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UNIX IN THE OFFICE

PRODUCTS • TRENDS • ISSUES • ANALYSIS

IBM's Unix

Moving to Distributed Network Computing

By Judith S. Hurwitz

IBM HAS A NEW VISION: to become a premier Unix systems vendor with a large installed base. It is not as though IBM just discovered Unix. Over the years, Big Blue has made numerous, albeit half-hearted, attempts to penetrate the market.

So, what's different now? IBM has realized that, in order to move from the traditional time-sharing system concept it has mastered over the past 20 years, it must come up with a different approach. The approach that will propel IBM into the next generation of computing—(continued on page 3)

RECENTLY, the *Office Computing Report*, a sister publication to *Unix in the Office*, was named the "Best Computer Newsletter" of 1987 by the Computer Press Association. We are, of course, gratified to receive this honor, but instead of going to our heads, the award has made us even more conscious of our editorial responsibility to you, the readership of our three reports, for whom we labor in love and dedication.

So to improve our service to you and the responsiveness of our publication to your needs, I am passing the stewardship of *Unix in the Office* to someone who can give it a great deal more attention than I can. I will continue as publisher, editorial advisor, and guiding light, but I have asked Judith Hurwitz to pick up the baton as our new editor-in-chief.

Judith Hurwitz has been an analyst and journalist in the technology industry for 10 years. She is the author of numerous articles (such as this month's feature) that we have published over the years in *Unix in the Office* and the *Office Computing Report*. Judith also serves as Senior Editor for both the *Office Computing Report* and the *Network Monitor*. Prior to joining us in 1986, Judith held several key editorial positions, including editor for *Mini-Micro Systems* and founding editor of *Data Training Magazine*. For four years, she was a senior consultant in office automation and end-user computing at both John Hancock Insurance and Apollo Computer. As an analyst at IDC, she wrote comprehensive market research studies in various areas of office automation and networking.

In the near future, we are planning to solicit feedback on our editorial direction and focus. And you will be hearing from Judith from time to time as she responds to your advice and opinions. But, even without a formal survey, we encourage you to let us know about your interests and your needs. Don't wait for us to ask! Don't be shy! We want to hear from you!

In thinking about our three monthly publications, I have become aware of what a strong foundation the three provide as a source of insight and direction as the industry shudders and shakes its way into the fourth wave of computing. Where would directions in office computing, networking architectures, and

• E D I T O R I A L •

Passing the Baton

Striving to Serve You Better

By Patricia B. Seybold

standards be without Unix? As you know, in *Unix in the Office*, we forecast the rapid infiltration of Unix into the commercial marketplace. We report on the standardization efforts surrounding Unix and the various platforms it runs on. We analyze the Unix strategies of the major players in the traditional data process-

ing arena, while we track the leaders in the Unix workstation and "hot box" arena. Where will you find in-depth analyses and comparisons of all the popular Unix DBMSs but by reading Judy Davis's excellent series in *Unix in the Office*?

In the *Office Computing Report*, we have been chronicling the transition from minicomputer-based integrated office systems to PC-LAN based systems. We keep you informed about issues surrounding the gradual migration to OS/2 and the infiltration of the Macintosh into the mainstream. We are concerned about issues of connectivity and integration as all of us in the industry try to glue these heterogeneous systems together, integrating mail systems, filing systems, and applications. And we are excited about the new possibilities unfolding in object-oriented architectures, image processing and retrieval, procedural automation, and computer-supported cooperative work.

And if you are also interested in networking trends, strategies, and implementation, then you will want to be reading our *Network Monitor* report regularly as well. In this publication, we compare the networking strategies of IBM, Digital, and Hewlett-Packard (HP). We chronicle the competitive moves of Novell, 3Com, and Banyan. We keep you abreast of wiring trends, fiber optic directions, ISO standards issues, and ISDN. And the *Network Monitor* is where you'll find the most complete coverage of the distributed network computing architectures towards which the entire industry is migrating.

So while we're proud of the *Office Computing Report* and of the recognition it has finally won after 11 years of publication, we're equally proud of our whole family of research publications. We are committed to providing all the elements you'll need to thread your way through the mine fields of computing in the late '80s and into the '90s. ©

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• IBM •

(continued from page 1) Distributed Network Computing (DNC)—will be Unix. In turn, DNC will lead IBM to the next generation of computer software: cooperative processing and workgroup software. In a nutshell, the company has begun to make such a strategy a reality by establishing a family of Unix products. As part of this family approach, IBM is:

- Incorporating industry standards at all levels
- Providing a consistent version of the operating system from the low end (PS/2 and RT PC) to the high end (System 370 line)
- Adding sophisticated networking
- Offering traditional VM customers who are interested in Unix a low-risk migration path
- Providing bridges to SAA

IBM is so serious about Unix that it has publicly stated that its Advanced Interactive Executive (AIX) Family Definition will have equal status with its sacred Systems Application Architecture (SAA). Now that's commitment! IBM defines the AIX Family Definition as "a framework for building portable, consistent AIX applications now and in the future for IBM System/370 (9370, 4381, and 3090), Reduced Instruction Set Computer (RISC) architecture, and Personal System/2 (PS/2) 80386 computing environments." Like SAA, the AIX family definition defines the complete systems environment. It will include operating system calls, high-level languages, programming interfaces, distributing processing and networking capabilities, and a common user interface. The AIX definitions are based on Unix, industry standards, and IBM extensions. As part of the definition, IBM has emphasized that through "networking and distributed processing capabilities, systems will be able to transparently share presentation graphics, data, and other available resources. Transparent to AIX users, the local system extends beyond the processor boundary, and the system becomes a network of attached processors."

The Corporate Perspective

IBM has long been one of the few vendors that did not have to emulate anyone else's standards to maintain market leadership. It could thumb its nose at industry standards by saying its proprietary approach made the most efficient and effective use of technology to the advantage of its broad and dedicated customer base. How times have changed. But over the past few

years, even IBM has begun to see the writing on the wall: Users were becoming dissatisfied with islands of automation, and systems from different vendors would have to be interconnected. Slowly, IBM began addressing the demand for industry standards, first through its popular PC line and then by adding industry-standard communications capabilities such as Transmission Control Protocol/Internet Protocol (TCP/IP), Ethernet support, and even VT-100 emulation. While these seem like small steps, they did indicate that IBM was headed in a new direction.

At the same time, IBM watched as young upstarts like Sun and Apollo took the technical and scientific workstation market by storm, earning millions of dollars. IBM has long realized that Unix was important to the university community. Therefore, the company has offered Berkeley Software Distribution (BSD) Unix for that community for years. When Apollo and Sun Microsystems began making big bucks creating high-powered workstations for the scientific and engineering as well as the university communities, IBM, among others, was caught off guard. It didn't take long for IBM to start paying closer attention.

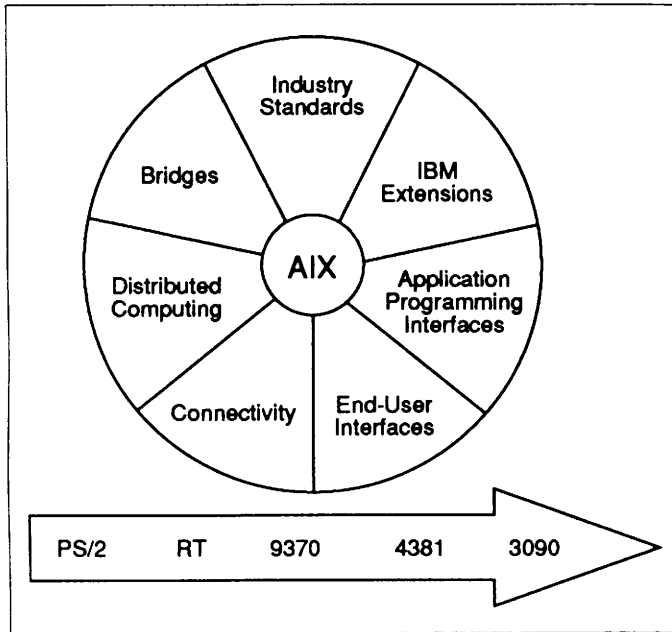
In response, IBM introduced its RISC architecture RT PC. Despite a sizable investment, when the workstation was initially introduced in 1985, it did not measure up. It was priced higher than the competition, was slow, and did not allow for the kind of connectivity workstation customers had come to expect. However, IBM did not underestimate the importance of this market and has continued to improve the technology.

The Saga of the RT PC

Is the RT PC destined to be another Series/1 (IBM's disastrous attempt to penetrate the minicomputer market)? If you looked at IBM's initial responses to the workstation marketplace, the answer would have had to be yes. Indeed, IBM's first workstation product, the 9000 (a 68000-based machine) failed. Undaunted by failure, in January 1986, IBM went on to introduce a RISC-based processor, the RT PC. The RT PC is based on a proprietary 32-bit RISC chip and a proprietary IBM virtual memory management chip with 40-bit addressing that supports up to a terabyte (one trillion characters) of virtual memory. Ironically, IBM's high-end 3090 (with 31-bit addressing) offers less virtual memory (a mere two gigabytes).

One area that has been problematic for the RT PC is its reliance on the 16-bit AT bus. Initially, networking for the RT PC was almost nonexistent. In a market dominated by complex networking, this did not go over very well with customers. Another problem for the new workstation was pricing. Initial models rated between 1.6 and 2.1 MIPS, ranged in price from \$11,700 to \$19,500. At these prices, IBM's products could not

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IBM's vision of Unix.

compete with those from either Sun, Apollo, or Digital.

IBM wasted no time. It began to make changes almost immediately. For example, in September 1986, IBM added a new Model 15 priced at \$10,500 with much more memory and storage than the higher priced older models. It also decreased the prices of the older Model 10 by 32 percent to \$7,900. Price of the Model 25 went down from \$17,490 to \$14,050. The top-of-the-line A25's price was slashed from \$19,510 to \$15,620. Pricing of the AIX operating system was also cut by 32 percent. The newer version of AIX (Version 2.1) was now upgraded to support 16 users (versus 8 on the earlier release).

Version 2.1 of the AIX operating system indicated the direction in which IBM was going to take Unix. IBM was allowing for communication between the RT PC and the System 370 (S/370) family via the 5088 Graphics Channel Controller. In addition, 3270 emulation and file transfer was available through the Workstation Host Interface Program (WHIP).

It is interesting to note that, in the March 1988 announcement, the PS/2 Model 80 has taken over the role originally intended for the low-end RT PC. It is the PS/2 Model 80 that has the strategic connection with the higher-end models.

This should not be interpreted to mean that the role of the RT PC is diminished. Indeed, we continue to believe that the RT PC is a strategic workstation product for IBM. For example, in IBM's RT PC announcements from March 1987, the company made significant changes to the product that have helped it considerably. The RT PC speed was increased dramatically so that data could be processed two to three times faster, with an eightfold increase in floating-point performance. Data can be moved between fixed disk and real memory up to four times faster than in the original RT PC models. In addition, new models were added (Models 115, 125, and B25) that included a faster

RISC processor (32-bit CMOS), and a built-in floating-point processor (20 MHz Motorola 68881).

In addition, IBM began to address the issue of industry standards. It adopted X-Window, Ethernet, and TCP/IP. However, IBM digressed from accepted standards by announcing its own distributed file system, Distributed Services, rather than the Sun's popular Network File System (NFS) (see box "Comparing DS to NFS").

In the March 1988 announcements, the RT PC took a back seat to the S/370 and PS/2 Model 80. This is to be expected since AIX was already well established on the RT PC and was being announced for the first time on these other platforms. It would be easy to dismiss the RT PC as a product that has not been able to compete. We believe that, in the next six months, more announcements will be made that will demonstrate IBM's commitment to the workstation market. We expect that one of the first significant moves will be the inclusion of the MicroChannel bus for the RT PC. This powerful and strategic bus announced for the PS/2 will be of major importance in the coming years. Because of its increased bandwidth, it will be a strategic partner for both of IBM's multitasking operating systems—OS/2 and Unix. Multitasking and the MicroChannel are made for each other. The MicroChannel bus should help considerably to make the RT PC a more competitive product. The other major advance we expect from IBM will be more powerful models of the RT PC that will make it comparable in price/performance to Sun's Model 4. However, IBM will have its work cut out for it. The company still has catching up to do in this highly competitive marketplace. If it can make up some of the technological edge it has lost, the RT PC could gain some respectable market share. However, in the short run, IBM will have to contend with its lackluster image.

