

USING PORTAL TECHNOLOGIES TO DEVELOP THE COMMON USER INTERFACE (CUI)

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ABSTRACT

Describes the use of portal technologies currently used by e-commerce systems to provide common user interface to online library catalogues and other electronic information resources. The Monash University Library has developed a window client called Monalisa which allows access to networked CD-ROMs and other locally hosted databases from a single menu.

Keywords: Portal technologies; Common user interface; Online catalogues; Monalisa (Windows client); Monash University Library.

USER REQUIREMENTS

In the virtual library environment, one can envisage a remote user sitting in front of a workstation trying to access a range of information resources. Unless there is a common interface, the user will probably be confused with information resources that would include CD-ROM databases (some of which are standalone while others are networked), electronic databases on local or remote hosts/servers, resources available on Web sites located within the user's country and overseas, document request systems by a variety of commercial suppliers and libraries, the user's library OPAC (which lists analogue materials acquired by the library) and the OPACs of other libraries accessible via the Internet. The user will also be confronted with a plethora of interfaces, search systems and protocols, workstations for different databases, access problems, etc. These are the issues that libraries are now grappling with, and there are as yet no easy solutions. The ideal system would be one that would permit a user to move transparently from one system to another via a common user interface and would include the ability to:

- search simultaneously a number of library online catalogues and generate document delivery requests;
- search one or more citation databases, and have either the results linked to the full text of the documents, or the ability to generate automatically document delivery requests;
- search across multiple library online catalogues;
- search across multiple and disparate electronic databases, subject gateways, web sites as well as online catalogues;

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- move seamlessly to locate information resources, which might be located anywhere;
- search for information using a single standard search language;
- comply with ergonomic requirements like good screen design, appropriate use of colours and icons, etc.

The few studies that have been carried out on user behaviour seem to confirm the view that users will only accept electronic information services if the following requirements are met:

- ease of use, and being as intuitive as possible
- preferably using a familiar interface
- access to all information from one source
- sufficient coverage (in the number of titles and in time)
- effective search capabilities
- high processing speed (downloading and printing)
- high publishing speed (timeliness of the information)
- good image text quality
- linking of information

COMMON USER INTERFACE

A number of technologies are required to create the virtual library service. But the most critical one is the development of a common user interface. In the traditional print based or analogue library, the online catalogue (OPAC) provides a common interface to all of the library's locally held resources in whatever format. With the increasing move towards digital libraries, the issue of a common user interface becomes more complex partly because the range of information resources are more disparate. Electronic resources comprise analogue as well as digital full text, bibliographic or citation databases, multimedia electronic documents, electronic journals, etc. They are also likely to be more distributed. This complexity is exacerbated by differences in:

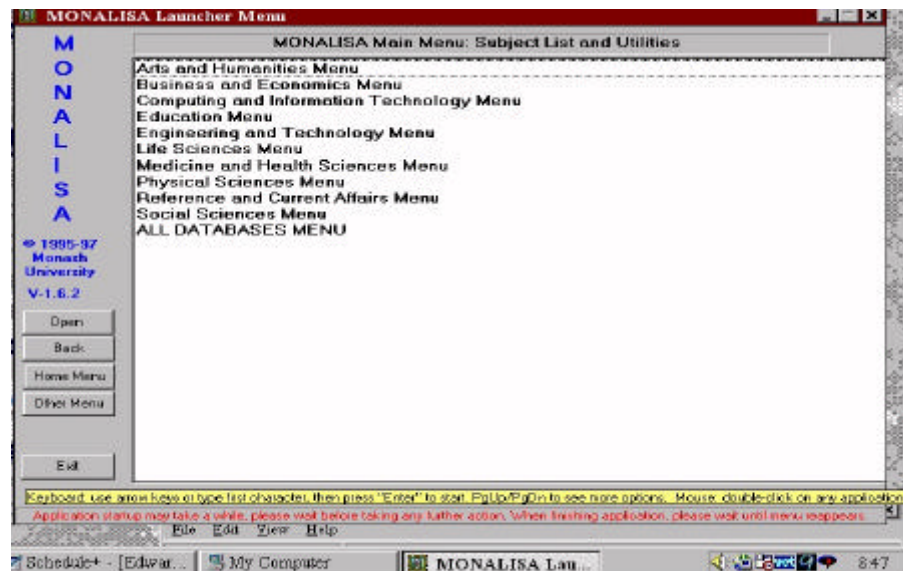
- proprietary systems
- operating systems (e.g. Windows, Unix)
- local area networks (e.g. Unix, Windows NT, Novell)
- wide area networks
- database structures
- search and retrieval languages
- standards and protocols

