OPACs through the Ages

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Introduction

This article covers the development of online public (or in some cases patron) access catalogues (OPACs) from the early days to the systems that are currently available. Fieldhouse and Hancock-Beaulieu[1] cover research that has been, and is being, undertaken on OPACs, in the OKAPI series of projects and so this will not be referred to by me, although this research has had a great impact on their development.

I intend to give a brief chronological overview of the development of OPACs and then to look at an OPAC as an example of any online search system which can be thought of as comprising four components: the user, the interface, the search software and the database.

1960s and Early 1970s

Computers were used in some public and academic libraries in the mid-1960s to assist with the production of catalogues. The catalogues of that time were usually based on 80-column punched cards with the resulting catalogue being printed on to paper. The computer systems were run in batch mode and so any thought of searching the catalogue online was "pie in the sky". The structure of the bibliographic record was defined by each individual library.

A report on automation at the Library of Congress (LC) in 1963 concluded that the bibliographic system within the LC could be automated within ten years. Work was started on the machine-readable cataloguing project (which came to be known as MARC) and by 1967 there was close co-operation between the USA and the UK in the design of a record format aimed at communicating bibliographic descriptions in machine-readable form which could then be reformatted as necessary for a particular application.

Work was also under way in the development of standards such as the Anglo-American Cataloguing Rules (AACR), the International Standard Bibliographic Description (ISBD) and the International Standard Book Number (ISBN).

Mid-1970s

By the mid-1970s computers began to be used for more library processes – particularly circulation control. Many of the systems were run on parent body computers with special data collection devices (developed by firms such as ALS

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and Plessey) at the issue counter. These local systems were usually designed and implemented by staff at the parent body's computer centre.

COM (computer output on microfilm) began to be a popular method of "printing" the catalogue. Early experiments on catalogue use were carried out by Philip Bryant at the Bath University Centre for Catalogue Research; these compared physical forms of catalogue (COM fiche, COM film, cards and line printer paper) as well as the order of the catalogue (name, title, classified and KWOC (keyword out of context).

The 1970s also saw a growth in co-operative cataloguing systems and resource sharing in libraries. Examples of co-operatives in the UK were BLCMP (Birmingham Libraries Co-operative Mechanization Project), SWALCAP (South Western Academic Libraries Co-operative Automation Project), LASER (London and South Eastern Library Region) and SCOLCAP (Scottish Libraries Co-operative Automation Project). Co-operative systems also developed in North America with OCLC (originally the Ohio College Library Center) being the prime example. These systems produced catalogue records for participating libraries either in COM form or on catalogue cards to be interfiled with the other catalogue cards.

Late 1970s and Early 1980s

In the late 1970s many libraries began to supplement the computer facilities available from their parent authority by having a minicomputer installed in the library. Such a computer was used in various ways with a popular one being the provision of online access to some of the files in the computer-based circulation system.

Some companies started to supply packaged hardware and software or "turnkey" systems for libraries. Many of the original suppliers of data collection devices entered this market (e.g. ALS and DS (which carried on from Plessey)). The co-operative systems (e.g. BLCMP and SWALCAP) also started to develop local stand-alone products which could be linked in to the central database of records. Some suppliers of systems in North America started to market their products in the UK and Europe. Geac is one example. It had developed a turnkey circulation system for the universities of Guelph and Waterloo in Canada in 1977. The first installation in a UK library was in 1979 and it became popular in university libraries in the 1980s. The original system incorporated a public query facility with the circulation system. This Geac Library Information System, as it became known, used Geac's own computers (the 8000 series or more recently the 9000 series) and proprietary software.

The ability to search bibliographic records online came to be referred to as an OPAC. These first generation OPACs were phrase-indexed or pre-co-ordinate OPACs with access points similar to those of a traditional card or COM catalogue, i.e. author, title (as a phrase), class mark or call number (as a phrase) or possibly subject headings (as a phrase). Derived, or acronym, keys could also be used. Such OPACs are primarily book-finding and locating tools and so are fairly good for

known item searching. A good description of catalogue designs of the early 1980s is given by Hildreth[2].

