

# INFORMATION TECHNOLOGIES FOR LIBRARIES AND INFORMATION CENTRES

A LAKSHMANA MOORTHY and V RAJENDRAN

*Defence Scientific Information and Documentation Centre, Delhi-110 054*

## ABSTRACT

For the past few years, the tremendous strides taken in the fields of information technologies have changed the society into an information conscious society. There is little doubt that the impact of these technologies on the day-to-day functions of information centres is an everlasting one. The innumerable advances in different fields such as computers, communications, electronic mail, voice mail, teletext, videotext, telefax, videodisc, CD-ROM, electronic publishing, etc have left no area in the library and information field immune for their application. And many areas still remain undiscovered.

This paper, first in a series, makes an attempt to overview the impact of the information technologies on the library and information services. A brief discussion of electronic message and document delivery systems, and electronic mail are also presented.

## 1. INTRODUCTION

Information is becoming one of the major resources on which our information society is based. Technology is the means by which this resource is stored, retrieved, and transmitted to the users in the form and at the location of their choice. Much of our attention is centred on the ways and means by which the above activities are best achieved.

Now a days, information centres are facing multiple problems. The number of documents published in any subject field is so vast that the libraries cannot think of acquiring comprehensive collections in any field. The

ever shrinking library budgets cannot help in acquiring balanced collections to satisfy the needs of its clientele. And the escalating prices of books and serials cannot keep libraries to maintain status quo in journal subscriptions and document acquisitions. This situation changed the basic norm of the libraries, from acquiring comprehensive collections to providing comprehensive access to information. To achieve the comprehensive access to information, libraries have to use various technologies and services.

Any information service will deal with the aspects of acquisition, storage, analysis, retrieval and dissemination of information to the users for whom the service is intended. The technologies which improve the efficiency and effectiveness are taken as inputs into the information system. These input technologies have been increasing in number and are known by the generic term 'information technologies' (ITs). Some of these are available for libraries for many years, while a few are now emerging as important tools of overcoming the barriers in the access of information. An appropriate mix of ITs and applications provide a competitive edge and ensure a timely and efficient dissemination of information.

The changes which resulted in the need for improving the information services are [1]:

- (a) The number of users of information is ever increasing and is hence becoming difficult to have informal, personal communication;
- (b) The geographic distances involved in certain routines of information acquisition

are too large. Though technology developments in other fields such as aeronautics, etc. has made the world closer, the huge prices involved in the acquisition of information by such means made it impossible. This has led to innovations in telecommunication fields;

- (c) The urge to use modern developments in the related fields of electronics, computers, and telecommunications;
- (d) The increasing role of information in shaping the economy of a society. This stems from the development that the countries which produce more information have an edge over others because of the use of that information results in technological developments and the dissemination brings in financial resources in foreign exchange; and
- (e) The changing notion of the information from *something to know* to *something to have* as any other commodity.

And unlike other commodities which can be exhausted by usage, information as a commodity is not depleted by use, rather the usage increments it; not lost by sharing, and is indivisible and accumulative. It has an important property of self-multiplication.

### 1.1 What Is Information Technology?

Broadly speaking, the telecommunications and computers constitute the major part of the information technology. While the latter's penetration is more in house-keeping, information processing, retrieval and dissemination, the former's penetration is in accessing the remotely-located databases. Perhaps there is no other technology which has penetrated libraries so much. The technology of information comprises a vast range of processes for storing information and duplicating it, for transmitting it from one place to another, for displaying it and for transforming it. The effects of the ever increasing usage of IT are felt in every day life, including home.

The first information revolution brought the written language for communication, the second came from the day printing and printed book came into vogue. Now computer and telecommunication technologies have brought the third information revolution, the effects of which, in terms of information, are far reaching.

