Oct, 20, 1987

E-Mail Services Broaden Links to Corporate, Telex Networks

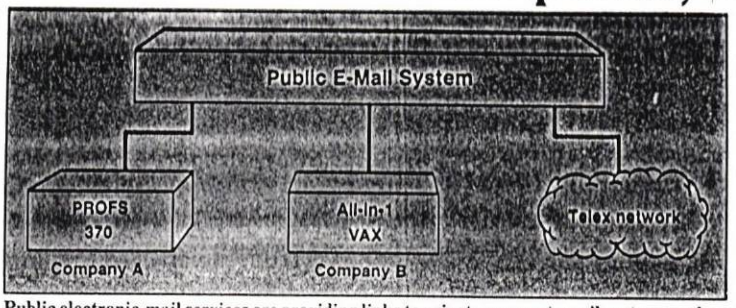
By Jeffrey Hairstow

"What's wrong with electronic messaging?" asks Allen Weitzner, vice president of engineering and operations for U.S. Sprint's Telenet Communications Corp., of Reston, Va., which provides an electronic-mail service, called Telemail. His answer? "We can change the technology [by providing interconnection and other facilities] relatively rapidly, but people need time to accept and acclimate to change."

After several years of pushing E-mail technology at users, public E-mail services are now listening to customers and responding to their applications needs. One of the results is a proliferation in the connections possible between private and public E-mail systems, and in a few cases, between public E-mail systems.

Largely, this is an acceptance by the public E-mail systems of an established private user base that is considerably larger than the public user base. "There are five million E-mail users in North America," said Mike Cavanagh, executive director of the Electronic Mail Association (EMA), of Washington. "But almost four million of those are users of in-house E-mail systems, largely based on IBM and DEC [Digital Computer Corp.] computer systems."

Many large companies with in-house systems now have experienced and frequent E-mail users, and can see a need for connection with either external E-mail services or between dissimilar systems at different locations within a company.



Public electronic-mail services are providing links to private corporate mail systems such as IBM's PROFS, along with connections to LANs and the international telex network.

"A couple of our largest commercial clients have been extremely vocal about their need for connections to IBM's PROFS [Professional Office System]," noted Beth Sibbring, product manager for CompuServe, a provider of remote-computer services, in Columbus, Ohio. As a result of those customer requests, CompuServe is about to introduce software that will allow IBM PROFS users to communicate with CompuServe's InfoPlex business E-mail service.

In doing so, CompuServe is following a trend: Most of the larger public E-mail services have already announced connection with both IBM PROFS and DISOSS (Distributed Office Support System) and with DEC's All-in-1 Service.

Most E-mail services are directing their attention toward establishing direct connections with IBM and DEC systems. However, one little-publicized but potentially major form of interconnection is being offered by the AT&T Mail service of Somerset, N.J.

Since the ability to contact other systems is inherent in all Unix-based computer systems, any Unix system can be hooked into AT&T Mail with the standard "mail" and "UUCP" (Unix-to-Unix Communications Program) software included with Unix. Mail is the standard package for communicating between users on the same Unix system, and UUCP automatically calls other Unix systems, responds to calls and downloads and delivers incoming messages via mail.

Subscribers to AT&T Mail who are away from their computers can call the service by Touch-Tone phone and have their messages read to them by voice synthesis.

In addition to software developed in-house by the major E-mail services for private-system interconnection, many service providers offer third-party software to connect with some of the less widely used private E-mail systems. For example, Western Union of Upper Saddle River, N.J., offers software for EasyLink connections to Wang's VS series (developed by The Information Organization Corp. in San Francisco), connections to DEC's VAX systems (produced by Alisa Systems of Pasadena, Calif.) and an IBM SNA/SDLC link (designed by Computer Application Services Inc. of Los Alamitos, Calif.)

"As we see other niche markets emerging, we will look for other third-party software," said Joseph Norton, vice president of product development for Western Union.

A similar effort is underway at G.E. Information Services of Rockville, Md. In addition to PROFS and DISOSS links, G.E. has opened its Quik-Comm E-mail architecture with a connector software interface that will permit simpler integration of custom interfaces, reported David Page, manager of business communications.

Several companies also offer packages for LAN connection with E-mail services. For example, 3Com Corp. of Santa Clara, Calif., markets a package called 3+Reach/MCI that permits PC users on a 3Com LAN to send and receive messages from MCI Mail users as if they were locally connected to the network. MCI Mail user names can be registered in the network's database so the system will recognize them and route messages automatically to MCI Mail.

Soft-Switch Inc., a communications-software developer in Wayne, Pa., offers a gateway for routing messages between 3Com networks and IBM mainframes. It uses IBM's Systems Network Architecture Distribution Services (SNADS). The gateway runs on a PC AT that appears to the network as a remote mail server.

While rapid progress is being made in offering connections between public and private services, the same cannot be said for connection between public E-mail services. There are at least a dozen public business-oriented E-mail providers in North America; the smallest with fewer than 20,000 mailboxes, and the largest—Western Union's EasyLink—with just over 150,000 mailboxes, according to a recent study by International Resource Development, a market-research company in New Canaan, Conn.

However, in the United States, the only existing direct connection between public services is between MCI Mail and CompuServe. A few other connections exist internationally, such as between Telemail and Telecom Canada's Envoy service, and between EasyLink and the French Missive service. But none of the U.S. public E-mail services appear to be ready to connect to their competitors.

"Our MCI Mail connection is working out well," said CompuServe's Beth Sibbring, "but we have yet to see any demand from our customers for interconnection with other E-mail services." But, in general, E-mail services shy away from interconnection for competitive reasons, according to Western Union's Mr. Norton.

However, according to CompuServe officials, many of CompuServe's users are consumer subscribers, while the majority of MCI Mail's users are from a business environment. In addition, the public services remain reluctant to deal with the business problems involved in interconnection.

"Technically, there's no reason why services can't be interconnected, but there are many administrative problems, such as billing, to be solved," Mr. Norton explained.

One-Way Transmission

General Videotex Corp. of Cambridge, Mass., offers the Delphi on-line service, an unusual form of interconnection. Delphi maintains a CompuServe account and mailbox, so users can send mail to CompuServe subscribers, but the transmission is strictly one-way. However, the Delphi sender must know both the subscriber name and numeric identifier of the intended recipient.

Such an arrangement is clearly possible in reverse, but Delphi does not offer it because "the billing problems would be too difficult," said Chip Matthes, product manager for Delphi.

However, one small entrepreneur has jumped in where the major E-mail services are fearing to tread. D.A. Systems, a communications-software company in Campbell, Calif., recently started DASnet, a service that maintains accounts on 18 E-mail systems and automatically exchanges mail sent to its mailboxes. Thus, a subscriber to, say, MCI Mail can send a message via the DASnet MCI mailbox to an EasyLink subscriber. DASnet periodically polls its MCI mailbox, determines the E-mail destination and distributes the message to its EasyLink mailbox, from where it is sent to the intended recipient.

To send to another E-mail system, the sender "must know the E-mail address of their correspondent," said Anna Lange, marketing manager for DASnet. Each public E-mail service maintains its own directory, accessible to its own subscribers, but those addresses are not available to outsiders.

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Virtually all public E-mail services offer connections to both domestic and international telex networks. The telex network also offers an indirect method of communication for subscribers to different E-mail services, pointed out Lynne Edwards, product manager of OnTyme, the messaging service of McDonnell Douglas Applied Communication Systems of Cupertino, Calif.

Since any subscriber to an E-mail service with telex connections is also assigned a telex number, messages can be sent through telex, provided the sender knows the recipient's telex number. However, this type of communication is more expensive than direct E-mail transmission because of the charges associated with telex.

The Old-Fashioned Way

Despite this rash of interconnection possibilities, many people are still beyond the reach of E-mail simply because they do not have access to a computer and a modem. Consequently, several E-mail services also provide some form of hard-copy postal delivery.

Telemail, for example, has 14 centers where messages can be laser-printed, placed in an envelope and delivered by the U.S. Postal Service. Users can incorporate business letterheads and facsimile signatures into their messages, as well as various types of reply envelopes. Several E-mail services also offer overnight delivery by courier service and even four-hour delivery in some major cities.

However, hard-copy delivery has not proved as valuable as many service providers had expected. "We've dropped hard copy delivery due to a complete lack of demand," said OnTyme's Ms. Edwards. CompuServe has also dropped hard-copy delivery, but is considering adding it again. "Users appear to expect hard-copy delivery even if they never use it," said Beth Sibbring. "Expectations and usage are often different in this market."

Despite these facts, some E-mail services are also adding facsimile delivery, following the recent trend to more widespread business fax use. EasyLink subscribers can designate a fax machine for the receipt of messages or send messages directly to any fax machine by using a fax phone number in the message header. However, it is not yet possible to send E-mail from a fax machine, said Western Union's Mr. Norton, because of the lack of standardized formats.

At a recent meeting of E-mail software developers, Mr. Norton called for solutions to the fax-origination problem, but "so far, no takers."

Nonetheless, several E-mail services are actively investigating fax delivery and origination. "We are in discussion with a couple of British companies that are close to solving the fax-input problem," reported Mandy Pritchett, director of international marketing for Dialcom, the Rockville, Md., service acquired last year by British Telecom from ITT. "One simple solution might be to input the message header by keyboard and then use a fax for the message itself," suggested Ms. Pritchett.

Although interconnection by custom interface is offered by several E-mail vendors, the problem will be simplified when private systems and public services offer services that conform to the X.400 standard (see related story, Page C/50). The X.400 standard was originally published in 1984, but progress in implementing the standard, at least in the United States, has been relatively slow. "The incentive for European PTTs [the national postal and telephone services that provide E-mail] to cooperate is very powerful," said John Morris, president of Dialcom. "And the influence of IBM on computer communications is less pervasive than in the United States." Dialcom will introduce X.400 service here in early 1988, according to Ms. Pritchett.

An International Affair

Dialcom operates a number of E-mail services in Europe for national PTTs, so the company's own incentive to offer X.400 service is significant. Indeed, the companies E-mail vendors most likely to conform to X.400 are those with considerable international business or with customers whose business is multinational. Telenet, for example, has been actively conducting tests with DEC and Data General of X.400 links, and has demonstrated X.400 service to Canada's Envoy and the French Atlas service. Telenet intends to offer regular X.400 service by the end of this year, according to Stuart Mathison, vice president.

An important demonstration of X.400 will take place at Telcom '87 in Geneva this week when some 20 vendors of systems and services will link up using X.400. Included in the link-up will be Telenet, Dialcom and several European PTTs, plus a number of private-system vendors including DEC, Data General, Nixdorf and IBM. Although IBM does not yet offer any X.400 products in the United States, industry observers expect IBM to begin selling them in Europe after the Telcom '87 demonstration. "There's a very strong likelihood of IBM offering X.400 in the United States within a year or two," said Telenet's Mr. Mathison.

Indeed, all the E-mail providers seem to endorse X.400 and claim they will shortly be offering X.400 products. However, most see X.400 as simplifying connections with private E-mail systems, rather than extending the universe of public systems. "We just don't see the demand from our customers for interconnection of public systems," said Mr. Norton, a view that is echoed by other E-mail executives. "It will come eventually, but I feel that it will be driven by applications involving EDI [Electronic Document Interchange, principally computer to computer], where one company deals with many vendors," said Mr. Norton. Several E-mail vendors are scrambling to offer EDI services as a way of increasing message volume rapidly.

The day of completely interconnected E-mail public and private systems may be some years away, but progress is being made because the business climate is changing in favor of electronic communication, said Telenet's Mr. Mathison. "Major corporations are committing to 'the electronic company' with workstations on every desk," he said. "Interconnection can't be stopped." For once, the users may be driving the expansion of E-mail. ■

Electronic Mail

- **Getting started with a modem, PC, phone**
- **Hard-copy printing and delivery**
- **Connecting in-house to public services**

BY
JEFFREY N. BAIRSTOW

Just as memos, letters, and reports can be created with ease and speed on a personal computer, those documents may be mailed from your keyboard without an envelope, a mail room, or a trip to the post office. Electronic mail, often shortened to E-mail, is the process of using computers to exchange documents and files over the telephone lines. According to the Washington, D.C.–based Electronic Mail Association (EMA), there are about 6 million electronic mailboxes in North America today, up from less than 10,000 barely a decade ago.

There are three types of electronic-mail systems: public E-mail services that any person or business may subscribe to and thus communicate with other subscribers; large mainframe computer-based E-mail systems that operate within a company largely for internal communications; and local area network (LAN) E-mail systems for PC users, usually within a relatively small work group.

Charges vary from company to company, but sending a memo usually costs less than $1.

The public E-mail services are provided by such communications companies as AT&T, Western Union, and MCI, and on-line computer services companies, such as CompuServe and GE Information Services. Anyone may sign up for one of these E-mail services. A yearly fee may be required (often under $20), and fees are charged each time the service is used. Charges vary from company to company, but an electronic memo typically costs less than $1. The major advantages of E-mail are that it is inexpensive and transmission is almost instantaneous, a major factor for many businesses.

To use a public E-mail service, you'll need a PC with a modem (a modulator/demodulator—a device that converts the digital signals produced by the computer into analog form for transmission over telephone lines) and communications software for controlling the sending and receiving of mail from the E-mail service. An external modem plugs into a serial adapter on your PC, and an internal modem hooks into a plug-in board mounted inside the computer. The modem is then connected to a telephone line with a standard RJ11 phone jack.

The major maker of PC modems is Hayes Microcomputer Products, in Atlanta, but many companies now manufacture Hayes-compatible modems. A 1,200-baud modem (one that will transmit a page of text in a few seconds) costs between $100 and $300. Most internal modems come with communications software that can easily access a public E-mail service or can be used to communicate with another PC. Software for an external modem goes for $100 or less. Alternatively, more sophisticated communications software packages, such as Crosstalk and ProComm, can be purchased for less than $200.

Most of the public E-mail services have local phone numbers in many U.S. metro areas or offer a toll-free number. In addition, most of the services can be reached through third-party computer data networks, such as Telenet and Tymnet, that have local numbers in many cities around the world.

Not only can you send electronic messages to other subscribers on the same system, but you can also send mail to nonsubscribers using a variety of delivery methods, including the U.S. Postal Service, overnight delivery courier services, telex, telegram, and facsimile machines. For hard-copy delivery, for example, MCI Mail has several printing centers across the United States and overseas. MCI Mail will print your letter by laser printer on a copy of your business or personal letterhead and add a copy of your signature, if you so request. The letters are then delivered by the mail service or overnight courier. Several E-mail services can also send your E-mail letter directly by using a fax machine.

A major stumbling block to the growth of electronic mail and a decided disadvantage to the prospective subscriber is that competitors do not connect with one another. For example, a subscriber to MCI Mail cannot send an E-mail message to a subscriber of AT&T Mail. However, MCI Mail has linked up with CompuServe for the exchange of electronic mail, and similar arrangements among other E-mail providers are likely in the next few years.

Until recently, another limitation of E-mail was the inability of in-house, mainframe systems to communicate with systems from different manufacturers or with public E-mail services. However, the makers of in-house E-mail systems have recently started to offer gateways, which can connect dissimilar systems to exchange mail and, in some cases, can even connect to public E-mail services. Thus, the potential subscriber audience is growing rapidly for both in-house and public services.

If your company already has a multiuser minicomputer or larger system, chances are that an electronic-mail software package is available from the maker of the computer. Similarly, for users of a LAN, the supplier of the network will usually offer an electronic-mail package as part of the software for the LAN.

