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## INITIAL SYSTEM DESIGN FOR THE OHIO COLLECT LIBRARY CENTER: A CASE HISTORY

Incorporation of the Ohio College Library Center (OCLC) as a not-for-profit corporation occurred on July 6, 1967. As expressed in the Article of Incorporation, the purpose of the corporation is "to establish, maintain and operate a computerized, regional library center to serve the academic libraries of Ohio (both state and private) and designed so as to become a part of any national electronic network for bibliographical communication." The director of the Center took up his duties in Columbus in early September and spent most of the next two months consummating legal organization. System design was initiated, however, during this period, and following OCLC formal organization meetings at the end of October, system design became the main order of business. This article narrates the development of the design of a computerized regional library system in the early months of the Center's existence. As a case history, the paper contains early efforts and diagnosis; at this writing it is too early for prognosis.

The history of events leading up to the establishment of OCLC helps shed light on the Center. The Ohio College Association (OCA) was responsible for founding OCLC. The Ohio College Association is a venerable organization that came into being in 1867 as the Association of Ohio Colleges; it changed its name to the present form in 1890. In 1867 there were a dozen charter members, including both state and private institutions; a century later, there are over sixty full and associate members. For a hundred years these Ohio institutions have been working together with an effectiveness that has long since spawned mutual confidence and allowed for the stability of OCA. Perhaps the major factor behind the establishment of OCLC is this long and quiet tradition of effective cooperation among Ohio academic institutions.

The immediate past history of activities, which culminated in the incorporation of OCLC, began late in 1951, when a Special Committee to

Consider an Ohio Cooperative Library came into being under auspices of OCA. Initially the special committee considered such topics as revision of an Ohio union list of serials that had appeared in 1936, cooperative acquisitions, and establishment of a storage center. From 1954 to 1956 the committee unsuccessfully sought grant support, and its activity dwindled until 1961 when it was revitalized as the Librarians' Committee on Library Cooperation. OCA allocated to this committee funds which enabled it to acquire the services of Wyman W. Parker, Librarian at Wesleyan University in Middletown, Connecticut, for a period of three months, during which he conducted an extensive survey subsequently published under the title, *The Possibility of Extensive Academic Library Cooperation in Ohio: A Survey*.<sup>1</sup> Major recommendations in this report were the establishment of a bibliographical center to facilitate interlibrary lending among Ohio academic libraries, and cooperative purchasing of microprint by the Center. As the committee sought to implement recommendations in the report, it developed a concept of basing activities of the bibliographical center on a union catalog. Two commercial firms presented proposals for construction of a union catalog of holdings in Ohio academic libraries, each proposal requiring about a million dollars to effect.

At this juncture, to evaluate proposals made by the two commercial companies, the committee called in two consultants, Ralph Parker of the University of Missouri, the present director of the Center. In a "Report to the Committee of Librarians of the Ohio College Association,"<sup>2</sup> submitted in late 1965, they recommended that a new approach be undertaken toward a central computerized catalog having many functions, among them that of a union catalog. The committee accepted and approved this report, and subsequently proposed to OCA that the recommendations of the report be acted upon. In its turn, OCA approved the report at a meeting on October 30, 1966, and empowered its president to appoint a committee of implementation to form a corporation, to employ a director, to choose a location for the center, and to arrange for receipt of funds. A year later, the Center was a fully organized, corporate entity, with its director embarking on design of a computerized regional library center.

The word "system" is singularly nonspecific, but in this paper, it has one specific meaning: a system is an on-going, information-based process that attains some wanted objective and is thought of as a comprehensive whole, rather than as a conglomeration of procedures. In contrast to a system, a procedure is a specified, ordered series of acts that produce, modify, or move an object. Unlike a system, a procedure characteristically has no objective. Indeed, the most significant characteristics of a system are its having an objective, and its process being information-based.

Information, in the phrase "information-based," is perhaps best defined as data used in a decision-making process. This information most emphatically is not data or knowledge in volumes. In other words, information is data concerning other data that are in process in the system; information is data about the processing, and is used for decision-making in driving the system.

