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Management Aspects of the Use of the IBM System/7 in Circulation Control

In the fall of 1972, the Van Pelt Library of the University of Pennsylvania Libraries installed the IBM System/7-2790 Data Communication System for circulation control replacing an IBM 1030 Data Collection System which had displaced a manual system in 1969. This article will describe the System/7 installation at the University of Pennsylvania with emphasis on the management aspects of the system with only brief mention of circulation procedures or processing programs. Reference will be made to variations in S/7 implementation by six other libraries.

System Configuration Description

The University of Pennsylvania Libraries, with a collection of 2,473,000 volumes, serves a student body of 20,000 and a faculty of 1,730. Of the twenty-three libraries on campus, four use the System/7 for circulation control: the Van Pelt Library, housing the general book collection of 1,455,000 volumes in the humanities and social sciences; the Fine Arts Library with 55,000 volumes; the Wharton School of Business Library with 163,000 volumes; and the Penniman Education Library with 93,000 volumes. Books are borrowed from these four libraries using a punched identification badge issued by the office of the registrar, and a punched 80-column book card prepared by the library's Data Input Office.

Van Pelt Library, with an annual out-of-library circulation of 170,000 has four 2791 area stations for circulation transaction input, whereas each of the three departmental libraries with a smaller annual circulation of

approximately 20,000 has one 2791 area station. These seven terminals are connected by a single-shielded multiple twisted-pair wire "loop" which leads out from and back to the System/7 minicomputer located in the Van Pelt Library.

The 14K System/7 supports the 2791 area stations; a 5028 operator station; the S/7 data files; and S/7 programs used for file initialization, file load from and transfer to the System/370, data capture from the 2791 area stations, and transaction logging on the fixed S/7 disk. The circulation control software packages for the System/7 used were developed by IBM with the University of Pennsylvania and are available from IBM as Field Developed Programs.

Communication with the host computer uses a binary synchronous adaptor, 2000 BPS Modem, voice grade line, and 2703 Transmission Control Unit Port. Transmission is at 2000bps via a dial-up facility, with processing on a System 370 Model 168 using OS/VS2 operating system at UNI-COLL, a computer consortium serving a number of colleges and universities in the Philadelphia area.

Reasons for Selection of System/7

After a thorough study of five circulation systems, initial arguments for a change to the System/7 from a 1030 system reflect an ongoing interest in the management and operation of the system, i.e., factors affecting cost and performance. System/7, we argued, with minimal increase in costs, would give increased hardware capability, would increase reliability and decrease maintenance with the less mechanical/more electronic hardware elements, would increase staff productivity by making work easier and faster, particularly with the keyed variable data entry, and would require a minimal adaptation of existing library software and circulation procedures.

2791 Area Stations

The programmed transactions of the 2791 area stations is the most important factor influencing staff performance, and consequently staff salary — the most costly component of the circulation budget. The 2791 terminals at the University of Pennsylvania accept twenty-four transactions, of which five (with asterisks) are not currently used. The major transactions are:

- Charge
- Discharge
- Renewal

Reserve Discharge

Fine Paid: Fine Paid Entry*

Fine Paid Renewal

Fine Paid Discharge

Fine Paid Entry, Keyed*

Call-in Request

Two transactions, Keyed Transactions and Special Transactions, are broken into several components by keying a function code. These are:

Charge, Keyed

Borrower's List

Borrower's List, Keyed

Reserve Charge, Keyed

Call-in Request, Keyed

Card Data Entry

Badge Data Entry*

Keyed Data Entry

Restricted Patron Entry

Delete Call-in Request

Change Reserve Period

Sign On*

Sign Off*

Badge Check

The 2791 area stations accept punched card, punched badge, and keyed data. This ability to key numeric information allows great flexibility in data entry for borrower identification numbers, loan periods, access numbers (or accession numbers), or codes.

All keyed data are easily verified before entry of the transaction by checking its display in a panel on the front of the terminal. A mistake noticed in the display may be cleared and correctly rekeyed without causing an error.