In the present day society, information plays a dominant role. It has become a *commodity* in the industrialised countries. The contribution of information industry to the GNP has been ever increasing in the developed and industrialised countries. It was reported by Eileen Shanahan back in October 1985 in *New York Times* that over 70 per cent of work force of the United States are involved in organisations directly producing information-based services. It also reported that for every US \$ earned, 50 cents are coming from an information-related activity. It was stated [2] that sales in the overall online market (which is only a part of the information industry) look good and is expected to reach US\$ 9.9 billion by 1990 showing an actual increase of 15.8 per cent in 1985 with an increase of 36 per cent over 1984 revenues.

It is estimated [3] that six per cent of the GDP of the European Community (EC) is produced by IT core industries such as computers and peripherals, computer services, software and components. A further 29 per cent GDP is produced by industries which are highly dependent upon IT including telecommunications, office and factory automation, consumer products, banking and insurance, and defence applications. A further 20 per cent GDP is derived from activities highly dependent upon efficient information systems supported by IT including wholesaling and retailing, CAD, CAM, quality control, etc. Consequently some 55 per cent of the EC's GDP is directly or indirectly dependent upon IT including telecommunications.

The number of the sectors supplying inputs to IT, telecommunication components,

systems and subsystems are large. There is no doubt that the information industry is the world's fastest growing sector which includes computers, software, databases, compact and videodiscs, communication equipment and a large number of the electronic gadgetry as well as the traditional printed media. Application of IT in information centres raises the efficiency of information acquisition, handling and use, and thereby assist us in being better informed about our relative economic performance.

Lancaster [4] is one of the few who foresaw a paperless information society. In his words, the society finds itself in the early stages of natural evolution from print-on-paper type communication to an electronic media type communication. In another context he reported [5] that by the year 2000, 50 per cent of the existing abstracting services will be available only in electronic form, while 25 per cent of the existing periodicals in science and technology, social sciences and the humanities will not reach this conversion level until after 2000. 25 per cent of the reference books will be in electronic form by 1990.

If the current trends in CD-ROM technology is any indication, there is no doubt that the above prophecy will become a reality in a very short time. In the times to come, more emphasis will probably be on non-print or audio-visual products such as microforms, videodiscs, videotex and teletext. As technology changes library activities too are certainly bound to change. This paper aims at overviewing the different technologies that penetrated the libraries and their impact on the information services. However, as the impact of computers is well known, this was not included in this review.

## 1.2 Electronic Library

An electronic library is one which provides a widest possible access to information by making use of the latest information technologies for retrieving information, to increase and manage its

information resources; and is equipped with a communication network for retrieving information that is not available locally. The main stress of an electronic library will be on the ability to enhance resources, speed of retrieval and communication of information; and usage of the ITs for timeliness of its information services, probably more cheaply than what we have been doing.

## 2. COMPUTER-BASED ELECTRONIC MESSAGE SYSTEMS

Computers are becoming common tools in many sectors of the society. The technological developments in the fields of computers and communications over the past three decades have led to a tremendous change in the electronic interchange of information between two points even if they are located in different continents.

A computer-based message system (CBMS) allows communication between people using computers. A message, or a unit of communication, is sent by its originator to one or more recipients [6].

CBMS can be used for communication between person-to-person, human-to-machine and machine-to-machine. DARPA Internet, CSNET, MLNET MZnet, and Diamond are examples of networks which use CBMS. A document or message sent through electronic systems may contain text, graphics, images, speech as well as other types of information such as electronic spread-sheets. A computer-based system used for sending a message or document may have such facilities as creating, editing, filing, receiving, transmitting and printing of the multimedia documents, all electronically. CBMS can be classified as shown in Fig. 1.

