APPLICATION OF INFORMATION TECHNOLOGY IN LIBRARIES

INTRODUCTION

Librarians are increasingly turning to information technology to automate a number of functions in the libraries. A large number of libraries in the world have automated one or more of the following functions:

a) Acquisition,
b) Serials control,
c) Circulation,
d) Cataloguing,
e) Inter-library loan, etc.

For automating the above functions, information technology offers two approaches at the system level, i.e. integrated systems approach, and distributed systems approach.

INTEGRATED SYSTEMS APPROACH

In the integrated systems approach, a single system is used to implement automation in all the functions or activities. This has the advantage that all the data files reside on a single system, which facilitates easy flow of information among various applications i.e. the automated functions of library. Data can be organised efficiently reducing redundancies to the minimum. However, the systems has some drawbacks, i.e.

a) To keep all the applications on the same system, a heavy investment on a large configuration is required.
b) To give on-line support to a large number of users, it requires a large disk storage and a powerful CPU to ensure reasonable response time for the users,
c) The system requires a mainframe computer which involves high initial investment and
d) Failure of the system puts all applications out of gear.

DISTRIBUTED SYSTEM APPROACH

A distributed system approach permits incremental growth with low initial investment. One application at a time can be implemented and dedicated systems can be used for different applications. Different systems are interconnected to cooperate with each other. Multiple interconnected systems provide backup capability, i.e. if one system fails, another could be used to run the same application. Critical data may be stored in more than one systems, thus providing redundant copies of the data that may be used in the event of a catastrophic failure. Distributed systems also permit the use of computers purchased from different vendors and thereby provides greater flexibility to the user. In general, the distributed systems give an overall improved response and performance.

The distributed systems are also not free from drawbacks. When multi-vendor systems are used, inter-system operability of hardware and software is not guaranteed. Data storage
formats in different systems may vary leading to difficulties in exchange of data among them. The maintenance of integrity, security and privacy are more difficult in the distributed system than in the centralised or an integrated system.

INFORMATION TECHNOLOGY AND COMPUTERS

For automating library functions, a variety of computer systems and latest techniques of information technology are used to a varying degree. They include:

- Personal computers
- Mini computers
- On-line systems
- Large centralised terminal oriented systems
- Local area networks
- Wide area networks
- Public switched telephone networks (PSTN)
- Satellite networks
- Fibre optic transmission systems
- Optical disk systems
- Facsimile systems
- Electronic imaging systems

Three approaches have emerged for the adoption of a software:

- Development of an in-house application program,
- Acquisition of a standard DBMS from commercial sources and addition of an application layer to suit the bibliographic applications.
- Acquisition of a tailor-made bibliographic DBMS from commercial sources.

CONFIGURATIONS FOR LIBRARIES OF DIFFERENT SIZES

The extent to which information technology is applied in a library depends largely on the size of the library. The number of holdings, the number of periodicals subscribed, the clientele and the availability/ non availability of on-line user services determine the computer configurations and the class and the number of computer systems to be used. In cases where on-line services are provided it is assumed that the bibliographic information about documents along with the keywords is maintained in the computer. The first step in planning a computer configuration for a library is to categorize the status of a library as follows:

If H, P, C, S, represent the maximum number of holdings, maximum number of periodicals subscribed, maximum number of registered users, on-line user service support, and S1 & S2 represent absence or presence of on-line user services, respectively, a library may be categorized by means of a tuple comprising four elements H,P,C,S as follows:

Very small library ( < 50,000, 100, 2000, S1);
Small library (1,50,000, 300, 3000, S1);
Medium Library(3,00,000, 500, 5000, S2);
Large library (5,00,000, 1000, 7000, S2);
Very large library ( >5,00,000, >1000, >7000, S2);

While selecting the computer configurations for various categories of libraries, four important parameters needed to be considered are as follows:
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a) Storage capacity;
b) Processor speed;
c) Software; and
d) Networking capability.

**Very Small Library**

For a very small library, two PC/XT systems with the following specifications would suffice.

- 8088 based CPU @ 8 or 10 MHz speed,
- 640 KB main memory,
- 40 MB Winchester disk,
- 1 serial port and 1 parallel port,
- B/W monitor,
- MSDOS operating system,
- CDS/ISIS or DBASE III plus software,
- PC-to-PC communication software and
- 132 Col. NLQ Printer.

Although one PC/XT will serve the purpose, it is desirable to have another PC/XT as a standby system. To get the best results, all the updates must be carried out on both the systems. In order to avoid the duplicate effort of inputting the information and the occurrence of possible inconsistency in data due to typographical errors, a simple PC-to-PC communication link may be established using RS 232 C links.

To transfer files between the system, many low cost software packages, such as KERMIT, MSNET, PROCOMM and CROSSTALK, are available. CDS/ISIS is a good choice to automate the library functions although DBASE III with some programming may well serve the same purpose. DBASE III plus also supports network functions and would enable file transfer between the two systems.

**Small Library**

For a small library, a system configuration with two computers similar to that of a very small library is suitable. However, a more powerful PC is required and a PC/AT with the following specifications will serve the purpose.

