TOP OF THE NEWS

The IRS picked a winner of its 15,000-unit laptop micro contract, IRS officials said last week. Industry observers expect IBM to be named as the supplier, and, perhaps next week, to unveil its long-heralded Clamshell. Page 2.

William Norris moved last week to shake up the declining fortunes of the Control Data he founded 29 years ago. Page 134.

Tolerant Systems, Inc. adds fault tolerance features to its products. Page 37.

The U.S. Department of Justice develops an on-line data base to track antitrust litigation, replacing index cards. Page 25.

Apple Computer's newest machine may not be compatible with all existing Macintosh software and peripherals. Page 5.

A Xerox spin-off offers to put Ethernet on wire as well as hook into IBM's Cabling System. Page 8.

Fourth-quarter financial reports and announcements of layoffs worldwide are expected from Intel this week. Indications are that the company could lay off 700 workers or more.

IBM watchers say the firm will announce its first reduced instruction set computing machine next week. The RISC offering is said to be a high-end stand-alone engineering workstation that is expected to shake up the market dominated by Apollo and Sun. Carnegie-Mellon University has set an announcement for Wednesday, and it is believed researchers there will unveil an operating system for the new device. Also expected are 10% or better price cuts on the 3080 mainframe series; slight price cuts to the 3090 systems; 4381 mainframe enhancements; and improvements to the company's DB2 data base. See NEWS page 5.

Data base unit uses 80286 chip

By John Gallant

LOS ANGELES — One of the leaders of the fledging data base machine market, Teradata Corp., last week unwrapped an Intel Corp. 80286-based Data Base Computer that more than doubles the performance of its earlier relational data base processor for IBM mainframes.

Teradata's introduction of the DBC/1012 Model 2, analysts say, strengthens the firm's ability to market its data base machines in the high-end IBM world. Data base machines — specialized back-end processors embodying relational data base management system software — offer significantly higher performance than software implementations of relational DBMS, with correspondingly higher price tags.

According to Michael Motto, director of technology management at Schering-Plough Corp. in Madison, N.J., his company tested the performance of the Model 2... See DATA page 4

Justice OKs piracy shield: vendors balk

By Bryan Wilkins

WASHINGTON, D.C. — The U.S. Department of Justice last week said it will not challenge a software industry group in its push for a hardware-based lock-and-key system standard to protect software programs from illegal duplication. But several major software companies that had previously supported the scheme have begun to back away from the proposed standard in response to initial user hostility.

The prime mover in the drive to thwart illegal duplication of software programs is the Association of Data Processing Service Organizations, Inc., representing computer software and service organizations. The association has spearheaded a yearlong drive to end illegal duplication of software programs, claiming that the practice cost the industry $800 million in 1985 and $1.3 billion between 1981 and 1984.

Last week, ADPSO announced it will release shortly a proposed draft standard of a lock-and-key system based on a hard... See JUSTICE page 6

Honeywell phasing out Multics line

By Paul Korzeniowski

A small group of loyal users will be informed by Honeywell, Inc. today that the company will no longer explore alternatives for extending the life of its 16-year-old Multics operating system.

Members of Honeywell's Large System Users Association, meeting in Hawaii, will be told that Honeywell has decided to cancel some long-term Multics projects because the small user base is not expected to increase sufficiently to justify costs. The company will attempt to migrate users to a new product line that it intends to announce later this year.

Despite a user base of less than 60 firms, Multics has acquired a devoted following that includes Ford Motor Co. Although Honeywell said it intends to continue with some planned Multics enhancements, many users in the U.S. and Europe are outraged by the action... See HONEYWELL page 13

Strained relations: DBMS debate turns bitter

By John Gallant

A controversy currently raging in the data base management world dramatically illustrates that, though nearly 16 years have passed since the birth of the relational model for data management, time has not cooled the heated debate over the capabilities of relational systems and perhaps more important, just what constitutes a relational data base management system in the first place.

Battle lines in the relational fray have been drawn between former IBM researchers E. F. Codd, who argues for strict adherence to relational concepts, and software vendors, which must implement those principles in products that address users' current concerns. The gulf that has opened between the caretakers of relational theory and those who implement the technology has left many users confused and has lent a hollow ring to the marketing claims of vendors now elevating for position in the DBMS market.

The latest round in the debate was sparked by Codd, who described the original relational model. Since the concept of relational data management debuted in 1970, the majority of computer users, as well as vendors and academicians, have embraced Codd's relational concept as the favored foundation for the future of DBMS.

But in a two-part Computerworld article [In Depth, Oct. 14; Oct. 21], Codd set out 12 rules of relational architecture and then asserted that "no existing DBMS product can honestly claim to be fully relational." Codd, who along with Chris Date cofounded the Relational Institute and the Codd & Date Consulting Group, then measured three leading DBMS programs against his 12 standards... See DBMS page 8
Vendor-initiated standards group provokes admiration, skepticism

By Clinton Wilder

A new vendors' organization being formed to promote the development and adoption of Open Systems Interconnect (OSI) and other data communications standards received mixed reactions from telecommunications users and industry analysts last week.

While praising the intentions of the Corporation for Open Systems (COS), most observers felt the 18-vendor consortium will not constitute the panacea for hardware, software and communications incompatibility among different vendors' products.

The group's first challenge, many believe, will be convincing IBM to join Digital Equipment Corp., AT&T, the BUNCH consortium and several others, to build fences around their own world for the moment. Nevertheless, some observers think COS's efforts are aimed at building fences around their own world for the moment. Nevertheless, some observers think COS's efforts are aimed at bringing competing vendors to the table, thus providing a forum to work on standards and a basis for a seal of approval for products that meet the standards.

According to the COS organizers, the group's first challenge will be convincing IBM to join the BUNCH consortium and several others to build fences around their own world for the moment.

For users, the chances for COS to succeed are uncertain. Some said they believe the effort to make the International Standards Organization's OSI model a workable standard will depend greatly on input from MIS and telecommunications directors in user organizations.

The group's first challenge will be convincing IBM to join the BUNCH consortium and several others to build fences around their own world for the moment. Nevertheless, some observers think COS's efforts are aimed at building fences around their own world for the moment. Nevertheless, some observers think COS's efforts are aimed at bringing competing vendors to the table, thus providing a forum to work on standards and a basis for a seal of approval for products that meet the standards.

According to the COS organizers, the group's first challenge will be convincing IBM to join the BUNCH consortium and several others to build fences around their own world for the moment. Nevertheless, some observers think COS's efforts are aimed at building fences around their own world for the moment. Nevertheless, some observers think COS's efforts are aimed at bringing competing vendors to the table, thus providing a forum to work on standards and a basis for a seal of approval for products that meet the standards.

By Mitch Betts

WASHINGTON, D.C. — Internal Revenue Service officials said last week they may award as soon as next week a contract for 15,000 portable microcomputers and software to be used by IRS auditors. IBM won the lucrative contract, although it has yet to announce a laptop micro, industry sources contended.

The IRS decision is expected to trigger the announcement of an IBM laptop, commonly referred to as Clamshell. Vendors and analysts said they hope an IBM laptop will spur greater demand for the small computing devices.

The agency's request for bids last April said the micros must have, at minimum, Microsoft Corp.'s MS-DOS operating system, 512K bytes of random-access memory, a 6-in. (diagonal) screen with 25 lines of 80 characters and an integrated disk drive for removable diskettes. The system, including a modem, must not exceed 18 pounds, the IRS document said.

John W. Lear, chief of the agency's evaluation branch, confirmed that there is an apparent winner of the contract. But, he said, approvals must still be obtained from the agency's computer policy board, legal counsel and the U.S. Department of the Treasury's procurement office.

Lear said the announcement of the contract award is expected next week. He and other IRS officials declined to elaborate. IBM spokesmen refused to comment on widespread reports that IBM will unveil a number of products Jan. 21. International Data Corp. analyst Aaron Goldberg was among those who confidently predicted the IBM laptop rollout on that date.

Vendors said there is much speculation that IBM is the apparent winner of the IRS contract, but an IBM spokesman stated, "We have no knowledge of being a finalist or a winner." "We hear that IBM is the winner, but we are not sure that mostly from reporters," said Pat McGloughlin, sales manager at the federal sales office of Zenith Data Systems Corp. in Vienna, Va.

Zenith and Grid Systems Corp., which has been successful selling its laptops to the government, are also among the finalists in the contract bidding, officials at each firm said. AT&T Information Systems — which also has not announced its laptop contract bid — would neither confirm nor deny that AT&T is another finalist.

The contract will put laptop micros in the hands of IRS field auditors so they can have access to the agency's mainframe computer files to conduct on-site tax audits and write reports (CW, Sept. 24, 1984).

Lear said the IRS conducted extensive functional tests and cost evaluations to select the winner, and it is confident it can win any legal protest that might be filed by a losing vendor. Training and first delivery will begin 90 days after the contract award, with 300 units to be delivered within 60 days. Nationwide implementation will begin 90 days after contract award and will require delivery of up to 1,000 micros a month to various offices in the U.S. for a period of 12 to 18 months.
What could be more fulfilling in life than to realize one’s absolute potential? And what could be sadder than to fail for lack of the proper equipment?

“Rousing Performance”
SyncSort allows you to perform like a virtuoso, drawing out the best your IBM Mainframe has to give.

If OS isn’t your tune, you’ll find our CMS and DOS performance equally impressive.

“Impressive Backstage Support”
Our Technical Service people, resolving more than 85% of all requests for technical service within 24 hours, will make you look like a star. A recent independent survey showed that 97% of SyncSort’s users rate our product reliability as Very Good or Excellent.

“Harmonious Features”
SyncSort’s features will impress even the most jaded impresarios, increasing programmer productivity and operational flexibility.

- **Sortwriter**—displays sorted data in user-tailored reports. Programmer efficiency is maximized through flexible report formatting of headers, trailers, sectioning, totals and subtotals.
- **Multiple Output**—provides multiple copies of the sorted output file. Each output file can be any subset of the full sorted output, and you can produce a different report format for each output file based on user-specified criteria.
- **Record Editing**—allows insertion of literals, commas, $, etc. as well as editing, repositioning or elimination of record fields, thereby reducing programming time.
- **Fast File Copy**—dramatically reduces the consumption of mainframe resources. All standard sorting features (Include/Omit, Inrec/Outrec, Sum, etc.) as well as SyncSort’s unique features can be activated in a normal copy operation.
- **Maxsort**—provides powerful operational flexibility in sorting very large files. Sorting of these files is automatically broken into optimal steps, executable at different times; thus, the amount of data that can be sorted is no longer restrained by the amount of disk space available.

SyncSort—for those who abhor wasted potential
Make us prove it: Call (201) 568-9700.
Tymnet strikes deal for net interconnection

Southern New England to provide local access

By John Dix

NEW HAVEN, Conn. — In a deal tested as the first of its kind, Tymnet/McDonnell Douglas Network Systems Co. has agreed to interconnect its native packet network with the local packet net service of Connecticut-based Southern New England Telephone.

"This deal is a hallmark," said Clint DeGabrielle, vice-president of marketing and field operations for Tymnet, referring to ongoing negotiations that Tymnet and other carriers are involved in with local phone companies developing packet services.

The divested Bell operating companies have been allowed only partially owned by AT&T prior to divestiture — are particularly interested in interconnect agreements. They are not allowed to offer services that cross state borders or the boundaries of Local Access Transport Areas (LATA). The Tymnet/CTEI (Connecticut Telephone Enterprise Inc.) structure is what is a long distance within the former Bell operating companies' regressive service territories.

Southern New England's ComNet packet network service will interconnect with the Tymnet network through a gateway interface with the CTIT (Connecticut Telephone Information Technology) Net 7.5 specifications. Customers connected to either network will now have the necessary resources supported by the other network.

According to DeGabrielle, both companies benefit from this agreement, as will their respective customers. "Southern New England provides us with universal local access in Connecticut. For us to provide that, we would have had to do it from them anyway, and this way we can offer customers a single number for their needs.

"Conversely, Southern New England can offer its customers a single number to reach any place in the world. In the long run it should impact our rates favorably with software-based data management systems. The Tymnet system is fault tolerant and can be attached to multiple host systems. Users can add processors and disk storage as requirements increase.

The original data base machine installed at Schering-Plough supports information center applications for the company's marketing and personnel departments. Data requests are formulated through Artificial Intelligence Corp.'s SQL compatible Intel- lence Corp.'s SQL-compatible Intel- lence Corp. SQL query form. SQL requests can also be sent from microcomputer workstations attached to the mainframe via Micro Decisionware, Inc.'s PC/SQL-Link.

Schering-Plough's production and test machines currently boast four IFPs and eight AMPs each. A Tera Data data base spokesman said that the data base configuration offers roughly 12 MIPS of processing power, 4G bytes of storage and 24M bytes of dynamic random-access memory.

"It is a trade-off," Motto said. "You pay more up front vs. the software approach. Relational is great for the end user, but it consumes a lot of processing power. The relational environment is dynamic, there are no predefined transactions. You are not sure what you will be asking the sys- tem to do. As your relational needs grow, along with the growth in use of other systems like IMS and CICS, the life cycle of your mainframe can be substantially shortened."

Motto said Schering-Plough also served as a beta test site for Release 2 of DBC/1012's operating software, which consists of host interface and relational DBMS support. A Tera Data spokesman said Release 2 en- hancements include changes in data formatting methods to reflect the machine overhead by nearly 50% and the use of data base optimization techniques to improve database performance. The spokesman said a typical 12 processor-AMP configuration with eight disk units and 4G bytes of storage is priced at $562,000. Processors and storage may also be added at $39,000 per MIPS and $21 per megabyte, re- spectively.
Apple's Macplus features more RAM, double-sided drive

Prime using machine to develop software

By Edward Warner
Computerworld News Service

FRAMINGHAM, Mass. — Macplus, the forthcoming enhanced version of the Apple Computer, Inc. Macintosh, will offer 1MB of random-access memory (RAM), a double-sided 800K-byte diskette drive and a numeric keypad built into its keyboard, according to the editor of a Macintosh users' newsletter who has seen one of the new machines.

Other changes include a doubling of the Macintosh's read-only memory (ROM) to 128K bytes and the addition of a small computer systems interface (SCSI), which would allow the machine to use large-scale storage devices as peripherals, said "Macintosh" editor Rick LePage.

The machine's expanded ROM, LePage said, lets the Macintosh operating system support subdirectories of files, something already available to users of IBM Personal Computers. Support for subdirectories, he said, makes the Macplus "more efficient" than its predecessor but causes the Macplus to be unable to run many existing Macintosh programs.

"That would surprise me very much," responded Scott Schwarts, president of Symmetry Corp., which produces the Picturebase and Quickdisk Macintosh programs. Schwarts said he had heard that about 5% of the programs suffered "compatibility problems" with Macplus' Hierarchical File System, which creates the subdirectories. "In many cases," he continued, "it's only cosmetic."

LePage, meanwhile, said an additional disadvantage of the Macplus is that it uses DIN-type connectors, not standard Macintosh connectors, at its output ports. "Anybody who upgrades their Macintosh is going to have to buy new connectors" for their peripherals, LePage explained.

LePage said the faster disk access speeds and doubled memory provide improvements over the 512K Macintosh, the machine it will replace. Apple, he added, is so solidly behind the Macplus that on Dec. 16, 1985, it stopped production of the machine's predecessor, the 512K Macintosh. The Macplus, he said, will be priced between $2,195 and $2,495.

Microsoft Corp., LePage said, will be among the first to take advantage of the greater memory by adding a dictionary and style sheets to the Macintosh version of the Word word processing program.

For users, more "RAM helps those applications that seem to be landlocked," he said. It also means large programs can be resident in memory, something long-awaited by Macintosh users who dreaded their machine's slow drives.

CONVERTING TO 3480'S USE FATS/FATAR Ver. 4.0

To copy your 3430's to 3480 cartridges...

FATS can create image copies of your tapes on 3480 cartridges...

From 1 to 9 tape drives can be copying simultaneously...

Virgin cartridges can be used without special processing...

Tape summary report on each tape and file processed...

Available for IBM OS, V5 and MVS/XA

Phone or write for your free 90 day trial now so you can compare FATS to your OFFLINE HARDWARE EVALUATOR reports generated by SMF and EREP.
Workstation agreements set Sun against Apollo, DEC

By Rosemary Hamilton

In this Superworkstation marketplace, Sun Microsystems, Inc. last week stole the show from archival Apollo Computer, Inc. when Sun announced joint marketing agreements with two low-end supercomputers makers, one of which — Alliant Computer Systems Corp. — struck a deal with Apollo late last year.

The agreements bring Sun up to par with Apollo, since both will now be offering computer-intensive machines in their product lines. Industry analysts said the additional computing power is essential for the workstation vendors to compete with Digital Equipment Corporation, which has been putting the squeeze on these two vendors since its introduction of a workstation product based on its successful Microvax II last year. DEC is expected to announce a workstation product this week.

Sun’s deal with Alliant will be a joint effort, whereas Apollo will be reselling Alliant’s FX series.

"The agreements are the answers to Apollo and Sun’s prayers against the encroachment of DEC," said David Wu, an analyst with S. G. Warburg, Bow, Fitzwilliam, Akroyd, Inc. in San Francisco.

The agreements also further Sun’s efforts to promote its Network File System (NFS) as an industry standard. NFS allows users to access transparently files across networks of multivendor systems. Both Alliant and Sun’s other new partner, Convex Corp., will implement NFS on their systems.

Alliant, which is based in the same area of California’s Silicon Valley as Sun, has a 32-bit workstation running under a derivative of the Unix operating system. Convex, which is based in Berkeley, has version 4.2 of the AT&T Unix operating system. Convex has been competing with Apollo to become the workstation industry’s leader. Apollo, which sells systems based on its proprietary Domain architecture, made a commitment to open architecture systems last year by introducing both Berkeley 4.2 and AT&T System V versions of Unix on its workstations. It also provided gateways to DEC’s systems running under VAX/VMS, to IBM systems on Systems Network Architecture networks and to IBM Personal Computers.

Sun said it is negotiating with 30 vendors to license NFS, and so far "about a dozen" have licensed it. "The issue here isn’t as much Sun as it is the Network File System," said David Miccichi, vice-president of marketing and sales at Alliant. "We, along with other vendors, are cooperating to promote and foster the development of NFS as a standard."

In a prepared statement, an Apollo spokesman said, "We were notified by Alliant that they’d reached an agreement with Sun. Alliant has a popular product. We don’t have much else to say." Apollo officials were not available for comment.

According to JoAnn Kahn, director of new business development at Sun, the two agreements are essentially the same. Both Alliant and Convex will first implement Sun’s NFS on their systems. Then, Sun will work separately with both vendors to develop networking management software for a batch execution facility that will interact with Sun’s technical workstations. The companies are also ironing out details for joint-marketing programs.

Alliant, for its part, said it sees no conflict with a start-up company making the C-1, a so-called Crayette computer because its architecture is based on the Cray Research, Inc. Cray-1 supercomputer. Sun, with a 32-bit workstation running under a derivative of the Unix operating system, is also making the C-1, along with Convex. The objective is to become a full-line supplier of workstations. The objective for Sun is to foster NFS.

\[\text{MAKE YOUR APPLICATIONS FLY...}^{\text{\textsuperscript{\textcopyright}}}\]

...with VS COBOL Workbench, the most complete and powerful micro and mainframe COBOL development environment on a PC.

Already fast, the latest version of VS COBOL Workbench really flies; supports Report Writer, has more extensive syntax, improved screen handling and host testing facilities.

If you’re concerned about productivity, then make sure you pick the best. Write or call now—

MICRO FOCUS

2465 East Bayshore Road, Palo Alto, CA 94303

Telephone: (415) 856-4161

Send to: Micro Focus Inc., 2465 East Bayshore Rd, Palo Alto, CA 94303

Name

Company

Address

City

State

Zip

Phone

an extra charge.

CSM 15103354-2

COBOL COBOL

Level II COBOL Compiler

Lexicon Compiler/Editor/ET

Mac COBOL

VS COBOL Compiler

Code/Graphics

COBOL Workbench

Professional COBOL

Lexicon Compiler

Mac COBOL

VS COBOL Compiler

Code/Graphics

Micro Focus offers the widest range of products for development on PCs and UNIX, tell us which interest you—

Distributed by

CWI, INC.

Level II COBOL Compiler

Lexicon Compiler/Editor/ET

Mac COBOL

VS COBOL Compiler

Code/Graphics

Make your applications fly...

ComputerWorld

Jan 13, 1986

Justice OKs piracy shield

From page 1

ware peripheral device that connects to microcomputer’s RS-232 communications port. ADAPSO said the draft will be available for a 90-day comment period before further action to adopt any standard is taken.

In response to ADAPSO’s demands, the Justice Department said it would not oppose that effort. But the clearance of antitrust considerations is contingent on limiting the standard “to the physical connections and communications between the registry and the system and the computer.”

The department informed ADAPSO that the group may not standardize the entire software protection system or use standards as a means of excluding other types of software protection mechanisms.

The two principal features addressed by ADAPSO’s draft affect the physical size of the key that contains, in chip memory, a critical part of a software program’s code — a part without which the program could not function — and the communications protocols governing the interaction of the key’s hardware key ring device with the RS-232 port on the micro.

Ironically, support for a hardware-based lock-and-key system has lost some of its support from software vendors in recent months. This comes as a result of surveys that indicate users were not receptive to the idea of attaching another component to their systems, especially a component that is interactively involved in communications through the RS-232 port, through which other peripheral devices such as printers and

商务部批准REMARKS

司法部批准一个软件保护系统和标准的提议，该提议旨在限制软件保护系统的物理连接和通信，并通过限制标准的范围来实现这一目的。但司法部对实施避难所原则表示不反对，前提是通过限制标准的范围来实现这一目的。但是，在实施避难所原则之前，必须对这些考虑予以考虑，而这些考虑是取决于限制标准的范围的，包括限制硬件和软件的标准。

商务部批准一个软件保护系统和标准的提议，该提议旨在限制软件保护系统的物理连接和通信，并通过限制标准的范围来实现这一目的。但司法部对实施避难所原则表示不反对，前提是通过限制标准的范围来实现这一目的。但是，在实施避难所原则之前，必须对这些考虑予以考虑，而这些考虑是取决于限制标准的范围的，包括限制硬件和软件的标准。
VMCENTENT...
THE DATA CENTER MANAGEMENT SYSTEM FOR VM.
INDISPENSABLE AT ANY PRICE, UNBELIEVABLE AT 8¢ A LINE.

If VMCENTENT cost a zillion dollars, you'd still find people who could justify it on price. After all, how else could anyone running VM gain so much control for so little effort? Whether the issue is security, DASD management, scheduling, billing, cost containment, or simply eliminating administrative headaches, VMCENTENT's facilities offer a degree of control that's unprecedented in the VM environment.

But even more to the point, VMCENTENT really works. In fact, it's working right now in some of the most demanding VM shops in the world. It's working to keep data and resources secure from outsiders and from those within the organization who should have limited authorizations. It's working to protect data from disaster, or the simple inadvertent deletion of a needed file. It's balancing workload by moving work to offpeak times, and accounting for all resource usage. VMCENTENT is even prescribing specific actions to regain use of under-utilized disk space.

So if things seem out of control in your data center, you don't have to spend a lot to get back on top. Just spend a minute. And give us a call.

VM Software, Inc. 2070 Chain Bridge Road, Vienna, Virginia 22180
800-562-7100
703-821-6886 in Virginia and outside the continental U.S.

VM SOFTWARE INC.
RUN WITH THE LEADER
Astranet scheme runs on IBM Cabling System

By John Dix

MOUNTAIN VIEW, Calif. — Products to implement Ethernet into network systems with Type 1 or 2 shielded twisted-pair wire were announced last week by Astra Communications, Inc.

Astranet, which can also be used with fiber-optic, under-carpet and air plenum cable, consists of a family of transceivers and concentrators used in conjunction with standard Ethernet host interface units. Used together, they provide an alternative Ethernet host interface units. Used to return for a Xerox seat on the company’s board of directors and a minority stock ownership.

Besides using unconventional media, Astranet differs from standard Ethernet in topology. Astranet is wired in a hierarchical star; nodes are wired star-like into concentrators that, in turn, can be connected to a central concentrator, said Ronald Schmidt, chief technical officer.

When implemented on an IBM Cabling System, Astranet components are used at the workstation and in the wiring closets. Astranet transceivers use a special utility cable to connect to IBM Cabling System wall outlets. Addressed packets are then transmitted to an Astranet concentrator in the wiring closet and are broadcast to all similarly attached devices, looking for the desired node.

"Essentially what we’ve done is shrink an Ethernet coaxial cable down to a 10-in. printed-circuit board from which we make runs out to nodes," Schmidt said. Concentrators can be expanded to eight six-port models for a total of 48 ports. Up to 32 concentrators can be connected into a central concentrator with fiber-optic cable.

Network nodes can be located more than 100 meters away from concentrators and sometimes farther.

Astranet, which operates at 10M bit/sec. like Ethernet, provides as good or better response time as coaxial-based Ethernet, Schmidt said, "but it probably isn’t noticeable."

The network has been alpha tested at Carnegie-Mellon University in Pittsburgh; Texas Instruments, Inc. in Dallas; Micos-Interlan, Inc. in Boxboro, Mass.; and in the Pentagon by the U.S. Department of Defense.

Astranet costs $425 to $450 per node, depending on the configuration and the number of units purchased.

It will be available beginning next quarter.

DBMS debate turns bitter

From page 1

IBM’s DB2 fared best, conforming to seven rules. But Codd assigned a zero score to Applied Data Research, Inc.’s (ADR) Datsym/DB and Culminate data base, Inc.’s IDS/M-R, saying the two most widely installed independent DBMS had failed to meet fully 12 rules.

Vender reaction was swift.

John Cullinane, chairman of Culminate, referred to Codd’s call for compromise between theory and the real world.

"Some backed Codd’s plea for relational purity, others embraced Cullinane’s call for compromise between theory and the real world."

Codd agreed that current relational systems cannot handle applications with "extremely severe performance requirements." Responding users sided with both Codd and Cullinane, and the number of units purchased. It is simply not as fast as the process of embedding and error checking. Today's hardware technology, a purely relational system cannot handle the most performance-sensitive user requirements.

Codd agreed that current relational systems have performance limitations, but he placed the onus for that problem squarely on vendors. "They keep barking on this performance myth because they haven’t put in the necessary research and development to make good performance with the relational approach. Without putting in the effort, they want to announce it as an impossible problem. It isn’t."

Can relational implementations stray from Codd’s theoretical foundations? "It is a complete confidence trick on the part of critics to say I am concerned more with theoretical purity than with practicality," Codd said. "They are saying that anything with a theoretical foundation cannot possibly be practical. It is ridiculous for vendors to talk about serving particular needs of users. Some needs can only be served through a decent theoretical foundation."

Antony Percy, director of product planning and innovation at a former data base administrator, said the value of relational implementation is not dependent solely on its adherence to Codd’s rules. "Codd is absolutely correct to clarify what he means by relational. We have embraced the rules to suit our needs. But with our products, we are trying to address productivity issues that are supported by some of the esoteric rules of data base. That is not to undermine the validity of the rules, but they are just not as important as some of the other problems MIS directors are facing today."

When all the issues are discussed, however, the relational controversy may be viewed as an outgrowth of a major difference in the approach to user needs.

"I am interested in seeing that users get what they need," Codd said. "One of the most important needs today is the ability of users to interact with data in data bases easily. People ask why the relational model isn’t fully implemented. I cannot answer that. There isn’t any good answer to that."

"As far as following every single rule," ADR’s Percy said, "some of them are fairly esoteric and not all that useful. They would have performance penalties, and users are prepared to compromise without them. This is not a binary issue. Some of the implementations may offer very useful benefits to users."

But Codd has cautionary words for systems vendors about what they can do. "I do not expect vendors to adopt every aspect of relational technology in one step. But I want them to look at what the other vendors have. I am very concerned with the dishonesty on the part of certain vendors, and I intend to see that it stops."
Learn how information can become a strategic corporate asset.

With a comprehensive database management system and appropriate tools, you can assure that data processing becomes a competitive advantage—not corporate overhead.

Learn how to satisfy the requirements of every department in your organization with advanced database technology, in combination with complete Information Center tools and applications rich in functionality, whose underlying architecture is built on, and takes full advantage of, that same advanced database technology.

Plan to attend one of Cullinet’s seminars in Database Management, Manufacturing, Financial Management, Human Resource Management or Information Center Management. Call soon to reserve spaces for yourself and your colleagues.

To enroll in a Cullinet Seminar, call 1-800-225-9930. In Massachusetts, phone 617-329-7700. All seminars through July 31 are listed below. Call for information on later seminars.

©1986 Cullinet Software, Inc., Westwood, MA 02090-2198

CULLINET SEMINARS/U.S.

<table>
<thead>
<tr>
<th>State, City</th>
<th>Date</th>
<th>Database Management System 1OM/86</th>
<th>Information Center Management System</th>
<th>Applications</th>
<th>Manufacturing</th>
<th>Financial/ Banking</th>
<th>Human Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALABAMA</td>
<td>Birmingham</td>
<td>6-15-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>ALASKA</td>
<td>Anchorage</td>
<td>6-29-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>ARIZONA</td>
<td>Phoenix</td>
<td>3-10-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>ARIZONA</td>
<td>Phoenix</td>
<td>6-18-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CALIFORNIA</td>
<td>Los Angeles</td>
<td>2-4-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CALIFORNIA</td>
<td>Los Angeles</td>
<td>6-19-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CAPITOL</td>
<td>Orange County</td>
<td>2-5-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CANTON</td>
<td>Orange County</td>
<td>3-10-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CHESTER</td>
<td>Sacramento</td>
<td>3-4-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CLEVELAND</td>
<td>San Diego</td>
<td>3-29-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CLEVELAND</td>
<td>San Francisco</td>
<td>6-8-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CONNECTICUT</td>
<td>San Jose</td>
<td>3-14-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CONNECTICUT</td>
<td>Ventura</td>
<td>3-11-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>COLORADO</td>
<td>Denver</td>
<td>2-8-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>COLORADO</td>
<td>Denver</td>
<td>5-20-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CONNECT/ CT</td>
<td>Hartford</td>
<td>3-27-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CONNECT/ CT</td>
<td>Hartford</td>
<td>5-20-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CONNECT/ CT</td>
<td>Troutman</td>
<td>3-11-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>DISTRICT OF COLUMBIA</td>
<td>Washington</td>
<td>3-4-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>DISTRICT OF COLUMBIA</td>
<td>Washington</td>
<td>2-27-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CONNECT/ FL</td>
<td>Jacksonville</td>
<td>6-30-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CONNECT/ FL</td>
<td>Miami</td>
<td>3-29-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CONNECT/ FL</td>
<td>Orlando</td>
<td>4-2-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CONNECT/ FL</td>
<td>Tampa</td>
<td>2-4-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CONNECT/ FL</td>
<td>West Palm Beach</td>
<td>3-6-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CONNECT/ FL</td>
<td>GEORGIA</td>
<td>Atlanta</td>
<td>3-30-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CONNECT/ FL</td>
<td>Columbus</td>
<td>6-18-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CONNECT/ HI</td>
<td>Honolulu</td>
<td>6-17-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CONNECT/ IL</td>
<td>Chicago</td>
<td>3-18-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CONNECT/ IL</td>
<td>Chicago</td>
<td>5-6-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CONNECT/ IL</td>
<td>Chicago</td>
<td>6-25-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CONNECT/ IN</td>
<td>Fort Wayne</td>
<td>3-19-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CONNECT/ IN</td>
<td>Indianapolis</td>
<td>3-18-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CONNECT/ IN</td>
<td>Indianapolis</td>
<td>6-30-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CONNECT/ IOW</td>
<td>Des Moines</td>
<td>3-18-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CONNECT/ KY</td>
<td>LOUISVILLE</td>
<td>2-25-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CONNECT/ LO</td>
<td>LOUISIANA</td>
<td>New Orleans</td>
<td>6-12-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CONNECT/ MA</td>
<td>MAINE</td>
<td>Portland</td>
<td>6-30-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CONNECT/ MA</td>
<td>Portland</td>
<td>5-20-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CONNECT/ MD</td>
<td>BALTIMORE</td>
<td>3-6-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CONNECT/ MA</td>
<td>MASSACHUSETTS</td>
<td>Boston</td>
<td>4-18-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CONNECT/ MA</td>
<td>Boston</td>
<td>6-6-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CONNECT/ MD</td>
<td>Lowell</td>
<td>3-18-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CONNECT/ ME</td>
<td>MEYERIAN</td>
<td>Denver</td>
<td>2-18-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CONNECT/ ME</td>
<td>Denver</td>
<td>4-18-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CONNECT/ MD</td>
<td>Grand Rapids</td>
<td>5-20-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CONNECT/ MN</td>
<td>MINNEAPOLIS</td>
<td>2-4-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CONNECT/ MN</td>
<td>Minneapolis</td>
<td>6-5-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CONNECT/ MN</td>
<td>Minneapolis</td>
<td>6-21-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CONNECT/ MN</td>
<td>Jackson</td>
<td>6-11-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CONNECT/ MS</td>
<td>MISSISSIPPI</td>
<td>2-20-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CONNECT/ MS</td>
<td>KANSAS CITY</td>
<td>3-20-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CONNECT/ MS</td>
<td>St. Louis</td>
<td>5-30-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CONNECT/ MS</td>
<td>St. Louis</td>
<td>6-18-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CONNECT/ ND</td>
<td>NERAKASKA</td>
<td>Omaha</td>
<td>2-10-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

CULLINET SEMINARS/CANADA

<table>
<thead>
<tr>
<th>Province, City</th>
<th>Date</th>
<th>Database Management System 1OM/86</th>
<th>Information Center Management System</th>
<th>Applications</th>
<th>Manufacturing</th>
<th>Financial/ Banking</th>
<th>Human Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALBERTA</td>
<td>Edmonton</td>
<td>5-26-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>ALBERTA</td>
<td>Edmonton</td>
<td>5-26-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>BRITISH COLUMBIA</td>
<td>Vancouver</td>
<td>5-26-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>MONTANA</td>
<td>Missoula</td>
<td>5-26-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>MONTANA</td>
<td>Missoula</td>
<td>7-27-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>QUEBEC</td>
<td>ST. JEROME</td>
<td>3-22-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>QUEBEC</td>
<td>ST. JEROME</td>
<td>5-26-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>QUEBEC</td>
<td>ST. JEROME</td>
<td>7-27-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>QUEBEC</td>
<td>MONTREAL</td>
<td>3-26-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>QUEBEC</td>
<td>MONTREAL</td>
<td>5-26-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>QUEBEC</td>
<td>MONTREAL</td>
<td>7-27-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>QUEBEC</td>
<td>QUEBEC</td>
<td>3-26-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>QUEBEC</td>
<td>QUEBEC</td>
<td>5-26-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>QUEBEC</td>
<td>QUEBEC</td>
<td>7-27-86</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

To enroll in a Cullinet Seminar, call 1-800-225-9930. In MA phone 617-329-7700.
Georgia agency opens bidding for Medicaid DP system

Current setup blamed for $4 million snafu

By James A. Martin

ATLANTA — The Department of Medical Assistance (DMA) for the state of Georgia will solicit bids in March for a new data processing system, claiming that problems in its current system caused approximately $4 million in overpayments to Medicaid recipients and does not accommodate new departmental processing needs.

Because of computer snafus, the U.S. Department of Health and Human Services in its computer performance review of the state agency said it would not certify the DMA system for nine months of its fiscal year 1984-85. This means the federal agency will reimburse the state department for computer operating expenses on a 50-50 basis for that period rather than at the regular rate of 75% in federal funds to match the state’s $25, a loss to DMA of more than $1 million.

In addition, the state auditor’s office said it would not be able to audit the Medicaid program in the state of Georgia for 1984-85 because of computer problems that resulted in missing records.

The department’s current DP applications are performed on a time-sharing basis by The Computer Co., a Richmond, Va.-based DP service. The DMA’s CICS applications are processed through a Paradyne Corp. Parallel Interface Extender at the DP service’s Atlanta office, which acts as a local control unit for tape drives and printers.

The Computer Co.’s Richmond office operates with IBM 3081 Model K and 3033 mainframes for batch and on-line processing and data entry in Remote Operating System Conversational Operating Environment and TSO environments. The Richmond systems service nationwide health care accounts for seven regional offices of the company. End users at the DMA access recipient claims information and have limited update capabilities on RJE terminals.

The DMA will renew its contract with The Computer Co. on June 30 for a portion of the next fiscal year to ensure a smooth changeover in computer systems, a DMA spokesman said. The state agency signed a five-year contract with the firm worth approximately $5 million each year in June 1984. The contract can be terminated after each year by the state if desired.

The programming errors reportedly began when the DMA converted its DP applications from a state-operated dual processor Sperry Corp. Uni-vac 1182 to the DP service’s system in July 1984. "There were some conversion problems stemming from the short amount of time between the contract award and the first date of live processing, with very little time for dual processing or parallel testing," said B. P. Fulmer, the company’s director of operations in Atlanta.

Problems with overpayments and delayed payments "happened over a year ago and were associated with our conversion, and you know conversions can be perilous," said Aaron J. Johnson, commissioner for the Georgia DMA. However, he added, "We believed the system would be fully operational from Day 1."

although the present system is "not problem free," Johnson said most of the earlier snags have been cleared up. Meanwhile, the DMA said it plans to seek bids in March for a new system so that the department can expand its services. "We want to expand to provide coverage for the medically needy," whose eligibility is determined by having income less than 50% of the base recipient," Johnson said. "The present system does not accommodate that population. Initially, we thought we could enhance the system to accommodate the changes we want, but we have determined the best way to make those changes is to go for a new system."

Having the company process that additional data would "constitute a major change in terms of the overall contract," Fulmer explained. "It would require major revisions and rewrites of the existing system. We concur with the state that the most equitable arrangement would be to rebid for a system."

Johnson said the DMA would consider any bids for a system from the firm. "I can’t say that we will [bid], and I can’t say that we won’t. Fulmer said at the firm’s decision not to rebid the contract will wait to see the state’s bid proposal before deciding what action to take.

The DMA has recovered some of the Medicaid overpayments and said it expects to locates all of them. Meanwhile, Georgia will appeal the Department of Health and Human Services’ decision not to reimburse for computer services at the 75:25 rate.

OEM Computer Product Buyers

“The Invitational Computer Conferences bring to you the latest high-tech information you need to hear, and the major OEM products you need to see. We’ll be there!”

And you’ll find other top OEM manufacturers, such as Fujitsu, NEC, Control Data, IBM, Telex, Xebec and Centronics, to name a few.

Celebrating its 15th year, the “OEM Only” ICs bring you the volume buying decision makers, together with the key suppliers of computer and peripheral products. The ICCs also bring you a full day of high-tech seminars, explaining the latest in computer product technologies and what they mean to you, the systems design engineer.

As an invited guest, there is no charge to attend the seminars or product displays.

For more information: R.J. Johnson & Associates, Inc.
3151 Airway Avenue, #C-2
Irvine, CA 92714
Phone: (714) 957-0171
Fax: 308025996 M JOHN
Oracle Corporation joins Dr. E. F. Codd in asking:

WHY ARE THESE PEOPLE CALLING THEIR DBMS RELATIONAL?

"Some vendors of nonrelational DBMS have quickly added a few relational features—in some cases, very few features—in order to be able to claim their systems are relational, even though they may not meet simple requirements for being rated minimally relational."

Dr. E. F. Codd, Computerworld, 10/21/85

"I know of no other DBMS which scores higher on the twelve rules of fidelity to the relational model than ORACLE."

Dr. E. F. Codd on ORACLE in his paper, "Is Your Relational Database Management System Really Relational? An Evaluation Scheme," 9/10/85.

A truly relational DBMS is so easy to use that, for the first time, end users can access their data independently of the programming staff. Meanwhile, a truly relational DBMS makes your programming staff ten times more efficient in creating production applications. And a truly relational DBMS preserves your investment in application software, and minimizes maintenance, because it provides a vastly higher degree of data independence than non-relational systems.

With all these benefits, is it any wonder that virtually every DBMS but IBM's IMS has employed radical label-engineering and is now calling itself "relational"? But benefits are delivered by products, not labels.

Oracle Corporation introduced the first relational DBMS and the first implementation of SQL back in 1979. Today, the largest companies around the world use ORACLE. In fact, INC MAGAZINE ranks Oracle as the fastest-growing major software company in the USA. ORACLE is the number one relational DBMS, with more than two-thousand installations on IBM mainframes and DEC VAX super-minicomputers. Thousands more on DG, HP, Sperry, Honeywell, Stratus, Prime, Apollo and most other vendors' minis. Ten-thousand more on IBM PCs. We owe this success to three important concepts: Compatibility, Portability and Connectability.

COMPATIBILITY

The ORACLE relational database management system is compatible with IBM's SQL/DS and DB2. SQL/DS and DB2 represent IBM's latest generation of database management technology for IBM's largest computers. ORACLE's capabilities and user interface—the SQL language—are identical to those of SQL/DS and DB2. Programs written for SQL/DS and DB2 will run on ORACLE.

RULE NO. 3

"ORACLE has an outstanding approach here."

Dr. E. F. Codd

PORTABILITY

SQL/DS and DB2 run only on IBM mainframes; ORACLE runs on IBM mainframes, DEC, DG, AT&T, HP, Stratus, Sperry and several other manufacturers' minicomputers, and on a wide range of microcomputers including the IBM PC/XT and PC/AT. All versions of ORACLE are identical and include a complete implementation of SQL—not a subset.

CONNECTABILITY

Having the same software running on your mainframe, minis, and micros greatly simplifies the task of connecting your machines into a network. ORACLE's network software allows microcomputer users to directly access data stored in the shared database on the mainframe or minicomputer, or copy that data into the database on their micros and operate independently.

RULE NO. 11

"ORACLE fully supports this rule."

Dr. E. F. Codd

T o attend the next free, half-day seminar in your area or receive additional information, write Oracle Corp., Dept. C6, 20 Davis Drive, Belmont, CA 94002, or call 1-800-345-DBMS. From now on, it's the only DBMS phone number you'll ever need.

1-800-345-DBMS
Xerox offers net to serve IBM micro, MS-DOS compatibles

Expands office systems line with workstations, printers, telecopier

By Charles Babcock

NEW YORK — Xerox Corp. officials last week announced they will offer an entry-level local-area network that serves IBM Personal Computers and Microsoft Corp. MS-DOS compatibles over twisted-pair telephone wire.

The Xerox Communications 22 (XC 22) network is a version of AT&T Information Systems' Starlan network and is marketed by Xerox under an agreement reached with AT&T in April, Xerox said.

The XC 22 baseband network transmits data at a rate of 1M bit/sec. over telephone wire. A common configuration would place 10 personal computers on the network at a distance of up to 400 feet, said Robert V. Adams, president of Xerox Systems Group, during a press conference in New York Wednesday.

With an optional device, the network extension unit, up to 11 workstations may be connected to the network. They may be located 800 feet from the extension unit and 600 feet from each other.

Any Xerox 6060 workstation equipped with a hard disk can function as a server on the network, eliminating the need for dedicated hardware to control network schedules, Xerox officials said.

XC 22 will be available at the end of the first quarter and can be installed at a cost of $420 per workstation, Xerox officials said.

XC 22 link to XC 24

Adams said Xerox is committed to producing local-area network products that will allow the XC 22 to connect to the higher speed XC 24 local-area network announced in November. The XC 24 transmits data at a rate of 10M bit/sec.

The XC 24 can connect up to 30 MS-DOS personal computers over a 600-ft coaxial cable and as many as 900 devices with additional cabling and repeaters. The XC 24 can share the same cable as an Ethernet network. Personal computers on a shared cable can be configured via software to be a member of one or both nets, Adams said.

Xerox markets the Xerox Network System (XNS) version of Ethernet, and the addition of a dedicated XNS network server to an XC 24 network will allow XC 24 users to migrate to a full XNS network, Xerox said.

Xerox also said it designed both the XC 22 and XC 24 networks to support application software intended to run under the MS-DOS 3.1 operating system, making them "software-compatible" with the IBM Token-Ring and PC Network, Xerox said.

Software compatibility, however, only permits IBM's PC-DOS and MS-DOS software to run on both the IBM and Xerox networks. An MS-DOS disk can be transferred physically from a machine on one network to a machine on the other, according to observers familiar with both offerings.

In other announcements, Xerox said it was continuing to expand its office systems line:

It announced two mid-range printers, the 4050 laser printer and the 4050 color ink-jet printer. The 4050 can print up to 50 page/min and was designed for volumes of up to 750,000 page/mo. A typical on-line version of the printer costs $140,500. It is available in selected cities immediately and will be available nationwide in the second quarter.

The 4020 ink-jet printer for personal computer users offers seven colors in 4,000 shades and prints a color graphics page in approximately two minutes. It is targeted at the low end of the engineering/scientific market as well as offices, Xerox officials said. It is compatible with 50 popular business graphics software packages developed for the IBM Personal Computer and compatible applications. They range in price from $100 to $495.

Xerox has added Integrated Financial Management to its business solutions packages to run on the Xerox 6085 MS-DOS professional computer, to create both text and graphics. It will be available in mid-1986, when prices will be announced.

Xerox announced a compact 700-series scanner for sending and receiving documents. It transmits at the rate of 0.6 bit/sec. but can fall back to speeds of 7.2K bit/sec., 4.8K bit/sec. or 2,400 bit/sec. It is compatible with most newer facsimile machines and is priced at $2,295. It will be available March 3.

Xerox announced Version 2 system software for its XPS 700 series, its line of electronic publishing systems that manage the input, composition and printing of documents. It will be made available to existing customers at no charge.

Xerox also made available six new or expanded modules in its Viewpoint system and VP series application software. They range in price from $100 to $405.

Xerox has added Integrated Financial Management to its business solutions packages to run on the Xerox professional computer, usually in conjunction with a department Digital Equipment Corp. VAX. Through the finance package, information on a company's cash position can be retrieved from the VAX and managed on the 6085.
Honeywell nixing Multics line

From page 1

The unwelcome news will not come as a complete surprise to the close-knit Multics community. The operating system, which was commercially introduced in 1973, has never garnered significant market share throughout its history, despite the fact that it represents a technical milestone and currently is the only operating system with a U.S. Department of Defense B2 security rating.

At an April 1985 HLSUA board meeting, the company foreshadowed this morning's bad news with the cancellation of a project, code-named Flower, that would have supplied a high-end Multics mainframe. "Cancelling the program was totally unexpected," said Ron Wong, HLSUA president and a member of Ford's Multics support staff. During 1984, Honeywell Vice-Chairman Dr. James J. Renier, then president of Honeywell Information Systems, visited users and told them about Honeywell's commitment to Flower.

The cancellation raised the ire of loyal users who had planned continued Multics use. "Any migration to another operating system represents a functional regression," noted one MIS manager who did not want to be identified.

This manager and others were not pleased as Honeywell's plans unfold last summer. Faced with the death of the operating system, users presented the company with three alternatives: build the Flower processor, port Multics to another company's high-end Multics hardware, will be manufactured until 1988, and two additional releases of the operating system, one in 1986, are scheduled.

However, users are very concerned about the cost of migrating to the new system. "Migration brings with it a high cost," Wong said. "A company must sacrifice opportunities to develop new applications or enhance existing applications. Also, there is a tremendous cost just moving applications from one system to another."

Users are also concerned about Honeywell's continued commitment to Multics. The company has pledged to support Multics "throughout the life cycle of the product" but would not pinpoint how long that life cycle would be.

For those users who choose to work with Honeywell, the migration path will begin to become clearer when the new 32-bit system is announced. The processor will not meet the needs of some large users who are already taxing their CPUs. To meet the large users' needs, Laubascher stated that in 1988 the company would add another system capable of supporting Multics.
**Honeywell nixes Multics**

From page 13

processing transactions at speeds up to 10 million instructions per second.

Another option, which some users are already taking, is to work with other vendors. Southern Co., an Atlanta utility company, installed a Multics processor approximately four years ago to complement existing IBM and Honeywell hardware.

The system has been primarily used for record management and graphics.

**Support not the greatest**

Dale Steinmeyer, a manager at Southern's system support department, said that the company has begun to trade in its Multics applications for IBM VM/CMS applications. "In the last few years, IBM's graphics capabilities have been improving," he said. "Also, Honeywell's support has not been the greatest, and we expect that sooner or later the company would withdraw full support."

Multics has suffered through an up-and-down history, and the company had previously considered dropping the operating system. "Whenever we considered dropping the operating system, shipments would increase or the company would decide to try another marketing approach," Josephs said. "Marketing has always been Multics' principal problem. "Multics is the best product that Honeywell has ever had to offer, but the product has been badly mis-understood in the industry and at the company," one observer stated.

The operating system was the result of a mid-1960s research project conceived by MIT, AT&T and General Electric Co. Team members included professionals, who later played key roles at Prime Computer, Inc. and Stratus Computer Co., as well as the designers of AT&T Unix.