ISO (International Standards Organisation), EMCA (Electronic Mail Corporation of America), and CCITT (International Consultative Committee for Telephony and Telegraphy), etc. have

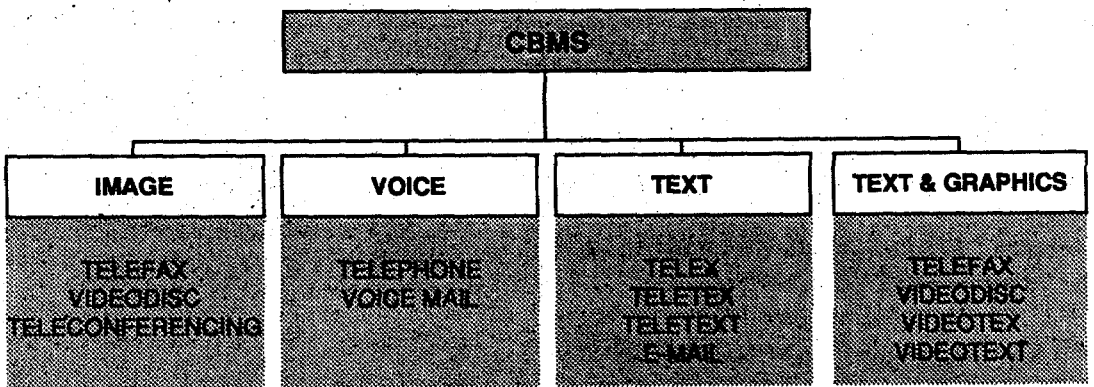


Figure 1: Classification of computer-based message systems

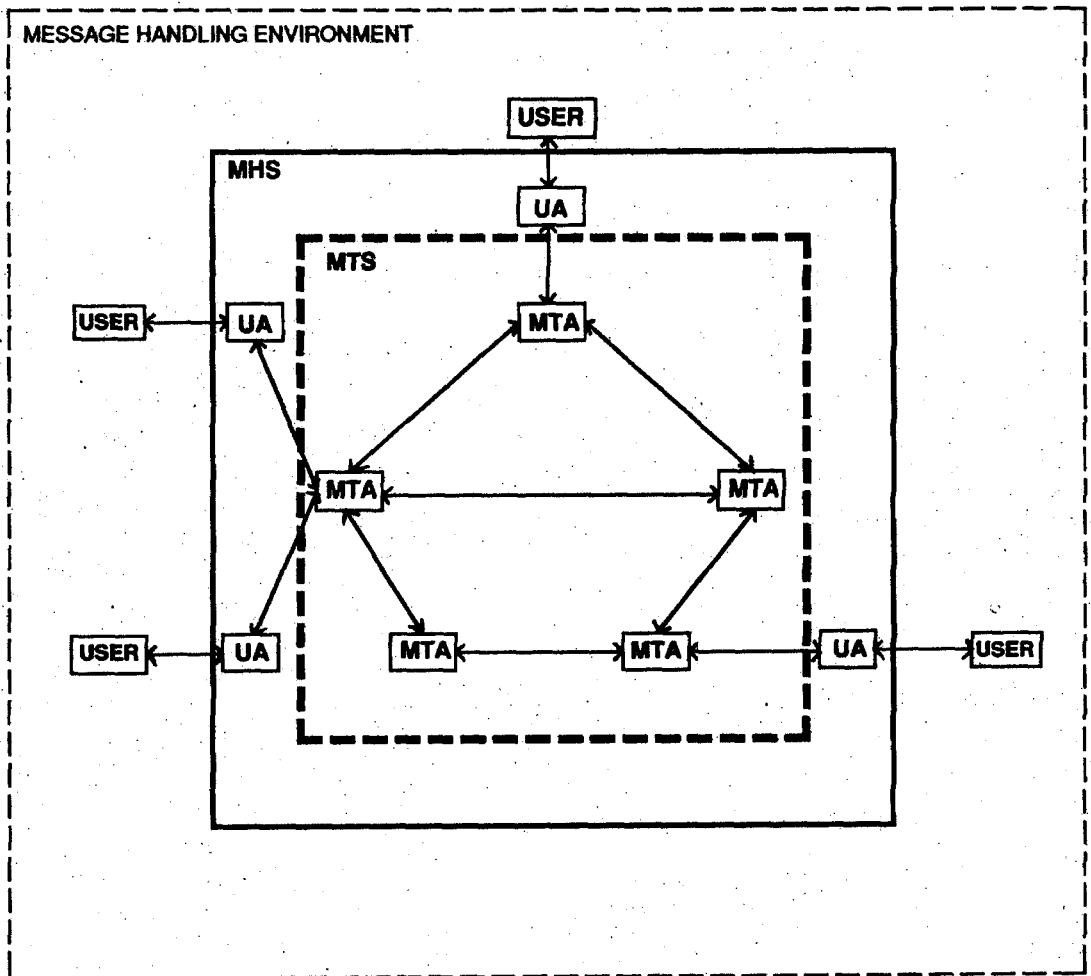


Figure 2: Electronic message handling and interchange model (CCITT)

developed models for electronic message handling and interchange. CCITT's model is shown in Fig. 2.

The CCITT recommendations on MHS [7] cover a wide range of subjects including service elements, protocols for message transfer, service facilities available to users, presentation, type conversion, teletex access, open system interconnection, etc.

An electronic message handling system (MHS) is a complex system comprising a message transfer system (MTS) which itself is a network of message transfer agents (MTA) and is aided by an intermediary, called user agent (UA). UA has two functions, viz. providing facilities to the user and allowing reception and transmission of messages to the MTA. The user can access the MHS through the UA to which commands can be given according to the need to send the message to a destination. The message is then passed to the MTS via the MTA associated with the user/intermediary which ultimately reaches the destination through the network.

Dissemination of information in an accurate, timely and economical manner is an important factor that can decide the future of any information system. Electronic messaging offers many advantages in improving the information flow process. The information may be orders for online acquisitions, invoicing, numerical data or any other information needed by the user.

Electronic messaging does not require the information provider (originator) and seeker (user) available at the same time. Systems using mailbox can offer a wide variety of options which include receiving, transmitting, sorting, filing and retrieving stored information when needed. Different persons working on the same project spread over a large area, and working in different hours can communicate with each other. Electronic transfer of information decreases