IBM views the RT PC as a linchpin in its future distributed computing environment. Without it, IBM would be left out of the dynamic workstation marketplace. We believe that IBM will not discontinue this troubled product, but will continue to aggressively improve it.

A hint at the future trends in this area is the 6152 Academic System, a PS/2 Model 60 with an RT coprocessor. An RT can act as a cluster manager, downloading applications from the RT to the PS/2 Model 60. The 6152 is the first implementation of the bus master facility multiprocessing capability of the MicroChannel. Because the 6152 is intended for the academic community, its operating system is based on BSD 4.3, which is popular in research circles.

Although this product is being marketed only to the academic community, we believe that IBM will use the same philosophy to closely link the RT PC to the PS/2. Already, the PS/2 Model 80 can be considered the low-end workstation. In addition, we have already begun to see IBM offer the same software products on both low-end system lines. Over time, IBM will begin to market the PS/2 and RT PC as a continuum of products with variations in power and graphics.

A critical component in the RT PC strategy was Unix. Initially, for this market, IBM chose a joint venture with Interac-

itive Systems. The first version of AIX was therefore based on Interactive Systems' design. At the same time, IBM announced a version of Unix for its S/370 line called IX and also announced Xenix for the PC. Each version of Unix was different, and no one version could communicate with the next. Needless to say, there was no cohesive strategy.

The biggest problem was not just that the three different varieties of Unix could not communicate, but, with the exception of Xenix, none was up to par with the competition. IX/370, for example was a guest operating system that relied on the host operating system for all its I/O. The net result was a slow and ineffective product.

Recognizing a Growing Market

IBM made the decision to commit extensive resources to Unix more than three years ago when it began to notice that it was getting more and more requests from customers for better Unix support. These demands came primarily from IBM's customers in the industrial sectors, such as process control—a market that has benefited from the high-end Unix workstation market. Slowly, however, the demand has begun to extend to some areas of the commercial sector as well. The combination of growing customer demand with market projections of a 25 to 30 percent growth rate for the Unix market in general is propelling IBM into this marketplace. IBM is paying attention to market projections of International Data Corporation (IDC) that the U.S. Unix market will be worth \$9.5 billion by 1990.

The driving factor for IBM's strategy is the government market, both in the United States and Europe. The U.S. federal government is requiring, almost without exception, that the Unix operating system be written into all proposals. An example of this requirement is the highly publicized Air Force bid for minicomputer based systems. This \$3.5 billion request for proposal (RFP) has stated that the operating system must be Unix, and, when available, Posix. A bid expected to come out of the Treasury Department will be valued at almost \$2 billion. A third bid for the Army is valued at about \$200 million. All these bids require Unix. They also all require that all systems, from the largest to the smallest, be able to communicate with each other.

The Depth of Commitment

When it introduced AIX/370 two months ago, IBM stated that the series of announcements was "only the beginning of IBM's commitment to Unix." In fact, IBM is calling Unix a "strategic operating environment," a designation also given to SAA. To demonstrate its commitment to the Unix market, IBM has begun

to pour financial and personnel resources into its new market. For example, IBM publicly states that as many development dollars are being spent for Unix as are going into PS/2 and its OS/2 operating system.

IBM has set up a new group to market and support Unix which will be headed by Jerry Latta, group director of Technical Computing Systems. His charter is to set up the marketing, service, and support for AIX. While the size of this organization can only be speculated upon, IBM states that support for Unix will be identical to support for proprietary systems. In 1987, for example, each of IBM's 275 local offices was asked to develop an AIX technical expert. Advanced development of Unix products will remain in IBM's Austin facility, the organization responsible for all previous Unix development.

Historically, IBM's Unix development has come out of Advanced Engineering Systems, a development group, the organization that was responsible for the RT PC. In 1986, this

group was reorganized and made part of the Entry Systems Division (ESD) headed by William Lowe, IBM vice president and president of ESD. We believe that it is significant that Lowe, responsible for overall development and marketing for IBM's PS/2 and OS/2, is in charge of AIX. Entry Systems Division prod-

ucts tend to be those that move quickly in pace with fast moving markets.

Overall responsibility for Unix development falls to Andrew Heller, vice president and general manager of Advanced Engineering Systems. Reporting to Heller is Daryl Wartluff, director of AIX Systems Management, who has product responsibility. It is interesting to note that, before moving to the Unix side of the house, Wartluff had marketing responsibility for the Professional Office System (PROFS). While PROFS may not be leading edge software, it has reaped substantial rewards for IBM from a marketing perspective. Today, PROFS is one of the top-selling electronic mail systems. Wartluff was responsible for taking PROFS from its days as a giveaway for VM users to its current status as highly profitable software.

How will IBM approach the overall Unix market? The company is trying to position itself as the guardian of standards. It has become very proactive in the IEEE Posix Committee, helping to come up with standard interface definitions between applications and the Unix operating system. IBM has given its test suite to the National Bureau of Standards as a means of testing Portable Operating System for Computer Environments (Posix) compliance. It is publicly extolling the virtues of standards. Indeed, it was fascinating that, at a recent ADAPSO conference, Wartluff stated to an audience of devoted IBM software and services providers that IBM realizes users want standards and not proprietary environments.

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The Implementation

With this strategy in mind, IBM is structuring its Unix products to compete in an increasingly competitive marketplace. In essence, it has a four-pronged strategy:

- Create a cohesive operating environment
- Adopt industry standards
- Build on an existing customer base
- Add value wherever possible, including networking, support, and product depth

THE AIX OPERATING SYSTEM STRATEGY. A mere two years ago, Unix was viewed as a necessary but not strategic operating system, a product necessary for certain niche markets. There was enough Unix support to be able to check off a requirement on a government RFP. Nothing more, nothing less.

With the realization of the growing importance of Unix, IBM started from scratch. It discontinued ix/370 at the high end and Xenix at the low end. Considering the fact that ix/370 was a poor performer and was incompatible with Xenix and AIX, the move made good sense. And AIX fills any gap that discontinuing Xenix might leave.

The initial introduction of AIX on the RT PC was a staging ground for the full IBM Unix strategy. Even at that point, IBM was subtly hinting that there was more to come. The new improved operating system is quite a contrast to the hodgepodge of operating systems. The new AIX is the foundation for IBM's Unix strategy. AIX consists of two million lines of code. The same two million lines comprise the operating system on the PS/2 Model 80, the RT PC, and the S/370 line (from the 9370 to the 4381 and the high-end 3090). The only differences reside in the kernels of each operating system and are directly tied to the differences in hardware architecture. AIX for the RT PC shipped in 1986. The version for the PS/2 model 80 will ship this September, and AIX/370 will ship in March 1989. While the code in all three platforms is identical, the role of AIX on each box is different. While the direction of AIX on the RT PC is clear, given its position in the workstation market, the role of AIX on the PS/2 and the S/370 systems is less obvious.

The Operating System Design

AIX is based on AT&T's System V.2 and BSD 4.3. While IBM is noncommittal about when and if it will move to System V.3, it is not shy about extolling the virtues of Posix. It is enthusias-

tically embracing Posix and has been very active in the IEEE P1003.1 Committee. No decision has been made as to whether or not IBM will make its VM operating system Posix compliant. It has also adopted Hewlett-Packard's National Language Support (NLS). NLS is intended to help translate Unix screens into other national languages that require the eight-bit addressing space.

At the same time that IBM is touting its adherence to industry standards, it is quick to point out that it is making sure that AIX will exploit IBM hardware and software—IBM's value-added. This value-added will come in making specific connections in two areas to IBM's grand SAA and to IBM's powerful communications base.

PS/2. The PS/2 will play a strategic role in IBM's Unix strategy. Within S/370 clusters (see "Transparent Computing Facility" below), the PS/2 Model 80 serves to off-load keystroke-intensive processing from the mainframe, a role actually similar to the role that PCs will play in the SAA architecture.

Another role for the PS/2 Model 80 will be as a low-end Unix system that could compete with other Unix vendors such as Altos and NCR. This low-end Unix market has been robust for years. Many of these boxes are sold by value-added resellers (VARs) with specialized software for vertical niches. Therefore,

this is a healthy growing marketplace that IBM cannot afford to ignore. Since AIX is an industry-standard Unix, IBM will have an automatic and plentiful warehouse of software for its Unix machines.

370 SYSTEMS. The S/370 represents some of IBM's oldest, newest, and most

powerful technology. At the lower end, IBM has been pushing hard to create momentum for its mid-range 9370 system. While this relatively new system has had mixed reviews, it is viewed, in the long term, as a strategic mid-range solution by IBM. The 4381, on the other hand, is a popular low-end mainframe that has enjoyed considerable success. The 3090 is the top-of-the-line mainframe. Why involve these systems in IBM's Unix strategy? Simply put, IBM hopes that its existing customers in the industrial sector will have an urgent need satisfied while its commercial customers will be willing to take a chance with an unknown quantity—Unix—and discover some unexpected benefits. A third intent is to lure a new set of commercial customers who are beginning to require Unix and for whom the depth of IBM's offerings will be a reason to take a second look.

AIX/370. The S/370, the mainstay corporate mainframe, was a natural addition to the AIX family. AIX runs under VM, including VM/SP, VM/SP HPO, and VM/XA SP. The decision to have Unix hosted under VM was strategic. With IBM's initial Unix host operating system (ix/370) all the I/O was handled by the host; therefore, performance was very poor. Now all the I/O for

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AIX is handled directly by AIX. VM customers will have the comfort of access programs running within VM and MVS with emulation in IBM's editors, including CMS and, eventually, through TSO. With the oncms facility, users gain access to SQL databases and DB2 databases, for example. Therefore, AIX users need not give up other IBM systems' capabilities by going with Unix—a value-added for IBM. Second, certain VM functions, such as error-correcting and spooling, are available to Unix users. Error-handling is a weakness of many other Unix systems.

IBM has understood the potential for capturing a new set of users for its hardware with the addition of Unix. After the initial failure of AIX, IBM has taken its time developing this operating system and has made some subtle but important advances. We believe that AIX/370 will become an increasingly strategic product for Big Blue. IBM has learned some important lessons from its earlier failure with ix/370.

Why VM?

VM is IBM's most interactive operating system and, therefore, is the most appropriate to bring the company into the next generation of software. This new generation of software will be highly interactive. It will allow groups of individuals to communicate with each other to complete joint projects. In addition, it will allow applications to be split over various processors. Other applications will be set up so that events will trigger different processes to be initiated. Because applications with these characteristics are appearing, it is not surprising that IBM has chosen VM as its most strategic operating system—at least for this generation of applications. MVS, on the other hand, is much better suited to transaction processing applications.

At the moment, IBM is restricting its Unix to the VM environment. While the company has officially said it will not migrate AIX to other operating systems, we believe this posture will change in the long term. For example, we expect that IBM could indeed make AIX available under MVS. As the transaction processing marketplace heats up with more Unix-based vendors taking more market share, we think that IBM will want to take AIX to that base of customers as well.

THE SAA CONNECTION. IBM has selected the most common languages—C and Fortran—within the Unix world to support its AIX Family. Interestingly, these languages are incorporated into the SAA standard set of languages. ANSI Standard C conforming to the X3J11 standard was chosen as was Fortran (ANSI programming standard X3.9-1978, ISO 1539-1980, including VS Fortran). Therefore, programs written to conform with SAA will also be usable in the AIX environment.

USER INTERFACE. IBM has made it clear that, under SAA, the Presentation Manager will be a clear and consistent user interface across platforms. The user interface decisions have not been so clearly defined under Unix.

Within the Unix world, IBM views user interface from two different perspectives: one interface for text and another for graphics. The primary call interface for text is an enhanced version of ANSI 3.64 terminal interface. Therefore, for users

with ASCII terminals and All Points Addressable (APA) displays, AT&T's Bourne Shell and the C Shell are available. IBM hints that the APA user interface will evolve to allow for a richer user interface that would include objects representing user actions, such as buttons and command bars, and will

issue guidelines as to where these features are best utilized. Sounds a lot like Presentation Manager. For graphics applications, X-Window Version 11 Libraries (X-LIB) is available. It would be logical for a Presentation Manager-like interface to be available for both application types (text and graphics).

