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INSIDE

PRODUCTS • TRENDS • ISSUES • ANALYSIS

Pyramid Technology

Planning for Client/Server Architectures

By Michael D. Millikin

WHEN IT BRASHLY hit the market with its 90x Reduced Instruction Set Computer (RISC)-based system five years ago, Pyramid Technology made pushing high-performance iron its primary strategy. Unfortunately, the market didn't respond consistently to the price/performance message delivered by the start-up's technology.

After a strong start, during which it pulled up to third place in the medium-scale Unix processor market behind AT&T and Digital, Pyramid stalled. After logging $3 million net income in 1985, Pyramid posted a $1.7 million loss in 1986.

(continued on page 3)

• E D I T O R I A L •

Workstation Prognosis: IBM-Style

By Patricia B. Seybold

AT A BRIEFING held in Boca Raton in February, Mike Maples, director of Software Strategy and Business Evaluation for IBM's Entry Systems Division (ESD), discussed the notion of acceptance theory in connection with OS/2. The classical acceptance-curve theory, according to Maples, says that once a new product or technology achieves a 10 percent penetration, the next 80 percent will occur in approximately half the time it took to reach the 10 percent threshold. He feels that OS/2 acceptance will reach that 10 percent threshold by mid-1989. (He defines the 10 percent mark as 10 percent of new systems acquired, not 10 percent of the installed base—there may be a hitch here.) Since OS/2 began shipping on January 4, 1988, and if IBM is right that the 10 percent of the market who are early adopters will be using OS/2 by mid-1989, then it follows, according to the theory, that OS/2 will achieve 90 percent penetration by the end of the first quarter of 1990.

Is this prognosis realistic? What Maples seems to be saying is that 90 percent of all new PCs sold by early 1990 will be shipped with OS/2 rather than MS-DOS support. That means that, within two years, the software industry will have migrated all major existing and new applications to the OS/2 platform, and that the OS/2 versions of applications are better enough than their DOS predecessors to keep anybody from settling for the old-fashioned applications. IBM reports that, as of February 10, the company had 79 OS/2 applications registered with real ship dates and prices. By the end of '88, IBM and Microsoft anticipate that there will be 1,000 OS/2 applications. However, bear in mind that approximately 20,000 MS-DOS applications are on the market today. On the other hand, perhaps it *is* realistic to assume that there would be 2,000 OS/2 applications by mid-1989. So, if the acceptance theory holds true, we could visualize a major penetration of OS/2 (80 to 90 percent) for new machines acquired by large organizations.

The vast small-business market is not as safe a bet, however. We don't see the same compulsion for small business to move from the comparative simplicity of the MS-DOS or Mac world to the elaborate real-world applications environment provided by OS/2. We think networked MS-DOS DBMSs will still provide the backbone for most small-business applications in the early '90s, with Unix DBMSs playing the runner-up.

What about Unix? What role will Unix play vis-à-vis OS/2? There seems to be a ground swell of interest in Unix as a viable commercial operating system, as exemplified by the healthy turnout at the UniForum trade show in Dallas in February. Unix is also gaining momentum among the second-tier system suppliers (HP, DG, Wang, Prime, et al.) as a survival strategy.

Both Microsoft and IBM make similar distinctions: OS/2 is the operating system of choice for networked workstations in the commercial environment. Unix (or AIX, as IBM calls it) is appropriate for multiuser systems supporting terminals, or as a server in a client-server networked system. We don't agree with that distinction. Sun Microsystems' recent successes in penetrating high-end commercial accounts (financial and brokerage applications) is testimony that networked Unix workstations provide a viable alternative to networked OS/2 workstations, and, by the way, an alternative that is available today, not next year.

Mid-Range Challenge? If IBM's Entry Systems Division is successful in meeting its goals, the PS/2 with OS/2 and Micro Channel will become the workstation of preference for large and small organizations running OS/2 Standard Edition in smaller companies and OS/2 Extended in Systems Network Architecture (SNA) accounts. These will be tied together in client-server networks and linked, in turn, to mainframes handling large image-and-data-intensive databases. What will be the fate of the current mid-range systems exemplified by IBM S/3X, 9370, and Digital VAX computers in the '90s? According to spokesmen from ESD, it will be all right with them if the mid-range disappears, subsumed by the networked micro architecture. And, just in case OS/2 doesn't make the fast track, IBM has AIX waiting in the wings. ◐

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•PYRAMID•

(continued from page 1)

Since then, Pyramid has greatly refined its marketing tactics, its technology, and its strategic message. Pyramid now targets specific commercial markets (notably database applications) and relies upon value-added resellers (VARs) for targeting other vertical markets. During the last year, Pyramid also introduced its new Series 9000 systems—multiprocessor RISC systems offering greater power at a very aggressive price point. Pyramid calls this system a "minimainframe"—a computer packing the wallop of a mainframe for the price of a minicomputer. (Fiscal 1987 was a good year for Pyramid—net income bounced back up to $1.9 million.)

But it is in the formulation and articulation of its strategic directions that Pyramid distinguishes itself from the pack. Rather than finding fault with the growing importance of multivendor networking in general and PC LANs in particular, as some systems vendors are wont to do, Pyramid is positioning itself as an integral high-end component of those networks. At the same time, the vendor is refining and enhancing its more traditional time-shared implementations. Pyramid thus has two primary strategic goals:

Rather than finding fault with the growing importance of multivendor networking and PC LANs, Pyramid is positioning itself as an integral high-end component of those networks.

- To provide the best price/performance solution for traditional time-shared, transaction-oriented applications
- To provide high-performance, high-capacity servers in the rapidly evolving distributed network computing architectures

Fundamental to all of the above is Pyramid's support for standards such as the Unix operating system and International Standards Organization/Consultive Committee on International Telephone and Telegraph (ISO/CCITT) networking and communications. There is some kinship between the strategies of Pyramid and Sun Microsystems. Both companies see their ultimate profit coming from the acceptance of a standards-based world where the particular value-added of their solutions can shine. Pyramid is also being aggressive in porting and implementing advanced networking solutions.

Pyramid has, for example, ported over Apollo's Network Computing System (NCS) protocols. Using NCS, a network can distribute applications tasks across an heterogeneous network. Pyramid announced early support for database start-up Sybase. Sybase offers a distributed relational DBMS with online transaction processing capabilities using the client/server architectural model. Additionally, Pyramid is one of the first vendors to announce the planned incorporation of the new LAN Manager/Unix (LM/X) product, jointly developed by Hewlett-Packard (HP) and Microsoft. LM/X is an implementation of the Microsoft/3Com LAN Manager on a Unix platform. Such a product will allow Pyramid to function as a server in a network that supports distributed applications processing. (More on this below.)

Pyramid recognizes that such distributed network configurations are a longer-term strategic need. Right now, there is still a large time-sharing market to sell into. Thus, Pyramid puts a great deal of effort into optimizing its hardware and systems software for existing applications (particularly transaction processing) and trying to nibble at the mainframe marketplace.

Along those lines, Pyramid recently licensed Unisoft's UniTECS software, which emulates IBM's Customer Information Control System (CICS) on Unix hosts.

Markets

Currently, Pyramid has sold more than a thousand systems. Of those, more than 75 percent have gone into commercial accounts (up from 50 percent two years ago). Pyramid sells quite a few systems to Regional Bell Operating Companies (RBOCs) and is fairly strong in the telecommunications market. Other targeted vertical markets include financial services, federal systems, and applications development including aerospace and manufacturing.

The vertical market splits run as follows:

• Telecommunications	40 percent
• Applications development	25 percent
• Federal government	20 percent
• Financial services	15 percent

Applications splits run 75 percent in commercial applications and software development, and 25 percent in scientific, technical, and engineering environments.

Half of Pyramid's sales are overseas (43 percent in Europe, 7 percent in Australia and the Far East)—the bulk of those going to Nixdorf, an original equipment manufacturer (OEM) that also is one of the major investors in Pyramid.

Pyramid is very clear on the increasing importance of the database. Consequently, the vendor works closely with database independent software vendors (ISVs), such as Oracle, relational Technology, and Informix. Last year, Pyramid announced R*TP—a packaging of Pyramid systems with the Sybase relational DBMS to create an On-Line Transaction Processing (OLTP) solution.

