only offer Table-of-Contents and possibly abstracts, while some offer full-text. It is not apparent to the user why and when this occurs. A subscribing library typically has no control over this confusing scenario. The supplier's interfaces (and navigation within them) also vary widely, and again the subscribing library is afforded little or no opportunity to standardise the interface and user pathways that are offered to the user.

To confuse the library user further, if a journal is owned both electronically and in paper format, libraries typically have opted to create two separate catalogue records:

- one for the electronic version (with no holdings details indicated, but a tantalising URL to full-text offered), and
- one for the paper version, with holdings, but requiring the user to either visit the library or request it (if they are entitled to that service, and know of the existence of that service).

By the time a user has expended effort to drill down along the e-version supplier's interface, only to discover that there is no full-text available electronically (even though the URL in the library catalogue promised full-text), the user is unlikely to recall that there was a second record in the catalogue that they still have not checked, and which might answer their need.

A further source of confusion to users is in understanding what they are looking at. Previously, the physical characteristics and packaging signalled the genre (a paper journal looked like a journal).

Soon after the emergence of electronic versions of indexing tools (such as Medline), some of these tools began to offer the occasional full-text within a subset of records, where the remaining records still only simply offered abstracts. Next, full-text suppliers (such as MCB) began to offer Table-of-Contents and abstracts for additional issues, and variants on these themes have continued.

In addition, libraries often have little control over the content of aggregations, with the result that they pay for and therefore offer their users access to all those versions of the journal. Thus a library might actively offer the user several means of accessing a journal, each with different electronic interfaces (requiring different navigation), as well as in paper format. This cannot but be confusing to the user.

To further confuse the user, e-journal suppliers (such as Elsevier and Blackwells) have begun to enhance their websites by offering users a search option, on their website's frontpage. It is often unclear to the user what they would actually be searching, and how to interpret the results.

Because of the volatility and other factors in the electronic information products market, libraries have and will continue to change suppliers for a given indexing tool, or e-journal. As well, students and academics may change institutions, and thus may find that, at their new institution, their favourite indexing tool or database is offered via a different interface.

A change in database interface not only means learning a new method of navigating around the service (such as Medline from Ovid or Medline from Ebsco), interpreting field tags of citations, saving citations, combining searches, and so on; but more importantly, it usually involves learning a new search syntax. For example, the search syntax for the same query run against the same database content, but using two different interfaces might be: *Title:(uv or ultra-violet or "ultra violet") and (alga\$ or seaweed\$)*, as compared with *(uv or ultra-violet or ultra violet) in ti and (alga* or seaweed*)*

While the loss of standardisation of interfaces has largely been beyond a library's control, this mutating library-mediated environment has posed a stay of confidence for some library users.

In a typical user pathway, having found a citation for what sounds like an interesting article, a user will search their library catalogue, to identify whether their library owns that issue of that journal. It is quite likely that a user will deduce that it is not subscribed to by the library because of the confusion deriving from catalogue records and interfaces discussed above. Assuming that they believe that they have ascertained that it is not owned locally, the information seeker typically then has several options (though they may not be aware of all of these):

- a. identify whether that issue is owned at another nearby library, and if so, go to that library
- b. (for some users) request delivery of it via InterLending and Document Delivery
- c. search the web, to see whether they can find a version of it there
- d. search the web (as opposed to a subscribed-to database) for other similar material
- e. try to locate the full-text of an alternate article, or otherwise modify their expectations

More than 10 years ago, a user in Australia wishing to follow path "a." would ideally have known to check *Serials in Australian Libraries* (or its predecessors). With the advent of web-based catalogues and more sophisticated ILMS (Integrated Library Management Systems), users can now go one step further and check the catalogue of another subscribing library- to identify whether that particular issue has been accessioned (especially if in paper format). With a citation for a book, they can identify whether that book is out on loan, or available to be borrowed. A common obstacle to this approach is that a user will only attempt to perform this task infrequently, and users often cannot recall how or where to access the relevant catalogues, or how to search them once these have been accessed. At their point-of-need, there is little guidance for them, and tools to ease this process are rarely provided by a library, thus removing this as a viable option.