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The Application Environment

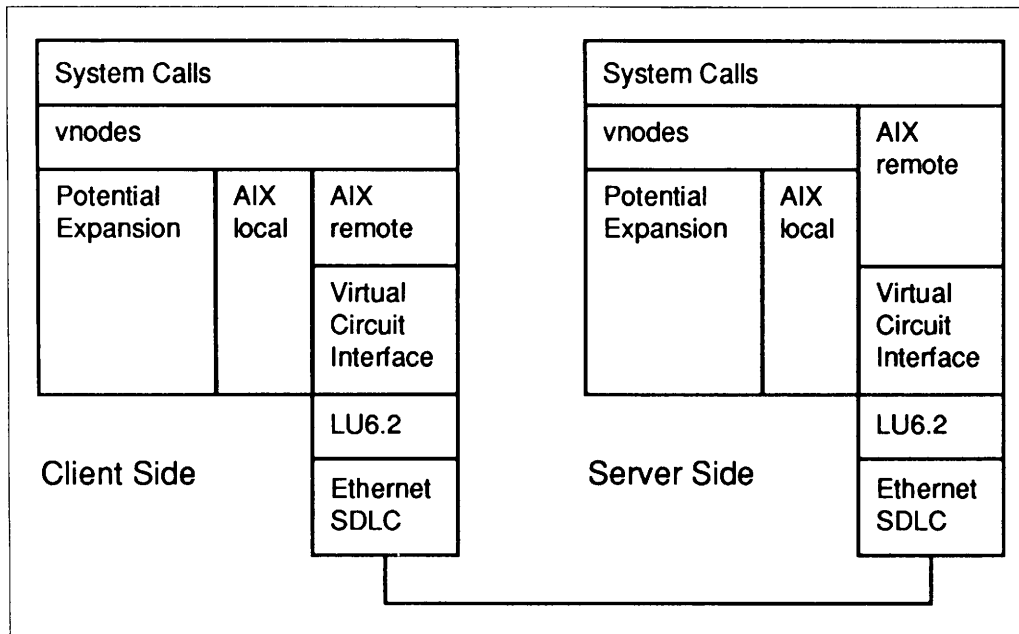
The next logical question, then, is, "What will IBM bring to the Unix software environment?" Initially, we expect that IBM will go the traditional Unix vendor route. It will approach the traditional Unix software vendors. We don't anticipate that many will be reluctant to port to AIX.

Most importantly, through AIX, users of S/370s, PC RTs, and PS/2s running AIX will be able to directly access Systems Network Architecture (SNA). This will be critical to an installed base that relies heavily on SNA networking.

Once a significant set of industry standard packages is available in a large variety of vertical-application areas, we anticipate that IBM may begin to try its hand at some of its own Unix software. We would encourage IBM to take this path and offer some leading edge direction in certain markets. However, there is little doubt that this will be some time into the future.

The Networking Underpinnings

While it would be easy to simply concentrate on the fact that IBM seems so committed to the Unix market, the real story is the networking underpinnings. To begin, IBM is implementing many industry-standard Unix network protocols. IBM has positioned itself to conform to all Unix communications standards. However, in addition, IBM is offering its value-added: an orientation toward distributed network computing through some IBM specific products.



Architectural structure of Distributed Services file system.

TCP/IP. The most important of the de facto industry-standard protocols is Transmission Control Protocol/Internet Protocol (TCP/IP). First, TCP/IP has been implemented both internally and as a means of bridging between AIX systems and to non-IBM systems. IBM has implemented Transmission Control Protocol (TCP) User Datagram Protocol (UDP), Internet Protocol (IP), Domain Name Server Protocol, Simple Message Transfer Protocol (SMTP), Telnet (for remote login), and Internet Routing Protocols. In addition, BSD Sockets have been implemented to provide the network-transparent interface for TCP/IP. In order to link AIX systems to other Unix systems, IBM has implemented Unix to Unix Copy Protocol (UUCP), which allows for asynchronous links based on ANSI 3.64 protocol for ASCII terminal connections. A number of physical, asynchronous link connections via RS-232C and RS-422A are also available.

Another BSD communications protocol called BSD Sendmail has been implemented. This general internetwork mail router allows mail to be routed between local and remote systems. A command level interface provides transparency for Unix-based mail applications to mail handling protocols such as BNU, UUCP, and SMPT. IBM will provide links into PROFS via these protocols.

AIX DISTRIBUTED PROCESSING. IBM is making a distinction between industry-standard communications facilities such as TCP/IP and its overall distributed processing directions. The company's stated goal is to have as much transparency between applications as possible. IBM is intending to use two methods to this end:

- Distributed Services (DS), an IBM-developed protocol that uses the Internet Protocol component of TCP/IP to provide

transparent file-sharing among AIX systems. Characteristics include file-level remote mounts, inherited mounts, cross-system file-locking, and local/remote process transparency of Interprocess Communication (IPC) message queues.

- Network File System (NFS) developed by Sun Microsystems. IBM is targeting NFS to be used in heterogeneous networks of IBM and non-IBM Unix systems. NFS provides transparent file-sharing, directory-level remote mounts, yellow pages directory lookup, and the Remote Procedure Call

(RPC) interface for remote processing. (See box "Comparing DS to NFS").

X.25 SUPPORT. In addition to these distributed processing protocols, we were pleased to see IBM offer X.25 support. This is especially important because X.25 is a key component within SAA. To IBM, X.25 is becoming an increasingly important protocol as the company moves into applications such as inter-organizational electronic mail and Electronic Data Interchange (EDI). The X.25 protocol can be accessed under AIX on both the RT PC and the PS/2.

TRANSPARENT COMPUTING FACILITY. Within SAA, the PS/2 becomes a front end for cooperative processing within the network. Likewise, within the AIX Family, the PS/2 takes on a coprocessing role within a cluster of 370 systems. This networking facility, called Transparent Computing Facility (TCF), allows up to 31 processors made up of a mixture of PS/2 Model 80s and a variety of S/370s. These machines can be clustered via an IBM Token-Ring, Ethernet LAN, or Channel to Channel Adapter (CTCA). A user who logs onto one node in a cluster can access the resources on all other nodes as if these resources were local. Dynamic cluster-reconfiguration allows nodes within a cluster to go off line or be brought into the network without affecting the cluster's operation.

The networking software can control which CPU to run certain programs on. Midway through a program, a systems administrator can request that the application be dynamically moved to a different processor within the cluster. In addition, a program can be subdivided into parts and spread over several different processors. The user sitting at a workstation has no idea where a particular program might be running. As far as the user knows, everything is happening locally. Clusters can be inter-

connected to one another via IBM's DS. When clusters are interconnected to other, non-IBM systems, the TCP/IP protocol can be used. (See box "TCF: A Distributed Model.")

Relationship to SAA

The way AIX will fit in with IBM's SAA is bound to be a source of confusion. IBM seems aware of this and is taking pains to show how the two sides of the house relate. Within the Unix/standards world, IBM is quick to state, in a choice between implementing in accordance with SAA or with Posix, IBM will choose Posix. IBM means to keep its Unix strategy as pure as possible. However, like any other Unix vendor worth its salt, IBM has to make sure to add some value. Wherever possible, IBM will build bridges between the two product lines.

It is interesting to note that the System 3X will not be part of the AIX family definition. This decision may well be due to either technical constraints or marketing positioning.

LU6.2

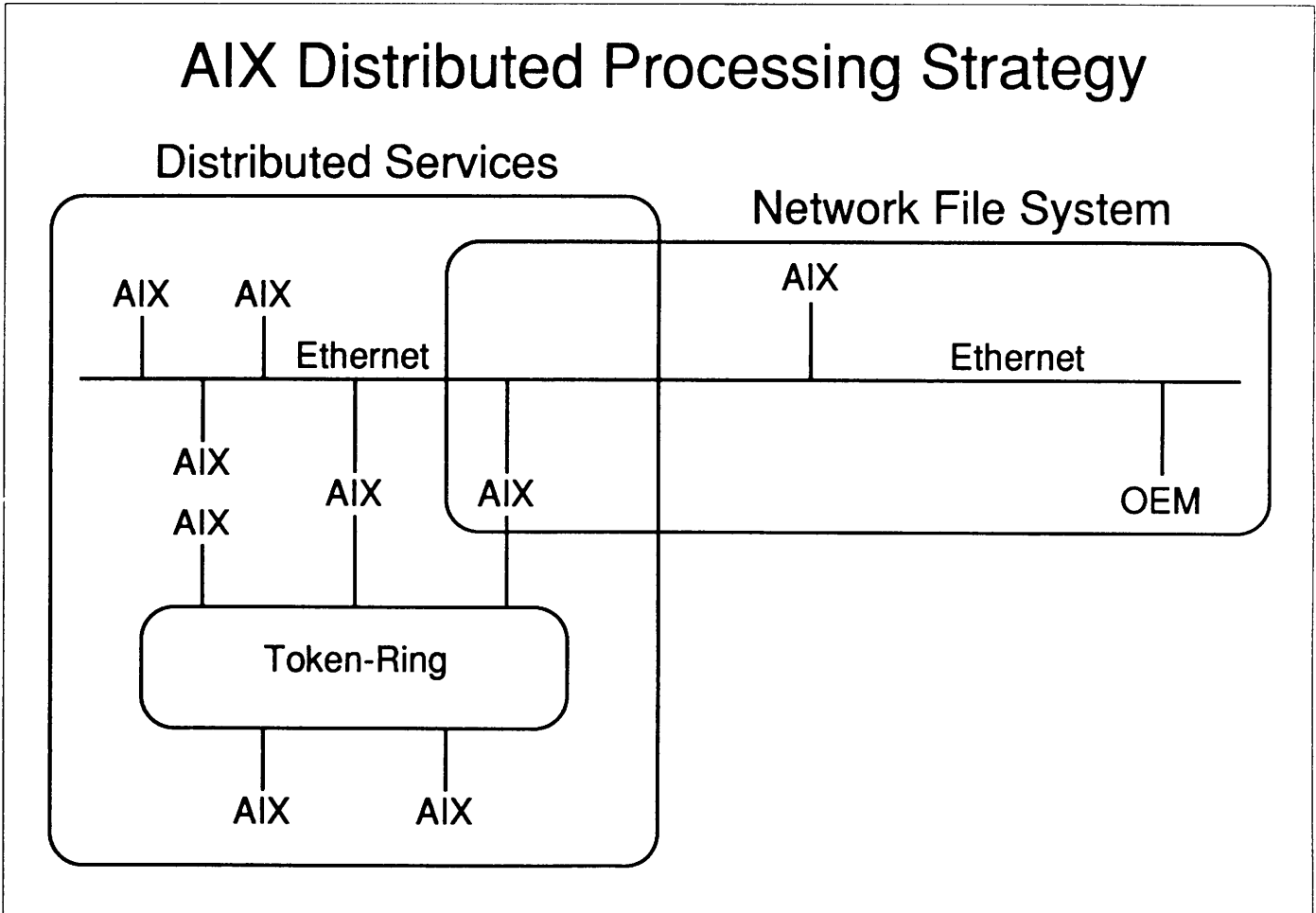
LU6.2 will be a key component in bridging between Unix and IBM's proprietary world. In fact, IBM intends to offer this protocol to other Unix vendors as well. It hopes to have LU6.2

and its Advanced Program-to-Program Communications (APPC) protocol become widely accepted as a means of communications.

Future Directions

On the surface, it appears that IBM is simply jumping into a hot market. No doubt this is true. However, IBM has a more subtle reason for entering the Unix marketplace. With its rich set of communications software, the company is moving fast to embrace the client/server architecture that is key to the cooperative computing model. IBM has made it clear with SAA that cooperative processing between the front end (PS/2) and the mainframe is strategic. SAA, however, is a solution for a particular set of customers that wish to continue in the proprietary, true blue mode. It is the only way that IBM systems with a variety of operating systems can appear to have applications and networking transparency. It is a necessary move for a company strapped with too many operating systems and too many types of hardware.

Ironically, Unix sets IBM free. It allows the company to explore a new frontier of cooperative and distributed network computing and to move to the distributed computing model. We believe that IBM holds a vision of workgroup computing. It will be through its Unix AIX Family that this vision will first be



TCF: A Distributed Model

TRANSSPARENT COMPUTING Facility (TCF) was jointly developed by IBM and Locus Computer. Locus has had several highly successful products in this arena, including DOS Merge, PC X-Windows, and PC Interface—all of which are available under AIX.