preparation and delivery costs compared to the traditional services such as telex, letter or courier. The person who is sending information can transmit the message faster avoiding a lot of intermediary routines associated with traditional services.

### 3. ELECTRONIC DOCUMENT DELIVERY SYSTEMS

One of the important functions of an information system is to provide material requested by its users. When the required material is not available in-house, the system may try to obtain the material from other libraries or a documents supply centre (DSC). Electronic document delivery system (EDDS) can provide immediate access to the user provided that the system is connected to the DSC and the required information is stored in electronic media. Magnetic tape, video tape, videodisc and CD-ROM, etc. can effectively be used in EDDS. This eliminates the inordinate delays in the supply of documents by conventional means, including online ordering. In online ordering, even when the required document is available, due to communication shortcomings and the time taken in supplying, it may take several days before the required document is received by the user. Though this can reduce the delay considerably over conventional ordering, it is not a match for EDDS which can provide immediate access. Another feature of EDDS, apart from speed, is the convenience in access.

Four major steps are involved in EDDS, namely inputting, storage, transmission and output or delivery. In inputting stage, the information in print media is converted into digital form using a suitable method such as optical character recognition (OCR) devices or scanners. When the information is already in machine-readable form, through a conversion program, this can be digitised. For storage there are three main media, viz. magnetic tape,

video tape and digital optical disc. Transmission of information is achieved by several means. Telefax or facsimile transmission can be used to transmit both textual and graphical material over telecommunication links. But satellites can offer a better transmission than telephone lines (for a comprehensive treatment of the subject see [8]). The output can be chosen in one of the three forms, namely, hardcopy, microform or alternately display on a TV screen or a VDU.

The following factors influenced to the establishment of many projects on EDDS.

