Library Automation: An Overview

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SINCE THE 1960s, libraries have used technology in general, and computers in particular, to automate a wide range of administrative, public, and technical services tasks. Designed as an overview of major facets of automation activity, this article surveys the current state of computer applications in six areas of library work: circulation control, descriptive cataloging, catalog maintenance and production, reference service, acquisitions, and serials control. For each area, the discussion briefly indicates the motives for automation and describes current dominant approaches, citing examples of representative products and services.

CIRCULATION CONTROL

Library interest in automated circulation control is, in large part, based on a long-standing awareness of the problems inherent in manual circulation systems. These problems include labor-intensive and time-consuming recordkeeping work routines, inaccuracy, high personnel turnover, an inability to generate statistics about circulation activity, and the lack of an interface between circulation files and other library files which contain much the same bibliographic data. Circulation control is one of the most widely automated library operations, and it is often the first and simplest activity to be automated in a given library, possibly because circulation control systems bear an obvious resemblance to inventory management, retail charge card operations, and other transaction processing activities which have been successfully automated in general business applications.

While specific circulation policies and procedures may be subject to considerable local variation, the major component of circulation

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control—the check-out/check-in procedure—is typically performed in a straightforward manner that is easily understood by computer application developers and systems analysts lacking formal library training. As library users, many data processing professionals have experienced the circulation activity firsthand and are at least broadly familiar with its purpose and nature. Because the bibliographic data required for automated circulation control are often less extensive and complex than those required to computerize such activities as cataloging and acquisitions, data conversion costs, software development time, and storage requirements may be substantially reduced.

Perhaps more than any other library activity, the historical development of automated circulation control has reflected changes in state-of-the-art data processing technology. Through the mid-1970s, most automated circulation control systems were custom-developed for a single library or library system. As early as the 1930s and extending into the 1960s, a number of libraries used keypunched cards in combination with sorters, collators, and other unit record equipment as an alternative to manual record keeping. Tabulating keypunched cards with information about books, borrowers, and due dates could be sorted to select overdue items or to identify all books on loan to a given person.

Such "precomputer" data processing systems, several of which were developed for academic libraries by methods and procedures analysts and operations research specialists, were typically based on inventory control models used in business. With the introduction of computers for business applications in the mid-1960s, a number of libraries developed computerized circulation control systems based on batch processing techniques. Such systems were usually implemented on a computer located in a data processing center operated by a university, municipality, corporation, or government agency with which the library was affiliated. In the typical installation, keypunch or key-to-tape devices were used to convert information about individual circulation transactions to computer-processible form. The resulting data were then batched for processing at predetermined intervals, a computer writing individual borrower numbers into item records contained in a master circulation file maintained on magnetic tape and printing a list of all items in circulation for library reference.

While some of these batch-processing circulation control systems remain in use, they are now mainly of interest for their limitations and impact on the design of subsequent systems. As a particular disadvantage, the printed lists produced by batch-processing systems necessarily reflect the status of a library's circulating collection at the time when the last batch of transaction records was processed. Part of the information contained in such lists is necessarily invalidated by circulation transactions occurring after that time.

By the mid-1970s, library automation specialists had begun to concentrate on the development of online, real-time circulation control

systems which process circulation transactions as they occur. Because pertinent data files are updated immediately, such real-time systems accurately reflect the status of a library's circulating collection. Printed lists are replaced by online terminal inquiries to determine the circulation status of specific items.

While real-time circulation control systems have been custom-developed for individual libraries, a number of vendors offer generalized, preformulated approaches to the computerization of circulation control that eliminate the need for customized system development and speed the implementation process. Such preformulated approaches, currently the dominant method of automating circulation control, can be divided into two related groups: (1) prewritten circulation control software intended for execution on a computer system operated by or for a given library; and (2) turnkey systems, consisting of preconfigured combinations of hardware and software marketed as self-contained products.

