Software simplifies micro-to-mainframe connection
Pharmacies process prescriptions by micro
Networking software fires LAN market
Some companies consider board assembly child's play.

There are a lot of little board companies out there vying for your business. And while they're probably not having children build boards during recess, chances are you'll have to hold their hand throughout the entire process anyway.

Well, at Systech, we know the last thing you want to do is babysit a board company. Especially since your first concern is getting your product out the door fast.

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NEWS/INTERPRETER

IBM offers System/36 PCs as economical mini entry ........................................ 33
UNIX software vendors exploit PC dominance ........................................ 36
Computer Associates sets pace in site licensing ........................................ 38
Publicity is key tactic in ADAPSO’s war on pirates ........................................ 41
ATTIS reaches out to IBM’s SNA network ........................................ 42
Pacific Perspective: Japan defines a market for machine language translation ........................................ 46
European MAP group augurs worldwide approval ........................................ 49
AT-compatibles fight for share of new standard ........................................ 50
Jazz and Excel: Can the Mac now get down to business? ........................................ 53
Heard on the Hill: Semiconductor group asks help in selling to Japan ........................................ 56

*EUROPEAN NEWS

Switch to digital exchanges boots Europe’s first ISDN ........................................ E3
Norsk Data extends fault tolerance ........................................ E4

*Appearing in the European edition only

VERTICAL MARKET INTEGRATOR

Pharmacists nationwide order drugs by computer ........................................ 59
OEM incorporates software duplication ........................................ 67
FEATURES

Feature Highlights ........................................ 79

Network software rejuvenates LAN market ............... 81
Increased competition in LANs and new networking alternatives create diverse choices for VARs

Protocols compete for LAN market ....................... 95
Ethernet technologies dominate the present local area network, but ISO standards will govern future workstation communications

Software speeds access to mainframe (Cover story) .... 106
Overcoming limitations of conventional 3270 emulators, 3270-Plus simplifies the micro-to-mainframe connection by permitting direct communications between networked devices

Options multiply for PC, PC-AT integrators ............. 117
A growing bus-based infrastructure offers integrators new opportunities in multuser systems and high-performance workstations

Top 32-bit buses claim multiprocessing edge ............ 129
Backers of Multibus II and VMEbus concede little merit to each other s systems in asserting multiprocessing superiority based on operation modes and arbitration methods

Lan software links diverse machines, OS's ............. 141
System integrators can build inexpensive LANs with PC/NOS, a communications software package that acts as a network operating system.

DEPARTMENTS

Editorial Staff .............................................. 4
Editorial .................................................. 11
Letters ................................................... 16
Breakpoints ............................................... 23
New Products ............................................ 149
Calendar .................................................. 168
Career Opportunities ................................... 171
Classified Advertising ................................. 174
System Integrators' Notebook ......................... 175
Index to Advertisers .................................. 176
Market Track ............................................ 177
Artful Intelligence ...................................... 178
Mini-Micro Marketplace ............................... 179
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THE KEY TO MICRO PERIPHERALS. The new Emulex QD01/D disk controller is a dual size board that's packed with capabilities. And with it, you get all the features of Mass Storage Control Protocol (MSCP). It interfaces to industry-standard DASD drives, handling disk transfer rates of up to 1.8MB/sec.

The Emulex QD12 tape controller is also dual size and ideal for backup of micro peripherals. Through firmware, it operates transparently to the driver. It has a QIC2 interface to operate with 5 1/4" footprint 1/4" tape drives.

THE KEY TO COMMUNICATIONS. Emulex delivers an edge in Q-bus communications.

THE KEY TO PACKAGED SUBSYSTEMS. Emulex's unique solutions for MicroVAX II extend to packaged micro subsystems.

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Unchain DEC's machines for enhanced capabilities now. For product or sales information, call toll-free 1-800-EMULEX3. In California, call (714) 662-5600. Or write: Emulex Corporation, 3545 Harbor Blvd., P.O. Box 6725, Costa Mesa, CA 92626.

THE KEY TO LARGE PERIPHERALS. Emulex's SC03/MS disk controller incorporates a fully transparent set of firmware which has the features of MSCP. It interfaces to industry-standard SMD drives, handling disk transfer rates of up to 1.8MB/sec.

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The new TC03 tape controller has all the features of the TC02 and also offers a large (3.5 KB) data buffer and block mode DMA for increased data throughput. It's also compatible with up to four Pertec industry-standard drives.

The TC05 handles 55 ips tape speeds, 8000 bpi densities on a Sentinel drive, and features a 3.5 KB buffer.

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Because your systems depend on disk drives. So it's important to have a disk drive supplier you can depend on.

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But back to the PCOX/3270 PC Upgrade. For immediate delivery call (800) 225-PCOX. In California, (415) 424-0700. Or write CXI, Inc., 3606 West Bayshore Road, Palo Alto, CA 94303, Telex: 821945.

And turn the IRMA board you have into the 3270 PC you want.

We don't have all the answers, just more of them.
WORDS OF CAUTION ABOUT TAX REFORM

Many system integrators think President Reagan's tax reform proposal will benefit the computer industry. The tax rate on capital gains would be cut, you see, and that's supposed to help the fast-growth, high-tech entrepreneurial companies which supply computer systems. Well, fine. We hope that's right. System integrators and their suppliers are in the same boat on the same stormy sea. What helps one is likely to help the other. Unfortunately, there's a case to be made that the tax reform proposal could do system integrators and their suppliers a lot of damage.

For the next year or so, system integrators will want to invest in communications equipment. One of the reasons given for why the computer industry has fallen on hard financial times recently is this: System integrators have quit buying hardware and software until they get a communications system installed for the equipment they already have. But communications is a capital-intensive business, and the Reagan tax-reform plan seems likely to cut the cash available for capital investment of all kinds. The estimates of lost revenues to U.S. industry if the investment tax credit is repealed are staggering. One comes from financial analyst Chase Econometrics, Bala Cynwyd, Pa.: $48 billion over two years.

If there's less money for capital investment, then system integrators will buy that critical communications gear over a longer period of time, and that will just delay the recovery of the entire computer/communications industry.

There's more. The fears now are that tax reform could create a $60 billion revenue shortfall for the government, already bedeviled by deficits. If that happens, warns Ward H. White, vice president for government and public affairs with the United States Telephone Association, Washington, the Treasury Department will target business for more taxes, "and the place where they're going to look first is at the depreciation allowance." Computers carry a beneficial five-year depreciation allowance under current law, better than that for a lot of other equipment, including most communications hardware. Since computers have a better deal in the depreciation sweepstakes, says USTA's White, that means, "Computers could become a target when the tax people start looking for revenue." If the depreciation period for computers goes to seven years, or even to 10 years, that could further trim money available to system integrators for new investment.

There's another side to the tax-reform debate, of course. Richard G. Darman, deputy Treasury secretary, says tax reform will increase efficiency, lead to higher growth for the entire economy and "encourage more productive investments." Many economists agree, but they see these as long-range benefits. They see trouble short range. Former presidential advisor Alan Greenspan says, "More efficient allocation of capital investment, which may occur in the years ahead, is irrelevant in the short run. In the short run, even inefficient capital investment boosts production and generates jobs. If these investments are shut down, the level of economic activity overall falls."

Meanwhile, the USTA and other communications-industry groups have mobilized battalions of lobbyists to work the Hill, especially in support of keeping the investment tax credit alive. So far, no computer-industry association has gotten into the act, although some industry giants, including IBM Corp., have testified to the benefits of investment tax credits. Whether or not there is organized computer-industry action on the Reagan reform package, it makes sense for system integrators and their suppliers to keep a wary eye on the proposal as it makes its way through Congress.

James F. Donohue
Managing Editor
WE CAN MAKE YOU THE BIGGEST FASTEST TOUGhest GUY ON THE BUS TODAY

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- First MULTIBUS token passing network controller...our LNC 5180.
- First SMD controller for the IBM® PC...our Maverick.
- First 32 bit VMEbus SMD disk controller...our V/SMD 3200.
- First full function, single board computer with built-in VMEbus expansion...our BASEboard.
- AND NOW...the first 32 bit, VMEbus ½" Tape Controller...our V/Tape 3209.

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SMD 2190 MULTIBUS DISK CONTROLLER

Provides your Multibus system with the SMD disk controller power, flexibility and ease of use you need. The SMD 2190 offers such benefits as UNIX™ optimized firmware, intelligent caching, 24 bit DMA addressing and Extended SMD data rates up to 20 megabits.

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Offers high-performance finesse with force for MULTIBUS on ST506, and ESDI Winchester disks, ½" tape drives and floppy disks drives. Storager's unique 68000 based Virtual Buffer Architecture speeds up your system by eliminating unnecessary disk latency and allowing concurrent disk / tape operation.

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The first high-performance SMD controller which allows you to exploit the full potential of the 32 bit VMEbus. The V/SMD 3200 supports two SMD disk drives at up to 20 megabits and above. Imagine... multitasking 68000 power with Virtual Buffering for UNIX optimized intelligent caching, and zero latency reads and writes. The V/SMD 3200 is the essential element to your VMEbus system performance.

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INTERPHASE's latest VMEbus product is a companion to the V/SMD 3200, and opens new VMEbus design options for you. The V/Tape will control up to 8, 9 track, ⅛ inch perece tape drives for start / stop and streaming applications.

The V/Tape also supports GCR as well as 1600 bpi operations and has ultra fast bus transfer rates at up to 200 ips. Advanced features like 128KB Tape Cache and an on-board 68000 family processor mean it can communicate directly with the INTERPHASE V/SMD 3200 disk controller…cutting your BUS usage in half.

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The write light

The affordable state-of-the-art LBP from Hitachi

The powerful advantages of a laser beam printer are clear: high speeds, letter quality, both text and graphic capabilities.

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The immediate facts

The SL-100 has a smaller footprint so it saves space and fits on any desk. Operating buttons are up front for convenience. The cartridge holds 200 sheets and these are printed at 10 pages per minute face down so you don't have to reverse-sort them later. Since the sheets come out on top, there's no copy tray sticking out in the back and this saves considerable space. With a resolution of $300 \times 300$ dots per inch, true letter quality is assured. And you are also assured of an end to printing headaches because the SL-100 is quite quiet: under 53 dB.

The long range facts

Hitachi's superiority is evident not only in the quality performance we've just detailed above but in the long term reliability and user maintenance that have been built in. This is the reason why the Hitachi LBP is an excellent investment.

Here is how Hitachi engineers have attained a low cost per page. Each component has been carefully designed for long life. Best of all, each component is user-replaceable. This makes a big difference.

Each component is cartridge user-replaceable

The drum, for example, normally lasts 6 to 8 times longer than the toner. But on some LBP printers, you cannot replace only the toner. You are forced to replace a number of components as a package. Hitachi has eliminated such wasteful expenditure and allows individual user-replacement of drum, developer, and toner. Replacement is simpler, less expensive and results in a far lower cost per sheet. Hitachi's proven reliability makes certain you can use the SL-100 for at least 300,000 sheets.

And while the SL-100 has an MCBJ of 5,000 sheets, there will be times when you have to open her up. That's why the Hitachi has a clam shell construction. It also opens from either the front or back. The point is down time is radically reduced.

A video interace is standard and there are other interface possibilities.

If you are looking for a quality LBP that offers your customers quality over the long term and the highest cost efficiency, Hitachi's SL-100 is a choice that is demonstrably wise.
LETTERS

MISTAKEN INTENTIONS
To the editor:
A gross error was made in your July issue when, in your article on AT&T Co. 32-bit chips (MMS, July, Page 35), you state that Flexible Computer Corp. intends to replace the National Semiconductor Corp. 32032 microprocessor in our Flex/32 Multicomputer. Nothing could be further from the truth.

The 32032 and its complementary chip set have been fine performers for us. As a young company, we needed to bring our product to market quickly. The 32032 offered us a complete family of system capabilities that allowed us to develop the Flex/32 in 10 months, two months ahead of schedule. The technical and marketing support supplied by National Semiconductor has strengthened our relationship, and we are distressed by any suggestion that we are anything but very pleased to be working with National Semiconductor. In fact, we are looking forward to the forthcoming extensions of the 32032. We expect our relationship with National Semiconductor to be long and fruitful for both of us.

Your reporter’s error may have come from a misunderstanding of the nature of the Flex/32 Multicomputer. We do not replace microprocessors in our system. We add microprocessors as they are demanded by the market. In the Flex/32, it is possible for a 32032-based computer to operate alongside of, and with the same software as, a computer based on any other microprocessor. It is our stated policy to implement state-of-the-art microprocessors in the Flex/32 as they are demanded by the market.

We expect the 32032 and other microprocessors to be state-of-the-art products for years to come. By offering heterogeneous microprocessors in the Flex/32, we will be offering our customers the best the industry has to offer, including the 32032.

Nicholas Matelan
President and Chief Executive Officer
Lawrence B. Samartin
Chairman and Executive Vice President for Marketing
Flexible Computer Corp.
Dallas, Texas

DISTRIBUTOR SWITCH
To the editor:
In your very informative February article, “UNIX Emerges As A Universal Tool Kit,” (MMS, February, Page 149) you mentioned the Oasis operating system.

We appreciate your including Oasis, but I wanted to bring something to your attention which you had no way of knowing at the time the article was being prepared.

The Oasis8 and Oasis86 systems are no longer being distributed by Phase One Systems Inc. The exclusive marketing rights now belong to Oasis Technologies Inc.

Pietro D. Van Zandt
Senior Vice President
WesCom Associates Inc.
Public Relations
San Jose, Calif.

KUDOS FOR TUCKER
To the editor:
I’d like to thank you for the very favorable, and yet completely truthful, press you gave Inspiration Systems Inc. and Prevail in your recent article. (MMS, April, Page 95)

The “Integrated Software Spurs Mini Market” article is a well-written, carefully researched story. Author Michael Tucker’s viewpoint—that multituser systems mean minicomputers, not necessarily UNIX—confirms my recent research into how and why people are purchasing multituser software.

Patricia D. Shannon
Marketing Communications Specialist
Inspiration Systems Inc.
Sewickley, Pa.

NEXT MONTH IN MMS
The October issue of Mini-Micro Systems spotlights software standards and portability.
If you're a major league VAR, we want you on our team.

IBM is scouting for the most valuable of VARs: those with outstanding new ideas and a great batting average.

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And, as one of the finest of VARs, you'll be selling the finest equipment: some of IBM's most competitive products. Our VARs can apply for the IBM 4300 systems, Series/1, System/38, System/36 and the IBM personal computers.

To find out more about the advantages of becoming an IBM VAR, simply send in the coupon below or call 1 800 IBM-VARS, Ext. 96.

If you think your company can qualify, now's the time to touch base.

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CIRCLE NO. 11 ON INQUIRY CARD
A Mannesmann Tally printer set a new world's record for computer printers in March, 1985. The printer produced 681.5 million characters of output in 57 days, printing around the clock. The last record was 622 million characters achieved in 120 days.

The record was established by EDP specialist Rudolf Hiener in Basel, Switzerland. According to Hiener, the goal was to beat the previous record in half the time.

When the goal was exceeded three days early by nearly 60,000,000 characters, Hiener ended the run by turning off the printer.

Three-quarters of a ton of paper was necessary to set the new world's record which was certified and will be entered into the Guinness Book of Records in autumn of this year.
a Mannesmann Tally record before it stopped.

According to our engineers, it should still be going.

For our engineers, it was a bitter-sweet experience.
Yes, the printer set a new world’s record in less than half the previous time.
But was that enough? Not for these engineers.
Admittedly, it was a pretty good start. But when the old record was decisively shattered, the printer was simply turned off.
A failure, the engineers maintain, of the human element.
Coming from them, that’s no surprise.
It’s simply one more demonstration of the dedication to long lasting, rock-solid performance they apply to every Mannesmann Tally printer.
The latest example? The $1995, 400 cps MT490.
It’s the latest generation 400 series: a serial printer with unequaled throughput and workload capacity in its price range.
It’s fully IBM compatible. And noise levels drop down to 57 dB(A).

Printer sets record, makes Guinness Book
A Mannesmann Tally printer set a new world’s record for computer printers in March, 1985.
The printer produced 681.5 million characters of output in 57 days, printing around the clock. The last record was 622 million characters achieved in 120 days.
The record was established by EDP specialist Rudolf Hiener in Basel, Switzerland. According to Hiener, the goal was to beat the previous record in half the time.
When the goal was exceeded three days early, printing went on for 1,000,000 characters. Hiener ended the run by turning off the printer.
Three-quarters of a ton of paper was necessary to set the new world’s record which was certified and will be entered into the Guinness Book of Records in autumn of this year.

You have modular interfaces that snap in and out quickly. Fewer friction points in paper handling. An 18-needle print head instead of 9.
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$1995
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We're shipping a true parallel computer that starts at— are you ready for this— fifty grand. It'll do 1 to 9 MIPs with 2 to 16 real 32-bit processors.

It's based on standard UNIX™. And it's totally transparent to existing applications, while allowing access for large and fine grain parallel processes.

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Okay, we know all this is hard to believe. But if you really can build a family of products based on one expandable computer, or expand a single system as your needs grow, without ever changing software, literature, spares, or training, isn't that worth a phone call?

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CIE Terminals has a video terminal that'll make you both happy. The CIT-220+.

It's a remarkably reliable piece of technology that yearns to show its stuff as much as the computer it's hooked up to. Something they'll both get plenty of chances to do. That's because the 220+ is so reliable, it's always up and running. Which means your computer is, too.

The 220+ is compatible with the DEC VT220. But it's not comparable. That's where the plus is. You'll find no less than 20 improvements and additions that make the most of your computer.

And because the 220+'s price is in direct contrast to its high performance, you get the best value for your money. So although the computer doesn't care about the cost, you don't have to think about it, either. For more information on the CIT 220+, contact your distributor or CIE Terminals at 2505 McCabe Way, Irvine, CA 92714-6297 (800) 624-2516.

Because your computer is only as good as its peripherals.
Breakpoints

**Sysgen Readies Full SCSI Disk/Tape Controller Board**

Evaluation units of the model SI-536 controller will be shipped this month by Sysgen Inc. of Fremont, Calif. Priced at around $400 and offering complete implementation of the small computer systems interface command set, including disconnect/reconnect with arbitration, the board can handle both rigid disk drives and quarter-inch tape. In order to achieve commonality of system commands, the controller translates standard disk commands to work with the tape system.—Carl Warren

**VCRs Find a New Role—Micro Data Storage**

Alpha Micro Systems claims that video cassette recorders (VCRs) are used to back up data on 90 percent of its installed base of multiuser systems. Beginning this month, the Santa Ana, Calif., company wants to try that idea on another installed base—IBM Corp.'s PC/AT and XT and compatible microcomputers. For $795, Alpha Micro will provide a controller and software to convert digital data to analog for backup on VCRs with Beta, VHS or European formats. Backup can be either by disk image or file-by-file. Alpha Micro claims the system is less expensive and slightly faster than streaming tape.—Mike Seither

**Datamart Opens for Business in San Francisco**

Datamart, the nation's second major all-in-one computer market, opens in San Francisco this month, hoping to offer the computer industry an alternative way of reaching customers by leasing part of its 175,000 square feet of flashy showroom space to manufacturers. Like Infomart, which opened in January in Dallas, DataMart will sponsor seminars, conferences and shows. Its promoters hope that value-added resellers will set up shop there, too. What's Datamart's VAR pitch? A stream of potential buyers, like the ones expected at a two-day conference on computers in finance beginning Sept. 16.—Mike Seither

**JVC to Debut Compact Optical Disk**

A 5¼-inch, compact optical disk designed specifically for data storage is expected shortly from JVC Electronics Ltd. of Tokyo. The CD ROM reportedly has a capacity of 700M bytes and will incorporate an embedded small computer systems interface with full arbitration. Data delivery will be 10M bits per second.—Carl Warren

**Motorola Four-Phase Reshapes UNIX Interface**

Motorola Inc. Four-Phase Systems, Cupertino, Calif., has replaced UNIX commands with a set of menus to run integrated office software on its Series 2000 and 6000 multiuser systems. The Business Assistant UNIX umbrella covers word processing, database management, spreadsheet calculation, electronic mail and calendaring. Configured with those
applications, the software is priced at about $5,200 per CPU. Other available modules include graphics, information retrieval and project management. Value-added resellers can choose the software modules they need or add their own applications built around the menu system.—Mike Seither

SUN WORKSTATIONS CONNECT WITH IBM’S SNA

Sun Microsystems Inc., Sunnyvale, Calif., has entered IBM Corp.’s Systems Network Architecture (SNA) world with a gateway that allows Sun workstations to run IBM mainframe applications. The $2,000 SunLink SNA 3270 Gateway software runs on either a standard Sun workstation or one equipped with a Sun communications coprocessor. The gateway connects with remote IBM 3705 or 3725 front-end communications processors by dial-up or leased lines. The workstation then emulates IBM 3278 terminals. Another software package, the $1,500 SunLink BSC RJE, lets Sun machines, acting as IBM 2760 or 3780 terminals, exchange files and execute remote programs with IBM’s Binary Synchronous Communications and Remote Job Entry environments.—Mike Seither

OREGON SOFTWARE’S PASCAL COMPILER MEETS ISO STANDARD

Portland-based Oregon Software Inc.’s Pascal-2 development system is the first Pascal compiler produced in the United States to be validated as conforming to the International Standards Organization Level 1 and ANSI/IEEE standard Pascal. The validation—which requires a compiler to correctly process a suite of 740 test programs—was performed by the Federal Software Testing Center with assistance by the British Standards Institute.—Carl Warren

START-UP ZVERT CORP. OFFERS LASER PRINTER PROTOCOL EMULATORS

Up to three users can take advantage of the Hewlett-Packard Co. Laserjet printer with Zvert Corp.’s new ZVT series of laser printer protocol converters/sharers, which also provide Diablo Systems Inc. 630 and Epson America Inc. FX printer emulation. The Los Angeles company offers the standalone ZVT-100 3-port sharing unit for $299; 630 and XT emulation is available for $100 each on the model ZVT-800. Each port supports from 9,600 baud to 19.2K baud and X-on/X-off and DTR flow control.
—Carl Warren

DEC PACKAGE LEADS A HAND TO OFFICE USERS

A comprehensive portfolio of integrated hardware and decision-support software, VAX Information Center from Digital Equipment Corp. has been designed to help information system departments facilitate end-user computing. Components of the package include VAX Toolbox, personal computing interconnection products, connection between DECnet and IBM Corp.’s Systems Network Architecture, training and seminars.—Lynn Haber
The GIGADISC laser optical disk system is built rugged enough for many industrial applications... smart enough for the sophisticated office-automation and EDP environments.

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CIRCLE NO. 15 ON INQUIRY CARD
Here's an affordable way to switch up to sixteen RS-232 ports in any interconnection. It's called the Smart Switch™ controller.

The SS-16 accommodates any peripheral: terminals, printers, CPUs and modems. Any port can select any other port. With up to eight pairs of ports communicating at the same time.

Create your own local network. The SS-16 is ideal for computer port expansion, computer sharing, engineering work clusters, and much more.

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There's even a HELP command. And for quick and easy installation, a push button defines each port for either DTE or DCE.

So if you need an intelligent, affordable way to link your RS-232 system, you're ready for WTI's Smart Switch.

For more information on the SS-16, or our other RS-232 switches, call Western Telematic toll-free at (800) 854-7226. In California call (714) 979-0363. Or write WTI, 2435 South Anne Street, Santa Ana, California 92704. Or telex 467741.
PERKIN-ELMER’S ‘CRUNCHER’ EMERGES FROM THE PIPELINE

Perkin-Elmer Corp., which introduced two members to its 3200 MPS family of multiprocessing systems this year, will round out its parallel processing line with the launch this month of its high-end 3280 MPS. Code-named “Cruncher,” the new machine employs pipeline processing and is reported to perform faster and cost less than Digital Equipment Corp.’s top-of-the-line VAX 8600.—Lynn Haber

MICRO DBMS USES ARTIFICIAL INTELLIGENCE

Belmont, Calif., start-up Ansa Software introduces this month its Paradox relational database software for microcomputers, said to be faster than most other high-end databases yet offering the ease of use of low-end file-management systems. Using machine-reasoning concepts from artificial-intelligence research, Paradox automatically writes programs to find answers when the user types in an example of what he is looking for. Consequently, there is no need for the user to learn a programming language and then write applications. The package uses a Lotus Development Corp. 1-2-3-like interface; requires two floppy disks, 512K bytes of RAM and MS-DOS 2.0 or above; and runs on IBM Corp. PC-compatibles. For complex turnkey applications, the program also comes with a full-function programming language. Suggested list price is $695, with availability next month.—Bruce MacDonald

TECH FILES: A QUICK LOOK AT INDUSTRY DEVELOPMENTS

Chip-set and controller manufacturer Adaptec Inc., Milpitas, Calif., recently announced the first commercially available, fully programmable, 24-MHz storage controller chip, the AIC-010. Full programmability allows it to work with all major disk and tape drive interfaces—including ST506/412, storage module device, enhanced small device interface and QIC-36—as well as a variety of encoding schemes such as 2,7 RLL and MFM. The AIC-010 will be available in the first quarter of 1986; 5-, 10- and 15-MHz versions are available now.—David Simpson

Multibus I users now have a clear upgrade path to 32-bit Multibus II applications with the $1,225 LNK/001 interface board from Intel Corp., Hillsboro, Ore. Converting Multibus I interrupts into Multibus II interrupt messages, LNK/001 permits Multibus II users to address as much as 16M bytes of Multibus I memory and as much as 32K bytes of Multibus I I/O. Multibus II systems can access data in the board’s 128K-byte, dual-port dynamic RAM without having to arbitrate for control of a Multibus I system bus.—Jesse Victor

Look this month for a new switch interface for VAX systems from Emulex Corp., Costa Mesa, Calif. The as-yet-unnamed board uses 2901 bit-
slice technology to combine 48 asynchronous lines on the VAX to a single cable connected to the communications switch. The company says the board not only replaces 48 separate lines from the VAX to the switch but also takes the place of three boards in the VAX. It will be priced at less than $7,500.—Carl Warren

A four-channel multiplexer for Multibus developers is now available from Systech Corp., San Diego. The Model DCP-8804-512 has 550K bytes of buffer memory for the four lines. In addition to a complete development-software package for the board, Systech offers an X.25 software package that provides the necessary hooks to the system and has been certified for major networks. In quantities of 100, the DCP-8804-512 is priced at $2,365; the X.25 is priced at $825 for binary license.—Carl Warren

Digital Equipment Corp.'s introduction of the MicroVAX II has encouraged Jupiter Systems Inc. of Alameda, Calif., to repack
display components of its Jupiter 12 graphics terminal. VAX II users can now buy a three-card set in two configurations: as three cards for $15,000 or bundled in a pedestal chassis, ready for connection to the MicroVAX II, at a cost of $20,000. Because the Jupiter's cards are already on the Q-bus used by the VAX line, they can use direct-memory access transfer rates across the Q-bus—about 2M bytes a second.—Jerry Borrell

NOTES FROM OVERSEAS: A family of supercomputers priced at around $1 million will be jointly launched within three years by Norsk Data A/S, Oslo, and Matra Datysysteme, Bois d'Arcy, France. One of the first groups of products to emerge from Eureka, the European cooperative R&D initiative, the machines will achieve speeds of approximately 100 million floating-point operations per second (megaflops) and will be optimized for mathematical computation. They will also be compatible with Norsk Data's existing ND 500 family of 32-bit minicomputers and will run a version of UNIX.
—Keith Jones

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At long last, a few companies have figured out how to make Winchester drives like Maxtor's. But they still haven't figured out how to duplicate the company that makes Maxtor drives. Which makes all the difference.