Upon its completion in 1969, Multics represented an advanced, technically pure operating system with features such as a relational data base, inherent security and dynamic linking.

As the finishing touches were made to the operating system, GE sold its computer business to Honeywell. Along with Multics came Honeywell's GCOS, another large-system, general-purpose operating system, one that was selling quite well.

Honeywell decided to market Multics to a select number of academic and government agencies where a small but loyal following emerged. For a number of years, Honeywell tried to position Multics in one of the small market. The project met with resistance of the Flower project.

"Multics users are a very diverse group, and we expected that sooner or later the company would withdraw full support." Josephs said. "Marketing has always been Multics' principal problem. Multics is the best product that Honeywell has ever had to offer, but the product has been badly misunderstood in the industry and at the company," one observer stated.

The operating system was the result of a mid-1960s research project conceived by MIT, AT&T and General Electric Co. Team members included professionals, who later played key roles at Prime Computer, Inc. and Stratus Computer Co., as well as the designers of AT&T Unix.

Upon its completion in 1969, Multics represented an advanced, technically pure operating system with features such as a relational data base, inherent security and dynamic linking.

As the finishing touches were made to the operating system, GE sold its computer business to Honeywell. Along with Multics came Honeywell's GCOS, another large-system, general-purpose operating system, one that was selling quite well.

Honeywell decided to market Multics to a select number of academic and government agencies where a small but loyal following emerged. Universities were enamored of the technical purity of the system and the product's ability to serve as a front-end processor for Cray Research, Inc. supercomputers. Government agencies were interested in the system's security features that were built into the operating system rather than being layered on top of it, which is typical for most large system operating systems.

The loyal following pressured Honeywell into introducing the product commercially in 1973. Despite its technical elegance, the operating system was never widely accepted in commercial markets. Ford is one of only approximately half a dozen large companies that chose to work with Multics.

A number of factors inhibited broad market acceptance. The operating system requires a lot of internal and external memory that pumps up its hefty initial price.

Also, third-party software principally consists of only utilities and languages. Little application software is available, and none of the popular data base management or payroll systems can run under Multics.

**Did not pursue third parties**

Users charged that Honeywell never actively pursued third parties. Honeywell said that the small user base dulled third-party interest. "We met with a company that had a package written in PL/I," Laubscher said. "Ninety percent of Multics' code is PL/I, so it should have been a rather simple port. The third party declined to write for Multics and was more interested in our small system line. He looked at the small Multics user base and the 30,000 small system licenses we have, and there was just no way he could justify writing for Multics."

Users added that Honeywell pushed its popular GCOS operating system at the expense of Multics. Honeywell also denied that claim. "Multics hasn't had the marketplace acceptance that many of our users felt it should, but it wasn't because we weren't trying to sell it," Josephs said.

In 1983 at the behest of a few large customers, Honeywell tried to position Multics in the office automation arena. Responsibility for the product was moved from Honeywell's Large Computer Products Division in Phoenix to the Office Management Systems Division in Billerica, Mass.

**Flower dries up**

A pilot project at Honeywell and one customer's site were set up to determine how well Multics would fit in this market. The project met with mixed results, which was a chief reason for the cancellation of the Flower project.

Jospehs, who took control of Multics in January 1985, searched for a niche for the beleaguered operating system. "Multics users are a very diverse group, and we were unable to find a niche for the product," he said. "The markets we examined just did not supply enough volume to justify substantial new investments."

So, Josephs had a decision to make. "One has to separate the users' strong technical love for Multics from a hard cold business decision where one has to make an investment," he said.

---

**WIZDOM**

*the intelligent problem solver*

**EXPERT SYSTEMS**

*for COMMERCIAL APPLICATIONS*

(IBM PC, XT, AT & Compatibles)

WIZDOM is powerful. For practical knowledge domains: Business, Financial, Manufacturing, Medical, Engineering, Insurance... and more.

Call or write:
Software Languages Laboratory, Inc.
Dept. C, 1503 Lamont Ave., Delafield, WI 53118.
(518) 589-1876 or TELEX 888361 SFTDWINH

---

**THE BEST ON YOUR VAX**

ACCENT R 4th GL and RDBMS offers the best solution.

Programming will have the power to develop complex application systems in a fraction of the time with ACCENT R's structured programming. Multics is expensive.

End Users will have the information they need when they need it with ACCENT R's non-procedural command language and full screen terminal interface.

If only the best will do for your programming needs, take a look at ACCENT R. We make it easy with a risk free 30-day evaluation.

**Jospehs**, who took control of Multics in January 1985, searched for a niche for the beleaguered operating system. "Multics users are a very diverse group, and we were unable to find a niche for the product," he said. "The markets we examined just did not supply enough volume to justify substantial new investments."

So, Josephs had a decision to make. "One has to separate the users' strong technical love for Multics from a hard cold business decision where one has to make an investment," he said.

---

**WIZDOM**

*the intelligent problem solver*

**EXPERT SYSTEMS**

*for COMMERCIAL APPLICATIONS*

(IBM PC, XT, AT & Compatibles)

WIZDOM is powerful. For practical knowledge domains: Business, Financial, Manufacturing, Medical, Engineering, Insurance... and more.

Call or write:
Software Languages Laboratory, Inc.
Dept. C, 1503 Lamont Ave., Delafield, WI 53118.
(518) 589-1876 or TELEX 888361 SFTDWINH

---

**THE BEST ON YOUR VAX**

ACCENT R 4th GL and RDBMS offers the best solution.

Programming will have the power to develop complex application systems in a fraction of the time with ACCENT R's structured programming. Multics is expensive.

End Users will have the information they need when they need it with ACCENT R's non-procedural command language and full screen terminal interface.

If only the best will do for your programming needs, take a look at ACCENT R. We make it easy with a risk free 30-day evaluation.

---

**WIZDOM**

*the intelligent problem solver*

**EXPERT SYSTEMS**

*for COMMERCIAL APPLICATIONS*

(IBM PC, XT, AT & Compatibles)

WIZDOM is powerful. For practical knowledge domains: Business, Financial, Manufacturing, Medical, Engineering, Insurance... and more.

Call or write:
Software Languages Laboratory, Inc.
Dept. C, 1503 Lamont Ave., Delafield, WI 53118.
(518) 589-1876 or TELEX 888361 SFTDWINH

---

**THE BEST ON YOUR VAX**

ACCENT R 4th GL and RDBMS offers the best solution.

Programming will have the power to develop complex application systems in a fraction of the time with ACCENT R's structured programming. Multics is expensive.

End Users will have the information they need when they need it with ACCENT R's non-procedural command language and full screen terminal interface.

If only the best will do for your programming needs, take a look at ACCENT R. We make it easy with a risk free 30-day evaluation.
Honeywell Multics decision irks European users

By Amiel Korrel
Computerworld News Service

PARIS (CWN) — Honeywell, Inc.'s decision to phase out its Multics operating system business has raised the ire of European users. According to Alain Buis, president of the French Multics users group, "We feel a bit abandoned."

More than 35 Multics systems have been installed in France, Great Britain, West Germany and the Netherlands. France, with 26 Multics sites, is by far the largest European market.

Bull, which distributes Honeywell equipment throughout much of Europe, has placed Bull in the cross fire between Honeywell and disappointed clients. A senior Bull official said that the company is entering into discussions with its clients to define solutions appropriate to each site.

Angry users are looking to Bull to supply them with a migration solution offering the same functions as Multics. "The decision to phase out Multics has placed Bull in the cross fire between Honeywell and disappointed clients. A senior Bull official said that the company is entering into discussions with its clients to define solutions appropriate to each site."

But according to a French user who requested anonymity, client reaction to Bull's initial propositions has been tepid. Many clients doubt that current operating systems can offer Multics-like functions.

French users, certainly the largest Multics lobby in Europe, plan to petition Bull at the end of January to define a contractual agreement assuring sufficient technical support for the system into the 1990s. Bull, replied the company official, is "ready anytime" to sign agreements with the users. Regardless of the outcome of those negotiations, European users, nearly unanimous in their acclaim of the system, will be sorry to see it go.

"The arrival of Multics was a breath of fresh air for computing research," said Georges Nissen, a manager at the Institut National de Recherche en Informatique et Automatique, "but now that air is becoming rarer."

Korrel is Paris hub bureau chief for the Computerworld News Service.

NCR rings up network links

By Charles Babcock

NEW YORK — NCR Corp.'s Office Systems Division last week announced communications products designed to link its personal computers, workstations and mainframe servers to each other through asynchronous RS-232 cable connections or telephone lines via modems. Remote file and printer access is provided through two additional software products that run on the WorkSaver 300, the Multi-Cluster Interconnect Agent and the Multi-Cluster Interconnect Server.

The maximum data exchange rate with Multi-Cluster Interconnect Level I is 19.2K bytes/sec. At its high-speed level, the WorkSaver Multi-Cluster Interconnect Level II uses Ethernet modules at each master workstation as a network controller for each cluster. The modules provide access to a coaxial cable network supporting up to 64 nodes.

The Level II network conforms to the IEEE 802.3 communications standard and can transmit data at 10M bit/sec over a distance of 500 meters, company spokesmen said.

Additional software, the Personal Computer Connect Package, is needed to allow an IBM-compatible NCR PC/P or PS/PC personal computer to be connected to the Tower server.

Prices on the communications products in Level I are as follows: Level I direct connection asynchronous software, $695 per unit; workstation-to-workstation cable, $100. For remote coollection, a $675 module should be added.

In Level II, the Ethernet Controller Module costs $2,395; the transceiver, $495; and Ethernet I, $695.

For Level II networks requiring servers, the Tower XP server is priced at $16,445; TowerSaver, $995; transceiver, $495; transceiver cable, $850; Ethernet adapter, $2,095; utilities, $200; and network terminal, $100.

Consider the possibilities. Here we have two of the most technologically advanced, yet easy-to-use, plain-paper products in all of image management.

The Kodak Starvue II reader-printer speeds through load, search, index, scan, and print functions. It produces positive prints from either positive or negative film. Not in back, not on the side, but right up front. Controls are close at hand, too. Work flow is improved, productivity potential is enormously increased, and plain-paper prints cost less than 2¢ each.

The Kodak IMT-350 microimage terminal provides exactly the same features and advantages. In addition, it automatically sets up jobs, monitors its own operations, instantly obeys up to 250 computer commands, and delivers directions to operators in plain language.

And if all the efficiencies and economies of these Kodak products weren't impressive enough, there's more. An image-length selection feature lets you select and print images of various sizes. So you can save on toner costs by choosing only that portion of the image you want to print. No more. No less.

For best results, interface the IMT-350 microimage terminal with your computer or any of the family of Kodak KAR information systems. And for high-speed, low-cost retrieval, consider the Starvue II reader-printer. Both use plain paper. Both are plainly outstanding.

For details on the lowest-cost retrieval you can buy, just return the coupon.

Plain-paper printing now with image-length selection.
IBM executive Berland challenged on site licensing, quality, pricing

In the article "IBM Information Services' Berland refutes critics' charges" [CW, Dec. 9], IBM's Robert Berland, director of Strategic Planning for IBM Information Services, stated that site licensing, where a company pays one fee to use as many software copies as it needs, is wrong because it leads to illegal copying and erosion of the software's asset value. Berland further stated that a volume discount structure provides superior asset value protection. These generalities are inaccurate.

A site license is analogous to an "all-you-can-eat" smorgasbord. Not knowing precisely how much food a patron will eat does not prevent the restaurant owner from setting a price. This is because the owner can reasonably estimate the maximum amount of food and drink a person is likely to consume and prevents patrons from taking lobster tails home in their pockets.

Albeit a rough analogy, IBM's pricing challenge is no tougher than that confronting Bob and Betty's Eatery. The number of software copies likely to be made at any site will bear a predictable relationship to certain identifiable characteristics of the site.

Further, it is always possible for the licensor to set some maximum use limitation to avoid abuse. This assumes that copying is limited to the company's internal use, an assumption that draws into the question the second objective of asset protection, namely, the protection of copyrights and trade secrets.

To be sure, the periodic purchase orders issued under a volume discount license serve to identify the number and identity of software copies a company possesses, assuming each such copy is protected.

Although helpful, such a record by itself will not stop misuse and theft of such copies. A properly drafted license agreement, volume discount or software copies it is this potential liability, and not a record of purchase orders and software serial numbers, that induces a company to prevent theft and misuse of a vendor's software.

Although it would be encouraging if IBM would voluntarily embrace and promote site licensing, the opportunities available to a vendor willing to bring its licensing practices back in touch with market realities will ultimately prove too profitable for software vendors, including Big Blue, to resist.

Michael Brownell
Berman, Roberts & Kelly
Chicago

I was extremely disturbed by the responses of IBM's Robert Berland to questions posed to him in the Computerworld article "IBM Information Services' Berland refutes critics' charges" [CW, Dec. 9].

His responses, which, by the way, are not typical of IBM executives, seemed to indicate a considerable apathy toward IBM's software customers and their concerns, particularly in the area of pricing and quality.

For example, to the question of unwarranted and frequent price hikes, Berland's response, "If more customers would buy these products, it would help us all relative to pricing," was a cop-out. Maybe if prices were lower and the quality were more in line with competition, more people would buy the product.

How about his answers to the questions of IBM being faulted for not offering products of as high quality as the competition's? To quote Berland: "You can't expect us to write the package." Well, if you don't have the expertise, why write the package?

Also, this is IBM, not some garage shop. Isn't IBM supposed to have high standards?

Then there was Berland's answer, "Site licensing... is wrong because you have no asset protection." What about the other side of the issue—the customer's needs? Volume discounting does not address the entire issue of why site licensing is needed or warranted.

Throughout the interview, there were numerous examples of a complete lack of sympathy for IBM's software users. As far as I am concerned, it's OK with me if Berland wants to hide behind the big blue walls of IBM, to ignore the facts and to blame the blue walls of IBM, to ignore the facts and to blame the

Sonny M. Taragin
Vice President
Global Computer Services, Ltd.
Glen Burnie, Md.
Things have a way of changing rapidly in the computer business. Like yesterday. And that's why COMPUTERWORLD comes to you weekly.

Get 51 issues for just $38.95. Plus 10 issues of COMPUTERWORLD FOCUS for news analysis all year long.

COMPUTERWORLD.
Keeping Up With Today. Anticipating Tomorrow.
Fill out and mail in the attached postage-paid envelope.

Please enter my subscription to Computerworld at the low Special Introductory rate of just $38.95 for 51 issues, a savings of $5 off the basic rate! Plus, I'll receive the COMPUTERWORLD FOCUS issues FREE with my subscription.

☐ Payment enclosed  ☐ Bill me
☐ Charge my credit card  ☐ AmEx  ☐ VISA  ☐ Mastercard

Signature _______________________________ Card Expires _______________________________

Address shown:  ☐ Home  ☐ Office
☐ I'm already a subscriber, but I'd like to extend my subscription at this special low rate. (Attach mailing label above.)

Canada, Central & South America $110/ Europe $165/ All other countries $245 (Airmail)
Foreign orders must be prepaid in U.S. dollars.

Please complete the information to the right to qualify for the special introductory rate.
There are two major ways to purchase a personal computer. The first is the "name brand" approach - buying from IBM, Apple, or any of the major manufacturers. The second is the "no-name" approach, buying computers from discounter stores or using the "cheat sheets" - the printed manuals that come bundled with the machine, and often contain instructions for how to build or upgrade the computer. The no-name approach is much cheaper, but it has its own drawbacks. For one thing, the hardware is often of lower quality, and the software is often not as reliable. For another, the support is often worse. If something goes wrong, you're on your own. But for many people, the savings are worth it. The no-name approach can be a good choice for those who don't need the latest and greatest technology, or who are looking for a computer that is more suited to their needs. However, it is important to be careful when buying a no-name computer, as not all of these machines are reliable. It is also important to consider the support that is available, as this can make a big difference in the overall cost of ownership. In general, the no-name approach is a good choice for those who are not too picky about their computer, and who are willing to put in a little extra effort to get the best deal.
Multiple Sessions You Can Cost Justify

Now you can dramatically increase productivity on your 327x terminal. Press a key to switch between environments (TSO to CICS or IMS), systems (MVS to VM to DOS), CPU’s (Chicago to New York to Los Angeles), etc.

PIE’s advanced software technology provides multiple sessions using your normal single sign-on ID. No other hardware or software solution offers PIE’s high performance and reliability.

When you log on to your “preferred environment” (TSO, CICS, VM) PIE automatically establishes your multiple sessions. You control who uses PIE, how many sessions they are allowed, what applications they can use and more.

You can switch back and forth between up to 16 sessions with a simple keystroke. Displays are saved exactly as you left them — even the cursor is in the right place.

Sessions can be started automatically or selected from a menu of available applications. PIE enhances any security system by allowing you to automatically LOCK your terminal if you step away for a few minutes.

First Year Savings Exceeded $106,000

“For less than the cost of a couple of 3290 terminals, PIE provides more facilities than a 3270PC without the overhead or expense.”

PIE/TSO For programmers, network control, operations, help desk.

With ONLY ONE TSO-ID you can switch between multiple ISPFs, SDSF, RMF, OMEGAMON, SAS, FOCUS, INFO/MVS, or any VTAM or TCAM applications such as CICS, IMS, IDMS, VM/VCNA, NCCF, and even cross domain to other CPU’s. You have dataset menus, full screen TSO Help, the ability to pass screens back and forth between users or capture screens to notepad or disk (great for technical support, documentation, troubleshooting, etc.).

PIE/VM For programmers, engineers.

Switch between multiple sessions of CMS, PROFS, SAS, FOCUS, or any guest application such as CICS, IMS, TSO, or MVS/consoles. Application menus, automatic sign-on, PF Key assignment, and more make PIE/VM a powerful tool. There’s full protocol conversion — any Personal Computer or ASCII terminal can interface to any application as a 327x terminal.

PIE/CICS For end users, programmers.

With only ONE CICS-ID you can “HotKey” between multiple CICS transactions and any other VTAM application. Without signing on or off you can press a key to switch back and forth between any transaction, electronic mail, spreadsheets, editors, a different CICS, IMS, TSO, ROSCOE, IDMS, VM, or even cross domain to other CPU’s. Create single-key menus that automatically sign user’s on to target applications.

PIE/CICS For end users, programmers.

With only ONE CICS-ID you can “HotKey” between multiple CICS transactions and any other VTAM application. Without signing on or off you can press a key to switch back and forth between any transaction, electronic mail, spreadsheets, editors, a different CICS, IMS, TSO, ROSCOE, IDMS, VM, or even cross domain to other CPU’s. Create single-key menus that automatically sign user’s on to target applications.

First Year Savings Exceeded $106,000

“There are people literally saving hours of time per day because of PIE. As an example, the first day we installed PIE, our security officer saved over two hours after only a five minute demonstration.”

PIE/VM For programmers, engineers.

Switch between multiple sessions of CMS, PROFS, SAS, FOCUS, or any guest application such as CICS, IMS, TSO, or MVS/consoles. Application menus, automatic sign-on, PF Key assignment, and more make PIE/VM a powerful tool. There’s full protocol conversion — any Personal Computer or ASCII terminal can interface to any application as a 327x terminal.

PIE/CICS For end users, programmers.

With only ONE CICS-ID you can “HotKey” between multiple CICS transactions and any other VTAM application. Without signing on or off you can press a key to switch back and forth between any transaction, electronic mail, spreadsheets, editors, a different CICS, IMS, TSO, ROSCOE, IDMS, VM, or even cross domain to other CPU’s. Create single-key menus that automatically sign user’s on to target applications.
NATA critical of FCC, Bell

Report charges Centrex revival as serious threat

By Bryan Wilkins

DALLAS — The North American Telecommunications Association (NATA) charged that the "unbridled promotion" of Centrex services by the divested Bell operating companies will ultimately cause a "crippling effect on the independent telephone equipment industry.

In a report released at its annual convention, NATA said the Centrex revival is a result of "artificial promotion" by the public policies of regulators, principally the Federal Communications Commission.

NATA said the Centrex service, based in a telephone company's central office switch as opposed to the customer's office, allows users to avoid federal access charges at the level equivalent to other lines and has been upgraded with features that render it an enhanced-service rather than a basic telephone line.

The report said Centrex line installation will increase 4.4% per year between 1983 and 1986, resulting in a net loss of more than two million equivalent private branch exchange lines.

The NATA report also said that the area of greatest growth for Centrex was occurring in hotel systems, with less than 100 lines, growth in Centrex has been greater than 50% per year.

In another development, NATA charged that the FCC is allowing the seven regional holding companies and their 22 divested Bell operating companies to fund their competitive equipment sales ventures from regulated local-service revenues.

The article examines the DOD protocol standards within that framework — or framework of distributed data processing and computer networking. The following are two key elements of that strategy:

@ Interoperability. Devices from multiple vendors must be able to communicate. For this purpose, the DOD issued a set of military standards for communications protocols.

@ Long-haul networking. To minimize long-haul communications costs and increase security, the DOD developed the Defense Data Network (DDN) and issued interface standards for attaching components to the network.

This article examines the DDN protocol standards. Next week's article will examine the DDN.

The DDN recently promulgated standards for a set of communications protocols. Its motivations are much the same as those of any computer system customer. The DDN needs to have efficient, compatible communications among computer systems from various vendors. To the dismay of the seven holding companies to which the seven Bell operating companies have a major impact on the design of communications comprising other protocols. The International Standards Organization (ISO) has also been active in this area. It defined a communications architecture — or framework for protocol standardization — and it is the process of developing protocol standards within that framework.

There is every sign that the ISO standards will enjoy widespread acceptance. Despite this expectation, the DOD defined its own architecture and developed its own protocol standards. There are two reasons for this decision:

@ DOD-specific requirements, such as security and robustness, have a major impact on the design of protocols and network architectures. These concerns have not been uppermost in the minds of the ISO developers and, predictably, are not well reflected in its net model.

@ The DDN protocols were specified and extensively used prior to ISO standardization of other protocols. Because the DOD's need was immediate, it felt it impractical to wait for the ISO protocols to evolve and stabilize.

The DOD architecture is based on a view of communications comprising processes, hosts and networks. Processes are the fundamental entities that communicate. Processes execute on hosts, which can often support multiple simultaneous processes.

U.S. view sparks Intelsat dispute

By Bryan Wilkins

WASHINGTON, D.C. — A nasty dispute that has taken on the tones of a family feud is threatening years of goodwill in the International Telecommunications Satellite Organization (Intelsat). The aggrieved party is none other than the U.S. government, which was largely responsible for the 1962 formation of the now 110-member consortium.

At issue is the recent change in U.S. government policy permitting private sector competition to enter Intelsat's monopoly market for international satellite services. To date, five U.S. firms have signaled their intentions and have received preliminary Federal Communications Commission approval.

We all have. — Bob Harcharik, president of MCI Digital Information Services Co.
Now there's one software solution for all your Information Center needs. One solution for all your applications, for all your mainframes, minicomputers, and microcomputers. One solution—the SAS System.

One Solution to Integrate All Your Computing Tasks.

The SAS System gives you efficient data management, superior statistical tools, an easy report generator, customized presentation graphics, and more. Choose between the simple English-like command language or a front-end menuing system with fill-in-the-blank screens. On-line help facilities make it easy to handle every application, quickly and accurately.

You can track sales leads, manage prospect files, determine market share, and present results with the SAS System. Plus you can file employee and applicant records, analyze benefit programs, and manage the payroll. The SAS System can handle all your accounting applications, and produce spreadsheet reports automatically.

That's not all. With the SAS System, you can take orders, keep inventory, and produce mass mailings. Schedule projects, determine product mix, and make forecasts. Your DP staff can measure hard-
ware resources or system usage, test data bases, and run production programs.

One Solution that's Friendly.

It's simple with the SAS System. You can write front-ends for all your SAS applications. With just a few keystrokes, you can modify the applications as your information needs change. One language handles all your tasks. And if you need to move between several operating systems, you'll find the language, syntax, and commands the same for the mainframe, minicomputer, and PC SAS System.

One Solution with Full Support.

Training is easy too. We offer instructor-based, video-based, and computer-based training. Technical support is provided for our mainframe, minicomputer, and microcomputer users, and documentation comes with your system.

Announcing Version 5

Whatever your application, the SAS System is your solution.

SAS Institute Inc.
SAS Circle, Box 8000
Cary, North Carolina
27511-8000, USA.

(919) 467-8000, x280
Telex 802505

The SAS System runs on IBM 3030/30, 43xx and compatible machines under OS, TSO, CMS, DOS/VS, SSX, and ICF; on Digital Equipment Corp. VAX 8600 and 11700 series under VM/SP; on Prime Computer, Inc. Prime 50 series under PRIMOS; on Data General Corp. ECLIPSE MV series under DMSVS; on IBM XT/370 and AT/370 under VM/SP; and on IBM PC XT and PC AT under PC DOS. Not all products are available on all operating systems.

SAS is the registered trademark of SAS Institute Inc., Cary, NC, USA.

Copyright © 1985 by SAS Institute Inc. Printed in the USA.
**ISDN bodes improvements**

From page 19

connected to is a carrier system. If we are talking about a dial-up connection and if Lee telephone company central office switch at the other end of the circuit is an old type, the information will be translated once again into an analog format to be switched. As the information leaves the switch, it may be redigitized for a short-haul fiber-optics system, then switched through a newer digital switch, then retranslated to analog format to be placed on an L5 coaxial or analog microwave long-haul system and so on down the line until the signal reaches its destination.

In the process, noise, cross talk, attenuation, distortion and other factors affect the signal. This, in turn, affects the bit error rate and with it the effective throughput and the user-experienced response time.

Using Nyquist's and Shannon's equations, we are able to show that the maximum conceivable throughput on a Series 5000 line will be around 25K bit/sec. Until a few years ago the problems listed above limited the practical data communications speed for such facilities to 4.8K bit/sec. Improvements in modem silicon processing technology have raised the standard to 9.6K bit/sec.

Modems introduced in the past couple of years are capable of transmitting at 14.4K bit/sec. or even 19.2K bit/sec. for short distances, but users normally find that they have to step back to the "safe" 9.6K bit/sec. mark because of the noise characteristics of private lines. This capacity limitation makes the Series 3000 ill suited for such applications as file transfers, local-area networks for on-premises distribution, video transmission and graphics.

The existing system used to provide Series 3000 private lines is optimized for voice. As such, frequency response, call setup time, throughput, error treatment and use of echo suppressors are geared for voice rather than data. In a system designed for data, echo suppressors will not be present, throughput will be much larger to accommodate for bursts of traffic, call setup time will be shorter, and the protocol will be quite different. Furthermore, data networks will contain error correction mechanisms such as forward error correction or the ability to request retransmissions. Finally, such networks will be totally transparent; when switching networks, users will not have to compensate for technologies, such as time-assignment and interpolation, used in analog systems.

ISDN is the next step in the evolution of the telephone system, and contrary to previous enhancements — such as digital switching and digital multiplexing that have been fairly transparent to the end user — ISDN promises to have high user visibility. The end user in a ISDN data communications user, will see substantially more bandwidth becoming available.

ISDN provides end-to-end digital connectivity, which in turn affords improved economics and performance. It will be an integrated service where the customer may be able to select from a menu of options, enhancing the flexibility of the communication pipe.

**The world’s most experienced UPS manufacturer now offers computer protection “From micro to mainframe.”**

Emerson Electric Co. is the most recognized name in UPS both in the U.S. and worldwide. With the largest base of installed systems in the world, Emerson has maintained a consistent sales leadership position for over 20 years. The critical need for Uninterruptible Power has now extended down from the mainframe computer into office, mini, and now micro applications.

Emerson has responded to this need by introducing an array of new products to cover all critical power requirements. All the products meet Emerson's high standards for quality, reliability, low price, and user-friendly benefits. Such as power monitoring status and simple start-up controls.

AP500 Series (Mainframe)

From 50 kVA modules up to 4000 kVA systems, Emerson's 500 Series systems provide Uninterruptible Power for many major DP sites and critical load needs throughout the world.

AP300 Series (Minis)

These new 15 & 30 kVA three phase systems with self-contained batteries bring quiet, convenient utility power into the DP room environment at lower costs than ever. The 15 kVA provides full UPS for IBM System 38 users.

AP100 Series (Minis)

With single phase ratings of 3, 5, & 10 kVA, the new AP100 Series brings a complete UPS into the office environment to cover a wide number of mini systems requirements. It's quiet, has full monitoring functions, and can meet many power distribution needs.

AP1000 Series (Micro)

Emerson’s newest addition provides micro and personal computer protection from 1500 watts down to 200 watts. And, it's backed by Emerson's history of quality and experience in the UPS business.

For more information on the most complete line of UPS systems available, call 1-800-BACKUPS.

**U.S. view sparks Intelsat dispute**

From page 19

proval to serve the North Atlantic market, which accounts for the majority of Intelsat business revenue.

Intelsat, led by Director General Richard Colino, charges that the competition will be "cream skimming," but he has fought back by making unused transponder capacity available to domestic users at prices and for periods of time that are said to be extremely attractive. This pricing is the source of contention between the U.S. and Intelsat.

Rodney Joyce, acting assistant secretary of commerce for national telecommunications, said U.S. policy favors "anyone who wants to compete in the market segment served by Intelsat." However, Joyce said, "the U.S. has serious questions whether the Intelsat rates are cost-justified."

Joyce's concern is apparently catching on in other Washington offices like the U.S. Congress, where Colino's abrasive dismissal of the U.S. government's concerns have not gone over well, especially since the U.S. pays roughly one quarter of Intelsat's expenses. One top-level congressional aide on the U.S. House of Representatives Foreign Affairs Committee said, "Colino has not helped Intelsat's cause up here at all. He has hurt it."

For its part, Intelsat has firmly asserted that the prices it is setting for its transponders and lease programs, which affect 190 available Intelsat transponders, "are equal to or greater than the prices that would be necessary to recover a full allocation of Intelsat's net book value for costs incurred as well as future program and operating costs." Intelsat said the program will generate $150 million in additional revenues.

The change in U.S. policy to consider satellite transponder capacity as a commodity, where pricing is determined by open market forces and competition, mirrors earlier FCC and congressional policy disputes over the course of the domestic U.S. telecommunications industry, which preceeded the breakup of AT&T.
Communication between processes takes place across nets to which hosts are attached. These three concepts yield a three-level architecture of the network. The transfer of data to a process can be accomplished by first getting it to the host where the process resides and then getting it to the process within the host. These two levels of de-multiplexing can be handled independently; therefore, a network need only be concerned with routing data between hosts, so long as the hosts agree on how to direct data to processes.

Four protocol layers

Using these concepts, it is natural to organize protocols into four layers: the network-access layer, the internet layer, the host-host layer and the process-application layer.

The network-access layer contains the protocols that provide access to a communications network. Protocols at this layer are between a communications node and an attached host or its logical equivalent.

A network layer entity is invoked typically by an entity in either the internet or host-host layer, but it may be invoked by a process-application layer entity. Standards at this layer are needed to attach to DDN.

The internet layer consists of the procedures required to allow data to traverse multiple networks between hosts. Thus it must provide a routing function. This protocol is usually implemented within hosts and gateways. A gateway is a processor connecting two networks whose primary function is to relay data between networks using an internetwork protocol.

The host-host layer contains protocol entities with the ability to deliver data between two processes on different host computers. A protocol entity at this level may (or may not) provide a logical connection between higher level entities.

The process-application layer contains protocols for resources sharing that is, computer to computer, and protocols for remote access, that is, terminal to computer. DOD-issued protocol standards include the following:

- The Simple Mail Transfer Protocol, This is a simple electronic mail facility.
- Telenet. A terminal-handling program, GTE Telenet Communications Corp.'s Telenet was designed primarily to handle simple asynchronous terminals but will also support synchronous terminal traffic.

The network-access layer is part of the architecture. The transfer of data to a process can be accomplished by first getting it to the host where the process resides and then getting it to the process within the host. These two levels of de-multiplexing can be handled independently; therefore, a network need only be concerned with routing data between hosts, so long as the hosts agree on how to direct data to processes.

Four protocol layers

Using these concepts, it is natural to organize protocols into four layers: the network-access layer, the internet layer, the host-host layer and the process-application layer.

The network-access layer contains the protocols that provide access to a communications network. Protocols at this layer are between a communications node and an attached host or its logical equivalent.

A network layer entity is invoked typically by an entity in either the internet or host-host layer, but it may be invoked by a process-application layer entity. Standards at this layer are needed to attach to DDN.

The internet layer consists of the procedures required to allow data to traverse multiple networks between hosts. Thus it must provide a routing function. This protocol is usually implemented within hosts and gateways. A gateway is a processor connecting two networks whose primary function is to relay data between networks using an internetwork protocol.

The host-host layer contains protocol entities with the ability to deliver data between two processes on different host computers. A protocol entity at this level may (or may not) provide a logical connection between higher level entities.

The process-application layer contains protocols for resources sharing that is, computer to computer, and protocols for remote access, that is, terminal to computer. DOD-issued protocol standards include the following:

- The Simple Mail Transfer Protocol, This is a simple electronic mail facility.
- Telenet. A terminal-handling program, GTE Telenet Communications Corp.'s Telenet was designed primarily to handle simple asynchronous terminals but will also support synchronous terminal traffic.

The network-access layer is part of the architecture. The transfer of data to a process can be accomplished by first getting it to the host where the process resides and then getting it to the process within the host. These two levels of de-multiplexing can be handled independently; therefore, a network need only be concerned with routing data between hosts, so long as the hosts agree on how to direct data to processes.
QUESTION: Which is a bigger headache? The COBOL-documentation problem or the high-cost-of-maintenance problem?

ANSWER: Both.

We're not kidding. Documentation and high maintenance costs are both parts of the same big headache. Here's why:

1. **THE PROBLEM BEGINS WITH DOCUMENTATION:** And it begins right at the program-development stage. Most programmers hate to document. And although they may think they are producing well organized programs, they really have no way of judging. If they produce badly organized programs, they will inevitably produce badly organized documentation, too. One always equals the other.

2. **BAD DOCUMENTATION LEADS TO COSTLY MAINTENANCE:** Even if the documentation started out being accurate, it's probably never been updated. When modifications occur, someone's got to go back and attempt to divine the underlying logic before new code can be inserted. A long and costly operation.

No wonder COBOL maintenance may consume as much as 75% of your entire budget!

**FAST RELIEF WITH SYDOC:** Our Structured Documentation System takes the documentation problem off the shoulders of your programmers and puts it where it belongs—on the computer:

- **SYDOC HELPS YOU DEVELOP STRUCTURED PROGRAMS.** It not only provides structured documentation, it is also a very useful guide for the production of structured COBOL programs. Flaws and inconsistencies can be spotted at the development stage. And corrected before they start driving your maintenance costs up.

As a manager, you will—for the first time—have a tool to standardize both your documentation and the quality of your programs.

- **SYDOC MAKES IT EASY TO MODIFY EXISTING PROGRAMS.** It can analyze "orphan" programs without adequate documentation and tell you everything you need to know about the program's structure, logic, variables and relationships. Armed with this knowledge, the maintenance problem shrinks.

No longer is it necessary for skilled programmers to spend days searching for clues about the program's logic. SYDOC makes all necessary information available quickly and easily.

But the best way to find out about SYDOC is to try it. If this remedy doesn't work you'll just have to try another—A-S-P-I-R-I-N.
Changes favor end-user access

The ability of business professionals to access and manipulate computerized information is essential to the management of any organization. Managers have long recognized that computerized information is a primary corporate resource that must be utilized effectively to meet strategic corporate objectives.

Until recently, it was difficult for both business and DP professionals to access and manipulate data. Top executives and managers often had to wait weeks for an overloaded DP staff to respond to requests for information from the data base. DP professionals also had been severely limited in their ability to respond to requests for information or services due to their reliance on inefficient, hand-crafted programming techniques. The manually oriented coding techniques used by most DP professionals are inadequate to meet the rapidly rising demand for access to information and for new computer applications.

Fortunately, major changes that radically simplify the interface between computers and all categories of users are now occurring. These changes represent a fundamental shift away from inefficient, DP-oriented information processing techniques and toward highly automated, end-user-driven techniques.

Advances in hardware and software technology enable information to be made available to executives, managers and operational personnel without direct support of information services. These advances include major improvements in information systems.

See CHANGES page 32

Minno is an independent consultant and editor of "The James Martin Report on High Productivity Languages," a computer-based publication. He is a consultant to organizations that provide continuously updated information on high-productivity tools.

By Mitch Bettis
WASHINGTON, D.C. — The Antitrust Division of the U.S. Department of Justice has developed what it said is the most comprehensive litigation tracking system in the government and now faces the challenge of weaning users away from their personal index card files to the on-line data base.

The new Antitrust Management Information System not only tracks the progress of investigations and court cases but also monitors staffing, personnel costs and other expenses, track court judgments and sentences, provides statistics for department economists and acts as a project accounting system, according to Dan Schwartz, chief of MIS.

Consequently, it can be used by senior management for budget reviews, personnel work load reports and economic studies and for answering congressional inquiries, Schwartz said in a recent interview. To assist other divisions and agencies, the system also tracks cases that have been appealed, he added. Users include about 330 lawyers and legal assistants, about 80 economists and 70 managers in the Antitrust Division.

In the past, lawyers kept track of their cases on index cards because the old batch-oriented tracking system was notoriously inaccurate and outdated. So when it came time to design a new system, "users realized we had a dog of a system and were willing to help us," according to Eugene Newman, senior systems analyst.

Because the users enter the data, it tends to be more accurate, Newman said. "We now put the onus on them to update and maintain their data," he said. "Our goal is to get rid of all those card files."

The new system was built on Cullinet Software, Inc.'s IDS/DM data base management system, running on an IBM 3083 mainframe at Computer Network Corp., a time-sharing facility in Washington, D.C. Users access the data base via Wang Laboratories, Inc. VS 100 workstations (with

SOFTWARE NOTES

Focus language for VAX upgraded

Information Builders, Inc. recently released the first production version of its Focus fourth-generation language for Digital Equipment Corp. VAX processors. Production Release Version 1 was an upgrade to the Early Release Version announcement in June. Production version enhancements allow users to read and relationally join DBMS files and RSMS sequential files and support concurrent updating of the Focus data base. As much as $20 million has been spent on the enhancements, said Peter R. Minno, the company's president.

Inference Corp. and the National Aeronautics and Space Administration have agreed to develop jointly a

By Eddy Goldberg
CARMEL, Ind. — A software package that makes it possible to test the quality of a Cobol program has been released by Eden Systems Corp.

According to President Richard P. Nash-leanas, QuickAudit is a software engineering tool expressly designed for quality assurance, that evaluates the degree to which Cobol programs comply with standards the user has set.

The product can also be used to assure that the quality of existing Cobol programs has not been degraded by maintenance.

QuickAudit includes nearly 200 different measurement standards that users can select in any combination. Each standard features a five-level grading system that users also define.

Q/Auditor runs on any system that has a Cobol compiler.

Version 1 for IBM MVS mainframes is currently available for $25,000. Prices of Q/Auditor vary for other systems.

Antitrust agency develops litigation tracking system

Eden monitors Cobol systems

SOFTWARE & SERVICES

New THIS WEEK

- Triangle Software introduces three Cobol maintenance utilities
- For more on these and other new products, see pp. 77-84.

INSTANT ANALYSIS

"You have to keep up with the field of information technology because it is constantly advancing. Software vendors tend to have nice ideas to begin with, but they don't spend the money needed to keep up with new ideas from other sources." - E. F. Codd on the evolution of data base management systems

BIM Spotlight

Wouldn't it be nice to have a couple more terminals on your desk?

Price: OS - $4000 or $200/mo.; DOS - $2400 or $120/mo.

BIM has 10 system software products for improving productivity and use of DOS/VSE, OS, and DFS, and also performs systems programming, consulting, marketing, and software development.
Exec: first AI language on supercomputer

By Edward Warner
Computerworld News Service

CAMBRIDGE, Mass. (CWN) —
Hoping to capitalize on what it believes is an approaching era of relatively low-cost multimicroprocessor supercomputers, Gold Hill Computers, Inc. recently announced an agreement with Intel Corp. to develop and market jointly a Common LISP language for Intel's Personal Super Computer (IPSC).

The move marks the first time "any AI language is being put on any supercomputer, period," according to Stan Curtis, vice-president of sales and consulting at Gold Hill. Curtis noted that high-powered microprocessors have allowed a new type of supercomputer to emerge — a machine that is actually a team of dozens of microprocessors all working at once. This unique variety of supercomputer offers a ratio of potential price/performance far superior to what supercomputers or dedicated LISP machines currently provide, he said.

Today, LISP machines typically offer processing speeds from 1 to 3 million instructions per second (MIPS), have up to 16M bytes of random-access memory (RAM) and cost about $100,000, Curtis said.

By contrast, the IPSC offers 32 microprocessors — each boasting 1-MIPS performance — and 128M bytes of RAM. In such a configuration, the IPSC has a theoretical top speed of 32 MIPS yet costs only $100,000 or so more than a typical LISP machine, according to Curtis.

From a user's standpoint, he said, the announcement points the way to a time when a business or laboratory can buy an artificial intelligence machine, running at supercomputer speeds, for what a minicomputer now costs.

That, Curtis predicted, will allow corporations to maintain an AI machine ready for compute-intensive, expert system queries such as, "What will a drop in the prime rate do to investments?" Users will get a response from the expert system application as quickly as they get a number from a mainframe data base today.

The advent of LISP support on supercomputers, Curtis continued, also means that the size and sophistication of AI programs will increase. Since they must access a multitude of rules in microseconds, AI applications are limited by RAM. But while the typical LISP machine has a memory ceiling of 16M bytes, Curtis said, the memory ceiling of a IPSC-type supercomputer could extend well beyond even 512M bytes of RAM.

The rub in all of this, of course, is how efficiently all of those microprocessors will be working together. Although Curtis said that tests using a LISP application in physics research kept "80% of the CPUs in a hypercube busy," the true test of the hypercube concept will come as it runs with a variety of LISP software — which is just what Gold Hill is seeking to provide.

Dossier tools get extra functions

PORTLAND, Ore. — Computer Concepts, Inc. has enhanced its Dossier line of shop management tools that run under IBM's DOS/VSE operating system.

Dossier Prove, an automated tool that performs documentation, standards and auditing functions, now supports cross-referenced reports for CICS programs. The software detects calls to CICS file controls, program controls and basic mapping functions. Dossier Prove supports command-level and macro-level CICS routines for programs written in Cobol, PL/I and assembler.

A second package, Dossier Browse, also has been enhanced to run interactively under IBM's CMS operating environment. A one-year license for either Dossier Prove or Dossier Browse costs $125 per month. A perpetual license sells for $3,750.
SUPRA™ is the all new advanced relational DBMS that soars above and beyond the capabilities of any other relational system now on the market.

With SUPRA you get simple, easy access; unsurpassed data integrity; and implementation ease like you've never seen before.

But don't take our word for it. Let us demonstrate exactly how SUPRA works. Close-up. Through our free seminars scheduled across the country.

Come out and see the value SUPRA delivers to your entire organization.

Come out and compare SUPRA to any other relational system that you may be considering.

Come out and experience first-hand, the innovative breakthroughs that have industry experts "very favorably impressed."

Come out and examine the only all-new relational DBMS since DB2.

Act now. Check the seminar schedule. And make your plans today to inspect SUPRA close-up.

We're confident that once you get all the facts, you'll understand why we're saying, "What we used to call competition, we're now calling prey."

SUPRA SEMINAR SCHEDULE

In the U.S., call 1-800-543-3010. In Ohio, call 513-661-6000.

Albuquerque, NM .......... January 31, 1986
Atlanta, GA ................. May 15, 1986
Birmingham, AL ............ April 10, 1986
Boston, MA .................. March 4, 1986
Buffalo, NY .................. March 11, 1986
Cincinnati, OH ............. May 13, 1986
Cleveland, OH .............. January 23, 1986
Columbus, OH .............. February 12, 1986
Dallas, TX ................... January 21, 1986
Denver, CO ................. February 4, 1986
Detroit, MI .................. February 19, 1986
P. Wayne, IN ............... January 29, 1986
Grand Rapids, MI .......... February 5, 1986
Houston, TX ............... March 12, 1986
Irvine, CA ................. January 27, 1986
Kansas City, KS ........... January 21, 1986
Los Angeles, CA .......... January 27, 1986
Louisville, KY ............. April 18, 1986
Madison, WI ............... January 23, 1986
Miami/Fort Lauderdale, FL.. January 30, 1986
Milwaukee, WI ............. January 22, 1986
Minneapolis, MN .......... January 28, 1986
Nashville, TN ............. April 8, 1986
New Orleans, LA .......... February 19, 1986
New York, NY .............. April 16, 1986
Oklahoma City/Tulsa, OK .. February 12, 1986
Orlando, FL ............... May 22, 1986
Philadelphia, PA .......... March 4, 1986
Phoenix, AZ ............... January 30, 1986
Pittsburgh, PA .......... February 13, 1986
Portland, OR .............. February 6, 1986
Raleigh, NC ............... April 16, 1986
Salt Lake City, UT ......... February 3, 1986
San Diego, CA .......... January 29, 1986
San Francisco, CA ......... February 7, 1986
Schaumburg, IL .......... February 20, 1986
Seattle, WA .............. February 5, 1986
South Bend, IN .......... January 30, 1986
Washington, DC .......... April 17, 1986

In Canada, call 1-800-387-9356.

Montreal, PQ .............. February 13, 1986
Quebec City, PQ .......... February 5, 1986
Toronto, ON ............. February 21, 1986

Cincom Systems

2300 Montana Avenue, Cincinnati, OH 45211
“What if...

you could grow from one PC to a network of a thousand without losing control?”
In fact, with HP's Personal Productivity Center (PPC), you can start small or big and create a compatible office information system. A system that lets you manage growth easily. A system that can change as you change, grow as you grow.

The PPC combines the strengths of data processing and personal computing. So individuals, work groups, departments or entire corporations can access, share and exchange information better. Naturally, this lets your people work smarter and more productively. But improving the way your people work with information is just part of the story.

PPC products are compatible across a wide range (more so than even IBM), so you can easily alter, upgrade or expand a PPC configuration. Without re-writing one line of software. For instance, a PPC can be just a few PCs, a local area network, a departmental system based around an HP 3000 minicomputer or a company-wide information network that ties together multiple PPC's. Where you go from there is up to you. It's that flexible.

The PPC is flexible in other ways, too. It can include advanced electronic mail, easy database access from PCs, and IBM mainframe communications that let your people manage information more effectively. The PPC supports a full range of HP products like our IBM PC/AT compatible Vectra PC (which, by the way, is 30% smaller and 30% faster than the IBM PC/AT), The Portable and HP LaserJet printers, to name a few. And since it also supports the IBM PC's, you can extend the PPC to these users as well.

To determine how the PPC can fit your needs, HP people can help. People who don't just sell products, they solve problems. People who follow through with service and support programs. People you can count on to deliver the right Personal Productivity Center... no matter what size you are, or how big you wish to grow.

Find out how we can help. For the number of your nearest authorized HP dealer or sales office, call 1 800 345-6366, Dept 282E today.

HEWLETT PACKARD
Business Computing Systems
Why does one DBMS win so many benchmarks? Find out.

When Computer Corporation of America’s MODEL 204 goes up against the competition, we win. Consistently. And the results are impressing a lot of information system managers.

Because in benchmark after benchmark, CCA has been setting a new standard of performance.

If your organization is currently evaluating DBMS software, you should be talking to us. Because seeing is believing.

Find out why more information system managers are including us in their DBMS evaluations. They’ve got good reasons. Reasons like high performance, Responsiveness to change, Capacity, Efficiency, Vendor reliability and support.

At CCA we don’t promise anything we can’t deliver. And right now, MODEL 204 is simply the best designed production-oriented, 4th generation, relational-based DBMS around.

Isn’t it time to take a look at why all those other information system managers are including CCA in their DBMS evaluation benchmarks?

We’re ready to demonstrate the reasons why. Call 1-800-258-4100, or send the coupon.

I’m interested in evaluating MODEL 204.
Mail to: Four Cambridge Center, Cambridge, MA 02142

Name __________________________________________
Company _______________________________________
Address _______________________________________
City ______________ State __________ Zip ___________
Telephone ______________________________________
Computer ______________________________________

Computer Corporation of America
** A Crowntek Company
Notes: Training centers open

From page 25

software development workstation using Inference's expert system.

Software AG has opened two additional regional user training facilities. Developed at a cost of $2 million, the Hasbrouck Heights, N.J., and Lakewood, Colo., centers will provide instruction in the use of Software AG's Adabas and Adabas. The company also unveiled three new training courses.

Prime Computer, Inc. has acquired marketing rights for Execucom Systems Corp.'s IFPS/Plus modeling and analysis package. Prime will market the product, which combines the Interactive Financial Planning System and a relational database management system, for its 50 series computers.