Obviously any device that is an efficient information processor would be a most desirable instrument for directing an information-based system. The electronic digital computer has enormous capability for information processing

and can use data to make simple yes-no decisions. Indeed, computers are unique machines in that they can process data such as an acquisitions record, and at the same time make use of knowledge about the data or record, such as knowledge of the amount of time a book has been in some section of the process, in order to make a decision as to whether or not the book should be moved along. Actually, data used in making this decision may consist of as many as eight different variables.<sup>3</sup>

Once the framework of a system has been constructed, techniques for completing details of the design usually do not differ greatly from the older techniques of knitting together a group of procedures. The principal difference between older varieties of management planning and newer systems designs is, for the most part, the major questions that are asked. For instance, initially it was necessary for the director to formulate the problem clearly and to choose appropriate objectives. What is the objective of a college library? Should it be a service agency for students and faculty? Should it be a conserver and protector of printed volumes? Should it participate in the mission, namely the educational program, of its institution? Questions such as these which concern objectives must be answered before design is undertaken.

One characteristic of system design (also a major feature of system engineering from which it evolved), is detection of areas of inadequate technology, i.e., areas for which research and development work must be undertaken. When there are inadequate data available for library system design, it is often possible for the design group to undertake, or arrange to have undertaken, research that will yield desired data. ~~However, it is unlikely that librarians will be able to undertake yield desired data.~~ However, it is unlikely that librarians will be able to undertake machine development when machine capability is inadequate in some area of a system. For instance, at the present time, efficient consoles for use of catalogers are not available, although they may be in a relatively few months. It will be a rare library system designer who will do engineering development to produce satisfactory terminal equipment, although in this particular case, Project Intrex at M.I.T. is working on a solution to the problem.<sup>4</sup> Also, at least one manufacturer is about to market a console which will have most of the features required by libraries and which will be economically feasible. Another manufacturer has received requests from at least two libraries to quote cost of modification of one of its consoles to give that console capabilities required by libraries. Even though librarians will not be undertaking engineering development, there are, as has just been shown, avenues by which inadequacies revealed by system design can be eliminated to the extent that it is possible for the system to operate.

Early formulation of the problem that the Ohio College Library Center is to solve had occurred in a general way before the Center became a corporate entity. Put succinctly, the problem to be solved was one of increasing resources to Ohio colleges and universities. From the college administrative point of view, the problem was that of hiring new faculty and enrolling new students in the future. Presidents of Ohio academic institutions were particularly aware that new Ph.D.'s are research-oriented. If these younger men are not offered an opportunity to pursue research programs, they are reluctant to join a faculty. Moreover, changing educational objectives in

colleges are requiring that undergraduates have an increasing opportunity to learn how to learn. Such opportunities can best be given to a student by providing him with resources for independent work.

Resources necessary to attract research-oriented faculty and to support independent work by undergraduates were identified in the early stages of design of the OCLC system. These resources are bibliographic materials, computation, laboratories, and the opportunity for research men to obtain stimulation from other researchers with similar interests. OCLC's main chore was defined as increasing bibliographic resources. However, it is entirely possible that the system being designed could also increase availability of computation to small institutions. OCLC will play no part in furnishing laboratory space but, of course, the Federal government has effectively provided financing which has enabled many institutions to build laboratories. Finally, OCLC cannot play a part in providing stimulation that comes only from discussion with one's peers in a particular field. At the present time, OCLC is not pursuing the mission of furnishing computation, but it has gently opened the door for access to this mission and will actively develop in this direction should the demand arise.

How can an institution's bibliographic resources be expanded? OCLC is giving first priority to increasing the availability of those resources already at the institution. A bibliographic information retrieval project will achieve this end, as will a circulation control project operating remotely from the library. Next, resources in the academic neighborhood can be made available to a single institution. Too often cooperative activities designed to increase resources among institutions are thought of in terms of acquiring materials from someone else, but OCLC will not rely on this type of cooperation.

What objectives should a computerized regional library center establish? A century ago, the objectives of Ohio academic libraries were to collect, catalog, and conserve printed material; in recent decades, academic librarians have concentrated on decreasing costs of their operations and they are still inclined to look upon libraries as being self-existent institutions. To be sure, services to students and faculty have been increased (at times perfectly outrageous demands for service have been made on academic libraries). However, examination of all the possible objectives led us at the Ohio College Library Center to the conclusion that patron service and collection maintenance would not be sufficient. It appears to us that the real objective of an academic library is to participate in the educational and research missions of the institution of which it is a part.