As a result, users frequently encounter problems when they search for resources using a variety of query languages, different user interfaces, different protocols and different computer platforms.

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Some attempts have been made by libraries to provide a "one stop shop" to their various electronic information resources. At Monash, for example, an in-house programming effort has resulted in the development of Monalisa, a Windows client that will allow access to networked CD-ROMs and other locally hosted databases from a single menu.

Fig. 1. Monalisa Windows Client



With this Windows client, users from any computer workstation linked to the Local Area Network (LAN) can access a wide range of electronic information resources. The problem is that the Monalisa client cannot yet be used from outside the university due to technical problems, although some initial efforts in using Monalisa to launch networked CD-ROM databases via the Web have proved promising.

Another early initiative of Monash University Library has been to try to organise all its electronic resources so that they can be accessed via the Web. The project was initiated in 1996 when Deidre Lowe, then a member of the Monash Library staff, was asked to investigate the issues relating to the management of electronic resources. The result of her internal report on the "Virtual Shelf" was the development of the Monash Electronic Resources Directory (URL: <http://www.lib.monash.edu.au/er>) which, as the publicity states, "is a Monash University

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Library service that provides information about online services, electronic journals and monographs, WWW sites, CD-ROMs and diskettes. Where these are available via the Internet, a direct link to the service is provided". Sue Steele (1998) has presented a paper describing this project at the 1998 VALA Conference. For a variety of reasons, including the difficulty of keeping the information up to date, this initiative has been abandoned.

Other libraries have developed similar services. Two projects which were also reported at the 1998 VALA Conference included the University of Melbourne's Buddy system (Cunningham, 1998) and a report by Deidre Low (1998) on the interface developed by the State Library of Victoria.

The problem with all the systems mentioned above is that their ancestry is basically the text-based menu systems of the past dressed up with a graphical user interface. While they allow for the logical organisation of a wide range of electronic information resources, they do not as yet permit searching of multiple databases with a single search command, or allow a user to move seamlessly from one database or electronic publication to another without having to move through a hierarchy of menus. Furthermore, the networked CD-ROM databases cannot as yet be accessed from remote sites, outside of the institution's LAN.

PORTAL TECHNOLOGIES

None of the projects mentioned above have solved the problem relating to the development of a Common User Interface (or CUI). An examination of the literature does not reveal many illuminating studies on this subject.

The current trend is to leverage the use of e-commerce technologies for library purposes. As more and more users begin to demand remote access to the resources of libraries, it is incumbent upon libraries to provide a user friendly interface by which users can gain access seamlessly to all the information resources and services of the library. In this connection, libraries can coopt many of the e-commerce technologies and methodologies developed by online retailers to improve the effectiveness of their services to their users.

One major technology used by e-retailers is the "portal". The portal has many different interpretations, but its strength lies in its ability to integrate more fully the information landscape within which users will operate. Some people use the term to mean any web site; others assume that the portal is the same as "subject gateways".

A portal, however, is more than a Web site or a subject gateway. The traditional library has always built collections or provided access to information resources

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designed to meet the needs of its primary clientele. That is to say, the information space within which its users have to navigate tends to be more focussed, confined and finite. The Internet, in spite of its apparent analogy to a library, is not really a library in that it lacks a coherent organisation, and researchers and information seekers are required to operate in an infinite information space and therefore face serious navigational problems.

This illustrates the basic difference between portals and subject gateways. A portal operates within an organised and focussed information space while a subject gateway has no theoretical limits to the information space that it can operate.