As PCs continue to proliferate in business, the use of E-mail is likely to grow rapidly. As the barriers among competing services and dissimilar systems are removed, the potential numbers of subscribers who can communicate electronically will grow exponentially, says Mike Cavanagh, executive director of EMA. Thus, the utility of E-mail will extend beyond large corporations to small and midsize companies. □

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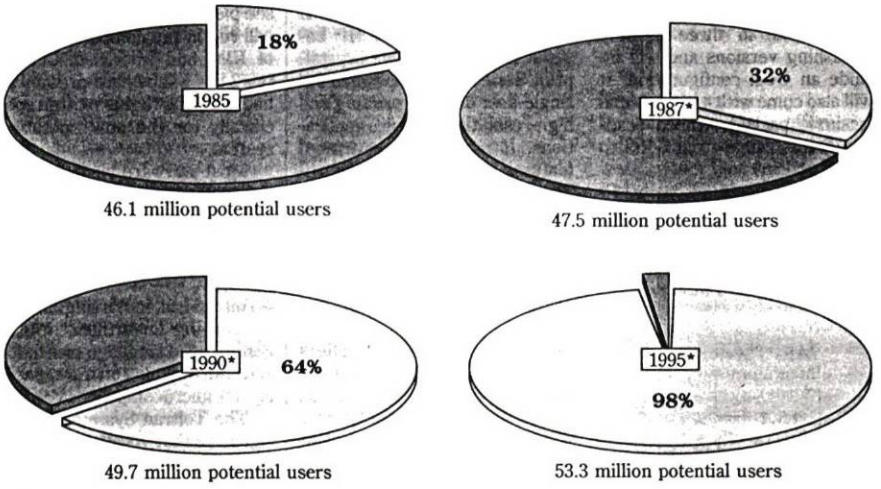
TRENDS

Electronic mail

By 1995, business use could approach the saturation point

ACTUAL USERS AS PERCENT OF POTENTIAL USERS



*Estimated

The number of people using electronic mail as a business tool will continue to grow at a rate of about 30% a year for the rest of the decade, according to "Electronic Mail & Micro Systems," published by International Resource Development, Inc. in New Canaan, Conn.

But only four of every 10 workers will have a real business need on the job for telex, facsimile, voice mail or any other computer-based messaging system, according to the newsletter's editor, Eric Arnum.

Based on recent U.S Department of Commerce statistics covering population and employment, Arnum estimates that only 46.1 million of the 107.1 million workers counted in 1985 are ever likely to use electronic mail on the job.

By 1995, assuming employment continues to grow, he predicts that about 44% of an estimated 122 million workers will use E-mail.

The newsletter also took a look at the use of various types of electronic messaging systems. Computer-based messaging systems, the most popular method today, will probably lose favor by 1995, dropping to third place.

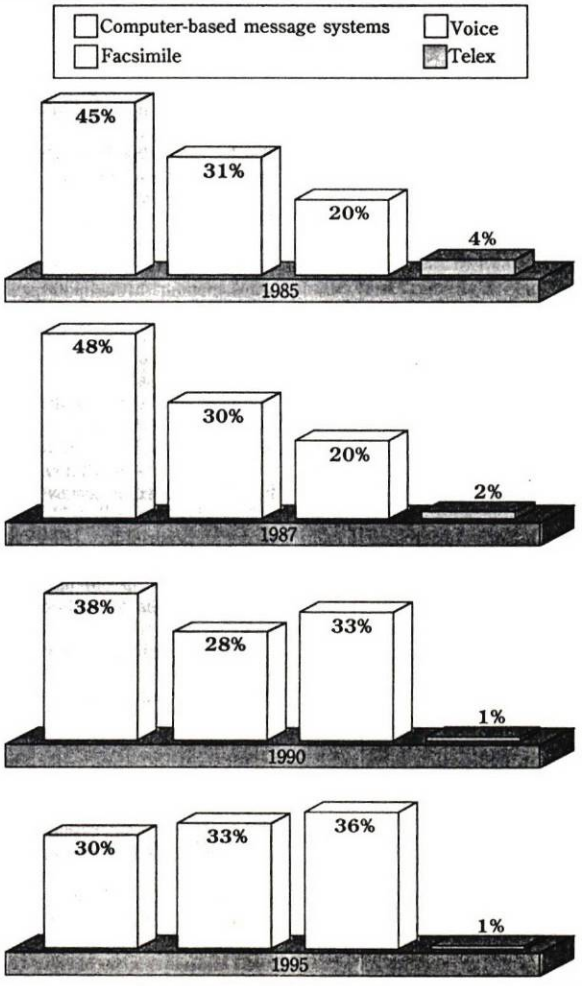
The 4.5 million facsimile users in 1987 could easily jump to 17 million by 1995, the newsletter claimed. Facsimile use is expected to pull ahead of telex and voice mail for a period, losing out to voice mail by 1990.

The voice mail market is expected to remain in the several-million-user range.

PATRICIA KEEFE

Users' media preferences should shift

PERCENT OF USE BY MEDIA TYPE



INFORMATION PROVIDED BY "ELECTRONIC MAIL & MICRO SYSTEMS"
CW CHARTS

INSIDE

Step right up . . . Amdahl's three- morrow. "In the center ring, we ha capable of 45 million instructions p juggling elephants awaits a universal own disk toss! And finally, below the ming box looking like a smaller versi K direct-access storage devices!" have its own big top, but that's what guarded Amdahl product rollout is when the company finally lifts the Tuesday.

Prerelease me, let me code. L may not ship until the end of this yea third parties from preannouncing a ference hosted by Lotus today, a nur expected to explain their planned w ten using Leaf, a proprietary Lotus l grams broader access to 1-2-3. And still confused about why Lotus is guage, the company will explain the the details.

What did Fred tell the doctor, him? Wang has notified selected use its slow-selling Professional Compu sional Computer and Professional I will no longer sell the three micros after June 30; they will only be availa larger system configuration.

Way to go, Ollie! In the 14 day North's testimony on his role in the IBM received its largest number of fessional Office System, or Profs, singer, chief technical officer at Co Buffalo, N.Y. Profs played a role in t revealed that the office automatio copies of North's communications e to shred the paper trail that led to his

Cleaning their Windows. Micros sion of its Windows operating en sources close to the company said l will not support Intel 8088-based p will be designed to work primarily machines. Sources said the Window variety of new drivers, including on chip, and enhancements for existing sion also has a memory manageme commodate large-memory applicati attempts to block the sale of Win slow the new package's release.

Reds on the bleeding edge. Ou tells us that not only does IBM have golden onion domes, but sales reps orders — just for Personal System/ will not do for Soviet users. Actually back orders, since the PS/2 may n shipment behind the Iron Curtain.

Although Cullinet sources dismis occurring rumor, the CW hot line company's shake-ups of the past tw prevented the company from being Associates. The source, who's batte agement departures, says Cullinet sell out, but Computer Associates c ing $10 per share because of the ex paying off golden parachutes and o visions that stretch far deeper into al. Computer Associates declined t a bid, but the source said Comput make an acquisition quickly, and candidates. Is J. R. Ewing behind up in the shower? Is Pam hiding ou Call the hot line at 800-3430-6474 help News Editor Pete Bartolik u ers.

INFORMATION PROCESSING 77, B. GILCHRIST, EDITOR

SOME PERSPECTIVES ON NETWORKS—PAST, PRESENT AND FUTURE

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(INVITED PAPER)

This paper reviews the initial motivation for the development of distributed networks using packet switching -- the need for military survivability. All the other highly desirable characteristics for distributed packet network configuration, such as economy, fell out as by-products. Early opposition to packet switching by virtue of its ill fit to a world of analog transmission and electromechanical switching is discussed. The subject is brought to date with a rationale and suggested approach for building future networks and systems in a more robust and distributed form. The goal, in part, is to reduce society's present excessive vulnerability to disruption by natural and man-made disasters ranging from juvenile mischief to terrorist attacks to wars. As an example of the underlying thesis, the paper considers the desirability, feasibility and some possible consequences of building international electronic mail systems on a distributed basis for low cost person-to-person communications.

1. INTRODUCTION

1.1 The RAND papers on distributed communications

The work that is the cause of this presentation today was a dozen or so memoranda I helped prepare while at the RAND Corporation 15 years ago [1]. This work laid out the notion of packet switching. It explored the payoffs for the most effective use of redundancy to achieve reliability in distributed switching; the use of standardized packet format size and the tradeoffs in its size; the header information required; adaptive routing; high speed switching; error detection and repeat transmission; and creation of virtual circuits, etc.

The motivation for this work was not to improve the state of the art of computer communications networking. Rather, it was a specific military need, one that did not lend itself to solution by then available technology.

In the late 1950's and early 1960's the two major world powers had developed intercontinental ballistic missile systems capable of carrying multi-megaton thermonuclear warheads. The technology of offense far eclipsed that of defense and a most dangerous and potentially unstable situation resulted. Only the country that unleashed its weapons first could be assured that it would survive.

Each nation relied upon receiving warning that their opponent had indeed fired their missiles before responding. With highly vulnerable command and control communications the dangers of a dangerous age are multiplied. Failure of these control systems, whether by accident, intent or mere stupidity, could tempt the isolated parts of the network to panic into irrevocable actions. What was needed was a defense system that could withstand the onslaught of a Pearl Harbor type attack and retain the capability for returning the favor in kind shortly thereafter. As unpleasant as this all is, the mutual building of tough, survivable defensive capabilities -- "second strike capability" -- neutralized much of the gain for opening hostilities. It is this single change of defense postures that cooled tensions among the great powers and made detente possible.

It was this need for survivability of communications that required plodding through new ground not previously explored. What was being sought were some insights into how to go about building tough, robust networks that would not come unstrung when stressed. All the side benefits beyond survivability and extreme reliability for distributed networks built with packet switching, such as very low cost, evolved solely as by-products of the data processing required to be present in the basic network design. Once you distribute processing or add packet-by-packet intelligence to switching nodes, a wide range of additional capabilities emerges. Thus, it is possible to build a system whose performance is more reliable than its parts. There is a minor cost in some redundancy, but with care, the amount of this needed redundancy can be shown to be modest. Extreme survivability was found to be achievable with redundancy factors of about three. This may sound wasteful, but as the reliability required for each element was reduced, the overall cost was potentially lower than the minimal redundancy case where every element must be extremely reliable. Thus, the aim to achieve more robust networks provided some insight into building less expensive networks for comparable system performance.

The study of distributed communications was aimed at acquiring an understanding of tradeoffs between robustness, reliability, channel capacity and costs. A network built to withstand physical attacks that destroy half the communications links but permit the residual system to still operate in a coherent, effective manner, achieves approximately the same performance as a system in a benign world built of communications links that can be inoperative about half the time. Such highly intermittent, noisy links are potentially inexpensive in comparison to links that must operate 99.99% of the time. The tradeoff curves between cost and system reliability suggest that the most reliable systems might be built of relatively unreliable and hence low cost elements, if it is system reliability at the lowest overall system cost that is at issue. However, by force of habit this line of systems thinking is hard to swallow and component reliability is still being sought at all costs.

1.2 Some untouched issues

In the last 15 years some of the design issues received much attention. Others have been ignored. Those issues dealing with topics that could be mathematically modeled received most attention, while the more complex and more important topics have gone relatively untouched. In packet switching, where packets travel by different paths, encounter different delay queues and are occasionally mangled, it is important to be assured that low overall error

rates, say 10^{-12}, are possible. A little theory plus some straightforward simulation showed early in the game that the flow and delay problems, while real, were of second order importance in a distributed network. Elegant suboptimization here could not possibly produce as much savings as the same effort spent elsewhere.

Most of the funds available at the time for research were earmarked for support of education. Topics that could fit the rubric of education were relatively well supported. An undue number of Ph.D. candidates were strongly guided by their thesis advisors into producing displays of mathematical symbol manipulations seeking to squeeze a little more out of an assumed hypothetically perfect communications channel in a packet network. For a period of several years research funds were readily available at many major U.S. universities if the student's thesis appeared to have anything to do with information processing science and defense. By proper choice of project titles, military relevence could be implied while the resulting thesis could be read by a thesis advisor totally untrained in the real world of communications systems. The refining of minor issues that lent themselves to straightforward mathematical analysis became an academically acceptable field of exploration, while the more important system issues remained untouched.

I do not wish to deprecate any of this work. My concern is that there are styles in research that is funded just as there are in the length of women's dresses. When one research topic becomes too fashionable it tends to divert the support from other subject areas. Looking back at some of those topics briefly considered 15 years ago and then passed over, some topics appear to stand out as being more promising. For example,

- The concepts of dynamic bandwidth allocations as a function of content, user importance and allowable data aging.
- The real world issues in achieving super-reliability -- the system never failing -- by using higher degrees of connectivity and avoidance of statistical interdependency of failures.
- System design implications of universal multiple layer, low level cryptography.
- Overall systems economics tradeoffs present in use of very low cost, unreliable communications links.
- Design of future generation terminals (including the voice telephone) with packet formation and unpacking inherent in the basic terminal design.

I would be hesitant to recommend any of these topics to a Ph.D. candidate who wishes to acquire his degree painlessly. These topics are too conceptually ill-defined to lend themselves to neat mathematical formulation and they may be too "practical" or, euphemistically, "applied," to carry status in most schools of electrical engineering or computer science today. While greater pay dirt exists in the broader conceptually fuzzy issues, massaging of minor problems that lend themselves to mathematical analysis and whose answers are generally intuitively predictable to within 10 percent, has a greater outcome of assured success.

1.3 Classification

A question asked of me from time to time is "why wasn't the work on distributed communications classified?" I think there was an implicit feeling at RAND at the time to minimize the level of classification here. Only classification to the minimum degree which local custom would comfortably permit was sought. An argument can be made that a more stable world situation exists if the adversary nation has the ability to survive attack and respond later. This reduces the proclivity for either party to take the opportunity of "winning" by going first. Hard as it is to imagine, it may be a non-zero sum game where it is to both parties' advantage to have a truly survivable command and control structure. The key objective of the military is preserving peace, not in fighting wars. A war is a failure to deter. Deterrence is not built by simply piling up more weapons, as the adversary's obvious counter is to build even more weapons in an uncontrolled arms race. But, a measure of stability does occur when each adversary has full respect for the damage the other side can inflict if attacked, thus making pre-emptive actions unrewarding. What at first may seem altruistic, in most instances is simply narrow, but long term best interest. It is doubtful if this early work would have any impact on command and control thinking at all if it were classified. Even making most of the early reports unclassified is not enough. Giving away ideas is not easy. Garbage and technical papers are two commodities of such low value in our culture that we must pay to have them hauled away. Fifteen years ago knowledge of digital processing by the communications community was limited. In particular, understanding of computer technology was absent in the governmental communications agencies that held operational responsibilities.

1.4 The experts' response

My most instructive experience with this emerging technology was the response by the communications community to it. I was in the Computer Science Department at RAND expounding building of non-hierarchical communications networks using computer technology. All signals were to be digital and processed on the fly in standardized blocks of 1024 bits. The notion was not taken seriously at all until the basic system concept was detailed. Then it was emotionally rejected as being thoroughly impractical and unworkable by some of the more respected people in the field of telecommunications at the time. This large and distinguished group included most of my friends at the telephone company and, at first, the Communications Department of RAND. On the other hand, I found many who thought that it all made sense. These people all had computer background -- I received particularly helpful support from the management of the Computer Science Department in the persons of the late John Williams, Willis Ware, Paul Armer and Keith Uncapher. The reason that it was necessary to write literally a two-inch thick pile of paper "On Distributed Communications" down to the transistor-by-transistor level was the response by communications experts not familiar with digital processing. They kicked, screamed, grumbled and worse. Their response tended to be emotional, often with anger, and rarely with humor. They were initially certain that the proponents did not understand how communications sytems work. Part of their response can be appreciated by the realization that the telephone plant even at that time represented an investment in the tens of billions of dollars. When someone comes around and talks about building inexpensive communications networks using unreliable links and nodes, and of networks arranged willy nilly for extremely high survivability, it violates all their basic premises of network design. As this was in the days prior to the FCC allowing competitive communications networks, the cost of unamortized facilities in place was so much larger than that proposed sub-network to be built that the former could not be safely compromised at the expense of the latter.