College and university educational programs are moving in the direction of producing perpetual students. In years ahead, educated men and women will need to continue to learn in the knowledge-based society in which they will be living, and the American college will surely have as its objective the production of young men and women who will remain life-time learners. Libraries will play a large part in this learning process and should begin to orient themselves to this function now.

It would appear that the major objectives for participating in institutional research and education programs would be to furnish data and knowledge to a researcher or student whenever it is needed. It is difficult to

see how these missions can be carried out with traditional library techniques. However it seems quite possible that by the end of this century, academic libraries will be truly paradisaical libraries that will always have data "on the shelf" which a borrower will always be able to take out, so to speak. Moreover, the borrower will be able to use the data wherever he may be, as long as he has access to a terminal which may not be much more complicated than a touch-tone telephone.

The library at this century's end also holds promise of being a truly personalized library in contrast to the dehumanized institutions with which we are all so familiar. Libraries strive to be all things for all people, and in consequence, are unable to treat individuals as distinct human beings. Libraries, except for the very smallest, are monolithic arrangements of volumes, catalogs, and indexes which are not and cannot be oriented toward the interests of any particular individual. However, when technical and intellectual ability exist to subject-index and subject-classify by machine huge stores of text, it will be possible for the user of the academic library to have the advantages of an enormous centralized collection and of a personalized segment of that collection not unlike the scholar's library of the nineteenth century.

Such a library system at the end of the century will be a network whose nodes will contain large amounts of computerized textual material. From node to node, much material will be duplicated but, also, each node will undoubtedly contain unique material not in other nodes in the immediate vicinity, nor, perhaps, elsewhere in the nation. A user seeking information will use a terminal which presumably would be as available as the telephone is today. If, at the node to which a user's terminal is attached, the information store does not produce the information he requires, or perhaps not all the information he requires, the inquiry will be switched to other nodes in the immediate vicinity. Such switching of inquiries will have to be under control of some specific network system that will supervise communication of messages among nodes. At the present time, these messages travel in our informal library network in a rather helter-skelter manner; this circumstance will not be tolerated in the future.

In addition to nodes containing unique information, as well as information duplicated in other nodes, there undoubtedly will be sub-nets interwoven in the major network, wherein nodes will occur less frequently. For instance, a sub-net for Far Eastern materials may have many fewer nodes than will the standard network. Nevertheless, an inquiry for Far Eastern information will not be restricted to stores primarily holding that type of information.

Two major objectives of the OCLC system should be: (1) furtherance of participation of academic libraries in educational and research programs of their institutions, and (2) a system design that would enable the system to evolve toward library systems of the end of the century. The mission by which OCLC will make it possible for academic libraries to participate in their institutional programs will be to increase availability of bibliographic resources within the institution and from neighboring institutions. Another mission will be design of systems that will bring bibliographic resources close to the user, so that he can gain access to them more nearly when and where he needs them than is possible in classical library practices.

In general, it seems clear that a regional computerized library network can increase availability of local and distant resources in a manner which individually computerized libraries can not. Similarly, and variably, and depending upon the size of the institution, the computerized regional network will furnish libraries with computer competence and capabilities that also could not be otherwise available. As for processing in an individual library, such a central computerization will effectively reduce amounts of duplicate processing that have plagued American librarians ever since the introduction of the card catalog. Of course, the card catalog has not been the sole factor responsible for costly duplicate processing; it has also been the increasing demand to obtain access to books rapidly, once they were received locally, that has forced the easily updated card catalog into being. Central computerization will also supply computerized services for mechanized cataloging, for circulation control, for serials control, and for technical processing, which are now forbidden to the large majority of libraries because of cost involved.

It is more than obvious from this discussion that central computerization of a group of academic libraries holds more than enough advantages for faculty and students, as well as for a library's own operations, to justify a regional system. However, the question arises as to whether the system should be designed to operate purely for the region or as a participant in a larger network. In other words, should OCLC design a system that would be an Ohio system on an Ohio computer for Ohio academic libraries, or should it design a system which would operate effectively for Ohio academic libraries, but which could operate with equal effectiveness for public libraries and special libraries in some other state or states?