On-line system tracks litigation

From page 25

IBM 3270 emulation capabilities) connected by dedicated lines to the mainframe, or through a cluster dial-up system using an IBM 3274-like controller made by Telex Computer Products, Inc. and a General Electric Co. 4.8K bit/sec. modem.

Schwartz and Newman designed the information system with an emphasis on easy-to-use data screens driven by function keys and menus. "It should make everything look simple," Newman said. "That's why you have programmers."

After studying user needs and data flows, the system staff developed the on-line system capability for a prototype version and had users test them before starting the full-scale programming effort, Schwartz said.

The MIS department selected the Cullinet package for a variety of price and performance reasons. For example, Schwartz and Newman pointed out that the network architecture of IDMS/R is important for handling the complex data relationships inherent in the case tracking system, and migration to Release 10 of the package brought enhanced security, data dictionary and on-line query features.

Generally, users are accepting the new system as they find they can generate ad hoc reports quickly with reliable data, Schwartz said. For example, lawyers can select data screens that show prior or active investigations that are similar to their assignments and discover which government lawyers have applicable expertise. Direct user access to the database — without intervention by the MIS department — is crucial at a time when the MIS staff is shrinking due to federal budget cuts, he said.

Software AG enhances link

RESTON, Va. — Software AG has released a new version of its micro/mainframe link, Natural/Connect. Version 2 is designed to operate with the IBM Personal Computer family and in conjunction with Natural, Software AG's mainframe fourth-generation language.

Improvements in Version 2 include increased functionality, speed and ease of use. Whereas Version 1 menus were fixed, Version 2 menus can be tailored for, or by, specific users. It allows users to access transparently mainframe applications through stored commands. Mainframe data is transparently converted into a user-selected personal computer format.

Other features of Version 2 include task switching capabilities that let users suspend one application and work on another. The original task is resumed whenever a user chooses. Attendance well beyond the expectations of Software AG.


don't miss the largest, most successful conference/exhibition devoted exclusively to commercial applications of Artificial Intelligence and advanced computer technology

As the leading forum on Artificial Intelligence, Al '86 emphasizes a widening array of commercial applications for increasing productivity and reducing costs in business offices, industrial plants, laboratories and many professions. The conference/exhibition brings suppliers and users together, and serves as an authoritative basepoint for the exchange of many ideas and innovations expected to transform Artificial Intelligence into a multi-billion dollar industry by the end of the 1980s.

Exhibition showcases advanced systems

The exhibition includes computer hardware and software, data processing systems and machines, speech and visual recognition equipment, expert systems, information processing systems, natural language software, data base management systems, general application components . . . and much more. The nation's top suppliers will answer specific questions, conduct technical briefings and demonstrate state-of-the-art systems.

Conference Program

The technical program charts AI's rapid progress into the world of practical application. More than 25 informative technical sessions and tutorial programs focus on the technological advances, with top industry experts serving as chairman and speakers. The General Program Chairman is Dr. Murray Teitell.

Chairman, Dept. of Computer and Information Science, Northrop University.

Who should attend?

This event provides a unique opportunity for business executives, computer systems specialists, engineers, manufacturing/production officials, financial personnel and members of the professions to evaluate AI's potentials . . . and to select the systems, equipment and technology available from the nation's top suppliers. Make plans NOW to attend the 1986 presentation.

Mail coupon today for details

Organized by: Tower Conference Management Company 331 W. Wesley St., Wheaton, IL 60187 (312) 668-8100 Telex: 350427

Co-Sponsored by:

Software AG enhances link

SOFTWARE & SERVICES


computerWORLD

January 13, 1986
Changes favor end-user access

From page 25

ments in personal computer technology as well as in end-user support facilities such as executive information systems, decision support systems and high-productivity application development systems. This new technology can be used to build a computerized corporation.

The first step in making use of the revolution in information technology is to define an effective end-user computing strategy. The objective of the strategy is to target specific end users who are making high-dollar-value decisions and to provide these targeted users with much better access to information. The approach is to get the right information to the right decision makers so they can make better decisions.

The next step is the definition of an appropriate hardware/software architecture. Modern computer architectures for end-user computing maintain networks of personal computers tightly integrated with departmental processors and/or mainframes. An important component of the overall design is a clear definition of both the data and the communications architecture.

The implementation of an effective end-user computing strategy frequently requires a major reorganization of the existing information services organization. This reorganization often involves splitting information services into an end-user support group and a traditional systems development group, both reporting to a business-oriented chief information officer. Most information services managers recognize the need to provide much more proactive support for end users. They should promote, not impede, the movement toward end-user computing and the development of a proactive support organization.

Software tools should not be selected until after the end-user computing strategy and hardware/software architecture have been defined. High-productivity, fourth-generation language tools should be selected according to their ability to support end users and DP professionals within an integrated network of personal computers, departmental computers, mainframes and distributed data bases. Desirable characteristics of such tools include at least a 10:1 improvement in productivity over Cobol and excellent human factoring.

One of the most important criteria in the selection of tools for end-user computing is the availability of support for personal computers. The personal computer is rapidly gaining acceptance as the key component of an end-user computing strategy.

Close integration of micro and mainframe facilities is an important component of end-user computing. At a minimum, support for the personal computer should include the ability to extract mainframe data and download the data transparently to the personal computer in a variety of standard personal computer data formats. In addition, the micro user should be able to process the downloaded data using either standard personal computer tools or a personal computer version of a mainframe, fourth-generation language tool. Prototype applications developed on the personal computer should be transportable without change for operation on the mainframe.

Exceptionally good human factoring is a growing requirement for end-user tools. There is no longer an excuse for tools that use alien syntax, specialized command languages or hard-to-remember codes. Users should look for tools that are graphics oriented and support rapid selection of menu items or icons using pointing devices such as a mouse or a touch-sensitive pad. Tools should be user seductive—in other words, they should be able to engage the user fully in a rapid sequence of interactions focused on the solution of a business problem.

Additional improvements in information technology directed primarily toward DP professionals include the availability of greatly improved design processes and the growing integration of expert systems technology with high-productivity languages. Sophisticated design automation tools that provide a detailed, on-line analysis of a specification as it is entered are now available. Some of these tools are beginning to use artificial intelligence techniques to aid in the detection of design errors.

Notes: Firm inks financing deal

From page 31

Master Software, Inc. and Vendor Funding Co. have inked an agreement through which Vendor Funding will finance user purchases of Master Software's Programaster Cobol applications development system. Master Software claims the deal is the first such third-party software financing arrangement. Under the deal, the financial firm will provide 36-month terms for users.

Control Data Corp. unwrapped a site licensing program for nonprofit higher education institutions. A CDC spokesman said that for an annual fee of $1,950 per course, an institution can reproduce in any quantity Plato college-level educational software. The Plato series software covered by the site licensing program are the IBM Personal Computer versions of CDC's Lower Division Education Curriculum.
Microsoft revamps Project

Software tackles bigger jobs in more formats

By Peggy Watt

BELLEVUE, Wash.--Microsoft Corp. has shipped a new version of its personal information management software, Microsoft Project, that can handle larger projects and chart tasks in new formats and includes a new on-line tutorial.

Version 2 of Project, which runs on IBM Personal Computers and was originally introduced in July 1984, can handle as many as 255 resources and 999 activities, said Phil Welt, product marketing manager. The new version also includes Pert as well as Gantt charts, allows schedules to be broken into increments ranging from minutes to months and can chart comparions of planned and actual schedules, Welt said. On-line Help files also were revamped.

Project enables users to enter information in a spreadsheet-like design and to build charts to schedule and track tasks, costs and resources using the critical path method. Pert chart (network) and Gantt charts, are available in the new version, for a total of 14 formats. Version 2 is priced at $395, up from the $250 price tag for Project 1. The higher price will "send a signal to the market that this is a full-featured, business-oriented product," Welt said. Current users may upgrade for $125. Demonstration disks are available for $10.

A typical Project user is juggling a task that has 50 to 60 activities, that will take more than six months to complete and that involves a $150,000-plus budget, Welt said. The user is "pretty technically oriented," he added. "We thought that technical and administrative managers would use it. But we've found that the people who use them were engineers and DP/MIS managers or 'Oypes.'"

Tool saves data for easy transfer

By Eric Bender

BRYN MAWR, PA. — Goldata Computer Services, Inc. has introduced Your Move, a mortgage-resident and copy that captures on-screen data for use as keyboard input, thus providing a straightforward method of transferring data between various programs.

"People on PCs always want to share data between applications without rekeying, but programs often lack suitable import and export facilities, noted Goldata President Elliot Goldberg. Even when those facilities are present, Goldata said, they may operate in a clumsy fashion — for example, users cannot select the fields of data they want to transfer."

Priced at $29.95 until Jan. 31 and $39.95 thereafter, Your Move permits users to key in and areas in which data is to be captured, with the data then stored in a random-access memory buffer or on disk.

Users then can run their application software and input the captured data by hitting one function key.

The utility also features a macro facility that enables users to store a sequence of Your Move commands and execute them with one keystroke, Goldberg said.

Shipping last month with a 60-day, full-refund guarantee, Your Move runs on IBM Personal Computers and compatible systems and takes less than 32K bytes of internal memory.

The software runs with other memory-resident programs such as Borland International's Sidekick but conflicts with a few packages that grab control of the keyboard, such as Samma Corp. word processing program. Goldberg suggested Goldata is a 10-year-old firm that started out in time-sharing and consulting and subsequently moved into microcomputer database management software. The supplier hopes to sell 12,000 copies of Your Move in the product's first year, Goldberg said. "If it saves two hours of clerical work, Your Move pays for itself," he claimed.
INTRODUCING THE PRINTER THAT MAKES THE BEST IMPRESSION ON ANY SYSTEM.

Most printers have been designed to work best with just one computing system. So if you bought different systems for different reasons, you also ended up buying different printers. And matching each printer to its system.

Now there's the LA210™ Letterprinter, compact and flexible enough to do the job of 2 printers. Or 3. Or 4. Because the LA210 gives you a serial interface to match Digital's own complete line of systems, and an available parallel interface for the IBM personal computer and compatibles. You can even order plug-in cartridges that emulate three of the most popular IBM compatible printers. Which means, quite simply, you can expand your computing capabilities any way you see fit. For word processing, data processing, bit map or mosaic graphics. For VAX™ PDP-11™ or any other Digital system, as well as the IBM environment, too.

And you don't need to worry about spending a lot of money for a new printer for each system.

THE LA210 DELIVERS WHAT YOU NEED WHERE YOU NEED IT.

The LA210's system independence is rivaled only by its general versatility. For applications with reams of output, like business accounting or complex scientific programming, the LA210's 9x7 dot matrix printhead will print up to 240 characters per second, or a full double-spaced page every 10 seconds.

But when your needs change, so can the LA210. Flick a switch and the LA210 shifts to an 18x33 matrix for crisp, near-letter quality copy at up to 40 characters per second.

Or let your host computer change modes for you automatically under program control. There's more, too. With its standard Courier type face, the LA210 can print 11 languages,
plus Digital's VT100™ line drawing set. And it gives you a choice of more than 35 optional faces and fonts - Courier, Orator, Gothic, APL, and italics as well as special custom fonts - through plug-in cartridges that let you vary your type face even more. Finally, the LA210 lets you print bold or condensed and change faces or fonts on a dynamic character-by-character basis. So your output is truly customized to suit just about any presentation you have in mind.

Plug-in cartridges also allow the LA210 to emulate three of the most popular IBM compatible printers - the IBM Graphics Printer, the Epson MX80™ with mosaic graphics, and the MX80 with Grafix™ bit map graphics. So you can produce charts and graphs with all the resolution and professional look of bit map graphics. Yet still retain complete compatibility with software that generates mosaics.

All without a hitch. All without compromising a bit of the power of the software you're using.

**STANDARD EQUIPMENT THAT OTHERS CALL OPTIONS. AND OPTIONS OTHERS CAN'T MATCH.**

It wouldn't make sense for a printer this versatile to lack any of the features you really need. So standard equipment includes a 2k buffer and adjustable forms tractor with acoustic cover. Making the LA210 one of the quietest printers in its class as well as one of the fastest.

Add the optional bi-directional tractor, and you can easily handle superscripting and subscripting and full page reverse for multiple column printing. There's even a cut sheet feeder to speed up correspondence on your letterhead.

The LA210 also comes with one more feature no other printer can offer. Digital's exceptional reputation. We've set industry standards with products like VAX and PDP-11 systems. We've done the same in terminals and printers with our VT100, LA36, LA120, and others. In fact, with more than 750,000 printers installed worldwide, we're a recognized leader with a proven record of reliability. And we back every printer we sell with one of the most comprehensive service plans in the business.

**ONE SOLUTION FOR AN OFFICE FULL OF NEEDS.**

No matter what your office needs may be, Digital has you covered with the new LA210.

You can work with systems within Digital's broad line of personal computers, within any of our larger systems - all the way up to the largest VAXcluster™ systems - or within the IBM PC environment.

You can handle mountains of throughput at draft speed, or print professional looking letters with near-letter quality. You can print bit map or mosaic graphics. You can even customize documents - word by word or letter by letter if need be - with a broad range of type faces and special effects. All with a single printer.

So whether you already have a number of different systems in place and want the economies of a single printer that can handle them all, or you just want the added flexibility for future expansion, no single printer handles all your problems like the LA210 from Digital.

**BEST ENGINEERED MEANS ENGINEERED TO A PLAN.**

The LA210, like every Digital hardware and software product, is engineered to conform to an overall computing strategy. This means our products are engineered to work together easily and expand economically. Only Digital provides you with a single, integrated computing strategy from desktop to data center.

For a detailed brochure or more information, as well as the name of the Authorized Terminals Distributor or Digital Representative near you, write Digital Equipment Corporation, 129 Parker Street, Maynard, MA 01754.

**THE BEST ENGINEERED COMPUTERS IN THE WORLD.**

digital™
A cryogenic refrigerator designed to cool infrared sensors has passed a test equivalent to operating device will be used with infrared sensors in space for applications such as defense and geological surveys. The sensors must be chilled to near absolute zero to maintain adequate sensitivity to low-temperature thermal radiation. The VM cooler, developed by Hughes Aircraft Company, is believed to be the only one of its type to have performed this long at such low temperatures.

Demonstrating a key feature of its advanced capabilities, an Amraam missile scored a direct hit on a target aircraft while receiving new target data en route. The test was the fourth consecutive success in the full-scale development program. The unarmed missile was launched from an F-16 flying at supersonic speed at 25,000 feet. The target flew in a head-on approach just below supersonic speed at 20,000 feet. The missile initially flew under control of its on-board inertial reference unit, using target coordinates provided by the F-16's radar before launch. The missile then received post-launch target updates from the F-16 through the radar data link communications system. It used this information to confirm it was on course, or to modify its heading if necessary. In the latter stages of flight, the Amraam switched to its terminal mode using its own active radar. Hughes is developing the AIM-120A advanced medium-range air-to-air missile for the U.S. Air Force and Navy.

An experimental digital-to-analog converter chip is 10 times faster than the fastest conventional device. The chip, being developed at Hughes for advanced airborne radars, uses gallium arsenide as the substrate material. It has a settling time of 200 picoseconds, about an order of magnitude faster than a record-holding 6-bit Hughes silicon device. The new converter so far outdistances commercial devices that design engineers are developing special interfaces so that the device can be hooked up in data conversion systems for further testing and analysis.

Battle management will get sophisticated new automated support when NATO's northern region installs a new system containing what may be the most complex large data base ever built. The system, known as NEC CCIS (Northern European Command, Command and Control Information System), will provide a secure network of computers and displays to support the commanders and staffs at 18 operations centers throughout Norway and Denmark. It will span echelons of command from squadron operations rooms and NATO air defense control centers to regional command headquarters. The system will gather, store, process, and display data to support the range of operational disciplines involved in multiverse battle management. Included are detailed status data on friendly units and intelligence on enemy forces. The system will help commanders use resources effectively and issue orders to tactical units. Hughes heads a team of Norwegian and Danish companies developing NEC CCIS, which is scheduled to go into operation by the end of the decade.

The Hughes Tucson facility, located in picturesque Southern Arizona, is a large, modern manufacturing complex with capabilities for producing advanced missile systems developed by Hughes. We have openings for experienced and graduating engineers to work on such advanced systems as the electro-optical Maverick, radar-guided Phoenix, TOW, and Amraam (advanced medium-range air-to-air missile). Please send your resume to Professional Employment, Dept. S3, Hughes Aircraft Company, P.O. Box 11337, Tucson, AZ 85734. Equal opportunity employer. U.S. citizenship required.

Currency Swings: Cutting Your Risks

If you make payment in a currency other than your own, you face the potential rise in its cost between new and payment times. If you receive payment in such currency, you face a full in its value between new and receipt time. Through interbank and other counterbalancing transactions, we can relieve you of your concern. Phone or relax.

For more information write to: P.O. Box 45068, Dept. 77-10, Los Angeles, CA 90045-0068

Revamped Project out

Gantt chart” as well as schedule by the hour, said Dick Neuman, Westin Hotel Co.'s systems and programming manager for corporate data processing in Seattle. He said he likes the new version’s ability to compare forecasts and actual results, something he could do before only through an interface he wrote between Project I and Microrim, Inc.’s Rhaise 5000 data base manager. Neuman helped beta test the update after using Project 1 for about a year to manage data processing development projects. The new network charts proved helpful in a major project, planning and scheduling equipment purchase and installation.

Anchorage Telephone Utility management assistant Marvin Barnes turned to Project to plan and implement a new customer records system.

"Microsoft Project gives us the structure to put tasks in a logical sequence, track all our resources and do an estimated budget," he said.

Because the program uses standard text characters, it can run on some Microsoft MS-DOS compatible, including the Tandy Corp. instruments, Inc. Professional and Wang Laboratories, Inc. Professional. Project requires MS-DOS 2 or higher and 256K bytes of random-access memory.

Trudge out of a Stone Age

From page 33

management/word processing system, gives one example.

Q&A is "the only microcomputer software with built-in intelligence," the company suggests. The natural language approach was designed to sing that to users, bypassing the biggest problem with traditional data base managers, who "were great after some guy with a degree in computational linguistics set up shop for you," key developer Gary Hendrix commented.

But while the package is well designed and executed, it's not clear that the natural language portion achieves much more than gimmick status. A solid technical structure underlies Q&A's natural language facilities, but many users will tire of answering on-screen questions such as, "Shall I do the following?" or "I don't know the word highlighted above. What would you like to do?"

If a boom in local-area nets finally arrives this year, we'll learn a lot about mul-

tiuser micro software in a hurry. The air will fill with thousands of developers "fingering about mysterious bugs, complicated access schemes and microoperating problems.

But all the time progress is being made — think how magical Q&A would have appeared three years ago when the standard data base manager was Ashton-Tate's Base II or how handy those networks will be when they finally get up and stay up. We're moving ahead, one swamp at a time.
Eternity now fault tolerant
System availability guaranteed in single-point failures

By Jeffry Beeler
SAN JOSE, Calif. — Tolerant Systems, Inc. has enhanced its family of on-line transaction processing hardware to support fault tolerance — a capability the products previously lacked.

Since its introduction in December 1984, Tolerant’s Eternity processor has supported the data integrity features that all on-line transaction processing applications and systems demand, but it now guarantees continuous system availability in the event of any single-point failure, according to Tolerant’s Marketing Director Shirley Henry.

The Eternity series’ fault tolerance has been made possible by the addition of a system interconnect bus, which consists basically of dual Ethernet controllers. The interconnect bus permits up to 15 of Tolerant’s System Building Blocks to be tied together.

As is reportedly the case with other on-line transaction processing systems like those of Tandem Computers, Inc., the Eternity series provides for linear expansion of processing power, Henry said. The firm claims that two tightly coupled System Building Blocks furnish twice as much performance as one machine, while adding a third unit boosts throughput threefold.

Each System Building Block consists of three main components: a user processing unit, a real-time processing unit and an I/O processing and will include up to 16M bytes of main memory and 6.5G bytes of disk storage. It operates

Plexus Unix-based P/75 system targets multivendor environments

By Rosemary Hamilton
SAN JOSE, Calif. — Plexus Computer, Inc. rolled out its top-of-the-line AT&T Unix-based computer last week that it said supports up to 80 users.

The P/75, dubbed a departmental computer, is targeted at multivendor environments. "Typically, what we get from customers is a whole long list of things that we have to connect to," said Kip Myers, a cofounder and vice-president of corporate development. "It would have been dumb of us to have a strategy that directly went against IBM."

The P/75, which has an entry-level price of $36,000, uses a Motorola, Inc. 68030 job processor and can be configured to include up to 16M bytes of main memory and 6.5G bytes of disk storage. It operates under Unix Version Sysv5.2, a Plexus adaptation of Unix System 5.

The system uses the company’s new front-end processor, called the Advanced Communication Processor (ACP), a single-board attachment that performs the 1/O and communications functions. ACP supports IBM Systems Network Architecture, IBM Binary Synchronous Communications, commercial X.25 and Defense Data Network protocols, the company said.

When communications functions are downloaded to the ACP, the job processor is freed for other tasks.

Because of the ACP, Plexus said the P/75 can perform up to twice as fast as the P/60, which had been the company’s high-end offering. Myers said the company does

FREE 12-month warranty with every TI Printer.
Lease or purchase any Texas Instruments Printer from DJC prior to February 28, 1986, and get DJC’s 12-Month Depot Maintenance Warranty at no extra charge. Offer worth as much as $250 depending on printer model.
Call your local DJC office or TOLL FREE now. 800 556-1234, ext. 235.
In California, 800 441-3454, ext. 235.
With Pansophic's TELON™
Travenol Laboratories, Inc.
Saved Over $1,100,000.

Information Services And International Distribution Made It Happen

“Thanks to TELON, the new international on-line order entry system was completed six months early and within budget.”

Ben Wolt
Director of Commercial Systems
Travenol Laboratories, Inc.

“We now process orders five times faster...and the reduced inventory overhead means the system paid for itself in just four months.”

John Helpap
Director of International Distribution
Travenol Laboratories, Inc.

“Three years ago, my department received the mandate—create a new, international, on-line order entry system and deliver it within six calendar months. We calculated a minimum of twelve calendar months to build the system at a cost in excess of $115,000 using traditional development methods. The solution? TELON...the applications development tool that doubled our productivity almost immediately.

The TELON pilot project created 50 IMS DB/DC programs, including order processing, on-line maintenance, billing interface, and invoice review. With a 2-to-1 productivity increase from detail design through string test, TELON delivered complex applications in record time and brought the project in with savings in excess of $60,000. The users, as expected, were delighted.

“In the three years since we installed TELON as the shop standard, we’ve added more than 700 IMS DB/DC programs to our production library and increased our maintenance productivity to about 5-to-1. TELON’s powerful features fit our MVS/XA environment, and it even generates COBOL code and reusable MACRO statements. Training is rapid, and so is staff acceptance. In fact, the work itself is more interesting, challenging, and pleasant since TELON has been installed. With TELON, we’ve doubled our productivity without compromising commitments to existing systems and techniques we know have worked well.

“The benefits of working with TELON are substantial. Detail design, coding, and testing are reduced, so our overall timeframes are compressed by at least 50%. With quicker delivery of improved systems by smaller project teams, TELON has delivered a productivity payoff that’s corporate-wide.”

“With TELON, we’re doing more with less.”

TELON offers unmatched application development productivity in the Pansophic tradition—a tradition built on over 24,000 installed software products including EASYTREIEV® PLUS, PANVALET®, and GENER/OL®. Contact us today for a demonstration of TELON...and discover its power and productivity first hand.

“Travenol ships over $200 Million in health care products to 96 foreign countries every year. When the world is your marketplace, the logistics are staggering. My department is called upon to coordinate inventory, order entry, shipping, language and currency translation on a daily basis. Under the old system, the pressure was enormous.

“Working with Ben’s group on the TELON pilot project, we created the optimal solution—an order processing system that lowers inventory and overhead. Here’s how it works: About 9:00 a.m. each workday, our computer connects with our agent at the port of departure. The program extracts the necessary paperwork, books the cargo, and even electronically files the declaration with the Commerce Department. The system also prepares documents in Portuguese, French, and Spanish...and it computes the prices in escudos, francs, and pesetas, if necessary.

“The payback was as timely as the operation we created. The entire system paid for itself in four months...and since that time, it has paid for itself many times over. With the TELON pilot project, I’ve documented savings of $1,100,000 in personnel, inventory, and operations in one year. Order processing time from our subsidiaries and foreign customers has been reduced from five working days to just one. We’ve enhanced our ability to support the priorities of other divisions, as well as the company as a whole. The TELON pilot project has energized my department and boosted morale throughout our international network.

“Systems created with TELON enable us to make the best organizational use of information...and now there’s no limit to what we can accomplish.”

™TELON is a registered trademark of Pansophic Systems, Inc.

Yes, Pansophic—I’d like to see TELON in action. Please have your representative contact me.

Name
Title
Company
Address
City State Zip
Phone

I need: [] Meeting User Requirements 
[] MIS Cost Control
help with: [ ] On-line Application Backlog

Pansophic Systems, Inc., 709 Enterprise Drive, Oak Brook, Illinois 60521
1-800/825-7335, in Illinois 312/986-6000
AUSTIN, Texas — Texas Instruments, Inc.'s Data Systems Group has announced enhancements, including additional memory and a Cobol accelerator, for its Business System Series 600A and 800A/B minicomputers.

The 600A series is now available with up to 1.5M bytes of on-board memory, in addition to the previous 512K-byte and 1M-byte configurations. The 800A/B series, with a previous maximum of 512K bytes, is now available with 1M byte of memory.

Prices for 600A configurations begin at $28,995. Prices for the 800A/B begin at $41,995.

The Cobol accelerator is manufactured by Ten X Technology, Inc. and is available as an option for the 600A and 800A/B. It was designed to relieve bottlenecks caused by overloads of Cobol programs by off-loading non-I/O Cobol. It costs $5,795.

Plexus P/75 system bows

From page 37

not measure performance in millions of instructions per second directly but in a series of benchmark tests in which the P/75 performed from 1% to three times faster than the P/60.

While the computer can accommodate up to 80 users, Myers said a typical configuration would be between 30 and 50 users, which would sell for between $50,000 and $60,000.

The minimally configured standard, supporting up to 16 users, comes with a 15-slot card cage, 1M byte of error-correcting main memory, a 60M-byte cartridge tape, a 5.25-in. Winchester disk drive and a 145M-byte, 8-in. Winchester disk drive.

Myers said the P/75 is compatible with the Plexus line. An upgrade kit for the P/60, which is a trade-in of the Motorola 68000 CPU for the 68020, costs about $4,000.

Season opens for industry

From page 37

briefings of the sales force.

“IBM will have announcements every other week or so from now right through the end of the first quarter,” Chuba said. He said other IBM products expected in the coming months include a replacement for the 3624 controller, a 3800-class printer, a low-end version of the 3480 cartridge tape drive and an autoload feature for the 3480.

Gens noted that IBM will concentrate on reducing the price/performance ratio for its 4350 family of low-end mainframes and superminis, according to Gens, who noted that DEC and DG claim price/performance ratios that are half those of the 4361 and 4381, with a replacement for the 4300s not expected until 1987.

To answer DEC and DG, IBM probably will introduce a 7 million instructions per second version of the 4381, a uniprocessor 4381 and a low-end 4361, Gens said. He said he also expects price cuts of 30% to 40% for existing 4300s and cuts for the remaining 3090 mainframes that were supplanted by the 3090.

According to Gens, IBM will focus on delivering products as soon as possible after they are announced. For example, he said he expects the Model 100 to be announced in January and delivered as soon as the second quarter of 1986.

If the rumor mills are right, most of these announcements, in addition to the usual surprises, should come in the next six weeks. It’s clear that the computer industry, which offered little for a month, is snapping out of its annual holiday daze.
The spectacular productivity machine.

You're looking at a model that's about to reshape your image of a computer terminal.

Sure, it's got eye-catching looks. But more than that, it combines some of the most dazzling specs you've ever seen.

The kind that can make your operators—and your system—more effective than ever.

**Screen**
- 14" Flat-profile CRT with exceptionally high resolution.
- Crystal-clear soft white, green or amber display.
- Multiple screen sizes up to 36 lines by 132 columns.
- Real-time clock/calendar.

**Keyboard**
- 108-key fully re-configurable keyboard.
- Designed for efficient data entry/retrieval.
- Styled for operator comfort.

**Software**
- Up to 6 windows for multi-tasking environments.
- Extra pages of local text storage.
- Compatible with industry-standard VDT protocols.
- Down-loadable character sets.

**Enclosure**
- Soft color tone, elegantly styled.
- Engineered for cool operation.
- Uses minimal desk space.

**Communications**
- Selectable RS232C/RS422 bi-directional ports.
- True 8-bit data capability.
- Baud rates up to 38.4 Kbps.

To screen test one of our attractive new models, call your local distributor today. Or contact Falco Data Products, 1294 Hammerwood Avenue, Sunnyvale, California 94089. (408) 745-7123. Toll-free (800) 835-8765.

The Falco 500. We think you're going to admire its body. But we know you're going to fall in love with its mind.
Quadram presents
the multifunction test
that AST failed.

<table>
<thead>
<tr>
<th>Silver Quadboard</th>
<th>SixPakPlus</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reliability:</strong></td>
<td><strong>Reliability:</strong></td>
</tr>
<tr>
<td>Advanced 256K tech-</td>
<td>Limited to 64K</td>
</tr>
<tr>
<td>nology combines with</td>
<td>technology.</td>
</tr>
<tr>
<td>64K technology for</td>
<td></td>
</tr>
<tr>
<td>greater reliability.</td>
<td></td>
</tr>
<tr>
<td><strong>Features:</strong></td>
<td><strong>Features:</strong></td>
</tr>
<tr>
<td>Two serial ports standard.</td>
<td>One serial port maximum.</td>
</tr>
<tr>
<td>Game port standard.</td>
<td>Game port extra.</td>
</tr>
<tr>
<td><strong>Warranty:</strong></td>
<td><strong>Warranty:</strong></td>
</tr>
<tr>
<td>5 year extended warranty</td>
<td>2 year warranty.</td>
</tr>
<tr>
<td>with 384K (factory installed).</td>
<td></td>
</tr>
<tr>
<td><strong>Compatibility:</strong></td>
<td><strong>Compatibility:</strong></td>
</tr>
<tr>
<td>100% PC compatible.</td>
<td>100% PC compatible.</td>
</tr>
<tr>
<td><strong>Software:</strong></td>
<td><strong>Software:</strong></td>
</tr>
<tr>
<td>RAM Drives, spooler and productivity software.</td>
<td>RAM Drives, spooler and productivity software.</td>
</tr>
<tr>
<td><strong>Price:</strong></td>
<td><strong>Price:</strong></td>
</tr>
<tr>
<td>Hundreds of dollars less than you would expect to pay.</td>
<td>Hundreds of dollars more than you should pay.</td>
</tr>
</tbody>
</table>

The Silver Quadboard is Quadrant.

Check the facts. You'll see why Silver Quadboard outperforms the competition everyday. Only Silver Quadboard combines so many standard features (including powerful PolyWindows DeskPlus desk top software) to deliver maximum power.

So before you buy a new multifunction board, check the facts yourself. Then check with your local Quadram dealer for a free demonstration. Or contact us at One Quad Way, Norcross, Georgia 30093-2919; 404-923-6666.

**SPECIFICATIONS:**

Silver Quadboard: Memory expansion in 64K or 256K increments, two serial ports, parallel port, game port, clock/calendar, QuadMaster III with RAM drive and spooler software, PolyWindows DeskPlus software.

**QUADRUM**
An Intelligent Design Company.
Expert Systems
The promise of a smart machine

By HARVEY P. NEWQUIST III

Expert systems — computer programs that use human traits like logic to solve problems — will serve as the vanguard for the advance of artificial intelligence into the office. They are the first of AI's new-wave technologies that MIS managers must meet head on.

These systems, which sort and crunch knowledge much as traditional computers sort and crunch numbers, are better suited to office use and are further along in development than any other artificial intelligence technique. Whether or not they are far enough along to bring most organizations strategic benefits remains open to question.

One one hand, about half of the companies in the Fortune 500 actively pursue expert system development, many with the hope of gaining an edge against competitors. Their interest gives the technology quite a bit of credence. Lockheed Corp., Digital Equipment Corp., General Electric Co., General Motors Corp. and Boeing Computer Services Co., for example, all have either begun in-house development or invested in expert system companies. Very few firms in this league ignore the technology altogether.

On the other hand, few expert system success stories have come to the business community's attention. And, frankly, there aren't too many success stories out there.

Most large-scale expert system development remains just that — development. For the most part, innovators in the field are currently finishing up on prototype systems; they still face great obstacles on the road to full implementation. Whether or not expert systems will work their way into corporations on a narrower scale is not open to doubt. They will, and MIS managers must prepare themselves.

Generally, MIS departments are not taking the lead in expert system development. Most shops are holding out until vendors can offer a link between the symbolic environment preferred for expert system development and the standard DP environments preferred for day-to-day business processing.

But while MIS waits for this missing link, users and top management will forge ahead with their own experiments in expert system use. DP professionals must keep abreast both of developments in technology and of action within their own

**Continued on page 44**

Interview:
Donald Waterman on intelligent systems/45

Understanding rule- and frame-based technologies/50

When to custom design an expert system/52

Microcomputer-based expert systems: inexpensive routes to commercial Al applications/54

Understanding symbolic processors and their languages/58
User's system
a great success

EL SEGUNDO, Calif. — LISF may be the language of choice for artificial intelligence programmers, but the developers of one highly successful expert system chose to get by without it.

Developers in Hughes Aircraft Co.'s Electro-Optical Product Operations Division mustered their Hi Class expert system in Fortran, enhanced it in Pascal and ported it to their internal, tightly running, Hi Class solves circuit board assembly problems and proves costing staff understood because LISP wanted to use languages that its experts knew that the desirable hardware language was not designed for expert system applications. Initially, Fortran put the firm at a disadvantage because the language was not designed for expert system development. After the problem-definition stage, however, the project advanced at a healthy clip. Hi Class development began in 1981 on a Hewlett-Packard Co. HP 3000 and switched over in 1983 to an Apollo Computer Inc. 32-bit processor. The system went into production by three-fourths the time that manufacturing and assembly instructions, and it saves costs. The expert system well suited to its task can even perform with its highest degree of certainty and success in areas like aircraft engine analysis, medical diagnosis, where faults and failures can be traced to a defined origin. For example, an engine fails because of a hairline turbine fracture, and a stomach pain arises from a bleeding ulcer.

An expert system well suited to its task can even perform with its highest degree of certainty and success in areas like aircraft engine analysis, medical diagnosis, where faults and failures can be traced to a defined origin. For example, an engine fails because of a hairline turbine fracture, and a stomach pain arises from a bleeding ulcer. An expert system well suited to its task can even perform with its highest degree of certainty and success in areas like aircraft engine analysis, medical diagnosis, where faults and failures can be traced to a defined origin. For example, an engine fails because of a hairline turbine fracture, and a stomach pain arises from a bleeding ulcer.

Figure 1. No organization should develop an expert system merely to play chess. Human chess masters, of course, possess a broader range of skills. Later, expert system developers brought forward more specialized applications (see chart page 51). Even the most recent developments, however, share one trait with their early predecessor: Expert systems excel only at solving specific problems within specific areas of knowledge. They perform with their highest degree of certainty and success in areas like aircraft engine analysis, medical diagnosis, where faults and failures can be traced to a defined origin. For example, an engine fails because of a hairline turbine fracture, and a stomach pain arises from a bleeding ulcer.

An expert system well suited to its task can even perform with its highest degree of certainty and success in areas like aircraft engine analysis, medical diagnosis, where faults and failures can be traced to a defined origin. For example, an engine fails because of a hairline turbine fracture, and a stomach pain arises from a bleeding ulcer. An expert system well suited to its task can even perform with its highest degree of certainty and success in areas like aircraft engine analysis, medical diagnosis, where faults and failures can be traced to a defined origin. For example, an engine fails because of a hairline turbine fracture, and a stomach pain arises from a bleeding ulcer.

Once an organization identifies an application for expert systems, it will proceed to its envisioned end or whether it will fall short of expectations. Successful systems usually center on an immediate need. The impending retirement of a corporation's sole expert in a given field, for instance, brings on an immediate need to preserve that person's expertise. An expert system can capture the individual's skill for the corporation. The expert system will aid and assist experts and novices alike.

An expert system embodies the traits that most people associate with artificial intelligence. It involves, for example, the use of logic (a decidedly human trait, though not one of which all humans seem capable) instead of relying on pattern matching and recognition (of which even insects are capable).

An expert system can respond to an operator's query about how to solve a problem and can give explanations for its answers. In addition, it can offer suggestions for alternative ways to solve the problem. The expert system operates by interpreting the query and comparing it against facts and rules that reside in a knowledge base — a collection of information gleaned from one or more experts in a given field and from supporting texts. (For more on expert system operations, see story page 50.)

These abilities lend themselves to solving most business problems, but only if the system itself is tightly defined. An incident from expert system history illustrates the point. Some of the pioneers of artificial intelligence envisioned an expert system that would rival human chess masters. They succeeded in creating the system, but it could do one thing and one thing only: play chess. Human chess masters, of course, possess a broader range of skills. Later, expert system developers brought forth more specialized applications (see chart page 51). Even the most recent developments, however, share one trait with their early predecessor: Expert systems excel only at solving specific problems within specific areas of knowledge. They perform with their highest degree of certainty and success in areas like aircraft engine analysis, medical diagnosis, where faults and failures can be traced to a defined origin. For example, an engine fails because of a hairline turbine fracture, and a stomach pain arises from a bleeding ulcer.

An expert system well suited to its task can even perform with its highest degree of certainty and success in areas like aircraft engine analysis, medical diagnosis, where faults and failures can be traced to a defined origin. For example, an engine fails because of a hairline turbine fracture, and a stomach pain arises from a bleeding ulcer. An expert system well suited to its task can even perform with its highest degree of certainty and success in areas like aircraft engine analysis, medical diagnosis, where faults and failures can be traced to a defined origin. For example, an engine fails because of a hairline turbine fracture, and a stomach pain arises from a bleeding ulcer.

Executive Report/Expert Systems

The promise of smart machines

From page 43

organizational offices, so they can integrate expert systems into mainstream computing environments when the tools that drive the office merger come to market.

Users will clamor for expert systems soon — and with good reason. Because expert systems accumulate, summarize and analyze incredible speed, these tools can help managers make better decisions.

Even their attractiveness to users, expert systems will infuse most organizations department by department, much as personal computers did before them. The onslaught will begin early this year as packaged expert system applications come to market.

These applications are to expert systems what Lotus Development Corp.'s Visiagic and MicroInternational Corp.'s Wordstar were to business micros: They are task-specific tools that let end users exploit a technology on their own, without much help from programmers.

Another aspect of expert systems — their efficiency at solving narrow rather than broad problems — indicates that these tools will enter organizations haphazardly rather than following a centralized, controlled plan.

Initially, most organizations will develop expert systems as individual fringe projects, usually within a single department or division. These systems, built to solve well-focused tasks like oil exploration or aircraft engine analysis, will have little relation to the data base management systems and financial reports generated within the MIS department.

Therefore, they will stay, for the time being, outside the umbrella of corporate DP. Yet MIS managers must prepare to take part in the utilization of expert systems. As these systems become more prolific and take on tasks such as asset management and intelligent test instruments that do affect the corporate host, MIS departments will need to assume control.

Right now, MIS managers will be advised to learn all they can about expert systems. A keen understanding of what an expert system can and cannot do will enable them identify the appropriate trial applications, knowledge of expert system development methods and tools will help them carry out initial projects with maximum success.

MIS managers must also keep watch for key technical advances in hardware, software and communications. These developments will signal that the time to act with greater urgency has arrived.

Abilities and limitations

An expert system embodies the traits that most people associate with artificial intelligence. It involves, for example, the use of logic (a decidedly human trait, though not one of which all humans seem capable) instead of relying on pattern matching and recognition (of which even insects are capable).

An expert system can respond to an operator's query about how to solve a problem and can give explanations for its answers. In addition, it can offer suggestions for alternative ways to solve the problem. The expert system operates by interpreting the query and comparing it against facts and rules that reside in a knowledge base — a collection of information gleaned from one or more experts in a given field and from supporting texts. (For more on expert system operations, see story page 50.)

These abilities lend themselves to solving most business problems, but only if the system itself is tightly defined. An incident from expert system history illustrates the point. Some of the pioneers of artificial intelligence envisioned an expert system that would rival human chess masters. They succeeded in creating the system, but it could do one thing and one thing only: play chess. Human chess masters, of course, possess a broader range of skills. Later, expert system developers brought forth more specialized applications (see chart page 51). Even the most recent developments, however, share one trait with their early predecessor: Expert systems excel only at solving specific problems within specific areas of knowledge. They perform with their highest degree of certainty and success in areas like aircraft engine analysis, medical diagnosis, where faults and failures can be traced to a defined origin. For example, an engine fails because of a hairline turbine fracture, and a stomach pain arises from a bleeding ulcer.

An expert system well suited to its task can even perform with its highest degree of certainty and success in areas like aircraft engine analysis, medical diagnosis, where faults and failures can be traced to a defined origin. For example, an engine fails because of a hairline turbine fracture, and a stomach pain arises from a bleeding ulcer.

Figure 1. No organization should develop an expert system merely to play chess. Human chess masters, of course, possess a broader range of skills. Later, expert system developers brought forth more specialized applications (see chart page 51). Even the most recent developments, however, share one trait with their early predecessor: Expert systems excel only at solving specific problems within specific areas of knowledge. They perform with their highest degree of certainty and success in areas like aircraft engine analysis, medical diagnosis, where faults and failures can be traced to a defined origin. For example, an engine fails because of a hairline turbine fracture, and a stomach pain arises from a bleeding ulcer.
Diagnostic problems suited to expert system applications

Donald Waterman is one of the designers of ROSIE, a rule-based expert system language, and the author of A Guide to Expert Systems (Addison-Wesley, 1986). Generally, he is a systems scientist at Rand Corp., where his work focuses on the application of expert systems in government and industry. Previously, Waterman was a research associate in psychology and computer science at Carnegie-Mellon University.

During a recent interview with Computerworld Senior Editor Janet M. Krieg, Waterman talked about advances in expert system technology.

Where are expert systems now in terms of their potential?

I think they are just at the beginning of their usefulness. Expert systems are really the leading edge of artificial intelligence technology. In the past, AI was confined to universities and classrooms, but with the advent of expert systems, that changed. Industry now sees the potential for using the technology in a cost-effective way. That is what has made the whole idea of expert systems seem so promising to the outside world, beyond academia, that is.

What types of problems are expert systems suited for in industry?

It is hard to point to any particular area that they are better suited for than others. Expert systems started out with an impact on the medical field, therefore it is now fairly well understood how to develop expert systems for diagnostic-type problems. Of course you can have diagnostic-type problems in areas other than medicine. Expert systems have been developed, for example, in finance and insurance and are applicable to most areas in general. It would not be advisable, however, to try to develop an expert system for a project in a research stage. Even though it could be done, and actually it probably wouldn't be as high as applying it to something that is established.

One advantage is that the expertise that is built into an expert system is generally very high-level expertise. This expertise is very scarce and costly in human terms. Once you have modeled human expertise in an expert system computer program, you can economically duplicate that program and have, in effect, that program in multiple locations solving problems in parallel at the same time.

Do expert systems have any disadvantages?

There are certain advantages. Probably the most obvious advantage is that expert systems are not as creative as human experts can. They aren't able to invent new ideas or come up with new solutions. Management must view the sacrifice as a long-term benefit.

Once the development team secures both a willing expert and the support of top management, it sets out to codify the expert's knowledge. A specially trained professional known as a knowledge engineer carries out this task. The knowledge engineer begins by studying texts and other written material that the expert has prepared. He then conducts one interview after another with the expert to determine how this codified professional makes his decisions. This is a long, laborious task for both the knowledge engineer and the expert because most experts have trouble explaining why and how they make decisions. Yet, if the project is to succeed, they must articulate the subconscious rules of thumb, acquired instincts and gut feelings that the expert follows in his work. The expert and the knowledge engineer must overcome frustrations and

Rand's Donald Waterman

"Managers have to start becoming familiar with the technology just to stay abreast of the competition."

In addition, it is more difficult for expert systems to understand their own limitations so that they won't attempt a problem that they really are not qualified to solve. A real expert can do this quickly. Real experts will say, 'That is not within my area of expertise, and I will refer you to someone who can solve this.' Now with this isn't true. Expert systems can't be designed to do this just because the current crop of expert systems are not designed to do this.

Do you have any recommendations for DP or MIS managers concerning expert systems?

I think managers should start considering expert systems right away. In a sense, they really have no choice. They have to start keeping up with the latest developments just to stay abreast of the competition.

Will expert systems provide corporations with a competitive edge that they need to survive?

Absolutely. In fact, it is probably worse than that. It is probably the other way around. Without expert systems, they will lose the competitive edge, and they won't survive.

If all of this is true, where do human experts come in? Should they work in conjunction with expert systems?

That is a very complex question. If all of this is true, then the expert systems can't be designed to do this just because the current crop of expert systems are not designed to do this.

Diagnostic problems suited to expert system applications

The systems described in this section are of particular interest to DP or MIS managers considering expert systems. They are representative of those systems that are available today and can be used most effectively to solve problems in the workplace?

There are certain advantages. Probably the most obvious advantage is that expert systems are not as creative as human experts can. They aren't able to invent new ideas or come up with new solutions. Management must view the sacrifice as a long-term benefit.

Once the development team secures both a willing expert and the support of top management, it sets out to codify the expert's knowledge. A specially trained professional known as a knowledge engineer carries out this task. The knowledge engineer begins by studying texts and other written material that the expert has prepared. He then conducts one interview after another with the expert to determine how this codified professional makes his decisions. This is a long, laborious task for both the knowledge engineer and the expert because most experts have trouble explaining why and how they make decisions. Yet, if the project is to succeed, they must articulate the subconscious rules of thumb, acquired instincts and gut feelings that the expert follows in his work. The expert and the knowledge engineer must overcome frustrations and

Rand's Donald Waterman

"Managers have to start becoming familiar with the technology just to stay abreast of the competition."

In addition, it is more difficult for expert systems to understand their own limitations so that they won't attempt a problem that they really are not qualified to solve. A real expert can do this quickly. Real experts will say, 'That is not within my area of expertise, and I will refer you to someone who can solve this.' Now with this isn't true. Expert systems can't be designed to do this just because the current crop of expert systems are not designed to do this.

Do you have any recommendations for DP or MIS managers concerning expert systems?

I think managers should start considering expert systems right away. In a sense, they really have no choice. They have to start keeping up with the latest developments just to stay abreast of the competition.

Will expert systems provide corporations with a competitive edge that they need to survive?

Absolutely. In fact, it is probably worse than that. It is probably the other way around. Without expert systems, they will lose the competitive edge, and they won't survive.

If all of this is true, where do human experts come in? Should they work in conjunction with expert systems?

That is a very complex question. If all of this is true, then the expert systems can't be designed to do this just because the current crop of expert systems are not designed to do this.

Diagnostic problems suited to expert system applications

The systems described in this section are of particular interest to DP or MIS managers considering expert systems. They are representative of those systems that are available today and can be used most effectively to solve problems in the workplace?

There are certain advantages. Probably the most obvious advantage is that expert systems are not as creative as human experts can. They aren't able to invent new ideas or come up with new solutions. Management must view the sacrifice as a long-term benefit.

Once the development team secures both a willing expert and the support of top management, it sets out to codify the expert's knowledge. A specially trained professional known as a knowledge engineer carries out this task. The knowledge engineer begins by studying texts and other written material that the expert has prepared. He then conducts one interview after another with the expert to determine how this codified professional makes his decisions. This is a long, laborious task for both the knowledge engineer and the expert because most experts have trouble explaining why and how they make decisions. Yet, if the project is to succeed, they must articulate the subconscious rules of thumb, acquired instincts and gut feelings that the expert follows in his work. The expert and the knowledge engineer must overcome frustrations and

Rand's Donald Waterman

"Managers have to start becoming familiar with the technology just to stay abreast of the competition."

In addition, it is more difficult for expert systems to understand their own limitations so that they won't attempt a problem that they really are not qualified to solve. A real expert can do this quickly. Real experts will say, 'That is not within my area of expertise, and I will refer you to someone who can solve this.' Now with this isn't true. Expert systems can't be designed to do this just because the current crop of expert systems are not designed to do this.

Do you have any recommendations for DP or MIS managers concerning expert systems?

I think managers should start considering expert systems right away. In a sense, they really have no choice. They have to start keeping up with the latest developments just to stay abreast of the competition.

Will expert systems provide corporations with a competitive edge that they need to survive?

Absolutely. In fact, it is probably worse than that. It is probably the other way around. Without expert systems, they will lose the competitive edge, and they won't survive.