Although I later came to have an extremely high

regard for the intelligence of my friends in AT&T, I must confess to being slightly dismayed in those early days, when after a long and detailed explanation of how communications networks could be built around the concept of all digital networks including links and high speed packet switching, I would be given a tutorial starting with how a carbon button telephone instrument worked.

At the Bell Telephone Laboratories I encountered a somewhat better reception. Of those competent in the analog technology only, about 90% were difficult to persuade. On the other hand, those proficient in digital processing technology had no difficulty in understanding what was being said. One such person was Edward E. David, then of Bell Labs. One evening, as a favor to Willis Ware, Ed graciously undertook to serve as translator to a senior person at AT&T. After a few of my sentences, Ed turned to his colleague to explain what I had said in telephonese. And, in turn, when his colleague responded in telephonese, his remarks were translated back to me. After this experience, I went off to learn to speak telephone jargon, including Western Electric parts numbers.

1.5 A conceptual block?

Computer trained people rarely had difficulty with the concept or details; those who lacked such background generally encountered difficulties in understanding. Why should intelligent and competent experts in communications systems have difficulty understanding what was so obvious to those with similar background, but who also had some computer experience? In part, it was the difficulty faced in mentally incorporating a new technology with distinctly different characteristics into a god-given larger framework of existing systems architecture. The present form of network required all additional elements to work without disruption to all that has gone before, and all before to be usable to the maximum extent with the improvement.

When one begins to talk to analog communications people about using unreliable trunks with switches that open before the next tandem trunk is connected, the conceptual lack of fit with the existing system creates a mental block. Truth and reality in the world of technology rely heavily on prior background training. The most effective response is then demonstration. How then to show that the notion is workable?

2. SYSTEM EVOLUTION

2.1 The ARPANET

The first workable packet network built was the ARPANET. This was an experiment that was initiated, managed, pushed and pulled and made successful by Lawrence Roberts, then with the Department of Defense, Advanced Research Projects Agency (ARPA). Other work was beginning to take place in this field independently elsewhere, particularly by Davies and others at the British NPL [2]. The ARPANET initially sought to demonstrate that the notion of switching packets on a high speed store and forward basis would, in fact, work. ARPA prepared a request for proposal. Many companies bid. Bolt, Beranek and Newman won the contract, and the BBN group became the first implementers. It was Robert's strong personal interest, effective leadership and control of a large research budget at ARPA that made packet switching feasible. For a few year period many universities in the U.S. found that they could obtain research dollars most readily by proposing work that related to the ARPANET. This mere scale of effort assured that some good work would result, and much did.

The initial ARPANET experiment was a network to interconnect computers at relatively low data rates so that ordinary telephone lines could be used to form the links. To reduce transit delays, 50 Kb bandwidths were used. What emerged became institutionalized, and is now synonymous with packet switching. Although the ARPANET is highly economic for data transmission, it only scratches the range of basic capabilities of this direction of communications system architecture. A few decades may have to pass before we begin to see the eventual evolution toward robust, large, universal services, high speed packet based networks operating at the 50 megabit per second rates and higher.

2.2 Future network architecture

Today's low data rate packet networks, while highly effective, should not be regarded as more than transitional developments. Opportunity for decimal magnitudes of improvement still await capture. But, it may take moving away from present approaches to consider future demands in fresh terms. The early work cited was not intended to describe an "ultimate" system. It was only intended to serve as an existence proof to suggest that there are other ways of approaching network design than the then solely considered hierarchical configuration.

2.3 Why tougher systems?

What sort of changes would be helpful in next generation networks? Of course higher data rates and lower cost are desirable, but of all parameters, I would opt for greater emphasis on robustness. In a world where natural and man-made damage is not unknown, networks tend to be vulnerable to damage by even small groups seeking to disrupt a nation's infrastructure. In a world we regard as being at peace, bombings are commonplace in a dozen countries every day. Some are set to attract the attention of the news media for political aims. A few individuals bent on changing their own governments, or a small nation seeking to change international order may well find telecommunications and other utility structures to often be their most cost effective targets. We tend to build minimum redundancy systems designed only for a benign world. This makes mischief and civil disruption most cost effective against the highly capital intensive shared utilities: common carrier transportation, electrical power and telecommunications. Information transmission structures tend to be highly vulnerable to sophisticated attack. Our large systems are generally well designed to cope with natural disasters, but tend to underplay the probability of and response to man-caused system failures.

2.4 Approach

We have learned a little about the payoff for distributed processing. We understand the use of redundancy in error correcting digital processing and in the building of reliable organisms. Perhaps it is time to consider transferring some of these concepts to the architectural design of our information systems and even our social order system. In the larger view, could we have a more stable world if it were organized along the same lines as distributed information and control systems? Is the concept of the sovereign level of government each centralized in a single vulnerable node, such as a Washington or a Moscow, a wise choice in the very long term future? Change cannot take place rapidly here. Try as we might to build a stable and peaceful world, national governments with inviolable internal sovereignty may be expected to be around for at least the next hundred years. During this time we must live with nationalistic sovereign nations with the right to do whatever they please within their borders, even in a world where the weapons are extremely destructive and

portable. Most governments are run by reasonable people primarily concerned with betterment of their own citizens' lives. Nuclear proliferation is occurring and we must face the long range reality that in the family of nations there are occasions, however rare, in which the power is in the hand of an erratic or even crazy leader.

3. COMPUTER DATA BECOMING PEOPLE DATA

3.1 Hidden use of data networks

Let us move beyond the negative issues of the need and directions for building more robust systems for the moment and consider a promising development -- the development of sophisticated electronic message services. This has come about by the broadened use of data networks in general, and the ARPANET in particular.

In the next several years the early packet networks of the world will begin to interconnect. The resulting overall network will be more effective and useful for international communications than ever before possible. It could well become more important than voice telephone connection. Most people believe the networks are conveying digital data between computers. More likely the major portion of the data traffic is language text. It is messages exchanged between humans with relatively unsophisticated intermediate processing. Increasingly computer terminals, and the connected computers, are primarily facilitating the exchange of human-to-human messages.

Those knowledgable about these matters are disposed to look the other way and pretend that it is only "data" being sent to avoid a sticky regulatory battle. By accident of history, the tariff structure used by the telephone and telegraph administrations throughout the world for language text transmission is based upon telegram transmission costs. The tremendous decline in transmission cost in terms of bit-kilometers has not been directly reflected to the network users. The savings by new transmission technology are, throughout the world, generally used to cross subsidize other services felt to be more socially desirable. Rate disparities are commonplace. Bit-kilometer tariffs between countries are disproportionately expensive in comparison to flows within a nation's borders. The telephone user pays less for his bits than the data user. A three minute international telephone call using a 56 Kb digital PCM channel can transmit 3 x 60 x 56 000 or over 10 million bits or about 7000 pages of text. This can be an awful lot of record traffic for a few dollars, but the old tariffs in existance block such applications. Thus, those who transmit data at these bargain rates do not want to talk about their loophole. In the process, however, we are concealing a major evolutionary development -- a breakthrough in low international communications costs for alphanumeric text.

3.2 Pro and anti-people technology

Some observers of mass communications consider communications technology in terms of being pro or anti unfettered person-to-person communications. For example, reusable magnetic tape video recorders are called "pro-people" because any individual can publish at a person-affordable cost (under $1000) to control their own communications medium. Other forms of video recording that require an expensive shared reproduction facility costing in the millions of dollars, such as that proposed by CBS, the Phillips/MCA disks, or the RCA disks, are called "anti-people." The high cost of the master producing machines takes power from individuals. This power is concentrated into the hands of those who can afford to own an expensive duplicating machine -- large organizations or governments. Amateur CB radio is "pro-people" communications. National network TV broadcasting is regarded as "anti-people" as it permits control by institutions.

The proponents of "pro-people," or small scale technology (versus conventional "anti-people," or large scale technology) hold an implicit belief. That is that a society organized on a distributed, or a more person-to-person basis, can be more stable, less constraining and more adaptable to change than more impersonal, hierarchical, monolithic organizations.

3.3 Building an international people-to-people network inexpensively

Would a "pro-people" international communications network be socially useful? Is it feasible? Could use of in-place telephone circuits plus a little small scale technology make it possible to build low cost people-to-people written text systems crossing national boundaries? Let us consider this wild thought a bit, including the applications, the technology, and its likely source of evolution.

Conventional communications networks represent large scale investments and are generally national monopolies. One impact of packet switching is to reduce the cost of entry into the bit transmission and remote processing business. It lends itself to permitting a small amount of raw transmission bandwidth to be purchased and subdivided among many non-co-located users. We must consider five major components of our hypothetical person-to-person packet switched network: 1) the user's terminal; 2) a local distribution system; 3) an IMP, or packet switching node; 4) long distance transmission lines or satellites; and 5) a host computer, somewhere.

In fathoming the future it is necessary to reconsider our old view as to the economics of complex electronics. The LSI revolution is far along and its offspring, the microprocessor, is here together with powerful support chips, plus very low cost memory. The hardware to build a workable switching node, or IMP, for a packet system even today is now affordable by the computer hobbyist. Very low cost terminals will soon be here. These can be bootlegged by acoustic coupling to the existing telephone network. Since the long distance telephone line cost is tolerable if we buy a voice circuit and divide it up among the potential users all the hardware ingredients will soon exist for a people-affordable network. We shall consider its application, but first let us ask "who might build such a system?"

3.4 Who may be the builders?

The computer hobby is a phenomenon less than two years old. Computer clubs abound in the U.S. At this time 250 stores in the U.S. specialize in selling microcomputers and low cost peripherals. The computer hobbyist group appears to be comprised of those who work in the computer field by day with their avocation following their vocational interest at night. These are highly competent and imaginative individuals, and are not totally impoverished. Each issue of the present hobby literature is probably richer in economically useful ideas than can be found in journals of the professional computer literature. Hobbyist software tends to be better written than commerical programs. A powerful Basic language jammed onto a single ROM chip or two is a common achievement. Unlike the commercial sector, hobbyists actively trade their software. It is the hobbyists who developed the most useful low cost magnetic media data exchange standard -- "the Kansas City Standard" -- for cassettes. By this I mean that one can build more cost effective

equipments using the hobbyist standard than commercial data processing standards. The computer hobbyists are probably having more profound effects on technology development than even the radio amateur operators did in the early days of radio -- when the spectrum above 200 meters was regarded as useless, only to be developed by the amateurs. We may well be entering a new era where small groups of individuals using their own funds can be the builders of the digital communications and processing systems of tomorrow. Of course, large companies, well funded government laboratories and other institutions will always be around to take claim for the commercialized versions of any innovations as has always been the case. We may have to watch this phenomenon carefully to see how it occurs. What we do know is that the basic elements needed are now down to the pocketbook level of the hobbyists. The major stumbling block that might hold back this person-to-person channel of development is the rigorous grip that the communications industry holds everywhere in the world by virtue of government monopoly regulation. This nationalization or heavy administrative control came from the past historic control of communications by the military agencies of government starting in the day of the optical semaphore telegraph. Perhaps it is time to reconsider the use and control of communications channels and extend personal freedom by allowing the public access rights to its own communications resource.

3.5 What will it be used for?

How is the new network going to be used? If the American scene is correct, we might see games and messages. The messages could well replace the postal mail. Of course, you may argue, we already have a good international mail system. Yes, a letter can generally be exchanged between any two people in much of the developed world in anywhere from a few days to perhaps two weeks. With a good electronic message system you can interact several times a day with virtually instantaneous transmission. A different form of communications results when messages are exchanged in hours in lieu of days at a time. With proper technology, the cost of electronic messages can be cheaper than postal rates.

3.6 Impact

Any time you change things by a decimal order of magnitude, you change quality as well as quantity. The automobile = 100 kilometers/hour; the airplane = 1000 kilometers/hour. Neglecting secondary characteristic differences, such as the airplane's ability to travel over water, the simple factor of 10 can provide revolutionary change in the structure of society. With a drastic increase in the speed of international person-to-person mail, a revolutionary change can take place; not simply in the speed and cost of transmitting written text, but also in the way letters are written and how they are used. With a good text editing and retrieval system there is less need for typists to retype letters before transmission, thus serving to both shorten the length of the messages and to accelerate turnaround time.

By its nature, data is a universal language. Certainly the Arabic numeral set is universal. Even the character sets of the world's written languages tend to map onto a much smaller set than the number of languages themselves. A single Roman language (with a handful of local character exceptions) combines the separate languages of the entire Western world. Many more people will be able to communicate across the written text language barriers than can the oral language barrier. (Many more read, albeit slowly and painfully, the language of others than can hear it and understand it in real time.)

3.7 Subversive objective

By undercutting the existing tariff structures for record traffic by bypassing government controls, we may be able to do more to create effective and international cooperation at the person-to-person level than all the grandiose institutions that have been tried in the past, including the United Nations, internation broadcasting, grandstand games such as the Soyuz-Apollo linkup, the Peace Corps and large scale diplomatic agencies taking turns entertaining one another at the expense of the taxpayers of the hosting nations.

4. CONCLUSIONS

I have discussed two seemingly divergent topics in the latter section of this paper: building tougher network structures and encouraging the development of person-to-person communications around the world bypassing rigid national control structures. They are really related issues as both are directed towards a more stable world order.

Very long term world stability can occur only if the vast economic and social disparities between nations can be reduced. This will take improved international communications, not only for governments and businesses, but also for people. Still, it might take a hundred years or more. In the interim, civil comfort may require understanding of how to build more robust information systems for societies' infrastructure.

Information is different than all other resources. If I sold you a physical commodity, I would no longer have it. Sharing information benefits all. After I give information to you, I still have it to use for myself. There are greater chances for devising a non-zero sum game for information activities in international intercourse than ever possible in physical resource trading. Improved information flows may well be more important than physical resources. In the highly developed countries of the world today more than half of the GNP is developed via the transmission and processing of information. Thus, the scope for economic impact can be great. God has sprinkled mineral resources very unevenly, but brains surprisingly uniformly throughout the world, considering the different needs to survive in different cultures. Altruism has its bounds. While it is nice to have a long range view of a world with reduced economic tensions (never forget that both Adam Smith and Karl Marx were only economists), there are heavy prices to be paid for any such transition.

To give an example close to home; with the future almost zero cost computer communications capability, it will be possible to program a computer from anywhere. Can you imagine a world where most of the software will be written by the lowest cost labor available, irrespective of what country it may be found? Clearly, it is a mixed blessing, with most of us who read this having very much to lose in the short term while the rewards may be long in coming and can be felt only by others. Maybe this is what statesmanship is all about.

REFERENCES

[1] Paul Baran, On distributed communications: I. Introduction to distributed communications networks, The RAND Corporation, Santa Monica, California, Memorandum RM-3420-PR, August 1964.

Sharla P. Boehm and Paul Baran, On distributed communications: II. Digital simulation of hot-potato routing in a broadband distributed communications network, RAND Corp. Memorandum RM-3103-PR, August 1964.

J.W. Smith, On distributed communications: III. Determination of path-lengths in a distributed network, RAND Corp. Memorandum RM-3578-PR, August 1964.

Paul Baran, On distributed communications: IV. Priority, precedence, and overload, RAND Corp. Memorandum RM-3638-PR, August 1964.

