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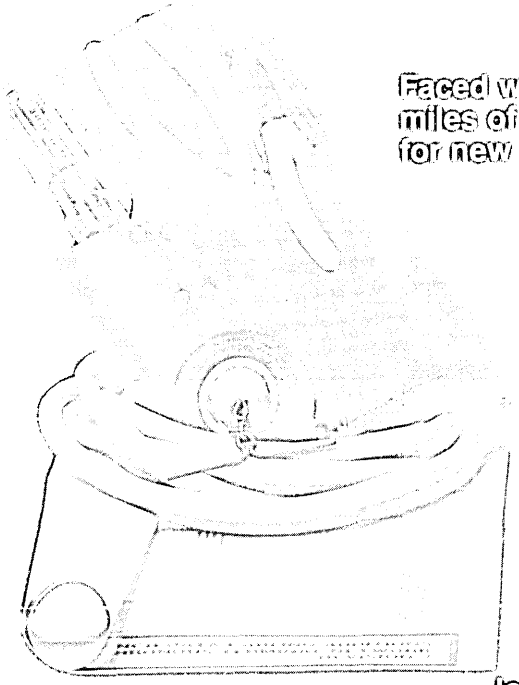

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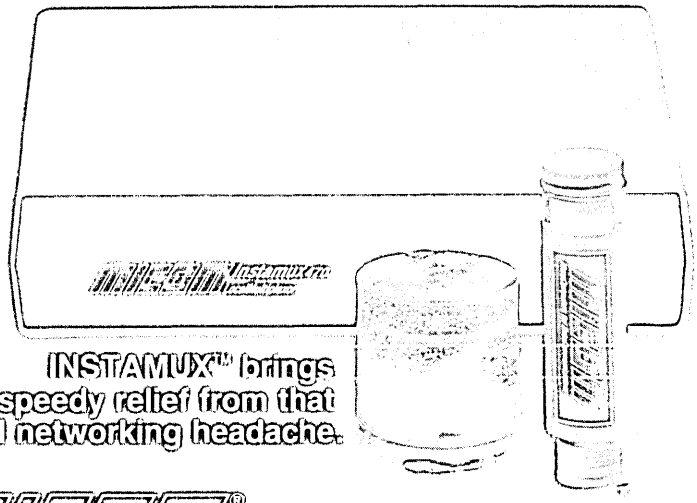

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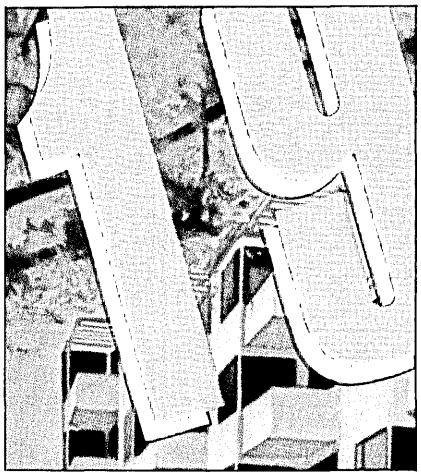

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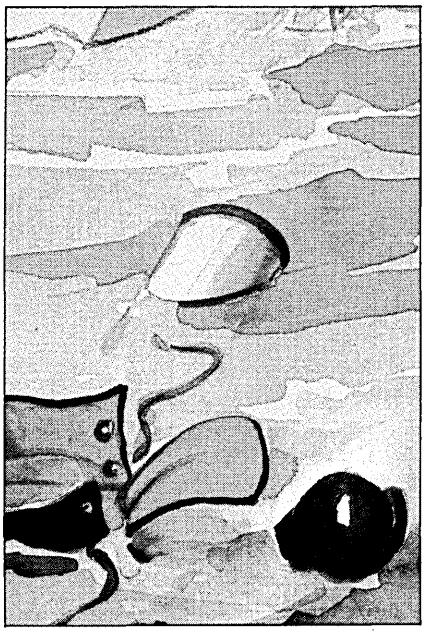

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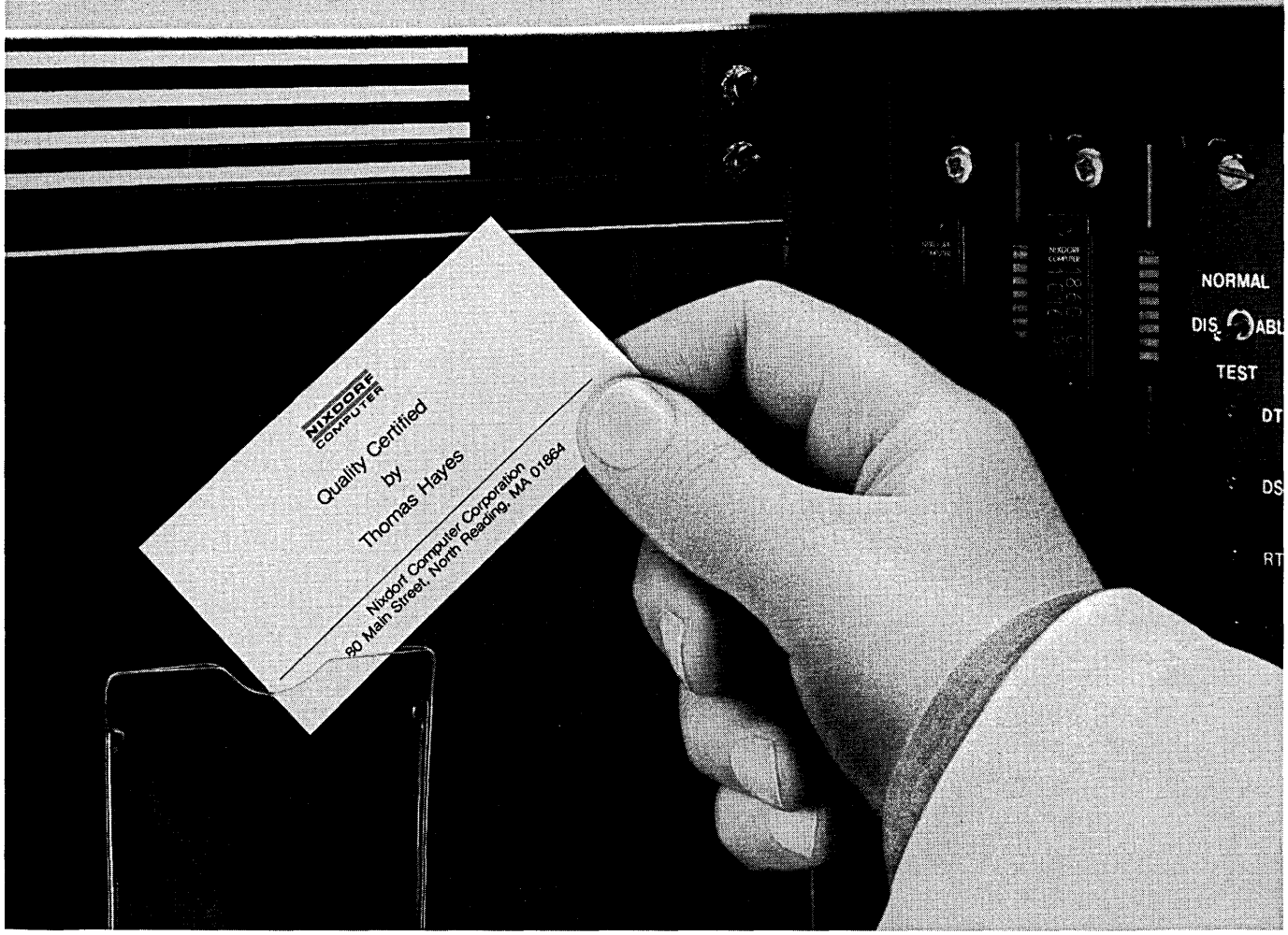

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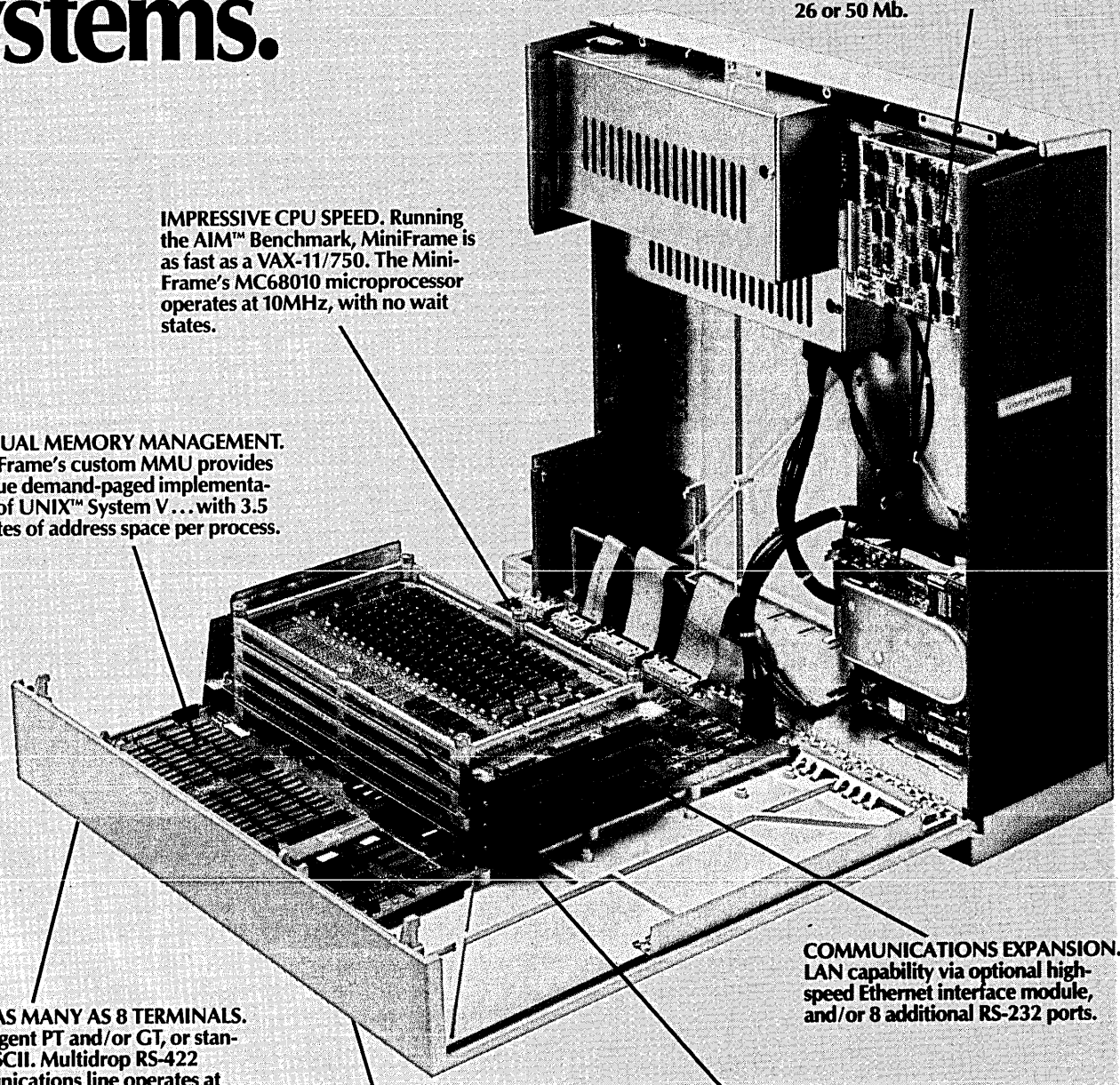

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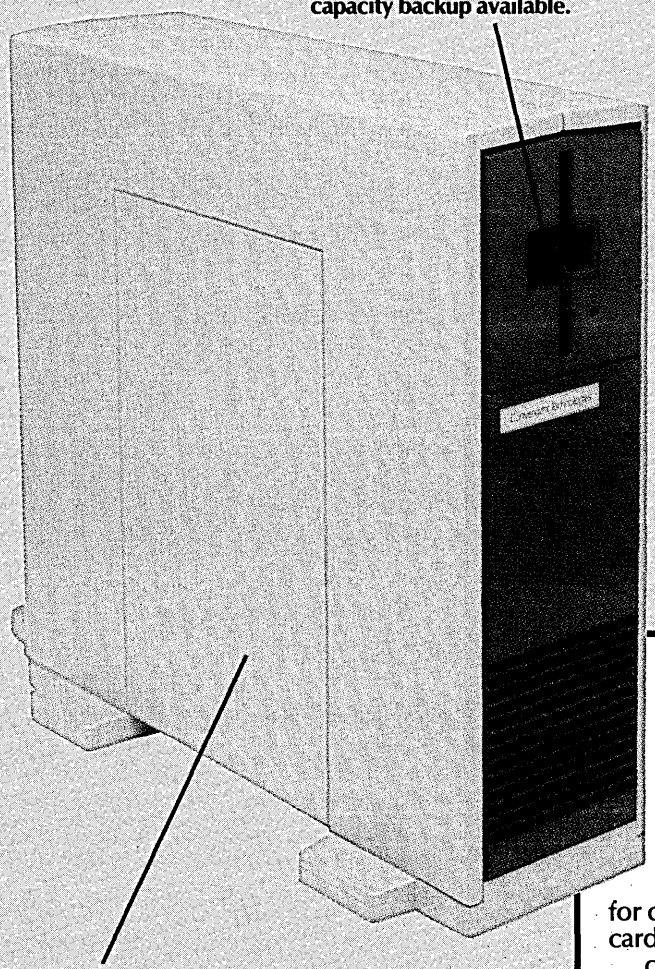
MiniFrame: another first from Convergent Technologies. Super-minicomputer power at PC prices.

OEMs can now meet the needs of small to medium-sized organizations for low-cost, high-performance systems capable of handling large UNIX-based applications.

The MiniFrame system—which effectively opens a whole new market for you—is unique not just for its price/performance advantages. It also provides complete flexibility in meeting requirements ranging from single-user "personal UNIX systems" to eight-terminal data-processing installations.



Convergent Technologies achieved this breakthrough by adapting the innovative hardware and software developed for its MegaFrame multiprocessor.

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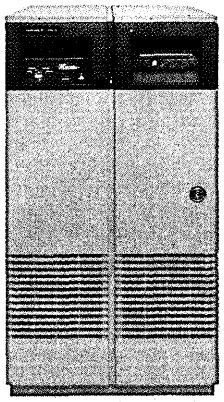

Applications software can be transported—unchanged—from the MiniFrame to the MegaFrame whenever the workload requires it. The two systems are object-code compatible, allowing OEMs to provide a complete family of systems.

MegaFrame: proof that if anyone can build a UNIX system the way it should be built—it's Convergent Technologies.

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See our ad on page 12

LOOKING BACK

IBM/SHARE'S NPL

July 1964: In the spring of '64, a new programming language was introduced by IBM and SHARE. It was called (temporarily, at any rate) NPL for New Progamming Language. Daniel McCracken, then editorial adviser to DATAMATION, gave readers a glimpse of the brief history of this new language, as well as a rundown of its features.

NPL was the product of a group called the SHARE Advanced Language Development Committee, which began work on the project in October of 1963. The committee disbanded in May of 1964. The first "public" report was dated March 1, and was later revised "to remove certain ambiguities and inconsistencies, and make the language more general."

At first glance, said McCracken, NPL gave the appearance of an extension of FORTRAN in the direction of ALGOL, with a few commercial dp features thrown in. He felt that, when compared with FORTRAN, NPL was both simpler and more powerful, depending on the users' point of view. A subset of NPL could be readily defined that would be a lot easier to learn than simple versions of FORTRAN. All that would be required, according to McCracken, was a cut-down manual (not a cut-down compiler). The naive users simply wouldn't know that there was any more to the language, and what they didn't know wouldn't hurt them. Not all languages, he said, worked this way.

NPL also offered features that FORTRAN just didn't have, like an ELSE path on the IF statement, alternate entry and return point for procedures, and provision for asynchronous operation of mass storage devices. Eventually, NPL was renamed PL/1. Although it never quite replaced FORTRAN and ALGOL the way it was intended to, the language still rates as the hardy number three contender.

ONE STRIKE, NO ERRORS

July 1974: A three-week strike at Stanford University forced management and programming personnel to man the Palo Alto campus's four main data centers. The strike ended with the return of some 90 computer and keypunch operators to their jobs, and some very enlightened management.

The "temporary help" found the ordeal a valuable experience because they discovered and remedied a number of operations problems. By putting systems programmers and others who had once been operators into the machine room, the staff was able to develop and document some procedures that would make better use of systems tools.

William H. Yundt, associate director of the Stanford Center for Information Processing (SCIP), noted, "Some of the people responsible for the creation of the software were put in the position of having to run it...which made it abundantly clear to them that there were holes in the operations documentation and areas for improvements in procedures for running their own systems."

Charles R. Dickens, director of SCIP, said that after only one or two days of running the computer, they realized there were a lot of things that needed to be done. The experience led him to conclude that the computer center management should periodically get the people who are doing development work, making major changes to the operating system, or developing major applications to run their own work. Most problems, he said, could be spotted after very little button pushing and mounting and dismounting tapes.

He also thought this should be limited to only once or twice a year, depending on the amount of development going on in the system; if it occurred too frequently, development personnel would adapt to the system rather than vice versa.

Despite all the good things brought about by the strike, the period was a difficult one, and some urgent projects were delayed. When the operators made it back to the job, they found management had changed its attitude a bit. Said Yundt, "It gave a lot of us a deep and sincere appreciation for the job that operations does in a very low-key fashion. . . . The absence of those trained operators made us more aware of the complexity of the job."

—Lauren D'Attilo

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Welcome to a historic micro to mainframe solution. Welcome to the SNA Gateway. The first... the complete... the full SNA interface... the OMNINET-based, disk/printer sharing LAN... the 3270 emulating... the 'beyond 3270' intelligent workstation. The SNA Gateway.

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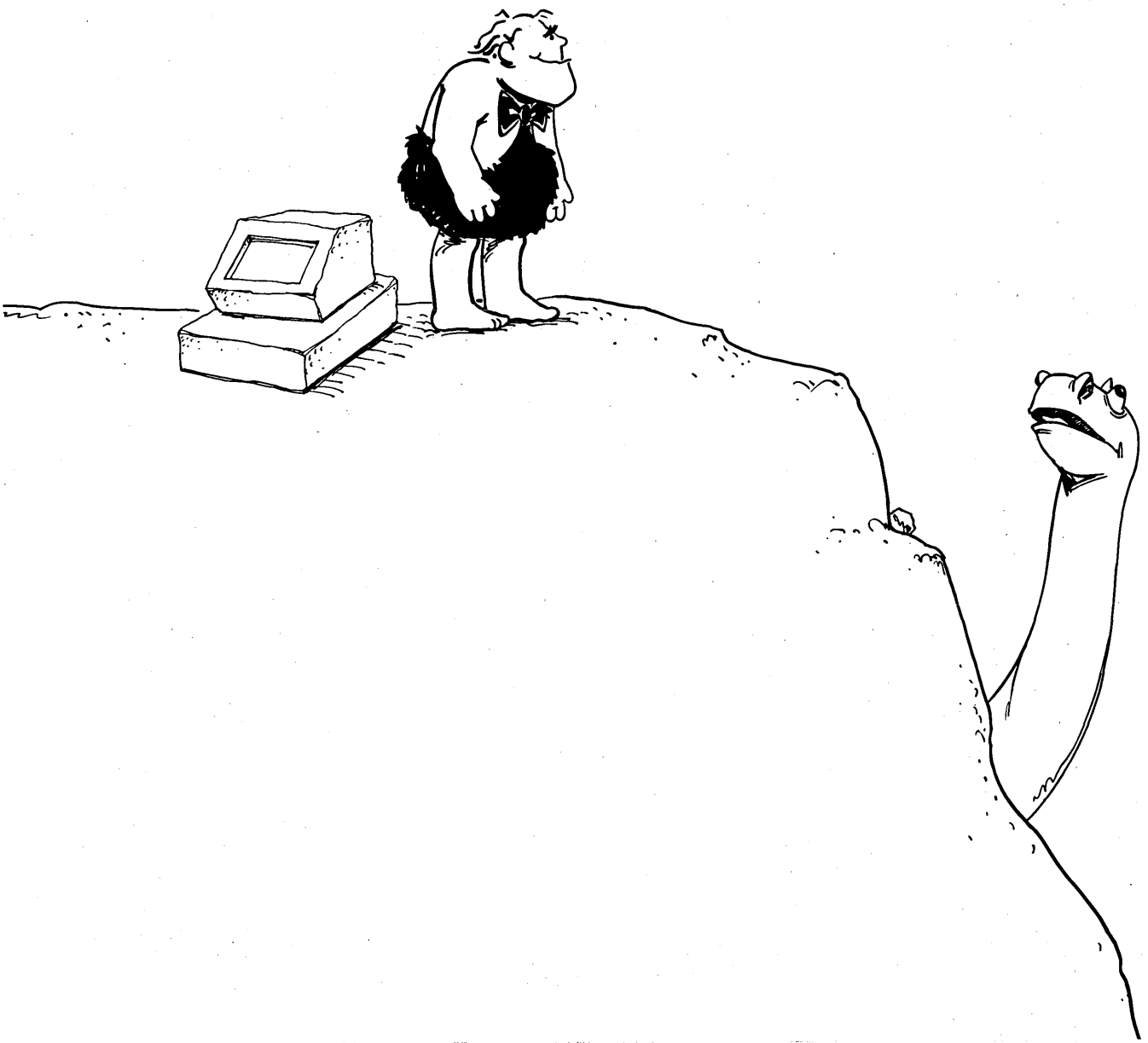


The SNA Gateway connects your micros to your mainframe through an OMNINET LAN, the most widely used and cost effective network available. This is the only full SNA Gateway which attaches micros to mainframes via a local area network.

SNA Gateway hardware is a stand-alone 4.5" x 15" x 17" dual processor. The Systems Center's SNA software resides in the SNA Gateway hardware and in each micro workstation.

What the SNA Gateway delivers is the highest order of micro to mainframe connection, including program to program communications. And it works with no required changes to the host environment or applications. You even get a complete network diagnostic and trace capability.

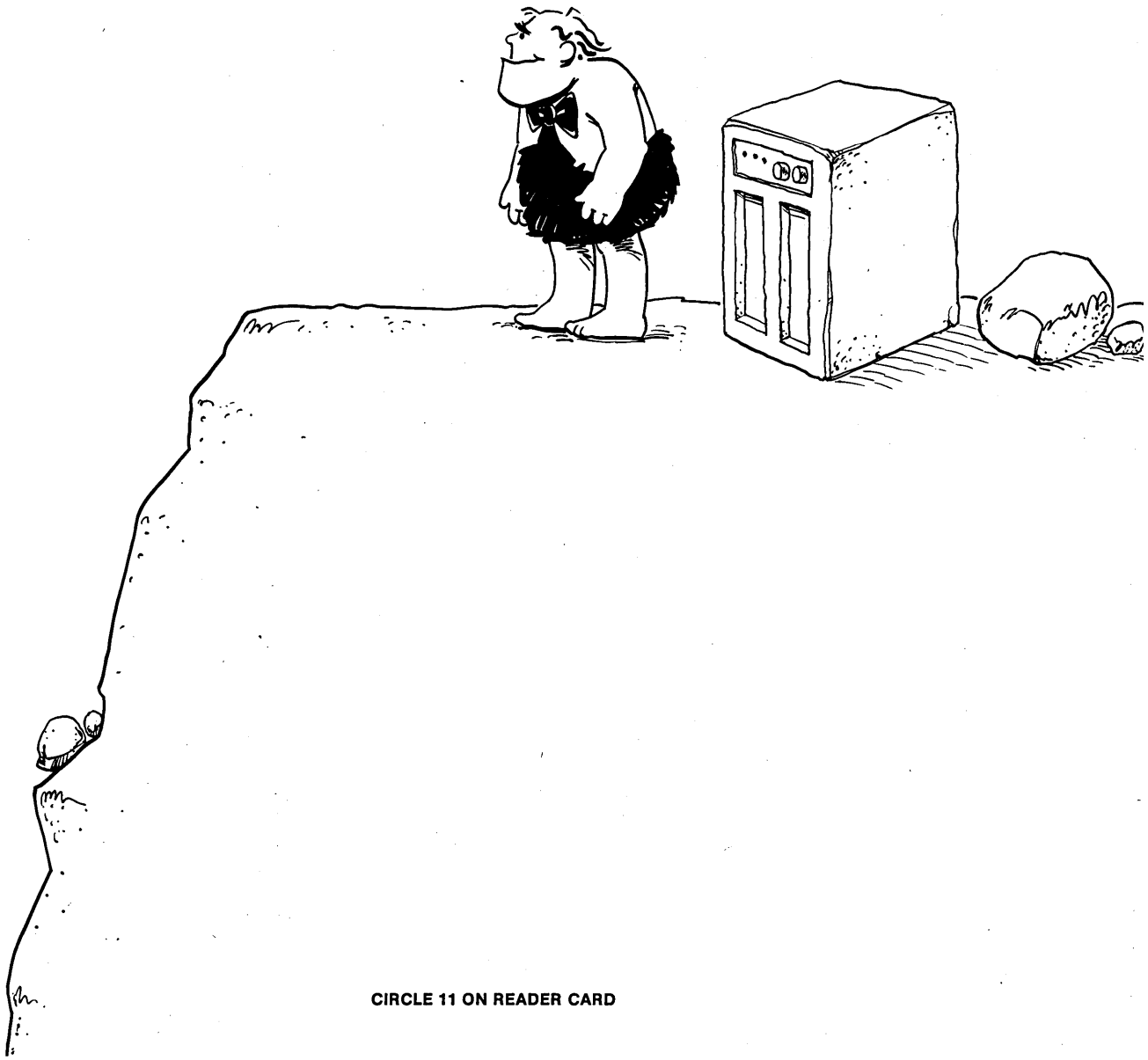
The SNA Gateway, when used with The Systems Center's Network Data Mover products, also allows the unattended, automatic distribution of different file types like text, graphics, programs and mail bags. In fact, a combination of the SNA Gateway and NDM gives you the most powerful set of network management tools available.

So keep your present systems from going the way of the dinosaur. Start satisfying your micro users while maintaining complete control.

For more information, call The Systems Center at (800) 345-0611 outside California, and (415) 345-0611 if you're calling from inside California.

Or write 2988 Campus Drive, Suite 325, San Mateo, CA 94403.

SYSTEMS CENTER



CIRCLE 11 ON READER CARD

For the 4300 user prepared to sacrifice performance for ease of use in a relational dbms, two little words:

You're in a tough position.

You've got management telling you they want the system up and running *yesterday.* And you've got a small technical staff that simply doesn't have the time to learn complex new skills.

So it's no surprise that your inclination is to settle for something less in your choice of databases.

In response, we have just one word of advice: *don't.* With Cullinet's new relational database, IDMS/R, you can have the best of both worlds – ease of use *and* performance – from the acknowledged leader in database management software.

IDMS/R is a powerful relational database that greatly reduces the time it takes to develop applications. Its facilities are so simple to use, your end users can develop applications without intervention from your data processing staff. All they have to do is define a relational record, and IDMS/R does the rest.

IDMS/R is also extremely flexible. It's a system that *anticipates* change by providing for the dynamic definition and redefinition of your relational database.

You'll also appreciate the fact that IDMS/R conserves your finite data processing resources. With a feature called "Relational Fastpath," you can tune the database and thus benefit from a dramatic boost in performance. It's this feature, in particular, that makes IDMS/R a high performance relational dbms.

And while the product itself has so much to recommend it, we'd be remiss if we failed to point out what our more than seven hundred 4300 users already know – namely, that it comes with the level of service and support Cullinet is noted for. Educational training, technical support, even a 24-hour hotline.

To find out more about IDMS/R, the database that combines high performance and ease of use, contact Cullinet.

The company that doesn't ask you to make sacrifices.

DN 7/15

I'd like both.

Name/Title _____

Company/Department _____

Address _____

City/State/Zip _____

Phone _____

Send to: Cullinet Software, 400 Blue Hill Drive, Westwood, MA 02090-2198

Database: Cullinet

Phone, toll-free, 1-800-225-9930. In MA, 617-329-7700.

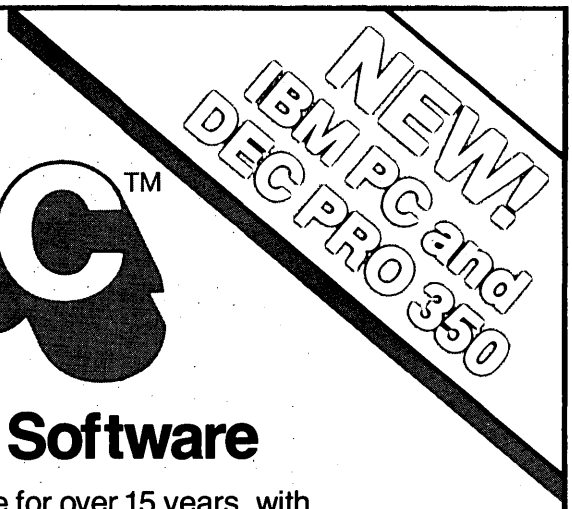
CIRCLE 9 ON READER CARD

LOOK AHEAD

ABA BANKS ON IBM	Next month should see IBM unveil a set of PC-based software packages designed for the thousands of small community banks and S&Ls still using service bureaus. What will make the software particularly powerful in the marketplace is the blessing it has already received from the American Banking Association. The trade group has been in on the software's development right from the beginning and will be heavily involved with related training activities. Some observers suggest IBM may be cruising for a bruising in this deal due to potential charges of constraint of trade. Meanwhile, look for IBM to strike similar trade association links in other vertical markets. Most lucrative of all may well be the medical trade. IBM, of course, has already won a large contract to build a value-added network for the insurance industry.
IPL ON THE BLOCK	IPL Systems Inc., a troubled maker of mid-sized, 370-compatible computers, is up for sale. Management is understood to have been seeking a buyer for several months, so far unsuccessfully. The Waltham, Mass., company has been showing losses for more than a year, due to lengthy delays in shipping a competitor to IBM's 4381 and aggressive IBM pricing. Just last month IPL laid off almost a third of its work force in an effort to trim costs and stay afloat.
PROLOG AIMED AT VAX	A November introduction of a VAX-based Prolog development system, designed for those building so-called expert systems, is planned by Quintus Computer Systems Inc., Palo Alto, Calif. The new venture is headed by Cuthbert C. Hurd, a veteran IBMer, and David Warren, who pioneered much Prolog usage at the University of Edinburgh. Warren and several other Quintus workers recently left Silogics, a Los Angeles-based Prolog vendor. Several other Prolog implementations are expected to be introduced during the coming year as vendors such as DEC, Symbolics, and Xerox add the language to their artificial intelligence tool kits. Despite Japan's choice of Prolog for the fifth generation project, however, Lisp is still expected to be the dominant AI language for now.
NEW PC OS FROM IBM	IBM is understood to be developing three operating systems for future members of the PC family. Code named Nina, Pinta, and Santa Maria, the systems are expected to offer single-user, multi-user, and Unix functionality, respectively. The new packages

LOOK AHEAD

	are expected to provide multiwindow screens similar to those offered on the 3270 PC.
AT&T PUSHES UNIX IN EUROPE	The phone company, along with 25% owned affiliate Olivetti of Italy, is hot to establish a proprietary Unix base in Europe. To do so it has set up Unix Europe Ltd. in the United Kingdom, which will promote the operating system throughout the Continent. Watch for public activities to begin this month.
NEW TOKEN PASSER	Look for Ungermann-Bass of Santa Clara, Calif., to give its Net/One local network token passing bus and ring capability by early next year. The product is claimed already to support CSMA/CD, CATV, fiber optic, and Ethernet implementations. U-B says it will have a factory automation version of the IEEE 802.4 token bus network running 10Mbps based on the General Motors MAPS spec, and an 802.5 ring. Don't count on an announcement until U-B sees how IBM handles its own token ring net, though.
WATCH THIS	VG Systems (formerly Vector General), Woodland Hills, Calif., has a big screen viewing attachment for its graphics workstations, which is attracting attention from other graphics hardware vendors. The company will probably oem the device for vector and raster terminals. It enables groups of people to observe changes being made to an engineering drawing as work is performed at a workstation.
UNIVAC'S LAN	Sperry Corp. has chosen Ethernet, the Xerox-backed local networking scheme, to connect Sperrylink terminals into its mainframes. The Blue Bell, Pa., mainframer has worked out a joint development deal with Bridge Communications, Mountain View, Calif., for the new networking products.
RUMORS AND RAW RANDOM DATA	Still holding off on introducing Spectrum, its long-awaited line of 32-bit minicomputers, Hewlett-Packard plans to extend its HP 3000 family downward in the late summer. . . .Lotus Development Corp., already enjoying strong sales of its 1-2-3 package in Latin America, plans to penetrate the territory even deeper with a Spanish version next fall. . . .We hear IBM is beginning to move 3270 PC machines through retail channels, beginning with the ComputerLand chain. . . . Morrow Designs, maker of a popular, low-priced CP/M micro, is soon to unveil a multi-user system aimed at the small business market. . . .Look for Zenith to introduce new machines this year.



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CIRCLE 12 ON READER CARD

R&D had certain requirements that had to be met; manufacturing, accounting and marketing had others. Then microcomputers started showing up on desktops, with modems and printers here and there. Now you face the task of making it all work together. Sharing resources. Sharing information. And making more effective use of the information processing equipment you've already invested in.

NET/ONE LEAVES YOU IN CONTROL OF EQUIPMENT DECISIONS.

Net/One® is a general purpose communications system that turns equipment from different vendors into a fully functional, fast, powerful, information processing network. Because it can connect equipment from virtually any vendor, you remain free to choose equipment based on capability, rather than compatibility.

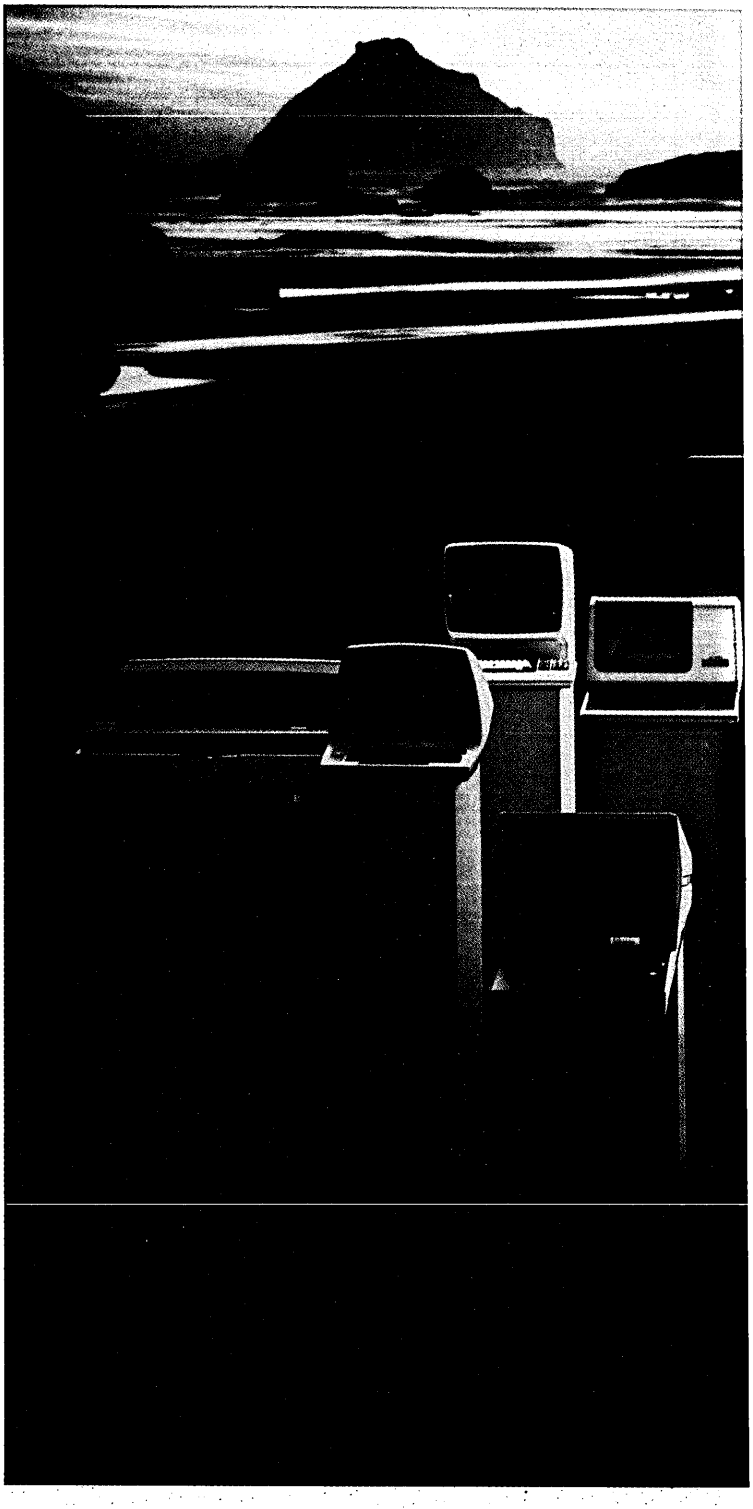
Off the shelf, Net/One supports industry-standard equipment interfaces—Async, Bisync, SDLC, through RS-232, V.35, RS-449 and IEEE-488 — as well as many high speed parallel interfaces. The list is expanding every month. But if you have special equipment that isn't in that list, Net/One is the only local area network that's fully programmable at every level so special interface protocols can be added now, or when you need them, later.

BROADBAND, BASEBAND, OR ANY COMBINATION THEREOF. YOU CALL THE SHOTS ON MEDIA, TOO.

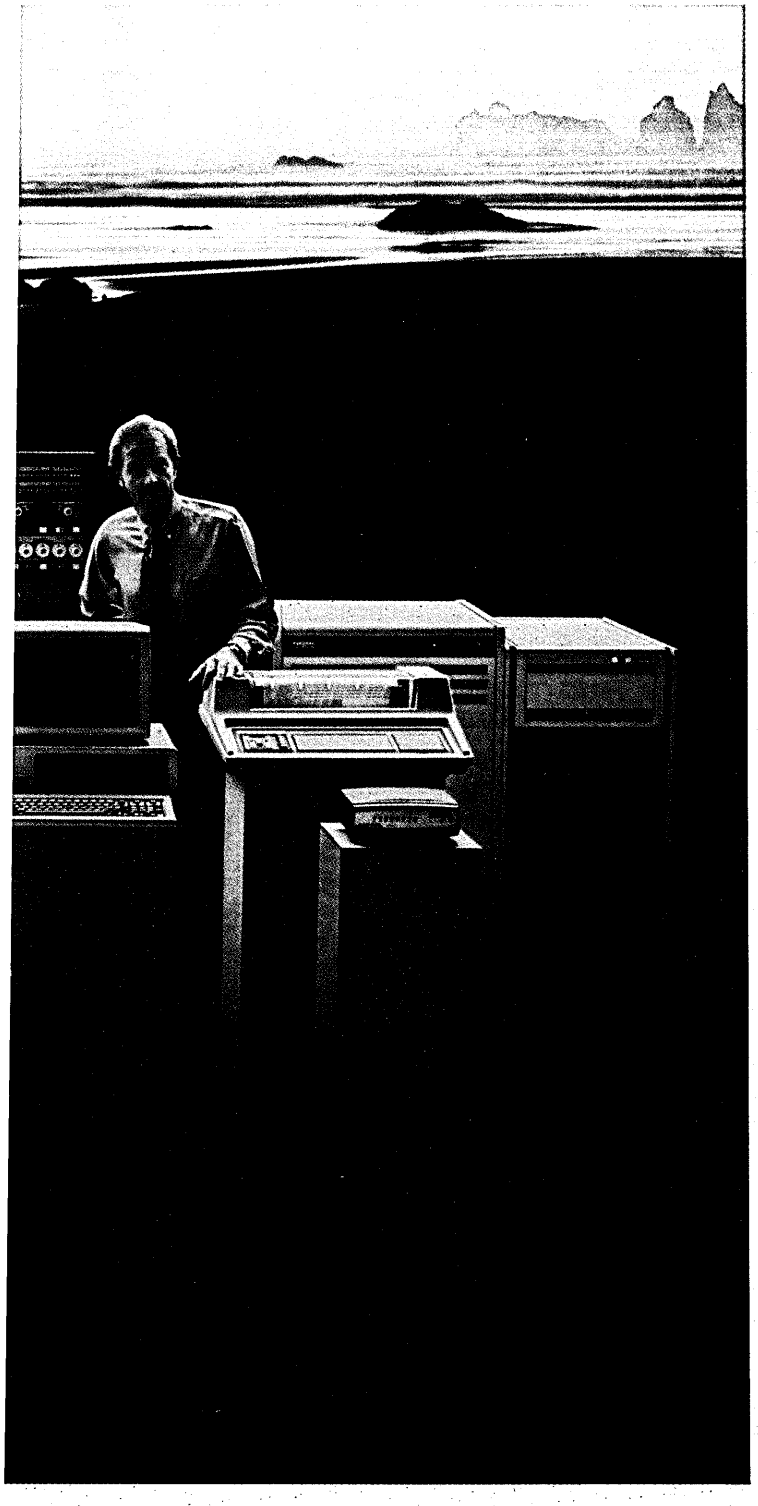
Net/One is the only local communications system that gives you the option of broadband or baseband or a combination of both, with architecture that will allow you to add other media such as fiber optics in the near future.

YOU DON'T HAVE TO KNOW EXACTLY WHERE YOU'RE GOING TO BUY A NETWORK THAT WILL GET YOU THERE.

Everything about Net/One has been designed to respond to your needs, as they evolve, and to remain fully adaptable to evolving communications technology. System architecture is completely modular, so it can grow at the

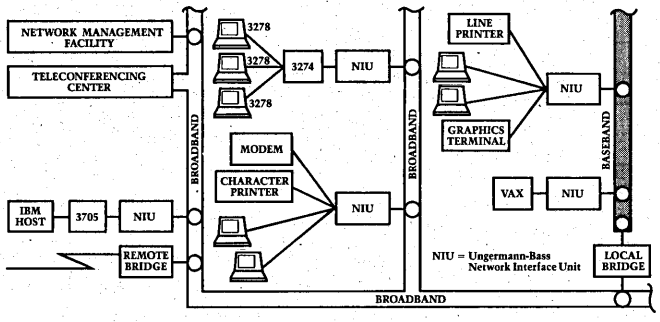


Net/One turns the e now into the netwo



same time and in the same direction you do. Regardless of the direction that turns out to be.

When separate divisions within a company or a campus need to share resources, one Net/One system can be bridged to others, and to remote networks. These bridges can interconnect baseband, broadband, or Net/One systems that include both. And like vendor independence and media independence, this bridging capability is available now from Ungermann-Bass.



NOW, THE IMPORTANT DIFFERENCE BETWEEN TALKING A GREAT NETWORK AND DELIVERING ONE.

We've been installing Net/One since July of 1980. Hundreds of our systems are already out there moving information for people like Control Data, Caltech, Fairchild, ITT, RCA, Boston University, U.S. Forest Service, and Ford Aerospace.

So we can do more than talk about what you need in a local area network. We can actually deliver one, now. And we can refer you to a long list of customers who are actually using one (or two or three) now.

Let's talk about how to turn the equipment you have, now—whatever it is—into the network you want, now. And the network that can take you wherever you want to go from here. Net/One.

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Net/One from Ungermann-Bass

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rk you want. Now.

CIRCLE 13 ON READER CARD

CALENDAR

JULY

SYNTOPICAN XII.
July 17-21, Chicago, Ill., contact: Association of Information Systems Professionals, 1015 North York Rd., Willow Grove, PA 19090, (215) 657-6300.

SIGGRAPH'84, The 11th Annual Conference on Computer Graphics and Interactive Techniques.
July 23-27, Minneapolis, Minn., contact: SIGGRAPH'84 Conference Office, 111 East Wacker Dr., Chicago, IL 60601, (312) 644-6610.

AUGUST

Great Southern Computer Show.
Aug. 2-4, Charlotte, N.C., contact: Chris Paul, Great Southern Computer Show, P.O. Box 655, Jacksonville, FL 32201.

AAAI-84 (The National Conference on Artificial Intelligence).
Aug. 6-10, Austin, Texas, contact: Claudia C. Mazzetti, American Association for Artificial Intelligence, 445 Burgess Dr., Menlo Park, CA 94025, (415) 328-3123.

The 1984 International Computers in Engineering Conference and Exhibit.
Aug. 12-15, Las Vegas, Nev., contact: The American Society of Mechanical Engineers, Dept. C-438, 345 E. 47th St., New York, NY 10017, (212) 705-7795.

SEPTEMBER

Midcon/84 and Mini/Micro Southwest-84.
Sept. 11-13, Dallas, Texas, contact: Nancy Hogan, Electronic Conventions Inc., 8110 Airport Blvd., Los Angeles, CA 90045, (213) 772-2965.

Eurographics '84.
Sept. 12-14, Copenhagen, Denmark, contact: Eurographics '84 secretariat, DIS Congress Service, Linde Alle 48, DK-2720 Vanlose, Denmark, tel. 45-1-712244.

Infodial Videotex '84.
Sept. 17-21, Paris, France, contact: Infodial-Videotex, 4, place de Valois, 75001 Paris, France, tel. (1) 261-52-42, telex 212597F.

The IBM System User Show.
Sept. 3-5, London, England, contact: Peter Walker Associates, 32 Fitzroy Sq., London W1P 5HH England, or call (44) 01-388-9871.

Electronic Imaging '84.
Sept. 11-13, Boston, Mass., contact: Electronic Imaging '84, Morgan-Grampian Expositions Group, 2 Park Avenue, New York, NY 10016-5667, or call (212) 340-9780.

Business Systems '84.
Sept. 17-22, Taipei, Taiwan, contact: American Institute in Taiwan, c/o CORDAG Associates Inc., 4405 East West Highway, Suite 401, Bethesda, MD 20814, or call (301) 652-6404.

Federal Computer Conference.
Sept. 18-20, Washington, D.C., contact: Federal Computer Conference, P.O. Box 368, Wayland, MA 01778, or call (800) 225-5926 or (617) 358-5181.

Fiber Optic Communications and Local Area Networks Exposition (FOC/LAN 84).
Sept. 19-21, Las Vegas, Nev., contact: Information Gatekeepers Inc., 138 Brighton Ave., Boston, MA 02134, or call (617) 787-1779.

PCExpo.
Sept. 24-26, Anaheim, Calif., contact: PCExpo, 333 Sylvan Ave., Englewood Cliffs, NJ 07632, or call (201) 569-8542.

Userfest/New York (formerly Applefest and PC'83).
Sept. 20-23, New York, N.Y. Contact: Northeast Expositions, 822 Boylston St., Chestnut Hill, MA 02167, (617) 739-2000.

OCTOBER

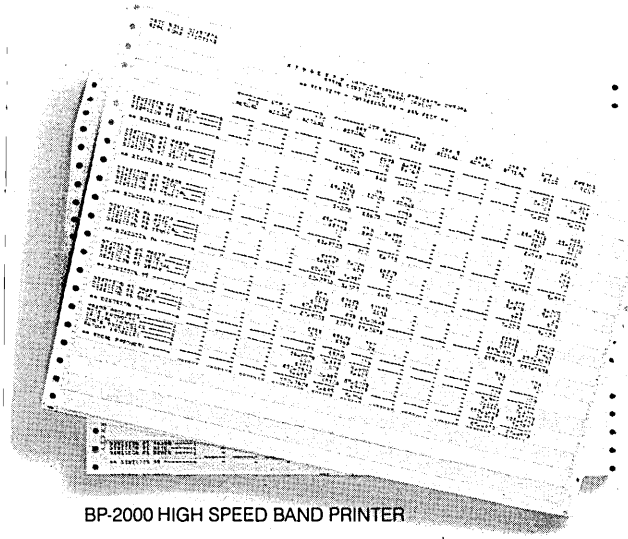
INFO 84 (The 11th International Information Management Exposition & Conference
Oct. 1-4, New York, N.Y. Contact: Clapp & Poliak, 708 Third Ave., New York, NY 10017, (212) 661-8010, telex 12-6186.

14th International Symposium on Industrial Robots (ISIR).
Oct. 2-4, Göteborg, Sweden. Contact: Svenska Massan Stiftelse, Box 5222, S-402 24 Göteborg, Sweden, telephone 46-31-20-00-00, telex 20600 MAESSAN S.

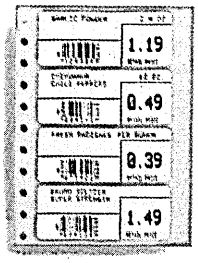
Infomatics '84. (The 16th Annual Conference and Exposition of the International Information Management Congress).
Oct. 2-4, Singapore. Contact: Infomatics '84, P.O. Box 34404, Bethesda, MD 20817, (301) 983-0604, telex 904100 WSH.

ACM 1984 Annual Conference.
Oct. 8-10, San Francisco, Calif. Contact: ACM, 11 W. 42nd St., New York, NY 10036, (212) 869-7440.

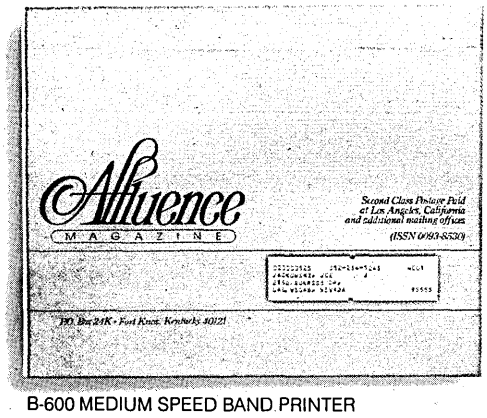
TeleCon IV (The Fourth Annual Teleconferencing Users Conference).
Oct. 15-17. Anaheim, Calif. Contact: Mrs. Patty Portway, Conference Director, Applied Business Communications, 5 Crow Canyon Ct., Ste. 209, San Ramon, CA 94583, (415) 820-5563.



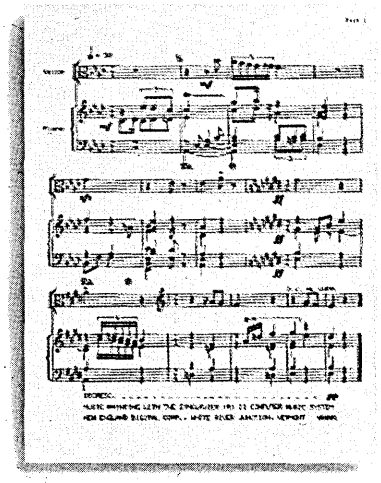
BP-2000 HIGH SPEED BAND PRINTER



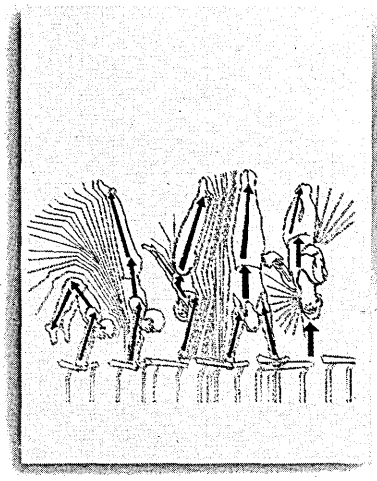
M-100L
MATRIX PRINTER



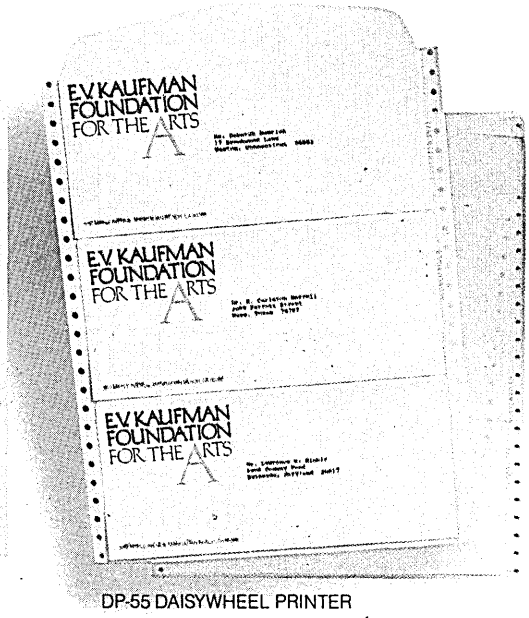
B-600 MEDIUM SPEED BAND PRINTER



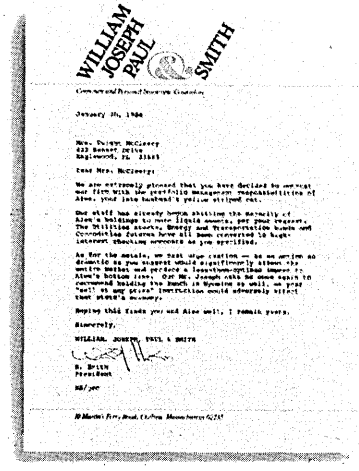
P-80 MATRIX PRINTER



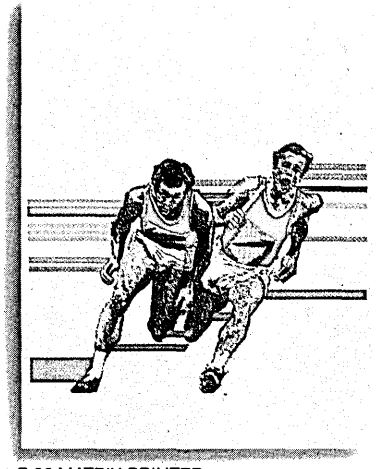
MODEL 480 MATRIX PRINTER



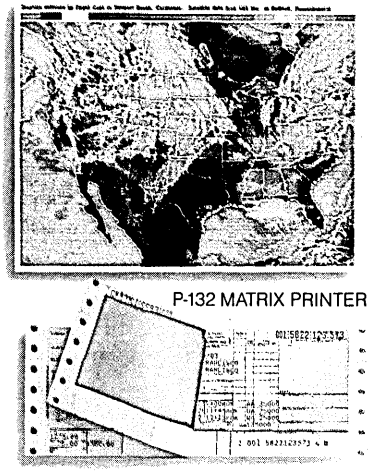
DP-55 DAISYWHEEL PRINTER



DP-35 DAISYWHEEL PRINTER



P-80 MATRIX PRINTER



P-132 MATRIX PRINTER

M-120 MATRIX PRINTER

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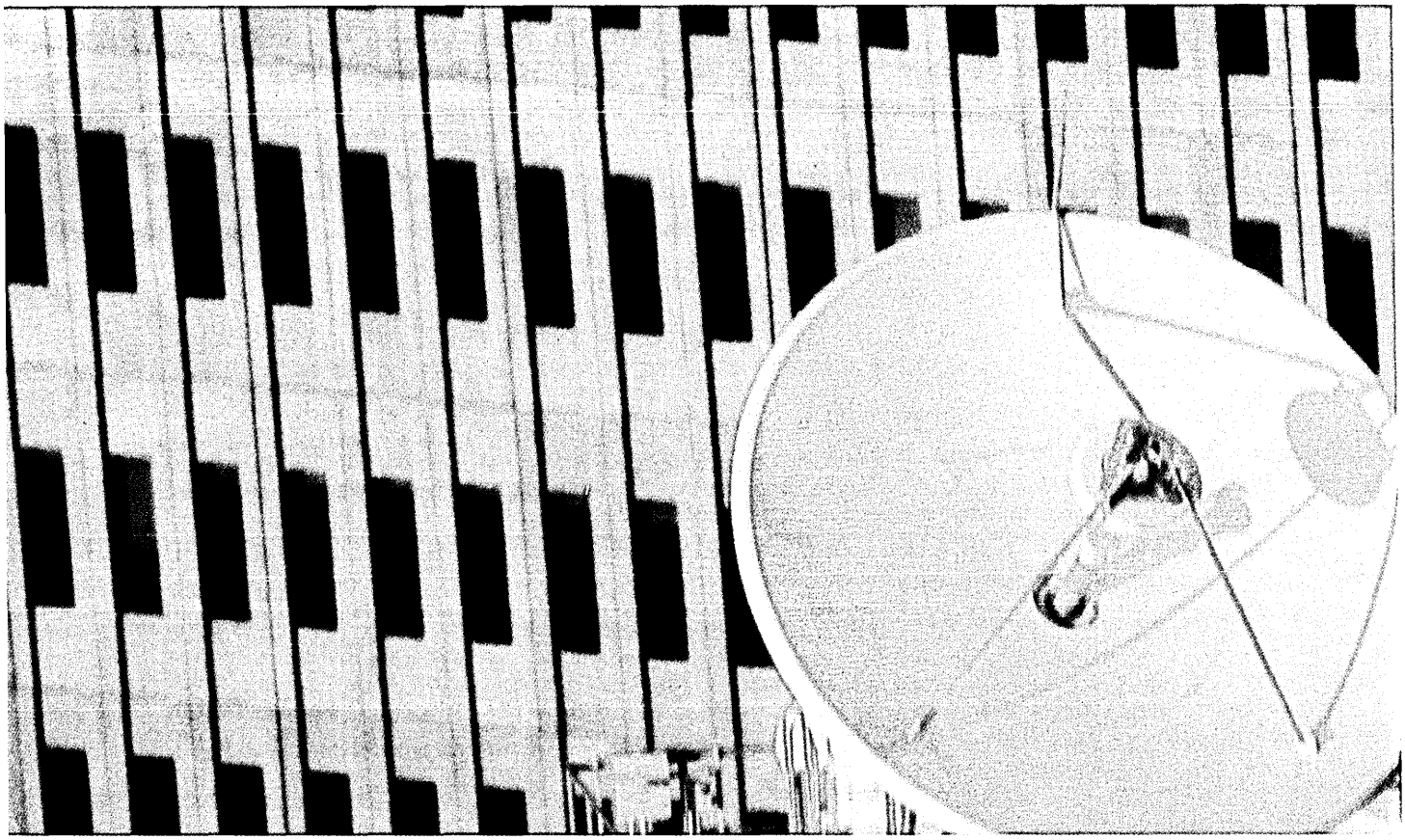
CIRCLE 14 ON READER CARD



WHATEVER THE RANGE OF YOUR NETWORKING NEEDS, DIGITAL HAS THE BEST ENGINEERED SOLUTIONS.