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It's a company.

PRESENTS

SCSI FORUM/ BOSTON '85

After two successful conferences in Palm Springs, the SCSI Forum is planning to move east this fall with a 2-1/2 day technical program devoted to discussing SCSI issues, hearing about the latest SCSI developments, learning about SCSI, and promoting industry standardization.

WHERE: Hilton at Merrimack, Exit 8, Everett Turnpike, Merrimack, New Hampshire

WHEN: October 8-11, 1985.

TOPICS/ISSUES

- What is the market for SCSI products?
- Who is using SCSI?
- What is the status of SCSI with ANSI, ECMA, and ISO?
- How does SCSI compare with IPI?
- Is there any way to reduce the number of SCSI flavors?
- How is SCSI being used?
- What is the status of synchronous SCSI?
- Embedded or separate SCSI controllers?

WORKSHOP

In addition to covering "leading edge" SCSI topics, delegates will have the opportunity to attend an optional 2-1/2 hour SCSI Principles Workshop scheduled for the eve of the Forum so that attendees may derive more benefit from the technical sessions to come.

RECEPTION

Delegates will also have an opportunity to see the latest in SCSI products during the Exhibitors Reception scheduled for Wednesday evening.

The SCSI Forum is sponsored by Technology Forums and the SCSI Forum Advisory Board which consists of the following companies: Adaptec, Adaptive Data Systems, Emulex, Fujitsu America, NCR, SMI/OMTI, and Xebec.

FEE

The registration fee of $795 for the 2-1/2 day SCSI Forum covers attendance at all scheduled sessions, a Delegate's Information Binder containing the speakers' presentations and other material, luncheon on Wednesday and Thursday, the Welcome Reception on Tuesday evening, the Exhibitors' Reception on Wednesday, refreshments at the start of each day and during breaks, gratuities, and taxes.

ATTENDANCE

Since attendance will be limited in order to preserve an appropriate atmosphere within which to learn and interact with other delegates, it is recommended that your registration form and payment be mailed early.

CANCELLATIONS

Registration fees are refundable, subject to a 10% service charge, if cancellation occurs before September 17th, 1985. Substitutions may be made at any time at no charge. Cancellations and substitutions must be in writing.

HOTEL ACCOMMODATIONS

A block of rooms has been set aside for SCSI Forum delegates at the Hilton at Merrimack, New Hampshire. It is recommended that you register early by completing and returning the Hotel Reservation Form which you will receive by mail with your Confirmation Kit, or by calling (603) 424-6181 and identifying yourself as an SCSI Forum delegate.

CONFIRMATION KIT

Shortly after registering, delegates will receive a Confirmation Kit by mail, containing registration confirmation, map, Hotel Reservation Form, Hotel brochure, name tag, receipt, and general information.

Please register me for the SCSI Forum to be held at the Hilton at Merrimack in Merrimack, New Hampshire on October 8-11, 1985.

Please print the following information as you want it to appear on your name tag and on the list of delegates:

NAME

TITLE

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registrations cannot be accepted unless accompanied by full payment. Please make check payable to SCSI FORUM, and mail with this registration form to:

Technology Forums 23409 Coyote Springs Drive

Diamond Bar, CA 91765

CIRCLE NO. 19 ON INQUIRY CARD
IBM offers System/36 PC as economical mini entry

Lynn Haber, Associate Editor

IBM Corp.'s recently introduced System/36 PC "desktop" version of its System/36 minicomputer threatens to take users one turn deeper into the gyre of product confusion. With a plethora of powerful, multiuser supermicrocomputers hitting the market—including IBM's own PC-AT—one is forced to ask: Does the S/36 PC fill an obvious need?

According to IBM, it does. For those who haven't been able to justify purchasing one of the larger 5360- or 5362-processor-based System/36s, Big Blue has pared them down to an entry-level system targeted for use in small companies or departments of large organizations.

For a base price of $5,995, a user receives a 5364 processor with 256K bytes of memory, a 40M-byte Winchester disk drive, cable to attach a required PC, PC/XT or PC-AT (priced separately), a driver card and a driver program for the directly attached PC. IBM's proprietary System/36 System Support Program (SSP) operating system must be purchased separately at a one-time-per-release charge of $995.

While the multiuser S/36 PC can support up to four workstations—including the directly attached PC acting as the system's control unit—one slot is likely to be designated as a system printer. This configuration, therefore, really allows a maximum of three users—a feature some industry analysts consider a major drawback. Additional PC workstations can be attached to the 5364 via coaxial cable and operate in a 5250 emulation mode. Thus, the individual PCs require terminal-emulation packages.

The S/36 PC gives users the option of running most PC application software, in addition to access to most of the approximately 4,000 business-oriented programs written for the System/36, such as the Manufacturing, Accounting and Product Information and Control System (MAPICS), the Communications Oriented Product Information and Control System (COPICS), the Distribution Management Accounting System (DMAS) and the Construction Management Accounting System (CMAS). The new computer, however, reportedly does not support popular integrated PC software packages such as Ashton-Tate's Framework and Lotus Development Corp.'s Symphony, nor IBM's own Topview operating environment. According to IBM, the 5364 processor can run System/36 programs while PC workstations run PC applications. But, when a user switches from PC mode to System/36 mode, the PC job gets suspended until the user switches back to PC mode.

Objections voiced

William Zachmann, vice president of office technology assessment at International Data Corp. (IDC), Framingham, Mass., says the S/36 PC does not satisfy any obvious need. "I think this product is a cripple version of the System/36. It seems that as IBM gets..."
more desperate to increase revenues, they introduce new products, an approach which basically says, 'let's throw everything up against the wall and see what sticks.'"

Relative to other System/36 products, says Zachmann, the new model is priced low. But, put side by side with multiuser microprocessor-based systems, the cost is high.

For example, IBM's own PC-AT multiuser superminicomputer, which uses the powerful Intel Corp. 80286 32-bit chip, is priced from $3,995. This includes 256K bytes of memory and a 1.2M-byte floppy disk. The PC-AT runs PC/DOS 3.0 and Microsoft Corp.'s XENIX multiuser operating system. It can be used as a standalone machine, a multiuser system—supporting three users—and can also operate with IBM's PC Network that enables PC users to share programs, information and peripherals.

A PC-AT user could not run System/36 application programs, but micro-to-mainframe links are available if users want to access corporate database information from an IBM host. Zachmann contends that there is a multitude of PC software to meet the needs of most end users.

Industry analyst Sandra Gant of InfoCorp, Cupertino, Calif., concurs.

**Remarketers face big challenge**

Nevertheless, says a spokesman from IBM's Information Systems Group in Rye Brook, N.Y., Big Blue expects that many of the 200 or so System/36 VARs will qualify as VADs. Besides marketing the S/36 PC through its own VADs, national accounts and marketing divisions, IBM plans to make the machine available through large retail outlets like ComputerLand Corp. and Entré Computer Centers Inc.

Even the attractive low price, coupled with IBM's discounts ranging from 12 percent for seven machines to 36 percent for 100 machines or more, may turn out to be a stumbling block for the qualified VADs. That's because, according to McCracken, IBM won't allow the VADs to combine S/36 PC sales with those of larger System/36s in order to gain the discounts.

That creates the chief concern of some VARs that retailers dealing in big volumes will practically give the machine away. "If the ComputerLands are offering discounts in excess of 30 percent, what's left?" wonders Joseph Goldsmith of Para Research, Gloucester, Mass., System/36 remarketer. "You're in a market with no margin built into it."

Another problem for remarketers, should they become S/36 PC VADs, is justifying the relatively high cost of their software compared with the price of the machine. For instance, Goldsmith says that Para Research sells a typical accounting package for about...
"If IBM positions this product as an upgrade path from the PC and talks the multiuser game, there are technologically better products, with better price/performance, better options that tell a better story within the box compared to the System/36," she states.

Gant believes IBM's best strategy would be to position the S/36 PC as an applications box because of the bulk of business software available for the System/36.

**IBM puts limits on the S/36 PC**

While IBM touts the S/36 PC as an entry into the company's System/36 minicomputer system, the upgrade path to the larger System/36 machines is not cheap. IBM admits it has priced the S/36 PC substantially lower than other 36 models because the user does not get automatic upgrades. Moving up to the mid-range, 5362 processor-based (known as the "Baby 36") or the top-end, 5360 processor-based System/36 involves new hardware, not to mention additional, more expensive software. The benefit to the user of staying within the 36 family is consistent user training, interfaces and applications.

"IBM's overall strategy for the S/36 PC," says InfoCorp's Gant, "is to position the machine as an entry-level system for users who want to move into the company's proprietary operating system and for PC users who are looking to move up." But, she adds, "IBM was careful to set limitations on the S/36 PC so it wouldn't pirate Baby/36 users and sales."

Gant believes the S/36 PC is a relatively cheap entry to the IBM minicomputer family. "But this scenario is better news for IBM than for customers because, if a user wants to get into the company's proprietary operating system, then IBM's got them," she maintains.

**Marketing strategy set**

Myron Kerstetter, program director for small computer system service at the Gartner Group, Stamford, Conn., says that IBM's targeted lower-end business market is a new one for the computer giant, whose traditional customers have been the Fortune 500 companies.

"Overall, large organizations won't find a need for the S/36 PC," contends Kerstetter. "I don't think this machine is appropriately configured for departmental use. Where large organizations may find it useful is within individual company entities such as in a warehouse or distribution organization," he adds.

Kerstetter believes that qualified IBM value-added dealers will be most successful in marketing the new de-

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**selling System/36 PC**

$13,000, with a complete turnkey System/36 going for between $60,000 and $70,000. He says that if his company decides to sell the S/36 PC—and it hasn't yet—some new software pricing strategy will be necessary.

But, as industry analyst Lewis sees it, "Value-added remarketers should be able to market the System/36 PC cleverly enough to hide the seeming discrepancy between the software and hardware cost." She says the key is to bundle a system and position it in a way that shows what it will do for the customer, whether it's a quick payback, improved profitability or better productivity.

IBM has recognized the pricing quandary and has reduced the price of System/36 software that will run on the smaller machine. For instance, IBM's Business Management Accounting System, consisting of several modules, sells for $1,800 per module for large System/36 processors. The same system costs $995 per module for the S/36 PC. IBM has made a similar price reduction for its Business Report and Application Development System, from $2,025 to $1,250. According to IBM, however, those less expensive programs will not run on large System/36s, only on the PC version. On the other hand, a utility is available to port software already developed for large System/36s over to the 5¼-inch disk format for the S/36 PC.

Another software difference between the big and small systems has to do with the System Support Program (SSP) operating system. Besides a price differential—$4,000 for the large-system SSP vs. $995 for the System/36 PC—those who buy the PC version will not receive operating system upgrades. That lack of support, says IBM, is the main reason the S/36 PC's operating system is four times cheaper.

With competition from IBM's internal sales organization and retailers with mass-merchandising know-how, many remarketers are skeptical about how much business the S/36 PC will bring them. "We're not about to jump on it with all four feet," says Rico McGhee of Jaycore Systems, a Marietta, Ga., remarketer that serves medical distribution and construction markets. "We'll continue to evaluate it, although it seems like a commodity product."

Value-added remarketer McCracken admits that even if he became a VAD in order to handle the new system, his company probably wouldn't sell that many. But he wishes IBM would still allow remarketers to handle the machine. "It would be nice to have them in your bag," he says. "For some customers with branch offices, it would be an alternative to a communication line to the main system."

—Mike Seither, Associate Western Editor
vice. "I think the retail market will be reluctant to handle this product because it's perceived as being much more complex than the PC," he says. "In addition, retailers are wary of related product-support requirements."

Industry analysts agree that product competition for the S/36 PC will come primarily from manufacturers of multi-user systems, such as Altos Computer Systems, Compaq Computer Corp., TeleVideo Systems Inc. and Texas Instruments, to name a few.

Kerstetter also sees direct competition coming from Digital Equipment Corp.'s PDP minicomputer products, as opposed to the recently introduced MicroVax II, which he feels is geared more towards the engineering and scientific market.

### UNIX software vendors exploit PC dominance

**Michael Tucker, Associate Editor**

Software developers working with AT&T Information Systems' UNIX System V are designing products that exploit, rather than compete with, the IBM Corp. PC. A host of new products has come to market which link machines, pipe data, translate information or otherwise connect UNIX with PC-DOS. This means UNIX software vendors have significantly modified their conception of that operating system's role in computing. They now envision UNIX-based machines as servers in distributed computing networks.

Vendors recently introducing new, or retooled existing, UNIX products for a PC-dominated world include Computerized Office Services Inc. (COSI), Ann Arbor, Mich.; Graphic Software Systems Inc. (GSS), Wilsonville, Ore.; Interactive Systems Corp., Santa Monica, Calif.; Relational Technology Inc., Alameda, Calif.; and several others.

### UNIX expectations altered

UNIX's partisans had originally hoped to make their operating system the OS of choice at the desktop level. That proved impossible, however, because the desktop market was already densely populated with IBM PCs and other microcomputers based on Microsoft Corp.'s MS-DOS or its close cousin, PC-DOS, which Microsoft developed for IBM. Now, UNIX software vendors are designing products to farm that population rather than replace it.

COSI is among the first to do so, with a program called Communiquè which allows the IBM PC to share data with UNIX-based hosts. Combining terminal emulation with file-transfer capabilities, Communiquè links host and PC by means of a standard modem. UNIX is the dominant partner in the relationship, essentially taking control of the PC and using it to provide local files or run MS-DOS and PC-DOS applications. Critics of Communiquè claim that it's little more than a terminal-emulation program that happens to be specifically designed to communicate with UNIX. But whatever the product is technologically, its marketing appears important for the industry. Early this year COSI reached an agreement with ATTIS, and Communiquè, renamed "Tango," will be sold under the ATTIS label.

A second UNIX-to-PC communications product is the Interactive Corporate Communications Systems (ICCS) from Interactive Systems. Introduced last January, ICCS allows users to build networks of PC-DOS and UNIX-based machines. Essentially, ICCS provides a combination of emulation and file-transfer services that allow a UNIX host to treat the IBM PC as a terminal, or—if one is a clever enough programmer to take advantage of multiprocessor problem-solving techniques—as a coprocessor. The product also offers several network services: electronic mail, text processing and so forth.

ICCS is of mixed parentage—Interactive is the same company that developed PC/IX, the variant of UNIX that IBM runs beside PC-DOS as the co-resident operating system of the
UNIX completes a connection

Just how closely UNIX and the IBM Corp. PC are being fused may be best shown in "The Connector," from Uniform Software Systems, Santa Monica, Calif. It performs a communication function within an individual machine.

UNIX implementations for the IBM PC have historically been coresident systems, with PC-DOS running along with a UNIX variant of some sort—such as Microsoft Corp.'s XENIX or Unisource Software Corp.'s VENIX. Unfortunately for software developers, it's difficult to link an application running under one operating system to software running under the other.

PC/XT. As a result, it has a sort of hybrid vigor. In addition to the simpler terminal emulation, it can also link IBM PC/XTs directly to another UNIX system via their common level of software.

Utility and development software vendors, meanwhile, are also adding UNIX-to-PC links to their products. GSS, for example, announced in June Grafstation, software that allows a single-user microcomputer to function as the graphics workstation of a multiuser host.

Essentially, Grafstation turns an IBM PC into a very intelligent graphics terminal emulator. It provides both a UNIX host and the workstation with a common layer of software—the virtual device interface proposed as a graphics standard by ANSI. It then uploads graphics tasks to the single-user computer while reserving everything else for the multiuser machine. The two interconnect via standard RS232C cable.

Grafstation's obvious targets are computer-aided design, engineering, modeling and other applications where number crunching must be combined with visual output. While GSS is not talking about Grafstation exclusively as a UNIX-to-PC product, the company does admit that the link will probably be a major market.

Meanwhile, there are even individual application programs that exploit a UNIX-PC-DOS connection. For some years, Relational Technology has been selling Ingres, a popular database manager for UNIX-based minicomputers and mainframes. Last April, the company announced a new variation on the theme, Ingres/PCLink.

Ingres/PCLink allows Ingres running on a UNIX-based host to connect to software running on an IBM PC via RS232C cable or Ethernet. In other words, users could tap into a corporate database, extract only what information they needed and then perform calculations on that data with a PC-DOS program like Lotus Development Corp.'s 1-2-3.

By like token, developers designing Ingres applications can do so from the comfort of their desktop IBM PCs and then upload them to the host. Either way, users have the advantage of working with UNIX applications in a familiar, desktop environment.

What all of this means is that UNIX vendors have abandoned their original, grandiose aim of making UNIX the standard operating system of the computer industry. Instead, they are going after an entirely new market niche—distributed computing. They are attempting to make UNIX the glue that holds different processors together.

TALLGRASS DEBUTS GRASSHOPPER

Tallgrass Storage Devices, Boulder, Colo., the OEM subsidiary of subsystem manufacturer Tallgrass Technologies Corp., is preparing to introduce its Model MC10/20 Grasshopper—a 3½-inch, ¼-inch cartridge tape drive—to OEMs and system integrators. Capable of storing 11.95M bytes on a 3M Corp. D-1000 cartridge or 22.1OM bytes on a 3M D-2000 cartridge, the file-oriented drive comes with an embedded controller/interface and a tape operating system. The drive employs group coded recording for greater density and the Tallgrass PC/T format to establish file formats and directory information.

LINKWARE TALKS TO DEC, IBM

File-server software from Linkware Corp., Waltham, Mass., is now available for IBM Corp.'s MVS/TSO environment and Digital Equipment Corp.'s VMS host environment. Linkware also recently announced personal computer support for Data General Corp.'s DG/One and Wang Laboratories Inc.'s Personal Computer. The Linkware integrated family of information-transfer products is based on a proprietary virtual-server technology and runs on a variety of computers.
Computer Associates sets pace in site-licensing

Mike Seither
Associate Western Editor

Software site-licensing has been a way of doing business in the mainframe and minicomputer worlds for years. One copy of a program is licensed to run on one multiuser machine at one site for one fee. The deal usually includes all program revisions, updates and support.

But only recently—and with some reluctance—have microcomputer software vendors begun to entertain the notion of site, or "corporate," licenses for companies whose offices are littered with hundreds, even thousands, of personal computers. Computer Associates' Microcomputer Products Division (formerly Sorcim/IUS Micro Software, San Jose, Calif.) is emerging as a leader in the trend.

From a corporation's point of view, there are good reasons to clamor for site licenses—most notably, savings on the cost of every copy of a program the company uses. In the case of Lotus Development Corp.'s 1-2-3, every copy costs about $500. A company's other concerns include controlling the duplication of programs, assuring that company personnel have up-to-date versions, training users and getting support from the software publisher.

But the dollar issue, according to many industry observers, is the primary reason that software companies have been dragging their feet over site licenses. "Pricing on a per-user basis is something that this [microcomputer software] industry has managed to perpetuate," says an OEM software sales director. "It's finally waking up to the needs of the corporate community because it's being forced to."

VARs in on sales

Some software companies are waking up earlier than others. This summer, for instance, Microcomputer Products unveiled a corporate site-license program that it hopes will satisfy all parties involved—itself, the buyer and the dealer—and tackle the thorny issue of illegal copying.

"Corporations have centralized purchasing, and the buyers are now management-information-system (MIS) and data-processing people, not users," says Microcomputer Products marketing vice president Michael Crosno.

Under its program, Microcomputer Products will leave direct sales to dealers or value-added resellers who complete the company's training session. For selling such Microcomputer Products programs as SuperCalc and EasyWriter, dealers get a 10 percent to 12 percent commission on the license fees. Licenses vary according to the number of copies and the selection of programs a corporation needs. Fees range from $293 to $7,800, depending upon the number of copies and the combination of programs.

Microcomputer Products doesn't make the copies but instead sends out master disks which the customer uses for duplication. The master has a counter that numbers each copy and identifies the customer on the program's splash screen. Once the licensed number of copies has been made, the master self-destructs.

Since Microcomputer Products doesn't copy-protect its software, it's possible that more than the licensed number of copies could be made by reproducing duplicates. But if that happened, says Crosno, at least the company would know where an in-house duplicate came from because it would be numbered. If pirated and used outside, the Microcomputer Products customer would at least have the satisfaction of knowing that, whenever the program was booted, the company's name would appear on the screen.

Under Microcomputer Products' support program for licensees, customers receive up to 150 free sets of documentation—$25 per set thereafter—or they can pay $3,500 for master sets for unlimited duplication. An optional maintenance program, free for the first six months and $1,500 annually after that, provides program updates and enhancements, a telephone hot-line and free documentation.

More to come

Compared with other software vendors' attempts at site-licensing, Microcomputer Products' is perhaps the most comprehensive and flexible, and it keeps dealers and VARs in the sales loop. By contrast, Summa Software, Beaverton, Ore., sells its Select word-processing program directly and lets customers make as many copies as they want for a flat fee of $7,000.

Another vendor, Multimate International Corp., East Hartford, Conn., the maker of the MultiMate word-processing program for IBM Corp. PCs, gives customers the option of either buying ready-made copies or making duplicates from masters provided by Multimate. Depending on the number of copies purchased, a customer can receive discounts of up to 50 percent. A Multimate license for 500 copies, for example, costs $10,000, or $200 a copy. The program regularly lists for $495.

Two of the major players in microcomputer software markets, Ashton-
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CIRCLE NO. 21 ON INQUIRY CARD
Tate, Culver City, Calif., and Lotus, Cambridge, Mass., have not made any significant moves toward site-licensing. Both have paid it lip service, but neither has come up with a plan.

Edward Esber, Ashton-Tate’s president and chief executive officer, this summer toured a number of Fortune 100 companies and afterward described their unanimous plea for site-licensing as a “primal scream.” However, Esber says site licensing means different things to different people, and Ashton-Tate is still trying to understand what those things are.

Until recently, Lotus had consistently said it would not implement a site-licensing program, but a company spokeswoman says that stance has changed. "Lotus is looking for solutions to site-licensing and actively studying corporate needs,” she says. "We want to be pro-active, not reactive.”

Robert Lefkowits, director of software services at InfoCorp, the Cupertino, Calif., market research company, believes that Lotus and Ashton-Tate will hold out as long as possible on site licensing but eventually will give in to demand from corporate MIS departments that are used to such deals. “Their single-CPU licenses continue to make money for them,” Lefkowits says. “There’s no need yet to give discounts or offer a lot of support.”

Publicity is key tactic in ADAPSO’s war on pirates

Stephen J. Shaw
Washington Editor

Round One has ended in the fight against software pirates with the software industry winning on points. In late May, the Association of Data Processing Service Organizations (ADAPSO), a trade association that counts many software developers as members, announced that it had settled its piracy lawsuit against American Brands Inc. and subsidiary Wilson Jones Co. for an undisclosed amount of cash. But according to some observers, money was not the issue.

“The real objective of the lawsuit was deterrence—get some publicity, raise the awareness level to the problem and discourage the rampant copying of programs within corporations,” speculates one computer industry analyst who asked to remain anonymous. ADAPSO alleged in its lawsuit that the companies had illegally copied the MailMerge, SpellStar and WordStar programs produced by MicroPro International Corp., San Rafael, Calif. American Brands admitted that the programs had been improperly duplicated by employees of its subsidiary, but it said such duplication was performed without the knowledge or acquiescence of American Brands or its executives.

American Brands stated that it and Wilson Jones agree with ADAPSO and MicroPro that software products should not be duplicated improperly, adding that the two companies “have agreed that appropriate procedures will be instituted to insure against such improper duplication.”

“We got everything we wanted,” comments David Sturtevant, ADAPSO’s public communications director. “There was no need to take it through the litigious process.” ADAPSO, say industry observers, carefully orchestrated its piracy lawsuit with public-

**LOST REVENUES GROW WITH MARKET**

(U.S. REVENUES ONLY—$ BILLIONS)

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**OFFICE SOFTWARE MARKET**

**Revenues Lost Due to Unauthorized Copies**

*Source: Future Computing Inc.*

Piracy cost the office-software industry nearly $1.3 billion in lost revenues between 1981 and 1984; the industry expects to lose $800 million in 1985.
awareness and advertising campaigns aimed at software end users.

The increased attention on software piracy may heighten demand from corporate users for protected programs or for some form of site-licensing agreements, speculates Pam Park, a computer industry analyst with research organization Future Computing Inc., Richardson, Texas.

One result of the lawsuit has been an increase in the number of companies writing internal policies that specifically prohibit copying of software packages, says Sturtevant. The ADAPSO spokesman adds that the association has received approximately 5,000 inquiries from companies, educational institutions, government agencies and individuals requesting more information about the legality of software copying. "We're seeing a new level of understanding," asserts Sturtevant.

The spokesman also notes that the lawsuit has brought to light other specific information about additional pirating, including signed affidavits concerning "piracy mills" allegedly run through electronic bulletin boards and large-scale counterfeiting operations. ADAPSO has turned over some of the information to the Department of Justice and expects to file additional lawsuits in the coming months.

According to a recent survey of end users of business software, half of all office software currently in use is unauthorized. Future Computing conducted the study with ADAPSO and 11 publishers of business software for personal computers. There were approximately 45,000 responses to the questionnaire mailed to 70,000 users. It focused on 12 leading business software packages, including Software Publishing Corp.'s PFS:File and Lotus Development Corp.'s 1-2-3.

Unauthorized copying of software will cost the industry approximately $800 million this year in lost revenues, estimates Mary Goldschmitt, vice president for industry relations at Lotus, Cambridge, Mass.

According to Goldschmitt, 90 percent of the software houses are not in good financial shape right now. The lost revenues are coming right out of their potential profits and are the difference between survival and death for these software companies.

Goldschmitt is chairman of ADAPSO's software protection committee, a group devoted to developing a hardware-based standard for protection against software piracy. The committee is designing a key system that would require an add-on device containing a user-identification number. A software program would be locked under the user's number when it is first installed on his system. Without the key device and the correct ID number, the program will not execute on the user's microcomputer. Goldschmitt says adoption of a hardware-key standard could happen this year. However, Goldschmitt admits that any type of hardware-based encryption system will make the software harder to use.

Industry analyst Park says some software companies may not go along with protection schemes for fear of alienating users. They'll put achieving maximum market penetration ahead of protecting revenue. "Some software houses want to see their packages copied just to get the programs out there," she says.

Despite the initial success against pirates represented by the settlement of ADAPSO's lawsuit against corporate software copiers, the software industry still has a long way to go in its effort to stanch the flow of lost revenues. A battle may have been won, but the war promises to be a long one.

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ATTIS reaches out to IBM's SNA network

Lynn Haber, Associate Editor

AT&T Information Systems' Computer Systems Division recently announced products to make its 3B line of minicomputers compatible with IBM Corp.'s Systems Network Architecture and also added two new models, the 3B2/400 and the 3B15. In aiming at SNA, ATTIS finally takes advantage of its own traditional strengths in communications and networking in order to leverage itself into new computer markets.

"Our goal is to tie together communication and data-processing applications via networking," says James D. Edwards, president of ATTIS' Computer Systems Division, Morristown, N.J. According to Edwards, the move to offer SNA compatibility articulates an important step toward that goal.

Included in the ATTIS announcement is a group of hardware and software products that will allow users to integrate microcomputers, minicomputers and mainframes, as well as to access other AT&T network products such as the Dataphone II Network Management System.