The terminal operator is guided through each step of a transaction by means of lighted messages on the Operator Guidance Panel. This panel matrix of thirty-two messages saves much time in the training of new staff members, particularly at the beginning of a new semester when up to as many as thirty new student assistants arrive in one week to work not only during the daytime hours when a supervisor is available, but also late nights and weekends when a supervisor is usually not on duty. The instructions also give guidance to the regular staff member entering transactions used occasionally. For example, to charge a book the messages read "Insert Patron ID," then "Insert Book Card." However, a more complicated transaction, such as

entering or deleting a Restricted Patron will have as many as five instruction messages to complete the transaction.

Several terminal transactions such as Restricted Patron Entry or Delete Call-in have built-in safeguards so that they cannot be used except with the express permission of the supervisor. These transactions require a supervisor key to be placed in the terminal in operation-mode before they may be performed, thereby preventing entry or deletion of data by unauthorized persons.

Since the 2791 area station transactions are programmable, a change in the function of a transaction is possible should such a change be necessary after initial planning. At the University of Pennsylvania one and one-half years have passed since we worked on the specifications for the terminal operations. Now that we are adding reserve book circulation to the system, our requirements for the reserve transaction have changed from our original specifications. With the flexibility that the programming capability of the terminal provides, we are able to have reprogrammed, at our expense of course, the Reserve Charge and the Keyed Data transactions to permit great variation in loan period for each library.

System/7 Files

The on-line file capability of the System/7 is one of the major advantages of the system over both the totally off-line system, which cannot provide immediate response, and the totally on-line system, which requires continuous connection with the main computer. The on-line files, which I will describe individually, are named Access Number, Call Number, Reserve Book, and Restricted Patron. A fifth file, the Transaction File, accepts information on-line but stores the data for later transmission to the host computer which then processes the data.

The Call Number File contains the call numbers and requestor number for books in general circulation which have been requested for use by another patron. As a book is discharged, a check of the Call Number File providing a match aborts the transaction and causes a "hold" message so that the book may be placed on the hold shelf. Upon the charge of a "hold" book the borrower ID number is checked against the file so that the first requestor only may charge the book. If the person charging the book is not the first requestor, the transaction is aborted, and the appropriate message notifies the terminal operator of this condition. Two requestor ID numbers may be held with each call number to provide for two charges of a recalled book in a single day.

The Access Number File contains the computer-assigned sequential access number of books which are called in. Since books are renewed or called in using this 6-digit number, which is listed beside each call number on the circulation printout, a matched entry on a renewal transaction will result in the message that the book has been called in. For books being recalled, display of the number of outstanding requestors will appear on the terminal display panel.

Deletions from both the Access and Call Number Files are made after processing by loading a program on the System/7 to pull back the library program update for each file from the host computer.

The Restricted Patron File contains the ID number and the numeric restricted reason code as entered by the library. A match made with this file as an ID badge is inserted in the terminal, or the ID number is keyed on the terminal, aborts the transaction, lights the appropriate message and displays the reason code. The restriction may be overridden by use of the supervisor key so that a patron restricted by one library might borrow at another as determined by library policy. The reason code contains three digits, two for library code and one for reason, so that more than one library may place a patron on the "restricted" file for a variety of reasons, such as lost ID badge, wrong address, or a large unpaid fine total.

The fourth on-line file, the Reserve Book File, contains the book, borrower ID and reserve loan period information. A discharge will eliminate the record from this file. However at discharge, if the book is overdue, the overdue time in hours and minutes will display so that a fine might be collected. The reserve transaction activity is passed into the fifth file—the Transaction File—for statistical reporting and those listings to be provided by the library processing programs.

The Transaction File, which can presently hold 15,000 transactions, gathers sequentially the input data and notes the julian date, terminal address, transaction code number, and time of each entry.

The ability of the on-line files to detect books which have been called in saved 2.5 hours per day of a library clerk's time by eliminating the necessity to retrieve recalled books from the library stacks and sorting shelves. The ability to detect improper withdrawal of a recalled book has saved the followup created when it was not possible to know in every case if the proper person was charging the book. The immediate knowledge that a book has been called in permits more accurate information at the circulation desk when either renewing or recalling that same book.

The use of the Restricted Patron File to alert a patron that his address has not been updated, to catch an ID badge that has been reported "lost," or

to remind the patron with very overdue books or unpaid library fines to rectify that situation has saved time spent in locating a library patron who, prior to using the System/7, could often not be identified at all.