In simplistic terms, a subject gateway is essentially a navigation site, which generally does not provide content, but uses a variety of methods to allow users to locate other sites on the Internet. Thus even though a subject gateway tries to provide an organised view of information by discipline, its basic purpose is to try to provide a navigational tool for all the information that resides on the Internet.

A portal, on the other hand, is more like a traditional library in that it provides a relatively "finite" view of the information space within which users will seek access to information resources. The concept has been developed by commercial sites like AOL, Yahoo and Excite whose aim is to "capture" or "confine" their clients within a defined information space, and leverage this client base for their own commercial purposes. This obviously gives them a competitive advantage as they can then offer a discrete user population to advertisers and retailers.

There are other differences between portals and subject gateways, although these differences are narrowing as subject gateways adopt many of the features of portals. The basic differences may be listed as follows:

- Portals usually have access to search engines; subject gateways do not. But this is changing as more and more subject gateways adopt one or more search engines to provide access to the almost infinite information space that is the Internet.
- Portals have content within the "finite" information space; subject gateways, being mainly navigational sites do not. Again, many subject gateways now include content on their sites.
- Portals are characterised by the distinctive use of a number of technologies, the most common ones being
 - the use of pull and push technologies which allow users to customise their access to information resources (pull) and ensure that only relevant information is sent to them (push);
 - the availability of email and sometimes chat facilities for virtual community activities;

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- the availability of facilities for secure payments;
- the shopping trolley facility to allow users to select a range of resources and add them to the "shopping trolley".

Many subject gateways have adopted a number of the above technologies, and in recent times there has been a gradual convergence of subject gateways and portals.

MODEL OF THE CUI USING PORTAL TECHNOLOGIES

Portal technologies can be used to develop the Common User Interface. The architecture comprises four layers, as follows:

- The Presentation Layer
- The Applications Layer
- The Protocols Layer
- The Contents Layer

The Presentation Layer

The presentation layer would be the interface that the user sees. It would be the interface with which the user interacts with the resources provided by the Library. The presentation layer could be a proprietary system using the Microsoft Windows interface or it could be based on the Web.

In the search for an interface that will enable users to navigate an increasing complex information environment, many libraries and publishers are increasingly relying on the World Wide Web's graphical interface. It is therefore not surprising that the portal makes use of web-based technologies in its presentation layer.

For a computer to display or print a formatted document an appropriate set of instructions must be given to the computer. These instructions will make the computer format the text for display or printing. A number of proprietary standards actually exist for this purpose. In the printing world, they include Postscript and the PCL language that drives Hewlett-Packard laser printers. Word processors have their own proprietary formats and languages that tell a computer how and when to format a page, display graphics, justify or indent paragraphs, produce page breaks, display bold or underline characters, and so on. For decades mathematicians have used (La)TeX to display mathematical symbols, while many publishers now use PDF (portable document format), a proprietary document specification language, developed by Adobe.

But the non-proprietary document format that is becoming the *de facto* standard on the World Wide Web is HTML (HyperText Markup Language). Using this

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document format, libraries are able to produce "gateways" to a range of resources, and also provide what might be thought to be the beginnings of a common user interface.

The W3C (World Wide Web Consortium) has made a recommendation to "reformulate" HTML as an XML (Extensible Markup Language) application. This new document type is called XHTML 1.0 (Extensible HyperText Markup Language). As defined by the W3C,

"XHTML is a family of current and future document types and modules that reproduce, subset, and extend HTML 4. XHTML family document types are XML based, and ultimately are designed to work in conjunction with XML-based user agents." (World Wide Web Consortium, 2000)

In general terms, XHTML straddles the gap between HTML and XML. It will conform to many of the XML standards, and so can be viewed, edited and validated by standard XML tools. At the same time, it will have backward compatibility with HTML, so that web sites which migrate to XHTML can be viewed by browsers based on the XML standard. This is a new document type that has yet to be adopted as an international standard.

The Applications Layer

The applications layer comprises a range of different types of software applications. These applications that usually rely on a database management system (e.g. Oracle) to manage the range of functionalities required by the portal may include the following:

- Authentication system
- One or more search engines
- Secure payments functionality
- Rights management
- Interlibrary loans module
- Customisation and Personalisation features
- Chat, Email and Videoconferencing
- Shopping cart

The above, while not a complete list of all the functions of the applications layer, represent the key ones. Some brief notes on each of them follow.