Introduced in the early 1970s, the earliest prewritten circulation control software packages and turnkey circulation systems were single-purpose products designed specifically and exclusively for library circulation activities. While such single-purpose systems remain available, library administrators, systems analysts, automation planners, and product developers are increasingly emphasizing integrated, multifunctional turnkey systems and software packages which combine circulation control with other capabilities. In addition to circulation control, the most complete integrated system implementations include interrelated application modules for cataloging, online catalog access by library users and/or staff, acquisitions, and serials control (perhaps supplemented by materials booking), a community bulletin board system, and electronic message transmission. In some cases, circulation is a standard integrated system component which may be implemented alone or in conjunction with other functions; in others, circulation control is an optional application module which must be purchased separately.

Whether designed as single-purpose products or as integrated system components, prewritten circulation software packages and turnkey systems can be implemented far more quickly than customized circulation control systems which may require months or perhaps years to develop. Speed of implementation is an especially important consideration in applications where automation of the circulation activity will result in a cost reduction. Similarly, prewritten software packages and turnkey systems minimize or eliminate requirements for local software expertise. Libraries acquiring such products usually do not need to hire programmers. In fact, customer programming is specifically prohibited by most vendors. Because the system design is predetermined, user training is limited to operational considerations. As a distinctive advantage of turnkey implementations, procurement-related tasks are greatly

simplified by the availability of a preconfigured combination of hardware and software components that are specifically designed to work together. With a single source for central processing equipment and peripheral devices, the necessity of dealing with multiple hardware vendors is eliminated, as are potential problems of equipment compatibility.

While prewritten circulation control software packages are available for computers of all types and sizes, medium-sized and larger public and academic libraries have typically relied on mainframe- and minicomputer-based products. Examples for IBM mainframes include the NOTIS software package, originally developed by Northwestern University for its own use; IBM's own DOBIS/LIBIS program; and the TECHLIB/STATS implementation of the BASIS software package which is marketed by the Information Dimensions subsidiary of Battelle. Originally developed by libraries in the Minnesota State University system, the PALS software package is marketed by Unisys for use with its own mainframe computers, while the LIAS system, developed by Pennsylvania State University, operates on Honeywell computers.

Examples of circulation software packages for popular minicomputer systems include Comstow's Bibliotech system for Digital Equipment's VAX product line; the Georgetown Library Information System (LIS) for Digital's PDP-11 Series models; the Washington University BACS system for Data General and other minicomputers which run under the MIIS operating environment; and the VTLS and Inlex systems for the Hewlett-Packard HP-3000 product line. Minicomputer-based turnkey circulation control systems are available from CLSI, Geac, Data Research Associates (DRA), Dynix, OCLC, Universal Library Systems, and other vendors. Reasonably priced and designed for readily available hardware configurations, microcomputer-based circulation control programs have proven particularly popular with small public, school, and special libraries. Vendors include Follett, Gaylord, Easy Data, Data Trek, Aball Software, Nichols Advanced Technologies, Scribe Software, Winnebago Software, and Richmond Software.

While the earliest circulation control programs and turnkey systems forced libraries to accept predetermined loan periods, borrower categories, and other operating parameters, most newer products flexibly support a varied range of library requirements. Unlike earlier systems which contained rigidly coded procedures to control charging, discharging, and related activities, all newer products are parameterized—i.e., they allow libraries to specify the conditions under which items will be circulated, file inquiries made, and printed output produced. Rather than being written into programs, particular operating parameters are selected by libraries from a range of possibilities. The resulting flexibility broadens the range of applications which a given system can address and is particularly important in installations where a single prewritten software package or turnkey system will be shared by many libraries.

Automated Cataloging

Descriptive cataloging is an intellectual activity requiring considerable decision-making and one that is time-consuming. As a result, many libraries experience cataloging backlogs which impede the flow of materials into circulating and reference collections thereby preventing library catalogs from representing those collections fully and accurately. Recognizing that the cost of descriptive cataloging can approach or even exceed the value of certain materials, many libraries do not catalog paperbound books, low-cost government publications, or other relatively inexpensive items. In some research libraries, materials of presumably limited interest may be placed in off-site storage facilities with only an abbreviated catalog record created. In most libraries, conventional descriptive cataloging is not even considered for individual titles in large microform sets, even though such materials may significantly augment a library's resources in particular subject areas, and the failure to catalog them impairs their utility.