Five months after the System/7 was installed, the Van Pelt circulation staff was able to decrease staff size from ten to nine full-time clerks due directly to the time saved by the on-line file capabilities and the increased speed with which the 2791 terminals accepted transactions, particularly those requiring keyed data. The departmental libraries, however, with less staff, have not been able to decrease staff size because of their need to have sufficient numbers of people to cover circulation desk schedules.

Factors Affecting Operation

Transmission of the files to the host computer is such that the instructions for start-up and initial program load are short and easily followed by the library staff simply by pressing the Start, Reset and Program Load buttons on the System/7 and typing brief instructions into the 5028 operator station. Thus, no specially trained personnel are required to handle the normal procedures for daily operation. The library clerk on duty in circulation until the library closes at midnight transmits the data as his final responsibility of the day. An average day's file of 3,000 records takes approximately 30 minutes to transmit.

Altogether six programs are utilized regularly by the library staff: SHASP to transmit data to the host; ANINE, CNINE, and TNINE to wipe out the Access, Call Number and Transaction Files after successful library processing is verified; RHASP to receive updated A and C files from the host; and LIBRARY to initiate the S/7 loop. Several variations may be used within the transmission of the Transaction File so that either a totally new file may be sent, or a partial file adding to a previous transmission starting with *Record XXXXX*, or a partial file to be viewed as a new file starting with *NEW (record) XXXXX*. These variations enable transmission of records to the host computer at various intervals, without the necessity for successful library processing to occur after each transmission.

When the library wishes to process after transmission of data, a telephone call is made to the university data processing office to enter the circulation job deck on their remote terminal. The library batch processing programs, written in PL/1 by the library systems office, process the transactions and update files usually four nights each week. These programs generate a circulation listing, notices, reports, messages, and punched book cards. The output is transmitted back to the university data processing office for

printing, decollating, and bursting before morning delivery to the Van Pelt Library.

The circulation staff can control all of the anticipated circulation operations. By entering a single punched card through the 2791 terminal using the Card Data Transaction, instructions are logged to run the special jobs using library program cataloged procedures producing the "End-of-the-Month" procedure which reorganizes the master file and prints monthly bills, or "Stack Search" request which lists in call number order all active tracers, Reported Lost-Reported Returns, and very overdue books. Job decks are entered at the data processing office to obtain faculty clearance notices, to change a loan period or fine assessment, to add an internal location badge, to change a notice message, or to obtain address lists for students, university personnel or library courtesy borrowers.

The service of a person trained in programming or operations is required for maintenance of the processing programs, or for special listings and reports. With the close of the library systems office in May 1974, the library has a contract with a local software firm to maintain the applications programs.

Maintenance of the hardware and System/7 control programs is handled by IBM as necessary. Loop diagnostic testing is done using 2K of the memory without the need to bring the loop down. Preventative maintenance is aided by the logging of error messages on the 5028 operator station connected to the System/7. Thus, when a particular terminal is losing tolerance for ID badge variations, the appropriate coded message is produced so that the badge reader might be adjusted. The excellent IBM service provided for the 1030 system has proved to be the same for the System/7. Should the loop need to be brought down for special line testing, arrangements are made to do the testing at times convenient for the library. Should the loop go down during normal operation, it is reinitiated by Load Library, a four-statement program, on the System/7 via the 5028 operator station.

Staff and User Response

The changeover from the 1030 System to the System/7 in Van Pelt Library was accomplished easily because of the similarity in operation of the 1030 and 2791 terminals. Batch program conversion was chiefly in the editing program to allow for the new S/7 record format. For the three departmental libraries, changing from a totally manual system to the S/7, the change was eased by complete documentation by IBM for the system software and by Van Pelt for the circulation software and procedures. Formal instruction by the circulation librarian covering the operation of the terminal and the basic

concepts of the library processing was held while equipment was being installed.

After several tests of programs with data input through the System/7 by the Van Pelt staff, the Van Pelt library changed from the 1030 system to the 2791 system in one day. After just one week of parallel operation, the departmental libraries were anxious to stop their manual systems to concentrate on the automated system. With one and one-half years of operation using the System/7, the initial enthusiasm for the system is still evident in the answers to a recent survey.

