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ALTERNATE APPROACHES TO OFFICE SYSTEMS

Although there is much talk about office automation, when one asks, "What are future office systems going to look like?" the discussions can become confusing. Vendors describe what they hope the structure of office systems will be (based on their current offerings). Consultants in the field generally have other opinions. And researchers point out requirements for 'good' office systems that often differ from all the above. In this issue, we pull together thoughts from these sources to see if a clear picture of future office systems is emerging. (An executive summary is on page 16.)

Lincoln National Life Insurance Company, with headquarters in Ft. Wayne, Indiana, is the 11th largest life insurance company in the U.S., as measured by life insurance in force. It has some $4.3 billion in assets and 3,500 employees. Lincoln National has four operating groups—re-insurance, pensions, group insurance, and individual insurance. They are the largest writer of life re-insurance, for re-insuring risk of other life insurance companies.

For the past three years, Lincoln National has been installing an office automation system. Most of their employees are located in Ft. Wayne, in two buildings about six miles (10 km) apart. Some 700 terminals have been installed, and there are 1200 active users of the system. (Their goal is one terminal per office employee.)

Their office system today. From the user's view, the system begins at the terminal. Lincoln National uses 'very dumb' terminals for their in-house system—they contain no application software. The terminals are connected to computers via existing telephone wires. A Teltone modem is plugged into the telephone jack, and the telephone and the terminal are plugged into the modem. The modem sends the digital data signal at a higher frequency than the voice signal, so both signals can travel over the lines simultaneously. While data speed can be as high as 9600 bits per second (bps), they have chosen to operate at 4800 bps, which is adequate for their office uses.

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As an aside, transaction processing terminals at outlying sites are linked to mainframes through a different, high-speed leased line data network.

At the Master Distribution Frame (similar to a PBX) where all the phone lines lead, a Teltone modem strips off the digital data signal and routes it to a port selector. The port selector connects the terminal to one of three options: (1) one of the Prime computers which run the company's advanced office system (AOS), (2) an IBM mainframe at the computer center, or (3) a shared personal computer.

The company has five Prime systems running AOS, which provides electronic mail, word processing, electronic filing, records management, decision support tools, end user programming, and access to 'the outside world.' If, for example, the user wants to connect to the Official Airline Guide database to create a travel itinerary, he or she types "See planes," and the system makes the outside connection, via Tymnet, to the OAG service. The Prime also converts the signal to X.25 protocol for this connection.

If the user chooses to connect to an IBM mainframe, a protocol conversion box at the port selector converts the TTY (asynchronous ASCII) signal to IBM's EBCDIC code and SNA protocol, making the terminal appear as an IBM 3270 terminal.

The third option—the shared microcomputer—is actually a box with four Z-80 processor boards in it (expandable to eight). The processors run CP/M and each is assigned to one user for the duration of an on-line session; they are not time-shared. Each processor can also use the resources of a shared Z-80 processor, which manages the 10M bytes hard disk drive and the printer port. So these users have most of the features of CP/M personal computers via a central service. The system is from Molecular Computer, of Palo Alto, California.

Lincoln National also has some shared peripherals accessible through AOS. For graphics they provide several output devices to which a user can route graphics work. These include a black and white Printronix printer, a Zeta color continuous paper plotter, and a Ramtek color system with a Dunn Camera attachment for making 35mm slides.

Their future office system. Lincoln National believes that in five years or so, the architecture of their office system will probably look much as it does today. It may include some new services, and it may take advantage of some new technologies (such as fiber optics), but the architecture is set.

The in-place network will handle voice, data and graphics. A separate video network will link a few conference rooms. And still another network may link highly specialized image terminals and an archival image library. As they tie subsidiary companies into the system, it will remain centralized, unless the economics change.

Reasons for their approach. Lincoln National chose this structure for their office system for several reasons. Perhaps most important, their structure allows them to control their own destiny. They are not dependent on the actions of any vendor; they can get any of their components from multiple sources. Also, by making innovative use of mature, well-tested communication technology, they think they will probably be able to make their decisions about local networks a few years hence, when the picture has clarified somewhat. In addition, Prime Computer provides them with good networking capabilities, as well as X.25—so their gateways to the outside world are in place. They plan to keep their options open in the volatile communication and micro-computer areas.

Second, since their offices are located mainly in Ft. Wayne, the system follows the company structure. They do not believe they would gain any more functionality or reliability by having networks of intelligent single-user work stations. And, in fact, they would not be able to handle some of the large modeling packages that they now use if they had only the 8-bit variety of single-user machines.

Third, they wanted all users to have access to all facilities, and they are pleased with the creativity that this approach has fostered. Many of their executives often keyboard their own work, using AOS—for documents under two pages in length. And these executives feel they are more efficient than if they passed this 'light work' to

their secretaries and then went through several revision cycles. Likewise, secretaries send messages and do end user programming. So user flexibility is important. In addition, they do not want users to worry about things such as backing up files, backing up computers, choosing software packages, and so on. They believe this technical expertise should remain with the data processing staff.