Authentication. It is important that only authorised users can have access to the system, and hence the need to develop an authentication system. In the e-

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commerce environment, systems have to be built around the concepts of trust and security. Authentication systems are necessary to ensure an open and interoperable system which will not inhibit progress and will make possible secure payments. Authentication systems in turn may include some form of digital certificates or signatures and other forms of certification.

Search engines. This will be one of the core features of the portal that allows the search and retrieval of information resources.

Secure payments. Although the libraries will initially pay the costs of article document delivery and interlibrary loan, I foresee the day when quotas will be imposed and control of these quotas will be in the form of "virtual cash". Users will be given a certain amount of "virtual" cash by their home libraries, which they can use to pay for document supply. Once this virtual cash is exhausted, users will have to pay real money either from their personal funds or from their departmental or faculty accounts. A secure payments facility is also required should libraries decide to charge for some of their services.

Rights management. It will be necessary to pay intellectual property owners royalties for document delivery services or for digitising their books/articles. Consequently, a rights management system would ensure that proper royalty payments are made.

Interlibrary loans module. One major function would be to allow the end user to undertake an unmediated search of the OPACs of other libraries or the databases of commercial document suppliers, and then to generate an ILL request. An ILL loans module would not only permit a broadcast search, but also manage the requests generated by users, as well as impose quotas and prevent the requesting of items held by the home library of the user.

Customisation and Personalisation. One distinctive feature of portal technology is that it permits users to use "pull technologies" to customise their access to information resources. At the same time, they can make use of "push technologies" to assist overloaded information users to select and evaluate resources as well as draw their attention to resources which may be of interest to them on the basis of user profiles or past use of resources in specific subject areas. This is a kind of SDI (Selective Dissemination of Information) service, except that the users develop their own interest profiles rather than rely on the librarian. Access to information resources should be driven by user needs rather than institutional imperatives. Thus, the traditional library policy of one-size-fits-all can be abandoned. These functions allow the user to create a "My.Portal" or "My.Library" page, and to always access these personalised and customised pages whenever they log on, rather than the more generic pages usually provided on library web sites.

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Chat, Email and Videoconferencing. These technologies will allow libraries to put a human face on the virtual library. Many libraries are beginning to realise that their web sites should not only place emphasis on resources, collections and facts, but also provide a facility for users to identify and contact staff who might be able to help them.

Shopping cart engine. This facility will allow users to select a range of documents (books or articles) that they wish to have, place them in a "shopping cart", review those selected, and then request to have the documents delivered to them. Those of us who have shopped for CD-ROMs or books on the Internet will be familiar with this technology.

A Web page, produced using HTML, is basically a static page. To give it interactivity, programs must be written to interact with the Web's presentation layer. This interactivity is achieved through a standard server interface such as CGI (Common Gateway Interface). CGI is not a programming language, but a protocol that defines how an applications program communicates with a Web server.

When some data is input into an HTML document (e.g. a data entry form) the data is passed to a script or program via CGI. Thus, CGI can be regarded as a pipeline between the Web page and a program or script. After the data has been processed by the program, the output is sent back to the Web server again via CGI. If the output is formatted correctly in HTML the server will send it out as an HTML document to the browser. By this means, it is also possible to connect to a database, to transmit information to the database engine, and receive the results back and display them to the web browser.

The most popular CGI programming language is PERL, largely because of PERL's plethora of simple but powerful string manipulation and parsing capabilities. However, in practice, any programming language can be used with CGI, with the most common being C/C++, Java, Visual Basic and PASCAL. CGI is not the only way by which the web server can communicate with software applications. Other communication software available are Proprietary API (Applications Programming Interface) standards developed by Netscape (NSAPI - Netscape API) and Microsoft (ISAPI - Internet Information Server API).

The Protocols Layer

Protocols are important to establish a standard communication method between the client side of the applications and the server side. The number of protocols underpinning the Internet and the Web is legion. However, we will only deal with

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three principal protocols which are germane to this discussion on the CUI: Z39.50, HTTP, and the Interlibrary Loan Protocol.