Locus's products have a strategic role to play in the Unix world. They have successfully created bridges between the PC DOS world and the sophisticated multitasking world of Unix. Locus's newest products take this concept a step further than simply emulating DOS under Unix. For example, PC X-Windows allows multiple DOS sessions to coexist under X-Window.

TCF has been under development for the past seven years, according to Locus President Jerry Popek. Popek began work on TCF while at he was a professor at UCLA. The product was prototyped in 1981. In 1982, Popek left UCLA to form Locus.

The philosophy behind all of Locus's products is transparency to the end user. For example, with the PC Interface product, the user sitting at a Unix workstation can access the DOS filing structure as though he or she were at a DOS PC. Therefore, the same user who just viewed a DOS directory can use a Unix command to start a procedure. The software understands enough to realize that it is a Unix command and acts appropriately. The user does not have to be bothered knowing where different programs are stored or which environment he or she is working in—the software handles all that. While many vendors have selected Locus's DOS and Unix products, TCF is an IBM-only product. Why? Simply put, the amount of work required to create the sophisticated software for the IBM environment would make doing the same work for other vendors difficult.

The Underpinnings

The TCF function requires a LAN to operate. IBM will support either Token-Ring or Ethernet. TCF allows certain parts of programs, such as editing, to be run on the PS/2. In addition, the software is designed so that, if you wish, you can

realized. All one has to do is take a close look at TCF along with its accompanying products, such as Distributed Services, to realize the direction IBM is headed.

We expect that, within the next few years, IBM and third-party software developers will begin to write applications that will take advantage of this client/server architecture. To accomplish this, it is critical for IBM to adopt Apollo's Network Computing System (NCS). Apollo has proposed NCS as a de facto standard. NCS allows users to distributed parts of programs

split different parts of programs among different CPUs. If the program is compute intensive, it may be appropriate to run it on a 3090 rather than a 9370. Therefore, the system administrator will monitor the network to see where the available CPU cycles might reside. Once it has found the appropriate machine, the administrator can move the application in flight. In essence, it runs in parallel on the two machines until the second processor is in synch with the first processor. At this point, control is passed to the second processor, and the first processor is released. This is all transparent to the user. The system software causes the reads and writes to be effected on the physical terminal where the user assumes the process is running. The commands that control this activity are encapsulated in the IP protocol. This protocol (part of TCP/IP) controls the movement of bytes. Where TCP differs from other software that uses the IP protocol is in the way Locus's software handles the content of the messages—in other words, how the software tells the system what to do with these bytes. For example, a stock broker on a local terminal running some "what if" scenarios might suddenly decide to calculate some complex, stock option processing. That stock option processing—which could be extremely CPU intensive—would automatically be run on a connected 3090. Split-second timing will be critical in this type of application. Another example of an application that will make good use of TCF is industrial process control. In a similar way, a program could be written to be automatically divided up among several different processors, depending on the CPU requirements. In essence, TCF allows users to make the best use of all CPUs.

NETWORK MANAGEMENT. As programs and CPU cycles fly through the network, network management may seem nightmarish. Not so, according to Popek. Even if 30 machines are clustered together, the software treats all 30 systems as one logical machine. Therefore, administration and management are simplified. Since the TCF creates a single file structure, there is no need for something like Sun's Yellow Pages to keep track of files. Another advantage of TCF is that machines can be added and subtracted from the network without interfering with on-going tasks.

across a network. It also allows programs to grab CPU cycles from any processor on the network that has spare cycles. As far as the individual user is concerned, all the resources of a multivendor network are local. NCS will help IBM move towards its goal of distributed network computing.

We would like to see IBM encourage third-party developers to design workgroup products that allow members of project teams to be able to all work on the same project plan or report simultaneously, without interfering with each other. We would

like to see applications that make deliberate use of the flexibility of TCF. These applications could make use of CPU cycles on 9730s as well as 3090s. Specialized industrial applications will probably surface first; however, we eagerly anticipate the emergence of some leading edge products for the knowledge worker.

Conclusion

IBM is embarking on a new direction in its history. For the first time, the company is looking to the standards environment to take it into the future. Indeed, it is a sign of the times. There was a time when this one computer giant could dictate what industry standards would apply. Needless to say, these standards were such products as SNA and CICS. The world is changing, and IBM has caught on.

We believe the strategy of having a cohesive software offering across platforms with strong networking underpinnings is a sound and sensible strategy. TCF is a wonderful product for the 370 class of systems. It also makes good use of the PS/2 as a front end processor for keystroke-intensive jobs.

From a hardware perspective, IBM has done its homework.

By hosting AIX on top of VM, IBM has a unique opportunity to lure its current and large customer base to try Unix. This offers the possibility of selling even more hardware and software if and when these customers begin to develop clusters of systems for a variety of applications. Indeed, this strategy could breathe new life into the high end of IBM's product lines. It could also attract a new set of users to Unix who will feel reassured that Unix has the IBM seal of approval. One could draw an analogy with the way IBM fueled the acceptance of the PC.

The Hurdles

IBM's path is not clear of hurdles in this marketplace. While the company has had Unix products for years, customers will not necessarily assume that IBM is the best choice. Also, users who want to implement large-scale Unix system today will have to wait until next March for AIX/370.

In the meantime, IBM will have to work hard to convince customers in this competitive marketplace to wait. Users will also have to be patient while IBM continues to work on its RISC product so that it can effectively compete in the workstation arena. IBM has taken a year to explain its SAA vision to the user

Comparing DS to NFS

IBM IS OFFERING two similar products—Distributed Services (DS) and Network File System (NFS) to its Unix customers. While both are methods of creating transparent distributed file systems, each product has distinctive characteristics. The primary difference between the two is the relationship between the client and the server.

NFS, for example, is stateless. This means that the client carries its own file structure and has no relationship to the server. The parameters of each procedure call contain all the necessary information, and the server doesn't keep track of any past requests. Therefore, on the positive side, if a client or server should crash, no information will be lost; the client would simply re-send the information to the server.

NFS uses the External Data Representation (XDR) specification to describe protocols in a machine. The three components within NFS are: the Remote Procedure Call (RPC), the Server Side, and the Client Side. The XDR protocol is implemented on top of an RPC, which is stateless, to help simplify protocol definition. The interface to the kernel is divided into two parts to separate the generic file system from the specific file system implementation. This is the facility that allows NFS to be ported onto many different platforms. The file system interface includes two parts: the Virtual File System (VFS) that defines the operations that can be done on a file system and the vnode interface that defines the operations that can be done on a particular file within the file system. In this way, a user could add a new file

system as if it were simply a device driver being added to the kernel. NFS is based on the ARPA UDP and IP for its transport level.

Statelessness has some problems. First, it precludes file-locking. Sun, recognizing this problem, has implemented a fix on top of NFS (called the Lock Manager) to handle this problem. However, because each client has to contain all its characteristics, NFS tends to be slower than some proprietary file systems.

Distributed Services

Unlike NFS, Distributed Services (DS) is an IBM-specific protocol. Also unlike NFS, it is partially stateful. Remote mounts can be either stateful or stateless in Distributed Services. DS designers decided it was necessary to maintain state between clients and servers to maximize speed. With the stateful implementation, DS can take advantage of disk-caching to both client and server and thus avoid unnecessary network traffic and associated delays.

Despite this difference, DS has some similarities to NFS. The major one is that DS uses the vnode interface of NFS. However, unlike NFS, DS does not use an RPC. Instead, it uses the APPC protocol similar to the design of OS/2.

Of course, the downside of distributed services is its restriction to IBM systems. However, we believe that IBM is interested in licensing this product to other vendors.

community; it now must do the same for its Unix vision.

We would like to see IBM continue its aggressive support for industry standards. We applaud this as an excellent move, but it is not as aggressive as we would like. IBM is still playing it safe by endorsing industry standards that are synonymous with motherhood (TCP/IP, NFS). We would have hoped that IBM would also adopt Apollo's NCS. It appears clear that, if NCS becomes a well accepted industry standard, IBM will jump on

the bandwagon. But why not take a voluntary plunge? We would also like to see IBM endorse and join X/Open, a consortium of international vendors advocating a standards-based environment and user interface for Unix. It is ironic that IBM has not yet joined X/Open since the goals of the two organizations are so closely aligned: Both hope to develop a common applications environment based on Unix. Whether IBM joins remains an open question. We recommend it does. ●



Office
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A Special Report

OS/2: Building Block for the Future

By Michael D. Millikin & Judith S. Hurwitz

TECHNOLOGY and market forces are favoring a shift to a fourth-generation systems architecture in which the network becomes the computer, rather than just a series of cables stringing together various resources and processors. In this fourth-generation architecture, applications are distributed, resources are distributed, and, soon, application subtasks will be distributed.

Such an architecture is an excellent model for future office systems. In this model, each individual has his or her own computer with transparent access to files and data that may be distributed anywhere across the network. To be able to take complete advantage of a distributed processing environment, a PC needs a multi-tasking operating system. Enter OS/2 and the LAN Manager from Microsoft/3Com.

IN THIS special report, we first take a closer look at the evolution of third-generation architectures to better position OS/2. We then describe the features and components of OS/2 and IBM's idea of a good OS/2 machine (the PS/2). We wrap up by assessing the effect OS/2 and the PS/2 will have on the industry.

OS/2: Building Block for the Future is available for \$395.

Order your copy today by calling Debbie Hay at (617) 742-5200, or send your check to:
Patricia Seybold's Office Computing Group, 148 State Street, Suite 612, Boston, MA 02109

Pushing Open the Window

CCI Unbundles Its OfficePower Software

By Ronni T. Marshak

WE'VE NEVER BEEN like those who take joy in saying "I told you so." But... For the past four years, we have tried to convince the upper echelon at Computer Consoles, Incorporated (CCI), to port the OfficePower Unix-based integrated office software to other Unix platforms as well as the company's own Power 5 and Power 6 line of minicomputers, but our recommendations have fallen on deaf ears. Until now. CCI has just announced that OfficePower is available to original equipment manufacturers (OEMs) for resale.

In addition to the software licenses, CCI is selling OEM/VAR development tools that include:

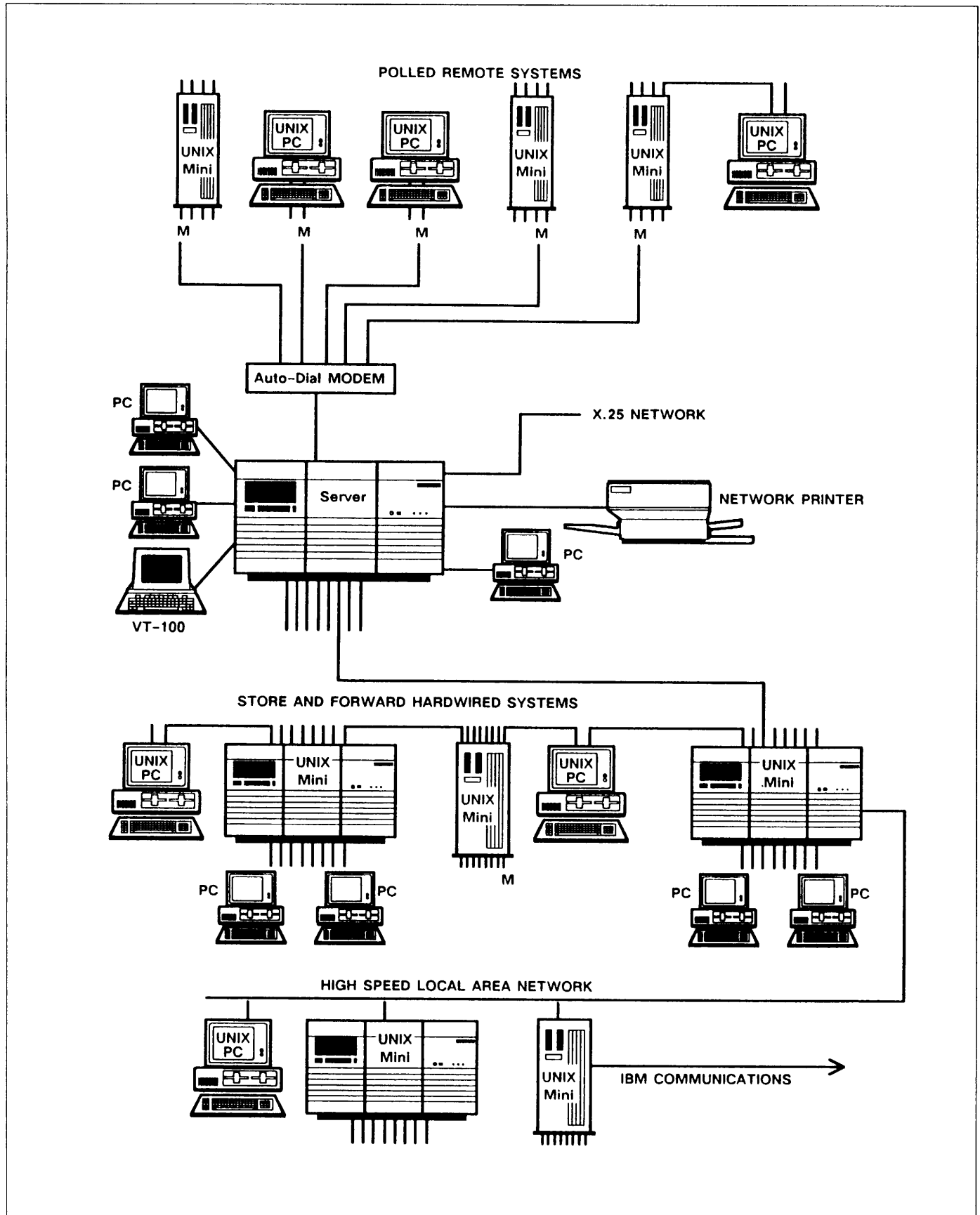
- Custom printer interface with graphics support. C library routines for writing printer back ends for nonsupported printers.
- Software Toolkit. Programmers' toolkit for integration of external applications with OfficePower or development of applications with an OfficePower look through C programming.
- Source licenses.