With regard to path "b", users are not necessarily aware that they are entitled to document delivery service, or the process required to request items. In addition, there are often request-quotas per user, with no mechanism for a user to check their remaining entitlement. There might also be an additional charge for the user per request. In addition, document delivery turnaround times in Australian academic institutions, are typically 2-3 weeks (unless a fast-track fee is paid). If the information seeker is balancing a need for rapid closure with relative quality of information, and some flexibility in the information that is finally acquired, options "c", "d", and "e" will almost certainly be adopted in preference to "a" and "b".

The situation has also changed for user pathways in searching for, discovering and accessing books. Relevant tools to use have changed, as have methods to assess the best approach to take. A search on the web for similar subject matter may well provide access to information that is immediately available, and sufficient for their particular information need.

3. Possible solutions

The above discussion shows that the potential user pathways to search for and access information have multiplied exponentially, and possibly more than a thousandfold, in the past 10 years. The problems of identifying the most effective way to search for information are manifold. A random list of these emphasises the problems that even the most seasoned reference librarian faces:

- which sources to use
- how to access these
- how to search them effectively
- how to interpret details offered
- how to navigate around a given paper tool or online interface
- how to track down a cited item
- how to identify the most appropriate information for a particular need, and
- how to identify the most effective way to access that information

AARLIN (Australian Academic and Research Library Network) was established largely to try to solve many of the information seeking problems faced by researchers, as well as the problems faced by individual libraries, in each trying to address the same

challenges. The main aim of the project, which has the support of both CAUL and CAUDIT, is to develop a national portal framework to facilitate access to research information. The project received funding for a pilot in 2001 from the Australian Research Council, to demonstrate proof of concept. The general success of the pilot and its general acceptance as a service model by the researchers who participated in the pilot, encouraged La Trobe University, as the lead institution, to make a further application for funding from DEST's Systemic Infrastructure Initiative. This application received the support of a large number of universities and the National Library of Australia, and was successful. AARLIN phase 2 was launched in 2002 and is concerned with rolling out the system to 21 participating universities.

The major objective of AARLIN is to establish a national "library" portal that includes the following features:

- Standardised user interface (especially for navigation, saving search results, running searches, saving the results of a search, downloading or exporting search citations to EndNote and similar products, etc.)
- Standardised search syntax
- Search engine that is capable of "federated searching", i.e. capable of searching simultaneously or in parallel a range of disparate information resources, such as library catalogues, electronic databases, e-journals and e-books, e-print archives, electronic theses and dissertations, local data repositories, subject gateways and websites.
- Standardised and partly automated linking to context sensitive services using the OpenURL protocol. In open linking, users are only provided links to services and resources to which they are entitled. Thus they will be provided with a link to the full text of an article if their library subscribes to the e-journal concerned, or will have a document delivery request form displayed and populated with relevant article or book details, if electronic full text is not available and they are entitled to this service.
- Links to local authentication systems to capture data relating to "user profiles", which could, using "push technology", raise user awareness of
 - changes to relevant resources and services
 - the searchable resources which are most appropriate to the usergroup that the user belongs to, as well as additional resources which are also relevant (i.e. better evaluation and filtering of resources for that user as would occur if a reference librarian were having a one-to-one session with them, rather than just presenting a long list of all resources in their broad discipline)
 - library-selected quality websites;
 - library-selected new resources;
 - better search options (such as using Boolean, synonyms, truncation, field searching, etc, as well as using hotlinked subject-headings)
- User customisation of their environment, using "pull technology"

Based on the above specifications, the AARLIN office issued an RFP in 2002 to vendors that were reputed to be able to supply software which incorporated many, but not all, of the features identified above. The RFP resulted in the decision to choose Ex Libris' Metalib and SFX products as the off the shelf software which could offer a suite of portal-like components, including the chance to search both individually and in parallel a range of heterogeneous targets using a standardised interface, a standardised search syntax, and a fuller implementation of OpenURL linking. It was recognised that some developmental work would be necessary to enhance the product, and this included linking the product to the individual authentication systems of participating universities, and in the longer term, further enhancements for interoperability with web based course management systems, university wide portal systems and research administration systems.

The AARLIN system utilises a number of protocols for interoperability. From the perspective of "information seeking", the two main ones are Z39.50 and OpenURL.