- 80286 CPU @ 10 or 12 MHz speed,
- 1 MB main memory,
- 80 MB Winchester disk,
- 1 serial and 1 parallel port,
- B/W monitor,
- 132 Col. NLQ printer,
- MSDOS operating system,
- CDS/ISIS or DBASE III plus software and
- PC to PC communication software

**Medium Size Library**

For medium size libraries with on-line access facilities, a larger computer system and a local area networking environment are required. Users may access the database from a number of terminals/PCs. Simultaneous operations of catalogue updating, inputting, issue/return, record and bibliographic search can take place. The larger computer system having a powerful CPU may hold the complete database and provide a good response time. A suitable configuration may be as follows:

- 80386 based CPU,
- 4 MB main memory,
- 160 MB Winchester disk,
- Serial and parallel ports,
- B/W monitor,
- 132 Col. NLQ printer,
- Unix operating systems and
- A bibliographic DBMS or a relational DBMS with a user written shell.
- A Local Area Network (LAN) can be configured in the library in one of the following three ways:
1. Star configuration of LAN,

\[
\begin{array}{c}
\text{T} \\
\text{PABX} \\
\text{T} \\
\text{MAIN}
\end{array}
\]

\[T = \text{Terminal system}\]

\[\text{MAIN} = \text{Main system holding the database}\]

2. Bus configuration of LAN

\[
\begin{array}{c}
\text{T} \\
\text{T} \\
\text{T} \\
\text{MAIN}
\end{array}
\]
In a star LAN, the serial ports of the main computer system are connected to telephone lines through modems. Similarly, other access systems like PCs are also connected to the telephone lines via modems. The PC can dial up the number corresponding to the port of the main system and establish communication link using the PABX lines. This configuration is economical and does not call for special networking interfaces and software. However, once a port of the main system is engaged for a user, it is not available for other users. On the other hand, the bus and the ring configurations permit a large number of systems to access the main system quasi-simultaneously. These configurations require specialised interfaces and software packages. These are generally suited for heavy traffic situation and are recommended for large and very large libraries.

**INTER LIBRARY NETWORK**

For catalogue access and document interchange among various libraries, inter library network is used with wide area communication facilities. These may be:

- Public Switched Telephone Network (PSTN),
- Public Data Networks (PDN),
- Satellite Data Networks (SDN),
- Network of Leased Lines and
- Integrated Services Digital Network (ISDN).

PSTN works on the basis of circuit switching. In this case, the computers in two different libraries are connected to each other by a wire path which is dedicated to these systems for the entire duration of communication. In this type of switching systems, a call is set up, data is transferred and the call is released. It may be noted that once a call is set up, the line is held
even though there is no data transfer using the line. PSTN, however, is the most easily available form of communication that could be used for data transfer purposes.

Presently, many countries have set up dedicated public data networks (PDN) for data transfer. These networks work on a packet switched mode wherein a physical line can be used more efficiently by multiplexing message packets from a number of sources. In packet switched networks, the packets are moved from one station to another in hops and thus the network functions in a store and forward fashion.

Satellite networks are, in general, broadcast networks where a message transmitted by one station is heard by all other stations. However, frequency division multiplexing and time division multiplexing techniques can be used for providing point to point links in satellite networks. The main reason for this is that a number of switching stations are involved in terrestrial connections whereas in the case of satellite networks the only switching station is the satellite itself. Satellite data networks may be single hop or two hop networks. In a single hop network, the ground stations use larger antenna and powerful transmitters and hence are more expensive. In a two hop network, there is a large central earth station and a small inexpensive user terminal. There can be no direct user to user communication in this case and all communications have to be routed via the main earth stations.

ISDN is relatively a new concept where a single network may be used for a number of services like voice, data, facsimile and so on. Such networks when realised will offer fairly inexpensive mode of data transmission and document interchange.

FULL TEXT STORAGE SYSTEM

Another important area of information technology that is likely to find extensive use in libraries is the electronic imaging system.

These systems permit the storage of complete documents including diagrams and graphs in electronic media. With the use of optical storage devices, these systems are ideally suited for archival purposes. A block diagram depicting various components of an electronic imaging system is shown below:
FIBRE-OPTICS

Optical fibres are emerging as an alternative transmission media to co-axial cables in telecommunication networks. There are three types of optical fibres:

- Step index single mode
- Graded index multi-mode
- Step index multi-mode

Of these, the first one is the most expensive but has a high bandwidth capacity. The commonly used fibres are graded index multi-mode type. Optical fibres have several advantages over the electrical cables but are not without problems. The merits of the optical fibres stem from the fact that the basic material used in their construction is non-metallic and electrically non-conductive. The problems are due to their delicate structure.

CONCLUSION

The world is passing through an age of unprecedented information explosion. As the time passes, the librarians and information scientists will be called upon to handle, process and supply larger and larger volumes of information. Recourse to automation and employment of information technology is, thus, inevitable. However, the computer and communication technology, itself, is passing through a period of extreme evolution and development. In the times ahead, therefore, libraries and information centres will have to employ more and more of modern information technology to cope with the rapidly multiplying literature and its demand all over the world.