Making Deals

CONVERGENT TECHNOLOGIES. CCI isn't just talking deals. It has already made several. The first significant reseller for OfficePower is Convergent Technologies (CT). The two companies have reached a co-marketing agreement whereby CT will recommend OfficePower to its OEMs. This is a big vote of confidence for OfficePower because CT has its own integrated office software, Work Group Solution (WGS)—a Unix, windowing-based, integrated office system running on dumb terminals. Yet OfficePower is being recommended above WGS in many cases. OfficePower is ported to the CT S Series 68020 platforms and to the CT 386-based server PC, a high-end 386 box.

SUN MICROSYSTEMS. Sun has licensed OfficePower products for resale to the government. They are funding CCI to integrate the product under their SunView windowing interface.

WHO ELSE? IBM has also offered support (albeit minimal) to CCI's new marketing strategy by listing OfficePower in IBM's third-party catalogue and Hands-On Network internal sales force information source. The software will run on the IBM PC RT. As we go to press, CCI is in contract negotiation with both Gould and Edge Computers.



A Unix mini with OfficePower can be a server in a LAN environment.

OEM Pricing

HERE'S HOW these deals will work: Resellers will purchase prepaid licenses of OfficePower. The larger the license (the more copies of OfficePower), the bigger the discount. The prepaid licensing also applies to Access Technologies' 20/20 spreadsheet as integrated into OfficePower. Pre-discount pricing for the basic OfficePower software is as follows:

Maximum Users	List Price
1	\$ 995
4	\$ 1,995
8	\$ 2,995
16	\$ 4,995
32	\$ 9,995
64	\$ 19,995
128	\$ 29,995
192	\$ 44,995
256	\$ 59,995

Similar price schedules are available for all optional software, including:

- Legal tables of authorities.
- Word processing statistics.
- Basic graphics.
- 20/20 spreadsheet.
- PCPower diskettes. Terminal emulation, graphics, and DOS file transfer software for IBM-compatible PCs.

What's So Special?

Why, exactly, is OfficePower garnering so much interest? First, OfficePower's functionality is very good (see box "CCI's OfficePower"). But, in addition, some of the administrative features are outstanding and unheard of from most of the Unix vendors. The most important of these is directory services within electronic mail.

With its directory services, lists of users are automatically synchronized with all other nodes. It can communicate with outside mail systems through Unix mail. Other nice administrative features are:

- Autofont conversion. The system will determine if the se-

lected printer can output the selected fonts. If not, the system will automatically convert to the most appropriate fonts (as defined by the systems administrator) and reformat the document if necessary. The process is transparent to the end user.

- Redundant file system. All files are automatically backed up onto a different host. If the primary host goes down, the backup will update the primary when it is rebooted. This feature provides fault-tolerant characteristics to Office Power.
- PC integration through PCPower. DOS users can share files and send and receive mail among each other. PC users also have access to OfficePower applications and resources, such as shared printers, electronic mail, OfficePower graphics display, and file conversion from DOS to OfficePower format including a bidirectional DCA filter. Users can archive OfficePower files onto the PC disk.
- Terminal support. CCI has added a facility that supports any ASCII terminal. The most popular terminal types (such as VT220 and Wyse 50) are supported through a customized interface. But a table-driven facility is provided through which virtually any terminal may be described to the system.
- Network facilities. CCI supports Transmission Control Protocol/Internet Protocol (TCP/IP) local networking through Ethernet or hard-wired RS232 serial lines. Wide area networking supports leased lines, dial-up lines, and X.25 networks. The network administration provides a network failure early warning system, connectivity check, network statistics, and host statistics. It also has store-and-forward, and polling within the network.

Release 4.02

The next version of OfficePower, Release 4.02 which will ship in the third quarter of 1988, offers many enhancements.

WORD PROCESSING. Enhancements include the following:

- Statistics that keep track of time spent editing, etc., for billing purposes
- Improved redlining comparing two documents in background mode
- Export and import of OfficePower word processing files into other file types—Unix, DOS, OfficePower External, UDAP, Desktop Publishing (export only)—and formats—ASCII, DCA (through filter), Navy DIF
- Search and replace, hyphenation, and spelling within headers, footers, and footnotes
- Multiple line entries in table of contents

CCI's OfficePower

THE CCI OFFICEPOWER Unix-based integrated office system is a well-designed, highly functional office solution. The user interface is based on UDAP, a user-defined applications generator, which is itself a component of the OfficePower system. UDAP is a feature for expanding the applicability of OfficePower. The UDAP system creates new applications with the same functionality and user interface of standard OfficePower applications. OfficePower also includes word processing, electronic mail, telephone list (rolodex), and calendaring, along with various utility features.

The user interface is positively addictive, offering an open/close paradigm which brings a three-dimensional feel to a two-dimensional system. The use of menus, soft keys, and an expert command mode make OfficePower very easy to learn and use.

On the negative side, the system does not have its own spreadsheet or relational database, though the 20/20 spreadsheet from Access Technologies is provided by CCI with some interface integration. CCI is working on using UDAP as

a front end to SQL for database manipulation.

The individual components of OfficePower are strong. Perhaps the weakest, though still perfectly acceptable, is the word processing. It offers all the standard features, but certain advanced functionality, such as multiple columns and style sheets, is not yet available. The system does provide user-defined keystroke sequences that work throughout all the applications—a very nice feature.

OfficePower does not yet offer any windowing capability. It is, in fact, a high compliment to its user interface that we find it so appealing without windows.

CCI did a good job in designing OfficePower. This shows up in the little things, like look-up tables and abbreviation lists (for example, typing in "asap" in a form will automatically expand to "as soon as possible," as defined by the user). Unlike many competitors, CCI has done its homework and has built the office system on a solid foundation. The work still to do is to keep product enhancements up to par with the competition.

PRINTING. Output has been improved as follows:

- Automatic pagination at print time (Long overdue!)
- Additional paper bin support (more than two)
- Custom printer interface for graphics printers
- PostScript support
- Character graphics printing on nongraphics printers
- Networked (Ethernet) printer support

OTHER ENHANCEMENTS. Release 4.02 also offers the following:

- Import/export of spreadsheets with UDAP datafiles
- One-step attachment of DOS files to mail messages
- Enhanced AT keyboard support for PCPower (software for connecting PCs to OfficePower)
- OfficePower installation security (password)
- Hotkey suspend within PCPower—transparent movement from DOS back to interrupted function in OfficePower

THE FUTURE. To achieve its goal of being "the premier integrated office system by providing superior office automation services designed for today's networked system," CCI has identified certain developmental areas:

Open Architecture. In addition to the existing architectural services, CCI plans to provide:

- Easy integration of off-the-shelf software by nontechnical users; treat foreign applications (spreadsheets, images, voice, graphics, etc.) as OfficePower objects; optional replacement of standard OfficePower applications (i.e., word processing, E-mail, etc.); support for industry standard file formats.
- PC orientation with DOS/Unix connections (support for standard networks and transparent data-sharing and distributed application execution); the OfficePower word processor, shell, and spreadsheet ported to PC; compatibility with MS Windows.
- Windowing and support for X-Windows, MS Windows, and SunView.
- International support including ISO 8859-1 eight-bit international character set, table-driven translation/localization, site-selectable data/time/number formats.

Core product enhancements are also planned as follows:

- Text processing. Snaking and synchronized columns and mixed fonts per document
- Databases. Data procedures and interface into SQL-based DBMS
- Improved user interface including bit-mapped display

Conclusion

All this is well and good. CCI has done some good work on the systems issues. Combined with a suite of applications that is competitively functional and exceptional in the interface area, the product can be hard to beat. But is the window of opportunity closed?

Obviously not completely. Deals are being signed. But we've yet to see a major U.S. office system supplier (ICL, in England, has been an OfficePower supplier since 1984 and is now shipping in volume in the international market) jump on the

OfficePower bandwagon.

If there is a substantial opening in the window at this late stage, it is not a result of CCI doing anything right. Rather, it is because the other Unix-based office system suppliers haven't done what is necessary to close the window. Some products, such as Uniplex, do not offer the system level and networking features, such as directory services or system backup features, that some of the minicomputer vendors have implemented; others, such as Q-Office, have a reputation for being buggy and hard to work with; still others, such as Alis, perform poorly and on limited platforms.

We like OfficePower and are pleased to see it go out into the world. But we remind CCI that it is a matter of luck that there is any market out there to buy the software. CCI needs to continue to upgrade OfficePower. As the Unix market heats up, we anticipate that other vendors will come out with competitive products. CCI should take advantage of its head start before someone closes the window. ●



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A Special Report

DEC's Networking Strategy

By David L. Terrie

DEC has been riding a wave of products and profits unmatched in the industry. More than anything else, DEC's network architecture has been responsible. It is now fair to say that DEC has joined IBM at the top of the heap when it comes to being a safe buy (as in you'll never get fired for recommending DEC). As a result of its star status, DEC's DNA has been the target of increasing scrutiny and criticism.

IN THIS 96-page special report, we take a hard look at DEC's networking products and strategies, pointing out the need for DEC to re-examine the strategies that have brought it success to date and adapt them to changing market conditions. In addition, we cast a critical eye on DEC's many new announcements, explaining both what they offer and why they are important.

DEC's Networking Strategy is available for \$495.

Order your copy today by calling Debbie Hay at (617) 742-5200, or send your check to:
Patricia Seybold's Office Computing Group, 148 State Street, Suite 612, Boston, MA 02109

• CSCW •



Software of a Different Color

By Ronni T. Marshak

In our last Computer-Supported Cooperative Work (CSCW) department, we looked at software for supporting the coauthoring process. This time, we take on another category: procedural automation.

routine n 1 : a prescribed and detailed course of action to be followed regularly **2** : a set of customary and often mechanically performed procedures or activities

procedure n 1 : a manner of proceeding : way of performing or effecting something **2** : an act composed of steps : course of action **3** : a set of established forms or methods for conducting the affairs of a business, legislative body, or court of law

Every business has them. And each routine or procedure has a flow chart of activities that must be carried out in a prescribed sequence and manner in order for the procedure to be completed. (This description of procedural automation first appeared in the *Office Computing Report*, Vol. 8, No. 6).

Several products address this market, such as FCMC's Staffware (see *Office Computing Report*, Vol. 8, No. 6, for more information)—a Unix-based procedural automation tool that

works on a business forms paradigm (duplicating preprinted forms on screen), now part of the Unisys Ensemble suite of office applications. And they are becoming more popular as the concept of the workgroup is embraced by the industry. Integrated office systems vendors are being charged with adding procedural automation to their products, and they are actively seeking out interesting solutions.