Fourth, because each user is on-line to the system an average of only about one and one-half hours a day, the cost of idle resources could be large. Therefore, they have selected multi-user mini-computers to serve the least expensive terminals they could find. A user's initial investment is low—$900 for a terminal and Teltone modem—compared with $3500 for a micro-computer. And the communication link is already in place. The price per month to use the services is $50.

Fifth, through their mini-computer approach they have been able to provide access to all the facilities using only two protocol conversions—from TTY to SNA or to X.25. And they have avoided the problem of dealing with user-purchased micros; there are none in use because an equivalent service is provided through the Molecular Computer shared micro.

And sixth, they have been able to build the system modularly and take advantage of facilities already installed, such as the telephone lines, the PBX, and the mainframes. They add about 100 terminals a quarter, and can add Prime computers as the need arises. Since all Prime machines use the same operating system, they can place small Primes at regional offices if desired.

Being a pioneer in office automation, the people at Lincoln National Life have received many requests from other companies about their work. Due to these requests, Lincoln National now holds a few in-depth seminars a year on their approach to office automation planning; for more information, see Reference 1.

Alternate approaches

There are a myriad of alternate structures being offered for future systems. In general, these structures follow vendors' existing data processing product structures. We have chosen to describe three vendors that offer different office system architectures, to illustrate what is on the market.

IBM

In mid 1980, IBM issued "a statement of office systems direction." It stated that, at that time, their major thrusts in office systems revolved around: (1) System/370 DISOSS (Distributed Office Support System), (2) DOSF/8100 (Distributed Office System Facility), (3) 5520 Administrative System, (4) Displaywriter System, and (5) 6670 Information Distributor.

The announcement also stated that document inter-change between these systems would be provided in the future. Subsequent product announcements imply that the communication architecture will be based on SNA (IBM's System Network Architecture). A local area network "will probably move most forms of information within a building or group of buildings," Reference 2 states.

Brief descriptions of these office system components are found in a booklet entitled, *IBM Office System Offerings* (Reference 3). The following is based mainly on that booklet.

The IBM office system structure involves three types of computer systems. One is the general purpose, large mainframe at a central site. The second is distributed systems located in departments or work groups. Users could have their own 'distributed systems' as well. And the third type is special purpose computers.

General purpose central systems. At the central site are 370, 30XX, or 4300 computers, with the following types of software.

For managerial and professional support, IBM has PROFS (Professional Office System), which runs under the VM operating system. Each professional and secretary using PROFS has a color or monochrome 3270 display terminal and a nearby printer; these communicate directly with the central host. The system provides facilities for document creation, filing and retrieval, automatic indexing of correspondence and documents, reminders, calendar management, distribution lists, text editing and formatting, and document distribution.

For moving documents between a central computer and a distributed system, or between distributed systems themselves (through the central host), IBM has DISOSS. DISOSS consists of two parts—one part resides on the central host, the other part resides on each participating distributed 8100 system having DOSF software (to be described). The Displaywriter and 5520 will also have DISOSS support.

DISOSS allows users to store their documents either locally or centrally and to give each document appropriate search and retrieval parameters. Users can then use these keywords to search for documents. There are also 'links' to various centrally located text facilities and to a document distribution facility. Documents can either be electronically transferred among distributed systems connected to the same central host or can be stored in centrally-located mailboxes for users of the distributed systems.

For mainframe text processing, IBM offers five complementary software products. These products provide more extensive capabilities than are offered on distributed processors.

The first, ATMS (Advanced Text Management System), is used directly via terminals to enter and edit long and formal documents (generally not correspondence). The major users of ATMS are publication departments, documentation centers, and such.

The second is DCF (Document Compositon Facility). It is also used via terminals, to format documents that have already been entered using, say, ATMS or DOSF.

Third is DLF (Document Library Facility). It is used to store and retrieve centrally-located files and documents which have been created at the central host or on a distributed system.

Fourth is DIF (Document Interchange Facility). It allows users of distributed systems to move their documents to the central site, for storage or to obtain more extensive formatting capabilities. It links the mainframe computers with the 8100 distributed systems. This facility consists of two sets of software—one at the central site and the other at the distributed sites.

And fifth is STAIRS (Storage and Information Retrieval System). It is a terminal-oriented storage, search, and retrieval product. It is generally used for searching large textual databases—of technical journal abstracts, contracts, legal documents, large correspondence files, and so on.

These are the office products IBM currently offers for its large, general purpose computer systems.

Distributed office systems. For use within individual departments, IBM offers three distributed office system alternatives—the 5520 Administrative System, the Displaywriter, and the DOSF/8100 System.

The 5520 is a general-purpose shared system that can support up to 18 display stations, 12 printers, 16 communication lines and about 30,000 pages of text. Users can be located locally or remotely. The system provides text processing, document distribution to several other types of IBM systems, file processing, and access to central host databases, via a 3270 terminal emulation mode. It can operate as a stand alone system, or in a network of various IBM products, or connected to a central host.