Mid- to Late 1980s

By the mid-1980s there were a large number of suppliers providing integrated systems for library management which included modules for various sub-systems such as cataloguing, acquisitions, circulation, serials control, interlibrary lending and, of course, OPAC. An analysis of the library automation system marketplace appears each year in the *Library Journal* (for the USA) and in *Program* (for the UK). Some new suppliers, such as Dynix, started to enter the market with products incorporating second generation OPACs based on the information retrieval techniques developed by the online search services, such as Dialog, in the 1970s. These OPACs are also known as keyword or post-co-ordinate OPACs. The access points in such OPACs are words from titles, subject headings, authors or other names, and search statements may be compiled by linking search terms using Boolean operators. Most current OPACs are of this type.

OPACs became very popular during the 1980s and this resulted in a rich literature. The April 1986 (Vol. 20 No. 2) issue of *Program* concentrated on OPACs and includes papers providing an overview of developments at that time in North America and Australia as well as operational OPACs in various types of library in the UK. The rapid availability of OPACs in Australia followed the first demonstration (at the biennial Victorian Association for Library Automation (VALA) conference) in 1981 of an OPAC from the University of Adelaide so that by 1985 many of the universities and institutes of technology and some public libraries had implemented integrated library management systems (such as URICA, VTLS, Geac, DOBIS/LIBIS) with OPAC modules. The 1986 meeting of the European Library Automation Group concentrated on OPACs[3] as did the 1985 Essen Symposium[4]. The British Library Research and Development Department adopted a policy of funding OPAC research and allocated £300,000 for such projects in 1985. Hildreth's edited volume[5] includes contributions from himself as well as many of the key people involved in OPAC developments such as:

- Hancock-Beaulieu, of City University in London, who describes the need for a better understanding of users so that OPACs can be better designed for their needs;
- Markey who describes a research project carried out at OCLC on the use of the Dewey Decimal Classification number for subject searching on OPACs; and
- Lynch, of the University of California, who was involved in the development in the early 1980s of a large OPAC known as MELVYL, describes the applications of performance and usage data in MELVYL.

Hunter[6] provides a chronological history of cataloguing (from 1787 to 1991) and suggests that the development of OPACs during the 1980s has greatly affected the cataloguing process. Staff at what became known in the 1980s as the Centre for

Bibliographic Management at Bath University carried out a number of projects related to cataloguing, MARC and OPACs. Some of this and related research were reported at regular conferences (e.g. [7]).

1990s

The 1990s have seen a great upheaval in the library management systems on offer with a trend away from proprietary systems and a move towards open systems. Crawshaw reports on the problems involved in choosing a system in the 1980s for Oxford University and the Bodleian Library[8]: "All the front-runners (DOBIS/LIBIS, Geac, LIBERTAS and URICA) could only run on one manufacturer's hardware. Geac and URICA could [then] only use vendor supplied terminals; Geac required a network to be installed which was not compatible with the university's network." CLSI was one of the first major suppliers to make the move away from a proprietary system as it found it was incapable of meeting the capacity, functionality and communications required. CLSI developed the LIBS 100Plus product which runs under UNIX and uses the relational database management system Progress; this is now supplied by Geac. The market is changing greatly at the moment and many of the suppliers are now offering products that run on a range of hardware platforms. These systems make use of low cost, high performance hardware as well as standards for communicating systems and relational database management systems and other similar "building-blocks". The architecture of some of these new systems separates the software into a "client" (which provides the interface to the user and usually runs on a PC or workstation) and a "server" (which provides for the database management usually on a remote computer). The client-server communication protocol defines rules by which clients and servers on disparate systems can interconnect seamlessly. Examples of these protocols are: the ISO standard for Search and Retrieve (ISO 10162/10163) which is implemented in the USA as National Information Standards Organization (NISO) Z39.50.

In terms of the OPAC some of the systems currently on offer incorporate features of what are often described as "third generation OPACs"; these include:

- non-Boolean retrieval techniques (perhaps based on "best match");
- enhanced records including additional controlled and uncontrolled access points (such as chapter titles in books);
- acceptance of search expressions in ordinary language, with facilities for using a dictionary to provide for abbreviations, synonyms or spelling variants;
- provision of context-dependent automatic help;
- using terms from relevant records retrieved to enhance the search strategy; and
- displaying the most relevant records first.