- \* The need for a rapid, reliable delivery of high quality primary information;
- \* The latest developments in the technology of information capturing, storing, transmission and display;
- \* The development of optical discs as an alternate medium of printed publications;
- \* The support given by inter-governmental agencies like the European Commission and the consortia like that of ADONIS; and
- \* The success, growth and popularity of online bibliographical retrieval services.

The Commission for European Communities (CEC) in 1979 has commissioned, a large American Consulting firm to undertake a feasibility study on large-scale document delivery system. As a result, ARTEMIS (Automated Retrieval of Text from Europe's Multinational Information Service), an open-ended network of computers and communication links through which a number of documentation centres could provide full-text on demand either in facsimile or digitised form was conceived. There have been a number of other projects and schemes for electronic transmission of documents. HERMES, which is basically a telex system sponsored by British National Physical Laboratory, Department of Trade and Industry and Printing Industry Research Association, UK, (1981); APOLLO (Article

Procurement with Online Local Ordering), a joint project of CEC and European Space Agency (1981), the British Library Facsimile Transmission Project, launched by the R&D Division of the British Library (1984), Transdoc, a French Consortium (1982), Fiz4 of West Germany (1982) and the Eurodocdel, a joint venture of Europe Data (of Elsevier) and CII Honey Well Bull of France, are a few to mention.

Specific mention is to be made here of the ADONIS (Advanced Document Over Network Information Services) project which is a Consortium of major European Publishers including Blackwell, Springer-Verlag, Pergamon, Elsevier, Academic and Wiley. The Consortium has undertaken discussions in Europe, USA, Japan and other governmental agencies and publishers, and document supply centres like BLDSC with a view to set up a world-wide electronic document supply system. ADONIS aims to supply articles on demand from a database of about 5000 important journals supplemented by a five-year back-file provided by 200 publishers. The journals will be stored on optical videodiscs from original printed versions and transmitted to local centres where they will be printed and supplied for a fee [9]. Useful features of the system include

- \* dissemination of contents lists of S&T periodicals, books, monographs, etc;
- \* full-text of patents, standards, articles required;
- \* availability of a comprehensive range of documents from a single source;
- \* easy online document ordering and delivery;
- \* automatic document delivery of pre-specified documents, such as documents on standing order, on regular basis;
- \* lists of current periodicals; and
- \* SDI.

The low level usage of EDDS, as of now, can be attributed to the high cost factor (compared to conventional services) and the not-so wider acceptance of the technology by the developing countries. It also needs deposit accounts to be maintained with the DSCs in advance, which means further cutting in the already dwindling library resources. The wide range of equipment and systems needed to establish the service initially are expensive and causes a frowning attitude in the library authorities. It can be seen that the majority of the users still wish to use traditional means to order and receive a document in need. Because the user has very simple need to be satisfied, a service that can supply needful documents in a reasonable time, say a week or ten days, reliably and that too at a price his library or the user himself can afford to pay. There are some doubts about the long time effects of the EDDS on the traditionally printed journals. But at a time when the publication of printed journal becomes totally uneconomical due to the rising costs of input materials, processes and the ever diminishing subscriptions, publishing from totally electronic data on demand could become common. Usage of the broadcasting satellites would greatly enhance the quality of such systems and reduce the costs also. EDDS is a conglomeration of new technologies. A few of them are briefly discussed in the following pages.

#### 4. ELECTRONIC MAIL

Electronic mail (E-mail) is a computer-based EDDS, used to create and transmit messages electronically addressed to an individual or a specified group of individuals. With its origin in 1960s, it became an important means of sending information via a computer-based network between addressed computer workstations. Like facsimile, telex and other message systems, E-mail systems allow people to send messages to each other electronically. This can be taken as an

extension of the traditional telex service with an exception that the sending and receiving points are not centralised as in the case of Telex Office [10]. Here any computer can communicate with a host computer. To send the mail, the user needs a modem to convert the computer signals into a form suitable for transmission and vice versa.