The Displaywriter is a diskette-based word processing system. It can be configured in several ways: (1) as a stand alone unit with one work station and one printer, (2) as a cluster of two or three work stations sharing a printer, or (3) as part of a document distribution network. With Reportpak, its most powerful software, the Displaywriter can be used as a general purpose typing work station with a spelling dictionary, for processing columns of figures, and for four-function mathematics. Furthermore, it can be used for creating and maintaining small data files.

The DOSF/8100 (Distributed Office Support Facility) is a shared office system, for both text and data processing. As mentioned earlier, with the addition of DISOSS software, it can become part of an office network through a central host. It is the most powerful of the three distributed office systems.

Special purpose systems. IBM currently has two special purpose systems. One is the 6670 Information Distributor, generally located in departments; the other is the Audio Distribution System, usually centrally located.

The 6670 is a word processing printer, remote data processing printer, electronic document distributor, and a convenience copier, all in one. It can be linked to all the above-mentioned distributed and central systems.

The Audio Distribution System is a voice store-and-forward system on a Series/1 computer. Using Touch-Tone telephones, office employees can send voice messages to one another, hear voice messages that have been sent to them, immediately reply to messages, and file and retransmit messages.

One question concerns the communication links that IBM will offer. The company encourages the use of in-house SNA data networks, for connecting all data processing and office system products. A local area network, that probably will use token-passing access control and interface with SNA, is reportedly in the offing.

We can thus say that the 'center of gravity' in IBM's offerings continues to be their general purpose central systems. They have some departmental and individual work station offerings, but these are designed to be tied to a centralized system. And so far, IBM is encouraging the use of SNA—again a host-based approach—for inter-connecting its products.

Wang Laboratories, Inc.

Wang Laboratories offers a single network approach which they foresee handling all conceivable types of company communications. They also offer several lines of computer systems—some aimed at word processing, others at data processing, and their newest ones aimed at integrating many office functions.

Wang's major lines of computers are their 2200, OIS, and VS systems.

The 2200 is a line of small business computers which supports from one to 12 users. It offers software for data processing, word processing, business graphics, and COBOL programming. It also has several communication options—use of Wang's Mailway to send messages and distribute documents to other Wang systems, X.21 and X.25 support for external communications, and SNA support for interactive and remote batch communication with IBM computers.

Wang's Office Information Systems (OIS) line concentrates on handling text. These systems can have from 14 to 32 peripherals; these peripherals include word processing terminals, photo composition machines, printer/copiers, and optical character recognition machines. OIS also provides some data processing functions (using the BASIC language). The newest member is the Alliance, which allows users to annotate text with voice messages and send voice messages to others.

The largest Wang systems are in their VS line, which is mainly data processing oriented. These systems offer several programming languages and can support up to 128 terminals. Like the other two lines of computers just described, VS systems support Mailway, IBM and X.25 communications, and word processing.

In the voice area, Wang recently announced two products. One is a voice store-and-forward system, the Digital Voice Exchange. Using Touch-Tone telephones, users can dial into the system, leave a voice message for someone else, retrieve messages sent by others, and edit and forward voice messages. The second product is their audio work station, which works with the Alliance system.

To tie all these systems together, and to enable communication with other systems as well, Wang announced WangNet last year. WangNet is a broadband local area network. It is currently divided into three 'bands,' each with a specific purpose. However, these three bands do not use all the cable's capacity, so other types of 'bands' can be anticipated in the future.

One band of WangNet is Wang Band; it is for local Wang-to-Wang system communication. It has a speed of 12M bps and uses a contention-type access method (CSMA/CD). Wang's 2200, OIS, and VS systems can communicate over this band via an intelligent interface unit at each network connection.

The second band is called the Interconnect Band; it is for communicating among Wang and non-Wang systems. This band offers two types of connections between devices—dedicated and switched. Levy (Reference 4) points out that by changing modem parameters and frequency assignments in the Interconnect Band, it could be

used for video conferencing, voice calls, and inter-computer file transfers, given the appropriate interfaces. This band provides the inter-connection; it does not provide protocol, speed, and code conversion facilities.

The third band, called the Utility Band, provides 6 megahertz CATV channels. These can be used for tele-conferencing, security, and other video applications.

Thus, Wang is offering a range of work group and departmental size processors which can be inter-connected by WangNet. Some interesting voice functions also are offered. For more information on Wang's products, contact them at One Industrial Avenue, Lowell, Massachusetts 01851.

Xerox Corporation

The most publicized office system strategy is that of Xerox Corporation. One reason is that it is a revolutionary approach—a local area network connecting many single-user work stations and numerous shared peripherals.

The network. Ethernet is a baseband network using coaxial cable. It can be up to 1.5 kilometers (0.9 miles) long, with gateways and repeaters to increase its length or connect it to another Ethernet. The network has a basic transmission rate of 10M bps.