Z39.50 Protocol

A common interface can work more effectively if the underlying communication protocol between the client search engine and the databases follows the Z39.50 (also the ISO 23950) standard. This standard was originally proposed in 1984 and has gone through three revisions, with each revision extending the features of the protocol. The protocol specifies the rules and the data structures that allow a client machine to communicate with a server machine, to search the databases located on a server machine and retrieve the records identified by the search.

The original version of the Z39.50 standard was intended to specify the rules for interrogating "Z-compliant" bibliographic databases. However, the latest version of the Z39.50 standard has extended the information retrieval functions to include the following:

- the ability to search multiple Z39.50-compliant databases simultaneously.
- improved search features, including not only complex boolean statements, comparison operators for dates, proximity searching, truncation and so on.
- authentication, thus ensuring only legitimate users have access to the Z-server and its databases
- accounting and resource control to allow for charging for usage
- defining record formats so that retrieved records might be downloaded into personal information databases
- "extended services" which include saving a result or query for later use, and as a corollary getting the system to undertake SDI searches periodically based on a saved search profile; searching and ordering an item in an ILL (Inter-Library Loan) operation; retrieving a record, editing it and then updating the database, and so on.
- While there is no doubt that the Z39.50 standard will be a boon to libraries and their users, one should be aware that vendors who claim Z39.50 compliant systems do not always implement all the features of the protocol. Nor do they necessarily implement the latest version of the standard. It is claimed that for more complex searching, it is sometimes necessary to use the original interface software which may provide additional range of search commands that are lost in the translation to the Z39.50 protocol.

HTTP and Z39.50

The Z39.50 standard only sets the protocols for interaction between a client and a server. It does not deal directly with the issues related to the user interface, which is the domain of another system or software. In the OPAC environment of many

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library systems, for example, the client software runs as part of the system, and translates the search request generated by the OPAC software into Z39.50 query language which the Z39.50 server can understand and respond to.

Thus while the Z39.50 standard does not define the common user interface, it provides the underlying mechanism that can make the common user interface work. Many vendors now use the forms-based interface of the WWW in conjunction with a Web browser like Netscape or the Internet Explorer to create a graphical friendly user interface for their online catalogues. However, there is one major disadvantage in using this method. The core Web protocol, HTTP (HyperText Transfer Protocol) is essentially "stateless". This protocol allows the user to request a document via the Web browser by making a TCP-IP connection to a host server where the document is stored. (This is usually done by clicking on a hypertext link). The host server transfers the document to the client and then breaks the connection when the whole document has been transferred. This is not a problem as long as the connection contains a single complete transaction between the client and the server. However, most applications are far more complicated than that and assume that the user is continuously connected to the server, and his/her activities are "known" to the server.

This contrasts with "state-oriented environment" or continuous connection protocols, such as those used in most online catalogues and information systems - where the connection with the host is not broken until the user chooses to do so. Using the Web interface means that search queries cannot be saved for subsequent searches nor can a search query be modified or refined if it provides too many irrelevant hits. What most systems attempt to do is to provide application programs which "keep track" of the user's requests and the responses of the server, thus maintaining the illusion of a "stateful" environment. There are currently efforts underway to add "stateful" or "state-managing" mechanisms to the underlying protocols. One possibility is obviously incorporating these mechanisms into the Z39.50 protocol.

There is one further advantage in incorporating the Z39.50 protocol in the WWW. Currently, the search engines and indices of the Web resources are all different and the data that they return are not structured in any useful way. It is thought that the incorporation of the protocol would be advantageous because it would permit the structured search of multiple Web indices. As Hammer and Favaro (1996, p.2) points out:

The Z39.50 standard specifies an abstract information system with a rich set of facilities for searching, retrieving records, browsing term lists, etc. At the server side, this abstract system is mapped onto the interface of whatever specific database management system is being used. The communication that takes place between the server and the client application is precisely defined. The client application is unaware of the implementation details of the software

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hiding behind the network interface, and it can access any type of database through the same, well-defined network protocol. On the client side, the abstract information system is mapped back onto an interface which can be tailored to the unique requirements of each user: a high-school student may require a simple, graphical interface with limited functionality, while an information specialist may need a complex, highly configurable information retrieval engine. Finally, casual users may prefer an interface which blends in smoothly with their word processor, database software, or, indeed, WWW browser.