Competition

Digital Equipment is Pyramid's biggest competitive roadblock. In the recent past, Pyramid has been helped by Digital's treatment of its Unix variant, Ultrix, as a poor relative to VMS. Digital's attitude is changing, however, and VAX systems running Ultrix will thereby become more of a threat to Pyramid.

That threat is certainly not one of price/performance, however. Pyramid trounces the VAX by any measure imaginable. At entry-level configurations, a Pyramid 9805 offers a cost of less than $6,000 per user, while a comparable VAX 8530 costs more than $12,000 per user.

Too, Digital's Achilles heel is its attitude toward PC LANs. Despite the recent announcements of Network Application Services that enfold Macintoshes and PCs into DECnet's comfy embrace, Digital still treats existing PC LANs as aberrations. "Fads," according to President Ken Olsen. Real men, in other words, use DECnet. Pyramid's incorporation of PC LAN standards within its own server solution thus will offer a very attractive lure to PC LAN users looking for some true horsepower on a specialty server in the network. As MIPS-hungry server applications evolve (expert systems, image processing, database, etc.), Pyramid's solution will become even more attractive.

Digital's Achilles heel is its attitude toward PC LANs. Despite the recent announcements of Network Application Services, Digital still treats PC LANs as aberrations.

Others

Other competitors come from the regular panoply of minicomputer vendors, particularly AT&T (because of the telecommunications marketplace). Because of Pyramid's increasing focus on database systems solutions, the company competes strongly with Tandem as well. Once again, Pyramid's price/performance gives it an edge.

AT&T will have a more competitive offering when it produces a Scalable Processor Architecture (SPARC)-based system. However, Pyramid remains confident in the technological superiority of its RISC processor over the SPARC chip.

Pyramid and the Evolution of Information Processing Architectures

No matter how snazzy your technology may be, someone is always breathing down your neck. Technology alone, as Pyramid learned the hard way during its early years, isn't a guarantee of market success.

Pyramid has—correctly, in our opinion—decided that future information processing architectures will be based on peer-level distributed networking systems implementing client/server models of applications. Within that architectural model, Pyramid has spotted a definite place for itself as a high-end server optimized for certain applications—database in particular.

To make sure that it is able to deliver the necessary products at the appropriate time, Pyramid is pushing hard on two fronts: support for existing database solutions, and designing the underpinnings necessary for the future.

To provide the guidance necessary for the latter, Pyramid hired Steve Tolchin as vice president of software development. Tolchin comes from the user side of the fence and has a background in client/server distributed systems. (One of his achievements was the implementation of Sun's RPC/XDR on a 308X at Johns Hopkins Hospital to create a distributed clinical information system. The system functionally integrated Unix, MVS/CICS, and MUMPS systems over Ethernet.)

Based on his experience, Tolchin is working on several well-grounded assumptions:

- Distributed network computing is the next stage of evolution for the industry.
- In such an environment, it doesn't pay to use a terminal. By the time you add in the cost of Bridge boxes, terminal servers, host ports, etc, you get a better cost performance from a PC.
- In a client/server architecture, you need consistency on the front end, while the back end can vary. PCs (Apple, DOS, OS/2, low-end Unix workstations) will be the standard architecture on the desktop.
- The front end of a client/server architecture can be an application maintenance nightmare. The obvious solution is for servers to boot applications.
- The world needs to agree on a standard for Remote Procedure Call (RPC) and External Data Representation (XDR) session management. An average standard is better than a great proprietary solution. (More bluntly, "Having a standard is better than having something good.")

EVOLUTION. *(See illustration at right.)* In the beginning was the primordial ooze, from which emerged the monocellular systems providing batch processing, and then time-sharing for transaction processing. Next came the gradual appearance of networking, with PCs as clients accessing restricted server applications for file- and resource-sharing.

This is, for the most part, our current state. The next evolutionary state will mark the implementation of PC LAN protocols upon larger systems. That done, PC LANs will become real clients in a true client/server architecture. As an industry, we are teetering on the cusp before that change.

Two basic approaches exist to provide PC LAN protocols on a larger system. The first approach, represented in part by IBM, is to make the larger system's protocols those of the PC. (That is part of the rationale behind Systems Application Architecture, or SAA, and OS/2 Extended.) The second is to take the evolving set of increasingly sophisticated PC LAN protocols and push them up onto larger systems. That is the approach embodied by the Microsoft/HP LAN Manager/X (LAN Manager protocols

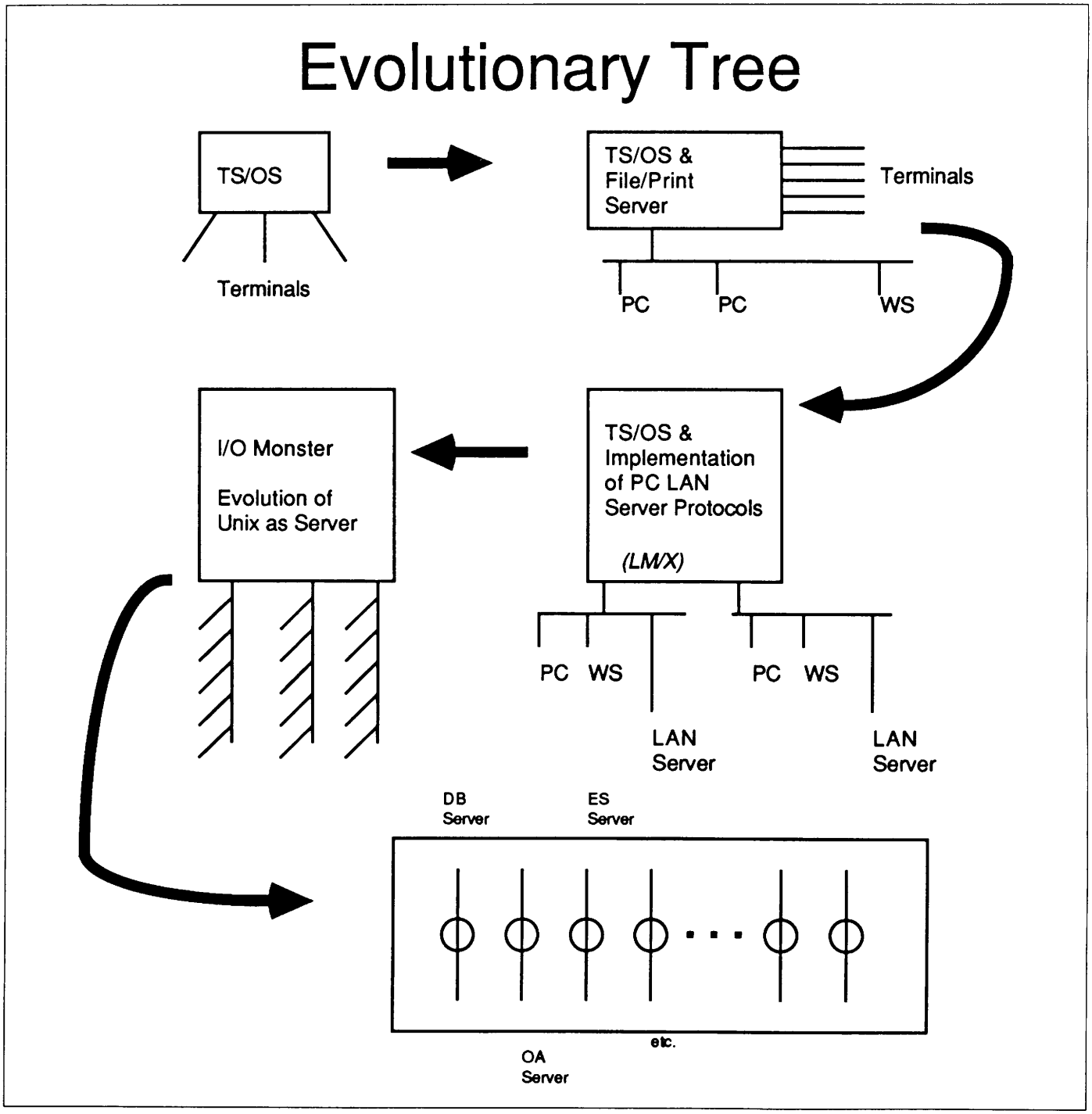
running under Unix).