ENTER WORKHORSE. One such product is Workhorse from Workhorse Systems Limited in Dublin, Ireland. Touted as "software that thinks," Workhorse is an impressive Unix-based system for creating the steps of a procedure including links into the applications needed to execute each step.

Mix and Match. Unlike products that come with their own application software, Workhorse is designed to work with any Unix applications resident on the system. The only requirement is that you have an active relational database management system (RDBMS). Workhorse can either front-end a number of different products (for example, Crystalwriter word processing, Oracle RDBMS, and 20/20 spreadsheet), or it can be integrated into a complete system, such as Uniplex, operating in that environment and using the office system's interface. The advantage to

the mix-and-match scenario is that users can choose their favorite applications; the disadvantage is that, besides the various interfaces on the applications, users must also learn the Workhorse interface.

The product is divided into two modules: Workhorse Office—what the user sees on the screen and uses in the procedure, and Workbench—the Workhorse environment designed for the non-computer literate to define the work patterns and procedures to be followed in the Workhorse Office.

Workhorse does provide some applications of its own:

- Electronic mail. Actually a front end into Unix mail, but can tie into any mail system
- Appointments Diary. A scheduling facility
- Calendar
- Document manager. Stores, retrieves, and assembles documents (more on this later)
- Database directory. Connects Workhorse into the customers' RDBMS (more on this later)
- Mailbag. Files and retrieves documents according to type and key information; provides text search capabilities

Document Manager. The document manager is more than a traditional filing system. It acts as an intermediary between you and your word processor of choice. You do not have to remember the file name you may have assigned weeks ago. If you remember some of the phrases and words you think the document may contain, Workhorse will locate any documents that meet (or sort of meet) the criteria and present the results in order of likelihood.

The document manager also allows you to create "one-off" files—documents that are to be used once or for a

limited time and then discarded. Documents can be assigned a life duration of, say, one week, and then discarded automatically. (A hard copy is always printed out as a safeguard.)

Document assembly is handled by the document manager in tandem with the intelligent questionnaire facility (part of the Workbench). The documents are assembled from bits and pieces of previously typed material, with blanks left for variable information. The intelligent questionnaire allows you to write prompts for each blank indicating what should be entered. In addition, if/then/else logic is supported.

Database Directory. The database directory allows Workhorse to connect to any Unix-based RDBMS to provide an SQL interface and keyword retrieval. It can connect text files to specific database entries to allow an unlimited amount of additional, free-form information to be kept with the structured database records. Using the intelligent questionnaire, the links to the database take prespecified data from datafiles and insert it into text files. If the data cannot be found, a mail message to the appropriate user is automatically generated.

In addition, the directory will link records with the database to user-defined "relationship" categories. When records are chained in this way, the related records may be examined in extended searches, and users can be less specific when configuring documents.

CREATING A PROCEDURE. Creating a master task (procedure) in Workhorse is surprisingly easy. Workhorse provides excellently prompted screens in which the steps of the task are specified. And the help available is also exceptional. If you are uncertain of what to enter in a field, a question mark brings up a list of valid entries. If there is only one option, it is automatically entered into the field.

We created a common personnel task (interviewing and hiring a new employee) in 10 minutes. We began the process by specifying the first step:

WORKHORSE		User Frank	10:12:88
You have appointments			
Messages		Tasks	
10/11/88	Pending appointment received from Louis	Haltontrees Cottage Inc. Precision Engineering Lease Verkloss RK Stable Caroline Gale	
10/11/88	Some manual questions need to be asked for the document used by the task 'Haltontrees Cottage Inc.'		
10/11/88	Documents printed for you by automatic print program		
		Reminders	
		Date	Action
	Hansen Return Call	10/11/88	N

The Workhorse Office screen displays messages from the system (different from E-mail messages), reminders, indications of whether you have mail or appointments to check, and the tasks currently on your plate.

Should an interview be scheduled for an applicant? If the answer is "no," the next step is for the system to merge the applicant's information into a "Thank you, no" letter. We were pleased to see that the system not only realized that we did not have such a letter in our files, but it allowed us to pull in the word processor and create the letter on the spot.

If an appointment should be scheduled for the applicant—the "yes" path—the next step will schedule the interview, realizing that the appointment diary is the necessary tool. After the interview, there are again two paths: Should references be checked? If no, the "Thank you, no" letter is sent. If yes, references are checked. And the process goes on.

To help with task creation, Workhorse names steps and assigns them to departments. Thus, you can copy a step any number of times. You do not need to recreate it (note the repeated use of the "Thank you, no" step above).

You can also assign deadlines to steps. For example, if more than two days elapse and no action is taken, the system notifies the supervisor or the individual who hasn't completed the step. The status of any procedure or any

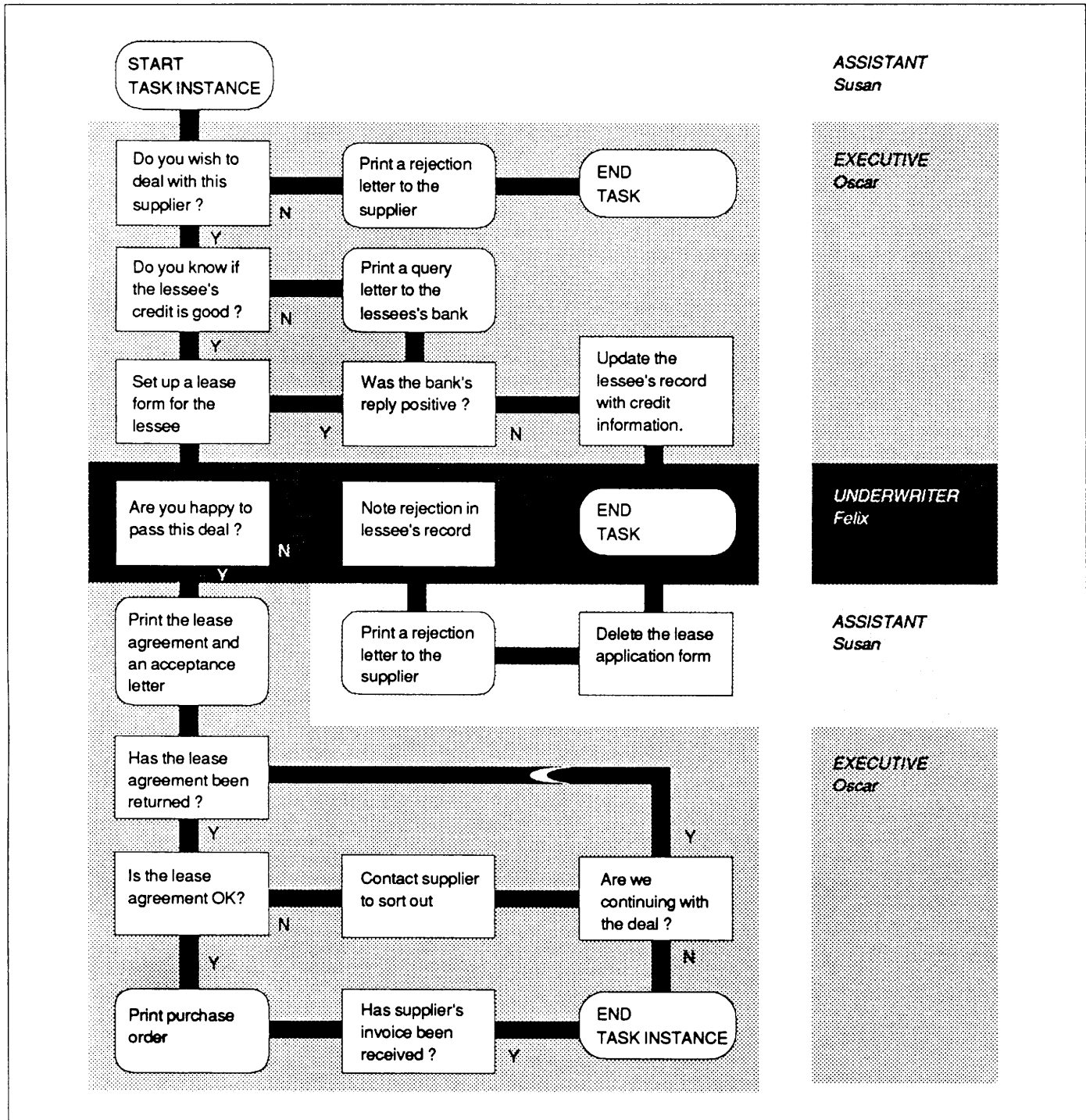
step can be checked at any time.

You can specify that a step calls for the use of an application (word processor, database, etc.). Workhorse will "suggest" that you may want to access the application. If you say yes, it automatically loads the software and displays the appropriate files or data.

Task-Mapping. But the nicest thing about Workhorse is that it creates the flow chart or map of the master task from the steps you specify. Creating the map is often the hardest part of planning a procedure. And steps are always left out. Workhorse allows you to work sequentially, creating the map as it goes. The map is useful for getting an overview of a process or for troubleshooting a master task as it is being developed.

Workhorse is the first product we have seen that actually creates the map for you, but FCMC is coming out with a DOS-based product, code-named Calypso, which will offer the same task-mapping capabilities.

LIMITATIONS. Two major limitations exist in the current version of Workhorse: simultaneous steps are not supported, and referrals are limited.



This is a simple example of a procedure Workhorse has been trained to execute at a mythical leasing company.

Simultaneous Steps. Most procedures have steps that must be taken at the same time. For example, when a sales representative places an order, the credit department has to check the customer's credit rating while the inventory department determines whether the merchandise ordered is in stock.

These steps could happen sequentially (in either order), but that's a waste of time. The inventory department could requisition new stock to fill the order only to find out that the customer's credit is no good, and vice versa.

Workhorse does not support simultaneous actions. There are only two

paths that can be taken from every step: yes or no. We would like to see multiple steps resulting from a yes (or no) action.

Referrals. Workhorse allows you to refer action to a "class" (i.e., administrator, executive, agent, etc.) instead of

an individual. But only one name per class can be associated with a procedure! So, for example, when the compliance step in the, say, certification procedure comes up, even if there are five compliance officers, only one of the five is authorized to handle the action. This doesn't work in many organizations where tasks are assigned on a "next person available" basis.

MARKETING FOCUS. Workhorse is seeking OEM and VAR agreements. And that's a good idea. While the mix-and-match option (use Workhorse to front-end your favorite applications and end up learning a bunch of different user interfaces, including Workhorse's) is attractive—you already know the packages you use, and the Workhorse interface is very nice—integrating Workhorse into a complete software

solution (Uniplex, Quadratron, etc.) would probably be an easier sale. A lot of the links between Workhorse and the applications, which aren't really hard to do but take time and preplanning, would already be set up. The product would work seamlessly, and there would only be one interface to use. Incidentally, some of the Unix integrated office products would benefit from adopting the Workhorse interface rather than vice versa.

CONCLUSION. Workhorse is an excellent example of innovative software for groups of people working on real-life business applications. It has taken some of the more painful aspects of setting up systems (drawing the flow chart) and automated the process. There are still some problems to iron out, but it is a great beginning.

Other products, including Staffware, are addressing the same issues. Staffware has solved one of the problems in Workhorse: The product supports simultaneous actions. But it does still limit referrals to a single individual.

Some industry analysts don't consider procedural automation to be part of the "groupware" category, but we do. Though, admittedly, the procedures typically demonstrated are mostly clerical rather than collaborative, as the tools improve and the technology becomes more common, we anticipate more creative processes being assisted through procedural automation. And any software that clarifies lines of communication within a process should be recognized as an aid to cooperation. ☉



The IBM 9370: An Assessment By Norman Rasmussen and Ross Gale

THE IBM 9370 product line has just had its first birthday, i.e., it is just one year since IBM launched this new "VAX-killer" minicomputer product line with a great deal of fanfare on its part, and a great deal of interest on the part of the computer user community, the trade press, and the investment community.

SINCE IBM still manages the news on the 9370, we know very little about actual product acceptance, or whether the product is meeting IBM's forecasts in that regard. We do know that the product is real, and that it appears to meet IBM's claims regarding packaging for office environments, performance, software installability, and hardware reliability. But, a number of serious questions remain, and this report documents why they warrant consideration by the careful minicomputer buyer.