Z39.50

The Z39.50 standard offers the potential to be able to reliably and consistently interrogate indexing tools, catalogues, subject gateways, and other relevant resources, whilst providing a standard unchanging interface to the user, even where a library's subscription to an indexing tool involves a change of supplier. Some of the products claim to provide the chance to use communication and metadata protocols additional to Z39.50, such as HTTP, XML and SQL.

OpenUrl

The advent of OpenUrl resolver software, and the emergent OpenUrl standard, provides hope of automating pathways from a citation to the actual full-text article, book, video, thesis or website. The ideal functionality that such a resolver would offer would be context sensitivity, i.e. user-sensitive, citation-sensitive, and library-rules and resources sensitive.

Thus, when a search of an electronic abstracting and indexing database produces a citation to an article, a user would be presented with a link (or links) directly to the article-level of the electronic version of the journal, if available to the user either as a library-subscription, or free on the web, and document delivery requesting would be suppressed. This deeplinking would address the user-difficulty described above.

If on the other hand, the electronic full-text were not available to the user, an option to check holdings elsewhere could be offered (if deemed a good service by the user's library); and a document delivery request-form, populated with relevant data, and linking to ILL systems such as LIDDAS, could be offered to relevant usergroups.

4. Technical issues

The solutions outlined above hold out plenty of promises. However, there are problems and technical issues that need to be resolved before a "perfect" system can be developed. For now, at least, the solutions provide pathways through the jungle of information in the analogue and digital world that represent improvements by a significant order of magnitude.

Z39.50

Undoubtedly, there are problems with using the Z39.50 protocol. These include the following:

- Implementation of this protocol is not widespread, although there have been noticeable changes over the past year
- Implementation by a database provider is often idiosyncratic and does not always follow the standard
- Implementation by a database supplier does not always match the setup for web interface

During the AARLIN pilot, we explored how well Z39.50 had been implemented using the Ex Libris Metalib version 1.3 software, and how well the cross-searching tool used could handle single and parallel searches of resources such as OPACs, databases, subject gateways, and union catalogues.

Previous studies and reports had indicated difficulties with Z39.50, such as the difficulty in retrieving correct search results as compared with the same search in the native interface. Other issues were the infrequent provision of the Scan and Sort features. A report by Stubbley, et al (2001)⁷, which assessed Z39.50 searching of OPACS, confirmed these findings. Thus, we initially expected that the parallel searching that would be offered to our users, within the portal (and using Z39.50 as an access protocol), might at best be a jumping-off point, assisting users to more easily discover resources, across a wider range of potential targets or information resources. Instead, we found that we were largely able to adjust configuration of Z39.50 attributes so that the user could effectively search combinations of the core fields which we aimed to configure for searching, and apply nested Boolean searching. The core fields set up by us included: Author, Title, Keyword, Subject ISSN, ISBN and Year. This configuration was applied to setups for more than 30 Australian University library catalogues, Kinetica, and several State Library catalogues. We also performed configuration setups for numerous databases on a range of representative platforms.

Recently, the availability of additional Z39.50 focussed products, including ILS products which appear to permit Z39.50 database searching, has improved things considerably: Database vendors are becoming more aware of the need to offer their data using this protocol, as part of their suite of access options. Nevertheless, it is still true that some ILS do not handle Z39.50 properly, especially in their ability to handle incoming SUTRS format records. As well, ILS' capacity to correctly map outgoing search queries to databases- even where they are Z39.50 accessible, and to map incoming records into a standardised format, remains in question. Regardless of the proprietary tool to be used, to search databases using Z39.50, configuration work to make Z39.50 searching of databases possible is fairly labour-intensive, particularly if the goal is to make that searching comparable to the results obtained if performing the same search in the native interface of that database supplier. This is the goal within AARLIN.