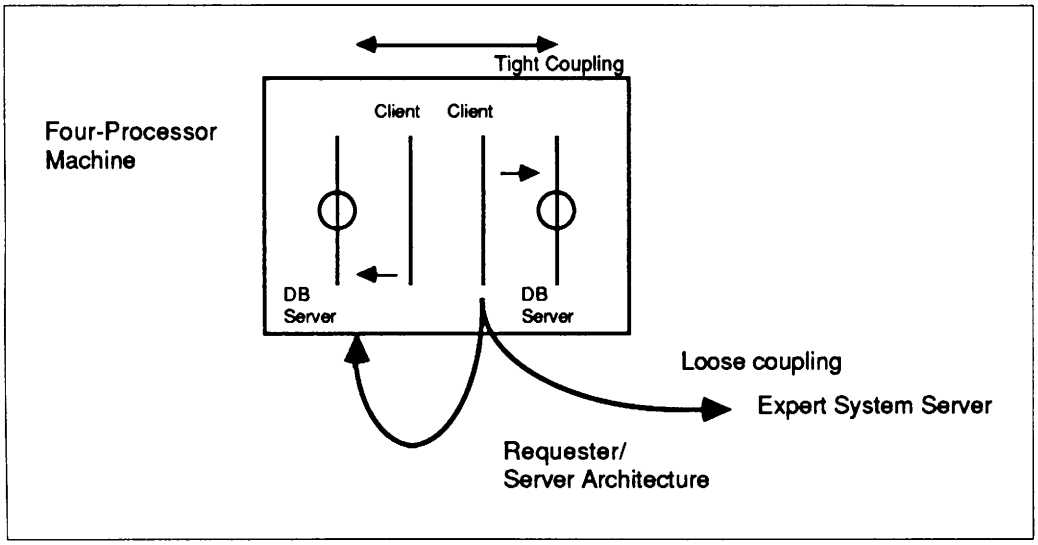
The advantage to the latter approach is that it provides scalability to buyers of third-party PC LANs. (More on this in a moment.)

Once we reach this next phase, then we'll start to see increasing differentiation on the server back end. Unix machines will grow to become I/O monsters supporting multiple channels of LANs and MIPs-hungry applications such as expert systems servers.

Tolchin believes that Pyramid's machines can handily grow into the role of I/O monster. To achieve that, Pyramid is taking certain strategic steps:

- It is enhancing and developing Unix to better support a server architecture.
- It is providing support for PC LAN protocols through the porting of LM/X.
- It is working in the Network Computing Forum (NCF) for the





Client/server processes distributed within a multiprocessor system.

consolidation of the industry around a standard RPC/XDR. Pyramid has ported the Network Computing System (NCS) to the Series 9000 as well.

Growth of Unix

According to Tolchin, Unix needs tweaking in several areas if it is to become the operating system foundation for the server I/O monsters of future networks.

First, Unix needs to scale to higher performance machines. "You can't write to disk every 30 seconds in such a situation," Tolchin notes.

Second, Unix will need to be able to provide better memory support. As multiprocessor architectures mature, Unix must be able to offer efficient processor-to-processor bridging mechanisms. Server application memory requirements are a bit different than those of normal time-sharing. The server-style applications such as database and even office automation tend to be highly nonlocal in a multiprocessing environment. Systems vendors need mechanisms to get away from memory bottlenecks that can clog system performance in such a situation.

With multiprocessor-based servers, the operating system should support both close coupling between internal processors and loose coupling between processors and other systems.

Obviously, Pyramid is committed to enhancing OSx (its own operating system) to exploit the increasing sophistication of its multiprocessor machines. Down the road will come an emphasis on distributing the operating system itself across the network.

Tolchin sees differentiation in the future, when vendors provide different versions of operating systems and hardware optimized for working with a certain type of application—database, for example.

The danger here is that a vendor may stray from the standards path and wind up with a proprietary offering again. If Pyramid—and other vendors—rigorously adhere to conventions such as Posix, however, this danger will be lessened.

Currently, Pyramid sees itself as offering a great file server for existing networks. Indeed, it even packages iso-processor models of the Series 9000 as NFS file servers. In the future, the company plans to evolve the Pyramid into packaged configurations supporting specific functions: OLTP, expert systems, communications servers, and so on. An early example of Pyramid's intentions in this direction is the R*TP systems announced last year.

R*TP

Pyramid Technologies packaged its 9000 series minimainframes with Sybase's database package to create a family of high-performance transaction processing systems. It's not quite shrink-wrapped OLTP, but almost. Users have a choice of five basic systems that range in performance from 10 transactions per second (TPS) using the TP-1 benchmark on the low-end Model 50 up to 75 TPS on the high-end Model 400. With pricing for the complete systems ranging from $165,000 to $675,000, the new Relational Distributed Transaction Processing Systems (R*TP) may offer the lowest cost-per-transaction in the industry.

The critical component in this system package is the Sybase software. Sybase is designed to be a relational database manager with the robust performance and function necessary in an OLTP system. Sybase, in other words, is bridging two currently disparate disciplines that have heretofore required separate software packages (at least for higher-performance OLTP). (For an initial look at Sybase, see our review, Vol. 2, No. 7, page 17.)

Briefly, Sybase's competitive distinctions are: a single-process back end, extended SQL commands, the ability to store integrity rules and procedures centrally in the data dictionary, the ability to maintain the system without requiring down-time, the ability to update multiple databases in a single transaction, and a graphics user interface that minimizes programmer time.

Sybase is designed to run well across a network, with workstation front ends and server back ends. The Microsoft/Ashton-Tate announcement of the marketing of the SQL server provides a Sybase back end for lower-end PC LANs.

Pyramid is positioning itself to go after the high-end server business with its R*TP family. In keeping with its philosophy of specializing Unix to meet certain server application needs, Pyramid also made some changes to OSx to enhance the OLTP capabilities of the R*TP systems.

For example, Pyramid added a facility that locks the back-

end server process into only one of its up to four processors, allowing the other processors in a Pyramid configuration to be used for other things—such as front ends. [Sybase uses a requester/server architecture, where the application functions can be handled separately from the data management functions. The DataServer runs the data management processes on a server—the back end. The DataToolset provides a set of window-based tools for building and running applications on either a character terminal or a bit-mapped workstation—the front end. With a multiprocessor architecture such as Pyramid's, you could have one processor running the back-end DataServer application and the other processor(s) running either front-end DataToolsets or other application programs. For performance reasons, Pyramid doesn't want the back-end server process migrating across different processors.]

To enhance overall performance, Pyramid put context-switching into microcode. And, to avoid the delays caused by Unix's blocking on a read, Pyramid added an asynchronous I/O fix to the raw file system. None of these changes disrupt OSx's compatibility with Unix standards, however.

The result of all this should be a high-performance OLTP system that is very attractive in price and that will be a natural for incorporation into the flexible, distributed networks that are evolving.

LM/X

Another strategic move for Pyramid is the endorsement of LM/X, announced this year at UniForum.