To simplify decision-making, to save time, and to reduce costs associated with descriptive cataloging, libraries have historically relied on cataloging copy—i.e., descriptive cataloging information prepared by other libraries, especially the Library of Congress. The automation of descriptive cataloging depends on the availability of such cataloging copy in computer-processible form. In the late 1960s, the Library of Congress developed the MARC format for the communication of bibliographic data on magnetic tape and began distributing machine-readable cataloging copy through its MARC Distribution Service. Since the late 1960s, MARC formats have been developed for various types of library materials, and the scope of the MARC program—once limited to English-language monographs—has broadened steadily and significantly. The LC MARC database—the accumulation of Library of Congress cataloging data in machine-readable form—now contains more than 2.5 million records, most of them cataloged since the inception of the MARC program.

Although MARC tapes can be purchased from the Library of Congress for input to local computer systems, most libraries obtain access to MARC data through products and services developed by publishers, computer system developers, time-sharing services, and other intermediaries. Among the earliest of these MARC-derivative products were computer-generated micropublications such as MARCFICHE, produced by MARC Applied Research, and Books in English produced by the British Library.

Created by computer-output microfilm (COM) technology, both products provided more timely and varied access to LC cataloging data than could be obtained through the conventionally printed National Union Catalog, which was itself discontinued in favor of a COM implementation in the early 1980s. As an equally timely and flexible alternative, several search services, including DIALOG and WILSONLINE,

offer online access to the LCMARC database. A growing number of vendors supply the MARC database on CD-ROM disks or digital optical videodiscs accompanied by software which supports the retrieval of specific cataloging records and the printing of card sets. Examples include the BIBLIOFILE system from the Library Corporation in Washington, D.C., the LASERSEARCH system from General Research Corporation, and the MINI MARC II system from Library Systems and Services Incorporated.

Although these products and services are important, most libraries obtain access to machine-readable cataloging records through one of the bibliographic utilities—organizations which maintain large databases of cataloging records and offer online access and other services to subscribing libraries. Examples include the Online Union Catalog implemented by the Online Computer Library Center (OCLC), the Research Libraries Information Network (RLIN) operated by the Research Libraries Group, the cataloging support service operated by the Western Library Network (WLN), the Cataloging Support System (CATSS) offered by Utlas International, the LIONS system operated by the New York Public Library, the AGILE II service offered by Auto-Graphics Incorporated, and Brodart's Interactive Access System (IAS).

While they differ in database size and composition, the number and nature of their subscribers, and the specific capabilities they support, these bibliographic utilities each maintain a database of MARC records obtained from the Library of Congress and other sources, supplemented by original MARC-format cataloging contributed by subscribing libraries. Working at local terminals, participating libraries can retrieve cataloging copy, modify it to meet local requirements, and order printed card sets, machine-readable cataloging records on magnetic tape, and other bibliographic products. Local workstations are also used to input original cataloging records for use by other subscribers. Supporting thousands of online terminals accessing millions of machine-readable records, the bibliographic utilities are among the world's largest and most intensively utilized computer-based information services.

Computer-Produced Catalogs

The automation of descriptive cataloging addresses only one part of the cataloging activity. In addition to using computers to facilitate access to cataloging copy, libraries are interested in computer-based solutions to the much discussed problems of card catalogs. The most frequently cited of such problems include substantial space consumption; the purchase of expensive cabinets and supporting furniture; labor-intensive and time-consuming catalog maintenance routines which are intensified by changes in cataloging rules affecting the choice and form of entries; and limited convenience and retrieval capabilities.

These problems can be minimized or eliminated by the replacement of card catalogs with computer-based book-form or online cata-

logs. Broadly defined, a book-form catalog contains successive bibliographic records listed in a page format on paper or microforms. Among the earliest applications of library automation, computer preparation of book-form catalogs can lower production time and costs while eliminating the labor-intensive file maintenance routines associated with card catalogs.

As an alternative to computer printed or typeset catalogs, computer-output microfilm catalogs have been widely implemented by libraries and library systems since the early 1970s. A number of service bureaus, book jobbers, bibliographic utilities, and other vendors have developed software to produce COM catalogs from library-supplied data, thereby eliminating the need for in-house COM recorders and customized programming.