Paul Baran, On distributed communications: V. History, alternative approaches, and comparisons, RAND Corp. Memorandum RM-3097-PR, August 1964.

Paul Baran, On distributed communications: VI. Mini-cost microwave, RAND Corp. Memorandum RM-3762-PR, August 1964.

Paul Baran, On distributed communications: VII. Tentative engineering specifications and preliminary design for a high-data-rate distributed network switching node, RAND Corp. Memorandum RM-3763-PR, August 1964.

Paul Baran, On distributed communications: VIII. The multiplexing station, RAND Corp. Memorandum RM-3764-PR, August 1964.

Paul Baran, On distributed communications: IX. Security, secrecy, and tamper-free considerations, RAND Corp. Memorandum RM-3765-PR, August 1964.

Paul Baran, On distributed communications: X. Cost estimate, RAND Corp. Memorandum RM-3766-PR, August 1964.

Paul Baran, On distributed communications: XI. Summary overview, RAND Corp. Memorandum RM-3767-PR, August 1964.

[2] D.W. Davies, K.A. Bartlett, R.A. Scantlebury, and P.T. Wilkinson, A digital communications network for computers giving rapid response at remote terminals, ACM Symposium, Gatlinburg, October 1967.

INWG GENERAL NOTE 192

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A BASIC MAIL SCHEME FOR EIN

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1.0 INTRODUCTION

This note describes and elaborates upon a basic message format and protocol that was proposed and discussed during an EIN meeting held at NPL on 11-12 January 1979.

The protocol is intended for the exchange of short messages between terminals connected through a data network, and is based on points made during the meeting and on ideas in some of the papers introduced by the participants, although not all of those present would necessarily support all the proposals detailed here.

It is assumed that a reliable transport service connects the sender and the receiver for the duration of the message transfer and its acknowledgement. This reliable transport service must provide a duplex (simultaneous, independent, forward and return channels) connection between the sender and receiver, with packet ordering and error correction. Connections through X25 interfaces or through EIN transport stations will be quite suitable to support the basic mail protocol. A mapping facility to allow a connection between a mail server process on an X25 network, and another on an EIN TS should be straightforward. This is a matter for further study, but in no way affects the design of the basic mail scheme described in this note.

2.0 DESIGN PRINCIPLES

2.1 The guiding principle in this design is the idea that a user with a typical visual display terminal should be able to construct a message and operate the transfer protocol by himself. In practice this may not actually happen, but the adoption of this approach should result in a scheme that can be used with small intelligent terminals, having local processing and editing features, as well as with mini and mainframe systems that support many dumb terminals. With these, of course, the user may expect to have comprehensive help from his local system in preparing and sending messages, but any such facilities are left to the local system designer to provide in whatever way he feels appropriate.

2.2 It is also very likely that an existing centralised mailbox service could be easily adapted to communicate with other mailbox services using this basic scheme. But, again, it is up to the designers concerned to make the decision on whether and how this could be done.

2.3 As far as possible, the present scheme is made self-explanatory to simplify the task of implementation, to promote a ready understanding by users and to facilitate fault-finding in what is, essentially, a distributed arrangement. To achieve these objectives, we

have employed simple, natural-language strings using only ISO printing characters for message headers, as well as for the contents of command and response fields. However, the message text itself can be in any code.

2.4 The scheme is made analagous to the ordinary postal service: there is an 'envelope' of information that must be provided by the sender (or his local system) accompanied by a 'letter' or 'message' text of one or more paragraphs.

2.5 The envelope is preceded by the header string <MAIL:SEND> and the letter text ends with the string <MAIL:ENDS>. (Note that the brackets < > are used to identify the string in each case, they do not themselves form part of it).

2.6 The envelope comprises five mandatory fields that may be sent in any order. Their headers (and their names) are as follows:- <TO:>, <FROM:>, <DATE:>, <TIME:>, <LENGTH:>

2.7 The letter text is sent with each paragraph in a separate field which is preceded by the header <PARA:(decimal number).> where (decimal number) is the sequence number of each paragraph, beginning with 1. (The paragraph PARA:0. i.e. paragraph zero, is reserved for any references inserted by a sophisticated future system or protocol, as is suggested by section 4).

2.8 The opening delimiter of the envelope is <MAIL:SEND> and the closing delimiter for any field of the envelope is any one of the specified envelope headers, or <PARA:>.

2.9 The contents of the envelope fields are defined below.

Any additional ISO formatting characters introduced during message composition may be transmitted, but can be ignored on reception. (See figures 1 and 2).

TO: this has the form <Name> @ <Place> where Name and Place are as advertised by the person interested in receiving messages.

FROM: this has the form <Name> @ <Place) where Name and Place must be the advertised address of the sender.

DATE: this must be in ISO standard form, e.g. year, month, day

19790122 or 1979 01 22

TIME: this must be in ISO standard form, e.g. hours, minutes (optionally seconds and decimal fractions of seconds may be added).

1430 or 143022.129 or 14 30 22.129

LENGTH: this is given as an aid to the receiver in planning his storage allocation. It is an approximate text length in number of characters.

(It must not, therefore, be checked against the actual length as a test for protocol violation). Possible extensions might be to allow lengths in lines or pages to be inserted in this field as well.

2.10 The letter text may contain any characters. However, the sender must obviously avoid using PARA:<any number>. and MAIL:ENDS within each paragraph. (Some local system designers may arrange to parse the text and warn the sender if the text contains these strings, so that he, or the system, may break up the string in the text by inserting, say, a space before the colon).

2.11 The message protocol consists of the opening of a call or liaison by the sender and his transmission of the string <TAKE:MAIL>. The receiver replies with <GIVE:MAIL> whereupon the sender despatches <MAIL:SEND> then the envelope followed by the letter text, and, finally, <MAIL:ENDS>.

2.12 The receiver acknowledges receipt of <MAIL:ENDS> by replying with <MAIL:OK> to indicate a successful reception, and then clears the call or liaison. In the absence of any reply the sender may be expected to clear the call and attempt to repeat the interaction at whatever interval he sees fit, because message retransmission is outside the scope of this particular protocol. A receiver may also return a non-delivery message before clearing the connection. This uses <MAIL:OK<any string>.>, where <any string> is the reason for non-delivery using printable ISO characters only. (Here non-delivery means the mail reached the 'place', but not the 'name'.)

Note the <.> (stop) used as an optional string delimiter. This is not essential because the liaison should in any case be closed after a timeout, but it makes for a cleaner termination. It is made optional so that a user who forgets to include it, while personally constructing the protocol at his terminal, will not cause a protocol failure. In effect, this means that the reply can be one sentence of any length.

3.0 MESSAGE CONSTRUCTION AND DESPATCH

3.1 In accordance with the principle that a message should be constructable on simple terminals, a user could set out the envelope and a message on his visual display and hold it in the terminal's local store, as shown in figure 1. He could then call the recipient (perhaps by dialling him through the PSTN) and type <TAKE:MAIL>. Upon receiving the reply <GIVE:MAIL>, indicating he was connected to a mail receiving process, he could command his own terminal to send the contents of its local store, as one long string of characters. Eventually, the reply <MAIL:OK.> would indicate success.

3.2 Alternatively, depending on the nature of the called system, the reply could be a readable non-delivery message of some kind, as decided by the designer of the called

system.

3.3 The calling user would, naturally, use formatting characters in laying out his message, and these are allowed to be sent to the called system to simplify the protocol implementation in the senders system (as shown in figure 1). Indeed, as we saw above, there need be no local sending process when the user constructs messages and manages his own calls. However, because all redundant characters may be charged, a local sending process may remove them to produce the compacted message shown in figure 2. Either of these two forms (figure 1 or figure 2) is allowed to be sent.

This is why the receiving system need not try to take account of formatting characters. Of course, even if the message is displayed on a simple receiving terminal that tries to interpret the format characters, it will almost certainly be capable of interpretation by the called user.

3.4 A more sophisticated system would help a user to construct his message. He would start with a request for the mail service, probably by typing MAIL, SENDMAIL or whatever such command was locally defined. The system reply prompt might be:

TO:

or perhaps

TO(type? for help):

(if the local system had a user help facility, such as is common in ARPAnet systems).

Maybe only the initials of the destination user would need to be given, and the correct full details would be substituted by the system. Certainly, all the locally known information could be inserted by the system on the users behalf. Possibly, the user could command the local system to send an existing file as the message text. He might even ask the system to despatch a series of messages when convenient and could check later to see whether MAIL:OK. had been returned, or whether some other non-delivery message (received from the called system) had been appended to the appropriate copies of his own messages retained by his local system.

3.5 Further refinements of a comprehensive mail sending process could include the broadcasting of 'carbon copies' to a list of addressees. This might (as in ARPAnet) use the local prompt:

CC (for help type?):

where either a name or file of names may be given by the user. Copies of the sender's message would then be sent independently by the local system, using the basic mail scheme defined in section 2 of this note. If this were done, a list of names could usefully be inserted as the

first paragraph of the message as an option, i.e.the use of PARA:0. described in section 2.6, without affecting the design of the basic protocol.

3.6 There are a variety of other items that might be included, automatically, in the message text by a sophisticated sending system. One possibility could be some authentication details comprehensible only by the destination user; perhaps a message sequence number or a reference of some kind would be useful, while an indication of when the message may be considered out-of-date might also be valuable. But the important principle to be adhered to is that all such extra features should be included in the message text rather than in the envelope, in order to keep the basic scheme simple and cheap for the ordinary user.

Again, the use of the reserved paragraph, < PARA:0.>, for such additional useful items would seem to be a good way to handle this requirement, if it is found to exist at a later stage.

4.0 MESSAGE RECEPTION AND ACKNOWLEDGEMENT

4.1 Messages in the forms shown in figure 1 and 2 could be printed directly on a simple terminal, and would be comprehensible to ordinary users. But a more sophisticated local receiving system could offer various extra facilities to its users.

4.2 Formatting to a local user's requirements would be an obvious feature to provide a layout of the message in another fashion; for example, as in figure 3. Here the transmitted formatting characters are discarded and the receiving process reformats the mandatory information to suit the receiving user's specification.

4.3 Further services might be to sort and list messages according to time, date, or sender; to re-address and forward messages to another site nominated by the receiving user; to print, or not print, received paragraph numbers; to automatically format a reply text and, if required, also copy it to a list of addresses, and so on. These kinds of features can all be provided without elaborating the basic mail scheme of section 2.0.

4.4 The acknowledgement of the message texts after it has been received, is catered for by the exchange of signals:

<MAIL:ENDS> and <MAIL:OK<string>.>

When the receiver is a user at a simple terminal the positive acknowledgement string <OK.> may be typed, or (in the case of non-delivery) a suitable string such as <wrong number.> or <moved to new address.>, that will convey useful information to the sending user. When the reply is from a receiving process, the text of failure messages will be left to the system designer. However, to accord with the spirit of this scheme they should be made understandable to the sender by the use of plain text, rather than the cryptic codes often used in older,

storage-limited, computer systems.

4.5 The acknowledgement of the receipt of the text of a message by the person to whom it is addressed cannot be readily made automatic, although a sophisticated system could, itself, generate and send a reply message such as:

"your message dated <time, date> to <addressee name> was read on <date>",

when the receiving user eventually logged on and called for a display of the original message.

4.6 However, any reply that relates to the meaning of the contents of a received message, will generally have to come from the person concerned; this reply would be in the form of a new message in which it was up to the user to make appropriate references to identify the original message. Often, the date, time and addressee name would suffice, and this could be automatically inserted by a message reply process as the first paragraph (<para:0.> of section 2.6) of the message. Again, all these features could be supported by the simple mail scheme already described.

5.0 THE MESSAGE PROTOCOL

5.1 The basic protocol is that shown in figure 4. The exchange of the messages <TAKE:MAIL> and <GIVE:MAIL> by the sending and receiving processes (after a call or liaison has been established) verifies that two mail servers are in contact. Thereafter, the envelope and text are sent as a continuous string, beginning with <MAIL:SEND> and ending with <MAIL:ENDS>.

5.2 The reply <MAIL:OK.> signifies success, otherwise a non-delivery message, a failure message or no reply at all may be generated by the receiver. The action of the sender and receiver in these four cases is at a higher level of protocol and depends on an agreement between sender and receiver. (A general protocol for this purpose could be the subject of further study).

5.3 A well designed protocol server will check protocol messages for correctness in a variety of ways. It may find errors introduced due to incorrect implementation at the remote site, or human error when a simple terminal is involved in the transaction. Rather than abort the proceedings abruptly, it is desirable for failure messages to be generated. This is up to the designer of the particular system, but a simple scheme would be to return the string that failed the test, enclosed in the reply <MAIL:FAIL:<string>.> where <string> may be the detected failed string, or some suitable explanation as appropriate. This elaboration of the protocol is compatible with the basic version, because the string <FAIL:<string>.> will be interpreted as a normal failure message by a basic sending process, and will be appended to the copy of the sender's original message in his local system.

As an example, if a sender had not given the date in ISO form, the failure message might be:-

MAIL:FAIL:JAN 22 1979.

The sender could, reasonably, deduce what had happened and would know that his message had not been received, having been aborted on receipt of the incorrect date field. A summary of protocol headers is given in figure 5.

6.0 IMPLEMENTATION NOTES

6.1 The sending system must be able to set up a call (or liaison) to the destination corresponding to the name and place given in the TO: field. A table of places readable through the network is therefore required to be held locally (ie. an "address file" corresponding to the notes of personal addresses and telephone numbers that most people carry). A table look-up need provide only the place, when the destination accommodates more than one recipient, because the receiving system can manage the selection of the right recipients. However, the name as well as the place will have to be used to look up the address for a call, say, to an intelligent terminal with one user. In any case, the original contents of the TO: field must be sent forward intact to the destination, as must be the contents of all the other fields. (For unknown addresses, the equivalent of the telephone directory is needed and this is probably a service that has to be implemented on a central system which everyone calls and then sends their name and place details. This could be automated quite easily, using the standard format proposed here. Just sending an envelope with a null message would suffice to let the system know a new subscriber existed).

NIC

6.2 The contents of the reply message acknowledging the receipt of the envelope and letter text must be appended to a local copy of the sent message kept by the sending system. This enables the sender to see what has happened. Normally, this reply will be "OK". No reply is assumed to indicate non receipt, while any other message should give a reason for a failure. But, whatever reply is received, it should be appended to the users local copy, so he may sort out what has gone wrong. His ability to do so will, of course, depend on the design of the mail server process at the destination site, and the quality of the diagnostic messages that it generates.

Bad place to keep it

6.3 A reasonable implementation of a receiving mail server should employ <MAIL:OK:<string>.> to indicate that the complete text has been received and is "being forwarded to" or "has been displayed to user" or "has been stored", and so on. When the complete message has not been properly received, the failure message should employ <MAIL:FAIL<string>.>, where <string> may be the part of the transmitted 'string' found to be in error, or may be a more informative message such as "only one paragraph accepted" or "text lost during PARA:N" or "text discarded from PARA:N". Such messages could be agreed as a higher level 'mail users' protocol, at a later stage, after experience with the basic scheme has been obtained.

Alternatively, they could be introduced piecemeal as a result of comments from users.

6.4 Care must be taken in the implementation of both sending and receiving mail server processes to ensure that liaisons and calls are not cleared until the ends of messages have had a reasonable chance of being delivered. In fact, there are a number of timeouts associated with the use of any protocol that are strictly, perhaps, the concern of the local system designer. Hopefully, after one or two trial implementations, some general guidance on these might be included in a future specification.

7.0 FILE TRANSFER AND EDITING

7.1 In this section we consider, briefly, some ways in which the basic idea of using simple strings in protocols could be extended to the manipulation of the text portion of the messages. Of course, this is just an outline to indicate possible lines of development, in what is really a complete subject in itself.