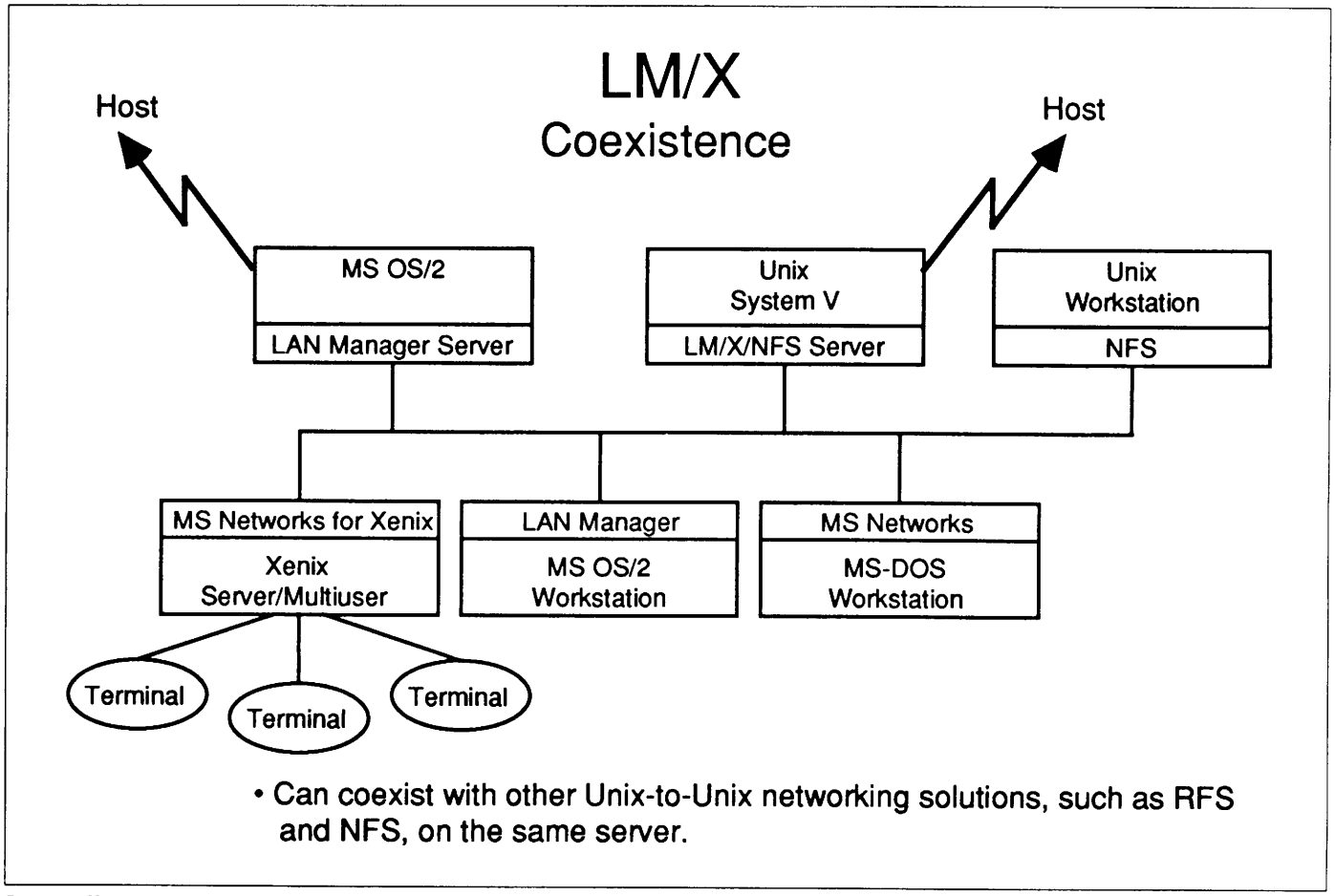
LAN Manager/X results from work done jointly by HP and Microsoft, and implements Microsoft's LAN Manager protocols under Unix. An LM/X server will be able to service requests from workstations running Microsoft networking software as well as related IBM products such as PC-LAN and OS/2 Extended Edition.

LM/X will provide support for the Named Pipes Application Programming Interface (API) in OS/2 LAN Manager, thereby supporting the distribution of applications across a network.

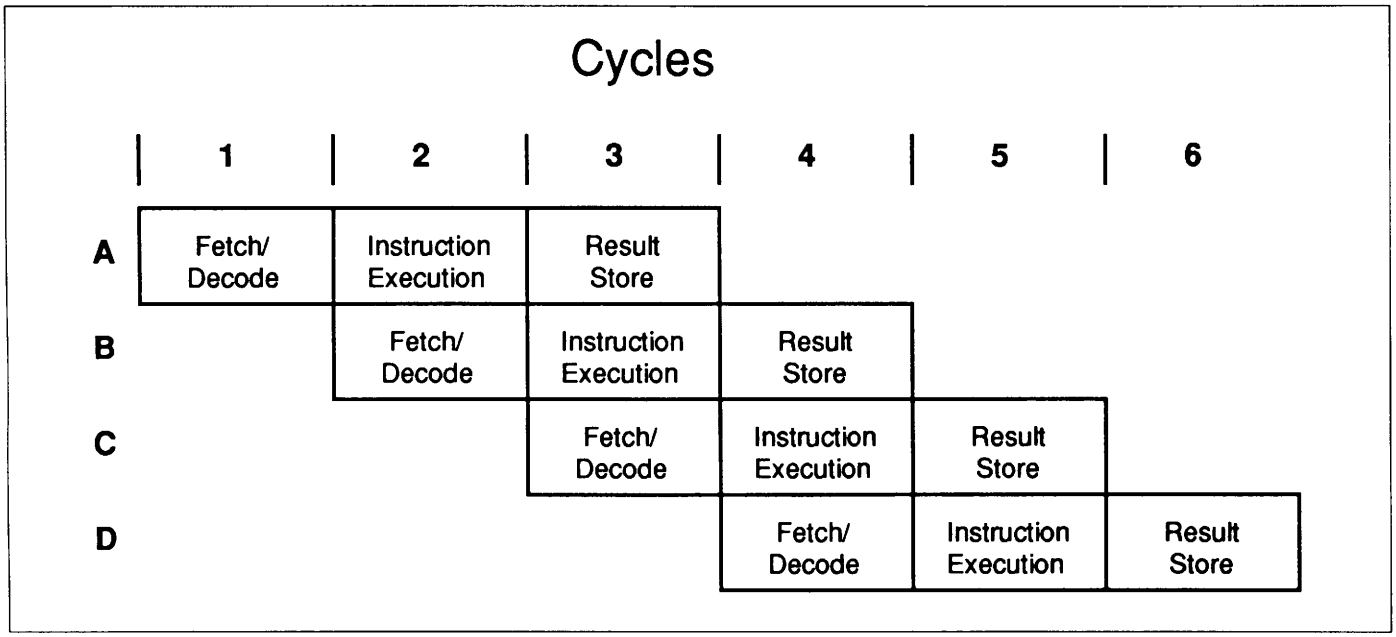
In short, a Unix system running LM/X offers PC LAN users scalability unachievable within the Intel world. A good example is a database application. Microsoft and Ashton-Tate are marketing the Sybase SQL Server as the back end of a Sybase database system running on an OS/2 server. By supporting LM/X, Pyramid will be able to drop into such a network, offering users the power of a Series 9000 with which to run a Sybase back end.

For users, the only change will be the increased power and performance of the database. The possibilities here are extremely exciting.

LM/X servers can continue to run the existing base of



LM/X offers PC LAN users scalability of a type previously not available.



Pyramid's pipelining reduces the apparent number of cycles required to complete execution of instructions.

terminal applications. This will provide Unix customers in general and Pyramid customers in specific a migration path from a terminal-oriented, time-shared environment to distributed network computing.

Pyramid is not alone in its announced support for LM/X (which is due out in early 1989). HP obviously is planning on offering the product as well. Pyramid is attitudinally ready to deal with the requirements for providing value-added on a playing field leveled by the use of standards. The company believes that the differentiation possible among various back-end server options will provide a wide market opening for its products.

NCS

Pyramid also has been an early and vocal supporter of Apollo's Network Computing System (NCS) as well as the Network Computing Forum (NCF)—the organization struggling to form a consensus and a standard for network computing.

The notion behind NCS is that applications requiring more horsepower can steal cycles from other computers on the network. These may be similar to processors or special purpose processors, such as those designed for transaction processing, supercomputing, or artificial intelligence (AI).

The current great conflict within the NCF is on the choice of the RPC for use within the system. Sun, which is also a member, has its own version. Apollo, which is trying to push its NCS as a standard, uses a different RPC.

Pyramid is in an interesting position. An early supporter of NFS, it also has ported NCS over to its systems. Tolchin believes that NCS is the best solution available on the market currently. However, consensus is necessary between the two factions. Whatever the outcome, Pyramid should be well positioned.

SERIES 9000

Hardware

The Series 9000 line currently consists of five models, the 9805 entry-level system and the 9810/20/30/40. All models are field upgradable to the top of the line 9840 (four-processor configuration).