If all of this is true, where do human experts come in? Should they work in conjunction with expert systems?

That is a very complex question. If all of this is true, then the expert systems can't be designed to do this just because the current crop of expert systems are not designed to do this.

Diagnostic problems suited to expert system applications

The systems described in this section are of particular interest to DP or MIS managers considering expert systems. They are representative of those systems that are available today and can be used most effectively to solve problems in the workplace?

There are certain advantages. Probably the most obvious advantage is that expert systems are not as creative as human experts can. They aren't able to invent new ideas or come up with new solutions. Management must view the sacrifice as a long-term benefit.

Once the development team secures both a willing expert and the support of top management, it sets out to codify the expert's knowledge. A specially trained professional known as a knowledge engineer carries out this task. The knowledge engineer begins by studying texts and other written material that the expert has prepared. He then conducts one interview after another with the expert to determine how this codified professional makes his decisions. This is a long, laborious task for both the knowledge engineer and the expert because most experts have trouble explaining why and how they make decisions. Yet, if the project is to succeed, they must articulate the subconscious rules of thumb, acquired instincts and gut feelings that the expert follows in his work. The expert and the knowledge engineer must overcome frustrations and

Rand's Donald Waterman

"Managers have to start becoming familiar with the technology just to stay abreast of the competition."

In addition, it is more difficult for expert systems to understand their own limitations so that they won't attempt a problem that they really are not qualified to solve. A real expert can do this quickly. Real experts will say, 'That is not within my area of expertise, and I will refer you to someone who can solve this.' Now with this isn't true. Expert systems can't be designed to do this just because the current crop of expert systems are not designed to do this.

Do you have any recommendations for DP or MIS managers concerning expert systems?

I think managers should start considering expert systems right away. In a sense, they really have no choice. They have to start keeping up with the latest developments just to stay abreast of the competition.

Will expert systems provide corporations with a competitive edge that they need to survive?

Absolutely. In fact, it is probably worse than that. It is probably the other way around. Without expert systems, they will lose the competitive edge, and they won't survive.

If all of this is true, where do human experts come in? Should they work in conjunction with expert systems?

That is a very complex question. If all of this is true, then the expert systems can't be designed to do this just because the current crop of expert systems are not designed to do this.
mental blocks to create a comprehensive and tangible outline of what comprises expertise.

After the two professionals create the outline, the knowledge engineer translates it into computer code, usually in LISP. The knowledge engineer can, however, use any language — from Basic to C — with which he is comfortable. The knowledge engineer then builds a structure known as the inference engine, which can correlate the outline's general rules to more specific pieces of knowledge that will get added to the system later.

In the next step, the knowledge engineer interviews the expert to uncover these specific pieces of information. He then enters the information into the system as a collection of facts, referred to as the system's knowledge base.

From the knowledge engineer's perspective, the expert system project is like a two-part structure. The first part is the outline of what comprises expertise. The second part, the expert system, is a computer program that makes use of the outline. The knowledge engineer then builds a structure known as the inference engine, which can correlate the outline's general rules to more specific pieces of knowledge that will get added to the system later.

Once the knowledge engineer has created the inference engine and the knowledge base, the expert system can be run. The expert system is a computer program that makes use of the outline. The knowledge engineer then builds a structure known as the inference engine, which can correlate the outline's general rules to more specific pieces of knowledge that will get added to the system later.

In the next step, the knowledge engineer interviews the expert to uncover these specific pieces of information. He then enters the information into the system as a collection of facts, referred to as the system's knowledge base.

From the knowledge engineer's perspective, the expert system project is like a two-part structure. The first part is the outline of what comprises expertise. The second part, the expert system, is a computer program that makes use of the outline. The knowledge engineer then builds a structure known as the inference engine, which can correlate the outline's general rules to more specific pieces of knowledge that will get added to the system later.

Once the knowledge engineer has created the inference engine and the knowledge base, the expert system can be run. The expert system is a computer program that makes use of the outline. The knowledge engineer then builds a structure known as the inference engine, which can correlate the outline's general rules to more specific pieces of knowledge that will get added to the system later.
Why do our customers choose Data Design financial software systems over the three largest vendors?

—David Low
President, Data Design

Because they did their homework. They talked to our customers and found out that for over 12 years, hundreds of Fortune 1000 companies have had exceptional results from financial software systems by Data Design.

They discovered what nationally recognized software surveys confirm year after year: that Data Design has an unsurpassed record of user satisfaction.

They learned they can expect fast, trouble-free implementation with our systems.

They were told that our systems are exceptionally flexible and easy to use.

They found out about our reputation for in-depth training and responsive, knowledgeable support.

They learned that Data Design places only management level people in customer service positions. People who average over 10 years experience—not trainees.

And more.


And find out why 68% of our customers, who previously had other vendor's systems in place, have now decided to use systems by Data Design.

To learn more about the best financial software available, call toll-free 800-556-5511 or complete and mail the coupon today.

By) DA DATA DESIGN ASSOCIATES Excellence in Financial Software.

1279 Oakmead Parkway, Sunnyvale, CA 94086
New York Metropolitan Area (203) 661-5668
Chicago Metropolitan Area (312) 310-0450

Financial Software by Data Design. Simply the best.

GENERAL LEDGER
ACCOUNTS PAYABLE
FIXED ASSETS
CAPITAL PROJECT
MANAGEMENT

Please send me additional information on:
□ General Ledger □ Fixed Assets
□ Accounts Payable □ Capital Project Management
○ My need is: [Immediate] [Short Term] [Long Term]
□ I am interested in attending a free seminar.

Name
Title
Company
Address
City, State, Zip
Telephone ( )
Computer Brand
Model

CWD
Introducing Smart Alec.
IRMA's reliable new way to connect PCs to IBM System 34s, 36s and 38s.

He comes from the IRMA™ family, the people who have linked more than 200,000 PCs to mainframes.

He's Smart Alec™, the new interface board that's now opening lines of communication between IBM® PCs and System 34s, 36s and 38s.

Smart Alec's hot key lets PC users switch back and forth from the personal computer to the host computer quickly and easily.

Smart Alec includes his own fast file transfer software for both uploading and downloading data into popular application packages like Lotus 1-2-3® and WordStar®.

He's so smart that he can handle three host sessions simultaneously.

And he's fully compatible with twinax cables.

What's more, our optional file transfer program gives you additional security and record-selection capabilities not available elsewhere.

So if you want your IBM PC, XT or AT to emulate a 5251 Model 11, 5291 or 5292 terminal—and your PC printer to emulate an IBM 5256 System printer—don't worry. It's so easy, a kid can do it.

To find out more about Smart Alec, call us at 1-800-241-IRMA. Or write Digital Communications Associates, Inc., 1000 Alderman Drive, Alpharetta, Georgia 30201.
Before an organization makes a strategic decision to invest in expert system technology, managers must make a conscious choice among expert system technology. The decision to rely on rule-based technology, frame-based technology, hybrid technology, or a hybrid of the two — the three choices currently available to managers — depends so strongly on an in-depth understanding of the different technologies that no MIS manager charged with expert system development can afford to remain ignorant.

Rule-based systems. Figure 1 shows the generic architecture of a rule-based system and how a rule-based system works, a blackboard and an inference engine. The rule base is a collection of statements, or rules, that have yet to be recognized — within a general domain of knowledge. The underlying assumption here is that after accumulating a critical mass of problem-independent knowledge about a given domain, a knowledge-based system will become capable of solving problems within that domain. Reliance on frame-based technology, on the other hand, will allow an organization to solve a variety of problems — even problems that have yet to be recognized — within a general domain of knowledge. The underlying assumption here is that after accumulating a critical mass of problem-independent knowledge about a given domain, a knowledge-based system will become capable of solving problems within that domain. Reliance on frame-based technology, on the other hand, will allow an organization to solve a variety of problems — even problems that have yet to be recognized — within a general domain of knowledge. The underlying assumption here is that after accumulating a critical mass of problem-independent knowledge about a given domain, a knowledge-based system will become capable of solving problems within that domain. Reliance on frame-based technology, on the other hand, will allow an organization to solve a variety of problems — even problems that have yet to be recognized — within a general domain of knowledge. The underlying assumption here is that after accumulating a critical mass of problem-independent knowledge about a given domain, a knowledge-based system will become capable of solving problems within that domain.

Figure 2, which depicts a portion of a frame-based system, shows the two components of a frame-based system: the blackboard and the inference engine. The blackboard is a collection of facts, observations, and similar elements that, taken together, describe the state of the world in which the expert system operates. It can include a mixture of facts, measurements, observations, and similar elements. In the example above, the blackboard might include these relevant items: Joe Smith works in the Boston office; Boston is 210 miles from New York; Joe Smith shows an interest in AT&T's Unix; "Unix in the DP Shop" is a seminar that takes place in New York. The inference engine, the only procedural part of a rule-based system, is the part that actually solves any given problem. It typically consists of two parts: a control mechanism, which uses a predetermined strategy to search through the blackboard and the rule base for solutions to a given problem; and a control strategy, which imposes a set of constraints on the control mechanism to keep it from wasting time on stray leads.

Commercial development tools for building rule-based expert systems typically use one of two predetermined strategies, forward chaining or backward chaining, to guide their control mechanisms' searches.

Forward-chaining control mechanisms begin with a premise and look through the rule base and the blackboard to find possible solutions. These mechanisms set out to answer the question, "What can be inferred from all the elements of the blackboard by using all the rules from the rule base?"

To answer this question, a forward-chaining control mechanism matches the conditional part (C) of every rule against all the elements on the blackboard. The action part (A) of any rule that matches the elements gets added to the blackboard as a newly inferred fact. The process continues until the control mechanism can make no further inferences.

A development tool called OPES, developed at Carnegie-Mellon University, makes use of the forward-chaining method. Organizations can obtain versions of the tool from different vendors for sale on a number of common hosts. Expert Systems Corp. offers ExpertOPES for the Apple/CompuServe, Inc. Macintosh; Artelligence, Inc. offers OPES+ for the Apple/CompuServe, Inc. Macintosh; and Digital Equipment Corp. offers OPS-2 for Vax 11/780.

Backward-chaining control mechanisms begin with a tentative solution (a hypothesis) and look through the rule base and the blackboard to find justifications for that solution. These mechanisms set out to answer the question, "Can the generated hypothesis be justified by the elements of the blackboard by applying the rules from the rule base?"

To answer this question, a backward-chaining control mechanism matches the hypothesis against the action part (A) of every rule. The conditional part (C) of any rule that matches the hypothesis gets tested against the blackboard. Any match of a rule condition to a blackboard element serves as justification for the hypothesis. All mismatches point out other possible hypotheses, which the control mechanism tests in turn.

Teknowledge, Inc., offers two backward-chaining tools, S.1 and M.1, for use on a large number of machines, including Dec VAX 11/780 and various LISP- and Unix-based machines. It will soon work within the Ada environment as well. M.1 runs on the IBM Personal Computer.

Frame-based systems. Unlike rule-based expert systems, which stay within defined architectural boundaries, frame-based systems are dynamic entities that change shape as their constituent parts — the frames and slots — interact.

Frames are collections of knowledge that describe various concepts by listing each concept's features and its relationships to other concepts. Slots are more specific pieces of information; they have typical values and procedures, that attach themselves to the frames and further describe the concepts they represent.

Figure 5, which depicts a portion of a frame-based system designed to describe different types of events, illustrates the features, slots, and their relationships to each other. This system's knowledge base consists of events and their characteristics, events and their causes, events and their duration, location, instructor, date and attendees. Each diamond on the diagram represents a frame, and each set of brackets represents a slot. The diagram also illustrates the general structure of a frame-based system: a collection of frames, each of which defines a concept from a different point of view or at a different level of abstraction. In Figure 5, the frames Seminar, One-Day-Events, and Events-In-New York describe the concept "events" from different points of view. The fractional name Seminar-Unix and Seminar-1 describe it at different levels of abstraction. Each frame, in turn, relates to each adjoining frame in a hierarchy of classes and subclasses. Seminar, for example, is a superclass of Event, as are One-Day-Events and Events-In-New York. Seminar-1, then, stands as an instance of each of the five classes directly and indirectly above it.

The control mechanism known as inheritance (represented in the diagram as the arcs that connect the frames) ensures that...
The niche applications listed above run on microcomputers and cost between $495 and $20,000. Persoft, Inc., another player in the expert system niche market, sells a mainframe-based application. Persoft's More, an expert system that provides organizations with all sorts of expertise that they cannot find in-house — everything from financial planning to factory scheduling. Certainly, companies that are not equipped to invest heavily in knowledge engineering will find these packages very attractive.

**Eye on the future**

Today, the expert system market is worth approximately $75 million. Government and research efforts at custom design account for most of the figure, as much as two-thirds. Fortune 500 companies' development efforts make up most of the remaining one-third, and these companies primarily use shells. The applications market is too new to generate figures that indicate market penetrations.

The greatest obstacle to more widespread use of expert systems lies in the initial development environment. A huge percentage of expert system work proceeds under LISP, but very little traditional computing gets done in this language.

The jump from LISP to a central computing environment is not an easy one; at times, it is impossible. Usually, organizations must take the expert systems they develop under LISP and rewrite them in a language that is either more portable or more efficient. For now, many companies employ their LISP machines for both development and delivery. But the expense of running developed systems on LISP machines makes this approach a burden for many applications. The above list is a representative selection of those systems.
Custom-developed expert systems offer strategic but costly benefits.

By JAMES R. DAVIS

From a cost-estimate point of view, custom expert systems development resembles typical custom software development, with one twist. Expert system development is far more expensive. Two factors serve to keep costs high: the scope and depth of expert system projects and the wages of the people involved.

Most organizations turn to custom development projects only after they identify artificial intelligence as a strategic weapon for attacking a problem area in which other computer science techniques have come up short.

Such projects are necessarily broad in their scope and depth. Developers typically tap the knowledge of a number of experts within the targeted domain and rely on a complex array of rule- and frame-based technologies. Managers expect the finished systems to improve business' a great deal.

AI programmers, knowledge engineers and other expert system professionals command a high price — and get it — because of the scarcity of AI expertise in a market that demands more and more.

A good Lisp programmer typically earns an annual salary of between $40,000 and $60,000. Trainees' salaries are lower, but an organization cannot expect a novice to come up to speed for a year.

Consultants cost more than in-house staff members, but they give their clients access to top-flight personnel and require no capital investment or long-term commitment.

No matter who does the work, an expert system development project costs from $150,000 to $200,000 for each man-year of effort. These per-man-year costs between $150,000 and $200,000, the organization should budget between $1.5 million and $3.2 million.

Most projects span between 1½ and 2½ calendar years from the time an organization identifies a likely expert system project to the time a prototype system is ready for testing.

The time and resources an organization must commit to a large-scale expert system development project divide neatly across three stages of development: the proof-of-concept stage, the demonstration stage and the prototype stage (see chart).

Resource commitment is proportionate, of course, to the number of components being built, the complexity of those components and the level to which each is being developed.

Proof of concept. The goal at this stage is to develop enough essential components to determine whether or not AI techniques can provide an appropriate solution to the problem at hand. To make that determination, the development team works through two steps. First, developers conduct a feasibility study, either as a stand-alone project or as part of a corporate strategic planning exercise. They check to see that the proposed application will benefit from expert system technology then suggest an appropriate scheme for representing the system's knowledge structure and a suitable control mechanism for driving its operations.

Typically, two people — a knowledge engineer and a programmer — work on this step for between four and six calendar weeks.

Second, the knowledge engineer and the programmer work on a small section of the system to develop...
Executive Report/Expert Systems

<table>
<thead>
<tr>
<th>Stage</th>
<th>System Components</th>
<th>Duration</th>
<th>Level of Effort</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proof of Concept</td>
<td>Small, simple knowledge base; skeletal control logic; skeletal user interface; operable by developers; no documentation</td>
<td>4 to 6 months</td>
<td>1 to 2 man-years</td>
<td>$150,000; $400,000 (to)$1.2 million</td>
</tr>
<tr>
<td>Demonstration</td>
<td>Medium-size knowledge base of moderate complexity; skeletal control logic; rough user interface; operable by trained experts; internal documentation</td>
<td>4 to 5 months</td>
<td>1 to 2 man-years</td>
<td>$150,000; $400,000 (to)</td>
</tr>
<tr>
<td>Prototype</td>
<td>Multiple, large knowledge bases; complete, complex control logic; complete user interface; operable by trained users; design documentation</td>
<td>12 to 18 months</td>
<td>8 to 12 man-years</td>
<td>$1.2 million to $2.4 million</td>
</tr>
</tbody>
</table>

**TOTAL RESOURCE COMMITMENT**

<table>
<thead>
<tr>
<th>Duration</th>
<th>Level of Effort</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 to 30 months</td>
<td>10 to 16 man-years</td>
<td>$1.5 million to $2.3 million</td>
</tr>
</tbody>
</table>

* Figures based on Arthur D. Little, Inc.’s experience in developing more than 30 large-scale, strategic knowledge-based systems, typically for Fortune 500 companies.

Large-scale custom development projects require 10 to 16 man-years of effort and $1.5 million to $3.2 million.

**D**emonstration. This stage encompasses two main goals: to flesh out the partial system’s knowledge base and to develop the overall user interface fully enough so that an expert who understands the subject matter can operate the system. Developers may also want to make the system’s knowledge representation scheme more complex or integrate the demonstration system into an existing system.

All efforts at this stage proceed according to a central motive: Developers rely on demonstration systems to convince top management to invest in a full-blown system. The time and money devoted to developing the demonstration system tend to equal the time and money devoted to the proof-of-concept stage. The number and type of professionals involved varies according to the system’s design and purpose.

**Prototype.** The goal at this stage is to develop a full working model of the expert system, a model that target users can operate on their own after they have been trained to do so. Developers expand the knowledge base to encompass all facets of the system’s subject matter; they add still more complexity to the control logic; and they complete the user interface and produce comprehensive design documentation.

Obviously, the prototype represents a large jump from the demonstration system. An organization might wish to build its development plans around intermediate steps, each targeted toward an important milestone (the completion of the user interface, for example, or the completion of the control logic).

Development of a prototype typically spans between one and 1½ calendar years. Even after an expert system is brought to the prototype stage, developers face a tremendous load of work. They must thoroughly verify, validate and debug the system and must polish up its documentation. These steps typically consume at least as much time and money as the proof-of-concept, demonstration, and prototype stages combined. Often, they require even more.

**NET/MASTER™**

Access Component simplifies access to your SNA/VTAM network.

Fast. Friendly. Ergonomically designed. NET/MASTER streamlines the maze of key words and cryptic commands that complicate your network access.

It provides a single access point for all your authorized users. And now you can experience the ease of NET/MASTER access. Free. In our 30-day trial offer.

Give us the go-ahead. And we’ll install a copy of our NET/MASTER Access Component on your system in a couple of hours. While you’re waiting, you can prepare your VTAM users for the easiest 30 days they’ve ever experienced.

Just call the toll-free number below. In Canada or Ohio call 513-661-6000.

1-800-543-3010

World Headquarters
2500 Montana Avenue
Cincinnati, Ohio 45211

1-800-543-3010
Micro-based systems pave low-cost route to commercial AI

By BEVERLY CRONIN

Microcomputer-based expert systems represent an inexpensive route to commercial applications of artificial intelligence technology.

Not too long ago, managers interested in exploring expert system applications needed a mainframe, a minicomputer or a special LISP machine, any of which would have cost tens of thousands of dollars at the very least. They also needed very expensive software and equally expensive programmers and knowledge engineers.

Today's managers can get by with a microcomputer and a micro-based expert system shell, and they can explore the field on their own. Most shells cost between $500 and $5,000.

On a diminished scale, expert systems built on micros with inexpensive shell software offer much of the same benefits as their larger counterparts. They archive rare knowledge, free up experts to work only on really tough problems, spread expertise around and promise to reduce operating costs.

Saving money is the ultimate business end, but the beginning for every business involves experimentation that breeds technical familiarity. The key to success is for system developers to choose an appropriate application for their initial experiments.

"Micro-based expert systems are viable entities in business if you get the right problem," according to Esther Dyson, editor and publisher of "Release 1.0," an industry newsletter. "You'll find them," she said, "where information can be easily crystallized into rules."

In this respect, micro-based systems are no different from those developed on mainframes and minis. The delineations that mark an application as being appropriate for a micro-based system are the application's size, or the amount of memory space it will require, and the scope of its domain, or the intricacy of the application's subject matter.

The application size a micro expert system can support depends on the specific expert system shell being used. Commercially available shells typically support between 250 and 2,000 rules, although some are much bigger.

A domain is a good candidate for conversion to an expert system — micro or otherwise — if it meets four criteria, according to Patrick H. Winston, professor of computer science and director of the AI laboratory at MIT:

- No common sense is needed to solve the problem.
- The problem takes about one hour for a human expert to solve.
- An expert with the knowledge of the organization is committed to the idea of developing the expert system.
- There is plenty of public domain knowledge with which to create the knowledge base.

Beverly Thompson, who operates the New York consulting firm Micro Expert Systems, has a succinct method for recognizing problems that a micro-based system can solve. Thompson pinpoints appropriate applications by asking whether a novice could solve the problem after a half-hour, give-and-take telephone dialogue with an expert.

Other authorities suggest different means for identifying applications. Carl Wolf, president of Gold Hill Computers, Inc., Cambridge, Mass.-based AI vendor, said micro-based expert systems make sense for tasks "where you have an army of people doing the same thing" but with different amounts of skill. With an expert system, Wolf said, "you homogenize the delivery of the expertise and raise the level of the expertise overall."

Training time, cost factors

William Harrelson, chief operating officer at Brattle Research Corp., an AI software developer based in Cambridge, considers training time and cost — two key factors to examine when evaluating potential applications. "Micro-based expert systems best solve routine judgment problems, problems for which you might ordinarily train someone for one to two months to do a job and where you have a high turnover," he said.

Jeffrey Perrone of the consulting firm Jeffrey Perrone and Associates, Inc. in San Francisco reinforced Harrelson's guidelines. "Basically, any kind of decision that requires specific information to be used repeatedly and routinely lends itself best to micro-based expert systems," Perrone said.

Once an organization chooses an application, it can proceed with development in almost any way it sees fit. Micro-based expert systems are just emerging as a phenomenon, and their eventualities have yet to unfold on a wide enough scale to force the formation of either tacit or explicit development rules.

Tom Schwartz of Tom Schwartz Associates in Mountain View, Calif., who serves as a consultant to some

NOW IT ONLY TAKES ONE TO TANGO.

Say hello to PhoneMail™ and say hello to the One Party Phone Call. No more waiting for the phone to ring, waiting for someone on the other end, waiting for your telephone partner in another city, another meeting, another time zone. Waiting.

PhoneMail is not your basic phone answering gadget. It's a digital voice-messaging system for your entire company that you can access from any Touch Tone* telephone anywhere in the world, any time.

PhoneMail can answer your phone with your personal greeting. (If you'd prefer, your secretary can take the call and direct the caller to PhoneMail.)

It will let you answer messages automatically. It can forward them, along with your comments, to dozens of your associates. It lets you send messages to a whole roster of
users of AI technology, offers only one strong suggestion. "Managers should start with something simple... to learn something about putting information into rules," Schwartz said. If the experiment produces nothing of immediate value, it will at least have served an educational purpose; if it produces real benefits, all the better.

Indeed, what started out as a learning endeavor at Travelers Corp., an insurance and financial firm in Hartford, Conn., turned out to be a practical solution for decreasing downtime in a nationwide network of 560 IBM 8100 controllers. Travelers chose the 8100s as a focus for expert system experimentation because the machines posed a problem to troubleshooters on the firm's DP help desk, who had not been trained to diagnose 8100 failures.

"We were trying to learn about AI," said Luther Weeks, assistant director of computer science in Travelers' DP department, "and the particular application we chose was one of the things our help desk staff spent more time on than others."

The controllers failed so infrequently that the firm could not justify training a lot of experts and keeping them around just waiting for a malfunction. A few 8100s went down almost every day, however, and when one did, help desk staff members had to play telephone tag with affected users and trained experts to solve the problem and bring the controller back up. The controllers typically stayed out of commission for between 30 minutes and two hours.

He controllers failed so infrequently that the firm could not justify training a lot of experts and keeping them around just waiting for a malfunction. A few 8100s went down almost every day, however, and when one did, help desk staff members had to play telephone tag with affected users and trained experts to solve the problem and bring the controller back up. The controllers typically stayed out of commission for between 30 minutes and two hours.

One of Weeks' DP staff members worked for three months with an IBM Personal Computer and Teknowledge, Inc.'s M1 expert system shell to develop a system that would diagnose 8100 problems for help desk staff members and cut down on telephone calls and downtime. The system he created, a 70-rule program called DIAG8100, worked as planned.

"The biggest benefit is decreased downtime," Weeks said. Since DIAG8100 went into full operation last May, typical downtime for the 8100s has been between five and 10 minutes.

Unless the DP department creates a system for its own use, as the Travelers shop did, DP staff members are unlikely to get involved in micro-based expert system development. "Typically, we're not seeing the expert systems coming out of the MIS department," Schwartz said. "Typically, it's your expert in various departments, who's gotten tired of answering questions all the time, who is interested in them.

Micro-based systems are at the point now where micros themselves were about 10 years ago. They are cropping up in various departments within companies but have not yet been integrated into the overall MIS picture.

As such, few guidelines exist regarding how to maintain finished systems and ensure that their knowledge bases remain sound.

Thompson explained that, in common practice, an expert system project often has a kind of godfather — someone who has overseen the project from its start — who rules on maintenance issues.

---

For further information

Readers who are interested in learning more about expert system technology and AI business applications may find the following publications and events helpful:

Publications


Events


MARCH 31-APRIL 4, ORLANDO, FLA. — Third Annual Conference on Applications of AI. Contact: Janet Houston, International Society for Optical Engineering, P.O. Box 1441, Boulder, Colo. 80306.

MARCH 31-APRIL 4, OMAHA, NEBR. — First International Conference on Expert Data Base Systems. Contact: Donald A. March, Department of Management, Columbia University, 506 Mudd Bldg., New York, N.Y. 10027.


AUGUST 11-15, PHILADELPHIA — AAAI-88 National Conference on AI. Contact: Lorraine Cooper, American Association for Artificial Intelligence, 44 S. Bur- gess, Menlo Park, Calif. 94025.
Subclasses and instances inherit the features and relationships of their superclasses. Because of inheritance, the expert system illustrated in the diagram understands not only that Seminar-1 takes place on Feb. 28 and is taught by Eric but also that it is in New York. Frame-based systems also take advantage of another special mechanism known as procedural attachment, whereby slots' values change as the result of generic procedures.

The slot attendees attached to the frame Seminar in Figure 2 illustrates this concept. It differs from the other slots in the diagram in that its value is a variable procedure, PROC RETRIEVE-ATT, rather than a fixed value such as “Los Angeles.”

Offer flexible solutions

Until very recently, frame-based systems operated exclusively within research laboratories. Business organizations that are confronted with complex problems and need flexible solutions are beginning to recognize the value these systems can offer, but no vendor currently offers development tools that lend themselves to the creation of a fully frame-based expert system.

Hybrid systems. Vendors do offer impressive tools for developing systems that combine the features and capabilities of rule- and frame-based technology. These hybrid tools bring a new level of flexibility and productivity to the development of large-scale expert systems.

With hybrid development tools, an organization can build an expert system application as an arbitrary mixture of frames and rules. These tools also let developers define rules as frames—a procedure that allows for the representation of extremely complex rule structures.

In addition, the majority of hybrid tools feature object-oriented programming languages, languages with which developers can build rich graphics interfaces between their systems and the systems' users.

Three of the most popular hybrid expert system development tools currently available include the following:

- The Automated Reasoning Tool from Inference Corp.
- The Knowledge Engineering Environment from Intellicorp.
- Knowledge Craft from Carnegie Group, Inc.

You don't have to put every system in your office, factory or lab on a network. Just most of them. And the more kinds of equipment you have, the more you need Bridge.

We network more systems from more vendors than anybody.

Our CS/1-SNA Communications Server lets async terminals talk to IBM® hosts by making them look like 3278s. Our CS/1-HSM lets you get into a VAX® minicomputer without a whole lot of cards and cables.

Thanks to EtherTerm, we can turn IBM® PCs into async terminals and link you up to any device on your network.

And our Gateway Servers hook up all your networks. X.25, broadband and Ethernet. Across town or across the country.

We even have Management Servers to help you configure, control and monitor your entire network from any terminal.

But don't take our...
The vendors' efforts vary in scope and are at different states of readiness:
- Lucid, Inc. is working to establish standard language protocols that allow LISP programs to run on different machines.
- Intellicorp and Gold Hill Computers, Inc. are developing networks that link LISP machines to machines with other architectures.
- Last August, Intellicorp introduced PC-Host, which takes programs developed on LISP machines and downloads them for execution on IBM Personal Computers. In November, Gold Hill began marketing GC-LISP Network, an Ethernet setup that connects IBM Personal Computers and Personal Computers and Personal Computer ATs to each other and to Symbolics LISP machines. With it, users are able to develop systems on the LISP machines and then refine and run them on the microcomputers.
- Software A & E, Teknowledge and Inference are bringing C versions of expert system shells to market right now.
- Software A & E has announced a C version of KEB, and Teknowledge has announced C versions of both S.1 and M.1. (a micro-based shell). Intellicorp plans to offer a C version of ART this summer.

Other vendors, notably Texas Instruments and Symbolics, are developing Lisp chips, processors that can be embedded in standard computers so users can run Lisp programs side-by-side with business applications on their corporate hosts. These chips should be on the market sometime in 1987.

Problem unsolved

The problem of connecting corporate computing environments to expert systems — those currently in the prototype stage at innovative Fortune 500 firms — remains unsolved. Any vendor that finally succeeds in making development environments compatible with IBM, DEC, Data General Corp. and other real-world machines will find itself incredibly successful.

What now? Throughout 1986, innovative businesses will bring up expert systems, both as products of in-house development and as results of AI applications packages. And, despite the small-paced implementation of expert systems into mainstream computing, the future looks quite bright.

Corporate commitment to artificial intelligence seems to be showing genuine results, especially in companies like Hewlett-Packard Co., Sperry Corp., Boeing and Lockheed that have invested in small AI companies in addition to creating in-house artificial intelligence facilities.

Although these large players may enter the AI business as vendors sometime down the road, their current efforts all focus on using expert systems to achieve a competitive edge in existing business concerns.

Managers in second-tier organizations would do well to keep an eye on advancements that give expert systems immediate practicality.
Knowledge of AI structures helps target hardware needs

By DAVID BENDEL HERTZ

Artificial intelligence researchers have devoted several decades to making expert systems viable for business and industry, first by developing specialized software tools and more recently by designing dedicated hardware.

Vendors now offer a variety of dedicated machines for expert system development, and the business world stands to gain. If a company purchases machines well suited to knowledge engineers' needs, it can help these AI professionals work more efficiently and can save itself some money in the expert system development process.

To understand their organizations' hardware requirements for developing and applying expert systems, DP and MIS managers need to become familiar with the programming structures used in AI: specialized languages and expert system shells. These structures determine the hardware requirements that DP shops must meet. They also define the problems and opportunities that the coming generation of AI applications will present to MIS managers.

Languages. The development of an expert system depends heavily on computer language techniques designed to process symbols (words and abstract characters) rather than numbers. Two development languages — LISP and Prolog — best embody these techniques. LISP consists of operators with which programmers can manipulate lists of objects, an object being anything to which a symbol is assigned. The language is powerful and modular, and it manages storage space very efficiently for programmers who need to construct large and complex expert systems. John McCarthy created LISP while he was working at MIT in 1968. Since then, it has been the language of choice for AI workers in the U.S.

Prolog's constructs provide expert system developers with an easy means for writing programs that manipulate logical expressions. The language gives knowledge engineers flexibility to choose among problem-solving behaviors and to borrow from these behaviors an interface that frees end users from procedural concerns.

Alain Colmerauer of the University of Marseilles in France developed Prolog in the early 1970s; it is the main AI programming language in Europe and Japan and is beginning to catch on in the U.S.

Because both languages offer distinct and separate advantages, AI practitioners are starting to use combinations of the two. Some vendors in the U.S. offer hybrid language.

Continued on page 60

Special from Avnet Computer Technologies, Inc.: (Formerly Data-Iron and Loonam Computer Products)

Save two ways on Texas Instruments' versatile TI 865 dual mode printer:

1. SAVE $284 OFF LIST PRICE

   List Price: $999. OUR PRICE: $715 (Includes 1 plug-in Gothic type font module)

2. GET A $40 PLUG-IN TYPE MODULE FREE

   Your choice: Courier or Prestige Elite

   The TI 865 is the hottest dual mode printer you can buy for your PC. You get superior letter quality printing (ideal for word processing) at 35 cps. Draft quality printing at 150 cps. A 16" carriage with friction and tractor feed to handle a wide range of paper and forms. And a choice of over 30 plug-in type font modules (up to 3 fonts on-line at any time) to add new impact and professionalism to everything you produce. All for a special low price.

   Best of all, we're offering discounts of up to 10% on annual maintenance agreements if you order now. So, at Avnet Computer Technologies, Inc., you save money after you buy, too. That's why we say …

   DON'T JUMP WITHOUT THE NET.

   For more information about the versatile TI 865 printer, simply complete and return the coupon. For immediate action, call 1-800-328-4028 after hours 1-601-342-4028, extension 304. Hurry! Offer ends January 31st, 1986.

   YES, rush me more information about the TI 865 dual mode printer.
   □ Tell me more about your annual maintenance agreements.
   □ On-site service (5% discount if ordered with printer)
   □ Depot service (5% discount if ordered with printer)
   □ While you're at it, please send me information about your other products and services. My needs include:
   □ PC peripherals and supplies
   □ Mainframe peripheral/PC-to-mainframe gateways
   □ PC LANs
   □ Multi-user microsystems

   TI 865 dual mode microprinter gives you a choice of over 30 plug-in type font modules.

   AVNET COMPUTER TECHNOLOGIES, INC.
   The Single Source Solution
   1-800-328-4028

   Name
   Company
   Address
   City
   State
   Zip
   Phone

   AVNET COMPUTER TECHNOLOGIES, INC.
   10000 West 76th Street
   Eden Prairie, Minnesota 55344
   Attn: L. Waltz
   Eden Prairie, Minnesota 55344
   10000 West 76th Street
   AVNET COMPUTER TECHNOLOGIES, INC.
   The Single Source Solution
   1-800-328-4028

   Current LISP system offerings

   Single-user LISP machines offer impressive features, usually at equally impressive prices. What can an organization expect for its money?

   The four machines described below are typical of current offerings:

   Symbolics, Inc.'s 3670. The 3670 supports Zeta LISP and Common LISP. It is based on Symbolics' Lisp architecture and communicates via Ethernet. The machine's random-access memory (RAM) ranges from 2M to 30M bytes, and its disk memory ranges from 474M to 3.5G bytes. The 3670 costs between $350,000 and $500,000, depending on features.

   Texas Instrument, Inc.'s Explorer. Explorer supports Zeta LISP and Common LISP. It is based on TI's Nabis architecture and communicates via Ethernet. The machine's RAM ranges from 2M to 16M bytes, and its disk memory ranges from 140M bytes to 1G byte. Explorer costs between $400,000 and $500,000, depending on features.

   Xerox Corp.'s 1132. The 1132 supports Interlisp-D. It is based on a proprietary Xerox high-speed architecture and communicates via Ethernet. The machine's RAM ranges from 2M to 16M bytes, and its disk memory ranges from 80M to 315M bytes. The 1132 costs between $100,000 and $160,000, depending on features.
Your whole organization will pull together with CON-NECT™—the fully integrated office solution.

A lot of software packages help individuals work more efficiently. Now there's one software system that enables whole organizations to work smarter and faster.

The Critical Difference . . .
CON-NECT serves as a "central filing cabinet" where documents can be centrally stored regardless of where they originate. CON-NECT users have direct access to an organization's core data which can be incorporated into documents and routed anywhere in the CON-NECT network. And, with CON-NECT, a multi-stage information processing project that once required the involvement of several different departments can now be accomplished as a single process.

Document Handling . . .
CON-NECT provides the bridge between the management of data and the management of documents by featuring comprehensive software facilities for the creation, modification, storage, distribution, and retrieval of documents.

Electronic Mail . . .
CON-NECT ties together communication at all levels of the organization with a highly sophisticated yet easy-to-use tool for the novice and experienced user alike.

Schedule Management . . .
CON-NECT brings a powerful time management tool for the individual and for the organization as a whole.

Taken separately, each of CON-NECT's core capabilities provides individuals with a powerful management tool. When integrated—with each other and with the full powers of Software AG's ADABAS/NATURAL environment—CON-NECT offers you the potential for revolutionary improvements in the way your organization does business.

With CON-NECT, your organization will pull together. And when that happens, your side wins.

Put CON-NECT on your side! Mail the coupon below or call toll-free:
1-800-336-3761, ext 123
(In Virginia or Canada, call 1-703-860-5050.)

YES! I am interested in putting CON-NECT on my side. Send me more information.

Name:
Title:
Address:
City_________ State _______ Zip_________
Daytime Telephone:

Mail to Software AG, 11800 Sunrise Valley Drive, Reston, VA 22091
Continued from page 58

products that give users the benefits of both LISP and Prolog.

Expert system development projects that use these languages differ from traditional development projects because they involve different pro-
gram architectures. MIS and DP managers are familiar with data base and computational programs in which acceptable types of input data have been foreseen and acceptable routes through the program have been predetermined. Ex-

pert systems depart from this norm; they are almost totally open ended.

Specialized AI architectures support open-ended operations and save programmers the trouble of working out every possible path through an expert system. In general, these alternative architectures are known as directed inference sys-
tems. Rule- and frame-based systems (see story page 50) are the most

popular. Many vendors offer develop-

ment environments that package a
directed inference architecture and a skeletal expert system structure with sets of pre-adopted tools for structuring I/O routines, debugging, editing, and alter-
ing, searching, and issuing commands.

Most of these packages, known as shells, consist of LISP or Prolog code, but some are built around conventional languages like Fortran, Pascal and C.

Shells are complete expert sys-
tems with generic knowledge of a specific task, but their factual content and their knowledge bases have been stripped out. Users follow pre-

written routines for knowledge acquisi-
tion and insert facts that are specific to the subject matter around which they wish to build an applica-
tion.

Development hardware

An expert system that must search through large knowledge bases and rule sets often looks for an optimum solution to a given problem but for the best solution it can find within a given amount of time. For such a system to be practi-
cal, speed is essential.

Dedicated LISP machines, de-

gined specifically to process sym-

tactic information at maximum effi-
ciency, provide the necessary speed. These processors can handle 10 to 20 times more logical instructions per second (LIPS) than general-purpose

computers can.

LISP machines feature very high-
speed processors, large memories, bit-mapped displays with overlapping windows, communications facili-
ties and specialized keyboards. Most of these machines support a number of interactive, concurrent operating structures, thereby permitting develop-
ers to build system specifications and applications programs at the same time.

Such features do not come cheap. A single-user LIPS machine can cost more than $200,000, and software packages that allow for efficient ex-

pert system development add at least $50,000 to the price an organization

must pay.

But knowledge engineers and oth-
er AI professionals also come at high

prices. A machine that helps them work efficiently can shave develop-
ment time and can pay off hand-
somely, especially in development projects that involve large-scale,

complex programs.

BOur vendors currently compete for user organizations' patron-

age in the marketplace for single-

user LISP machines: Symbolics, Inc., with its 3640 and 3670 machines; Lisp Machines, Inc., with its Lambda line; Xerox Corp., with its Archon and 1132; and Texas Instruments, Inc., with its TI Explorer.

User organizations can also develop expert systems on mainframes

and superminicomputers. In fact, the majority of large-scale expert sys-
tems that are operating today run on Digital Equipment Corp. VAX ma-

chines.

Software vendors offer a variety of expert system development pack-

ages that run on the VAXes and other popular processors. But for large-

scale projects, development on tradi-
tional processors can take two or three times as long as it takes on dedicated machines.

Proceed with caution

Vendors also tout the merits of microcomputer-based expert system develop-

ment environments, but MIS and DP managers should proceed with caution. Bandwagon hype not-

withstanding, AI is a tough game. If an expert system is to be useful, it is likely to be big — in program size, memory requirements and processor speed.

Personal computers with less than 1M byte of memory can support nothing beyond a baby expert sys-

tem. Micros with 3M-byte memories can support rudimentary applica-
tions, but most projects require ma-

chines with memories of between 6M and 20M bytes.

Even today's powerful AI comput-
er systems have limitations. Although they process symbolic information at relatively high LIPS speeds, for example, currently available AI computers cannot match the floating-point op-
erations per second (Flops) speeds at which traditional machines process numerical data.

And although dedicated AI ma-

chines can run expert system soft-

ware, they cannot work through problems the same way as human experts do.

Human experts consider many fac-

ets of a problem simultaneously and converge on a solution. Ma-

chines, on the other hand, branch through different sets of knowledge piece by piece, diverging until they identify a solution.

These constraints are likely to be overcome in the future, when LIPS performance will match Flops perfor-
mance and when some form of parallelism in hardware and software will allow machines to con-

verge on solutions, much as humans do.

Future machines will also take ad-

vantage of laser technology to sup-

port enormous data bases of sound and video information, which they will deliver as instructions to en-

users in place of the textual output that most expert systems supply to day.
ASCII and you shall receive.

Just tell us what you want. Price? The WY-30, right out front, makes your system look and feel like a million bucks for $399. Flat screen, crisp 80-column display, Touch-Tilt, 41 programmable functions.

Heavy duty applications? The WY-50, at $599, is the industry's favorite for a lot of good reasons. 132 columns, tilt/swivel, 16 dedicated function keys.

Even more sophistication? The WY-50+, at $699, packs top-end functionality: multi-page memory, variable length function keys, bidirectional auxiliary port, and so on.

Color? The WY-350 gives you full WY-50 emulation plus 64 colors, 16 palettes for $1195.

All our ASCII terminals share the exclusive Wyse keyboard layout, 26-line screen, and across-the-board software compatibility, so you have complete design flexibility. Users can move from one Wyse terminal to another without relearning or reprogramming.

No matter what you ASCII for, your answer is Wyse. Call us today.

WYSE

Call 800-GET-WYSE
What's high-flying NASA doing in Saskatoon, Saskatchewan? They're getting Develnet—the big, sophisticated, distributed data network from Develcon.

Before coming to Saskatoon, NASA looked high and low for the appropriate solution. And talked to a number of companies that are much more well known than Develcon.

But when it came right down to it, Develnet offered what nobody else could: an unsurpassed level of performance and reliability. At a price the federal government could afford.

As a truly distributed data networking product, Develnet has maintained its lead by offering multiple X.25 gateways. Access to integrated LAN technologies such as 802.3, IBM 3270 protocol conversion for both BSC and SNA/SDLC. Support for virtually any kind of connection—from baseband and broadband to coaxial and fiber optics. Plus network management and a wealth of configurations.

The result: Develnet is the ideal backbone for today's distributed networks. Whether across town or across the continent, Develnet can unify all of the different devices and technologies that you have scattered throughout your corporate empire.

Even though NASA knows a thing or two about technology, they're not the first organization to choose us. Despite being off the beaten path, corporate giants, including companies like Hughes Aircraft, General Electric, and Sohio, to name just a few, have beaten a path to our door to get Develnet's advantages.

Now we'd like to beat a path to your door. Call our toll-free number:

1-800-667-3740

Or write to:
Develcon
856 51st Street East
Saskatoon
Saskatchewan S7K 5C7
Canada

You'll find when it comes to reaching new heights in network performance, there's no better place to go than Saskatoon.

Just ask NASA.
An index of 1985 feature articles

In Depth articles

Jan. 14 Peter Keen A walk through decision support systems
Jan. 21 Michael Zisman Good fits, bad fits and misfits
Jan. 21 Scott Brepool (Making document interchange work)
Jan. 28 Mario Goldschmitt Thou shalt not dupe
Jan. 28 Charles Apé, John Kitchum Flat panels: A new face for terminals
Feb. 4 George Proudfoot Productivity now!
Feb. 11 Paul Strassman Reflections on an anonymous programmer
Feb. 11 Steve Blake Information payoff
Feb. 18 Donald McGuire Choosing your first (or second or third) DBMS
Feb. 18 Harold Needle Large firms keep count on micros
Feb. 25 Larry Harris The natural — languages for end users
Feb. 25 Holger Opderbeck The PBSX: equal rights for voice and data
Mar. 4 Ed Milisap, Ken Sloan, Steve Gerrard Relational DBMS: They can run faster than you might think
Mar. 4 Arthur Buonanno, Robert Jones How to account for project planning
Mar. 11 George Harrar, Steve Henkel, Pieter Mimno What's on your mind? (Survey results)
Mar. 11 Dave Ackley, Put Ackley Can MIS lead the push for productivity?
Mar. 18 Paul Harmon, David King The engineers behind expert systems
Mar. 18 Jennyhara Iriq, Ken Edwards, Dennis Bradley Users talk back
Mar. 25 Ed Ailey A tale of three languages: C, Ada and Lisp
Mar. 25 Tony Bolton Going with a standard
Apr. 1 Vincent Cavo In search of a printer
Apr. 1 Thomas Johnston Building logical data models

April 8 George Harrar, Pieter Mimno For the sake of IBM and science (Thomas J. Watson Research Center)
April 8 Pieter Mimno Fourth-generation languages (Part 1)
April 8 William Taylor Power to the users
April 15 Pieter Mimno Why automatic factories are not Fourth-generation languages (Part 2)
April 15 Robert Head Power from the products
April 22 George Harrar Information centers, information systems — divided they stand
April 22 Thomas Clarkson Needed: graphics standards
April 29 Bruce Kula Understanding the DP professional (Part 1)

May 6 Harvey Poppel New partners in information
May 6 Bruce Kula Understanding the DP professional (Part 2)
May 6 Stephanie Di Donato Microprocessors — what you need to know
May 6 Lee Adamski Microprocessors — what you need to know
May 13 Michael Weiner, John Girvin Prototyping is: fast-effectuve-practical
May 13 George Harrar Chief information officer: Does your company need one?
May 13 George Harrar Three interviews with chief information officers
May 20 Charles Wieman What's on your mind? (Survey)
May 27 R. E. Nienburg, M. C. Steele The marriage of video and computer graphics
June 3 Robert Holts Strategic vision

In Depth run articles

Jan. 21 Jan. 28

March 4 Ed Milisap, Ken Sloan, Steve Gerrard Relational DBMS: They can run faster than you might think
March 4 Arthur Buonanno, Robert Jones How to account for project planning
March 11 George Harrar, Steve Henkel, Pieter Mimno What's on your mind? (Survey results)
March 11 Dave Ackley, Put Ackley Can MIS lead the push for productivity?
March 18 Paul Harmon, David King The engineers behind expert systems
March 18 Jennyhara Iriq, Ken Edwards, Dennis Bradley Users talk back
March 25 Ed Ailey A tale of three languages: C, Ada and Lisp
Mar. 25 Tony Bolton Going with a standard
Apr. 1 Vincent Cavo In search of a printer
Apr. 1 Thomas Johnston Building logical data models

April 8 George Harrar, Pieter Mimno For the sake of IBM and science (Thomas J. Watson Research Center)
April 8 Pieter Mimno Fourth-generation languages (Part 1)
April 8 William Taylor Power to the users
April 15 Pieter Mimno Why automatic factories are not Fourth-generation languages (Part 2)
April 15 Robert Head Power from the products
April 22 George Harrar Information centers, information systems — divided they stand
April 22 Thomas Clarkson Needed: graphics standards
April 29 Bruce Kula Understanding the DP professional (Part 1)

May 6 Harvey Poppel New partners in information
May 6 Bruce Kula Understanding the DP professional (Part 2)
May 6 Stephanie Di Donato Microprocessors — what you need to know
May 6 Lee Adamski Microprocessors — what you need to know
May 13 Michael Weiner, John Girvin Prototyping is: fast-effectuve-practical
May 13 George Harrar Chief information officer: Does your company need one?
May 13 George Harrar Three interviews with chief information officers
May 20 Charles Wieman What's on your mind? (Survey)
May 27 R. E. Nienburg, M. C. Steele The marriage of video and computer graphics
June 3 Robert Holts Strategic vision

In Depth/1985 Index

April 8 George Harrar, Pieter Mimno For the sake of IBM and science (Thomas J. Watson Research Center)
April 8 Pieter Mimno Fourth-generation languages (Part 1)
April 8 William Taylor Power to the users
April 15 Pieter Mimno Why automatic factories are not Fourth-generation languages (Part 2)
April 15 Robert Head Power from the products
April 22 George Harrar Information centers, information systems — divided they stand
Executive interview: Jim Sutter of Rockwell International

For the sake of IBM and science (Thomas J. Watson Research Center)

Power to the users

Why automatic factories are not

Fourth-generation languages (Part 2)

Power from the products

Information centers, information systems — divided they stand

Executive interview: Jim Sutter of Rockwell International

New partners in information

Understanding the DP professional (Part 2)

Microprocessors — what you need to know

Prototyping is: fast-effectuve-practical

Chief information officer: Does your company need one?