ATTIS recognized that 70 percent of the mainframe environment is dominated by IBM. So, it targeted IBM in offering the following four host connectors: SNA/3270 Emulator+, BSC/3270 Emulator+, 3270 Application Program Interface and the Communi-
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CIRCLE NO. 23 ON INQUIRY CARD
AT&T EXPANDS ITS 3B FAMILY

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<th>Floppy disk (bytes)</th>
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<th>Processor</th>
<th>Performance (may vary with mix of 3B2 applications)</th>
<th>Asynchronous ports</th>
<th>Memory configuration (bytes)</th>
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<td>WE32100</td>
<td>10-20 simultaneous users; max. 46 terminals; 1.1 MIPS</td>
<td>2 RS323C; max. 46</td>
<td>1M; 2M; 3M; 4M</td>
<td>23M-byte streaming tape drive</td>
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<td>10M, 30M or 72M (max. 432M)</td>
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<td>WE32000</td>
<td>6-10 simultaneous users; max. 18 terminals; 6 MIPS</td>
<td>2 RS323C; max. 18</td>
<td>½M; 1M; 2M</td>
<td>optional 23M-byte streaming tape drive</td>
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<td>1.1G max. (models 101 and 301)</td>
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<td>5 I/O (model 101)</td>
<td>WE3200 (model 101); WE32000 (high-speed version) (models 201, 301), &quot;To be upgraded to WE32100 later this year.&quot;</td>
<td>16-32 simultaneous users (model 101); max. 48 simultaneous users (models 201, 301)</td>
<td>supports RS322, RS449 interfaces and variety of asynchronous terminals and printers</td>
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<td>3B15 multitasking supermini</td>
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<td>2.1G max. (models 201 and 301)</td>
<td>5 I/O (model 101)</td>
<td>WE32100</td>
<td>20-48 simultaneous users (model 101); max. 60 simultaneous users (models 201, 301)</td>
<td>supports RS323, RS449 interfaces and variety of asynchronous terminals and printers</td>
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major computer manufacturers are already doing. "Basically, ATTIS is in a catching-up mode," he states. "They haven't been in the computer business long, and they're moving in the right direction. But overall the steps are a relatively simplistic approach to getting the job done."

ATTIS' computer marketing strategy is to target banking, brokerage, health and manufacturing, which it hopes to penetrate via strategic alliances with companies already positioned in those areas. One such agreement was recently made with Quotron Systems Inc., Los Angeles, which provides financial information to stockbrokers. ATTIS will furnish Quotron customers with their computers.

The new 3B2/400 supermicrocomputer is a full 32-bit multiser machine based on the Western Electric (WE) 32100 microprocessor. The system can simultaneously support up to 25 users and runs the company's UNIX System V operating system. Features include one or two built-in 30M-byte or 72M-byte hard disk drives, a 23M-byte streaming tape back-up unit, an I/O backplane with 12 expansion slots, at least six RS232C ports, main memory configurations of up to 4M bytes and an optional floating-point math coprocessor. Base prices range from $19,950 to $34,950. The product will be available in the third quarter.

The 3B15 superminicomputer is also a 32-bit device based on the WE 32100 microprocessor. Running under the UNIX System V operating system, the 3B15 supports up to 60 simultaneous users and has a main-memory expansion of up to 16M bytes. Prices range from $54,500 to $64,500 depending upon configuration. Availability is slated for the first quarter of 1986.

The company also announced price reductions for the 3B2/300 and 3B5 minicomputers, new modems and new application software for accounting and banking tasks.

Despite the acceptance of UNIX in the technical and scientific markets, the operating system has met resistance in transaction-processing application environments. To this end, the Computer Systems Division is promoting UNIX as an "enabler," rather than as "selling UNIX for UNIX," according to William O'Shea, a spokesman for the ATTIS software group.

Although the company continues to publicize the operating systems' strengths, such as multitasking and multiprocessor capabilities, portability and so forth, ATTIS is putting the accent on the networking aspect of system integration.

William C. Rosser, vice president at the Gartner Group Inc., a Stamford, Conn., market research company, thinks ATTIS' recent move will bring the company in line with what other
PACIFIC PERSPECTIVE

Japan defines a market for machine language translation

Ichiro Kakehashi
Tokyo Correspondent

The challenges of writing a computer program to turn Japanese into English and English into Japanese have been addressed for about 30 years, but only in the last two have there been significant breakthroughs. Now, spurred by urgent international politics—trade conflicts, particularly—and encouraged by technical refinements in microelectronics, several Japanese companies are bringing machine translation to market. A few claim machine translation that will run on microcomputers.

The problems of translation for Japanese export trade are acute, as is obvious to anyone who has ever tried to decipher an English-language Japanese manual. You will find instructions such as, "Please fixing by referral to the following your careful reading." Fujitsu Ltd. conducted a study of Japanese companies that use translation services and found that 50 percent of the documents involved are manuals, catalogs and other technical material for products shipped outside Japan.

On the market, or close to it, are a number of other systems:

- In September of last year, the Fujitsu ATLAS automatic translation system was released, and Fujitsu is using a version of it at its pavilion at Tsukuba Expo '85 at Tsukuba Science City, about an hour northeast of Tokyo.
- NEC Corp. is completing a mainframe-based system called VENUS that the company is also developing for microcomputers.
- The Bravice Pak Japanese-English translation system was introduced just over a year ago by Bravice International Inc. of Tokyo. It runs on a Digital Equipment Corp. VAX II or VAX 8600.
- Sharp Electronics Corp. has simplified English-to-Japanese translation to the point where it will run on a 16-bit desktop minicomputer, the Sharp OA-90DX.
- Hitachi Ltd. and the Market Data Center, an independent market-research company and database supplier, have recently codeveloped an English-Japanese translation system especially for economics.
- Finally, Toshiba Corp. demonstrated in June a mechanical translation system that uses a 32-bit minicomputer running under the UNIX operating system. The company expects to have a commercial version ready for market in December.

The objective of all these systems is to translate simple text from one language into simple text in the other. They are not expected to translate novels or poetry, but they are expected to provide syntactically correct translations of such things as manuals, catalogs, contracts and patent forms.

Fujitsu sells two ATLAS systems, ATLAS-I for English-to-Japanese translation and ATLAS-II for Japanese-to-English translation. In translating from English to Japanese, for example, the original sentence is first broken down into its component words and the words converted to Japanese by straight comparison via a 50,000-word dictionary.

Then the system identifies the elements of the original sentence, analyzes its syntax, establishes its grammatical structure and selects the appropriate interpretation. The operations are executed on the basis of stored rules. The system then sets up the modal elements of the sentence and assembles all of the elements to form a sentence in Japanese. The system runs either on a mainframe or superminicomputer.

In the NEC VENUS approach, the same machine-translation system handles both Japanese-to-English and English-to-Japanese translations. In research to date, the program only runs on a mainframe, but NEC is developing VENUS to run on a microcomputer.

To run on a microcomputer, however, the system must incorporate sufficient peripheral memory to handle the huge volumes of dictionary space required to store all of the standard and inference-reference entries for word meaning and grammatical distinction.

The Bravice Pak, the first commercial translation system available in Japan, was developed in cooperation with Weidner Communications Inc., Provo, Utah, to translate from Japanese into English. There are about 20 Bravice Pak systems in place. Users lease them for approximately $2,000 per month, including software.

The system uses a prompting program and requires an operator-editor to smooth out the translation. The company claims an accuracy rate of 85 percent to 92 percent. Bravice is currently bringing the software into scale to run on personal computers.

The key phrase in Japan is, "Smaller is better," and at least one company is simplifying the machine translation process even further. Sharp's OA-90DX, introduced a year ago, uses a Motorola Inc. MC68000 microprocessor and runs under a UNIX-based operating system. It has 768K bytes of RAM, expandable to 1.28M bytes. It offers plenty of memory, too—40M bytes on a 5-inch hard disk.

Sharp claims that their system translates 5,000 words an hour, or about one page of English into Japanese every 5 minutes. That is about two to three times faster than a very good human translator can work, and the system provides the added bonus of legible, printed text.

A commercial version of the system, including hardware, software and a printer, will be available for about $14,000.
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European MAP group augurs worldwide approval

Keith Jones, European Editor

Members of Europe’s leading automotive and petrochemical companies are forming a user group in support of the Manufacturing Automation Protocol (MAP), General Motors Corp.’s standard communications specifications for the factory floor. The European MAP User Group, which will also include European vendors of MAP products, presents further evidence that MAP is well on its way to worldwide acceptance.

Michael Kaminski, MAP project manager at GM, predicts that some form of worldwide user group to guard against deviation from MAP standards may be forthcoming. He is sure that the structure of the user group will be influenced by the steering committee of the North American MAP User Group, and by that group’s secretariat, the Society of Manufacturing Engineers, Dearborn, Mich., rather than by GM itself.

Kaminski says there is now also a growing interest in MAP in Australia, Japan and other parts of the Far East, in addition to North America and Europe. At least one European manufacturer of MAP-compatible technology, the Energy and Automation Systems Group of Siemens AG, Munich, will participate in the next large public demonstrations of MAP, the manufacturing automation show Autofact, in Detroit, from Nov. 4 to 7. At Autofact, a local area network using MAP protocols to connect manufacturing workstations and devices will be demonstrated working with an Ethernet LAN configured with office-automation attachments.

In addition to users, MAP-product vendors and system integrators will be allowed to join the European MAP User Group, says Victor Gregory, coordinator of the fledgling group’s steering committee and manager of corporate projects at Unilever Plc., London, one of the world’s largest household-products manufacturers.

Gregory says Unilever’s numerous factories worldwide badly need a standard like MAP because they use computers and process controllers from more than 30 vendors. The company has to reconfigure its system each time different products need to communicate.

But Gregory stresses that like the North American MAP User Group, users, rather than vendors, will dominate the new group’s steering committee. The interim secretariat, which may become permanent, is the European office of CAM-i (Computer-Aided Manufacturing International Inc., Arlington, Texas) in Poole, England. CAM-i is a worldwide non-profit organization that manages research and development projects for its member companies. Dr. Peter Bunce, CAM-i European technical manager, looks forward to a full user group meeting before the year-end.

Bunce observes that the adoption of MAP in Europe will be aided by performance testing centers for computer standards now being established by the European Commission, the governing body of the European Economic Community. The standards to be tested include the open systems interconnection (OSI) standards being defined by the International Standards Organization. MAP will conform with the seven-layer structure of OSI.

A longer term goal for MAP is the interconnection of a broadband-bus backbone with multiple token-passing baseband buses, each running at 5M bits per second. The backbone will employ the existing MAP broadband transmission technology, where frequency multiplexing is used to transmit multiple signals simultaneously.

Testing of such a mixed broadband and baseband network was carried out last June at Eastman Kodak Co., Rochester, N.Y., notes Dittmar Janetsky, manager of the systems communications group within the Siemens systems engineering development divi-
sion at Karlsruhe, West Germany. He says that the demonstration was staged in conjunction with two U.S.-based MAP equipment vendors, Motorola Inc., Schaumburg, Ill., and Concord Data Systems Inc., Waltham, Mass. Janetsky explains that IEEE 802.4 embraces token-passing buses employing broadband and baseband transmission. Janetsky is a member of the IEEE 802.4 standards committee and is also involved with a standards body giving worldwide endorsement to the token-passing bus technology embraced by MAP. This is the Geneva-based International Electrotechnical Commission (IEC), which is preparing a worldwide manufacturing bus standard called Proway. Janetsky, a member of the Proway working group, finds Proway to be compatible with IEEE 802.4.

Siemens' interest in MAP is mainly as a vendor of programmable logic controllers for machines like robots and numerical control equipment. But computer vendors in general are interested in MAP, observes Christopher Warham, technical networks marketing manager at Hewlett-Packard Ltd., Wokingham, England. He says that HP regards MAP as the linchpin of future factory-floor communication and over the next year will introduce a variety of hardware and software interfaces implementing MAP protocols for its computers and workstations. 

AT-compatibles fight for share of new standard

Lynn Haber, Associate Editor

The number of manufacturers who sell IBM Corp. PC-AT-compatible computers seems to grow every day. But the question is: Can all the vendors survive? Continued demand for IBM's PC-AT and AT-compatible products remains uncertain, and industry analysts suggest that the success of individual AT-compatible manufacturers will rest squarely on product integrity, not simply on the availability of the IBM product.

Aaron Goldberg, analyst with market research concern International Data Corp. (IDC), Santa Clara, Calif., estimates that PC-AT unit shipments in 1985 will reach 300,000, compared with 25,000 in 1984. Yet, Goldberg says, "The survival of AT clones will be based on the quality of a particular product and whether the manufacturer is responsive to his customers' needs. The fate of the compatible manufacturers won't rest with IBM but with their own management."

Five U.S. manufacturers are currently offering AT-compatible products: Compaq Computer Corp., Coro-
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vendors, however, report that they are experiencing no delays in shipments.)

Compaq, manufacturer of the DeskPro 286 and other Intel Corp. 80286-based products, is expected to do well in the PC-AT-compatible market. With Compaq No. 3 in sales behind IBM and Apple Computer Inc. in dealer distribution channels, industry analysts believe the company is in a good competitive position.

IDC's Goldberg estimates that Compaq will report sales of approximately 75,000 units in 1985. This figure includes the DeskPro and the Portable 286, both 80286-based.

Michael S. Swavely, vice president of product marketing for Compaq, contends that the IBM shipping delay was more of a negative than a positive for AT-compatible manufacturers. "Delayed shipments resulted in a slowdown in the overall market. Also, if the AT had been readily available, software developers would have made it a priority to get software to market early, which would have, in turn, boosted the overall market sooner," Swavely says.

TI, Austin, Texas, expects to be successful with its AT-compatible computer—the Business Pro—because of positioning through the value-added reseller channel. "The VAR channel has been the strength of our minicomputer business over the last couple of years, and we expect to expand that well-developed channel with the Business Pro," says Roger Roberts, manager of personal systems marketing for TI.

The company will also sell direct, but sees most of its PC-AT-compatible competitors targeting their products for the retail desktop-PC, high-performance-workstation and PC-replacement markets. "We're going to emphasize the VAR channel. The other vendors don't seem to be taking that track," Roberts adds.

Rumors prevail that IBM will expand its 80286-based line (currently just the PC-AT) and integrate the new products into the company's overall office-automation strategy. The PC-AT will represent the top-of-the-line unit, while the much-talked-about PC II, expected to make its official appearance within the next six months, will replace the PC as the company's low-end machine.

"The AT will increasingly become part of integrated, information-processing office-automation systems," says Arthur D. Little's Weizer. "It will become an IBM standard." According to the analyst, IBM has already stated that its primary intelligent workstation is the PC—and therefore the AT" he suggests. In addition, he says, "It makes sense that IBM will standardize its office-automation architecture to more fully integrate with the rest of the company's product line."

Weizer believes that if IBM does standardize the architecture, the PC-AT-compatible manufacturers could face some difficulties. "Now, this is where large users get nervous about clones," he says. "Increasingly, we're finding that large business users are doing long-range planning—and PCs are a part of the office-automation systems. So, users have to get that warm feeling about vendors that whatever changes IBM makes in hardware or software, they, the end user, will be able to follow."

According to Weizer, the nature of the market changes as one deals more with the PC as part of a larger system or as a workstation. "It's much different than dealing with the PC as a standalone device—and this concept will give the AT-compatible manufacturers some trouble," he contends.

Goldberg doesn't believe that a redirected strategy on the part of IBM will hurt the PC-AT-compatible manufacturers. "I don't think it will be a disaster for the AT-compatible vendors—at least not the good ones," he says. "And I don't think customers should be scared away from these products, because some of them are better and less expensive than IBM's machines."

TT's Roberts believes that an IBM endorsement of the 80286-product would be good sales incentive for other manufacturers' offerings. "I think it reinforces the 80286 standard in the marketplace and will contribute to a longer life for such products," he says.

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Jazz and Excel: Can the Mac now get down to business?

Lynn Haber, Associate Editor

The threatened battle between Lotus Development Corp.'s Jazz and Microsoft Corp.'s Excel software will never develop. The real question facing these powerful new application packages is whether they can make the computer for which they were designed—Apple Computer Corp.'s Macintosh—a serious player in the business computer market.

Neither Lotus nor Microsoft are solely vying for market share within the approximately 275,000 Macs now installed. Rather, they hope to create a new market for the Mac and, therefore, for themselves.

"I don't see direct competition between Jazz and Excel," asserts Robert M. Lefkowits, director of the software industry research program at InfoCorp, a market research concern in Cupertino, Calif. "I believe that success for these products depends on whether the companies can create new markets for their products instead of simply tapping into existing needs."

But can Jazz, an integrated software package for first-time microcomputer users, and Excel, a robust microcomputer spreadsheet, bring the Macintosh to the large business users Apple would like to address?

The Apple Macintosh microcomputer, introduced in January 1984, has a clientele comprised primarily of small-business and home users. Last January, Apple introduced the Macintosh office concept to attract a stronger business-office clientele. With the introduction of LaserWriter, a high-reso-
lution printer, and AppleTalk, a local area network that allows the Mac to communicate with other personal computers, Apple promotes an integrated range of business products. Both Lotus and Microsoft see their software products as an expansion of this business concept.

**Lotus promises innovations**

According to Eric Bedell, product marketing manager for Jazz, the target user for the $595 integrated package is the work group and the departmental-level user in both small and large organizations. "In all companies, there are certain workers who perform similar tasks—decision-makers who move from one task to another throughout the course of the day," he explains. “Jazz is personal-productivity software designed to facilitate the job of the first-time [managerial or professional] microcomputer user."

Jazz integrates five functions—worksheet, word-processing, graphics, database and communications—in a single package. According to Lotus, the communications function can retrieve information from other personal computers or minicomputers and mainframes. Additionally, users can convert files from Lotus' 1-2-3 and Symphony software packages and from Microsoft's Multiplan into Jazz files. Currently, 1-2-3 and Symphony cannot convert Jazz files, but according to Bedell, Lotus will offer a new version of these products that will convert the files.

The company will also make available this fall the Jazz internal file format so that third-party developers can write macros for the software. A macro is a feature that enables a user to tailor the software for a specific, often-used task. Bucking criticism from some industry analysts who chided Lotus for not including a macro in Jazz, Bedell defends the company's decision, saying that, by and large, the targeted Jazz user doesn't require such a sophisticated tool.

Lotus is also making available the internal file formats of 1-2-3 Version 2 and Symphony Version 1.1. According to the company, the availability of this information will assist third-party developers and application designers to work with and interchange data between all Lotus products.

InfoCorp's Lefkowits views Jazz as a general-purpose business tool. "It's good for users who aren't sure what they'll use the Mac for," he says. "They'll use Jazz to dabble in a bit of everything." But the industry analyst questions whether enough people have layered purchasing personal-productivity tools because they were waiting for something like Jazz, or that Jazz will spur the sale of Macs to this untapped market.

**Excel designed for power**

Microsoft's Excel is a spreadsheet package designed to run on the 512K-byte Macintosh. The software combines automatic macros, user-defined functions, array-handling and two-way file compatibility with Lotus' 1-2-3. Not only is the spreadsheet large—256 rows by 16,384 columns—but also extremely fast by virtue of recalculating only those cells affected by a change. Excel is priced at $395 and will reportedly begin shipping in September.

According to Michael Slate, product marketing manager for Excel, the target customer is the power user as well as the first-time user. "No other spreadsheet product is as powerful as Excel," claims Slate. "This software is specifically for people who have to do some serious work with numbers."

While Lotus' Bedell claims that the spreadsheet in Jazz can do all the things Microsoft's Excel can do, Eric Arnum, research analyst at International Research Development Corp. (IRD) in Norwalk, Conn., says, "These two software packages are different in philosophy as well as product." Neither, he claims, will be all things to all users.

Despite the fact that Excel has been lauded by industry analysts as a "meaty" spreadsheet package, these same analysts again question whether users needing serious number-crunching have been sitting around waiting for a package such as Excel, rather than having already purchased IBM Corp. PCs and the business-oriented software packages written for them.

"Is there a need for a super-sized spreadsheet for Mac users?" asks InfoCorp's Lefkowits. "I think most users who need a good spreadsheet went the IBM/Lotus 1-2-3 route." Analysts also wonder if the Mac, with only 512K bytes of memory, will be adequate for such powerful packages.

How much of an influence these two products will exert on the undecided customer has still to be seen. "One thing I don't believe is that Jazz and Lotus alone will make the Mac an office product," says IRD's Arnum.

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### How Jazz and Excel Match Up

<table>
<thead>
<tr>
<th>Package</th>
<th>Functions</th>
<th>Memory required</th>
<th>Features</th>
<th>Price  ($)</th>
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<tbody>
<tr>
<td>Jazz</td>
<td>spreadsheet, word processing,</td>
<td>Apple Macintosh 512K (plus external</td>
<td>employs Macintosh conventions; pull-down menus;</td>
<td>595</td>
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<td></td>
<td>database, graphics,</td>
<td>disk drive)</td>
<td>visual icons; multiple documents open at once;</td>
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<tr>
<td></td>
<td>communications</td>
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<td>supports Apple's ImageWriter, LaserWriter and</td>
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<td></td>
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<td>AppleTalk</td>
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<td>Excel</td>
<td>spreadsheet</td>
<td>Apple Macintosh 512K (plus external</td>
<td>graphics interface; automatic programming of</td>
<td>395</td>
</tr>
<tr>
<td></td>
<td></td>
<td>disk drive)</td>
<td>macros; array-handling; two-way file compatibility with Lotus 1-2-3</td>
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</tbody>
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<table>
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Semiconductor group asks help in selling to Japan

Stephen J. Shaw
Washington Editor

Joining a crowded field, the U.S. Semiconductor Industry Association (SIA) has become the latest industry organization to voice complaints about how its members are treated in the Japanese market.

SIA, a trade group representing 57 U.S. semiconductor manufacturers, has petitioned the Office of the U.S. Trade Representative (USTR) for a determination that Japanese companies and government agencies have actively conspired to keep U.S.-made semiconductors out of the Japanese market.

In July, the U.S. Trade Representative Clayton Yeutter agreed to launch a formal investigation of SIA's complaints. Two weeks later the International Trade Commission issued a preliminary ruling that Micron Technologies Inc., a Boise, Idaho, semiconductor manufacturer, had suffered economic harm because of Japanese dumping of chips on the U.S. market at prices below their usual cost.

The Department of Justice in August agreed to SIA's request to launch an investigation into possible predatory pricing of semiconductors by Hitachi Ltd.

Some industry observers feel that the petition is an attempt to pressure Japanese manufacturers to sit down with U.S. companies and arrange a set of mutually agreeable market shares. SIA contends, however, that specific quotas are not the goal. Rather, they want to force the Japanese to work domestically under the same set of market risks that U.S. manufacturers operate under at home.

"The Japanese in the early 1970s had virtually no presence in the U.S. market for semiconductors. They targeted the U.S. market and significantly increased their presence here," comments Pat Cox, a computer industry analyst with Dataquest Inc., a Cupertino, Calif., research organization that worked with SIA in developing market estimates.

According to SIA figures, American semiconductor manufacturers controlled only 11 percent of the 1984 market for semiconductors in Japan. The Japanese share of the U.S. market, however, is estimated at 17 percent. "If U.S. companies had the same market share in Japan as Japanese manufacturers have here, U.S. sales would have been $3.3 billion higher in 1984, and we would have had an additional 27,000 jobs," claims an SIA spokeswoman.

Negotiations on the issue are already under way as part of the ongoing bilateral trade talks between the United States and Japan. However, acting U.S. trade representative Michael B. Smith told a congressional committee that progress on most agenda items was moving at a "glacier pace."

SIA filed its petition partly out of frustration over the slow pace. "We would not have filed our petition if the U.S.-Japanese talks...had not appeared to have failed," says the SIA representative.

The petition cited SIA fears that Japanese manufacturers are repeating the techniques they used in 1981 to 1982 to dominate a major portion of the world market for 16K and 64K RAMs: establish a restricted domestic market that allowed Japanese companies to expand production capacities, then flood the world market with relatively inexpensive semiconductors.

SIA cited a memo from Hitachi Corp. to its dealers that SIA claimed provided proof of Japanese intentions to gain market share regardless of cost. The memo illustrated Hitachi's "10 percent rule:" dealers were instructed to quote to prospective customers prices that were 10 percent below the competition. Dealers were told to keep bidding 10 percent below competitors' prices if the competitor matched Hitachi's price. "The bidding stops when Hitachi wins," the memo stated, according to SIA. Apparently, Hitachi is willing to bear any revenue losses itself. Dealers were guaranteed a 25 percent profit.

SIA also raised the specter that anti-dumping actions would be pursued against Japanese manufacturers selling into the United States unless U.S. companies achieved some sort of market-share parity in Japan. The association urged the President to prevent potential dumping of semiconductors in the American market. SIA maintains, however, that it will not file for an investigation into alleged dumping. That will be left up to individual member companies, according to the association. SIA has requested that the U.S. Department of Justice investigate whether "the collusive and anti-competitive activities of Japanese semiconductor producers have violated U.S. antitrust laws."

The Japanese government dropped formal protection of the Japanese semiconductor market by 1975. But by encouraging a "Buy Japanese" attitude, as well as close cooperation between semiconductor researchers and suppliers, and development of a large captive market for semiconductors within Japanese companies, the Japanese government has effectively blocked penetration of the market by non-Japanese companies.

The SIA's petition was filed under Section 301 of the 1974 Trade Act. The USTR was expected to rule by the end of July whether to launch an investigation of SIA's complaints. If USTR's initial ruling is positive, expected, comments will be solicited from other executive agencies, industry and the public. And if the USTR finds in SIA's favor, the President is expected to last into late 1986.

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PHARMACISTS NATIONWIDE ORDER DRUGS BY COMPUTER

Network speeds drug orders and price updates through countertop terminals

Joan Tharp

Approximately 200 pharmacies nationwide daily place drug orders for as many as 400 prescriptions over a pharmaceutical network system from RxNet Systems, a division of Northwestern Drug Co. Each pharmacy's system has a microcomputer, one to eight terminals, one to eight printers and a modem that connects to a minicomputer at Northwestern Drug headquarters in Auburn, Wash.

Because many of its customers are first-time users, RxNet strives to keep the system simple and to make any changes transparent to users. But in 1980 the company's terminal supplier, Ampex Corp., Cupertino, Calif., discontinued the line that RxNet was using, and RxNet was faced with having to replace the terminals, rewrite its application programs and retrain its customers.

Customizing the terminals

As a result, RxNet set out to find new terminals while keeping its application program intact. The company looked for terminals similar in features and functions to those of Ampex but with smaller footprints because counter space in pharmacies is limited. After looking at many standard terminals, RxNet officials found none of the right size that would interface smoothly with the RxNet software. What's more, says RxNet general manager Rip Corter, "The manufacturers insisted that we'd have to change our application to fit their hardware."

The only viable solution seemed to be custom-designed terminals. However, because RxNet did not require its customers to switch to the new systems, the company's initial order was for only 100 terminals. RxNet then found that many vendors couldn't accommodate such a small order and that those that could would have attached a prohibitive price tag. However, one company that RxNet evaluated, Falco Data Products Inc., Sunnyvale, Calif., could provide RxNet with a small quantity of a reasonably priced terminal—the TS-1—and customize it to work with RxNet's application software.

After choosing the TS-1, RxNet's Corter and the Falco engineering department fine-tuned the terminal to the RxNet system. Corter described the desired keyboard layout for the RxNet system and outlined the functions the TS-1 had to perform. Using Corter's suggestions, Falco developed specifications and shipped a prototype...
Each pharmacy in the RxNet network includes a microcomputer, one to eight terminals, one to eight printers and a modem that connects the pharmacies to a Prime minicomputer at Northwestern Drug headquarters.

MINI PROVIDES DRUGGISTS' LINKUP

To RxNet for evaluation.

To use the RxNet system, a pharmacist enters the product stock number and requested quantity. This information is stored until the pharmacist is ready to send a batch of orders, which he does via the auto-dial, auto-answer Signalman modem from Anchor Automation, Van Nuys, Calif., and Magic Wand electronic mail from Peachtree Software Inc., Atlanta.