7.2 The use of numbered paragraphs allows a text file to be manipulated in terms of paragraphs, so recovery from errors may be made to the nearest correct paragraph. After a call failure, a re-sent message may start from just before the point where a breakdown occurred; instead of having to be repeated from the begining. Certainly in person-to-person transfers this avoids tedious repetition, and it would also be easy to design a simple file transfer protocol to allow processes to exploit the paragraph structure to exchange long files in an efficient way. This differs from the conventional file transfer protocols which use arbitrary markers for recovery puposes.

Need unique message Identification Too.

7.3 Useful commands would be <FORWARD to PARA:>, <BACK to PARA:>, <REPEAT FROM PARA:> and so on. If these are given as natural language strings, the implementation of the receiving process can (if necessary) be made without any discussion with the designer of the sending system. This is certainly not the case when compact coding is used, for example, with a single character to indicate each command. Of course, a command delimiter would be helpful to separate commands from text, and one way to do this would be to enclose commands within "less than" < and 'greater than' > brackets, as indeed, has been done in this text.

Who initiates transmission?

I don't believe there is a standard

Of course, it is necessary to avoid possible confusion with the use of these symbols in mathematical texts. This could be done as in the NPL Scrapbook system, by using the asterisk as well to form a combination rare in normal text. ie. *<"Characters of special meaning to the system and not to be taken as part of the text">*

7.4 The above scheme could be extended to allow formatting of text to be achieved using meaningful strings of characters instead of codes as is generally the case at present. For example, it is obvious what *<form feed>* or *<new page>* means, whereas the CCITT alphabet No.5 character that means form feed is not immediately known to everyone. Again, *<SKIP 10 LINES>* or *<INSERT 200 SPACES>* are

Do we need a standard formatter?

intelligible to anyone designing a process to implement them. And, if a formatting process finds a new command that it cannot interpret, it can be left in the text unchanged so the user can see and understand what was intended by the originator.

7.5 In conclusion, therefore, the MAIL scheme and its file handling extension proposed here, can be seen to be simple, but powerful, because it is based on alphanumeric string commands and responses. It minimises ambiguity in implementation and is capable of indefinite extension as has been indicated in this section. Of course, the use of strings compared with traditional encodings increases the cost of transmission and storage, but it gives increased understanding and an enhanced ability to identify and recover from errors. These will probably be decisive elements in the effective development of 'open systems' that have to interact through public data networks with other systems of different design and manufacture.

8.0 USE OF OTHER NATURAL LANGUAGES

8.1 We have, for obvious reasons, described this scheme in terms of our own native tongue. However, the use of natural language strings has a potentially important advantage for international message transfer, because it could allow the use of alternative, equivalent strings for the commands and responses governing an interaction.

For example, a French mail process might use: <PRENEZ:COURRIER> and <DONNEZ:COURRIER>, possibly truncated to <PREN:COUR> and <DONN:COUR>, while a German mail process might use <GEBEN:BRIEF> and <NEHMEN:BRIEF>, and so on.

8.2 Adopting these proposals would appear to add complication to the mail server processes for international interactions, but the appropriate local look-up tables could be selected at the time of a connection to give some simplification. International protocol exchanges would probably be in a mixed language because each server process would, presumably, transmit commands in its own language and look for responses in that appropriate for the other party.

8.3 But even when such a protocol had to be conducted by a person at a terminal, an interaction would still be feasible, because it would be easy for him to remember the local commands and responses that had to be transmitted, and not too difficult for him to guess the meaning of those received from the other end.

8.4 The agreement of local user interfaces in different natural languages is, of course, not a problem at all, because they can be made independent of the basic mail protocol. A simple translation into French is given in figure 6. to illustrate this point. The user's local mail process would carry out the translation between such an interface and the commands used by the mail exchange protocol, which could well be in the mixed form mentioned above. But, ideally, it might even be possible to chose a

set of natural language strings to reduce the processing load for international mail transfers. For example, Latin might provide a common basis for an acceptable set, at least in Europe among the remnants of the Roman Empire.

8.5 Of course, there remains the problem faced by the recipient of a message text when it is sent to him in a foreign tongue. But there is nothing - short of machine translation - that our proposed scheme can do to help him.

9.0 CONCLUSIONS

In this note, we have endeavoured to present a scheme by which messages may be exchanged freely between people with terminals, even when they are not greatly assisted by a powerful local processing system.

We are conscious that many difficulties remain to be dealt with, but we put these ideas forward in the hope that they will be constructively criticised by those who care to think about the problems we have addressed.

We are most grateful for the discussions at the EIN meeting, which catalysed the thinking that led to this note, and we acknowledge the debt to our colleagues whose comments have already helped to polish this basic mail scheme to its present stage of development.

FIGURE 1: FORMATTED MESSAGE

```
MAIL:SEND

TO:       ABC@XYZ

DATE:     19790122  TIME: 16 50

FROM:     DLAB@EIN

LENGTH:   100

PARA:1.
          This is an example of a message format proposed
          for the simple mail service.
PARA:2.
          This is another possibility.

MAIL:ENDS
```

FIGURE 2: COMPACTED MESSAGE

```
MAIL:SEND:TO:ABC@XYZDATE:19790122TIME:1650FROM:DLAB@EINLENGTH:100PARA:1.
          This is an example of a message format proposed
          for the simple mail service.
PARA:2.
          This is another possibility.
MAIL:ENDS
```

FIGURE 3: ALTERNATIVE FORMATTING BY RECEIVER

Message from: <Name>of<Place>

Dated: <hours><minutes><am/pm> local time
<day><month name><year>

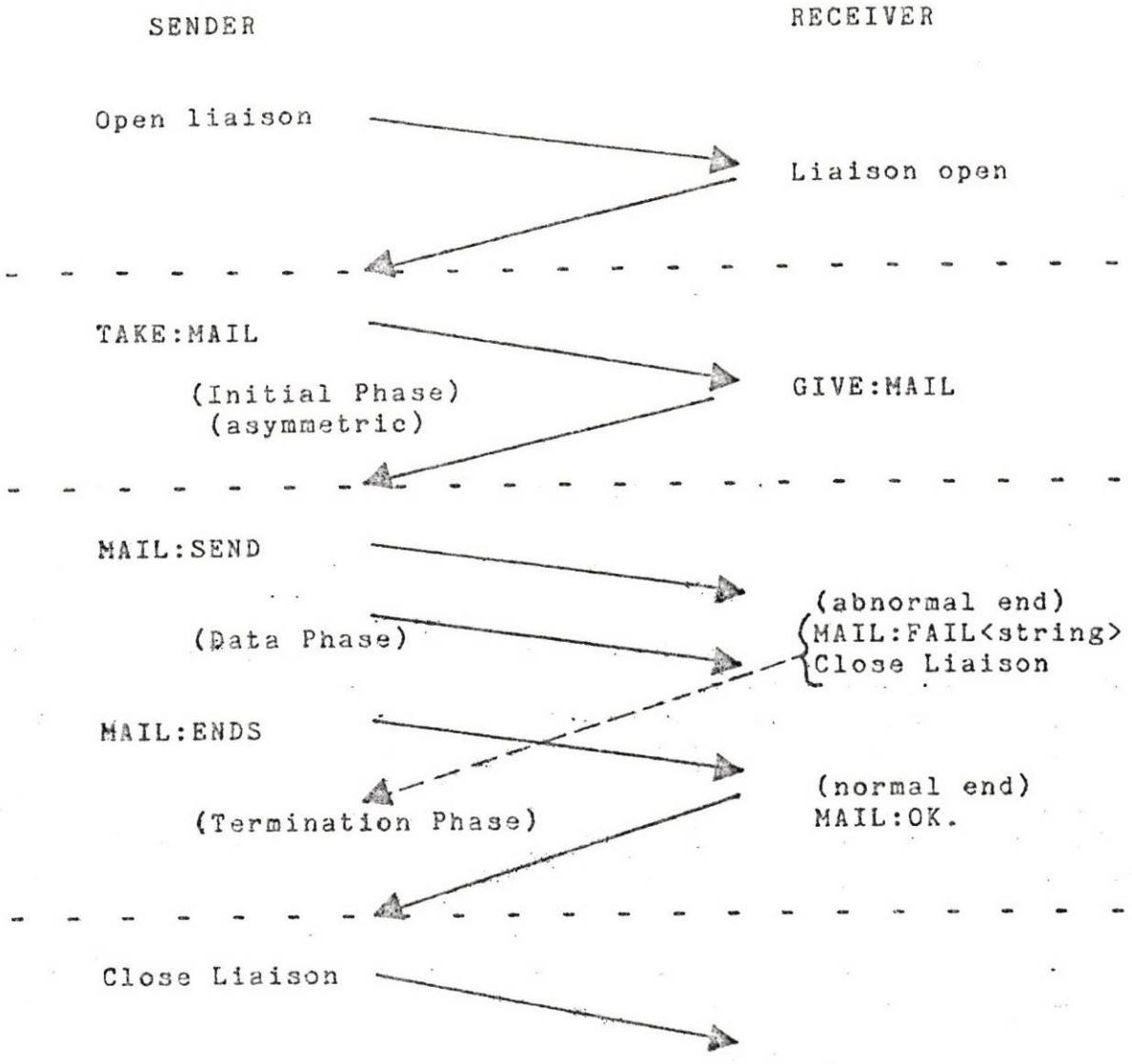
Received and Acknowledged:<time><date>

Text of Message is:

(Text with, or without, paragraph numbers)
or (Message text stored in file <name>)
or (First paragraph <contents>, others stored in file<name>)
or (any other desired scheme)

Do you wish to reply (type yes or no)?
(to automatically call a reply process that merely requires the text to be returned to the sender)

FIGURE 4: THE BASIC PROTOCOL



Notes: 1) Normal end liaison closed by SENDER
2) Abnormal end liaison closed by RECEIVER

FIGURE 5: SUMMARY OF PROTOCOL COMMANDS AND MESSAGE HEADERS

1. From sender

```
TAKE:MAIL
MAIL:SEND
     TO:      <string>                    <name@place>
     FROM:    <string>                    <name@place>
     DATE:    <ISO format>                <year,month,day>
     TIME:    <ISO format>                <hours,mins,zone>
     LENGTH:<approximate in characters>
     PARA:<decimal number>.
MAIL:ENDS
```

2. From receiver

```
GIVE:MAIL
MAIL:OK.                                 normal end
MAIL:OK:<string>.                        <reason for non-delivery>
MAIL:FAIL:<string>.                      <reason for failure>
No Reply                                 'abnormal' end
```

FIGURE 6: DIFFERENT LOCAL USER INTERFACES

COURRIER:ENVOYEZ

A:

DATE:

DE:

LONGUEUR:

PARA:1. Voici un example du service courrier de l'EIN

COURRIER:FIN

INWG NOTE 199
March 1979

AMENDMENTS TO BASIC MAIL SCHEME

D L A Barber, Director - European Informatics Network

Following the receipt of comments on INWG Note 192, both in Note 198 and verbally from various sources, I propose the following modifications. These also line up with some of the ideas in Notes 190 and 191.

Firstly, the use of @ between <name> and <place>, i.e. <name>@<place> has been criticised. I suggest the use of OF: replaces @ in the destination address and AT: replaces @ in the originators address.

Secondly, the use of a subject field in the envelope allows sorting of messages and seems worth including as mandatory. If so, an empty subject field is not allowed. Otherwise any printing character, or character string with spaces is permitted.

Thirdly, transparency and speed of parseing for commands would be enhanced by preceding the command words by an escape sequence. This could be () i.e. a pair of brackets without any intervening symbol or character code. If this is encountered in the text the second 'right' bracket is duplicated on transmission. So () becomes ()) and is restored to (). Using these modifications, the MAIL Commands become as shown in Figure 1 and the Protocol as in Figure 2. There are several reasons for choosing () as the escape sequence:-

1) Parentheses appear in most character sets, even Telex.

2) Open and Close brackets seldom, if ever, appear with no intervening character.

3) The scheme can be a special case of a more general one for handling strings of comments embedded in file texts

This general scheme is based on that of INWG Note 191, but the *<" ">* symbols proposed there are not available in some character sets, so I propose they be substituted by ()' and '(), which are asymetric triples. The rules for use of these should be:-

1) Where commands etc. are continuous strings, it is sufficient to preceed the string by ().

   Thus ()MAILSEND, ()formfeed or ()SKIP-10-LINES are valid, because the first space encountered is the closing delimiter.

2) Where commands include spaces they are preceded by ()' and terminated by '().

   Thus ()'Form Feed'() and ()'Throw 1 Page'() are valid.

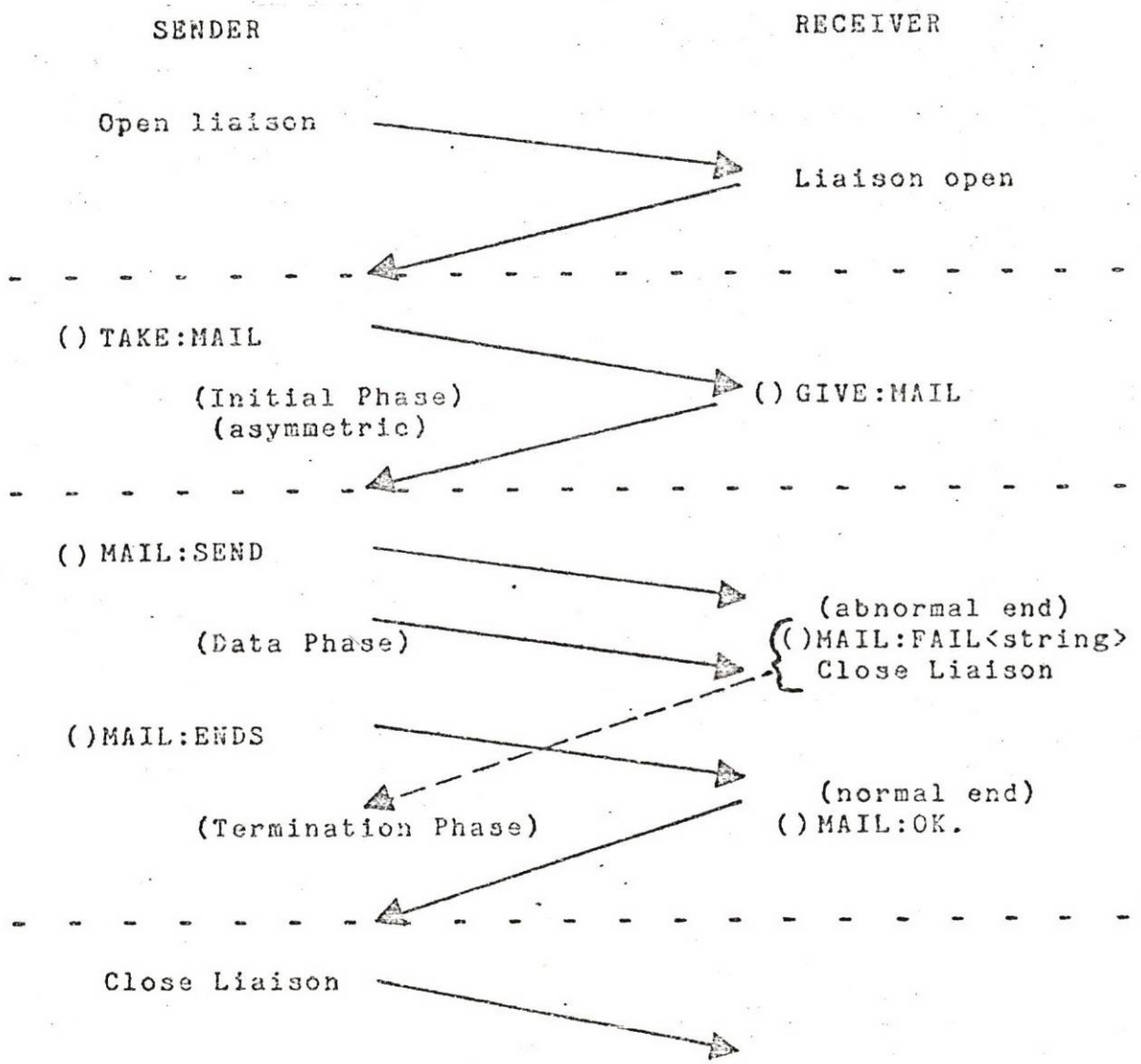
Transparency is introduced by the rule given above so the string delimiters are expanded to ())' or '()), should the strings ()' or '() have to appear in the text portion of the file.