A processor wishing to send a message 'listens' to the network to hear if any messages are being transmitted. If it hears none, it broadcasts its message. It also 'listens' while broadcasting to determine if other traffic has been started at the same time, causing a collision. If a collision occurs, it waits for a pre-determined time and tries again. This type of protocol is called carrier sense multiple access with collision detection (CSMA/CD). Each station on the network receives each message, checks the destination address and, if not addressed to it, discards the message.

Digital Equipment Corporation and Intel Corporation have joined with Xerox to develop and support Ethernet. The European Computer Manufacturers Association has endorsed the Ethernet approach, we were told. In addition, numerous other companies (over 50, we understand) are offering or have announced their intent to offer Ethernet-compatible products.

Ethernet is intended to handle bursty types of communications, such as queries, messages, interactive processing, and such—the types of communications found in offices. It is not aimed at process control, real time applications, large file transfers, or applications requiring fixed intervals between messages.

The work stations. The processors Xerox offers to work on Ethernet are called Xerox 8000 network systems. All processors connected to the network are equal; there is no controlling processor. Some of the processors, called work stations, contain application software for graphics, word processing, and other office functions. Others, known as servers, perform only one function, such as accessing files in shared disk storage, providing printing services, and linking Ethernets. Xerox currently offers three types of work stations and three types of servers.

The smallest work station is the 820-II personal computer. It contains a Z-80A processor and has 64K bytes of memory. It has a monochrome display of 80 characters by 24 lines and comes with floppy disks or a hard disk. It uses the CP/M operating system and can operate as a personal computer, as an intelligent terminal, as a batch terminal, or as a message send/receive unit.

The Xerox 860 information processing system handles office record processing—both text and data—as well as word processing and end user programming. The system has a full-page display, operates under CP/M, and has a BASIC interpreter. It can operate on an Ethernet or as a stand alone system; and it can process information created on an IBM Office System 6.

The most powerful work station currently offered is the 8010 Star Information System. It has a large screen which can display two full pages of information side by side. A user 'navigates' the cursor around the screen by rolling a control unit (which Xerox calls a 'mouse') on the desktop. One of the two buttons on the mouse allows the user to select (say) a file—which is shown on the screen as a picture of a file folder with a name on it. Once selected, the user can manipulate that file in many ways—open it and edit its contents, have a spelling checker check it, enclosed it in a message and send it to someone else, print it at a local or remote printer, or even

'throw it in the waste basket.' Each of these options is represented by a small picture (an icon) on the screen. Most of this manipulating is performed using only the mouse and its two buttons, plus four control keys on the keyboard.

The Star has powerful text formatting and graphics capabilities. It is aimed at professionals who work with numerous documents.

Network servers. The System 8000 print server is a 12 page-per-minute printer. It has resolution of 90,000 dots per square inch (about 14,000 dots per square centimeter), the same as the Xerox 5700 and 9700 electronic printing systems. It provides a variety of fonts and print spacings. In normal operation on an Ethernet, documents to be printed are stored on a disk at that printer and then printed in the order received.

The System 8000 file server has three models; they hold 10, 29, or 58 megabytes of information. Ethernet users have a choice of storing their programs, data files, and text files locally at their work stations or at one of these shared file systems. Files are organized as in a filing cabinet—by file drawer, file folder, and document. For electronic mail, the file server uses its 'mailbox catalog' to distribute mail to the appropriate recipients.

The System 8000 communication server provides four services. It enables Xerox 860 systems to exchange electronic mail with each other, it inter-connects two Ethernets, it allows users to access servers on another connected Ethernet, and it allows linking of devices to the network that were not originally designed for Ethernet.

Xerox's office system structure is much different from most data processing system architectures, because it places the processing power at the single-user work stations. Xerox provides facilities for sharing expensive peripherals, and for attaching a mainframe to an Ethernet.

Ethernet is aimed at handling most office requirements. But there are two possible future needs that it does not yet cover—interactive voice and full-motion video. For the first, Xerox says that they are working on interactive voice on Ethernet and expect to offer it.

For more information on the above-mentioned products, contact Xerox, Office Systems Division, 1341 West Mockingbird Lane, Dallas, Texas 75247.

What will office systems be like?

Do these three vendor views differ? Yes, and significantly, we think. First, they emphasize different placement of processing power—at the mainframe, at group computers, or at individual work stations. The decision on where to put processing and storage affects the types of functions a system can provide to individuals and to groups. It also may influence system reliability, distribution of software, backup provisions, and plausible security measures.

These different vendor views also imply where control of the system will lie—with a central authority, with a department manager, or with individual employees.

But vendor views are obviously influenced by the products that they currently offer. To get more than a vendor-oriented view of alternative structures of future office systems, we talked to two experts in the field. We asked them what they thought the structure of future office systems might be like.

Walter Ulrich, of Walter E. Ulrich Consulting Inc. in Houston, Texas, has been helping companies implement office automation pilot projects for several years, particularly in the electronic mail area.

He believes that no one architecture will 'win' in the office automation 'battle.' He expects that companies will mix and match such components as mainframes, PBXs, local area networks, personal computers, and mini-computers in many different ways.