Based on the target group, E-mail can be conveniently grouped into four, viz. one-to-one, one-to-many, many-to-one, and many-to-many. One-to-one mode is the most common of all and is useful to send communications from one user to any other user. In one-to-many, the mail is directed to many users, while many-to-one is exactly the opposite of this mode. Many-to-many is a mode which enables 'posting' a communication publicly, where others can read and leave their comments to be read by many. Buckland [11] discussed the applications of these four modes as 'notes, broadcasts, comments, and bulletin boards'. Computer conferencing can be taken as a form of the fourth group.

The E-mail would look after the messages until the user wishes to access them at the time and place of his or her choice. A mailbox can sort the mail into different categories, inform the urgent matters which needs immediate attention, help in dealing with messages, take care of filing, searching and retrieving of messages upon request, thus virtually becoming a sort of personal assistant. When individual codes, possibly with encryption or passwords are assigned, users could log-on from different locations while in trip, at any time of the day and send messages to others or retrieve messages accumulated since the previous log-on.

Another advantage of the E-mail is that the distribution lists can be stored in the system, which aids in selecting the recipients to receive a particular information or message and transmits simultaneously to all the recipients.

E-mail is primarily used at present for informal communications between people separated by geographical distance and time zone differences. This benefits the individuals by saving time, reducing interruptions and improving communications. However these benefits are intangible, difficult to measure and do not make a direct impact on the profitability of an organisation.

Three important beneficial characters of E-mail are the speed and reliability of delivery and security and privacy of messages [12]. The potential uses include general correspondence, exchange of documents, teleconferencing, announcements, etc. On the library side, E-mail is being used heavily for transmitting interlibrary loan requests and document purchase orders. OCLC has a subsystem (OCLC ILL) connecting some 700 libraries which is a dedicated inter library loan system. Of late, library professionals have also begun to use E-mail for communications among officers of professional associations. E-mail can also be used for reference queries that could range from ready reference-type to problem solving questions in the areas of cataloguing or MARC formats which can be greatly expedited by the use of E-mail. A record of the responses can also be kept. Both the sender and recipient can initiate the message or pick up the message when it is convenient for them. This applications list is by no means exhaustive. Many uses remain undiscovered.

The E-mail is much cheaper than conventional telex for sending messages to outstations. Combined with its easy readability due to the mixed letter base (upper/lower case), which is not available in telex, it is a *viable alternative to telex* for institutions for international communications. The communication is faster through E-mail than telex or cable.

Many E-mail networks of universities, commercial agencies, etc are interconnected through major networks such as USENET, INTERNET and BITNET, which in turn are

interconnected through gateway machines. This interconnection between commercial networks are non-existent until recently. It is possible to send messages, documents from one network to another only when they are interconnected by means of gateways. Conformity of protocols, etc with the CCITT X.400 standard will allow the interconnectivity of different networks with each other. In this environment one can send mail to anyone having mailbox in any other system because of their connections to diverse communication media. Some E-mail systems have sophisticated features which make them extremely useful. E-mail can be sent to even fax machines, [13] telex printers and remote printers. AT&T Mail is an example of such an advanced features system.

Document supply centres like NTIS, University Microfilm International Article Clearinghouse and British Library Document Supply Centre (BLDSC) have E-mail addresses, and accept orders through E-mail, thus speeding and facilitating the delivery of required documents. This feature is also available with most of the online search services such as DIALMAIL of DIALOG, EasyPlex and InfoPlex of CompuServe network, and public packet-switched networks. These can forward the retrieved citations by E-mail to a DSC of the searcher's choice.

Systems with E-mail features OnTyme II, designed and marketed for library community, include JANET (Joint Academic Network), Envoy Post of Canada Telecom, Postcorp, E-COM (Electronic Computer Originated Mail) of EMCA (USA), DMAIL of Delphi, MCI Mail, ALANET of the American Library Association, Telemail, Easylink, etc.

Facilities provided by E-mail systems are categorised as follows [14]:

*Message Preparation:* Word processing, note book facilities, annotation of messages received prior to forwarding or filing.