In summary, the essential power of Z39.50 is that it allows diverse information resources to look and act the same to the individual user. At the same time, it allows each information system to assume a different interface for every user, perfectly suited to his or her particular needs.

Searching the Web can be frustrating because there is a variety of search engines and user interfaces. It is thought that if an optional Z39.50 interface were added to the search engines, much of the frustration and time wasting can be avoided. This would allow libraries to set parameters to filter unwanted Web content.

The Interlibrary Loan (ILL) Protocol

The model of the CUI also requires that when users have been successful in locating a document, they should be able to generate automatically an unmediated ILL request. In order to do that, the underlying layer should preferably incorporate the ILL protocol so that communication between compatible systems can occur without intermediation.

The Interlibrary Loan Protocol (ILL) is covered in two ISO documents:

- ISO 10160 - Interlibrary Loan Application Service Definition
- ISO 10161 - Interlibrary Loan Application Protocol Specification

The protocol identifies all the services provided in an ILL transaction. According to Barbara Shuh (1998) the main elements of the protocol are:

- *Formalisation of the number and types of ILL messages exchanged*
Examples of the messages that are sent by the requesting library include request for a loan, indication of the return of the borrowed item, request for renewal of a loan, notification that an item has been lost, request for information on the status of the loan and so on. On the supplier side, the messages include responses to the requests and renewals, reports on status of the ILL transaction, the notification of an overdue loan, etc.

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- *Definition of the data elements contained in ILL messages*

The data elements specified are fairly comprehensive. Examples:

 - ❑ Transaction identification
 - ❑ Service date and time
 - ❑ Requestor identification
 - ❑ Transaction type
 - ❑ Delivery address
 - ❑ Billing address
 - ❑ Item identification
 - ❑ Cost information
 - ❑ Copyright compliance, etc.
- *Specifying the correct sequence for communication of ILL messages*

For each stage of a transaction, the protocol defines the service and message that can next be used. Each stage of an ILL transaction is identified by what is called "a state". For example, the state of transaction for a requesting library is PENDING, but that for the supplying library is IN-PROCESS. The rules are very specific regarding the sequence of services and messages permitted.
- *Identifying the encoding scheme for data elements contained in ILL messages*

Two encoding schemes are proposed in the ILL protocol - Basic Encoding Rules for Abstract Syntax Notation One (ISO8825) or EDIFACT (ISO9735).

THE CONTENTS LAYER

The Contents Layer includes all the "information resources" that a user or client wishes to access. These would include the citation or bibliographic databases, full text publications like electronic journals, subject gateways, metadata repositories, and other web sites.

PUTTING IT ALL TOGETHER

The diagram in the Appendix (Fig. 2) provides a general concept of the Common User Interface model using the portal technology. Because it is a two-dimensional model, not all the complexities of the model can be illustrated.

In this model, the portal also incorporates other types of software which will enhance user access to the resources and services provided by the Library. This is not a feature that is common in the use of the portal in the commercial environment. This will permit it to provide a single user-interface as well as integrate the delivery of analogue and digital information resources.

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For example, if we were to integrate a piece of software such as LIDDAS (Local Inter-lending and Document Delivery Administration System) it will be possible for end users to have unmediated access to the resources not only of their home library, but also those of other universities. It would thus be possible for users, once authenticated, to use the portal to search the OPACs of participating libraries, and automatically generate interlibrary loan requests from those libraries, or they can request articles from commercial document suppliers (if permitted to do so by their host institutions).