RISC ARCHITECTURE. Pyramid bases its products on a proprietary 32-bit RISC processor. Like many other viable RISC implementations, Pyramid's occupies the middle ground between the theoretically requisite 32 RISC instructions and the hundreds of instructions found on traditional Complex Instruction Set Computer (CISC) systems. Pyramid's processor uses 128 instructions. Many of the additional 96 instructions improve the handling of I/O, floating point, and multiprocessing.

Only the most complex instructions are implemented in microcode; the rest are hard-wired, thereby reducing the number of cycles required to execute an instruction. The CPU pipelines executions, reducing the apparent number of cycles required for the execution of instructions.

The RISC processor offers 528 32-bit registers. Each CPU has a 16KB instruction cache and a 64KB data cache.

The single processor 9805 uses a 3.5 VAX MIPS CPU. The symmetric multiprocessors in the family, Models 9810 through 9840, use 7 VAX MIPS CPUs as components. Pyramid's symmetric multiprocessing eliminates any CPU overhead that would be required by assigning tasks to particular processors; any available processor can perform all portions of a given task.

This design allows the system to handle both user and system tasks without delay. The next task in the queue always goes to the first available processor. Pyramid achieves its multi-

processing through a proprietary semaphore mechanism complementing Unix process synchronization (e.g., sleep, wake-up). Although the operating system retains the normal Unix organization, the multiple CPUs share a single copy of the OS kernel and data structure, gaining equal access to all shared resources.

XTEND BUS. Pyramid's CPUs communicate with memory and I/O over the 40 MBps, 32-bit XTEND bus. All of Pyramid's I/O and communications controllers use their own intelligent processors. This reduces the burden on the XTEND bus, which thus transfers only short, high-level messages between CPUs and controllers. This, in turn, reduces bus activity and helps prevent I/O bottlenecks, thus improving performance.

INTELLIGENT I/O PROCESSOR. Each 9000 uses a proprietary intelligent I/O processor (IOP) and tape/printer/Ethernet (TPE) controller subsystem attached to the IOP. The IOP uses a 16-bit AMD 29116 processor and 14 parallel Direct Memory Access (DMA) channels with a maximum speed of 5 MBps to provide an aggregate sustainable I/O throughput of 11 MBps (20 MBps peak). A Series 9000 can support up to eight IOPs, each of which, in turn, can support two TPEs.

In addition to the microcontroller and DMA channels, the IOP also offers an SMD disk controller. The disk controller supports up to four Pyramid drives with transfer rates of up to 2.5 MBps. The disk controller implements local tasks, such as cylinder and head selection, in addition to implementing overlapped "seeks" and rotational position sensing (allocating the DMA data path to the first drive ready to transfer data).

The TPE combines support for a 1/2-inch tape controller, a printer controller, and an Ethernet line controller onto a single board.

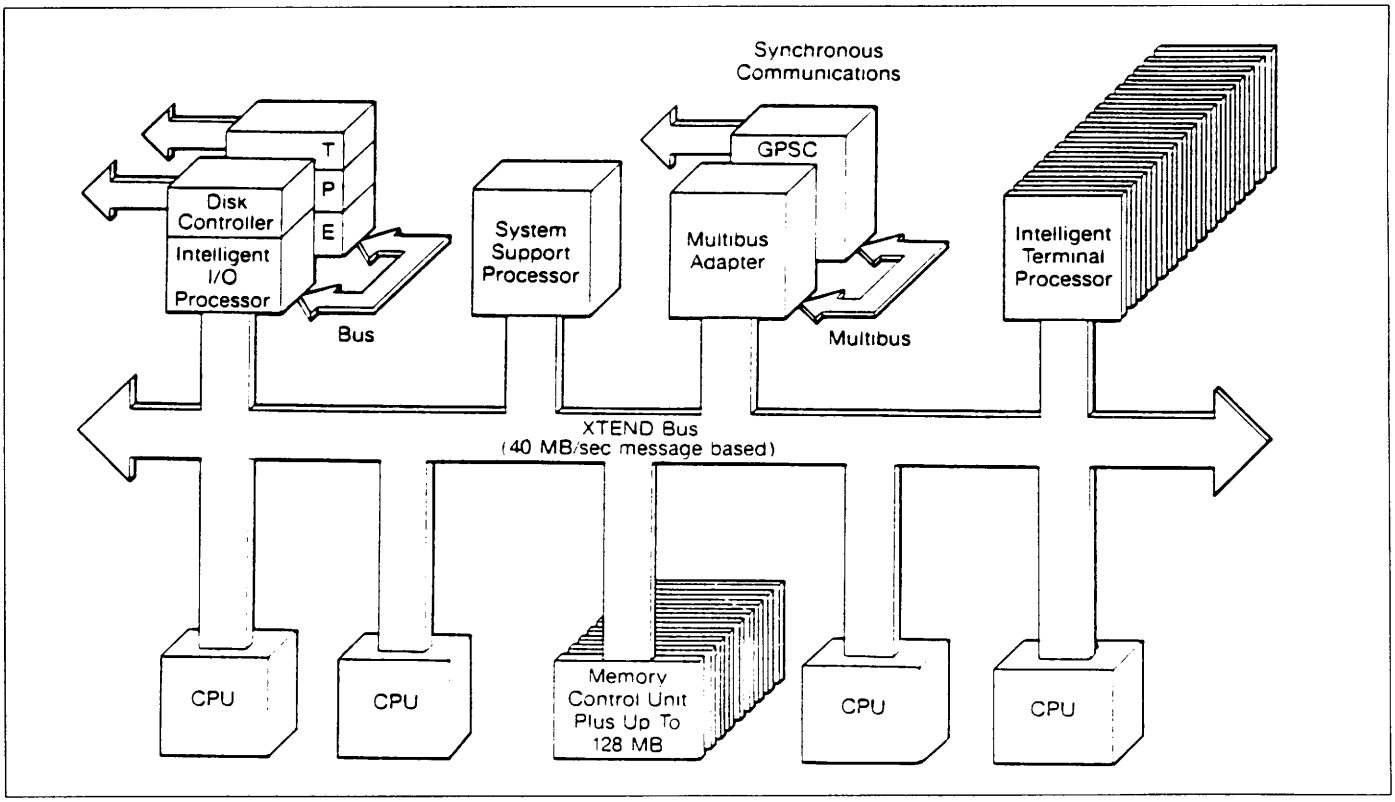
MEMORY. Physical memory can reach 128MB, using either 4 or 16MB modules. Each process can use up to 4GB of virtual address space. All memory arrays come with Error Correcting Code (ECC) logic to correct single-bit errors and detect double-bit errors.

SYSTEM SUPPORT PROCESSOR. Each 9000 contains an independent System Support Processor (SSP) that downloads microcode for the central and I/O processors, performs diagnostic and test functions, and provides the interface to the system console.