When the pharmacist wants to receive his electronic mail, he selects "EMS" from the software menu and then chooses an option, such as price updates, express mail or regular mail. He then enters the time that he wants to begin receiving his mail. If the pharmacist has a problem with the system, he can enter it into the communications mode of the system. Then, hardware/software communications support can correct the problem. The system can send program updates to the pharmacist via modem.

At Northwestern Drug headquarters, a minicomputer from Prime Computer Inc. receives the data and processes the drug order. It provides pharmacists with drug price updates and allows them to leave messages for other pharmacists on the network. It also sends information to an NCR Corp. mainframe, which then produces order documentation and "pick tickets" to identify the products ordered.

One change in the TS-1 Corter had suggested...
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to Falco was reprogramming of the 10-key function keypad so that it would match the procedures of RxNet's electronic-mail system, which incorporates Peachtree's Magic Wand word-processing software. For example, Falco changed some of the TS-1's numerical keys to arrows that executed such Magic Wand tasks as inserting characters and lines. In addition, Falco moved the TS-1's function keys to the top of the keyboard to match the Ampex terminal's keyboard layout.

**Faster CPU requires new terminal**

Last summer, RxNet changed the system's CPU to a microcomputer from Integrated Business Computers (IBC), Chatsworth, Calif. The IBC unit runs the Oasis 6.0 operating system from Phase One Systems Inc., Oakland, Calif. Because the IBC unit operates twice as fast as the previous CPU that RxNet was using, RxNet had to switch to a faster Falco terminal—the Fame II, an ergonomic TS-1 replacement.

The $795 Fame II provides higher micro-processor speed through the use of an extra crystal oscillator and several new circuits on the logic board. In addition, the Fame II meets ANSI X3.64 standards and supports the 2674 and 2675 CRT controller chips, which improve the display and the screen attributes and provide smoother scrolling.

Besides improved processing ability, the Fame II provides better ergonomics, including the ability to tilt and swivel. With a smaller footprint than the TS-1, the Fame II also fits more easily onto pharmacy countertops. The reduced-glare Fame II displays 24 lines by 80 or 132 columns and features a 77-character-per-key character memory, which, Corter says, helps pharmacists store detailed commands.

Falco and RxNet updated the keyboard firmware so that the terminal could accept data from the more powerful CPU. The two companies also changed the “freeze” key from single to multiple stroke to prevent its being accidentally struck by pharmacists when they reach for a nearby key. Falco and RxNet also reprogrammed the Fame II firmware to respond to RxNet's 20 non-standard escape sequences.

Falco attributes its ability to offer lower cost terminals than its competitors do to using electrically programmable ROM, incorporating modular software and employing flexible manufacturing techniques. Through the use of EPROM circuits, Falco simplified the customizing of the RxNet order, according to Kachun Lee, Falco's vice president of development. "Most terminal manufacturers have their software burned into thousands of ROMs, which can't be altered for special orders," says Lee. "By using EPROMs, we can program any kind of software to meet customer specifications. And, if we discover a bug, we can erase all of the ones we have programmed and burn them back again."

Lee says that the modular structure of the terminal's software gives Falco added flexibility in customizing. "Changing the software isn't a major job for us. We just have to change one chip," and the changes to the chip do not affect the rest of the circuitry in the terminal, he adds.

In addition, Falco uses "work centers" rather than rigid assembly lines in manufacturing. The company claims these flexible work centers also aid in the production of small orders of customized terminals, such as the one for RxNet.

Joan Tharp is a business writer from Palo Alto, Calif.

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OEM INCORPORATES SOFTWARE DUPLICATION

A word-processing manufacturer cuts labor costs 90 percent and reduces order turnaround to less than a day with a software-duplication system

Mike Knight, CPT Corp.,
and Sandra Clifford, IXI Laboratories Inc.

Until recently, CPT Corp., a Minneapolis OEM of word-processing and other office-automation systems, handled software releases and field upgrades to its customers manually. Customers would order software from any combination of 15 options. Field salesmen then installed the software on the customers’ equipment, which normally took about 30 minutes per item.

But this method became burdensome when CPT’s installed base grew to 60,000 systems, each of which received three or more updates per year. Because there were more than 500 salesmen worldwide installing and updating software, the chances for error were great.

Initially, CPT tried to solve the problem by bringing the work in-house. Efficiency increased, but software sales were rising. CPT projected it would soon be selling 30,000 floppy disks per month. Even a software-duplication expert could configure no more than seven disks per hour. So, at the projected volume, CPT would require more than 4,000 additional man-hours or 27 additional staff members.

CPT turns to ‘project circle’

To solve the problem, CPT formed a “project circle” comprised of members of the affected departments—manufacturing, software engineering, order entry, marketing and accounting—along with a corporate facilitator. The project circle’s goal was to develop a flexible software-distribution system that would cut manufacturing costs, cut turnaround time to less than 24 hours and develop software-protection schemes that would eliminate software piracy.

The project circle was required to address the needs of the company’s various departments. For example, the manufacturing department wanted to computerize order processing. For its part, the order-entry department wanted a menu-driven entry system so orders could be taken easily by phone. Previously, operators had to enter 15-digit numbers for each order. Marketing department personnel wanted a system that would facilitate price changes and allow them to offer specially priced option packages. They also wanted the system to record purchases so that personnel could analyze orders demographically and set sales quotas. In addition, the billing and accounting department wanted the system to eliminate the necessity for customers to return software for credit.

Circle selects software duplication

After testing various automatic duplication systems for data integrity and other specifications, CPT chose the FDFS format/copy system from IXI Laboratories Inc., Minneapolis. The FDFS duplicates CPT’s master disk, which con-
Even a software-duplication expert could configure no more than seven disks per hour.

tains all software options. It consists of a CRT terminal and a base station that controls as many as 30 autoloading duplicators simultaneously.

The base station includes a manual module for loading CPT’s original software programs into the system. It stores these master programs on a hard disk and sends them to the autoloaders as needed. With the base station, users can analyze and copy formats and devise, implement and duplicate copy-protection schemes.

The FDFS also provides menu-adjustable quality parameters. In addition, the duplicated floppy disks can operate in almost any end-user drive. The autoloaders can handle 3½-, 5¼- or 8-inch disks with track densities of 48 or 96 tracks per inch. Each autoloader can handle 85 to 135 floppy disks per hour, and at full capacity of 30 autoloaders the system can duplicate 4,050 floppy disks per hour. Input hoppers for the autoloaders are available in 100- and 250-disk capacities.

System links departments

In addition to performing copy protection, the IXI duplicator also had to link to the corporate computer, a Sperry Corp. 1100/80 mainframe system, which contains all order information.

The first step in this procedure is order entry. Using a a Sperry terminal system, an operator first determines whether a customer is new and, if so, creates a file for that customer. Then, the operator enters the customer’s order into the 1100/80. The 1100/80 also sends this information to a remote printer, which prints shipping schedules. After the order is entered, the 1100/80 places the order in a queue and lists all options, both installed and on order.

Meanwhile, other personnel load blank floppy disks into the IXI autoloaders. From these, the IXI FDFS mass-produces formatted floppy disks that contain all options. The system can duplicate up to 30 disks simultaneously. Once the blank disks are loaded into the hopper, this process can occur without operator intervention.

The next step in the process is customizing, which begins when the 1100/80 computer transmits the orders entered via phone line to a bank of networked Phoenix JR word-processing systems, using a CPT SRS45 mass-storage system. Upon receipt of the orders, the SRS45 network dials back to the mainframe for the next block of orders. As the mainframe sends this data, it also sends the shipping and production schedule to the shipping department, and a printer produces an order report.

After receiving a block of orders, a controller for the SRS45 network looks for the first open word-processing console in the network and

In selecting software-duplication equipment, CPT Corp., Minneapolis, ranked data integrity as an important criterion. The company used a time-interval analyzer to test this criterion on IXI Laboratories Inc.’s FDFS format/copy system (results shown, left) and another manufacturer’s equipment (right). The analyzer measures the two parameters that most affect data integrity: bit shift and bit jitter. It also tests motor-speed variations and read/write circuitry.

CPT took measurements at the innermost (worst-case) track of a 3½-inch floppy disk onto which a worst-case pattern was recorded. The numbers after the letter “C” in the lower left corner of both charts indicate the number of bits sampled. The curves represent the number of times within three data windows that data occurred. Variance from the center measures bit jitter, and left or right displacement of the curves represents bit shift. Optimum recording results in a curve that is narrow, symmetrical and centered as on the IXI equipment.
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sends it the next work order. Then, operators load the duplicated floppy disks into word-processing consoles for customizing. The consoles delete from the floppy disks any unselected options, add loading instructions and record disk-label information.

Operators then load the customized disks back into the IXI FDFS base station, which installs copy protection. CPT personnel then verify the disks by running them on a word-processing console, ensuring that the disk can be loaded into the system, that it will operate and that it is copy-protected. A printer then produces labels for the floppy disks.

If the floppy disks pass the test, the label shows part, shipper, license and serial numbers. If the disk fails the disk test, the label indicates the identifying numbers plus instructions to reorder. Currently, the CPT system rejects only 1 percent of the disks compared with 5 percent on the manual system. The last step in the process is for workers to insert the disk into a manual and send it to the distribution department for shipment.

CPT plans eventually to port all the SRS45's software to the IXI duplicators. This would eliminate some steps in the process because the IXI duplicators have network capabilities and can directly communicate with the mainframe computer. However, the CPT word-processing system would still handle labeling, although IXI's in-line labeler is now an available option.

The FDFS software-protection scheme is unique to CPT's application. To protect a disk,
With the FDFS, users can place blocks of information, which serve as locks, almost anywhere on a floppy disk. Operators use the edit function of the IXI format/copy system with a proprietary disk drive controller. With the FDFS, users can place blocks of information, which serve as locks, almost anywhere on a floppy disk. These locks prevent users from duplicating files from the floppy disk.

For example, users could lock their software by altering an identification mark. To run the software, the system would have to locate the lock (the altered ID mark). A non-IXI controller would generate an accurate ID mark but would not be able to locate the inaccurate one. As a result, a second user could not open the first user’s file, and the software would be useless.

In devising a protection scheme, IXI combines locks and disk locations to provide a virtually infinite number of protection schemes, which users can change weekly or monthly using the format/copy system.

With the FDFS, CPT met its goals for software duplication. In a production run of 10,000 duplicated disks, the company was able to lower its labor costs by 90 percent. First, the system reduced costs by producing formatted, non-copyable disks at 49 cents less per disk than with the manual system. Use of the IXI system also reduced costs by decreasing labor from 80,000 to 8,000 man-minutes.

In addition, CPT reduced errors by 75 percent and shortened turnaround time to less than 24 hours for most orders. Formerly, the company could turn around only 5 percent of its orders within 24 hours.

What’s more, the new order-entry system provides a bill-of-materials program, which allows marketing department personnel to establish prices, promotional packaging and specials. When specials are available, the system automatically changes the order-entry screen. This system also eliminates the need for customers to return disks to CPT to order options and provides for end-user licensing without the need for customers to mail in cards.
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NCMS offers a range of diagnostic functions, starting with continuous monitoring of eight key analog parameters, and including EIA lead status.

For measurement of error rates, NCMS provides analog and digital loopback, with multipoint, end-to-end, and self-testing. Plus automatic polling tests. NCMS even allows downline loading of modem options for easy installation and control.

Continuously monitoring the communications network, NCMS automatically alerts the system operator to problems, so they can be quickly identified, isolated and resolved. It also provides multilevel password protection for system security. And to simplify administration, NCMS generates trouble tickets and network management reports.

The NEC Network Control and Management System. The simple solution to complex networking problems.

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For rapid fault diagnosis, the N500A offers local and remote testing capabilities. In a multi-drop environment, the N500A allows the user to address an individual DSU/CSU for testing from the central site—an industry first.

Also built in is an LCD display for front panel monitoring of equipment status, data rate, and error performance when in the test mode. Seven LEDs indicate EIA status.

The N500A is available in both stand alone and card versions for Rack Mounting.

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<tr>
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<th>300 b/s</th>
<th>1200 b/s</th>
<th>1800 b/s</th>
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<td>Half Duplex</td>
<td>N103J</td>
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<td>N1220</td>
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<td>Full Duplex</td>
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CIRCLE NO. 45 ON INQUIRY CARD
Network software rejuvenates LAN market

Popular opinion to the contrary, value-added resellers in search of networking software compatible with Microsoft's MS-DOS 3.1 can still shop around for something other than IBM's PC Network. Although IBM and Microsoft seem to control the game, other players—such as Novell and 3Com—have strong cards. But the joker in the deck is UNIX.

Protocols compete for LAN market

A variety of acronyms are crowding the workstation LAN market. To make informed decisions on how to link diverse workstations on heterogeneous networks, you'll have to understand the significance of OSI, ISO, XNS, DARPA, ARPANET, TCP/IP, NFS and MAP.

Micro-to-mainframe links: software speeds access to mainframe

Many of the micro-to-mainframe links being touted today fall short of DP/MIS managers' expectations. One company claims to overcome some of the conventional limitations with a software solution that permits direct program-to-program communications between microcomputers and mainframes in SNA environments.

Options multiply for PC, PC-AT integrators

There are a number of approaches to integrating a workstation based on the IBM PC and PC-AT buses. These include starting with a motherboard and building on it, working through one of the new "PC OEMs" and configuring a system based on an expansion unit.

Top 32-bit buses claim multiprocessing edge

The battle between backers of Multibus II and VMEbus borders on a war of claims and counterclaims. This second part of a two-part series focuses on operation modes (synchronous vs. asynchronous) and arbitration methods.

LAN software links diverse machines, OSs

PC/NOS, a network operating system, provides a standardized connection language and message-passing protocol among the diverse machines and OSs in a network.
Only Microware’s OS-9 Operating System Covers the Entire 68000 Spectrum

Is complicated software and expensive hardware keeping you back from Unix? Look into OS-9, the operating system from Microware that gives 68000 systems a Unix-style environment with much less overhead and complexity.

OS-9 is versatile, inexpensive, and delivers outstanding performance on any size system. The OS-9 executive is much smaller and far more efficient than Unix because it’s written in fast, compact assembly language, making it ideal for critical real-time applications. OS-9 can run on a broad range of 6 to 32 bit systems based on the 68000 or 6809 family MPUs from ROM-based industrial controllers up to large multiuser systems.

OS-9’S OUTSTANDING C COMPILER IS YOUR BRIDGE TO UNIX

Microware’s C compiler technology is another OS-9 advantage. The compiler produces extremely fast, compact, and ROMable code. You can easily develop and port system or application software back and forth to standard Unix systems. Cross-compiler versions for VAX and PDP-11 make coordinated Unix/OS-9 software development a pleasure.

SUPPORT FOR MODULAR SOFTWARE
— AN OS-9 EXCLUSIVE

Comprehensive support for modular software puts OS-9 a generation ahead of other operating systems. It multiplies programmer productivity and memory efficiency. Application software can be built from individually testable software modules including standard “library” modules. The modular structure lets you customize and reconfigure OS-9 for specific hardware easily and quickly.

A SYSTEM WITH A PROVEN TRACK RECORD

Once an underground classic, OS-9 is now a solid hit. Since 1980 OS-9 has been ported to over a hundred 6809 and 68000 systems under license to some of the biggest names in the business. OS-9 has been imbedded in numerous consumer, industrial, and OEM products, and is supported by many independent software suppliers.
NETWORK SOFTWARE REJUVENATES LAN MARKET

Increased competition in LANs and new networking alternatives create diverse choices for VARs

Michael Tucker, Associate Editor

Reports of the death of the personal computer local area network market have proved greatly exaggerated. Popular opinion to the contrary, value-added resellers in search of networking software compatible with Microsoft Corp.'s MS-DOS 3.1 can still shop around for something other than IBM Corp.'s PC Network. A host of communications products—ranging from full-scale networks like Novell Inc.'s Netware to smaller, "limited area networks (LmANs)"—remains very much alive and kicking.

PC Network may even be in for competition from other products from IBM. Some buyers in the office-automation market seem to be delaying LAN investment until IBM's token-ring network comes to market.

And finally, the effects of the UNIX operating system on the personal computer LAN market remain unclear.

When IBM first announced that it would support PC Network, a variant of Microsoft's MS-NET, many observers felt that the LAN market was pretty much wrapped up. The conventional wisdom was that, given IBM's mass, and the sheer number of IBM PCs and compatibles already on the market, all LANs would eventually be PC Network variants of some kind—even, according to some analysts, those in industrial applications.

To a certain extent, that may yet happen. Market analysts already predict that the network operating system that can't link with PC Network is doomed. "The key to success for networking software is to make it compatible with PC Network," says David L. Terrie, director of office systems research for the market research concern, the Yankee Group, Boston. With the exception of proprietary systems such as AppleTalk from Apple Computer Inc., he says, this boils the major players in full-service personal computer LAN software down to a tiny few. "PC Network, MS-Net, Novell's Netware and..."
PC Network has a few problems of its own—not the least of them springing from IBM.

3Com Corp.'s EtherSeries; those are the four that are going to survive," Terrie says.

Of these four, some market analysts say that if MS-NET and PC Network aren't already the same product with two names they soon will be. "The thing we're really interested in watching is how quickly MS-NET and PC Network get compatible," says Kim Myhre, director of communications industry research at International Data Corp., Framingham, Mass.

PC Networks set the pace

For 3Com and Novell, the challenge now is to gain and maintain PC Network compatibility. Terrie notes that 3Com is already making a significant effort to do exactly that. 3Com has an advantage in being in the hardware business as well. Even assuming that their EtherSeries network operating system had to be completely rewritten to match PC Network, the company might be able to profit nicely with such products as its recently introduced network server, the 3Server.

Which leaves Novell as the Big Four member most exposed. "Novell's NetWare, at least from everything I've heard, is a far more complete operating system than PC Network," says Myhre. "But Novell's got the problem it's always had. People aren't writing for NetWare. Software developers know that IBM is going to be around forever. They can't say the same about Novell."

"It's not so much a technical question as a marketing one," says Eric Arnum, editor of the EMS Newsletter of the market research company International Resource Development Inc. (IRD), Stamford, Conn. "If everybody writes applications for Microsoft's network, and nobody writes Novell's, then it doesn't matter if Novell's product is better...It's a question for the marketplace. Where the software developers go, the customers will follow."

Token ring awaited

But PC Network has a few problems of its own—not the least of them springing from IBM itself. Big Blue is also bringing a token-ring LAN market. "IBM itself actually endorses three networks," says J. Edward Snyder, general manager of the Information Networks Division of

NetWare from Novell is one of the leading contenders in the current round of network operating system wars. NetWare is a server-based system, meaning it runs in a central location to interconnect individual workstations via their common operating system—usually MS-DOS.
Candy is dandy but it won't do diddly for your throughput

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It means your computer's CPU can function at its full design speed and the overall performance of your computer can be greatly increased — providing as much as five times more throughput than a conventional disk-based system. Performance that can't be gained simply by acquiring a more powerful (and expensive) computer.

That performance adds up to new life for your PDP-11 or VAX system...eliminating the need to consider a new, more powerful CPU (which won't solve the I/O bottleneck anyway)!

The Need for High-Speed Storage
Whether for transaction processing, commercial data processing, database management, CAD/CAM, artificial intelligence, simulation or process control applications, many programs spend relatively little time performing calculations on data. A system will spend most of its time transferring data back and forth between main memory and disk (often referred to as "thrashing"). As a result, the full power of the CPU is hardly used.

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CIRCLE NO. 47 ON INQUIRY CARD

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CIRCLE NO. 48 ON INQUIRY CARD
TRW Inc., Torrance, Calif., "one meant for industrial situations, one—PC Network—for office automation, and the token-ring, which is neither for the office nor for the factory floor."

And, says IRD's Arnum, "The token ring is expected to have a lot of the capabilities of PC Network. Many buyers seem to be waiting for the token ring, which would give them both [office and factory] sets of functions in one package...IBM is by no means assured of success with its office LAN."

In addition, PC Network has come head-on against the one single problem faced by all personal computer networks—they are not viable products unless they can connect with something larger than personal computers. "Personal computer networks can't survive on their own," says Myhre. "The big question for IBM is how fast they can phase PC Network environments into their mainframe and minicomputer environments—particularly, IBM System/36 environments."

Blending personal computer networks with IBM mainframe and minicomputer environments is something several companies are becoming clever at. Last January, for example, Novell announced a comarketing arrangement with Pathway Design Inc., Wellesley, Mass.

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How Novell views standards

Michael Durr, Novell Inc.

The local area network industry is still struggling over standardization. But, fortunately, a standard is being established, and the struggle today is toward the standard, not against it.

That emerging standard is Microsoft Corp.'s MS-DOS 3.1, which is, of course, MS-DOS upgraded to include primitives for network access and synchronization. Most LAN companies have said they will upgrade their LANs to remain compatible with MS-DOS 3.1.

DOS commands this following for the same reason that it dominates the personal computer industry—its attractiveness to software developers. Any LAN that did not remain DOS-compatible could not share in the benefits of software written for DOS.

The application-to-network interface, defined by MS-DOS 3.1, is the key component to LAN standardization—as well as the reason standardization is beneficial.

A standard application-to-network interface lets developers reach a larger market with less effort and gives LAN users a large variety of application software from which to choose. It also allows LAN users to migrate to new technology.

As new applications appear, most will be compatible with the standard interface, and applications can be exchanged without modifying the network. Similarly, when new network technology appears, it can be moved in under existing applications without having to change the application, recreate the data or retrain users.

Another reason for standardization is internetworking. LANs should be able to communicate—globally, nationwide and intra-company. It's not unusual for a business to have two or more types of LANs and want to connect them in a single system.

Bridges and gateways—the devices that let separate and dissimilar LANs communicate—will therefore be key elements in the future of local area networking. Standards will not lessen their importance. Instead, by providing developers with a common software base, standards will make it easier to design and install such bridges. Different networks can connect above their hardware at some point where they share hardware compatibility.

Novell Inc., Orem, Utah, for example, achieves interconnectivity via bridge software. All of the 18 LANs supported by the company's Netware can be internetworked. With the Netware operating system running on top, the internetwork is totally transparent. To both user and application, it looks like a single LAN.

A common misconception is that standards would make all LANs identical in physical characteristics, functionality and performance. In fact, the negative aspects of such a uniformity would far outweigh its value. Different installations have different requirements and LANs have tended to meet these requirements by specialization—usually specialization of hardware.

However, no one hardware choice can suit every environment. In cost/performance measurements, for example, broadband hardware is ideal for workstations where multichannel capability is required. In a three-workstation LAN, however, broadband performance would be overkill.

The only way to meet these different needs is for the LAN industry to offer a variety of hardware and standardize hardware-software interfacing. This would provide interlinking without sacrificing flexibility or practicality.

Michael Durr is manager of public relations for Novell Inc., Orem, Utah. He is the author of A Practical Guide to Networking IBM PCs.
All the players in the PC LANs game remain acutely aware of a joker in the deck—UNIX.

Under the terms of the agreement, Pathway produced “Netpath,” an IBM Systems Network Architecture gateway that allows Netware-linked IBM PCs and compatibles to communicate with IBM hosts.

Available from either Novell or Pathway for $1,995, Netpath is a communication circuit card and associated software that runs on a single IBM PC or compatible in a Netware network. With it, up to 32 users can access an IBM host (or hosts) over dial-up, leased, point-to-point or multidropped lines. They can upload or download files, use host applications and switch between the personal computer and host environments with single keystrokes.

Meanwhile, the dominance of the Big Four is under attack. Office integrators are beginning to explore other communications options that lie outside the LAN technologies that have been traditional in office automation. For example, some system integrators are making use of “message-passing” network operating systems that behave like tiny packet-switching networks whose terminals happen to be IBM PCs.

Such networks haven’t shown up in personal computer LANs as a rule because they were viewed as massive overkill. Frequently, in these networks, every node functions as a server, something the average office system just doesn’t need—and doesn’t want—because it involves complex problems of network control. On the other hand, multiple servers do mean it’s very hard to crash the network.

Examples of this particular approach include the PC/NOS network operating system from Applied Intelligence Inc., Mountain View, Calif., and Waterloo Port from Waterloo Microsystems Inc., Waterloo, Ontario.

Waterloo Port runs on Arcnet and links IBM PCs and compatibles. Waterloo Port’s user interface reflects a commitment to marketing—it’s designed with the non-programmer in mind. For example, a visual interface in which network
MIP-512 - The Single Board Multibus Machine Vision System

- 512 x 512 or 1024 x 1024 resolution
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- 16.7 million color LUT
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- Dual ported video RAM for true DMA
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REAL-TIME IMAGE ACQUISITION
An 8 bit flash A/D converter is used for digitizing an external video signal. External sync genlock or internal sync generation are software selectable. On-board programmable offset and gain controls and input look-up tables are provided for real-time pre-processing of raw video data.

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The MIP-512 contains 256K Bytes of dual ported video RAM for storing a 512 x 512 x 8 image. The new MIP-1024 contains 1M Byte of dual ported video RAM for storing four 512 x 512 x 8 images or one 1024 x 1024 image. Images can be loaded or unloaded from Multibus to video memory under DMA control in just a fraction of a second.

- 8 bit frame grabber
- 90ns/sec/pixel video ALU
- MIP-LIB image processing software library
- Image processing functions:
  - addition & subtraction
  - averaging
  - convolution (N x M)

The MIP-512 supports instantaneous pixel by pixel panning and scrolling of images, and zooming by a factor of x2 or x4. Up to 256 colors or shades of gray can be displayed from the 16.7 million color LUT.

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The new MIP-LIB image processing software library is available for free to all MIP-512 customers. MIP-LIB lets you get your application up and running quickly.

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And as you can see, AMT actually out-performs many plotters, large or small, on high precision applications.

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resources are represented as "rooms" that the user can enter or exit.

Another option system integrators can exploit is the LmAN (MMS, June, Page 179). A LmAN differs from a LAN in that it links machines via RS232C ports. They’re called “limited” because they’re subject to the inherent limitations of the RS232C—they’re relatively slow, for instance, with transmission rates of about 9,600 baud.

However, 9,600 baud is more than fast enough for many network applications. LmANs also have a wide area networking capacity, because the addition of a modem gives them the power to link up with other machines via standard phone lines. And, LmANs are inexpensive—less than $100 a connection.

Server Technology, Sunnyvale, Calif., for example, markets a LmAN named “EasyLAN.” EasyLAN is a convenient method of linking small numbers of IBM PCs—less than 10—into a serviceable network at low cost. A kit to network two IBM PCs, with up to 30 feet of cable between them, is priced at $179.

Another RS232C-based LmAN is Ideashare from Ideassociates Inc., Billerica, Mass. Ideashare can link up to four IBM PCs, PC-ATs, PC/XTs, PCjs, compatibles or assorted combinations thereof into a star LAN in which one node acts as a server. Ideashare sells retail at $325.

LmANs aren’t for every application—putting one in a computer-aided design/computer-aided engineering network, for instance, would beg for disaster. But, they seem tailor-made for small to medium businesses. “The other day we installed one at a large insurance company,” says Server Technology president, Carrell Ewing, “and the fellow there said an interesting thing, ’It does 95 percent of everything the big boys do. And that 95 percent is 100 percent of everything I need.’”

UNIX plays the joker

Meanwhile, all the players in the PC LANs game remain acutely aware of a joker in the deck—UNIX. Nobody even pretends to know the long-term impact of AT&T Information Systems’ favorite operating system on the LAN market. If ATTIS is successful in making UNIX System V a desktop product—and the company’s recent releases of UNIX-based personal computers amply demonstrate its intention to do exactly that—then existing personal computer networks could be endangered.