OpenURL

To harvest requisite data from incoming records, and correctly populate an outgoing OpenUrl, flexible software tools are required. The OpenUrl mechanism linking to journal articles typically relies on ISSN, volume, issues and year data being effectively and reliably harvested and passed through as part of the OpenUrl. However, a number of databases do not include an ISSN at all; and in other cases, the ISSN is stored inconsistently in records, and thus parsing records to extract it is problematic. Not all e-journal suppliers and aggregators are set up by ExLibris' OpenURL Resolver product (SFX), and of those that are, not all are setup to link to the article-level. The reasons for this vary, and are sometimes connected with the design of the ejournal suppliers website and data access there. From the side of the openurl resolver software, menu options for users vary. While this is what should occur, based on complete but varying incoming data (and rules established by the user's library), varying services in a menu may also be because of other factors, such as inadequate data being received by the OpenUrl resolver. From the user's perspective, the variation in services offered may seem (and may be) inappropriately inconsistent. Therefore, there needs to be some way to clearly state for the user, what data has been received from the "source", what rules the resolver is using before offering services, and why it is offering the current range of services. In partly automating the user-pathways process, users need to be able to account for options presented, and any inconsistencies that arise in the automated process – some of which are unavoidable, and some a matter of refining a given product. Nonetheless, the current functionality is still a vast improvement for users, who previously had to note down citation details, check the OPAC, choose the correct record from several records, choose a "full-text here" link, and then drill down from the aggregator's homepage several more levels, often in an unfamiliar interface.

Standardised search syntax

The uniform search syntax issue is a bit more complex than anticipated. The following are some of the problems:

- some resources, e.g. Subject gateways, only have two fields (title and keyword), as compared with the standard seven fields usually offered to users (keyword, author, title, subject, year, issn, isbn)
- some resources do not allow full Boolean searching and phrase searching combined across all of their searchable indices. For example; they might only allow phrase searching within one or two of their fields, or might only allow Boolean "AND" between fields, or might not allow the Boolean operator "NOT" at all
- some resources offer Z39.50 searching across more than the seven standard fields.

Authentication

There is currently no national standard for authentication systems among Australian universities. Each implementation is based on the individual requirements of universities. WAGUL (Western Australian Group for University Libraries) is involved in developing an authentication system that follows a common standard which will be used by the participating universities. Other universities make use of varying interpretations of the LDAP protocol to house the data for their authentication systems. There is also no Single Signon system available, and the requirement for multiple authentication to access various systems and resources irritates users. What this means for AARLIN is that the links to authentication systems are required to be individually tailored and developed so that the portal can capture profiling information of users from the respective participating universities.

Other

It is clear that –with the standardisation of the user-interface come other issues that can be confusing to users. Mechanisms for better online help in a range of possible forms remain a goal (especially a means to describe the type of information that can be retrieved from a search target, as well as any limitations relevant to searching); as does the incorporation of an online reference service. Even in the new user-environment, there is need for clearer signals of "what" a user is looking at, and the most appropriate pathway in that circumstance (eg whether is it a record for a subject gateway, etc), and ideally this kind of help would be offered proactively; as would clearer context-sensitive hints on possible pathways, and the one advocated by the library.

5. Conclusion

It is clear from the above discussion that "somewhere over the rainbow", the perfect search and linking tool (the pot of gold) is still to be found. The AARLIN system will need to be improved over time before we can definitely claim that we have found the pot of gold. Changes within the database-providers and database vendor community (ensuring better quality of data, and more thorough as well as comprehensive adoption of the Z39.50 standard) and portal product vendor community are also prerequisites.

If database vendors are convinced that any library subscription should be provided with both web and z39.50 access to their data, then the library community will reap the benefit in reduction of search-access configurations' maintenance. Obviously, there is a need to encourage improvements in the implementation of the various protocols among vendors so that interoperability can be achieved among different systems. Further enhancements to the system will also need to be undertaken in the area of the format and adequacy of the openurl, as well as the AARLIN licenced portal software's adherence to the potential of the openurl standard to date.

Further research will also need to be undertaken to find out the importance of the following:

- to what extent users find federated searching to be of great benefit
- whether openlinking and context sensitive services will improve services to users
- whether users will find the push features of AARLIN to be useful or too paternalistic
- whether users will take the time, using the pull features, to customise the environment in which they undertake their searching
- whether there is a need to introduce a thesauri scheme within the AARLIN portal to improve search precision
- whether there is a need to automate "hints for better searching" contextually so that users can be assisted at the point of need
- whether there is a need to provide a human interface by adding an interactive chat or desktop video conferencing feature to the portal interface.

The range of issues to be dealt with as well as the range of possible software enhancements appears to be unlimited. Ultimately, however, the goal of AARLIN must be to deliver with great precision and relevance the information that users want at the point of need in a seamless manner.

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