Now that you've invested in computers, a good network is how you'll get the most out of them.

A good network today is a single computing entity. It shares resources automatically. It is so flexible it can change size, shape, even purpose with minimal impact on your users and your pocketbook. More than accommodating new technologies, a good network invites them.

The very best networks do this in near invisible ways. This kind of transparency is the engineering goal of the networking products Digital makes. It is the elegance built into the over 14,000 network nodes Digital already supports around the world.

DECnet™ software is the centerpiece of Digital networking products. The new Phase IV Version is compatible with virtually every processor and operating system Digital makes. This allows you to build networks using essentially any combination of Professional 350s,™ PDP-11,™ VAX,™ DECsystem-10,™ and DECSYSTEM-20™ computers. DECnet Phase IV also accommodates the Ethernet protocol.

DECNET LETS COMPUTERS COMMUNICATE AS EASILY AS PEOPLE.

DECnet is distinguished by a remarkable set of high-level user functions. These are available to every network user. From every point on the network. On a DECnet network of any size.

Adaptive routing, for example, eliminates the need for direct physical links between each system pair. DECnet picks the most efficient route and automatically avoids failed lines.

Virtual terminal mode gives you remote terminal-to-terminal access. Logging on anywhere, you can reach and manipulate the data of any authorized node on the net.

Program-to-program communications enable you to swap data between programs written in different languages, running under different operating systems.

DECnet is state of the art in networking software. It manages your network so efficiently, you can manage DECnet from a single terminal.

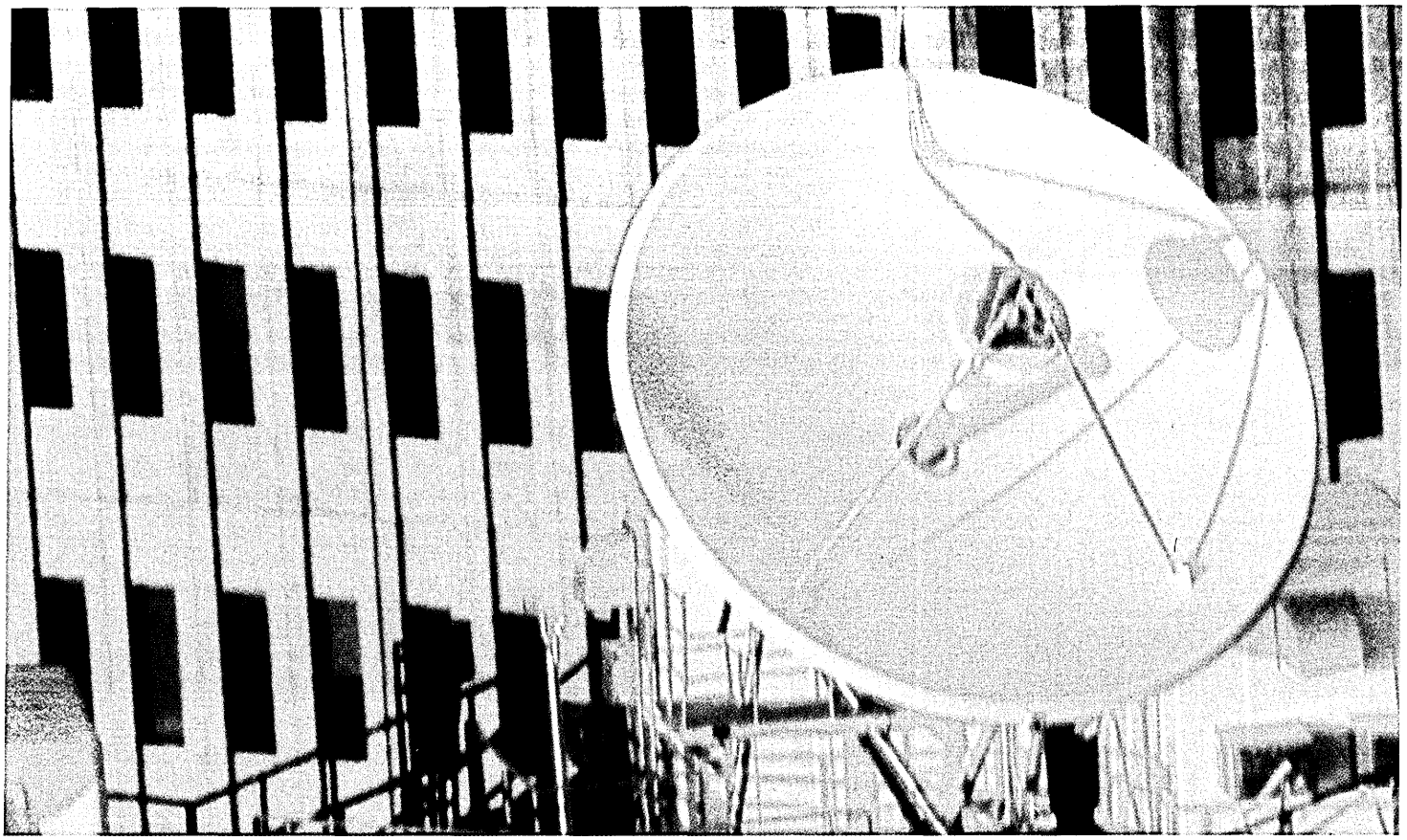
PRODUCT RANGE GIVES YOU EXTRAORDINARY NETWORKING FLEXIBILITY.

Within a single networking architecture, Digital makes some eighty discrete products.

At the local level, Digital's Ethernet repeaters allow you to extend your LAN to link departments, buildings, or projects as needed. New systems simply clamp onto the coaxial cable with interfaces that take just minutes to install. Add Digital terminal servers and you break the dependency between terminals and specific processors. This allows any user on the LAN to access the resources of any host.

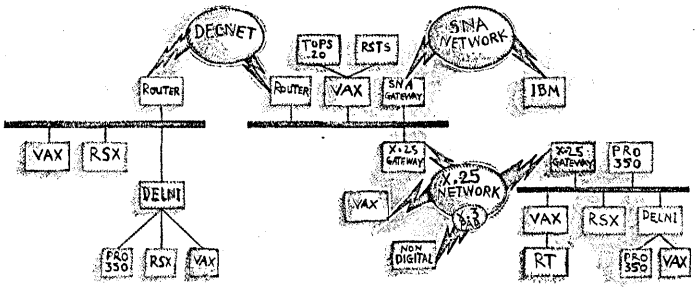
Add Digital communication servers and you can connect LANs to wide area networks.

Digital supports cooperative computing with special gateways that translate protocols between unlike architectures. One gives you access to the X.25 packet-switching technology for cost-effective international communications.



Others connect Digital equipment to IBM's SNA. More than just permitting communications, these gateways give your users direct access to both the batch and transaction processing environments of IBM mainframes.

Digital networking products dramatically enhance the effectiveness of your distributed computing resources. They can be combined in almost endless ways to build a network comprised of just two nodes, or over a thousand. Users in the next cubicle or on another continent can share information, applications and peripherals. They can integrate work at any level. Smaller systems gain access to the powerful capabilities of centralized facilities. Large systems can off-load tasks to smaller dedicated systems.



DECnet software keeps Digital networking simple. Simplicity keeps Digital networking reliable.

SETTING THE NETWORK STANDARD FOR EASE OF USE.

Digital believes that excellence in networking is best measured from the user's point of view. And by and large, communications on a Digital network is just plain automatic.

You can transfer files by simply noting the node of the receiver. You can reach, via DECmail™ software, any number of people just by naming them. With DATATRIEVE™ software you can sort and report information without regard for how and where it is filed.

To the user, how it all happens is of little or no concern. User commands remain consistent across operating systems, across distances supported by DECnet and despite the fact that your message might travel by fiber optic cable, private or public lines, and then by satellite link.

DIGITAL WILL GO TO GREAT LENGTHS TO BUILD YOUR NETWORK.

With Digital software, no proposed network use is too unlikely. No combination of technologies is out of the question. And because Digital maintains service centers in every corner of the world, no remote node is too remote.

Digital will design, install, help manage and constantly evaluate the state of your network. You, your users, your future data communications management can all be Digital-trained. Digital will give you round-the-clock support with guaranteed service and warranteed product performance.

Most of all, Digital will provide you with networking solutions so open-ended they will instill you with confidence about the most far-reaching computing decision you face.

BEST ENGINEERED MEANS ENGINEERED TO A PLAN.

Digital networking products, like every Digital hardware and software product, are engineered to conform to an overall product plan. This means Digital systems are engineered to work together easily and expand inexpensively. Only Digital provides you with a single, integrated computing strategy direct from desktop to data center.

For a copy of the brochure, "Digital: Tomorrow's Networks Today," call 1-800-DIGITAL. Or write: Digital Equipment Corporation, Attn: Media Response Manager, 200 Baker Avenue, West Concord, Massachusetts 01742.

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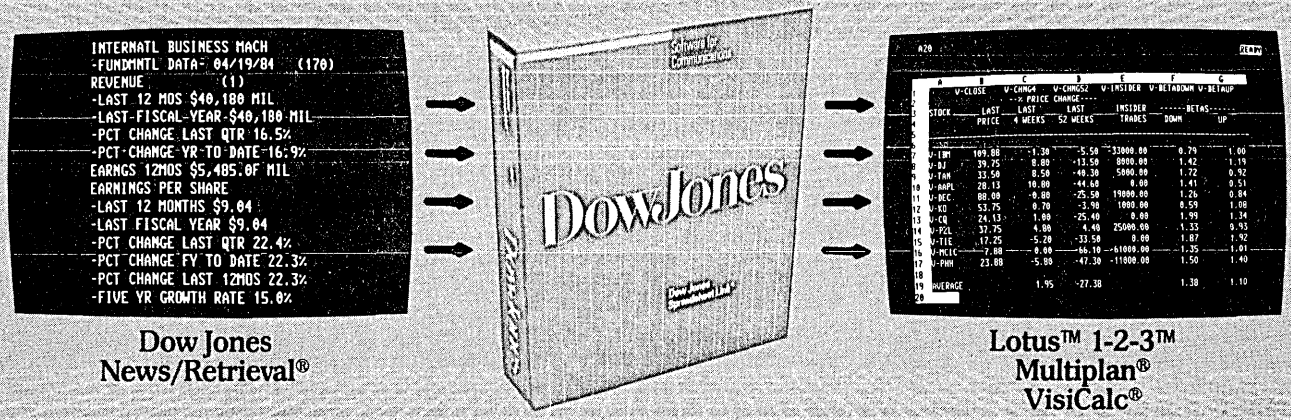

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Approved for the IBM® 3270 PC.

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CIRCLE 15 ON READER CARD

LETTERS

PERSONDACIOUS MACHINES

I couldn't resist feeding a chunk of Tom Parrett's article "Mendacious Machines" (April 1, p. 134) to the Writer's Workbench (WWB), one of those writer's programs he so cynically discussed in the article.

Of the 834-word sample it gobbled up, WWB burped on precious little. Its objection to Parrett's use of "commences" (instead of the simpler "begins") and "so as to" (instead of "to") is, in my opinion, overruled by his instinctive feel for the rhythmic demands of his sentences. I even looked the other way when WWB got a little testy about "needless to say." WWB might have a point, however, when it suggests Parrett reconsider his use of "men" in the sentence "consider that intelligent word processing will disguise not only bad men, but also bad ideas."

Among the tidbits WWB coughed up: simple sentences, 68%; complex sentences, 32%. WWB respectfully submits that Parrett bring these percentages closer together—and it explains why.

Admittedly, suggestions and statistics like these will have little impact on a skilled writer like Parrett, who obviously loves the language and is relaxed enough to play with it. He's right when he says that "for the professional writer, word processing won't change much." Good and great writers will continue to make the wrong choices for all the right reasons.

But alack the poor writer! Without helpers like WWB, he (sic) will, needless to say, always commence to choose the polysyllabic and convoluted over the simple—so as to cloak his mendacity, no doubt.

ANGELA R. JUST
Product Planner, AT&T Technologies
Lisle, Illinois

ENLIGHTENED

Your article titled "Training + Technology = Profits" (April 1, p. 161) was enlightening. Associations such as the American Society for Training and Development (ASTD) serve as a very good network for the professional trainer.

Training takes a back seat in many organizations because we as trainers have a lackadaisical attitude and do not speak up when we feel changes need to be made in order to make the training function more effective. There is a lot more to training than just teaching classes, and it is up to us as trainers to get more involved in the management of the organization in order to develop an effective and efficient training department.

We need to become more active in organizations such as ASTD, get involved in developing a good network of information in order to increase our awareness of what's available in the marketplace, and assess how market changes affect the training function. Only then can we develop an efficient and effective training program. Never before has the business world seen such sweeping change in organizations as we see today in the "Information Age." It is up to us as trainers to be aware of change and have up-to-date training programs in place that will be a good resource for the organizations to use. We can only do that if we have the right tools and become more involved in developing an adequate network for trainers and support our professional organizations for trainers.

PHIL LEAMON
Manager, Product Programs
Systems Software Division
UCCEL
Dallas, Texas

CONFUSED

The article by Warren H. Lewis entitled "A Dozen Electrical Mistakes" (May 1, p. 109) seemed to contain cautions and points that were important. Unfortunately, Lewis made two common errors:

1. He assumed readers knew far more about the subject than some of us do.

2. He used terms and ideas that are probably well known in the electrical trade, but which are jargon to those of us not trained as electricians.

Even the illustrations were not helpful. For example, Fig. 1 seemed to imply that someone could get an electrical shock by touching the equipment. How, or why, or what should be done to avoid it was not clear from the picture, nor was it clarified by the text.

Would it be possible to have someone cover what are apparently serious problems in an understandable way—understandable by those of us who are not electricians but who are concerned about the safety of personnel and equipment?

BRYAN L. WILKINSON
Manager, EDP Audit
Teledyne Inc.
Los Angeles, California

THANKS FOR THE MISINFORMATION

A caller focused our attention on an error in DATAMATION's article entitled "Mending Crazy Quilt Systems" (May 15, p. 130). You identified Morino Associates as the developers of the SUPERSTRUCTURE program; we are not.

Moreover, you did not give us credit for the two Morino Associates products that were mentioned in the article: our MVS Integrated Control System (MICS) and TSO/MON.

In the long run, however, I must thank you for printing the misinformation. I enjoyed my phone conversation with Mr. Richardson and hearing about the interesting applications for which Texaco is using MICS. Who knows? We may have a prospect for another in our series of user stories!

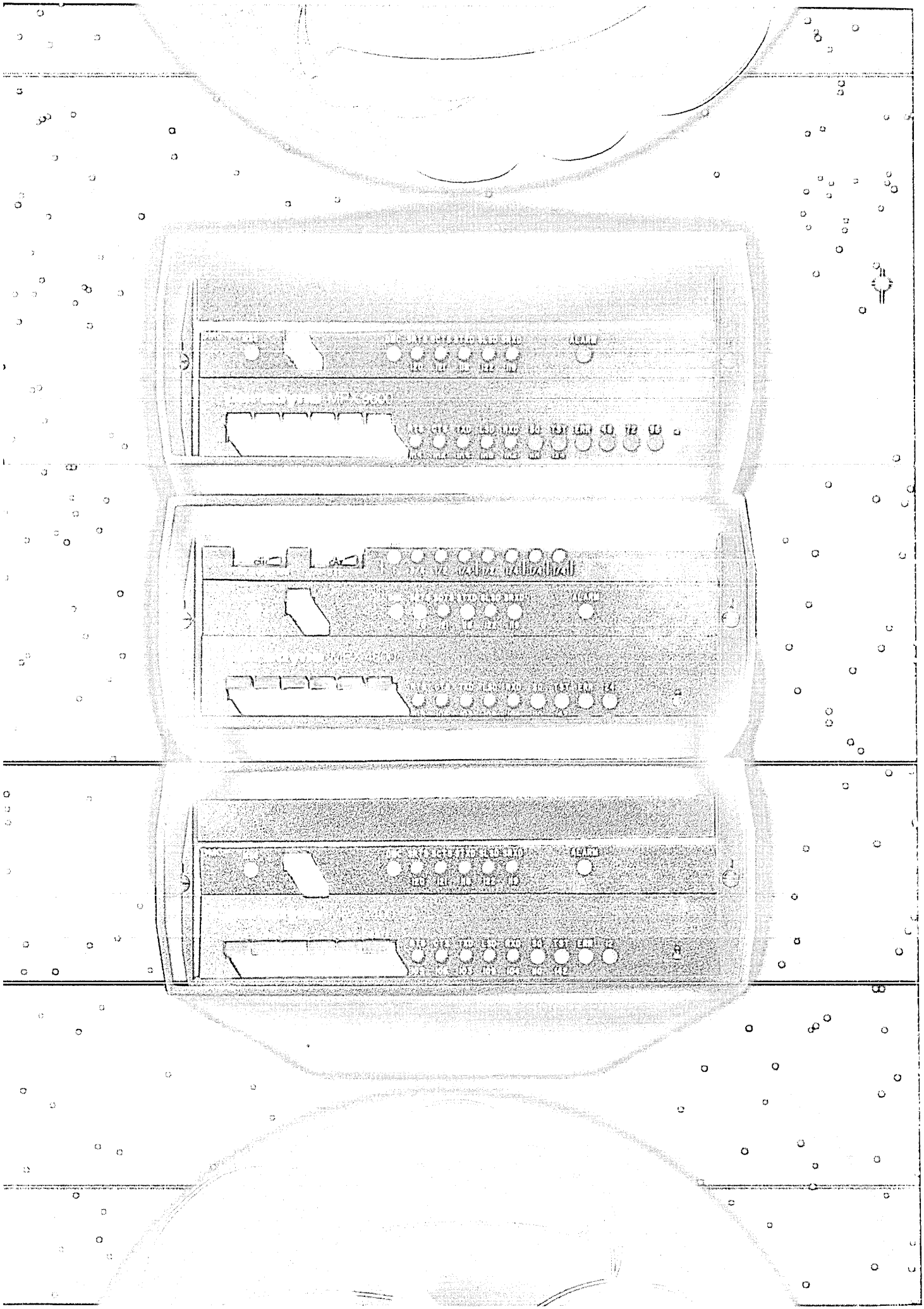
BETTY LOU COOKE
Director, Public Relations and Advertising
Morino Associates Inc.
Vienna, Virginia

Group Operations Inc. of Washington, D.C., should have been listed as the producer of SUPERSTRUCTURE. We apologize for the error.—Ed.

INCORRECTLY CREDITED

The credit for the cover illustration appearing at the bottom of the table of contents (June 1, p. 3) should have read: illustration by Ponder Goembel. The credits incorrectly listed were a preview of the next issue's artists.—Ed.

Your comments on DATAMATION are always welcome. We do reserve the right to edit the letters for either brevity or clarity. Letters should be addressed to Editor, DATAMATION, 875 Third Ave., New York, NY 10022.



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CIRCLE 16 ON READER CARD

ADDS Viewpoint/Color from your point of view.

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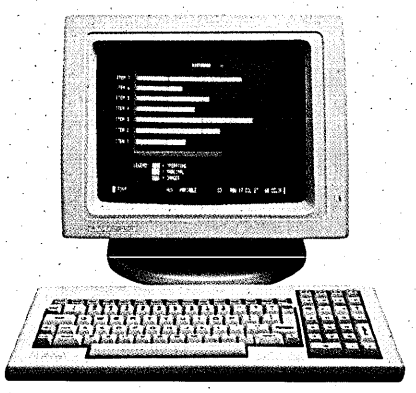

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CIRCLE 21 ON READER CARD

Rebecca S. Barna, Editor

EDITORIAL

SHAKEOUT IN SIGHT

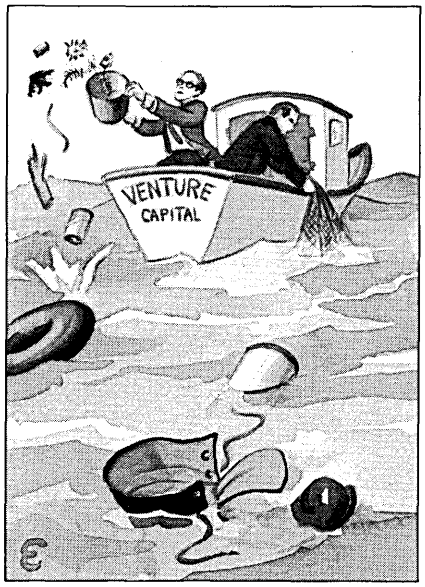

ILLUSTRATION BY DORIS ETTLINGER

In one of New York's most venerable clubs, the smells of gin, furniture polish, and money laundered by long ownership drift through rooms overlooking Park Avenue. Postpreppies talk business, sotto voce. A deal is being offered to a software developer in need of cash. "New Jersey money," murmurs the bankroller, his chalk stripes indistinguishable from those of the lawyers and investment bankers, their hair damp from the tortures of the squash court. Like any mobster pledged to the code of silence, the man refuses to say more about where the money comes from. The terms offered were frightful: the entrepreneur would pay back 200% of the principal, plus interest that, the entrepreneur says, "would have embarrassed a loan shark."

Senior staff writer Parker Hodges recalls this tale heard during his investigation into the inner workings of the venture capital game. His report, "On a Short String," on p. 30, is more than fascinating reading; as the first of three articles in this issue to offer some sound advice for sorting through the confusion over micro software, it offers some interesting insights into the data processing industry.

Everyone with a computer is subjected these days to a barrage of new product announcements and unrealistic promises about new hardware and software. Much of this torrent of words was financed by the venture capitalists, who until recently only knew to sign checks for millions of dollars; in one example in Hodges's story, Mr. Moneybags couldn't tell the difference between a software and a hardware product after a 45-minute multimedia briefing.

The investors responsible for financing the half-baked, unrealistic, and just plain garbage software and hardware floating through the industry like so much flotsam and jetsam are now trying to correct their mistakes. A revolving door can be found in several executive suites now, and some "first-rate scientists turned into second-rate businessmen" will soon be looking for new offices. We are witnessing the end of an era when just about anybody could get into the software business. After all, the task of keeping the current crop of new companies from going belly-up takes most of the VC's time—and funds.

What should the perplexed dp manager do when faced with such a chaotic scene? Waiting for the shakeout is not the best strategy, according to the second article in our series, "Evaluating Micro Software," on p. 74. Consultant Irene Nesbit says it may be easy to ignore a few floppies in an office, but hundreds of incompatible word processing packages in one company is an administrative nightmare that need not have happened. "Where there is a noticeable lack of care and concern, MIS loses control of the microcomputer situation and risks erosion of its authority over computing in general."

Among the microcomputer software purchase decisions facing MIS, none is as important as the micro-to-mainframe link. As you read through the analysis of the various packages, their limitations as well as their attributes, in "Tying the Micro-Mainframe Knot," by consultant Vincent Rauzino, notice that the names of established, knowledgeable vendors are starting to appear. Recent announcements of joint ventures, such as the MSA-ADR deal, are a welcome sign after the unrelenting shower of bulletins heralding yet another software startup.

Not that we're against entrepreneurs or the brilliant minds who created new product categories in garages. It's just that, contrary to the general handwringing in the media, the shakeout or consolidation is not entirely a bad thing. The sorting out will leave the best ideas where MIS personnel can find them without the noise of an overhyped market. *

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CIRCLE 17 ON READER CARD

IN FOCUS

ON A SHORT STRING

Venture capitalists, the money men and women who supplied cash to create new dp companies, are exerting more control than ever.

by Parker Hodges

Venture capitalists like to think of themselves as the Dutch uncles of American success. They're the people who back the entrepreneurs who end up on the covers of *Fortune* and *Business Week*. Venture capitalists are quick to tell you that they provide advice and handholding as well as cash. This is value-added investing, they say. But there's talk that venture capitalists are getting meaner than is good for anybody—especially for the dp industry.

The dp industry is particularly tied to venture capital: Apple, Genigraphics, McCormack and Dodge, Softsel, Vector Graphic, and Digital Equipment Corp. are just a few of the dp companies that exist because venture capitalists said yes and wrote out some checks. The list could go on; in 1983, for example, about half of the almost $3 billion invested by venture capitalists was put into computer-related enterprises.

Right now, venture capitalists control more than $11 billion, money that they have, or will shortly, bet on the prospects of a few thousand American startup companies. Usually, venture capital money is not secured, guaranteed, or bound by a repayment schedule. Venture capitalists bet on the future, and the collateral to back their investments is composed of ideas and prototypes, business plans and the résumés of entrepreneurs. In the past, venture capitalists have proved themselves canny handicappers of new ventures: it has been estimated that 80% of the companies backed by professional venture capitalists have stayed in business long enough to pay back their initial investors.

It is a small industry. According to David T. Thompson, a partner in the Big Eight accounting firm Deloitte Haskins & Sells, fewer than 400 venture capital companies are currently active, and only 50 of these control $200 million or more. Most of the cash the venture capitalists place comes from pension funds, large family fortunes, insurance companies, university endowments, and, in a few cases, from publicly raised, mutual fundlike accumulations of capital. Two thousand professional venture capitalists decide who gets a piece of these billions, and thus who gets a shot at what has been latter-day capitalism's guaranteed jackpot: going public with your own company.

The massacre of high-tech stock values that began in July 1983 wiped out a lot of paper profits that had made the venture capitalists look like wizards. Where people had seemed willing to buy any issue their brokers offered, paying prices that commonly were 30 times earnings-per-share, more sensible multipliers now prevail. There is less talk about 50% and 60% return on investments. Realism is the new buzzword, and one can no longer go public with just anything.

But venture capitalists still expect to make a lot of money from the companies they back. Jackie Morby, a general partner at TA Associates, a Boston-based venture capital fund, says, "There are investments that only double in value: they aren't very exciting." More exciting to Morby are companies like Tandon: it paid its investors almost $100 for every dollar they'd invested. Or Emulex, which paid 50 to 1. Or Vector Graphic, which paid 10 to 1. "Then there are the companies that pay 5 to 1," says Morby, who admits that even "two times your money isn't bad, but we're not proud [of those]."

Murphy says the new breed of "tough" professional venture capitalist is too willing to fire the entrepreneur if things aren't going according to the venture capitalist's game plan.

According to Stanley Pratt, editor and publisher of the authoritative *Venture Capital Journal*, the most recent boom in venture capital began in the late '70s when a lot of new money hit the venture capital table, particularly because it became legal to play the risk-capital game with pension funds. Beginner companies that had been "starving to death for two or three years" were backed by the newly flush venture capitalists, explains Pratt. "Some of those companies came through the process very quickly; we developed some early winners," he says.

"Then the startup activity peaked in '81." Some of these startups don't look so good in 1984. "I firmly believe that in the next couple of years, venture capitalists are going to be spending more time developing (the companies in) their present portfolios. We're leaving the stock picking phase, and entering the business development phase."

But Thomas P. Murphy, who writes a column about venture capital for *Forbes* magazine, recently suggested that the bond between the entrepreneur and the venture

ILLUSTRATION BY RICHARD ANDERSON

capitalist is fraying. In the old days, says Murphy, who heads a venture capital fund in Stamford, Conn., venture capitalists and entrepreneurs viewed their relationship as one of partners. The recent boom in venture capital, however, has brought new people into the industry. Managers of huge pools of money, like insurance companies and pension funds, their expertise largely confined to making buy-and-sell decisions, are running their own venture capital, rather than entrusting it to established venture capital funds. Consequently, it's feared that these new players have neither the time, the commitment, nor the experience to help their investments become successful companies. Nowadays, Murphy says, the new breed of "tough" professional venture capitalist is too willing to fire the entrepreneur if things aren't proceeding according to the venture capitalist's game plan. Venture capitalist A. David Silver goes further. In his new book, *Who's Who in Venture Capital,* he warns of "inexperienced and ruthless" venture capitalists.

Who are the venture capitalists, these people who are defining the direction the data processing industry will take? Take a look at one pro, George Kokkinakis, chairman of Merrill Lynch Venture Partners I. Kokkinakis was brought in to head Merrill Lynch's $60 million, publicly raised, venture capital fund for the same reason venture capitalists back entrepreneurs: his résumé showed he was in the habit of making a lot of money for people who hired him. Kokkinakis got into the venture capitalist game in 1971, finding venture investments for Exxon. He'd spent six years working in the aerospace industry, and had worked for Peat, Marwick, Mitchell & Co., one of the Big Eight. It was apparently the perfect preparation: Zilog, Ramtek, and Qume are three of the Exxon-era investments to which Kokkinakis points with understandable pride. Kokkinakis describes himself as having "a technical undergraduate degree and an MBA." He describes this academic combination as "kind of classic in this business."

A. David Silver agrees with Kokkinakis's description, but isn't thrilled with the recipe. "Over half [of professional venture capitalists] are MBAs with financial backgrounds," he writes. "Approximately half of the MBAs in the venture capital industry have engineering undergraduate degrees. This group of venture capitalists is relatively young and inexperienced and I fear for the money they manage when the next serious recession occurs."

Venture capitalists can also bring real business experience to the table. Kip Moore, for example, was senior vice president of network services for ADP in Ann Arbor before becoming a general partner in the Wall Street venture capital firm Welsh, Carson, Anderson and Stowe.

Other venture capitalists may bring more naiveté than experience to the table. Ralph Watson, president of Powerbase Systems, a New York-based software company, tells of being 45 minutes into a presentation to a venture capitalist. He'd shown the venture capitalist the charts, told him projected sales figures, described the micro market's need for database management systems, and was about to launch into a detailed distribution plan, when the venture capitalist pushed back his chair and drawled, "Now, just a minute here, son. Is this hardware or software we're talking about?"

Venture capitalists with real potential for troublemaking don't usually reveal their ignorance so quickly. They are more likely to fail the entrepreneur when they are most needed: when times turn tough or when follow-on money is needed. John Diebold, chairman of the Diebold Group Inc., the international management consulting firm, says that some of these problems may arise because of newcomers to the venture capital field: "A lot of the money that's gone into venture capital in the last couple of years is from very large portfolios whose managers felt they should earmark a certain percentage for venture capital. They tend to treat it like just another portfolio item." Diebold fears that the large institutions that have recently gotten into venture capitalism have neither the experience nor the will to give their venture companies the help they need to succeed.

"This group of venture capitalists is relatively young and inexperienced and I fear for the money they manage when the next serious recession occurs."

David Thompson of Deloitte Haskins & Sells doesn't see much here that's new. Thompson, who heads a national program that advises would-be entrepreneurs on how to raise venture capital, says, "People are simply moving more quickly to recognize situations where the entrepreneurs aren't able to function as managers." According to Thompson, this happens in about 20% or 25% of venture capitalized startups, "but it has always been like that."

Several people have claimed to be the founder of modern venture capitalism. One was the scion of a family whose money dated from the era of the robber barons. He was John Hay Whitney, sometime publisher of the *New York Herald Tribune* and cousin of Gloria Vanderbilt. Whitney's money backed Minute Maid almost 40 years ago; thus was the frozen juice business born. Whitney founded his firm, J.H. Whitney & Co., in 1946, and at first people misunderstood what it was up to. To make it clear that the firm wasn't an ordinary investment banker, Whitney and a partner, Benno Schmidt, came up with the name "venture capital." Schmidt recently told Charlotte Curtis of *The New York Times* that their first investment, in Spencer Chemical in Kansas, more than doubled their capital in the first year.

The other favorite contender is the nearly legendary General Georges Doriot, president of the American Research and Development Corp. (ARD). Doriot's most famous investment was the $70,000 he gave Kenneth Olsen in 1957 to start Digital Equipment Corp.; 14 years later, when ARD distributed to its shareholders the DEC stock it owned, the shares were worth $350 million in relatively uninflated cash. Doriot was recruited to run ARD by the Boston-based financiers and scientist/educators who put the company together just after World War II. During the war, Doriot had served as director of military planning for the Army's Quartermaster General and later as deputy director of R&D for the War Department general staff. Before the war, he had been a successful businessman/academic: he was assistant dean of the Harvard Graduate School of Business Administration, served on the boards of several corporations, and was president for a time of the McKeesport Tin Plate Corp. From such are legends formed.

Doriot was famous for the care he took with the companies in which ARD invested. A position on the board of directors was only the beginning of Doriot's involvement: he meant to see that his companies succeeded. Doriot's inspired meddling—particularly in personnel matters—is often credited with having made the difference between success and failure for ARD's investments. It is this continuing involvement with his companies that makes Doriot the forerunner of today's venture capitalists.

"An experienced venture capitalist has access to more information than an entrepreneur does," says Kip Moore of Welsh Carson. "The venture capitalist can find a vice president of sales, can help find senior management people." (Moore is saying this as we talk over breakfast, a time he chose because it wouldn't interfere with business. "I could be making money," he'd said of several other hours suggested for the meeting.)

TA Associates' Morby says of the companies in which her company's funds are invested, "Some companies are already tremendously managed, and just want our money and for us to come to a board meeting every three months. But because we're always seeing people, judging people, others like us to interview people they're going to hire."

According to Moore, "In 80% of the situations in which we invest, we have someone on the board of directors. The other 20% of the time, someone from another

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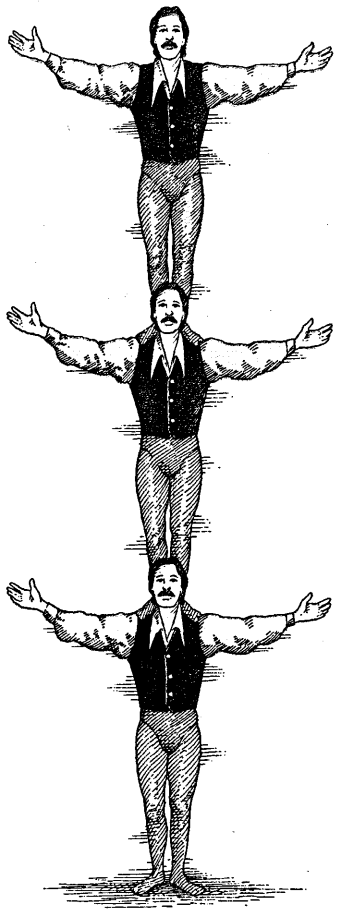

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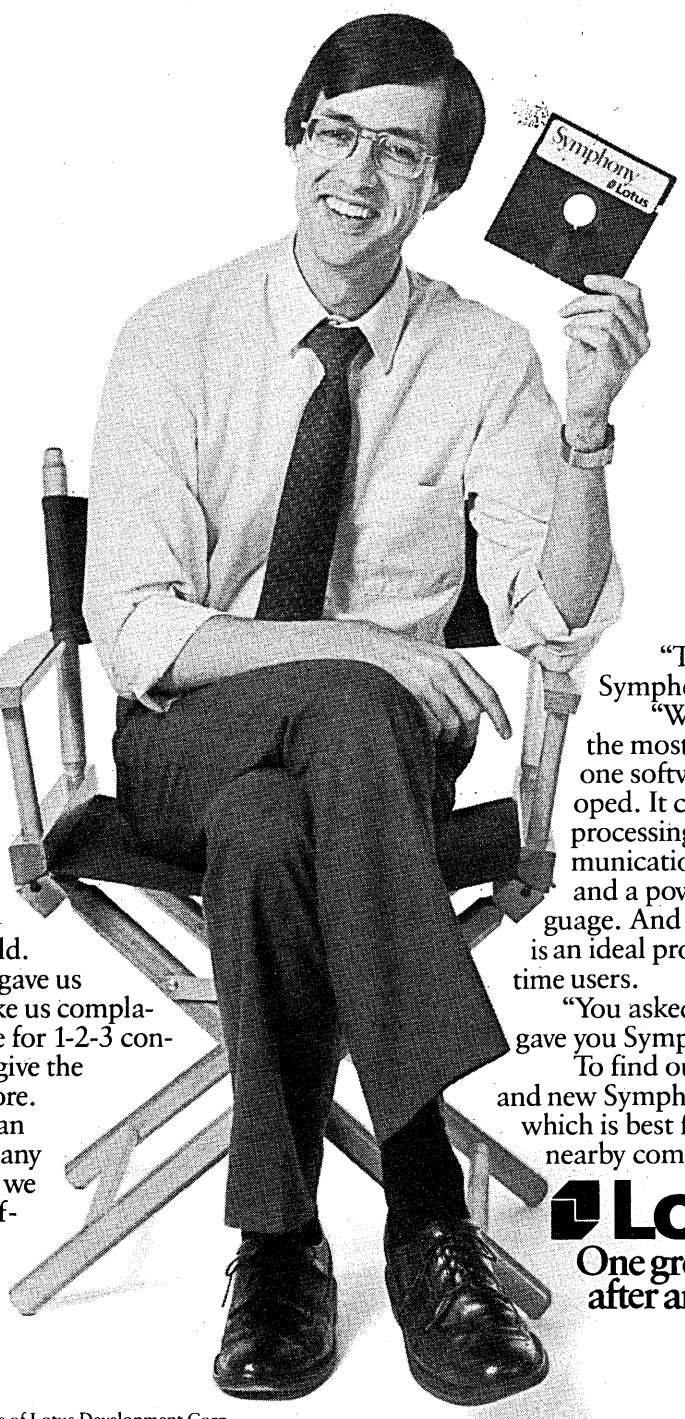
CIRCLE 18 ON READER CARD

"You asked for an encore.

Brian Stains is the Symphony Program Manager at Lotus Development Corporation. He was previously involved with the creation of 1-2-3 software and is one of the original members of the company.

We gave you a Symphony."



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CIRCLE 19 ON READER CARD

VC firm is on the board." But Moore stressed that watching the investment is only about 25% of the reason for venture capitalist presence on the board. "If someone is going to go south with your money, you want to know before the door closes. But the main reason is that an experienced venture capitalist has helped 20, 30, or 40 companies get off the ground." Like other venture capitalists—it is almost a litany—Moore suggests that the venture capitalist's most important contribution to a new company is access—to the people, the money, and the markets that can make success probable. Thompson adds, "You have more chance of success with a venture capitalist on your side. You have prestige and contacts that are going to make you look better than your competition."

In particular, the startup will have the prestige that money brings. The news that Venrock (the Rockefeller family) or Sprout (Donaldson, Lufkin and Jenrette's venture arm) or Kleiner, Perkins, Caulfield & Byers (a big West Coast VC firm) is backing a company almost always makes even more money available. As TA's Morby puts it, "We make the new company visible in the financial community."

(Visibility can sometimes lead to what one entrepreneur describes as the "feeding frenzy" that occurs when venture capitalists gather around what the industry has decided is a hot property. "We'd been trying to raise about $3 million for months," the entrepreneur says. "Nothing. No nibbles. Depression reigned. But within days of our having gotten a commitment for half a million, there were offers for $6 million [from other venture capitalists] on the table. We had to tell some people we didn't want their money.")

Entrepreneurs seem to agree. Ralph Watson says of the venture capitalists that

Doriot's most famous investment was the $70,000 he gave Kenneth Olsen in 1957 to start Digital Equipment Corp.; 14 years later, the shares were worth $350 million.

are backing his company, "They have been of enormous help to us. They've introduced us to people in the financial community, they've helped us make sales, they've helped with distribution. They've been very sensitive to our needs."

Watson's company was a small New York computer services company, doing work for clients like Citibank, Chemical Bank, and Manufacturers Hanover, when one of its programmers came up with a menu-driven relational database for micros that ceo Watson thought had promise. The resulting product, Powerbase, is now being shipped in volume and has earned some enthusiastic notices from software reviewers. Equally as important in the crowded micro software field, Powerbase has gotten shelf space in the computer stores. Watson gives the venture capitalists who've backed his company some of the credit for this visibility in retail stores.

Armed with the contacts he'd put together during a decade of doing business in a big financial center, Watson thought that raising the necessary capital wouldn't be too tough. He had a successful business. He had a product, and he had the business plan. "You have to show you know where you are going," he says. But, before Watson got his money, he was on what he now calls "an emotional roller coaster ride." It took Watson about seven months to raise his money. Today, Watson can pinpoint the reason for his difficulty: "We didn't have package goods experience."

Watson's travail is not unusual. A lot of people want money, and venture capitalists have to be choosy if they are to maintain their record of success. They want to be very, very sure they'll end up backing a winner. David P. Tarrant, vice president of marketing at Graphic Communications, Waltham, Mass., a company financed by venture capital, says, "Venture capitalists are all tremendously optimistic, right up to the point where they say no."

According to Stanley Pratt, would-be entrepreneurs are going to hear no more often than before. "In the first half of 1983, everybody involved in the process got unrealistic expectations." Entrepreneurs read in their morning papers that their breed would save American capitalism, and they put inflated valuations on their companies. Venture capitalists thought that everything they touched would obediently turn to gold. And investors, looking at the short term, rushed in at the top of the market. With what Pratt calls "the gyration down" in the price of high-tech startups—new issues fell by an average of 32% between June 1983 and February 1984—the sure things don't look so certain anymore.

What this means is that would-be entrepreneurs are going to have to scout the VC community even harder than they might have six months ago, and they'll also have to give away more of their companies. Robin Grossman, a partner in Sevin Rosen, a venture capital firm that hit big with Lotus 1-2-3 and Compaq, says, "Some companies that could have raised money six months ago cannot raise it today. Venture capitalists are looking a little harder and a little longer at deals before they commit." When a startup company does get money from a venture capitalist, the venture capitalist will be offering less money for a bigger piece of the action. "Six months ago you had startup or early-stage companies commanding enormous valuations that, frankly, the companies could not justify," she says. "People put in their money [into companies] thinking that 'the market is going to hold up until we get our money out.' Well, that didn't come to pass." According to Grossman, the high-quality company is still going to get both attention and cash from the venture community. "People still want to get in on a terrific deal," she says. (Grossman herself is a symbol of the burgeoning world of venture capital: she was formerly an editor at *Business Week*.)

Grossman says that entrepreneurs

"You have more chance of success with a venture capitalist on your side. You have prestige and contacts that are going to make you look better than your competition."

who want to get into the micro software field will find themselves looking at a market that has changed a lot recently. "There are clear front-runners starting to emerge," she says, "like Lotus Development Corp., like Microsoft, like Ashton-Tate. These are companies that are more than just one-product companies." Double trouble for would-be microsoftware tycoons: they must convince an increasingly tough group of venture capitalists that their products can make it in a hardening market.

One way to make the money raising easier is to delay hitting the venture capitalists until a company is already a going concern. As TA's Morby points out, "It doesn't cost much to start a software company."

When Welsh, Carson, Anderson and Stowe backed Relational Technology Inc., Berkeley, Calif., it did so after having decided that it wanted to have in its portfolio a company making relational database management systems. "We must have called 50 companies with an average employee population of one," said Kip Moore. "Relational had the best management team, 15 people, and the sales guy had been head of sales for Cullinet."

Richard Rabins, president of Alpha Software, Boston, makers of Database Manager II and the new PCjr system called Electric Desk, also got his venture capitalist money by waiting. In the spring of '82, Rabins put an ad in a local Boston computer newsletter saying that, in return for seed money, the company would pay advance royalties on software. Only a couple of grand appeared, but it was enough to get the business going. He soon had sales to boast of, profits to talk about. The venture capitalists came looking for him. "Venture capitalists like to feel like sleuths," Rabins says. "They like to think they've found something nobody else knows about." Rabins raised $2.8 million in weeks.

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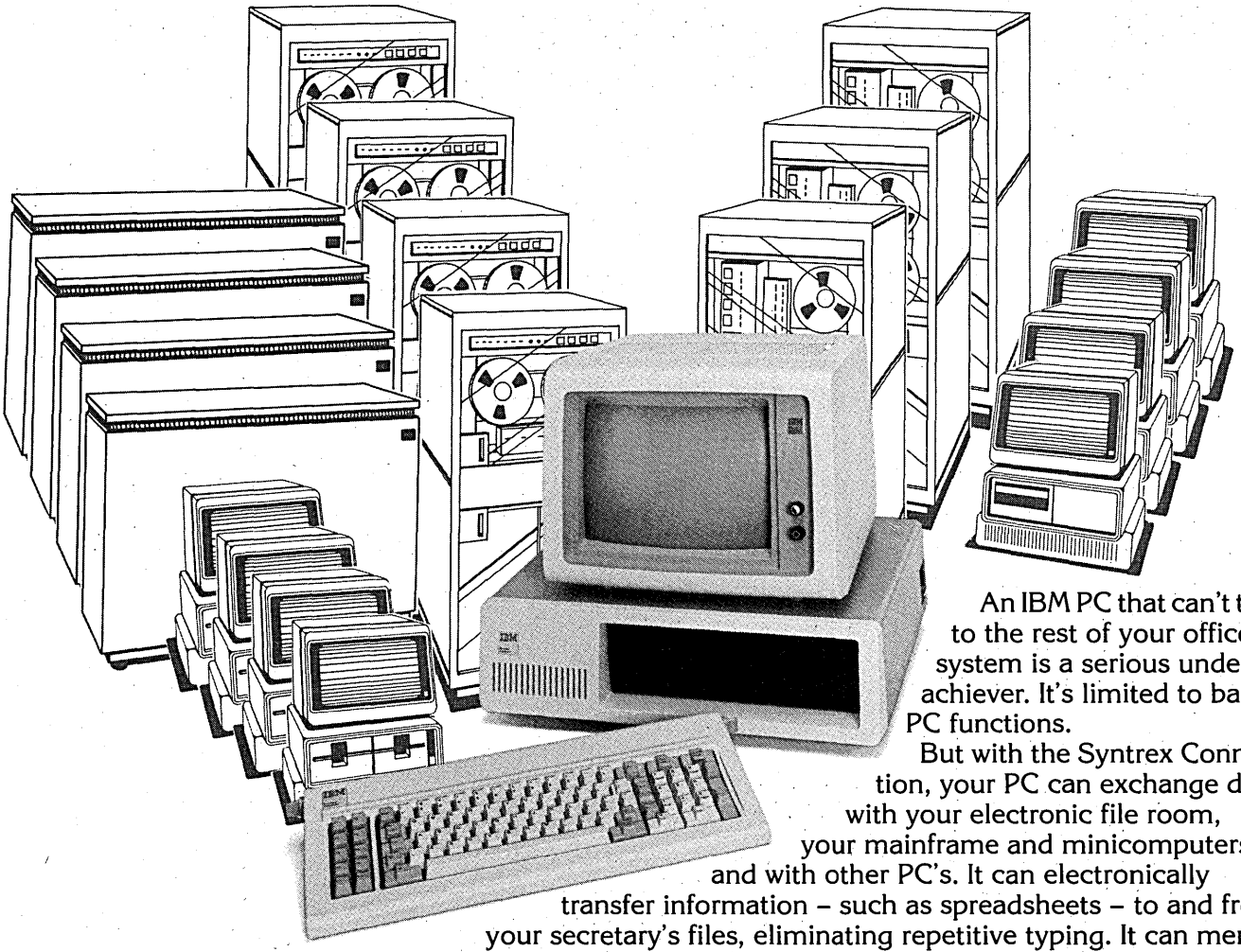

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CIRCLE 20 ON READER CARD

But a would-be entrepreneur with just a business plan and a great idea had better not be a complete mystery to the venture capitalist. Rabins warns, "You don't want to make a cold call." David Thompson estimates, for example, that venture capitalists invest in between 1% and 3% of the schemes they see. Archie McGill, head of the Rothschild family's American venture capital operation, says he sees about 75 proposals a month. Thompson warns that the would-be entrepreneur "must go to the venture capitalist as a referral." He suggests an attorney, an accountant, or a colleague. "That is the key to success." Powerbase's Watson built his list of 25 or so venture capitalists by networking through friends, neighbors—he lives in Connecticut's "stockbroker belt"—and personal contacts. "You cannot go to a venture capitalist cold," says Watson. "Our cold-turkey calls got us nowhere."

Again, management is the key that will open the wallets of the venture capitalists. Thompson of Deloitte Haskins puts it this way: "You can have the best product in the world, but if you don't have the right management team, you're not going to get the funding."

Here is Thompson's recipe for a VC's ideal management team: "They want people who can create a big company. They want people who have had experience running a profit center—a business, or a line of business, or a division of a company." TA's Morby says that venture capitalists are also impressed with management teams that have worked together on earlier projects. "In a startup, particularly, you don't have anything to bet on except someone's having done it before," says Morby. "You like to back people with good management records, good development records on other projects, in other places." Morby cites some specifics: "That's why [John W.] Poduska from Prime who did Apollo got backed immediately. Everybody knew he'd done it before. And that's why we're backing a company called Non-Procedural Systems started by Hal Feinleib, who wrote Nomad for National CSS. We know he's done it before."

"Some companies that could have raised money six months ago, cannot raise it today. Venture capitalists are looking a little harder and a little longer before they commit.

There's a reason venture capitalists place so much emphasis on the well-conceived business plan and on experienced management: "There are a lot of first-rate scientists trying to become second-rate businessmen," said one venture capitalist.

Watson says that entrepreneurs can make sure that the venture capitalist with whom they are dealing is first-rate by asking a few questions: "How big is your fund? Where does the money come from? What percent is committed? What percent is in cash? What other deals have you made?" And, most important, says Watson, "How successful have your other deals been?" John Diebold suggests that would-be entrepreneurs "be very careful. To the extent that they have options, they are better off if their capital comes from people who have experience helping new ventures over long periods of time."

Most venture capital outfits run several discrete chunks of money, each called a fund. These funds have predetermined life spans, commonly seven, 10, or 12 years. "It takes three or four years to invest the money, a few years for the companies to get going, and a few years to get your profits," says Stanley Pratt. "Venture capitalists don't sell at the initial public offering. The biggest money they make is by holding on to the successes after they've gone public," Pratt adds.

The venture capital firm makes its expenses and pays salaries by taking 2.5% of the value of each of its funds each year. Pratt says that aside from travel expenses, the cost of doing business is not very high in the VC game. (Kip Moore jokes that his firm doesn't have a California office: "Instead, we own several planes.") Salaries in the industry are up, with general partners earning in the $100,000 to $175,000 neighborhood. A nice neighborhood, you might say, but as Pratt points out, these people could be getting bigger salaries elsewhere. Venture capitalists make their big scores when a fund matures. They take 20% of the profits, returning the rest to their investors.

So far, there are almost always profits. Venture capitalists boast that no venture capital firm has ever gone broke. (Stanley Pratt says that, in boasting of their success, venture capitalists set up careful limits. They qualify a professional venture capitalist as being "adequately funded," and funded by institutional investors "seeking a return on their investment.") The secret of their success is fairly obvious. A venture capitalist can lose no more than his investment, and can make as much as the markets will churn out. Moreover, the conditions under which the venture capitalist operates make behaving too foolishly difficult: because of the long-term nature of the funds, most venture capitalists are immune to the effect of financial panics—those times when "everybody"says it's wise to sell out, thus making sure that "everybody" loses.

To make this clearer, take a look at some recent boom-bust-boom cycles in American startups.

- In 1969, venture capitalists put a total of $450 million into new companies; the public market that year for companies with net worths of under $5 million raised $1.367 billion for 698 companies.
- In 1975, a much glummer year, venture capitalists put up $250 million for new companies; the public market invested $16 million in four under-$5 million companies.

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CARTOON BY ARTEMAS COLE

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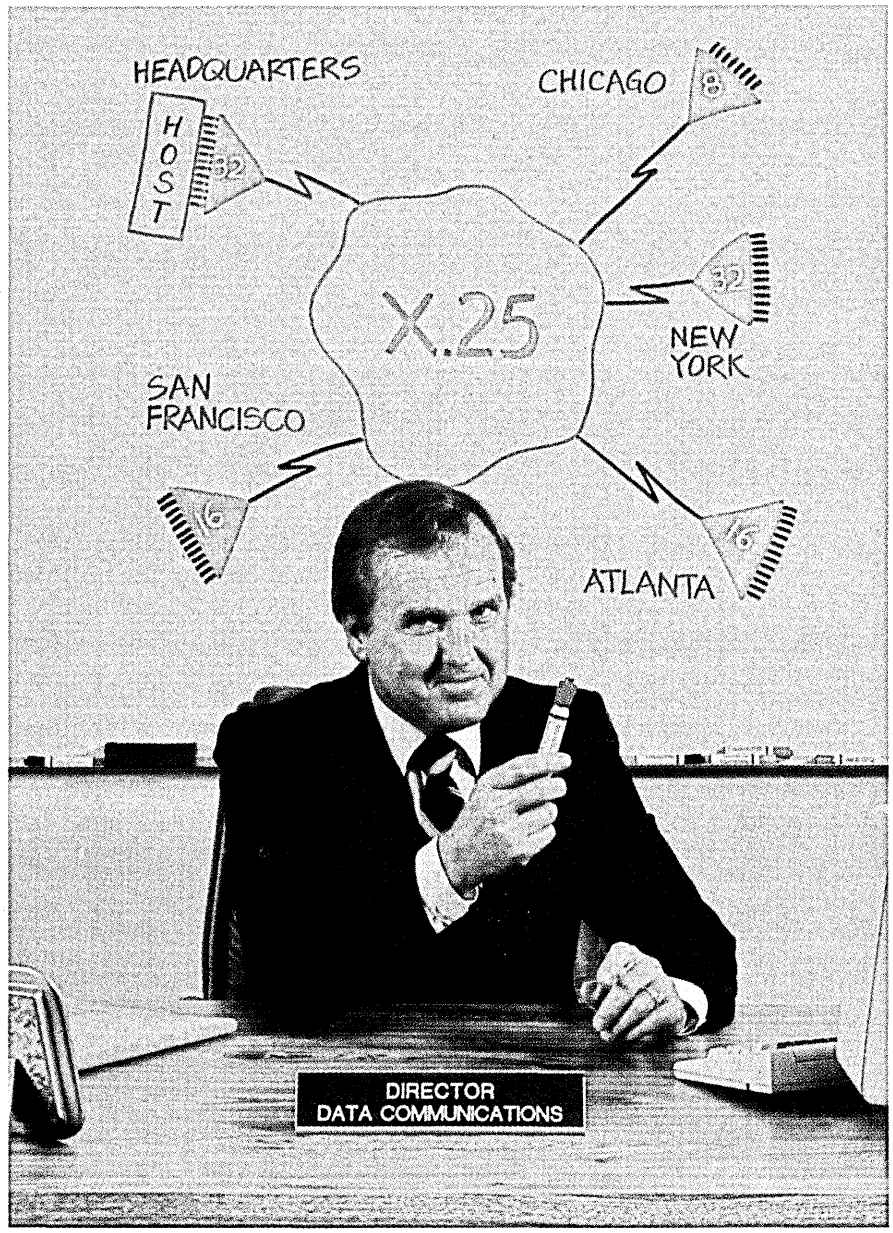

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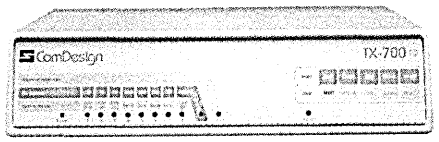

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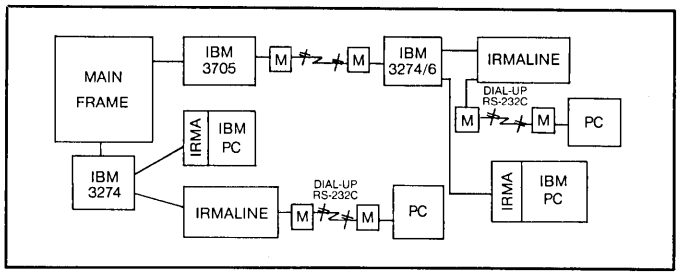

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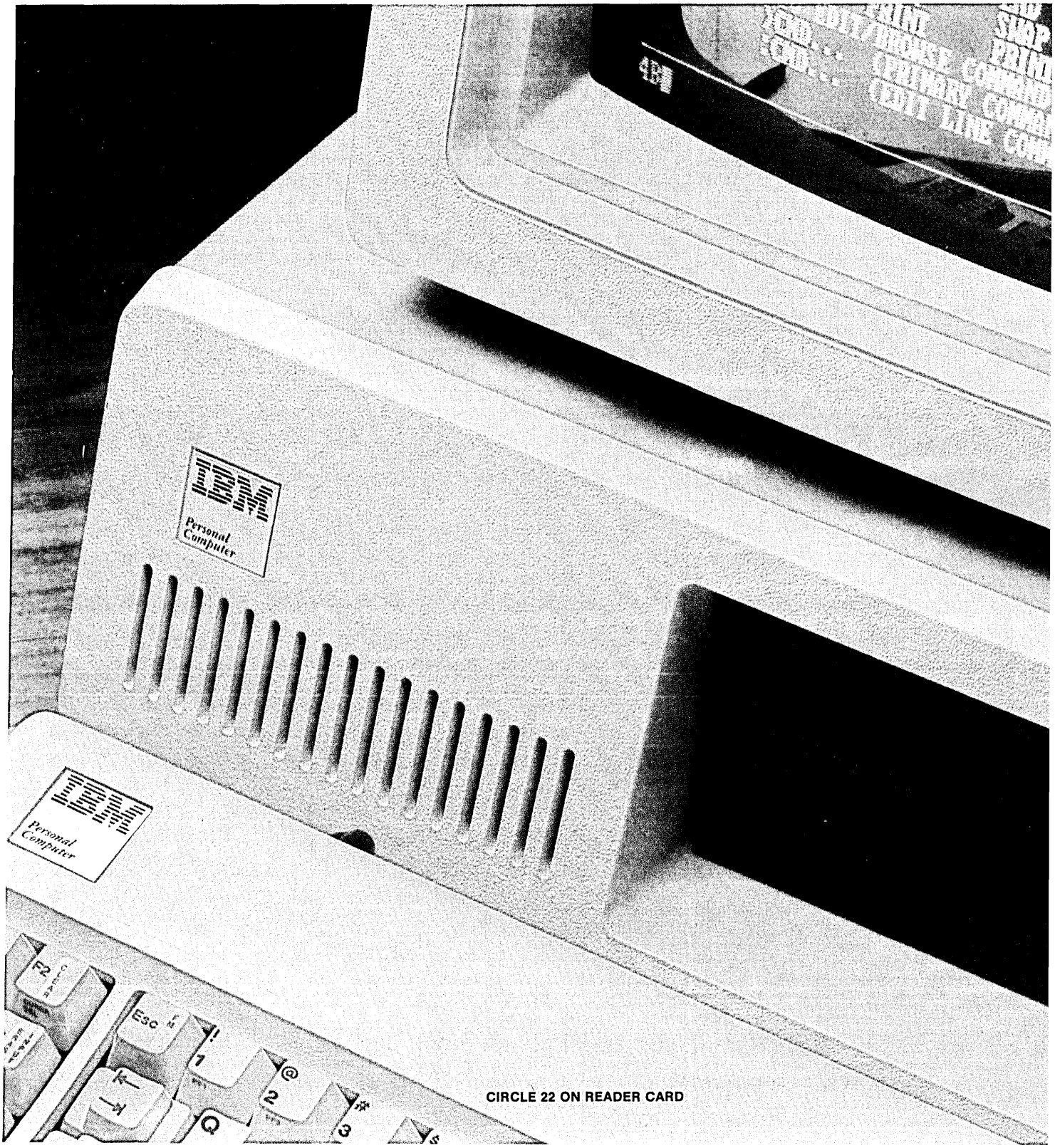


CIRCLE 22 ON READER CARD

IN FOCUS

• In 1981, before the fall, venture capitalists invested $1.4 billion; the public market put $1.76 billion in 306 under-$5 million companies.
• In 1982, after the fall, venture capitalists invested $1.8 billion; the public market raised $619 million for 113 under-$5 million companies.