A good description of some of these general developments in library housekeeping systems is given in[9], while Heseltine[10] discusses the impact

these developments might have on academic libraries, and states that some suppliers are beginning to see library automation systems as genuine resource management tools being used to monitor, not just book stock, but also staff resources, space, equipment and financial resources.

A survey of academic library catalogues in Great Britain was carried out by Crawford *et al.* in 1992[11]. The main aim of the survey was to collect information to facilitate the future planning of subject access policies, but more general information on OPACs also emerged. One hundred and four questionnaires were distributed to universities, polytechnics, institutions of higher education, Scottish central institutions, and colleges of education. Of these, 12 reported wholly or partly manual catalogues, seven reported using in-house software for their OPAC and 75 reported using commercial systems (BLCMP-22, Libertas-16, Geac-10, Dynix-9, URICA-6, Bookshelf-4, Adlib-3, CLSI-2, LS/2000-2, DOBIS/LIBIS-1). It was found that considerable progress had been made in retrospective conversion with 54 of the OPACs making 75 per cent or over of their stock available. Also it was found that the OPAC covers not just monograph holdings but also periodicals (60), theses (71), microforms (65), maps (46), music (42), computer software (42) and so on.

A study in the USA of the current state of OPACs with emphasis on the degree to which access has been extended beyond that available in card, microform and early OPACs is reported by Boss[12]. He reports that, although journal titles are routinely incorporated into OPACs, only recently have some libraries started to include individual journal citations with several database producers such as Information Access Company, Institute for Scientific Information, and Wilson providing site licences for local loading of databases. Dynix has recently announced its VISTA service which provides OPAC-type access to journal abstract databases as well as gateways to other library catalogues. OCLC's FIRSTSEARCH also provides access via a single interface to a variety of databases including WORLDCAT, ERIC and Medline. At a recent conference in Bahrain of the Arabian Gulf Chapter of the Special Libraries Association, Itohoff of Columbiana Public Library in Alabama described a system (called ShelbyCat) which was a bibliographic union catalogue on CD-ROM for the local region. The CD-ROM catalogue includes the bibliographic citations of all books owned by the ten libraries and the full text of 90 popular magazines and abstracts of 405 other magazines. Full-text items retrieved can be printed at the workstation. The six design criteria for the catalogue were:

- stand-alone workstation;
- one-search interface;
- easy to use;
- requires little staff intervention;
- simultaneous search of bibliographic citations and full-text information; and
- a generation of an interlibrary loans request if the search is unsuccessful.

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The system also includes features such as the colour-coding of keys, the ability to browse the shelves electronically, a bulletin board of local information and a map to show the location of a selected book in the library.

The User

The user usually comes to the OPAC with a particular need for information. In preparing this article I decided to check recent publications related to OPACs. I was able, via the campus information network at Aberystwyth, to search the university library's catalogue from the PC-based workstation on my desk. The gateway access on the main LIBERTAS menu also provides access to the OPACs at other Welsh libraries, including the National Library of Wales. I could then also go on to search the OPACs of 60 or so other academic libraries in the UK through the National Information on Software and Services (NISS) computer at Bath University and the Joint Academic Network (JANET). A connection through to the Bulletin Board for Libraries (BUBL) enables access to Hytelnet which, via the Internet, enables searches to be made of OPACs in libraries all over the world. At present, however, I need to know how to use each of these different search systems. Some are easier than others and some seem quite difficult to use with commands that might be applicable if using the OPAC locally but are not relevant when using the OPAC over a network. The implementation of standards, such as Z39.50, will overcome this. Dempsey[13] describes the impact of such networks and standards on users and refers to a project in Ireland, known as IRIS, which among other things enables users to search the OPACs of six Irish libraries (and, in some cases, to request items from them) in a way which hides the different OPAC interfaces of the individual libraries and the connection details. The six participating libraries are Dublin City University, Trinity College Dublin, University College Dublin, University College Galway, University of Limerick and Forbairt (an industrial technical support agency) and the systems used are BLCMP, Dynix, Oracle and URICA. The user with the information need may well also wish to search sources other than library catalogues and in many libraries (particularly academic) the OPAC is being seen as not just providing access to local holdings but as a gateway to other libraries and information sources. Royan, of the University of Stirling, describes the "scholar's workstation" which provides access to a range of information sources[14].