The staff likes using the terminal, finds it easy to use and faster than the 1030 terminal in acceptance of data. It finds the guidance instruction panel easy to follow, and uses the instruction messages particularly when entering a little-used transaction. Staff members with experience using the 1030 system said that benefits of the System/7 are greater reliability and versatility, less chance for error due to mechanical problems, and the ability of one terminal to handle all transaction types. Those staff members comparing the System/7 to a manual system said that S/7 benefits are that it: eliminates routine overdue searching and tedious recordkeeping, allows more time to assist the library users, provides better organization of the work to be done, enables work to be kept up to date, eliminates illegible charge records, and makes circulation information readily available to the public.

In a recent survey of user response to the new circulation system, 82 percent of the 406 respondents said they like the automated system; 15 percent said they liked it most of the time, while only 2 percent said they disliked it; 91 percent said book charging was faster; and 72 percent said they rarely had to stand in line to get a book charged.

Reports

Although not a specific function of the System/7, a noteworthy aspect of the management of the circulation system is the reports generated by the library processing programs, such as daily statistical reports, terminal usage, interlibrary loan charging, inventory and missing book listings, and collection usage. Altogether the programs provide for twenty notices printed on mailer forms, and twenty-four messages which can be produced daily as applicable. A History File containing book information, borrower ID, date charged, date discharged, date due and transaction status at time of discharge is used for report generation as requests arise. The addition of the Reserve Book Circulation File will enable us to look at reserve collection usage by call number, length of loan, and time of day.

As part of the recent circulation procedures and user study, a statistical report indicating the number of transaction types per hour per terminal enabled the staff assignment for charging and discharging to be rescheduled on the basis of proven activity. This eliminated 31 hours per week of time previously designated for these functions.

As with most other automated systems, however, the greatest savings have not been with reduction of staff, but with the increased activity and output of the staff. Even with an increase of 10 percent in circulation activity and the decrease of staff size since the installation of the System/7, library clerk assignment to service a very busy information desk has been increased by 6 hours a day, and all functions are now regularly performed including an extensive monthly stack search for missing books.

Occasionally the loop is down so that a backup procedure for charging using a temporary book card set must become operational. However this occurrence is rare, and the invalid format listing for bad transmission of data is so infrequent that several months pass before an error of this type is listed for correction.

Responsibility

Several aspects of the circulation procedures are controlled centrally: the keypunch operation for production of book cards; entry of all card data transactions—tracers, reported returned/lost, and temporary book cards; the dissemination of output; handling of supplies; system maintenance; and system operation. This centralization has provided a channel for clear communication between the four library circulation departments, IBM personnel, and the library systems planning office. However, each library maintains control for its own policy regarding loan periods, fines, exceptions to restrictions, and hours of operation. Each library receives its own circulation listing, messages, notices, and daily reports.

The budget considerations are handled centrally by the Van Pelt circulation department, so that decisions such as to process during premium time, not to process at all, or the proposal to extend and modify the system for reserve circulation are made by the circulation librarian in conjunction with the systems office or in consultation with the director of libraries. Unlike many automation projects, the library is totally responsible for the cost of supplies, equipment, maintenance contracts and processing charges at UNI-COLL where processing is done during the third shift to keep costs at a minimum. Costs of the DPC for paper, printing, decollating and bursting, however, are assumed by the DPC and are not currently charged to the library.

Uses of System/7 by Other Libraries

Although I have described the use of the System/7-2790 data communication system as used by the University of Pennsylvania, other libraries using the System/7 for circulation have made modifications in the Field Developed Programs, or contracted separately with IBM to write support for the System/7 to meet their specifications. Brookdale Community College utilizes the keyed data function heavily for charging of nonbook materials by modifying the charge transaction of the FDP. A two-digit media code assigned to audiovisual materials or equipment kits allows up to ninety-nine different types of material to circulate by keying the assigned number in the terminal.

American University, Georgetown University, Howard University, and the University of Ottawa collaborated in the development of their system requirements. Each uses fewer transactions on the 2791 area stations than the FDP provides, and each uses three files on the S/7 disk—Transaction, Hold, and Delinquent Patron. At American University two 1053 printers are attached to the area stations for the printing of fine receipts upon entry of the Fine Paid transaction. Georgetown uses a printer for receipts, exit passes, and brief messages, for example to flag a hold book or an ID being used with no address on file. Georgetown can inquire the Transaction or "Log" file via the 5028 printer. Both universities have the host computer call up the System/7 for the transmission of data.