Stanley Pratt, who supplied these figures, adds that in 1983, the venture capitalists raised $2.8 billion, and the public markets $3.6 billion for companies with net worths under $5 million. "And the only thing I can tell you about this year is that the public markets will be way the hell down," Pratt says.

Clearly, however, the record shows that VC money is less likely to be scared by financial downdrafts than is public money. For example, Rothschild's McGill says, "We're investing at a pace that's as fast as or faster than ever before. In fact, we're seeing more deals, and the quality of the deals has increased significantly."

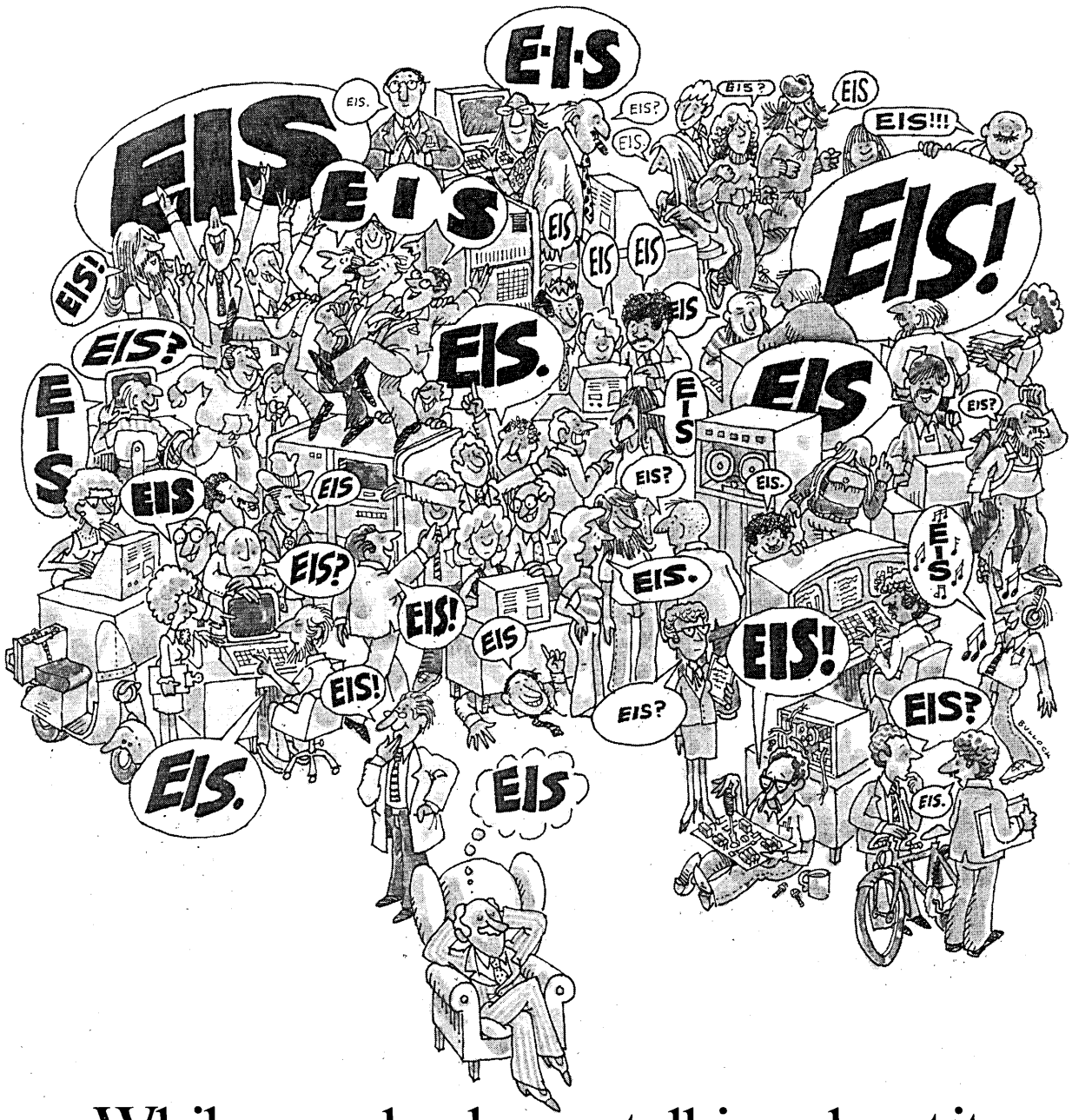
But, just as clearly, an important word in the venture capitalist's vocabulary, "valuation," is very susceptible to changes in the financial climate. Valuation is an imaginary figure representing the venture capitalist's estimate of the value of an entrepreneur's company when and if it goes public. It is the key to just how rich an entrepreneur can expect to become, and just how much money a venture capitalist will ante up in return for just how big a piece of a company. In flush times (when it seems that all a company need do to go public at a vast multiplier is sport a name that ends in -tech or -tronic), the optimistic venture capitalist looks into the future and sees big money, ergo, the venture capitalist is willing to kick in a lot of money for a not-so-big piece of the company. In gloomier moments, when, say, a couple of the venture capitalist's portfolio companies are looking shaky and nobody is buying new issues, the venture capitalist peers ahead and finds possible disaster. The result is that the entrepreneur will receive less in return for surrendering a bigger piece of his or her company.

"There are a lot of first-rate scientists trying to become second-rate businessmen," said one venture capitalist.

A. David Silver tells the story of a Scotts Valley, Calif., maker of peripherals for Apple. When times were good it turned down a $1 million offer for 15% of its common stock; later, during the recession of 1982, the "capital-starved" company "floated a business plan that sought the same $1 million, but this time for 40% of its common stock."

According to Kip Moore, professional venture capitalists make sure this kind of starvation doesn't happen to companies they back. "With venture capital, when the initial money runs out—and it almost always does—the venture capital firm has more to invest." Thompson adds that it's not new deals that increase the work load of venture capitalists, it is the growing pains of their portfolio companies. Thompson notes that, currently, venture capitalists are spending a lot of time trying to help out some of the Winchester disk drive companies in their portfolios: "Several of the companies have fallen by the wayside, and several others are in trouble."

Entrepreneurs can give away a lot when they go to venture capitalists for financing. They may end up being relieved of their command, like Gary Friedman at Fortune Systems, Lore Harp at Vector Graphic, or Chuck Peddle at Victor Technologies. But venture capitalists tie up their own capital for as long as a decade, with no guaranteed return; in exchange, an entrepreneur gets a chance at the big dream, the solid gold one. "It's not cheap money," says Thompson, "but you have more chance of success. After all, venture capitalists are in the business of making millionaires and multimillionaires out of entrepreneurs." ❋



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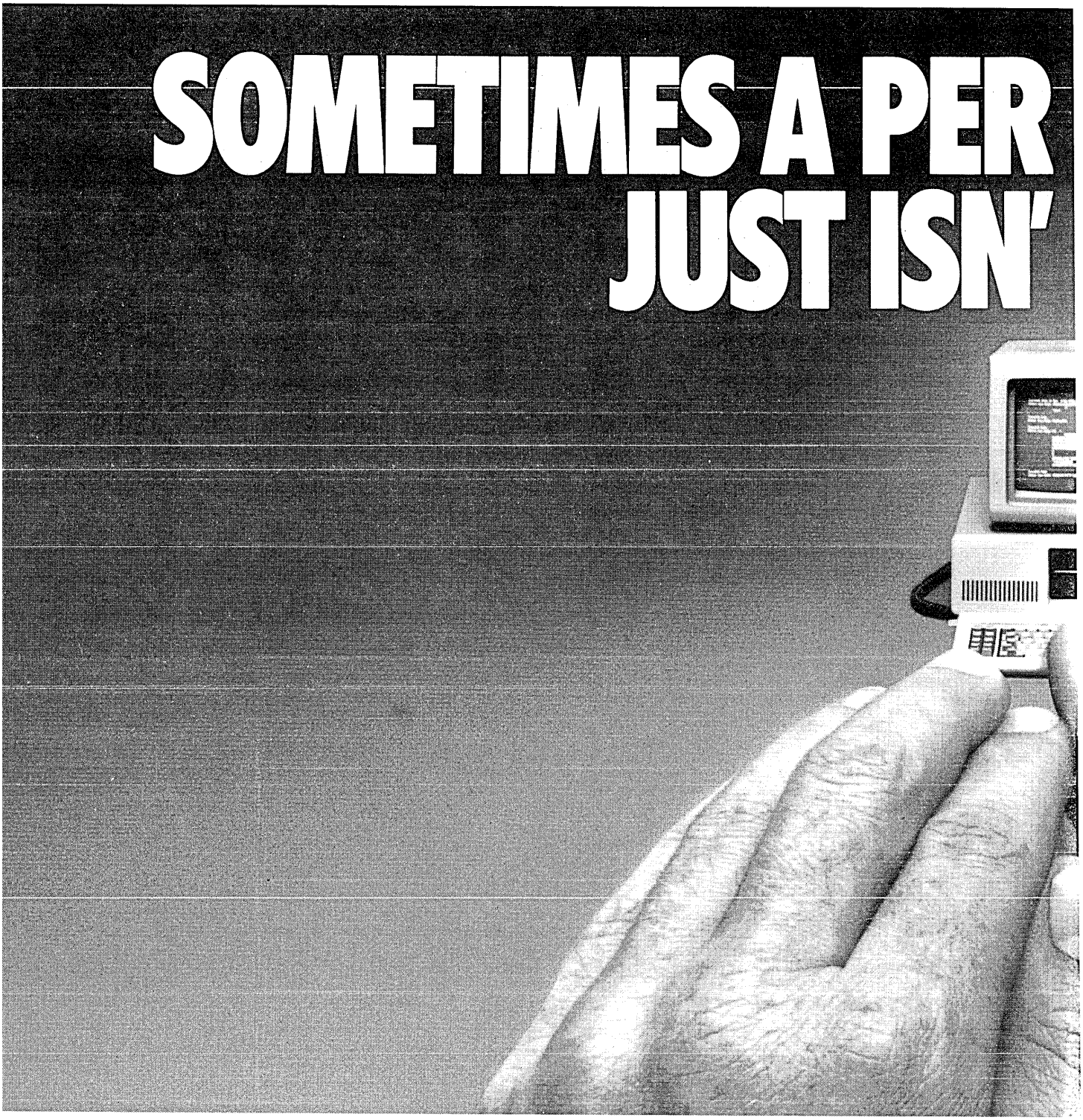

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CIRCLE 27 ON READER CARD

NEWS IN PERSPECTIVE

MICROCOMPUTERS

FLAT PANEL FUROR

Display makers back different technologies as alternatives to bulky crts where size is critical.

by Edith Myers

The information display industry is on a reducing binge that makes Weight Watchers look like pikers.

A bevy of introductions and anticipated introductions of lightweight "lap" computers has fueled a demand for thin, flat-panel display screens that has monitor makers lining up behind the one of a variety of technologies they see as *the* alternative to the bulky, power consuming, and somewhat fragile crt.

The latest flat-panel market study, by Arthur D. Little Inc., predicts a yearly volume of $4.5 billion by 1992. San Jose, Calif.-based Dataquest Corp. projects that in five years flat screens will account for 20% of the computer display market.

Dr. T. Peter Brody, vice chairman and director of technology at Panelvision Corp., Pittsburgh, which introduced a flat-panel display using active matrix addressing at a Society for Information Display (SID) conference in San Francisco last month, says he foresees a flat-panel market of from $6 billion to $7 billion by 1992. "Most of that will be active matrix based," he says.

Interest in flat panels was high at the SID conference but it was not the only issue addressed. It will be next Oct. 30 and 31 in San Jose at Flat Information Displays 1984, a conference sponsored by Stanford Resources Inc., a six-year-old San Jose-based market research firm specializing in information displays.

"There has been a lot of interest in these things over the last 12 months and we want to bring users and manufacturers together to talk about which applications fit which technologies," says Joe Castellano, Stanford Resources president. He says his company did a study of 20 computer terminal manufacturers and "I was surprised at the lack of knowledge [of flat-panel technologies] of some of the key people."

The three leading technologies appear to be liquid crystal displays (LCDs), electroluminscents (ELs), and plasma gas discharge. A fourth, vacuum fluorescence (VF), has caught on so far only among Japanese vendors. Castellano describes a VF display as "like a crt that's flat. A cathode emits electrodes. There is a grid between cathode and anode and the anode is coated with a phosphor that emits light, typically green." He said VF displays "show up a lot in automobile dashboard displays and in microwave ovens. Normally they display only digits but now they're doing some graphics."

All the flat-screen technologies involve sandwiching a thin layer of chemicals between two or more layers of glass, and producing an image by electrically charging the chemicals in one way or another. Castellano says the Japanese are way ahead "in all flat electronics technology because, until recently, the U.S. was only interested in plasma." Among the companies interested in plasma is IBM, which has developed an AC gas plasma display for its 3290 terminal. It sells for $7,000, can display up to 10,000 characters, can do full graphics, and handle four windows.

Another, says Castellano, is Plasma Graphics Corp., Warren, N.J., a spin-off of Burroughs, which is just coming out with a similar but very much smaller display.

Plasma panels, both AC and DC driven, were developed in the '60s and have been commercially available from the early '70s. Panelvision's Brody sees plasma efforts as diminishing because, among other reasons, "the panels are complex to manufacture and to assemble."

John O'Donnell, crt/components engineering manager, Conrac Div., Conrac Corp., Covina, Calif., says he's "not a proponent of plasma. The basic color is orange, period." Brody says that while AC plasmas are restricted to orange, other colors in DC plasmas are possible but not practical.

O'Donnel finds a second fault with plasma display. "They have restricted resolution. You can't turn them up. They're either on or off." He doesn't look for much improvement. "If I had to choose between a plasma display and a crt 50 years from now, I'd probably still choose a crt."

"If I had to choose between a plasma display and a crt 50 years from now, I'd probably still choose a crt."

What O'Donnell and Conrac are looking at are EL displays, particularly EL displays from Planar Systems, a small Beaverton, Ore., spin-off from Tektronix that is 31% owned by Tektronix.

EL displays produced by Japanese giant Sharp Electronics Corp., which had sales of $3.7 billion in 1983, are used by Grid Systems Corp., Santa Clara, Calif., in its portable Compass computer, and Hewlett-Packard is taking a hard look at similar displays from a Finnish firm, Lohja, which

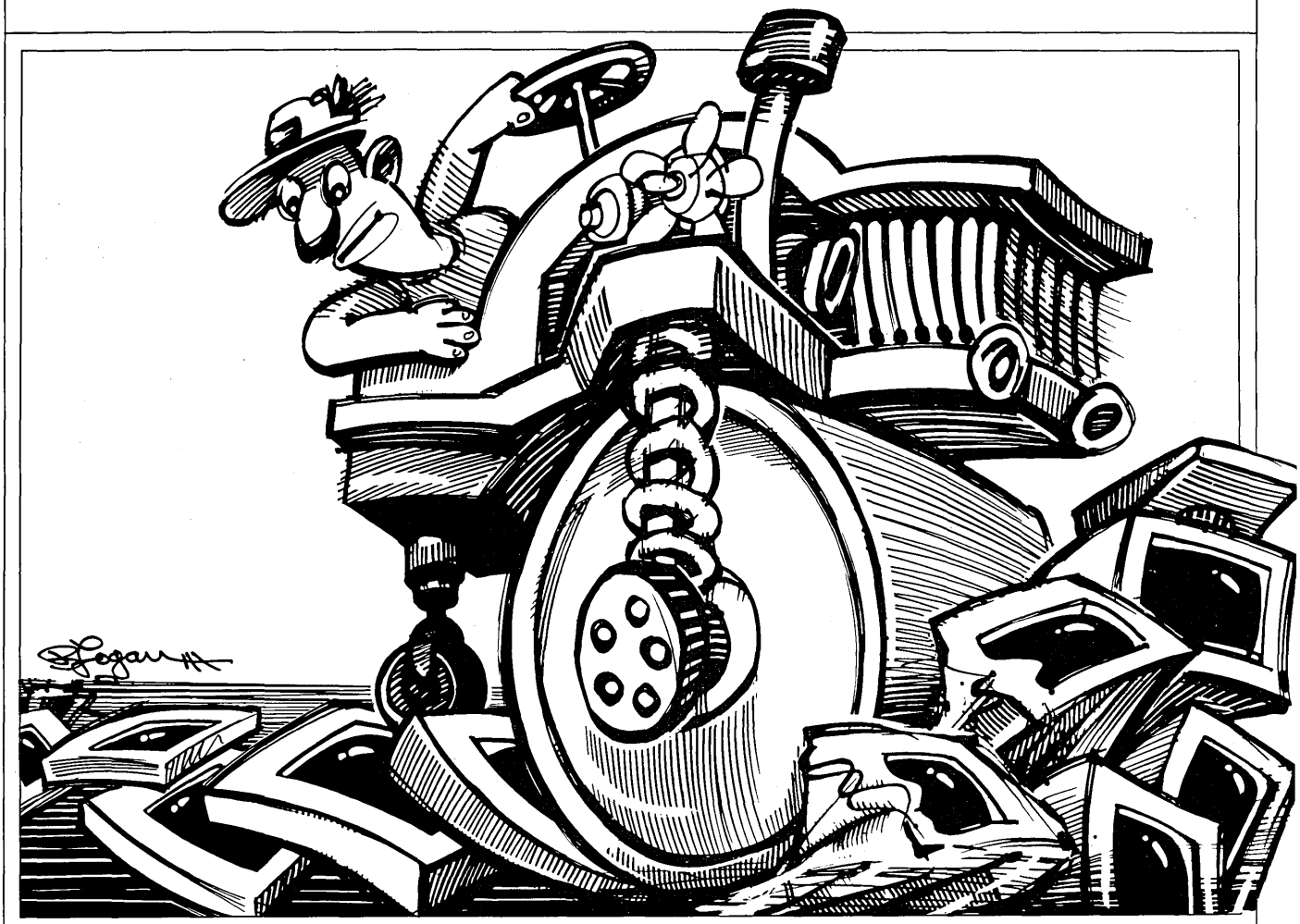


ILLUSTRATION BY BILL LOGAN

had 1983 sales of $350 million.

Tiny Planar has yet to deliver a display, but O'Donnell has ordered a quantity. He saw one at a Society of Photoptical and Instrumentation Engineers (SPIE) show in Los Angeles last January and liked what he saw.

"That was our first showing," said Jim Hurd, president of Planar, of the SPIE show. "It generated a lot of interest. It's definitely a supply limited market." Planar began shipping from a custom, low-volume production line in January and is gearing up a high-volume production line from which it expects to ship in November. Price for the low-volume units is $3,000 apiece, while the company is quoting a $500 per unit price for its high-volume deliveries. "The technology is extensively tied to economies of scale," said Hurd. "It's like the semiconductor industry."

Planar is one year old and has 35 employees. Hurd had been manager of solid state research at Tektronix. The company's existing units are monochromatic yellow, but Hurd said red, green, and blue phosphors have been developed. "All of our R&D work is in color and we're convinced multicolor displays are technically feasible. We're now looking at the manufacturability aspect. We look for dual colors in the '86–'87 time frame and full color at the end of the decade."

There has been talk of GTE coming out with an EL display, but Castellano of Stanford Resources thinks it's just that. "They've made noises about it but it's not their thing."

All of the existing flat display technologies remain more costly than crts. Where a medium-resolution crt monitor can be had for $125, the cheapest existing flat-screen monitor goes for about $400. As for true portability, only LCDs and EL displays can be run on batteries and the latter only for a few hours, which is one reason LCDs lead in portable computer implementation.

Active matrix addressing replaces the grid of electrodes with chemical films.

"But most of these [existing portable computer LCD displays] don't handle full page," says Castellano. "They have up to eight lines, but to do what you can do with a desktop [computer], you need 25 lines."

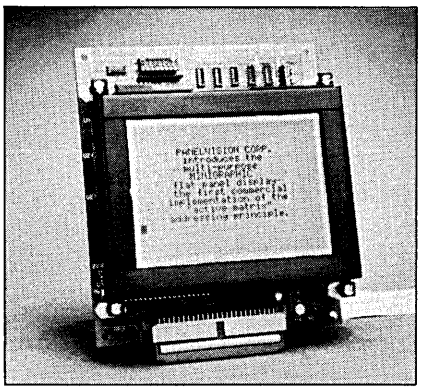
Two companies are promising LCD-based displays with 25 lines. One is Panelvision and the other is Crystalvision of Sunnyvale, Calif.

The display introduced by Panelvision in San Francisco, called MiniGraphic, is 4 by 5 by one-half-inch thick and can display 16 lines of 32 characters and handles graphics. It uses active matrix technology originally developed at Westinghouse Electric Corp. from which Panelvision holds a license and from whence its founders came.

On the drawing boards of the Pittsburgh firm is the PV 2000 full-width display, which is roughly four times as large as the MiniGraphic, uses 10 times as many pixels (more than 250,000), and achieves 400-line resolution.

Brody emphasizes that active matrix addressing is a display drive and integration technique. not a display technique, as such. "It is applicable to practically all currently used display materials to varying degrees. It can do more for certain classes of materials than for others. There is little doubt that, as new and improved electro-optical materials emerge, active matrix addressing will benefit these as well, but its main field of application in the near future will be to light modulating [LCDs] rather than light-emitting [all others] materials."

O'Donnell of Conrac feels the fact that LCDs are "subtractive displays," which reflect rather than emit light, can be seen as a weakness or a strength. "For now it means they need ambient light to be visible, but for a long term they have potential



ON DISPLAY: Panelvision Corp.'s flat-panel display, backed by a controller board, uses liquid-crystal display technology to show 16 lines of 32 characters each. Prices begin at $1,475 for a complete system, but are expected to fall as production volume rises.

because they are not restricted to their own light as a light source."

Active matrix addressing replaces the grid of electrodes with chemical films. A single transistor is created at each pixel on a flat screen, allowing a continuous electrical signal to activate the liquid crystal. This alleviates contrast problems and widens the viewing arc, which is 30 degrees for most LCDs, to 50 degrees.

Production is an acknowledged problem since near sterile environments are required at some points on the production line. Panelvision in May completed its latest round of venture capital funding, bringing its total funding to $11 million. The company says this will enable it to expand its pilot production line for the MiniGraphic and continue development of the PV 2000, which it expects to be available in the first quarter of 1985.

Single quantity pricing for the MiniGraphic is $750 for display only and $1,475 for a system. In quantities of 500, prices go to $360 and $700; higher-volume prices will be lower. Availability is August.

Bob Duboc, product marketing manager for Crystalvision, has some reservations about active matrix addressing. He acknowledges that "putting a little diode under each pixel can give high image quality, but it's very difficult to do that. The smaller version looks good, but can they [Panelvision] do a 25-line display?"

Crystalvision has announced a display, the CVA 640/250 (640 pixel columns by 250 pixel rows), that handles 25 lines of 80 characters based on what Duboc describes as a "phase change LCD technique." Ordinary liquid crystals, he says, relax when they're not being energized by voltage. As each line comes up on a screen, previous lines begin to relax. "You're constantly having to twist back and refresh. Our crystals don't relax back. We use a liquid crystal that's as solid at normal ambient temperature as hard wax or soap. They're like liquid crystals with memory."

Crystalvision's one-inch-thick display is currently selling at $1,750 for evaluation units. Duboc expects the price to go down to $300 for high volumes. The company recently purchased LCD production equipment from nearby Fairchild Camera and Instrument Corp., which, he says, will enable it to produce from 40,000 to 80,000 units per month by late '85 or early '86. Currently its pilot production rate is 10 to 20 panels per week. Duboc says the company has received some 70 orders for units for which shipment will begin in July.

Crystalvision got started two years ago as an outgrowth of an R&D firm. The primary investor is Renaissance Corp., New York, which provided much of the funding that made possible the purchase of the Fairchild equipment.

Does all this portend the demise of the crt? No, says Castellano. "In desktop applications, traditional crts will dominate over the next five to six years."

"Far from it," says O'Donnell. "High-resolution monitors haven't begun to reach the vast audience waiting for them. If development stopped today with the 1,000-line, noninterlaced picture currently available, the momentum generated in every application area from business graphics to animation to home television would guarantee an increase in high-resolution monitor production over many years."

TROUBLE AT THE HELM

After six months of internal storms, Altos Computer Systems now faces the challenge of IBM.

by Michael Tyler

It was Tuesday night at Comdex and Altos Computer Systems was throwing a big cocktail party at Atlanta's High Museum of Art. The supermicro maker wanted its dealers, who were crucial to Altos's grand future plans, to meet a new management team.

Leading the team were David W. Hanna, president, and Phillip E. White, senior vice president of marketing, two ex-IBMers who had been hired in the last four months to help the fast-growing company over the $100 million mark and, it was hoped, into the ranks of the long-term survivors. A good impression with dealers was important, for several top executives had recently left the company, apparently because of differences with Hanna and White.

Unexpectedly, the party climaxed six months of turmoil within Altos Computer Systems that had included changes in the executive suite, redirection of marketing strategies, and preparation to meet IBM in the very market Altos had exploited so successfully.

Altos's growth in the previous year had been strong, although not up to the explosive levels of earlier years. Calendar 1983 revenues of $82.4 million were 36% better than the year earlier, and earnings

White was hired because "neither Hanna nor Conway had the ability to plan a strategy."

rose 26% to $7.6 million in the same period. The growth continued through the first quarter of 1984, leading the company to predict that year-end revenues would top the $100 million mark. Altos has $60 million in cash and no debt, and wanted to impress dealers and the press that its management was as stable as its finances.

As reporters and others approached the museum's main entrance, however, that image came crashing down. A panicking publicity agent burst out of the building, running full tilt and shouting, "Go away! You can't come in!"

The cause of the PR man's consternation was that inside, Altos founder and chairman David Jackson was telling dealers that top management had been reshuffled, yet again, that very day. Hanna was out and Jackson, who had been Altos's president from the time he founded the company in 1977 through January 1984, was back in.

"The meeting lasted about 30 seconds," recalls Carl O. Markkanen of Systronics Computer Systems, Hasbrouck Heights, N.J. "Jackson simply announced that he was assuming control as president and ceo and whatever else he wants to call himself."

William T. Glover, head of MicroScience Corp., an Altos distributor in Dunwoody, Ga., says, "Jackson didn't even mention Hanna at all during the meeting. I think the phrase he used was that he had parked his boat and was coming ashore in an active role."

Jackson also announced that former marketing vice president Ronald Conway had rejoined the company to run sales and marketing for oems and value-added resellers. Conway, manufacturing vice president Gary Streuter, and marketing director Bob Bozman were the three executives who had resigned suddenly in mid-May.

"Comdex certainly was traumatic, because the timing was so unfortunate,"

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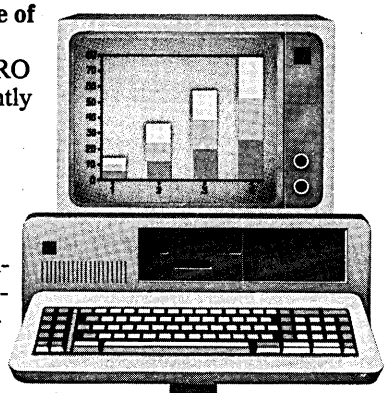

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says Elizabeth Horn, who runs Altos's advertising and public relations departments. "When it all happened, it was something of a surprise. There was no time to get used to the news—you just had to accept it."

The press was banned from the museum reception and a press conference called to introduce the Hanna management team was canceled. As it turned out, the management team was newer than anyone had expected.

The storms, like everything else at Altos, were initiated by Jackson, who owns 46% of the firm's stock. Five years after creating the company, the British-born entrepeneur took it public in November 1982. A year later, according to sources close to Jackson, he had become restless and ready for a change. He had also come to realize—some say the Altos board of directors had forced him to realize—that his computer science training was no longer sufficient to manage a large corporation, and he hired Hanna to succeed him as president and ceo.

Hanna wanted to wait and see what IBM's product would be, while Jackson wanted a more aggressive fight.

Hanna also was experienced in the computer business. He had been the president of GRiD Systems in nearby Mountain View, Calif., after spending 14 years at IBM, culminating with the position of vice president of general office systems in the national accounts division. "Altos hired Hanna because he had the image of a big company and they thought that that image could get us into the Fortune 1,000," White says, and indeed Hanna's experience at IBM spilled over to his work at Altos.

"Traditionally, Altos has really pushed the dealer and distribution networks, and deemphasized direct sales," says George D. Elling, who follows the company for Oppenheimer & Co. in New York. "Hanna was more inclined, having been at IBM, to go directly at the government and the Fortune 1,000 companies."

Hanna also changed Altos's internal management. "There was a lot of plain old management that needed to go on," Horn says. "Hanna moved quickly in realigning the company and implementing some major changes in the way we worked here. Jackson totally supports all Hanna's changes."

Hanna's biggest move in reshaping the company in IBM's image was to hire White to plan a marketing and business strategy. "Hanna and White knew each other at IBM," Horn says, "and they have been very good friends for years and years. Hanna was even a mentor for White at IBM. They were totally in sync with each other."

Others attribute White's joining Altos to Jackson. "Neither Hanna nor Conway had the ability to plan a strategy," says a big supplier to Altos. The supplier, who asked not to be identified, says that Hanna could not have hired White of his own initiative. "Hanna was not given the authority to hire anybody," the supplier says. "The board and Jackson kept a tight rein on him."

Horn at Altos maintains that Hanna was the primary reason White joined the firm, but she concedes that the move still worked to Jackson's advantage. "Jackson thought that with a strategist like White involved, he could just let go of the company," she says. "But he got tired of being on vacation. Jackson had no doubts about Hanna or White, and held them in the highest regard." Nonetheless, fundamental differences arose between Jackson and Hanna, and White got caught in the middle.

The main difference concerned marketing strategy. Hanna may have given White too much latitude in reformulating the strategy to favor large corporations at the expense of distributors and oems. Oppenheimer's Elling notes, "Hanna brought in his own people, but in doing so he nudged aside Jackson's original team, until they felt compelled to resign. Jackson was afraid Hanna would alienate the Altos dealer network."

Clearly, he alienated Conway, Bozman, and Streuter, whose departures dismayed distributors. "I don't know Hanna," Markkanen of Systronics says, "but when he came in I believed that Conway would leave. I was happier with Jackson and Conway at the helm, because I started with Dave Jackson when Altos had just four people and Jackson himself took the orders. To my knowledge he hasn't made too many mistakes."

James L. Pierce, head of the Star-Tronic Distributor Co. in Farmington Hills, Mich., says, "It was a real shock when Ron Conway resigned. Ron was a very responsible and key individual who had been there since the beginning. It showed a significant difference in opinion between those who had been there from the beginning and the new kids on the street. Something had to happen because you don't let your top people go like that."

The debate over marketing channels had financial ramifications as well. "Under Jackson, Altos had followed rather conservative financial and marketing plans," says Jean W. Orr, an analyst with Smith Barney in New York. "Hanna was expected to be somewhat less conservative, short term, in marketing expenditures, with the goal of increasing the rate of growth. I suspect that Jackson's conservative approach and Hanna's aggressive approach were just too much in conflict to coexist."

Horn says, "Jackson was concerned about Altos's products getting out to market. He felt he could implement Altos's product strategies better than Hanna, and that if he were more directly involved in the day-to-day work, then the company could move more quickly to get the product out. He felt he wanted to manage the technical end for a while longer."

Jackson's desire to get back into the lab coincided with a realization that the firm would soon have to compete directly with IBM. "Altos is facing a Tet offensive when IBM introduces a multi-user system later this year," one supplier says. Hanna wanted to take a wait-and-see approach, with the intention of second sourcing whatever multi-user system IBM eventually introduces. Hanna preferred this "peaceful coexistence, the high road," because he felt an aggressive reaction would weaken Altos' public image and disaffect software writers.

Jackson, on the other hand, wanted more of a fight. "He's not the type of guy to sit back and react. It's contrary to his make-up. He wanted to take the fight to them, and Conway felt the same way." Jackson and Conway dreamed of making Altos a "West Coast version of DEC, doing things better and faster than IBM."

White, meanwhile, caught in the middle, worked out his own plans, which involved repositioning current lines rather than relying on new products. "We're just going to expand off our base," he says. The Intel 8086-based 586 and 986 models, currently the mainstays of the Altos line, won't be the focus of that expansion, however.

"The 8-bit market is still great, especially in Europe and the rest of the world," White says. "It's a mature market here but we're still selling 500 to 700 systems a month there, and 25% of our revenues comes from outside the U.S." Moreover, he says, the technological upgrades needed to compete with IBM will come from the firm's ACS 68000 line, based on the Motorola 68000 microprocessor, rather than from the Intel-based products.

The irony of the split is that many of the strategic differences between Jackson and Hanna have since been resolved.

Sources differ on whether marketing strategy, product, or the departure of Jackson's friend Conway pushed the Jackson-Hanna relationship to the brink. Yet the most direct cause of the rift was the personalities involved, Oppenheimer's Elling says. "You had two strong-willed people, and something had to give."

As the split widened, Hanna found his status and influence eroding. White, not Hanna, was now perceived as "the IBM man," because Hanna had been too long at GRiD after leaving IBM. White's star rose as Hanna's faded, leading to Hanna's surprise resignation and Jackson's resurgence at Comdex.

"Hanna and Jackson had their disagreements, and they both realized that the only amicable way to resolve it was for one of them to resign," White says.

The parting was indeed amicable, according to outside sources in contact with both men. "I think the more important question concerns any repercussions over Hanna's leaving: Would Phil White leave as well? With Conway rejoining the company and White apparently staying also, I think that to a large extent a lot of the bleeding that could have taken place has been avoided," Elling says.

According to company sources, nobody has followed Hanna out the door because Hanna and Jackson have taken steps to heal the company's wounds.

The irony of the split is that many of the strategic differences between Jackson and Hanna have since been resolved in a way that would have been acceptable to both. "Look at their marketing channels," Elling says. "Even after Hanna has left, they're still going ahead and hitting the Fortune 1,000 market, but now they're not putting all their eggs in that basket."

The question of how to compete with IBM's forthcoming supermicro, meanwhile, may have been much ado about, well, not much at all. White says that Altos "won't go head-to-head with IBM. We will go to the Fortune 1,000, not by our direct sales force, but by oems such as RCA and Control Data and ADP."

The challenge may also be diluted by IBM itself, Elling says. "When IBM comes into a market, they don't try to kill everybody by pricing the product so low that no one can compete. They didn't bring out their first personal computer at $1,000, but at a price that would give them a large share of an increasing market and still leave room for others." The same will happen in the supermicro market, he believes, where Altos's vars and oems, and its software development programs, will all help the firm compete against IBM.

Pierce of StarTronic Distributor agrees. "Altos has eight months' head start, and they have a much better setup for selling supermicros because the systems integrators they use sell Unix supermicros very well." By comparison, he says, IBM may have a major marketing problem when it moves from single-user PC/DOS machines to multi-user Unix machines.

"IBM uses retail channels, and I defy the normal user to go into a computer store to buy a Unix machine and be able to use it," Pierce says. "IBM will will have to create new marketing channels that Altos already has."

For now, Altos seems to have regained an even keel. Says White optimistically, ignoring for a moment the big blue shadow lurking below the calm, "There isn't a single crack in the Altos ship's hull." *

FINDING NEW WAYS TO SELL

Vendors of microcomputer products are changing their methods and approaches to a maturing marketplace.

by Michael Tyler

The microcomputer industry has reached the point where the quality and features of a product are no longer as important as its marketing and distribution. Most popular hardware and software products are sufficiently similar to their competition that their success ultimately rides on marketing and promotional talents.

Increasingly, however, those talents are being found not at the vendor itself but in the dealers and distributors employed to move product to market.

Lotus Development Corp.'s announcement in late May that it would abandon direct sales to corporate customers and depend solely on dealers and distributors for sales into big companies is a prime example of this trend. Stephen J. Crummey, director of sales at Lotus, explains that the Cambridge, Mass., vendor found itself competing against its own dealers by selling directly to large firms.

Says David B. Readerman, analyst with Smith Barney in New York, "The Corporate Accounts Program was discontinued as a result of channel distribution conflicts between retailers and Lotus's direct sales efforts. Although Lotus established its key dealer program to furnish major retailers with corporate sales leads, I believe that Lotus's direct marketing efforts exerted margin pressures on dealers' sales."

Lotus will still compete against itself, Crummey admitted, although the competition will now be entirely indirect. Lotus is continuing to sell its original 1-2-3 product and the follow-on Symphony program through hardware oems such as Hewlett-Packard and through software value-added resellers like Management Science America and Computer Corp. of America, he says. Many of those firms will sell Lotus products into the same accounts that the dealers are being encouraged to penetrate.

"There's always some channel conflict," he says, "but a two-way conflict is better than a three-way conflict."

Under the new program, Lotus will not make any direct sales to corporate accounts. Large users hoping to buy the 1-2-3 or Symphony products directly from Lotus will be given a list of authorized dealers in their geographic region, with key dealers highlighted, and told to work through the dealer.

"In our experience, it's not an issue of where the order is placed or how it is fulfilled," says company president Mitchell D. Kapor. "I don't expect to lose a single account because of where the order is placed.

"The key issue is support and service, and we have a whole portfolio of activities designed to make the customer feel confident about service wherever he buys the product from," Kapor says. He explains that some 45 of Lotus's 2,000 authorized dealers are listed as key dealers, meaning that they have met "rigorous standards such as having an outside direct sales force to large firms, in-house training, on-site support, and other activities."

Lotus will also provide educational seminars, maintenance, and other services to the national accounts, he says.

"The program will benefit both dealers and users," Kapor adds. "Dealers will benefit from increased training, a potential $10 million to $15 million windfall from 1-2-3 trade-ins for Symphony, and increased traffic through their stores. People may stop and buy peripherals or other items while they're inside. The corporate accounts will be happier because they will have a local source and will be able to benefit from a richer program of seminars, courseware, hot lines, and other forms of support."

More than half of the Big Eight accounting firms purchased 1-2-3 directly from Lotus.

Industry observers agree that Lotus's move will not jeopardize many of its accounts. Readerman of Smith Barney notes that Lotus's Corporate Accounts Program accounted for only 10% to 15% of Lotus's $53 million in revenues in 1983. By comparison, fully 26% of Lotus's sales came from the ComputerLand chain of retail stores, with another 22% coming from the Softsel distributorship.

Nonetheless, he warns, the accounts that dealt directly with Lotus are significant: more than half of the Big Eight accounting firms and more than 100 of the Fortune 1,000 corporations purchased 1-2-3 directly from Lotus. (Symphony was scheduled to reach dealer shelves by July 2, although Kapor said that Softsel and other distributors had in May signed large contracts to carry the product.)

Lotus's abandonment of the direct sales channel is a bitter pill to take for many vendors, say industry analysts, because they had followed the example of large systems vendors and insisted that a direct sales

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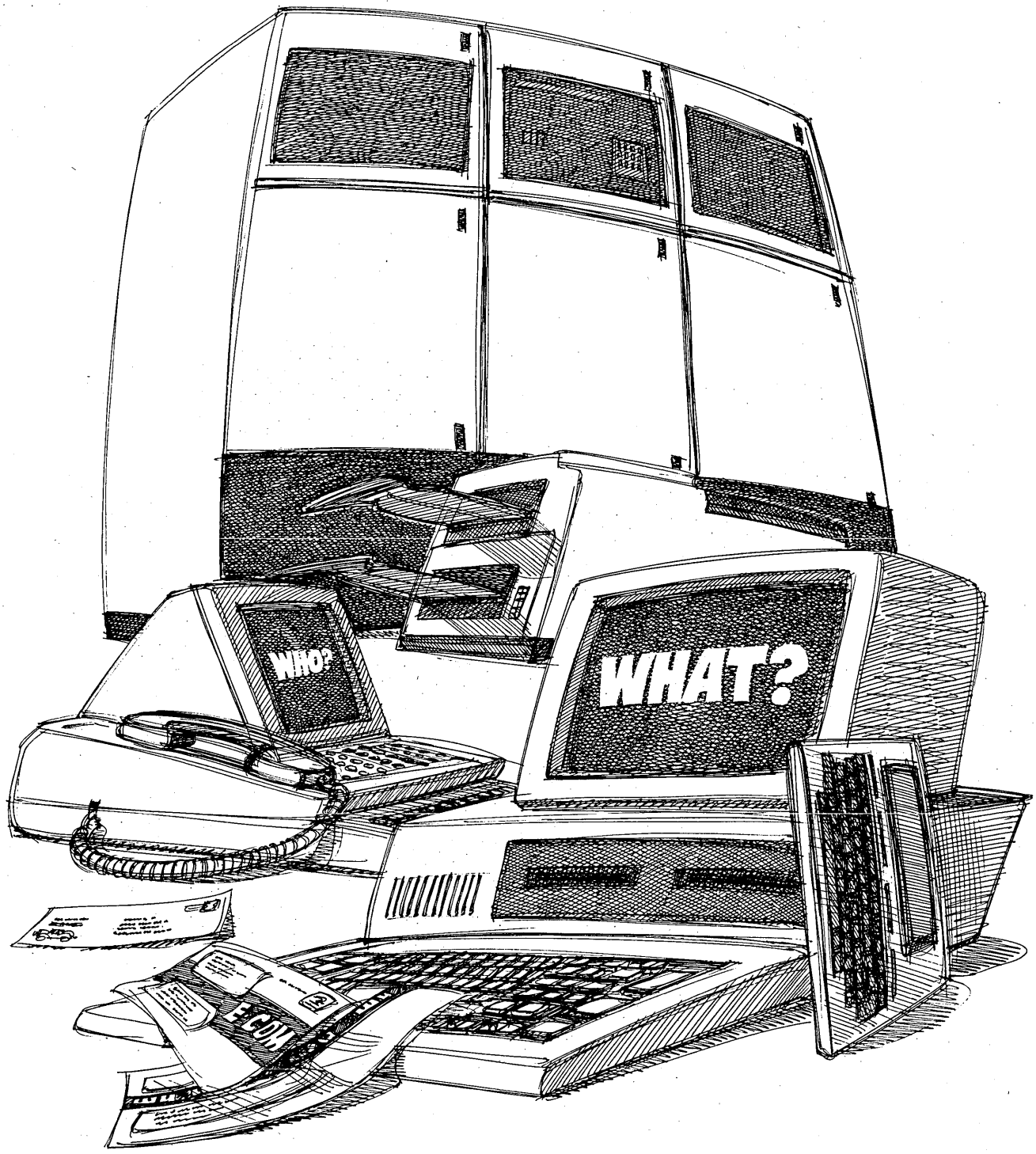

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force was the best way to reach the corporate market. Indeed, Readerman says, "the Corporate Accounts Program was a contributing factor in expanding the 1-2-3 user base and making 1-2-3 the number one productivity tool for the business market."

Small wonder, then, that many firms followed Lotus's example and set up their own direct sales forces. "More and more, software firms have been going to direct sales to national accounts," says Chris Yalonis, director of the microcomputer group at Creative Strategies International, a San Jose, Calif., market research firm.

But following Lotus now and taking the dealer route may not be the answer either, because a reduction in channel conflicts will almost certainly lead to clogging of existing channels. Dealers can only stock a limited number of product lines, notes Richard Crouch, president of the California DataMart in San Francisco. Moreover, he adds, "the existing dealer channels are also limited by the experience of the salespeople and by the competition for their share of mind. They can only spend a limited amount of time learning new products or they're not going to be able to spend any time selling them."

Vendors are tripping over each other to find ways to spend vast sums of money on gimmicky promotions to sell new products.

Dealer training programs, Crouch says, can only work if the dealers have the time and desire to be trained. "They are going to emphasize products that maximize their margins and inventory turns, and minimize the selling costs. They will sell down the path of least resistance."

Software vendors will find the dealer channel particularly turbid since the margin per unit sold is about one sixth that for hardware products, he says, and because "80% of a dealer's software revenue comes from six to 10 titles. New vendors will have an especially difficult time marketing their products if they base their marketing strategies on dealer training programs" and similar attempts to woo retailers.

These factors have been building for several months, and the most common recourse so far has been an unfocused one-upmanship approach. Vendors are tripping over each other trying to find new ways to spend vast sums of money on increasingly gimmicky promotions for new products, without making any effort to target specific niches of the market. Ashton-Tate, maker of the popular dBASE II DBMS package, spent $8 million to launch its Framework product, Yalonis says. Crouch notes that the average entry cost—just for promotion and marketing—for a new software product is in the range of $2 million to $4 million. Hardware vendors will need to pay about twice that, he adds.

"Spending megabucks on promotion is a necessary but by no means sufficient activity in introducting new products," states Lotus's Kapor. "There is no guarantee that it will ensure success."

Yet there are less expensive ways to reach the market more effectively, industry observers say. Both Digital Equipment and Computer Associates International have adopted new methods of selling microcomputer hardware and software.

Digital recently completed a reorganization of its pc marketing, so that it now markets the same products through four different corporate organizations to four different markets. Each of the four has several channels of distribution at its disposal, so that DEC can cope with clogging in one or more of them without serious detriment, says Ward D. MacKenzie, vice president of DEC's Business Computer Group, which has responsibility for selling all pc and minicomputer products through all channels targeted at corporations with under $100 million in annual revenues.

Similar groups exist for selling the same products to commercial and technical oems, and directly to the largest corporations. "If a large company wants to buy 5,000 pcs or copies of a DEC software program, we'd prefer to sell it directly to them," MacKenzie says. "It's easier because you have centralized accounting and support and service. If you're in a smaller organization and want to go with a dealer, then we can support you that way also."

Digital's multichannel approach will not cause undue conflict among the channels, he says. "That's the black art of management. The customer requires that all channels be open even if they conflict, and we have to participate in all of them or we cannot win in the market."

The Maynard, Mass., firm cannot abandon its direct sales force the way Lotus has, MacKenzie says, because even when dealing with small departments within large organizations there is often a centralized chain of command to which DEC needs to be sensitive.

Dealer training programs can only work if dealers have the time and desire to be trained.

"Dealing with a small corporation is not the same as dealing with a department the same size in a larger corporation. In the large corporation you're still dealing with an MIS department with its input and some remote networking needs and data transport issues. The dp environment in a small corporation is very different from the environment in the department of a large organization, and that's important to us. It may not be as important to a micro software vendor," he explains.

Computer Associates International, the Jericho., N.Y., mainframe software house, has taken yet another approach: it has acquired two leading micro software firms, Information Unlimited Software of Kansas City, Mo., and Sorcim of San Jose, Calif., and will integrate their marketing departments into its own. The IUS and Sorcim software thus completely avoids the traditional micro software distribution channels and finds its way directly to large users via CA's mainframe software sales force. The drawback is that CA will have a difficult time marketing the software to non-CA users, limiting the potential size of the IUS/Sorcim market. Similar approaches have also been taken by MSA with its Peachtree unit and by Dun & Bradstreet with its McCormack & Dodge subsidiary.

Other approaches are also being tested by worried vendors. Crouch reports that his California DataMart, Boston's Boscom, the New York Computer Center, and Dallas's Infomart are all signing up permanent tenants even as the buildings are being constructed. "The mart concept restores direct selling to the publisher, but without the cost of direct sales," he claims, because the mart brings the buyer to the seller. "The average cost of a direct sales contact is about $200, compared to a cost per contact for a mart of $20 to $30."

Electronic distribution is expected to account for 7% of all business software sales by 1987.

Still other vendors are experimenting with electronic distribution. Yalonis of Creative Strategies, in a report about to be published, has found only "sparing" use of electronic distribution at present, but he says that up to 7% of all business software sales will be through that channel by 1987. "It's no panacea because it has problems with shipping documentation," he adds, "but it offers immediate updates, eliminates the middleman, and has some other advantages that other channels don't."

Clearly, all of the available channels for marketing micro products have their problems. Yet to be successful, vendors in most cases do need to participate in the major channels at whatever cost. That cost is high now, but will almost certainly grow higher as the market expands. "The market is growing very fast," says DEC's MacKenzie, "and there's room for a lot of vendors. The software vendors are frustrated now because they have a product and they see the size of the market, but the channels don't yet exist to get the hardware out there. The supply and demand are both there, but the distribution needs to be worked out." ✲

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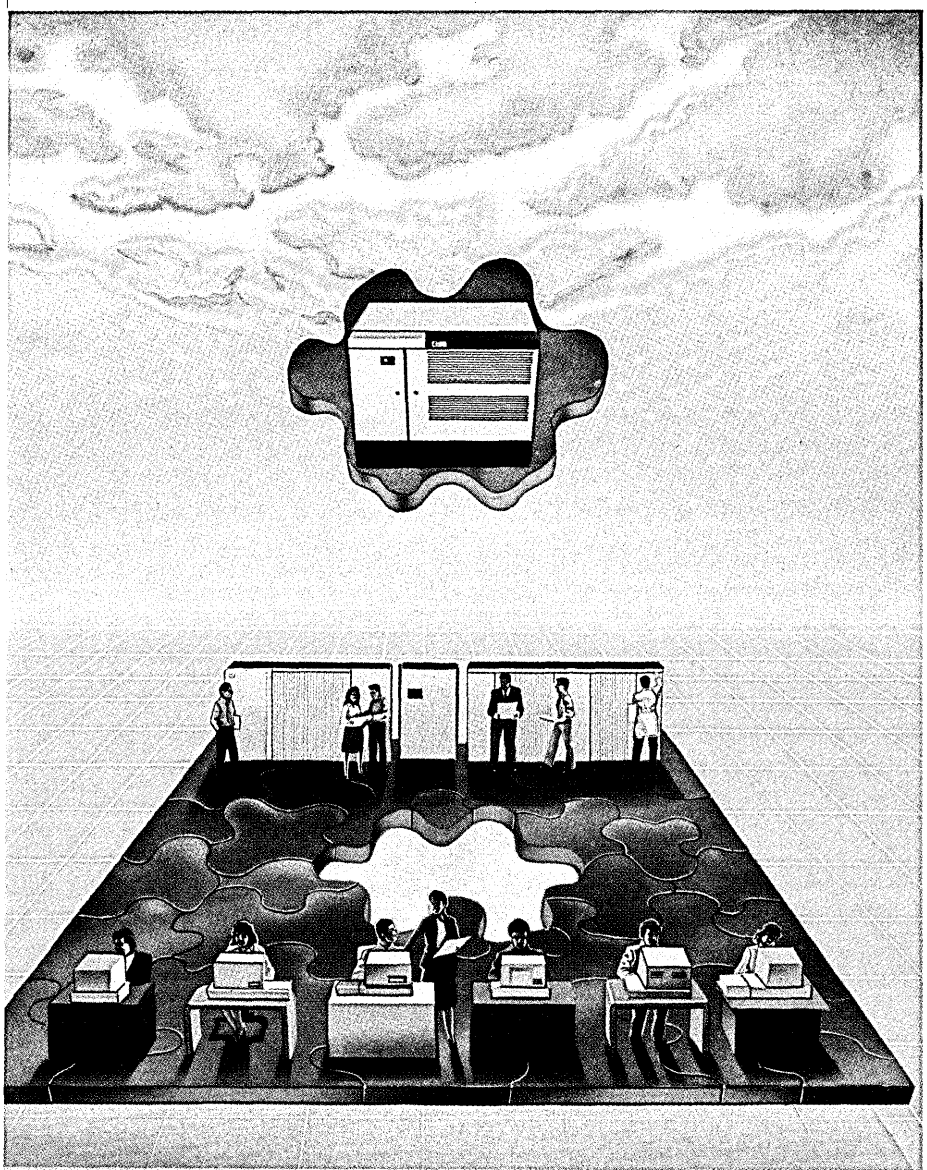

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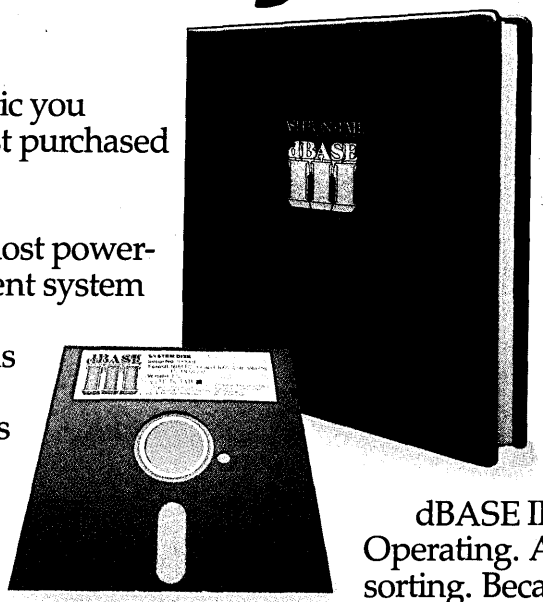

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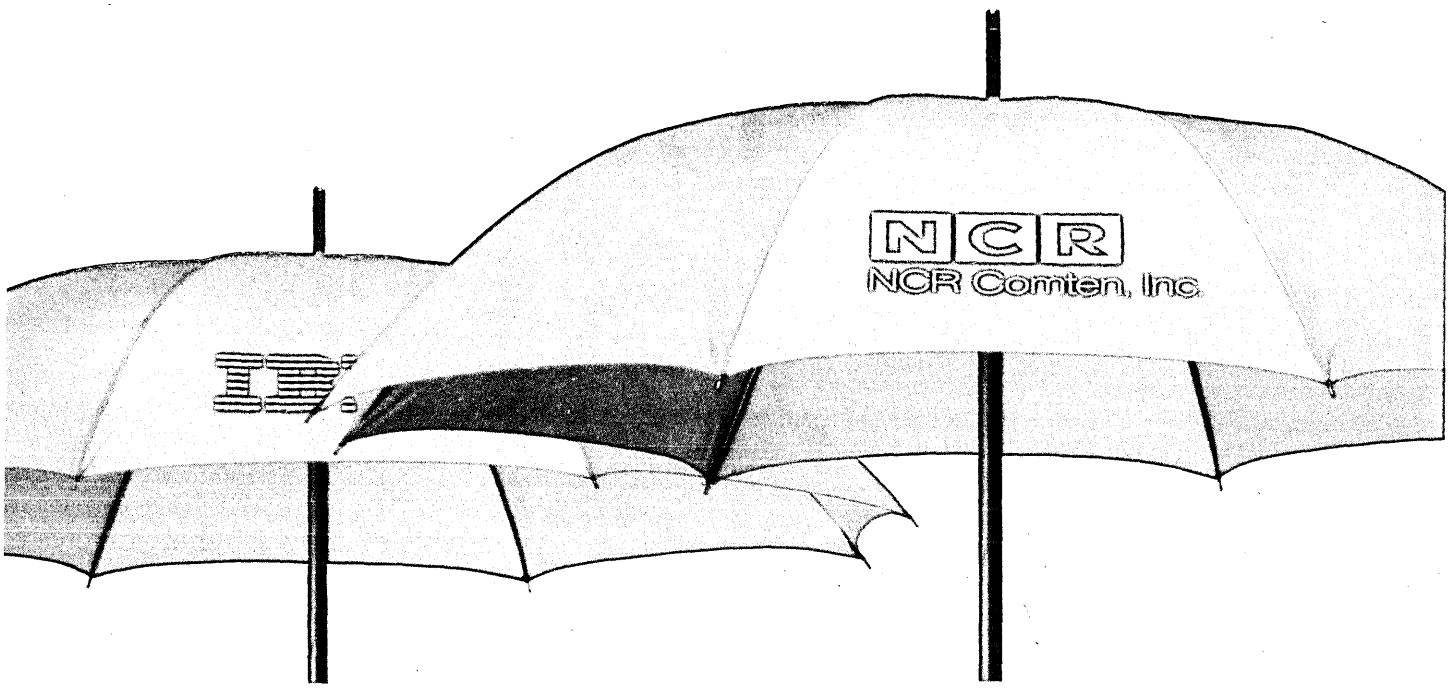

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WASHINGTON

BIG PLANS, NO ACTION

What was to have been an "impeccable" voice for the computer industry choked before it could open its mouth.

by Willie Schatz

The Information Age Institute came into this world with trumpets sounding and drums rolling.

It was going to ease society's adjustment to technology in the workplace. It planned to undertake a "credible" public relations program on everything from video display terminals to privacy. It was touted as "an independent agency with impeccable credentials."

It was never any of the above. And after the heraldry surrounding its birth, it didn't even get a decent burial.

"The idea for the institute springs from events surrounding our experience with visual display legislation," the Computer Business and Equipment Manufacturers Association (CBEMA) announced last December.

