Implementing electronic mail in a telephone system: more than just talk

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INTRODUCTION

For most of us, the office of the future is a vague concept. We can see some dim shapes through the mists which look like they might be the place we want to be in a few years, but there is no obvious road from here to there. It would help to define our goal so that we can know whether or not we have arrived at the right place once we have gotten somewhere, and it would help even more to know whether or not we are getting closer to it as we move forward. Then we could pick one of the paths that seems to lead in the right direction.

We are tempted to define the office of the future as a collection of hardware, software or procedures, but I believe it is really a label we give to a result we devoutly wish for: increased white collar productivity. We have many support systems today which look like paths toward that goal: data, text, image and the most pervasive information support system in the office, the telephone system. Each of our enterprises will find a different road to our own future office, a path that becomes clearer step by step as we proceed. For that reason, today's planning and purchasing decisions for these information systems must allow for this evolutionary, learning process. Flexibility, growth capacity, standard interfaces—these are the key words for the systems of today that can become the systems of the future.

In this piece, I will illustrate one of the growth paths by describing the evolution of a digital telephone system into an integrated voice and text information system. A specific type of electronic mail can now be provided from the telephone system to give the office workers a more complete information system, aimed at increasing their productivity. It also illustrates the potential future role of the digital telephone system as the brain and central nervous system of the office of the future. And it brings forward some of the organizational impact that will accompany the move into the future.

WHITE COLLABOR PRODUCTIVITY: THE NEED FOR NEW TOOLS

The office of the 1980's needs some new tools. The evidence is expressed in an increasingly familiar litany:

- White collar payroll has grown to more than 50 percent of total payroll.
- However, the productivity of white collar workers is increasing scarcely at all, up a mere 4 percent over a ten year period.

The search for solutions to this growing problem begins with an analysis of office worker occupations and the time spent in key activities.* Sixty-six percent of white collar payroll dollars (not headcount) goes to managers, administrators and professionals (engineers, for example), 6 percent to secretaries and 28 percent to other clerical support workers. The first class of workers spends most of its time in information communication activities: gathering, sharing, creating and processing information in many ways. For a top executive, 95 percent of the day can be spent in these activities; for a design engineer, perhaps only 50 percent. But for this class as a whole, an average 75 percent of the day is spent reading, writing, making phone calls, going to meetings, preparing for meetings, even teleconferencing.

If most of the white collar payroll goes to workers who spend most of their time on information communications activities, the obvious place to look for increased productivity is the information support systems for these workers. Today we find word processing, the most advanced technology in the office, serving the secretarial workers, not helping a manager get significantly more done in a day. But it has given us a taste of what technology can do for us. The office of the 1980's must feature more information support systems, and they must be aimed primarily at the managers and professionals.

AN ELECTRONIC MESSAGE SYSTEM (EMS)

One of the new information systems which can be introduced to the office for increased productivity is variously called an electronic message system, electronic mailbox or computer based message system. This system allows users

to send and receive message communications (those brief, informal and usually perishable intra-company communications) electronically. Messages are created, read and otherwise manipulated on terminals, which may be printers or paperless CRT's. After creation, messages are stored on online media for retrieval by the addressee. A central computer provides information control and processing functions for users of the system.

In practice, an electronic mailbox is used just as a physical mailbox. The user checks for new input a couple of times a day, discards or answers the messages, and creates new messages for other workers who use the system. Occasionally, he or she may want to forward a message to another worker for their information.

If terminals are conveniently located, an electronic message system can substitute for some of the phone calls to and from an office worker. All of those calls which are one way ("Monday's staff meeting is cancelled") or which don't require an immediate response ("Can we meet Thursday at 10:00?") can be handled by an electronic mailbox. Twenty to thirty percent of all intra-company calls may be of this nature. An EMS saves time otherwise spent in telephone tag, chasing back and forth to complete the communication.

It also saves the time wasted when a phone call interrupts your dictation and you have to rewind your thinking, and the time wasted while another party searches for information. See Figure 1.