The University of Ottawa, with an asynchronous communication link to a 360/65 computer, has developed programs to IPL from a remote terminal when transmission of data from a S/7 disk to the computer needs to be initiated.

Slippery Rock State College uses a System/7 without a disk which connects directly to the school's 370 computer or to an 029 keypunch when the computer cannot be dedicated to the library.

White Plains Public Library, with needs differing from college and university libraries, is using six transactions—charge, discharge, renewal, special loan, reserve or "hold," and update for reserve and patron alert updates. Their processing will be handled somewhat differently by removing the S/7 disk and taking it to the City of White Plains data processing center, there using a compatible IBM System/3 computer for processing. Inventory control will be handled by attaching a 2796 terminal to the System/7 loop. This terminal will be taken to the stacks where the book card accession number will be read into the terminal and registered in the System/7 disk file. A match of these items against the circulation file and bibliographic file will determine the missing items.

Future Plans and Summary

The University of Pennsylvania Libraries is successfully using the System/7 in four libraries for main stack circulation control. Plans to extend the use of the system to the reserve book collection are well underway. To do this a second disk will be added to the System/7 and core increased to 16K. Since developmental efforts will no longer be borne by the library in the form of a library systems staff, the library has contracted with IBM to modify System/7 software to enable use of the disk and with Information Engineering to modify the library processing programs to manipulate a reserve file for report purposes.

The circulation system using the System/7 minicomputer, or a distributed logic computer system, has the advantages of: immediate detection of book reservations; on-line file search, for reserve collection circulation or restricted borrower; access to recent transaction file on the minicomputer; programmable transactions to meet individual library needs; and complete documentation to support the software package for System/7. The on-line features are all available at avoidance of expense of continuous computer time and storage dedicated to the library. Certainly the adaptability of the System/7 to library circulation systems makes it an attractive contender for circulation control.

Costs

Although the costs of any system vary depending on the configuration of the hardware, the software capability and the algorithm for computer processing charges, the list of costs for the University of Pennsylvania give some information, not for comparative purposes, but for additional information regarding this particular system. Table 1 gives cost information.

Installation of System/7		
Ship terminals		\$ 251.26
Install terminals—University of Pennsylvania		164.37
Install terminals—IBM		1,605.93
Wiring		2,945.26
Install security/Cate		369.85
Install data set		115.00
Total		\$5,451.67
Purchase		
4-drawer file for 80-col. cards		99.00
8-drawer file for bills		155.20
Wright line card punch		935.00
Square hole registration punch		475.00
Total		\$ 1,664.20
Supplies		
Book cards	75,000/yr.	137.00
Temporary book card sets	25,000/yr.	655.00
Data mailers	75,000/yr.	2,254.50
Validation stickers	33,000/yr.	330.00
ID courtesy badges	3,000/yr.	490.00
(Printout paper—not charged to library)		
Total		\$ 3,866.50
Equipment Rental		
Data set	\$ 79.15/mo.	949.80/yr.
3 029 card punches	265.00	3,180.00
7 2791 terminals	1,014.00	12,168.00
System/7 modules	1,916.00	22,992.00
1 5028 station	120.00	1,440.00
Program Rental (2 years only)		
Sys/7 control programs	\$ 275.00/mo.	3,300.00/yr.
Sys/7 S370 Communications	50.00	600.00
Total		\$44,629.80
Processing*		
CPU, core, storage, channel, cards read, cards punched, lines printed, tape rental, cards, forms change		\$16,732.00
Staff		
3 data input clerks		23,400.00
135 clerical supporting staff (inc. 3 supervisors)		138,940.00
Student assistants—Van Pelt 8072 hr/yr.		16,940.00
-3 departmental libraries		?

*1974 Processing Charges to date are 50 percent less than 1973 charges.

Table 1. 1973 Circulation Costs for Van Pelt, Fine Arts,
Lippincott and Penniman Libraries of the University of Pennsylvania