Given the vast installed base of IBM PCs,

The UNIX-based, multiuser Tandy 6000 links to Tandy personal computers through ViaNet, from ViaNetix. Products like ViaNet and the Tandy 6000, which combine UNIX and MS-DOS into a single network, could be the shape of LANs to come.

Under the Banyan tree

System integrators have been hamstrung by the lack of standards in local area networks for years, but now they can also exploit that lack. When confronted with an office that contains a number of incompatible machines, LANs and peripherals, an office-system integrator could tie in all those dissimilar parts with intelligent gateways/servers just now coming to market.

Among the first of these is the Banyan Server from Banyan Systems Inc., Westboro, Mass. A 32-bit UNIX-based system with proprietary software, Banyan Server can link diverse microcomputers, minicomputers, mainframes and LANs into what is effectively a distributed multuser system.

In the process, says Banyan president David Mahoney, the Banyan Server “provides what we call ‘network services.’ Specifically, electronic mail, file- and record-locking, file- and disk-sharing, resource management and centralized system administration.”

Depending on the configuration, the Banyan costs between $9,000 and $40,000. So far, it’s been sold primarily into offices where 10 to 20 individuals are using IBM Corp. PCs as executive workstations. Mahoney notes though that the product is in no way limited to that particular machine. In fact, he says, the company is now looking into the possibility of including the Apple Computer Corp. Macintosh into the Banyan network.

“It’s a nice little box for people who have to deal with a mess of different LANs and operating systems,” says Kim Myrhe, director of communications industry research for International Data Corp., Framingham, Mass. “We expect it to be the first of a series of very intelligent server/gateways on the market.”
If mixed UNIX-DOS networks become commonplace, LmANs could have significant advantages over orthodox personal computer LANs.

that's probably not going to happen soon. But, even so, UNIX is bound to play an increasingly important role in the personal computer LAN industry—particularly if it becomes the operating system of choice for file- and network-serving machines.

One sign of things to come may be ViaNet from ViaNetix Inc., Boulder, Colo. A distributed, message-passing network operating system running on such media as Ethernet, ViaNet can link PC-DOS or MS-DOS systems with UNIX machines. By constantly translating MS-DOS system calls to UNIX system calls, ViaNet makes it easy to link IBM PC workstations in a network centered on a UNIX-based minicomputer or multiuser microcomputer. Radio Shack, for example, is remarketing ViaNet to link personal computers to its new XENIX-based multiuser microcomputer, the Tandy 6000.

Meanwhile, even LmANs are getting into the UNIX-to-MS-DOS networking business. TouchStone Software Corp., Seal Beach, Calif., for example, markets a collection of terminal-emulation, file-transfer and communications software under the general name “The Connectables Network.” The package allows a system developer to build up what is effectively a LmAN—but one which freely mixes IBM PCs, UNIX-based machines and even Apple Macintoshes.

Products like TouchStone’s can manage cross-vendor linking partly because they can make use of the standardized RS232C interface. Indeed, if mixed UNIX-DOS networks become commonplace, LmANs could have significant advantages over orthodox personal computer LANs.

But, no matter what the effect of UNIX, the trend in the personal computer market seems to be increased competition among vendors—something that can’t help but provide system integrators with a host of new options and lower prices. Notes IDC’s Myhre, “The feeling at IDC is that personal computer LANs will have to be sold with some value-added technology...because they are going to be so cheap that nobody’s going to be able to survive selling them by themselves.”

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<table>
<thead>
<tr>
<th>FEATURES</th>
<th>3161</th>
<th>3163</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lines x Characters</td>
<td>25 x 80</td>
<td>25 x 80</td>
</tr>
<tr>
<td>Double-sized chars</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Line drawing chars</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>Vertical scroll</td>
<td>Jump</td>
<td>Jump/Smooth</td>
</tr>
<tr>
<td>Definable function keys</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>Windowing</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Partitioning</td>
<td>Horiz</td>
<td>Vert/Horiz</td>
</tr>
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LOCAL AREA NETWORKS

PROTOCOLS COMPETE FOR LAN MARKET

UNIX and Ethernet technologies dominate the present local area network market, but ISO standards will govern future workstation communications

Jerry Borrell, Senior Western Editor

The race by workstation vendors for the sophisticated user market has obscured a less obvious competition in communications networks to support the workstations. As products proliferate among scientists, technicians, engineers and programmers, their need to share information has brought networking to the forefront. Standards and products now under development will shape the workstation industry over the next decade.

To date, three features have characterized the workstations: a move toward 32-bit microprocessor technology, use of some version of UNIX as an operating system, and communications via Ethernet. Now, a fourth characteristic arises: a demand that workstations from different manufacturers communicate with each other. This goes beyond mere communication from one workstation to another, to communication among workstations on different, or heterogeneous, networks.

UNIX has become the operating system of choice for sophisticated end-user workstations. The two main versions of UNIX contending for the role are Berkeley UNIX Version 4.2, which was originally developed at the University of California at Berkeley, and AT&T Information Systems' System V. Traditionally, UNIX 4.2 has been the version that's shown up on engineering workstations, partly because of its origins in the research community. Recently, however, System V has begun to take on 4.2-like characteristics and the two UNIXes may ultimately merge.

The Apollo Domain workstation runs concurrent local and remote processes in overlapping windows. A solid modeling application appears at bottom left, a DEC VAX stress-analysis of that model runs at bottom right, and an IBM materials requirements planning application runs in the middle. Electronic mail from other Domain workstations appears at top left and right; menu icons for Berkeley UNIX Version 4.2 and System V appear in the smallest boxes.

The Ethernet standard for physical and datalink protocol connections is a de facto market
Users demand that workstations have the mutual ability to transfer files and to invoke remote procedures across diverse machines.

Call for cross-networking

To meet the demand that workstations have the mutual ability to transfer files and to invoke remote procedures across diverse networks, vendors must select higher level communications protocols—particularly open systems interconnection (OSI) layers four and five. These two layers, the network- and transport-level protocols, describe the connection and exchange of data between devices across networks. They are critical because higher layers, such as the application level, are based upon them.

Such communications capabilities already exist on homogeneous or proprietary networks. Several companies' products offer robust functionality across all the OSI layers, including Apollo's Domain, DEC's DECnet, the Xerox Network Services (XNS), Datapoint Corp.'s ARCNET, and McDonnell Douglas Manufacturing Industry System Co.'s UG-net. However, all these networks fall short in heterogeneous environments. Their common approach to inter-network communications has been the provision of gateways, which often are criticized for inefficient protocol conversion. Also, they may be proprietary, tying buyers to one company's products. Michael Katz, product manager for Domain heterogeneous networking at Apollo, Chelmsford, Mass., defends the proprietary approach as offering higher performance and functionality.

Despite the advantages of a proprietary, homogeneous network, heterogeneity is often required in large-user environments. Bob Judd, group leader of the computer department at Lawrence Livermore Laboratories, Livermore, Calif., works with supercomputers, personal computers and technical workstations distributed among 1,800 offices. Judd points out that "no single supplier can support such an environment, requiring the user to select computing tools as needed."

Military spurs heterogeneity

Until recently only Datapoint and Xerox had published their proprietary protocols, and both are criticized as having done so too late to provide public standards suitable for heterogeneous networks. The one such set of protocols publicly available for almost a decade and having the widest implementation came out of the Department of Defense.

The ISO/OSI model is the center point of LAN competition. In hardware (levels one and two), rivalry is fiercest between Ethernet IEEE 802.3, the token bus IEEE 802.4 supported by proponents of the manufacturing automation protocol (MAP) and token ring IEEE 802.5 supported by IBM. In software (levels three through seven), supporters of DARPA's UNIX-related TCP/IP, Xerox's XNS and the various industrial protocols square off.
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The Defense Advanced Research Project Agency (DARPA) undertook the development of communications links between heterogeneous computers in the mid 1960s. The project, called ARPANET, had three goals—the provision of file transfer, access to remote terminals and electronic-mail service. By 1974, there were a large number of users on ARPANET at defense-related research facilities throughout the United States.

Military needs then dictated that the project be extended to provide ARPANET capability to mobile communications devices for use in the field. This project, the Packet Radio Network, provided the impetus for developing two protocols: the transport control protocol (TCP) and the internet protocol (IP). TCP ensured reliable delivery of data packets by sending end-to-end acknowledgements of shipment and receipt. IP provides the means for internetwork communications (e.g. ARPANET to nets of other types). TCP and IP were first demonstrated in 1975, marking the first heterogeneous network communications.

Barry Leiner, assistant director of information-processing technology at DARPA in Arlington, Va., comments that “TCP/IP was designed to work over many networks, not just 802.3. It's not the optimum protocol for specific products, but allows communications serving a wide group of networks.” Use of the protocols ensures that any two machines or networks can share data.

**NFS links disparate systems**

As the number of engineers, scientists and programmers using workstation networks increase, their ability to share common files becomes crucial. A severe drawback of UNIX-associated networks to date has been the need to copy original files in order to allow their use by different workstations. For example, Apollo Computer Inc.'s Domain lets several users access the original copy of a file, while preventing more than one user at a time from editing.

Sun Microsystems Inc., responding to this criticism, has made available its Network File System as a public document. The NFS describes an approach to vendor, media and protocol-independent communication of files in heterogeneous networks. It addresses International Standards Organization open systems interconnection protocols on the seventh—or applications level—and requires the support of the fifth and sixth layer protocols, called remote procedure call and external device reference. Sun has implemented the NFS and two additional protocol layers, 5 (RPC), and 6 (XDR), as have Gould/SEL, Fort Lauderdale, Fla., and Pyramid Technology Inc., Mountain View, Calif. However, the protocol could be implemented over Xerox Corp.'s XNS or even on a different Ethernet standard, such as a token ring (802.5), or a token bus (802.4).

The intent of NFS, says David Cardinal, manager of consulting services at Sun, “originate with the desires of those of us at Sun who have worked with several manufacturers' workstations—Xerox, Hewlett-Packard Co. and others. We know that people want to use different equipment on networks of differing capability.” As a result, Sun spent two years developing the protocols. The protocols were published to help promulgate the concept of open networks. The protocols also provide Sun's workstations with the “virtual paging” capability that has been one of Apollo's best selling points.

Michael Katz, product manager of Domain Heterogeneous Networking at Apollo looks less charitably upon the effort. “The NFS has become good PR for Sun, but critical examination shows that their use of TCP/IP has the same constraints as those they refer to as proprietary networks such as Domain.” Katz states that “the real competition for heterogeneity rests on who has the best performance on ISO standards implementation, and for off-the-shelf software.”
provided that they are using a version of the protocol that meets the published DOD specifications.

Part of TCP/IP's wide implementation originates with the DOD's use of the protocols as part of the mandatory specifications in military procurement. The involvement of research institutions where ARPANET was installed has also proved important. Many universities, such as Stanford University, Stanford, Calif., and the University of California at Berkeley, borrowed the TCP/IP protocols for use in developing UNIX-based systems. Thus, most of the UNIX-based workstations in the marketplace already use the TCP/IP protocols. Sudbash Bal, vice president of marketing at Excelan Inc., San Jose, Calif., says that efforts at his company to provide TCP/IP protocols in firmware on front-

**MAP charts automation's course**

The manufacturing automation protocol (MAP) encompasses a family of International Standards Organization communications protocols evolved from work done at General Motors Corp. to reduce problems in the development and installation of automation systems. According to Gary Workman, staff development engineer on the MAP Program at GM's Technical Center in Warren, Mich., "Our problems at the beginning of the 1980s in maintenance, development and support of equipment from different vendors had become enormous." Workman cites studies showing that up to 50 percent of the cost of installing systems could come from communications-related expenses.

GM tackled the issue by forming study groups, and by making joint technology-study agreements with Digital Equipment Corp., Hewlett-Packard Co. and IBM Corp. One of the first results was the decision by GM to promote and adhere to standards for communications products, rather than continue developing systems unique to GM. The National Bureau of Standards (NBS), Gaithersburg, Md., also studying communications protocols, began to chair a series of workshops between GM and interested vendors. The result was a public demonstration by GM and several vendors at the 1984 National Computer Conference exhibition of communications protocols for message service and file transfers across IEEE 802.4 standard communications links. IEEE 802.4 was chosen because it offered high performance, reliable data shipment and a straight-line topology suited to manufacturing. All the participants at NCC agreed to a two-year series of workshops, again to be chaired by the NBS.

Concurrent with the MAP demonstration, another group of vendors sponsored by Boeing Computer Services Co., Bellevue, Wash., participated in a demonstration of ISO standard protocols on an 802.3 Ethernet link. They included DEC, HP, Charles River Data Systems Inc., Eagle Computer Inc., Honeywell Inc., ICL Inc., Intel Corp. and NCR Corp. Their concerns were less with real-time, process-control communications than with the data processing in manufacturing and automation systems.

Laurie Bride, manager of advanced data-communications technology at Boeing, says that the Boeing-sponsored vendors will demonstrate an application-specific subset of the ISO protocols analogous to the MAP protocol, called "TOP," for technical office protocols. Bride says TOP has been proposed to address requirements specific to the technical office such as the virtual device interface, file-transfer techniques and protocols closer to office needs.

This interim demonstration of TOP is scheduled for November at the Society of Manufacturing Engineers Autofact show in Detroit. Although, "The demonstrations will show minimal level product functionality," says GM's Workman, there also will be "products conforming to the MAP specification and ISO/OSI [open systems interconnection] standards for layers one, two, three and four; the kernel functionality of layer 5 and the FTAM (File Transfer and Management) of layer seven." For these reasons, John Heafner, chief of the Systems and Network Architecture Division at NBS sees "the work of the 30 or 40 participating vendors as advancing the ISO standards." At the same time, MAP represents an industry-proposed standard—a fortunate and unusual coincidence for communications protocols.
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Bill Joy, co-founder and vice president of Sun Microsystems Inc., Mountain View, Calif., developed the Berkeley extensions of UNIX which incorporate TCP/IP. More recently, he helped develop protocols based upon TCP/IP that extend the functionality to layer seven, making a complete International Standards Organization OSI model implementation that Joy sees as “an intermediate step toward the eventual use of ISO standard protocols.”

**XNS renews its growth**

XNS protocols have common roots with TCP/IP in that both were developed as a result of DARPA-funded research at Stanford University. Yogen Dalal, vice president for systems development at Metaphor Computer Systems Inc., Mountain View, explains that both share the layer three “datagram” concepts on which higher level protocols are based. “TCP/IP was developed for public data networks, so it has a somewhat more cumbersome architecture. When we designed XNS, we knew that public networks would be involved, but the architecture was made for local area networks to which file servers and workstations would be attached.” He believes that XNS thus solved more problems across layers one through seven of the ISO protocols, but Xerox did not make public the transport and network levels until 1981.

Dennis Frahmman, manager of protocol development for the Xerox Office Systems division, Palo Alto, Calif., contends that the company now takes a more aggressive stance toward marketing the protocols. He points to the publication of layers five, six and seven during 1984 and a renewed effort to publish application layers. Xerox has recently released two more applications: the Raster Encoding Standard (bit graphics) and its Printer Integration Service (which describes how Xerox’s page formatting software, Intrepress, works on the company’s laser printers).

XNS finds growing support from other vendors. Greg Chesson, the senior scientist at Silicon Graphics Inc., Mountain View, co-chairs an XNS user group of 35 companies. Chesson states, “The XNS has all of the problems of the TCP/IP and then some….It nevertheless qualifies as the best high-level standard available.” His opinion reflects the demands that SGI’s IRIS workstations make in real-time multiple process applications such as flight simulation.

TCP/IP and XNS protocols are faced with developments in ISO standards. Judy Estrin, executive vice president of research and development at Bridge Communications Inc., Mountain View, whose company builds products for both XNS and TCP/IP protocols, predicts that “both protocols will continue, but the ISO standards will grow in importance during 1986.”

One large system integrator, McDonnell Douglas, Cypress, Calif., has recognized that “the ISO network standards will evolve as the leader,” explains Tom Hamilton, product manager for MicroVAX and Unigraphics Network. “But we had to make a choice. TCP/IP was well-supported on DEC computers and was relatively portable to the Data General [Corp.] minicomputers, but not available on both DEC and IBM [Corp.] machines. XNS was available on both DEC and IBM machines, and was relatively portable, so we chose XNS.” Hamilton points out that as the ISO standards evolve, they, too, will be implemented at McDonnell Douglas. It should be noted that the company primarily serves the mechanical computer-aided design marketplace with its workstation products, as distinct from the electrical CAD market where end users are more willing to accept UNIX and therefore TCP/IP operating environments.

**The transmission of true color images**, like this one generated on PERQ Systems Corp.’s Perq 4 graphics workstation, is one of the chief goals of LAN developers. Sending such images across networks is difficult because of the large amount of data they contain—typically 640K bytes or more.

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Today’s office-automation systems aim at completely integrating microcomputers, terminals, printers and other peripherals with the host mainframe computer to achieve true distributed processing. However, integrating diverse devices and packages into a working network can be difficult, and accessing mainframe data can be a complicated and time-consuming process. A key approach to the problems—the micro-to-mainframe link—has not turned out to be the satisfactory solution expected by many management information system (MIS)/data-processing (DP) managers.

In contrast, Rabbit Software Corp.’s 3270-Plus software overcomes the limitations of conventional 3270 emulators and permits easily customized and flexible micro-to-mainframe links. Its program interface module (PIM) eases microcomputer-to-host integration by permitting direct program-to-program communications among connected devices in a computer network.

Micro-to-mainframe links do seem to promise significant benefits in distributed-processing environments. With them, users should be able to access and manipulate host data from a local or remote microcomputer. File-access and file-transfer capabilities should allow the generation of customized reports from several host files. In short, this “automated” process should give business decision makers faster, more efficient access to information and provide system managers with a cost-effective data-processing system.

Links fall short

In reality, however, micro-to-mainframe links sometimes fall short of achieving these goals. For example, many systems cannot download data from the host computer directly into microcomputer-based application programs.

In addition, most micro-to-mainframe links employ host-to-device communications based on resource-sharing mainframe protocols and IBM Corp. Systems Network Architecture—logical-unit (LU) types designed for emulation of specific 3270-system devices. As a consequence, standard emulation-based micro-to-mainframe products using boards, coaxial cable or software do not permit the integration of local or remote application programs with the host system. They also cannot coordinate application-processing tasks across an office network.

Standard emulation products require powerful microcomputers to serve as dumb 3270-type terminals in order to access host data, reducing the computers to the performance of the display-only functions of less-expensive ASCII-type terminals. Although terminal emulation can “trick” the mainframe into thinking it is talking to a 3270 terminal, it cannot implement interactive and simultaneous data manipulation among con-
Modular, four-part architecture allows the package’s protocols to be distributed among gateway and information nodes. Thus the data-link and protocol-handler layers reside at the gateway to the mainframe—a microcomputer or other device. System integrators, however, can place the two upper-level, device-handler and terminal-emulation protocols anywhere throughout the LAN on any number of user nodes. Multidropping addresses to proprietary protocol
buffers allow the LAN-to-mainframe system also to support as many as 128 logical devices.

The micro-to-mainframe links thus permit system integrators to connect any number of devices to the mainframe in any network topology: one microcomputer, ASCII terminals in multi-user systems or using Network 3270-Plus, remote-computer systems. In contrast, coaxial links can connect, at most, four devices per cable.

The 3270-Plus link’s capabilities improve on standard 3270 functions. A read-ahead feature reduces response time when the user is accessing read-only screens from the host. It requests the next screen from the host while the user is viewing the current screen. A suspend/resume capability allows a user to suspend 3270 functions, freeing the screen and memory for local processing. It reduces the possibility of network outages by limiting the number of physical disconnects and reconnects.

A browse feature permits users to page back and forth through previous screens to review data without additional host transmissions. A screen-to-printer command produces a hard copy of any screen without retransmission from

**SOFTWARE IMPLEMENTS FLEXIBLE MICRO-TO-MAINFRAME LINKS**

**SINGLE-NODE CONNECTION**

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**TERMINAL CLUSTER**

IBM 3270 MAINFRAME —— MICROCOMPUTER —— 3270-PLUS —— ASCII TERMINAL

**RING LAN**

IBM 3270 MAINFRAME —— MICROCOMPUTER —— NETWORK 3270-PLUS —— MICROCOMPUTER

**RING LAN CONNECTED TO REMOTE SYSTEM**

IBM 3270 MAINFRAME —— MICROCOMPUTER —— NETWORK 3270-PLUS —— MICROCOMPUTER —— REMOTE LINK —— ASCII TERMINAL

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the host computer to the printer. With the screen-to-file capability, users can copy data for local applications. A multisession feature supports multiple host sessions on any terminal.

Local programs talking directly to host-computer programs unhampered by 3270 mainframe restrictions is the key to effective micro-to-mainframe communications. A forerunner of IBM's LU 6.2 protocol, the PIM feature of 3270-Plus generates this kind of dialogue on an application-to-application basis (see "LU 6.2 implements device-to-device communications," below).

It thus allows communications between any two application programs regardless of the language employed. A programmer, therefore, does not have to know the language used in the host application to write a microprocessor-based program that shares information with it.

An implementation of a protocol boundary allowing programs to access the 3270-based presentation services layer of SNA, PIM also provides terminal and printer emulation as well as 3274 terminal-controller emulation. It permits users to move host data to local files or peripheral devices, such as printers, using simple commands, without end users having to log in and log out of host sessions.

PIM allows application programs to call the 3270 emulator as a background subroutine, making it transparent to the user. Because the PIM interface is transparent to microcomputer users, MIS managers need only train them on application programs and not on the mainframe 3270 interface program.

**Adapts to user demands**

By incorporating modular, flexible-software architectures, 3270-Plus and Network 3270-Plus create data-communications channels that can easily be upgraded and adapted to specific user and computer-system requirements. System integrators can tailor 3270-Plus via four user-editable files referenced by the software's processes. They are:

- A configuration profile defining the 3270 device type, screen size, buffer size and other attributes as they appear to the host computer. System integrators can use it to define configurations for as many as 128 system addresses. They can also specify passwords for all or some of the

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<tr>
<th>IBM SNA LAYERS</th>
<th>LU 6.2 END-USER INTERFACE</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 PRESENTATION SERVICES</td>
<td>LU HANDLER</td>
</tr>
<tr>
<td>5 DATA-FLOW CONTROL</td>
<td></td>
</tr>
<tr>
<td>4 TRANSMISSION CONTROL</td>
<td>PROTOCOL</td>
</tr>
<tr>
<td>3 PATH CONTROL</td>
<td>HANDLER</td>
</tr>
<tr>
<td>2 DATA-LINK CONTROL</td>
<td>SDLC</td>
</tr>
<tr>
<td>1 PHYSICAL CONTROL</td>
<td></td>
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**Logical unit (LU) type 6.2** allows a microcomputer user to simultaneously request several conversations with different host applications under, for example, IBM's mainframe document interchange architecture (DIA). An implementation of the presentation services layer of SNA, LU 6.2 builds on earlier LU types that handle lower level SNA functions such as synchronous data link control (SDLC) and accommodation of network communications protocols.

area network configurations.

In addition, with the LU 6.2 protocol, microcomputer users can simultaneously request multiple conversations with different mainframe processes.
PIM allows application programs to call the 3270 emulator as a background subroutine, making it transparent to the user.

addresses to restrict data access.

- A terminal-option-set profile which defines parameters such as the data-I/O paths used to read from and write to the host computers, connections to local files and read-ahead specifications.
- A printer-option-set profile specifying I/O paths for the printers. A user can direct host output to a local file or a printer-spooler file, or directly to the printer. Multiple printer addresses are supported.
- A keyboard profile defining the value assigned to each key permits users or system integrators to customize keyboard configurations.

Microcomputer users, however, are not locked into the parameters set by the profiles. The package's on-line profile-change capability allows an operator, through menu screens, to temporarily alter these specifications during a 3270-Plus session. A user can thus turn on and off the screen read-ahead feature or designate a different printer-spooler file. Such changes last only for the life of the session; when the session ends, the parameters revert back to the ones originally specified by the profiles.

These capabilities, when combined with Network 3270-Plus' modular architecture, permit flexible micro-to-mainframe communications that are adaptable to different users and applications, easy to use in a variety of microcomputer-to-host configurations and readily integrated with new devices and technologies.

John Doherty is vice president of marketing at Rabbit Software Corp., Malvern, Pa. Previously, he worked at Sequoia Systems Inc., Nixdorf Computer Corp. and Mohawk Data Sciences Corp. Doherty has a bachelor of science degree in economics and a master of business administration degree in finance and marketing from the Wharton School and the University of North Florida.

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MINI-MICRO SYSTEMS/September 1985
OPTIONS MULTIPLY FOR PC, PC-AT INTEGRATORS

A growing bus-based infrastructure offers integrators new opportunities in multiuser systems and high-performance workstations

Rick Dalrymple, Senior Editor

A deluge of IBM Corp. PC-AT compatibles is extending the de facto standards first set by products surrounding the PC into application areas previously untouched by personal computers. The worldwide installed base of PCs and PC compatibles now exceeds 2 million units. This pervasiveness, combined with a growing infrastructure (hardware for PC and PC-AT buses and software designed to run under PC-DOS or MS-DOS), has already set standards for workstations in the office, on the engineering bench, inside the factory and even in the laboratory. Several ways in which system integrators exploit this development were cited in the March issue of Mini-Micro Systems (MMS, March, Page 147).

The performance advantages of the IBM PC-AT and compatibles over the PC have made practical the use of PC-ATs as foundation modules in workstation clusters. Similarly, new coprocessor boards for the PC-AT bus have made possible the operation of PC-DOS or MS-DOS in conjunction with UNIX System V. And graphics coprocessor boards for both the PC and PC-AT buses allow workstations based on these buses to compete with existing graphics workstations (MMS, August, Page 113).

Benefits abound for integrators

Although the performance enhancements listed above are reasons enough to consider the PC and PC-AT buses for workstation integration, additional benefits for system integrators make these buses even more attractive:

- OEMtek's OTI Model 2 features IBM PC-AT compatibility within a system module that is 50 percent smaller than the PC-AT. It consists of a 10¾-by-16-by-15½-inch enclosure with eight expansion slots and space for six 5½-inch half-height drives (floppy, hard or streaming tape).

- Flexibility of integration from software-only to hardware configurations that build from the bus up
- Ability to customize in a manner that still permits end users to exploit a huge library of off-the-shelf software
- The growing installed base of PC, PC/XT, PC-AT and compatible systems will motivate software developers, add-in board manufacturers and add-on peripheral manufacturers to continue to develop products that build on this family of computer systems.

The simplest methods of PC and PC-AT bus integration merely add software, boards or pe-
Workstation clusters preserve all the functions of a personal computer.

Workstation clusters preserve all the functions of a personal computer. These popular methods allow end users to configure systems themselves or expand systems originally configured by a system integrator. System integrators, of course, employ a wider variety of methods.

For example, you can build from the ground up by starting with a motherboard from companies such as Faraday Electronics, Sunnyvale, Calif.; Mostron Inc., Milpitas, Calif.; Seattle Telecom & Data Inc., Redmond, Wash.; and Wave Mate Inc., Hawthorne, Calif. The objective here is not to structure just another compatible clone, but rather to create a custom product that might neither look nor act like a personal computer, but which is nevertheless fully PC or PC-AT compatible.

Or the system integrator may turn to one of the new “PC OEMs” such as OEMtek, San Jose, Calif., and Personal Computers Products Inc., San Diego. These companies offer a variety of “mix-and-match” PC-compatible kits, which offer system integrators a wide selection of boards, monitors, keyboards and disk drives (MMS, August, Page 89).