"It quickly became apparent to us that ignorance of the facts surrounding the introduction of technology into the workplace produces fantasies and fears that discourage people from using technology with the potential to help them.

"Only an independent agency with impeccable credentials can hope to undertake a credible educational campaign. And as public debates careen from visual displays to technology and employment to privacy in '1984,' we clearly see the vital need for such education. Interest in the institute has been very high," the trade association stated.

Then it must have gotten very low in a hurry. There wasn't exactly an *Indiana Jones* line waiting to get in the IAI's door. Only CBEMA and the National Electrical Manufacturers Association (NEMA) parted with initial funding. CBEMA's expectation of support from its members never came true, although IBM reportedly offered oral support. But CBEMA's members apparently never signed a single check to get IAI off the ground.

You'd never have known it from the association, though. As late as May 21, it announced that IAI was open for business and would address information technology issues. It would also sponsor a variety of research projects and make the results known to the public.

"Membership will expand to include companies, association, unions, and individuals with a common interest in information technology," CBEMA said.

Eight days later, the IAI was pronounced dead. It closed its doors June 30, giving it a life span of less than six months. Officially, the cause of death was a lack of funds. Unofficially, it was a fatal case of sponsor uninvolvement.

"It was a question of timing more than anything else," CBEMA president Vico Henriques says.

"We organized it too early. Companies look at the nature of the beast when they're deciding their priorities. The IAI was intended to be a 501 (c) (3) organization [thus making tax-deductible any contributions to it.] That takes a lot of time. I think companies were reserving judgment on it until that was finished."

"It was represented to me that a certain number of organizations would come on board as soon as the IAI had opened its doors, which we did on Feb. 6," IAI president Carol Lee Hilewick says. "I know there was a big difference among CBEMA members on how to handle the issue. But it doesn't appear to me that the fund-raising and contacting was performed at the necessary high levels within the CBEMA companies."

"We can't respond to that," CBEMA director of communications Charlotte LeGates said when asked if CBEMA had lined up IAI members before announcing its formation and opening. Nevertheless, all the evidence seems to indicate that CBEMA failed to do either its fund-raising or its priorities homework among its members.

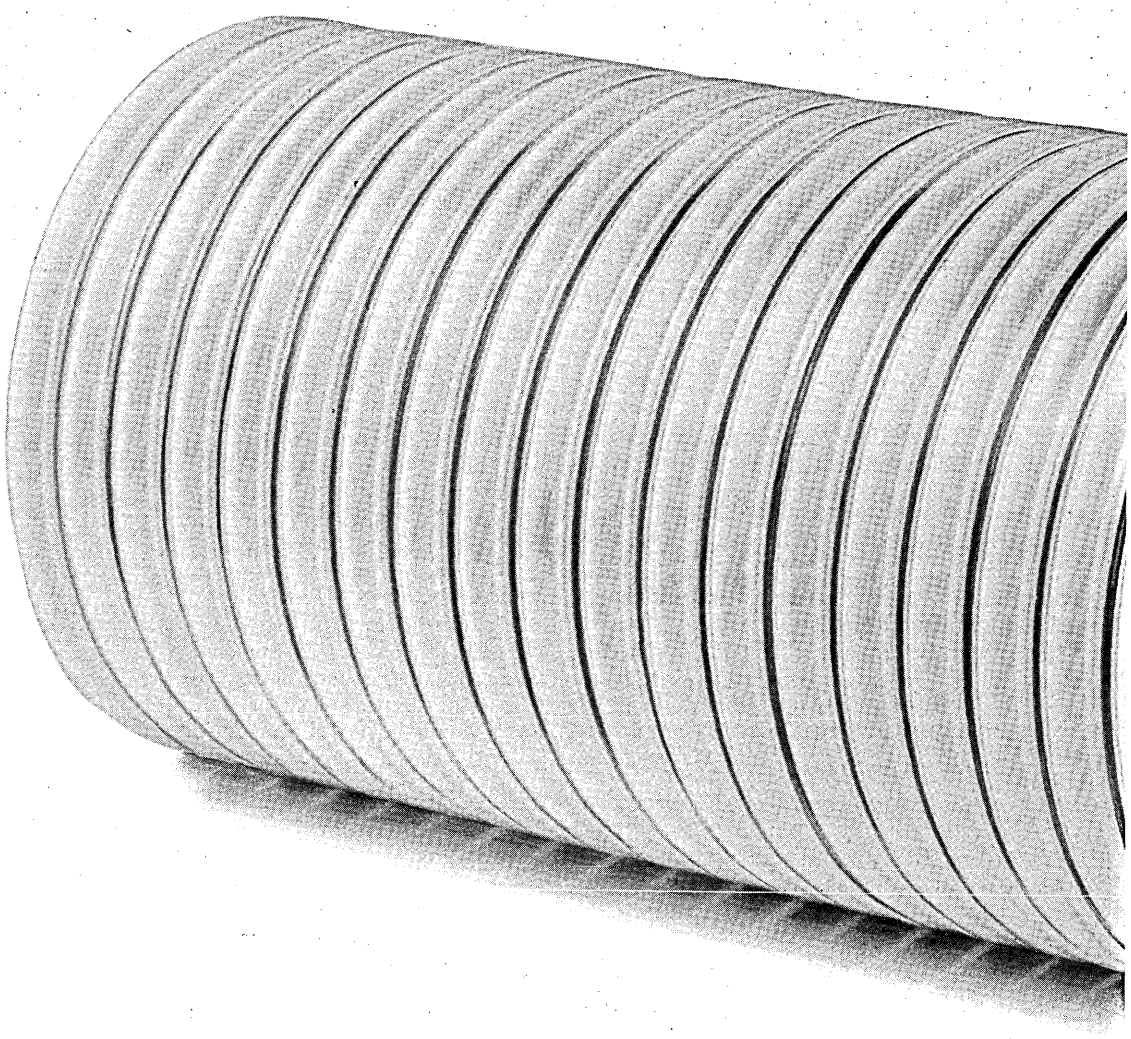
"It was a question of timing more than anything else," says CBEMA's Vico Henriques. "We organized it too early."

Hilewick and CBEMA had been talking about IAI since last summer, when Hilewick was executive director of the U.S. Council for World Communications Year. Convinced that the IAI was the place to be, Hilewick left AT&T, assembled a staff, and started down the arduous fund-raising road.

With CBEMA's backing, the IAI in late March developed a 15-page prospectus outlining goals, objectives, and activities. The institute was to "promote broad societal goals through impartial research and public education aimed at raising levels of public- and private-sector understanding of the nature and effects of the new information and communications technologies."

Objectives included higher levels of technology-based employment; a computer-literate, technology-competent work-

For fast relief



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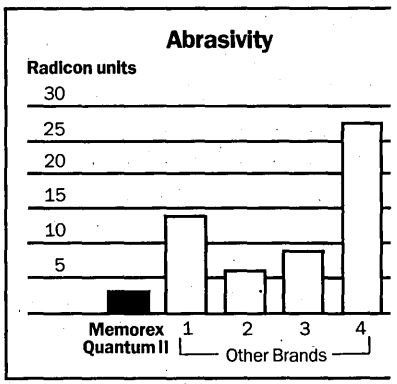

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force; an enhanced work environment; and informed use of technology. The IAI as of May 15 had circulated a research proposal to evaluate available evidence of VDU effects in the workplace.

A 19-person board of directors was planned. Five seats would be occupied by representatives of manufacturers and users.

Three seats each were allotted for associations, universities, and foundations. Memberships were to be available at $10,000 for manufacturers, user corporations and institutions, and trade and labor associations. Professional and scholarly associations and universities and foundations could join for half as much.

That never came to pass. An interim board of directors, consisting of Henriques, CBEMA executive vice president Oliver Smoot, CBEMA senior director Bill Hanrahan, and NEMA vice president Bill Rowland was formed, but they apparently didn't have enough friends in high places, or didn't talk to the ones they had, even if IBM was on their side.

"When we looked at our priorities, IAI wasn't at the top of our list," explains Hugh Donaghue, who is Control Data Corporation's vice president of governmental relations and international trade development.

"We don't consider this a significant loss," Henriques says. "We still have a corporate structure."

An IBM spokesman says the company supported the concept of IAI "because we saw the need for an activity that could explore various information industry issues within as broad a constituency as possible. IBM continues to believe that such an activity would be useful and beneficial."

So do other major players, from Henriques to Hilewick. If IAI has lost its heart, it hasn't necessarily lost its soul. The corporate shell lives on, albeit homeless and unpopulated. While IAI may have died unmourned by its creator, its issues remain very much alive.

"We don't consider this a significant loss," Henriques says. "We still have the corporate structure. If the thing looks like it will take off, fine. We'll just let it sit for now. I think the things it focused on will get done in any event."

"The concept is still valid," Hilewick contends. "I'd like to find an opportunity to prove it. It's definitely a loss. We started something that could have made a lot of things happen. We just weren't given a chance to do more than open up.

"There's not a day that I don't get a call about doing something through IAI. I've just had to turn it all off."

It won't be easy to turn it on again. ✱

DATA COMMUNICATIONS

IT'S IN THE MAIL

Electronic mail, that is, where a small but potentially decisive standards battle is brewing.

by Willie Schatz

The standard line about standards these days is that they're easy to love because there are so many of them. You wouldn't think two is a whole lot. It's one too many for message handling, though.

Message handling is just a fancy name for electronic mail. The idea is that sending a message via computer should be easier, faster, and less mistake-prone than the current manual method. Naturally, neither rain, snow, sleet, nor gloom of night would stay electronic mail from its appointed rounds. This wonderful world will only come about when there is one way, and only one way, to send messages among the machines that comprise the public data networks. Right now there are two, and therein lies the tale of how deviatory this standards business can be.

In one corner is the National Bureau of Standards' (NBS) Federal Information Processing Standard (FIPS) 98. Opposing it is the International Consultative Committee on Telephone and Telegraph's (CCITT) X.400 series. Both believe their standard is the one that should be used for computer-based messaging. After taking an early lead, NBS has suffered.

Actually, the two organizations aren't that far apart. They disagree only on the encoding procedures for message handling. But that's enough to have caused consternation among vendors and conflict between the standard setters.

The problem stems from NBS staying home and CCITT doing some hard traveling. FIPS 98 is designed for U.S. government procurement, which is standard NBS procedure. The X.400 series is geared to the international market and purportedly will be to electronic mail what X.25 is to packet switching.

"FIPS 98 is referenced by government agencies in the procurement process," explains Chris Ware of the National Telecommunications Information Agency (NTIA) and chair of CCITT's Study Group 7, which has taken the organization's penultimate step by approving the X.400 series. "CCITT is an international organization. The people who look at its product are manufacturers all over the world. They're interested in PTT business as well as U.S. business."

In the draft recommendations for the X.400 series, which will be rubber-stamped by the CCITT plenary session in October, the study group notes that the establishment in various countries of telematic services and computer-based store-and-forward messages "creates a need to produce standards to facilitate international message exchange between subscribers to such services."

Funny, that's just what NBS thought it was doing.

"If we didn't think FIPS 98 was a satisfactory standard, we wouldn't have put it out," says Jim Burroughs, director of NBS's Institute of Computer Science and Technology. The standard has been around since September 1982, when NBS first solicited comments on its draft proposal.

While NBS was circulating its draft, CCITT was putting its ideas on paper. It produced its own draft and, apparently because of its international composition, wrested the initiative away from NBS.

"The Canadians really did us in at the CCITT meeting," Burroughs charges. "We weren't at the meeting, but we knew what was happening. We didn't understand their motives. We tried to make our standard the same as theirs, but we couldn't."

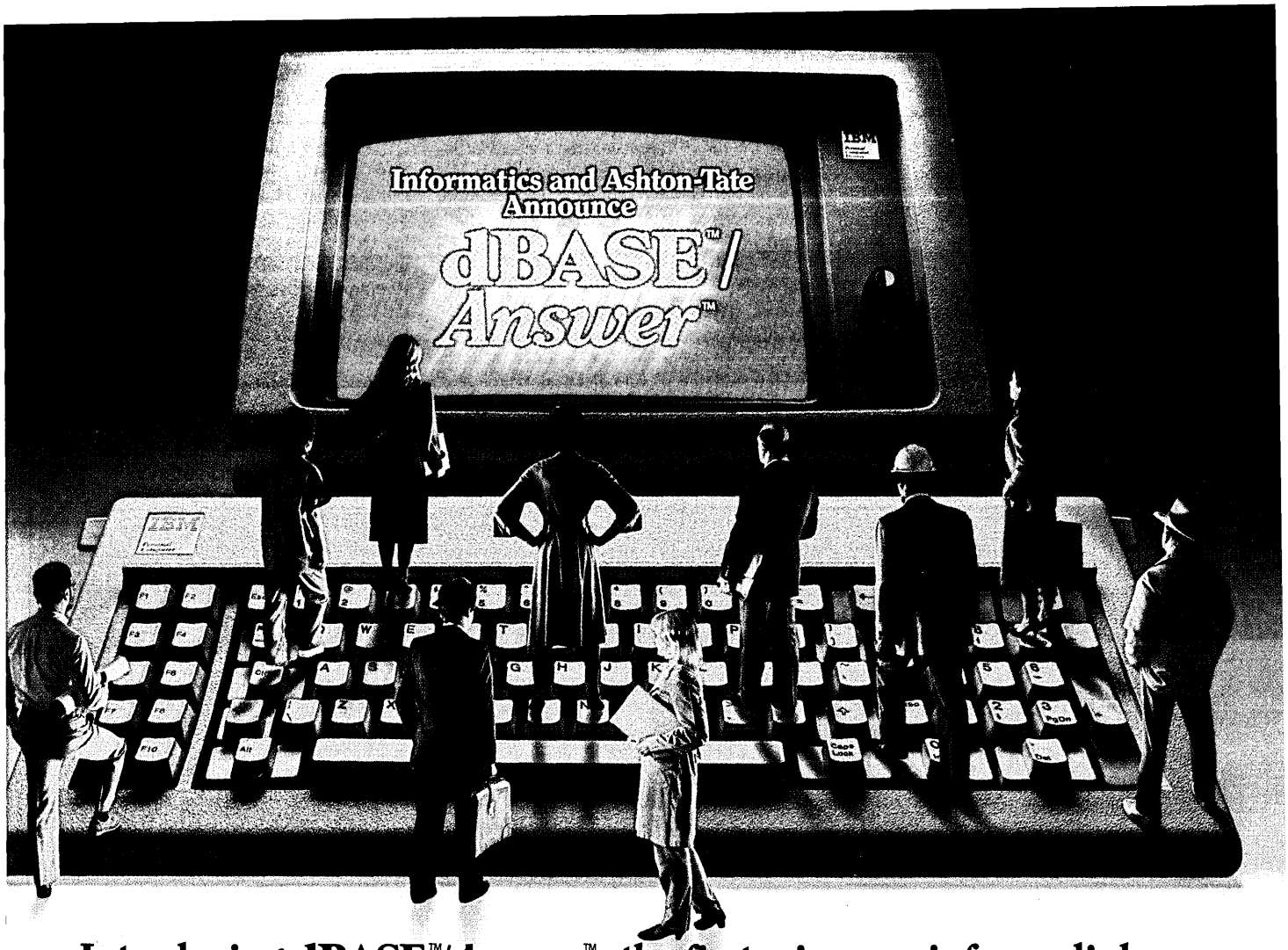
"NBS was most definitely involved," says Ian Cunningham of Canada's Bell Northern Research, who served as the CCITT special rapporteur on message handling. "We had the solid support of all the U.S. attendees. FIPS 98 didn't address the envelope issue. CCITT did the envelope issue first, then message transfer. NBS went the other way. The electronic mail community needs more than protocols. It needs an infrastructure, which CCITT can provide and NBS can't. And NBS wasn't addressing the compatibility issues of the telematic services, such as teletext and facsimile.

"If we didn't think FIPS 98 was a satisfactory standard, we wouldn't have put it out."

"NBS was a marvelous catalyst and idea generator. But it's not an international standardizations body. It wanted CCITT to adopt FIPS 98 lock, stock, and barrel. There was a bit of idealism by the NBS people. I think they had a hard time accepting the fact they weren't going to get everything they wanted. I also don't think they're in love with me personally."

NBS also isn't thrilled at the prospect of telling the whole world—or at least the part that reads the Federal Register—that it may say hello to X.400 and goodbye to FIPS 98. An announcement in the Federal Register soliciting comment from industry on which direction it wants to go was expected by late June.

"We don't want to back off," Burroughs says. "We will put out an an-



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nouncement asking industry what they want us to do. We'll circulate it around the government, too. I think if people want us to move to X.400, we will. But before we put out FIPS 98, we had a lot of discussion with industry. I imagine they feel chagrined about this."

That's just his imagination running away with him. Most of industry seems to be rooting for CCITT. The Electronic Mail Association, composed of the biggest in the business, strongly supports the adoption of the CCITT standard and has urged NBS not to publish a separate standard. According to Cunningham, among the major North American vendors rooting for CCITT are AT&T, Northern Telecom, Xerox, GTE/Telenet, and ITT/Dialcom. A number of manufacturers are reportedly readying or enhancing products to support the X.400 series.

"CCITT's work extends and improves FIPS 98's architecture," IBM's Roger Forte says. "Its scheme in X.409 [the presentation transfer syntax and notation] is a definite improvement over FIPS 98. This current conflict between them is reasonable because we're all trying to get one standard. It costs a lot of money to implement multiple standards."

"If you want to support both, that means building a protocol converter," says Paul Bartoli of AT&T Information Systems. "One standard can't communicate with the other without a translator. They look the same, but they're not. Right now I'd say CCITT has the edge, especially internationally. CCITT isn't going to adopt FIPS 98. Whichever standard impacts the bigger market is the one people will go with."

By that logic, CCITT is a lock, since FIPS 98 applies only in America. That was good enough for at least Digital Equipment Corporation, which built the Router system based on FIPS 98. MCI uses that system for its mail service. Burroughs claims that seven companies were producing products conforming to FIPS 98 specifications, although it's unclear whether anyone has actually gone through the procurement process with FIPS 98 as the standard.

Those companies now may have to eat those products, especially if NBS is forced to beat a hasty retreat. If NBS does indeed follow what appears to be the strong industry sentiment, FIPS 98 will be a zero.

"FIPS 98 isn't going to solve the U.S. government's international connection problems," Cunningham says. "If the government says its agencies must implement FIPS 98, how are they going to communicate with users and corporations using the X.400 series? How are they going to communicate overseas? CCITT is building a worldwide electronic mail system. FIPS 98 is just a federal procurement standard."

"If there had been an international standard at the time we promulgated FIPS 98, we would have accepted it," Burroughs says. "Our differences aren't necessarily serious, but they're clearly there. We've got an outstanding problem. The solution depends upon how popular the CCITT standard is."

It appears to be the chosen one at the moment.

"We put FIPS 98 on the shelf to gather dust," says Doug Corman of Computer Corp. of America, Cambridge, Mass., which sells the private electronic mail system Comet. "There's pressure on manufacturers to do something with CCITT standards. All PTTs require it. There's no pressure [in the U.S.] to comply with FIPS 98, but no one will be selling to a PTT in two or three years unless they have CCITT-compatible products."

Says Bell Northern Research's Cunningham, "FIPS 98 isn't going-to-solve the U.S. government's international connection problems. If the government says its agencies must implement FIPS 98, how are they going to communicate with users and corporations using the X.400 series? How are they going to communicate overseas? CCITT is building a worldwide electronic mail system. FIPS 98 is just a federal procurement standard."

To which NBS's Hefner replies: "Our intent is to be compatible and use the international standard. We have to harmonize the requirements for U.S. manufacturers in a worldwide market and the need for the cheapest and best service for U.S government. We will make sure that the American manufacturers who supported us will not be jeopardized or damaged. If industry or current users of FIPS 98 would like to see us migrate to the international standards, we will do it gracefully."

That does it for the U.S. government. But not for the rest of the world. ✱

IMPORT-EXPORT

A MODEM MOVING STORY

Confusion reigns as suppliers and customers try to sort out U.S. export controls.

by Willie Schatz

So Cable & Wireless Systems (CWS) didn't mean what the Department of Commerce (DOC) said it did. So U.S. export controls aren't quite as blameless as DOC alleges they are.

Chalk it all up to a gigantic international failure to communicate.

The whole thing started with a cable from foreign commercial service officer Lyn Edinger in Hong Kong describing a meeting among DOC, the General Accounting Office (GAO), and CWS officials regarding the effects of U.S. export controls on foreign business (see "A Noisy Turf Battle," May 1, p. 38). By the time it was finished—if it is indeed over—DOC had performed an internal study absolving export controls as the raison d'etre for CWS's apparent decision to jettison U.S. suppliers for foreign ones.

When the original cable appeared in print, DOC was less than pleased by CWS's remarks as reported by Edinger. CWS general manager Chris Cox was quoted as saying, among other uncomplimentary things,

"We had a lot of discussion with industry. I imagine they feel chagrined about this."

that "obtaining timely decisions on U.S. licenses is totally unpredictable"; that U.S. products constitute an "unacceptable risk"; that "once people turn away [from U.S. suppliers] and find out there are other sources, they're not going to turn back"; and that CWS had implemented a policy of nonselection of U.S. products two weeks before the meeting. Perhaps most jarring was Cox's assertion that "due to a series of embarrassments caused by delays and confusion in export licensing we have moved away from U.S. products and by next year we may not be taking any U.S. equipment at all."

DOC came back with two pages of its own. John Boidock, director of the Office of Export Administration (OEA), received a report from OEA director of policy David Schlechty discounting export controls as a reason why CNS would stop using U.S. equipment. Schlechty reviewed the licensing procedures for Harris Corp., Racal-Milgo, and Emerson Electric and found them to be timely with few exceptions.

"Although there were a couple of instances of delays, primarily because the import certificate of other information was not adequate, the cable from Hong Kong is not supported by the fact," the report says. "This is an example where the vast majority of the cases were efficiently and expeditiously processed, and a very small number of cases—two or three—were not. But those are the ones that are remembered."

One of the protagonists remembers more than that.

"That cable was inaccurate in a number of respects," says CWS's Cox. "We were misquoted where we made reference to substituting Italian modems for the ones we were importing from Racal-Milgo. That's not true, and we've made our peace with the supplier. We also are not substituting Japanese and British equipment for

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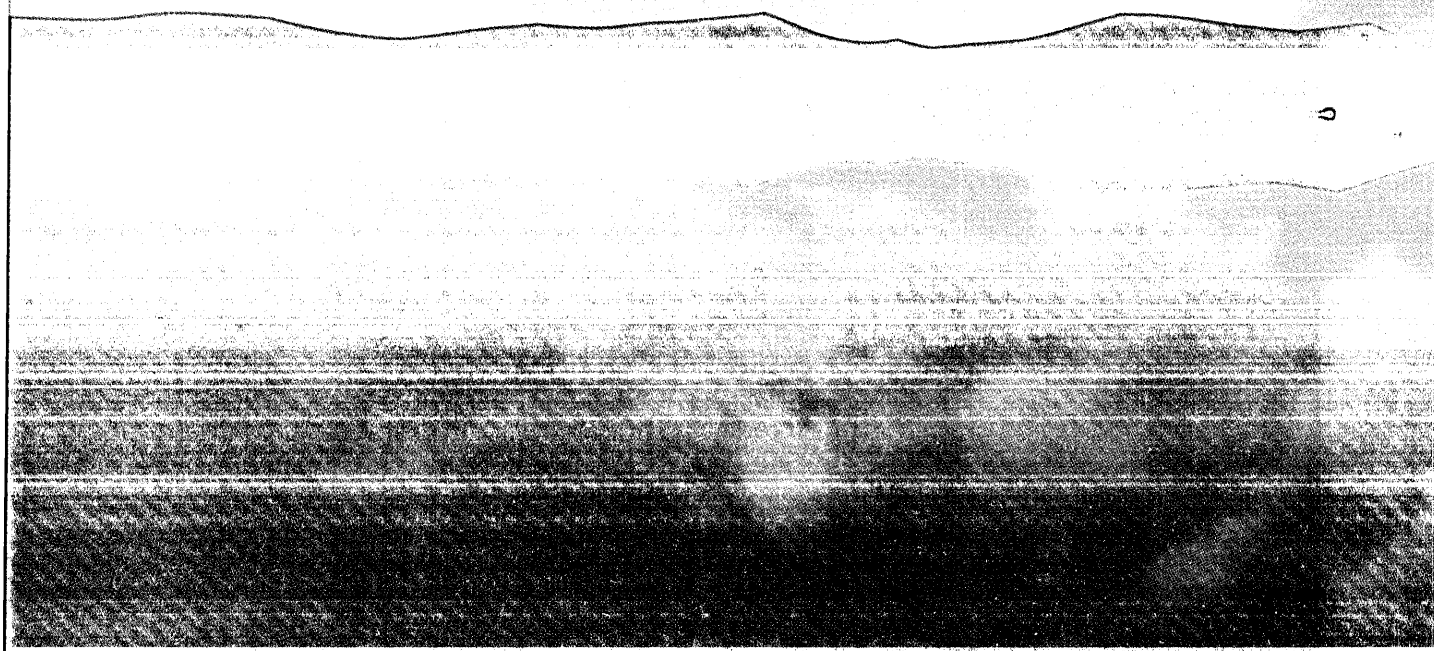

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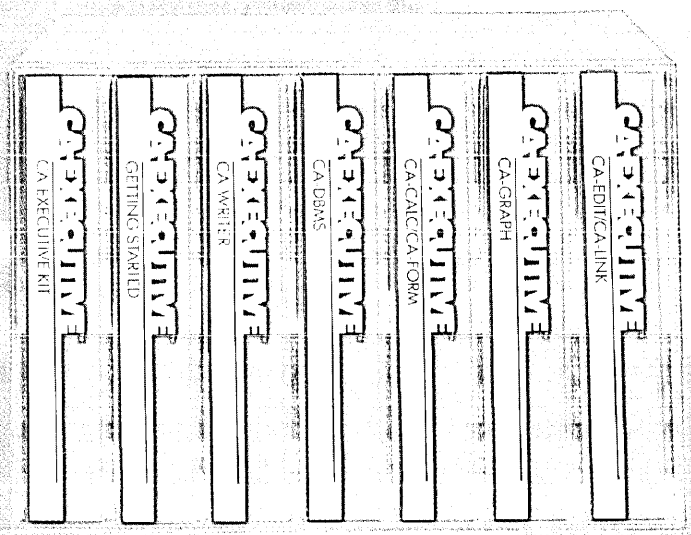

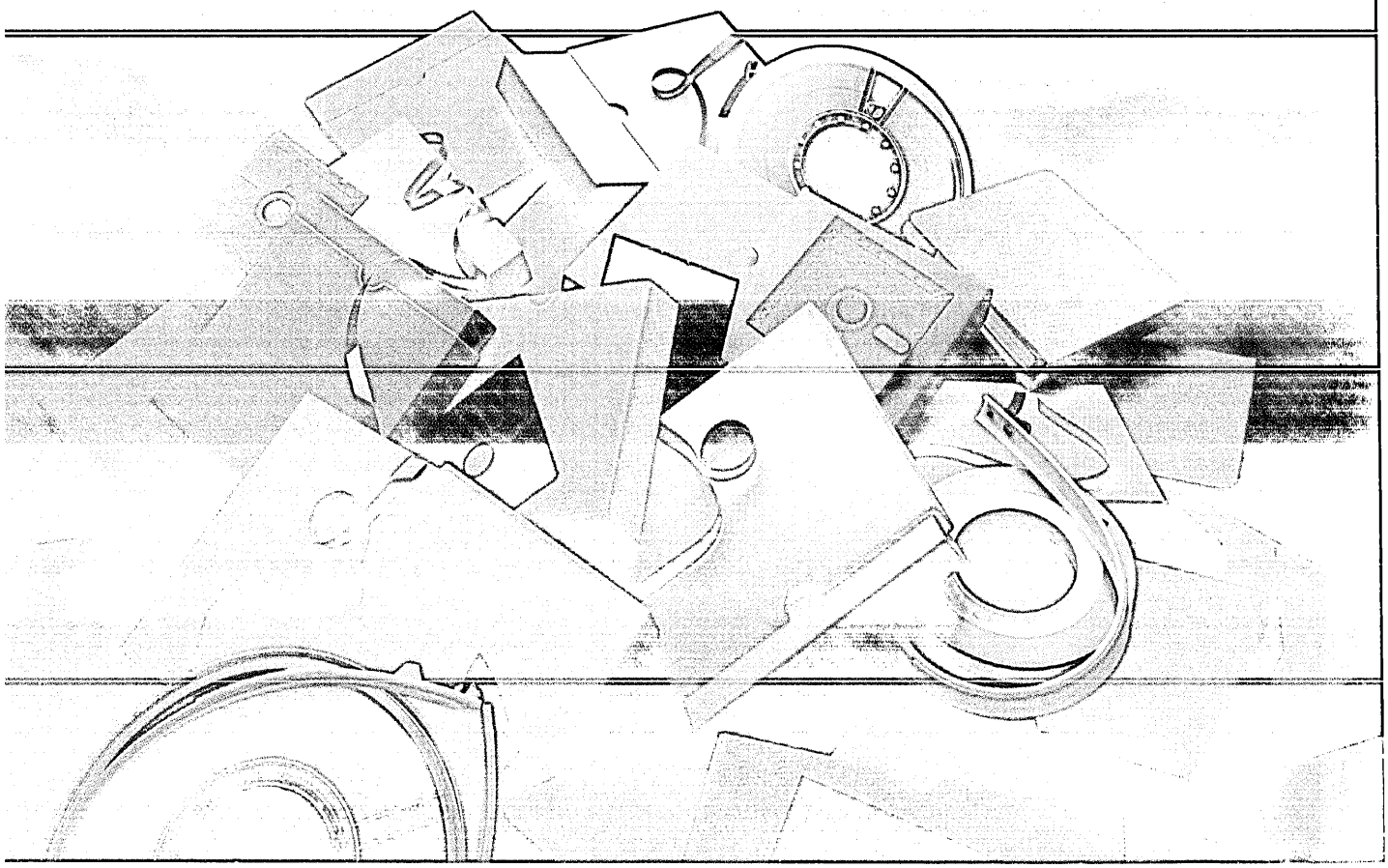

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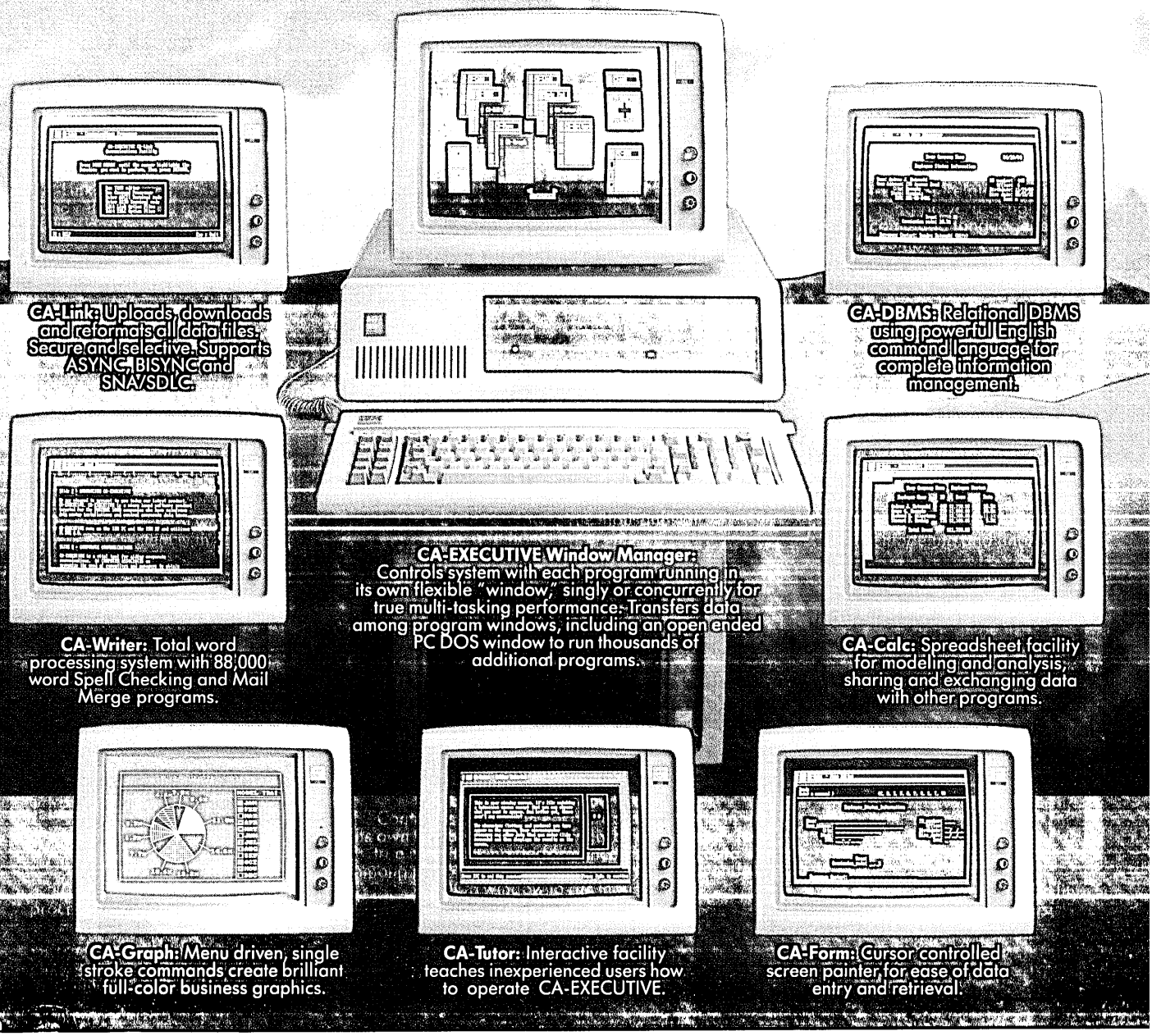

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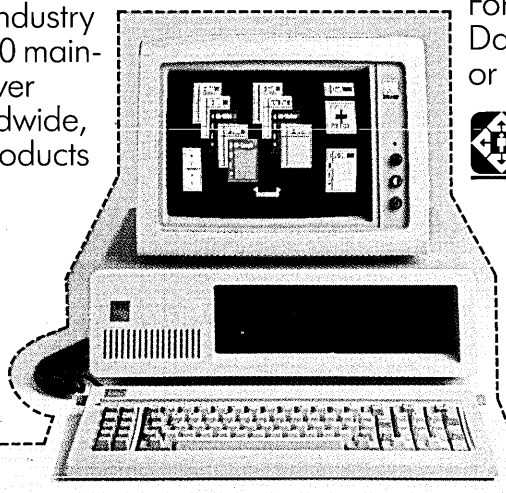

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American products. There have been no major changes in our trading patterns.

"What we were referring to in that meeting was the [Jan. 19] Department of Commerce proposal to tighten distribution licenses," Cox continues (see "Export Laws on the Line," March, p. 38). If there's a major tightening up and conditions get worse, we may have to make a major change in our trading patterns. We were talking not about the present but about what worries us in the future. We might have to change our pattern if we're forced to."

According to the OEA report, CWS has nothing to fear. The Digital Telephone System Division of Harris filed 22 separate applications over a 16-month period. The aggregate value was about $750,000, with specific applications ranging in value from $2,000 to $80,000. Most were approved in 10 to 20 days, although Schlechty acknowledges "special problems" on two applications in late 1983. One license was turned down twice in four months, then never resubmitted. The other was granted after 46 days, according to the report.

That's not all, folks.

"One of the straws that may have broken the camel's back is a case destined for the PRC [People's Republic of China] via Hong Kong. The case was RWA'd [returned without action] after 43 days," the study notes. The study also acknowledges that CWS was correct in at least one instance with its complaint of a 6 to 9 month delay on Harris equipment for the PRC. About $25,000 worth of telephone switching equipment, similar to what Harris had been exporting to Hong Kong, took most of 1983 for OEA approval. The study attributes the delay "to the redefinition of our China policy." That redefinition has caused the PRC to rethink its business relationship with CWS.

"In those long cases we had no indications of when the license would be granted," Cox says. "On a day-to-day basis with those customers, we were just trying to hold on. It was always tomorrow, tomorrow, tomorrow.

"We held on to the PRC, but they weren't very happy. We didn't lose that particular sale, but whether we make another or not is open to question. I suspect it has already damaged our business with that customer. I'll be surprised if he approaches us again." Don't blame OEA. It did its job.

"Perhaps licensing performance could be improved by reducing the turnaround time slightly, perhaps by a week, but on balance the performance seems good," Schlechty wrote. He concluded there was no evidence to support CWS's view that a regional communications network for the Bank of America (Asianet) is being "held up solely by delays in the supply of Racal-Milgo modems" owing to U.S. export controls.

"Our study revealed that even the licenses that we might concede took longer than they should have did not take an inordinate amount of time," Boidock of OEA contends. "Maybe one day is unacceptably long to CWS. I don't know what is. I'm talking about time periods that are less than 20 days. I don't think that's unacceptably long from the DOC standpoint. "In my view, export controls are not at fault."

Others don't see eye-to-eye with Boidock, however.

"The whole system is lousy," complains Boyd McKelvaine, manager of national technology programs for General Electric. "It doesn't take any extraordinary delay or red tape to make it a relatively bad system in international competition."

"In my view, export controls are certainly not at fault."

GE has just finished examining the export license procedure. From the first quarter of 1983 to the first quarter of this year, the average number of days from application to approval has gone to 42 from 30. And that's for COCOM countries, supposedly the easiest to which to send exports. For non-COCOM countries, the delays over the same time period rose to 40 days from 28. In the approximately 250 licenses studied, the shortest approval time was 17 days. The longest was 51.

"Thirty days is ridiculous. It's totally unacceptable," says a government relations expert at a leading computer firm. "If the rest of the world could depend on 30 days, it wouldn't be as bad as it is now. Now they're told that's how long it will be and they know it's going to be longer. There's no reliability built into the system.

"The weakest link is what destroys the chain," says the GAO's Bill Newman, who was present at the Hong Kong meeting. "DOC could process 900 applications correctly, but it's the two that are held up that might be the linchpin of the entire contract. Other licensing systems are much more predictable than ours. Exporters know they'll get a license. If there's a question, they can get it answered quickly. There's an arrogance and disdain with U.S. exports that's not apparent in other countries."

All the delays and problems have not caused CWS to abandon the U.S., although Cox takes great pains to make it clear he may have to do that if the proposed DOC tightening is approved. Some of the sting may have been taken out of Cox's remarks in a corrective cable subsequently dispatched by Edinger. Cox never received a copy, though he and Edinger sat down and went over the inaccuracies of the first dispatch. *

NEWS IN PERSPECTIVE

BENCHMARKS

ORCHESTRATION: Hoping to increase pressure on the European Economic Community, which was seen as readying a final judgment against IBM in its long-standing antitrust case, the company unleashed an unusually combative counteroffensive in early June. In a rare press briefing closed to trade publications, IBM's chief counsel, Nicholas deB. Katzenbach, used the *Wall Street Journal* and the *New York Times*, among others, to tell the world that IBM would appeal any ruling against it by the EEC that called for early disclosure of new product designs. Katzenbach refused to discuss the two settlement proposals IBM has offered the EEC court, but he reportedly lashed out at the EEC and its potentially damaging suit in uncharacteristically harsh language. The court is generally expected to rule in August that IBM has indeed abused its dominant market position in Europe and to demand that IBM disclose interface specs for 370-type systems at the date of introduction instead of the day of first shipment. That remedy, understood to be the only one acceptable to EEC plaintiffs, would likely provide European and, particularly, Japanese competitors with the very kinds of information "Hitachi stole or tried to steal," Katzenbach reportedly stated. "It's possible the commission could come down against us anytime soon, so why let the EC [sic] dominate the press coverage?" he was quoted as saying. No stranger to fighting antitrust actions, Katzenbach was attorney general in the Johnson administration and joined IBM as chief counsel just weeks before the Justice Department filed its antitrust suit against the company in 1969.

CULLINET BUYS: Cullinet Software Inc. continued its plunge into the applications software market with an agreement to buy Bob White Computing and Software Inc., an Oak Brook, Ill., firm specializing in software for banks. No terms were disclosed. Cullinet, the Westwood, Mass., vendor of the IDMS mainframe database management system, has also annnounced applications products in finance, human resources, and manufacturing in the past year. If the acquisition is approved, Bob White will operate as a subsidiary, focusing on integrating its banking applications with IDMS. The Bob White products will form the basis of the Cullinet Banking System, which will consist of five modules: deposits, loans, customer information system, electronic banking, and portfolio management.

ONE UP, ONE DOWN: One company formed to bring optical recording technology to the 5¼-inch disk drive market is bowing out while another is just getting started. Laser Memory Systems, Calabasas, Calif. (see "Optical Disks Foreseen," June 1, p. 32), is in the process of dissolution. Founder and president Raymond Brooke, formerly president of Computer Memories Inc., Chatsworth, Calif., attributed the firm's problems to a shortage of optical media sources. Meanwhile, Information Storage Inc., Colorado Springs, Colo., has signed R&D contracts to develop 5¼-inch optical drives with CPT Corp., the Minneapolis word processing system maker, and Tallgrass Technologies Inc., Overland Park, Kans. ISI's founder and president, Steve Popovich, was previously president of Control Data's Optical Peripherals Lab in Colorado Springs. That lab is now part of a CDC-Philips joint venture.

CLOSER TIE: Fujitsu Ltd. of Japan has extended its technology and joint marketing agreement with British vendor International Computers Ltd. (ICL), despite the latter's having done poorly selling Fujitsu's 370-compatible Atlas cpus. The new agreement, whose full scope and details have yet to be worked out, continues the relationship between the companies into 1991. ICL gains further access to Fujitsu's semiconductor technology, which is considered to be state of the art, for its upcoming DM-1 and Estriel mainframes. ICL is understood to have sold only four or five of the Atlas machines in the United Kingdom, far below its original sales goal of 18 units, and is reportedly seeking an end to that part of its marketing agreement with Fujitsu. Fujitsu's gain from the extended relationship is expected to be additional marketing help in the U.K. as well as access to ICL's software and parallel processing expertise. In an unrelated disclosure, ICL said it had laid off 14% of its 840-person French subsidiary due to continuing losses.

BID OVERTURNED: It looked as if Burroughs' System Development Corp. subsidiary had won the $48.6 million contract to supply the FBI with highly secure terminals and printers, but a persistent Delta Data Systems Corp. brought its opposing arguments to court and won. The Trevose, Pa., company first filed a protest to the General Accounting Office last fall and then brought suit in federal court seeking an injunction against further shipments by Burroughs. GAO found the contract to be misawarded and Judge Harold Greene early last month ordered it to be given to Delta Data. The terminals ordered under the contract were to be "Tempestized," meaning secured against eavesdropping through radio frequency emmissions. Burroughs has already installed some 2,000 of the total 6,000 terminals in the contract, but none were Tempestized. The Detroit company said it would eventually replace those commercial-grade units with appropriate gear. Delta Data was evidently disqualified from the bidding because of doubts by the FBI about its "financial responsibility"—the company had shown a string of yearly losses until several years ago—not its technical abilities or pricing. Burroughs said it would appeal Judge Greene's injunction.

TRILOGY STRIKES OUT: The man who pioneered the plug-compatible cpu industry, Dr. Gene Amdahl, dropped plans to build another large-scale mainframe. Faced with insurmountable technical difficulties, Amdahl's Trilogy Ltd., Cupertino, Calif., scrapped the cpu plans after pushing the first customer ship date into 1987. What the heavily funded company will now do is not clear. Board members of the firm from backers Sperry Corp. and CII-Honeywell resigned, portending legal action against Trilogy, which stated that it was discussing "modifying the existing arrangements with such companies." One possibility for staying afloat, according to Trilogy officials, was that manufacturing capacity and technology would be devoted to making chips for the merchant semiconductor market.

WHERE EAGLES FLY: Computerdom may see its own megamerger if Ross Perot, the Texan entrepreneur, decides to follow through on an offer to buy his Electronic Data Systems Corp., Dallas, which might go for an estimated $2 billion. Perot said in mid-May that EDS had been in talks with an unidentified suitor about a transaction that would include the acquisition of the company. He initially declined to comment on reports that General Motors was the company seeking the merger. He founded EDS in the mid-'60s and has led it to revenues of over $650 million. Perot and his family control just over 50% of the facilities management company and have declined takeover offers in the past. The company is perceived by Wall Street analysts as an attractive takeover candidate because of its strength in processing health insurance claims and its relatively large cash reserves. In addition to its main business of claims processing, EDS has lately been seeking large government contracts. It won a $350 million, eight-year contract to supply the Navy with computing services, and a $200 million, seven-year deal from the U.S. Postal Service.

NIPPON NOD: A voice store-and-forward system made by VMX Inc., Richardson, Texas, is the first to be approved for use in Japan by the Nippon Telegraph and Telephone Corp. (NTT). Called voice message exchange, the system will be marketed in Japan by Marubeni Corp., Tokyo. It was submitted to NTT for approval in early 1983. Initial approval documents cover use of the system only within Japan; international connections of the VMX gear in Japan will require further approval. ✱

New from Interactive Systems/3M:

The first high-speed broadband local-area network that guards against data crashes.

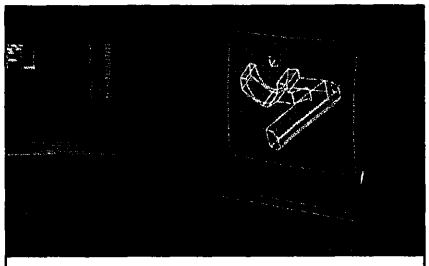
If you've been thinking of investing in a contention network, consider this: How do you guard against data crashes during times of heavy system use?

Answer: You don't, because contention schemes simply don't provide any kind of data insurance.

Fortunately, there is a new type of network that *does* protect against data loss. It's called 3M Videodata® LAN/1. And it's the first intelligent broadband local-area network that's designed to get data through on time, no matter how much traffic is on the cable.

Videodata® LAN/1: The efficiency of token-passing plus the proven flexibility and expandability of broadband.

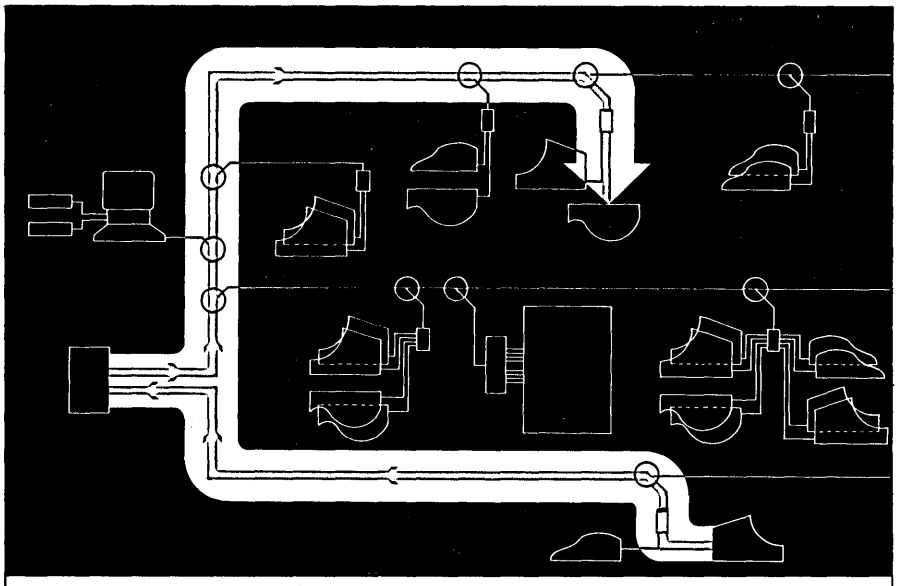
Token-passing networks eliminate contention troubles and data crashes by passing an electronic "token" from terminal to terminal. When a terminal has to transmit, it grabs the token and sends data packets to the receiving device. Receipt is acknowledged and the token is automatically released to continue its rounds. Because the system assigns a network entry address to each user, everyone has an opportunity to send data during each token cycle.



Because Videodata LAN/1 is a broadband system, dedicated channels can be used for full-motion video applications such as CAD/CAM and teleconferencing. These video signals are kept entirely separate from digital traffic on the network's token-passing channels.

So far, so good. But most token-passing networks are baseband systems, meaning that terminals must share a common channel as they would in a typical contention network. This can limit speed and capacity in some applications.

LAN/1 overcomes this possible limitation by combining token-passing with a proven *broadband* technology that allows many channels to be put on a single cable. The payoff: higher channel speeds, ranging up to 2.5 MB/s over a maximum seven-mile radius, with terminal data rates of up to 19.2 KB/s. Plus a capacity of up to 10,000 devices to allow plenty of room for future expansion.



In the Videodata LAN/1 network, messages can be sent from any terminal to any other without going through the host processor. Network Interface Units (NIUs) connect digital devices to mechanical taps (shown as small circles) on the main coaxial cable. A Network Monitoring Unit, or NMU, keeps a statistical record of network performance.

Self-monitoring, with a printed record of network performance.

LAN/1 gives statistical proof of its own performance in printed form, thanks to a microcomputer-based Network Monitoring Unit (NMU). This unit, which also helps in routine maintenance and troubleshooting, may be used for remote monitoring as well.

Separate channels for voice, video, and graphics. Plus the ability to work in point-to-point applications.

Because LAN/1 is a broadband network, channels can be set aside for real-time voice, video, and high-speed graphics. This can be done without compromising digital traffic capacity.

LAN/1's broadband design also permits flexibility in network architecture, so that it can be used in high-speed point-to-point applications which can't be served efficiently with contention systems.

Other benefits include full transparency, an automatic shut-off feature to keep any one terminal from capturing the token, and compatibility with both dumb and intelligent terminals. The list of features goes on and on.

For the full story on the new Videodata LAN/1 network from Interactive Systems/3M, call 800-328-1684 toll free. (In Minnesota, 800-792-1072.) Or mail the coupon.

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CIRCLE 38 ON READER CARD

Some tips on how dp departments can separate winners from losers in the world of pc packages.

EVALUATING MICRO SOFTWARE

by Irene S. Nesbit

Because mainframe software tends to be part of an entire MIS environment, buying a mainframe package can be compared to buying a house. When you purchase a house, you acquire not only shelter, but also a neighborhood, local shops, schools, services, and neighbors. Microcomputer software is more like soap: it won't change your life, but you will use it frequently and develop definite opinions about its quality.

In the early phase of microcomputing, MIS people didn't pay too much attention to micro software. They figured the soap packages would disappear when the users got tired of doing their own laundry. But the packages have endured, and dp professionals need to be concerned about their use. Although microcomputer software may seem a trivial commodity within a broad MIS context, its importance to the user community is considerable. Where there is a noticeable lack of care and concern, MIS loses control of the microcomputer situation and risks erosion of its authority over computing in general.

An obvious difference between mainframe and micro software is cost. Many mainframe packages sell for $80,000 to $120,000. Most micro packages, by contrast, cost between $30 and $1,000. The individual price tag, however, may be deceiving. MIS executives usually purchase only a few copies of a mainframe package, but micro software is often purchased in volume. If there are 300 pcs in your organization and you decide that each one should have a copy of a selected $300 package—bingo! You've just spent $90,000. So, while micro software may resemble soap, dp departments will be buying it in industrial quantities before long.

Another important difference between mainframe and microcomputer software is access and distribution. On a mainframe, the operating system (or associated utilities) can track users and types of uses. The input and output processes can, to a large degree, be monitored and controlled. This is not the case with micro software. Users acquire the diskette and use the software. MIS may never even know about the purchase and use of a particular product.

Central purchasing and distribution channels can help an organization achieve control over the distribution process. A few MIS organizations are even planning to distribute software electronically, from a central point. In this scenario, software packages would be purchased centrally and downloaded to authorized pc users. All of this creates responsibilities and tasks that don't exist when you're buying mainframe software.

A micro package has a life cycle that's different from its larger cousin. A mainframe purchase will probably be used for 10 years or more, but micro software purchased today will be used for only a year or two before something new and better is available. Consider the spreadsheets. In 1982, VisiCalc was the leading package. By 1983 it was out of date and Lotus 1-2-3 was the acknowledged leader. Now Lotus has announced Symphony. Graphics packages and database management systems are even more volatile right now, with new, better packages appearing each month. The potential life cycle of a package should be factored into purchase decisions, but the fact that a package may be outmoded in a year may not be a reason to reject it. If it is a package that is needed and will be profitably used over that period of time, the short life cycle may be irrelevant.

When you're purchasing mainframe software, the operating system environment is a key consideration. Accounting packages for IBM mainframes are sold to run under MVS or VM, with or without CICS, etc. Most current microcomputer software runs under PC/DOS or MS/DOS. That's it. As yet, micros do not have the extensive layers of operating environment that exist on mainframes. Relative to the operating environment, micro packages are simpler to select because the choices are fewer.

ANALYZE SOFTWARE NEEDS

Software selection for mainframes traditionally involves a requirements analysis. User requirements, business objectives, and machine specifications are all listed and defined. Then a package is sought that will satisfy these needs. This process usually takes several man-months and is specific to a particular business requirement and set of users.

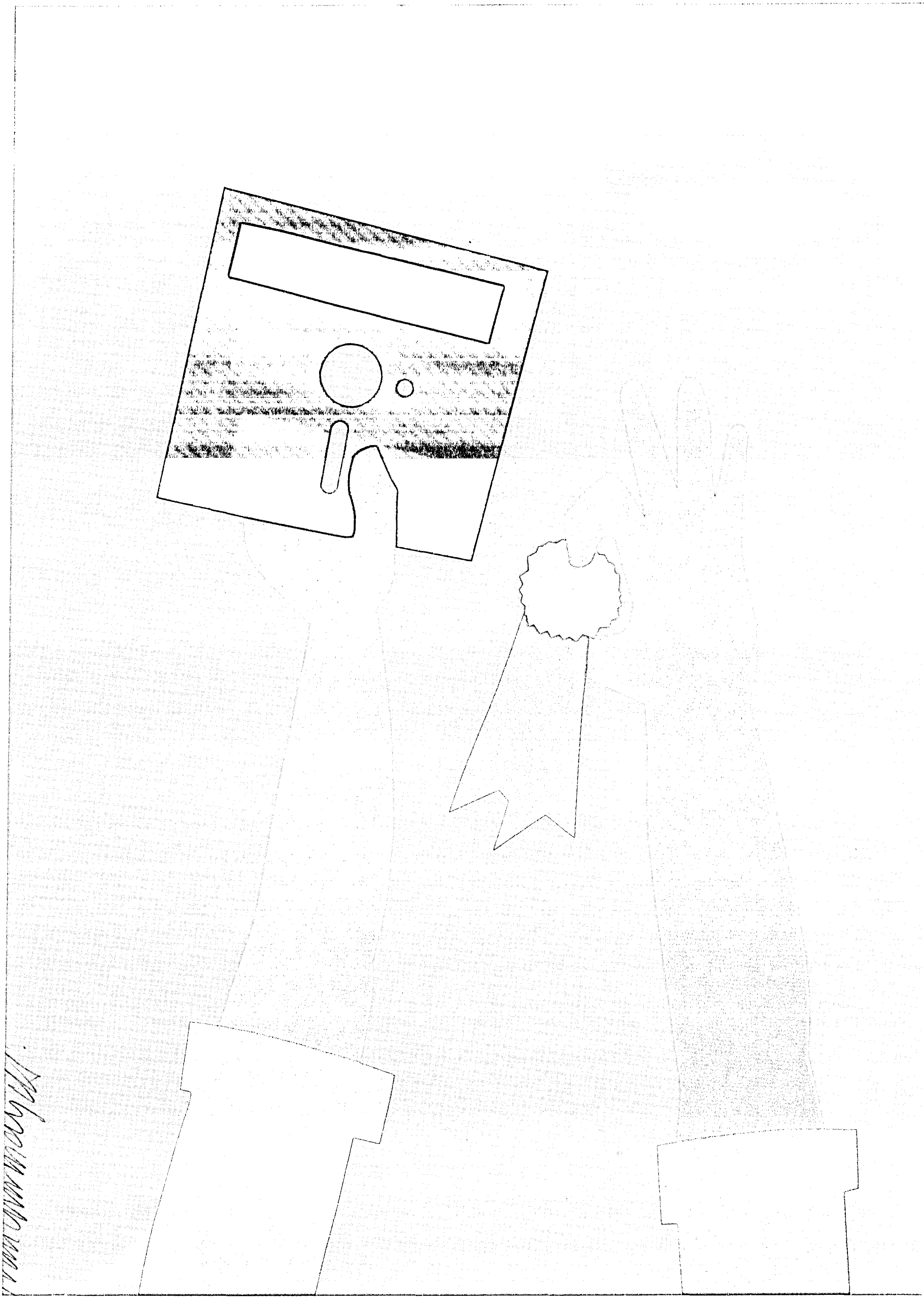
The user requirements for microcomputer software are articulated in a very general way. Users are interested in spreadsheet capability or word processing. You may hear a user say he wants a spreadsheet to do departmental budgeting or forecasting, but he's unlikely to describe his needs precisely. Even so, it is possible to apply guidelines and discipline to the problem.

Selecting the best packages for microcomputer users is a matter of understanding general features and requirements and knowing what makes good microcomputer software. The characteristics of good micro software include the following:

The user interfaces require little effort. That means few keystrokes, simple screen navigation facilities, and easy entry and exit. The user should not have to work hard to use the software. Although WordStar has its fans, it often requires two keys (e.g., CTL and a letter key) to move the cursor around the text on the screen. In at least one company that attempted to train staff in WordStar, the secretaries froze. It was so cumbersome and unnatural that both the trainer and trainees gave up. And everyone hated the computer.