Compared to paper-based book catalogs, COM catalogs offer several advantages, the most important being economy of production, durability, and compactness. Several companies, including Auto-Graphics and Information Design, have introduced display devices designed specifically for library COM applications. These devices, which feature preprinted instructions and simple controls, employ large reels of 16mm or 105mm microfilm, the latter containing several hundred uncut microfiche. In most cases, a library's entire catalog will fit on a single reel which remains inside the reader and need not be handled by the user.

While COM catalogs have been widely implemented, libraries seeking high-performance alternatives to card catalogs are increasingly turning to online catalogs. Broadly defined, an online catalog is an organized, machine-readable accumulation of bibliographic records which are maintained on disks or other direct-access computer storage media for retrieval by library users and staff members working at interactive terminals or appropriately configured microcomputer workstations. In addition to saving space and automating file maintenance, online catalogs permit remote access by authorized persons equipped with compatible terminals, and they can support information retrieval operations—such as keyword searching of titles and series names—which are not conveniently possible with card or book-form catalogs.

Online catalogs may be custom-developed for specific library installations or purchased as prewritten software packages or turnkey systems. Examples of custom-developed online catalogs include the Library of Congress Computerized Catalog, the MELVYL system at the University of California, the LIAS system at Pennsylvania State University, the Library Computer System (LCS) at Ohio State University, and the Dartmouth College Online Catalog. Prewritten software packages suitable for online catalog implementations include BRS/SEARCH from BRS Information Technologies, a powerful information retrieval program that is available in mainframe, minicomputer, and microcomputer versions; INMAGIC, a versatile data management program for

minicomputer and microcomputer installations marketed by Inmagic Incorporated; and MINISIS, a program for Hewlett-Packard minicomputers produced by the International Development Research Centre. As an alternative to prewritten software packages designed to operate on computers owned by a given library, several vendors offer turnkey information storage and retrieval systems which include preconfigured combinations of hardware and software components suitable for online catalog implementations. Examples include the STAR system from Cuadra Associates and the MARCIVE/PAC system from Marcive Incorporated.

Since the mid-1980s, however, online catalog implementations have been dominated by integrated library systems which combine database management and catalog access capabilities with circulation control, acquisitions, serials control, and other operations. Such systems may be implemented as complete turnkey configurations of hardware and software or as prewritten software packages designed to operate on a library-owned mainframe, minicomputer, or microcomputer. Vendors include CLSI, Geac, Notis, Dynix, OCLC, Virginia Tech, Data Research Associates, Carlyle, Comstow Information Systems, Universal Library Systems, Sobeco, Sigma Data/Centel, Georgetown Medical Library, Washington University, IBM, Inlex, Sirsi, Utlas, Innovative Interfaces, Eyring Research Institute, Easy Data, Data Trek, and Unisys.

Among the newest and most widely publicized approaches to online catalog implementation, a growing number of vendors offer public access catalog systems which employ CD-ROM storage technology. Examples include the IMPACT system from Auto-Graphics, LASERGUIDE from General Research, THE INTELLIGENT CATALOG from the Library Corporation, and the LEPAC system from Brodart. In such implementations, the library provides a machine-readable version of its catalog, typically consisting of MARC format records on magnetic tapes obtained from bibliographic utilities or other sources, to a CD-ROM system vendor who indexes and otherwise prepares it for conversion to one or more CD-ROM disks. The disks themselves are created by a mastering process in special manufacturing facilities, and the library receives a specified number of disk copies plus menu-driven software designed for public catalog access at microcomputer-based workstations. Updated by periodic replacement in the manner of book-form catalogs, such CD-ROM catalogs are increasingly mentioned as an alternative to computer output microfilm for union catalogs and similar implementations.

Automated Reference Service

Since the late 1960s, many publishers of printed bibliographies, indexing and abstracting journals, and other reference works have offered machine-readable versions of their products for use in computer-

assisted reference applications. Initially intended for government, corporate, and academic libraries supporting research in scientific and technical disciplines, such machine-readable reference sources have become widely available in business, the social sciences, and the humanities. In addition to databases which correspond to printed publications, a growing number of reference sources have been developed specifically for use in computer-based systems and have no printed counterparts. While the earliest machine-readable databases were bibliographic in character, nonbibliographic numeric and directory-type databases are increasingly commonplace.