It will also be possible to integrate software such as OCLC's SiteSearch software (URL:<http://www.oclc.org/oclc/menu/site.htm>) in the portal so that users can undertake a broadcast search of a range of databases by subject using a single set of search commands. With software such as this, it will be possible to integrate all of the library's electronic resources, search and browse multiple databases simultaneously, and provide access to unique local digital objects, including sound and video files. At the same time, users can move seamlessly to subject gateways like MetaChem (URL:<http://metachem.ch.adfa.edu.au/>) which is a catalogue of chemistry resources, Agrigate, Agriculture Information Gateway for Australian Researchers (URL:<http://www.agrigate.edu.au/>) and AVEL, Australian Virtual Engineering Library (URL: [http://www.avel.edu. au/AVEL](http://www.avel.edu.au/AVEL)), and also retrieve information from commercial citation or full text databases. Theoretically, the portal can provide facilities for cross browsing and cross searching of subject gateways - in the latter case via a metadata repository (such as the OCLC's Cooperative Online Resource Catalog (URL:[http://www. oclc.org/oclc/corc/index.htm](http://www.oclc.org/oclc/corc/index.htm)))

As mentioned earlier, one of the major advantages of the portal is in its use of push and pull technologies. This will allow users to create their own customised site (**My.portal**) so that they will only view those resources they are interested in accessing each time they log on. They can also "personalise" their requests, so that they are kept informed of the latest developments in their area of interest (for instance, they can ask to be sent email messages of the contents pages of journals that they are interested in browsing regularly). Another major advantage is that it will be possible to incorporate rights management and secure payments systems as part of the portal.

In summary, via the library portal

- users can search multiple Z39.50 compliant databases simultaneously;
- users can search the Library's OPAC or the OPACs of other libraries, and generate an unmediated request for a book to be delivered to their home or office;
- if reciprocal agreements have been reached with other universities, users can access the resources of those libraries;

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- they can access contents page information and generate unmediated document delivery requests to be delivered to them electronically;
- they can access full text books, journals or articles via the OPAC or from citation databases;
- they can communicate with library staff globally on a 24-hour basis either using email, chat or desktop videoconferencing facilities. In other words, while the portal will permit the user to customise and personalise their access to information resources, it also provides them with the human face in the virtual environment;
- they can obtain their information literacy skills virtually, usually linked to a particular course or subject
- they can pay for access to those resources and services for which there is a charge.

CONCLUSION

The portal will provide libraries with all the facilities that will make these e-commerce operations possible - authentication, secure payments system, rights management, push and pull technologies, delivery of both analogue and digital objects directly to customers, chat, email and conferencing facilities.

We are currently in a transition period. Obviously, we cannot disestablish libraries in order to bring a wholly new service into being, but we can make use of the e-commerce technologies that are now available to provide more efficient services to our users.

Steve Coffman (March 1999) suggests that libraries might use the amazon.com model to "build the single largest library ever created in the history of the Earth. Volumes which now lie scattered across the face of the globe in thousands of separate buildings and collections will come together in a single unified catalog accessible to all - and not one of those bare-bones catalogues you so often find in yesterday's libraries either, but a catalog designed for the selection decision, with records that carry reviews, cover art, tables of contents, excerpts, and any other kind of content that could help a person find out what a book could tell them. Plus it will have marvellous browsing categories, a recommendation service that makes personalized suggestions, and a search engine that corrects misspellings and suggests alternatives when a search comes up empty."

The power of electronic communications will cause a major structural change in the distribution of goods and services. We have all heard of the success stories of many e-commerce operations. There is now a dominant belief that the traditional bricks and mortar retailers will eventually succumb to the nimble e-commerce

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merchants of the Web. We should not be therefore be surprised if libraries which are also brick and mortar establishments will also be affected.

The Bulletin in its January 18, 2000 issue speaks of a new generation of users, whom they call the e-generation. Individuals in this generation possess several characteristics that we should be aware of. They have a high level of computer literacy, are time poor and are constantly looking for convenience. They want to bridge geographical separation and look to technology to do it. They want to do their everyday transactions using their own resources at a time that suits them. What frustrates them most is lack of service or dissatisfaction with the service they are getting. "Their loyalty lasts only as long as they are getting the service they want". (*The Bulletin*, Jan 18, 2000, p.62)

This is the generation that is attracted by the flexibility of flexible learning, this is the generation that has a very short attention span, this is the generation that wants information instantly, and this is the generation that librarians ignore at their peril.

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Fig. 2. Model of Common User Interface Using Portal Technologies