**Message Transmission:** Timed delivery, directory services, multiple addressing, distribution lists, abbreviated addressing, message priorities, automatic route selection, message transfer information, links to other networks.

**Message Receipt:** Mail scanning, selection replying, forwarding, rerouting, filtering of messages, and notification of new messages.

**Security and Reliability:** System security, protection against message lost, encryption, security software and inhibiting hard copy.

**Message Filing and Retrieval:** Storage capacity, retrieval and archival facilities.

**Message Logging:** Accounting and management reports.

One main disadvantage of E-mail is that the current systems normally allow files of more than 100Kbytes, whereas document files may be of the order of several megabytes. Bill Tuck has compared [15] the cost of sending a megabyte file over Telecom Gold of the British Telecom (80 pounds in peak time and 20 in off-peak time) and Integrated Digital Access also available through British Telecom (13p or 4.4p!). Other factors include the ongoing high cost involved in the usage of E-mail, equipment and service overhead costs. Set up costs of E-mail services can include training, documentation, monthly minimums of usage and telecommunications cost [16]. In spite of these factors, E-mail is widely recognised as a convenient and cost-effective means of communication.

The main difference between E-mail and teletex (or telefax) is that in the case of E-mail, messages can be held in the memory of the sender's computer and transferred to receiving computers (as per the E-mail addresses). The received messages can be stored till they are retrieved by the recipient. In the teletex (or telefax) transmission is instantaneous and no intermediary storage is

possible as these operate on point-to-point mode (i.e., from sending terminal to receiving terminal).

#### 4.1 Electronic (Online) Ordering

To avoid delays taking place in the conventional ordering, many document supply centres (for example, BLDSC) and information retrieval services such as DIALOG and CAS have been offering electronic ordering facility for the users. BLDSC is accepting document supply requests over telex for quite sometime now, and has been offering online ordering facility called ADRS since 1981. This still did not get full acceptance of the users as the requests are not growing at any significant rate. The prerequisite in this type of service is that the customer has to have an account with the DSC. The dial-order services of CAS introduced in 1982 has evoked good response with nearly 25,000 requests in the first months by more than 1,300 subscribers. Many prefer to use conventional post for ordering. Information retrieval services such as DIALOG and those linked with E-mail systems and many major publishers and book vendors are accepting dial-order services or entertain electronic ordering (for example, Baker & Taylor, Ingram in USA). Many also maintain mail-boxes with E-mail systems like DIALMAIL, ALANET, etc where possible, the requested document can also be delivered via an EDDS.

#### 4.2 Voice Mail

This is the most sophisticated type of the E-mail. This does not require anyone to type or input a message to be sent. The recipient of the communication is to be named first and the message is dictated. The system transmits the message by digitising the analog voice signals. At the receiver's end, the message is reconstructed.

In a voice mail system, the computer records the message, stores and then delivers the message as and when called for. Modems

are used to convert the binary signal into an ac signal for transmission and the transmitted ac signal into binary signal upon receipt.

There are two methods of voice digitisation [17]. In the first method, speech can be digitised by vocoders. The vocoders analyse the pitch of the voice and vocoder filters divide the signal into different frequency ranges. The advantages of the system include the use of the transmission lines to a maximum efficiency, error control and correction, and data encryption. This is more compact than the analog speech on a voice-grade line and uses the transmission medium to a lesser extent.

Second method is the waveform analysis. Here voice digitisation depends on the software used for digitisation. Pulse code modulation is a type of waveform analysis. The main advantage of this is its lower cost.

Voice mail system can do most of the things that an E-mail system does, i.e., messages can be read, printed, answered, filed, etc. Image mail system, where one can see the picture of the message sender actually speaking, is too expensive and luxury. As all these technologies have common basic features, image, voice and text may converge in the future to give a comprehensive E-mail system.