Yet another approach begins with an expansion unit and adds boards, disk and tape drives, monitors and keyboards. Expansion units, when combined with multiuser and multitasking software, suit workstation clustering—an option that allows integrators to configure multiuser systems using the PC and/or the PC-AT bus. Vendors producing these products are: Advanced Digital Corp., Huntington Beach, Calif.; Alloy Computer Products Inc., Framingham, Mass.; Anex Technology Inc., Congers, N.Y.; PC Technologies Inc., Ann Arbor, Mich.; and Sritek Inc., Cleveland.

Clustering considered

Workstation clusters are neither single-user nor multiuser systems, but lie somewhere in between. They preserve all the functions of a personal computer and add capabilities usually available through a local area network or a multiuser system. Unlike PC LANs, workstation

Variations on the motherboard theme

Looking for a way to get PC-AT performance without buying an IBM Corp. PC-AT or compatible? Consider upgrading by replacing the motherboard in a PC or PC/XT. In fact, you may wish to go even further by choosing a processor that doubles PC-AT performance.

Seattle Telecom & Data Inc., Redmond, Wash., is currently offering both single-user and multiuser versions of its PC-286, an Intel Corp. 80286-based add-in board aimed at PC and PC/XT systems. Both versions are available with 6-, 8- or 10-MHz 80286s. With 6 MHz, CPU speed is 30 percent faster than an IBM PC-AT; an 8- or 10-MHz 80286 increases CPU speed by 50 percent and 100 percent respectively. The single-user, 6-MHz version with 640K bytes of RAM sells for $1,995; with 2.5M bytes, the price is $3,575.

The installation of the PC-286 does not require removal of the entire motherboard. Instead, the only item that must be removed is the Intel 8088 microprocessor. Using a 40-10 cable, the 8088 socket is connected to the PC-286 board, which resides in one of the PC or PC/XT expansion slots. Because the PC-286 contains its own high-speed RAM, the RAM chips on the motherboard are disabled and the user may choose to unplug these chips for use on some other board.

The multiuser version of the PC-286 does not include multiuser, multitasking software. Seattle Telecom recommends Multi-Link from Software Link Inc., Atlanta. Multi-Link, an enhancement to PC-DOS, provides a multiuser, multitasking environment by using the same time-slice algorithm technique found in Multi-DOS from Anex Technology Inc., Congers, N.Y. Unlike Multi-DOS, Multi-Link has been written for RS232-based ASCII terminals and may also be used in an RS232-based, server/satellite local area network implemented with Software Link’s LAN Link architecture.
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<td>Oct. 10</td>
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<td>Oct. 17</td>
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clusters are created by attaching remote users—equipped with either a dumb ASCII terminal or a red-green-blue monitor and keyboard—to an expansion unit that, in turn, is attached to a host IBM PC, PC/XT, PC-AT or compatible.

Each workstation-cluster vendor has its own method of creating a multiuser, multitasking environment. Anex, for example, provides a software package for a PC-AT host—called Multi-DOS—that allows up to eight users to share the Intel Corp. 80286-based computer's processing power, storage and application software. By using a time-slice algorithm that connects and disconnects each user 50 times per second, Anex's Multi-DOS makes the system's original DOS think it is seeing only one keyboard, one video adapter and one bank of memory at a time. Anex has also rewritten the screen-handling routines and disk I/O so DOS, running under Multi-DOS, executes two times faster than without it. The combined time-slice algorithm and enhanced routines provide a response time so fast that it appears each user has an 80286-based computer.

Multi-DOS also allows a user to access files created by other system users via a simple request by file name. Because only one user is connected to the 80286 at a time, there is no contention for the disk drive. By using an optional software package, users may also automatically lock files or records and assign passwords.

Instead of sharing the processor of the host personal computer, other workstation-cluster vendors add more processors. For instance, Alloy’s PC-Plus dedicates an 8-MHz Intel 8088-based slave processor board to each user. (Advanced Digital offers these same slave boards under a license from Alloy.) To share files and data, as well as system resources such as disk drives, tape drives, printers and modems, Alloy's PC-RTNX software converts the host system's processor into a cluster master.

In a PC-Plus system, the host processor functions as the master I/O controller, allowing slave-board users to transparently access system resources.

Some system integrators avoid selling hardware altogether.

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Workstation clusters—configuration choices aplenty

Workstation-cluster vendors provide only a small portion of the hardware required to configure personal computer-based multiuser systems. This restriction gives system integrators an opportunity to increase their profit margins by adding some or all of the necessary hardware items. Although the specific hardware required will vary among the workstation-cluster vendors, the Multi-AT from Anex Technology Inc., Congers, N.Y., serves as a useful example.

The only hardware items that a system integrator must purchase from Anex are an expansion unit and cables. The cables connect the expansion unit to the host personal computer and remote users to the expansion unit. All other hardware items may be provided by system integrators or end users.

Remote users on a Multi-AT system connect to the expansion unit using Anex's shielded twisted-pair RS422 cables (up to a maximum length of 500 feet). Each remote user must have an red-green-blue monitor, a keyboard and a video card placed in the expansion unit. The selection of each of these items is left to the system integrator along with the choice of the host (either an IBM PC-AT or compatible) plus any host add-in boards (RAM, Modem, PC Network interface) and add-on peripherals (disk and tape drives).
resources while running PC-DOS or MS-DOS programs on their individual processors. Besides supporting selective file and record locking, Alley's PC-RTNX software provides password facilities and allows disk volumes to be "hidden"—known only to a select group of users.

Still another method of creating a multiuser, multitasking environment on a host PC is to add a processor board set to the host plus a multiuser operating system. In these board sets, PC-DOS and MS-DOS programs run as "guests" under the host operating system. A major advantage of these products is that they offer software migration paths. For example, a user currently employing Ryan-McFarland Corp.'s RM COBOL programs and Commerical Operating System (RM-COS) on a minicomputer can now port those programs to a workstation-cluster system.

Examples include two products from Sritek, one based on the Motorola Inc. 68000 available with either RM-COS or UNIX System V, and another based on National Semiconductor Corp.'s 32016 and its GENIX 4.1 BSD operating system. In addition, PC Technologies offers an Intel 80186/80286-based board set using an operating system derived from Digital Research Inc.'s Concurrent DOS 3.1.

Is there a price advantage to clusters compared with a PC LAN? Absolutely. An eight-user workstation cluster can be configured for about half the cost of eight personal computers connected to a PC LAN. Because a variety of ways exist to configure workstation clusters—often mixing and matching items from a collection of vendors—workstation clustering is a task best handled by system integrators (see "Workstation clusters—configuration choices aplenty," Page 121).

Some integrators offer software only

Even with the hardware integration options available, some system integrators avoid selling hardware altogether. Because the system hardware components are available from a variety of vendors, software-only system integrators sell only a software package and documentation. This situation leaves the task of finding the best hardware deal to the user (who may already own all or most of the necessary items).

Several vendors of microcomputer-based computer-aided design systems have chosen this approach. Their software packages are neither solid nor surface, but rather so-called 2½-D drafting packages. In these packages, all the geometry is 2-D with the facilities to automatically generate isometric views from a 2-D figure. For example, Datagraphic Systems Inc., Plymouth, Mich., claims that its CAD Master 2.0 package can generate 1,000-line drawings in less than 4 minutes on the IBM PC-AT.

A nifty marketing tool used by many software vendors involves a self-demonstration kit. For example, ask for CADKEY, a package from Micro Control Systems Inc., Vernon, Conn. You will receive a kit containing two disks and complete demonstration instructions.

The instructions itemize the hardware required and guide the user through a routine that adapts the CADKEY program to the user's system configuration. CADKEY supports the IBM PC, PC/XT, PC-AT and a variety of compatibles as well as a variety of monitors, graphics adapter cards and digitizers.) After system configuration, the user can view several self-running demonstrations. Then, the user can perform a hands-on session that presents the building blocks of the program. Next, the user can create custom drawings. Of course, the demonstration software does not allow drawing storage. To obtain that capability, users must purchase the package.

The software package/demo kit approach offers system integrators three key advantages. First, it avoids the problems of carrying a hardware inventory. Second, users feel they get the best hardware deal because they selected the hardware from a variety of products. And third, the demo kit allows the user to see the configuration in action before purchasing the software.

A notable disadvantage of the software-only approach is that system integrators must forgo the opportunity to profit on hardware sales.

Unlimited combinations beckon

A popular technique for combining hardware and software consists of bundling software along with an add-in card and a peripheral. Concept Technologies Inc., Portland, Ore., chose this technique. The company's Concept System, a professional publishing workstation, integrates Concept 100 software with an IBM PC, PC/XT or compatible computer, a Concept Graphcard 100 and the Concept Laser Printer, based on the Canon U.S.A. Inc. LBP-CX print engine. The Graphcard 100 is an 80186-based graphics coprocessor board that includes two proprietary gate-array chips and the ANSI graphical kernel system standard and virtual device interface standard as implemented by Graphic Software Systems Inc., Wilsonville, Ore.

The resultant publishing system combines text and graphics on screen exactly as they appear in finished form. However, this publishing system is not precluded from performing other tasks. Because the host system is an IBM PC, PC/XT or compatible, it can run PC-DOS- and MS-
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*Source: Datamation Magazine, June 1, 1985.
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RELATIONAL DATABASE SYSTEMS, INC.
DOS-based third-party software as well as take advantage of other add-in boards.

Another technique centers on forming an informal consortium of third-party vendors to configure workstations. Complete Technologies Corp. (CTC), Flint, Mich., pulled together a collection of vendors to provide products for CTC's System 5000/GWS, an IBM PC-AT-based graphics workstation that competes with IBM's own 3270 PC/G and PC/GX.

Aimed at automotive, industrial and laboratory engineers, the System 5000/GWS can download mainframe graphics files from IBM's Graphical Data Display Manager (GDDM), process the files locally in the workstation and upload the enhanced GDDM file back to the host mainframe. (GDDM is an "access method" programming technique created by IBM to store and receive graphics files on IBM host computers, the 3270 PC/G and PC/GX, and 3279-compatible graphics terminals.)

The key to System 5000/GWS is Enterconnect and Entergraphics software developed by Entertronics Research Inc., St. Louis. IBM contributed to the development of these products by providing sample GDDM files. IBM's 3270 PC/G and PC/GX use Enterconnect to load GDDM files into Entergraphics, which can then enhance the basic GDDM file by graphing data input from Lotus Development Corp.'s 1-2-3, Microsoft Corp.'s Multiplan or Paladine Software Corp.'s VisiCalc.

To develop the System 5000/GWS, Entertronics Research, in cooperation with Vetrix Corp., Greensboro, N.C., modified its software so it would work with Vetrix's VX/PC graphics board. CTC then integrated the Vetrix VX/PC graphics board and the Forte-PJ 3270 emulation board, from Forte Data Systems, San Jose, into the IBM PC-AT along with Entertronics Research's Enterconnect and Entergraphics software.

The product concept for the System 5000/GWS came from Complete Technologies. The company expects to sell initial quantities of the System 5000/GWS to automotive manufacturing companies.

Board vendors cooperate

Unlike the early days of the personal computer business, add-in board manufacturers clearly recognize the opportunities presented in the value-added reseller channel. In addition to their marketing efforts in the retail and mail-order channels, many personal computer board manufacturers have created organizations to serve system integrators and computer manufacturers.

For example, AST Research Inc., Irvine, Calif., manufacturer of a wide variety of personal computer add-in boards, has recently added an OEM Systems Group. The new organization is currently working with both computer manufacturers and system integrators to offer AST's engineering and manufacturing services in addition to AST products.

For large OEMs, AST's Systems Group will design and manufacture products on an exclusive basis. For other volume customers, the group will modify existing products, allowing system integrators to offer unique add-in board products. A good example of the latter category is the addition of software created by system integrators and placed on the board in the form of firmware ROMs.

The PC and PC-AT bus infrastructure clearly offers a multitude of choices. And, as it continues to grow, so do the chances that there is a combination that is just right for you.

Interest Quotient (Circle One)
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TOP 32-BIT BUSES CLAIM MULTIPROCESSING EDGE

Backers of Multibus II and VMEbus concede little merit in each other’s systems in asserting multiprocessing superiority based on operating modes and arbitration methods.

Jesse Victor, Associate Editor

The “bus war” is heating up. In their quest for market share, vendors of Multibus II and VMEbus products are becoming more strident in broadcasting claims of superiority. They tend to find multiple virtues, and no faults, in their respective buses’ ability to handle the rigorous demands of multiprocessing systems. In reality, however, both buses have operational pluses and minuses associated with synchronous or asynchronous operation and different methods of arbitration.

Multibus II’s primary bus, the parallel system bus (PSB), is synchronous and multiplexed. VMEbus’ system bus, also called the VMEbus, is asynchronous and non-multiplexed. Multiplexing enables Multibus II to pack all the PSB’s address and data lines into one 96-pin DIN connector; the VMEbus requires two connectors to implement 32-bit data transfers. Multiplexing also cuts in half the number of high-current drivers needed for the interface, reducing a Multibus II board’s power requirements.

Multibus II vendors point out that the term “synchronous operation” can be easily misinterpreted. It does not mean that the bus clock controls all the devices on the bus or that they

This is the second of two articles comparing Multibus II with VMEbus. The first article appeared in the August issue of Mini-Micro Systems and focused on interrupt handling, message passing and 32-bit single-board-computer-based products.

A distributed-interrupt system apportions interrupt-handling tasks among processors for multiprocessor VMEbus systems. VMEbus’ seven prioritized interrupt request lines are distributed among interrupt handlers on each processor board. Message passing among processors using the global memory prevents “lock-ups”—simultaneous attempts to access the same resource, such as a disk controller.
must run at the same clock rate. Processor and other boards on the bus must, however, synchronize with the system clock to transfer data.

**The case for synchronous**

Multibus II advocates claim numerous benefits from the bus' synchronous operation, including higher reliability and noise immunity, enhanced data integrity and device testability and easier bus interface design.

"The synchronous protocol defines the sampling time when signals are sensed on the bus to an 8-nsec window," explains Joel Barthmaier, Multibus II marketing product manager at Intel Corp., Hillsboro, Ore. "You are thus sampling the bus and making yourself vulnerable to noise bursts from external events, such as induction motors turning on, only approximately 8 percent of the time. You have higher reliability with a synchronous protocol." In contrast, asynchronous buses, claims Intel's technical marketing manager John Beaston, are vulnerable to noise at almost any point in a data transfer because each rising or falling edge on every control line has some significance.

Synchronous operation and parity checking are major factors in increasing Multibus II's reliability, asserts Jeff Roloff, president of Multi-

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**BUS ARCHITECTURE SPEEDS INTERPROCESSOR COMMUNICATION**

VMEbus and Multibus II architectures handle the demands of multiple processors and peripheral boards by assigning interprocessor communications to the primary system buses (VMEbus, iPSB) and off-loading memory and I/O transfers to auxiliary data paths.
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bus II board vendor, Central Data Corp., Champaign, Ill. “We have a lot of large OEM customers. They are very concerned about reliability and serviceability and what features the next bus generation will add in those areas.”

Roloff argues that synchronous operation increases reliability by eliminating unstable or metastable states. “When you have two signals that come in asymetrically, randomly with respect to each other,” he explains, “you have to synchronize them to determine which came in first, a typical arbitration problem.” Thus, when several boards arbitrate to control the bus, Roloff notes, there is always going to be some question of “whether or not an unstable state will be settled out, depending on the time you take for arbitration.”

If you take a sufficiently long time, Roloff adds, the probability of such a state will be low. But there is a trade-off between making the arbitration time shorter and reducing the probability to zero. Beaston echoes this assessment: “In asynchronous buses, metastable problems can pop up virtually anywhere in the bus interface depending on transfer and edge rates.”

A synchronous bus is also more reliable, Roloff claims, because it allows all modules on the bus to be designed for a specific frequency of operation, the bus clock rate. “No glitches appear on the bus because everything is changing with respect to the same clock.”

Testing seen easier

Synchronous operation, Multibus II backers point out, also makes it easier to test board-level systems using standard logic analyzers, and it permits all of a vendor’s new boards—or upgrades to existing products—to be designed around a bus’ selected clock frequency.

Synchronous bus interfaces are easier to design, says Beaston, because synchronous clocking makes it easier to take advantage of “top-down,” structured design methods using computer-aided design and to implement VLSI components such as Intel’s bus arbiter/controller and message interrupt controller.

That a synchronous bus interface is easier to design is one assessment, at least, echoed by a VMEbus vendor, Motorola Inc. Its publication, “A Microcomputer System Bus Technical Comparison,” notes: “There is a drawback to an asynchronous system. More thought must be given to the design of an asynchronous interface than a synchronous one. The asynchronous interface is event-driven and requires experience in designing ‘cause-effect’ type logic to properly design boards.”

VMEbus advocates are quick to emphasize the advantages of asynchronous operation and some of the drawbacks of a synchronous system. Both Multibus II and VMEbus claim to be processor independent, enabling single-board computers from different manufacturers running at different clock rates to operate on the bus. Asynchronous buses, VMEbus backers point out, allow each processor in a multiprocessor system to transfer data at its fastest possible rate. However, Multibus II and other synchronous buses require, for example, a 16-MHz Motorola 68020 to synchronize with Multibus II’s maximum PSB clock rate of 10 MHz to transfer data, degrading data-transfer performance.

“It’s like trying to take two spinning gear wheels and push them together,” comments John Black Jr., manager of the systems and technology group at Motorola Microsystems Inc., Tempe, Ariz. “There is a delay involved in the synchronization process.”

A synchronous bus could also impose a delay in a data transfer between a device controlling the bus, the current bus master, and a responding slave device, Black argues. “On synchronous buses, responses can occur only concurrently with the clock edge, which means that if you miss the clock edge on the slave, you have inserted a wait state of 100 nsec because you have to wait for the next one.”

An asynchronous bus adapts itself better to new technology, Black asserts, because as in the

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**Figure:**

**VMEbus Uses Two Connectors for 32-Bit Transfers**

The P1 connector on a VMEbus’ single-height card furnishes non-multiplexed 16-bit data and 24-bit address paths, VMSbus signals and control and utility lines. A double-height card adds the P2 connector for 32-bit addressing and data.
VMEmbus advocates are quick to emphasize the advantages of asynchronous operation.

In the preceding example, the response time depends only on the responder rather than on a fixed protocol imposed by the bus. Black sees this factor as a major point in favor of the VMEmbus: As the speed of future bus products increases, transfer rates will also increase. In contrast, future Multibus II products, VMEmbus vendors assert, will always be constrained by that bus’ 10-MHz maximum clock rate.

Multibus II uses what it calls a “distributed” arbitration scheme in which the “bus masters,” boards attempting to gain access to the bus, arbitrate among themselves for access. Each board is assigned a prioritized arbitration ID number by the Multibus II central services module (CSM). During the resolution phase of the arbitration cycle, the board with the lowest number (highest priority) normally gets control of the bus first. When the first bus master begins its last data transfer, the remaining masters will rearbitrate for bus control on the basis of priority. In high-priority mode, a board can force itself into the next resolution phase and, therefore, gain control of the bus before other requesting boards, regardless of their priority.

VMEmbus’ arbitration method is “centralized,” to the extent that one global arbiter board, in slot one of the card cage, handles bus-access requests over dedicated, daisy-chained bus-request and bus-grant lines to the other boards’ requester circuitry. Boards sharing the same bus-request line are given priority by their slot position.

Intel claims Multibus II’s arbitration scheme better suits the needs of multiprocessor systems. These systems can handle as many as 20 potential bus masters without the restrictions of dedicated lines because Multibus II’s “no-starvation policy” of arbitrating bus requests means that each board has an equal opportunity of gaining access. VMEmbus’ “slot dependency,” Intel charges, can allow an active board near the top of the daisy chain to lock out bus access from a board lower down. In addition, Intel says, Multibus II’s distributed architecture is more tolerant to system faults or failures.

VMEmbus defends its arbitration scheme

VMEmbus vendors dispute these claims, calling some of them a matter of semantics. Schlomo Pri-Tal, staff engineer in Motorola Micromax systems and technology group, denies that a board far down in the VMEmbus daisy chain might never get serviced. “The only way a board

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**Separate buses reduce throughput bottlenecks**

VMEmbus and Multibus II use multiple buses serving dedicated functions to ensure the high throughput afforded by 32-bit-wide data paths. An upgrade of the 16-bit Multibus I, Multibus II includes five buses in its specification; VMEmbus four. But there are functional similarities between them. Both have a parallel system bus (IPSB, VMEmbus) for interboard communications and data movement, a local high-speed bus extension to memory (iLBX, VMXbus) and a lower cost serial alternative to the parallel system bus (iSSB, VMMSbus).

Multibus II carries over two buses unchanged from Multibus I: the ISBX I/O expansion bus, permitting the addition of multimodules to processor and other system boards, and the Multichannel I/O bus for direct-memory-access block transfers to intelligent I/O devices.

VMEmbus’ I/O Channel, which serves local I/O expansion up to 12 feet, is similar to Multibus II’s ISBX. Although not part of the Multibus II specification, Bitbus is designed for local industrial I/O to 30m using a synchronous data link control-like protocol and twisted-pair wiring.

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<table>
<thead>
<tr>
<th>Function</th>
<th>Maximum data rate (bytes per sec.)</th>
<th>Type</th>
<th>Data width (bits)</th>
</tr>
</thead>
<tbody>
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<td><strong>Multibus II</strong></td>
<td></td>
<td></td>
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</tr>
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<td>IPSB</td>
<td>parallel system bus</td>
<td>40M</td>
<td>synchronous,</td>
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<td></td>
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<td></td>
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<td>iLBX II</td>
<td>local high-speed memory extension</td>
<td>48M</td>
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<tr>
<td></td>
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<td>nonmultiplexed</td>
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<tr>
<td>iSBX</td>
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<td>Multichannel I/O</td>
<td>remote DMA</td>
<td>8M</td>
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<td>iSSB</td>
<td>lower cost serial system bus</td>
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<td>CSMA/CD protocol</td>
</tr>
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<td>Bitbus</td>
<td>local industrial I/O</td>
<td>2.4M</td>
<td>protocol similar to SDLC</td>
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<td></td>
<td></td>
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<td>VMSbus</td>
<td>lower cost serial system bus</td>
<td>3M</td>
<td>token-passing</td>
</tr>
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can be prevented from getting on the bus," Pri-Tal insists, "is if, say, board number two generates more interrupt requests than can be handled by the system. But that is not a problem caused by the daisy chain but is a more general bus problem."

Pri-Tal also rejects Intel's assertion that distributed architecture is more tolerant to faults or failures. "Any board on Multibus II that holds one of the arbitration lines low is going to stop the arbitration system completely," he argues. "VMEbus, in fact, is more tolerant to that type of failure. The system can continue to use the remaining lines."

Pri-Tal claims greater flexibility for VMEbus' more centralized approach and detects problems in Multibus II's method. "Both buses allow arbitration to be performed in parallel with data transfers over the bus," he stresses. But for the Multibus II system to start arbitration, the CSM has to initialize all the boards on the bus. It's therefore not as decentralized as its advocates claim, Pri-Tal contends.

The "decentralization" issue, Pri-Tal maintains, centers on where you put the control logic that does the arbitration. Multibus II puts part of the logic on each of the boards in the system. But, he says, "VMEbus can claim the same. We have requester circuitry on each board that determines when the current bus master gives up the bus."

The main problem with Multibus arbitration, Motorola's Black insists, centers on block data transfer. Multibus II has no way to determine how many potential bus masters are arbitrating for the bus or how long each master will hold the bus, he says.

"There is no limit to the block-transfer cycle," Black argues. "Once a master gets on the bus, you are not going to be able to service any interrupts until the block transfer is completed. That can be a real problem for real-time applications."

VMEbus' strength, Black says, is in the flexibility of its arbitration scheme, which allows four priority levels and three modes: "prioritized," round robin and single level. Prioritized arbitration assigns the bus to the board driving the highest priority bus-request line. In round robin, the arbiter assigns access on a rotating-priority basis, from highest to lowest. Single-level arbitration serves one level of priority, relying on the daisy-chained bus-grant lines to determine the order in which boards get access to the bus.

In weighing the claims of bus advocates, system integrators will rely heavily on prior experience with VMEbus or Multibus I in choosing boards for a particular industrial, scientific or business application.

"The people who will innovate with Multibus II or VMEbus's 68020 are the same people who have innovated with Multibus I and 68000 boards," concludes Joe Ramunni, manager of marketing at VMEbus and Multibus II board vendor, Heurikon Corp., Madison, Wis. "Multibus II will focus on very heavy processing requirements and target high-end applications, such as signal and image processing. VMEbus is well-accepted in industrial markets and will continue to have strength in these applications."

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**Multibus II uses a 'distributed' arbitration scheme in which the 'bus masters' arbitrate among themselves for access to the bus.**

**LOOKING AHEAD IN MMS**
- The October issue will cover mass storage memories and add-in/add-on boards.
- The Fall issue of the Peripherals Digest will arrive in mid November.
Major improvements have taken place in the networking industry over the last several months. At last there is a network standard. Best of all, the standard works well and satisfies virtually everyone.

The heart of the emerging standard is DOS 3.1, the latest version of Microsoft's popular microcomputer operating system.

DOS 3.1 has been enhanced with multiuser primitives that control access between the application and the network. Every LAN that supports DOS 3.1 must use this standardized interface. And, any multiuser software package written for DOS 3.1 will run on any LAN that supports DOS 3.1.

From the LAN vendor side, the strength of the new standard can be seen from the fact that nearly every major LAN company has indicated an intent to eventually upgrade to DOS 3.1 compatibility.

Similarly, applications developers are enthusiastically endorsing the standard. Prior to this time, LANs have each used a different application-to-network interface. Applications developers had to create and maintain a separate version of their software for every LAN they wished to support.

Under the new standard, developers can reach a very large market with a single version of their software. We at Novell, and virtually all other network observers, look for this standardization to be a strong inducement to developers to get more active in the area of multiuser packages.

Besides the application-to-network interface that's been standardized, the LAN operating environment has been standardized as well. DOS 3.1 compatibility requires a file server environment.

In the file server system, disk I/O is managed by the file server software running on a single machine. Workstations send requests to the file server, but only the file server actually talks to the disk and manages directories and file allocation tables. This centralized data management system maintains data integrity equal to that of mainframe systems.

Network Design

While DOS 3.1 has defined the LAN standard, its role in networking is often misunderstood. DOS 3.1 supports some networking functions, but it is not a network operating system. Several other functions are needed in a full network operating system.

In a file server environment, the main components of the network operating system are the file server program and the redirector. The redirector intercepts application requests and routes them to the local operating system or to the network file server.

The file server program manages network resources, including disk I/O and network security. The file server design is especially important in network performance.

One design option is to run the file server as an application of DOS. Requests are sent to the file server, then processed through DOS and sent to the disk.

"While DOS 3.1 has defined the LAN standard, its role in networking is often misunderstood."

DOS has some drawbacks when it comes to managing a network. The jobs that it normally does at a workstation tend to be wasted overhead in a network server. Also, DOS is not optimized for speed. It's especially slow when it comes to handling file directories. This overhead becomes critical in a multiuser environment.

The other way to set up the operating system is to move DOS out of the picture. Requests which come into the file server are processed and sent directly to the hard disk. Obviously, some of the functionality of DOS must now be built into the file server. The benefit is that now those functions are performed by a special purpose system designed for networking.

Microsoft Networks

Three network operating systems currently support the DOS 3.1 standard: Microsoft Networks, IBM PC Network Program and Novell NetWare.

Microsoft Networks (MS-NET) is Microsoft's full network operating system. Microsoft is now offering MS-NET to vendors who want a DOS 3.1 compatible environment.

DOS 3.1 is part of MS-NET. The other components are the redirector, which routes network requests, and the file server program, which manages disk I/O.

