Introduction to electronic mail

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ELECTRONIC MAIL

Electronic Mail is the forwarding of message content by electronic means, and is normally associated with communications between people. In the case of traditional postal service (as opposed to Electronic Mail), the document is physically delivered to its destination using transportation methods. In electronic mail, the content of the message is transformed into electrical signals and forwarded over communication channels for at least some portion of its journey.

Examples of electronic transmission include traditional teletype services, store and forward computer message systems (CMS), and facsimile.

MOTIVATION

There are two basic motivations for implementing Electronic Mail Systems: 1) to provide a quick, efficient, and inexpensive method for sending and receiving messages; and 2) to increase the productivity of the office (or "knowledge") worker. I will briefly touch upon each one and qualify the market potential.

Efficient message systems

The cost of a first class letter is now 15¢ and is projected to more than double by 1985.¹ Mail service is not universally acclaimed either for its speed or dependability. The cost of a TWX/Telex message is in the $1.50 price range. A long distance three minute telephone call that is dialed direct from Houston to Los Angeles costs $1.24 and one from New York to Los Angeles costs $1.46. A computer message service can now send that same message for between 25¢ and 50¢, and provide some new services as well. An internal CMS can send a message for less than a nickel where there is high message traffic.

Facsimile systems provide for the electronic reproduction of the page at the receiving end. For less than the price of a computer terminal, there are systems that will transmit a page over the telephone network in 2 or 3 minutes. This is especially convenient where graphics are involved or where the sender is transmitting a document that is already physically available.

Office automation

During a recent 10-year period, the productivity of office workers has improved only slightly against nearly a doubling of productivity for the factory worker. The production worker is supported by eight (8) times the capital investment of the clerical employee.²

Businesses are becoming more complex and need more and more information. The increasing need for office support, the low level of capital employed to assist the knowledge worker, the increasing wage and salary spiral, and the improving productivity and price performance of computer/communications are together a potent force. These factors justify the implementation and use of sophisticated electronic mail and word processing systems in many organizations today.

The market

Companies see a major opportunity in supplying this market. As cost decreases and functionality increases, Electronic Mail becomes an attractive substitute to traditional methods. Even a small part of 50 million TWX/Telex messages, 60 billion pieces of first class mail, and 250 billion (or more) telephone calls is a lot of traffic.

It is predicted that the number of messages sent via computer message systems will grow from 40 million in 1979 to 275 million in 1982.³ I believe this projection to be conservative. Over 80,000 facsimile units were to be shipped in 1979, at a value in excess of $200 million—a 65 percent increase over the previous year.⁴ Communicating multi-function terminals and communicating word processors (combined) will grow from some 33,500 units at the end of 1979 to close to 380,000 units in use by year end 1983.⁵ While it is difficult to make accurate long term forecasts for such new products, the market potential by any measure is tremendous.

ELECTRONIC MAIL COMPONENTS

Electronic Mail is a very broad topic which includes many alternatives and approaches. Messages can be text, documents, graphics, voice, or video. Underlying transmission methods range from cable to fibres to satellite to microwave
transmission. Intermediate carriers provide value-added services. User interface methods range from document insertion to dumb keyboards and printers to highly “intelligent” terminals.

This introduction is limited to a historical look at the teletype and an introduction of four aspects of Electronic Mail: computer message systems, a combined message switch/PBX system, facsimile, and a distributed approach to message communications. These four are chosen because they are important, interesting, and representative of the kind of developments taking place in this field.

The teletype

The telegraph was invented by Samuel Morse in 1844, and the teletype was introduced in this country in 1917. Teletype services provide for the entry of message text from a keyboard. A physical circuit is established, and the text is transmitted from the sender to the recipient, typically at 6.6 or 10 characters per second (cps). There are presently some 150,000 or more TWX/Telex terminals in the United States and throughout North America.