A number of surveys have been undertaken over the years on users' reactions to OPACs. One of the first was a major study by Matthews *et al.*[15] in 1982 of some 8,000 users and 4,000 non-users of OPACs in 31 libraries in the USA. The general results showed that "over 90 per cent of users liked the OPAC" and that 80 per cent were satisfied with the results of their search. However, it was also found that most users were searching by topic or subject (and not for known items) and that subject searching was difficult.

OPACs are providing librarians with the opportunity, for the first time, to look in great detail at what actually happens when users try to find material in a library, or when looking for a particular topic. Most OPACs provide help screens to assist users in their subject searches. Slack[16] has investigated the use and

effectiveness of online help facilities for subject searching in British academic libraries.

The physical aspects (such as cabling, lighting, use of colour on the screen, noise control and design of associated furniture) relating to the siting of OPAC terminals or workstations must be considered. Sometimes OPAC terminals are sited so that the user can search (perhaps for a quick reference) while standing up, whereas others may be designed for the user to access while sitting at an appropriate chair. In the university library at Aberystwyth the option to access "the rest of the world" is not available from the OPAC terminals within the library on the grounds that users may sit for too long at a terminal; such access is possible over the campus network. Dyer[17] outlines the problems that can be caused by poor workstation design and suggests various solutions.

The Interface

Any librarian implementing an OPAC will be able to make some decisions regarding the layout of the screens, format of the messages, details of the record displays and so on. Crawford[18] provides much practical guidance, with many examples of OPAC screens and suggestions for good OPAC design. Points made in his book include:

- the first screen of a new session should identify the library, be clear and inviting for new users and allow experienced searchers to start searching immediately;
- an OPAC should always give some indication to the user about where they are, how they got there and where they can go next;
- an OPAC should avoid jargon and codes and should use vocabulary familiar to most users;
- browsing screens may be denser than other screens and should be arranged in columns to make them readable;
- users should be able to edit commands that fail;
- repeated mistakes can be interpreted as calls for help;
- a search result screen should show the number of items retrieved;
- when a known item is retrieved the first display should include the location, circulation status and call number;
- blank lines and spacing lines should be used to make bibliographic references clear and easy to read;
- users should be able to place holds on (i.e. reserve) items and should be able to request that items be recalled;
- OPACs should provide printing of screen images, bibliographies and one-line-per-item pick lists for finding items on shelves;
- system messages should be clear and neutral, not hostile and congratulatory, and should generally avoid humour;

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- help should always be available;
- fast response is a fundamental attribute of a successful OPAC.

A general overview of all aspects relating to the design of online search interfaces is provided by the Vickerys[19].

There is much work in progress at the moment relating to the OPAC interface with a move away from the menu-type interface to a windows-based interface with the use of a mouse to manipulate pointers to various icons to carry out a search. At the University of Huddersfield, Murphy *et al.*[20] were funded by the BLR&DD to develop a prototype icon-based user interface on an Apple Macintosh. Many suppliers have, or are developing WIMP (windows, icons, mouse, pointers) interfaces for their OPAC. For example, the new product, Genesis, from SCG could be seen at the exhibition where the paper on which this article is based was presented.

Bovey[21] describes a system running on a SUN workstation which provides OPAC access to a catalogue of cartoon drawings and which displays the retrieved cartoon as appropriate. A totally graphic interface has been developed in Denmark to support novice, casual users in public libraries; this BOOK HOUSE system is described by Pejtersen[22] who discusses its relevance in the context of multimedia interfaces in OPAC systems. Dynix has recently developed the Marquis system which operates in using client-server architecture with the application software being loaded on the workstations and the server holding the database. One of the first libraries in the world to implement Marquis is that of East Carolina University and Marks and Nielsen[23] describe their experiences in migrating to a client-server system. The Department of Trade and Industry Information and Library System is the first UK user of Marquis. DS Ltd has developed the Viewpoint system as a one-stop public access system. This aims to allow the user to access a range of host information services including CD-ROM, national viewdata, library management and community information.

The Search Software

The general functions available in the OPAC modules of library management packages are ably described by Leeves[24] in her description of the systems available in the UK marketplace in the late 1980s. The third edition, in publication, will cover systems available in Europe.