The corporate mainframe(s) will become the depository for corporate data and for both specialized and general purpose computing. Such a facility will probably have both a database processor (back end) and a communications computer (front end). The corporate computer center will also have several specialized processors, in the mini-computer range. Each will be dedicated to one office function; one might serve as the corporate electronic mail system, for example.

Ulrich sees companies migrating to dedicated machines gradually. First, he says, companies

will subscribe to a service, such as an electronic mail service, to gain familiarity with the new application. Once the application is justified, they will move it in-house to a general purpose mainframe. But, since this office application requires fast response and a different type of processing (text versus data, for example), this solution will not be satisfactory. Thus, the company will eventually move the application to a dedicated machine.

These dedicated machines will act as repositories for the specialized data (for example, messages) and they will also provide an 'intelligent interface' to users. For example, users of both powerful work stations and dumb terminals will be able to use the same shared electronic mail system. For the terminal user, the shared system will need to provide all the application prompts; for the work station, which contains its own version of the electronic mail software, the shared system will only need to distribute the message once it has been composed.

Another important aspect of the man/machine interface is that it should provide consistency across all terminals. Users will receive the same electronic mail prompts, for example, whether they are in their offices, in the company library, or visiting a distant office.

Several types of 'networks' will connect users to the corporate computer center. For transaction processing personnel, such as customer order entry, the current data communication network with terminals will continue. This arrangement is efficient and effective and will continue in the future, because these employees do not need other types of automated office support, says Ulrich.

For communities of knowledge workers, local area networks will be installed to connect various types of work stations. For outlying or small groups, or individuals who travel much of the time, leased lines or dial-up facilities will be used.

Work stations will vary in capabilities, depending on what each employee needs. For example, for the sales executive who travels much of the time, the office work station will be a combined terminal and telephone, because his or her major needs are database access and voice and electronic mail. Not much software will reside at this work station, says Ulrich. However, secretaries will have powerful work stations which include sophisticated word processing. Furthermore, managers and staff members who need analysis tools will most likely have several options. They will have some modeling tools on their work stations, and they will be able to access more elaborate, shared ones from the computer center.

The decision of where the software for each function will reside will be made mainly by the users, with guidance by data processing, based on where it will be most economic, says Ulrich. If the application is specific to one user, the software will likely be put onto that user's personal computer work station. However, the reponsibility for both the hardware and software will remain with data processing, because, when an employee leaves, the information and tools that the employee used are important to the company and need to be passed on to someone else. Without a central authority being responsible for these 'office tools,' they can become 'lost' instead of being passed along.

A super-PBX will connect employees to the outside world. It will act as a gateway between users and (1) local in-house services, (2) remote in-house services, and (3) commercial services. The PBX will also provide (or co-ordinate) the integrated message facility, which will be important in future offices. This service combines electronic mail, voice mail, and enhanced telephone features, so that users can combine voice and text in one message. It also will perform call forwarding, call conferencing, and such. So the telephone system will be linked to store-and-forward services via the PBX, speculates Ulrich.

In conclusion, Ulrich sees work-stations, controllers, networks, and computers of many types in organizations. The use of these technologies will be tailored to the special needs of the individual.

Dean Meyer, of N. Dean Meyer and Associates Inc. in Ridgefield, Connecticut, has been in the office automation field since the late 1960s. And in 1978, he was a co-founder of the Diebold Automated Office Program. More recently he headed the New York office for Communications

Studies and Planning Ltd. of London, England, and he now heads his own firm.

Meyer believes that future office systems will be hierarchical, consisting of five levels of computing: (1) personal, (2) group, (3) establishment, (4) organization, and (5) world. Each level will have its own computer and communication systems designed to perform the functions it needs.

The *personal computing* level will serve individual office workers. The hardware will be micro-computer based work stations—one per employee. Some of the software needed by the employee will reside in the work station, the rest will either be (a) downloaded to the work station from other sources or (b) used in a time sharing mode with the work station acting as a terminal.

One type of software likely to be on the work station is what Meyer calls a 'semantic support system.' This is a product that helps users write; it is more than a word processor because it helps people organize their thinking. His example of such a system is Tymshare's Augment system, which surrounds a hierarchical text editor with a broad range of knowledge worker tools. The work station of the future will also contain decision support, data processing and graphics tools. Plus, it will store some data files—most likely the individual's correspondence, work plans, and lists of various kinds.

In the long run, the work station will become equivalent to one's desktop, says Meyer—meaning that most processing will be performed at this level, with results passed to the other levels. Employees will pull data out of a group or organization computer, temporarily store it in the work station to manipulate it, and then pass it back to the group computer in order to include it in (say) a message, a report, or a computer conferencing record.

The *group computing* level of future office systems will support the needs of small work groups—such as project teams, co-authors, or even managers and their staffs—and large groups—such as departments or even divisions. The computer will serve one or more groups and will be a multi-tasking, multi-user micro or mini computer. Meyer also believes that audio and audio-graphic conferencing facilities will be provided at this level.