When advantages of a system designed purely for Ohio academic libraries operated on some existing Ohio computer were compared by OCLC with advantages of a regional system that would be a part of a national network, the latter appeared obviously superior. Indeed, it was difficult to detect any real advantages in a uniquely regional design. Disadvantages of such a system would raise to the network level the amount of uncoordinated computerization now going on among individual libraries. To be sure, computerization within individual libraries is yielding valuable experience and knowledge, and will continue to do so in years ahead. Nevertheless, it is certain that it will be almost impossible, for a variety of technical reasons, to meld individually computerized libraries into a network in the foreseeable future. Therefore, design of a regional system that could be a node in a national network seems to be the obvious choice, and the decision at OCLC was to proceed along this avenue in hopes of producing a system whose hardware, programs, and data, could be duplicated for operation in another region and with minimal development expense.

After the decision was made to design the system as a prototype node in a national network, the next major question examined was: What will be the characteristics of a prototype node that will also enable individual academic libraries to attain their objectives? There are two groups of users of such a system: (1) faculty and students, and (2) library staff. The OCLC system is dedicated to concentration on participation with faculty and students, but to do so requires a large store of machine-readable bibliographic

information. Therefore, it was decided that the first major project to be activated will be a shared-cataloging activity dependent upon a single central computerized catalog which will record the holdings of each academic library.

A particular advantage of the shared-cataloging system for libraries will be elimination of duplicate cataloging, at least duplicate descriptive cataloging, in the Ohio community. Moreover, the Library of Congress has agreed to supply the OCLC system daily with machine-readable cataloging records from a console maintained by OCLC in the Library. When enough machine-readable cataloging records originating in Ohio have accumulated to make it worthwhile to do so, the Library of Congress will start to take such machine-readable records out of the Ohio system for use in cataloging at the Library of Congress. From the very start of system design, it was determined that the MARC II format would be used to insure easy compatibility and communication, as well as greater opportunity for use of programs written elsewhere. As the result of OCLC's decision to use the MARC II format, it will be perfectly simple to acquire machine-readable cataloging from the Library of Congress and to furnish it to the Library in return.

The computer required to operate a shared-cataloging system wherein only passage of cataloging records and formatting of original cataloging is involved need not be a large one. Indeed, a relatively small computer will be adequate for these purposes. However, a great deal of computer power is required for sophisticated catalog card production. Therefore, it was decided to design a stand-alone system involving a small, dedicated computer which would manipulate messages consisting of copies of bibliographic records. Catalog card production would be accomplished by having those records from which cards were to be produced for a specific library written on a magnetic tape. After close of business each day, this tape would be dismounted, mounted on a tape drive of a large computer and used for catalog card production. Such cards would be produced according to specifications furnished by each library. The Center would send them to the requesting library hopefully within twenty-four hours after cataloging had been completed. Cards would be arranged in packs, in final form, and alphabetized for filing in a catalog, a single pack being designed for a specific catalog.

In short, the system is being designed so that an individual library will have greater liberty in carrying out cataloging policies and practices than it does now, and at the same time will gain the advantages of centralization. If an individual librarian elects to instruct his catalogers to follow Library of Congress cataloging exactly, no matter what, he is free to do so. On the other hand, a librarian who may wish to have his catalogers change subject classification and subject headings for the needs of his users, when those needs are known, is also free to do so. A middle path, which some librarians pursue in recognition of the fact that the Library of Congress cannot always maintain its own standards, is also possible; in this case, inaccuracies and inadequacies of Library of Congress cataloging are eliminated and the cataloging is brought up to LC standards.

The dedicated computer, together with its peripheral equipment, programs, and indeed data, will constitute a system which can be duplicated in another region without expenditure of large sums for development. Such a

small, dedicated computer will have the ability to interface with another computers of its own model and possibly with larger computers, thereby eliminating the inelegant procedure of interfacing by magnetic tape.

An early cost-benefit study for an actual academic library in Ohio having 50,000 volumes, a \$60,000 annual budget, and 1.5 catalogers processing 3,000 titles a year yielded a total of \$6,323, of which \$1,739 was the prorated share of its use of the central computer facility and \$4,584 for console, dataphone, and telephone line charges. In return for this expenditure, the library could release one of its one and one-half catalogers for other activities, would have on-line access to a union catalog of holdings of recent imprints in Ohio libraries, and would be able to communicate with any other Ohio library, particularly to determine whether or not needed volumes were immediately available. In addition, the library could receive copy for production of monthly accession lists and, of course, would have catalog cards produced at a cost equal to or lower than it now expends. The Center could also furnish spine labels, book cards, and book pockets.