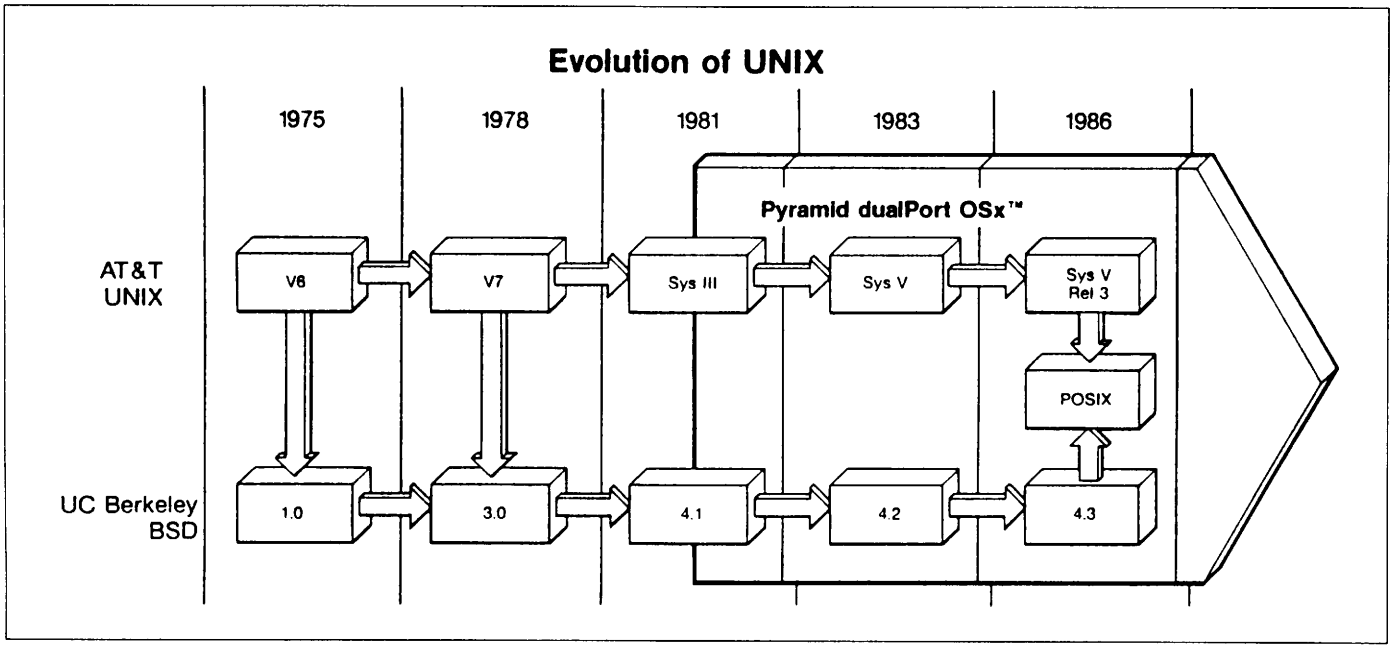
MULTIBUS ADAPTER. Based on a Motorola 68000, the Multibus Adapter permits the attachment of IEEE 796 Mutlibus-compatible peripherals and communications controllers. Pyramid uses the latter capability to provide an intelligent synchronous communications controller for the 9000s.

The Multibus Adapter offers 104KB of memory and 8KB of boot ROM (with initialization and diagnostic programs). Maximum data transfer rate over the adapter is 2 MBps. Each 9000 can support up to four adapters, each of which in turn can support up to two Multibus controller boards.

The Intelligent Synchronous Communications (ISC) con-



Series 9000 Architecture.



The evolution of Unix and Pyramid's OSx. Pyramid has matched the enhancements in the two main camps of the Unix world during the past six years. Although Pyramid will provide Posix compliance and support for the Converged AT&T/Sun Unix, it will also continue to provide its own enhancements to the operating systems, the better to optimize its systems for certain applications, such as database.

troller is one such board; the General Purpose Synchronous Communications (GPSC) controller is another.

The ISC works in conjunction with the SNA software packages (SNA/3270, RJE-Hasp, and SNA/API) and supports SDLC transmission. Line speeds are user-selectable and range from 1200 to 9600 baud. The GPSC, on the other hand, is compatible with IBM BSC protocol, supporting character- and bit-oriented synchronous protocols, RJE-Hasp, and X.25. Each GPSC supports four communications lines. The first two lines transmit at rates of 1200 baud to 64 Kbps; the second two run at 1200 baud to 19.2 Kbps.

PRICING. System prices range from $106,650 for an entry-level Model 9805 to more than $2,000,000 for a four-processor 9840.

DualPort OSx

From its inception, Pyramid has been committed to Unix. Instead of jumping into either the AT&T camp or the Berkeley camp, Pyramid opted for a dual-port implementation, dualPort OSx, that provided concurrent access to both environments.

Users pick either AT&T or Berkeley as their log-in environment. Subsequently, the users can switch between the two systems with a single command. Each environment can call utilities and applications within the other.

As mentioned earlier, dualPort OSx is designed to exploit the symmetric multiprocessor architecture by allowing either user or kernel code to execute upon any free CPU. Pyramid's semaphore mechanism protects critical code and controls simultaneous access to kernel data structures. This design mechanism permits support for symmetric multiprocessing without requiring major changes to the underlying Unix kernel.

By contrast, a master/slave multiprocessor architecture relegates the slave CPU to processing user code, reserving kernel code execution for the master CPU itself. The problem with this design is that the resulting workload is unbalanced.

Pyramid adduces studies showing that more than 50 percent of total CPU time is spent in the kernel mode. A second CPU that processes only user code may not reach full utilization.

Another drawback to the master/slave design is the allocation of systems calls. A user process requiring system resources must execute a system call. If only the master CPU can execute such calls, however, the system architecture is creating a bottleneck. In such a situation, the slave (user) CPU passes the system call to the master (kernel) CPU. The master then must switch context from whatever task it is handling to execute the user process's system call. This switching and queuing reduces throughput.

Pyramid claims that its symmetric multiprocessing architecture can generate 1.85 times the throughput of a single CPU system, while a master/slave multiprocessing architecture generates 1.5 times single CPU throughput (both instances in a dual-processor configuration).

VIRTUAL MEMORY. Pyramid's operating system offers users demand-paged virtual memory that provides up to 4GB of directly addressable space per process. Normally, the OS rewrites page updates to disk only when they retire from active use (page size is 2KB).

The file system uses a 2KB physical sector and logical block

sizes of up to 16KB (with fragments). Pyramid exploits the features of Berkeley's 4.3 BSD Fast File System to offer higher storage and retrieval data rates than usual under vanilla System V. (Both System V and BSD users under dualPort benefit.)

VIRTUAL DISK FACILITY. To reduce disk I/O bottlenecks, Pyramid designed a virtual disk facility that sits between the kernel and the disk I/O drivers. The system administrator uses this layer to map a virtual disk to one or more physical disk partitions. (Mapping can span multiple physical disk drives as well as multiple disk controllers.) Five mappings currently are possible: "normal", concatenated, striped, mirrored, and memory.

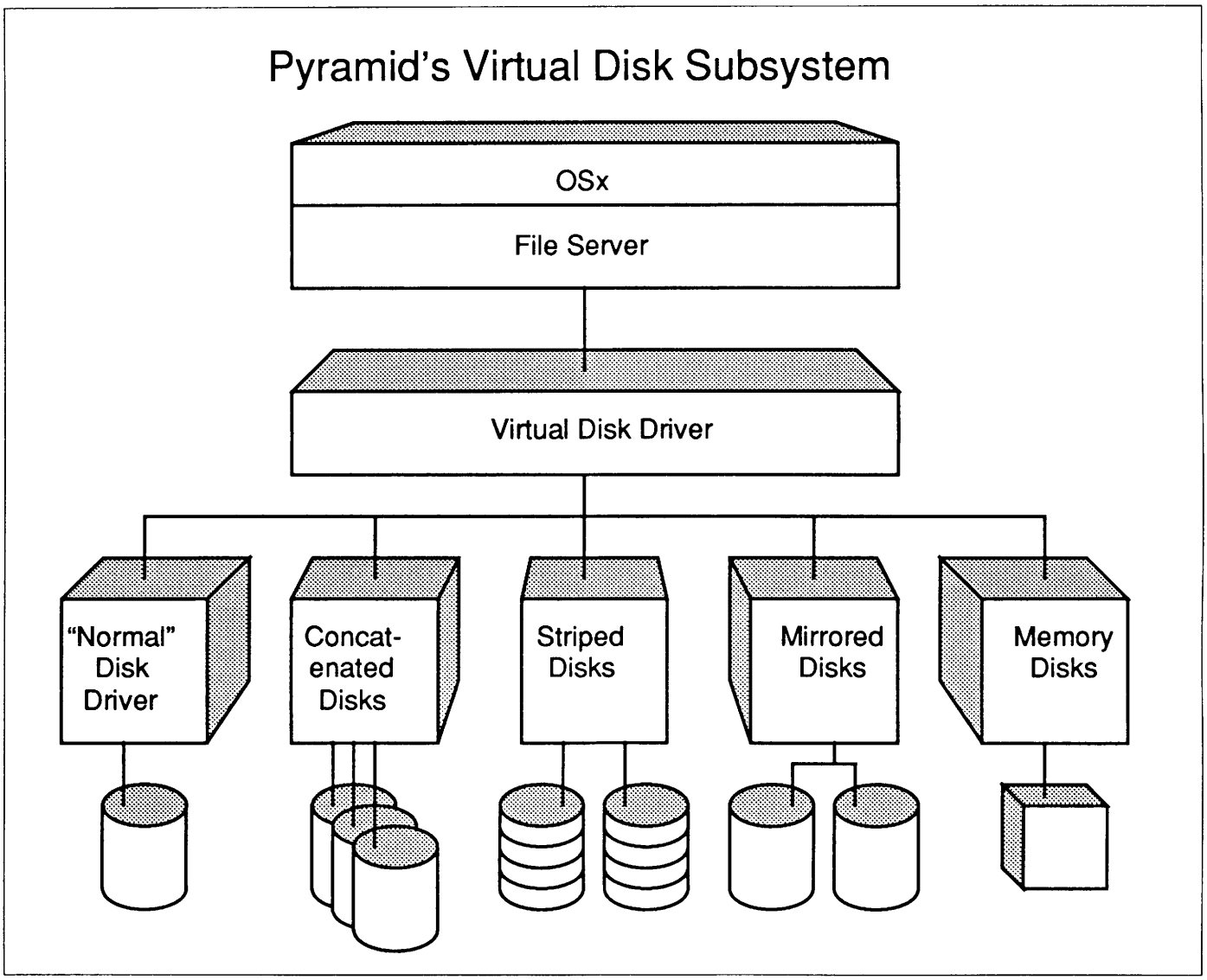
The "normal" map is straightforward—the virtual disk maps onto a single physical drive. Memory disks (or RAM disks) segment off a portion of memory as a file system.