The IBM 9370: An Assessment is available for \$395.

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NEWS

PRODUCTS • TRENDS • ISSUES • ANALYSIS

ANALYSIS

• I N S I D E •

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• SUN MICROSYSTEMS •

The 386 Also Rises

With the introduction of the Sun386i workstation, Sun is seizing the window of opportunity that OS/2 has provided by raising customers' expectations. The initial impetus for moving to the Intel platform comes from current (and potential) Unix users who want access to the great number of applications available in the DOS world. Transparent integration between DOS and Unix applications has been high on users' wish lists for some time. But Sun is not stopping at simply satisfying the DOS access wishes. Rather, Sun is taking dead aim at OS/2.

AN OPEN WINDOW. Sun sees users desiring a multitasking operating system to run their favorite DOS applications but not wedded to OS/2 as the solution. Sun is counting on an 18-to-24-month window before users will demand OS/2 support. Even then, according to Sun president Scott McNealy, the Unix-based solution will be superior to OS/2. McNealy notes that OS/2 allows only a single DOS application to be run at one time, while Unix permits as many as memory will allow. In his

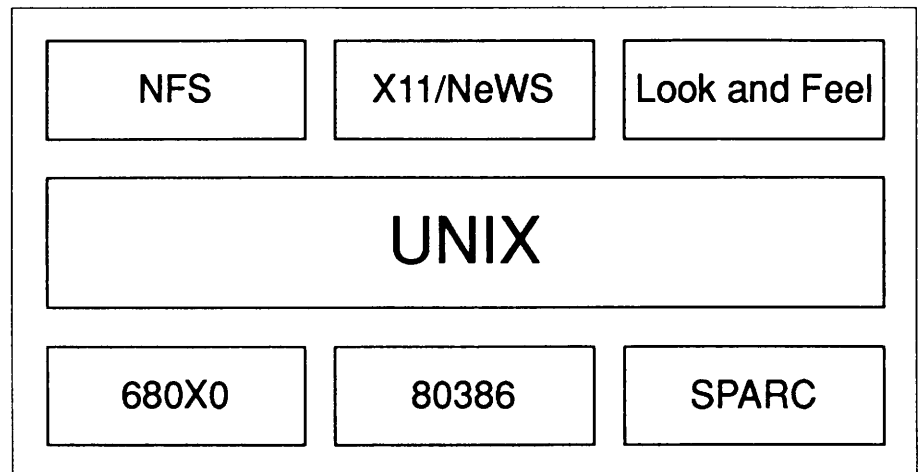
view, DOS is the operating system for the 8088/8086, OS/2 is the operating system for the 80286, and Unix is the operating system for the 80386. McNealy warns, "Don't cede the desktop to OS/2 yet."

BRIDGING THE GAPS. The 386i, a Unix workstation built on the Intel 80386 microprocessor, bridges a number of systems that, heretofore, have coexisted rather gingerly. Sun boasts that the 386i (the "i" in 386i stands for "integrated") brings together a single solution from a single vendor, which encompasses Motorola (680X0), Intel (80386), and Scalable Processor Architecture (SPARC) Reduced Instruction Set Computer (RISC) as well as bridg-

ing Unix and DOS.

Sun's vision holds Unix to be the great equalizer. Different platforms, instruction sets, and operating systems are all smoothed out using Unix (eventually System V, Release 4). Operating system and networking differences will be made transparent via a common graphical user interface. Sun's vision includes a family of interconnected products, with the Sun3 (80286) at the lower end, the Sun386i (80386) at the mid-range, and the Sun4 (SPARC) as the high-end offering.

WINDOWS AND MORE WINDOWS. The Sun386i comes with SunView, the user interface of SunOS. SunView is a graphical windowing system that sup-



Unix: The Great Equalizer.

ports concurrent operation of icon-based user applications (Unix and DOS) and system management tools. File management, electronic mail, database management, editing, launching applications, etc. can all be done through icons. No knowledge of Unix is necessary, though one of the applications that can be launched is a Unix system prompt. Online contextual and hypertextual help is available. We expect SunView to evolve to the just announced Open Look (see below).

The interface is object oriented. Thus, a user can click on a file (e.g., Monthly Report) that is really a DOS .wk1 file. The operating system first opens a DOS window, loads DOS, loads 1-2-3, and finally loads the worksheet. The user never has to know what the operating system is or where the program or data is located.

This last point is a crucial advantage that Sun is seeking to leverage. Every Sun workstation (Sun3, Sun4, Sun386i) comes automatically self-configuring within a Network File System (NFS) network.

THE ROADRUNNER. Dubbed the Roadrunner, the 386i is indeed a screamer. It is the first machine to use the 25 MHz version of the 80386, with the high-end Sun386i/250 reaching 5 MIPS with memory-caching.

The workstation comes in two flavors, with a number of "toppings" available with each. The lower-end Sun386i/150, which uses the 20 MIPS 80386, features 4MB standard RAM, while the 250 comes with 8MB. Both can be increased to 16MB. Each also includes an 80387 math coprocessor. Standard I/O controllers include Ethernet, Small Computer System Interface (SCSI), serial and parallel ports on the motherboard. Four additional AT-type slots are provided for add-on boards. A number of displays are available, ranging from 15-inch monochrome to 19-inch color (1,152 by 900 pixels).

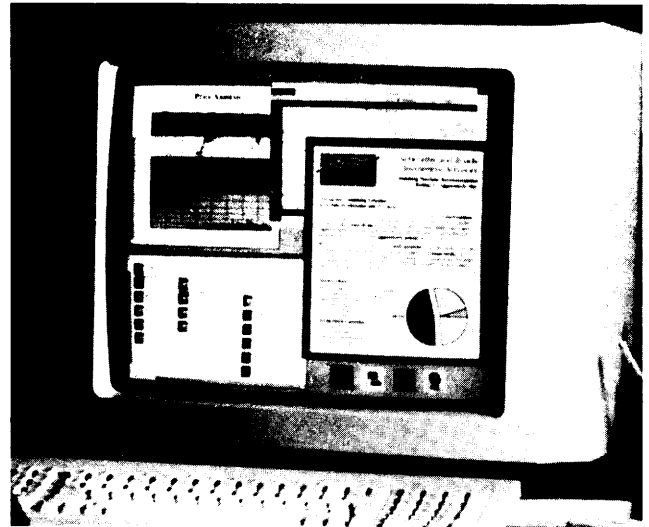
All systems include a single 3.5-inch 1.44 MB floppy disk drive. Systems can be configured with floppy disk only, or with a 91 or 327 MB hard

drive. Prices range from \$7,990 for the base Sun386i/150 monochrome workstation with a 15-inch monitor, 4MB dynamic memory, a keyboard, an optical mouse, and SunOS loaded into the system. A similarly configured 150-color system that includes a 14-inch color monitor and a 91MB hard disk is priced at \$10,990. A Sun386i/250 monochrome workstation with a 19-inch monitor, 8MB of cache memory, and 91MB disk costs \$13,990, while a 250 with a 19-inch color monitor and 327MB disk runs \$23,990.

THIRD-PARTY SUPPORT. An impressive list of over 75 independent software vendors (ISVs) have signed up to port their applications from 680-by-0-based workstations to the 386i. Sun claims that its "instruction-set independent" approach has made the process very easy for the ISVs.

VAR CHANNEL. Sun, which has traditionally sold through original equipment manufacturers (OEMs) and direct sales to government and large accounts, now plans to sell through its recently announced value-added reseller (VAR) channel to reach small and medium-size businesses. The company feels that the 386i is a strong product to target at this market.

THE OS/2 CHALLENGE. Sun's challenge is exactly on time. The next 12 to 18 months will provide the greatest opportunity for Unix-based solutions to penetrate the business arena. Public perception may be the key. Sun and others will have to sell Unix as a solution as well as selling its workstations. Sun will also have to deal with users' fears that taking the Unix solution might lock them out of their favorite applications when the OS/2 version



The Sun386i User Interface.

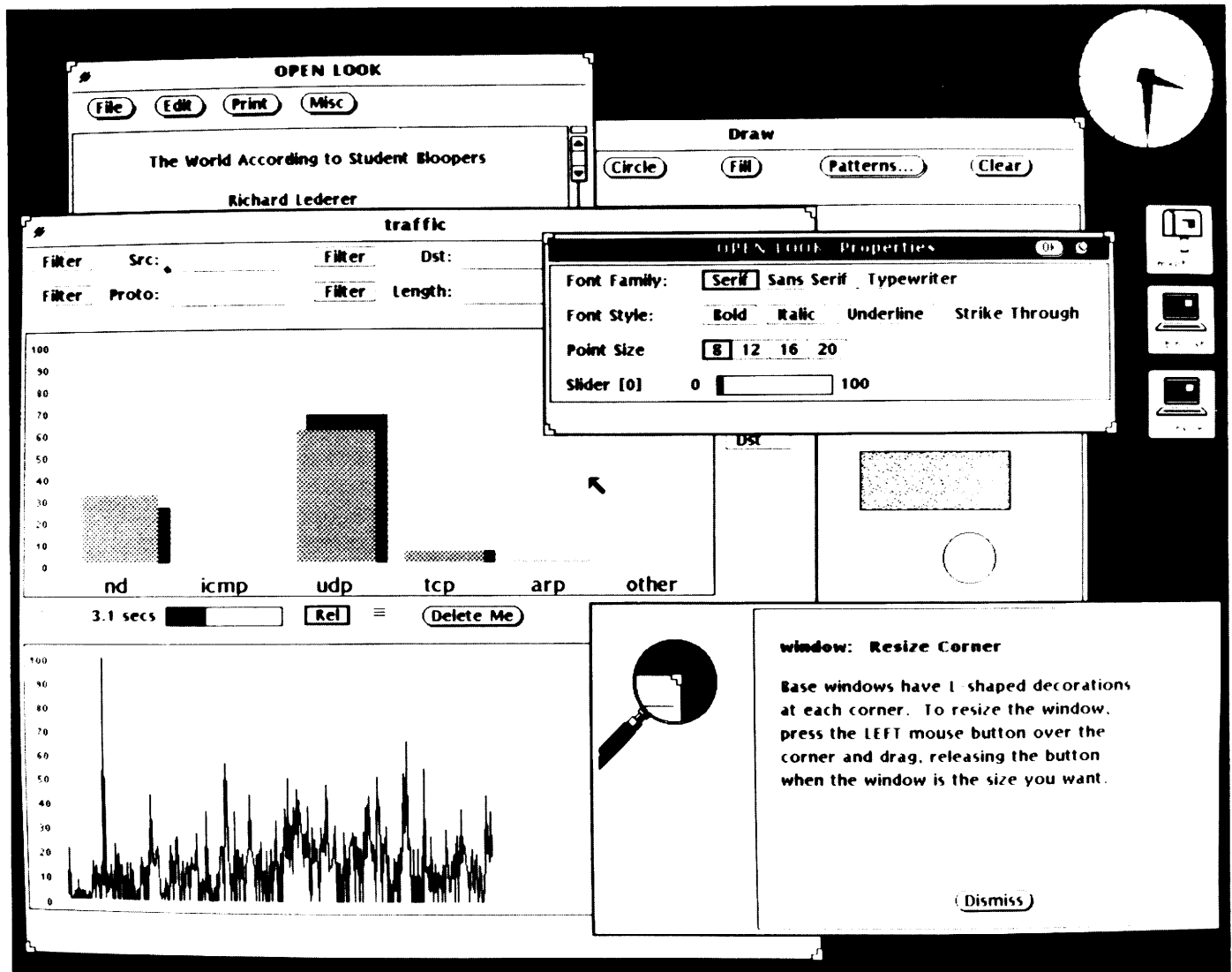
appears. Sun will certainly point to the increasing number of ISVs writing for both DOS and Unix (and OS/2), but many users will have to be assured that a migration path will be available to them. ● —D. Marshak

• A T & T •

New User Interface Standard

Just when it looks as if the Unix user interface issue was beginning to be sorted out, up pops a new standard. Called Open Look, the graphical user interface was designed by Sun Microsystems for AT&T, and much of the interface itself is based on work done by Xerox Parc. We think the interface will appeal to Unix vendors and users alike, since it should take the mystery out of talking to the powerful yet awesome operating system. We particularly liked the fact that there are novice and expert modes. For example, while the new user may go to the top level menu, the experienced user can double-click to enter an application. In addition, sub-menus are available from within an application.