The user need not memorize com-

COLLAGE BY IVAN CHERMAYEFF



Reviewing hardware specifications is an important part of the evaluation process.

mands, functions, or processes. Functions should be intuitive because people may use the software infrequently. I know a user who decided to use a project management program to control and schedule a departmental project. The program required odd commands—asterisks, peculiar date formats, and weird symbols to indicate critical paths. The initial setup was laborious. No one could remember how to update and change either the project tasks or the schedule. The output gradually became unusable because no one wanted to go back to the manual to figure out how to change things.

The software is not frustrating to use. Recently I tested VisiOn, the windowing package from VisiCorp. The version I had operated very slowly. That is tolerable, but I could not readily understand how to move between or within windows, or how to expand or contract a window. I felt like a brand-new computer user until the person working with me (who had been evaluating VisiOn for a week) said that he still felt that way. It never got easier.

The package mimics the work patterns of the user. In the current jargon, the software should be a metaphor for the task at hand. One reason spreadsheet packages became so popular was because they mirrored electronically what many people had been doing at their desks.

The package must perform useful work. Someone once gave me a recipe program. After you enter (or check off) foods that are in your cupboard, the program displays recipes for dishes you can make with the available ingredients. When I used it, all the recommendations were based on tomato sauce or sauerkraut. I hate sauerkraut and concluded that the package was a loser.

With most microcomputer software, users view a menu and then select an option. One important criterion for micro software is easy navigation between menus. Also important are consistent keystroke commands and cursor movements across all screens; they help to make the package easy to learn and easy to use. Status and error information should be displayed in an understandable manner. Also, good microcomputer software prevents the user from accidental problems. Deletions, quick exits, and other functions that may erase data or files should be double-checked by the software before the function is executed. All of these features contribute to effortless use and reduced frustration.

LENGTHY LISTS OF FEATURES

Within each type of generic software—spreadsheets, DBMS, word processing—there are features that should be identified and evaluated. A DBMS needs data entry and validation features as well as reporting and data retrieval functions. Word processing packages usually have a list of features two or three pages long. They are offered with spelling checkers, customized letter facilities, envelope address preparation, proportional spacing, margin alignment, and many other features that may or may not be important to the user.

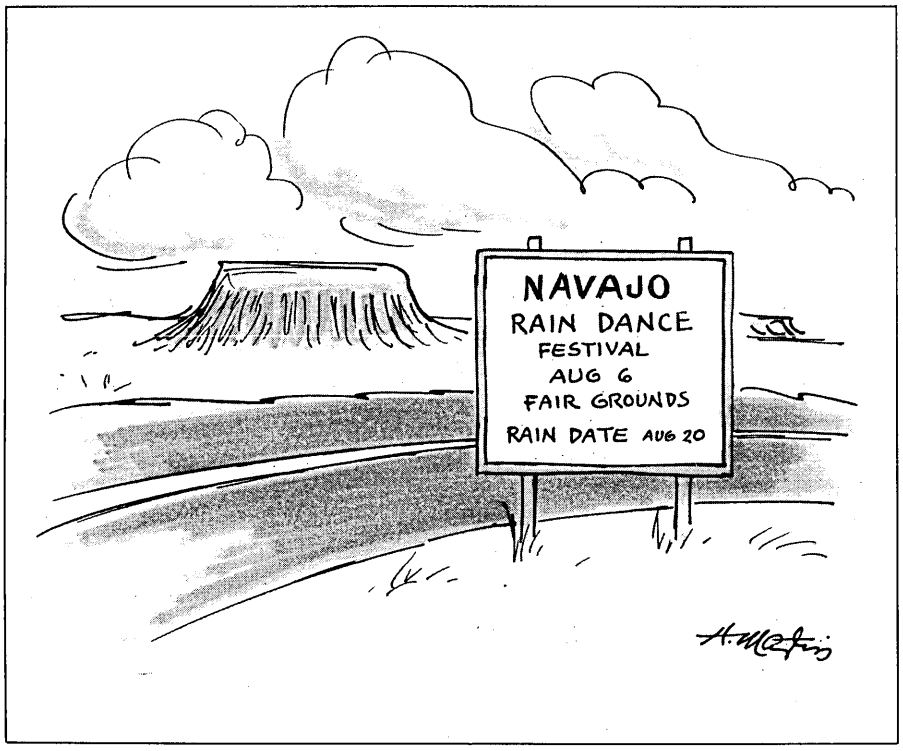
There are other packages besides those that handle word processing, spreadsheets, and data management, and dp professionals will probably understand them even better than their users. These are packages that can help to extend the usefulness of corporate micros. MIS can make a welcome contribution here by indentifying, evaluating, and acquiring some of the less well-known (or less advertised) programs.

There are packages that serve as tools, augmenting and facilitating applications. Sideways, from Funk Software, Cambridge, Mass., is a handy piece of software that prints spreadsheets sideways, so all columns can be put on one continuous page. ProKey, from Rose Soft, Seattle, Wash., allows for changing and saving protocols, commands, and requests for most of the popular software packages. There are also utilities that help manage data files, and provide diagnostics, backups, and recoveries. Also, there are numerous packages that perform special functions, including cash-flow projections, lease/purchase analysis, tax depletion analysis, statistical analysis, and hundreds more.

Reviewing the hardware specifications for the requested software is an important part of the evaluation process. Certain wp software requires certain kinds of printers. Graphics software often requires a specific board or color monitor. In addition, if the user wants to route output to a plotter or other special device, the software needs to be verified for support of the exact device. The software's hardware requirements must always be verified and reviewed. Although this is true for mainframe software as well, that software is usually designed and sold for a particular hardware configuration. Microcomputer software, on the other hand, is often sold for a number of machines with a variety of configurations.

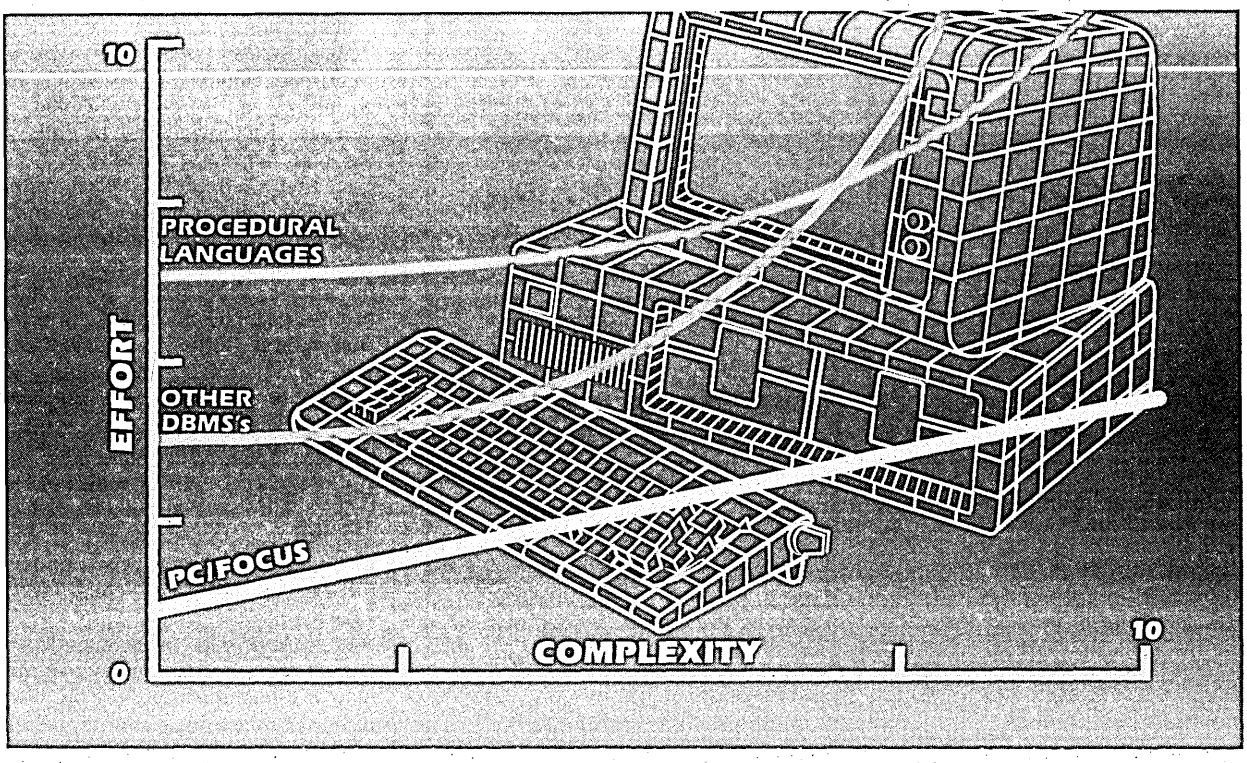
Integration facilities are becoming increasingly important to micro users. Products such as 1-2-3 and Context MBA offer application-level integration as part of the package. The capability to transfer files between packages, or into and out of packages, gives the user the opportunity to use various packages and establish the integration as needed. The Data Interchange Facility (DIF) allows for data—but not formulas or equations—to be transferred between spreadsheet programs and into other programs that accept DIF format. PFS:Graph, for example, accepts DIF format. This means that you can create a spreadsheet, save it in DIF mode, then transfer it into PFS:Graph to create a graphical representation of the data.

The file interchange facilities between machines are more complex, both in



CARTOON BY HENRY MARTIN

EFFORT VS. COMPLEXITY.



PC/FOCUS DATABASE.

It Stays Easy to Use as Your Applications Grow More Complex.

If you're building applications with existing "database" systems, handling the simple jobs can seem pretty easy. But as your needs evolve and your applications grow more complex, these older tools quickly become more difficult, even impossible to use.

At this point, you need a quantum jump in productivity. You need **PC/FOCUS!**

It's the DBMS that stays simple to use as applications grow complex, because its powerful, built-in facilities do much of the work for you. It lets you build systems **ten times faster** than older technologies, enabling you to do mainframe-level applications with simple, plain-English commands.

Just like mainframe FOCUS, the industry's leading, 4th generation database system, PC/FOCUS gives you the ability to query and report from files, build systems and manipulate data. It incorporates a relational database, screen manager & report writer, and offers dramatic abilities in graphics, financial modeling and statistical analysis.

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Dealer Inquiries Invited.

CIRCLE 39 ON READER CARD

function and use. Downloading files from a mainframe usually requires special software and/or hardware. Then, the receiving microcomputer program must be able to accept the format. Data transfers of this type will become more common. Users want to use data on the pc, and there are a number of new packages that provide these facilities. One of the more interesting approaches is Goldengate, from Cullinet, Westwood, Mass. This is not just a micro product. The company is offering IDMS/R, a relational version of IDMS; InfoDB, a logical database that is an extract of the IDMS/R database; and a relational DBMS that resides on the micro and will accept data from InfoDB. So, if you upgrade to IDMS/R, you can download, with control, selected portions of the database to a user's pc.

LOCAL NETWORK TIE-INS

The connections and interfaces are likely to become even more sophisticated and varied. Local networks that tie into large networks, for example, can be expected to become a part of MIS strategic planning.

Many data processing departments are not organized for these activities. There may be a micro manager responsible for selecting and acquiring hardware and software, but he is likely to be overwhelmed with the daily tasks of supporting users. Micro support staff rarely have enough resources available to apply to careful review, identification, and selection of software, and they are usually not in a position to contribute to strategic planning. Selection of microcomputer software cannot be isolated from the overall planning for software in a distributed environment. MIS executives need to consider their organizational structure relative to these increasingly important requirements. This is a new, critical, and highly visible role for MIS, and it should not be kept separate from the department's mainstream activities.

There are rewards for choosing good software. The responsibilities associated with user support will be eased. Training is simple if the package is easy to learn. The tech support activities should be minimal. And any application or system support (e.g., integration, developing spreadsheet templates) should be straightforward. If a package has high support obligations, it may not be worthwhile.

Microcomputer software is inexpensive enough for a department to buy a copy of a program and experiment with it. Many vendors even offer demonstration diskettes for $5 or $10. It's hard to imagine experimenting with mainframe software, but then again you can't experiment with buying a house. It's a lot easier to experiment with brands of soap.

Irene S. Nesbit is president of Nesbit Systems Inc., a software consulting firm based in Princeton, N.J. She's been installing small systems at large companies for the last three years. She previously worked at NBC and the Rand Corp.

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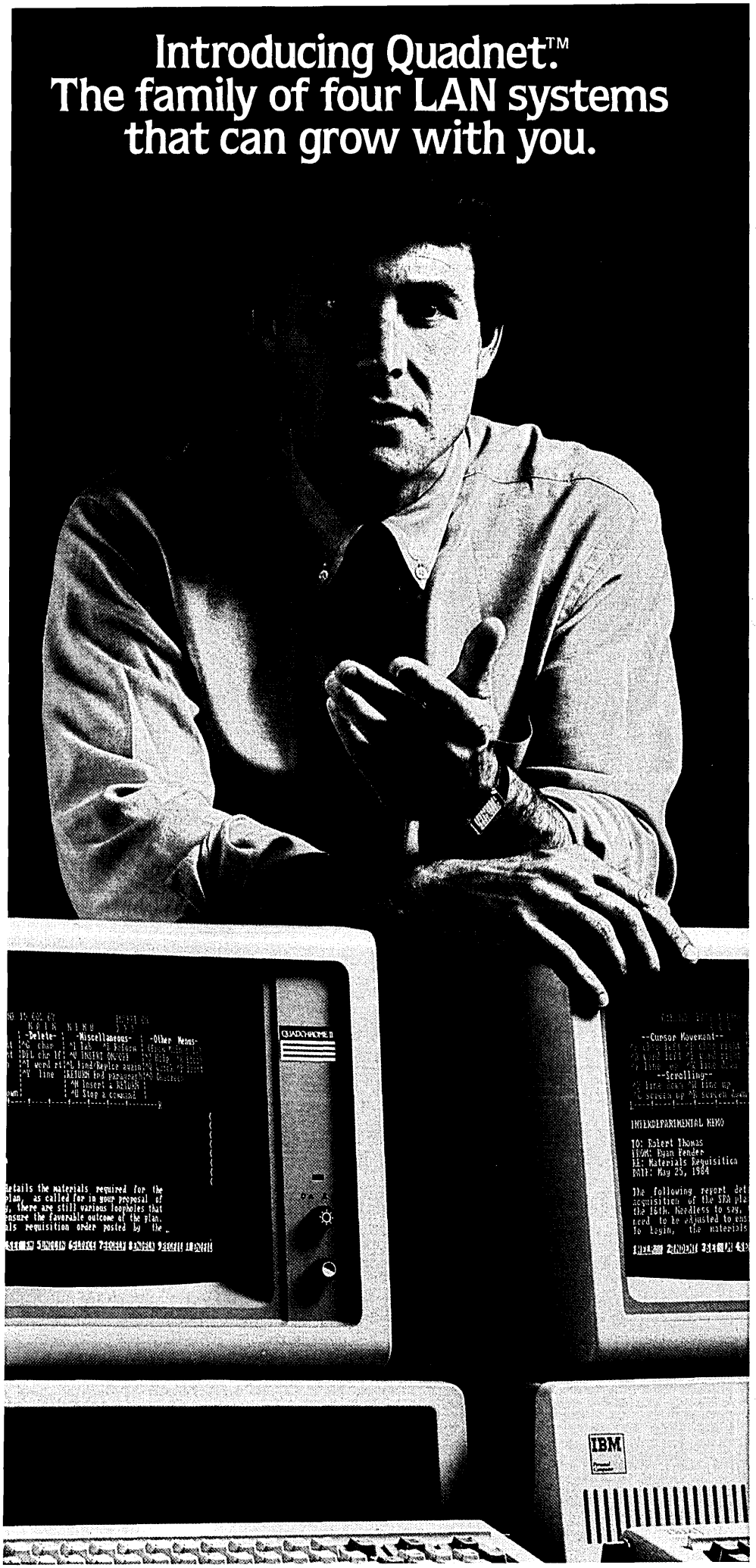

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We realize that no two companies have the same service needs, so we'll provide you with a contract that is designed to your company's specific needs, at a most cost-effective rate. It means you can get different levels of service on different pieces. You can cover your most critical PC equipment on a rapid *Customer Engineer Exchange* and your less critical pieces on overnight *Courier Service Exchange* or *Ship-in Exchange.*

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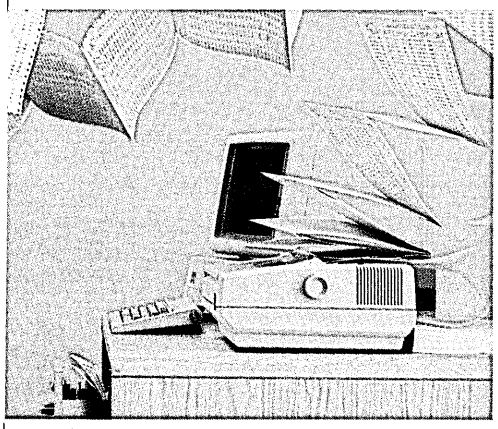
As of yet, it's probably difficult for you to speculate on

America's business



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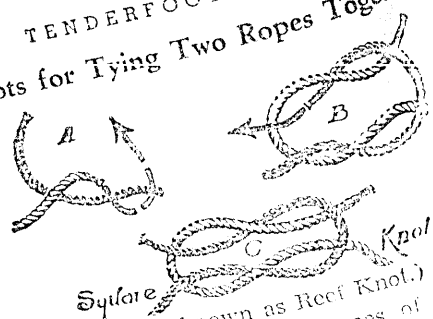
CONTROL DATA

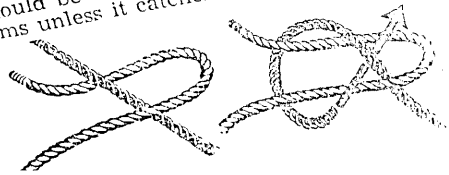
CIRCLE 42 ON READER CARD

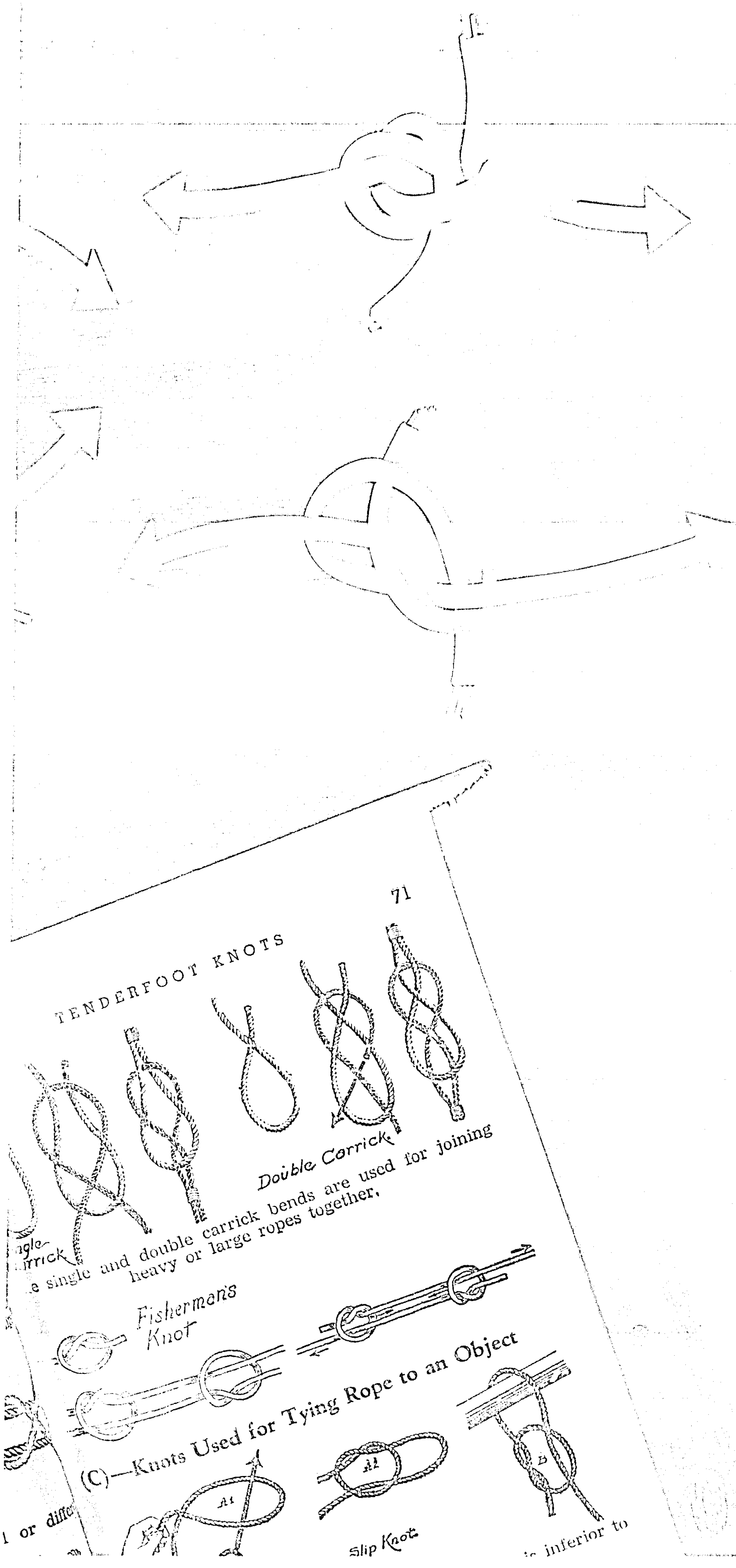
(B)—Knots for Tying Two Ropes Together



(Also known as Reef Knot.)

The commonest knot for two ropes of
Should be used in all First Aid bandaging.
jams unless it catches on an object and fo





Linking small computers to large ones is a problem of Gordian complexity, but elegant solutions are starting to arrive.

TYING THE MICRO-MAINFRAME KNOT

by Vincent Rauzino

The greatest calamity ever visited on Man was not the eviction from Eden. It occurred a little later when Jehovah's ire was raised by the Tower of Babel. Sin, it turns out, is easier to live with than communications barriers.

Computers have always reflected human communications problems. Computer communications channels are machine-to-machine, man-to-machine, man-to-machine-to-man . . . the permutations are many, and each transition requires the same kind of thoughtful attention as is needed to move from, say, Arabic to Urdu. The translations are usually manageable within the boundaries of a local dp shop because the hardware/software homogeneity of the local shop has allowed it to be managed somewhat like a feudal fiefdom. Unfortunately, the feudal era ended with the introduction of the microcomputer.

Microcomputers galloped onto the dp scene as true renegades, owing allegiance to no one. They promised to free small corporate users from the domination of in-place dp hierarchies. They also introduced their own operating systems and stimulated a clutter of third-party applications software that makes the Tower of Babel look like a ranch house. But, in spite of some real and costly communications incompatibilities among machines, operating systems, and applications software, microcomputers have dis-

The mainframe can't permit its satellite pcs to charge through its files and progams like small bulls in china shops.

MAKING FRIENDS IN HIGH PLACES

A COMPARISON OF HIGH-LEVEL PRODUCTS THAT LINK MICROS TO MAINFRAMES

		MAINFRAME		
VENDOR	PRODUCT	OPERATING SYSTEM	REQUISITE SOFTWARE	ACCESSIBLE SOFTWARE
Applied Data Research Princeton, N.J. **FOR DATA CIRCLE 350 ON READER CARD**	ADR/PC-Datacom	IBM OS/VS, DOS/VS, VSE	ADR/Link ADR/Datacom/DB ADR/Data Dictionary ADR/Dataquery	All ADR Products
Artificial Intelligence Inc. Waltham, Mass. **FOR DATA CIRCLE 351 ON READER CARD**	Micro-to-Mainframe Link	IBM VM/CMS, MVS/TSO	Micro-to-mainframe software option; Intellect	SQL/DS, IDMS, ADABAS, VSAM, DFAM, sequential file
Cap Gemini Software Products Inc. Dallas, Texas **FOR DATA CIRCLE 352 ON READER CARD**	Multipro	IBM VM/CMS	Micro-to-mainframe package	Most popular librarians, such as ADR Librarian, Panvalet
Cincom Systems Inc. Cincinnati, Ohio **FOR DATA CIRCLE 354 ON READER CARD**	PC Contact	All IBM OS, DOS	MANTIS	All Cincom products accessible through MANTIS
Computer Corporation of America Cambridge, Mass. **FOR DATA CIRCLE 355 ON READER CARD**	PC/204	All IBM OS	Model 204 DBMS	Only CCA products
Cullinet Software Inc. Westwood, Mass. **FOR DATA CIRCLE 356 ON READER CARD**	Information Database	All IBM OS, DOS	Information Database	Cullinet products plus IMS and VSAM
First Concept Technologies Inc. Rochester, N.Y. **FOR DATA CIRCLE 353 ON READER CARD**	Interchange/1	IBM OS/VS under CICS, Environ/1, COM-PLETE, or IDMS-PC	Interchange/1	Cincom Total/TIS, Cullinet IDMS, Software AG, ADABAS, VSAM
Forte Data Systems Inc. Santa Clara, Calif. **FOR DATA CIRCLE 357 ON READER CARD**	Filenet Series	IBM VM/CMS, CICS, MVS/TSO	Filenet	Any host-resident software under TP monitor

persed computer power into previously vacant nooks and crannies, to the tune of $2 billion in 1984 and possibly $13 billion by 1986. A market of this size creates its own solutions.

The IBM PC's dominance of the micro market has created a de facto standard for operating systems that gives third-party software vendors a fixed target. This was a bitter pill for the other micro vendors to swallow, but it is a real boon for micro users (particularly corporate and professional users) because it gives them a foundation on which to form ranks for an assault on corporate mainframes.

The newly emancipated professional users quickly adapted to the likes of Lotus 1-2-3, VisiCalc, dBase II, etc., and just as quickly saw how advantageous it would be to connect their local pc software with the corporate mainframe's DBMS and applications software. Dp managers were not as enthusiastic about the liaison, but since IBM had already tacitly blessed it with the PC, the micro user could not be ignored in the corporate context. Once the idea of a pc-to-mainframe connection was accepted by corporate dp,

MICRO					PRICE		
TYPE	CONFIGURATION	COMMUNICATIONS MODE	DOWNLOAD/ UPLOAD	SECURITY	MF	PC	AVAILABILITY
IBM PC series, PC/DOS	128K RAM, 1 or 2 diskette drives	IRMA board to 3274 emulation	Yes/Yes	Password log-on	$12,000 $13,500	$495 each	Current
IBM PC series, concurrent CP/M/86 or PC/DOS	256K RAM, 1 or 2 diskette drives	RS232C Autodial 300/1200 baud modem or 3274 controller	Yes/No	Password to file, record, and field levels	$15,000	$250 each (10 minimum)	Oct. '84
IBM PC XT PC/DOS	320K RAM	Interlink 3278 bisync	Yes/Yes	Password log-on	$24,000	$1,900 each	Current
IBM PC series, PC/DOS	128K RAM, 1 or 2 diskette drives	Async or IRMA board to 3274	Yes/Yes	Password log-on	$10,000 to $30,000	$1,000 each	Fall '84
IBM PC series, PC/DOS	256K RAM, 2 DS/ DD diskette drives or PC XT	Block-mode async	Yes/Yes	Password log-on	$10,000	$750 each (10 minimum)	Current
IBM PC XT PC/DOS	256K RAM	3278 emulation	Yes/Yes, but may require programmer intervention	Two-stage password	$75,000	$1,000 each	Aug. '84
IBM PC series, Tandy, Apple series, Wang pc series	Depends on user record size	Async, sync, bisync, SNA/SDLC, tty	Yes/Yes	Multilevel through DBA template	$45,000	—	Current
IBM PC series, PC/DOS	64K RAM, 1 or 2 diskette drives	Proprietary 3270 emulation boards	Yes/Yes	Password log-on, host access control	$15,000 for CICS, $1,000 for TSO or CMS	—	Current

dozens of hardware and software solutions began to appear (see "In Search of Missing Links," November 1983, p. 142). They are still appearing.

A link can have at least three levels of pc-to-mainframe communications quality. The first level simply converts between mainframe and pc data formats/protocols. Examples are the black box protocol converters, which have full conversion but no file transfer control facilities, and the Irma board, which is a full-blown translator with file transfer capabilities. The second level consists of software emulators with, perhaps, a rudimentary understanding of SNA and the interconnect features to other networks. This level also has the ability to reformat data into user-applicable formats; data from a host IMS, for example, can be reformatted to fit into Lotus 1-2-3 and vice versa. The limitation at this level is that the products are designed to *emulate* a specific terminal, such as the 3270, and are thus restricted to that terminal's application programs.

Third-level products are sometimes called software integrators. They approach the link from an applications point of view

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On one system.

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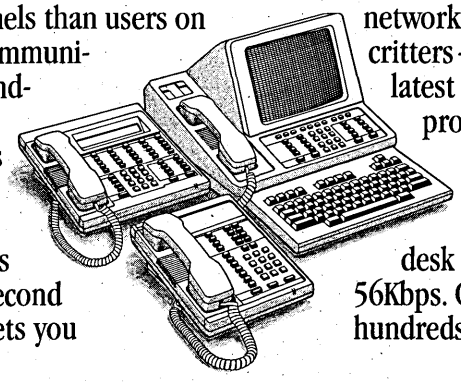

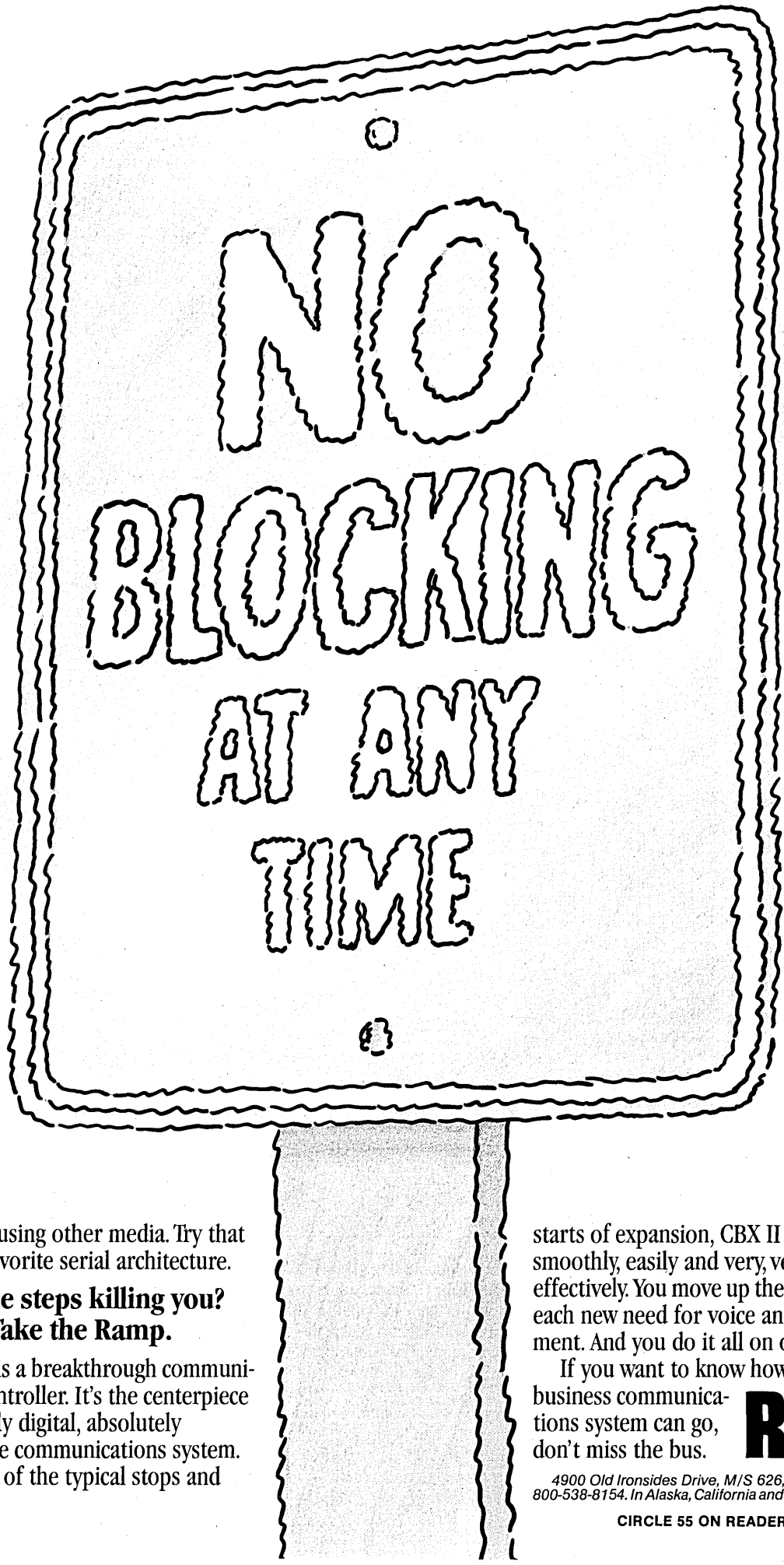

megabits, using other media. Try that on your favorite serial architecture.

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CIRCLE 55 ON READER CARD

The basic issue is how much mobility to grant the pc user within the files and programs of the mainframe.

MAKING FRIENDS IN HIGH PLACES

A COMPARISON OF HIGH-LEVEL PRODUCTS THAT LINK MICROS TO MAINFRAMES

VENDOR	PRODUCT	MAINFRAME		
		OPERATING SYSTEM	REQUISITE SOFTWARE	ACCESSIBLE SOFTWARE
InfoCenter Software Inc. New Paltz, N.Y. **FOR DATA CIRCLE 358 ON READER CARD**	iLink	IBM VM/CMS	iLink	RAMIS, FOCUS, SAS, ADRS, APL DI, FPS
Information Builders Inc. New York, N.Y. **FOR DATA CIRCLE 365 ON READER CARD**	PC/FOCUS	VM, MVS	FOCUS	IMS, IDMS, Total, ADABAS, ISAM, QSAM, VSAM
Informatics General Corp. Canoga Park, Calif. **FOR DATA CIRCLE 359 ON READER CARD**	VisiAnswer	IBM MVS, DOS/VSE	Answer/DB	IMS, DL/1, ADABAS, Total, Mark IV, VSAM
Intel Corp. Santa Clara, Calif. **FOR DATA CIRCLE 360 ON READER CARD**	iDIS 735 (Xenix-based standalone hardware device)	IBM, Sperry, CDC	System 2000	System 2000
Management Science America Inc. Atlanta, Ga. **FOR DATA CIRCLE 361 ON READER CARD**	Executive Peachpak II	IBM OS, DOS	None	MSA products
Mathematica Products Group Princeton, N.J. **FOR DATA CIRCLE 362 ON READER CARD**	RAMLink	IBM OS	RAMIS II	IMS, DL/1, IDMS, Total, ADABAS, VSAM, ISAM, Sequential file through facilities of RAMIS II
McCormack & Dodge Natick, Mass. **FOR DATA CIRCLE 363 ON READER CARD**	PC Link	IBM OS, DOS	PC Link	All M&D applications
On-Line Software International Fort Lee, N.J. **FOR DATA CIRCLE 364 ON READER CARD**	Omnilink PC Link/ Omnimicro	IBM OS, DOS, Wang VS, OIS	PC Link	ISAM and VSAM files

and are generally divided into two parts. One part resides in the host mainframe and services all the pcs in the linked configuration; the other part is replicated in each pc. These packages are priced for the mainframe purchaser, not the pc purchaser, and most of them will run only in their vendor's software environment. An example is Cullinet's pc-to-mainframe product group, which costs $75,000 for the mainframe portion and $500 to $1,000 for each pc in the configuration.

Implementations at levels one and two are straightforward. Data are either in or are put into a form, such as ASCII or data interchange format (DIF), that is acceptable to both pc and mainframe. Protocols are converted back and forth across the data interface. Mainframe data files are searched and accessed according to well-established mainframe procedures that handle the type of terminal represented by the pc. Ditto for applications programs.

HOW MUCH MOBILITY TO USERS?

Third-level implementations are less straightforward because the basic issue here is how much mobility to grant the pc user within the files and programs of the mainframe. Unless a person, such as a database administrator, is constantly referenced throughout a pc-to-mainframe dialog to arbitrate conflicts and to smooth out inconsistencies, each degree of mobility above the plateau of emulation be-

MICRO					PRICE		
TYPE	CONFIGURATION	COMMUNICATIONS MODE	DOWNLOAD/ UPLOAD	SECURITY	MF	PC	AVAILABILITY
IBM PC series, PC/DOS	128K RAM, 1 or 2 diskette drives	Any user-selected mode	Yes/Yes	Uses host's facilities	$12,500 includes 2 mainframe links & 10 PCs	$400 each	Aug. '84
IBM PC XT, Wang, TI pc, PC/DOS	512K RAM minimum, 640K RAM recommended	Async, bisync via supplied LINK card	Yes/Yes	Host's facilities	—	$1,595 each	Current
IBM PC series, PC/DOS	128K-192K RAM, 2 DS/DD diskette drives or PC XT	IRMA board to 3278 emulation, async	Yes/No	Set by host DBA	$45,000 (handles 50 PCs)	$525-$799 each	Current
IBM PC series, PC/DOS	Any	HASP RJE 2780/ 3780 RJE tty passthrough 3270 bisync	Yes/Yes	Uses host's facilities	$22,900	—	Current
IBM PC series, PC/DOS	128K RAM, two DS/DD diskette drives or PC XT	IRMA board 3270 emulation	Yes/Yes	Password	—	$6,000 each	Current
IBM PC series, PC/DOS	128K RAM, two DS/DD diskette drives or PC XT	Async, 3270 emulation	Yes/Yes	Multilevel password	$4,500 $9,000	$185 each	Current
IBM PC series, PC/DOS	256K RAM, two DS/DD diskette drives or PC XT	3278 emulation	Yes/Yes	Password to access, host controls upload	$25,000	$2,500 each	Current
IBM PC series, PC/DOS	192K RAM, two DS/DD diskette drives or PC XT	3270 bisync, SNA/ SDLC or tty 33/35	Yes/Yes	Host's facilities	$24,000 to $30,000	$1,800 each	Current

comes increasingly software intensive. This is part of the reason why certain advanced-function packages, like Cullinet's, are so expensive.

Unrestricted mobility within the mainframe is the pc user's goal, but the mainframe certainly can't permit its satellite pcs to go charging through its files and programs like small bulls in a china shop. Accessing mobility is not a problem because accessing is a passive function that the mainframe software can control easily. Modification and update mobility, however, is a major problem because the pc represents more than just another user whose quality of interaction is predefined to the system. The pc is a potential source of constant surprises to the mainframe because it can do significant processing outside the mainframe's scope of awareness. Each "surprise" is actually a little body of uncertainties, doubts, and questions about the results of code that was not executed in the mainframe. This condition implies the need for yet another level of strictly supervisory communications that lets the mainframe software know everything about the pc's processing schedule.

The "ideal" micro-to-mainframe link would have all of the above, plus the added ingredients of complete transparency and universality. These latter qualities may require some of the magic of artificial intelligence to make them work. First, the link will

The ideal micro-to-mainframe link would have the added ingredients of complete transparency and universality.

automatically translate from any data/protocol types and reformat the data according to the identity of the requesting program (Lotus 1-2-3, say, or VisiCalc) complete with user-added modifications. Second, the link will automatically identify and connect to all the host softv are implicitly requested by the pc applicat Third, the link will connect to any sof resident in or accessible to the mainfr On the mainframe end, each pc will ap a well-defined set of hardware and so resources that can be polled and used by nainframe in a background relationship he primary pc users.

T following survey provides short descripti s of the most significant level-three mi -to-mainframe link packages currently of red. Many of the packages have been ann nced but not yet delivered; this situation noted in the descriptions. Each vendor n urally claims to have devised the best solu on to the linkage problem, but please n e that very few of the packages have hac enough (if any) user exposure to verify th vendors' claims of perfection.

N t every dp installation needs to have leve three communications with its micros. For example, if the micro users' processing tasks lie well outside the installation's mainstream processing goals, and if there is no need to merge the two, then a simple dumb-terminal, read-only relationship might be enough to keep everyone happy. The micro user can then access the mainframe's files, and the mainframe doesn't have to worry about file contamination. Local conditions such as these, however, lie outside the scope of this article. The purpose here is to review selected leading-edge products that are pushing the state of the art toward the "ideal" linkage. To this end, we have not included some very worthwhile products such as Tominy's Data Base-plus (relies on CICS for data extraction/upload capabilities) and Pathway's various pc link products (emulators).

Each of the packages included in this survey offers (at least on paper) very distinctive features and capabilities. Unfortunately, many of these features and capabilities are available only in vendor-specific environments. One vendor-specific package that caught our attention, though, is CCA's PC/204. It offers a menu-driven database view/extraction facility with automatic reformatting between relational and Lotus 1-2-3 formats. This is a giant step toward meeting the first criterion of the ideal link defined above. If only it would work with IMS, ADABAS, IDMS . . . .

Two noteworthy nonvendor-specific packages are Interchange/1 from First Concept Technologies and iLINK from Infocenter Software. Interchange/1 operates under the host's TP monitor for OS independence. It can run on micros from IBM, Tandy, Apple, and Wang and can connect with Total/TIS, IDMS, ADABAS, and VSAM. iLINK runs on the IBM PC and under VM/CMS in the host. It offers product links to SAS, RAMIS, FOCUS, ADRS, APLDI, and FPS. These two packages support the third criterion of the ideal link. ✱

Vincent Rauzino is a senior consultant with Advanced Office Concepts, a Bala Cynwyd, Pa., consulting firm.

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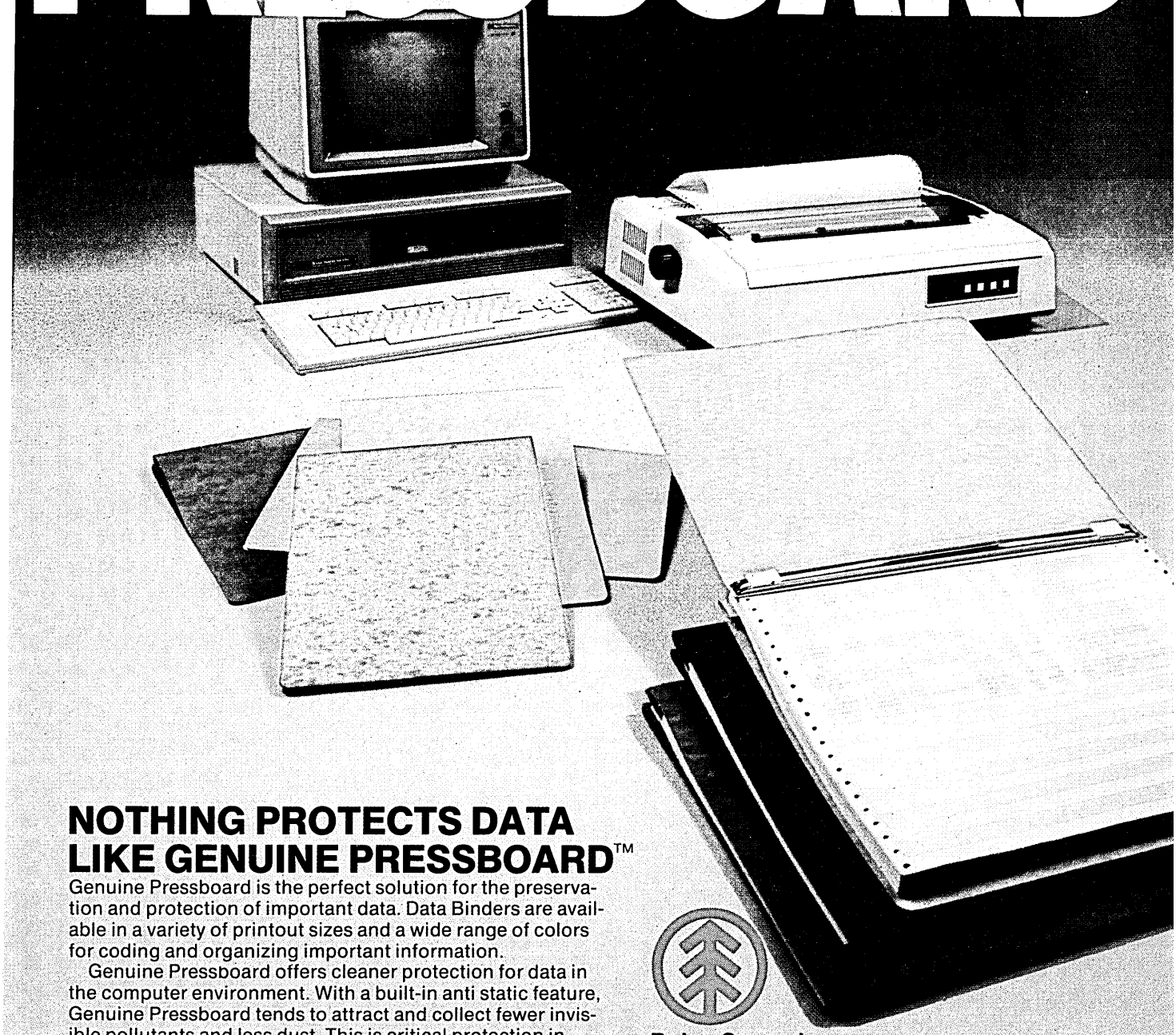

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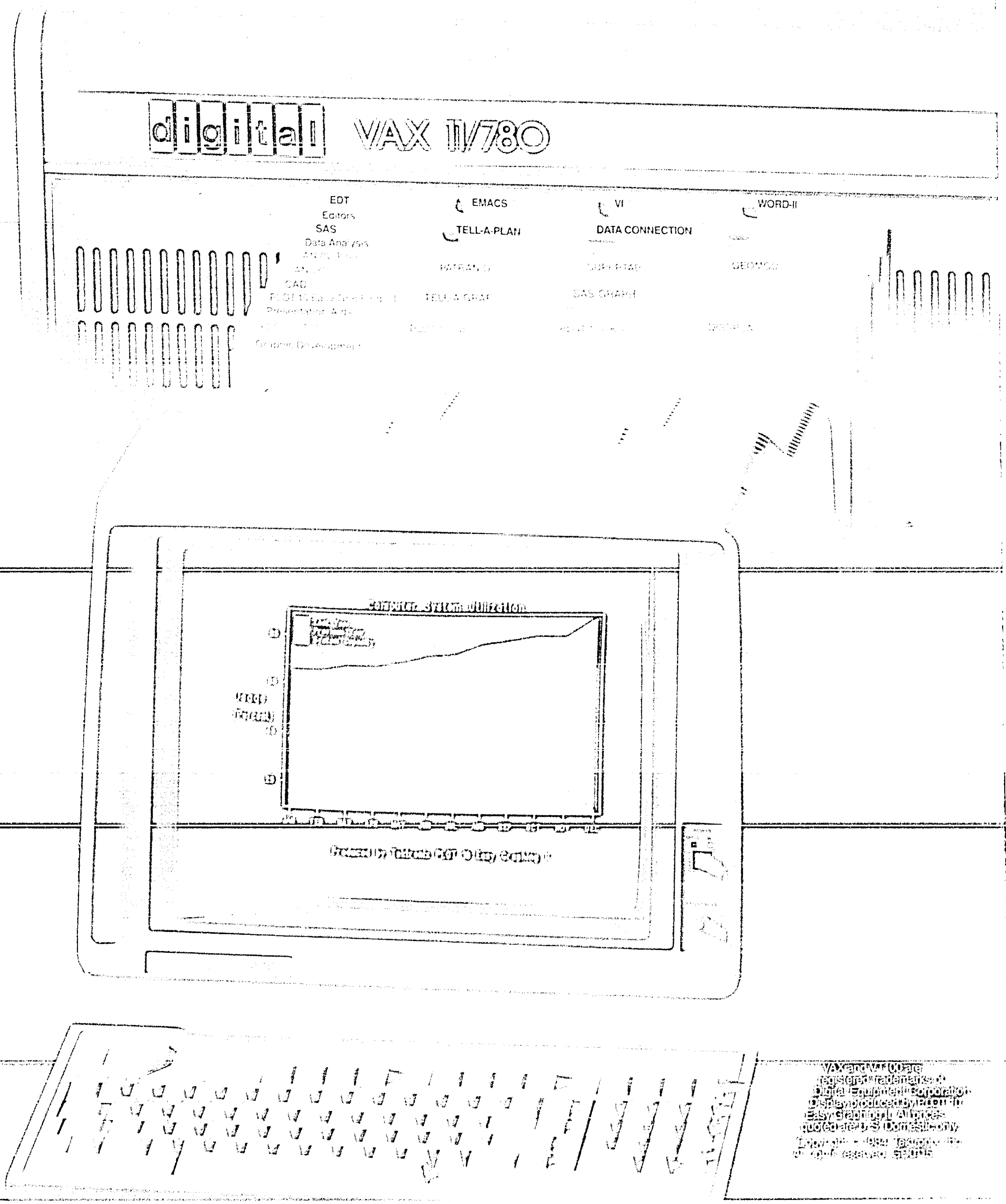

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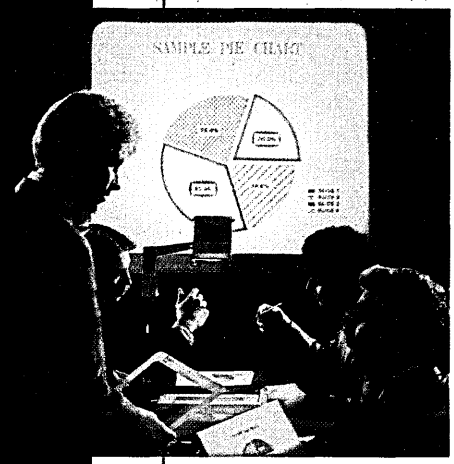

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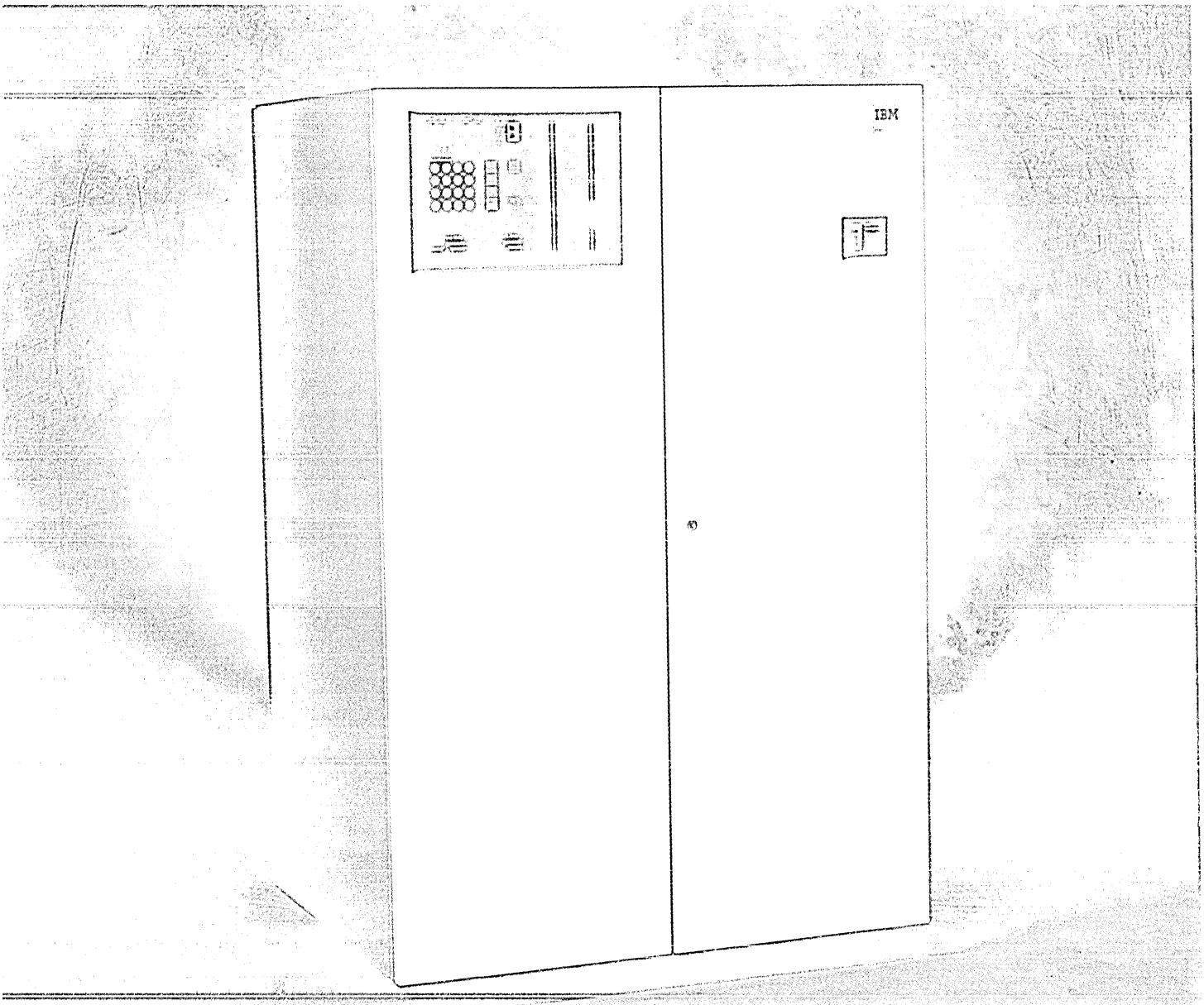

IBM

How Digital Equipment Corp. miniaturized a large machine operating system into micro size.

SHRINKING VMS

by Kathleen D. Morse

Digital's goal in implementing the VAX virtual memory architecture in a 32-bit microcomputer was to retain the same capabilities and programmer interface characteristics provided by larger members of the VAX computer family. These capabilities include data sharing and synchronization, interrupts and errors, restartability, and file structure. The programmer interface characteristics of a system architecture are mainly instruction set, memory management, addressing modes, command language, and programming languages.

The first VAX microcomputer was the MicroVAX I, introduced in late 1983. The first system software for VAX micros consisted of the general purpose MicroVMS, Ultrix (Digital's version of Bell Laboratories' Unix) operating systems, and the VAXELN executive operating system for dedicated and distributed real-time applications.

Digital's design objective for MicroVMS was to shrink the widely used Virtual Memory System (VMS) operating system—developed along with the VAX-11/780 superminicomputer in the mid-1970s—so it could perform with MicroVAX's miniaturized hardware, yet support true VAX architecture. Departing again from usual computer engineering practice, the MicroVMS operating system and MicroVAX cpu hardware were also developed in parallel, with constant coordination between the software and hardware design teams. The process of recreating VAX architecture in a small machine meant that the two teams frequently had to decide together whether particular processing functions were better implemented as macrocode in MicroVMS system software or as microcode on MicroVAX cpu hardware.

VAX functions and programmer interface characteristics were to be achieved in a micro environment—whatever the particular cpu hardware implementation— and the operating system was to be responsible for masking hardware differences from users. The MicroVAX I cpu (Fig. 1) consists of a memory control module (MCT) and a data path module (DAP), each occupying an 8½ by 10¼ inch printed circuit board. The ultimate goal is to base future MicroVAX hardware implementations on a single-chip cpu. Though this is a significant change in many ways, it nevertheless represents a consistent VAX architecture.

Two of the architecture's chief assets are its instruction set and memory management. In the larger VAX computers, both the full instruction set and memory management are implemented in microcode on ROMs on the cpu printed circuit board modules; their processing tasks are generally faster in hardware than in software, so machine performance is optimized. Miniaturizing MicroVAX hardware, particularly in the single-chip cpu implementation, meant that some proportion of microcode would have to be converted to macrocode in the operating system. The choice of microcode or macrocode for particular functions also involved consideration of the impact on overall cpu performance and the relative costs of software and hardware engineering.

Memory management includes a number of functions that support a virtual memory data processing environment. Among others, these are enforcing memory protection between access modes, context switching, translating virtual addresses to physical addresses, and maintaining a database that describes the current state of physical and virtual pages of memory.

The MicroVAX hardware team determined early on that all memory management functions could be implemented in microcode on a single-chip cpu. This was doubly fortunate, because engineering time for hardware implementation would clearly be a good deal shorter than for building memory management functions into the operating system. Moreover, time would also be saved in developing all the operating system software, especially the VAXELN real-time executive.

WHAT WAS CONVERTED

The MicroVAX instruction set, implemented with both hardware and software emulation, consists of 304 instructions that handle a variety of data types, addressing modes, and numbers of operands. Only the PDP-11 compatibility mode instructions in the full VAX instruction set were dropped. Even without these and the floating point instructions that were to reside on a separate chip, future implementation on a single cpu chip required that perhaps a fifth of the full VAX instruction set be converted from microcode to macrocode.

There were two outstanding concerns: what instructions to convert and how to best provide for their functionality in software. The decisions were complicated because the amount of microcode in individual instructions varied so widely—and more microcode meant either more chip real estate or more system software. In addition to the many shorter bread-and-butter instructions (such as add, branch, push, and move), there were a number of enriched instructions that contributed a great deal to VAX computer performance, which preferably would be retained in hardware form. These instructions include, for example, INSQUE and REMQUE, which manage queue structures, and CASEB and CASEW, which handle case branching. All four of these are equivalent to at least several simpler instructions.

The VAX instruction set handles six different data types: integer, floating point, character string, packed decimal, numeric

All instructions were converted by means of emulation.

string, and variable-length bit field. The design team soon decided to keep the integer, numeric string, and variable length bit field instructions in hardware; these three make efficient use of ROM space since they involve relatively little microcode, and they contribute significantly to fast execution since they are used frequently. The three remaining data types were then considered strong candidates for conversion to software, namely, character string (used by all compilers and often by the operating system), packed decimal (commonly used in COBOL programming), and floating point (used for real numbers in science and engineering).

It was assumed, at first, that instructions could be converted to software by either emulation or substitution. In emulation, the instruction branches to a software module in the operating system, which performs the operation through a series of instructions that produce the same result. The emulator is available to every VAX high-level language program and is accessed, without change to the code generator in the compiler, as if it were chip-resident microcode. In substitution, compilers and assemblers are modified to accomplish the same result with a substitute instruction stream based on available microcoded instructions.