Concatenated disks support a virtual disk larger than that available on a single disk drive. A virtual drive file system can be configured up to 2GB to support files and databases that cannot span multiple drives.

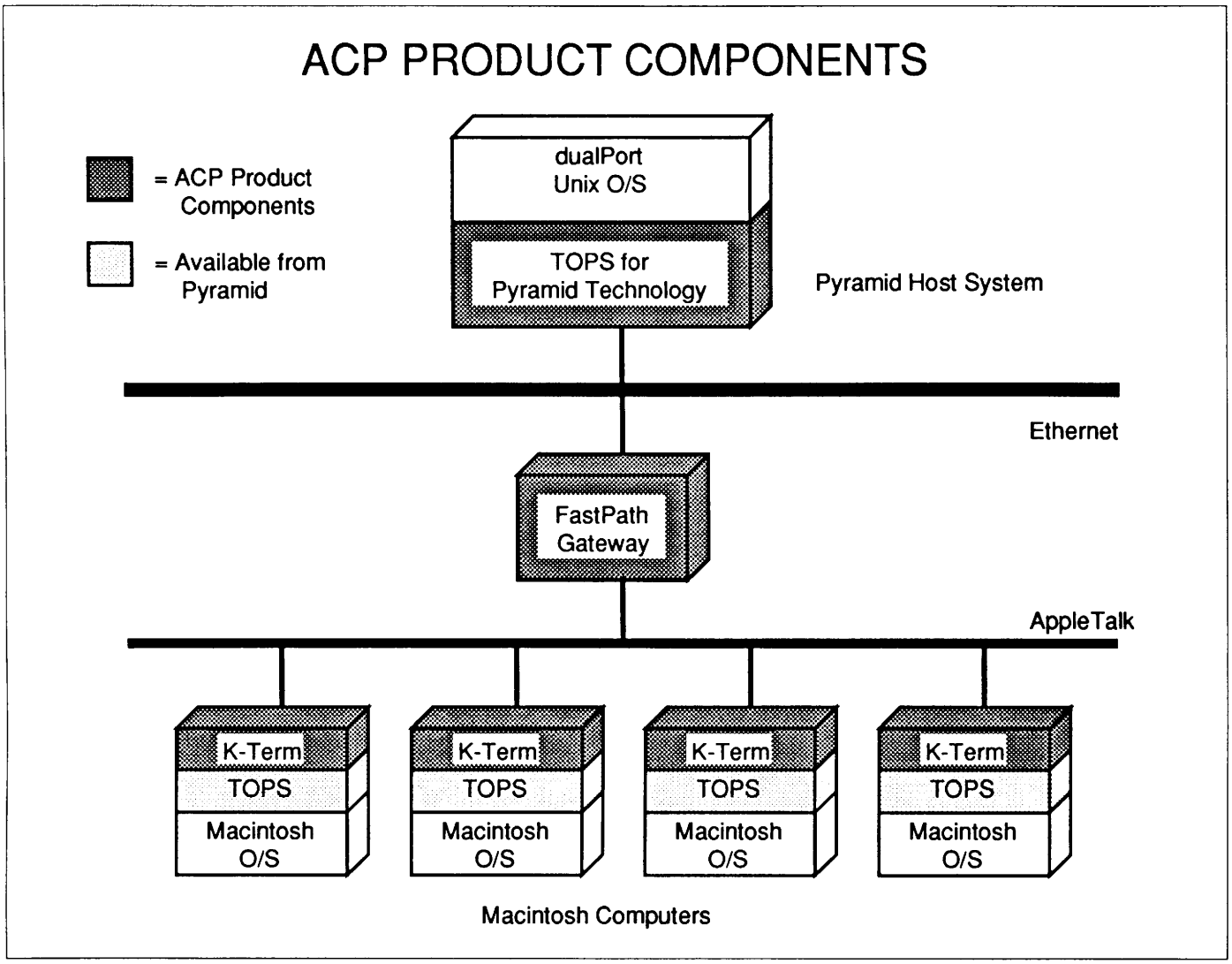
In a striped disk mapping, the virtual disk consists of partitions interleaved across multiple disks and/or controllers. For example, a 100MB virtual drive could consist of two 50MB sections on two separate disks. This spreads disk I/O evenly across devices, with the result of improving general system performance.

Pyramid's newest mapping configuration offers support for mirrored disks. Here, the system automatically duplicates files on separate disk partitions. Such a capability is extremely important in disk-intensive commercial applications environments (such as OLTP) that require high availability.

RPC. Pyramid provides a Remote Procedure Call (RPC) External Data Representation (XDR) library as a standard component of its operating system. XDR allows procedure-to-procedure communications between multivendor systems using different word length, byte-ordering, and data types. RPC supports the



Pyramid's Virtual Disk facility maps virtual drives onto five different types of physical disk configurations.



ACP Components.

communication with remote services in a manner comparable to that of normal procedure calls. The combination of the two creates the foundation for machine-independent applications distribution across a network.

Connectivity

Pyramid has always been aggressive about standards-based connectivity. It was one of the first of its kind to offer X.25 and NFS, and it was the first vendor to link AppleTalk to a supermini host as a file server.

Pyramid gathers its networking solutions together under the name of Pyrnet. This rubric covers Ethernet and terminal connection, connection to packet-switched data networks (both X.25 and X.25/XI—the XI denotes the integration of X.25 with the DARPA Internet Protocol, resulting in WAN connectivity to DDN), and mainframe connectivity.

Pyramid offers a basic SNA/3270 package that runs on the ISC controller and provides 3274 Model 51C, 3270, and 3280 emulation. An SNA/API package allows C programs to interface directly to a virtual 3278. RJE/Hasp is a bisynchronous multi-leaving workstation package that allows a Pyramid to appear as an RJE-Hasp workstation to an IBM host.

RJE-Hasp requires the General Purpose Synchronous Communications (GPSC) controller.

CRAY CONNECTION. Pyramid offers a channel connection to CRAY supercomputers using the HyperChannel network.

APPLETALK. The AppleTalk Connectivity Package uses TOPS networking software to turn a Series 9000 into a server for a Macintosh network.

NETWORKING SOFTWARE PACKAGE. The Networking Software Package (NSP) is the Ethernet software that runs in conjunction with the Ethernet Link Controller. NSP uses the OSI architectural model, but implements Transmission Control Protocol/Internet Protocol (TCP/IP) and some services. For

example, NSP uses TCP and IP at the transport and network layers.

In addition, Pyramid includes the Berkeley version of the more basic ARPA applications, such as "rlogin" for virtual terminal, "rcp" file transfer, and "rsh" remote command execution. Another command—"ftp"—supports file transfer using the Internet standard File Transfer Protocol (FTP) on TCP. NSP also offers "tftp" for file transfer between hosts using FTP on the User Datagram Protocol (UDP).