The survey by Crawford *et al.*[11] revealed a wide variety of access points: author (79), keyword (78), corporate name (76), class number (72), title alphabetical (66), series file (60), author/title acronym (59), subject heading keyword (52) and subject heading browse (35).

Most OPACs provide for phrase and keyword searching, although only two (URICA and Libertas) perform a keyword search if the phrase search fails. Phrase searching usually consists of implicitly ANDing words in the phrase and matching them with the index. Not all OPACs offer explicit Boolean searching. Some systems (e.g. Geac's ADVANCE, Dynix and BLCMP's BLS) have facilities for showing related works (e.g. other works by the same author or on the same subject). IME's TINlib system has a "browse and navigate" facility which allows

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further searching on any term. TINlib is being sold successfully in Europe and has been translated into many languages. Walker's talk at a workshop entitled OPAC 2000[25] which was organized by the British Library Research and Development Department and the Library Association's Information Technology Group in late 1990 demonstrated how bad some current OPACs are at subject searching. The topic search, "The influence of mothers on the personality of their children", was carried out on seven OPACs in academic libraries in the UK. Some expected the user to search a printed index to choose an appropriate classification code, some provided alphabetical phrase matching against a list of subject headings and the rest relied on an implicit Boolean search statement. Only one system (Libertas at University College London) found any references! He then compared this appalling result with the case of a student searching the same topic using OKAPI and finding 21 books in 12 minutes.

The Database

The development of OPACs and of library management systems generally has created a demand for currency of data and content enhancement. These requirements are not compatible and national bibliographic agencies are facing major problems , given the current increase in publications.

MARC, which is used as a basic record format for many OPACs, was conceived as a carrier for card catalogue information and so concentrates more on descriptive cataloguing aspects than subject cataloguing. Content enhancement of the basic record has been requested by many. For instance, records enriched with an abstract, contents page, back-of-the-book index or even level of potential readership would greatly enhance subject searching. One example of a bibliographic database which does include this sort of data is BookData, described by Martin in [7] with some sample records. As well as the basic bibliographic details, BookData records include subject indicators, descriptive text, trade data and publishing-specific information. Incorporating publishers' descriptive information into catalogue records was suggested at another conference entitled "OPACs and beyond" which was held between the British Library, the DBMIST (Direction des Bibliothèques, des Musées et de l'Information Scientifique et Technique) and OCLC in 1988[26]. It was suggested that such enhancements would assist particularly when large sets of references are retrieved.

Enhancing the subject content of records by either a controlled vocabulary or by natural language has been investigated. Cousins[27] reports on a project involving the collection and indexing of some 500 subject queries as brought by users to the OPACs at Coventry Public and Coventry Polytechnic libraries. It was felt that, if the collected queries could adequately be represented by terms in a controlled vocabulary, then that vocabulary could be used to enhance the records. The queries were indexed using the Library of Congress Subject Headings, DDC and PRECIS (Preserved Context Indexing System). Of the three, DDC performed least well, LCSH performed creditably, whereas PRECIS proved to be best at representing users' queries. LCSH is used widely and may become more used for

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subject searching. In Europe it is used in many national libraries (e.g. France, Belgium and Portugal), having been translated into the appropriate languages. PRECIS is not widely used and is perceived as being somewhat complex because of its history of being developed to assist in the production of printed indexes. However, the British Library has, since 1991, used a PRECIS-based system, known as COMPASS (Computer-Aided Subject System) to enhance the UKMARC records. COMPASS aims to take from PRECIS the basic components of an authority file of controlled terms and subject statements and a network of related terms.

Crawford *et al.*[11] include the results of searching for ten subjects on 22 OPACs in UK academic libraries. They discovered that "most OPACs were not found to be particularly easy to use and consequently are still dependent on users' expertise for reasonably successful operation". Although the Libertas OPACs scored "best", they generated false drops and gave imprecise results. Their article ends with a suggestion for abandoning subject access and relying on keyword access to enhanced bibliographic records.

Conclusions

I hope that in this article I have been able to show you how OPACs have developed from being electronic versions of traditional card catalogues to being the interface to a system which provides information on books held in the library, on order or on loan as well as linking to other libraries' collections and providing access to other types of material. More details on OPAC developments may be found in Crawford[28] and Ra[29], while Tedd[30] includes some screens of current OPACs.

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