Finally, I am frankly doubtful if the new approach to open systems given in INWG 191 has any value, but would like to hear from those interested in further discussion. In particular, would anyone care to join in a trial implementation of the basic mail scheme as covered by INWG 192 and amended by this note?

FIGURE 1: FORMATTED MESSAGE

```
()MAIL:SEND

()TO: ABC    ()OF: XYZ

()DATE: 19790329

()TIME: 14 30

()FROM: DLAB    ()AT: EIN

()LENGTH: 100

()SUBJECT: Mail Service

()PARA:1.
        This is an example of a message format proposed
        for the simple mail service.
()PARA:2.
        This is another possibility.

()MAIL:ENDS
```

FIGURE 2: THE BASIC PROTOCOL



Computer Decisions 10(9): 34-42 Sept 1978

Telecommunications

Electronic messaging can make cents

by Becky Barna

Increased productivity is the most important effect of intracompany electronic mail, although speedy, sure delivery is the initial objective.

"It's a revolution in the way businesses operate."

This is how one expert characterized electronic mail. It's not just a quicker way of sending messages and not just a substitute for the U.S. Postal Service. In fact, it is also a welcome substitute for phoning.

Slow and erratic mail delivery via the USPS is the reason most often cited by corporations for investigating intracompany electronic message systems (EMS). But for those companies that have moved past the study stage and into the implementation phase, EMS has acquired a whole new vocabulary of justifications. Those EMS users are now citing such plusses as cost avoidance, improved managerial productivity and increased span of control.

Whipping boy

EMS isn't *all* savings. "The USPS is the whipping boy," comments electronic mail consultant Howard Anderson, president of the Yankee Group in Cambridge, MA. "As it turns out," he says. "the 15 cent postage stamp is one hell of a bargain." Although electronic systems cannot beat the per-message price of today's first class postage, their benefits are eyed in a number of other ways.

Because electronic messaging is but a nascent technology, its beauty is still in the eye of the beholder. There are as many different types of systems as there are applications. Systems range from conventional facsimile networks to the more sophisticated communicating word processors, message switching systems and computer-based message systems.

Fax facts

Although developed over a century ago, facsimile continues to provide the answer for many corporations on the lookout for faster, surer delivery. The reasons are many. Fax affords accuracy, since an exact duplicate of the original document is produced. There is no need for rekeyboarding or retyping, which saves both time and errors. The machines are simple to install and operate, and their cost is substantially less than other EMS systems that require major investments in hardware and software.

Fax gear rents from a low of $39 a month* for a machine that transmits a page in six minutes to a high of about $325 per month for a machine with sub-minute transmission speeds. The obvious advantage of the higher speed units is the drastic reduction in communications time and, consequently, costs.

According to the Yankee Group's Anderson, the faster but more expensive fax units can prove more cost effective than the slower and less expensive units only if there is heavy user volume. (See box on the next page for a comparison of sub-minute and slower-speed machines.) Not only is the overall cost lowered with faster fax when there is high volume, but less operator time is consumed in the transmission. Also, the faster, more automated machines can offer the added benefits of unattended operation. They can be set to communicate automatically after 11 p.m., when long-distance telephone rates are about 60 percent lower than in the daytime. (For example, the first minute coast-to-coast DDD charge is only 22 cents after 11 p.m.)

Services crop up

A number of companies now offer innovative facsimile services. TDX Systems Inc. in McLean, VA offers a fax service called Datapost. For a minimum monthly charge of $210, corporate customers can forward their messages via fax to the central Datapost distribution center in Chicago. There the company sorts and bundles the messages by zip code and hands them over to the USPS for next-day delivery in 25 major cities as priority mail. The minimum monthly fee provides for 200 messages to be sent at $1.05 each, a cost that compares favorably to the Western Union/USPS Mailgram service. Each Mailgram costs an average of $2, and for the same turnaround time.

A similar service is offered by Graphic Scanning Inc., Englewood, NJ, with communications via its own Graphnet network that goes into 110 cities. Customers forward their messages via Telex or TWX terminals, and recipients get a telephone call relaying the message from the receiving end, along with the hard-copy Faxgram that is forwarded for follow-up. A Faxgram costs $2.23 plus the monthly $1 service charge.

Common carrier offerings

Some of the newest offerings in fax communications come from common carriers. SPC Communications Corp. offers Speedfax service that operates as a facsimile message forwarding center serving 30 cities. The cost is only 25 cents a minute, even during the normal coast-to-coast business hours of 5 a.m. to 5 p.m. Pacific time. Another attractively priced carrier offering is making the

*As of Sept. 1, Quip Systems, Inc. raised the monthly rental of its lowest-speed units from $29 to $39. The Xerox-compatible model is now $49 a month.

regulatory rounds in Washington towards approval. ITT Domestic Transmission Service has proposed a service called Faxpak that will allow users to route fax messages through ITT central computers for a cost of 19½ cents a minute.

An added incentive to fax use is its ability to handle inter- as well as intracompany communications, at least where compatible equipment exists. And if the proposed standards wending their way through the Consultative Committee for International Telephone and Telegraph (CCITT) are adopted, compatibility will cease to be a concern.

"Facsimile is still the biggest thing in electronic mail, and will be for a long time to come," asserts Anderson. The Yankee Group president projects that fax manufacturers will place 42,000 units this year alone, supplementing the 146,000 now in service, the greatest number of which are supplied by Xerox. Anderson predicts the volume supplier will be Qwip, a division of Exxon Enterprises, with new installations this year numbering 16,000.

Close encounters of the word kind

While facsimile is the tried and true mode of electronic messaging, less is known about the cost effectiveness of such newer systems as communicating word processors (CWPs). Stephen Caswell, director of development for International Resource Development, New Canaan, CT, comments, "The communicating word processors are not being used anywhere near the rate that was expected a few years ago. This is not to say that nobody uses CWPs. [*Editor's Note:* only five percent of word processors are equipped with communicating capability.] It is to say that the world has not rushed to the banner of the communicating word processor." Caswell suggests a number of reasons why.

First, he says, CWPs represent a true merger of computer and communications technologies into an office product. Those managing two disciplines, however, "won't be easily brought together." Caswell further contends that word processing centers have never actually planned what it is they intend to communicate, primarily because those centers act as service bureaus for users within the same building. (See article on word processing starting on p. 26.)

Cost is also a stumbling block, Caswell claims. While he sees the CWP potential as "enormous" if the cost per machine were in the $1,000 range, the average price is more than 10 times that amount.

Despite all the problems inherent in CWP use, the IRD executive notes that more and more word processing systems are incorporating communications as an option, whether or not it is presently used. While most word processing users have no concrete plans for communications, he says, that capability is considered a prerequisite for effective participation in the "office of the future." Thus, users want the communications capability available as a field upgrade, if and when they need it.

Breaking out CWP costs

An EMS report published recently by Kalba Bowen Associates, a Cambridge, MA information consulting and research company, details some typical costs associated with CWPs. It notes that a single station word processor, rents for about $525 a month. In a shared-processor three-terminal operation, the cost increases to $1,035 a month, or $345 for each terminal. The extra monthly charge per word processor for the communications option is $94. A modem is also needed for each CWP, with the average monthly charge for a 4,800-baud modem being approximately $135. These costs can be considered fixed costs necessary to perform an EMS application, the report notes, while the communications costs constitute the variables since they are incurred only when a message is sent.

The Kalba Bowen report further breaks out the EMS application costs by showing the differences in cost when either 10 or 25 percent of the total terminal hours is used for sending messages and a similar percentage of printer time is devoted to printing out received messages. In other words, out of a 40-hour week, either four or 10 hours are devoted to the mail application. Thus, communications costs are $229 per word processor ($94 for the communications option and $135 for the modem) plus 10 or 25 percent of the monthly equipment charge. For a single terminal the costs can be summarized on a monthly basis as $282 at 16 hours a month (the 10 percent allocation of terminal use) or $360 at 40 hours a month (the 25 percent allocation). For a three-terminal system, the costs per terminal would be $111 (at 10 percent use) and $163 (at 25 percent use).

The remaining costs depend on the number and length of messages transmitted. At 4,800 baud, the transmission rate is 480 characters per second, or 3.13 seconds per 1500-

The tortoise and the hare

What volume of traffic justifies a "sub-minute" facsimile machine?

Compare a high-speed unit, which actually transmits a document in 35 seconds, and rents for $300 a month on a 12-month contract, with the lowest-price unit on the market, the Qwip 1000, which now rents for $39 a month (up from $29 as of Sept. 1) on a 12-month contract. The break-even point is 219 messages a month, assuming that all the traffic is coast-to-coast and that all messages are sent one at a time during normal working hours, when phone usage costs 54 cents for the first minute plus 38 cents for each succeeding minute.

The differential in rental is $261. The per-message cost of transmission is 59 cents (54 cents plus 5 cents per sheet of paper) for the high-speed unit versus $1.78 (54 cents plus 3 times 38 cents plus 10 cents per sheet of paper) for the Qwip. This works out to a differential of $1.19 per document, which goes into the rental differential 219 times.

However, if the Qwip Two, which takes only two minutes to transmit a message, is used, then the break-even level of traffic goes up to 537 messages a month based on the $69-a-month rental of the unit on a 12-month contract. What if messages are sent in batches of five? Then the break-even point in favor of the high-speed machine over the Qwip 1000 drops to 194 messages a month. The high-speed machine also appears more cost effective if a user finds, as is true of Hayden Publishing, which uses a Qwip 1200, that six minutes is required for transmission of certain visual documents for clarity.

There is one circumstance under which the high-speed machine can never be cost justified over the Qwip Two: when all traffic is intrastate and the caller is charged for two minutes, no matter how short the call.

character page. If the average message is 1000 characters, the transmission time is two seconds. Using the 22-cents-a-minute communications rate for after-11 p.m. use, the lowest transmission costs could be obtained if 30 messages were batched and sent in one minute, producing a per-message charge of $.0008. If only one message were to be transmitted, the rate would be the flat 22 cents for one minute. "Thus," the report stresses, "the communications aspect of message costs is very volume dependent."

Switched-on messages

Message switching provides yet another form of EMS, as does the computer-based message system (CBMS). While the two methods are quite similar, they do have subtle distinctions. The differences are analogous to having your mail delivered directly to your door or continually visiting your local post office box to see if any mail awaits you.

An example of having messages "delivered to your door" is the message switching system offered by Wiltek Inc., Norwalk, CT., now profitable again after a bout of bankruptcy. The company's electronic mail system, called Wilcom, is currently in use at more than 50 large corporations, including Squibb, Allegheny-Ludlum and Del Monte. The Wiltek system consists of buffered Wiltek terminals installed at each corporate location and the Wilcom electronic mail service, which controls all communications over the network. Terminal operators at locations across the country enter messages into their terminals throughout the day. The messages can be addressed to one or more of the other corporate terminal locations in the network.

Automatic pickup and distribution of messages is handled by Wilcom. A Wilcom computer picks up mail by sequentially placing phone calls to each individual terminal. When polled, a terminal automatically answers and sends to the computer all completed correspondence. The computer then delivers to that terminal all correspondence collected from other locations. Users can select the time between calls and hours of operation for each terminal in the network. Typically terminals are polled at 30-minute intervals.

The Wiltek terminals cost between $8,000 and $12,000, and per-message costs average 50 cents. With the system, messages are automatically delivered to a specific location, where the user is notified that a message is ready to be retrieved. This process differs from the electronic mailbox concept, considered a CBMS.

Emptying the Mailbox

Scientific Time Sharing Corp., headquartered in Bethesda, MD, pioneered the electronic mailbox in 1972. In fact, its electronic mail system is called Mailbox. Prior to Election Day, 1976, Presidential and Vice Presidential candidates Carter and Mondale used STSC's Mailbox to coordinate their frenetic campaign schedules (COMPUTER DECISIONS, January 1977). Last year STSC got approval from the Federal Communications Commission to offer the Mailbox message processing system as a resale common carrier.

Implemented on STSC's Amdahl 470, Mailbox is a system of software programs devoted exclusively to the exchange of messages between individuals within a single company. A user does not have to be at his home office location to receive his messages as he does with the Wilcom system. With his access code and password, the Mailbox user can access his Mailbox file at any time from any terminal location. As with the conventional post office box, the user never knows if his box is empty or filled to the brim unless he checks in. The Mailbox user must contact the computer periodically to see if messages are on file.

Mailbox can be accessed by asynchronous teletypewriter terminals operating at 300 and 600 baud. These terminals may be dial-in or connected via leased lines. Using organizations are charged a minimum monthly fee of $100. For terminals operating at 300 baud or less, there is a connect charge of $2.50 per hour and an I/O charge of 20 cents per 1000 characters. For terminals operating at 600 baud, the connect charge is $3.50 per hour and the I/O charge is 10 cents per 1000 characters. The In-WATS cost for all terminals is $14.50 an hour. Other charges include 15 cents per address above the first one, $15 per hour connected for time beyond 15 minutes, 50 cents per message delivered, and storage charges of 1 cent per 1000 characters per calendar day.

In larger corporate offices two fax machines are often in use simultaneously, one sending while the other receives. These are Qwip 1000 Series machines, which require at least four minutes to send or receive a document. On a 12-month minimum contract they rent for $39/month.

Ontyme messages

Tymnet Inc., a subsidiary of Tymshare, was also certified by the FCC last year as a resale common carrier. In July 1977 it began offering its Ontyme electronic message service. Running as the only application program on a minicomputer dedi-

cated to message service, Ontyme allows the user to log in, create a message and send it to another user.

The Ontyme computer can be accessed through the Tymnet packet network from most major cities, using virtually any type of terminal. The Tymnet network does all the necessary speed and code conversions. As with STSC's Mailbox, Ontyme users are charged for connect time and transmission associated with reading the message. While those costs are comparable for the two services, the per-message charge for Ontyme is 5 cents, compared to the Mailbox charge of 50 cents.

A system for execs

Yet another example of a CBMS is Comet. The Computer Message Transmission system offered by Computer Corporation of America in Cambridge, MA is both a time-shared service, with everything except data transmission and terminals supplied by CCA, and a turnkey package for in-house installation.

Comet software is optimized for handling short intracompany messages and memos and is designed for use by executives themselves rather than by secretaries or special operators. For this reason the user interface has been kept very simple. It steers clear of the elaborate text-editing functions found on the typical word processor. Thus, Comet is not suitable for handling long documents. Another limiting feature of the system is the simple password identification method that makes it impossible for an executive to allow a secretary to "open" the mail without giving over access to all the message files, some of which are likely to include confidential correspondence. (Two levels of confidentiality could be set up with secretaries permitted to access nonconfidential messages, but this would make the system more cumbersome.)