Three interviews with chief information officers

What's on your mind? (Survey)

The marriage of video and computer graphics

Strategic vision

A call for mainframe software standards

Managing the software crisis (Part 1)

The house that 1-2-3 built (Lotus Development Corp.)

A conversation with Mitch Kapor

Executive interview: John Pralick of TRW, Inc.

Growing up with MS-DOS (Microsoft Corp.)

A conversation with Bill Gates

Managing the software crisis (Part 2)

Voice/data integration: Three views

Motivating maintenance personnel

4GL vs. Cobol

The science and art of debugging

The microcomputer and decision support

High-tech directorates: The board game

White collar computing: The professional as artist

Are you rushing too fast to subsecond response time?

The next wave of user documentation

The politics of data

Who needs 2,400 bit/sec. modems?

Harnessing corporate culture

Software maintenance: penny wise, program foolish

RJE reaches for the upper hand

The best policy is missing deadlines — sometimes
| Oct. 7 | Gary Slaughter | Gary Rush | The back-to-school training blues | Nov. 18 | O. Richard Pomorow | Users press Icon into commercial service |
| Oct. 7 | Amy Sommerfeld | E. F. Codd | A Fast way to define system requirements | Nov. 18 | John Kadore | Multiple-session software emulates a messy desk |
| Oct. 14 | Lois Zells | E. F. Codd | A walk through the Computer Museum with Gordon Bell | Nov. 25 | William Atkins | Jesse James at the terminal |
| Oct. 21 | Lois Zells | Daryl Conner | Making change | Dec. 2 | Johanna Ambrosio | Publishing in-house can sharpen DP image |
| Oct. 21 | E. F. Codd | Brian Consen | Fourth-generation languages: from backwater to mainstream | Dec. 2 | Earl Boshe : ; | Trojan horse rolls up to DP gate |
| Dec. 9 | Beatrice Garcia | Kenneth Rou | Does your DBMS run by the rules? (Part 2) | Dec. 2 | Bill Young | Planning amid change |
| Nov. 4 | Terry Miholland, George Roberts | Terry Miholland, George Roberts | The information center adapts to corporate America | Dec. 9 | William Gruber, Max Hughes | Structured analysis can streamline software design |
| Nov. 4 | Amy Sommerfeld | John Vacca | Boeing rolls out 'ultimate' network (Technical Office Protocol) | Dec. 16 | G. David: | Technical review exposes weaknesses of micro systems |
| Nov. 11 | O. Richard Fonorow | William Atkins | Gateways grow up | Dec. 16 | Rusty Williamson | Black-box technique automates quality control |
| Nov. 11 | Eric Bender | John Vacca | Compaq: Redefining the micro standard | Dec. 16 | Michael Sobol | DP alliance bolsters security |
| Nov. 11 | Eric Bender | William Atkins | A conversation with Rod Canion | Dec. 23 | Raymond Wong | One-time passwords |
| Nov. 11 | Donald Wylans | William Atkins | Software that learns | | | |
| Nov. 11 | Donald Wylans | William Atkins | Dressing up SNA | | | |
| Nov. 18 | Daniel Miller | William Atkins | Universal networking — it's a mirage | | | |

**Special Report sections**

| Jan. 25 | Application software packages | | | | | |
| Feb. 25 | Communications networks | | | | | |
| March 25 | Graphics systems | | | | | |
| April 29 | Manufacturing systems | | | | | |
| May 27 | Microcomputers in big business | | | | | |
| June 24 | Data base management systems | | | | | |
| Aug. 26 | Software productivity | | | | | |
| Sept. 30 | Minicomputers and small business systems | | | | | |
| Oct. 28 | Data communication terminals | | | | | |
| Nov. 25 | Protecting the corporate information resource | | | | | |

**Update sections**

| May 6 | Toward the fifth generation | | | | | |
| June 3 | DP pros: Where to find them, how to keep them | | | | | |
| Aug. 5 | The paper chase: Trends in printer technologies | | | | | }

---

**AXIOS, PLEASE SEND ME FETCH TO TRY ON MY SYSTEM FOR 30 DAYS FREE**

CLIP AND MAIL TO AXIOS INC., 1455 VETS HWY, HAUPPAUGE, N.Y. 11788 (516) 346-1900

"Gigabytes Funnies", TM 1985 by Axios, Inc.
How not to measure programming productivity

By Capers Jones

S cientific progress in every field has been heavily dependent upon the ability to take accurate measurements. Progress in all of the sciences that deal with macro phenomena has been significantly obliged to progress in measurement for progress in the science itself.

To a surprising degree, Fahrenheit's invention of the mercury thermometer; Harrison's invention of the chronometer; and the invention of instruments to measure pressure, voltage, speed, the force of gravity and other natural phenomena have been important precursors to new scientific concepts and sounder theories.

But the measurement of programming has been the weakest link in the whole science of software engineering. When the common metrics used for programming are explored under controlled situations, we discover three major mathematical paradoxes that have completely distorted the history of programming and concealed significant true progress:

- **Lines-of-code measures** penalize high-level languages and often move in the wrong direction as productivity improves.
- **Cost-per-defect measures** penalize high-quality programs and always move in the wrong direction as quality improves.
- **Ratios** established for programming subactivities such as design, coding, integration or testing often move in unexpected directions in response to unanticipated factors.

In addition to these major paradoxes, other measurement problems must be overcome for programming to achieve the level of a science. The six most significant problems have been the following:

- Failure to define the counting rules for source code statements or

The paradoxes of measuring software begin with lines-of-code measures that penalize high-level languages and cost-per-defect measures that rise as quality improves. These and other metric issues must be settled before programming can become a science.

**Part 1**

lines of code has introduced errors of more than an order of magnitude into many published reports on both productivity and quality.

- Failure to define the scope of effort actually included in productivity analyses has introduced errors of more than two orders of magnitude in many published reports on productivity.
- Peripheral and support activities for programming projects, such as documentation, management, training and travel, have been underreported and largely unmeasured. In some cases, there are not even any metrics defined for the activities.
- There has been a blurring together of the concepts of economic productivity (for example, goods or services produced per unit of labor and expense) and common productivity (such as finishing a task as rapidly as possible). This has caused significant misunderstandings and has caused many measurement reports to focus on code development rather than on economic factors such as products delivered.
- Some of the most significant factors that affect quality directly, and productivity indirectly, are still intangible and hard to quantify and are underreported. For example, the physical office environment is seldom evaluated as a productivity factor.
- The two elements of programming maintenance are the addition of new functions to existing programs and the repair of defects in existing programs. These two concepts have been blurred together, with the result that the costs of the two separate activities are not clearly distinguished.

Of all the issues that must be dealt with for programming to become a science, measurement is the most fundamental and the most important.

Each of the major problems must be clearly understood for progress to occur. When they are understood, then it is possible to consider measurements that will be accurate and reliable.

Since the programming industry began, the single most widespread assumption about productivity has been that improving software productivity means augmenting the ability to write
Lines of code as a productivity indicator

<table>
<thead>
<tr>
<th>Source</th>
<th>Assembler</th>
<th>PL/I</th>
<th>APL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity</td>
<td>100,000</td>
<td>28,000</td>
<td>10,000</td>
</tr>
<tr>
<td>- Requirements</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>- Design</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>- Coding</td>
<td>115</td>
<td>25</td>
<td>10</td>
</tr>
<tr>
<td>- Documentation</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>- Integration/Facing</td>
<td>25</td>
<td>125</td>
<td>10</td>
</tr>
<tr>
<td>Total person-months</td>
<td>200</td>
<td>109</td>
<td>80</td>
</tr>
<tr>
<td>Lines of source code per person-month</td>
<td>600</td>
<td>250</td>
<td>125</td>
</tr>
<tr>
<td>Total cost</td>
<td>$1,000,000</td>
<td>$500,000</td>
<td>$400,000</td>
</tr>
<tr>
<td>Cost per source line</td>
<td>$10</td>
<td>$20</td>
<td>$40</td>
</tr>
</tbody>
</table>

Figure 1

How is Duquesne Systems teaching Fortune 500 companies to share?

Duquesne Systems, a company that provides shared device management products, is helping many Fortune 500 companies save costs and improve efficiency in their operations. Their products, such as STAM, SDSI, and SCON, provide a single console interface for multiple system environments, allowing for increased productivity and better management of resources.

Lines of source code as a productivity indicator

- Source lines
- Activity in person-months
- Requirements
- Design
- Coding
- Documentation
- Integration/Facing
- Total person-months
- Lines of source code per person-month
- Total cost
- Cost per source line

The paradox in the programming industry is that high-level languages tend to cause lines-of-code production rates to get smaller rather than larger. This is because many of the activities of programming development, such as documentation and maintenance, are not really affected by the choice of programming language.

The paradox is based upon a classic industrial phenomenon. When a manufacturing process has a high level of fixed costs, and there is a decline in the number of units produced, the cost per unit will go up. Programming development also has a significant amount of costs that are either fixed or, at any rate, inelastic and not affected by source languages.

When projects written in high-level languages are compared with projects written in assembler language, these fixed or inelastic costs become increasingly significant, and they drive up the cost per source line and drive down the lines of code per unit of time.

Lack of clear distinction

This paradox also highlights a major issue: the lack of a clear distinction between economic productivity and common productivity. In standard economic theory, productivity is defined as the amount of goods or services produced per unit of labor or expense. For programming, economic productivity would mean the functions delivered to users per unit of labor or expense. A line of source code is neither goods nor services, and hence, it is not an economic unit of measure.

The lines-of-code paradox is made more troublesome by the fact that high-level languages actually do improve coding speed. Note in the assembler language example that coding alone proceeded at a rate of 870 lines per month, while the PL/I and APL versions proceeded at a slightly faster rate of 1,000 lines per month. Yet this increase is overshadowed by the noncoding tasks that are always part of programming development, and which have a tendency to act like fixed costs when an entire development cycle is analyzed.

When the paradoxical problems with source lines are encountered, it might be thought that switching over to object lines or bytes of memory would avoid the problems. But this is not the case, as object lines and bytes actually increase the noncoding tasks that are always part of programming development, and which have a tendency to act like fixed costs when an entire development cycle is analyzed.

The paradox that true improvements are masked when expressed in terms of lines of code also affects quality, if all defect types are includ-
For $400, you've always known what kind of extras to expect in a terminal.
Introducing the TeleVideo 905. High-end features at a low-end price.

Let's face it, despite most manufacturers' hype, you know what you get for $400. A basic core terminal, a few tacked-on bells and whistles, and not much more.

All that has changed with the new TeleVideo 905.

PROGRAMMABLE FUNCTION KEYS
16 special keys let you condense up to 32 sets of commands into simple, single keystrokes.

At $409, the TeleVideo 905 is the first of a new generation of "super terminals," offering an extended feature set so powerful you'd think you were sitting at an expensive workstation.

ENHANCED NUMERIC KEYPAD
This is the way people are used to entering numbers—quickly, smoothly and with far less chance for errors.

HIGH READABILITY SCREEN
The 14" super-high resolution flat screen has more than just contrast going for it. We also put more space between the characters for even better readability.

Start with the 905's smooth, sleek design. The small footprint makes it a natural on any desk. The super-high contrast 14" flat screen offers the most readable image in the industry. And the screen tilts and swivels through a full 270° right and left, and from −5° to +15° up and down to reduce eyestrain, neck, and back problems.

What the screen does for the eyes, the keyboard does for the fingers. New sculptured keycaps make for smooth, comfortable typing. Sixteen non-volatile, programmable function keys eliminate repetitive keystroking. And the keyswitches have been tested to 100,000,000 strokes, five times the rating of Wyse keyboards. About the only way to improve on our keyboard would be to add an enhanced numeric keypad.

Which we did. This functional little terminal not only fits comfortably on any desk,

©1985 TeleVideo Systems, Inc.
it fits comfortably into most any system, too. That's because it's compatible with the TeleVideo 925 command set, the most popular and widely emulated ASCII command set in the world. In addition, you can make your terminal think it's an ADDS Regent 25; or a Viewpoint A2; or Hazeltine; or Lear Siegler.

**FULL TILT AND SWIVEL** You can adjust the screen just about any way you want, right or left, up or down, for the maximum in user comfort.

Or a TeleVideo 910 or 910+

There's even a buffered printer port (standard), so your users don't have to sit around waiting for hard copy.

# The TeleVideo 905 is the latest in a long line of quality terminals that have been shipped to over half a million users, worldwide.

And now we're making it easy for you to get your hands on a terminal that's short on hype and long on performance.

<table>
<thead>
<tr>
<th>TELEVIDEO 905 VS. WYSE WY-30</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FEATURES</strong></td>
</tr>
<tr>
<td>ENHANCED NUMERIC KEYPAD</td>
</tr>
<tr>
<td>PROGRAMMABLE FUNCTION KEYS</td>
</tr>
<tr>
<td>TILT AND SWIVEL</td>
</tr>
<tr>
<td>HIGH CONTRAST DARK SCREEN</td>
</tr>
<tr>
<td>WORDSTAR MODE</td>
</tr>
</tbody>
</table>

The high-performance TeleVideo 905. It'll change the way you think about low-priced terminals.

**TeleVideo**

TeleVideo Systems, Inc., 550 East Brokaw Road, San Jose, CA 95150-6602, (408) 971-0255

REGIONAL OFFICES: WEST (408) 971-0255, SOUTHWEST (714) 476-0244, SOUTHERN CALIFORNIA (213) 258-6776, SOUTHEAST (404) 447-1221, MIDWEST (312) 397-5400, EAST (516) 486-4777, NORTHWEST (617) 880-3262, AMSTERDAM 31.2503.5444, PARIS 33.1.687.34.40, LONDON 44.9908.6464.

*U.S. and Canada only.*
ed. Figure 2 gives examples of the kinds of defect counts that might be anticipated in the assembler language, PL/I and APL examples shown in Figure 1.

Note that in spite of a significant reduction in total defects and an eightfold decrease in coding defects, the defect count normalized to defects per 1,000 lines of code heavily penalizes high-level languages. The reason is that for most large programming systems, errors outside the code are more significant than errors within the code.

The impact of the paradox has caused three major problems for the programming community. These have been critical in commercial and governmental programming, where costs, schedules and quality are often determined by contractual and marketing considerations.

First, the paradox has been a major factor in estimating errors, since many managers assume that switching from a given language to a higher level language will cause an increase in lines of code produced per time unit, when in fact it causes a decrease. Estimates made without consideration for the paradox are immediately off the scale, and projects will be more costly than anticipated.

Second, when productivity or quality comparisons are made between projects written in different languages, the paradox always penalizes the higher level language and conceals significant true gains in productivity.

Third, when measurements are made at the enterprise level, such as corporate productivity and quality metrics programs, the paradox sometimes causes management to think that productivity or quality has declined, when in fact migration from lower level to higher level languages has brought about an increase in economic productivity and in actual quality.

Once the mathematical paradox associated with trying to use lines of source code as a productivity indicator is understood, then we can compensate for it. Although using lines-of-code metrics is now possible without excessive distortion, the paradoxical results from incorrect and uncompensated historical usage have damaged the credibility of this metric to the point where it is unlikely that it will ever be fully credible again.

Cost per defect

One of the most widely repeated aphorisms of the software community is, "It costs up to 100 times as much to fix a bug during maintenance as it does during development." This statement, as it is commonly used, is incorrect and has no basis in fact. Here, too, a fundamental rule of industrial production has not been respected. Cost per defect is always lowest where the number of defects found is greatest and always highest where the number of defects found is least.

Since the number of bugs found during development is usually much greater than the number of bugs found during production, the cost per defect will always be higher during production.

Indeed, for the few zero-defect programs being created, which still have some maintenance effort associated with them, cost per defect can reach infinity. This is because of the fixed and inelastic costs associated with defect removal (Figure 3).

The primary error introduced by cost per defect is to fail to recognize that even high-quality, zero-defect software will have substantial costs associated with preparation and execution of defect removal activities, even though repair costs may be zero.

What occurs is that the fixed costs associated with preparation, training and readiness become increasingly significant as the variable costs decline, and this artificially drives up the cost per defect and leads to erroneous conclusions.

The major paradox associated with cost per defect is that as program quality improves, cost per defect will rise steadily until it reaches infinity for a zero-defect program; hence, this metric penalizes quality and rewards errors.

The cost-per-defect paradox has a mathematical reason for existing and does not reflect the actual work of finding and repairing faults. This reason is the common method of calculating cost per defect by simply dividing the total defect removal expenses by the total number of defects removed. This method ignores the fixed and inelastic costs of preparation and execution, which will still be incurred even for zero-defect programs.

Incidentally, the cost-per-defect paradox also occurs in fields outside of programming, such as computer hardware repair, but its significance is less understood for software than for other activities.

There are three independent sources of expense in removing defects:

* Preparation expenses, such as writing test cases.
* Execution expenses, such as running test cases.
* Repair expenses, such as fixing bugs and recompiling.
Of these three, only the third is directly related to the number of bugs present in a programming system.

Since the paradox of cost per defect is understood, time and motion studies reveal true variations in defect removal efforts as a function of quality. As program quality improves in real life, both the number of bugs and the number of severe bugs are reduced at a faster rate than the mid-range defects. Thus, the defects encountered in high-quality programs, on the average, actually do take more effort to repair than the defects encountered in low-quality programs.

In low-quality software, the enormous numbers of relatively simple bugs tend to mask the more serious bugs when cost per defect is used to assess productivity. To understand the economics of defect removal, it is necessary to analyze preparation time, execution time and defect repair times separately. However, only a few reports have dealt with the fine structures of defect removal. The fine structure of defect removal has been masked by the use of cost per defect, and it includes fixed costs such as preparation, inelastic costs such as repairs, and variable costs such as execution and variable costs such as repairs.

Paradox of percentages

One of the most common methods in the programming industry for expressing the relative costs of programming activities is the use of percentages or ratios. Such the historical rule of thumb for assembler language programs that design will take 25%, coding will take 35%, and integration and testing will take 50%. The more precise rule of thumb for high-level language programs that design will take 40%, coding will take 25%, and integration and testing will take 35%; or the hypermodern rule of thumb for spreadsheet programs that design will take 35%, coding will take 90%, and validation will take 5%.

Unfortunately, ratios and percentages have paradoxical aspects that cause them to be very inaccurate and unreliable. The ratio-and-percentage paradox is a subset of the line-of-code paradox; the first problem with using percentages is that they break down completely when programs in different languages are being compared.

There are many other phenomena that can cause ratios and percentages to vary widely from one program to another, and the general conclusion is that percentages invariably are misleading. Some of the other factors that cause ratio or percentage changes in otherwise similar programs are the following:

- Programs involving multiple development locations will have significantly different ratios from single-site programs.
- Programs involving new tools or insufficient tools will have significantly different ratios from programs developed with a well-formed tool set.
- Programs that are novel or of a kind with which the staff has no experience will have significantly different ratios from programs that are of a familiar type.

To demonstrate some of the cautions and current ratios and percentages, it should be noted that coding, the heart of the software discipline, may vary from a high of 90% of all development effort for small personal spreadsheet programs to a low of less than 25% of all development effort for large government contract programs with significant documentation requirements, independent verification and validation and other ancillary tasks.

Percentages and ratios are hazardous and unreliable, and their common usage for software projects is one of the reasons for estimating and planning errors.

Defining lines of code

The next measurement problem to be discussed is not paradoxical, in that the results do not move backward or in counterintuitive directions as progress is made. However, the range of variation from inconsistent definitions of lines of code can yield apparent differences in both productivity and quality of more than 5:1.

Although the phrase “lines of code” is used daily by almost all commercial, industrial, and governmental programming enterprises, there is no universally agreed-to definition for exactly what a line of code really is. There are 11 major variations in two sets that must be considered, plus the special case of how to count deleted code.

Set 1. Line-counting variations at the program level.

Method 1: Count only executable lines.
Method 2: Count executable lines plus data definitions.
Method 3: Count executable lines, data definitions, and comments.
Method 4: Count executable lines, data definitions, comments and JCL.
Method 5: Count lines as physical lines or as input statements.
Method 6: Count lines as terminated by logical delimiters.
Set 2. Line-counting variations at the project level.

Method 1: Count only new lines.
Method 2: Count new lines and changed lines.
Method 3: Count new lines, changed lines and reused lines.

Cost per defect within a software development cycle

<table>
<thead>
<tr>
<th>Number of defects</th>
<th>Fixed costs</th>
<th>Variable costs</th>
<th>Total costs</th>
<th>Cost per defect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reviews</td>
<td>$5,000</td>
<td>$20,000</td>
<td>$25,000</td>
<td>$125</td>
</tr>
<tr>
<td>Testing</td>
<td>$10,000</td>
<td>$5,000</td>
<td>$15,000</td>
<td>$175</td>
</tr>
<tr>
<td>Production</td>
<td>$15,000</td>
<td>$10,000</td>
<td>$25,000</td>
<td>$1,000</td>
</tr>
<tr>
<td>Total</td>
<td>$25,000</td>
<td>$35,000</td>
<td>$60,000</td>
<td>$200</td>
</tr>
</tbody>
</table>

Method 4: Count all delivered lines plus temporary scaffold code.
Method 5: Count all delivered lines, temporary code and support code.
Method 6: Count all lines, temporary code and support code.

There is a range of as much as 5:1 between the most diffuse counting technique and the most compact. Since few authors bother to define the line-counting rules they used, much of the software productivity literature has an uncertainty of perhaps 500% attributable to line-counting variations — plainly an unsatisfactory condition.

As an example, a single Basic program analyzed by the author consisted of 900 executable statements, 400 data definitions and 100 remarks or commentary statements. The average number of executable statements per physical line was 2.5. Counted in the most compact way, the program might appear to consist of 360 physical, executable lines. Counted in the most diffuse way, it might appear to consist of 1,500 total statements.

In his book, Software Engineering Economics (Prentice-Hall, Inc., Englewood Cliffs, N.J., 1981) B. W. Boehm uses Method 5, while the data in this article uses Method 6. The distinction between Boehm’s method of counting code and the methods of other authors illustrates the generally hazy status of software measurement today. There are no current standards, and each researcher selects the technique that seems most appropriate. Since Boehm’s book uses different methods from the ones used in this article, each would show the same programs as having different sizes.

For programs written in assembler language and restricted to a single physical line per statement, Boehm’s...
method, which includes comments, the yield of independent languages featuring multiprocessor languages may be about 15% larger than the method used here. However, for most large programming organizations, the number of comments is not sufficient either for counting lines, Boehm's method of counting physical lines would yield sizes that are smaller by as much as 75%.

Needless to say, while productivity researchers can define the size of the same program in ways that differ by several hundred percent, there is clearly a need for future standardization.

In the early days of programming, almost all programs were new, and all of the code was uniquely developed for each application. In this environment, it was appropriate to consider only new code production rates. But as the industry matures, more and more programming is done to add functions to existing systems. This is starting to trigger a subtle but profound change in both measurement and philosophy. What is important to productivity is not how fast a program can be developed but how fast the program functions can be delivered.

If measurement switches from development to delivery and reused code is considered, in the productivity measurements, enormous productivity rates can be encountered. Depending upon the quantity of reused code, productivity rates of more than 25,000 lines of code per person-year are not uncommon, with peaks of more than 100,000 lines of code per person-year happening occasionally. Indeed, it is now technically possible to develop some new applications that consist entirely of reused code, with no unique hand-coded modules being developed at all.

The other line-counting variations listed previously in Set 2 are also concerns in industrial and commercial programming organizations. During programming development, a large amount of temporary or "scaffolding" code frequently will be developed for testing purposes and then discarded when the program is complete. A question then arises: Should this temporary code be considered for productivity purposes? Most enterprises do not include temporary code in their productivity metrics, although a few projects may count temporary code separately for calibration purposes.

It may be necessary to develop tools and support packaging before a new program can be completed. Should these tools be viewed as independent programs and measured separately, or should their development be considered as part of the effort for the program they support?

From a technical point of view, the tool and support packages would be better dealt with as independent programs and measured separately. However, it may sometimes happen that for contractual purposes, the expense of tool development will be added to the expense of developing the primary application covered by the contract.

Deleted code is technically the most difficult aspect of programming to measure. It is not uncommon for real-time programming systems to have considerable efforts devoted to pruning, or carefully following the code to improve speed or reduce memory utilization. Obviously, any metric that equates productivity gains with developing more lines of code per time unit will come to grief when the activity being measured is the deletion of lines of code.

Perhaps the most common way of dealing with this situation is simply to ignore the deleted code. This, of course, drives down the productivity rate, but since performance tuning and code compression are difficult tasks that reduction should be expected and planned for.

**Combination techniques**

The lack of standard line-counting methods for programming makes productivity and quality research difficult, but it does not make them impossible. However, one factor comes close to making the research impossible, or at least the results unusable, and that is to publish a study on programming productivity or quality without stating the line-counting method used.

This is a relatively common occurrence, unfortunately, and it means that much of the literature on software engineering productivity cannot be used for serious research because the definitions either are not included or are not sufficient.
to understand what was being measured. Since the possible variations span a range of greater than 5:1, there is no way that the omissions can simply be ignored.

Scope of effort
Once the fundamental paradoxes and uncertainties of dealing with lines of code have been overcome, a new and equally significant problem appears in the area of what human activities should be included in productivity measurements.

The widespread failure in the software literature to report exactly which activities were included in measurements and over what time period the measurements were taken has introduced potential uncertainties that in extreme cases can span more than two orders of magnitude.

The variation in apparent productivity is symptomatic of the fact that the software engineering literature has blurred together, without considering their various implications, three different concepts of productivity:
- Personal productivity.
- Project productivity.
- Enterprise productivity.

The first and oldest productivity concept is that of the personal productivity of an individual programmer. This concept was started by programmers themselves in the days when programming was done partly in machine language and partly in assembler language, and writing lines of code rapidly was such a difficult feat that those who could do it felt a justifiable pride in their accomplishment. Although historically the oldest, personal productivity is not a very satisfactory measurement method.

In the second productivity concept, project productivity, the concern is not just coding but the entire development cycle, ranging from requirements through delivery and sometimes out through maintenance. Although project productivity is still commonly measured in terms of lines of code per person, much of the work is not long-er coding, and activities such as documentation, testing, and program assurance and management must be considered.

The third, emerging, productivity concept is that of productivity at the enterprise level, or economic productivity. Since economic productivity deals with goods and services produced per unit of labor and expense, productivity at the enterprise level measures such factors as the cost of canceled projects, maintenance, capital equipment purchases, travel expenses, hiring and training expenses, real estate costs, and many other factors that were not historically considered aspects of programming productivity, since they were associated with many projects and were not "owned" by any single programming group.

Yet enterprise productivity is in many ways the most important topic of the productivity domain. Improving productivity at the enterprise level implies knowledge of cost elements such as hiring, relocation, project transfers, canceled projects and many others. A much broader scope of measurement and analysis is required to deal with enterprise productivity than to deal with personal and project productivity.

Peripheral activities
The desirability of considering economic and enterprise productivity brings up the point that modern programming spans a much broader range of activities than coding alone. Indeed, for a very large system such as an operating system or a military system, only about a fourth of the personnel involved may do any coding at all.

The following are discussions of the major peripheral and support activities that should be measured at the project and enterprise level.

Documentation. While smaller programming projects may have comparatively little documentation, the documentation requirements for large programming systems sometimes elevate the documentation costs to the greatest single expense element. For example, an analysis of the documentation of a large telecommunications system revealed a total of more than 100 different kinds of documents produced and more than 60,000 total pages, with an overall total in excess of 30 million words. This was an average of 120 English words per line of source code.

While this was a fairly large system, the documenta-
For medium-to-large programming systems, defect removal costs are usually the most expensive single activity.

One major software system, whose development involved five European locations and one U.S. location, required more than 3,000 trips, and the cost of travel and hotels actually exceeded the cost of coding.

Hiring and relocation. Because the turnover and voluntary attrition rate among programmers is in the vicinity of 20% in the U.S., most programming organizations have relatively high recruiting and relocation costs. By the time agency fees, furniture moves, mortgage assistance, and other costs, as well as the expense of training new hires in company policies and methods, are totaled, from $25,000 to $75,000 per professional can be expended.

Capital equipment. It is interesting to note that the organizations at the leading edge in terms of productivity often average more than one terminal per programmer, accompanied by ample computing power and second-respose time. One of the major issues in programming productivity is to quantify just exactly what impacts capital expenditures have on programming productivity. Yet, this factor is seldom measured or quantified at the project level, and many companies have not even attempted a convenient way of linking capital purchases to individual projects.

Quality assurance. Within large corporations that have formal quality assurance organizations, the resources devoted to this activity range from less than 1% to the high of approximately 10% that IBM applies to marketed commercial systems. Quality assurance has developed some very interesting measurement techniques, such as "software quality" or the other quality assurance metrics of significance.

Training and education. It is not widely recognized, but the number of staff instructors and educational personnel in the set of Fortune 500 companies in the U.S. approximates the total faculty size of all U.S. universities. In terms of student-days, it is possible that the private, in-house training programs of major corporations approach the combined computer science departments of U.S. academic institutions. For a number of corporations, technical training is a major commitment, and targets such as 10 to 20 days of training per staff member per year are not uncommon.

Although the evidence is not conclusive, in his book Foundation for Growth — Productivity and Quality in Application Development (Nolan, Norton and Co., Lexington, Mass., 1984), T. Lutz suggests a correlation between staff technical training and software productivity. Some correlation between staff education and productivity apparently may exist, since those organizations that encourage education and professional activities, such as IBM, Digital Equipment Corp. and AT&T Bell Laboratories, appear to be among the leading-edge organizations in terms of economic productivity.

Integrating all application programs and microcomputer software may have no integration requirements. However, it may find 15% of the total development time and effort are associated with integration, or tasks such as getting the separate pieces of a large programming system to work together simultaneously.

Canceled projects. Very few enterprises include canceled projects in their productivity measures. Yet the overall impact of such projects can be very high. Within two large corporations, between 20% to 30% of all projects larger than 100,000 source statements were not completed and were canceled before delivery.

Measurement and tracking. Productivity and quality measurement is itself a significant cost element for those enterprises that do that. Within three large corporations, the number of full-time professional personnel engaged in measurement activities ranged from 1% to 3% of the total number of software professionals. When part-time and intermittent
Modems are remarkable little gadgets. They can connect you and your PC to mountains of data and oceans of information. But up until now, deciding which modem to buy hasn't been easy. So to solve that little problem, IBM is offering two 1,200 bps PC modems. Modems that not only give you the best features currently available on PC modems, but also offer features usually found only on higher priced, higher speed modems.

First, a Brief Introduction to the IBM PC Modems:

The IBM 5841 is a stand-alone modem capable of operating at 0-300, 600 and 1,200 bps in asynchronous mode, and 600 and 1,200 bps synchronous. Our other modem is the IBM Personal Computer Modem—an internal, half-card modem that operates at 0-300, 600 and 1,200 bps asynchronous.

The Non-Identical Twins

In some respects, these two modems are very similar. For example, they both have Automatic Adaptive Equalization—which means they will continuously fine-tune themselves to compensate for changes and noises on the telephone line. The result is, you can receive data over a wider range of phone line conditions. This is one of those features more often found on faster, more expensive modems.

In addition to automatic answering, both modems offer Adaptive Dialing—which means that if you don't specify either tone or pulse dialing, the modems try tone dialing for one digit, and if that doesn't work, they automatically switch to pulse dialing.

Both modems will automatically redial a number as many times as you tell them to. Or if you prefer, they can switch to an alternate number on a busy signal or a no answer. Once a connection is made, the modems automatically detect and adjust to the incoming transmission speed. They can also initiate an automatic log-on sequence including control characters, ID number and password.

And both modems have extensive "Help" menus, a complete complement of built-in diagnostics, a programmable speaker, and two phone jacks on the back so both your phone and the modem can be connected to the same line at the same time. You can even switch between voice and data without interrupting the phone call.

A Modem with a Memory of Its Own

The IBM 5841 stand-alone modem has some additional features you don't usually find on 1,200 bps modems. For example, the modem is switchable between asynchronous and synchronous modes and has a 20-entry Dialing Directory. Kept in non-volatile storage, the directory enables the modem to dial up and log on to systems automatically. This feature is most convenient when the 5841 is used with a fixed-function ASCII terminal such as the IBM 3610 or 3612.

The front panel of the 5841 has a complete array of eight LED Status Indicators to give you a visual check on what's happening.

Standards & Compatibility

You'll be pleased to know that both modems meet the Bell 103/212A and V. 22 CCITT standards. Both can use the industry standard "AT" command set, as well as the IBM command set.

And both modems have been tested for compatibility with leading PC communications software such as the IBM PC Communications Manager, Crosstalk™ XVI, Smartcom II® and Transporter™. So if you've been thinking about tying your PC into your company's computer, or accessing an outside data base for stock market information or airline schedules, or using electronic mail, or just exchanging information on a user group's bulletin board—then it's time you got an IBM modem for your PC.

For the Authorized IBM PC Dealer or the IBM Product Center nearest you—or for free literature—call 1-800-IBM-2468, Ext. 90/YU.

Or contact your IBM marketing representative.
Noncoding activities

Since considerably less than half of the effort on large programming systems is devoted to coding, another question arises: What kinds of measurements exist for the noncoding activities? Productivity has three different meanings that should be, but often are not, considered in the context of measurements:

- Productivity in the sense of speed.
- Productivity in the sense of cost.
- Productivity in the sense of yield.

When attempting to improve the productivity of a given activity, is it more important to speed up the activity or to lower its cost?

Since the definitions and technologies that relate to speed are not necessarily the same as the ones that relate to cost or to yield, this distinction can lead to very different conclusions.

This lack of measures for speed and yield has introduced subtle distortions into the overall understanding of software productivity. For example, the lack of full-life-cycle speed measures has caused undue emphasis on the few activities, such as coding, that do have common speed measures. The lack of common yield measures has slowed down the economic analysis of software.

Economic measures

The overwhelming historical emphasis on lines of code has been the central theme of most programming measurement studies. However, as programming becomes a mature discipline, other alternatives are being explored.

Economic productivity is defined as the amount of software produced per unit of labor or expense. When programming is analyzed in this fashion, a significant problem arises: What, exactly, are the expenses of a program, or how can a program be viewed as economic?

Although software and programming lack absolute productivity measures that are effective and they lack economic productivity measures, it is possible to deal with productivity in a relative fashion.

For example, suppose that a small manufacturing company developed an order-entry system in 1975 with a new and inexperienced staff of personnel and no particular use of structured programming methods. At that time, the system took 12 calendar months and 150 person-months to develop.

In 1985, the company was ready to replace the system with a new version, but this time the personnel were experienced, and full use was made of the structured programming methods. The new system is functionally equivalent to the old but was completed in only six calendar months requiring only 50 person-months for development.

From this type of analysis, it may be seen that economic productivity improved significantly: Identical functions were produced in only half of the calendar time, with only one-third of the resources. This kind of analysis does not yield absolute productivity measures, but it provides helpful information about significant trends and improvements.

Note that if the two projects were compared by means of hazardous metrics such as lines of code, the improvements would not be so visible. Indeed, if the company's early system were written in assembler language and took 30,000 source statements, and if its new system were written in Cobol and took only 10,000 source statements, both would have identical productivity rates of 200 lines of code per person-month.

Only for costs are there relatively stable measures; this is one of the reasons the cost of software production is much better understood than either speed or yield. Indeed, if costs of software production is much better understood than either speed or yield, the cost of software production is usually mapped, even if the problems have not yet been solved. From this point on, new metrics can be developed that are free of the distortions and paradoxes that have been so troublesome in the past.

Economic productivity is defined as the amount of software produced per unit of labor or expense. When programming is analyzed in this fashion, a significant problem arises: What, exactly, are the expenses of a program, or how can a program be viewed as economic?

Although software and programming lack absolute productivity measures that are effective and they lack economic productivity measures, it is possible to deal with productivity in a relative fashion.

For example, suppose that a small manufacturing company developed an order-entry system in 1975 with a new and inexperienced staff of personnel and no particular use of structured programming methods. At that time, the system took 12 calendar months and 150 person-months to develop.

In 1985, the company was ready to replace the system with a new version, but this time the personnel were experienced, and full use was made of the structured programming methods. The new system is functionally equivalent to the old but was completed in only six calendar months requiring only 50 person-months for development.

From this type of analysis, it may be seen that economic productivity improved significantly: Identical functions were produced in only half of the calendar time, with only one-third of the resources. This kind of analysis does not yield absolute productivity measures, but it provides helpful information about significant trends and improvements.

Note that if the two projects were compared by means of hazardous metrics such as lines of code, the improvements would not be so visible. Indeed, if the company's early system were written in assembler language and took 30,000 source statements, and if its new system were written in Cobol and took only 10,000 source statements, both would have identical productivity rates of 200 lines of code per person-month.

Only for costs are there relatively stable measures; this is one of the reasons the cost of software production is much better understood than either speed or yield. Indeed, if costs of software production is usually mapped, even if the problems have not yet been solved. From this point on, new metrics can be developed that are free of the distortions and paradoxes that have been so troublesome in the past.
NEW PRODUCTS

**DEC units get subsystem**

Model 41 provides noninterleaved disk data transfer

Scientific Micro Systems, Inc. has announced the SMS 1000 Model 41, a high-throughput data storage subsystem designed to operate with any Digital Equipment Corp. Microvax II or LSI-11 computer system. The Model 41 combines up to 280M bytes of Winchester storage with resident and tape drive options. It offers a range of configurations including 8-in. (1.28MB) or 5¼-in. floppies, which are DEC RX50-compatible and double sided to provide twice the capacity of the standard RX50 drive.

Also available is a 60M-byte, 5¼-in. off-line streaming cartridge tape and an online, file-oriented tape system said to allow the running of all DEC software, the vendor said.

Standard performance features of the Model 41 include noninterleave disk data transfer, overlapped seeking, seek order dering, flaw mapping and error correction. High-performance 5¼-in. Winchester provides a transfer rate of 625KB/s/sec. Computer average access time of 27msec.

The Model 41 integrates the mass storage device control and the Sense Monitor on a single board. The Sense Monitor contains resident firmware and hardware used for system status analysis, system utilities and diagnostics. According to the vendor, the user interface may be customized according to the user's level of understanding and can be operated from the Model 41's front panel or from a menu-driven console terminal.

The SMS 1000 Model 41 is priced ranging from $18,000 to $46,000, in quantities of one to 5.

Scientific Micro Systems also announced capabilities include its entire series 1000 model series with the Microvax II.

**Triangle’s three Cobol utilities debut**

Triangle Software Co. of San Jose, Calif., introduced the Perfex family of utilities designed to speed up and simplify Cobol program maintenance.

The three utilities — Illustrate, Crosscheck and Finaltest — are said to help automate the once manual procedures of Cobol program maintenance and testing while running under OS/VS and DOS.

The Illustrate utility displays a hierarchical structure chart showing program flow and execution. According to the vendor, it simplifies maintenance, training and documentation on structured Cobol programs automatically generating hierarchical structure charts and related information.

Charting both the structure and logic of a program eliminates the need for searching through source code listings and reduces time and resources spent on training new programmers.

The Crosscheck program is a file comparison utility. It compares any two source programs, job control language, macro language, tape or image data files and identifies the specific differences between them. Detailed reports show additions and deletions with a line-by-line comparison.

The program features a file matching technique that allows the comparison of two files of any size and type. The program will pinpoint the location of changes made during program updates for easier debugging, verifying that source code or files were not accidentally added or deleted and automatically provide documentation of program and file maintenance changes.

The Finaltest program reportedly reduces production failures caused by incomplete testing before turnover. The utility verifies that the program is thoroughly tested before turnover to production by automatically identifying all unexecuted paths and related branches. The program helps users to avoid production failures by improving program testing, to eliminate guesswork by clearly identifying untested program paths and to determine where to fine-tune test data until test coverage is complete.

Each product is priced at $1,650 per year for a three-year license or $375 rental per month.

**Graphics, text station bows**

Forward Technology, Inc. of San Jose, Calif., has introduced the Graphpix I graphics and text station that combines a stand-alone graphics workstation with a high-resolution VDT.

The Graphpix I was designed to operate with AT&T Unix and VMS systems. It is compatible with Digital Equipment Corp. V7000 and V702 and Tektronix, Inc. 4010 and 4014 protocols. It can also serve as an intelligent extension port of the DEC Microvax II and stand-alone workstations.

The monochrome monitor of the Graphpix I has a 15-inch screen and offers 1,024 by 768-pixel resolution. Standard capabilities include multiwindowing, multiformats and use of a mouse. The menu-driven interface operates through either a pair of BS-2532 ports or a single RS-422 port. Interface with laser printers for local re-creation of documents is also possible.

The Graphpix I is priced at $2,950.

Tandon Corp. of Chatsworth, Calif., has introduced the Diskard 21, an add-in card that contains an integral Winchester disk drive.

The Diskard 21 has 21.3M bytes of formatted capacity.

The product reportedly plugs into a single slot in any IBM Personal Computer XT or compatible.

No accessory boards needed

According to a spokesman, the Diskard 21 is easy to use. It does not require any accessory boards, cables or installation software.

The Diskard 21 has plug-in compatibility with IBM PC-DOS and Microsoft Corp. MS-DOS 2 and higher. Media is plated, and power consumption is 1.1W.

A dedicated head parking zone off the data surface is provided for increased data protection, and the heads are positioned using a temperature-compensated, pseudo-close-loop system.

Diskard 21 add-in card is priced at approximately $995, according to the vendor.
There's more to choosing an effective voice message system than just buying the right equipment.

With the Xerox Voice Message Exchange, installation isn't over when the hardware's plugged in. You see, there's a system behind our system.

First, we'll closely analyze your present communications program. And then recommend an XVMX configuration specifically designed for your needs.
designed to complement it.

Next, we'll train your system operators at our extensive facilities in Leesburgh, Virginia. There they'll learn to oversee every aspect of XVMX. From managing user mailboxes to monitoring operation reports.

And we don't stop there. Through guides for user instruction, we'll make sure everyone in your company knows how to put the XVMX to use. You'll also be able to purchase optional software to analyze data on XVMX activity and set up an efficient billing system.

So, for a voice message exchange system backed by the most responsive service and support organization in the world, call on Xerox. At 1-800-TEAM-XRX, ext. 128. Or send in the coupon. We won't link you and leave you.

the system system.
and retrieves plans. Other modules use word processing techniques to create and modify plans, classify and code parts to form parts families and modify existing plans and storage. A Graphics/GE-CAPP-Plus interface module allows the system to accept graphic input from external sources and display them at workstations.

Other modules display plans on shop floor terminals, calculate operation and planning times from lot sizes, set up times to develop time standards or analyze group technology for optimum machine utilization. Available for Digital Equipment Corp. VAX units, GE-CAPP-Plus can be licensed for between $50,000 and $125,000, depending on system size. GE, Industrial Automation Systems Department, 12 Corporate Woods Blvd., Albany, N.Y. 12211.

**Application packages**

Versatec has introduced Release 2 of its Versaplot Random plotting software for IBM OS/MVS, VS and VM/CMS computers.

Release 2 supports eight line colors, 256 predefined area colors, 256 user-definable area colors, as well as monochrome plotting. Call compatible with pen plotter programs, the software lets users define clipping windows, plotting viewports and pen attributes such as width and color. Both hatched and solid colors can be generated. Plotter widths run 24, 36 and 42 in. by virtually any length. Release 2 is available on nine-track, 1,600 bit/in. magnetic tape for $6,000. Versatec, 2710 Walsh Ave., Santa Clara, Calif. 95051.

**NEW PRODUCTS/SOFTWARE & SERVICES**

Computers World, January 13, 1986

**SOFTWARE & SERVICES**

**Systems software**

Hewlett-Packard Co. has upgraded its HP 50955A IBM 3278 display station emulator to run on the HP 9000 Series 200 and 300 engineering workstations with the Pascal 3.1 operating system.

The Pascal 3.1-based version provides bidirectional file transfer capability for IBM VM/CMS and MVS/TSO operating systems and for emulation of native command files for the HP 50955A display station emulator. The emulator operates with bit-mapped and alpha(graphics displays, HP-III, and HP 9816/9836 keyboards and printers and mass storage devices are supported by Pascal 3.1. The HP 50955A costs $1,500. HP, 3000 Hanover St., Palo Alto, Calif. 94304.

**Klein Allen Co.** has announced External Program Calls for the IBM System/36. 

External Program Calls allows an RPG program to load and execute other RPG programs. It provides a communications path that permits programs to dynamically pass data and indicators back and forth. The program eliminates redundant code and reduces overlapping program functions. With the product, conventional System/36 limits on program region size, number of allocated files and number of arrays can be bypassed. The product licenses for $450. Klein Allen, #3 20 South Center, American Fork, Utah 84003.

**Panasophic Systems, Inc.** has announced Pananid Plus 2, an enhanced version of its auditing system for testing and reporting on data stored in computer files. Recent features include enhanced routines such as encrypt/decrypt, data base access and expanded processing capabilities. It costs $19,900 for OS versions and $15,900 for DOS versions. Panasophic, 709 Enterprise Drive, Oak Brook, Ill. 60521.

**New Unit, Inc.** has announced Plot, a data analysis program for scientific users featuring publication-quality graphic output. Plot is available for Digital Equipment Corp. PDP-11 and LSI-11 systems running TSX-Plus and all VAX systems running VMS. Features include command file nesting to 16 levels, user-definable functions, variables and up to 64,000 data points. Plot requires no coding. It has five resident character sets and offers support for up to 50 output devices. Plot is priced at $1,000 for TSX-Plus and $2,500 for VMS versions. New Unit, DeWitt Building, 215 N. Cayuga St., Ithaca, N.Y. 14850.

**General Electric Co.** has unveiled GI-CAPP-Plus, a computer-aided process planning package said to increase factory production rates, shorten planning cycles and reduce overall manufacturing costs. The base system creates, stores

**The problem with most 4GLs is they're finished before you are.**

And where does that leave you? With the final, tricky ten percent of your application yet to write, and no 4GL left to write it with. Sound familiar? Introducing INFORMIX-4GL. Never again will you have to switch to C or COBOL to truly customize your application. Instead, INFORMIX-4GL provides an all encompassing syntax for every aspect of your application building. So once you're programming in INFORMIX-4GL, you never have to leave it. And considering all it can do, you may never want to. Now, for instance, you can write in

See us at UniForum, February 4-7, Booth 1594.
### NEW PRODUCTS/SOFTWARE & SERVICES

#### Methodologies

<table>
<thead>
<tr>
<th>Methodologies</th>
<th>Training</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tamp Computer Systems, Inc. has announced the Disaster Recovery System. The Disaster Recovery System contains a comprehensive plan that can be adapted to any environment. It is based on Tamp's six-phase approach methodology. The Disaster Recovery System includes sample questionnaires, interoffice memos, external letters and the instructional information necessary to complete a disaster recovery project. The system is available on floppy disk ready to be implemented under IBM Personal Computer-compatible operating systems. And, of course, it's compatible with INFORMIX-SQL—our popular, proven DBMS. So files you build with one, you can access with the other.</td>
<td>McGraw-Hill Training Systems has added a Reflex data base software tutorial called Faststart Reflex to its Faststart training series. Faststart Reflex runs simultaneously with the applications software, allowing the user to perform tasks such as creating and storing files. The tutorial is compatible with Reflex from Analytica Corp. and Reflex: The Analyst from Borland International/Analytica. The course comes on 5%-in. and 3%-in. diskettes and is designed to run on IBM Personal Computers and compatibles as well as Digital General Corp. DG/One and Dasher/One systems.</td>
</tr>
<tr>
<td>Pricing starts at $2,995 for DOS versions and $5,995 for Unix systems. Modern Technologies International, Inc. has announced its Disaster Recovery System. It is based on Tamp's six-phase approach methodology. The Disaster Recovery System includes sample questionnaires, interoffice memos, external letters and the instructional information necessary to complete a disaster recovery project. The system is available on floppy disk ready to be implemented under IBM Personal Computer-compatible operating systems. And, of course, it's compatible with INFORMIX-SQL—our popular, proven DBMS. So files you build with one, you can access with the other.</td>
<td>Pricing starts at $89.95, Faststart Reflex requires an IBM Personal Computer with at least 384K bytes of memory and two double-sided disk drives or an IBM Personal Computer XT and one double-sided disk drive.</td>
</tr>
</tbody>
</table>

- **RELATIONAL DATABASE SYSTEMS, INC.**

just ten to twenty pages of 4GL code, applications that would take hundreds of pages with C. That's because INFORMIX-4GL was designed from the start to be an application building language. It's built around the full implementation of ANSI Standard SQL. And features Custom Screen Generation, Custom Menu Building and a built-in Report Writer. What's more, INFORMIX-4GL works with UNIX, MS-DOS and Networked DOS operating systems. And, of course, it's compatible with INFORMIX-SQL—our popular, proven DBMS. So files you build with one, you can access with the other. For more information and our free booklet, *The 20-Minute Guide to INFORMIX-4GL, call 415/322-4100.* Or write RDS, 4100 Bohannon Drive, Menlo Park, CA 94025. And start taking your applications to even greater heights.