As it turned out, all instructions were converted by means of emulation, because substitution would have been difficult for both MicroVMS developers and user programmers. Substitution, although requiring no modification in the operating system, would have meant writing algorithms for substituted instructions in each of more than a dozen current VAX high-level language compilers. From the users' point of view, programmers would have had to recompile all source code already written for VAX computers running VMS.

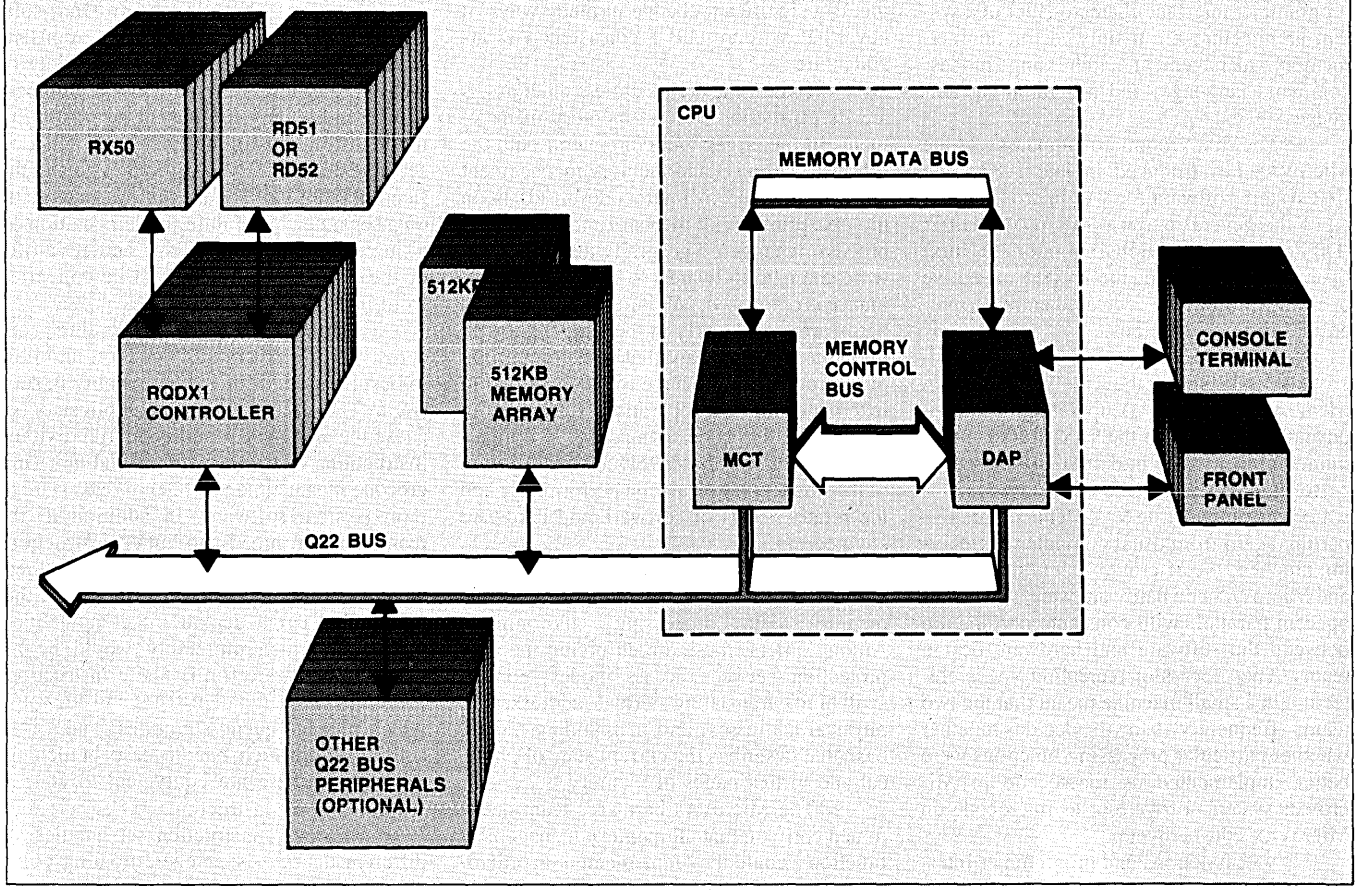
To identify those instructions that would have least effect on performance, were they converted to macrocode emulation, the MicroVMS design team analyzed a source code listing for the VMS operating system itself. Thousands of instructions were searched for the number of times that each emulated instruction was used. Based on this analysis, all 17 packed-decimal instructions, all but two of 12 character string instructions, and the H (128 bits) floating point instructions were emulated—a total of 56 VAX instructions.

The CMPC3 and CMPC5 compare character string instructions, for example, are emulated by repeated byte comparisons using the CMPB instruction. On the other hand, two string instructions, MOVC3 for three-operand moves and MOVC5 for five-operand moves, were kept in hardware on the cpu chip because they were short and frequently used. The more than 70 D (64 bits), F (32 bits), and G (64 bits) floating point instructions were placed on a separate chip.

Emulation of the character string and packed decimal instructions involved converting three basic and familiar processing functions from hardware to software (Fig. 2): opcode decode, operand decode, and instruction execution. Software modules for the two decode functions could be made common for all instructions, but execution logic would

FIG. 1

BLOCK DIAGRAM OF THE MICROVAX I SYSTEM



Having emulation code split between hardware and software required designing a software interface.

have to be written for each of 124 individual instructions.

PROTOTYPE SOFTWARE WRITTEN Prototype software for all three modules was written and tested to determine the cpu overhead involved for emulation, and in part, to find out whether inline substitution code might be necessary in place of any costly instructions. Test runs on a VAX-11/730 showed that operand decoding in software consumed about half the total instruction processing time for character string instructions, very much slowing up what were otherwise reasonably fast operations. Operand decoding represented a much smaller proportion of total processing time for packed decimal instructions, because the execution modules themselves were relatively long.

Because it was particularly important to maintain the operating system's speed, the opcode and operand decode functions for character string and packed decimal instructions were moved over to cpu hardware, leaving only the execution logic in software. No additional hardware resources were needed. Hardware decode for character string data already existed to handle the MOVC instructions, and the hardware team was able to provide equivalent decode functionality for packed decimal instructions (of course, the performance benefit in the case of packed decimal instructions was not nearly as great).

Having emulation code split between hardware and software required designing a software interface to pass decoded opcodes and operands to MicroVMS emulation software. A new same-mode emulation exception was defined so the operands would be placed on the current access mode's stack. This way of handling hardware decodes was consistent with VAX architecture and, in any case, avoided use of scarce register space.

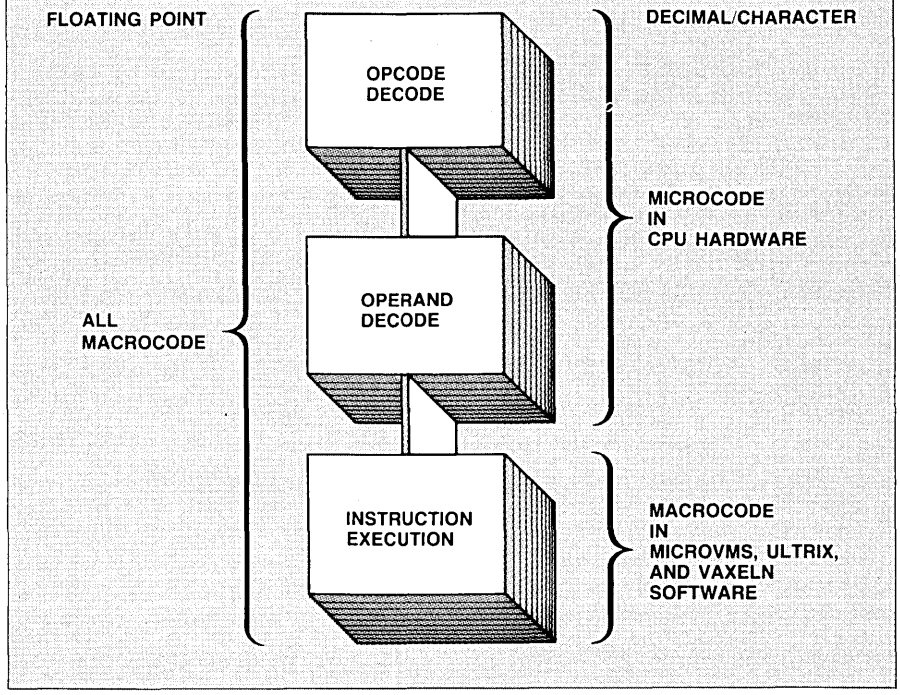
MicroVAX I, as might be expected, does not have all the functions provided in larger VAX computer implementations. Because it does not have a dedicated microprocessor for terminal console service, the bootstrap routine that had been transferred from a floppy diskette controlled by the console micro has been placed in ROM. The routine has been modified to reduce substantially the amount of code involved and to account for the fact that it can no longer be easily changed. The micro does not have a time-of-year clock, either, which, among other things, provides for time-stamping of data files. Instead, the operating system uses the VAX-standard interval timer software for time stamping.

Another hardware change that MicroVMS software had to account for was the substantial reduction in ROM space available for bootstrap code. The VAX-11/780 computer has 36 pages (512 bytes per page or block) of bootstrap ROM, whereas MicroVAX I has only 14 pages. File lookup booting, in which the bootstrap code must understand the specific disk structure, was retained for MicroVMS and VAXELN even though it consumes a good deal of ROM space.

There is not enough bootstrap space on ROM, however, to define the different disk structures of ULTRIX and other operating systems that might be implemented on MicroVAX I. Therefore, bootblock booting, which reads the first logical blocks on the disk and then executes the code found in them, was retained for support of other operating systems. For the VAXELN real-time executive to be downline-loaded from a host in a diskless system, it was also necessary to include networking protocols on the MicroVAX I ROM.

FIG. 2

IMPLEMENTING THE THREE BASIC INSTRUCTION PROCESSING FUNCTIONS



PACKAGING MAKES OS FLEXIBLE The packaging of an operating system helps determine its convenience and flexibility for users. VMS is distributed on either nine-track magnetic tape or on one of two sizes of removable disks. MicroVMS, on the other hand, must be supplied on floppy diskettes—the only removable data storage medium currently available with the MicroVAX I computer—and transferred to either a 10MB or 28MB fixed Winchester disk drive.

The initial problem was that VMS occupied about 20MB of disk space. At least 12MB had to be removed to create a MicroVMS operating system package that would fit onto a 10MB Winchester. Fortunately, a number of functions could be deleted to save disk space without materially affecting the system's functions in a micro environment.

Following is a list of the functions (and the approximate numbers of blocks) that were deleted from VMS to produce MicroVMS (Fig. 3):

- UNIBUS and MASSBUS drivers, and other cpu-dependent code (800 blocks).
- Object form of run-time library subroutines, which had been shipped along with shareable images as a convenience to users. In addition, the run-time support was separated into a number of small modules. Therefore, only the modules that are actually needed are included at the time application software is linked. There is no reason to map the entire run-time library into the user's virtual address space every time a program is run (1,700 blocks).
- Sample programs in source code for editing by users (these are now provided on paper; 800 blocks).

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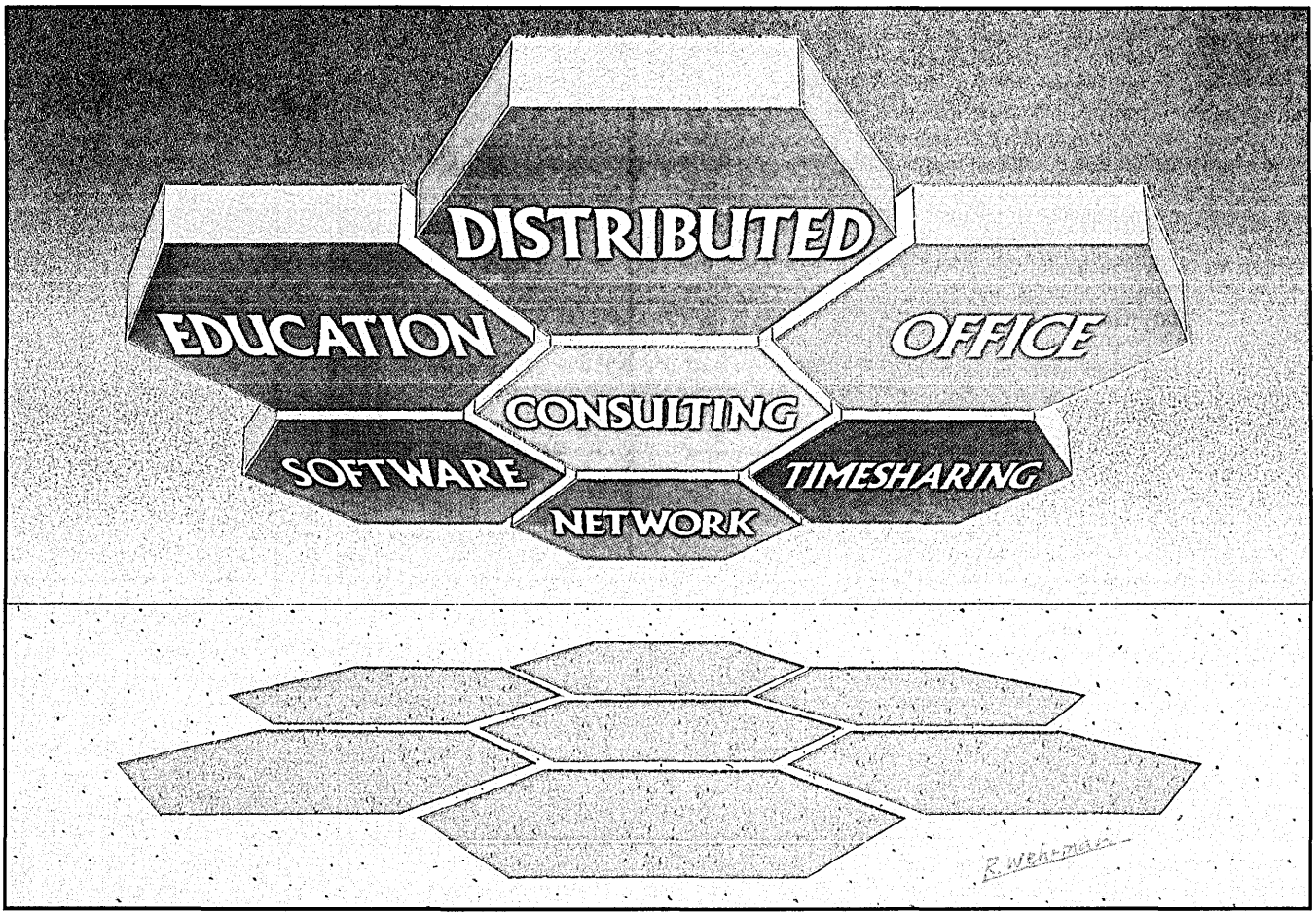

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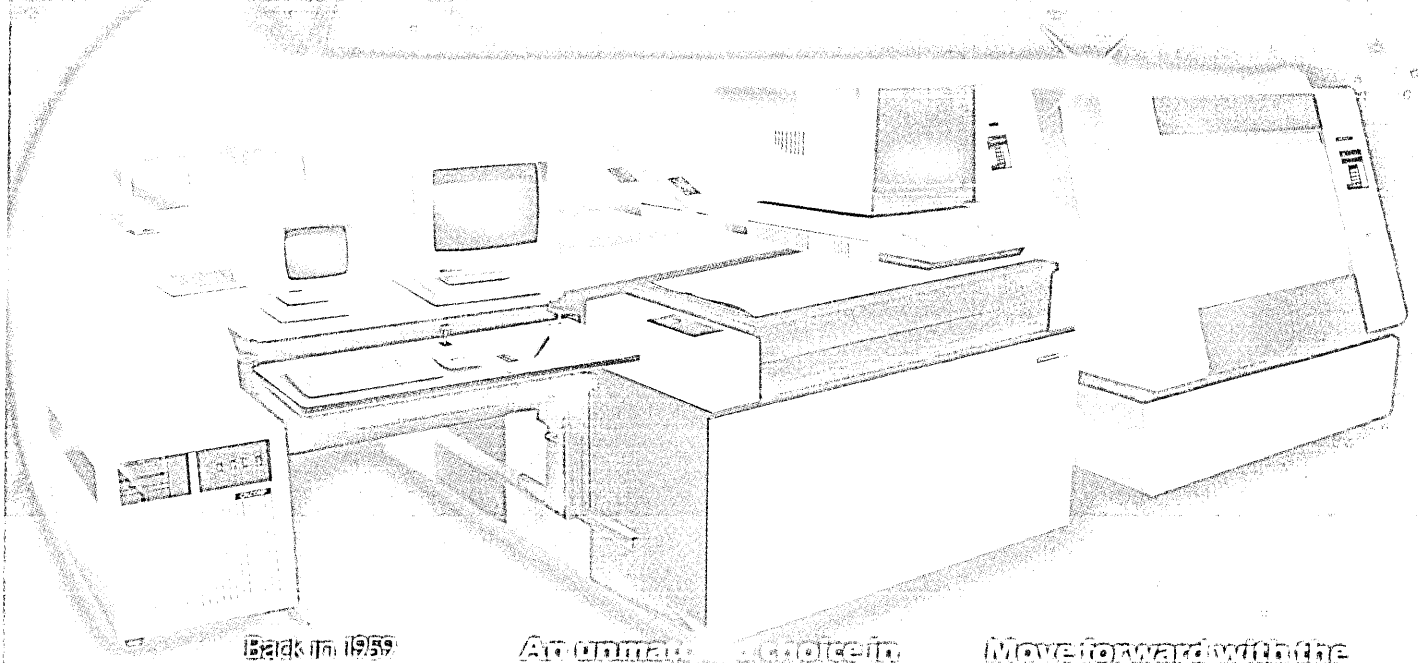

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- User environmental test package that verifies the VAX cpu and other system components. This software is unnecessary on MicroVAX I, because MicroVMS can only be successfully installed if the floppy diskette drive, Winchester drive, cpu, and console terminal are all operating properly in the first place (1,800 blocks).

These deletions eliminated a total of about 3MB of the 20MB of system software, yet the remaining 17MB was still too large for the 10MB Winchester disks.

The full MicroVMS operating system was then divided into modules grouped into a base system and several sets of options. The base system, which occupies only 5MB of disk space (2½MB for the operating system, 2½MB for the page file), is a run-time system that will execute any existing VAX application program but does not provide the tools needed for program development. The base system fits on nine 5¼-inch 400KB floppies and takes about 20 minutes to install on the fixed Winchester disk.

The five sets of MicroVMS options (Fig. 4) and the number of floppies for each set are:

- Common utilities (three floppies). These include mail (about 100 blocks), help differences, dump, search, and runoff.
- DECnet (three floppies). MicroVAX I can be made a network node, so it can transfer files, execute transferred program images, and communicate with mail users on other machines in the network.
- Program development tools (six floppies). These include assembler, debugger, libraries of object modules, and various utilities.
- Secure user environment (one floppy). These include facilities for regulating and protecting multiple accounts (such as disk quotas), and accounting report generator.
- System programming (five floppies). These include writing/debugging drivers and analyzing crash dumps, among other things.

In addition to the base system, the programmer need install only those modules within these sets that are actually required and may delete any module at any time. A MicroVMS software utility informs the programmer whether there is enough space on the Winchester disk for loading requested options. The base system and all sets of options, of course, can be installed together on a 28MB Winchester disk.

MicroVMS is a true miniaturized version of the VMS operating system; it is not in any way a subset system. The VMS instruction set and memory management are intact, as well as all other functions characteristic of a general purpose virtual memory operating system. At the same time, there are none of the software overlays or operating restrictions that might normally be expected in a microcomputer. ❋

FIG. 3

THE TOP FOUR FUNCTIONS DELETED FROM VMS TO PRODUCE MICRO VMS

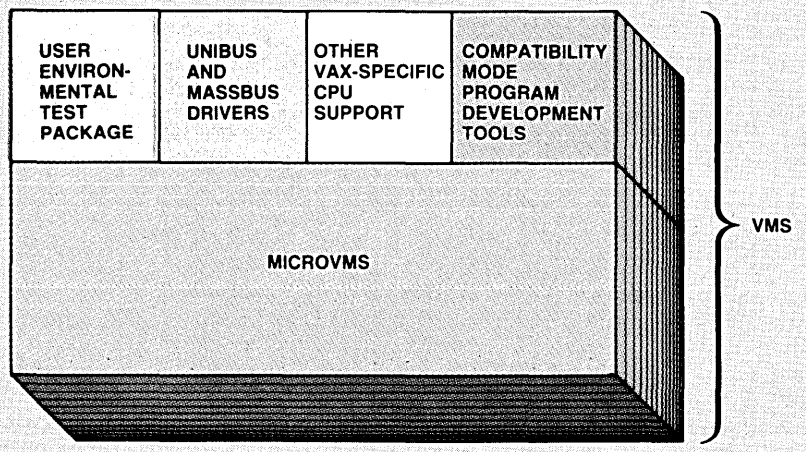
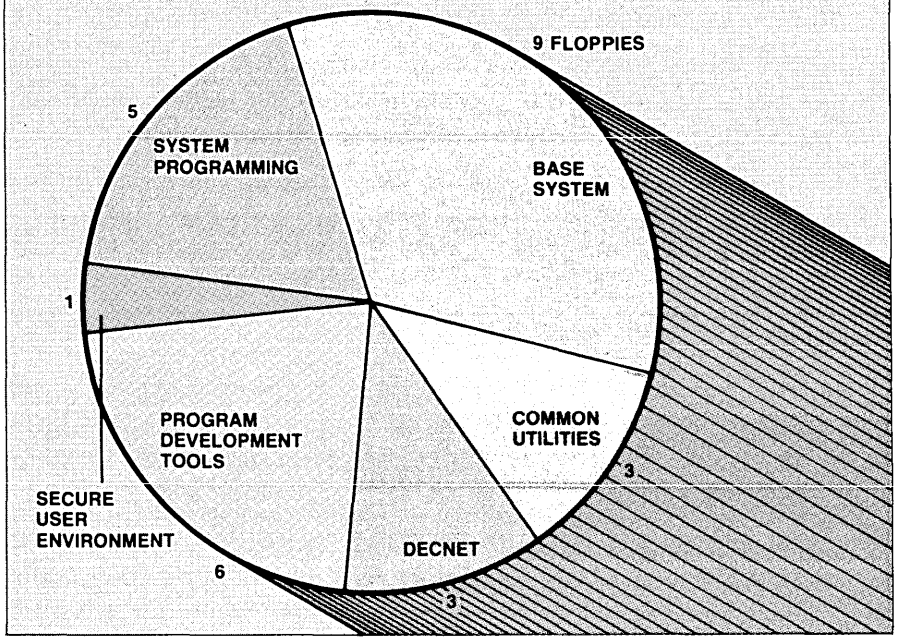


FIG. 4

THE MICROVMS OPERATING SYSTEM



Kathleen Morse, a consulting software engineer, is the MicroVMS project leader in Digital Equipment Corp.'s Nashua, N.H., VAX/VMS software development department. In this group since VMS work began, she wrote the software for the VAX-11/782 and also worked on Digital's memory management software.

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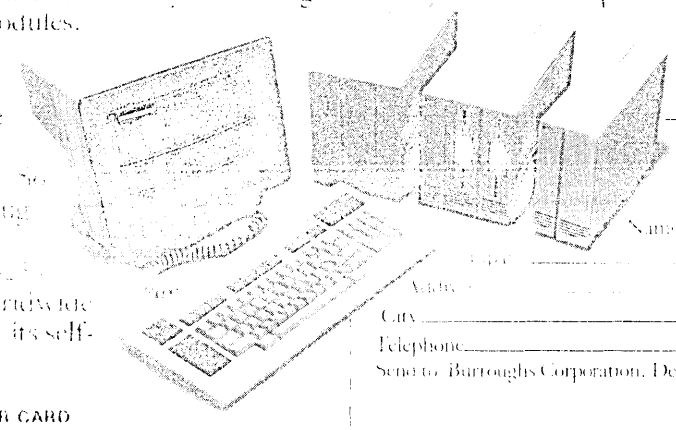

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An exclusive look at the great satirist's unfinished masterpiece.

ORWELL THAT ENDS WELL

Orwell's *1984* is often referred to as if it were a book about technology, when in fact it is a work of political satire in which machines play only a minor role. Anyone who has read *1984* knows this much. What most readers don't know, however, is that this amazingly prescient writer did get around to addressing technological issues before he died.

In 1949, Orwell witnessed a demonstration of ENIAC. He was extremely impressed, and immediately began to prepare a revised version of his masterpiece. His publisher was enthusiastic, and commissioned a book jacket (shown at left). The working title was *1994*.

Sadly, Orwell died soon after, and the novel was never completed. More sadly still, the manuscript was lost. It was believed to have been destroyed in a fire, though a few critics offered darker conjectures.

In April 1984, those conjectures were proved wrong when a hacker named Eric Blair discovered a notebook in an attic in Hammersmith, a London neighborhood. An Orwell fan, he immediately recognized the supposedly lost manuscript and forwarded it to DATAMATION.

The notebook contains only fragments; most likely, this is all that Orwell was able to complete. But the fragments do convey what the scope of this work might have been, and they are astonishing reading in their own right. The target of the satire is perhaps less clear than in *Animal Farm* or *1984*; critics will no doubt be bickering about it for years. But one thing seems indisputable: had *1994* been completed, it would have been one of the great works of the twentieth century.

It was a cold, bright day, and the digital chronometer was sounding 13. Winston Smith shivered, and drew his coat tightly about him.

The wind tore at the poster opposite Victory Condos, the poster Winston must have seen a thousand times—the same piercing blue logo that seemed to look deep into you, the same warning. Victory Condos is like all of Research Facility 5, he thought: the clapboard; the rows of ugly little houses with their solar panels and Jacuzzis, tepid now in the winter cold; the sad-looking BMWs and Hondas. It wasn't always like this. He could remember when RF-5 was known as the Valley, when it contained distinct towns with names like Cupertino and Mountain View.

The poster stared back at him in the lobby: Big Blue is Watching You. He shuddered, and climbed the stairs to his apartment. You couldn't escape it. Universal Thinking Machines was everything, owned everyone—at least 15% of everyone, with an eight-year option to go to 30%. You couldn't buy anything that wasn't UTM. The logo was everywhere—on computers, typewriters, portables, manufacturing equipment, medical gear, facsimile, peripherals, software.

They told you things were better. There were constant boasts about how programmer productivity had been increased 500%, or how everything now talked to DISOSS, or how user-friendliness had been doubled, or how you could run VM on your pocket calculator. (If you had one. There were always shortages these days, and it seemed years since Winston had even seen an 80186, let alone programmed an application around one.) Yet things never seemed to get better. Back at MICROSEC, nobody could even remember what things had been like before the 370 architecture, and MS/DOS hadn't been upgraded in years.

THE LAST MICRO IN THE WORLD

Once he was out of sight of the plasma display, Winston took the micro out. He'd bought it on impulse, in a shop in the prole quarter. He knew it was dangerous to have one, but somehow it didn't seem to matter. The screen was a little small but the operating system was a joy, and as he picked up the mouse he felt a thrill. Perhaps this was the last micro in Research Facility 5 that didn't run MS/DOS applications, perhaps it was the last in the world. He knew that if the Compatibility Police caught him it would be all over—he'd be withdrawn, or at the very least sent to program in CICS for 10 years. Funny how you learn to live with these things, he thought, and he began to write.

A knock on the door terrified him. He was relieved to find it was only Mrs. Parsons.

"I'm sorry to disturb you," she said, "but Mr. Parsons isn't home, and the DBMS has gone down."

"Of course," said Winston. "Of course." Parsons worked with Winston at MICROSEC, and he was always working late, or out persuading people to visit the Product Center. The children stared at Winston as he came in—particularly the boy, who had an ugly, aggressive face.

"I know what you are."

"Oh?" said Winston, fumbling with the keyboard.

"You're a spy! You're stealing source code and giving it to Napaj."

"Brat," thought Winston.

"You're stealing thin-film head technology. You're infringing on UTM's property!"

Mrs. Parsons said something about oh, no, that's Mr. Smith, but the boy went on. "I'm going to have you withdrawn!"

Winston hurried to leave.

"I'm telling External Security!"

MICROSEC was quiet this morning. Winston's job was to update product manuals, and the task on his desk was a new release of Easy Thinker. The old release had some bugs in it, and it was Winston's job to rewrite the manual as if Release 1.0 had never been. He'd always been good at Newspeak, and he soon had all the right phrases: the new release was a "sophisticated, user-friendly system suitable for complex thinking tasks." He thought for a moment, then added, "An insurance agent might use the system for comparing wrong thoughts with the system's built-in glossary of intellectual errors, and might then use the 'Denounce' key to turn himself in."

"Winston!"

Winston hated Parsons, but it would be impossible to avoid him. The cafeteria queue was long.

"Heard the news?" cried Parsons. "It just came over the bulletin board. We've just won a big victory! Took out a whole BOC! We got the lot—retail outlets, service, modems. The lot!"

Winston tried to sound enthusiastic, but without much success. Always you heard the same thing, and always it was just mo-

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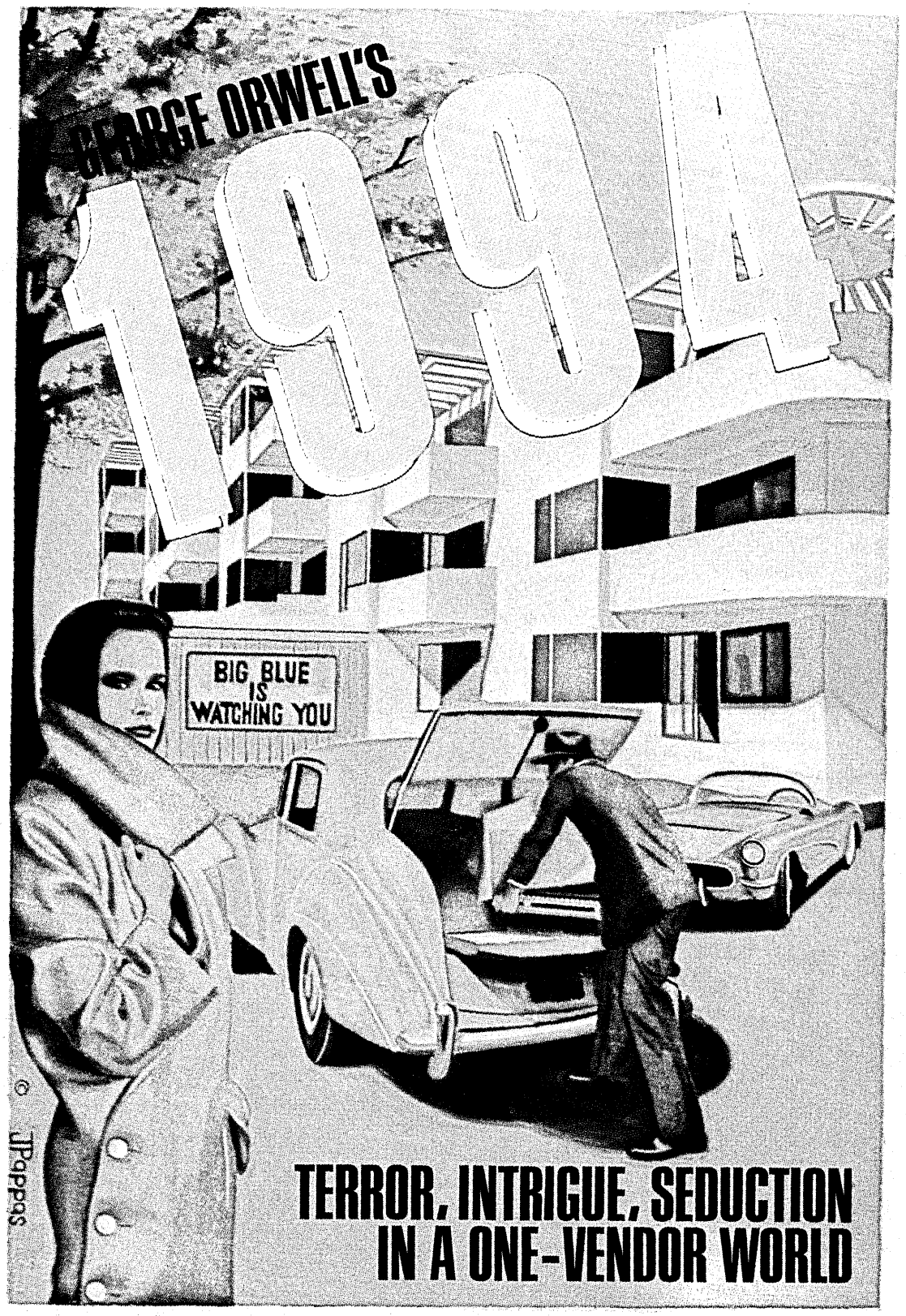

GEORGE ORWELL'S
1984
BIG BLUE IS WATCHING YOU
© JPappas
TERROR, INTRIGUE, SEDUCTION
IN A ONE-VENDOR WORLD

If the Compatibility Police caught him, he might be sent to program in CICS for 10 years.

dems. The BOCs changed hands all the time, they'd been fought over for so long that there couldn't be much left of them anymore. Parsons was enthusiastic, though. Parsons was always enthusiastic.

"Absolutely wonderful," said Parsons. "We're really beating them. That's the third market segment they've lost this year. By the way, did you go to the hanging?"

Winston reached for the Victory Guacamole and pretended not to hear.

She was beautiful, Winston thought. He had seen her around the office, proudly displaying the sash of the Anti-Programming League, and they were always the worst—the ones most likely to denounce you for altering subroutines or booting Apple/DOS.

BIG BLUE MAKES THE DECISIONS

Programming was wrong, because Big Blue had already selected the applications, decided which was best for your requirements, thought out your migration path. The only purpose of programming was to serve the Company, to provide new file transfer capabilities for the Displaywriter, or to implement the 1400 architecture on a 68000. Winston's wife had been like that. In her heart she hated to program, to think that somehow the company was imperfect, that IMS needed to be improved.

Winston remembered that once he had gone down to one of the prole quarters, had looked for a programmer. He'd been a little drunk, and she'd taken him to a back room. He was horrified by what he saw—an old mainframe, a CDC from before the wars, a batch machine. But he had done it just the same.

"Attention!" commanded the loudspeaker. "Stand by for an important Statement of Direction at 1300 hours!"

Must be bad news, Winston thought.

He was early for the Two Minutes Hate. No harm in that; good for people to think you were eager. He saw O'Brien come in and sit with a group from the Inner Company. They wore even darker blue suits than the members of the Outer Company. Then the girl from the Anti-Programming League entered. She didn't even look at him.

She must hate Gartsky, thought Winston, must hate Emanuel Gartsky, the traitor. They had all been taught to hate him since they were old enough to reach an on switch. Gartsky had once been a big figure at UTM. Some said he had been close to Big Blue himself, had seen the legendary source code of XA with his own eyes. Then he had betrayed them all, had sold the innermost secrets of Big Blue to Napaj, and now it was said that he led a secret network of traitors and saboteurs. Always there were warnings to beware of Napaj, not to source keyboards from them, not to do market research for them. But new traitors were always found.

"Yes," said O'Brien. "It is true. PCM does exist. We are committed to overthrowing Big Blue."

Winston and Julia were in O'Brien's luxurious flat. He had turned the plasma display off.

"You wish to join us?"

"Yes," they both said.

"Then you must understand that this is a fight to the death. If you are caught, you will be withdrawn. At the very least, you will be moved to Not In New Production."

"We understand," said Winston.

"Then you are prepared to do what PCM tells you?"

"Yes."

"Are you prepared to scramble microcode?"

"Yes."

"Are you prepared to cause databases to crash?"

"Yes."

"Are you prepared to hire ex-UTM employees and to turn over confidential documentation to Napaj?"

"Yes."

"Are you prepared to put bugs into games software for children?"

"Yes."

"Very well," said O'Brien. "You will receive your source code in due course. And," he hesitated, then smiled. "Welcome."

It was a dingy room. Winston felt Julia stir beside him, and he looked again at the terminal. It was old, from the days of monochrome. It only did batch, and there wasn't a drop of plasma in it. The host was one of the old BUNCH. It wasn't approved, even for a gateway.

DO WHAT MAKES YOU FEEL GOOD

She had surprised him at first. She'd been programming since she was 17, since a Company man had taught her to run Space Invaders on a 303X. Her philosophy was to do what made you feel good, and damn TSO. They'd shared a lot together, even once programmed in TRS/DOS. They'd used mice, light pens, played Pac-Man.

He was still thinking about Pac-Man when they kicked the door in.

"Yes," said O'Brien. "We've known about you from the beginning. About your micro, and about your sordid little affair with CDC. We've been watching you."

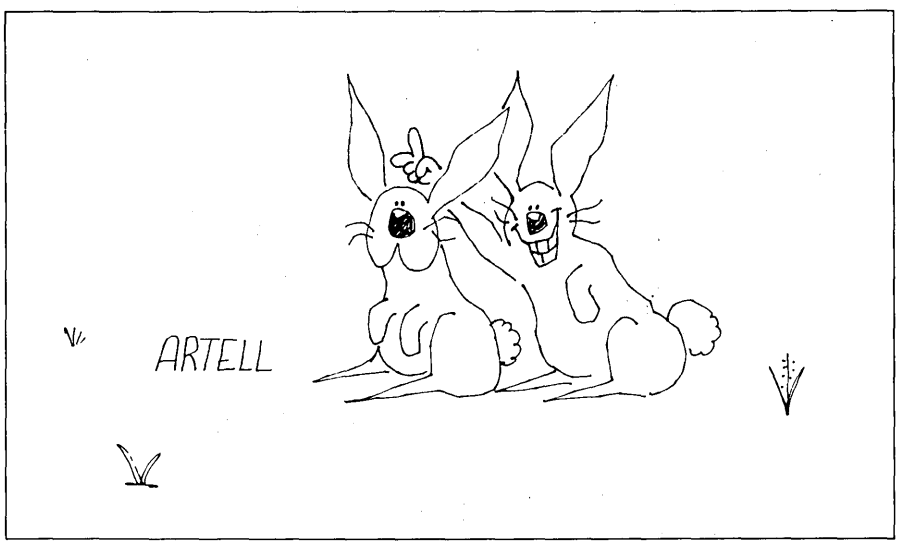
"I suppose you're going to have me withdrawn," said Winston dully. It didn't seem to matter anymore.

O'Brien laughed. "No, Winston. That would be too simple. We acknowledge our social responsibilities. We want everyone to share our point of view."

"But. . . "

"Shut up. You're a nobody, but even nobodies must understand. You, Winston, are a minority of one: a malcontent. You want leading-edge products, UNIX, graphics. But that's not what the people want, Winston. They have software investments, decades of VM applications—some of them have ported their applications all the way from the 360 series." Winston struggled to remember the 360 series.

"You want to go to them and say, throw it all away, fire your CICS programmers, junk VTAM, throw your 3278s out the



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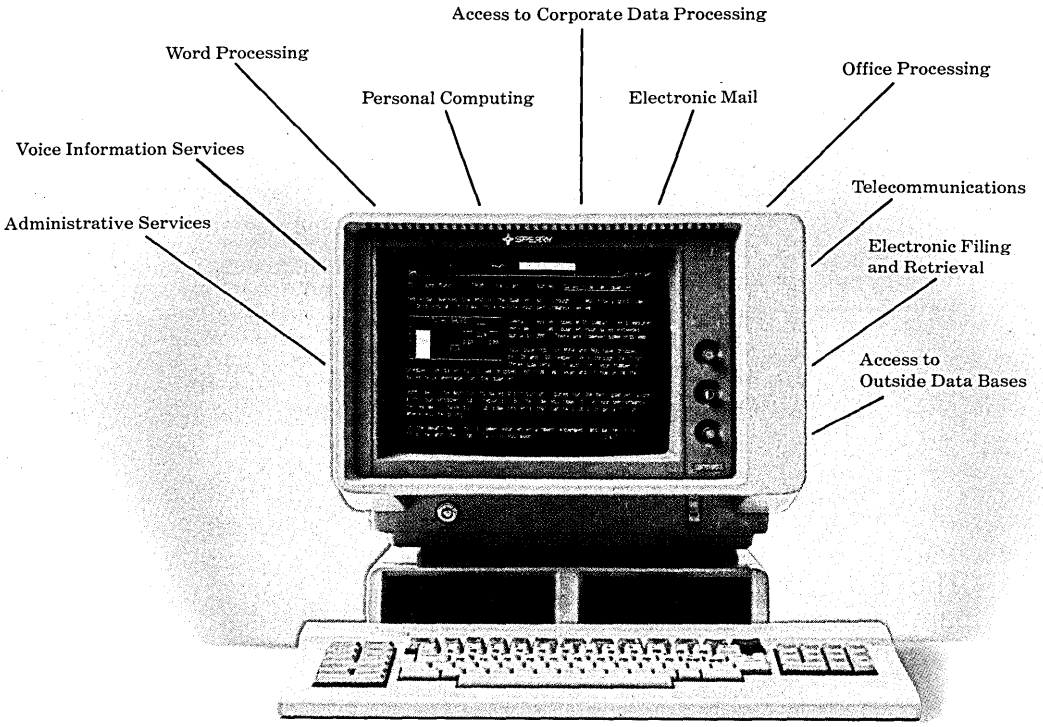

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ASHTON·TATE

He had seen her around the office, proudly displaying the sash of the Antiprogramming League.

window. But we give them what they want. We serve them, we give them migration paths. We lease to them."

"What about the proles?" asked Winston.

"The proles! We've given them everything they have. We've given them micros, we've selected their applications, we've protected them from unscrupulous retailers who'd sell them boards that would run anything. *Anything!* What would the proles do with LisaDraw? They'd keep potatoes in it. Do you know what they'd be using if it weren't for us?"

Winston confessed he didn't.

"Selectrics! It was we who delivered them from that."

Winston couldn't respond. The full-page ads they'd been making him read were starting to take effect.

"Do you know how much we spent on R&D last year, Winston? How many Nobel prizes we've won? How many cover stories the major publications have given us? *They* all said we were right; who are *you* to disagree? We are the only defense against Napaj. You saw what they did in Motown."

Winston knew what he meant. He'd seen the videos. Once-mighty ceos begging for subsidies in the streets, the wasteland of what had been a thriving city.

"That's what it would have been like," said O'Brien. "They'd have taken our microcode, undercut our price/performance, stolen our software! *We are the only defense!* Our technology is state of the art. Our marketing is cost-effective. Our manufacturing is magnificent. We are shipping 3278s in record volumes! The Personal Computer is a juggernaut! Our earnings projections . . ."

"No!" shouted Winston. "Stop! 3270! 5520! DISOSS! IMS! Datamaster!"

"Room 101," said O'Brien.

Winston struggled, but the chair was too ergonomic for him to move much.

"Everyone knows what's in room 101," said O'Brien. "It's the worst thing in the world. It varies from person to person, of course. Sometimes it's a little thing . . ."

Winston felt his skin crawl. He was seated at a desk, in front of something covered by a sheet, something that hummed and glowed.

"You see, Winston, you've recognized your errors, but that's not enough."

The humming grew louder, and at last Winston recognized it: *vacuum tubes!* "I'm wrong," he shouted. "I love Big Blue! I love MS/DOS!"

O'Brien spoke softly now. "You're going to program it, Winston. You're going to sit at your workstation and work with it." A paper tape snaked out, and O'Brien pulled the cover from the device.

"No! Please! No!"

"Congratulations, Winston. You're going to beta test the XT/ENIAC."

Winston ordered another piña colada with cinnamon, the specialty of the house. The bartender filled his glass. Funny how nobody would sit with him, he thought.

He had a good job now, though he didn't go there much. He served on a subcommittee for OS/VS documentation, and they were all like him there: loyal and well intentioned, but strangely listless. Winston knew they'd come for him before too long, but it didn't matter.

He loved Big Blue. ✱

SECOND ANNUAL

Software User Survey Forecasts Prosperity and Problems for Major Vendors

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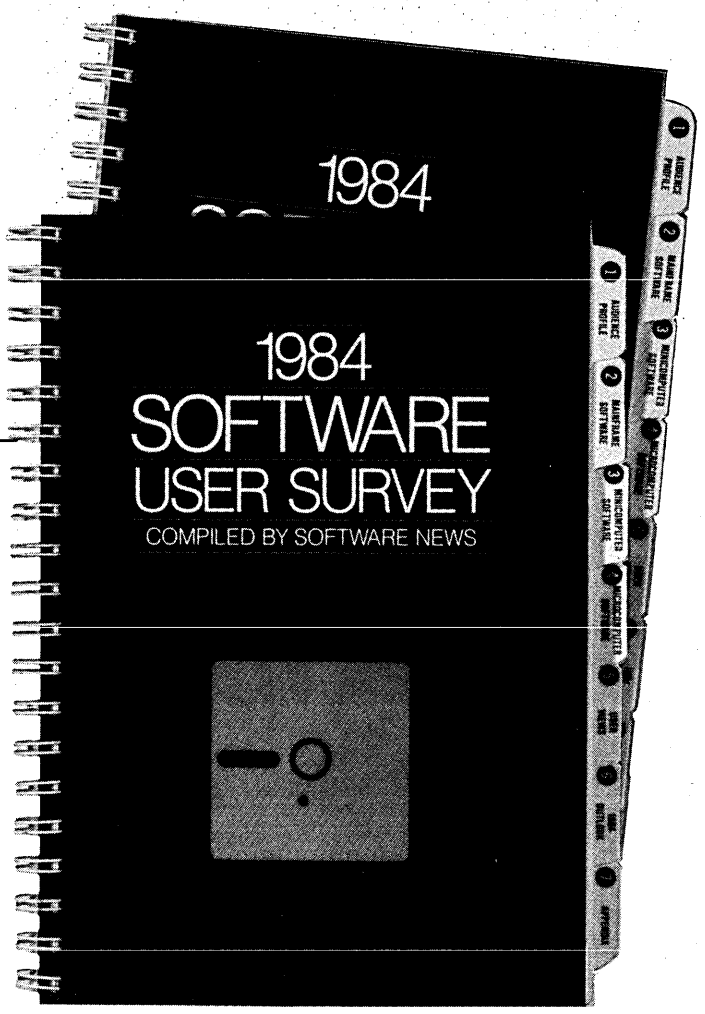

The results are now in from the second annual Software User Survey conducted by Software News. Over 2000 major national accounts participated.

Virtually every sector of the U.S. economy was polled...banks, insurance firms, manufacturers, distributors, medical and legal groups, educational institutions, systems

houses, process industries, etc. The respondents identified the software packages they are now using and what they plan to buy in 1984. The mainframes, minis and microcomputers currently in use and those planned for purchase in 1984 are also identified.

The 200-page report of the survey results ranks the leading software vendors by their relative market shares. The expected increases in 1984 software expenditures are analyzed separately for mainframes, minis and micros. Twenty-seven specific categories of applications and systems software were studied to identify the fastest growing segments. Examine the Table of Contents for more details.

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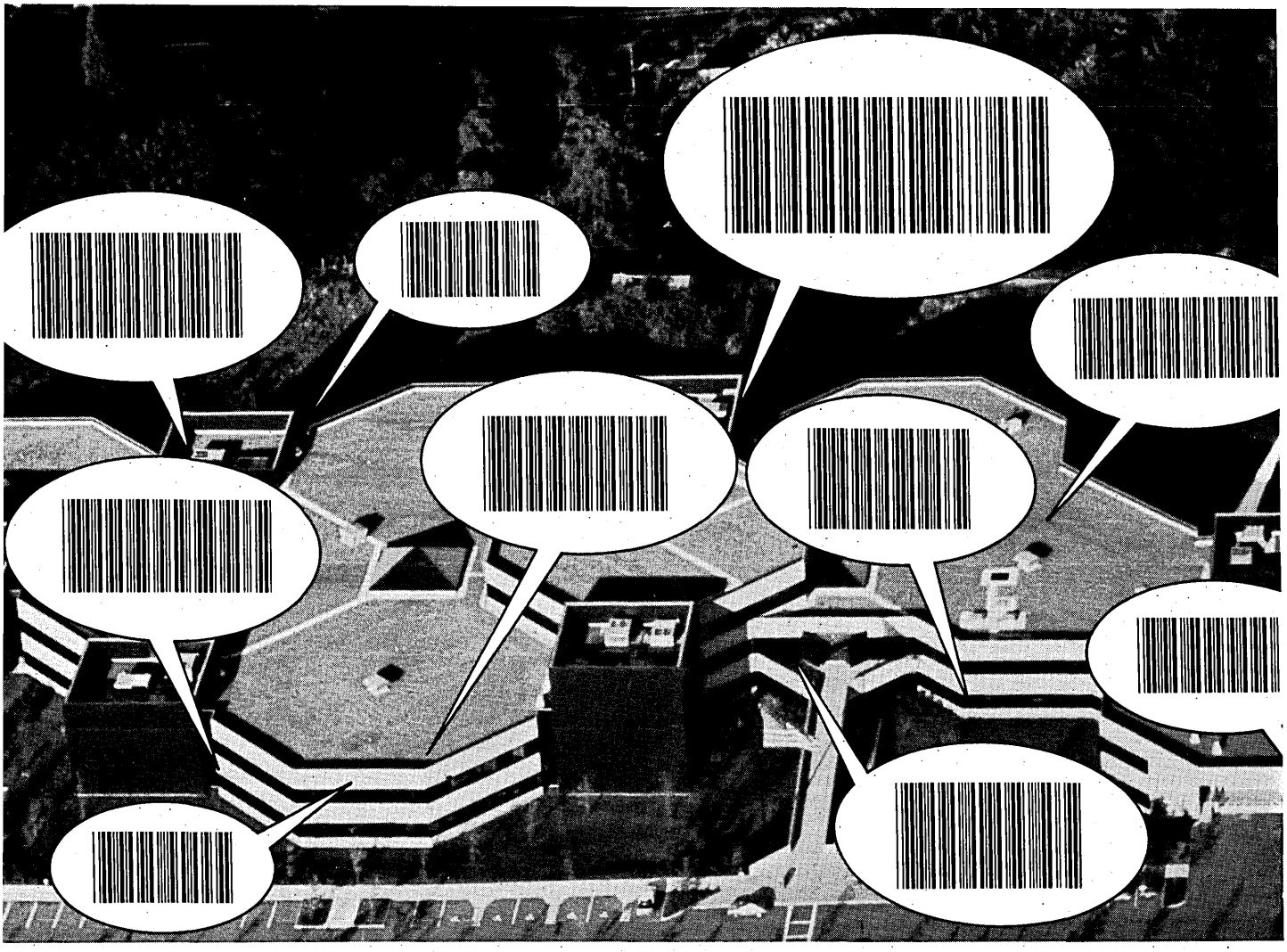

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It's the next best thing to being there; sometimes it's even better.

COMPUTER CONFERENCING

by Dennis Livingston

Cities Service Company had a problem. The oil exploration and drilling firm needed a cost-effective and efficient way of coordinating communications among a drilling operation in Manila, project management in Houston, and corporate offices in Tulsa. Teletype and telephone systems were available, but had certain limitations: messages often had to be duplicated to reach individuals at all three sites, and telephone calls had to take account of the 14-hour time difference between Manila and the U.S. locations. Was there a better way?

The Western Behavioral Sciences Institute faced a similar dilemma. This San Diego-based social science research company wanted to offer senior corporate officials a two-year series of courses on advanced management topics. But business managers usually can't spare much time for educational purposes. Was there a means of bringing the courses to the managers, rather than the other way around, in a manner that approximated the personal interaction of a classroom?

Independent Investors Forum of Washington, D.C., had an idea: an investment advisory service for individuals making investments of under $10,000 a year. Subscribers would receive timely advice and would discuss recommendations with company experts. Telephones and newsletters would be relatively awkward; was there an alternative?

All three firms found their solutions in a novel form of interactive group communications called computer-based teleconferencing. Computer conferencing is one species of teleconferencing, a generic term for any electronically mediated method of communication among people who are geographically separated, that is, not engaged in face-to-face conversation.

Teleconferencing, especially in the form of video systems, has always seemed to be one of those concepts whose full-scale application lies just over the horizon. According to my research, computer conferencing is already in use by over 100 U.S. companies, government agencies, and nonprofit institutions, as well as by thousands of individuals who have hooked up their personal computers to public information utilities that offer conferencing capabilities. One market research firm, International Resource Development of Norwalk, Conn., estimates that computer conferencing will generate $6 million in revenues from conference subscription services this year, and that number is expected to climb to $2.3 billion by 1992. (These figures exclude fees earned by conferencing firms that license their products to run on clients' in-house computers.)

Formally speaking, a computer conference is a software applications package designed to facilitate text-based group communications. Besides the software itself, a conferencing system typically requires a keyboard terminal (such as a microcomputer or communicating word processor); a modem to connect the terminal with a telephone; a host computer for storage, retrieval, and distribution of written material within the system; and a packet switching data communications network (like GTE's Telenet and Tymshare's Tymnet) that enables multiple users using local telephone access lines to communicate with each other through the host computer. Messages may be read on the terminal's screen or printed out as hardcopy.

A list of hardware requirements, however, does not begin to indicate the unique range of applications that emerge from communicating with distant colleagues through a keyboard. As a communications process, computer conferencing is best described as a virtual meeting taking place in a shared communications space, as a kind of enhanced electronic mail, and as an invisible electronic college.

My introduction to computer conferencing came in the mid-1970s, when I was invited to join a group of academics in discussing the methodological and conceptual issues arising from the new field of future studies. Sponsored for several years by the National Science Foundation, our group made use of the Electronic Information Exchange System (EIES), a pioneer conferencing format devised by Murray Turoff at the New Jersey Institute of Technology.

Although initially hesitant to touch anything labeled computer, even one disguised as a smart typewriter, I soon became addicted to the perfect communications medium for someone who loves to receive mail but hates to write letters. It was also apparent after a short time that computer conferencing had significant differences from other forms of electronic communications, along with some similarities.

CONFER ANY PLACE ANY TIME

Like electronic and voice mail (both store-and-forward message systems), computer conferencing can take place independent of time, geography, or the availability of any particular participant. While conferencing may occur in real time, the usual mode is asynchronous, so you enter the conference at your convenience, whether or not anyone else is on the system at that moment. This feature allowed me to wander over to the campus computer center at Rensselaer Polytechnic Institute, Troy, New York, at 5 a.m., if that was when I felt like seeing what my conference was doing.

The conference "site," then, is any location in the world at which a terminal/telephone connection can be made. In essence, the network is the permanent meeting hall, but members need not enter the sessions at preselected times.

Another striking quality of conferencing is the complete absence of visual and aural cues basic to video, telephone, and physical meetings. Those who rely on body language, voice inflections, and pressing the flesh as primary ways of "reading" people's intentions may be disconcerted, at first, by a medium in which ghostly comments flit across one's screen as if it were an electronic Ouija board. But conferencing quickly takes on a life of its own, and individual personal-

People may be disconcerted by a medium in which ghostly comments flit across the screen as if it were an electronic Ouija board.

CONFERENCING VENDORS AND THEIR PRODUCTS.

One way for individuals or organizations to begin computer conferencing is to subscribe to public information utilities. A couple of such utilities are available:

- The Source, McLean, Va., has approximately 40,000 subscribers and offers programs in communications, news, business, personal computing, education, shopping, and games. These services include Participate conferencing. Access is via Telenet, Tymnet, direct dial, and WATS lines. The hourly cost ranges from $7.75 (nonprime time) to $20.75 (prime time) for 300 baud service, and $10.75 to $25.75 for 1200 baud service. There is an initial charge of $100 and a minimum rate of $10 per month, but no extra fee for Participate.
- Compuserve, Columbus, Ohio, is basically a timesharing agency, but also offers a range of consumer services similar to those on The Source. Among these are the conference-like Special Interest Groups formed by members. Compuserve has about 95,000 subscribers. The cost ranges from $6 (nonprime time) to $12.50 (prime time) for 300 baud service, and $12.50 to $15 for 1200 baud service. The initial charge is $40, there is no monthly minimum, and access is free over Compuserve's own network, or $2 per hour over Tymnet or Telenet.
- Individuals may purchase software to turn their IBM PCs into miniconferencing systems using the MIST Plus package from New Era Technologies, Washington, D.C., at a cost of $495.
- A second route to conferencing for organizations is to access systems offered by software vendors through subscription, lease, or purchase. Most vendors also supply consulting services on the installation and use of their products.
- Infomedia Corporation, San Bruno, Calif., offers Notepad, which is oriented toward the project management and operational needs of organizations. Infomedia clients tend to be those with overseas activities. Subscription costs include access to Tymnet at $7 per hour, a $1,000 initial fee, and a charge of $60 per hour. Alternatively, Notepad is sold to run on any DEC System 20 with Tops 20 (an operating system) for $50,000. A version is being planned for IBM's VM/SP operating system.
- Tymshare, Cupertino, Calif., offers Augment, an "integrated office information system" intended for the manipulation of computer-generated text and graphics in a wide variety of compositional formats. Conferencing is carried out within a journal system, which is only a part of Augment's capabilities. Augment users are predominantly government agencies, some of which are cross-linked to the system over Milnet (formerly Arpanet). Otherwise, access is via Tymnet, with cost averaging between $14 and $20 per hour. There is a minimum fee of $500 per month after the third month and $1,000 per month after the 12th month. Augment is also available for sale on the DEC System 20 with Tops 20. Tymshare leases a special terminal, the Augment 1250 Display Workstation, for $200 per month and sells it for $3,995.
- Cross Information Company, Boulder, Colo., offers Matrix Information Exchange for management control in corporate organizations. It is available as an on-line system over Telenet for $25 per hour and an initial fee of $50, as a rental system for installation on DEC equipment at $1,000 per month, and for purchase at $5,000 plus maintenance at $1,000 per year.
- Advertel, Ann Arbor, Mich., has sold its Confer system predominantly to government agencies and associations. Confer is based at Wayne State University, Detroit, and runs on Amdahl V8 computers with the MTS operating system. It is available for sub scription over Telenet at an average cost of $20 to $25 per hour. The company is presently working on licensing arrangements.
- The Electronic Information Exchange System is available for use from the New Jersey Institute of Technology, Newark, N.J. As a resource for exploring and developing computer conferencing, EIES has 1,500 subscribers, half local and the other half external to the university. Membership costs $75 per month plus access charges. As a member of Edunet, NJIT can offer a Telenet fee of $3 per hour (nonprime time) and $9.50 per hour (prime time). EIES is also available for license at $35,000, running on the Perkin-Elmer INTERDATA line.
- ITT Dialcom, Silver Spring, Md., markets a variety of communications and information systems to business organizations. Testing is under way on incorporating Participate into this network. Dialcom requires a minimum fee of $100 per month, does not carry an initial charge, and is available over Tymnet at an average cost of $17 to $21 per hour.
- Participation Systems Inc., Winchester, Mass., is the originator of Participate. In addition to residing on The Source and Dialcom, this product is available for licensing at $20,000 ($10,000 for educational institutions), plus maintenance at $1,000 per quarter. Participate runs on Prime Series 50, Honeywell DPS 6, DEC VAX, and IBM machines.

ities and feelings can be recognized through the sender's writing style alone.