Electronic messages also substitute for some of the paper flow in the office. Because they are delivered to the electronic mailbox instantly, there is no expense for intra-company mail, copying costs, delivery costs, or postage. And instant delivery means no wasted effort due to the late arrival of an important message. It also means an increased feeling of teamwork among the participants, when all team members can be equally well informed, even if geographically spread out. The benefits compound if users are in multiple time zones, or travel frequently.

The elements needed to implement a successful electronic message system are:

- **Input/output**—Terminals should be convenient to the users, installed in or near their work area.
- **Processor**—Operation by many users at once is necessary, especially in larger offices. Response time must be short, on the order of 1 second or less, but the terminal input rate is small bursts at long intervals.

**THE PAY OFF — TIME SAVED FOR OFFICE WORKERS**

<table>
<thead>
<tr>
<th>8 HOUR DAY</th>
<th>POTENTIAL TIME SAVED</th>
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<tbody>
<tr>
<td>2 HOURS NON-COMMUNICATIONS ACTIVITIES</td>
<td>30 MINUTES BUSY — REDIAL</td>
</tr>
<tr>
<td>6 HOURS COMMUNICATIONS ACTIVITIES</td>
<td>60 MINUTES WAITING INTERRUPTION—START OVER</td>
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**SOURCE:** SRI INTERNATIONAL

Figure 1 — The pay off—time saved for office workers.
Implementing Electronic Mail in a Telephone System

Storage—For perishable messages, there must be enough online storage for several days' traffic. Many installations have found that the average user generates three 500-character messages a day, and that three days of storage is generally adequate. Each site and application has different requirements which alter these guidelines.

Hard copy— Provision for hard copy is essential, although printers can be centralized or shared since their use is less frequent than CRT's.

Simplicity—The system must be simple to operate by office workers with no technical or computer systems background; and it must provide prompting or assistance when necessary, since usage will be infrequent—once or twice a day with occasional lapses of several weeks.

Remote access—Users who are not on site must be able to use the system to achieve the full benefits.

Security—Mailboxes must be protected from access by other people.

System management tools—The system manager must have statistics on usage and errors to effectively plan and control.

IMPLEMENTING AN EMS IN A TELEPHONE SYSTEM

There are many ways to implement an electronic message system. A mainframe or minicomputer can be programmed to operate an electronic mailbox, and packaged software is available for this purpose. Time-sharing services also offer this capability. In 1979, ROLM Corp. announced a new way, integrating an electronic mailbox system with a telephone system, the ROLM CBX (Computerized Branch Exchange). This was called REMS, for ROLM Electronic Message System. See Figure 2.

The ROLM CBX is a computer controlled digital switch. To switch telephones, as a PABX, the analog signals are converted to digital form by pulse code modulation, and connected by a time division multiplex bus. The TDM bus is, of course, indifferent to whether the digits being switched originated from telephones or business equipment such as terminals.

To interface terminals to the TDM network, ROLM developed an RS232 interface for its electronic telephone set, the ETS 100™. See Figure 3. This telephone set has a pair of wires connecting its analog voice signal to the switch, and another pair carrying data to and from the switch for signalling and supervision. With the addition of the terminal interface, terminal data is combined with signalling data, and the result is an integrated voice and data communication system using common telephone wiring without modems. Furthermore, the addition of the data interface does not detract from telephone service, an important point since even in the office of the future, voice will remain a major form of communication. Telephone and terminal may be used in-

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**SYSTEM DIAGRAM**

[Diagram of the ROLM CBX system]
MESSAGE TERMINAL PLUGS INTO ETS-100

Figure 3—Message terminal plugs into ETS-100.

dependently, simultaneously without affecting each other's performance.

The processor to operate REMS was easily found. The CBX is run by a 16 bit minicomputer, and a CBX can be configured to have redundant processors, one maintained on standby processor with the electronic message system soft if the primary processor should fail. By programming this standby processor with the electronic message system software, ROLM integrated REMS in the CBX. Data from a general class of ASCII, non-buffered terminals goes to the CBX over telephone wiring, onto the TDM bus where several simultaneous users can be accessing the system running in the standby processor.