---

**Henco Software, Inc.** has announced Info Computer-Based Training (Info CBT), a course on Henco's Info data management systems. The course comes on 5%-in. and 3%-in. diskettes and is designed to run on IBM Personal Computers and compatibles as well as Digital General Corp. DG/One and Dasher/One systems. Info CBT includes a series of diskettes containing 22 interactive lessons, an Info Pocket Reference Guide and a course workbook. Lessons start with an introduction and continue through advanced concepts and facilities.

- **Henco Software costs $1,200.**

**Advanced Systems, Inc.** has announced MVS System Operator Commands, a computer-based training course designed to teach MVS computer operators how to use MVS/XA and MVS/VS system commands more effectively. The course works interactively to teach the 99 MVS system commands, including XA. It covers basic command syntax and console procedures and takes users through more than 100 simulated operating situations. The course contains 16 units on four microcomputer diskettes, a student guide and reference cards. It runs under the IBM PC/XT or Trainer 3000 and may be uploaded to run under the Mainframe IS system. The course costs $6,000. Advanced Systems, 155 E. Algonquin Road, Arlington Heights, Ill. 60005.

- **Miller Smith, Inc.** has announced training seminars on IBM System/38 database design. The two-day seminars will take place in the Denver area. They are said to provide a study and review of IBM System/38 database design, analysis and implementation. Topics covered include business modeling techniques, building the data structure diagram and constructing a logical database design example. Seminar fees, including workbooks, are $395 per student. Seminars for 1986 are scheduled for Jan. 23 and 24, Feb. 20 and 21 and March 20 and 21. Miller Smith, P.O. Box 33517, Denver, Colo. 80223.

- **Relational Data Base Services, Inc.** has announced five new seminars in its winter and spring 1986 seminar offerings. The new seminars include a three-day System Manager's Workshop and one-day seminars including Designing and Relocating Computer Centers; System 1032 Efficiency; Data Base System Design Techniques; and Host Language Programming with System 1032. Seminars are scheduled in North Carolina, New York, Florida, Texas and Illinois throughout the year. One-day seminars are priced at $360 per student, and three-day seminars are $940 per student. Relational Data Base Services, P.O. Box 644, 121 S. Main St., Kernersville, N.C. 27285.
We just lost Pittsburgh! Where's the datacomm manager?
Don’t jump.

Network management.
With it, you’re on top of the world.
Without it, you’re a goner.
Hold on.

We’re Infotron. We design, build and install communications networks. Reliable. Compatible. Sophisticated networks that offer single-point control and real-time monitoring.

Our ANM Advanced Network Manager, coupled with a 990/992NP Network Processor, can pinpoint real or potential trouble spots, plus eliminate costly downtime by automatically rerouting data.

Control yourself. Take the first step: Call 1-800-345-4636.
ON MARCH 19, WE'LL TAKE A CLOSE LOOK AT MANUFACTURING

Ultimately, computers will extend to every department in every company. And when they do, the MIS/DP department will be called in to help with the decisions.

That's why vendors such as Impell, Micro Data Systems, and Structured Software Systems are creating software that will integrate smoothly with existing and future systems. And productivity will be improved, not disrupted.

We'll zero in on CAD/CAM.

March's Computerworld Focus will present a special section devoted to CAD/CAM. We'll find out what's available now — both products and development tools. Who the major vendors are and where they're taking us. And we'll take a good hard look at the task of implementing and maintaining a CAD/CAM system within an organization.

Look the people you really want.

What's more, the people we'll be reaching are the people you want most: 189,000 MIS/DP professionals who subscribe to Computerworld. Plus 9,000 market and sales people of manufacturing companies. And 107,000 MIS/DP professionals who have bought Escrow Accounts or Application Notes in any combination of Computerworld, Computer Modern, or Data Systems and Applications. They are the people you really want — the ones who will significantly influence your Company's purchase decisions.

Issue: March 19 — Closing: February 7

CONTINUED ON PAGE 88

MIS/DP professionals will learn what they need to know to make intelligent decisions about integrating design and manufacturing systems within the corporate framework. Whether they are involved in CAM, robotics and CAD/CAM, or they are involved in design and manufacturing that allows users to view several independent concepts simultaneously.

The new release has enhanced internal modeling capabilities. It is written in PC Scheme Lisp.

Arborist Release 2 costs $505.

New York
San Francisco
Computers and the Apple Computer, 128K bytes for the Personal Computer, AT and 48K bytes of memory for the Apple II family.

Unit Conversions costs $49.95.

MASS Polytechnic University, 9280 E. 29th Street, Indianapolis, Ind. 46205.

Micro Data Systems, Inc. has announced Arborist Release 2 decision tree software that works with Lotus Development Corp.'s 1-2-3.

Lattice, Inc. has introduced the Lattice Screen Editor. The Screen Editor offers a multiwindow feature that allows two files to be edited simultaneously and errors and random-access file support.

Structured Software Systems, Inc. has upgraded its HPL-Plus operating system to run on Hewlett-Packard and Co. Series 3000 desktops.

Structured Software Systems, Box 1072, Irick Road, Mountain Holly, N.J. 07860.

International Computing, Inc. has announced Unit Conversions, a software program for IBM Personal Computers and the Apple Computer, Inc. Apple II family.

Unit Conversions allows users to reference 3,550 measurement conversions within two different families of units. It requires a minimum of 64K bytes of memory for the IBM Personal Computer, 128K bytes for the Personal Computer XT and AT and 48K bytes of memory for the Apple II family.

International Computing, 1501 Monroe St., Madison, Wis. 53711.

Texas Instruments, Inc. has announced Arborist Release 2 decision tree software that works with Lotus Development Corp.'s 1-2-3.

Structured Software Systems, 1072, Irick Road, Mountain Holly, N.J. 07860.

Unit Conversions costs $49.95.

International Computing, 1501 Monroe St., Madison, Wis. 53711.

Micro Data Systems, Inc. has released Version 3.1 of its Escrow Accounting System II.

The new version provides multiuser capabilities. It maintains investment company codes, title policy numbers and legal descriptions. It processes interest-only, principle-only and standard escrows. It is compatible with Digital Research, Inc. CP/M, CP/M-86, MS/M II and MS/M-86 and Microsoft Corp. MS-DOS or IBM PC-DOS-based micros.

Unit Conversions has an unlimited number of files, sorts, totals and subtotals automatically.

The tool merges information from an unlimited number of files, sorts, totals and subtotals automatically.

The system includes a language translator for processing Dbase source and a runtime library tool box to replace the Dbase screen handler.

The system is available under Microsoft Corp. MS-DOS and Xenix and AT&T Unix. The package price ranges from $325 to $1,000.

Desktop A.1., #3, 1720 Post Road E., Westport, Conn. 06880.

Structured Software Systems, Inc. has upgraded its HPL-Plus operating system to run on Hewlett-Packard and Co. Series 3000 desktops. HPL-Plus supports color graphics, is compatible with programs written to run on HPL Version 2.1 and is compatible with the original HPL. HPL-Plus is priced at $600.

Structured Software Systems, Box 1072, Irick Road, Mountain Holly, N.J. 07860.

International Computing, Inc. has announced Unit Conversions, a software program for IBM Personal Computers and the Apple Computer, Inc. Apple II family.

Unit Conversions allows users to reference 3,550 measurement conversions within two different families of units. It requires a minimum of 64K bytes of memory for the IBM Personal Computer, 128K bytes for the Personal Computer XT and AT and 48K bytes of memory for the Apple II family.

Unit Conversions costs $49.95.

International Computing, 1501 Monroe St., Madison, Wis. 53711.

Texas Instruments, Inc. has announced Arborist Release 2 decision tree software that works with Lotus Development Corp.'s 1-2-3.

Arborist Release 2 is used for examining decisions and incorporating uncertain data into spreadsheet analysis. It has a window-based structure that allows users to view several independent concepts simultaneously.

The new release has enhanced internal modeling capabilities. It is written in PC Scheme Lisp.

Arborist Release 2 costs $505.

TL, Data Systems Group, P.O. Box 2909, M/S 2180, H-827, Austin, Texas 78769.

Micro Data Systems, Inc. has released Version 3.1 of its Escrow Accounting System II.

The new version provides multiuser capabilities. It maintains investment company codes, title policy numbers and legal descriptions. It processes interest-only, principle-only and standard escrows. It is compatible with Digital Research, Inc. CP/M, CP/M-86, MS/M II and MS/M-86 and Microsoft Corp. MS-DOS or IBM PC-DOS-based micros.

Version 3.1 retail costs $42,495.

Micro Data Systems, 1314 N. Fourth St., Coeur D'Alene, Ind. 83814.
Digital Products, Inc. has introduced the Sub-Lan, a hardware-software combination network for personal computers. Sub-Lan implements an asynchronous net. The hardware is the firm's Netcommander, an intelligent asynchronous data exchange. The software is Server Technology, Inc.'s Easyylan and Communications Research Group, Inc.'s Blast communications packages as well as Digital Products, Inc.'s NetCommander. In addition to retaining all of the Personal Computer's stand-alone capabilities, PC-On-Coax adds two operating modes: a networking Personal Computer mode using the 3200 as a file and printer server and a terminal mode using the 3200 as a multiuser host computer. PC-On-Coax is priced at approximately $695 for each connection.

Pertec Computer, 17112 Armstrong Ave., Irvine, Calif. 92713.
Provide 24 Hour CICS Service

IBM gave dynamic file allocation to CICS... but you need Netec's CAFC to make it easy. CAFC allows a single command to OPEN or CLOSE 5 or 50 files and to enable or disable the transactions. It allows CICS and your batch programs to automatically add, remove and share files.

Browse, Print and Archive CICS Dumps

The CICS Dump Display Facility offers a variety of access modes for transaction dumps. "You may selectively inhibit dump generation or archive the dumps for after-the-fact off-line analysis. CDOD automatically switches the dump data sets for you.

Storage

Disc Tech One, Inc. has announced the RB Link product line of diskettes. It allows the Digital Equipment Corp. Rainbow 100 series compatible with IBM Personal Computer hardware and software.

The RB Link series includes the RB Link, RB Link Jr. and RB Link Sr. The RB Link adds an expansion slot and allows the subsystem to run the IBM Personal Computer hardware and software. The RB Link Jr. includes a 48 track/in. floppy disk drive and two expansion slots. The RB Link Sr. provides file expansion slots and a 3¼-in. Winchester hard disk drive.

Prices for RB Link, RB Link Jr. and RB Link Sr. are $1,300, $800 and $3,800, respectively.

Disc Tech One, 840 Ward Drive, Santa Barbara, Calif. 93111.

Systems Peripherals Consultants is offering the Diskit series of low-profile Winchester disk drives for computers that run on Digital Research, Inc. CP/M, IBM PC-DOS or Microsoft Corp. MS-DOS.

The drives are housed in 2-in.-high Pro/File cabinets that can be mounted on top of or alongside the computer. Diskit drives are available as primary on-line storage devices, in removable cartridge models as backup devices or as part of the Diskit Combo, where an additional drive is stored in the same chassis to provide 50M bytes of on-line storage.

Prices range from $1,095 to $1,995.

Systems Peripherals Consultants, 9747 Business Park Ave., San Diego, Calif. 92131.
"My idea was to give my AT users the performance of a minicomputer."

Our IDEA Supermax multifunction board lets her do that at microcomputer prices.

Get the performance of a minicomputer for the price of a microcomputer with Supermax, the latest addition to the IDEAboard line.

The new IDEA Supermax gives users more memory and greater options than ever before. Now they can have an AT board that goes beyond 3MB of RAM. IDEA Supermax lets users go all the way from bare board to 4MB of memory. And we don't stop there!

Two serial ports and one parallel port are standard with the Supermax. These powerful interfaces make your AT the kingpin of your office computing system.

And IDEA Supermax features outstanding price and performance, too.

At 3MB and 4MB of RAM you save thousands of dollars and still get three standard I/O ports. That's a four figure cost advantage over the competition.

You'll never lack additional memory for integrated software applications like Symphony™ or Framework™ when you plug in Supermax. In a LAN with the AT acting as a file server, you can partition memory on the Supermax for individual users on the network. You can even combine the Supermax with our 10MB to 120MB IDEAdisks to build the AT into a desktop supercomputer.

Like every IDEAboard, the Supermax comes with our free library of software, including IDEAmenu, RAMfloppy, Printer Spooler, Diagnostics, Clock Routine, and more.

For your other applications, these IDEAboards offer the same price and performance advantages as the Supermax:

- IDEAmax 384 has 384K RAM, parallel, serial, game ports, and clock/calendar.
- IDEA mini short I/O card is perfect for the XT, Portable, and PC/3270 short slots. Your choice of two serial ports, parallel port and clock.
- IDEA Minimax has the same short slot size and holds up to 384K RAM.

So when you have a great idea for your IBM AT, look to IDEA to make it a reality. Call 800-257-5027 for the IDEA dealer nearest you.
Continued from page 86

concentration and relieves
the host of all interactive
communications processing.
Multiple dial-up capability is
supported, as is connection'
to IBM 5250 and 5249 control
units.

The 3805 Network Con-
troller is based on the IBM
Series/1 with IBM's EDX op-
erating system and other
IBM-supported hardware. It
is supplied as a bundled sys-
tem solution.

Prices range from $50,000
to $142,000.

CWA International, Suite
210, 18805 Cox Ave.; Sarato-
ga, Calif. 95070.

Voice/data
communications

Metapath, Inc. is market-
ing a 240-port data private
branch exchange called CDS-
240 that is able to intercon-
nect nearly any computer,
terminal and peripheral con-
taining an RS-232 serial or
standard parallel interface.
The PBX switch supports
1,125 ports on a single net-
work. It attaches up to 192
serial devices operating at
9.6K bit/sec. and 48 devices
with parallel interfaces at
40K bit/sec.
Remote sites have the
same port selection and
queuing capabilities as local
users with automatic time-
out and logoff features. Secu-
irty passwords prevent un-
authorized access.

Prices start at $4,900 for a
minimum configuration.

Metapath, 222 Lincoln
Centre Drive, Foster City,
Calif. 94404.

Opcom has announced the
Dial/DID interface for direct
inward dial (DID) trunks. It
allows Opcom's Dial system
to provide 24-hour, seven-
day integrated secondary an-
swering for private branch
exchanges.
The interface allows Dial
to inform a caller when a par-
ty is unavailable and then al-
lows the caller to choose an-
other extension or leave a
message.
Dial/DID comes in a mod-
ule containing one to three
interface cards, each sup-
porting eight trunks. Up to
20 modules can be installed,
supporting a maximum of
480 trunks.

Dial/DID costs $3,500 for
the first eight trunks and
$1,500 for each additional
eight trunks up to 24.

Opcom, 536 Oakmead
Pkwy., Sunnyvale, Calif.
94086.

Protocol converters

Quasitronics, Inc. has an-
ounced the Q-4220 RS-232/
RS-422 protocol converter.
The converter is a device
that provides bidirectional
synchronous or asynchro-
nous conversion of all com-
monly used RS-232 and RS-

422 signals. Each port is
 jumper configurable for data
terminal equipment or data
communications equipment
operation.
The unit was designed to
be configured with one port
set as data terminal equip-
ment and the other port set
as data communications equip-
ment, according to the
vendor.
The Q-4220 converter is
priced at $219.

Quasitronics, 211 Vandale
Drive, Houston, Pa. 15342.

Scitec Corp. has an-
nounced the Scitec E4-T
communications standard
converter said to convert Eu-
ropean CCITT G703 circuits
to AT&T Bell Laboratories
DB6 circuits.
The converter provides

carrier frequency conversion
of 1.544M bit/sec. to 2.048M
bit/sec. with each interface
conforming to electrical
specifications for AT&T Bell
Laboratories and CCITT di-
phase pulse transmission. It
features four channels, ex-
pandable to 128.
The converter is priced
from $10,000.

Scitec, 860 Aquidneck
Ave., Middletown, R.I.
02840.

Software

Gammalink is offering
Gammafax, a software pack-
age that enables its 9.6K bit/
sec. Gammacomm modem
board to communicate with
Group III digital facsimile
machines over dial-up tele-
phone lines.
The package allows page
images scanned by a facsimi-
le machine to be sent to a per-
sonal computer and stored as
disk files. In turn, ASCII files
or graphics generated on the
micro can be sent to remote
facsimile machines.

Gammalink, 2452 Embar-
cadero Way, Palo Alto, Calif.
94303.

Don't your IBM products deserve IBM service?

You chose IBM products for lots of good reasons. And now that you depend on
them to help keep your office running smoothly, doesn't it make sense to help protect
your investment with blue chip service from IBM?

Whether you have an IBM Personal Computer or one of our larger computers,
blue chip service is more than just expert repair.

Blue chip service means a lot of things you don't see. Quality. Speed. Commitment.
And IBM experience. Every year IBM invests many hours of training to keep its service
representatives current on technologies that never stand still.

Then there are our extensive data bases used to help identify common problems
Netlink, Inc. has announced the 3711 SNA Gate, the first of a family of IBM Systems Network Architecture (SNA) servers providing a generalized gateway from X.25 or any local-area network to SNA using IBM's Netbios interface.

The 3711 SNA Gate provides software to attach one personal computer card and its Netbios interface to the SNA Gate. Asynchronous devices or personal computers attached to local nets or X.25 networks running asynchronous terminal emulators can connect to the SNA Gate and appear to IBM's SNA as a Logical Unit Type 1 or Logical Unit Type 2.

The 3711 SNA Gate can operate upstream to an SNA host at speeds up to 64K bit/sec. Prices for the 3711 start at $11,100.

Netlink, 3214 Spring Forest Road, Raleigh, N.C. 27604.

Multiplexers/modems

ABM Computer Systems has unwrapped Bright Modem, a Hayes Microcomputer Products, Inc.-compatible 300/1,200 bit/sec. asynchronous modem for the IBM Personal Computer.

Bright Modem reportedly derives its intelligence from the Personal Computer's processor, rather than from an on-board dedicated processor, to allow for future extensions or alterations to the modem's instruction set via software upgrades to the driver.

Features include autotransfer and autodial in tone or pulse mode, according to the vendor. The product is also said to have the capability to be configured as either COM1 or COM2.

Bright Modem is priced at $109.

ABM Computer Systems, 3 Whatney, Irvine, Calif. 92718.

Data General Corp. has announced its Model 5095 time division multiplexer, which connects terminals or devices to transmit simultaneously over a single high-speed communications line.

The Model 5095 is compatible with DG computer terminals. It supports data transmission speeds up to 9.6K bit/sec. with X.25 and remote terminal clusters and a mixture of RS-232 and RS-422 interface types.

The multiplexer interconnects user equipment to one high-speed composite line for serial transmission and operates at distances up to 2,000 ft using twisted-pair cable.

The Model 5095 is priced at $995.

DG, Route 9, Southboro, Mass. 01772.

Lantel Corp. has announced the Lantel 168 central retransmission unit (CRU) and the Lantel 500T and 500DC voice modems.

The 168 CRU is a single-channel frequency translator that allows the IBM PC Network to accommodate up to 1,000 personal computers. It allows the network to serve an area up to three miles wide on a standard broadband cable system.

The two modems allow broadband local-area network operators to add telephone capability to their networks. Dedicated voice ring down circuits are installed using two 500T modems.

The 168 CRU costs $1,495. The 500T and 500DC modems cost $895.

Lantel, 3100 Northwoods Place, Norcross, Ga. 30071.

Inmac Corp. has introduced Data Cypher 384, a security device for any terminal or personal computer that sends or receives information, and the Clear Signal Smart 300-Baud Modem for swapping data with local computers and accessing nearby data bases.

Data Cypher 384 uses code to scramble data for transmission over phone lines or directly onto tapes or disks. It plugs between any RS-232C-compatible terminal or personal computer and modem and operates at up to 38.4K bit/sec.

The Clear Signal Smart 300-Baud Modem offers autodial and autotransfer. It is Hayes Microcomputer Products, Inc. compatible and has a 25-pin female RS-232C connector and an RJ11 phone cord.

Data Cypher 384 is priced at $399; the Clear Signal Smart 300-Baud Modem costs $429.

Inmac, 2465 Augustine Drive, Santa Clara, Calif. 95054.

Blue chip service from IBM
While everyone looked for an inexpensive and powerful way to communicate within IBM environments, TYMNET created it. By integrating Async-to-3270 protocol conversion within our network, we've eliminated the need for expensive leased lines, WATS, and protocol converters. Plus, you benefit from TYMNET's Value-Added capabilities... capabilities that "Big Blue" and "Ma Bell" alone can't provide.

TYMNET's 3270 Service is ideal for remote Personal Computers and terminals that need access to either 3270 SNA/SDLC or 3270 bisync hosts. And, you can use virtually all major brands of Personal Computers or inexpensive async terminals to access your 3270 applications. So now there's an alternative to those 3270 devices that cost so much.

And that's not all! In addition to cost savings and Value-Added capabilities, TYMNET's full-service network management means fewer headaches for you!

Call or write for more information regarding cost-effective, convenient solutions that provide more than just 3270 access for async terminals.

TYMNET
2710 Orchard Parkway
San Jose, CA 95134
(408) 942-5254

Public and Private Data Networks
JANUARY 13, 1986

NEW PRODUCTS/SYSTEMS & PERIPHERALS

Processors
Models 7865 and 7866, two multi-function Intel Corp. 8088 CPUs for the Winchester drive that offer an optional communications controller that provides both an RS-232C interface and RS-422/485 communications. The second CPU card, the 7866, includes two 36-pin SBX connectors, an eight-level priority-interrupt controller and a software-selectable counter/timer.

Mercury Computer Systems, Inc. has announced the Megazip modular parallel processing array processor designed for computationally intensive applications.

Megazip operates as a true coprocessing system, requiring very little involvement from the host computer. The product can interface with IBM Personal Computer ATs as well as with systems from Masscomp, Motorola, Inc., Intel Corp., Sun Microsystems, Inc. and with Digital Equipment Corp. Q-bus.

Megazip offers up to five processing nodes. It features between four $80,000 for a single node to $90,000 for a five-node system.

Mercury Computer Systems, Wannancol Technology Center, 600 Suffolk St., Lowell, Mass. 01854.

Data storage
Pram Corp. has added three 544-in. Winchester disk drives, Models 617, 623 and 728.

The average access time of Models 617 and 623 is said to be 18 msec. Model 617 offers 172M bytes, and Model 623 offers 244M bytes of unformatted storage capacity.

The 244M-byte Model 725 provides a 20-msec average access time. Its interface supports the ANSI X3T9.2 small computer systems interface standard for both extended and common sets.

The interface includes bus arbitration with disconnected memory and connection; host transparent defect correction code; and asynchronous data transfers to 1.3M byte/sec.

Prices are $1,495 for Model 617, $1,795 for Model 623 and $1,995 for Model 725.

Pram, 20 W. Montague Expy., San Jose, Calif. 95134.

Toshiba America, Inc. has announced the MK-150 series of 544-in. Winchester disk drives available in 173M-byte, 1212M-byte and 864-byte capacities.

The drives provide an average random-access time of 25 msec and a 30,000-hour mean time between failures.

The first MK-150 drives will offer 20K bytes per track. They also provide a data transfer rate of 10M bit/sec.

Other features include dedicated head landing zone, automatic power down lock, mechanical crash stops, voice coil positioner with center stack servo and remote indicator capability.

Prices range from $1,095 to $1,695 in OEM quantities.

Toshiba America, #103, 3910 Freedom Circle, Santa Clara, Calif. 95054.

Amdedine, Inc. has introduced the Tomahawk 7130, a rigid disk drive that provides a 27M-byte removable cartridge and 81M bytes of formatted storage capacity.

Continued on page 92
Continued from page 91

fixed storage.

The 8-in. drive has three fixed

The access average time is 25 msec. It

is available in two versions, distin-

guished by either a storage module

drive or a small computer systems
electrical interface.

The Tomahawk 7130 with storage
module drive interface is priced at
$3,375 each in quantities of 500.

Amcodyne, 1301 S. Sunset St.,
Longmont, Colo. 80501.

Amdahl Corp. has added the 6300
Models AE4 and BE4 to its 6000 se-
ries of storage products.

Both models contain four indepen-
dent disk enclosures, each with a
maximum storage capacity of 1,260M
bytes of user data.

The purchase price for the 6380
Model AE4 is $104,110 and $78,510
for the 6380 Model BE4. A typical
20G-byte configuration, consisting of
a 6880 Model G2 control unit, one
6380 Model AE4 disk storage unit
and three 6380 Model BE4 disk stor-
age units has a list price of $398,610,
with monthly maintenance charges
of $1,143.

Amdahl, P.O. Box 3470, 1250 E.
Arques Ave., Sunnyvale, Calif.
94089.

Terminals

Human Designed Systems, Inc.
has added four Digital Equipment
Corp. VT220-compatible terminals,
the HDS2100, HDS220G, HDS221
and the HDS221G, to its HDS200
family of display terminals.

The HDS220 is an ANSI standard
terminal. The HDS220G has graphics
capabilities including 720- by 350-
pixel resolution, Tektronix, Inc.
4010/4014 emulation and local print-
er support. The HDS221 and HDS221G add the APL character set
and keyboard and have the capabili-
ty of generating AFL overstruck
characters.

All four offer a 15-in. monitor.

Pricing for the HDS220, HDS220G,
HDS221 and HDS221G is $995, $1,295,
$1,295 and $1,595, respect-
ively.

Human Designed Systems, 3440

Printers/plotters

JDL, Inc. has announced the JDL-
750E, a color dot matrix printer for
engineering workstations.

The 750E prints at speeds of 100
char./sec. in letter-quality mode and
180 char./sec. in draft mode. Graph-
ics are available in 14 colors. Resolu-
tion is 180 by 180 dot/in. with letter-
quality resolution at 180 by 360 dot/
in.

Six character fonts can be resident
simultaneously, with up to four addi-
tional fonts downloaded.

The product has a standard paral-
lel interface and supports an optional
serial interface.

The single-quantity price is
$1,850.

JDL, Suite 104, 2801 Townsgate
Road, Westlake Village, Calif. 91361.

Microtek Lab, Inc. has un-
wrapped two document scanners, the
MS-300 and MSF-300, that offer up
to 300 dot/in. resolution.

Other resolutions — such as 240
dot/in. to match the IBM 3820 Page
Printer — are available through an
on-line scaling process. The MS-200
can also scan documents at 200 dot/
in. allowing page makeup, Group III
facsimile or optical character recog-
nition applications involving 10-
point or larger typefaces.

The scanners perform Group III
CCITT one-dimensional data com-
presation at an average 10:1 ratio for
text and graphics.

There are three interface options:
parallel, RS-422 and RS-232C.

Single-unit prices are $2,300 for
the MS-300, including scanner unit,
interface kit and driver program, and
$1,700 for the MS-200.

Microtek Lab, 16601 S. Western
Ave., Gardena, Calif. 90247.

Recognition Equipment, Inc. has
announced the Beam Reader bar-
code scanner.

The Beam Reader uses a nonlaser
LED visible light source.

The product can be configured
with devices including point-of-sale
terminals, personal computers, data
terminal and portable data col-
lection units.

The Beam Reader bar-code scan-
ner and decoder electronics module is
priced at $995.

Recognition Equipment, P.O. Box
660204, Dallas, Texas 75266.

Sharp Electronics Corp. has an-
ounced the JX-720 compact color
ink-jet printer.

The printer has four ink cartridges
that can be combined to produce up
to 256 basic colors. It accommodates
either 8%- by 11-in. cut sheets, over-
head transparencies or roll paper.

It connects to office and personal
computers through a Centronics Data
Computer Parallel interface and
has a printing resolution of 120
dot/in. The number of printed dots
can be adjusted to produce halftones
for color images up to 8%- in. wide.

The JX-720 costs $1,495.

Sharp Electronics, 10 Sharp Plaza,
Paramus, N.J. 07652.

Epson America, Inc. has intro-
duced the FX-286, a 136-col. dot ma-
atrix printer.

It offers both 9- by 9-dot draft-
quality characters and 18- by 18-dot
near-letter-quality characters. In
draft mode it prints at a rate of up to
200 char./sec. In near-letter-quality
mode the rate is 40 char./sec. The
FX-286 can emulate the IBM 4201
Proprinter.

It has an 8K-byte buffer and can
mix graphics with text in 136-col.
printouts.

The product offers six character
pitches and over 160 type-style com-
binations.

The FX-286 is priced at $749, in-
cluding both friction and tractor pa-
per feed.

Epson America, 2780 Lomita
Blvd., Torrance, Calif. 90505.
General Business Technology, Inc. has introduced the 5227FA, a 120 char./sec. forms access matrix printer. The 5227FA combines an adjustable pin-feed platen with a tear bar to allow instant removal of printed forms without advancing the paper or wasting the next form. Another feature is its character font flexibility. It connects directly to the IBM System/34, 36 and 38 either locally or at remote IBM 5251 Model 12 or 5294 sites.

The 5227FA is priced at $1,995. General Business Technology, 1801 McGraw Ave., Irvine, Calif. 92714.

Syntest Corp. has announced the SP-700 40-col. printer. The SP-700 has two-color capability along with 1.5 line/sec. throughput. It features RS-232C or 20-mA data input at 150 to 9.6K bps, double-width printing, data or text mode printing with ASCII command and mechanical dimensions of 10.7 by 9.9 in. The printer is priced at $385.

Power supplies

Two power conditioner line regulating transformers for protecting computers, peripherals and other electronic equipment from power line irregularities — the RV-250 and the RV-550 — are available from Perma Power Electronics, Inc. The conditioners combine the functions of a voltage stabilizer, surge suppressor and radio frequency and electromagnetic interference noise filter. Offered in 250VA and 550VA models, they respond to power line voltage changes even if the incoming voltage sags as low as 60V or rises as high as 130V.

They protect equipment from transient spikes and surges up to 6000V, filter radio frequency and electromagnetic interference noise. The conditioners handle power interruptions of up to 3 msec.

Prices are $179 for the RV-250 and $350 for the RV-550.

Perma Power Electronics, 5615 W. Howard Ave., Chicago, Ill. 60648.

Syntest Corp. has announced the SP-700 has two-color capability along with 1.5 line/sec. throughput. It features RS-232C or 20-mA data input at 150 to 9.6K bps, double-width printing, data or text mode printing with ASCII command and mechanical dimensions of 10.7 by 9.9 in. The printer is priced at $385.

Power supplies

Two power conditioner line regulating transformers for protecting computers, peripherals and other electronic equipment from power line irregularities — the RV-250 and the RV-550 — are available from Perma Power Electronics, Inc. The conditioners combine the functions of a voltage stabilizer, surge suppressor and radio frequency and electromagnetic interference noise filter. Offered in 250VA and 550VA models, they respond to power line voltage changes even if the incoming voltage sags as low as 60V or rises as high as 130V.

They protect equipment from transient spikes and surges up to 6000V, filter radio frequency and electromagnetic interference noise. The conditioners handle power interruptions of up to 3 msec.

Prices are $179 for the RV-250 and $350 for the RV-550.

Perma Power Electronics, 5615 W. Howard Ave., Chicago, Ill. 60648.

Marcioni Instruments has added the 6919 75-ohm impedance power sensor to its line of detectors used with its 6900 Digital and 6950 Analog power meters. The 6919 sensor, with a 50dB dynamic range from +30 dBm to +20 dBm, covers the frequencies from 30 KHz to 3 GHz.

The product enhances the range capability by providing a sensor with a robust 75-ohm N-type connector. The 6919 is well suited for power measurements in the areas of cable television, video and telecommunications equipment. The 6919 costs $695.

Marcioni Instruments, 3 Pearl Court, Allendale, N.J. 07401.

Emulex Corp. has announced the QD21 and the DM01 disk controllers. The QD21 interfaces two industry-standard serial-mode enhanced small disk interface 5/4-in. Winchester disk drives to Digital Equipment Corp.'s Q-bus.

The QD21 implements DEC's MSCP protocol on the Microvax I and II, Micro/PDP-11 and LSI-11 computers. The DM01 interfaces a Q-bus CPU with two 7506/412 5/4-in. Winchester drives and one or two floppy disk drives while implementing MSCP. It supports direct memory access data transfers in 16-, 18- and 22-bit addressing modes as well as block-mode transfers.

The QD21 costs 1,295; the DM01 costs 1,205.

Emulex, P.O. Box 6735, 3545 Harbor Blvd., Costa Mesa, Calif. 92626.

Distributed Logic Corp. has introduced the DQ412 tape coupler for use with Digital Equipment Corp. LSI-11 and Micro/PDP-11 computers.

The DQ412 provides switch-selectable direct memory access burst size and a 4-Kbyte first-in first-out buffer. It allows virtually any type of 9-track, 1/2-in. magnetic tape drive into an LSI-11 system.

Each DQ412 is contained on a single quad-size printed-circuit board. The price is $1,260.

Distributed Logic, P.O. Box 6270, 1555 S. Sinclair St., Anaheim, Calif. 92806.

Computrol, a division of Kidde Automated Systems, Inc., has added the Megalink Q-100, a Digital Equipment Corp. Q-bus-compatible board, to its family of Megalink interfaces. The Q-100 is a double-board set that interfaces either Computrol's FM coaxial Modem or Computrol's Redundant Multidrop Fiber-Optic Modem. It supports up to 2M bits of direct memory access block transfers between computers. It can be networked with up to 89 other compatible megalinks. Q-100 units are priced at $1,925 in quantities of 100.

Computrol, 15 Ethan Allen Highway, Ridgefield, Conn. 06877.
**NEW PRODUCTS/SYSTEMS & PERIPHERALS**

**INTERNATIONAL**

**ILC Data Device Corp.** has announced the BUS-65508 MIL-STD-1553 Intel Corp. Multibus interface card. The interface card includes dual redundant bus controller, remote terminal unit and bus monitor functions, an ILC Data Device representative said.

The BUS-65508 provides an intelligent interface between a 1553 serial multiplexer data bus and a parallel Multibus, according to the representative.

The product reportedly includes a 4K-byte by 16-bit memory as well as six subsystem command registers and four types of subsystem interrupts.

The BUS-65508 is priced from $7,695.

**IAC Corp.** has introduced the HXP-604 4M-byte memory said to double the memory capacity for Hewlett-Packard Co. HP 3000 computers, Models 64 and 68 and the MVXII-8MB add-in memory card for the Digital Equipment Corp. Microvax II.

The HXP-604 allows users to exceed the current 8M-byte memory limit of the systems.

The MVXII-8MB provides 8,192K bytes of additional memory. It supports parity checking and all other memory system features of the Microvax II.

The HXP-604 is available with instructions that enable the systems to address the additional memory for $25,500. The MVXII-8MB costs $6,600.

**EMC Corp.** has announced the Signal Pro T-Switch and the Security Monitor.

**Auxiliary equipment**

**Inmac Corp.** has introduced the Signal Pro T-Switch and the Security Monitor.

The Security Monitor costs $249.

The Signal Pro T-Switch ranges from $169 to $299. The Security Monitor costs $249.

**Forte Communications** has reduced the price of its Fortigraph micro-to-mainframe graphics products. Fortigraph S300, including a Forte PJ communications board, now costs $1,995. The cost for an upgrade to an existing PJ board is $995. Forte Communications has increased price reductions on its Laserprint-20.

The Laserprint-20 was designed as an additional line printer for mini-computer and mainframe environments requiring a high-duty cycle of more than 100,000 pages per month.

The new cost is $11,996 with no per-page maintenance charge.

**Integrated Business Computers** has announced price reductions on its DMX family of memory products for the Wang Laboratories, Inc. Wang 2200 and its SDS-Extended Basic-2 operating system releases.

The DMX memory family, SMX-1255K, DMX-655K and DMX-1MB, are now priced at $450, $900, $1,600 and $2,700, respectively.

Release 2.7 of the SDS-Extended Basic-2 enhanced operating system now costs $140.

**Free Evaluation Kit.**

**PolySHARE software** is perfect for any company or department that includes a population of PCs and one or more VAX systems. And security features insure that even sensitive and confidential information can be stored in the library.

Engineers and scientists store test data and frequently used programs. Accountants deposit budgets, forecasts, and commonly-used worksheets. Managers file reports, production information, and sales reports. Administrators and secretaries instantly recall standardized sections of contracts, proposals, and business letters. And software developers organize original and updated code modules.

The PolySHARE program's breadth of appeal is matched by its ease of use. It provides a menu interface, on-line help and fully automatic transfers of library entries to and from PCs.

And it's available for both ALL-IN-1 and standard VMS configurations.

**FREE EVALUATION KIT.**

Call today and ask for our fully functional evaluation kit. This no-risk offer will let you put polySHARE to the most important test: how well it work for you?

**Before we can share ideas, we have to share information.**
THINK SYNC!

For micro-to-mainframe or micro-to-micro bisync communications

New Sync-Up\textsuperscript{TM} modems from UDS now bring synchronous communication capability to your IBM or IBM-compatible microcomputers. These units are ideal for bisync applications requiring automatic dialing. Other features include auto-answer, automatic pulse/tone dialing selection, blind dialing, call progress detection and built-in diagnostic tests.

After initial set-up, options are keyboard selectable.

**CHOICE OF SPEED**

Sync-Up modems are available in two models: 201C for half-duplex 2400bps and 208B for 4800 bps half-duplex communication via the dial-up telephone network. 4800 bps version is strappable to the 208A configuration, which delivers full-duplex capability on four-wire dedicated lines.

**CHOICE OF SOFTWARE**

To enhance the performance of Sync-Up modems, UDS offers two custom software packages — Sync-Up "Dial" and Sync-Up "BSC." "Dial" exercises complete control of the device until connection with the remote modem is achieved; control is then shifted to the RS-232C interface. "BSC" is the ideal package for micro-to-mainframe or micro-to-micro communication, since it fully emulates either a 2780/3780 or a 3270 terminal.

For full details and quantity prices on the Sync-Up hardware/software packages, contact UDS today. Universal Data Systems, 5000 Bradford Drive, Huntsville, AL 35805. Telephone 205/837-8900, Telex 752602 UDS HTV.

**QUANTITY ONE PRICES**

<table>
<thead>
<tr>
<th></th>
<th>201C</th>
<th>208A</th>
</tr>
</thead>
<tbody>
<tr>
<td>With &quot;Dial&quot; Software</td>
<td>$565</td>
<td>$1200</td>
</tr>
<tr>
<td>With &quot;BSC&quot; Software</td>
<td>$999</td>
<td>$410</td>
</tr>
<tr>
<td>Without Software</td>
<td>$355</td>
<td>$1140</td>
</tr>
</tbody>
</table>

Universal Data Systems

**Please send me more information:**

Name ___________________________

Title __________________________

Company _________________________

Address _______________________________________

State __________________ Zip ________

Phone # __________________________

**MAIL TO:**

Universal Data Systems
5000 Bradford Drive
Huntsville, AL 35805

ATTN: MARKETING DEPARTMENT
IF YOU LIKE WHAT'S INSIDE THE TOWER 32, YOU'LL LOVE WHAT'S BEHIND IT.

The NCR OEM Systems Division introduces the Tower® 32: Up to three times faster than the Tower XP. Memory capacity of up to 16MB, with an amazing 14MB per program. SCSI (Small Computer System Interface) providing up to 4GB of mass storage. Connectivity for up to 32 users and a host of industry standard interfaces. An NCR-enhanced UNIX® operating system. And more.

That's a lot to like. But NCR knows that high performance specs alone do not set an OEM's heart aflutter. You need to know that you're buying more than a hot box. You need to know you're buying a reliable system with proven software from a vendor you can count on, for years to come.

The NCR OEM Systems Division has more to offer OEMs right down the line, beginning with our comprehensive product line: Mini-Tower (1-8 users), Tower XP (1-16 users) and the new Tower 32 (1-32 users). So, no matter what size businesses you're selling into, or planning to sell into, NCR has a Tower product to fit your customers' exact needs.

And, Tower upgradeability means that as your customers grow so can their Tower system. Painlessly. With minimum software investment, minimum support investment. Maximum return on your Tower investment.

Plus, every Tower you sell is backed by a $4 billion corporation with a reputation for fanatical attention to quality and reliability. An installed base of thousands of Towers, and massive production capabilities to fill orders for thousands more. 7,000 service representatives in over 400 field service locations nationwide. And more.

The Towers: easy to configure, easy to sell, easy to install, easy to service. All of which makes the Tower family very easy to love.

THE TOWERS.
BUILT FOR SYSTEMS BUILDERS
BY NIT-PICKING FANATICS.

OEM Systems Division, NCR Corporation, U.S. Data Processing Group, USG-1, Dayton, OH 45479. Nationwide (800) CALL NCR.

Tower is a registered trademark of NCR Corp. UNIX is a trademark of AT&T. Specs subject to change. © 1985 NCR Corporation.
Some people just ask for trouble.

Isn't it amazing just how many people go around asking for trouble? Why, we're willing to bet there are people in your DP department this very minute flirting with disaster. They're running the risk of a misplaced DD override, an invalid concatenation, or some other equally obscure JCL error bringing the whole kit and caboodle to a screeching halt.

When all they have to do is keep things running smoothly is all JCL errors and provides complete, on-line JCL validation and concise error diagnostics. Plus complete documentation on a job stream or entire production system suitable for insertion in the run book. And it can operate under TSO, TONE, ROSCOE or CMS. No more errors — no more troubles. It's that simple. And successful.

Over 400 DP departments now use JCLCHECK software to correct the errors of their ways, and save money at the same time. To put it in another perspective, we're willing to bet that most of them have been saved more than you.

To that we can only add, better look before you leap.
Get the news when you can use it... and get off the route slip circuit!

Order your own subscription to COMPUTERWORLD. Each issue costs about what you'd pay for a morning's cup of coffee.

CALL TOLL FREE
1-800-544-3712
...76¢ an issue...
or use the postage-paid order form you'll find bound into this issue.
(In PA call collect 215-768-0388)
Exec typifies rise of independents

From page 134

tive role in defining and advocating the independent software industry," said Patrick J. McGovern, chairman of CW Communications, Inc., which publishes Computerworld. McGovern has known Goetz for 20 years.

Goetz, a beaming, diffident man who refuses to have a space reserved in the company parking lot, has been the technical leader of ADR since it was founded in 1959.

"I am very happy. I always wanted to be in charge of my own destiny, to work for a small company and be able to participate in its growth," Goetz said recently during lunch near his Princeton, N.J., office.

With the acquisition by Ameritech, ADR will lose some of its independence, he conceded, "but we've acquired long-term viability."

In a year in which profits have evaporated and stock values have slumped, there were worse possible fates, and Goetz and the ADR directors were keenly aware of them.

As a company's shares decline in value, it becomes an easier target for an unresponsive takeover. ADR felt uneasy on this point because several other software companies have been swallowed up by corporations hungry for their expertise, and the number of ADR shares controlled by insiders had shrunk.

ADR has a generous stock option plan — 400 of its 1,800 employees receive options each year. Stock issued under the plan and additional public offerings had diluted the control of major inside shareholders from 40% of the company to less than 10%. "My own share, which started out at 14%, is now below 5%," Goetz said.

Another factor weighing on ADR management was the heavy institutional ownership of ADR stock. Sixty percent of the stock is owned by institutional investors, who react to quarterly results and have few barriers to accepting tender offers, friendly or otherwise.

The Lord Abbott & Co. Development and Grow mutual fund in New York owns 300,000 shares of ADR, and its managers watched its value drop to $15 5/8 earlier this year before Ameritech offered $32 a share.

"When the price of a stock doubles almost overnight, it tends to be a happy event," a Lord Abbott spokesman said.

An additional factor, Goetz said, was IBM's new aggressiveness. ADR has been selling software to IBM customers for years, but today's buyers of data base management products are concerned about the longevity of the companies with which they do business.

By agreeing to the Ameritech acquisition, ADR gained a strong financial partner that was obligated by Judge Harold Greene's Second Computer Inquiry decision to maintain a position in the Macintosh market by giving the software away.

ADR proceeded to sell 2,000 copies of Autoflow, making it a successful product in the fledgling independent software industry, but found itself again at odds with IBM after bringing out Roscoe, its on-line programming environment. ADR was seeking niches where it would not have to compete head to head with IBM, but without knowing what IBM was developing, it could never be sure that its products had a future, Goetz said.

"You can't build a business with products so good they can compete with something for free," he noted. "I started speaking out against the unfair competition of bundled software."

In 1968, the U.S. Department of Justice initiated antitrust proceedings against IBM, and in April 1969, ADR sued IBM for monopolizing the software marketplace. Two months after the ADR filing, IBM announced that it would unbundle most systems software, and it settled the lawsuit with ADR for $2 million, Goetz recalled.

A succession of system software products followed, and now ADR, with $128 million in revenue in 1984, is completing a second addition to its building in a former cornfield outside of Princeton.

Goetz said that the acquisition-by Ameritech will help ADR's long-term development capabilities, and he intends to be around for many years "to continue to grow them."

Announcing the only devoted to the
Survey shows user confidence in ADR's Ideal

Vendor initiated study to counteract criticism

PRINCETON, N.J. — Applied Data Research, Inc. (ADR) said users gave its fourth-generation language and data base management system a strong vote of confidence in a survey commissioned recently by the software firm.

The survey, conducted by Input, Inc., a Mountain View, Calif., market research firm, found that 75% of the users said they believe the Ideal fourth-generation language can replace COBOL and PL/I for most of their backlogged applications.

According to the survey, eight out of 10 users said they experienced a doubling of productivity over COBOL. One in six said they gained productivity of 10 times or more.

ADR officials said the survey was initiated "to counteract some recent articles that questioned the effectiveness of applications written in fourth-generation languages, including Ideal."

ADR's Ideal and its Datacom/DB relational data base management system were mentioned in recent Computerworld stories on implementation snafus at the New Jersey Department of Motor Vehicles and in a report on fourth-generation languages [CW, Sept. 30, Oct. 14; and Nov. 11].

The respondents had an average of 14 months personal experience with Ideal, and 97% said Ideal ranged from "easy" to "very easy" to use. Eighty-six percent said Ideal was "effective" to "very effective" for prototyping.

Users rated Ideal's performance in large-volume applications at 3.7 on a scale of one to five. More than 80% said they would recommend Ideal to another data processing professional.

ADR gave Input the names of 200 users of Ideal; the firm surveyed 80 of the users, who were promised anonymity for their responses. — Charles Babcock

Federal bids now closed to Paradyne

WASHINGTON, D.C. — The U.S. Department of Health and Human Services has barred Paradyne Corp. from all government business, including its 5-year-old contract with the Social Security Administration (SSA) on which the indictment was based.

A Florida grand jury charged that Paradyne and seven of the company's top officials conspired to bribe SSA officials to win the lucrative data communications terminals contract in 1981. Other allegations include fraud, false testimony before the SSA and obstruction of justice.

The SSA had already removed the contract with Paradyne for support of its installed terminals for $12.4 million in 1986. But Paradyne will be prohibited from bidding for data communications equipment contracts for the SSA's processing center in Baltimore.

A Paradyne spokesman said approximately 10% of the firm's revenue comes from federal contracts, with the SSA contract accounting for approximately half of that. — Clinton Wilder

Consulting firm cuts staff by 15%, refocuses strategy

NATICK, Mass. — In an effort to focus more on the development of networking software products, Software Research Corp. dismissed 15% of its work force last week.

The cuts primarily affected employees in its consulting and services division.

Chief Executive Officer Paul Tucker said the layoff of 18 of the firm's 120 employees did not result from a poor financial performance last year, although he did acknowledge that "small companies like us get impacted from the industry downturn.

From consulting to packaged software

"Consulting was the basis of this company, but, let's face it, packaged software is where we're going," Tucker said.

Privately held Software Research was founded in 1978 to provide network-related consulting services to vendors developing IBM-compatible equipment. It began marketing packages such as Docupower in 1984.

Tucker said the cutback came about when he had pinpointed "who was contributing to the mainstream and who was not."
As you can more or less see, a typical $600 terminal manages to fit 132 columns on a 14" screen. By crunching them together a lot tighter than normal. Which can lead to eyestrain, headaches, and just plain mistakes. All of which tend to be on the expensive side.
As you can clearly see, at TeleVideo® we've found a better way to put 132 columns on a 14" screen. By redesigning the proportion of our characters and putting more space between them, we've given the TeleVideo 955 the most readable 132 column display available. And that's just the beginning. We've also given it a whole list of features you won't find on any other 132 column machine.

Like 64 non-volatile programmable function keys. With 512 bytes of dynamically allocated variable memory. Your choice of green or amber screen. And ergonomics that, unlike Wyse's, meet the human factors standards recommended for adoption by the American National Standards Institute. And you get all this for only $629.