Soon after the shared-cataloging project goes into operation, there will be activated a bibliographic information retrieval system which will allow users of Ohio libraries to obtain rapid and complete searches under subjects. An effort will be made to increase amounts of subject indexing, which are presently inadequate in all libraries. After the bibliographic information retrieval project is operational, work will begin on a circulation system. Here it is hoped that the Ohio State University Libraries will be able to undertake design of the system for their own purposes and for OCLC. The base of the system will be a brief cataloging record in the central machine system for each title in an Ohio academic library—a system quite like that which recently went into operation at the Bell Laboratories.<sup>5</sup> Design of this system will strive for eventual use of touch-tone telephones enabling a user to gain access to bibliographic records from a great many locations in contrast to the single card catalog available to him today. However, it is likely that the first application of this system will use typewriter consoles which in larger universities may be located in each university building and in smaller institutions probably restricted to the library.

A preliminary cost-benefit study at the Ohio State University libraries indicates that huge savings to users may be achieved. A conservative estimate employing the minimum wage rate for students and \$10 an hour for faculty yielded an annual savings to users of nearly a million dollars in time. Innovations, such as this type of circulation system, will vastly improve capability of libraries to participate in their institutions' educational and research programs.

A fourth project for the OCLC system will be a serials control program, and a fifth one, a sophisticated technical processing system which will computerize not only clerical activity but also some supervisory activities and will furnish management information. Such a technical processing system requires large amounts of computer power and will necessitate an interface between the stand-alone system and a larger local computer.

The entire system, including shared catalog, bibliographic information retrieval, circulation control, serials control, and technical processing, will be

based on one file, thereby achieving a truly comprehensive system. Examination of a rough model of the system reveals several inadequacies. Perhaps the principal inadequacy is the present lack of a technique for organizing a huge file of bibliographic entries that might be as large as 10,000,000 items. Such a basic file would have various indexes to it, such as subject indexes, and call number indexes, but, ideally, the file itself should be organized so that each entry is self-addressing, thereby making it possible to retrieve each entry without having to search through a series of large indexing files. Work on solution to this problem is currently underway at Yale University and at OCLC.

Another major inadequacy is terminals. At the present time, it seems clear that a CRT terminal is the preferred type for catalogers to use. However, the principal reason is that from the human point of view it is vastly easier to use than any other type of terminal, particularly for editing cataloging copy. As noted above, a CRT capable of efficient service to a cataloger does not, at the moment, exist, although at least one manufacturer is in the process of making one available, and other manufacturers are designing consoles with upper- and lower-case capability for production in the near future.

The library user does not need to have a console that will enable him to do editing. Indeed, it would be undesirable for him to edit just as it is now undesirable to have enthusiastic borrowers write emendations on catalog cards. The most desirable characteristic of a terminal for users is that it should be cheap and widely available. Clearly, the most likely candidate in this respect is the standard telephone set. It is anticipated that touch-tone telephones will be widely available in a few years, and since recent models of touch-tone telephones possess twelve buttons, they communicate alphabetic as well as numeric information. In anticipation that such an instrument will become widely available, it is hoped that a design can be developed which will make it possible for users to gain access to the library bibliographic system from such instruments. However, there is one obvious problem: the communication of results back to the user over telephone instruments. Clearly, this inadequacy could be eliminated by employing human beings to repeat to the user, information produced from the computer. Although such a procedure might be effective, it is an undesirable employment of human beings.

This paper is a synoptic case history of the systems design of a regional computerized library system. Objectives of the system are library participation in educational and research programs, the development of a prototype node in a national network, and design of a system which will evolve into a far more sophisticated system which in the decades ahead will contain not just bibliographic information, but also textual material. The case history is presented to relate how the early stages of system design were undertaken in a specific instance. The actual design as presented is not the final design, but only the current organization of an evolving system. The only guarantee that can be made about the design is that it will be different within a month after this article appears.

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