Already there is an impressive list of vendors (hardware and software)



The look and feel of Open Look.

ready to support Open Look. Lotus Development Corporation will port its Version 3 of 1-2-3 spreadsheet (when ever it's ready) to Unix with Open Look, as will Ashton Tate (DB2) and Sybase. Other notable software vendors endorsing the product include Informix, Frame, Interleaf, and Oracle. Hardware vendors including NCR, Unisys, MIPS, and Olivetti will buy in as well. Noticeably absent was Microsoft, which is deeply mired in finishing Presentation Manager and contending with its Apple suit.

AT&T Data Systems Division president Vittorio Cassoni anticipates that this new graphical user interface will bring "the power of Unix to a new

set of users." In his view, it will bring Unix to the distributed computing environment, since it is based on MIT's X-Window protocol for distributed workstations.

The catch is that, in order to gain access to this very usable interface, vendors will have to migrate to System V.4. With the controversy still swirling over who owns Unix, this may not be easy for some vendors to accept—at least initially. But we expect momentum to build quickly. The final version of the style guide will be available in the third quarter of 1988 for comment. AT&T will provide Open Look on its own 386 boxes this summer. The XT toolkit for building applications based

on the interface will be available to the general market for licensing by the fourth quarter. To ensure that developers get up to speed quickly, AT&T is sponsoring eight software developers' conferences across the country.

CONCLUSION. We are impressed. We think that Open Look will set a new standard for user interface within the distributed network computing environment. The collaboration between AT&T, Sun, and Xerox has indeed yielded some sophisticated and plump fruit. What will this mean for the rest of the industry? First, it will give Microsoft and IBM some room to do some soul-searching. While Presentation

Manager is a step in the right direction, it does not approach Open Look. Apple, on the other hand, will no longer have a monopoly on ease of use. Apollo will have reason to feel dismayed. While its own user interface toolkit, Open Dialog, had some nice functionality, the company did not make its move fast enough to gather industry support. Sun does seem to have a knack for marketing, doesn't it? ●

—J. Hurwitz

• SYBASE •

Sybase Ups the Ante

Sybase Incorporated (Berkeley, California) continues to take a leadership role in relational database management systems designed for online transaction processing (OLTP) applications. Just as some major competitors are ready to hit the market with OLTP versions of their RDBMSs (Oracle and Ingres, to name two), Sybase has announced two new versions of its RDBMS. Sybase Release 3.0, available now, improves performance over its predecessor (Release 2.1) by an impressive 100 percent. Release 3.1, which will be available by the end of June, increases system availability with software-based fault tolerance for all three of Sybase's current platforms—Digital's VAX under VMS and Pyramid and Sun Microsystems computers under Unix.

PERFORMANCE ENHANCEMENTS. Release 3.0 improves multiuser performance through improved overlapped I/O, locking, shared buffers, shared commits, and network optimization. Single-user performance is enhanced with improved memory usage, buffering, and optimization of query-processing paths.

● **TP1 Benchmark.** Sybase measured the performance of Release 3.0 using the TP1 benchmark test. TP1 simulates a

banking environment, where a bank teller or automatic teller machine submits a flow of transactions that each update several tables. Each transaction updates a customer's account, a branch balance, and a teller's balance, and inserts a record into a history table. The entire transaction is then committed to the database. Sybase performed in four different hardware configurations, as indicated in the accompanying table. In each configuration, logging was active, page level locking was in use, and the benchmarks ran for a sufficient period of time to reach "steady state." An accounts table of 100,000 records was used.

Since it can be difficult to accurately compare apples to apples in evaluating benchmark results, Sybase has been very careful to clearly document its benchmark configurations and implementation. In the process, it hopes to provide its competitors with very clear targets at which to aim. The company obviously welcomes any and all challengers ("Go ahead, make my day") and is confident that Sybase has nothing to fear in this arena.

In addition, to ensure that the results are "squeaky clean," Sybase had them validated by an outside consulting firm, AIM Technology of Palo Alto, California, which specializes in performance measurement.

In the marketing warfare rampant

among the DBMS vendors, Sybase continues to apply the pressure. And speaking of the competition, as we went to press, Relational Technology Incorporated (Alameda, California) announced Release 6 of its Ingres relational DBMS. Release 6 features a multi-server data manager designed to maximize the power of systems with multiple processors, such as Sequent or a VAXcluster. Relational Technology is also touting benchmark results for its new product. We will take a closer look at this next month.

FAULT TOLERANCE. With Release 3.1, Sybase will improve system availability with fault-tolerance capabilities. In the past, Sybase has always maintained high availability by keeping applications running during scheduled database maintenance operations, such as database backup or design changes. (In most other RDBMSs, performing these functions requires taking the system down.) Now Sybase will also protect applications from unplanned events, such as disk or CPU failures.

Sybase's fault tolerance is not only software based, but it is also enforced through the RDBMS itself, rather than through the operating system. Sybase claims that it is the first fault-tolerant system to provide online recovery with no performance penalty and no loss of data.

Sybase Release 3.0 TP1 Benchmark Results

Hardware	Transactions Per Second (TPS)	Average Response Time (secs.)	Simulated Workload*
VAX 8700	29.3	.68	600 users
MicroVAX II	6.2	.80	150 users
Sun 3/280	19.1	.78	450 users
Pyramid 9820	22.7	.88	600 users

* Each user initiates a new transaction every 30 seconds.

Companion Server for VAXclusters. For a VAXcluster, Sybase provides what it calls a Companion Server, which runs on a different CPU from the main Sybase DataServer. If the DataServer fails, all applications are automatically and immediately routed to the Companion Server.

Mirrored Databases and Logs. In all three environments—VAX, Sun, and Pyramid—Release 3.1 offers software-mirrored databases and logs that maintain copies of the database and transaction log on two different disks. In case of a disk failure, Sybase can access the second copy of the data and log on the functioning disk. When the failed disk is repaired, the database and log are automatically remirrored. Mirrored databases ensure against loss of data, and mirrored logs ensure against loss of committed transactions if a disk should fail.

Another feature of Release 3.1 is the ability to mirror a single database rather than the contents of an entire disk, as most other mirroring systems require. This provides for optimum use of disk space.

COST AND AVAILABILITY. The Sybase DataServer, which currently runs in three environments—VAX/VMS, Sun/Unix, and Pyramid/OSx—ranges in cost from \$20,000 to \$100,000 for minicomputers, and from \$2,000 to \$10,000 for workstations. Release 3.0 (performance enhancements) is available now, and Release 3.1 (fault tolerance) will ship before the end of the second quarter. Both 3.0 and the software-mirrored databases and logs will be provided at no cost to current customers. The Companion Server for the VAXcluster environment will be priced from \$1,500 to \$7,500 depending on CPU cost.

SUN 386i. Sybase has also announced availability in July of its DataToolset for the new Sun 386i workstation. The Sybase DataToolset is a set of front-end tools for building and running Sybase

applications. Both a development and run-time version of the DataToolset will be offered. The development version will cost between \$3,000 and \$4,000, and the run-time version will cost \$1,000. © —J. Davis

• VENTURCOM •

Prelude Improves as It Goes On

Several months ago, we took a look at the Prelude Office Information System from VenturCom, Cambridge, Massachusetts. While the combination of applications and underlying strategy—the entire product has a proprietary fourth-generation language (4GL) as its foundation—were intriguing, the user interface was sufficiently dismal to turn us off. We relegated Prelude to the “if we have time and nothing else interesting is happening” pile.

Well, things have gotten much better. The current interface is not only improved, it's pretty friendly. There are still too many keystrokes and too few customization options, but, all in all, VenturCom is on the right track.

PLATFORMS. Right now, Prelude runs on the AT&T 3B family running Unix V.2 or V.3 or on a PC AT or above platform running VenturCom's Unix-based Venix operating system. Xenix and Interactive 386 ports are forthcoming in second-quarter 1988. We're glad to see VenturCom expanding the platform base. It is currently severely limited.

PRELUDE ENVIRONMENT. Prelude is built upon a relational database with a proprietary data manipulation language (DML). The DML has a simple-to-use front end with which end users can create and query datafiles. On top of the underlying database are three layers: a common user interface, application modules, and Prelude's own as well as standard Unix development tools.

Common Interface. The system uses a full-screen menu at the main menu level only. All other menus are pull-down, Lotus-like, complete with second-line messages indicating what each option means. There is contextual help, including, in many cases, the ability to see all applicable options (i.e., if selecting a file to edit, the user can call up a display list of all available files from which to choose). Going even one step further, the system will show only the files that fit the criteria. For example, if you are calling a file within the spreadsheet, only files with the spreadsheet extension are displayed in the list.

In addition, common functions can be accessed via soft keys that are consistently mapped from screen to screen (i.e., F1 is always Quit, F2 is always Help, while other keys will vary from operation to operation). We do have a problem with the Quit command. Not only does it allow you to exit a function, but, in most cases, it executes the function. This is not intuitive. There is also a Cancel option, but we always think of Cancel as a way to abort an operation in progress; Quit is a command to leave a module. Neither option implies actually executing an action or accepting changes. In Prelude, Cancel aborts an action, while Quit executes the action and/or (depending where you are) takes you out of operation.

The screen display is very consistent. The pull-down menus appear at the top of the screen only when accessed. (This can be annoying. At times you need to go through several menus consecutively, but you have to call up the menu line each time!) Soft-key assignments are listed across the bottom of the display. A status line is directly above the soft keys indicating the active module (see below); mail status—new mail, mail (read but not filed or deleted), or no mail—which is updated approximately every 60 seconds; a reminder window for timed messages to yourself; and the date and time.

The rest of the screen is given over to the active application. Help and system messages window in. The interface

is far from graphic, but it is nicely designed.

Modularity. A lot of modules are contained within Prelude, including the following:

- Authentication, which allows the user to add a header to a file indicating that this version is sacrosanct.
- Backup/Restore, which provides a menu interface into the Unix filing system.
- Business Graphics, which works with the spreadsheet and independently.
- Calendar, which includes meeting-scheduling and reminders.
- Central filing, which is a read-only directory for authenticated and other noneditable files.
- Mail, which is an augmented version of Unix mail.
- Personal database, which is actually a relational database management system. The user must go into Unix for forms creation and multiuser activities. It does not use SQL. (A mistake, we believe. Prelude's DML would be a logical front end for SQL, opening up integration possibilities to the entire Unix database world.)
- Project manager, which tracks resources and charts activities.

- Spell corrector, which is also available within word processing. It can spell-check any ASCII file.
- Spreadsheet.
- Statistics, which provides nine types of analysis on any spreadsheet or database file (not necessarily VenturCom's).
- Task manager, which assigns and tracks specific tasks. It is not integrated with project manager (though it should be).
- Word processor.

You can interrupt any module to move to any other module by calling up the main menu (it would be nice if popular modules—mail, word processing—were available on soft keys). And the system supports an unlimited number of interrupts. Data may be exchanged among modules through named clipboards.

Underlying Development Tools. The Prelude DML, used in combination with Unix development tools and the relational database, can be utilized by programmers to develop scripted applications. By using the DML to build screens and logical conditions in combination with various modules, such as the project manager, task manager, word processing, etc., complete business procedures (procedural automation) can be developed. Unfortunately,

these tools are not available to any non-programming user. There are no end-user macro facilities except in the spreadsheet. We would like to see VenturCom bring more of this power to the users.

INTEGRATION BETWEEN MODULES. It is very easy to move information between modules using clipboards. And some links have been provided by VenturCom. For example, when a meeting is scheduled from the calendar, a message is automatically sent to participants through the mail module. But there isn't enough of this kind of integration. In order to schedule the meeting, the mail recipient must go into the calendar, acknowledge that he or she has a meeting request, and then accept or reject the meeting. Granted, the user can interrupt the mail session to enter the calendar, but why not automate the entire procedure?

This is where Prelude needs work. Oh sure, certain features and functions need to be added or improved (macros, please!), but the company needs to look at the logical flow of tasks rather than the functionality of individual modules. VenturCom's background is in the more technological areas of office systems, specifically operating system design (Venix). So the technological aspects are impeccable. It's the business perspective that is only now being added. We hope VenturCom will continue to improve this part of Prelude at the same rate that it enhanced the interface. ☺

—R. Marshak

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