Communicating with a group, however, carries unexpected implications. Electronic mail can be sent over conferencing systems from one person to another or to sets of participants. But we rarely experience the kind of many-to-many communication that can occur in computer conferencing among groups of people who are either predesignated for this purpose, like my coven of futurists, or who coalesce around a subject of common concern to a larger electronic community. It is always possible for conference members to branch out into more specialized subtopics of interest only to themselves, while maintaining the flow of contributions to the original arena. In this sense, conferencing has been likened to a cocktail party at which you can simultaneously engage in all the eddies of conversation taking place in the room without interrupting the dialog of any one group.

Moreover, as a continuous record of transmitted material, the conference comments become a cumulative database that can be tapped by members according to keyword tags, date, sequence number, and author. Thus, however dispersed in its concerns a conference might become, the technology allows you to formulate your own coherent record of the proceedings at any time.

All conference formats possess a similar set of basic features. At the heart of the system is the conferencing space, the area in which users topically organize their discussions. For example, subjects of interest to my group included writing futuristic scenarios, a history of forecasts, and teaching classes on the future. A conference can be public, open to any member of the system, or private, open only to those granted access.

Other features common to conferencing systems are the private messaging (electronic mail) capability, a personal notebook for writing and editing material before submission to a conference (several jointly authored articles in my group started life in this manner), a directory with brief autobiographical information about conference members, an index to conference topics, bulletin boards for posting public notices (job listings are always popular), and balloting functions for instant polls.

In addition, when you enter a conference, you receive only those comments that

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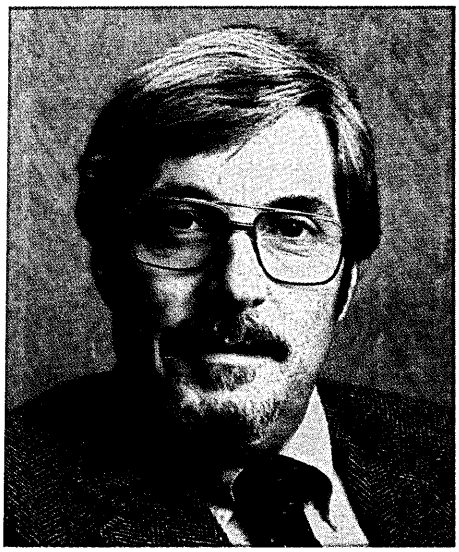

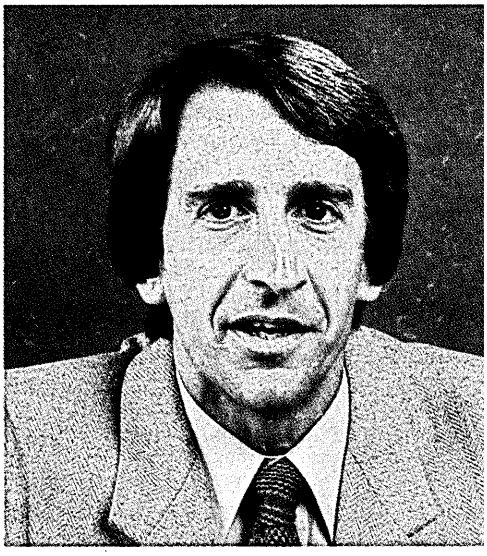

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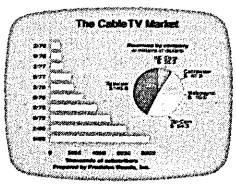

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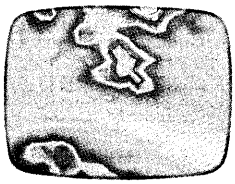

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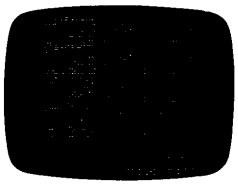

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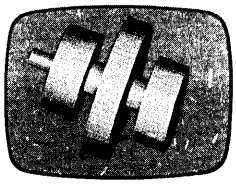
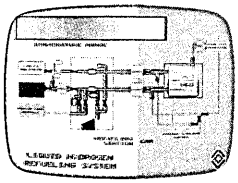


Process Control



*UNIX is a trademark of BELL Laboratories, Inc.

Several groups have used computer conferencing as a supplement to face-to-face meetings.

have been sent since you last joined the meeting—a subtle way of motivating members to keep up with conferences and thus avoid pages of printout littering the floor. A newcomer, of course, can catch up with past conversations at any convenient point in the conference record.

Roaming among all these options is facilitated by the menu-driven system, which can always be replaced with simple commands for such functions as read, write, edit, scan, and send.

Since my days on EIES, computer conferencing has attracted two broad categories of users. One consists of individuals who join conferences as part of their subscriptions to the two major public information utilities, The Source and Compuserve. The other conferencing market is comprised of commercial group users who may also join an information utility or who may lease or purchase conferencing turnkey systems for operation on in-house computers (see "Conferencing Vendors and Their Products," p. 112, for a brief rundown of vendors).

ACROSS TIME ZONES

The logical candidates for the commercial user group are organizations with employees dispersed across one or more time zones—although conferences have successfully taken place within the same region and even the same building—and which have some task or project-related need to engage in frequent communication.

Some of the earliest conferencing applications were for emergency planning and coordination. The Emergency Management Information System and Reference Index (EMISARI), also created by Murray Turoff, and its successors at later U.S. emergency preparedness agencies were used in coordinating information on the wage and price freeze of 1971, the truckers' strike of 1974, and a chlorine shortage in 1975. Another example is the recent establishment by the Institute of Nuclear Power Operations, Atlanta, Ga., of an international conferencing network using Infomedia's Notepad. Conference members include over 400 individuals in all U.S. utility companies involved with nuclear power plants, as well as in selected reactor vendor and engineering firms. Conferences on the system are devoted to safety, licensing, design, and operation of nuclear plants, including "significant event" reports and an emergency hotline.

Most applications fall into the project management category, particularly those involving scientific researchers, engineering staffs, and construction managers. City Service's drilling project used Notepad in this manner, as has Bechtel Corporation in several of its far-flung construction jobs—including a mining operation in Papua, New Guinea, managed by offices in Australia and San Francisco. There are plenty of other examples as well: IEEE's Joint Electron Device Engineering Councils worked through EIES to develop solid-state device standards; MIT's Center for Information Systems Research has brought its corporate clients on-line over Participate on The Source for discussion and planning of research projects; the U.S. Army uses Advertel's Confer to carry out planning requirements; and Notepad has served as the conferencing medium for NASA's Goddard Space Flight Center to link individuals gathering data on space physics.

As a supplement to face-to-face meetings, computer conferencing has been used by several groups for conference planning. The American Federation of Information Processing Societies (AFIPS), Reston, Va., put together the 1982 Office Automation Conference over Notepad, while the U.S. Department of Commerce sponsored a discussion among 50 ceos using EIES as an on-line adjunct to the 1983 White House Conference on Productivity.

The Western Behavioral Sciences Institute's management strategy courses, which use EIES, illustrate the potential of conferencing for education and training purposes. Celebrity "electures" are taking place over Participate on The Source this year, featuring written lectures by, and follow-up interaction with, such luminaries as John Naisbitt and Daniel Bell. One of the most intriguing applications of conferencing in an inquiry-response educational format has been Carinet, sponsored by Partnership for Productivity in Washington, D.C., over EIES. This system is used to refer technical questions from groups in third world countries to volunteer experts in U.S. organizations, with responses rapidly sent back over the network.

Companies have also used publicly available conferencing systems to organize closed meetings as test pilots before making decisions about implementing permanent in-house versions. Participate is being used toward this end by Avon on The Source and by Olin on Dialcom.

Some of the quantitative costs and benefits of conferencing can be pinned down. In addition to terminal and modem expenses, organizations may subscribe to conference software systems at rates from $10 to $25 per hour, plus initial fees and, in several cases, vendor surcharges. Conferencing software for internal use may be purchased at prices between $5,000 and $50,000, with average costs around $25,000.

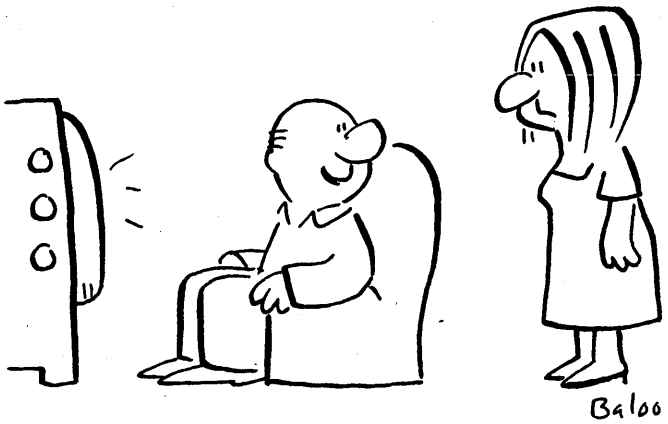
The exact amount that can be saved through use of all forms of teleconferencing is not known, but cost savings accrue by avoiding rising transportation and hotel costs, reducing airport waiting time, eliminating the need and time it takes to schedule many meetings, and lessening wear and tear on traveling managers.

The irritation and expense of telephone tag is well illustrated by Louis M. Galie, director of office workstation engineering, Burroughs Corp., who estimates that it takes an average of six phone calls to reach someone. Reaching someone in a different time zone is also a problem. Conferencing avoids such frustrations.

NO ONE CAN DOMINATE

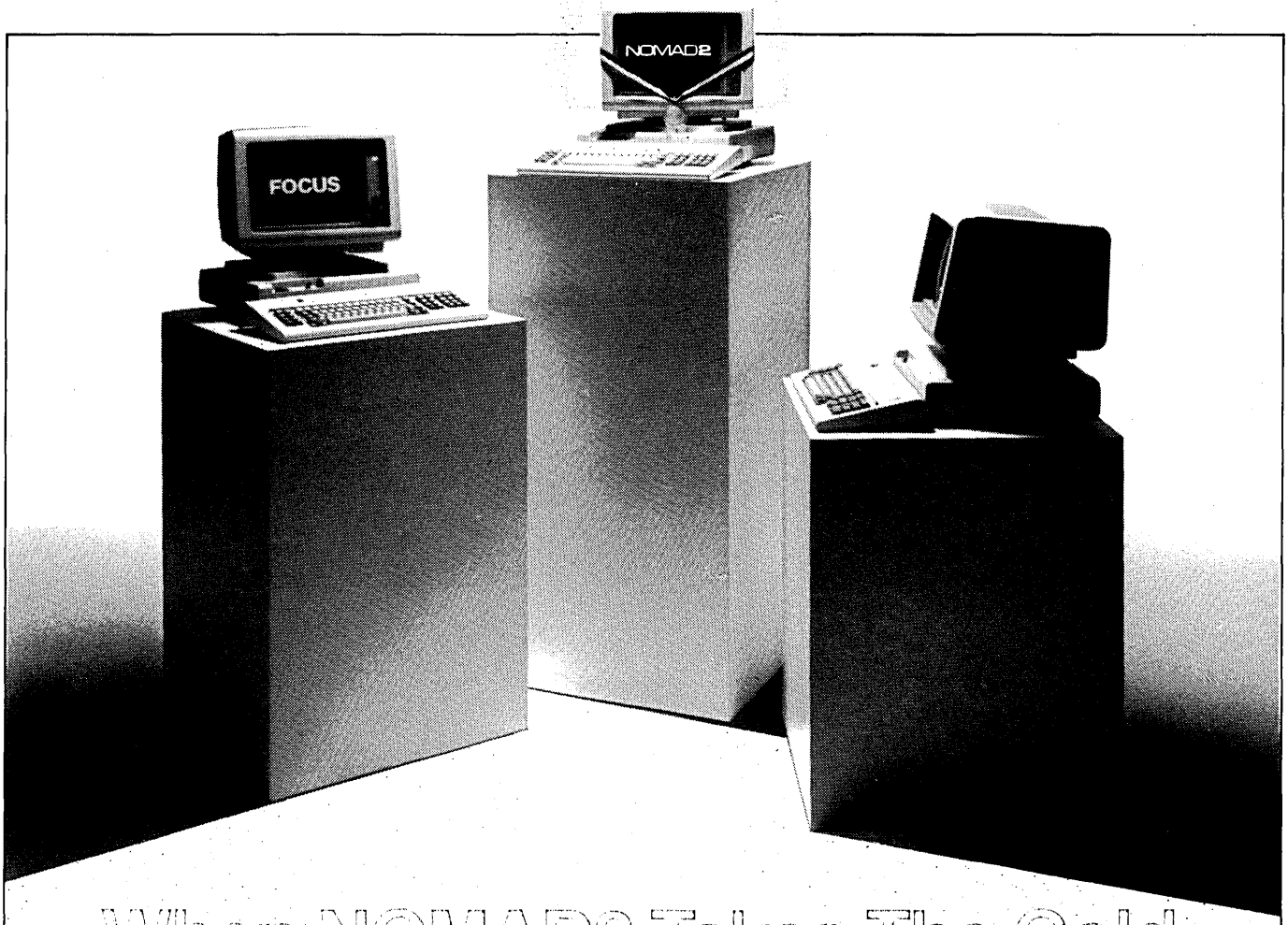
It is the qualitative realm, however, in which the most significant organizational implications of computer conferencing lie. In particular, this medium can noticeably affect the productivity and effectiveness of meetings.

For example, both experimental and commercial conferencing applications reveal that the physical absence of participants can



"It may insult my intelligence, but it's very supportive of my libido."

CARTOON BY REX F. MAY



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CIRCLE 58 ON READER CARD

Over the next 10 years, computer conferencing is likely to spread more rapidly.

favorably influence the quality of communications. No one person can dominate proceedings by virtue of a charismatic personality or a loud voice. Conference members need not feel inhibited by perceived low status, physical appearance, or any other personal factor that might lead to discrimination in everyday settings.

Decisions in a conference can be communicated swiftly, but needn't be made in a rush, or left to a rump group that remains after everybody else has gotten too tired to stick around (as often happens in physical meetings). The issues for discussion can be defined in advance, rather than taking up time during the meeting, and more people can contribute their expertise to a conference than are usually available to attend any particular face-to-face meeting.

Given these factors, corporate managers have reported increased control may be possible via conferencing, particularly when they need not always interact with their staffs in real time. Experiments with matrix management or decentralized forms of group decision-making and brainstorming can also be facilitated with computer conferencing.

In addition, managers involved with conferencing have noted improvements in the quality of messages sent over the system. This may be due to both the possibility and the necessity for deliberation that conferencing usually imposes on members—the very fact of having to communicate through writing forces one to think before replying.

These byproducts of computer conferencing do not mean it should replace all face-to-face meetings. Sales calls, some kinds of bargaining sessions, and first contacts with business colleagues are often more effectively done in person. The very existence of a continuous written record of conferences sets another kind of limitation on the type of occasion on which it may be used. But in general, computer conferences, especially when made up of people who have a strong commitment to sustain participation, can often be used to supplement other forms of communications and offer opportunities for conducting business operations that are unique to this medium.

Over the next 10 years, conferencing is likely to spread more rapidly, in conjunction with the increasing familiarity with terminal use in homes and offices. It is likely that conferencing as described here will merge with related capabilities, including graphics transmission, access to external databases, document preparation, and voice mail.

New applications should also emerge—ones that encompass extension education, brokerage and auction services, interaction with on-line publications, diffusion and discussion of trading information among buyers and sellers in various markets, and provision of market research information for product planning purposes.

As it becomes integrated with other communications tools and services, computer conferencing is ultimately bound only by the community of those having access to the required technology. By the 1990s, this is likely to encompass most medium- to large-sized organizations. *

Dennis Livingston currently works with State Street Consultants, a telemarketing company based in Boston. He is a frequent writer and speaker on high-technology issues.

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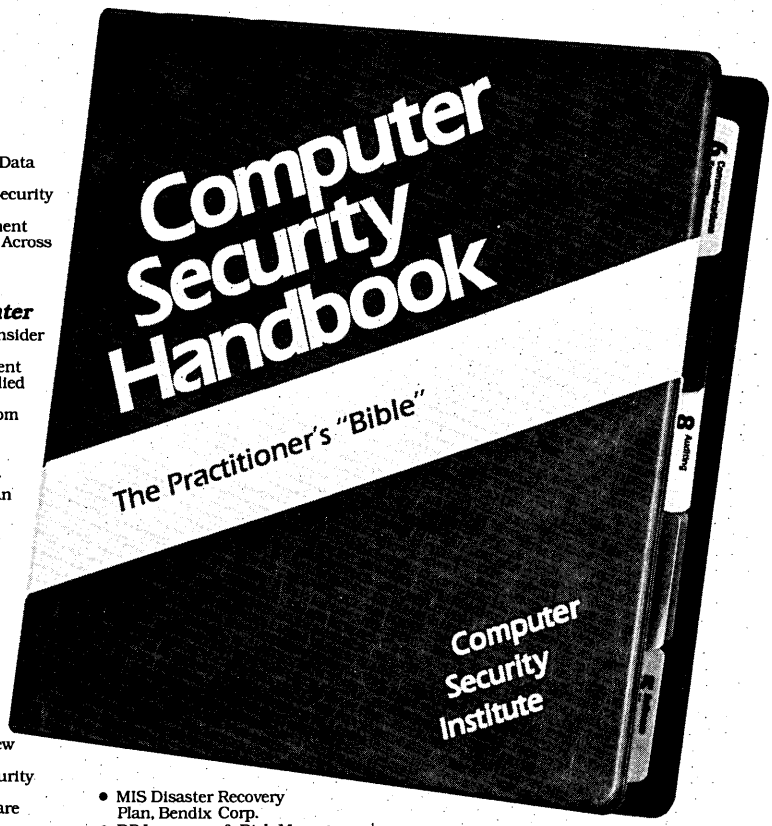

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Everybody wants one, but few people know what it is.

WHAT, IF ANYTHING, IS A RELATIONAL DATABASE?

by Frank Sweet

The relational approach to designing, organizing, and accessing data is increasingly hailed as the wave of the future. IBM put its stamp of approval on the notion by announcing DB2, the MVS version of SQL. Cullinet is likewise committed to the approach, as evidenced by IDMS-R, the next release of their DBMS, now in beta test.

Yet we hear that relational access slows response and adds hardware load, especially with large, heavily updated files. Database designers, trying to bring order out of the chaos of user requirements, complain that normalization, though theoretically elegant, is not practical. Some shops unwrap their new, brightly ribboned relational package only to find an inverted list inside, or a network with a bit of cosmetic paint. In short, it seems each of last week's relational claims is refuted by this week's procedural claim.

As with most disagreements, each school has a piece of truth by the tail and sometimes thinks it's got the whole truth. In fact, the two approaches, procedural and relational, complement one another. The tools for building a pool of sharable business data (i.e., a database) are different from those needed to extract, tabulate, and summarize the same data. The way you maintain data, in other words, is different from the way you turn it into information. The former lends itself to entity-relationship design, procedural languages, and pointer-chain connected records. The latter is best served by normalization, relational languages, and transparent select/project/join operators.

What, if anything, is a relational database? What impact will it have on dp, on our users? We can find hints to the answers by approaching the subject in eight topics:

- Codd and Date and the mathematics of data,
- selling software and snake oil,
- normalization in a nutshell,
- the relational commands,
- pure normalization doesn't work,
- pure relational is slow and unreliable,
- turning data into information demands a mixture, and
- there's no such thing as a relational database.

But first, let me tell you about Columbus and the egg.

Why do you hear "Anyone could have done that!" whenever you think up something truly ingenious? It's one of life's minor irritations. The more obviously useful an idea is, the less likely you are to receive recognition.

There's a Portuguese folk tale about the phenomenon. They say eliciting this response is the mark of true genius, and they tell of Christopher Columbus and the hard-boiled egg.

A clause in Columbus's contract with Queen Isabela said he would get 10% of anything he discovered. The queen had been happy to agree to this before he sailed; she never expected him to find a whole New World. Within five years, rivers of wealth were flowing into Spain but Chris's requests for payment were ignored. The issue came to a head at a royal banquet attended by courtiers and nobility. When Columbus complained that he hadn't been paid for discovering America, the queen replied, "Well, anyone could have done it," and all the nobles agreed with her.

Patiently, Columbus explained: "Look folks, of course it seems easy afterwards. The point is, no one thought of it before. Look at this bowl of hard-boiled eggs, for instance. I'll bet nobody here can stand an egg on end. What's more, I predict that after you try and fail, you'll all insist it's impossible. But after everyone gives up, I'll take an egg and stand it on end, and you will all say anyone could have done that! The amount of the wager? My 10%, for if it happens as I say, I'll have proven my point."

THE EGG BALANCING TRICK

With a clatter of swords, officers and aristocrats grabbed eggs and started balancing. Some on the wide end and some on the narrow, some gently and some spinning them like tops, but none succeeding. After frustrating minutes, they began to quit one by one, grumbling that Columbus had made fools of them.

After a pause, Columbus asked if the queen would pay his 10% if he proved his point by standing an egg on end. "Certainly," she replied, "but we've no fear of that, for it evidently cannot be done."

Chris then grasped an egg, wide end down, and smacked it against the tabletop. Crunch. The egg stood there on its flattened bottom.

Two shocked seconds of silence. Then, with a ringing shout, the queen, king, dukes, counts, and all cried out, "But anybody could have done *that*!"

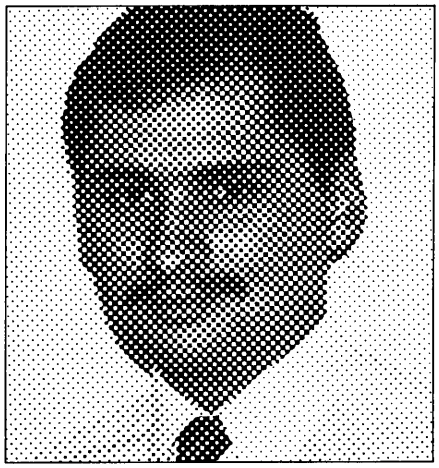
So remember, the next time someone replies to your stroke of brilliance with the phrase, "anyone could have done that," take it as an honor. You're in the company of the great explorer himself, and have been praised with the mark of true genius.

No, he never got paid. In fact, they locked him up. Oh well, back to relational databases.

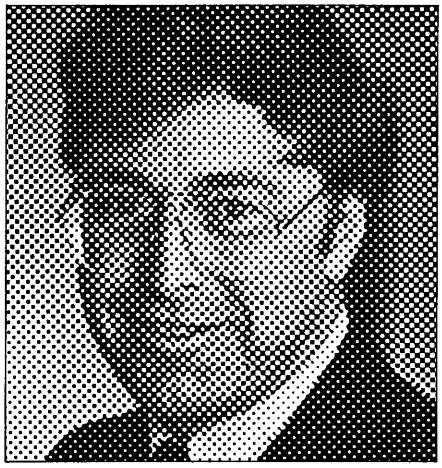
In the early 1970s, two IBMers, E.F. Codd and C.J. Date, published a mathematical approach to defining and manipulating the concept "data." Codd's work introduced normalization. His first, second, and third normal forms were steps in a process of describing interdependencies among data elements. Date expressed the ideas clearly in *Introduction to Database Systems* (Addison Wesley, 1971), the most widely read work on the topic and now a standard text in hundreds of colleges and universities. He described a hypothetical programming language that would access strictly defined data, and called it a "relational" language in contrast with COBOL or PL/1, which are procedural.

The work of Codd and Date had an electrifying effect on our industry. By 1972 it seemed we would soon design, organize, and access databases with rigor, rather than via intuition. To avoid confusion with the nebulous terms then in use (file, record, field) which, once you think about them, have only vague empirical definitions, they coined strictly defined terms for data itself (relation, tuple, attribute) and for the operations that can be performed on data (select, project, join).

Understand, now, these men did

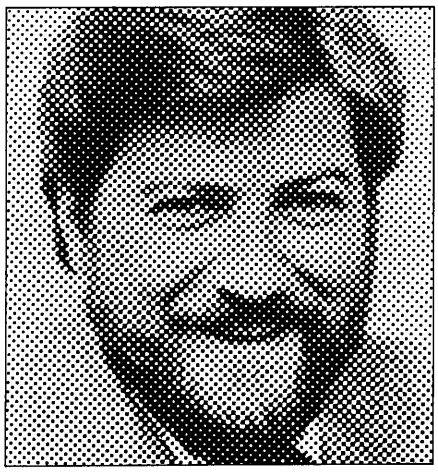


Luis Portero
Accounting operations manager
"A database where certain information is linked in a way where you can extract different kinds of variables."



Nicholas Rawlings
Director, senior technical advisor
"A relational database can relate data based on concepts as opposed to previously determined relationships."

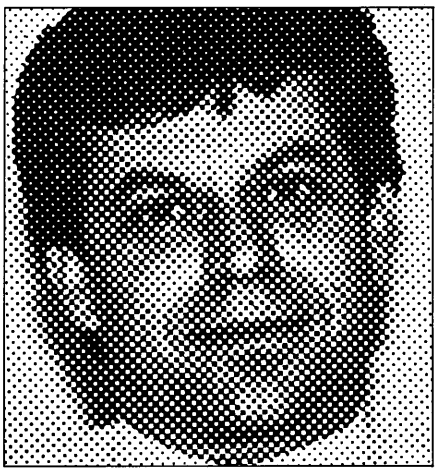
Diane Kuduk
Accounting operations manager
"I don't know. Call up a computer store."



David Cole
President and ceo
"A relational database is whatever the market says it is."

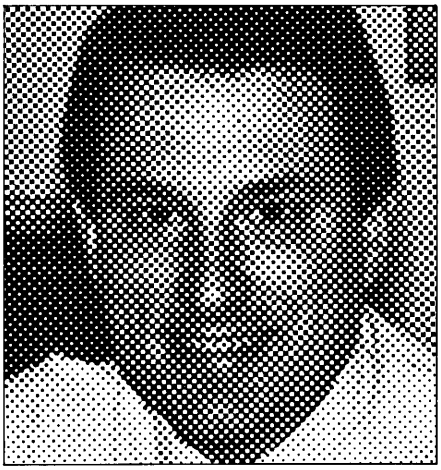
Kiki Bhatia
Computer operator
"I know what a database is but have no idea what a relational database is. What do you mean by relational?"

Joe Bingham
Systems manager
"I couldn't imagine not having one."



Gordon Cody
Regional controller
"Accounting people view a database differently than dp people do, but the word relational indicates an exchange of information between databases."

David Hungerford
Data processing manager
"You have a data manipulation language and you can define records element by element. A file is a table and can be defined that way."



John Bartlett
Dir., corp. planning & development
"A relational database is better than a sequential file; records can be interrelated and you can change the reporting relationship as you want."

The work of Codd and Date had an electrifying effect on our industry.

nothing more than lay a rigorous underpinning for data analysis (though in itself, a stupendous achievement). They developed no software and had no intention of so doing. Nevertheless, the immediate, almost instinctive, reaction of dp shops around the world was to ask, "Where can I buy one?"

JUST WHAT WAS BEING OFFERED?

The immediate, almost instinctive, reaction of software vendors around the world was to answer, "Right here, buy mine!" To understand the difference between promise and reality, let's inspect, under the revealing light of Bachman diagrams, just what was being offered.

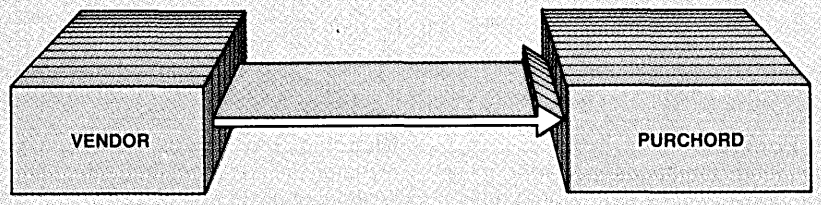
Bachman diagrams clarify the features and limitations of DBMSs because they pack many ideas into just two symbols: boxes and arrows. Each box represents a type of record. Each arrow represents a one-to-many relationship between two record types. The arrowhead is the "many" end of the relationship. Fig. 1, for example, shows that each vendor can have many purchase orders (PO), but each PO belongs to only one vendor. (A more complete explanation of Bachman diagrams can be found in "The Winchester House Syndrome," April 15).

Most DBMS packages model a relationship (arrow) between two records (boxes) with disk-address pointer chains. Each vendor record holds the address of its first PO while each PO record holds the address of the next PO belonging to that vendor. Hence, a DBMS can retrieve all POs belonging to a given vendor, or the vendor belonging to a given PO. Since a typical database holds many types of records, related in many ways, a complete diagram resembles a network and DBMSs that model such situations are called "network" packages.

But the internal mechanism is unimportant. What's significant is that each arrow is physically reflected in the database. In the relational language, on the other hand, relationships are not predefined. They can be established, ad-hoc, as the records are accessed. "Relational," then, does not mean that interrecord relationships can be designed into the database. On the contrary, it means they need not be.

Cincom's Total is a network package that allows boxes (records) to be interconnected by arrows (relationships). Its major limitation is that any box with arrows pointing out of it can have no arrows pointing inward (or vice versa). In other words, if a vendor record owns a chain of purchase orders, then a PO cannot own a chain of anything else (such as PO line items). Total uses neither Date's syntax nor Codd's concepts. Yet, from 1972 to 1976, some touted the package as "relational." The claim was justified with the argument that, with Total, records could be "related" to one another. Compared to Date's concepts, this was, at least, a semantic misunderstanding.

FIG. 1
SAMPLE OF A BACHMAN DIAGRAM



IBM's IMS/DL1 is also a network package. It, too, enabled boxes to be linked by a net of arrows, but its limit was that no more than two arrows could point into any box. In 1972, salespeople began calling IMS/DL1 "hierarchical" instead of a "network," to differentiate their product from its competition. (A hierarchy is where no box can have more than one in-pointing arrow.) The term is odd, considering that: 1) the package is clearly a network, since DL/1's logical relationships enable a record to have two owners, or "parents" in DL/1; and 2) if it were a hierarchy as claimed, it would be unusable. In response, other vendors (i.e., Cullinane and Cincom) began preaching that networks were better than hierarchies. Their argument was that if you limit yourself to one in-pointing arrow per box, you could build a hierarchical database with a network DBMS, but no comparably bizarre exercise of willpower could produce a freely related network using DL/1. In any event, from 1977 to 1982, some IBMers began implying that IMS/DL1 was somehow a step on the road to relational. Again, a misunderstanding, at least.

Similarly, other packages, such as IDMS, allow data entities to be interrelated. But to call them "relational" misses the term's meaning. Though "relational" DBMS packages, like snake oil, have been around for years, it's only recently that real progress has been made in implementing them.

Some years ago, I lectured to a class of aspiring database designers, "It is obvious that the vendor's name and address should be in the vendor master record, and not in every purchase order."

IT'S NOT OBVIOUS; PROVE IT

Immediately, a student (may she be cursed with broken disk-address pointer chains) piped up with, "Well, it's not obvious to me. Prove it."

Go ahead. You try to prove it.

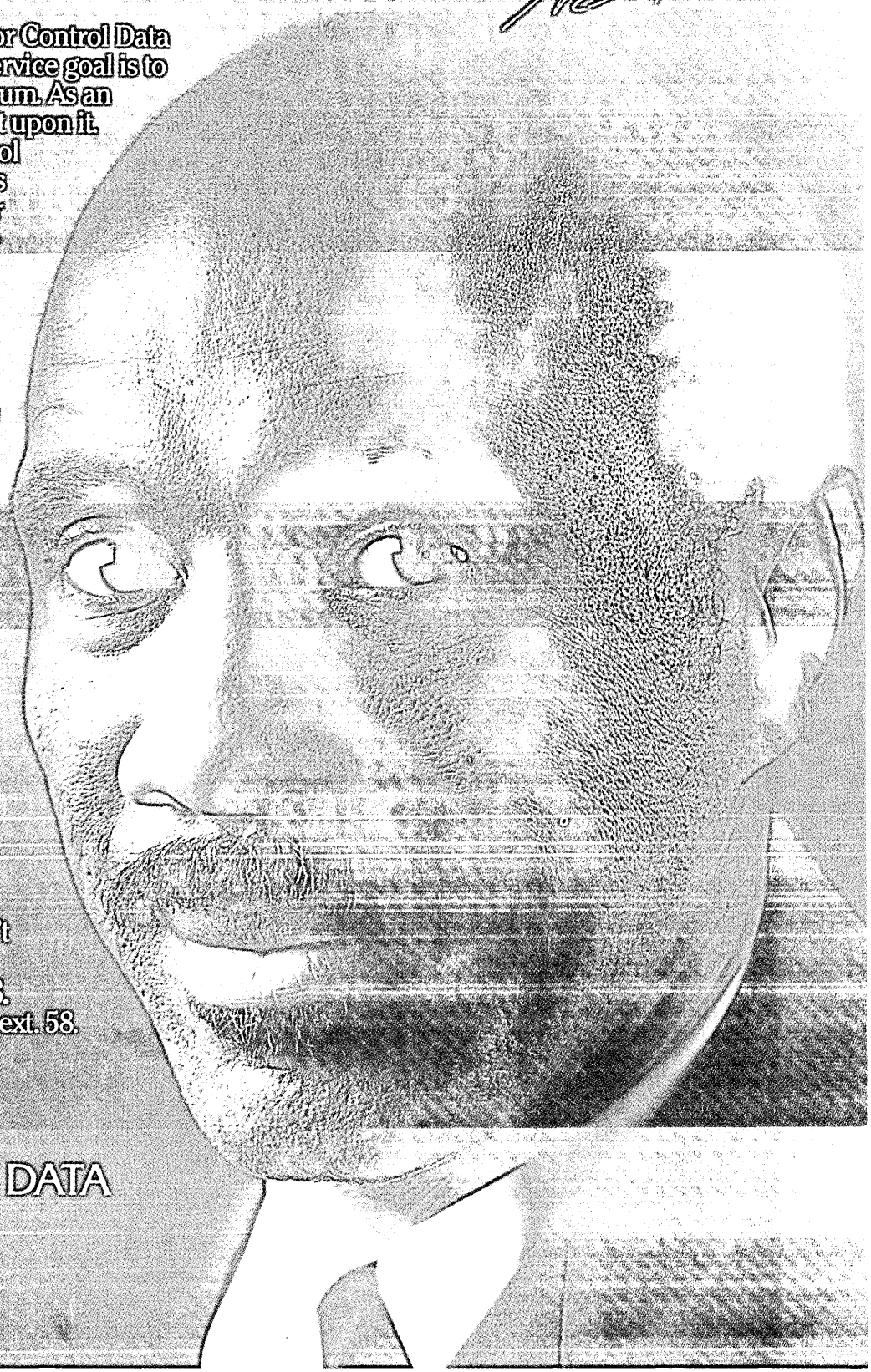
Normalization is a tool with which you can prove the assertion. To understand why, first inspect the terminology, then examine the law of the third normal form.

Imagine you have 100 vendors and 1,000 purchase orders recorded on disk. How many files do you have? How many records? The questions reveal the imprecision of the terms themselves. To answer the first, you must decide if we're talking about logical files (whatever that means) or about physical datasets. The second question not only confuses logical records with physical blocks but, worse, confuses occurrences (there are 1,100) with record types (just two). In relational terminology, we'd have two files ("relations" they're called). Each relation is a collection of identically formatted record occurrences (a record occurrence is called a "tuple"). So, in the example, there are two relations (two record types) containing 1,100 tuples in all (occurrences). There's nothing wrong with calling them two files, each with one record type, each with many occurrences of that record. Just keep in mind that Codd's terms are less ambiguous.

Now, each field in a record occurrence describes an attribute or fact about that occurrence. Vendor name and vendor address are facts about a vendor; price and delivery date are PO facts or fields. But all fields are not equal. Each vendor record has one chief field that uniquely and unambiguously identifies that vendor: the vendor ID number, the record's key. Similarly the PO relation also has a key, the PO number. The law of the third normal form (the important one in design) says that "Every fact in a tuple is a fact about the key, the whole key, and nothing but the key."

- A fact about the key: Imagine that we put, in the vendor record, the field region code, region description, and region manager. The first is a fact about the vendor—it tells what region he's in. The other two are facts about the region, not the vendor. They do not belong in the vendor record because they are not facts about the key (the occurrence's vendor ID). They should go in another relation entire-

"One thing I'm sure of: all my engineers hate computer downtime as much as you do."



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ly, perhaps in a table of region codes.

• The whole key: Imagine that the PO number is made of two pieces: its vendor's ID, plus a sequence number. Putting vendor address in the PO record violates the second part of this rule. Vendor address is a fact about vendor ID (just the first piece of the PO key), and not about the whole key, PO number.

• And nothing but the key: Item price, item quantity, and item description are, in a sense, facts about a multi-item purchase order. But PO number alone is not enough to identify them unambiguously. These fields are facts about a record that's not even in our example, the PO line item. Its key would be PO number plus line number. Putting these fields into the PO record would violate the third part of the law.

Did you hear that? Hundreds of experienced dpers just groaned, "But these rules are obvious! We've been following them for years!" And so, we have. But that very obviousness indicates the true genius of Codd's formalization. Remember Columbus?

MUCH MORE THAN EASY RULES

The bad news is that there is much, much more to conceptual database design than these simple record-level rules. We'll return to the bad news in a moment. First, let's examine the commands of a relational language.

Codd's imaginary relational language included no syntax for updating records. It dealt only with retrieval. Also, it retrieved whole flocks of records at a whack; it had no one-tuple-at-a-time commands. The three commands are select, project, and join, and they work like this:

Select creates a new relation, a temporary file or table of just those records whose fields pass a selection sieve. "GET ALL VENDOR WHERE (STATE = NJ)" is an example of a select command in OLQ, an almost-relational language with which many of us are familiar. (Cullinet, OLQ's vendor, does not claim the language is relational; that's the author's opinion.)

Project limits a relation to specific, named attributes. "DISPLAY FIELDS = (VENDOR-ID, VENDOR-NAME, VENDOR-CITY)" is OLQ's project command.

Join concatenates two related records, thus forming a longer record or relation. Recall, in the Bachman diagram example, that each vendor could own several purchase orders. "GET ALL PURCHORD. THEN GET OWNER VENDOR BELONGING TO PURCHORD," is OLQ's join command. The result is a table of all purchase orders, where each PO record is lengthened because its parent vendor's data is glued onto the right-hand end. The field on which the two original relations are joined is, of course, the vendor ID number that appeared in both. Another way of expressing the same join in OLQ is "GET ALL VENDOR. THEN GET ALL PURCHORD BELONGING TO VENDOR." In this case, each vendor record is replicated for each of its purchase orders, and each copy gets one purchase order attached to it. Notice that except for the sequence of fields in the new records, both joins give precisely the same result.

But OLQ, a real language, has limitations. Its join, for example, depends on relationships that were physically modeled in the database; it uses those disk-address pointer chains we mentioned. This means that any interrecord relationships not planned by the database designer are inaccessible. If it met ideal relational specs, OLQ would support joins on any field, planned or not, and a command like "GET ALL VENDOR. THEN GET ALL EMPLOYEE WHERE (VENDOR-CITY = EMPLOYEE-CITY)" would work.

Back to the bad news. Without the predesigned relationships ("sets" in COBOL) that permit select and join, real languages must inspect many candidate records for each one presented. Try OLQ's "GET ALL VENDOR WHERE (VENDOR-STATE = NJ)" on a file with half a million vendors, and you'll have time for dinner, a movie, and a good novel.

Both benefits of relational database research (normalization and the relational commands) are powerful mind-tools that are transforming our industry. Yet both are incomplete. Procedural methods (entity-relationship design and better procedural languages) offer equally useful instruments. Today's database technology is becoming a synthesis of procedural and relational thought.

Pure normalization does not work. Relations, tuples, and attributes are more precise terms for record layouts, record occurrences, and fields. The semantic precision enables formal normalization rules ("the key, the whole key, and nothing but the key") to codify the principles of sound record design, making it less mysterious to the novice and less subjective to the veteran.

REASONS APPROACH FAILS

Unfortunately, normalization offers no similar metaphor for thinking about data in large chunks. This makes it an incomplete tool for designing real databases for real people. Pure normalization begins with a bunch of data elements or attributes. Out of these, it helps you assemble relations (record layouts) rather like turning bricks into buildings. There are three steps: 1. identify all the data elements; 2. determine how the individual elements relate to one another; and 3. assemble one-to-one related elements (such as vendor name and vendor address) into records. There are four reasons why this approach fails:

• Unstandardized vernacular. We are seldom handed predefined data elements when we begin design. Different users, even in the same department, use different terms for the same thing, such as shop order, work order, manufacturing job, and job order. They often use the same term for entirely different things, as with location code, active flag and file key.

• Peripheral data. When we do collect predefined elements, on manual forms for example, they're often the wrong ones. Forms and documents include many secondary, redundant, and derived fields because they are intended for carrying data from one human to another, not for capturing the essence of "what's going on here?"

• Dpers' lack of business understanding. The best user answer I've yet heard to "How do these two elements relate?" was "Not bad, they're both Geminis."

• Sheer volume. Imagine developing an overall database architecture or a large application using normalization: You'd have to resolve every field-to-field relationship in a 500 by 500 matrix of fields.

The alternative is the entity-relationship approach to database design. This is a top-down method with three steps: 1) Identify the business entities—the things you plan to store business data about, such as vendors and POs; 2) find the relationships among them—one vendor can have many POs but each PO must belong to only one vendor; 3) uncover the data elements that describe the attributes of each entity.

The flaw is that this works best in the hands of a veteran designer who intuitively realizes that "every fact is a fact about the key," etc. It can lead to disastrously redundant designs when applied by the inexperienced.

Increasingly, we find database design is best done by beginning with entity-relationship design, then checking your work with normalization. Pure relational is inherently slow, unreliable, and read-only. The select, project, and join relational operators are powerful instruments for information retrieval, but fail to help us organize data for reliable updating and maintenance. First, the relational commands deal with whole groups of records, while updating is done one record at a time. Hence, database maintenance is inherently procedural, not relational. Consequently, real languages will incorporate procedural (record at a time) read and write commands for updating the database. They must. To be more useful, languages must be less relational.

Also, relational concepts do not recognize referential integrity. In other words, most file designers would agree there is something fundamentally, viscerally wrong

COBOL can no more access a relational database than a circle can have corners.

with storing a purchase order for a vendor that's not on file or with erasing a vendor who has open purchase orders. The preplanned one-to-many relationship is not just an access tool; it's the heart of data integrity. No real database update language could survive without features supporting referential integrity. Again, synthesis in the form of predefined mandatory joins will make real languages less relational but more reliable.

Finally, predefined joins and selects are essential for speed in any real machine. Seen in this light, recent ping-ponging arguments about relational's supposed inherent slowness are more semantic than technical.

Turning data into information demands a mixture. The two approaches, relational and procedural, are opposite sides of the same coin. Imagine the three aspects of each approach—design, access language, and implementation—as perceived by two hypothetical groups of dpers. The first is a development center (DC) responsible for constructing and maintaining a sharable pool of business data about the firm. The second is an information center (IC) whose job is to help users transform facts from the database into usable information for running the business.

"Design," says the DC, "must follow the top-down entity-relationship approach. We are never handed predefined raw elements. We must first sketch out the entities (records) and then fill in the details with elements to be identified, collected, validated, and posted into the database, each in its appropriate slot. That's the only way to get the job done in a reasonable length of time."

"Design," answers the IC, "should be normalized. Of course the elements preexist. There they are, in the database. Normalization does not take long, it's easy to learn, and it insures that vendor address winds up in the vendor record and not in each PO. It's the only way to get the job done by dpers with a reasonable level of experience."

"Access language," retorts the DC, "must be procedural. How else can we fulfill our responsibility of making sure that the data are accurate or, at least, internally consistent? We must have the ability to precisely specify, step-by-step, the operations that the computer performs in processing the data. Like an algebraic equation, we can be sure of the result only if we've specified all the operations properly. It's the simplest way, for example, of preventing deletion of a vendor with outstanding POs."

"Access language," rebuts the IC, "must be relational. How else can we fulfill our responsibility of making information usable? We must have the ability to vaguely specify the end result we want and let the software figure out what sets or records or whatever must be read to do the job. Like an equation in calculus, we can be sure of the result without having any idea of how it was brought about. It's the easiest way, for example, of producing a report that shows the sum of outstanding balance on all the POs for vendors in Florida."

LINK-LIST POINTER CHAINS

"Implementation," concludes the DC, smugly, "forces us to use link-list pointer chains. Without them, you would have to scan every single PO in the file just to select the ones for Acme Office Products, and our machine would grind to a halt with every on-line inquiry."

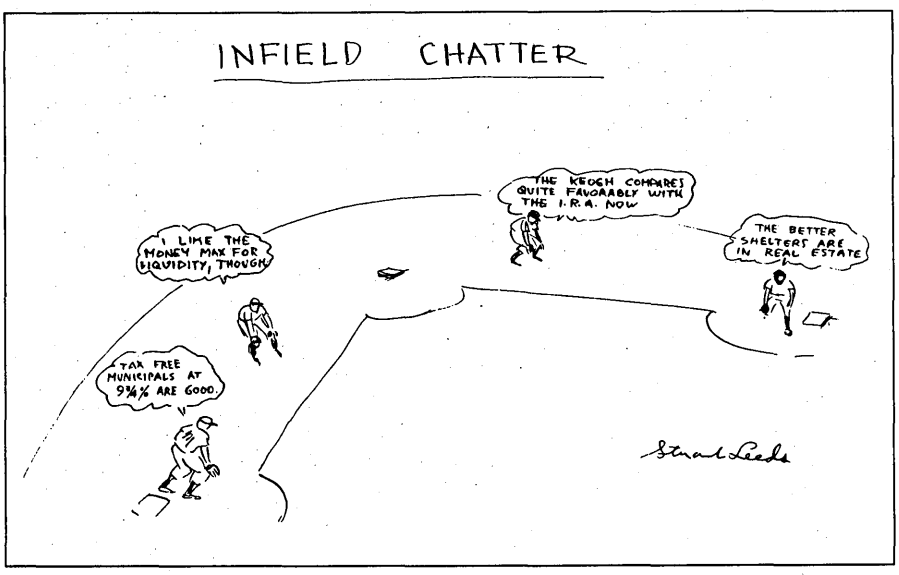
'Implementation," points out the IC, "depends on ingenuity of software and hardware design plus brute force. Without file searches, the database designer must prophesy every conceivable inquiry and ad hoc request and then preprogram pointer chains for them into the schema." Like the seven wise men and the elephant, they're both right. Each assesses the situation accurately. But each touches only part of the beast.

Fourteen years ago our profession recognized the need for relational languages. It's simply taken this long to develop them. The dialogue above shows that fully half of dp's activity would be better supported with Date's relational syntax. But it also points out that the procedural-relational contrast is not an argument between database packages, nor even between competing ways of conceptualizing data itself. It addresses the essence of how one goes about programming a computer. Relational simply means nonprocedural in that you need only specify the desired result and the software figures out the steps. Procedural means that, like COBOL, you define the actual steps, and if each step is correct, you get the result you want.

COBOL can no more access a relational database than a circle can have corners. It's simply a contradiction in terms. Is COBOL dead? Yes and no. It has essentially been replaced by better, more economical tools for information centers—relational languages like SQL, OLQ, DB2, and IDMS-R, or relational/procedural hybrids like Culprit and Easytrieve. But no, it isn't dead, because hundreds of millions of dollars worldwide are invested in COBOL programs that collect, validate, and maintain the databases that feed the raw data to the data-into-information process. It will take decades to replace this investment with something else and when this happens, the replacement will simply be better procedural, nonrelational languages like ADS/On-line or DMS.

There's no such thing as a relational database. When you get right down to it, "relational database" is as meaningless as "plaid music" or "scratchy color". The adjective describes languages or processes, not data. The database itself, the pool of shared business data, can be neither procedural nor relational. For a database processes nothing, it just sits there, waiting to be accessed.

Instead, there are relational data access languages like QBE, SQL, and IDMS-R and procedural ones like COBOL and ADS/On-line. Both types of language will be used: the latter to maintain the raw material, or data, and the former to turn it into information. Your database will continue to be the hub of both processes. *



CARTOON BY STUART LEEDS

Frank Sweet is corporate manager of data administration for The Charter Co., a Fortune 100 firm in Jacksonville, Fla. He also publishes *Boxes and Arrows*, a monthly newsletter for DBAs using IDMS.

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MEDIA INTELLIGENCE

The personal computer is making change a constant in information centers.

THE EVOLUTION OF THE INFORMATION CENTER

by Tor Guimaraes

The evolution of the information center owes a lot to creationism. As is so often true in the dp world, IBM did the creating. Or, at least, the naming.

The concept that became known as the information center first arose in the '60s, but when IBM gave the idea a name in the '70s, information centers took off. And the explosive growth of personal computing in American corporations since then has made the information center a necessity.

Here's how the information center has evolved so far. I will also describe the shape I believe the information center must take in order to ensure that personal computing is a corporate computing asset.

The overwhelming growth of personal computing in organizations has created problems and situations that need to be managed, but the control mechanisms that are established must not stifle personal computing freedom within the organization.

Companies have learned that user participation in equipment acquisition, systems development and operation, education, and problem solving should be promoted. But MIS professionals must assume the responsibility of assisting users as they seek to satisfy their information needs.

MIS departments that don't accept this new challenge will find themselves increasingly isolated from company business activities and left to perform only the more mundane or specialized corporate information tasks. Personal, end-user computing grew out of the introduction of microcomputers in the late 1970s, and the concept has had little time to evolve in managerial terms. Yet, the experience of many companies reveals a strongly perceived need to manage user computing through information centers.

In the information center format, users depend on their MIS departments for resource acquisition, primarily because the software usually resides on the organization mainframe. But users may either access a generalized software package (usually purchased and installed by the MIS department) or user-developed applications software. The MIS departments provide training, education, and operational support. User access to application software is through a wide variety of terminals (crts, hardcopy, plotters) that may be centrally located or scattered throughout user departments. Access to these terminals may be controlled by the MIS department, the user department, or by individual users.

To meet these new challenges, the information center has evolved in several ways, handling its own problems and meeting its clients' needs with ad hoc solutions. I want to talk about this evolution and propose some changes in how most companies manage their information centers.

Phase I information centers: the past. Despite the existence of report-generating software packages such as Easytrieve and Mark IV, in this historic environment, end-user access to computer terminals was rarely possible. Few companies had any end users operating mainframe terminals. For the most part, the MIS department controlled all aspects of computing, from resource acquisition and systems development to report generation. The number, types, and capabilities of the software packages then commercially available was, of course, rather limited compared with what is available today.

Phase II information centers: the present. Motivated by the urgent need of MIS departments to reduce the backlog of user requests for information, in the late '70s IBM introduced the concept of an information center.

To reduce this backlog, IBM proposed that organizations make available to present and prospective computer users tools that would allow them to do their own computing. While the MIS departments would provide the necessary training, an integral part of the IBM information center concept was the notion that users *must* do their own computing. In addition to terminals, the suggested user computing tools included a wide assortment of software packages and procedural languages. Personal computers were not included in the IBM proposal for information centers.

Phase III information centers: the future. In direct contrast with the phase II notion that users must do their own computing, the cornerstone of phase III information centers is full user support. Full user support means that MIS departments assist users to satisfy their information needs by providing as many computing alternatives as possible, including developing systems for users whenever possible. The MIS department helps users select the appropriate solution to their specific problem, provides them with appropriate education and training, and assists them with problem management.

USERS SHOULD CHOOSE

Individual users should be able to choose any viable computing alternative as long as user department managers are willing to pay for it and overall company interests have been protected. It is important that MIS departments educate business managers about the company-wide and long-term implications of their departmental computing decisions.

Many user computing activities need to be managed in an integrated fashion under the aegis of the MIS department, among them, matching of user requests for information with appropriate computing alternatives, user training, user computing equipment acquisition, and problem management.

An opinion survey of MIS managers about problems encountered with personal computing reveals several items that may represent significant and unnecessary costs to an organization:

- Users of personal computers throughout the organization tend to "reinvent the wheel" by not sharing knowledge or access to tools, methods, vendors, etc.
- Because of their isolation, many users learn through an expensive process of trial and error.
- Since user experience about the managerial aspects of computing is cultivated through trial and error, exposure to major disasters is common. For example, file backup and recovery and system quality assurance measures are issues neglected by most users according to many MIS managers who are in

Personal computer users throughout the organization tend to reinvent the wheel.

THE TROUBLE WITH USERS

Major personal computing problems were identified by 52 MIS managers attending a seminar on information center management. This sample represents a wide cross-section of large- and middle-sized companies from several industries. The managers were presented with a list of possible problem areas and were asked to indicate, on a scale of 1 to 5, their level of concern with each problem: 1. not concerned at all, 2. a little concerned, 3. concerned, 4. very concerned, 5. extremely concerned. They were also instructed to add to the list as they saw fit, and the results were used to tailor the seminar to their needs. Here is the final list of problems. The respective average level of concern is within parentheses.

(4.1) Unnecessary high costs to the company due to users "reinventing the wheel" in systems development.

(4.3) Unnecessary high costs to the company due to users learning by trial and error how to use available software packages.

(2.3) Unnecessary high costs to the company due to users learning by trial and error how to negotiate with vendors.

(2.6) Unnecessary high costs to the company due to users learning by trial and error about lack of compatibility with other micros.

(4.6) Unnecessary high costs to the company due to users learning by trial and error about lack of compatibility with mainframe(s).

(1.7) Unnecessary high costs to the company due to users learning by trial and error about lack of compatibility with microcomputer peripherals.

(4.6) Poor maintainability of user-developed systems.

(3.5) Lack of adequate support from hardware vendors.

(3.2) Lack of adequate support from software vendors.

(4.2) Contamination of corporate data on the company's mainframe.

(4.4) Overwhelming growth of user requests for assistance from the MIS department.

(3.2) Lack of control over user computing resources utilization in user departments by the MIS department.

(3.6) Lack of control over user computing resources utilization in user departments by the user department management.

(3.9) Lack of user knowledge or concern about microcomputer data integrity measures such as a file backup.

(3.1) Lack of user concern about personal computing equipment security.

(1.4) Malicious or unauthorized user behavior regarding company property.

(4.7) Lack of user education regarding a companywide and a long-term perspective about personal computing.

(3.2) Personal computing is further straining MIS department relations with users.

(4.2) Mismatch of user applications to other possible user computing alternatives, such as mainframe packages or the traditional approach for systems development.

(4.8) Lack of a company plan for personal computing.

(4.5) General lack of communication between the MIS department and users.

(3.1) Information overloading due to too many vendors and products in a given area: micros, software packages, local area networks, etc.

(4.2) MIS department has image problem with personal computing users.

(2.9) Lack of integration in MIS management of personal computing and mainframe user computing.

(3.2) Lack of centralized management over corporate data resources to support user personal computing.

(4.2) Lack of equivalent or better (more user-friendly, etc.) mainframe software packages to compete successfully with microcomputer software packages.

(3.7) Inability of mainframe computing to compete with personal computing in terms of cost/benefit in certain areas.

(2.9) Lack of user interest in using personal computers.

(2.1) Measuring the level of user computing activity.

(3.8) Lack of integration of micro/mainframe data exchange and control.

(4.2) Lack of adequate training on products, computer concepts, etc.

(3.2) Lack of appropriate staffing to identify and service potential information center customers.

touch with personal computing activities in their companies. But, worse, some MIS managers admit to a complete or substantial lack of knowledge about such activities.

- Many technical problems require a substantial investment of user time for solution. In many cases, it is in the organization's best interest that the problem be addressed by MIS professionals who have considerably more knowledge on the subject.

Many personal computing problems can be corrected by business managers if the problem is brought to their attention, so it is important that MIS and business managers periodically consult on the user computing activities within individual departments.

Several organizations with substantial personal computing activity have saved millions of dollars by implementing or promoting relatively simple measures such as:

- Centralized microcomputer acquisition;
- a "help desk" to which users can go for advice and assistance on computing problems;
- user groups on various software products;
- short "consciousness raising" seminars on

FIG. 1

APPARENT TRENDS IN PERSONAL COMPUTING BASED ON 96 ORGANIZATIONS SURVEYED (1982-1984)

	1982	1984
Companies with business personal computing	13	68
In the selection and acquisition of personal computers, the MIS department has:		
control over the selection process	2	52
advisory capacity only	6	13
no input	3*	3*
Formal user training program	0	26
Formal help desk	0	33
Company planning for personal computing	0	8
Local area networking	0	12
User groups	2	41
Personal computing library	0	29
Equipment demonstration facilities	2	38

*These organizations are not the same three.