As one of their main tasks, group computers will support intra-group work. For example, they will have project management and time management tools. They will also provide enhanced word text processing services through 'shared staff specialists,' such as word processing typists.

Associated with each group computer will probably be several group peripherals, which are too expensive for single users. These include printers that can produce graphics, facsimile machines, and optical character recognition machines. Mass storage devices will be important at this level. They will contain day-to-day group and department work files, public calendars, project files, and such. And they will be used to archive personal files, work group files, and department files.

As another task, group computers will serve as the 'gateways' for the work stations to the corporate computer center and to outside commercial services. Each work station will be linked in some way to one group computer.

The *establishment computing* level will serve a building or group of nearby buildings. Hardware systems at this level will consist of one or more local area networks, a PBX, and probably some specialized facilities, such as an optical character recognition machine and a tele-conferencing 'bridge.' The local area network will link the group computers, and the corporate computers. The PBX will perform all normal telephone functions and voice store-and-forward—and it may sometimes serve as the local area network. The tele-conferencing bridge will link several audio-graphic conferencing rooms, one or more in each building. These rooms will be in addition to the audio conferencing facilities provided to groups within a building.

The *organization computing* level provides electronic services that can be used by anyone in the entire organization. Such facilities will include one or more mainframe computers and communication facilities. The computers will handle company-wide transaction processing, as they do today, as well as other organization-wide services. One such service will be a corporate computer message service, for store-and-forward electronic communications to people within the

organization. Electronic mail service to others outside the company will be handled by a gateway to outside electronic mail services. Corporate databases, such as the financial and personnel databases, will also be held at this level.

On the communications side, the organization could use public or private long-haul networks, or both, to provide links between establishment computers, organization computers, and terminal access from the field.

The *world computing* level refers to all services available outside the organization. One such service is a computer message system for sending messages to people in other organizations. Meyer believes that organizations will make use of outside time-shared services that: (1) they need only occasionally, or (2) are specialized and would be prohibitively expensive to re-invent in-house, or (3) allow them to communicate with the outside world, or (4) offer publicly-available databases.

Meyer believes organizations can evolve toward this integrated, hierarchical network while still solving local needs, if they balance top-down planning—to achieve the technical integration—with bottom-up implementation—to respond to local needs.

Office system goals

In the computer field, the 1960s were characterized as the period when most user companies converted from second generation computers to families of compatible third generation computers. The 1970s, in turn, were the period of consolidation, when smaller data centers were merged into larger ones. At the same time, the older data communications networks were being replaced with new, application-independent ones.

What will be the main characteristic of the 1980s? We believe that it will be the period during which *integration* of information systems occurs. Employees, using their work stations, will be able to access and exchange information, almost regardless of where it is stored.

Like Dean Meyer, we see multiple levels where processing power and storage capacity might be located—although our levels differ somewhat from his. These levels are: (1) the individual work station, (2) a group of employees working on a common task, (3) the department level, (4) the site or plant level, (5) the region or country level, and (6) the corporate headquarters level. We believe that processors and storage devices will be placed at all these levels, in an integrated fashion.

New services to support individual workers, such as text editors with spelling, grammar and punctuation checkers will be added to the currently available services (word processing, calendars, message systems, etc.). Text, graphics, data, and even voice (for voice annotation of text) will be handled on the same systems—as is already occurring. In short, it will be possible to move a variety of types of information from work station to work station.

Perhaps even more important, services to support *groups* of workers will become commonplace.

Supporting work groups

Ellis (Reference 5), at a recent conference, said that he felt the recent big step forward in office systems has been the integration into work stations of functions that support individual workers. He mentioned computer mail, calendars, and electronic filing and retrieving. The next big step forward in office systems, in his opinion, will be systems that support closely-knit communities of people.

Ellis has been doing research at Xerox's Palo Alto Research Center, on an advanced distributed office system called "Officetalk-D." He describes some 'communal' office aids they are developing.

Group tasks that would be aided by this kind of support, says Ellis, include: (1) bargaining, for (say) dealing with remote customers, (2) problem solving among several people for (say) handling exceptions, and (3) multi-tasking, for (say) allowing several employees to use the same software to work on different data or with different customers at the same time. Furthermore, says Ellis, managers would have the capability of tracking the actual flow of work within their areas of responsibility.

We asked James Norton of Tymshare, Inc., in Cupertino, California, what types of aids he

foresees in future office systems aimed specifically at aiding work groups. He is the marketing manager for the office automation division, and has personally used Tymshare's Augment office automation system for thousands of hours in the past 13 years. He sees group support aids coming in six areas.

The first is *electronic mail.* He uses this term broadly to mean processing messages and large documents as well as the attendant cataloging, filing, retrieval, and security facilities that go with such files.

Second, he sees *clerical word processing* and *professional support systems* being connected to facilitate the whole document production and control process.

Third, Norton sees *database management* as a group support facility. This includes management of both publicly available (purchased) data and internal corporate and individual work station data. The facility should have several levels of access control and several different facilities for searching and retrieval.