During the late 1960s and early 1970s, a number of libraries purchased machine-readable bibliographic and nonbibliographic databases for processing on in-house computers using custom-developed information retrieval software. Most libraries, however, lacked access to the hardware and software resources required to implement such systems. Through the early 1970s, the needs of such libraries were addressed by fee-based search services operated by the producers of machine-readable databases or other organizations such as large research libraries. Such services, which operated in the offline, batch processing mode, were replaced in the mid-1970s by services offering online database searching on a time sharing basis to libraries equipped with conventional terminals.

Now widely utilized by libraries of all types and sizes, online search services can be divided into two broad groups: (1) multidisciplinary services—including DIALOG, BRS, ORBIT, WILSONLINE, DATA-STAR, and ESA-IRS—that provide database coverage of a varied range of subjects for a broad clientele; and (2) specialized services—such as the NLM SEARCH SERVICE, STN INTERNATIONAL, LEXIS, and WESTLAW—that provide online access to one or more databases relevant to a single subject discipline, profession, or activity, such as medicine, law, or engineering. Various types of specialized search services provide online access to databases containing a specific type of information such as news. Examples include the NEXIS, VU/TEXT, DATA TIMES, and NEWSNET search services.

While they differ in the number and type of databases offered and in the specific retrieval capabilities supported, multidisciplinary and specialized search services share a common operating methodology: they purchase or otherwise obtain bibliographic and nonbibliographic databases in machine-readable form from their producers, convert the databases to a form required for storage on their computers, and allow libraries or other subscribers to perform various retrieval operations on such data using prewritten database management software. The software features a nonprocedural query language which permits a user at an online terminal to initiate literature searches or other information retrieval operations by entering specified commands. While their query languages are relatively easy to learn, online search services are more

often providing menu-driven interfaces for novice users. Some services also offer private file capabilities which allow libraries to establish their own databases.

As a recently implemented supplement or alternative to online search services, an increasing number of bibliographic and nonbibliographic databases are available on CD-ROM disks. Accompanied by information retrieval software, such CD-ROM reference products permit database searching at local microcomputer workstations (over 100 titles were available at the time of this writing). Offered on a subscription basis, they can prove less expensive than online searching for databases that are accessed frequently, although infrequent updating, slow response time for complex searches, and other performance limitations may make them unsuitable for some applications. As a hybrid implementation with potentially attractive cost/performance characteristics, several vendors combine CD-ROM searching of backfile data with online access to the most current information.

Acquisitions

More informed decision-making through improved statistical analysis and reporting of procurement activity is the most frequently cited motive for automating acquisitions operations. Since the 1960s, automated acquisitions systems have been implemented in at least four different ways: as a custom-developed program designed to operate on a computer owned by a library or its parent organization; as an acquisitions-specific prewritten software package or turnkey system; as an application module supported by a multifunctional integrated library system; or as a time-sharing service offered by a bibliographic utility or a book jobber.

Each method has advantages and limitations. Customized acquisitions systems, an implementation option in any automated application, can be developed to a particular library's specifications but are expensive and time-consuming to create. Prewritten acquisitions-specific software, and the acquisitions application modules supported by integrated library systems, can minimize the worst implementation problems associated with customized software development, but a library must have access to required hardware and system software components. Turnkey systems, consisting of preconfigured combinations of hardware and software, are available as both acquisitions-specific products and as integrated systems. In the latter group, the integration of acquisitions with cataloging and circulation in a single system offers several advantages, including the ability to establish a preliminary bibliographic record at the time an item is ordered.

All of the foregoing approaches require a substantial capital investment which can be minimized if automated acquisitions capabilities are obtained on a time-sharing basis through a bibliographic utility or bookseller. Because charges are incurred as the acquisitions facility is

used, this approach is especially attractive to libraries with modest annual volumes of acquisitions activity. Use of a bibliographic utility for acquisitions offers other advantages as well. Its database can be used for bibliographic verification, and data can be transferred from cataloging records to facilitate order preparation. In addition, the use of a single system for acquisitions and cataloging simplifies staff training requirements, while the immediate online availability of information about the holdings of other libraries supports cooperative collection development. Acquisitions systems offered by booksellers typically feature online access to inventory data with electronic ordering capabilities.