Comet is essentially an applications program designed to run in a timesharing mode on a DEC PDP-11 minicomputer. Actual communications links have to be provided separately via the standard direct-dialed phone network, by a private leased line network, or a public packet network. Comet offers full capabilities for composing, editing, sending, receiving, forwarding and distributing messages.

Comet software costs $40,000 or $1,446 a month on a three-year payout lease. As a timesharing service, each account is charged $100 a month plus $50 a month for each user within that account. These costs cover seven hours of connect time and 500 messages stored each month. The customer must obtain his own terminals and incur his own communications costs.

CCA's Comet development efforts were in part funded by Digital Equipment Corp., which in turn received a Comet license for its own internal electronic mail system. Other users include Bell Northern Research, the Defense Logistics Agency, the Department of Energy, Raytheon Corp. and Shell of Canada.

The DEC system started early this year. It now serves about 230 users, of which roughly 21 percent are management, 51 percent professional (70 percent of those are programmers), and 28 percent support personnel, including secretaries, clerks, operators, technicians, etc.

Favorable reactions

According to Robert Erickson, manager of Corporate Message Services at Digital, reactions to the EMS have been favorable. "Speed is important to DEC," Erickson says, "where often a department is divided among several buildings in different locations. A memo can be sent on EMS within a few seconds to any user on the system, no matter where he is located."

But more important than speed, Erickson says, is the fact that "EMS is a nonsimultaneous means of communication. He explains that this fact is particularly appreciated by DEC's secretaries, who have found that EMS cuts down on the number of annoying and time-consuming phone call interruptions.

Management's view of the new system, Erickson says, is that it too likes getting fewer phone calls, that EMS speeds up decision-making, that differing time zones and geographi-

Why Electronic Mail Now?

As this is written, wild-cat strikes are crippling mail delivery in several metropolitan areas (the same areas hit hardest by the long strike of postal workers eight years ago). To make sure that the accompanying article was delivered from our Washington office, it was sent via private courier instead of by the U.S. Postal Service.

Even when the U.S.P.S. isn't hit by work stoppages, the mail doesn't move fast enough, reliably enough or come through the postal system unscathed: aside from a high level of damage, packages, and even letters, are also subject to much pilferage in the same metropolitan areas.

Several years ago a national magazine published an article entitled "They've Taken the Zip out of the U.S. Mail." The writer emphasized that first-class mail often moves slower than it did in the middle of the last century via Pony Express!

The situation is worse today. Now we know that the U.S. Postal Service's two-billion-dollar investment in bulk-mail handling centers has been a big flop. One reason is private enterprise. The United Parcel Service, which now delivers in all 48 contiguous states, has surpassed the Parcel Post in volume and will continue to take business away from the U.S.P.S. as more and more individuals (business has long since switched to U.P.S.) find a way to use this superior service. For instance, many enlightened employers permit their employes to leave packages for pick-up by U.P.S. chauffeurs and collect the charges later. This is sensible, because otherwise employes might take overly long lunch hours as a result of waiting to be served at local post offices.

In anticipation of the withering away of the U.S.P.S., businesses must seek alternatives for moving messages and packages vital to profitable operations. The U.P.S. and courier services are the obvious choice for packages. Electronic mail is the obvious alternative for intra-company mail. Once enough companies have set up their own electronic mail systems, it's an easy step to inter-company electronic mail.

There's another way in which computer techniques are helping to kill off the U.S.P.S.: using "updupping" programs to eliminate wasteful duplication on mailing lists. Publishers have long used such programs; corporations with extensive mailing lists of customers should rent these programs to clean up their lists. With the cost of first-class mail predicted to reach 34¢ for the first ounce by the mid 1980s, such computer programs should be a bargain.

Getting into the fax act

Anyone can send documents to tens of thousands of users of Xerox fax machines. Some "copy shops" equipped with Xerox photocopiers also offer facsimile service to other shops equipped with the same units and to organizations with the same machines. To find out if some outfit you want to send documents to quickly has a Xerox Telecopier and will accept input from outside the company, call this toll-free number: (800) 255-4180. The charge for this service posted by the Xerox Reproduction Center in New York is $8 for the first page and $5 for each succeeding page, plus the phone charges.

cal separation become irrelevant, and that time spent at the terminal is highly productive.

Internal EMS abounds

With applicable hardware and software available, organizations are afforded a great deal of flexibility in fashioning their own internal electronic message systems, if such suits their fancies. And as is true at DEC, a number of large corporations have already gotten the jump on what could be called the office of the future.

Citibank Corporation in New York has invested nearly $10 million over the last several years developing its Integrated Electronic Office. Citibank's EMS design is based on the management workstation concept that caters to senior level executives. The workstations allow the manager/secretary team to create, store, receive and send electronic documents to and from other management workstations. It allows standard office applications such as appointment calendars and message logs to be maintained on a purely electronic basis. The workstation team can create and use special computer programs as desired. Also, the team can access remote computers in an automatic dial-up mode.

Until the beginning of this year, the Citibank system operated with 16 workstations located in four buildings in New York. Those first workstations consisted of a mini or microcomputer, two keyboard display units, a high quality printer, mass storage and communications equipment. The initial installation was based on the DEC PDP-8-based word processor system.

After tests of the initial system, Citibank contacted Lexar Corporation for help in redesign of the planned expansion system. Early this year, Citibank installed an additional 15 workstations developed by Lexar. The new workstations include multiple microprocessors, send/receive communications lines, format control language for forms design, a built-in desk calculator and a *Basic* language interpreter.

Responsive communications

According to William Salway, director of domestic communications at Citibank, the objective of the system is "to provide our managers with more responsive communications so as to enlarge their span of control." Each manager presently supervises seven subordinates. If expanded use of sophisticated equipment can improve managerial productivity, as is expected, then the span of control could conceivably increase to 9 to 1 in a few years. By keeping the number of employes constant but upping their output by 20 to 30 percent, Citibank hopes to effect major cost savings.

Reactions from Citibank employes to the newfangled system have been mixed, Salway admits. Secretaries tend to use and appreciate the new system more than do the managers. Some of management's reluctance to use the system is attributed to the preference for face-to-face communications, as opposed to the indirect, remote communications afforded by electronics. That psychological barrier, however, is expected to be overcome as more experience with the system is gained.

Offers cost avoidance

Bank of America also sees increased managerial productivity as the pacing element for stepped-up office automation. Before implementing its electronic mail/word processing system, the San Francisco-based bank conducted an extensive feasibility study on the cost effectiveness of using technology to improve corporate information flow. Assistant vice president Neil Jackson, who was in charge of the study, claims that the way a company can justify greater use of technology is through cost avoidance.

The B-of-A feasibility study confirmed that the real cost of a business letter is much higher than the 15 cent first-class postage stamp. Jackson claims a business letter today costs at least $5,* if one considers secretarial time, office overhead, machine costs, depreciation costs, supplies, postage—the works. A decade ago, Jackson found, the real cost of the business letter was half that amount, or $2.50.

Corporations also employ twice as many secretaries today as they did a decade ago, the bank learned. Furthermore, the average salaries for clerical workers increased a staggering 9.6 percent in one year's time between 1974 and 1975, and that trend continues. Paperwork and document costs are still on the upswing. In sum, Bank of America found that all costs of office administration have skyrocketed in recent years, and yet productivity levels have barely inched along.

The bank says that as personnel costs climb at the rate of 22 percent yearly and electronic equipment costs decrease seven percent per year, the crossover point will soon come when a corporation can justify investing in equipment instead of additional personnel. As Bank of America sees it, this significant juncture can be crossed sooner by those companies that generally increase their use of advanced equipment and consequently improve the productivity levels of existing personnel.

In addition to increased productivity, Jackson says other benefits derived from B-of-A's word processing installations are improved quality of work, new career paths for employes, job enrichment, improved morale, increased corporate revenues and possible cost reductions in office administration.

Cook's combined system

A highly sophisticated internal messaging system was developed at Cook Industries Inc. in Memphis, TN. Cook, No. 465 on the Fortune 500 list, is one of the largest grain and cotton merchants in the U.S. The company's primary busi-

*Dartnell Institute of Chicago reports that the true cost of a business letter today is $4.77. In 1960 the cost was $2.54.

ness is the export of feed grains. The physical movement of grain, with its attendant requirements for storage, grading, sampling, etc. and compliance with many government regulations, involves a substantial amount of logistical, contractual and accounting information being transmitted from one company location to another.

The Cook Administrative Message System (CAMS) is the overall network that handles the distribution of messages. An electronic mailbox subsystem handles messages originating and terminating at the company's Memphis headquarters. CAMS employs store-and-forward message switches in Hong Kong, Memphis and Paris. Radiating out of each message switch are leased lines in a star arrangement. Trunk lines connect the three message centers to each other. Extensive multiplexing is used to overlay voice, data and teletype traffic over the same leased lines. Quotron Systems served as the equipment vendor that helped Cook put all the elements in place.

Interfacing of a message system, the company's 370/158 and the commodity exchange permits a single terminal to serve a user for message sending, receiving, timesharing, accessing commodity trading information, inquiry-response and data entry. One-time development cost of CAMS was $40,000. Total monthly recurring costs, including the financial information services and the electronic mailbox systems, are $12,688. Implementation of the system took two years and is still continuing.

What's next?

"The future for electronic mail burns brighter than ever," says Yankee Group's Anderson. "First of all, electronics can do superbly what distribution via the USPS does poorly. The second reason is technology, which allows vendors to offer better and cheaper hardware to do the job. And the third reason is that carriers are providing cheaper, more intelligent, more abundant and more accessible communications links."

Then too, there are the already announced services that have yet to come into play in the EMS arena. By April of next year the USPS, Comsat and the European Postal, Telephone and Telegraphs (PTTs) will inaugurate an international electronic mail experiment based on facsimile.

Salesmen and executives can receive documents anywhere there's a phone via the Xerox Model 400 Telecopier which weighs only 21 pounds with the $85 carrying case. This 4/6-minute facsimile rents for $64/month on a one-year basis.

The cost of sending message from the U.S. to, say, London could be no greater than $10 for the convenience of instant delivery.

Within the next two to three years, the Postal Service is supposed to begin implementing a domestic form of EMS. Its plans call for setting up 87 public electronic messaging centers, each of which will have an output station capable of printing, folding and stuffing between four and 10 letters per second. Corporations will be able to deliver a magnetic tape to the USPS, which will then print out the high volume messages, such as bills or dunning notices. From its output centers, the Postal Service will be able to make quicker mail sorts and then deliver the mail by the next day. "It's like an expanded version of Mailgram," says IRD's Caswell. He claims the cost per message would be about 25 cents or lower.

SBS by 1981

Then too, Satellite Business Systems will be up and running in 1981. Its network will provide corporate customers with integrated voice, data and video capability using all-digital transmission. One application that can be implemented on the SBS system is document distribution. Although the company says it has no present plans to offer a service for electronic mail, if a customer wants to do document distribution, SBS will help but will leave him on his own. The user would have to design his system, select the equipment, and implement any special features he requires.

AT&T's Rubicon

Then last, but not least, is the service that will be brought to the U.S., approval pending, by American Telephone & Telegraph. The recently announced Advanced Communications Service could serve as an alternative to the current resale carriers or a private network for the support of timesharing EMS. ACS will be able to take dissimilar terminal devices and computers and make them compatible, do some storage and message routing and rerouting. The possibilities are limitless.

According to Yankee Group's Anderson, "ACS is AT&T's Rubicon. They either cross this barrier and get into a high-growth data communications business, or they are going to be left behind for the next 20 years. It's AT&T's last shot, and I think they'll hit the target." □

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COMMUNICATING WORD PROCESSORS

AN INTEGRATION STUDY

COMMUNICATING WORD PROCESSORS

AN INTEGRATION STUDY

8 Jun 79

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INTRODUCTION

This document is intended to serve as the final report on the Communicating Word Processor (CWP) Study Project undertaken by TYMSHARE, Inc. with the voluntary participation of the Diebold members supporting the Office Automation Program.

The focus of this study will be directed at one of the essential tools needed to achieve the integration of office devices through electronic communication. Specifically, we will be concentrating on Communicating Word Processors (CWPs) of different types.

TYMSHARE would like to take this opportunity to thank the Diebold Group and the members of the Office Automation Program for their cooperation which made this study a reality.

PURPOSE OF STUDY

The purpose of the CWP Study was to evaluate the usefulness of a packet switched network in the interconnection and integration of Communicating Word Processors and the potential application of an Electronic Mail system as the store-and-forward switching mechanism.

The two vehicles used in this study were TYMNET and INTERFACE. However, they are just two of several such vehicles available to the general office community.

DEFINITION OF TERMS

Before going into a discussion of the tests performed in more detail, a few explanatory words about the terms used in describing these tests may be in order.

TYMNET is TYMSHARE's packet switched communications network which provides terminal access to all of TYMSHARE's 60 computer systems from any point in the U.S. by placing a local telephone call. TYMNET also provides gateways to other public networks both in the U.S. and in foreign countries.

In addition, TYMSHARE's subsidiary, TYMNET,INC. provides system interconnection services for some 150 host computers for its various client organizations.

INTERFACE is the Electronic Mail system used in this study. Its main design purpose is to allow valid users to sign on to the system, create text (i.e., letter, memo, etc.) and deposit it in other users' mailboxes. The communication between the sender and the receiver may be synchronous or asynchronous, that is the receiver does not have to be signed on to the system at the same time as the sender. Once the incoming message is placed in the recipient's in-basket, he/she may pick it up whenever it is convenient to do so.

TELECOMMUNICATION EMULATORS are programs that run on the CWPs. They are designed to make the CWP look like a terminal that can communicate with other CWPs or host computers using different kinds of protocols.

METHODOLOGY

The overall methodology used for the study called for a step-by-step approach in which each new step or test would be slightly more complex than the previous one. As a problem area was uncovered either a revision was put into the TYMSHARE software or an attempt was made to get around the problem some other way.

A TYMSHARE team visited each participating member's offices and checked out the equipment to be included in the study.

The first test was signing on to TYMNET. Once a clean interface with TYMNET was established, which took several attempts on some of the machines due to various different codes and procedures used, the next step was to use the word processing machine as a simple terminal and sign on to INTERFACE. For the purpose of the study, a new account was established in INTERFACE, and each participating company given a user ID within that account.

After signing on to INTERFACE, a short message was typed in and "sent" to the same user-ID. Then the message was "read" on the terminal that originally sent it. This test verified that the word processing system is able to interact with the INTERFACE system successfully via the network.

The next test performed was the transmitting of a message that was prepared on the word processor off-line. Once this message was filed as a text file in the memory (disk, tape or card) of the word processor, the sign-on procedure was repeated and then the telecommunications emulator was directed to transmit that file to INTERFACE as a message using the same user-id for the recipient. Following this, the message was read and a copy of it filed in the storage device of the word processor. This established that text prepared on the word processing system could be successfully transmitted to the INTERFACE system with no loss of data.

All the tests described so far have been performed by the TYMSHARE team with the cooperation of the participating members of the study.

At the conclusion of this period, it was evident that a vast majority of the CWP's were able to communicate with TYMNET and INTERFACE with few problems. Therefore, each location that had a machine and the personnel readily available was set up as an electronic mail station. From this point on, INTERFACE became the primary means of communication between TYMSHARE and participating members.

The last large scale test performed was the broadcast test.

Each participant was asked to access a text file that was stored in INTERFACE as a shared file. This text was similar to a form letter. Each member would copy the text onto permanent storage on their CWP, fill in the blanks as required and "send" it to all other participants via a distribution list. A copy of this text may be found in Appendixes C and D. The purpose of this test was to identify any basic incompatibilities between the CWP's being studied.