Available options include WY-50/50+ compatibility, graphics add-in board, and up to three additional pages of screen memory.

To show you how much more the TeleVideo 955 gives you, we'd like you to get your hands on one and check it out from top to bottom. So if you're a computer professional, MIS manager, or VAR in the U.S. or Canada, we'll send you an evaluation unit for the special price of $400, including shipping. Offer expires February 28, 1986. One per company, please. Just call 800-227-6703 and ask for department 78. (In California, 800-632-7979.)

The high-performance TeleVideo 955. It's a real eye-opener.
Industry mulls omens for '86

From page 134

The bright side, however, is that modest profits should return to firms within the last 12 turbulent months. Such indications are already apparent at Apple Computer, Inc. and possibly at Data General Corp. Whether that will constitute an industry upturn or not is really a matter of semantics; it might be more parent at Apple Computer, Inc. and Whether that will constitute an in- industry at Data General Corp. The bright side, however, is that modest profits should return to firms within the last 12 turbulent months. Such indications are already apparent at Apple Computer, Inc. and possibly at Data General Corp. Whether that will constitute an industry upturn or not is really a matter of semantics; it might be more parent at Apple Computer, Inc. and Whether that will constitute an industry at Data General Corp. Whether that will constitute an in-

The only direct reference to Jobs' departure is in a paragraph of the shareholders' letter by President and Chief Executive Officer John Sculley. It refers to Jobs as "a brilliant young entrepreneur and one of our cofounders, who ceased to hold management responsibility for the Macintosh Division when it was absorbed into the Product Operations Group as part of the major reorganization in June. Steve subsequently resigned as Chairman of the Board, taking a handful of employees with him to found a new company. With regret, the Board of Directors felt it had to take legal action against Steve. We will pursue this action only so far as is necessary to protect the interests of our company and our shareholders."

In the gray pages at the back, the report lists steadily growing net sales of $4.9 billion, slightly increased research and development spending of $72.5 million, a nearly tripled increase to $337 million in cash assets, an increased $550 million in shareholders' equity and a 99 cent per share earning, the lowest since 1981.

Apple's fiscal year ended Sept. 27. Its annual meeting of shareholders will be Jan. 20, in Cupertino, Calif. And the Super Bowl, another traditional significant date for Apple, is Jan. 26.

In the "What happened to that rumor?" department: Is AT&T still shopping for a computer company?

Telenet denies sabotage charge, files countersuit

By Bryan Wilkins

CHICAGO — The American Medical Association (AMA) and GTE Telenet Communications Corp. have filed countersuits against each other stemming from the AMA's charge that GTE Telenet sabotaged an on-line medical information service sponsored by the association.

The AMA alleges that GTE Telenet, the public packet-switching data communications subsidiary of GTE Corp., based in Reston, Va., deliberately sought to damage the AMA's medical information service business, called Minet, which is distributed via Telenet to 10,000 physicians across the country.

The AMA said that Telenet, in a letter dated Oct. 31, informed the association that it planned to discontinue "virtually all of the data bases that Telenet agreed to market."

The AMA filed the original suit in December, seeking $15 million in damages.

GTE Corp. filed its countersuit last week, denying the AMA allegations and seeking $25 million in compensatory damages and $50 million in punitive damages.

Allegations are baseless

"We are surprised by the lawsuit. We have been working in good faith, working with the users of Minet to address the mutual concerns in its operations. The allegations are baseless," Telenet said in a statement.

The AMA further charged that Telenet "orally threatened to assign some or all of its contract obligations without the AMA's consent."

Telenet and AMA agreed to join forces four years ago to develop and market medical information data bases as well as a computer-based information retrieval system to store and disseminate medical information. The system was originally called Infotrak and then Minet.

The AMA suit said Telenet's effort to halt distribution of Minet was not legal because the costs used to justify termination were misidentified, and "the cost and revenue data relied upon by Telenet are the direct result of Telenet's own breaches."
Now, professional application developers have something to be truly excited about: PRO-IV—the first true production-oriented 4th generation language.

Based on a technically original concept (not just another “Me too” product), PRO-IV combines lightning-quick 4GL development speed with fast 3GL hardware execution speeds. And with PRO-IV’s unique codeless, specification-driven system, maintenance programming can finally step into the 4th generation, and with 100% automatic systems documentation.

Sound too good to be true? Read on.

PRO-IV is also completely portable between all supported hardware and operating systems. Imagine transporting PRO-IV applications between any of the following environments with a simple command:

<table>
<thead>
<tr>
<th>Mainframes</th>
<th>Minicomputers</th>
<th>Multi-/Single-User</th>
<th>Microcomputers</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBM</td>
<td>Digital</td>
<td>Altos</td>
<td>Hewlett-Packard PC</td>
</tr>
<tr>
<td>MVS/CICS</td>
<td>VAX</td>
<td>AT&amp;T 7300</td>
<td>IBM PC-XT/AT</td>
</tr>
<tr>
<td>MVS/IMS</td>
<td>PDP-11</td>
<td>Compaq PC</td>
<td>Motorola 6300</td>
</tr>
<tr>
<td>MVS/TSO</td>
<td>Prime</td>
<td>Digital</td>
<td>NCR Tower</td>
</tr>
<tr>
<td>DOS/CICS</td>
<td>Honeywell DPS6</td>
<td>Micro Vax</td>
<td>Wang PC</td>
</tr>
<tr>
<td>DOS/DLI</td>
<td></td>
<td>Micro PDP-11</td>
<td>Zilog 8000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rainbow/PRO</td>
<td></td>
</tr>
</tbody>
</table>

The IBM System 36 and Honeywell DPS 8 versions will be available in early 1986.

PRO-IV is available under corporate CPU or site licensing. Comprehensive VAR/System Integrator Packages are also available. For further information, call toll-free at 1-800-225-PRO4 (In California, 1-800-225-7774) or write, Pro Computer Sciences, Inc., 23181 Verdugo Drive, Suite 103A, Laguna Hills, CA 92653.

Leading the Next Generation of Software.
National Semi losses down

Tax credit increases second-quarter figures

By Maura McEnaney

SANTA CLARA, Calif. — National Semiconductor Corp. reported a loss of $34.8 million, or 41 cents per share, during the second quarter ended Dec. 15, bringing losses for the first quarter of $88 million. The losses come with profits of $8.5 million for the same quarter a year ago.

Sales for the second quarter were $762.7 million, down from $964.4 million during the same period in 1984.

National Semiconductor's third consecutive quarterly loss, reduced by a $2.1 million tax credit, comes in lower than the previous quarterly loss of $53 million.

Capital spending at National Semi was slashed to $15 million in the second quarter from $129 million in the second quarter 1984. For the first half of this fiscal year, capital expenditures were approximately $60 million, compared with $231.7 million during the same period a year ago.

National Semiconductor President Charles Sporck said "Until our semiconductor order rates show strength for a prolonged period, our financial performance will remain under pressure."

Modest computer growth predicted

From page 134

would increase 17% and semiconductor industry sales would increase 16%, but both predictions proved to be too optimistic.

The expected 1986 rebound still falls short of historical trends for the high-tech industries. The computer industry grew at a 23% rate — compounded annually — from 1977 to 1982; and the semiconductor industry grew at a 19% rate over the same period, with a growth spurt of 43% from 1983 to 1984.

The projections assume greater economic growth in 1986 than in 1985. However, the Commerce Department based its 648-page annual forecast on the Reagan administration's assumption that the country's, real gross national product (GNP) will increase 4%, a growth rate that private economists consider optimistic.

A National Association of Business Economists poll of 300 members predicted GNP growth of 2.9%.

A substantial part of U.S. computer shipments in 1986 will come from existing inventory, a report added, so industry employment will show little growth in 1986.

The report predicted the following trends for 1986:

- **Mainframes.** The mainframe sector will recover from its relatively flat 1985 as many new models reach the market. The value of U.S. shipments should increase 15% to $18 billion. Sales of mainframe software will increase 25% to $5.1 billion, partly spurred by demand for data base management software.

- **Minicomputers.** Superminicomputer firms will continue to benefit from strong demand for the latest high-performance offerings. As a result, shipments of A-B types of minicomputers should increase 18% to $14 billion. The outlook for packaged software for minis also appears favorable, with a projected increase of 28% to $8.7 billion.

- **Microcomputers.** The microcomputer industry should experience a year of moderate growth in 1986. The value of micro shipments will rise 18% to $12 billion, while the number of units shipped will increase 12% to 5 million units. Many of the factors that caused slower industry growth in 1985 will persist, including the postponement of orders by businesses. Demand for micro software should remain strong, pushing software revenues up 37% to $2.7 billion.

- **Supercomputers.** Demand for supercomputers should moderate as users wait for the introduction of faster, more powerful systems. U.S. manufacturers will increase deliveries 24% above the 1985 level to roughly $560 million.

- **Software.** Worldwide revenues of the U.S. software industry should grow about 25% in 1986, according to the forecast. This is slightly above the 23% growth rate recorded in 1985, but it is still well below the compound annual growth rate of 51% a year between 1980 and 1984.

- **Services.** In the wide-ranging information services industry, computer services such as remote data processing and software development will grow moderately in 1986, at a rate of 10% to 15% to about $16.5 billion, while electronic data base services are expected to grow 18% to $2.2 billion.

- **Semiconductors.** The semiconductor industry will resume its growth in 1986, although by historical standards the recovery will be sluggish. "Product shipments will increase by only 9.7% in nominal terms, and our prices are very competitive. Save a bundle. Call us today."

MTI is an Authorized Distributor for Digital Equipment Corp., so we get these great printers first. Whether you buy, lease or rent, you'll find MTI is the one source for all the computer and data communications equipment, applications expertise and service you'll ever need. And our prices are very competitive. Save a bundle. Call us today.

N.Y.: 212/226-2337 Ohio: 216/464-6688
516/449-5959 Ky.: 502/496-6656
502/499-6656 I11.: 312/773-2300
201/227-5552 Ca.: 818/883-7633
714/220-6487 Or call: 800/645-6530

MTI SYSTEMS CORP.
A SUBSIDIARY OF DUCOMM INCORPORATED
Computer & Data Communications Equipment
Sales / Leasing / Service / Systems Integration

Computer & Data Communications Equipment
Sales / Leasing / Service / Systems Integration

Prints letter-quality reports & letters at up to 8 pages/minute. Very low cost per page.

Prints simple graphics, too.

Even prints on transparencies or overhead projection.

IBM PC Users Bonus: FREE Microsoft Word - the fastest way to produce professional-quality documents with your IBM PC. If you buy, lease or rent your LN03 before January 31st from MTI, Call today.

Got a minute?
Print an 8-page report with the Digital LN03 laser printer.

Buy, lease or rent at great prices from MTI Systems.

Digital's LN03 laser printer will hum quietly along in your office printing out letter-quality reports at speeds up to eight pages per minute. And it's so easy to use. The LN03 has an input and output capacity of up to 250 sheets, an easy-loading front drawer, and it automatically sequences output for you.

The LN03 works in a number of operating systems environments including VMS, ULTRIX, RT-11, RSX-11, RSTS systems and PC operating systems such as MS-DOS and P/OS. Software support is also enhanced by LN01, LPQO2 and LA100 printer compatibility modes.
Statistics, reports and plots happen magically with SPSS/PC+
the enhanced and expanded Statistical Package for
IBM PC/XT/AT's:

SPSS/PC+ is the most comprehensive statistical program for performing simple or complex tasks. For nearly 20 years, SPSS Inc.'s reputation and reliability as the leading producer of mainframe statistical and reporting software is unsurpassed. SPSS/PC+ carries this reputation into the PC environment.


SPSS/PC+ Advanced Statistics —
Factor, cluster, discriminant and loglinear analyses, MANOVA


SPSS/PC+ documentation is rated Number One by both novices and experienced analysts. SPSS Inc. also offers a full training schedule and a customer support hot-line.

To order, contact our Sales Department at

312/329-3500

SPSS Inc., 444 N. Michigan Avenue
Chicago, IL 60611-312/329-3500

In Europe: SPSS Europe BV, 4200 AC Eekinghem, The Netherlands
Phone: 31 31 830 1711
TWX: 21019

*SPSS/PC+ runs on the IBM PC, XT, AT & with hard disk. Contact SPSS Inc. for compatible microcomputers.

IBM PC/AT and PC/AT are trademarks of International Business Machines Corporation. dBASE III is a trademark of Ashton-Tate. 1-2-3 is a trademark of Lotus Development Corporation. SAS is a registered trademark of SAS Institute, Inc. SPSS, SPSS/PC+, SPSS/PC+ Tables, and SPSS/PC+ Advanced Statistics are trademarks of SPSS Inc. for its proprietary computer software.
Bill aims to curb Communist spy activity in Silicon Valley

WASHINGTON, D.C. — U.S. Rep. Ed Zschau (R-Calif.) recently introduced legislation that he said would restrict the access of Communist spies to California's Silicon Valley and other parts of the U.S.

According to Zschau, the bill, H.R. 3910, would make it more difficult for Soviet bloc intelligence agents to obtain U.S. technological secrets. The bill places travel restrictions on Soviet bloc diplomats, trade emissaries and their families.

Zschau said the bill would place the same travel restrictions on diplomats from Soviet satellite countries as those that currently apply to diplomats from the Soviet Union itself. The bill listed the Soviet bloc countries as East Germany, Bulgaria, Poland, Hungary, Romania, Czechoslovakia, Mongolia, Cuba and Vietnam.

Diplomats from the Soviet Union are prevented from traveling more than 25 miles from their embassy or mission without the permission of the U.S. Department of State and are prohibited from entering certain areas that are critical to national security, such as the Silicon Valley.

Zschau said restricting the travel of Soviet bloc diplomats in the U.S. is necessary because so many Communist spies operate in the U.S. under diplomatic cover.

Fujitsu America, Inc.'s Storage Products Division announced Fujitsu's affiliation with the APO Company of Japan, has signed a technology licensing agreement with Tan- don Corp.

Synercom Technology, Inc. has finalized a distributorship agreement with Mighty Exim Corp. of Taipei, Taiwan, giving Mighty Exim exclusive rights to distribute Synercom's mapping information management software and workstations in Taiwan.

Quadrant Corp. and Microsoft Corp. have agreed in principle to bundle Microsoft Windows with the recently announced Quadega + Enhance Graphics Adaptor board. Microsoft Windows began bundling exclusively with Quadrant's Quadega + this month, and additional bundling arrangements are scheduled for Quadrant boards in early 1986.

U.S. Telecom and GTE Sprunt Communications Corp. announced that a definitive agreement has been signed between the two companies. U.S. Telecom will provide capacity along 2,560 route miles of its network while GTE will provide 763 route miles of capacity to U.S. Telecom.

CICS Storage Protection

SAFE-GUARD

Eliminate CICS storage violations forever with SAFE-GUARD the CICS STORAGE PROTECTION SYSTEM available independently of elaborate and expensive host systems

SAFE-GUARD:

• Intercepts storage violations before they occur
• Monitors CICS PRODUCTION & TEST Systems
• Automatic Monitoring by Term, Trans or Programs
• Permits access to common shared storage areas
• Supports COMMAND & MACRO LEVEL Programs
• Menu driven displays of all CICS areas
• Maps all storage areas owned by a task
• Speeds program development
• Extremely low overhead
• Installs easily — Simple to use
• No training required

SAFE-GUARD means greater CICS UPTIME and fewer user complaints.

CALL (212) 246-5314 or Send for a FREE Trial

INFORMATION TECHNOLOGY CORPORATION
322 West 57 Street New York New York 10019

WHY ARE MORE AND MORE
JES3 USERS SWITCHING TO
FLASHER?

BECAUSE OF ALL THESE CAPABILITIES:

• INSTANTANEOUS OUTPUT RETRIEVAL
• SELECT, DELETE, AND REQUdLE SPOOLED JOBS FROM USER PROGRAMMABLE SPF PANELS
• LIMIT DISPLAY TO LINES WHICH CONTAIN DESIRED CHARACTER STRINGS
• VIEW INDIVIDUAL SPOOLED DATASETS
• VIEW NON-HIELD OUTPUT
• USES REAL SPX BROWSE
• SPW TUTORIAL
• VIEW SYSTLOG
• SECURITY
• INEXPENSIVE
• FREE TRIAL

ALSO FOR JES

SOFTWARE CORPORATION
311 John Street
Huntington, NY 11743
(516) 991-9460 Telex 181592
At $395, still no competition.

Why hasn't Wyse, TeleVideo or Esprit offered you an ASCII editing terminal under $400 with this many features? Or 25,000-hour reliability? Or a one year end-user warranty?

We think the answer is simple:

Only Qume, with the resources of ITT behind us, can deliver and support a new generation of fully optimized, lower-cost editing terminals to meet your need for more productivity with less investment. The QVT 101, is the first of Qume's lower-cost terminals. Nothing comes even close to matching it.

Today, if you want to save up to 40% of your terminal costs without sacrificing performance or support, well be there. With no competition. For more information, call (800) 223-2479. Qume Corporation, 2350 Qume Drive, San Jose, CA 95131.
Performance Monitoring of Non-IBM Databases

It's another first! Now CICS users can track the performance of non-IBM databases with The Monitor for CICS.

Capture utilization and performance statistics for:

- ADABAS™
- IDMS™
- and others!
- DATACOM/DB™
- TOTAL™

No wonder The Monitor for CICS is the standard for CICS performance management systems.

Find out more about this enhancement today! Call Landmark Systems Corporation at (800) 227-8911 (in Virginia, 703/922-7101).
Louisiana sales law can snag unwary national distributors

National distributors of computer hardware or software selling their products in Louisiana must be cognizant that the normal law of sales prevalent throughout the U.S. does not apply there. This exists because Louisiana is the only U.S. jurisdiction that has not adopted Article Two of the Uniform Commercial Code that codifies the law of sales. Article Two grew out of the English law of merchants. Its purpose is to provide a uniform set of laws dealing with sales, relationships between merchants, creation and disclaimers of warranties and the like, so a person from one state doing business with a person in another state would have a general grasp of what duties and liabilities were required of the other party.

The reason Louisiana has not adopted Article Two is that its law, the law of sales, is not one of them. The main difference facing the distributor is a concept known as "rehabitation." Under Louisiana law, "rehabitation is the avoidance of a sale on account of a defect in the thing sold, which renders it either absolutely useless, or its use is so inconvenient and imperfect, that it must be supposed that the buyer would not have purchased it, had he known of the vice." That is, the product has some defect, which, had it been known to the buyer before purchase, would have caused the buyer to forego the purchase. There is no objective standard for something to be rehibitory. It is a subjective standard that depends on what duties and desires of each individual purchaser. What is an important or a nonrehibitory defect to one person may be a major and rehibitory defect to another.

It is possible to draft a sales contract whereby a purchaser waives a possible rehibitory defect. Under Louisiana case law, the waiver must meet three criteria: 1) It must be clear and unambiguous. 2) It must be contained in the sales document. 3) It must be brought to the purchaser's attention.

An analysis of cases shows that Louisiana courts are very stringent in applying these criteria. Between 1973 and 1985, there were only four reported cases where the waiver was found to be effective. In those cases, the document containing the waiver was signed by the buyer, and in two of them, signature was made after a lawyer had reviewed the contract. Furthermore, Louisiana courts are very insistent that there be actual proof that the notice of waiver of warranty was given; it cannot be implied by the mere signing of a contract or other document. Given this requirement, it is very doubtful that warranty disclaimers currently used in most computer products are valid in Louisiana. There is no doubt that rehabitation can be a powerful consumer protection device. According to the only Louisiana case discussing software, Land and Marine Services, Inc. v. Diablo Data Systems, the buyer does not have to prove the existence of a particular defect. Rather, all that must be shown is that the software failed under normal use to do what it was supposed to do, and the burden of proof then shifts to the seller or developer to prove that the software is not rehibitory.

If a developer or marketer refuses to take back a rehibitory product, the buyer is entitled to damages. These include refund of the purchase price, reimbursement of reasonable expenses incurred in preserving the object and attorney fees.

How to advertise in every major computer market in the world as easily as you advertise in the U.S.

CW INTERNATIONAL Marketing Services will help you penetrate the most profitable computer markets worldwide — easily, effectively, and economically. Your ads will receive the attention they deserve. Our network of more than 55 computer publications in over 25 countries is the largest in existence. More than 9,000,000 computer-involved people around the world rely on us for the information they need to stay ahead.

With more than 10 years of experience in international marketing, we’re the only service of our kind. We can help you make your ads more effective. Our local offices can translate your ads for a 15% surcharge on the space you purchase. And you’ll be able to advertise in even more markets when you take advantage of our corporate discounts. We’re also available to advise you on your campaign strategy — such as when to advertise in order to coincide with special-focus issues and trade shows.

All you need to do is send us your advertising materials. We’ll handle all the transactions. And we’ll bill you in U.S. dollars so you won’t have to worry about exchange rates. We’ll help you increase your market penetration. We have publications in all of the following countries: Argentina, Australia, Brazil, Chile, Denmark, Finland, France, Greece, India, Italy, Japan, South Korea, Mexico, Norway, People’s Republic of China, South Africa, Spain, Sweden, Switzerland, the Netherlands, United Kingdom, Venezuela, and West Germany.

Call Diana La Muraglia. She’ll be happy to send you rate cards for any of our publications or any of our series of market fact brochures on specific countries. You can reach her toll-free at (800) 343-6474. In Massachusetts call (617) 879-0700. Or you can reach her through Telex, at number 95-1153. Or if you prefer, fill out the coupon below and return it today. Do it now. The sooner we hear from you, the sooner you’ll hear from our readers.

KW COMMUNICATIONS INC.
Diana La Muraglia
General Manager
CW International Marketing Services
270 Cochituate Road, Box 680
Framingham, MA 01701
USA

How to advertise in every major computer market in the world as easily as you advertise in the U.S.

C W INTERNATIONAL Marketing Services will help you penetrate the most profitable computer markets worldwide — easily, effectively, and economically. Your ads will receive the attention they deserve. We have publications in all of the following countries: Argentina, Australia, Brazil, Chile, Denmark, Finland, France, Greece, India, Italy, Japan, South Korea, Mexico, Norway, People’s Republic of China, South Africa, Spain, Sweden, Switzerland, the Netherlands, United Kingdom, Venezuela, and West Germany.

Call Diana La Muraglia. She’ll be happy to send you rate cards for any of our publications or any of our series of market fact brochures on specific countries. You can reach her toll-free at (800) 343-6474. In Massachusetts call (617) 879-0700. Or you can reach her through Telex, at number 95-1153. Or if you prefer, fill out the coupon below and return it today. Do it now. The sooner we hear from you, the sooner you’ll hear from our readers.

How to advertise in every major computer market in the world as easily as you advertise in the U.S.

C W INTERNATIONAL Marketing Services will help you penetrate the most profitable computer markets worldwide — easily, effectively, and economically. Your ads will receive the attention they deserve. We have publications in all of the following countries: Argentina, Australia, Brazil, Chile, Denmark, Finland, France, Greece, India, Italy, Japan, South Korea, Mexico, Norway, People’s Republic of China, South Africa, Spain, Sweden, Switzerland, the Netherlands, United Kingdom, Venezuela, and West Germany.

Call Diana La Muraglia. She’ll be happy to send you rate cards for any of our publications or any of our series of market fact brochures on specific countries. You can reach her toll-free at (800) 343-6474. In Massachusetts call (617) 879-0700. Or you can reach her through Telex, at number 95-1153. Or if you prefer, fill out the coupon below and return it today. Do it now. The sooner we hear from you, the sooner you’ll hear from our readers.

How to advertise in every major computer market in the world as easily as you advertise in the U.S.

C W INTERNATIONAL Marketing Services will help you penetrate the most profitable computer markets worldwide — easily, effectively, and economically. Your ads will receive the attention they deserve. We have publications in all of the following countries: Argentina, Australia, Brazil, Chile, Denmark, Finland, France, Greece, India, Italy, Japan, South Korea, Mexico, Norway, People’s Republic of China, South Africa, Spain, Sweden, Switzerland, the Netherlands, United Kingdom, Venezuela, and West Germany.

Call Diana La Muraglia. She’ll be happy to send you rate cards for any of our publications or any of our series of market fact brochures on specific countries. You can reach her toll-free at (800) 343-6474. In Massachusetts call (617) 879-0700. Or you can reach her through Telex, at number 95-1153. Or if you prefer, fill out the coupon below and return it today. Do it now. The sooner we hear from you, the sooner you’ll hear from our readers.

How to advertise in every major computer market in the world as easily as you advertise in the U.S.

C W INTERNATIONAL Marketing Services will help you penetrate the most profitable computer markets worldwide — easily, effectively, and economically. Your ads will receive the attention they deserve. We have publications in all of the following countries: Argentina, Australia, Brazil, Chile, Denmark, Finland, France, Greece, India, Italy, Japan, South Korea, Mexico, Norway, People’s Republic of China, South Africa, Spain, Sweden, Switzerland, the Netherlands, United Kingdom, Venezuela, and West Germany.

Call Diana La Muraglia. She’ll be happy to send you rate cards for any of our publications or any of our series of market fact brochures on specific countries. You can reach her toll-free at (800) 343-6474. In Massachusetts call (617) 879-0700. Or you can reach her through Telex, at number 95-1153. Or if you prefer, fill out the coupon below and return it today. Do it now. The sooner we hear from you, the sooner you’ll hear from our readers.

How to advertise in every major computer market in the world as easily as you advertise in the U.S.

C W INTERNATIONAL Marketing Services will help you penetrate the most profitable computer markets worldwide — easily, effectively, and economically. Your ads will receive the attention they deserve. We have publications in all of the following countries: Argentina, Australia, Brazil, Chile, Denmark, Finland, France, Greece, India, Italy, Japan, South Korea, Mexico, Norway, People’s Republic of China, South Africa, Spain, Sweden, Switzerland, the Netherlands, United Kingdom, Venezuela, and West Germany.

Call Diana La Muraglia. She’ll be happy to send you rate cards for any of our publications or any of our series of market fact brochures on specific countries. You can reach her toll-free at (800) 343-6474. In Massachusetts call (617) 879-0700. Or you can reach her through Telex, at number 95-1153. Or if you prefer, fill out the coupon below and return it today. Do it now. The sooner we hear from you, the sooner you’ll hear from our readers.
Whether you've been in the telecommunications field for one year or ten, you've never seen things changing so fast. It's exciting... complex... confusing. That's why you need to attend COMMUNICATION NETWORKS '86.

Even if you can spare only one day, it will be worth your while to get a look at the very latest in telecommunications products and services — data communications and equipment, including modems, multiplexers and high-speed T-1 class transmission equipment... hardware and software for local area networks... electronic PBXs... satellite transmission... fiber optics... new low cost, long-distance services... and more.

See the latest in telecommunications from these top companies:

- ACC
- Adcock Corp.
- ADI Communications Inc.
- American Telephone Service Co.
- American Microwave Inc.
- American Telesis Corp.
- Amrit Inc.
- Amtel Systems Corp.
- Anchor Pad International
- Anderson Laboratories Inc.
- ATR Business Inc.
- Applied Communication Services Inc.
- Allied Communication Corp.
- The ARDIS Co.
- Atlantic Research Corp.
- AT&T
- AT&T Communications
- AT&T Documentation Management Group
- AT&T Service Management Group
- AT&T World Systems
- Avant Communications Corp.
- Avanta Technologies Inc.
- Alyko Monitor Systems
- Baran Systems Inc.
- BCE Enterprises Inc.
- BGS Systems Inc.
- Bell Atlantic
- Bell Communications Research Inc.
- Byte Corp.
- C&G Data Systems
- Case Communications Inc.
- COM/McCaw Inc.
- C-COM Electronics Inc.
- CTY Sales Inc.
- C&P Publications
- CBA Engineering Corp.
- Champion Network Corp.
- Comdesign Inc.
- COMM + Systems Inc.
- Comstar Inc.
- Communications News
- COM
- Compression Labs Inc.
- Comsat International
- Comshare Corp.
- Comshare Inc.
- CoreCom Corp.
- Coredata Systems
- Connect Telecommunications Inc.
- Connect International Inc.
- Contact Information Systems
- Courier Class Works
- Creative Management Systems Inc.
- Data Communications/McCaw-Hill
- Digital Communications Systems Corp.
- Data Plus Inc.

FULL CONFERENCE PROGRAM

Use the coupon below to register for exhibits-only or call us to register for the full conference program. Seminar speakers such as Leonard Kleinrock, Arch McGill, Mark Fowler and Terry Lautenbach as well as 200 other speakers and panelists will bring you the largest conference program in the industry. Both introductory and advanced sessions will be held.

For complete conference program details and prices call toll free 800-225-4698 or 617-879-0700.

OVER 1,000 EXHIBIT BOOTHS

The exhibits alone will be an education — new products and services offered by some of the world's leading companies will be on display.

ATTEND EXHIBITS FREE

Bring this special coupon to the Washington Convention Center and be admitted to the exhibits FREE! Exhibit hours are Tuesday and Wednesday, January 28th and 29th — 9:30 AM - 5:00 PM; Thursday, January 30th — 9:30 AM - 3:00 PM.

You'll also get to meet exhibitors informally in their hospitality suites, plus enjoy all the fun and excitement of the nation's capitol city. Free bus service will be provided between the Washington Convention Center and the conference hotels.

Don't miss COMMUNICATION NETWORKS '86 in Washington, D.C. January 28-30, 1986 — the most important communications conference of the year.

ATTEND EXHIBITS FREE

Attend the most advanced data and voice communications exposition of 1986 FREE . . .

The 8th Annual
Communication Networks
January 28-30, 1986
Washington Convention Center
Washington, D.C.

FREE ADMISSION COUPON

This coupon entitles bearer to FREE exhibits-only registration at COMMUNICATION NETWORKS '86. Valid Jan. 28 & 29 (9:30 AM - 5:00 PM) or Jan. 30 (9:30 AM - 3:00 PM) at the Washington Convention Center, Washington, D.C. No pre-registration required.

NAME ________________________________
TITLE ________________________________
COMPANY ____________________________
ADDRESS ____________________________
CITY __________________ STATE __ ZIP __
PHONE ______________________________

This coupon must be presented at the door for FREE admission to the exhibits.

Communication Networks is produced by CW/Conference Management Group a division of CW Communications Inc.

375 Cochituate Rd., Box 880, Framingham, MA 01701

* as of December 6, 1985
Here's Everything You Always Wanted From Data General. But Couldn't Get.

We buy, sell and swap Data General gear of all kinds—processors, peripherals, storage, communications, etc. But we're also authorized distributors for higher-performance DG-compatible equipment like Spectralogic controllers and C. Itoh and NEC printers, as well as for CDC, Fujitsu, Zetaco, MICOM, FACIT, Data Products and Kennedy.

We've got field service at a fraction of DG's prices. And depot service with immediate replacement of defective parts. As well as custom software on request.

Call or write Hanson Data Systems
60 Brigham St., Marlboro, MA 01752
(617) 481-3901
Outside Mass. (800) 225-9215

Data General's Only Single-Source Second Source.
MISSISSIPPI CENTRAL DATA PROCESSING AUTHORITY

Sealed proposals will be received by the CDPA, 301 N. Lamar St., 301 Building, Suite 508, Jackson, MS 39201 for the following data processing equipment and services:

Request for Proposal No. 1070, due Monday, January 27, 1986 at 3:30 p.m. for the acquisition of a multiprogramming minicomputer for use at the Mississippi Agriculture and Forestry Experiment Station, located at MISSISSIPPI STATE UNIVERSITY.

Request for Proposal No. 1071, due Tuesday, February 11, 1986 at 3:30 p.m. for the acquisition of an SNA distributed system – totally compatible with a Four Phase IV/95 and capable of running Vision for the MISSISSIPPI BUREAU OF MARINE RESOURCES.

Detailed specifications may be obtained from the CDPA office. The CDPA reserves the right to reject any and all bids and proposals and to waive informalities.

Lisa Winstead or Colleen Downing,
State Central Data Processing Authority
601/359-1395

We Buy & Sell IBM Processors and Peripheral Equipment
Established 1969

BUY, SELL & LEASE IBM Processors and Peripheral Equipment
Valley Computer & Financial, Inc.
1225 Nicollet Avenue, Burnsville, MN 55337

If Data General makes it...NPA
- SERVICES
- SELLS
- TRADES
- LEASES & PURCHASES IT!!

Data General

SPECIALIZING IN FIELD SERVICE, DE-
PUTS IN UPGRADES AND MAINTENANCE.

BOUPT A NPA OUR COMMITMENT TO
QUALITY PRODUCTS FIRST.
Our maintenance cost is approximately 15% to
20% less than that built for users and our parts
and materials rates are lower than that of any
maintenance organization in the area.

NPA Data Systems Inc.
761 COATES AVE., HOLLIDAY, N.Y. 11746
(516) 667-2500 415-548-9333

THE SOURCE FOR

WANT TO BUY IBM 3081K 32x24
Available on/before March 31, 1986
PRINCIPALS ONLY
Call or Write
Harold Bumgardner
P.O. Box 21267
Seattle, WA 98111
(206) 464-3642

JANUARY 13, 1986

We Buy & Sell
DEC Systems
Components

call:713 445-0082
digital computer, memory, tape, etc.
Houston 11, 77002

Don’t trust us to keep
your classified information secret

Every week, we deliver more of your target audience than anyone else. Over 600,000 computer professionals. Including MIS/DP directors, systems analysts, programmers, and engineers – as well as corporate presidents, treasurers, and general managers.

And we deliver these readers for less. Compare costs and the people reached. You’ll see that Computerworld is the number one medium for reaching MIS/DP professionals.

Our readers rely on Computerworld’s classified section. In fact, 41% of our subscribers read the recruitment section every week. And 95% of our subscribers read this section regularly.

Readership like this means responses. Just ask some of the 4,000 organizations that ran more than 6,500 recruitment ads in Computerworld in 1984.

We make your ads work harder. Because we divide the classified section into logical categories: Position Announcements; Buy, Sell, Swap; Software For Sale; Time & Services; and The Bulletin Board. (Available on request: Software Wanted; Business Opportunities; and Real Estate).

So the people you want to reach will spend less time looking for your ad, and more time reading it.

We’ll even typeset your ad at no extra charge. All you need to do is attach clean, typewritten copy to your order. (Figure about 80-90 words per column inch, not including headlines). Or give us your order over the phone. We’ll do the rest.

And since we publish weekly, we can offer you a fast turn-around from when you place your order to when your ad appears. As little as 10 days.

The next time you want results, advertise in Computerworld’s classified section. Call toll-free at (800) 543-6474. In Massachusetts, call (617) 679-0700. Call now.
TIME & SERVICES

DEC REPAIR - All our Repair Prices are up to 25% less than DECmailers.
VAX 780 • VAX 750 • VAX 730

VAX TIME
MOST MAJOR LANGUAGES AVAILABLE
ELECTRONIC LAGE CAPABILITIES
ADVERTISING MANAGEMENT
FLIGHT MANAGEMENT
ACCOUNTING PAYROLL
PROGRAMMING SERVICES AVAILABLE
CHOOSE THE PLAN BEST FOR YOU:
A • DEC/UNIX
B • DEC/OS/360
C • DEC/VMS/SPP
D • DEC/VM
E • DEC/OS/90
F • DEC/VM/TP
G • DEC/VAX WAREHOUSE
H • DEC/VAX WAREHOUSE
I • DEC/VAX WAREHOUSE

DATA CENTER SERVICES
• MILLERIFIC
• NOMAD2
• OS/MVS/SP
• TSO/SP
• VM/SPO
• CICS
• DOSE/VM/ICP
• INF/SDBC
• CMS
• TELNET ACCESS
Info Center Products
Access by Micros
EXCELLENT SERVICE LEVELS
VOLUME DISCOUNTS

CHCS • TBO • VM
COMPUTER TIME RENTAL

IBM 4331
DEC/VM
ICCF

Rental Terminals or Time in the Classified Pages of Computerworld.
Call 800-343-6474 (or 617-879-0700) for more information.

SOFTWARE FOR SALE

Award-Winning

Unsurpassed Documentation
Large Scale Integration
User-Defined Vocabulary
Paperless Processing

Featuring:

IBM 5/36 & 5/38
Computers

J.D. Edwards & Company

5454 S. Syracuse/Suite 5500
Denver, CO 80237

Dallas — 214-458-0058
Houston — 713-980-8278
San Francisco — 415-571-9755
Newport Beach — 714-955-0118
Tulsa — 918-493-1477

TIMBERRY, INC

6001 Biscayne Blvd. Miami, FL 33138

Call 800-343-6474 or 617-879-0700

THY IS A - DISK

OR TIME

IN THE CLASSIFIED PAGES OF COMPUTERWORLD.

Call 800-343-6474 (or 617-879-0700) for more information.
Is your future in these cards?

You don't need a fortune-teller to predict your career opportunities at Arthur Young. Our Big 8 accounting firm provides expert consulting services to a star-studded list of major clients. If you have COBOL and large IBM-mainframe experience and can handle a heavy travel schedule, our experienced Programmers & Analysts are just what you need.

For information, call us collect at (614) 224-6258, or send your resume in complete confidence to:

Diana Mackey
Manager, Professional Staffing
ARTHUR YOUNG & COMPANY
100 East Broad Street
Columbus, Ohio 43215

If you are interested in contributing your technical ideas, join the leader in multisite banking—First Interstate Bank.

SYSTEMS PROJECT ANALYST

Your major responsibilities will include determining, designing, and integrating new and existing equipment at the micro and mainframe levels. We will provide the control, satellite, and remote support necessary for the areas of communication technology such as graphics, voice, and electronic mail and text processing. Qualified candidates should possess knowledge of personal computer functioning to include personal computer to mainframe technology as well as IBM-operating systems. Project planning experience and strong analytical and communication skills are also required.

Along with an outstanding systems environment, First Interstate Bank provides excellent salaries and benefits. For consideration, send your resume and salary history to: First Interstate Bank, Mail Sort WS-6, Dept. TH3, 707 Wilshire Blvd., Los Angeles, CA 90017.

A FOCUSED OPPORTUNITY

CTG is an equal opportunity employer.

Experienced Programmers & Analysts

If you are an experienced (two years or more), assertive, upwardly mobile computer professional, you can benefit by talking to Computer Task Group (CTG).

We are the leading provider of career opportunities for professionals like you. Through a network of forty-five branch offices in major cities across the country, CTG develops information systems for Fortune 500 companies.

We're looking for multi-talented people with large scale project experience to work in challenging environments. CTG offers you the opportunity to enhance your career in a wide variety of specialty areas and in geographical locations of your own choosing.

With us you'll be bringing state-of-the-art technology to major clients. You'll have the satisfaction of working on various projects in diverse industries.

CTG offers competitive salaries, a first rate, comprehensive benefits program, extensive educational opportunities— including courses at our own Institute for Technical and Management Training — and a stock plan.

The greatest benefit CTG offers you is our commitment to help our people reach their full potential. Come and grow with us!

Send your resume to Mr. Robert Buster, Manager, Corporate Recruiting, at 800 Delaware Ave., Buffalo, NY 14209, or call collect (716) 882-8000.

CTG Computer Task Group INC.

CORPORATE EDP AUDITOR

At the forefront of the healthcare industry you will find MAXICARE Health Plans, Inc.

MAXICARE owns and operates a rapidly growing system of health maintenance organizations. The corporation's state-of-the-art Management Information Systems linking 15 computers in an integrated network is a key element in the smooth and efficient administration of its national network of healthcare facilities. MAXICARE has begun to use advanced configurations for new and existing equipment that will include clustering of computers and Local Area Networking. MAXICARE has been chosen to adopt the advanced concepts of computer science.

The greatest benefit CTG offers you is our commitment to help our people reach their full potential. Come and grow with us!

Send your resume to Mr. Robert Buster, Manager, Corporate Recruiting, at 800 Delaware Ave., Buffalo, NY 14209, or call collect (716) 882-8000.
FREE!

1986

Computer Salary Survey

and Career Planning Guide
New 1986 Survey explores the latest trends in computer salaries, technology and career opportunities

You know how quickly technology and salaries can change. But, do you know how much "swing" there is in compensation levels for computer professionals who perform comparable functions...or how much salaries can change in different industries or geographic locations? In 1986, for example, some computer professionals are able to earn as much as 244% more than their peers!

Over the years, we've found that those who make the most of their careers—those who command the highest salaries and the most rewarding positions—are those professionals who react to market trends and develop skills that are most in demand.

Comprehensive review of salaries, trends and demand
The new 1986 Computer Salary Survey and Career Planning Guide is based on information from more than 48,000 computer professionals and 36,000 firms across North America. Salaries for sixty-three position titles are reviewed including those in programming, systems analysis, software engineering, EDP auditing, office automation, operations, computer sales, marketing, technical support, management and much more. We'll learn if your compensation is keeping pace with your peers—and what you can expect to earn as you advance in your career.

New computing trends in disciplines such as networking, database, data communications, CAD/CAM and more are coupled with relevant strategies on what you might do to capitalize on them.

Charts, exhibits and graphs to assess your progress
Included in the new Survey are a series of charts, exhibits and graphs to help you get a clearer picture of the profession and how to advance. Proven methods for defining your career objectives, implementing strategies, monitoring your progress and then taking corrective actions (when it's needed) are defined. Five documented case studies on professional growth are also provided to point out typical mistakes so that you can avoid them to stay in the mainstream of your career.

Free to computer professionals
This valuable 24-page Survey is available without charge. Since 1966 we have distributed over one-half million copies to other professionals like you who are determined to realize their fullest career potential. You owe it to yourself to be informed. Call us today.

To get your free copy of the 1986 Computer Salary Survey and Career Planning Guide, call the Source EDP office nearest you. We'll mail you a copy in strict confidence, without obligation.

Delaware
Wilmington 302/652-0833

New Hampshire

Massachusetts

Boston 617/227-0761
Springfield 413/732-3083
Worcester 508/752-2700

Michigan

Detroit 313/226-1563
Grand Rapids 616/458-3569
Lansing 517/486-4654

Minnesota

Minneapolis 612/322-6600
St. Paul 612/227-6700

Mississippi

Jackson 601/617-6176

Missouri

Kansas City 816/747-3440
St. Louis 314/727-2605

Montana

Helena 406/442-4200

California

San Francisco 415/986-4200
Los Angeles 213/465-2890

New York

Albany 518/485-2055
Buffalo 716/855-0400
New York City 212/691-3800

New Jersey

Newark 973/334-3340

North Carolina

Raleigh 919/736-7560
Winston-Salem 919/752-4100

Ohio

Cleveland 216/442-4000
Columbus 614/328-4800
Dayton 513/384-5000
Toledo 419/242-3700

California

Los Angeles 213/986-0210
San Diego 213/295-8111
San Francisco 415/986-3000
San Fernando Valley 818/746-4800

Colorado

Colorado Springs 303/756-7200
Denver 303/629-2300
Englewood 303/257-5883

Connecticut

Danbury 203/652-5800

Washington

Seattle 206/281-5000

Source Edp Personnel Services

Phone Numbers

Boston 617/227-3411
Springfield 413/738-4831
Worcester 508/752-2700

E-Mail Address

hansedpp@sourceedp.com

Visit Our Website

http://www.sourceedp.com

To get your free copy of the 1986 Computer Salary Survey and Career Planning Guide, call the Source EDP office nearest you. We’ll mail you a copy in strict confidence, without obligation.

The new 1986 Survey shows the enormous range of salaries that one can expect to find within certain disciplines in the computer industry. Sharp variations—as much as 244% within the same area of specialization—can be found! The graph above vividly shows compensation differences for people performing the same basic functions. While some salary differences may be due to unique factors such as geographic location, many others just might be within your control. Our Survey can help you gain that control and make sure you are maximizing your potential.
Get a bonus with your subscription — 10 issues of COMPUTERWORLD FOCUS. Each new issue for 1986 will deal in depth with such topics as Communications, Microcomputing, Manufacturing and more. To subscribe, complete the order form and mail in this postage paid envelope. Or call 1-800-544-3712 for faster service.

* In Pa call collect 215 768-0388.

COMPUTERWORLD.
Keeping Up With Today. Anticipating Tomorrow.
Systems Engineers
Software Developers

AT&T Bell Laboratories

Where one idea leads to another

Specific expertises being sought:
- Business analysis
- CIM/CAD
- Communications planning
- Communications protocols
- Computer networking
- CT
- Database management
- Design and manufacture integration planning
- Digital networks/services
- Digital signal processing
- Expert systems
- Human factors
- International applications
- Integrated networks
- Lightwave applications
- Local area networks
- Market definition for new technologies and services
- Measurement systems
- Network optimization tools
- Network planning and design
- Operations automation
- Packet switching
- Performance measurement and analysis
- Product planning
- Software development tools
- Subjective testing
- Systems architecture
- Systems planning
- Transmission systems
- UNIX® systems applications

At AT&T Bell Laboratories talented individuals from a wide variety of technical backgrounds share their insights and knowledge to create innovative information systems, services and products.

In this environment, every person's contributions are important and personal ownership in the overall outcome of each effort is valued. Excellent resources are at hand to support distinguished results.

We have opportunities available at our facilities in New Jersey, Illinois, Ohio, Pennsylvania and Massachusetts.

With the development of new and expanding projects, we are seeking people who can create forward-looking solutions, evaluate alternative architectures, perform competitive analyses, assess service viability, define, implement and measure systems or develop strategies to get products to market.

If you have a Master's or PhD in Systems Engineering, Computer Science, Electrical Engineering, Mathematics, Physics, Statistics, or Operations Research with hardware and/or software experience, or a BS in these fields with a minimum of 5 years highly relevant experience, please send your resume to:

Director, Technical Employment
AT&T Bell Laboratories
Dept. 63/6603/86
101 J. F. Kennedy Parkway
Short Hills, NJ 07078-0905

An equal opportunity employer.
Software Development Professionals

How to make your career move in the right circles.

We're looking for SOFTWARE DEVELOPERS.

Our unique approach to providing practical business solutions has made us a leading supplier of advanced information system development software. From data base management to helping end-users, our integrated circle of products is reaching wider and wider circles of users. Products like COM-PLETE, our on-line environment management and transaction processing system. COM-PLETE combines powerful data communications facilities, interactive programming development tools, end-user system management and terminal functions for the IBM mainframe world. Thanks to a product like COM-PLETE we're growing faster than ever before. That's why our career opportunities for talented software development professionals are wide open.

We're looking for Software Developers. We want to talk to you if you have experience as a Systems Programmer or Systems Software Developer with a working knowledge of low-level complex IBM Assembler code, operating systems, TP and telecommunications.

For more information call us TOLL-FREE at 1-800-336-3761 and ask for 8701 or write to: Sam Mara, Software AG of North America, Inc., 11800 Sunrise Valley Drive, Reston, VA 22091.

IBM SYSTEM PROGRAMMERS
MVS/VM/XA VTAM NCP ACF

If you have ever wanted to bring up a new computer center from scratch, this is your chance. This could be a major plus for your career. Multiple IBM and 3M60 with all the up-to-date IBM equipment and software to run all the latest revisions of MVS/VM, MVS/SA, VTAM, and NCP with the latest techniques.

Your ability as a System Programmer will put you in the forefront of a top flight worldwide consulting company. TAPP is a leader in Data Processing and is forging ahead with state-of-art systems and design.

If you have current experience in the systems, possess U.S. Citizenship, and are willing to travel, send your resume to: Total Assets Protection, Inc., Director, Software, 200 Brookline Ave., Suite 120, Chestnut Hill, Boston, MA 02135. (For your convenience, interviews will be held Sat., Sun., and in the evenings.)

DALLAS
S/38 Project Mgr.
A progressive chance to move into project management. Ground floor opportunity to take project from concept to finish. Contact Richard Kammerly, JPM & San Antonio. Fee paid.

1201 Commerce St.
Dallas, TX 75202 (214) 697-8850

IBM SYSTEM PROGRAMMERS
MVS/SA VM/XA VTAM NCP ACF

If you have ever wanted to bring up a new computer center from scratch, this is your chance. This could be a major plus for your career. Multiple IBM and 3M60 with all the up-to-date IBM equipment and software to run all the latest revisions of MVS/VM, MVS/SA, VTAM, and NCP with the latest techniques.

Your ability as a System Programmer will put you in the forefront of a top flight worldwide consulting company. TAPP is a leader in Data Processing and is forging ahead with state-of-art systems and design.

If you have current experience in the systems, possess U.S. Citizenship, and are willing to travel, send your resume to: Total Assets Protection, Inc., Director, Software, 200 Brookline Ave., Suite 120, Chestnut Hill, Boston, MA 02135. (For your convenience, interviews will be held Sat., Sun., and in the evenings.)

DALLAS
S/38 Project Mgr.
A progressive chance to move into project management. Ground floor opportunity to take project from concept to finish. Contact Richard Kammerly, JPM & San Antonio. Fee paid.