Fourth, he sees *'application inter-connection'* as a group support tool. By this he means providing a single interface through which users can access and combine specialized tools and data that are too large or too expensive to keep locally on a work station.

Fifth, he believes that *calendar co-ordination,* for both public and private calendars, is needed to support groups. A private calendar is one which only an employee (and perhaps his or her secretary) can update. A public calendar is one which shows blocks of time either occupied or open. Someone wishing to meet with another person can look at the other person's public calendar and then propose a meeting time.

And sixth is *computer conferencing co-ordination.* Here Norton is referring to managing both simultaneous and non-simultaneous group messaging, consensus-taking, and summarization and presentation support.

Also, following are some additional thoughts on the subject of group support.

How might group aids differ from individual aids? Consider the following needs of closely-knit groups. Within a defined work group, there should be abbreviated addressing, so that other members of the group can be reached with little effort. If transactions, records, or other such information must be passed along from one worker to another, such pass-along should be easy, including the automatic adjustment of any control totals that might be needed. If a printer is shared among several workers, the output for each worker generally should be produced separately, instead of inter-mixing the outputs.

Shared-screen facilities should be available, coupled with voice telephone. To solve a problem, a person might request one or more other people to look at the same information on their screens and to discuss the matter over the phone, on a conference call basis. Another assistance feature might support such requests as "Who can help me on this matter?" or "Has anyone come across something like this? If so, how did you handle it?"

For group work, office automation networks should provide the means for circulating information among members of groups. Such services include computer mail, as well as 'bulletin boards,' broadcasting information and news, and so on. Tools will be needed to support group coordination and administration, as well as group discussions and conferences. And software will be needed to allow group members to access shared data files, to retrieve desired data.

And, there should be a training facility, so that a supervisor (or another) can oversee the training of new employees (which will be performed with computer aided learning) and then monitor the new employees' work from time to time. The group should have a central program library, with rapid and efficient down loading of programs to the individual work stations, so that everyone in the group uses the same programs. And, of course, the services should provide for the easy creation of backup files for the group, and for using backup work stations or terminals.

If the new information systems support close-knit groups in such ways, two main points stand out. For one thing, these systems must have high reliability, high availability and fast response times—much better than is currently provided by heavily-loaded mainframes. These services will become as necessary to the workers as electricity and phone services are today. (Incidentally, mi-

cro-computers generally provide a much higher degree of availability than mainframes do.)

The second point is that these systems must provide a high degree of flexibility—to add, change, or delete equipment, or applications, or employee group membership. The desired degree of flexibility in setting up work groups, for instance, is the same as is provided today by data management systems for setting up new application systems. The tools used should allow for quickly setting up a new 'logical' network to inter-connect the group members, letting the users use it and spot shortcomings, then revising the logical network quickly to meet their needs.

Current office automation tools are aimed mainly at individuals. The next step could well be tools for closely-knit work groups. Co-ordination within such groups is a problem that office automation systems should address. One might conclude, then, that the effect of office automation probably will be evolutionary. First it will affect the work styles of individuals. Later, it will affect the work styles of groups of people. Then departmental work styles may change, then plant or site, until the entire corporation's work style is affected. Today's office system products are only the first steps in supporting such a work style evolution.

Conclusion

Much of today's thinking about office system structure starts with the hardware—that is, what office worker needs can be served with such-and-such computer? Obviously, most computer manufacturers are taking this approach to increase the number of uses of their existing product lines.

The hardware is not the right place to start this thinking, in our opinion. The proper place to start is with the employees and their jobs. At the very least, start with the way employees are performing their jobs today. But the desirable—and challenging—step is to try to conceive how employees will perform their jobs *after they have become accustomed to the new office systems.*

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Associate Editor

The time period just ahead might well involve the highest risks of any period to date, for computer-using organizations—as they install distributed systems, office systems, and integrated communications systems. Not since the big conversion days of the 1960s has there been such a need for well considered plans. Next month, we will give some views on developing these plans.

COMMENTARY

AUGMENTED MEETING SUPPORT

By Dean Meyer, of N. Dean Meyer and Associates,

and John C. Bulyk, of Organizational Resources Group, Inc.

"My whole day was shot in meetings... I know they're necessary, but it takes so long to get anything done."

The perceived lack of meeting effectiveness is a problem companies should not ignore. Meetings are becoming more frequent and lengthy; they are not going to go away. No wonder people dislike meetings. Discussions wander. Issues are repeated again and again. Points are often lost, especially when they are not on the immediate topic of discussion. Subtle distinctions are often difficult to explain verbally. Political 'game-playing' thwarts meeting objectives. And follow-up is often weak, for lack of accurate and prompt minutes. Fortunately, solutions are emerging; one is augmented meeting support.

What is an augmented meeting? Augmented meeting support applies office automation tools to meetings. There are four elements in an augmented meeting—meeting room, hardware, software, and 'meeting facilitators.'

The meeting takes place in a normal conference room, equipped with a large projection screen. In addition, the room contains a micro-computer and an attached video projector, a telephone, and a modem. The projector and projection screen allow all participants to see the computer's display screen. The telephone and modem are used to access the organization's internal data bases as well as public databases, such as the New York Times Index, UPI, Dow Jones, and other bibliographic databases.