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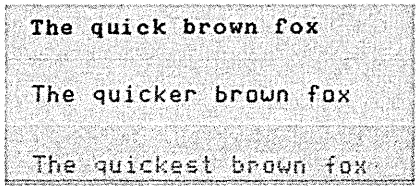

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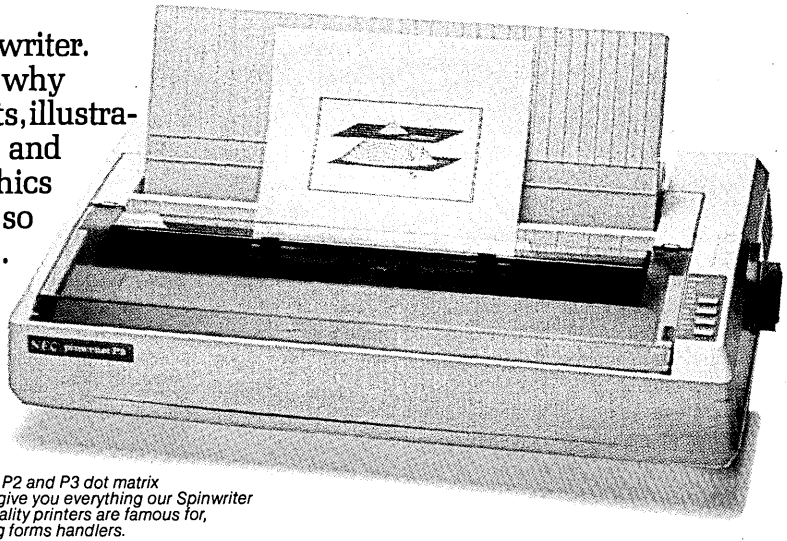

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CIRCLE 65 ON READER CARD

The most important change in data management will be the increased level of direct service to personal computing users.

the benefits and problems of personal computing, in which companywide and longterm perspectives are emphasized.

There are some computing processes and managerial tasks that are performed more effectively when integrated throughout the organization and across all user computing alternatives. It is the MIS manager's duty to persuade company management that this integration is needed. Examples of processes amenable to integrated management include dispensing information on overall company computing resources, planning for computing resources acquisition, and matching user information requirements with appropriate computing alternatives.

Many organizations have grown so large that organizational subunits and individuals within these units are completely unaware of the relevant activities of others. This knowledge isolation leads to unnecessary costs. A critical task of the information center is to collect and disseminate information about available computing resources (equipment, user-developed systems, software packages, and data) that can be shared. This requires the centralization of knowledge about all company computing activities, including personal computing.

MASTER PLAN FOR COMPANY

Planning resource acquisition for personal computing and for information centers must be integrated under a master plan for all company computing activities. Future user information requirements can, to a considerable extent, be satisfied by more than one computing alternative. The planning of any one alternative will affect the others. For example, if the MIS department is not aware that a significant number of users will be acquiring personal computers instead of using the terminals attached to the company mainframe, MIS capacity plans will be significantly inaccurate.

Matching users with appropriate computing alternatives, a task totally neglected by phase II information centers, receives great emphasis under the phase III concept. It is imperative that information centers have mechanisms to make prospective computer users aware of alternatives to personal computers and that users' requirements be matched with these alternatives.

Countless personal computer users have spent substantial amounts of time and resources in developing systems (databases) on microcomputers. Only later do they discover severe limitations to a system's ability to evolve and that more powerful tools were available on the company mainframe.

Because good matching requires substantial knowledge of microcomputers as well as mainframe tools, many companies effectively use a committee with two or three members as the matching mechanism.

In early 1982, a survey of 96 northeast Ohio business organizations with gross revenues ranging from $50 million to over $2 billion was undertaken to evaluate the state of user computing. At that time, in 13 of the organizations personal computers were being used for business applications (see Fig. 1). By early 1984, 68 of the same organizations had at least one personal computer being used for the same purposes.

In 1982, four of the MIS departments had some measure of control over the selection and acquisition of personal computers, six had advisory capacity only, and three had no input at all. For 1984, the figures were 52, 13, and three, respectively. The three organizations at which MIS departments had no input in early 1984 now have standard vendor equipment, and users receive considerable support from MIS.

No organization provided any formal training for the users in 1982 compared with 26 companies that now have at least one course related to personal computing.

No organization had a help desk, or used local area networks to share computing resources or to communicate. Now, the figures are 33 and 12, respectively. Two companies had recognized user groups compared with 41 companies today. While no company had a personal computing library before, 29 presently have one. Only two organizations gave hardware and software demonstrations to users compared with today's 38.

These changes—implemented in the last two years—are rated as major successes by the MIS managers. Very likely more companies will find them useful with time.

Besides these trends, some important future developments can be forecast.

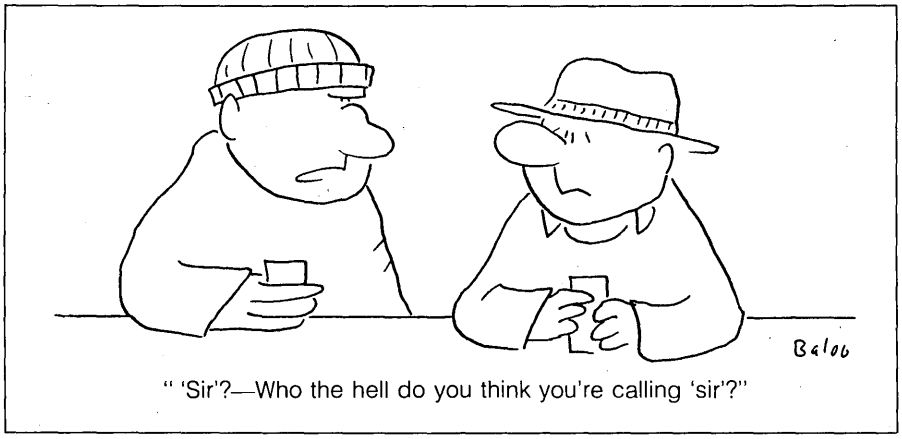
In most organizations personal computing users will substantially increase the demand for data resources inside and outside the corporation. MIS departments in the immediate future will have a renewed interest in purchasing data administration tools, such as data base management systems (DBMS) and data dictionaries and directories (DDD).

The trend toward substantially more powerful and user-friendly DBMSs, for microcomputers will continue, even though mainframes will remain the dominant store for corporate data.

The most important change in data management will be the increased level of direct service to personal computing users. Dispensing information on data item availability, access requirements, and cost will become a major component of the data administration function. Many MIS departments are planning to include data items on outside databases as part of their service responsibility to their user communities.

An important new development for MIS departments will be methodologies to teach users to define their information requirements. Several new approaches have been tested with promising results. MIS managers feel that having prospective computer users define their own information requirements is in most cases more efficient than asking users to try to communicate their requirements to an analyst. Also, most MIS managers are delighted to see the people-intensive process of information requirements definition shifting toward user departments.

The major obstacle to widespread use of this concept seems to be a generally low credibility of MIS departments with business managers. MIS managers are reluctant to try the exercise on their own and prefer to use an outside consultant. This is likely to be a temporary problem, however. Based on the encouraging results, the idea is likely to spread. It will eventually become common practice in most organizations. *



" 'Sir'?—Who the hell do you think you're calling 'sir'?"

CARTOON BY REX F. MAY

Tor Guimaraes is director of the postgraduate MIS certification program at the Weatherhead School of Management of Case Western Reserve University in Cleveland.

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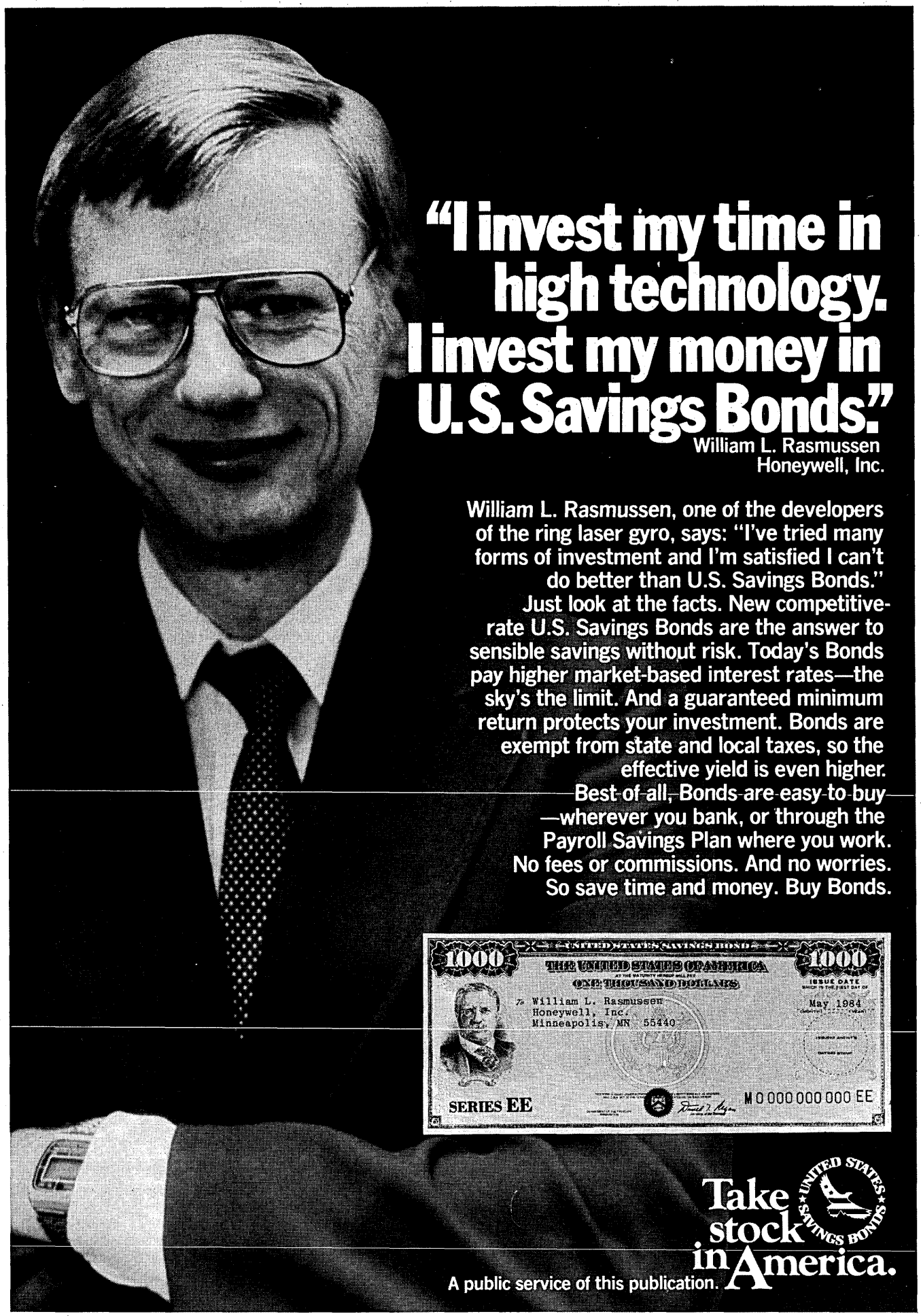
CIRCLE 66 ON READER CARD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HARDWARE

OFF-LINE

The National Computer Conference last week in Las Vegas brought to a close the spring fashion season in the computer industry and ushered in a summer of evaluating and waiting. Since February, many trade shows have showcased vendors' hottest new products, but many of these will not become available until this fall. Moreover, many vendors will hold back on competing products until the fall fashion season, which begins with the Federal Computer Conference in Washington in two months. This summer, then, is the time to digest the rapid-fire product announcements of the past few months and to anticipate products coming this fall, in preparation for the budget-setting process that begins in September for many companies.

Increasingly, as the spring's new product offerings have made clear, the computer industry is leaning toward a consolidation around several leading operating systems, with less tolerance for nonstandard systems. For some time, MS/DOS has been the OS of choice on micros, and in the minicomputer world the absence of Unix on any system is more noteworthy than its presence. The popularity of Unix has been attributed to everything from AT&T entering the minicomputer marketplace to the increasing use of Unix with 68000-based micros to the predilection of programmers to write applications in a system that's easy for them, regardless of how it operates in a production environment. So far, however, MIS/dp departments have failed to embrace Unix as thoroughly as its proponents would like, using it instead in limited applications or not at all. The heavy emphasis on Unix in this season's new hardware may force many MIS/dp departments to consider taking some more definitive action on the operating system this summer.

More than Unix, however, the most important issue of the spring trade show season has continued to be the rise of the corporate microcomputer. Traditional large-system shows like Interface for datacom, Comdex for oems, and the NCC, were overrun by micros. That is indicative of the trend in the industry, according to a study by Newton-Evans Research Co. Inc., Ellicott City, Md., entitled "Microcomputer Usage Trends in Fortune Corporations." The study reveals that MIS/dp executives project a 66% growth in microcomputers in their companies. In fact, by the end of 1984, the study says that more than half these companies will have more than 100 micros installed. The 153 respondents project that by the end of 1985, about 420 micros will be installed in the "average" large company. The same study points out that 52% of the desktop micro users are professionals, 23% managers and executives, and 25% clerical staff.

Dp departments were not quick to accept micros, nor were users quick to seek out dp for advice concerning their new toys. Some vendors took advantage of that state by going to the user to make a sale, while others went to the dp manager. Whatever the case, users today look to the dp shop for their purchasing, networking, and repair needs, as a study by the Data Processing Management Association shows. Some 89.5% of dp respondents noted that end users now seek their advice and assistance. However, according to DPMA, there is an "urgent" need to implement micro policies and guidelines in the corporate environment. The study found that 45% of the respondents said financial applications are the most common on micros, followed by decision support at 20% and word processing at 18.5%.

EDITING VDT

The Ampex 210 editing vdt emulates 14 terminal models made by five manufacturers. The system's video attributes include blinking, reverse video, underline, blank, and half intensity. Editing functions can be executed from the keyboard. The system can insert or delete lines or characters, clear page, erase to end of line or end of page, and move the cursor left, right, up, down, or home. The operator can also select block or underline cursor, steady or blinking, or no cursor at all. The system has a smooth scroll mode that moves the data vertically one line at a time, 5.4 lines per second, on the single display page.

The terminal has a 14-inch diagonal nonglare screen that can be viewed in amber or green screens. The terminal's footprint allows it to fit on a standard office desk. It can be tilted five degrees forward and 20 degrees backward, and swivel on its base in a 90-degree arc.

The Selectric III-type keyboard is detachable and has a six-foot coiled interface cable with modular connector. The terminal includes 96 ASCII characters, 32 control characters, and 15 graphic characters. Seven character sets are resident and user selectable in the system.

The data format is 24 lines by 80 characters with a 25th status line. The character format is a 27 by 9 dot matrix, with a 9 by 12 field with true descenders. The system also has dual RS232C asynchronous ports. A serial printer interface is standard. The 210 costs $550, and the vendor says discounts are available for volume purchases. AMPEX CORP., Redwood City, Calif.

FOR DATA CIRCLE 301 ON READER CARD

MINIFRAME

The Miniframe is a minicomputer based on the Motorola 68010, 10MHz microprocessor. It has from 0.5 to 2MB of RAM in a 4MB virtual address space, a discrete memory management unit, and a Western Digital 1010 VLSI disk controller.

The unit's mass storage options in-

clude a fixed 5¼-inch disk drive in a choice of capacities including 13, 26, and 50 megabytes, unformatted; and a removable 5¼-inch floppy disk drive with a capacity of 640KB. The system features a Centronics parallel port for printer support, two to 10 RS232C ports, offering speeds up to 9.6Kps, a multidrop RS422 port with speeds up to 307Kbps, and an Ethernet controller.

The computer supports up to 10 standard RS232 terminals. The system runs under Unix, and has a window manager that provides up to four independent screen windows. According to the vendor, this feature allows users to execute four programs simultaneously and to copy and move information between windows. Additional software includes COBOL, FORTRAN, BASIC, Pascal, C, and assembler programming and a range of Unix development tools, data management facilities, and communications. Oem prices for the Miniframe start at $4,700, with a system priced at $10,000 that supports eight users. CONVERGENT TECHNOLOGIES, Santa Clara, Calif.

FOR DATA CIRCLE 302 ON READER CARD

VOICE/DATA PBX

The Delta-Plex Series 2000 is a digital voice/data PBX designed to integrate the vendor's communications, information processing, and building control technologies. The unit serves users with single, clustered, or geographically dispersed facilities who require a flexible communication system that handles voice and data communications simultaneously while interfacing to various information processing, networking, and control systems. The unit can also be used as a complete, standalone voice communication system for users who do not yet have data transmission requirements. The device will address various applications, including standalone voice/data communications, combined PBX and tandem networking, integrated building control and tenant services, and data communications and data networking.

The unit uses digital switching technology, with fully modular, distributed processing voice/data capabilities. The system architecture allows expansion from 100 to 12,000 lines in 200-line increments, without replacing any components in the original configuration.

The PBX offers networking, packet switching, and electronic mail capabilities. According to the vendor, it requires little floor space and it operates at low power consumption levels and functions in normal office conditions. The Delta-Plex Series 2000 costs from $700 to $1,100 per line. HONEYWELL INC., Minneapolis.

FOR DATA CIRCLE 303 ON READER CARD

NONIMPACT PAGE PRINTER

The 60/240 is a high-speed, high-duty-cycle nonimpact printer designed for high-volume printing applications requiring mixed text and graphics output.

According to the vendor, this printer uses a proprietary image processor. The unit prints on cut-sheet paper at a speed of 60 pages per minute and a resolution of 240 dots per inch. It supports many host computers including those running operating systems such as Unix and supporting document composition systems such as Troff, Tex, and Scribe. When not used as a high-volume, composition-quality printer, the unit can print files formatted for daisywheel and line printers, as well as the Tektronix 4014. The printer is based on the 68000 microprocessor and has 256KB RAM and up to 1,024KB optional memory. The 60/240 costs $80,000. IMAGEN CORP., Mountain View, Calif.

FOR DATA CIRCLE 304 ON READER CARD

DISPLAY STATIONS

This vendor introduced two display stations. The 3179 color and 3180 monochrome display stations provide advanced functions such as a modifiable keyboard with layouts that can be defined by the user. People in organizations that have varied keyboard requirements or applications, such as airline scheduling or inventory control, can customize the basic unit instead of placing orders for special keyboard arrangements.

Both display terminals can be used with the IBM 8100 system. The 3179 and 3180 can be used with the 8100 via a 3274 attachment or any System/370. The 3180 is a 15-inch monochrome display unit. It has a logic element, modifiable keyboard, cable attachment, and flexible coiled keyboard cable. The 3179 has all the features of the 3180 with a seven-color, 14-inch display unit. The 3179 and 3180 cost $2,300 each. IBM CORP., Town of Rye, N.Y.

FOR DATA CIRCLE 305 ON READER CARD

DIAL MODEM

The DialNet3000 Model 3024 is a full-duplex modem for use over the dial telephone, passing synchronous or asynchronous inputs. The CCITT V.22 bis-compatible unit can communicate at 2,400 bps with other V.22 bis modems or, alternatively, at 1200 bps with Bell 212-type units.

A manual-originate and manual- or auto-answer modem, the Model 3024 uses a single board utilizing semicustom CMOS circuitry, a microprocessor controller, and a digital signal processor chip. As a result, up to 16 of the rack-mount versions of the product can fit in a single rack 8¾ inches high. In addition to its ability to automatically determine and match the transmitting speed and mode of a calling modem, the unit also provides local analog loopback diagnostics, which can be locally or remotely invoked. The standard desktop version of the Model 3024 is priced at $800. Its card module counterpart costs $750, with corresponding ModemRack3200 running $750. MICOM SYSTEMS INC., Chatsworth, Calif.

FOR DATA CIRCLE 306 ON READER CARD

—Robert J. Crutchfield

HARDWARE SPOTLIGHT

PORTABLE COMPUTER

The Portable is a nine-pound, notebook-sized computer that features a flip-up, 16-line by 60-column LCD and a full-sized keyboard. The computer also has built-in software, including Lotus 1-2-3. It contains almost two thirds of a megabyte of memory and can run MS/DOS software and share data with HP, IBM, and other personal computers.

Measuring 13 by 10 by 3 inches, the Portable runs on rechargeable batteries for one to two weeks of use. Potential customers include managers, consultants, financial analysts, salespersons, and other professionals who travel by airline or train or who simply want to work away from their desks. The machine can be used as a standalone computer, with part of its continuous memory acting as a disk drive; as a remote terminal with its built-in modem; or as a data sharing companion to other desktop computers. It has 272KB of RAM. All memory is continuous so users can load several additional programs into RAM, then create, without a disk drive, spreadsheets, memos, and other work while traveling.

The vendor estimates that 80% of personal computing applications are covered by programs built into the unit's 384KB of ROM. The software on a chip includes a personal applications manager that shields the user from having to learn MS/DOS to use the computer; MemoMaker, a word processing program; Lotus 1-2-3; and a terminal emulation program for connecting to other computers.

The unit can share data with other computers via the Portable-Desktop Link package. Additionally, the built-in modem allows access to public databanks and other computers. It also has an RS232C interface. The Portable costs $3,000. HEWLETT-PACKARD CO., Palo Alto, Calif.

FOR DATA CIRCLE 300 ON READER CARD

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CIRCLE 69 ON READER CARD

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System accounting in a VM interactive environment inherently demands a different approach than you may expect. VM just doesn't provide the raw accounting data offered by other systems. Still, you need to account for system and resource usage in your VM Information Center.

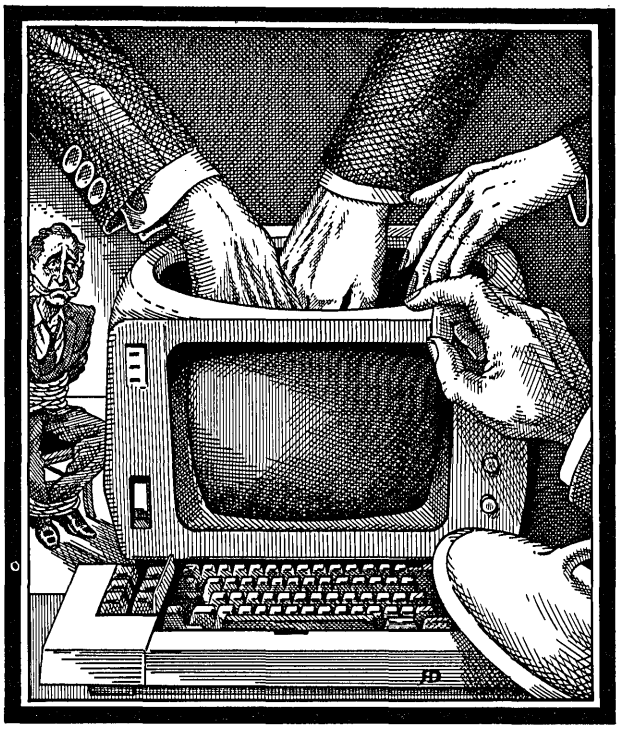
PERSPECTIVE

Many MIS and DP executives began their careers in the MVS environment, and consequently view system software product evaluations from an MVS perspective. A *VM based* Information Center though, simply does not fit into the MVS world. That is not to say that VM is inherently better; it's just very different.

HISTORY

MVS has been a strategic product for IBM since at least the early 1970s. This strategic "label" caused IBM to devote substantial development resources, over a long period, to enhancing MVS and all of its component parts. The success of this long term effort shows today. MVS is a robust, full featured, reliable, and stable *batch* operating environment. But as an interactive support environment, it is seriously deficient in terms of productivity and end-user friendliness.

This deficiency created the need for VM. The explosive growth in the number of VM sites is largely due to VM's clear superiority over MVS as an interactive decision support environment. As the Information Center and Development Center concepts grew in popularity, IBM labeled VM as a "highly strategic" product and began to devote extensive development resources to enhancing the product. IBM's VM



development team is moving aggressively to close the enhancement gap between MVS and VM.

SYSTEM ACCOUNTING

A good example of the difference in relative sophistication of features between MVS and VM internals is in system accounting.

MVS allows you to collect over 200 different types of records from the Systems Management Facility (SMF) and the Resource Management Facility (RMF). Independent software vendors have created products that allow this SMF and RMF data to be summarized and reported in a myriad of useful ways. The key to this success is that MVS itself offers native realtime collection and management of these records in the SYS1.MAN data sets.

VM in contrast produces only six basic accounting records. Many more are required before system accounting in VM will reach the level of sophistication enjoyed by MVS. No software vendor can build a VM accounting product as complete and strong as the existing MVS products because the raw data just isn't available in VM. Many enhancements to MVS accounting came as a result of pressure from IBM user groups. These groups are placing similar pressure now on IBM to enhance VM accounting. VM *will* evolve substantially, but you need resource accounting now.

YOUR ACCOUNTING NEEDS

What is important to the MIS or DP manager in an interactive decision support environment? The accounting demands of MVS and VM system accounting are externally similar, but with significant internal differences. The needs are the same, but the implementations are different.

Let's look at your needs from an overall management perspective. First, if you are running an Information Center under VM, you don't have the control over resource consumption that you would under MVS, nor do you have the predictability of the timing of resource demand. Other departments can consume huge portions of your resources without notice, and worse, without accountability.

Next, you may be forced to fund large software purchases for another department with no way to recoup the cost or even determine whether the acquired software product is being used.

Similar problems exist in project accounting. You must be able to track expenditures to budget and enforce budget controls by project.

To be accurate in a VM environment, this data must be collected realtime. Batch accounting is sufficient for a batch environment, but for pure interactive work, only realtime accounting is timely enough.

Of course you also require the ability to do the traditional system accounting functions of invoicing, management reporting, auditing, and security enforcement.

WHAT IS YOUR SOLUTION?

The senior developers at VM Software Inc. have the experience to force an accounting system to meet these needs through extensive modifications to VM internals; but this would be a serious mistake. IBM is moving so aggressively to enhance VM that there is no way to ensure that internal modifications to VM made by an independent software vendor today will operate on the next VM release. This is an assurance you must have before you acquire any software package. An effective VM accounting system *must* work within the existing framework of the VM environment, yet allow for future VM growth.

We at VM Software Inc. have developed six products that work together to help you run your VM Information Center more efficiently. VMACCOUNT meets the resource accounting needs discussed above. Perhaps more importantly, VMACCOUNT is specifically designed to grow in sophistication as IBM enhances VM to collect and report more detailed data on system usage. VMSI, as the leading vendor of VM system software products, understands the intricacies of VM and the needs of VM Information Centers. VMACCOUNT is designed to meet these needs, now and in the future.

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SOFTWARE AND SERVICES

UPDATES

As legal precedents continue to reinforce the copyright laws' protection of personal computer basic I/O systems (BIOSs), many clone makers have become more than a little concerned about how to prevent their companies from getting tangled up in costly litigation. One maker of an IBM PC compatible goes as far as not allowing his software engineers to see IBM's BIOS documentation. They have to develop their own BIOS blind to IBM's design and still make it compatible. Moreover, the president of this company says, the resulting BIOS was later reviewed by a top copyright law firm in Chicago. The executive notes that every step of the BIOS development must be documented so that it can be proven that the intent of the company was not to copy someone else's BIOS should any other vendor take them to court.

Another company, Phoenix Software Associates Ltd., has developed an IBM PC-compatible ROM BIOS software package for resale. The company says that the BIOS was developed under "strict controls" to avoid copyright infringement and is insured against infringement suits. The vendor claims that this is the first time the OEM market has been provided with an original off-the-shelf PC ROM BIOS designed so that other pc makers can develop products without infringing on IBM's ROM BIOS copyright. According to Phoenix, this software was also developed by programmers who had no knowledge of IBM's BIOS, and the design is "very different" from Big Blue's. Phoenix is convinced that its BIOS is immune to litigation, but just in case it has taken out a $2 million policy against copyright infringement suits, should IBM or some other company decide that this software is not as clean as it looks. The Hartford Group is underwriting the policy, which was taken out "in order to reassure our customers of the legitimacy of our product."

It seems that if a software vendor isn't worrying about being sued, it is worrying about its software being copied or pirated. Strange, then, that the firms pressing for legislation against software piracy are not the software publishers. Those firms are, to be fair, pursuing other avenues, but they have so far refrained from entering the political arena. Instead, companies such as Vault Corp., Westlake, Calif., which specially treats floppy diskettes to prevent piracy, are the firms pressing for laws to aid in their cause. Georgia recently became the third state to consider such legislation, though no state yet has such a law on the books. Georgia's bill has the support of Governor Joe Frank Harris, but it was not clear at press time what chance it had of passing the state's legislature. According to W. Krag Brotby, Vault's chairman, projected losses from unauthorized copying or duplication of software will reach $700 million in 1984, or 20% of the industry's estimated gross revenues of $3.5 billion. Brotby says passage of the bill would "strengthen the ability of software publishers and distributors to enforce their rights under the copyright law."

The bill would also enable publishers and distributors to enforce their rights under trade secret laws. California and Louisiana are the other states considering similar bills. It remains to be seen, however, whether this software bill will be at all effective against software pirates. Either way, Vault benefits: if the law works, it can claim civic pride; if the law fails, it can market its own products to do what the law should do but can't. In any case, there are no easy solutions.

DOCUMENT MANAGEMENT

This vendor is offering two document retrieval and management packages for the IBM 4300 computer systems. The packages are identical, though one is designed to run on the 4300 under DOS/VSE and the other under the OS/MVS operating system. Both are under CICS.

This software enhances computer assisted micrographic document retrieval and controls mainframe document files. According to the vendor, document retrieval that sometimes requires several minutes can be accomplished with this package in under five seconds. A specially designed master record concept utilized in this software accelerates the document retrieval process. Under this concept, a master record file is called up on a workstation crt screen. One keystroke then provides a list of all the documents associated with that master record. Adding a document can be done in the same way. An unrestricted number of documents may be included in each master record file.

Both packages support mixed media such as a single and multilevel blip 16mm film, fiche, 35mm film, and optical disk, within the same application. A status code is included in the display. Extraction of data from the host computer database can also be performed by the software. Document management packages cost $25,000 each. 3M, St. Paul, Minn.

FOR DATA CIRCLE 326 ON READER CARD

COMMUNICATIONS SOFTWARE

The EasyLink Instant Mail Manager is a versatile communications package that helps personal computer users manage their electronic messages. Features built into the software such as word processing, addressing management, and disk filing extend its application beyond send and receive functions. The software is designed to enhance the vendor's EasyLink electronic communications service, which allows personal computer users to communicate with more than 1.5 million Western Union communications network subscribers worldwide.

The mail merge provides all the

standard features of a general purpose communications package, including the ability to access corporate mainframes and information database retrieval services. The communications software allows users to create the message, identify the recipients, and select the message format, including Instant Mail, Telex, Worldwide Telex, Mailgram, Telegram, Cablegram, and Computer Letter.

Log-on information can be preset for up to 16 different services and accessed by a single keystroke. Other functions allow users to select a specific time for sending or receiving messages to take advantage of discount rates.

Word processing software has been integrated to aid users in composing messages. Address book management software allows users to maintain a database of frequent message recipients and to update it. Disk file management provides a built-in filing system. The system automatically stores transmitted messages on a diskette for future reference, lists all stored communications, displays messages for editing and resending, and renames or deletes mail stored on diskette.

The software can also capture all input/output information in a 100-line screen buffer and scroll through the message while it is on-line. It also automatically redials the last phone number entered into the system and completes the necessary log-on sequence. The initial version of the software is designed for use with the IBM PC, PC XT, or PC-compatible systems. EasyLink Instant Mail Manager costs $95, which includes $35 of free EasyLink service usage. WESTERN UNION CORP., Upper Saddle River, N.J.

FOR DATA CIRCLE 327 ON READER CARD

SOFTWARE SPOTLIGHT

MICRO-TO-MAINFRAME LINK

Ashton-Tate and Informatics General Corp. have developed dBase/Answer, a micro-to-mainframe link for personal computer database management systems. This software package provides access to most IBM mainframes and plug compatibles running under OS and DOS, IMS/DC, or CICS. CMS will soon be supported. It also provides access to all IBM supported databases, including IMS/DL1 and VSAM, ADABAS, TOTAL, and IDMS.

This product allows users to selectively access and download IBM mainframe database information to the microcomputer in a format compatible with most personal computer business software. According to the vendor, by transferring requested information directly from mainframe to micro, the software eliminates rekeying, making it possible to utilize corporate databases to develop ad hoc reports, create local databases, or generate general applications.

The software consists of two packages, dBase/Answer for the micro and Answer/DB for the mainframe. The microcomputer software portion utilizes a series of menus, screen messages, and help screens to assist users in formulating queries and selecting desired data. There are a total of 32 screens grouped into six types of functions. After the choices are made, Answer/DB takes over and automatically selects and extracts the specific data requested from the mainframe database. The information is then delivered in detailed or summarized form to the personal computer in a file format compatible with Ashton-Tate's or other vendors' products.

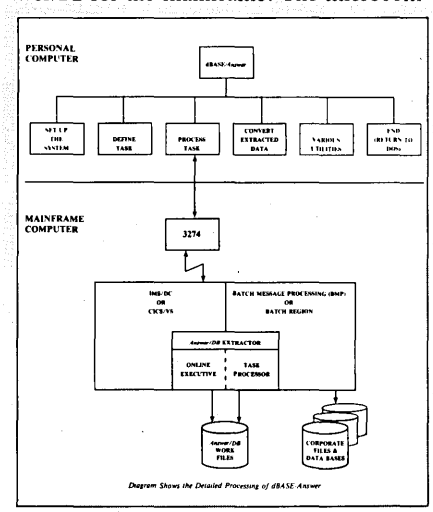

Diagram Shows the Detailed Processing of dBASE/Answer

Features such as security, download, and upload capabilities give users access to information, while also allowing MIS and dp managers to maintain full control over central computer databases. The security of mainframe data is protected because the MIS department sets up user profiles, which specify which parts of the database are accessible to each micro user. Authorized users are able to extract information from the mainframe, manipulate the data at the micro, and send them back to the larger computer to be stored in files set up specifically for end-user storage. Users, however, may not update the central databases maintained by the MIS department.

Initially, the micro side of this product is compatible with the IBM PC XT with a minimum of 256KB of storage. Two double-sided, double-density disk drives are also required. It currently operates under the IMS/DC and CICS telecommunications monitors via a proprietary asynchronous protocol or 3270 emulation using an IRMA board. A configuration consisting of an Answer/DB module for a single mainframe and dBase/Answer for 50 personal computers costs $45,000. ASHTON-TATE, Culver City, Calif., and INFORMATICS GENERAL CORP., Woodland Hills, Calif.

FOR DATA CIRCLE 325 ON READER CARD

FUNCTIONAL PLANNER

PC Prism functional planner software enables data processing professionals to work more closely with top management. This software runs on the IBM PC and PC XT.

It compiles data on the company's people, resources, and information. It then uses relational analysis to show how these elements can be used to align a company's organization with its objectives. According to the vendor, relational analysis is a mechanical process that lets a company manipulate entities to examine and compare the various ways of dealing with a very specific issue. It is an integrated set of software tools that can be used to support and extend the use of different planning approaches. This software helps define issues and their causes. The module develops matrices and integrates the capabilities of the company's personnel, and sources. It then develops strategies for handling threats and opportunities. PC Prism costs between $5,000 and $20,000. DELTACOM INC., Philadelphia.

FOR DATA CIRCLE 328 ON READER CARD

INTERACTIVE LEXICON

This release of Intellect features an interactive lexicon as well as report formatting facilities for "instant English" queries by nontechnical business users.

The interactive lexicon facility consists of three components to automate the construction of the initial lexicon and simplify the ongoing enhancement of it. These components are the Instant English facility, the English Definition Facility, and the Lexicon Screen Editor.

The Instant English facility automatically transforms the data dictionary information that describes the database into a lexicon for Intellect's use. The English Definition Facility allows end users to add definitions to the lexicon by typing a simple English definition. This facility allows end users to add definitions where the Instant English leaves off. The Lexicon Screen Editor is used for building and maintaining lexicons for large, complex database applications. Any definition displayed by the lexicon editor can be changed immediately by changing any component of the definition as it appears on the screen. The screen editor can be invoked anytime during the Intellect session.

Report Formatter provides users with the ability to customize the output format of an Intellect request. There is no need to learn a special report-writing language. It can provide both hardcopy and screen-oriented reports with user-defined titles, headings, footings, and control breaks. Series 300 of Intellect costs $69,500 in MVS and $49,000 in DOS. Current Intellect customers will receive Release 301 as part of the vendor's maintenance program. ARTIFICIAL INTELLIGENCE CORP., Waltham, Mass.

FOR DATA CIRCLE 329 ON READER CARD

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ON THE JOB

THE SHAPE OF THINGS TO COME

Less than 6% of all new jobs between now and 1995 will be in high-tech fields. That was the conclusion reached by Russell W. Rumberger and Henry M. Levin of Stanford University's Institute for Research on Educational Finance and Governance (IFG) after they performed extensive analysis of several long-term labor forecasts. They claim that none of the 10 occupations with the largest expected growth in new jobs will be related to high tech.

Their findings are based on projections of the U.S. labor market to 1995 from the Bureau of Labor Statistics (BLS), and on similar studies by the National Science Foundation and the Institute for Economic Analysis (IEA). They also maintain that while past projections have been fairly accurate, the growth rates of technical occupations were overstated, and the decline rates of certain traditional jobs was understated.

Rumberger and Levin claim that only 15% or less of the U.S. work force is employed in high-tech industries, and most of those jobs are in production and office areas that pay below average wages.

According to the BLS's definition of high-tech jobs, only 3% of all employment falls into this category. So even if high-tech jobs are expected to increase 46% by 1995, that would still account for only 6% of the entire work force.

The findings of the IFG are published in a report entitled "Forecasting the Impact of New Technologies on the Future Job Market." You can obtain a free copy by writing to IFG, CERAS Bldg., Stanford, CA 94305, or by calling (415) 497-2754.

MOST WANTED

Lamalie Associates, a New York City-based senior-level search firm, reports that after a strong finish in 1983, demand for

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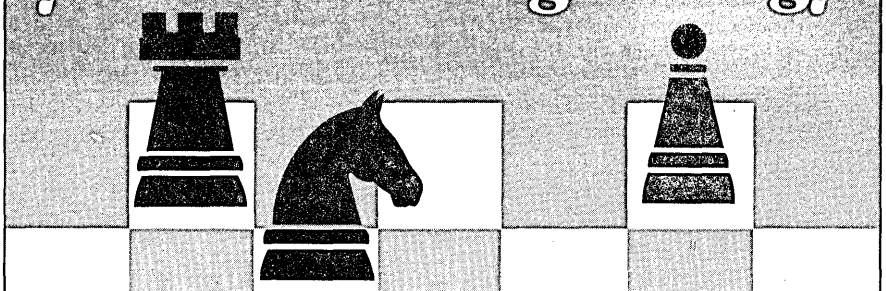

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ON THE JOB

executives in the first quarter of 1984 dropped 26% in comparison with the first quarter of 1983.

What makes these numbers particularly interesting, though, is that the demand for senior execs (with salaries over $100,000) accounted for almost 60% of all search activity during both periods. The demand for the middle manager continued to creep along at the same low level it attained in '83. Robert Lamalie, president of the company, said "Most companies are investing in top management talent to capitalize on the recovery and retain a competitive edge. At the same time, they are making a determined effort to stay lean at the middle-management level, even though some of the earnings pressure is off."

SOURCE SPOT

On Oct. 9 and 10, Business People Inc., Minneapolis (BPI) will produce the broadcast recruiting messages of 20 major companies to 21 colleges and universities throughout the country.

David Aberman, executive vp of BPI, claims it's not a replacement for traditional college recruiting, but the teleconferencing format will save students and companies a lot of time.

For $2,400, companies can communicate with graduating technical students on campuses at Berkeley, Howard, Illinois Institute of Technology, Georgia Institute of Technology, California Polytechnic Institute, Duke University, and others. Students watching the presentation on large-screen television can query company reps after their presentations. Companies can even present a video tour of their facilities, and show their products to viewers.

While some personnel people may be apprehensive about the effectiveness of teleconferencing, as opposed to face-to-face meetings and company literature, company participants think the television generation will adapt quite naturally to the broadcasting format.

Satellite Inc. (SatServ) is coordinating the event using its self-designed satellite delivery system and its "backbone" of connected earth stations and associated facilities. Receiving sites will be on or near the participating college campuses. The conference will be broadcast from Washington, D.C. For more information, contact Business People Inc., 100 North 7th St., Suite 602, Minneapolis, MN 55403, (612) 370-0550.

SURVEY SAYS . . .

A national survey of 402 U.S. electronics and information technology companies shows this year's Bachelor of Science grads will command salaries averaging between $24,204 and $28,044.

The survey, conducted by the American Electronics Association (AEA), also reported that actual starting salaries paid to last year's graduates ranged between an average low of $23,328 and an average high of $26,580. The San Francisco Bay area led the average high list in both actual and anticipated salaries. The bay area averaged offers of $29,014, followed by Orange County, Calif. ($28,980), the Midwest ($28,908), Arizona/Texas ($28,404), and Los Angeles ($28,392).

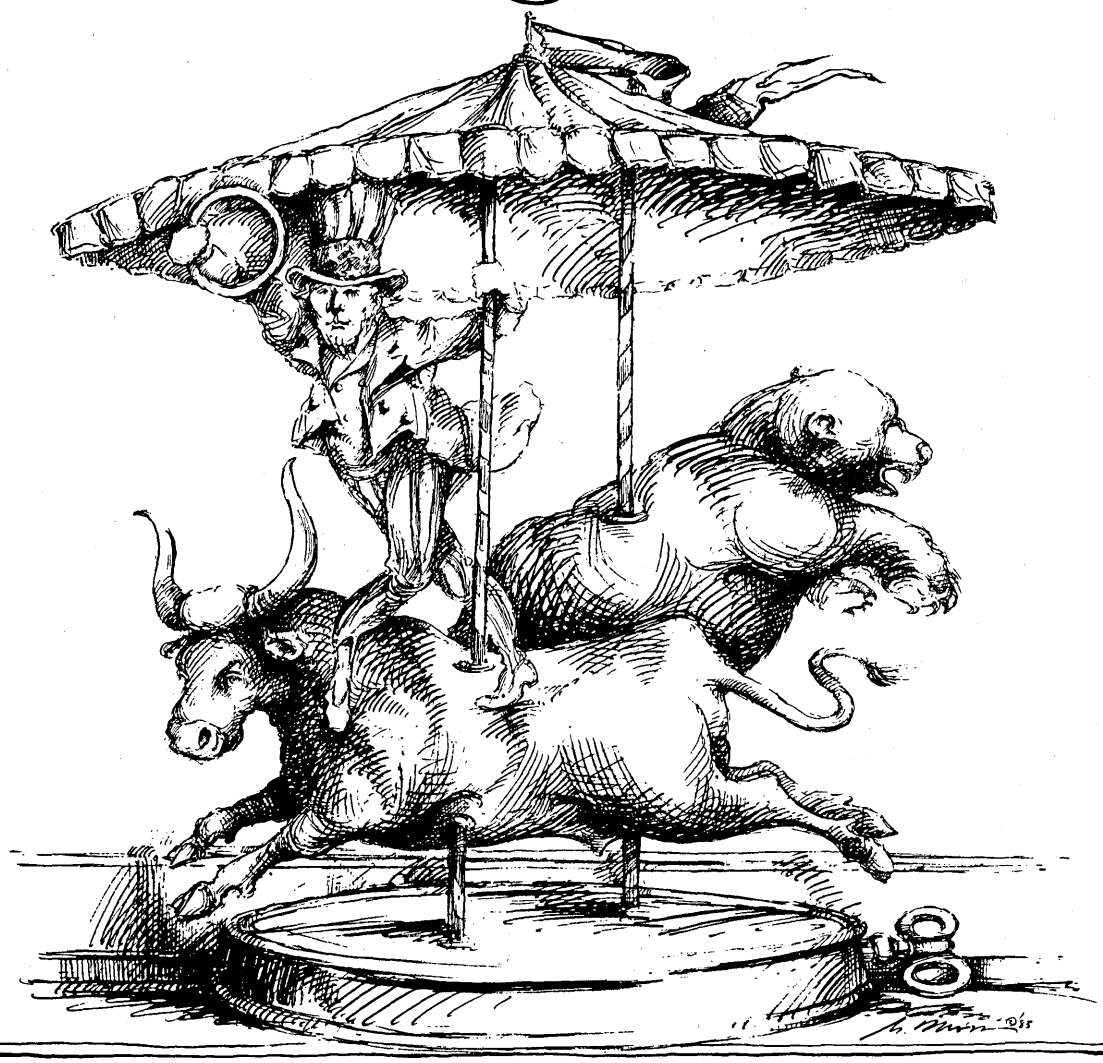
Heading the average low list (as it did in 1983's actual salaries) was Arizona/Texas with offers of $24,936, followed by the San Francisco Bay area ($24,840), Los Angeles, ($24,516), New England ($24,156), and the Midwest ($24,132).

The New York area's offers were reported to average between $23,904 and $26,784 (actual 1983 salaries averaged between $23,088 and $26,088).

For more information about AEA's survey, contact Joe Weber, the American Electronics Association, 2680 Hanover St., Palo Alto, CA 94304, or call (415) 857-9300.

—Lauren D'Attilo

About Bulls & Bears & Savings Bonds.



According to people in the stock market, bulls are good and bears are bad. But if you're buying U.S. Savings Bonds through the Payroll Savings Plan, you don't have to worry about missing a ride on the bull or being devoured by the Wall Street bear.

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An exchange of readers' ideas and experiences. Your contributions are invited.

READERS' FORUM

STEPS TO BETTER TRAINING

The topic of training dp personnel has been a popular one ever since the onset of the structured programming vs. everything else debate. The promise of better programs, more productive staff and lower systems cost has lured gullible companies into taking training firms at their word.

The results have been spotty—locally encouraging but disappointing overall. Productivity, for example, remains "an urgent priority," as a recent trade show theme stated it. The reasons behind this failure vary from organization to organization. However, several common, underlying causes have been identified both through firsthand experience and the collective wisdom of foremost software technologists at an IEEE Software Technology Transfer Workshop in Miami last year.

Although the economics and logistics of effective training efforts are now well known, the realities regarding what is and is not possible through training are only now emerging. There is a distinct difference between training and technology transfer. Training involves classroom instruction but true technology transfer results in a change in behavior. Although training is always possible, true technology transfer is not. The three primary reasons for this are that people are naturally resistive to change; companies, or groups within them, have not defined what it is they expect to get out of training; and, management very often does not actively support change, but merely consumes the training budget allocated to it by sending those that can be spared to class.

Our workshop on software technology transfer was organized into four different groups. Each took some aspect of the topic and identified ways in which that aspect could be addressed. Significantly, the four groups came up with a common point of agreement: Training without the use of follow-on consulting is a waste of money.

But yet, follow-on consulting in the use of newer methods is resisted by most firms via internal policies and/or the fact that consulting adds to the overhead of the organization. This can lead to an oscillating cycle of training to alleviate problems, little change being identified, and more training being engaged in. This Chinese Lunch Syndrome (as it has been referred to) can be broken only through innovation. Three approaches used in combination can, and do, work well together.

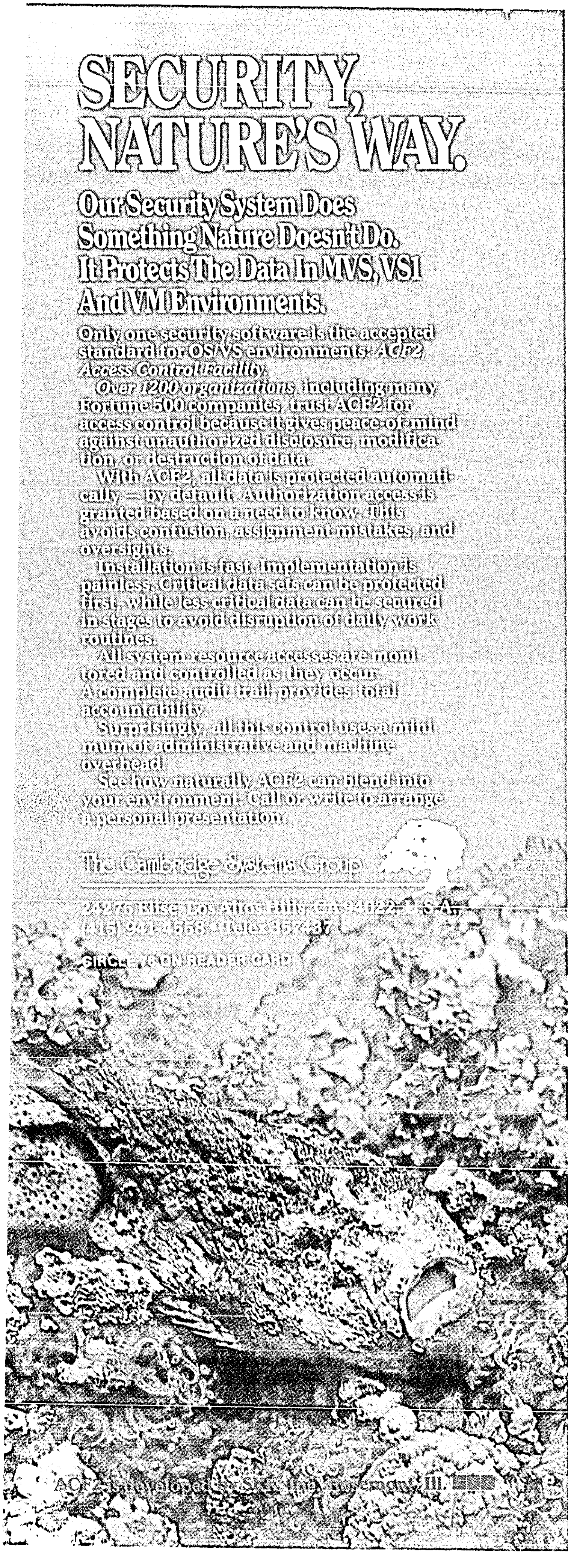
Combine training and consulting into a single effort. At least one software technology transfer firm offers training classes that combine classroom instruction with on-site consultation on the use of the methods being taught. The consultation is with one or more subsets of the class and results in both immediate progress on the project they are immediately at work on, a brief report on the current status of that project, and a recommended plan of action for management. The challenge to training firms who choose this approach is that qualified staff members will be hard to find as compared with the more traditional approach where the instructor merely needs to read transparencies, answer the 10 most asked questions on the subject, and be polite and entertaining.

Creation and maintenance of a nurturing environment for the new methods. Many managers fail to realize that they cannot send people to a class on software design and expect returning students to get code out as early on in a project as they always did. There is a necessary shift in the planning, scheduling, and controlling of projects with which many managers are unwilling or unable to cope.

The methods learned in the classroom are only the beginning. Most firms that have had success using a particular method find it must be tailored to maximize its effectiveness. This maturity can be speeded up greatly when on-site, experienced help is available.

The key to success in true technology transfer is to establish where the organization wants to go and plan a means of getting there. This may sound simple but in reality it is anything but. For one thing, throughout our academic training the subjects of planning and indeterminate problem solving were left sorely lacking. What is being attempted is highly indeterminate in nature. For another, managers tend to view their organizations as either being individuals or homogenous mass rather than a collage of potentially mutually supportive groups. Combine views of this type with a lack of planning and you have a situation where managers send people to classes when they can be spared, *not* when the people actually need the technology transfer. Some remedies follow.

- Plan all training for a time when the students will be able to use the methods they are learning *immediately* (or close to it) after returning from class.
- If possible, use in-house (only your students may attend) classes exclusively. Hold the classes away from company premises to avoid the interruptions that can occur at the workplace.
- Avoid classes that do not provide a combination of classroom and consultation. Do not confuse consultation with elaborate, in-class case studies that have no relationship to the kinds of problems students must deal with every day.
- Have the training firm propose a combination of training and consulting as well as life-cycle and procedures development to support the project(s) involved in the classes.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- Carefully scrutinize the academic background, work experience, and professional accomplishments (e.g., publications, indications of technological expertise, and practical knowledge) of the instructor to be used. Remember, the delivered product is only as good as the people who deliver it. Popular, entertaining instructors are rarely technically astute.
- Working with the consultant and management, lay out a set of measurable objectives and a time line associated with the technology transfer to be accomplished.
- Make sure management supports the method(s) involved and that it sees them as part of a software development and maintenance system. Again, the consulting firm can play a key role here as an information resource if not an active participant.
- Require that the consultation, whether done in conjunction with the class or afterward, result in a written report to the company within a specified time. This should identify who was seen, what was done, hours expended, and recommendations both long term and short term.

—Lawrence Peters
Kent, Washington

FRIEND OR FOE?

Lately, I've heard a number of debates on whether any system can really be user friendly. The basic argument seems to be that anything simple enough for the inexperienced user will be tedious and restrictive to the expert. And anything with the complexity and power required by an experienced user will bewilder the novice. I disagree.

When Apple announced its intent to build a computer anyone could learn to use in 30 minutes, the idea sounded absurd. Such a system would have to be so simple as to be useless, wouldn't it? Then I found out about the mouse, icons, and the desktop metaphor. Lo and behold, the system was learnable in 30 minutes, despite its unprecedented power.

Now consider electronic spreadsheets. It doesn't matter which one. Go visit your company controller's office and look at any application they have on a spreadsheet. Ask them how long it took to set up. Now think about how long it would have taken to set up that report using COBOL or FORTRAN. Think about how long it would take a nondper to learn to set up a spreadsheet application in FORTRAN, and then ask how long it took to learn to use the electronic spreadsheet. Friends, user friendly exists!

Consider Lotus Development Corp.'s 1-2-3. As a spreadsheet, it is a knockout product, far superior to the original VisiCalc that helped launch the personal computing revolution. Users learn to use 1-2-3 quickly, in large part because its menu structure is simple and easily understood. Experts can achieve results through a rapid succession of keystrokes, all but ignoring the menus. The program is well suited to both novice and expert.

Developing software is very much like writing. Almost anyone can write a letter—or a program. But there are very few outstanding novelists. The best writers know how to express powerful ideas clearly and succinctly; their writings are "reader friendly." Of course, it is not possible for a physics text to be suitable for both a graduate-level college course and an elementary school class, no matter how skillful the author. Applications software is no different; both books and programs must be written for specific applications.

—Geoff Pennington
Arlington, Virginia

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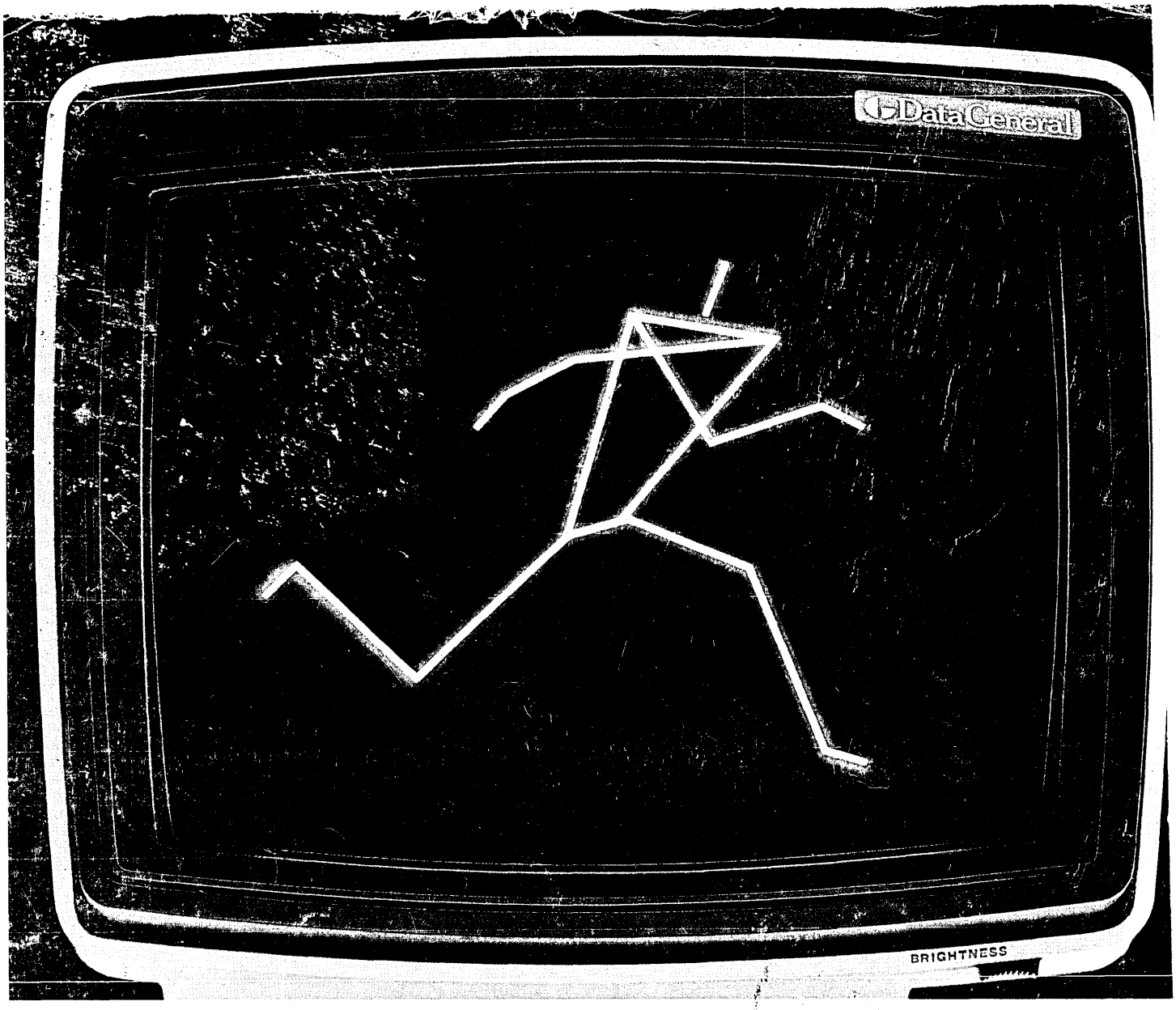

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