Functionally, MS-NET supports the access and synchronization tools supplied by DOS 3.1, the Extended Open and the Physical Lock. The machine running the MS-NET file server software must be a dedicated machine and cannot be used as a workstation while it's in operation as a server.

Error recovery on MS-NET is difficult. Under certain circumstances, a workstation can exit an application with record locks still in place on the data. On MS-NET, to clear these orphan locks the workstation must be restarted and the lock released by the workstation. The only alternative is for the server to be rebooted, a process that will stop all activity on the network.

Performance on MS-NET is limited because of its dependence upon DOS 3.1 at the server. The MS-NET file server is run as an application of DOS, creating the excessive overhead discussed earlier.
For security, MS-NET requires that every object on the network be assigned a name and a password. Any time access is attempted, the person must log into the particular object. Part of the security scheme is that someone cannot get a directory listing of resources on the network, but must request each object by name.

In summary, MS-NET is not a retail product, but is the product that Microsoft is offering to OEMs. Products that are actually marketed to end-users will undoubtedly include many improvements over the basic MS-NET operating system.

IBM's PC Network Program is based on MS-NET and its current state is probably a good example of the types of improvements that OEMs must consider making.

IBM PC Network Program

Superficially, the PC Network Program looks very much like MS-NET. But IBM has added to the functionality and improved the user interface.

The IBM Redirector has been modified so that there are different user interfaces for different classes of user. Three types of interface are supported: a menu-driven interface for casual users, a DOS-like command line interface for experienced users, and a low-level interface for developers.

The security mechanisms in PC Network Program are similar to MS-NET. Names and passwords are assigned to network resources. Under the PC Network Program, names and users are not people. They are machines or devices. Each node on the network is assigned a unique identifier known by its permanent name.

The synchronization and sharing functions in PC Network Program are limited to the Extended Open and the Physical Lock. IBM has permitted the machine running the file server software to be used in concurrent mode, so that it can function as both a workstation and as a server.

On PC Network Program, an orphan lock can be cleared from the server without having to find the down station and bring it back up or restart the network.

As with MS-NET, the file server software in PC Network Program runs as an application of DOS, restricting the network performance.

Novell NetWare

Novell NetWare is compatible with the DOS 3.1 standard, but is designed to deliver high performance and functionality.

One of the keys to NetWare performance is that DOS is not part of the file server. Instead, NetWare uses a proprietary multitasking operating system that is enhanced for network file serving. DOS is run as an application of the file server, so that the server machine can be used concurrently as a workstation.

In addition to the basic DOS functions, NetWare also provides a set of extended functions.

NetWare supports a shared Physical Lock that can be used to increase the availability of data. The shared lock is a Read-Only record lock that permits others to use the record, but prohibits any user from modifying the record.

Applications written prior to DOS 3.1 typically use a mechanism called a semaphore for record locking. NetWare continues to support semaphores, also referred to as logical locks.

Another function included in NetWare is the timeout. If a record is already locked when a lock request is received, a timeout allows the request to be placed into a queue at the server. When the record finally becomes available, the server checks the queue and grants the lock to the next requester. This system places minimum overhead on the server and guarantees that the request is answered as soon as possible.

Security provisions in NetWare can be regulated through both user profiles and file attributes. People log in to the network with their own unique name and password, at which time they can access individual directories and subdirectories to which they've been granted rights. Files can be protected with flags, such as Read-Only, that limit their use.

NetWare offers virtually unlimited expandability. A network can have multiple servers, and single workstations can be attached to as many as eight servers simultaneously. NetWare runs on all common LAN hardware systems, and these can all be internetworked using NetWare Bridges.

Summary

The importance of the new LAN software standard cannot be overestimated. It directly addresses the two major impediments to the growth of networking: the need for applications and the need for good data integrity.

Of the three operating systems which currently support the standard, Microsoft Networks is an OEM product that requires considerable upgrading to attain the functionality needed in today's LANs.

The IBM PC Network Program provides adequate functionality for many environments. However, its reliance on the Extended Open and the Physical Lock restricts its potential in multiuser applications. Both MS-NET and PC Network Program are deficient in performance.

Novell NetWare is designed for high performance and functionality. For end-users, NetWare offers a way to upgrade their current LAN to the new DOS 3.1 standard without changing their current LAN hardware. At the same time, end-users will see their performance and functionality improve by several magnitudes. With NetWare installed, end-users can create almost limitless internetwork topologies.

For OEMs, NetWare has the capability of upgrading LAN products to the point where they are highly competitive with the IBM PC Network.

For more information, order the 1985 LAN Software Report by writing or calling:

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LAN SOFTWARE LINKS
DIVERSE MACHINES, OS’s

System integrators can build inexpensive LANs with PC/NOS, a communications software package that acts as a network operating system

John Row, Applied Intelligence Inc.

Increasingly, office systems integrators must deal not with single minicomputers but with networks of many personal computers. A typical workplace now contains any number of employees performing vastly different tasks with the aid of vastly different computers—all running on vastly different operating systems. It’s both convenient and mandatory that those computers be linked so data and resources can be shared.

Until recently, linking computers into a common network has been expensive and complex. A company usually had to either buy a prenetworked computer system with one central server and many terminals—and waste the personal computer resources already in place—or hire expensive software experts to create a reliable link between differing operating systems.

As a result, system integrators have begun to experiment with alternate methods of linking computers. Most promising of these is to install a communications software package that functions in a network the way a local operating system functions in a standalone computer. This network operating system can then provide a standardized connection language and message-passing protocol among the individual operating systems of the networked machines. This method requires little programmer intervention, and the user is thus free to create and implement application programs and to access network resources.

One such network operating system available to OEMs is PC/NOS from Applied Intelligence Inc., Mountain View, Calif.

PC/NOS converts the host operating system of any node computer into a message-based system and the network into a multiprocessor system. It runs in every node of the network. Thus, a PC/NOS-driven network doesn’t need a central server.

Basically, PC/NOS converts the host operating system of each machine in a network into a message-based system and the network as a whole, into a multiprocessor system. Because it runs in every node, PC/NOS-driven networks
Network operating systems

Netview, PC/NOS' window-based user interface, allows users to "browse" through the network to connect and disconnect their plug resources to local or remote socket resources.

don't need a central server or a single system administrator. Indeed, to PC/NOS, a central server looks much like just another node.

PC/NOS features make it attractive for office automation. A "superuser," for instance, is built into the network to provide overall control and administration. In fact, with a system of access and update privileges, PC/NOS can keep track of who is authorized to use the network and which resources any individual user can access and/or update. Network administrators and users can change these privileges as needed.

PC/NOS also includes a window-based user interface called Netview. With it, users can "browse" through the network to connect and disconnect their plug resources to local or remote socket resources.

Written in C, PC/NOS ports across operating systems, networks and computer systems. Storage requirements on a typical IBM Corp.-compatible configuration would be approximately 112K bytes, including MS-DOS.

Network distributes caching

Because PC/NOS is not tied to a particular operating system or hardware design, it overcomes the incompatibility of network entities. But like all network operating systems, PC/NOS faces the problem of how to distribute and manage data shared by all network users, and how to do so quickly and efficiently. Its approach to the problem is a distributed caching scheme based on the concept of equivalence.

Equivalence, in this instance, means the ability of the distributed caching scheme to simultaneously store identical copies of data in more than one network address space. Many conventional computer concepts relate to equivalence.

For example, virtual memory, caching, blocking, deblocking and I/O read and write all involve keeping copies of the same data in more than one address space.

In PC/NOS, an address space can be virtual, such as a host operating system file, or physical, such as a RAM buffer or a disk. To establish and maintain equivalence between address spaces, each space must be linked so data can flow freely among them. They can exist in the same physical address space or at different network locations.

Because in this sort of network a file server is simply another node, any user node or workstation can function as a server. This means that the resources available at each network node are accessible to every other node with no restrictions other than the access privileges determined by the system administrator for each user.

Because the initial version of PC/NOS targets CP/M and MS-DOS machines, the minimum sector size for transfers between address spaces—or "granularity,"—is configured as 128 bytes for front-end modules. The normal block size for network transfers depends on the host hardware, but is typically 1K or 2K bytes. However, the programmer has complete flexibility in determining both the block size for transfers and the granularity appropriate to any host operating system.

Granularity has a direct impact on performance because it controls how much data moves across the network in front-end modules and how much data is read off the disk in back-end modules. Too much or too little data slows performance time on the network.

The overseer for communication between address spaces is the address space manager (ASM), a software code that functions as an interface between the user and PC/NOS. Every address space in the network has its own ASM, which coordinates with other ASMs to establish and maintain equivalences. Whereas the ASM itself is transparent to the user, the programmer can access it via the packet manager interface, which is roughly analogous to the basic kernel or operating-system call defined by most operating systems.

The programmer sends transactions to defined plugs and sockets, connected to such network resources as disk volumes and printers. When the network system is initially configured, each network resource is assigned an address at a node socket in association with the packet manager.

The ASM facilitates updates and controls establishing, maintaining and relinquishing equivalence. To accomplish these functions, the ASM maintains, at each node, equivalence tables for
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its address space. These tables keep track of where various data reside in the network. If a disk read of a file is requested, for instance, the ASM may discover via its equivalence tables that a copy of the data exists in a local RAM buffer or address space. The ASM can then access the data in a fraction of the time required for it to be read from disk.

In the PC/NOS' nomenclature, a cache is simply an equivalence between two address spaces; one virtual and the other physical, usually a RAM buffer. A cache control block (CCB) contained within the address space describes and manages the equivalence between addresses.

In PC/NOS, the terms "update" and "establish equivalence" are used, rather than simply "read" and "write," because the operating system is a distributed asynchronous system, whereas reads and writes are generally conceived of as sequential operations. A conventional read involves passing a read request to a controller or buffer manager and then waiting for the read to complete. PC/NOS splits this sequence of operations into separate asynchronous messages. The read request becomes a message saying, "establish equivalence between the source and destination address spaces."

The operating system expands the possibilities of linked virtual and physical address spaces so that data can travel from any point in the distributed system to any other point. It also stores equivalences over a period of time with different kinds of messages. In most standard sequentially oriented designs, once a read operation has begun, the system (and the user) must wait for the read to complete before another operation can begin. In contrast, the asynchronous message-passing orientation of PC/NOS allows an ASM to stream data from processor to processor in a distributed environment by generating many packets in parallel.

**ASM overcomes 'read before write'**

The ASMs also address the "read before write" constraint. In most systems, if the user wishes to change 1 byte on a 512 byte disk sector, the entire 512 bytes must be read first, then the new byte written, and finally the entire 512 bytes written again. This approach severely degrades local area network performance.

PC/NOS deals with the problem by defining a minimum granularity between linked address spaces via the CCB. This solution means that even if the normal block size on the net is 1,024 bytes, the minimum update size can be as low as 1 byte.

The ASM keeps a "partial equivalence" table to record which bytes within a block have been updated. Thus, only the updated portions are sent to the next ASM in a chain. If an application or operating-system interface stays within the defined granularity, it can avoid read before write difficulties on the network.

Updates larger than the defined granularity can still be processed without a read before write constraint. In this case, the update is passed on the next ASM in the chain and performs a local maintain equivalence operation.

Data is transferred and manipulated by the ASM and the other network operating system entities in packets. These packets are either sent directly to a destination (which can be multiple nodes that receive information from the instructions), or routed through one or more socket subaddresses.

All packets have a common transmission header that indicates the destination node and socket, user number and packet type. Four packet types are relevant to address spaces and equivalences: update, establish equivalence, maintain equivalence and relinquish equivalence.

An update request, which causes the data in the packet to overwrite data in a designated address space is responsible for changes in stored data. Host operating system interface routines translate write requests into PC/NOS update packets. The update packet contains the network address of the destination address space, the address to write the data, an update parameter that is a function of the destination ASM and the data itself.

Depending on the system, the ASM does one of several things. In the simplest case, the ASM stores an update packet in its own RAM. In a situation where the virtual and physical address spaces are linked in a network, the ASM propagates the Update packet "down the chain" to designated destination ASMs. The ASM may also check its equivalence tables to see if other copies exist, in which case it links to other caches.
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and propagates Maintain Equivalence packets "up the chain" to where equivalences exist. Rather than wasting time transferring the entire data memory around the net, the ASM remains on the lookout for copies that merely need to be updated.

When a program or piece of data is to be transferred from physical memory to some other location in the network, equivalence must be established between the original location—for example a hard disk—and the destination—perhaps remote RAM. In this case, the remote ASM sends an establish equivalence packet, which is really a request for an Update packet, to the destination address. This packet contains the source and destination address to be made equivalent, a byte count of the equivalence and the starting address of the data to be made equivalent.

If the destination is a virtual address space, the address is translated and transferred on to the next ASM in the chain until the destination is a physical ASM.

Basic to the concept of equivalence is the ability of an ASM to maintain identical copies of data at more than one address over a period of time. When a change or Update is sent to a piece of data that is held in common by several network entities, the ASM must ensure that the changes are sent to every copy or equivalence of that data in the network. The source ASM sends a maintain equivalence packet that contains the destination address to be maintained and a parameter that is a function of the destination ASMs.

When a copy of data is no longer needed at a given address—i.e., the user wishes to remove a file—the destination ASM receives a relinquish equivalence packet that flushes the cache and unlinks it from the chain of equivalences.

Networks address security

Certain safeguards are essential in a distributed system: protection of sensitive data and programs, control of simultaneous access to multiplexed or shared sockets (such as those linked to shared disk volumes) and control of user access to unshared network resources.

PC/NOS provides access security for all networked resources. Access to resources is based on a resources access privilege and the user's assigned privileges. A password is used for user log-on to validate the user ID, but this password does not affect the user's privileges. This approach allows the user to control his own password without impairing user access to resources. Users may also be assigned to groups.

Controlling simultaneous updates in shared data—a more complex situation than updates in unshared data—is handled through PC/NOS modules that communicate with the Address Space Managers. The back-end modules filter file/access requests via individual host operating systems to provide file and record locking. PC/NOS provides file and record locking. Implicit and explicit file and record locking are provided.

Locking schemes such as these, combined with a distributed processing cache approach, improve the overall processing of both the disk and the network, making the entire system more flexible and efficient. In short, PC/NOS provides an environment for the development of multi-user applications on a solid base of single-user host operating systems. In an age when networking is increasingly the path to system integrators' profits, such network operating systems are bound to play an increasingly important role.
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UNIX system handles 30 users

- UNIX System V
- 68020 microprocessor
- 1M-byte RAM

Employing the 68020 microprocessor and the UNIX System V operating system, the model 3068 multiuser, 32-bit supermicrocomputer system accommodates up to 30 users. Operating as a standalone system or in a distributed network, the system connects to other systems via the proprietary WorkNet LAN and to mainframe computers via 3270 Bisynch, SNA, X.25 and 3780 communications options. System configuration consists of 1M byte of RAM, a 20M-byte hard disk drive and a 1.2M-byte floppy disk drive supporting up to 10 users. RAM is expandable to 16M bytes in 1M-, 2M- or 4M-byte increments. Hard disks are upgradeable to 240M bytes in 20M-, 60M- or 80M-byte increments. Eight board slots and horizontal communications software, including the proprietary AOE office-automation package, come with the system. $7,000. Altos Computer Systems, 2641 Orchard Parkway, San Jose, Calif. 95234, (408) 946-6700. Circle 301

Systems target AI development

- 13-, 19-inch screens
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- ANSI X3.64 emulation

Using a Motorola 68020 microprocessor and a 68881 floating-point coprocessor, models 4405 and 4406 Artificial Intelligence Systems serve as AI development tools and delivery systems for complex applications. The 4406 displays 1,280 by 1,024 pixels on a 19-inch, 60-Hz screen and offers 2M bytes of RAM (expandable to 4M bytes), a 32M-byte virtual memory address space, a 90M-byte hard disk drive and a 5¼-inch floppy drive. Model 4405 comes with a 13-inch, 60-Hz screen with a 640-by-480-pixel, viewable display that acts as a window to the 1,024-by-1,024-pixel, addressable bit map. RAM capacity is 1M byte, expandable to 4M bytes. Virtual memory address space is 8M bytes. The 4405 includes a 45M-byte, hard disk drive and a 5¼-inch floppy drive. Standard software is Xerox's Smalltalk-80 programming environment, a UNIX-like operating system and a C compiler. Both models provide an RS232 and a Centronics interface, keyboard, mouse and ANSI X3.64 terminal emulation. $23,950, 4406; $14,950, 4405. Tektronix Inc., P.O. Box 500, Beaverton, Ore. 97077. (503) 664-0161. Circle 302
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- Up to 7.5M-byte RAM
- 12-, 17-, 19-inch monitors

The 300 Series of technical workstations offer a choice of CPUs, displays, systems software, programming language and peripherals. The systems are aimed at the instrument-control and engineering- or technical-design environments. A 10-MHz, 68010 CPU is available for an entry-level system, while a 16.6-MHz, 68020 suits high-speed processor performance. RAM capacity is 1M byte, expandable to 7.5M bytes. Two 12-inch, low-resolution monitors, for use in entry-level applications, generate 512-by-400-pixel, bit-mapped graphics. The 19-inch, color and 17-inch, black-and-white monitors offer 1,024-by-768-pixel resolution. Programming languages

---

**The first 8" disk the extended**

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The Fujitsu M1053A Intelligent Disk Controller (IDC) can keep pace with the most sophisticated multi-host, multi-tasking SCSI-based system you can design.

With it, you can at last have a high-performance, 8" disk drive subsystem that takes full advantage of the extended performance features of SCSI, including the disconnect/reselect and arbitration commands.

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You can use the Fujitsu IDC to put up to four of our high-performance 8" disk drives—1.3 gigabytes of storage—on a single SCSI connection. In a multi-drive configuration, that represents significant savings in controller cost. And you can build in expansion capacity without using up valuable connections to your SCSI bus.

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[Image: Norman B. Petersen, President, Storage and Peripheral Products, Fujitsu America, Inc.]
and operating systems include BASIC version 4.0, Pascal 3.1 and HP-UZ, the proprietary version of the UNIX operating system. $5,500, entry-level configuration; $55,000, high-end configuration. Hewlett-Packard Co., 1820 Embarcadero Road, Palo Alto, Calif. 94303, (415) 857-1501. Circle 304

Micro supports 20 users

- XENIX OS
- 8086 CPU
- 2M-byte RAM

A supermicrocomputer accommodating up to 20 users, the model 2086 uses the 8-MHz 8086 microprocessor and runs the XENIX operating system. Communications protocols supported include 3270 Bisynch, 2780 Bisynch and 3270 SNA/SDLC. The 2M bytes of RAM are expandable to 16M bytes. The basic configuration also includes an 80M-byte hard disk drive; a 1.2M-byte, floppy disk drive; a 60M-byte, streaming tape unit, an Altos III terminal and eight board slots. $19,990. Altos Computer Systems, 2641 Orchard Parkway, San Jose, Calif. 95134, (408) 946-6700. Circle 305

Systems suit CAD applications

- 1M-byte floppy disk
- Four RS232 ports
- 4M- to 8M-byte memory

Based on a reduced instruction set computer architecture, models 32/110, 32/130, 32/310 and 32/330 computers are aimed at computationally intensive applications such as mechanical and electrical CAD, animation and imaging and scientific research. Both the 100 series and the 300 series support the UNIX operating system, color or monochrome displays and Ethernet protocols. The 32/110 uses the proprietary standard CPU and comes with 4M bytes of memory, four RS232 ports, a 78M-byte disk drive and a 1M-byte floppy disk. The 32/130 uses a high-performance CPU with floating-point capability and offers 4M bytes of memory, four expansion slots, a 150M-byte disk drive and a 1M-byte floppy disk. The 32/310, based on the standard CPU, includes a 150M-byte hard disk, a 1M-byte floppy disk, 4M bytes of main memory and nine expansion slots. The high-end 32/330 employs the high-performance CPU, stores 8M bytes of memory, and offers eight expansion slots, a 150M-byte hard disk drive and a 1M-byte floppy disk drive. $39,000, 32/110; $47,000, 32/130; $56,000, 32/310; $69,000, 32/330. Ridge Computers, 2451 Mission College Blvd., Santa Clara, Calif. 95054, (408) 986-8500. Circle 306

The performance of the Fujitsu disk drive itself is equally important. Just take a look at the specs we've included here.

We've achieved performance levels that set the industry standard. And because we've done it using proven technologies, you can be sure Fujitsu drives will keep performing.

For more information about Fujitsu's IDC and 8" drives, call (408) 946-8777. Or write Fujitsu America, Inc., Storage Products Division, 3055 Orchard Drive, San Jose, CA 95134-2017.

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CIRCLE NO. 85 ON INQUIRY CARD
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CIRCLE NO. 104 ON INQUIRY CARD
Subsystem backs up DEC systems

- 70M bytes
- DMA controller
- 55 ips

The CI-TQK25 tape-cartridge subsystem for DEC LSI-11 or MicroVAX systems backs up 70M bytes of data in 20 minutes. Employing a quad-height, 22-bit, DMA controller, the unit emulates the DEC TQK25 subsystem and uses the MS handler software on DEC operating systems. This emulation permits software-transparent operation under RSTS-E, RSX11M, RSX11M+, RT11, Ultrix and MicroVMS operating systems. Drive rotational speed is 55 ips. Features include formatting capability and self diagnostics. $3,545. Christlin Industries Inc., 31352 Via Colinas, #101, Westlake Village, Calif. 91362, (818) 991-2254. Circle 307

Series offers multiple system emulation

- 332M, 265M, 199M bytes
- 8-inch drive
- SMD-compatible

For multiuser, multiaccess applications, the DX-332 series of 8-inch Winchester disk drives stores 332M, 265M and 199M bytes. Compatible with SMD, MMD, RM03, DF980 and BD80 systems, the drives emulate four 82.9M-byte drives, two 165.9M-byte drives or one 315.2M-byte drive. A single-port version provides ANSI and SMD interfaces; the dual-port version comes with an SMD interface. All three models record 1,083 tpi at 12,022 bpi on 1,649 tracks per surface. Average access time is 22 msec; data-transfer rate, 9.67 MHz. The 332M, 265M and 199M-byte versions use six, five or four disks, respectively, with 10, eight or six heads. The drives’ positioner includes an automatic head retraction to a dedicated landing zone. MTBF is 20,000 hours. $4,300, 199M-byte version; $4,650, 265M-byte version; $5,000, 332M-byte version. Pertec Peripherals Corp., 9610 DeSoto Ave., P.O. Box 2198, Chatsworth, Calif. 91311, (818) 717-3474. Circle 306

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a single, ledger-sized image (11 by 17 inches) or dual-buffered, letter-sized images. The LZR 2650 supports single letter- and legal-sized images. Both models come with two input cassettes and a manual feed tray. The upper cassette holds 500 sheets; the lower, 250. $11,080, LZR 2650; $12,320, LZR 2655. Data-products Corp., 6200 Canoga Ave., Woodland Hills, Calif. 91365, (213) 887-8451. Circle 310

Printer targets data processing

- 700 cps
- 4K buffer
- 100 by 69 dpi

A 700-cps, serial dot-matrix printer for microcomputers and minicomputers, the model OT-700 offers correspondence-quality printing at 350 cps and dot-addressable graphics capability. Graphics resolution is 50 by 69 dpi for high-speed output or 100 by 69 dpi for high-resolution copies. It serves high-volume output needs of data-processing environments and has no duty-cycle limitations. At 10 cpi, the unit prints 136 cpi; at 16.6 cpi, 226 condensed characters; at 8.3 cpi, 116 enhanced characters; and at 5 cpi, 68 enlarged characters. Centronics and RS232C interfaces are standard. Features include a 4K buffer, 96-character ASCII set, 136-column carriage width with adjustable sprocket feed tractors and LED indicator lights. $2,000. Output Technology Corp., E. 9922 Montgomery, Spokane, Wash. 99206, (509) 926-3855. Circle 311

Dot-matrix printer supports IBM PC programs

- 140 cps, draft
- 27 cps, NLQ
- Parallel interface

The A-40 impact dot-matrix printer supporting IBM PC application programs comes with the IBM Graphics Printer character set and provides escape codes compatible with the IBM Graphics Printer. Printing 140 cps in draft mode and 27 cps in near-letter-quality (NLQ) mode, the unit accommodates 10-inch-wide cutsheet, fanfold or multipart paper. It operates bidirectionally in text mode and unidirectionally in image mode. The printhead lasts for 100 million characters. Print fonts include standard, enlarged, condensed, condensed enlarged, NLQ pica and NLQ pica enlarged. Features include a 1.4K-byte buffer and an 8-bit parallel interface. $349. Canon U.S.A. Inc., Printer Division, 1 Canon Plaza, Lake Success, N.Y. 11042, (516) 488-6700. Circle 312

Ethernet TCP/IP for VAX/VMS Off the Shelf!

Complete package for $8,795

Excelan offers a complete high-performance communications package including hardware, software, transceiver and all cables. Everything you need to perform high speed file transfers or do remote logins via Ethernet from a VAX running VMS or UNIX System V to UNIX 4.2 BSD machines and vice versa. Software includes TCP/IP protocols, and standard FTP (file transfer) and Telnet (virtual terminal) applications.

The entire VAX/VMS package is only $8,795, including the EXOS 204 Ethernet controller (quad-size Unibus board), EXOS 8040 TCP/IP software, EXOS 1100 transceiver and cables. And the entire UNIX System V package is only $7,295.

Excelan also offers similar packages for DEC PDPs, UNIX supermicros, and the IBM PC, XT and AT.

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800-LEAR-DPD (800-532-7373).
Alphanumeric terminal supports four hosts

- ANSI-standard
- 80 to 160 columns
- 30 to 60 lines

Working with up to four hosts simultaneously, the VXL ANSI-standard alphanumeric terminal is DEC software-compatible and emulates the Tektronix 4010 and 4014 terminals. It provides 20K bytes of local display memory, which can be divided into eight pages of up to 255 columns and 512 lines. Pages can be dynamically connected or disconnected to any host, and the keyboard can be switched from host to host. The 15-inch monitor displays one window per page. Windows may be displayed fully or can be partially overlapped. Each window is a viewport to its underlying page. The unit shows up to two 8½-by-11-inch sheets, each with 80 to 160 columns and 36 to 60 lines. The keyboard is programmable up to eight shift levels. $2,795.

Ann Arbor Terminals Inc., 6175 Jackson Road, Ann Arbor, Mich. 48103, (313) 663-8000. Circle 313

Monitor displays 16 to 64 colors

- 13-inch
- Dual-scan
- 16, 64 colors

For use with the IBM Enhanced Graphic Adapter and its compatibles, the CM-1380, 13-inch, color monitor accepts RGB or TTL input. At a 15.75-kHz scan frequency, the unit offers 16 colors; at 21.85 kHz, 64 colors. Resolution is 640 dots horizontal, 200 or 350 lines vertical. The display is switch-selectable from a color screen to an all-green screen for word-processing applications. A switching-mode power supply offers wide-range power input and low power dissipation. $849. Tatung Co. of America, 2850 El Presidio St., Long Beach, Calif. 90810, (213) 637-2105. Circle XXX

Graphics terminals provide alphanumerics

- Tektronix 4014 emulation
- 1,024 by 800 pixels
- Vector mode

Achieving a vector drawing rate of 1 million pixels per second, the series 1500 graphics display terminals provide Tektronix 4010 and 4014 emulation and alphanumerics compatibility. Model 1575 is DEC VT102 compatible; model 1550, ADM, TVI, ADDS and Hazeltine compatible. Display resolution is 1,024 by 800 pixels with a 1,024-by-1,024 physical memory area. Transmission rate is 38.4K baud. Tektronix 4010/4014 features include GIN mode, vector mode, point plot, incremental point plot, multiple character sizes and line styles. The 14-inch, green or amber screen produces 24 rows by 80 or 132 columns with four-speed, smooth scrolling. Capabilities include pan and zoom functions, block-mode transmission, 32 programmable function keys, soft setup mode and a printer port. $2,395, model 1575; $2,295, model 1550. Cleveland Codonics Inc., 18001 Englewood Drive, Cleveland, Ohio 44130, (216) 243-1198. Circle 314

Terminal works with DEC VT220

- Multipage feature
- 14-inch screen
- Green, amber

DEC VT220-compatible, the Vision 11-3220 terminal suits program-development or multiprocessor applications.
There's a fortune in reading cards.