Serials Control

Current serials automation activities are directed toward two types of tasks—the bibliographic control of serial publications and the management of serials collections in individual libraries. The task of bibliographic control is the establishment of definitive bibliographic information about serial publications.

Among automated approaches to this task, R.R. Bowker offers machine-readable versions of its various printed guides to serial publications including Ulrich's *International Periodicals Directory*. The International Serials Data System (ISDS) and the International Centre for the Registration of Serials are charged with responsibility for the establishment and maintenance of a comprehensive machine-readable registry of bibliographic information about serials published throughout the world. In the United States, the Library of Congress has developed a MARC format for serial publications and participates in the CONSER program which creates and maintains a high-quality machine-readable database of cataloging records. The CONSER database is maintained by OCLC, and CONSER records are disseminated through the MARC distribution service.

To manage local collections, a number of libraries and several vendors have developed systems which automate one or more aspects of serials processing, including union list production, ordering, check-in, claiming, and the routing of received issues to designated persons. Computer-based production of union lists of serials is routinely supported by data management software or word processing systems. Such lists may be printed on paper or microfiche. The last option is especially useful for very long lists that will be mailed or otherwise distributed to multiple locations. As an example, microfiche is the output medium for the California Union List of Periodicals (CULP) which contains information for over 63,000 periodicals held by 700 California libraries. The CULP database is also accessible online through BRS.

As with conventional book acquisitions, computers can be used to minimize the labor-intensive sorting, filing, and other paper-handling work routines associated with manual serials processing. A number of

libraries developed customized serials control systems during the 1960s and 1970s. The PHILSOM system, developed by the Washington University School of Medicine Library, is perhaps the most famous example. As an alternative to the time and expense associated with customized system development, libraries can obtain access to serials control capabilities on a time-sharing basis through subscription service companies. Examples of such time-shared serials control services include F.W. Faxon's LYNX system and the EBSCONET system offered by EBSCO Subscription Services.

Several companies and other organizations have developed prewritten software and turnkey systems designed specifically for serials control. The INNOVACQ Acquisitions and Serials Control System, for example, offers a comprehensive range of serials ordering, check-in, and claiming capabilities. It can download records from bibliographic utilities and transfer serials records to a local circulation control or public access catalog system. Among microcomputer-based products, OCLC's SC350 Serials Control System can retrieve bibliographic information, local data, and publishers' addresses from the OCLC online union catalog. It facilitates the check-in of received issues, produces claims and claim cancellations, maintains binding instructions, and prints bindery slips. It can also transmit serials records to OCLC's union list component. As an alternative to single-purpose implementations, several integrated library systems support serials control modules, and others have announced such capabilities for future implementation.

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Library automation refers to the use of computer to serve the needs of library users. It is the use of automatic and semi-automatic data processing machine to perform such traditional activities such as acquisition, cataloguing, serial more.Â Ms. Pramila Khushali Velip "Library Automation: An Overview" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-2 | Issue-6 , October 2018, URL: http://www.ijtsrd.com/papers/ijtsrd18559.pdf. Direct Link: http://www.ijtsrd.com/other-scientific-research-area/other/18559/library-automation-an-overview/ms-pramila-khushali-velip. Save to Library. Download. Library Automation an Overview by Rashid (1996) reviews the significant developments in the area of library automation, size, library management system, and information retrieval system, OPAC, CD-ROMs and networking. Further he added that librarians and vendors are working together to improve service and systems and develop new products in response to user needs. 26. Vaishnav, and Bapal, (1995) deals in the article Library Automation: A feasibility Study with library automation programme of BAMUL Aurangabad. It identifies the problems in the existing system and gives reasons for automation. Th In this context, library automation is referring to hardware and software systems that are implemented in the library...Â This paper describes an overview regarding library automation and present possibilities to handle books using robots in the context of library activities. In this context, library automation is referring to hardware and software systems that are implemented in the library process activities in order to automate book handling applications. Some similar developments are presented. Also, two CAD models of the proposed book manipulator using linear drives are presented.