Traditional teletype services provide for immediate message delivery. As a byte of information is sent, it is transmitted to the recipient across a physical connection instantaneously. In most cases, using paper tape or a buffered terminal, the message is keyed in first and then sent as a continuous stream of bytes. The device at the far end must be ready to receive the message or it cannot be sent. Furthermore, the only record of the transmission is the billing information and the physical hard copy.

Computer message systems (CMS)

In computer message systems, the message is entered by the sender and stored in digital form by a computer for subsequent delivery to one or more recipients. Because these message systems are computer based, there is an opportunity for providing a wide variety of additional services.

Typical CMS messages are initiated from a keyboard for eventual output on a CRT display or on paper. That is, many of these messages are originated at one terminal for delivery to one or more other terminals. Actually, the messages are first transmitted to the CMS computer(s) and then sent to the recipient(s). Typical transmission media include hardwiring (for a local device), leased and dial-up telephone lines, value-added (packet) networks, and teletype networks.

Sophisticated message preparation features might be included. Text editing commands assist the user to modify the message before it is sent.

As text is entered, the incoming bytes are stored in digital form. CMS will maintain a copy of a message as it is being entered into the system. Typically, a copy is also stored in auxiliary storage (disk) at least until its delivery to the recipient(s). On some CMS, that message may be around for a long time.

In some systems, a message can only be sent to one address. Similar restrictions are found with traditional teletype services, facsimile, and the telephone system. Sending the message to multiple recipients requires multiple message entry. Fortunately, this is not the case for most CMS.

In many CMS, there are convenient facilities for sending a message to a small number of individual recipients, to specific groups by using their “group name,” or to all users (called a broadcast message). Senders can sometimes generate their own “group name” files, and can mix and match addresses for any particular message.

Filing provisions of CMS sometimes include (1) archival of some or all messages, (2) filing of messages into user-created files (like subject files), and (3) filing of prepared text. In some systems, access to these files can be separately controlled. Retrieval features refer to the user’s ability to get at these files and to review and scan the message of interest. For example, a user might want to review all messages on a certain subject sent between certain dates.

Special files might also be maintained. Examples might include an electronic “out basket” for each sender giving the delivery status of all messages sent; an electronic “in basket” giving the recipient a list of all outstanding incoming messages; and a list identifying each special file that a user may have created.

Some systems are location-oriented; that is, the “recipient” is a terminal. This is similar to the teletype network. Other systems are address-oriented; that is the recipient is a person or group of people.

Address-oriented CMS are classified as “Mailbox” systems. The message, when sent, is flagged by the CMS as “pending” until delivered to the recipient. When the recipient accesses the CMS from any point, the recipient identifies himself to the system. At that point, the message becomes available. In other words, the message is stored in the addressee’s electronic “Mailbox” until it is called for.

Computerized communication exchange

Start with a programmable computerized business telephone system (PABX). Such a system might provide some or all of the following features to a business customer: conference calls, call holding, call forwarding, chain calling, answer any station and other night service features, secretarial hunt, paging access, call recording, traffic measuring and storage, optimal and alternate call routing, and lots more.

At the heart of such a system is a computer. A logical growth of this computerized system is to include message switching (or CMS) software as part of the computerized telephone system. Terminals could be conveniently plugged in wherever there are telephone jacks, or even through a plug in the telephone instrument itself. Terminals at remote locations would access the system through the telephone network using a modem or acoustic coupler. The concept of sharing the same facilities for voice and message communications is interesting and can provide certain econ-
omies; the further integration of these communications offers some exciting possibilities.

Facsimile

While there was some earlier work, the "classical" facsimile system was developed by William Sawyer in 1875. Facsimile works by identifying whether each point on the page is dark or light, and transferring the information across a telephone line. The receiving device will either mark the equivalent point on a blank page or leave it white. Since there may be many points per page, depending on the resolution of the unit, a lot of information is sent.

The usefulness of facsimile for business was increased substantially with the introduction of a low-priced, plain paper, desk top facsimile unit in 1966. It interfaced to the telephone network with an acoustic coupler and was relatively easy to use. The transmission would take as long as 6 minutes per page.