1201 Commerce St.
Dallas, TX 75202 (214) 697-8850

IBM SYSTEM PROGRAMMERS
MVS/SA VM/XA VTAM NCP ACF

If you have ever wanted to bring up a new computer center from scratch, this is your chance. This could be a major plus for your career. Multiple IBM and 3M60 with all the up-to-date IBM equipment and software to run all the latest revisions of MVS/VM, MVS/SA, VTAM, and NCP with the latest techniques.

Your ability as a System Programmer will put you in the forefront of a top flight worldwide consulting company. TAPP is a leader in Data Processing and is forging ahead with state-of-art systems and design.

If you have current experience in the systems, possess U.S. Citizenship, and are willing to travel, send your resume to: Total Assets Protection, Inc., Director, Software, 200 Brookline Ave., Suite 120, Chestnut Hill, Boston, MA 02135. (For your convenience, interviews will be held Sat., Sun., and in the evenings.)

DALLAS
S/38 Project Mgr.
A progressive chance to move into project management. Ground floor opportunity to take project from concept to finish. Contact Richard Kammerly, JPM & San Antonio. Fee paid.

1201 Commerce St.
Dallas, TX 75202 (214) 697-8850

IBM SYSTEM PROGRAMMERS
MVS/SA VM/XA VTAM NCP ACF

If you have ever wanted to bring up a new computer center from scratch, this is your chance. This could be a major plus for your career. Multiple IBM and 3M60 with all the up-to-date IBM equipment and software to run all the latest revisions of MVS/VM, MVS/SA, VTAM, and NCP with the latest techniques.

Your ability as a System Programmer will put you in the forefront of a top flight worldwide consulting company. TAPP is a leader in Data Processing and is forging ahead with state-of-art systems and design.

If you have current experience in the systems, possess U.S. Citizenship, and are willing to travel, send your resume to: Total Assets Protection, Inc., Director, Software, 200 Brookline Ave., Suite 120, Chestnut Hill, Boston, MA 02135. (For your convenience, interviews will be held Sat., Sun., and in the evenings.)

DALLAS
S/38 Project Mgr.
A progressive chance to move into project management. Ground floor opportunity to take project from concept to finish. Contact Richard Kammerly, JPM & San Antonio. Fee paid.

1201 Commerce St.
Dallas, TX 75202 (214) 697-8850

IBM SYSTEM PROGRAMMERS
MVS/SA VM/XA VTAM NCP ACF

If you have ever wanted to bring up a new computer center from scratch, this is your chance. This could be a major plus for your career. Multiple IBM and 3M60 with all the up-to-date IBM equipment and software to run all the latest revisions of MVS/VM, MVS/SA, VTAM, and NCP with the latest techniques.

Your ability as a System Programmer will put you in the forefront of a top flight worldwide consulting company. TAPP is a leader in Data Processing and is forging ahead with state-of-art systems and design.

If you have current experience in the systems, possess U.S. Citizenship, and are willing to travel, send your resume to: Total Assets Protection, Inc., Director, Software, 200 Brookline Ave., Suite 120, Chestnut Hill, Boston, MA 02135. (For your convenience, interviews will be held Sat., Sun., and in the evenings.)

DALLAS
S/38 Project Mgr.
A progressive chance to move into project management. Ground floor opportunity to take project from concept to finish. Contact Richard Kammerly, JPM & San Antonio. Fee paid.

1201 Commerce St.
Dallas, TX 75202 (214) 697-8850

IBM SYSTEM PROGRAMMERS
MVS/SA VM/XA VTAM NCP ACF

If you have ever wanted to bring up a new computer center from scratch, this is your chance. This could be a major plus for your career. Multiple IBM and 3M60 with all the up-to-date IBM equipment and software to run all the latest revisions of MVS/VM, MVS/SA, VTAM, and NCP with the latest techniques.

Your ability as a System Programmer will put you in the forefront of a top flight worldwide consulting company. TAPP is a leader in Data Processing and is forging ahead with state-of-art systems and design.

If you have current experience in the systems, possess U.S. Citizenship, and are willing to travel, send your resume to: Total Assets Protection, Inc., Director, Software, 200 Brookline Ave., Suite 120, Chestnut Hill, Boston, MA 02135. (For your convenience, interviews will be held Sat., Sun., and in the evenings.)
EDP OPPORTUNITIES
COAST TO COAST

Robert Half, staffed by EDP professionals for EDP professionals with 80 offices throughout the U.S., Canada & Great Britain, is the largest network of personnel consultants in the Data Processing field. And its establishment in 1948 also makes Robert Half the oldest. One call and you can search the local, national and international markets. ALL FEES ARE PAID BY CLIENT COMPANIES, OF COURSE. The following is a partial listing of opportunities and locations.

ROBERT HALF AUDIT SUPVR
Highly regarded BOSTON CPA firm seeks accomplished audit specialist w/ experience. Top 50 bank w/state-of-the-art IBM sys. Excellent benefits. Full reloc (house, moving, etc.). Bonus payable. Salary to $45,000.

HARTFORD
DANK PROJECT MANAGER
Exclusive CT CT-supply world analyst/project mgr/w/40+ YRS. Top 50 bank w/state-of-the-art IBM sys. Excellent benefits. Full reloc (house, moving, etc.). Bonus payable. Salary to $45,000.

TECH CONSULTANTS
Prestige tech firm seeks experienced computer operators w/minimums. Insured bonuses, relaxed travel. Excellent opportunity to advance. Salary to $40,000.

SYSTEMS ANALYST
Join a dynamic growing org in a SUBURBAN setting. Work on state-of-the-art IBM sys. Min 2+ yrs exp w/Life syst. IBM exp. CICS & data base skills. Excellent benefits. Growth potential. Salary to $40,000.

PROG/ANALYSTS
Major fin. org seeks qualified prog/analysts to work w/state-of-the-art IBM env. Min 2+ yrs exp w/40+ YRS. IBM exp. Excellent benefits. Full rel. To $32,000.

BUFFALO
SYSTEMS PROGRAMMER
Min 3+ yrs tech bgd in IBM/MVS env w/excellent people skills reqd for indiv. to assume key tech staff position leading to near term mgmt. Full rel. Rel. costs offered. Salary to $40,000.

MGR DATA SECURITY
Min 8 yrs drp exp w/current emphasis on data/physical security. ex. sys. RACF, IBM/MVS. Disaster Recovery, etc. bgd reqd for this "start-up" debut! Salary to $40,000.

PROFIT SUPVR
Excellent career opp with expanding IBM shop. Requires any MVS systems prog. Exp. Start-up. Rel. salary changes.

PROF 900 Turkey Head Building
P.O. Box 22
White Plains, NY 10604
(914) 274-9700

PROVIDENCE ANALYST
Progressive insurance co seeks person to provide lead in new app development & implement. Prior IBM OS/MVS, COBOL & strong exp needed. Salary to $30,000. HI visibility role inc extensive interaction with advanced personnel. Salary to $33,000.

NEW ORLEANS
SYSTEMS PROGRAMMER
Excellent career opp with expanding IBM shop. Requires any MVS systems prog. Exp. Start-up. Rel. salary changes.

PROFIT SUPVR
Excellent career opp with expanding IBM shop. Requires any MVS systems prog. Exp. Start-up. Rel. salary changes.

PROJECT LEADER
Major South Florida Corp seeks several business applications programmers using COBOL, IMS (DB2) in a large IBM environment. To assist in both design and implementation of major on-line claiming systems and to provide lead in development of new programs. Excellent potential. Salary to $45,000.

NEW YORK CITY
SENIOR SYSTEMS ANALYST
Immediate need for 5+ yrs exp w/3+ yrs in systems w/IBM mainframe, MVS, COBOL and BAL. This is a working manager's position w/unlimited potential & paid rel. Salary to $83,000.

ROBERT HALF
P.O. Box 3320
New Orleans, LA 70130
(504) 864-4557

ST. LOUIS
CICS PROGRAMMER ANALYST
Prestigious service organization seeks an experienced CICS COBOL Programmer Analyst to design & develop Financial Applications. This is a large MVS shop supporting CICS, IMS, VSAM, etc. If you have 2 years or more in any of these applications areas, you will want to consider this role to provide lead in new application development. Excellent potential. Salary to $35,000.

DATA BASE ADMINISTRATOR
Immediate need for an experienced MIS/DBA for a well-managed Wisconsin insurance company. $30-40,000

MINNEAPOLIS
ST. PAUL
PROJECT LEADER
Excellent new business formation for advancement at leading Twin Cities firm. Project leader to develop all new business systems. Requires 2-5 years mainframe experience using IMS, CICS, or DB2. To $30,000

Mark David or Tim Smith
ROBERT HALF
of Minneapolis
3330 IDS Bldg.
Minneapolis, MN 55402
(612) 334-9001

NASHVILLE
SYSTEMS ANALYST
Multi-mainframe MVS/MVS shop requires COBOL, CICS or IMS experience. Project mgmt experience a plus. Insurance processing background helpful. To $45,000

ROBERT HALF
1101 Kimmel Dr., Ste. 407
Nashville, TN 37217
(615) 316-4800

WASHINGTON
PROJECT LEADER
Large major law firm seeks skilled VAX Basic programmer. Must know FMS, RMS, Data -recovery. Opportunity to manage DP Dep. Excellent benefits. Salary to $37,000.

ROBERT HALF
7315 Wisconsin Avenue
Washington, DC 20014
(202) 852-3980

WISCONSIN
PROJECT LEADER
Well-managed Wisconsin in -surer seeks individual with large national experience. Life-comm experience a plus. To $40,000

INFO CENTER ANALYST
Excellent visibility. Wisc -onin-based multi-national manufacturer requires someone with 2+ yrs experience in an information cen ter. Excellent benefit pro gram. Salary to $30,000.

Ed Lance or Dick Bird
ROBERT HALF
1777 E. Wisconsin Ave.
Milwaukee, WI 53212
(414) 271-5253

FREE:
Ask for our latest Salary Survey

1986
COMPUTERWORLD
123
SLAWSON COMPANIES

We are a growing, diversified affiliation of privately held companies based in Wichita, Kansas. Due to continued expansion, we are currently seeking individuals to provide a significant contribution to our Data Processing team at corporate headquarters in Wichita.

PROJECT LEADER/ANALYST

Will be responsible for leading application development as well as directly analyzing some applications. This position reports to the data processing manager.

Requirements:
- 2 years experience as DAP Applications Analyst and a minimum of 1 year in a supervisory capacity.
- Exposure to IBM S/38 and/or oil and gas a plus.

PROGRAMMER

Will be coding a wide range of applications in a multiple S/38 environment.

Requirements:
- previous experience in RPG III and control language using an IBM S/38.

These positions offer career growth potential and a competitive salary and benefits package.

Interested candidates should forward their resumes to:

Human Resources Department
SLAWSON COMPANIES, INC.
104 S. Broadway
Wichita, Kansas 67202

Principals Only Please
Equal Opportunity Employer

PROJECT MANAGERS

POS/UNIX, RETAIL SYSTEMS
SYSTEMS CONVERSION
TELECOMMUNICATIONS ANALYST

Challengeing opportunities to coordinate large projects. Additional opportunities for experienced personnel with management experience. Responsibilities include: Project planning, sequencing and scheduling. Policies and procedures, as well as overall project direction. Candidates should have a B.S. in Computer Science or related field and at least 2 years' experience. Must be a self-starter and able to work in a team environment.

Please send resume with salary history no later than January 30, 1986 to:

Integrated Information Systems
Manager Technical Systems
P.O. Box 605
San Diego, CA 92112

COMPUTERWORLD

There’s No Time
For DOWNTIME!

And that goes for your business as well as your computer system!

So, while the industry works on your system’s problems, let us work on your business problems. Advertise in...

COMPUTERWORLD CLASSIFIEDS

One insertion will let a potential audience of over a half a million readers know what you are looking for or have to offer. Whether you are looking to recruit computer professionals, want to buy, sell or lease equipment, have computer time or services to offer, or software packages to sell, and more, ComputerWorld Classifieds will help you get a lot of exposure and get things done faster.

The open line rate is $11.55 per line and there is a minimum size of 1 column by 2" at a cost of $323.40. We can accommodate up to 5 columns and depth measurement increases by half inch increments.

Ads may be mailed in, cleanly typewritten, with a letter stating the size desired and the issue in which it is to be run. Our adtakers will take ads seven days (prior to the issue date desired).

Advertisements may include contact number, rate, rate and depth measurement increases by half inch increments.

For DOWNTIME!

FOR DOWNTIME!

FOR DOWNTIME!
PARTNERS IN THE FUTURE.

DATA PROCESSING CAREERS WITH

FIREMAN'S FUND.

Data Processing Opportunity Hotline
Sunday, January 19
10 a.m. to 4 p.m.
(Pacific Standard Time)

Position yourself at Fireman's Fund Insurance Companies and prepare for dynamic growth.

You'll be working in one of Northern California's largest state-of-the-art IBM shops involved in major development projects now underway. Our charter: to transform 125 application systems and 15,000 programs into 15 integrated systems based on 35 logical data bases—all within 4 years.

Join us in our multiple IBM 3081/3080 MVS/XA environment where you'll be utilizing DB2, IMS DB/DC, CICS, TSO and VSAM.

SR./LEAD SYSTEMS ANALYSTS

Working with several project teams, your technical design consultations will be key in developing an integrated systems architecture composed of mainframes, minicomputers and intelligent workstations. Candidates for this high-importance position must have 6+ years progressive application development experience, preferably with insurance financial services systems.

SR./LEAD DATA ANALYSTS

Your role in our ambitious program requires familiarity with entity/relationship data modeling and logical data design. Prior conceptual data modeling experience, in support of comprehensive application development efforts, preferred.

SR./LEAD DATA BASE ANALYSTS

In addition to 3+ years of application and physical data base design experience, strong coordination skills are needed to successfully support a variety of applications development projects.

SR./LEAD IMS SYSTEMS PROGRAMMER

This position requires 3+ years of demonstrated experience in problem determination/resolution, performance analysis/tuning and software installation. Lead candidates must also have proven planning and management ability. IMS DB/DC, XA, TSO, JES2, DFHSM, SMP/E and Security knowledge desirable.

PROGRAMMING SUPERVISORS

Very strong people, planning and coordination skills, complemented by ambition and strong technical experience are necessary to lead design and programming efforts on medium to large scale applications development projects.

SR./LEAD EQUIPMENT PLANNERS

You will be responsible for capacity planning, cost value analysis, configuration analysis and design, and preparation of acquisition proposals in our rapidly growing environment. 5-8 years equipment planning experience required.

CALL COLLECT (415) 492-6439

No waiting—for experienced DP Professionals. A simple phone call this Sunday will put you directly in touch with one of our Technical Hiring Managers.

As one of the nation's leading property-liability insurers, we're committed to continued growth and success. We offer you the opportunity to make a viable impact within our EDP environment. Your rewards will be competitive salaries and benefits, now including an Employee Stock Ownership Plan, an Incentive Savings Plan and relocation assistance.

If you're planning to attend the Westech Job Fair in San Jose, CA on January 20 & 21, please stop by our booth to discuss these opportunities.

If you miss the January 10 Phone-In, please forward your resume (referring to position of Interest) with salary history to Fireman's Fund Insurance Companies, Systems Division, Central Employment Services C-18, Job FM14, 1800 Leo Gams Dr., San Rafael, CA 94901. An equal opportunity employer. Principals only, please.
FUCED Opportunity

First Interstate Bank continues to rapidly advance in data processing and communications for the financial industry. Our Operations Services Group utilizes the latest technologies in its approach to developing innovative systems. If you would like to contribute your technical ideas, join a leader in multistate banking—First Interstate Bank.

PROJECT MANAGER

This position requires previous experience in financial industry project management and familiarity with banking applications in the field of wholesale payment systems and data security.

SYSTEMS ANALYST

Use your knowledge of financial delivery systems, IBM and Tandem hardware, and on-line banking systems to write design specs and document user requirements.

MANAGER, COMPUTER OPERATIONS

Your demonstrated managerial talent coupled with a complete understanding of computer operations and networking is necessary. Additionally, knowledge of banking industry computer hardware and software systems is required. Knowledge of International Banking Systems and accounting procedures helpful. SWIFTFIP is used.

Along with an outstanding systems environment, First Interstate Bank provides excellent salaries and benefits. For confidential consideration forward your resume and salary requirements to First Interstate Bank, Mail Group 10.1, Dept. SW1, 1200 W. 7th Street, Los Angeles, CA 90007.

New England, Westchester & NY Metropolitan Areas

INDIVIDUALS WITH 5+ YEARS EXPERIENCE

HIRE NOW

- Project Management
- Systems Analysis
- Systems Design
- Programming

COPYRIGHTED MATERIAL. ANY DATA
- COMPUTER ANALYSIS, INC.
- 1200 W. 7th St., RY. NY 10019
- Tel. (212) 307-0939

RICHFOOD, INC.

Richfood, Inc., a leading grocery cooperative serving the mid-Atlantic states for some 50 years, has exceptional opportunities for Senior Programmers, Analysts, and Systems Analysts. Our progressive systems and programming department uses IBM 4341 and 4331 computers and is currently operating in MVS with CICS, IMS, DB, Librarian, Roscoe, Data Manager, and Data Dictionary. Previous programming experience in the retail, grocery or financial industries would be a plus. Qualified candidates must possess a background in computer science & software engineering.

SENIOR PROGRAMMER/ANALYSTS - 3-1/2 years

Richfood offers an excellent salary and a competitive benefits package. For immediate consideration forward your resume and salary requirements before 2/1/86 to:

Ms. Marion Moylan

RICHFOOD, INC.
PO. Box 880
Framingham, MA 01701

An Equal Opportunity Employer M/F

UNIT SOFTWARE / SERVICE MANAGER

This executive position is responsible for the day to day operations of all software development activities. Must have 7-8 years experience in the field of software design and development, or 3 years in a supervisory role. Experience in software development projects is essential.

SENIOR PROGRAMMER/ANALYSTS - 3-4 years

Richfood offers an excellent salary and a competitive benefits package. For immediate consideration forward your resume and salary requirements before 2/1/86 to:

Lachman Associates, Inc.

Commited to Software Excellence!

LAL is a growing systems software development and consulting firm that can use your talents in UNIX, C, VT100, and Networking! We have over 150 professionals and have been leaders in UNIX related software development for the past 7 years. We promote the professional growth and fulfillment of our staff by providing a variety of challenging technical services for our clients.

Our specialties include network protocol development, communications, telephony, advanced Unix terminal support, and technical systems support in Chicago, California, Columbus, and New Jersey. For further information, please contact:

Lachman Associates, Inc.
Attn: Staffing-CW
914 Blackhawk Drive
Westmont, IL 60556

UNIX is a trademark of AT&T Bell Laboratories
UTS is a trademark of Amdahl

PROGRAMMER/ANALYST

Programmer/iutput for growing, diversified company in a rapidly growing software development tour. Responsibilities include writing code for a new software-based product. Must have 3 years experience with a C-based language. Must have Unix knowledge. Salary range $21,804 to $31,619. Send resume to Software Design Associates, Inc., 711 Fifth Avenue, New York, NY 10033.

Get your money's worth.

Computerworld

will lower

your cost-per-hire.

When you're looking to fill MIS/DP positions, there's really only one place you need to advertise, Computerworld.

In every major market, Computerworld reaches more data-processing professionals than the local recruitment media. And we reach them for less.

Over 600,000 computer-involved professionals receive Computerworld every week. That's 45% of all computer trade journal, business publications, or general-interest magazine.

Compare costs and the people reached. You'll find Computerworld really only one place you need to advertise. Computerworld. That's why over 4,000 advertisers run more than 5,600 recruitment ads in Computerworld in 1984. The openings they advertised cover for the whole gamut of MIS/DP positions — including systems analysts, computer science & software engineers, directors of MIS/DP, programmers, sales managers, and systems analysts.

As a matter of fact, recruitment advertising has made Computerworld the national leader in classified advertising among specialized business publications (according to Business Marketing magazine).

Compare costs and the people reached. You'll find that Computerworld is the number one medium for computer-related recruitment advertising. Computerworld

Classified Advertising
P.O. Box 888
375 Cochituate Road
Framingham, MA 01701
Computer Professionals

Battelle, Pacific Northwest Laboratories at Richland, Washington has the following opportunities available:

**Datacommunications Engineer**
This position involves support of datacommunications in a dynamic, distributed computing environment utilizing advanced technologies such as Digital PABX, intelligent port selectors, microwave and fiber optic transmission media, and Ethernet local area networks. Duties include design and acquisition of datacommunications systems, coordination of troubleshooting, network administration, and communications software development. A degree in electrical engineering, computer science, or equivalent experience is required. Experience with DECnet, Ungermann-Bass Net-One, and mixed DEC/IBM environments is desired.

**Minicomputer Systems Support**
This position involves technical support of distributed minicomputer systems and scientific workstations. Duties include system software development and support, software installation, troubleshooting, user consultation, and equipment and software acquisition. A degree in computer science and two years’ experience with DEC PDP-11 and/or VAX minicomputer is required.

U.S. Citizenship required. Reply in confidence with detailed resume and salary requirements to: C.J. Mitchell, Battelle Northwest, P.O. Box 999, Richland, WA 99352. An Equal Opportunity Employer M/F.

---

**HEARTBEAT OF THE SOUTH!**

CAP GEMINI DASD, an internationally established leader in the Data Processing Consulting field, has multiple openings in the Atlanta Branch Office for qualified candidates with experience in the following areas: Programmers, Programmer/Analysts, Systems Analysts, Project Leaders, and D.B.A.’s.

Qualified applicants will have experience in two or more of the following skills:

- MVS or OS/VS: IMS DB/DC
- COBOL
- RPG II/III
- PL/1
- CICS
- Tandum
- ADABAS
- IMS DB/DC
- HONEYWELL
- DB/DC
- VORDON
- ASSEMBLER
- MAPICS
- YORDON
- IBM S/34/36/38
- TANDEM
- MAPICS
- TANDEM
- ADSO
- UNIVAC
- ASSEMBLER
- TANDEM
- UNIVAC
- IBM S/34/36/38
- MAPICS
- TANDEM
- ADSO
- UNIVAC
- ASSEMBLER
- TANDEM
- UNIVAC

As a career-oriented company, we offer a comprehensive benefits program including paid overtime. If you have an interest in improving your career and lifestyle in the South’s perfect climate, please call or submit your resume.

2960 Brandywine Road, Suite 202
Atlanta, GA 30341
(404) 455-9301

CAP GEMINI DASD
PEOPLE/PRODUCTS/RESULTS

---

**ATTEND:**

**PROJECT USA SYMPOSIUM**
By Invitation Only
January 24, 1986
Dinner at 6 PM
Bring your spouse or guest

Call or write today for personal interview and invitation

PERSONNEL SCIENCES, INC.
11 East 44th Street, Suite 707, New York, New York 10017
ATTN: BOB BEAUDET — (212) 286-0430

---

**DISCOVER:**

- OUTSTANDING CAREERS AT AT&T COMMUNICATIONS
  (Representatives from AT&T facilities will provide career briefings.)
- LARGE SCALE APPLICATION DEVELOPMENT
  (Join in the building of one of AT&T’s largest development projects.)
- EXPANSIVE ENVIRONMENT
  (Large nationwide network in support of on-line systems.)
- OUTSTANDING BENEFITS PROVIDED by AT&T
  (Competitive salaries of $25,000-$44,000)
  (Relocation Assistance Program)

IMMEDIATE HIRING DECISION...

- Symposium Banquet to include Presentation
- Technical Interviews • Hiring Banquet

THE SYMPOSIUM WILL BE A SUCCESS BECAUSE OF:

- Your Technical & Interpersonal Skills
- AT&T Management Commitment
- Nationwide Search for Quality Candidates
- Joint Project Relationship between AT&T and Personnel Sciences, Inc.

START-UP MISI

SENIOR PROGRAMMERS/ANALYSTS
We are an international service organization growing at 30% annually and approaching $300M in sales. Our Systems and Data Processing Department is revolutionizing all of our information systems including:

- GENERAL LEDGER
- BILLING
- INVOICE RECEIVABLE
- ACCOUNTS PAYABLE

These high-quality positions require individuals who have 3-5 years experience in COBOL programming in a VAX environment. Strong communication and analytical skills, as well as prior experience with the above accounting environments. Using our computer system, your problem-solving skills will contribute to the overall development effort.

For consideration, please send your resume with salary requirements to:

Denis J. Festa
Manager Systems & Programming
TAD Technical Services Corp.
639 Mass Ave., Cambridge, MA 02139

---

**AT&T**
The right choice.
COMPUTER PROFESSIONALS

We've got the power to generate success in your career.

As San Diego continues to grow as “America’s Finest City”, with a living and working environment unsurpassed in the U.S., San Diego Gas & Electric continues to grow with revenues exceeding 1.5 billion.

We currently have a high visibility position available for an EDP Auditor, to join our corporate Auditing staff to perform audits of all phases of electronic data processing.

The qualified candidate will have at least one year’s strong background with IDMS in an MVS - IBM environment and a combination of at least 3 years’ experience in the following: TSO/SPF, CICS, COBOL, ACF2, SMF, TSO-MON, or FORTRAN.

Familiarity with STRADS, Easytrieve, Pervadit, SAS, Add-on-line, contracts, and microcomputers is helpful. A Bachelor’s degree and certification are preferred. Excellent oral and written communication skills are necessary.

We offer a progressive auditing environment, excellent salary and benefits packages, relocation assistance and the outstanding climate of beautiful southern California.

Submit your resume and salary history to: Employment Office 422
San Diego Gas & Electric
P.O. Box 1831
San Diego, CA 92112
An Affirmative Action Equal Opportunity Employer

TELECOMMUNICATION SYSTEM SPECIALISTS

If you know what VTAM, X.25, 2.10, 2.5, and X.25 are, and how to use them, know how to use an HN495, Hostol, and Breakout box, and would like to design communication systems into the 1980’s, then you should take the time to consider Total Assets Protection, Inc.

Your abilities as a Telecommunication Professional will put you in the forefront of a world class consulting company. TAPP is a mated in Data Processing and Communication Systems.

If you have current experience with these systems, possess U.S. Citizenship, and are willing to travel, send your resume to: Total Assets Protection, Inc., Arlington, TX 76006. (For your convenience, interviews will be held Sat., Sun., and in the evenings.)

TOTAL ASSETS PROTECTION
INCORPORATED
An Equal Opportunity Employer

FLORIDA & THE SOUTHEAST
NUMEROUS OPENINGS
STAFF & CONTRACTORS

If you have three or more of these skills:

Send resume to:
Mr. R. Latham
915 Tunxis Hill Road
Newington, CT 06111
(203) 336-1722

EASTERN CONNECTICUT UNIVERSITY
DIRECTOR OF COMPUTER & INFORMATION SYSTEMS

Coordinate all University Administrative and Academic Computing Systems and ensure the growth and development of campus computer resources. Must have on-going planning demonstrated leadership, knowledge of out-put devices, and a B.S. or M.S. degree in computer science.


MIS SYSTEMS ANALYSTS

Staff Corporation is a leading manufacturer, and is seeking MIS Systems Analysts. Candidates must have a minimum of 2 years experience in the implementation of computer systems. Must be familiar with micro manufacturing systems. At least 2 years experience in designing production, inventory and accounting systems for a manufacturing facility is required. We offer an excellent salary and fringe benefits.

SNE CORPORATION
910 Cleveland Ave., P.O. Box 1607
Rochester, NY 14603

Send this form to:
COMPUTERWORLD CLASSIFIED ADVERTISING
375 Cochituate Road
Box 680
Framingham, MA 01701

Telecopyer extensions: 451 410
DATA ADMINISTRATION SPECIALISTS

United Airlines competes within a dynamic industry. Our continued success and growth will be driven by having a corporate commitment to the strategic use of data management technologies. This is a unique opportunity to create a state-of-the-art data administration function.

To complete our team, we are seeking MIS professionals with experience in logical/conceptual data base design or data/information modeling. Preferably, you will have progressed from programming through systems design on very large systems. BS in Computer Science or equivalent preferred. MBA a definite plus.

- Sr. Data Administration Specialist: At least 4-7 years experience required. Financial/Accounting Applications a plus.
- Data Administration Specialist: At least 3-5 years experience required. Financial/Accounting Applications a plus.

Your responsibilities shall include: analyzing UAL's information requirements and developing the logical data architecture to support them; identifying and resolving existing conflicts in data definition and use; working with UAL departments to establish data access and update authorities; and interfacing with MIS Data Base Administrators to implement physical data structures consistent with the Strategic Data Plan. To complete this exceptional opportunity, you will need: ability to provide a comprehensive benefits program; pass/reduced fare air travel privileges in accordance with UAL policies; and relocation. For consideration, please forward your resume to United Airlines, Employment/EXOPX-C1DA, P.O. Box 66100, Chicago, IL 60666. Equal Opportunity Employer.

COMPUTER PROFESSIONALS

We are a high technology custom software development company. We produce our new systems using an internally developed 4GL tool that generates 4GL code. Exalted? We are currently undergoing explosive growth and are looking for top-quality personnel to participate in this growth. Opportunities are currently available for:

- SENIOR SYSTEMS ANALYSTS
- TELECOMMUNICATIONS ANALYSTS
- PROGRAMMER ANALYSTS
- 4GL PROGRAMMERS

We have positions in the following: large scale IBM Systems environment, various telecom access methods, operating systems and transmission techniques. The ideal candidate will have 7+ years experience in the large scale IBM Systems environment and extensive experience in data administration and design, with extensive experience in administration and development. Banking experience preferred.

Senior Technical Consultant

You will write, review, and test software, design data bases, and maintain system documentation. Opportunities are currently available for enhancements to existing systems and development of new systems. Extensive experience required in planning and development activities, analysis and design, project management, user relations and vendor interfaces. Bank data communications experience helpful.

Seattle

RainerBank, the largest independent banking company in Washington State, is headquartered in Seattle. We have over $7 billion in assets, 131 state-wide branches, 18 international offices in 8 nations, 41 mortgage banking and insurance offices in 10 western states and 7,486 employees.

While our investment in data processing and office automation systems represents a multi-million dollar commitment, we feel the people behind the system deserve first consideration. Imaginative, energetic people have made RainierBank a leading independent bank on a national basis. The same type of people will help us develop the systems and equipment that will meet the banking challenges of the future.

We are interested in people who are interested in joining a winning team. And, we encourage that winning team through training programs, sponsorship in professional groups, and attendance at advanced technical seminars.

We are seeking other experienced CICS/IMS/MVS IMS systems professionals. We currently have openings for the following positions:

- Data Base Administration Manager

You will be responsible for developing strategic data planning and technical support programs, including logical data base design expertise and consulting, physical data base design, and implementation for all systems. You must have 10 years EDP experience with a minimum of six years in data base analysis and design, with extensive experience in administration and development. Banking experience preferred.

Mail your resume to: Human Resource Department, RainerBank, P.O. Box 3966, No 5-4, Seattle, WA 98124. We are pleased to offer a competitive salary, stock options, and a wide range of benefits to our employees.
For many, the career path is a dark hallway with many doors. Some say ENTER, but should really say EXIT. Some say OTHERWISE, though you can't enter. Some say EVERYTHING YOU EVER WANTED, but they are locked. At Consultant Systems we have an open door policy. We've taken excellent compensation and fringe benefits and added:

- Professional Environment
- Variety of Assignments
- Visibility on Important Projects
- Enhancement of Existing Skills
- Advanced Based on Performance

We are seeking:

- Programmer/Analysts
- Senior Programmer Analysts

Opportunities in different areas of the continental U.S. Skills with CICS or IDMS or IMS DB/DC or MARK IV or MANTIS or Honeywell DM4TP are a plus. Call COLLECT or drop us a line...We are a NYC based vendor of DEC computer applications specifically and AIMS. B.S. Engineering (Comput)

**PROFESSIONAL: DESIGN, code, test, enhance & maintain computer applications specified related to banking, utilizing COBOL, RPGII, DUT, VSY, IMS, ETT, EXPLR, HOMAD, DOSIV & VISAM on IBM mainframe platform or related requirements studies & prepare system specifications & program related programming experience. Requires M.S. degree in Industrial Engineering. Brewer Reported to A.M., Decision Strategies, Inc., Route 17, Hasbrouch Hts., NJ 07987. Salary $67,000 per year. 40-hour week. Send resumes to:

**SUNBELL $25 - $45K**

LARGE SCALE IBM PROG NS REQUIRE EXPERTISE IN SYSTEMS
type SUPPORT TECH SERVICES

- INSURANCE - BANKING - MFG
- Large and medium problems
- Solved by client companies
- Send resumes to:

**WHITTIER & ASSOCIATES**

3960 Pacific Rim NE
Suites 206-202
Atlanta, Georgia 30324
Telephone 404-262-2668

**SUNBELL $25 - $45K**

LARGE SCALE IBM PROGNS REQUIRE EXPERTISE IN SYSTEMS
type SUPPORT TECH SERVICES

- INSURANCE - BANKING - MFG
- Large and medium problems
- Solved by client companies
- Send resumes to:

**WHITTIER & ASSOCIATES**

3960 Pacific Rim NE
Suites 206-202
Atlanta, Georgia 30324
Telephone 404-262-2668

**COMPUTERWORLD**

COMPUTERWORLD's paid circulation climbed to over 126,000 this fall. Folio 400 (Folio Magazine's study of trade publication performance) placed us first in total revenue. As the industry grows, so will COMPUTERWORLD. It will continue to offer the high quality news coverage and editorial content that has attracted its readers. What does that mean to you, our advertisers? Good news...in the form of wider exposure.


**COMPUTERWORLD**

COMPUTERWORLD's paid circulation climbed to over 126,000 this fall. Folio 400 (Folio Magazine's study of trade publication performance) placed us first in total revenue. As the industry grows, so will COMPUTERWORLD. It will continue to offer the high quality news coverage and editorial content that has attracted its readers. What does that mean to you, our advertisers? Good news...in the form of wider exposure.

**COMPUTERWORLD**

COMPUTERWORLD's paid circulation climbed to over 126,000 this fall. Folio 400 (Folio Magazine's study of trade publication performance) placed us first in total revenue. As the industry grows, so will COMPUTERWORLD. It will continue to offer the high quality news coverage and editorial content that has attracted its readers. What does that mean to you, our advertisers? Good news...in the form of wider exposure.

**COMPUTERWORLD**

COMPUTERWORLD's paid circulation climbed to over 126,000 this fall. Folio 400 (Folio Magazine's study of trade publication performance) placed us first in total revenue. As the industry grows, so will COMPUTERWORLD. It will continue to offer the high quality news coverage and editorial content that has attracted its readers. What does that mean to you, our advertisers? Good news...in the form of wider exposure.
Advertisers Index

Accountant Microsystems .................. 108
Ad Verbum Corp .................. 38
Al '96 .................. 31
Aluminum Case Company .................. 108
Ametek Computer Technologies .............. 64
Axios, Inc .................. 64
B.I. Moyle Associates .................. 25
Boole & Babbage .................. 13
Bridge Communications .................. 56-57
Brookville Associates .................. 14
Cambridge Systems .................. 26
Cartefone Communications .................. 85
Charles River Development .................. 85
Cincoph Systems .................. 27-51-53
Connet '86 .................. 112
Computer Corporation of America ............ 30
Computer Management Research ............. 23
Computer Power Corp .................. 40
Computer Technology Group .................. 91
Convex .................. 104
Cultinet .................. 9
CW Circular .................. 99
CW Focus .................. 84
CWMMs .................. 111
Data Design Associates .................. 47
Data Base Management, Inc .................. 91
DCA .................. 48-49
Deltapoint .................. 82
Charles River Development .................. 85
digital Equipment Corp .................. 34-35
NCR Corp .................. 96-97
NETECH .................. 86
Duquesne Systems, Inc .................. 66
Eastman Kodak Co .................. 15
Emerson Electric Corp .................. 22
Falco Data .......................... 41
General Technology Inc .................. 60
Goal Systems .......................... 85
H & W Computer Systems, Inc .................. 74
Hewlett-Packard .................. 28-29
Hughs Aircraft Company .................. 36
IBM .......................... 75-88, 99,135
IDE Associates .......................... 87
infomation Data Processing .................. 5
Innovation Technology Corp .................. 109
Infotrones Systems Corp .................. 82-83
Invitational Computer Conference .................. 10
Ken Orr & Associates .................. 60
Landmark Systems .................. 110
Leasametric .................. 32
MacWorld Exposition .................. 100-101
Micro Focus .......................... 6
MICRO International .................. 36
MBA .................. 136
MTI Systems Corp .................. 106
National Information Systems .................. 14
NT Computer .................. 83-84
NETECH .................. 86
On-Line Software International .................. 72-73
Oracle Corp .................. 11,33
Persis Systems .................. 36-39
Polycom Associates .................. 94
Pro Computer Sciences .................. 105
Quadram .................. 42
Qume .................. 109
Realita Inc .................. 46
Relational Database Systems .................. 80-81
Roim Corp .................. 54-55
SAS Institute .................. 20-21
Software AG .................. 59
Software Corporation of America ............. 23
Triangulation .................. 98
TRW .................. 86
Tyme .................. 95
Universal Data Systems .................. 95
VM Software, Inc .................. 7
Worldcom .................. 61
Xerox Corp .................. 78-79

This index is provided as an additional service. The publisher does not assume any liability for errors or omissions.
Norris retires from CDC

From page 134

built such a big company has to step down at such a difficult moment," said mainframe market analyst Da- 

vid Moschella of International Data Corp., in Framingham, Mass. 

Many feel that Norris' passing the torch will not change the direction of the company but will spur CDC's movement away from many of its non-computer-related diversifications. "CDC's actions are very con- 

strained by cash flow considerations now, rather than the strategic direc-

tion of the CEO," Blauer said. 

The former vice-president and general manager of Sperry-Rand Corp.'s Univac division, Norris left to 

join MSA lost $3.2 million on $94 million of its top executives said last week. 

"It absolutely is not a reference to 

any lack of a marketplace for optical disk technology," said Les Cowan of "Optical Memory News," pub- 

lished by Rothschild Consultants in San Francisco. 

The vitality of the optical memory market was perhaps best illustrated recently at Comdex/Fall '85, where 

and data processing services, but Norris always stuck to his guns. 

"These programs are the future of the company," Norris said in a Com- 

tputerworld interview last year. "It has been a difficult strategy, but it's 
going to pay off handsomely." 

Others have blamed CDC's recent financial woes on its failure to grasp 

fundamental trends in computing. CDC was alone among the BUNCH 

companies in not entering the end-

user office market, the rise of which has cut into remote time-sharing ser-

vices such as CDC's. And CDC's 

building of a large peripherals busi-

ness through acquisitions was a 

stroke of genius to compete against 

IBM in the 1960s, but overcapacity 

and cut-rate offshore products have 

since decimated the storage market. 

Although fundamental changes in 

the near term are not likely at CDC 

after Norris' departure, economic re-

alities will force the company into 

continued retrenchment from the ex-

pansive, acquisitive giant that Norris 

built. "Initially, his retirement will 

cause the image more than any-

thing," Moschella said. "It will be-

come easier to make necessary 

changes that he has resisted. Up to 

now, who was going to go against the 

chairman? But this is kind of a mile-

stone. There aren't many who have 

been around longer than Norris." 

STC exits strong optical mart

By Maura McNaney

Storage Technology Corp.'s (STC) recent exodus from the optical disk market by no means sounds the death knell for optical disk technology, ana-

lysts said. 

"It absolutely is not a reference to 

any lack of a marketplace for optical memory products," said Les Cowan of "Optical Memory News," pub-

lished by Rothschild Consultants in San Francisco. 

The vitality of the optical memory market was perhaps best illustrated recently at Comdex/Fall '85, where 

more than 50 firms displayed optical memory products, many of which ac-

claimed displays capable of being used in real applications in 

real systems," Cowan said. 

Financial problems were the driv-

ing factor behind Louisville, Colo.-

based STC's recent decision to drop production plans for a 14-in. optical disk drive, despite a four-year, $100 million investment. The product of 

"These programs are the future of the company," Norris said in a Com-

tputerworld interview last year. "It has been a difficult strategy, but it's 
going to pay off handsomely." 

Others have blamed CDC's recent financial woes on its failure to grasp 

fundamental trends in computing. CDC was alone among the BUNCH 

companies in not entering the end-

user office market, the rise of which has cut into remote time-sharing ser-

vices such as CDC's. And CDC's 

building of a large peripherals busi-

ness through acquisitions was a 

stroke of genius to compete against 

IBM in the 1960s, but overcapacity 

and cut-rate offshore products have 

since decimated the storage market. 

Although fundamental changes in 

the near term are not likely at CDC 

after Norris' departure, economic re-

alities will force the company into 

continued retrenchment from the ex-

pansive, acquisitive giant that Norris 

built. "Initially, his retirement will 

cause the image more than any-

thing," Moschella said. "It will be-

come easier to make necessary 

changes that he has resisted. Up to 

now, who was going to go against the 

chairman? But this is kind of a mile-

stone. There aren't many who have 

been around longer than Norris." 

STC exits strong optical mart

By Maura McNaney

Storage Technology Corp.'s (STC) recent exodus from the optical disk market by no means sounds the death knell for optical disk technology, ana-

lysts said. 

"It absolutely is not a reference to 

any lack of a marketplace for optical memory products," said Les Cowan of "Optical Memory News," pub-

lished by Rothschild Consultants in San Francisco. 

The vitality of the optical memory market was perhaps best illustrated recently at Comdex/Fall '85, where 

more than 50 firms displayed optical memory products, many of which ac-

claimed displays capable of being used in real applications in 

real systems," Cowan said. 

Financial problems were the driv-

ing factor behind Louisville, Colo.-

based STC's recent decision to drop production plans for a 14-in. optical disk drive, despite a four-year, $100 million investment. The product of 

See STC page 133

STC exits strong optical mart

By Maura McNaney

Storage Technology Corp.'s (STC) recent exodus from the optical disk market by no means sounds the death knell for optical disk technology, ana-

lysts said. 

"It absolutely is not a reference to 

any lack of a marketplace for optical memory products," said Les Cowan of "Optical Memory News," pub-

lished by Rothschild Consultants in San Francisco. 

The vitality of the optical memory market was perhaps best illustrated recently at Comdex/Fall '85, where 

more than 50 firms displayed optical memory products, many of which ac-

claimed displays capable of being used in real applications in 

real systems," Cowan said. 

Financial problems were the driv-

ing factor behind Louisville, Colo.-

based STC's recent decision to drop production plans for a 14-in. optical disk drive, despite a four-year, $100 million investment. The product of
STC exits strong mart

From page 132

that effort, demonstrated in STC laboratories, was capable of storing 4G bytes per disk side and transferring information up to 3M byte/sec, a spokesman for the company said. Had it made it to market, the STC drive would have been the fastest and largest optical disk product available, analysts said.

STC, which filed for protection under Chapter 11 of the Federal Bankruptcy Code in October 1984, has been working on a reorganization plan to trim expenses. Robert Costain, STC's vice-president for strategic planning, said the firm is approaching final negotiations with its credit committee. STC cannot afford an estimated $80 million needed to bring the product into production by 1988, Costain said.

Optical disk technology will see some significant market inroads this year, particularly at the low end with compact disk storage units. Worldwide shipments of compact disk read-only memory drives will reach 40,000 this year and 353,000 in 1988, according to "Disk/Trend," a storage industry newsletter. Most of those installations will be used in conjunction with micros.

Year-end tallies: Don't look for any surprises

By most accounts, financial results for the December 1985 quarter are nothing to write home about.

Michael R. Weisberg, director of technology research at Prudential-Bache Securities, Inc., says he believes the December quarter results "will be in line with expectations in the computer sector." Weisberg added, "I don't think you're going to see major surprises in either direction," he said.

Undoubtedly, most attention focuses on IBM's fourth-quarter earnings. Despite three down quarters, IBM has insisted that net income for fiscal 1985 would see slight improvement over fiscal 1984's net of $6.58 billion.

Porteus is president of Strand Research Associates, a Centerville, Mass.-based company that provides customized research services for financial and high-tech firms.

To match last year's performance, IBM will need to post December quarter earnings of $4.46 per share, which would represent a 25% increase in net income over 1984's fourth quarter.

"Clearly, IBM is pulling out all the stops to show that up year," says Steve Milunovich, a technology analyst with First Boston Corp. Nevertheless, Milunovich estimates that IBM will fall a little short of the mark, earning $10.05 per share for the year vs. $10.77 per share in fiscal 1984.

A number of analysts share Milunovich's view that IBM's fourth-quarter results will be somewhat disappointing. According to Zachs Investment Research, Inc., a Chicago-based consulting firm that tracks Wall Street estimates, the average earnings estimates for IBM's fourth quarter is $4.38 a share. A slight disappointment in earnings is not expected to affect IBM's stock price significantly.

According to Milunovich, there should be few surprises in the December quarter results for BUNCH companies. He estimates Burroughs Corp. will show an up quarter with $2.17 per share against $2.08 per share in last year's fourth quarter.

"Honeywell, Inc. is stretching to get back to a flat year," Milunovich says, "but I don't think they will do it." Milunovich estimates Honeywell will earn $2.62 per share in the December quarter.

"If any company gives us a modest upside surprise, it will be Digital Equipment Corp.," says Barry Bosak, vice-president with Eberstadt Fleming, Inc.

"I don't think you're going to see any significant surprises in the computer sector," says Michael R. Weisberg, director of technology research at Prudential-Bache Securities, Inc. While many analysts believe IBM will not likely be any meaningful uptick," Sherlund estimates that Lotus Development Corp. will probably report fourth-quarter earnings between 70 and 80 cents a share vs. 73 cents a share in the fourth quarter of 1984. Software Publishing Corp. estimates will post a significant down quarter - in the 20 to 30 cents per share range - owing to lackluster seasonal sales.


"Investors are looking for a reason to be encouraged about Cullinet," Sherlund adds, "so Cullinet's stock would view any unexpected earnings improvement very positively."
Norris retires from CDC

Norris named successor for beleaguered company

By Clinton Wilder

MINNEAPOLIS — An era in mainframe computer history came to an end last Friday when 74-year-old William C. Norris, the venerable and sometimes crusty chairman and chief executive officer of Control Data Corp., announced his retirement from the company he founded 29 years ago.

The CDC board accepted Norris' retirement and named President Robert M. Price, who has run the firm's day-to-day operations since 1980, to succeed him. The promotion appeared to be a vote of confidence in Price, but some analysts believe the board and the company's creditor banks are still considering further changes in top management.

"Whether Price's elevation will be permanent or interim remains to be seen," according to Gary Blauer of Dain, Bosworth, Inc., an investment firm based in Minneapolis.

Norris' departure comes at a turbulent time for CDC, which has been struggling to keep its financial ship afloat in recent months. CDC's core mainframe systems business is expected to lose some $100 million in fiscal 1985 and other divisions are also running in the red. CDC has sold off or scrambled many pieces of its peripheral and financial services businesses and laid off some 9,000 employees.

"It is unfortunate that a guy who has seen the company through thick and thin, but some analysts believe the board and the company's creditor banks are still considering further changes in top management."
A big feature of the IBM System/36 PC

$5995*

*Suggested Retail Price for a 256K, 40MB System/36 Processor.

A surprisingly small price to pull your business together. Some people think it costs four times that much for this kind of power.

Just connect the System/36 PC to your IBM personal computer. And you can also connect any combination of up to three additional IBM PCs, System/36 terminals and compatible printers. So you can share information and resources.

Now you can work with the most popular PC software. And with thousands of business applications written for the System/36 family.

Another big feature: All this power comes in a very small package. Place it on your desk. Or under it. Even beside it.

And as your business grows, the System/36 family can grow to fit your needs.

The IBM System/36 PC. Use it in a department. Or as a standalone computer for a small business.

But don't expect your business to stay that size forever.

For a free brochure on the IBM System/36 PC or for information on product availability from participating Authorized IBM PC Dealers, Value Added Dealers or IBM Product Centers, call 1-800-IBM-2468, ext. 090/YY. Or call your IBM marketing representative.
No, we’re not crazy. And no, we’re not joking.

We’re Management Science America, Inc. The largest independent applications software company in the world. And by Jan. 27, 1986, we plan to give $20 million worth of our newest software to over 2,000 of our customers. Instantly making it the industry standard for fourth generation technology.

If you’re particular about what you get for free, here are the particulars. We call this technology Information Expert™. Because it allows all your software systems to carry on intelligent conversations. With one another. In English. And thanks to our data dictionary, nothing will ever sound like Greek.

For end users, our system makes it easy to design reports. Our menus guide you through the process with such ease and intelligence, they’ll even tell you the proper responses to use for whatever job you need.

Information Expert also provides a fourth generation language that your data processing staff can use for applications development. So you can do in minutes what used to take hours. Or do in hours what used to take days.

It even allows borderless retrieval of information. That way, you can get all the information you need. Not all the information you don’t need.

Why are we giving all this away? It’s part of our customer support policy. And if that doesn’t sound familiar to you, you should obviously become familiar with us. MSA.