Alloy's PC-CARD automatically reads credit card data. Alloy's PC-CARD is a hand operated magnetic stripe card reader that reads standard magnetically encoded credit card and security badge data into your IBM or compatible PC without using the keyboard. Use PC-CARD for: Security access control. Password validation. Credit card sales and transactions. Data logging.

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Alloy Computer Products, Inc., 100 Pennsylvania Ave., Framingham, MA 01701, (617) 875-6100, TX: 710-346-0394; Europe: Alloy Computer Products (Europe) Ltd., Cirencester, Gloucestershire, England, Tel: 0285-68709, TX: 43340

CIRCLE NO. 91 ON INQUIRY CARD

NEW PRODUCTS TERMINALS

Monitors plug into IBM PC-AT

- 20-MHz bandwidth
- 720 dots by 350 lines
- 12-inch screen

The green phosphor JB-1280DA and amber phosphor JB-1285DA are both plug-compatible with IBM PCs and PC-compatibles. The 12-inch monitors connect to the IBM PC-AT and compatibles equipped with a monochrome display adapter card. Active display area is 210 mm wide by 150 mm high. Video bandwidth is 20 MHz for a resolution of 720 horizontal dots by 350 vertical lines. The 14-pound units produce 80 columns by 25 lines and accommodate TTL positive video signals. Front panels indicate power, contrast and brightness. $199, both models. NEC Home Electronics Inc., Personal Computer Division, Suite 10, 700 Nicholas Blvd., Elk Grove Village, Ill. 60007, (312) 228-5900.

Circle 316
GTX-100. Computer security so advanced, it could even foil Mata Hari.

Computer thieves are becoming smarter and bolder all the time. They're continually prowling the telephone lines to tamper with data stored in computers. They can steal information. Or erase it. Or alter it to their advantage.

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CIRCLE NO. 94 ON INQUIRY CARD
LAN links 32 IBM PCs

- 1M bps
- 256K-byte RAM requirement
- File locking

A baseband network utilizing twisted-pair, telephone-type wiring, the Quadnet II LAN links up to 32 IBM PCs and compatibles. The network supports the carrier sense multiple access with collision avoidance communications protocol, transferring data at 1M bps. It permits the sharing of data files, output devices and software programs. Features include password security, file- and record-locking, print spooling, disk caching and help facilities. Required are an IBM PC or compatible with a hard disk, an 8088 CPU, 256K bytes of RAM for a dedicated machine or 385K bytes for a non-dedicated machine, and an operating system supporting DOS 1.1 and DOS 2.0. $1,095, Master Kit (network interface card, user manual, operating software and key card); $95, User Kit (interface card); $95, Starter Kit (cabling to connect three workstations). Quadram Corp., 4355 International Blvd., Norcross, Ga. 30093, (404) 923-6666. Circle 317

Switching system operates at 40M bps

- Supports 4,000 devices
- Locates faults
- 9,600 bps

Operating at T1 speeds over all facilities and at 40M bps over a fiber-optics switch bus, the INX4400 Intelligent Network Exchange and INX4200 Network Control Matrix Switch provide data switching, networking, network control and LAN capabilities. The INX4400 disk-based electronic switch supports 4,000 devices connected to remote INX4400 slaves in a ring network with 2-km segments. Data-transfer rate is 35M bps on a time/diversity switch bus. The INX4200 locates faults, isolates problems, restores service and manages information. Finding use in synchronous, on-line, real-time environments, the switch handles 1,000 cross connections at 9,600 bps. A fiber-optic interface links 64 remote locations. $5,500. Circle 318

Board combines modem, protocol converter

- 9,600 bps
- PU2 emulation
- Dial-up operation

The ZIPmodem is a combined 9,600-baud, dial-up, synchronous modem and an SNA/SDLC protocol converter on an IBM plug-in board. Requiring one floppy disk, it comes with software and a communications program for on-line, mainframe computing. The protocol converter, in SNA/SDLC 3270 interactive or batch mode, emulates a PU2 with one LU2 terminal and one LU2 or LU3 printer. The modem transfers data at 9,600, 7,200 or 4,800 bps, CCITT V.29 specification, and 4,800 or 2,400 bps, CCITT V.27 specification. Features include error monitoring with automatic fallback to lower speeds, a speaker that monitors the telephone line during initial connection and a permissive or programmed telephone interface option. $2,995, personal computer and standalone version; $1,995, mainframe version. DecaTek Inc., P.O. Box 569, Stone Mountain, Ga. 30086-0569, (404) 493-7273. Circle 321

Unit executes electronic mail

- 64K-byte memory
- Three passwords
- Remote access

The Signalman Computer Mailbox, a modem-message-center unit, receives and stores incoming messages without requiring the computer to be on line, and provides remote access and message pickup with multilevel password protection. Storing 64K bytes of memory, the unit features a message-waiting visual indicator and three passwords allowing message storage, access to stored messages and the option to change the first two passwords and clear the buffer. $299. Anchor Automation Inc., 6913 Valjean Ave., Van Nuys, Calif. 91406, (818) 997-7758. Circle 318

Multiplexer runs at 64K bps

- Selective repeat
- Time division
- 48-user support

The DTM48 is a wideband statistical multiplexer combined with an internal, time-division multiplexer. Supporting up to 48 user ports for point-to-point applications requiring data link speeds of 64K bps, the statistical multiplexer transmits synchronous and asynchronous data. Buffer memories handle traffic loads that exceed data-link capacity. An automatic request for repetition feature aids links that have significant delay. A selective repeat feature retransmits only faulty data frames. The internal, time-division multiplexer transparently handles synchronous protocols. TDM bandwidth can be dynamically allocated or permanently assigned on a per-port basis. Network security features include isolation techniques and signal alarms. Diagnostic capabilities include hardware and firmware tests, local and remote port and data-link loopbacks and test messages. $6,600. Timeplex Inc., 400 Chestnut Ridge Road, Woodcliff Lake, N.J. 07675, (201) 391-1111. Circle 320
System converts PC to protocol analyzer

- 9,600 baud
- 1,024-character buffer
- ASCII character set

The Datametric System, consisting of software and hardware, permits personal computers to display and record data characters traveling over RS232 communications lines to resolve protocol incompatibilities or to control line problems, measure bit-error rates and monitor line conditions. The system includes a hardware adapter, which in itself is an RS232 breakout box. Half- or full-duplex data can be received using any 5-, 6-, 7- or 8-bit character set. Maximum data rate is 9,600 baud, full duplex. Buffer memory capacity is 1,024 characters (ASCII and user-definable). Error conditions detected include parity, overrun, training and break. The software, using a five-menu format, provides help screens. The system requires one communications port, a monochrome or color adapter and 200K bytes of memory. $495, Datametric system; $350, software system without hardware adapter. Burr-Brown Corp., International Airport Industrial Park, P.O. Box 11400, Tucson, Ariz. 85734, (602) 746-1111. Circle 322

Board connects PC to host via Ethernet

- Dual-ported
- 128K-byte memory
- IBM-compatible

Working with the proprietary transmission control protocol/internet protocol (TCP/IP) software, the EXOS 205 front-end processor board connects IBM PCs, PC/XTs or PC-ATs and compatibles with UNIX-based systems, DEC PDPs, DEC VAXes and others via Ethernet. The board offloads the communications functions from the IBM PC's CPU to its 8-MHz, 80186-based IEEE 802.3 Ethernet controller. Storing 128K bytes, the dual-ported board requires a 16K-byte window of PC address space for communications processing. The EXOS 8050 and 8011 TCP/IP software consists of the protocol module, which executes the processor board, and file-transfer and Telnet (virtual terminal) applications. $995, EXOS 205; $350, 8050 and 8011 software. Exelan Inc., 2180 Fortune Drive, San Jose, Calif. 95131, (408) 945-9526. Circle 323
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**Spreadsheet combines graphics, database**

- Runs on Macintosh
- Automatic macros
- Integrated charting

The Excel spreadsheet combines automatic macros, user-defined functions, array handling and two-way file compatibility while incorporating business graphics and an on-sheet database. Operating on the 512K-byte Macintosh microcomputer, the package’s graphic interface generates 16,384 rows by 256 columns. It builds interactive, visible links between worksheets, connecting their contents. Macros automate commonly performed tasks; a macro language writes automated applications, automated templates and user-defined functions. Charts and spreadsheets can be viewed simultaneously and are interactively linked with an integrated charting function, one of 42 built-in chart functions in the spreadsheet. An array-handling capability performs linear programming and problem solving. Addressing needs of number processors to data extraction for analysis, the integrated database queries, extracts and sorts data. Offering two-way file compatibility with Lotus 1-2-3 on the IBM PC, the package is also compatible with Microsoft Chart and Multiplan for the Macintosh. $395. *Microsoft Corp.*, 10700 Northup Way, Box 97200, Bellevue, Wash., 98009. (206) 828-7400.

**System builds menu in 7 minutes**

- Application Express
- FileGateway
- 256K-byte requirement

The R:base 5000 database-management system for microcomputers builds a customer tracking menu in 7 minutes. Its Application Express menu-driven feature prompts into a visual-mode mode which provides a graphic presentation of a database table. Applications are generated with automated screen, menu builders, data entry forms and reports and pre-written commands. Program development tools include a procedural language, custom macros, report writer and compiler. A FileGateway feature transfers data from Lotus 1-2-3, dBASE II or ASCII files into R:base format without programming or re-keying. The software operates on an IBM PC, PC/XT, PC-AT or compatibles requiring 256K bytes of memory. $700. *Microrim Inc.*, 3380 146th Place S.E., Bellevue, Wash. 98007. (206) 641-6619.
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MINI-MICRO SYSTEMS/September 1985

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- Split memory addressing
- Software driver
- 640K-byte paging

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- 32K-byte EPROM
- Z80 CPU

A single-board computer (SBC) providing multiprocessing for the STDbus, the model CPU-9 uses a Z80 CPU opera-
NEW PRODUCTS

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RAM board operates with no wait states

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OCTOBER

2-4 First International Conference in Japan on Optical Storage Technology, Keidanren Kaikan, Tokyo, Japan, sponsored by the Technology Opportunity Conference (TOC). Contact: TOC, P.O. Box 14817, San Francisco, Calif. 94114-0817, (415) 626-1133.

7-10 IEEE International Conference on Computer Design: VLSI in Computers, Port Chester, N.Y., sponsored by the IEEE Circuits and Systems Society and the IEEE Computer Society. Contact: ICCD '85, Suite 300, 1109 Spring St., Silver Spring, Md. 20910, (301) 589-8142.


14-17 Information Management Exposition and Conference (INFO), New York Coliseum, New York, sponsored by Cahners Exposition Group. Contact: CEG Client Services, 999 Summer St., Stamford, Conn. 06905, (203) 964-8287.

15-17 Ohmcon '85 High-Technology Electronics Exhibition and Convention, Cobb Hall, Detroit, sponsored by the Electronic Representatives Association and the IEEE. Contact: Ohmcon '85, P.O. Box 699, Utica, Mich. 48087-0699, (313) 781-4551.

18-20 Great Southern Computer and Electronics Show, Orlando, Fla., sponsored by Great Southern Shows. Contact: Great Southern Shows, P.O. Box 655, Jacksonville, Fla. 32201, (904) 743-8000.


MINI-MICRO SYSTEMS/September 1985
22-24 Northcon/85 High-Technology Electronics Exhibition and Convention, Portland Memorial Coliseum, Portland, Ore., sponsored by Electronic Conventions Management. Contact: Jerry Fossler or Nancy Hogan, Electronic Conventions Management, 8110 Airport Blvd., Los Angeles, Calif. 90045, (213) 772-2965.


25-27 UCSD p-System User's Society Fall National Meeting, Omni International Hotel, Baltimore, Md., offered by the UCSD p-System User's Society. Contact: Carl Van Dyke, VP Member Services, P.O. Box 1148, La Jolla, Calif. 92038, (804) 320-2561.


NOVEMBER

5-8 The National Database and 4th Generation Language Symposium (DB & 4GL), Dallas, sponsored by Software Institute of America and conducted by Digital Consulting Associates Inc. Contact: Kristin Kittle Lynch, Digital Consulting Associates Inc., 6 Windsor St., Andover, Mass. 01810, (617) 470-3870. Also to be held Dec. 3-6, Boston.
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MINI-MICRO SYSTEMS/September 1985

173
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SYSTEM INTEGRATORS' NOTEBOOK

Tips that make dollars and sense

SYSTEM TOOLS EASE DATA SEARCH

Carl Warren, Western Editor

Finding information buried somewhere in a file on a system's storage device(s) can be difficult. Locating a specific file is relatively easy. You simply look at a directory. Locating specific information is more involved, but system tools make the job easier.

For example, with the MS-DOS/PC-DOS machines' FIND filter you can specify information you would like to locate within a given file. A filter is a software utility that allows a user to extract certain information.

As with many of the utilities found in DOS, the FIND filter provides a great deal of flexibility. For one thing, it allows you to define paths (levels of directories) where various files might be located.

Because FIND uses the syntax: FIND "locate this string" \path names and file names, you can build a tool in BASIC (or Pascal) to search at various levels. You can direct all the file names to a particular file by typing DIR > filename, and then use this information to furnish the file names to FIND. Additionally, the verb PATH, when executed, displays the current directory paths set up in DOS. These paths can be piped into a separate file and used as variables in a program.

Notice that you only use the piping function of DOS to create files about what's contained in the system. Now the PATH represents only those directory paths established by the AUTO-EXEC file on bootup, or later by you by entering PATH and specific subdirectories. You may discover that the information you are looking for extends to many volumes (different disk drives) and that the current path won't deliver the desired data. Therefore, you may have to create separate files of all directories on all volumes, or keep a special file that defines the paths to all files and records anywhere on the system. You can do this by using an autobatch file, which invokes the system shell and saves new subdirectories as they are created.

Once you have defined where your files are, you can proceed to locate specific information. Ideally, you would have carefully segmented files as to type. Text files, for instance, should always exist in one specific area under one grouping of subdirectories. The same goes for spreadsheet and other data files. This is simply part of system management, but it can save a great deal of time.

Although the FIND function locates almost any data, its real power comes from its ability to locate string data. For example, if you have a database of all the articles appearing in Mini-Micro Systems and EDN since 1978, you could find everything written by a particular writer by making one entry. Your front-end program should only ask for the information you want—the rest of the parameters are built by the system automatically.

Locating a string of data does assume that the data is stored in text format and can be converted to displayable ASCII. In most cases, this is possible. But, for some files—such as Ashton-Tate’s dBase II, Lotus Development Corp.'s WKS and MicroPro International Corp.'s Wordstar—the format is different enough to require conversion. Even though the data isn't stored in text format, FIND will locate it in most cases. What it displays, however, may not be readable—often requiring the resetting of the eighth bit. This can also be handled by the Pascal or BASIC operating program.

Because FIND is a filter, unreadable data can be piped into a file for further processing. At that point, you can check for text type (e.g. Wordstar) and do any necessary conversions. In addition, you can set up a display program to present the data in a useful way. Therefore, you can have an automated system for locating specific information.

Looking Ahead in MMS

Be sure to watch for these editorial highlights in coming issues of Mini-Micro Systems.

• The October issue will cover mass storage memories and add-in/add-on boards.
• Power supplies and terminals will be featured in the November issue.

MINI-MICRO SYSTEMS/September 1985

Interest Quotient (Circle One)
High 492 Medium 493 Low 494
## ADVERTISERS INDEX

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Page Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced Matrix Technology Inc.</td>
<td>88</td>
</tr>
<tr>
<td>Alcatel Thomson Gigadisc</td>
<td>25</td>
</tr>
<tr>
<td>Alloy</td>
<td>101-158</td>
</tr>
<tr>
<td>AMF Logic Sciences</td>
<td>102</td>
</tr>
<tr>
<td>Ampro</td>
<td>16</td>
</tr>
<tr>
<td>Cahners Exposition Group</td>
<td>73</td>
</tr>
<tr>
<td>Carroll Touch Technology</td>
<td>61</td>
</tr>
<tr>
<td>Charles River Data Systems</td>
<td>69</td>
</tr>
<tr>
<td>CIE Terminals</td>
<td>22</td>
</tr>
<tr>
<td>Compaq Computer Corp.</td>
<td>123</td>
</tr>
<tr>
<td>Computer Museum</td>
<td>72</td>
</tr>
<tr>
<td>Concept Technologies</td>
<td>40</td>
</tr>
<tr>
<td>Concord Data Systems</td>
<td>135</td>
</tr>
<tr>
<td>Control Data Corp.</td>
<td>116</td>
</tr>
<tr>
<td>Craig Data Cable</td>
<td>90</td>
</tr>
<tr>
<td>CTS Corp.</td>
<td>154</td>
</tr>
<tr>
<td>CXI</td>
<td>10</td>
</tr>
<tr>
<td>Dataprodts</td>
<td>97</td>
</tr>
<tr>
<td>Dataram</td>
<td>83</td>
</tr>
<tr>
<td>Delta Airlines</td>
<td>128</td>
</tr>
<tr>
<td>Digital Sound Corp.</td>
<td>120</td>
</tr>
<tr>
<td>Dual Systems</td>
<td>4</td>
</tr>
<tr>
<td>Elgar</td>
<td>144</td>
</tr>
<tr>
<td>Emulex Corp.</td>
<td>57-74</td>
</tr>
<tr>
<td>Equinox Systems</td>
<td>62</td>
</tr>
<tr>
<td>Excelan</td>
<td>155</td>
</tr>
<tr>
<td>Facit</td>
<td>136</td>
</tr>
<tr>
<td>Fujitsu America Inc.-Data Products Division</td>
<td>132</td>
</tr>
<tr>
<td>Fujitsu America Inc.-Storage Division</td>
<td>58, 150-151</td>
</tr>
<tr>
<td>Fujitsu America Inc.-Printer Div.</td>
<td>110</td>
</tr>
<tr>
<td>General Power Systems</td>
<td>131</td>
</tr>
<tr>
<td>Giltronix</td>
<td>140</td>
</tr>
<tr>
<td>Heurikon Corp.</td>
<td>94</td>
</tr>
<tr>
<td>Hewlett-Packard Co.</td>
<td>64-65, 163, 165</td>
</tr>
<tr>
<td>Hitachi America Ltd.</td>
<td>14-15, 162</td>
</tr>
<tr>
<td>Human Designed Systems Inc. (HDS)</td>
<td>39</td>
</tr>
<tr>
<td>IBM Corp.</td>
<td>17-91-93</td>
</tr>
<tr>
<td>IDEAAssociates</td>
<td>114-115</td>
</tr>
<tr>
<td>Illbruck/USA</td>
<td>167</td>
</tr>
<tr>
<td>Infotron Systems Corp.</td>
<td>1</td>
</tr>
<tr>
<td>Interface Group</td>
<td>104-105</td>
</tr>
<tr>
<td>Interphase Corp.</td>
<td>12-13</td>
</tr>
<tr>
<td>Invitational Computer Conferences</td>
<td>160</td>
</tr>
<tr>
<td>Irwin Magnetics</td>
<td>51</td>
</tr>
<tr>
<td>ITT Information Systems</td>
<td>98</td>
</tr>
<tr>
<td>Keytronics</td>
<td>66</td>
</tr>
<tr>
<td>Lear Siegler Inc.</td>
<td>156</td>
</tr>
<tr>
<td>Lockheed Getex</td>
<td>159</td>
</tr>
<tr>
<td>Mannesmann Tally</td>
<td>18-19</td>
</tr>
<tr>
<td>Matrox Electronic Systems Ltd.</td>
<td>87</td>
</tr>
<tr>
<td>Maxtor Corp.</td>
<td>30-31</td>
</tr>
<tr>
<td>MCG Electronics Inc.</td>
<td>158</td>
</tr>
<tr>
<td>Megatek Corp.</td>
<td>44</td>
</tr>
<tr>
<td>Method Systems Inc.</td>
<td>112</td>
</tr>
<tr>
<td>Microdesign International</td>
<td>47</td>
</tr>
<tr>
<td>Microplot Systems</td>
<td>72</td>
</tr>
<tr>
<td>Microwave</td>
<td>80</td>
</tr>
<tr>
<td>Mostek Corp.</td>
<td>70, C3</td>
</tr>
<tr>
<td>Multi-Tech.</td>
<td>78</td>
</tr>
<tr>
<td>NCR Corp.</td>
<td>74-75</td>
</tr>
<tr>
<td>NEC America</td>
<td>72A-D</td>
</tr>
<tr>
<td>NEC Information Systems Inc.</td>
<td>52</td>
</tr>
<tr>
<td>NEC Peripherals</td>
<td>8-9</td>
</tr>
<tr>
<td>Newbury Data</td>
<td>113</td>
</tr>
<tr>
<td>Novell Data Systems</td>
<td>138-139</td>
</tr>
<tr>
<td>Oracle</td>
<td>E2</td>
</tr>
<tr>
<td>Output Technology</td>
<td>48</td>
</tr>
<tr>
<td>Pioneer Research</td>
<td>57</td>
</tr>
<tr>
<td>Plessey Microsystems</td>
<td>55</td>
</tr>
<tr>
<td>Preston Scientific</td>
<td>63</td>
</tr>
<tr>
<td>Quantum</td>
<td>126-127</td>
</tr>
<tr>
<td>RDS-Relational Database Systems</td>
<td>124</td>
</tr>
<tr>
<td>Seiko Instruments USA</td>
<td>146</td>
</tr>
<tr>
<td>Sequent Computer Systems</td>
<td>20-21</td>
</tr>
<tr>
<td>Shape Magnetronics Inc.</td>
<td>153</td>
</tr>
<tr>
<td>SimpacT Assoc. Inc.</td>
<td>4</td>
</tr>
<tr>
<td>Software Express</td>
<td>119</td>
</tr>
<tr>
<td>Spectra Logic</td>
<td>143</td>
</tr>
<tr>
<td>Speech Plus Inc.</td>
<td>166</td>
</tr>
<tr>
<td>SyQuest Technology</td>
<td>43</td>
</tr>
<tr>
<td>Systech</td>
<td>C2</td>
</tr>
<tr>
<td>TEAC Corp.</td>
<td>E1</td>
</tr>
<tr>
<td>Technology Forum</td>
<td>32</td>
</tr>
<tr>
<td>Teabyte Technology</td>
<td>90</td>
</tr>
<tr>
<td>TeleVideo Terminals</td>
<td>148</td>
</tr>
<tr>
<td>Texas Instruments Inc.</td>
<td>84, 109</td>
</tr>
<tr>
<td>Unity Corp.</td>
<td>76-77</td>
</tr>
<tr>
<td>Universal Data Systems Inc.</td>
<td>C4</td>
</tr>
<tr>
<td>Viking Acoustical</td>
<td>167</td>
</tr>
<tr>
<td>Viking Software Services</td>
<td>169</td>
</tr>
<tr>
<td>Western Telematic Inc.</td>
<td>26</td>
</tr>
<tr>
<td>Wyse Technology</td>
<td>28-29</td>
</tr>
</tbody>
</table>

See P. 174 for Classified Advertisers

See P. 170-173 for Career Opportunity Advertisers

See P. 179-180 for Mini-Micro Marketplace

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Shipments of personal computer add-on devices for integrated voice and data communications are expected to reach 330,000 units in 1989, up from the 5,000 units shipped in 1984, according to a recent market study by Advanced Resources Development (ARD). Moreover, by 1989, the add-on devices will be a standard option for personal computers and will support the growth of fully integrated voice/data terminals (IVDTs), which are expected to have shipments totaling 375,000 units by 1989, the study says.

According to ARD, there are over 3 million IBM Corp. PCs and compatibles installed in the United States and millions more are expected to be sold over the next few years. A large number of these PCs are enhanced with modems, reflecting users' strong interest in data communications.

Add-on devices typically add integrated voice features for telecommunications applications, simultaneous voice/data communications, electronic messaging and voice mail. The study says PC users are interested in these combined capabilities and are attracted by the relatively low cost.

Add-on devices consist of a variety of technologies. Some are external “black boxes” with computer and telephone interfaces, intelligent modems and telephone-management software. Others are components configured on internal, plug-in boards. The devices allow communication between PCs and access to databases and telephone-management functions, such as directories and auto-dial. These are the basic applications offered on fully integrated IVDTs.

The price of the study is $1,150 and is available through Advanced Resources Development, 28A Park Street Station, Medfield, Mass. 02052.

Circle 350

MINI-MICRO SYSTEMS/September 1985
### ARTFUL INTELLIGENCE

**By John K. Young**

#### ACROSS

2 To remember information
3 Time needed to accelerate to operating speed
5 Gate type
6 Impulse to do certain things
11 Piece of clear, prepunched acetate
12 Special function
13 Section restricted for particular use
14 Concessions derived by appeasement
15 What graphics must be
16 Disney center
17 Optimum exposure test
20 Small drink
21 Denotes singularity
22 Engine for space vehicles
23 Heroine in "The Works"
24 Statement
25 Page in front of book (Abb.)
26 Musical note
27 Multiple passes
28 Engine in "The Works"
29 Motorcycle in "The Works"
30 Heroine in "The Works"
31 Statement
32 Page in front of book (Abb.)
33 Color background for photographic action
34 Combining form meaning "of the Chinese people"
35 Currently fashionable
36 Black silhouette image preventing exposure in specific area of film
37 Beauty queen's coronet
38 Horse's favorite cereal grain
39 Value for money
40 Product dominant in fast-growing market
41 To record animation
42 Fork prong
43 Close-up shot
44 A movement of the knee
45 Logical operation
46 Card punch
47 Grass Valley's electronic memory device
48 Grass Valley's electronic memory device
49 Optical printer
50 Tantalum (Chem.)
51 Silver (Abb.)
52 Beauty queen's coronet

#### DOWN

1 Group of keys in numeric calculator-style layout
2 Its capital is Pierre (Abb.)
3 To mingle
4 Electrical current
5 To mingle
6 Gate type
7 To mingle
8 Ballet movement with knees bent outward, back held straight
9 To mingle
10 Sorry, but -----
11 Gate type
12 Piece of clear, prepunched acetate
13 Special function
14 Section restricted for particular use
15 What graphics must be
16 Disney center
17 Optimum exposure test
20 Small drink
21 Denotes singularity
22 Engine for space vehicles
23 Heroine in "The Works"
24 Statement
25 Page in front of book (Abb.)
26 Musical note
27 Multiple passes
28 Engine in "The Works"
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30 Heroine in "The Works"
31 Statement
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33 Color background for photographic action
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46 Card punch
47 Grass Valley's electronic memory device
48 Grass Valley's electronic memory device
49 Optical printer
50 Tantalum (Chem.)
51 Silver (Abb.)

---

_I just came from the dentist, and I feel awful..._ **Yeah but how come I hate having repair on my teeth you right? Worked on it.**

_Oh yeah? Well... what's that noise?_ **What noise? I don't hear any noise!**

_Relax, machine head... I think it's your hard disk._

_Geez! You doped humans are so cursed to do about your own hardware!_ **No! You know I hate having my hard disk worked on!!**

---

Solution will be printed next month.

Answers to August's puzzles can be found on Page 164.

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