Storage of up to 1 MB for messages is provided on floppy disks. For average use, this storage is adequate for 200 users. Hard copy can be produced at a printer nearest the author or recipient of a message on command, and REMS allows the use of CRT's with integral or daisy chained printers for further hard copy options.

Remote access to REMS is possible via dial up line using a terminal and modem. A modem at the CBX allows the remote terminal to be connected to the REMS processor, and thereby use REMS identically to all on-site terminals.

REMS can deliver messages to remote terminals, too, using the modem at the CBX. With this capability, a complete store and forward message system can be constructed.

The commands to operate REMS are simple English language words (SEND, READ, PRINT, etc.) which require no typing skill to peck out. Prompting is available, HELP can be requested, and error messages are provided so that even infrequent users can operate the system. Proficient users can elect to use an abbreviated set of commands, but drop back to the basic level if necessary.

Security is provided by password access which can be changed by the user from the terminal. Indeed, an electronic mailbox is more secure than the typical inbox. In addition, remote terminals in open areas can be configured not to print a message but rather a notice that a message is waiting to be read.

Finally, REMS provides the system manager with statistics on system usage, memory, and errors for planning and control.
THE ADVANTAGE OF AN EMS IN A TELEPHONE SYSTEM

The advantages of integrating an EMS in a CBX are both economic and enhanced performance. The most obvious advantages are the elimination of modems and special wiring, a single vendor for both voice and message systems, and usually the lower cost of the total system. Since the CBX purchase is justified on the basis of cost reductions in voice communications alone, typically 33 percent, REMS can be viewed as an incremental expansion of the CBX, costing less than a separate stand-alone system.

Integrating REMS in the CBX provides features and performance which a stand-alone system could not offer without considerably more expense. For example, a message alert can be provided to the user through the telephone system, notifying him that a new message has arrived in his mailbox via a display on his electronic telephone, or potentially in other ways. Message delivery can take advantage of the least cost route selection which the CBX can perform for all outgoing calls. And users gain a great deal of flexibility by using the telephone wiring. Terminals can be added easily, and relocated without expensive rewiring.

FUTURE DEVELOPMENT

The future of REMS will depend on users' experiences with it. Along the evolutionary path to the office of the future, as users discover what they like and dislike, the system will develop accordingly. Software will be modified and hardware added in the likely direction of more functionality at the terminal, more network options, interfaces or integration with other systems, more storage, or specific applications such as nurses' stations.

REMS illustrates the potential future development of information systems integrated in a CBX in several ways. The use of the telephone wiring as an office central nervous system can certainly be applied to many applications, and the switching, concentrating and information processing functions of the CBX can be extended to provide many information services to the office workers.

ORGANIZATIONAL IMPACT

The impact on the organization has to be considered when any move toward the future office is evaluated. Unfortunately, many proposed solutions require significant changes, such as giving up secretaries or changing job descriptions, to deliver their benefits. Consequently, they are slow to be accepted.

An EMS requires no significant organizational change to deliver its benefits. For the information services manager looking for an opportunity to begin moving toward the future office, an EMS is a non-threatening supplement to the existing information systems, but it provides an opportunity to introduce office workers to terminals, electronic mail, store and forward systems and electronic filing and retrieval.

A company should be prepared to recognize and reward the office workers who succeed in using the new tools to produce more results. Most firms are unlikely to lay off their managers and professionals, even if new systems succeed in freeing time in the day. The additional results that these people can produce with that time have far more impact on the bottom line than payroll cost reduction, but the organizational climate has to favor that behavior.

An interesting organizational impact of an EMS is the opportunity it provides for a firm's information services managers to work together. The voice communications and office automation managers can use the installation of an EMS to establish common goals and objectives, develop specifications, and learn to work as a team to deliver the new system to their users. The future office will come that much nearer as they combine their imaginations and talents.