In our augmented meetings, for software support, we use Augment, an office support system from Tymshare, Inc. It provides us with the ability to build hierarchies of paragraphs, and to edit the structure quickly. Thus, it is more than a word processor. In addition, we use (when needed) an electronic spreadsheet package, a data communications package, an on-line query language, internal word processing systems, and calendar and reminder systems.

Our 'meeting facilitators' consist of a 'chauffeur' and a 'process analyst.' The 'chauffeur' operates the computer. He or she uses the software tools for sketching words in an outline structure, calculating numbers on the electronic spreadsheet, and accessing internal and public data bases, through the telephone link.

The 'process analyst' observes the way the group interacts and provides feedback, according to guidelines pre-arranged with the meeting chairman. This helps to surface hidden agenda items, highlight sources of misunderstanding, keep the discussion on track, encourage minority opinions, and help issues reach an appropriate closure. No special training or preparation for attendees is required.

The meeting procedure in an augmented meeting is as follows. As the group discusses its agenda, the 'chauffeur' records their thoughts in key words on an evolving outline. All points are captured as they are made, building a structured outline of the discussion. Meeting participants may view and modify the structure of the outline. When discussing numbers, the group can interactively create and modify an electronic spreadsheet model, looking at alternate cases by changing an assumption and watching the effects ripple through the entire spreadsheet. In addition, the 'chauffeur' can call-up previously prepared documents and access databases.

Observed impacts on group dynamics. All of the augmented meetings we have led have been more dynamic and achieved better results than 'regular' meetings, the participants have told us. The approach seemed to increase task orientation—members experienced longer attention spans and greater focus on the meeting objectives. Meeting participation was enhanced—strong individuals were less likely to dominate, and the on-line feedback provided incentives for quiet attendees to offer their ideas.

Displaying pre-entered documents and spreadsheets led to more effective presentations. Working with written (instead of verbal) language helped clarify subtle concepts in a shorter time. And recording all thoughts permitted the groups to work with greater volumes of information, without being overwhelmed or limited to the space on blackboards and flip charts. Because divergent ideas were encouraged, the groups were able to consider a broader range of options. And the technique encouraged brainstorming.

In an augmented meeting, the projected video screen becomes the focus of collaboration, and attendees become more conscious of relationships between ideas. Alternatives can be placed side by side on the screen, allowing 'what if' discussion.

As a side benefit, participants have seen how office automation tools can increase people's effectiveness, not just cut costs.

A case example. We have applied augmented meeting support to a variety of settings. In one case, it was utilized by the president of an operating company, twenty of his vice presidents, and their key staff, for two days, to complete their strategic plan for the coming year. A draft plan and financial forecasts were entered into the computer before the meeting, and the tools were used to present them. The group was able to challenge assumptions, and refine the plan, based on their experience and data. The president felt the facilitation resulted in a better plan than had been produced in prior years. Furthermore, he felt confident that his staff was committed to implementing difficult operating objectives.

In conclusion, we have seen augmented meeting support provide a setting for high performance teamwork. It launches an attack on the conventional wisdom that 'meetings are a waste of time.'

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EXECUTIVE SUMMARY

A growing number of office system architectures are appearing on the marketplace. Most are enhancements to existing product lines. For instance, some vendors—notably IBM—offer mainly mainframe-centered architectures. IBM also offers office work stations and departmental machines, of course, but their focus is on centrally-located mainframes.

Other vendors, such as Wang, offer department-oriented office systems. Their orientation is toward office systems made up of inter-connected computers each serving a group of people.

And still other vendors, such as Xerox, offer work station-oriented architectures. Here, processing power and storage are distributed out to the individual work stations.

All three of these approaches are described in the report.

The most desirable architecture for office systems is not yet evident. But two experts in the field, to whom we talked, believe that organizations will migrate toward a multi-level architecture, with different types of computers and networks serving different levels in the organization. In addition, they foresee more widespread use of specialized systems, each of which provides one primary service.

Before choosing an architecture, the needs of office workers and entire organizations must be assessed, of course. In this regard, organizations can be viewed as having (say) six levels: (1) individual workers, (2) groups of workers, (3) departments, (4) plants or sites, (5) regions or countries, and (6) corporate headquarters. It is likely that each of these levels will need its own computing resources.

Within this hierarchy, not all needs are yet well-defined, such as the needs of closely-knit groups of office workers. Few vendors are offering software for work groups; most office automation systems seem to be concerned mainly with supporting individuals. Yet, not all types of today's computer systems might be appropriate for supporting such work groups.

For instance, closely-knit work groups will need high reliability, high availability, and fast response times (for reasons we discuss). These requirements might require powerful individual work-stations, instead of links to a mainframe or to departmental computers.

Basing one's office system architecture on existing product offerings might not be wise. A more prudent approach might be to visualize the future needs of office workers, and use those as a target.