## 5. CONCLUSION

The impact of the information technologies has already been felt by the library community. Quite a few number of libraries already are using the new technologies in many fields. Use of computers in house keeping process has been on the increase. So is the access to online databases through gateway packet-switching networks and DIALOG etc, and the transmission of important and urgent documents through telefacsimile. Thanks to the breakthroughs and developments in electronics and related fields, the cost of these technologies is within the reach and these technologies which were

looked upon as 'elitist' a decade ago are finding their wide acceptance and usage in many libraries. Though electronic mail is a late comer to India, already a few centres have the facility (for example, DESIDOC and INSDOC) to serve the users in an efficient way. E-mail will greatly improve the information delivery, particularly for document supply centres. The convergence of online information retrieval and E-mail (as is evident from the addition of E-mail features to the major online information retrieval systems), have already proven their acceptance. It is also envisaged that the E-mail networks would provide access to online information shortly. It is time for adopting ourselves to the 'order of information society' which has great potential to enhance the economical growth of the nation.

## ACKNOWLEDGEMENTS

The authors are grateful to Dr SS Murthy, Director, DESIDOC for giving permission to publish the paper.

## REFERENCES

1. Jones, Barry O. Social implications of information-based society: the role of libraries and librarians. In Meeting the challenge of technology, Proceedings of the VALA National Conference on Library Automation, Vol. 1. Victoria Association for Library Automation, Melbourne, 1982. pp. 3-4.
2. Department of Commerce, USA. US Industrial Outlook for 1986. NTIS, Springfield, 1986.
3. Huber, Roland. The role of information technology and telecommunications in promoting economic development in the European Community. *International Journal of Technology Management*, 1989, 2(3/4), 501-514.
4. Lancaster, F.W. Towards paperless information systems. Academic Press, New York, 1978.

5. Lancaster, F.W. The future of the library in the age of telecommunications. *In* Telecommunications and libraries: a primary for librarians and information managers, edited by D.W. King and others. Knowledge Industry, White Plains, 1981.
6. Deusch, Debra P. Implementing distribution lists in computer-based message systems. *In* Computer-based message systems, edited by H.T. Smith. North-Holland, Amsterdam, 1984. p. 3.
7. CCITT 5/VII. Recommendations X.400 MHS: system model service elements and optional user facilities. ITU, Geneva, 1983.
8. News, trends and comments. *Information Services & Use*, 1989, 9(3), 177-188.
9. Lee, Peter W. Electronic document delivery: current European developments. *In* Beyond 1984: the future of the library technical services, edited by Peter Gellatly. Howarth Press, New York, 1983. pp. 233-239.
10. Bourne, Charles P. CD-ROM and other computer-based information tools for developing countries. *In* Bibliographic databases and networks, Proceedings of the International Conference, New Delhi, 22-25 February 1989, edited by S.S. Murthy, Anuradha Ravi and A. Lakshmana Moorthy. Tata McGraw-Hill, New Delhi, 1990. pp. 1.75-1.83.
11. Buckland, Michael H. Combining electronic mail with online retrieval in a library context. *Information Technology and Libraries*, December 1987, 266-271.
12. Trudell, Libby, et al. Options for electronic mail. Knowledge Industry, White Plains, 1984. pp.21.
13. Hawkins, Donald T. Technotrends: information delivery—paper and E-mail. *Online*, 1990, 14(2), 100-103.
14. Welch, J.A. and Wilson, P.A. Electronic mail systems - a practical evaluation guide. NCC/Wiley, London, 1981:
15. Tuck, Bill. Using ISDN for document delivery. *Program*, 1988, 22(4), 360.
16. Whitaker, Becki. Electronic mail in library. *Library Trends*, 1989, 39(3), p.363.
17. Marney-Petix, Victoria C. Networking and data communications. Reston, Reston, 1986. 180 p.



*Whatever Nature has in store for mankind, unpleasant as it may be, men must accept, for ignorance is never better than knowledge.*

**—Enrico Fermi**