One last test was performed using one machine. In this test the participating member was asked to use all the special formatting characters and codes available on the machine in use. The purpose of this test was to examine the problems that might arise from the use of such codes.

EVALUATION OF TEST RESULTS

This section is an account of tests performed on each machine.

DEC WT/78 located at Shell Canada Limited:

The DEC WT/78 connected successfully with INTERFACE. A characteristic of the CX option on the telecommunications emulator is that it strips format codes and underscores before transmitting. This is not always desirable since it necessitates the re-insertion of such codes at the receiving end. Transmission speed was 300 baud.

LANIER LTE-3 located at American Airlines:

This was the only CWP that was not able to communicate with TYMNET. The LTE-3 was not equipped with the right telecommunications option required for this test. Subsequent attempts by American Airlines to acquire the proper software and make it work have not borne any fruit yet.

WANG SYSTEM-30 located at Tenneco, Inc.:

This CWP has a reasonably complete telecommunications emulator. Using the TTY mode and 300 baud transmission

speeds the Wang-30 had no trouble communicating with INTERFACE through TYMNET. However, a new update installed by Wang on this particular machine has introduced a bug into the system which precludes it from establishing communication with the network. As of this writing, the problem is under scrutiny.

MICOM 2000 located at the Department of Labor:

This system was also successful communicating with INTERFACE through TYMNET once the emulator was equipped with the proper options. Sending, receiving, filing and retrieving of messages were accomplished quite easily. A similar test on an identical Micom 2000 in another room, however, could not duplicate the same results. The problem appears to be due to the use of a different version of the same emulator software.

A. B. DICK MAGNA I located at the Department of Labor:

The Magna I performed well during all tests using the TTY emulator and 300 baud lines. The only difficulty was encountered during the recording of the test data being received. Initially, it was thought that the machine was not capable of performing this function. However, subsequent investigations proved that the

fault lay in the procedure used rather than the machine.

WANG SYSTEM-30 located at the Department of Labor:

Performed similar to the other Wang-30.

CPT 8000 located at Johnson Wax:

The CPT 8000 was a representative of the new generation of WP machines in that it features a full page screen and a 10,000 character buffer for text in the workspace. Once configured with the proper options on the TTY emulator the CPT worked very well. Line speed used was 300 baud.

IBM CMC I located at Bechtel Corporation:

The Communicating Mag Card I performed satisfactorily using the 2741 protocol at 134.5 baud . It was able to send and receive messages. However, difficulties encountered in obtaining an outside line through the switchboard and schedule considerations prevented the remainder of the tests from being completed.

XEROX 800 located at Bechtel Corporation:

The Xerox 800 performed very well in all the tests. It was the only machine that used cassette tape as the

data storage medium. The comprehensive communication emulator offers many choices to the user. The emulator has the ability to communicate with an EBCDIC host, ASCII host, other Xerox 800's, etc. The emulator used was the ASCII host option and 300 baud lines.

The rest of this section will present some of the problems that were observed and what actions were required to solve or bypass them.

1. The most important consideration is that the proper emulator is being used for communicating with a host computer. The emulator must be designed to shake hands with a host computer and let the host be the master while the CWP assumes the role of a slave terminal. An emulator designed to communicate with another CWP only will not work as was the case with the DEC WT/78 using the DX communication option.

2. Although transmission speeds from 134.5 to 1200 baud were used successfully, there are two points that must be considered:

   a. Is the storage device on the CWP (disk, tape, etc.) able to handle (write) the data being received at the higher speeds?

b. Is the host system being used capable of accepting input data at the higher speeds?.

In the first case, the Wang-30 at the Department of Labor which had multiple workstations attached to it was not able to receive data at 1200 baud without losing data. Switching to 300 baud solved the problem.

In the second case, it was brought to our attention that another Electronic Mail system that was being used by one of the members was not able to receive input data stored on the CWP. INTERFACE demonstrated its ability to accept data at rates of 1200 and above.

3. Another problem surfaced when the text prepared on the CWP contained format control characters that looked like escape characters to the computer. One such character is a coded carriage return that is available on certain machines. Page markers, new paragraph indicators, overstrikes, margin alignment codes, etc. could belong in this group also. An escape code tells INTERFACE and other systems that the user wants to cancel whatever he/she was doing. Therefore, encountering any of the codes listed

above causes INTERFACE to reject text preceding these characters. Another revision implemented in INTERFACE as an option allows the CWP to send format control characters by directing INTERFACE to consider them as part of the text.

This test was performed using the CPT 8000. All of the coded function keys were used in a demonstration message which was fed into INTERFACE. When this message was returned to the CPT 8000, all but very few of the codes seemed to be handled properly. Advanced knowledge of which codes work and which do not can alleviate the problem altogether by avoiding the use of those few codes. Please, refer to Appendix G for a list of these codes.

4. The problem of different versions of the same emulator has come up on two occasions. This is an area that needs scrutiny when users receive updates on telecommunication software for their CWP's.

CONCLUSIONS AND RECOMMENDATIONS

As stated at the beginning of this document, the main objective of this study was to gather basic information about the CWP's for the purpose of allowing CWP's of different types to communicate with each other using existing networks and electronic mail software.

It is obvious that if the CWP's are equipped with an emulator that allows them to communicate with a host, as most of them are, there are no major problems in getting text in and out of the host.

It was also observed that as long as text structures are kept simple (i.e., avoid using formatting codes) it is possible to prepare a document on one CWP and send it to another.

Complications arise when the special formatting codes are used. This is unfortunate because those very same special formatting capabilities are what make Word Processing machines so attractive to the user. A possible solution is discussed in the next section.

Aside from the problem of special formatting, there is no reason why a CWP cannot be used as an electronic mail cen-

ter. The properties that should be looked for in a machine of this sort are:

- The availability of several emulators to allow users to communicate with different hosts at different speeds. This will allow the user to utilize the same machine for varied applications.
- An option in the emulator that allows transmission of text with or without special codes.
- The ability to invoke the emulator easily and to terminate the communication session just as easily without having to turn the machine on and off.
- The ability to easily record and transmit data.

Similarly, there are some important characteristics to be looked for in the telecommunications network and the electronic mail software:

- The network should be able to handle various character sets and transmission speeds, and perform character translation from ASCII to EBCDIC and correspondence and vice versa.
- The electronic mail software should have an easy-to-learn user interface.

- The electronic mail software should be able to receive large continuous streams without losing any data.

- The electonic mail system should be of such a design as to allow required changes to be made easily and quickly in order to accommodate peculiarities in different CWPs.

WHAT THE FUTURE HOLDS

The problem numbered (3) in the section EVALUATION OF TEST RESULTS shows clearly that a mechanism is necessary to translate each format control character input on one CWP to an equivalent character that is valid on the recipient CWP. Only this would allow completely transparent operation which would facilitate preparing a document on CWP-A and transmitting it to CWP-B for the purpose of printing or doing further work on it.

The following is a possible approach that will solve this problem.

As data is being input from CWP-A to the host computer all format control characters are translated into a universal code set that the host understands using a table lookup technique that associates each format control character to a CWP and a meaning. Thus, the text is filed in a universal language.

When it is time to transmit the text to CWP-B, the host will utilize the table for CWP-B and use the codes that are available for the recipient CWP. In the event that some of the codes that are needed do not exist in the recipient table, then the text can be expanded and then transmitted to CWP-B.

As can be deduced from this brief discussion, to develop and implement a system to perform the translation function is not a trivial project.

Due to the heavy workload on the CWP's installed at the users' locations and the time limitations imposed upon the project, it has not been possible to test all machines available to the members. However, TYMSHARE suggests that members of the program who desire to experiment with additional CWPs contact our Corporate Offices.

SUMMARY

To summarize the findings of this study the following points should be made:

- Most CWP's are able to communicate with a network such as TYMNET and access an electronic mail system such as INTERFACE.

- A network such as TYMNET and an electronic mail system such as INTERFACE are capable of handling the various character sets and transmission speeds that are used in CWP's.

- It is possible using current technology to send a text file (without using special format codes) from one CWP to a dissimilar CWP.

- It is also possible using current technology to send a text file containing special characters from one CWP to an identical CWP.

APPENDIX A

The following table summarizes CWP data:

CWP	SEND MSG.	RECEIVE MSG.	SEND FILE	RECEIVE FILE	EMULATOR USED	TRANS. SPEED (BAUD)	STORAGE MEDIUM
AB Dick Magna I	Y	Y	Y	Y	TTY	300	Mag Card
CPT 8000	Y	Y	Y	Y	TTY	300	Diskette
DEC-WT78	Y	Y	Y	Y	CX(TTY)	300	Diskette
IBM CMC I	Y	Y	?	?	TTY	134.5	Mag Card
Lanier LTE-3	N	N	N	N	Textran	N/A	Mini Diskette
Micom 2000	Y	Y	Y	Y	TTY	300	Diskette
Wang 30	Y	Y	Y	Y	TTY	300/ 1200	Diskette/ Disk
Xerox 800	Y	Y	Y	Y	TTY	300	Cassette

APPENDIX B

Some CWP's need to have a profile established for each different kind of communication protocol. Once stored on a diskette, it can be reused time after time.

The following sample is from the Micom 2000:

# of entries	15
Character Length	7
Baud Rate	300
Transmit Type	Character
Data Format	Ascii
Log Option	No
Parity	even
End of Line Character	13H
Wrap Around Option	yes
Line Type	Full Duplex
Break Character	1CH
Rubout Character	00H
X-on,x-off option	No
No. of Stop bits	1
Column Width	132

phone: 123-4567

APPENDIX C

This is the *BROADCAST file that each participant accessed in the INTERFACE System and filled in the blanks, a sample of which appears on the next page.

****

This is a broadcast test message that is being sent
to all the participants of the TYMSHARE-DIEBOLD
CWP Study project.

The name and address of this participant follows:

    Replace this line with
    the name and address of
    your company.

This message is being prepared using the following
word processing equipment:

Model :
Communication Emulator :
Line Speed :

The primary usage on this machine consists of
the following:

    Replace these lines with
    your comments.

The communications capability, if available, would
be used for the following applications:

    Replace these lines with
    your comments.

If the communications capability were available
we would like to communicate with the following
models of word processors:

    Replace these lines with
    your comments.

Contact Name:
Phone Number:

APPENDIX D

This is the same *BROADCAST file after being modified by one of the participants.

****

This is a broadcast test message that is being sent to all the participants of the TYMSHARE-DIEBOLD CWP Study Project.

The name and address of this participant follows:

S. C. JOHNSON & SON, INC.
1525 Howe Street
Racine, Wisconsin 53403

This message is being prepared using the following word processing equipment:

Model : CPT 8000
Communication Emulator : Asynchronous tty
Line Speed : 300

The primary usage on this machine consists of the following:

The communications capability, if available, would be used for the following applications.

electronic mail for our national and international offices.

If the communications capability were available we would like to communicate with the following models of word processors:

Wang
Honeywell 6000 - asynchronous tty - 1200
Xerox
CPT

Contact: Joan Hubbard
Phone Number: 414-554-2971

M#: AAA633
S#: 2
TO: CWP.TENNECO
FR: CWP.SHELL
DA: 30-MAR-1979 17:15 TZ: CEN
RD: 2-APR-1979 12:48 TZ: CEN

This is a broadcast test message that is being sent to all the participants of the Tymshare-Diebold CWP Study Project.

The name and address of this participant follows:

Shell Canada Limited
Head Office,
Box 400, Terminal A,
Toronto, Ontario,
Canada. M5W 1E1

This message is being prepared using the following word processing equipment: Digital Equipment Corporation

Model : WS78
Communication Emulator : Asynchronous ASCII
Line Speed : 300 baud

The primary usage on this machine consists of the following:

Word Processing
Electronic Mail

The communications capability, if available, would be used for the following applications:

Information Storage and Retrieval

If the communications capability were available we would like to communicate with the following models of word processors:

AB Dick Magna II
AES 100P
IBM OS/6
Micom 2000
Wang 30

Contact Name: Joseph Yao
Phone Number: 416-597-7281

NOTE:

Actual sample
BROADCAST File

:read

M#: AAB190
S#: 18
TO: CWP.BECHTEL
FR: CWP.SUP
DA: 21-MAY-1979 11:01 TZ: PAC
RD: 21-MAY-1979 11:01 TZ: PAC

This is a broadcast test message that is being sent to all the participants of the Tymshare-Diebold CWP Study Project.

The name and address of this participant follows:

Tenneco Inc.
Main Office
P.O. Box 2511
Houston, Texas 77001

This message is being prepared using the following word processing equipment:

Model	:	Wang System 30
Communication Emulator	:	Asynchronous - tty
Line Speed	:	300 Baud

The primary usage on this machine consists of the following:

Word Processing and typesetting capabilities in connection with the Bowne Information Services.

The communications capability, if available, would be used for the following applications:

to be able to communicate by electronic mail with our offices nationwide and maybe worldwide.

If the communications capability were available we would like to communicate with the following models of word processors:

Linolex
Vydec
IBM OS/6
IBM Mag Card II

Contact Name: Linda Dillon
Phone Number: 713-757-2423

:read

NOTE:

Actual sample BROADCAST File

M#: AAB191
S#: 19
TO: CWP.BECHTEL
FR: CWP.SUP
DA: 21-MAY-1979 11:02 TZ: PAC
RD: 21-MAY-1979 11:02 TZ: PAC

APPENDIX E

The following is a list of participants in this study:

COMPANY	CONTACT NAME(S)	CWP
American Airlines New York, NY	Robert E. McCarney	Lanier No-Problem LTE-3
American Express New York, NY	Pat Welton Edward M. Campbell Charles Popper	Wang (not tested)
Bechtel Corp. San Francisco, Ca.	Michael Conheim Connie Nichols	IBM Mag Card I Xerox 800
Dept. of Labor Washington, D.C.	James Stoval Peter Yates Tom Zuromskis	Micom 2000 Wang 30 AB Dick Magna I
S. C. Johnson & Son, Inc. Racine, Wis.	Frederick C. Lane Joan Hubbard	CPT 8000
Shell Canada Toronto, Canada	Walter F. Yeo Joseph Yao	DEC-WT78
Tenneco, Inc. Houston, Tx.	Glenn R. Reed Marilynn Campos	Wang 30

APPENDIX F

The following is a list of CWP vendors whose equipment is represented in this study:

CPT Corporation
1001 S. 2nd Street
Hopkins, MN 55343
(612) 935-0381

A. B. Dick Company
5700 West Touhy Ave.
Chicago, IL 60648
(312) 763-1900

Digital Equipment Corporation
Maynard, MA 01754
(617) 897-5111

IBM
Office Products Division
Parsons Pond Drive
Franklin Lakes, NJ 07417
(201) 848-1900

Lanier Business Products
1700 Chantilly Drive, NE
Atlanta, GA 30324
(404) 321-0911

Micom Data Systems Ltd.
447 Saint Helen Street
Montreal,Quebec H2Y 2K9
Canada
(514) 288-8373

Wang Laboratories
836 North Street
Tewksbury, MA 01876
(617) 851-4111

Xerox Corporation
Office Systems Division
P.O. Box 29466
Dallas, TX 75229
(214) 630-2611

APPENDIX G

Results of special format code tests on CPT 8000:

FUNCTION	STATUS
Tabs & Margins	OK
Coded Carriage Return	OK
Tabs	OK
Decimal Tabs	OK
Brackets	OK
New Paragraph Indicator	OK
Registered	OK
Copyright	No
Section Indicator	OK
Trademark	OK
Subscript,Superscript	??
Coded Centering	OK
Insertion of External Text	OK
Vertical Underscore	??
Overstrike	No
Program Key	OK

Key:
OK=Successful
No=Not Successful
??=Questionable