Facsimile units are classified on the basis of transmission speed. Group I units, like the one introduced in 1966, are analog devices that transmit a page in 4 to 6 minutes. Group II apparatus employ bandwidth compression techniques to achieve transmission times of 2 to 3 minutes per page. Group III hardware reduces the information transmitted, usually by digital techniques, and sends a page in a minute or less over normal telephone lines.

The tradeoff with facsimile choices are cost versus transmission time and cost versus ease of use. High speed devices are more expensive, but reduce telephone charges and length of operator attention per page. Ease of use features (like automatic page feeders) also add to cost. Key considerations include the volume of documents, location of intended recipients, type of equipment in use by intended recipients (compatibility), and kind of documents.

High bandwidth communication links offer even faster facsimile transmission. To utilize spare capacity on broadband satellite channels, one vendor will be offering a one second (3600 pages/hr) facsimile device. It is envisioned that the documents would be inserted and stored in digital form and forwarded in batches when the links were not being utilized for other forms of communications. Multiple copies would only be transmitted once, and the system would make the added copies.

DISTRIBUTED APPROACH TO ELECTRONIC MAIL

In early Electronic Mail systems, the user dealt with a simple facsimile transceiver or a dumb terminal. There was no intelligence at the user location. The routing and delivery was handled by the telephone network or a central computer.

The decreasing cost and increasing functionality of computer hardware has made it possible to distribute intelligence to the user. Integral processors make it possible to perform complex compression algorithms in digital facsimile devices. In computer message systems, intelligent terminals make for powerful message stations. Complex text editing features can be included in the terminal, and messages can be batched or even held until after hours. In both cases, the local processor makes it possible to optimize the utilization of communication bandwidth.

Distributed data processing, however, offers more advantages than just compression schemes and batch message preparation (data entry). In a truly distributed environment, the central mail functions are shared by a hierarchy of processors. Scratch pad notes and drafts are stored at the users mail station. Intraoffice mail is collected at the on-site message exchange, or even shared between the local mail stations. Interoffice mail is handled by regional or centralized message exchanges.

As time goes on, the local message station has evolved from a simple message (data) entry device to a sophisticated word processor. Graphics will be added. A facsimile input device will be included, perhaps with optical character recognition (OCR) ability. Eventually digital voice and freeze-frame video interfaces will further broaden the communication alternatives available locally to the user. Ultimately, why not holographic images providing full color three dimensional face to face meetings—complete in every way except for the handshake.

ELECTRONIC MAIL: THE STATE OF THE ART

The four speakers at this session will write on and discuss these topics in depth. Their organizations are noted and have been active in one or more aspects of Electronic Mail development.

Computer Corporation of America (CCA) is the designer and developer of the COMET computer message system. COMET is one of the first systems of its kind to be commercially marketed as a stand-alone in-house electronic mail system. CCA has also done some interesting basic research in the Distributed Database area and is active in storage technologies.

ROLM Corporation is a progressive supplier of computerized business telephone systems (PABX), and last year announced its Rolm Electronic Mail System (REMS). REMS is a computer message system that can be integrated into their PABX product. This eliminates the need for local modems and provides for a sharing of voice and message facilities.

Qwip Systems, a division of Exxon Enterprises, has been very effective in marketing its low cost Qwip and Qwip II facsimile units. Funded by Exxon, Qwip has grown rapidly since 1974 and will have an estimated 30,000 units (25 percent of all units) in place by the end of 1979. And they expect to garner an even greater share in 1980.

Datapoint Corporation has been successful in a number of areas related to Electronic Mail including distributed data processing and communicating intelligent terminals. The focus of the company is clearly on the "office of the future." The facilities for Electronic Mail are in place and its importance in tomorrow's office is certain. Datapoint offers a number of computer-based telephone related products as well. These papers, like Electronic Mail, cover a broad area.
Yet, the fundamental goal is the same: to increase the effectiveness of human and business communications. And these diverse approaches will come together. Electronic Mail is the prototype for and will be the archetypal examples of the convergence of computers and communications.

REFERENCES