TCP/IP versus ISO. Both TCP/IP and ISO-OSI models are designed to permit internetworking of different systems. TCP/IP is the favored abbreviation referring to the Department of Defense (DoD) Internet Architecture. The OSI model is the result of international committee work laboring to establish a de jure networking standard.

TCP/IP is mature and well established. A large base of development activity supports it, and its implementation dominates governmental computing. It is being ported to new architectures and operating systems, and developers are laboring to augment its fairly rudimentary services. It helps to have the weight of the DoD behind you.

ISO, on the other hand, while well defined in certain aspects, is lacking in others. Full ISO protocol suites are just beginning to arrive, and application services are still developing. (Lower layer protocols are, however, extremely stable.) For example, the File Transfer and Access Management (FTAM) application has appeared in several different versions which didn't necessarily support each other. Convergence is under way, however.

The federal government—one of the major forces for standardization in the United States—issued the GOSIP report in December 1986, which mandates the incorporation of ISO protocols within five years. Naturally, TCP/IP users are up in arms.

However, it seems clear that the market will, in general, shift over to the OSI protocols and services during the next decade. As long as a vendor can offer a strong, viable TCP/IP product now and commit to a gradual migration over to OSI, it should be fine. Pyramid can do that. Examples of protocols and services exist in the five upper layers of the OSI and TCP/IP models. Although each model has seven layers in all, there is not an exact correspondence. For example, the TCP/IP Utility maps onto both the OSI Presentation and Session layers. The OSI Network, in turn, maps over onto the TCP/IP Internetwork and Network layers.

NFS. Pyramid offers Sun's Network File System as an option under dualPort OSx. NFS provides a client/server model for a file system distributed across a network. At UniForum, Pyramid announced support for Sun's diskless NFS (D/NFS) as well. When Sun releases Version 4.0 of NFS, Pyramid will supply multiple Ethernet channels with remote boot and page capabilities to support networks of diskless Sun workstations.

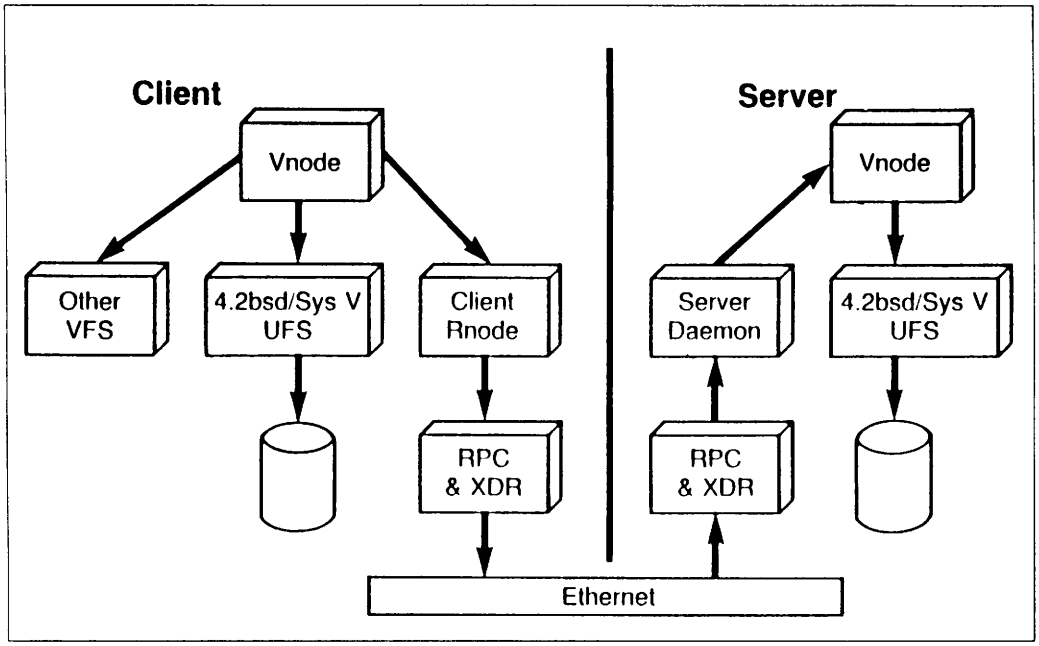
Pyramid has extended the NFS protocol to support the Series 9000 multiprocessor models and the dualPort OSx. All operations on files and directories are transparently available across the network in both OSx environments. AT&T System V applications can thus transparently access shared remote files and directories.

Pyramid also offers a client-only implementation of NFS for PCs. This allows the micro to access the distributed network file system, but not to act as a file server within that network.

Conclusion

Pyramid has an extremely clear strategy designed for both current and future market conditions. Although it began life as a technology vendor, Pyramid now is in the business of selling

OSI Layers		TCP/IP Layers	
Application	FTAM, Virtual Terminal Service, X.400 Messaging, Common Application Service Elements, etc.	Application	File Transfer Server, rcp, TELNET (virtual terminal)
Presentation	ISO 8823 Connection-Oriented Presentation Protocol	Utility	File Transfer Protocol (FTP), NFS
Session	ISO 8327 Connection-Oriented Session Protocol	Transport	TCP, UDP
Transport	ISO 8073/X.224 Transport Protocol	Internetwork	IP
Network	X.25	Network	X.25



NFS Architecture. NFS implements a virtual file system between OSx system calls and the actual file system. A virtual node (vnode) name identifies files. When users mount a file system, the client virtual-file system switches either to the local Unix file system (UFS) or the Network File System (NFS). What makes this even more interesting in Pyramid's case is that the local file system also has a virtual layer, permitting the mapping of a virtual drive onto a variety of physical configurations. Maximum flexibility.

solutions that are technology based. This shift in emphasis should give Pyramid the flexibility it needs to make the transition from selling cost-effective, Unix-based, time-sharing solutions to cost-effective, I/O monster, server solutions.

The transition of the architecture's underlying information processing is beginning to accelerate. Time-sharing is on the way out; distributed network computing is on the way in.

This shift isn't occurring for idle theoretical reasons. There are fundamental benefits to the end user of such a configuration, benefits that are quantitative as well as qualitative.

Pyramid is managing to provide leading edge solutions for the older architecture while still visibly positioning itself as a proponent of the new. No mean feat technologically, this duality bodes well for Pyramid's future success.

CONCERNS. Not that Pyramid will steam to success on completely balmy seas. There is at least one patch of heavy weather ahead: The "IBM can do it and Unix can't" mentality of large MIS shops. Based partly on technological concerns and partly on culture, this mentality builds resistance to buying into a Unix-based system for mainframe-style applications. Pyramid is doing its best to undermine that attitude, with ever-increasing price-performance and by licensing packages such as Unisoft's UniTECS, which emulates IBM's CICS (Customer Information Control System) on Unix. However, of all its potential markets, Pyramid will probably encounter the stiffest resistence there. One thing in Pyramid's favor is its targeting of a critical application area: database management. And, as Unix increasingly gains a much higher commercial profile in other areas, we expect to see resistance crumbling even at the high-end.

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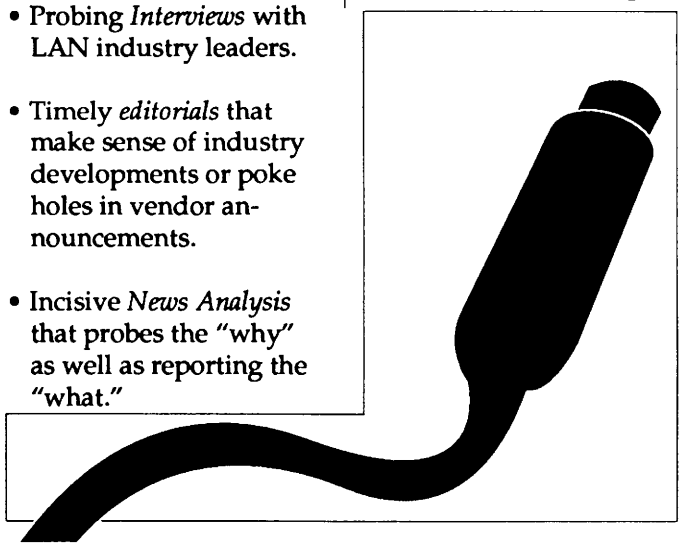

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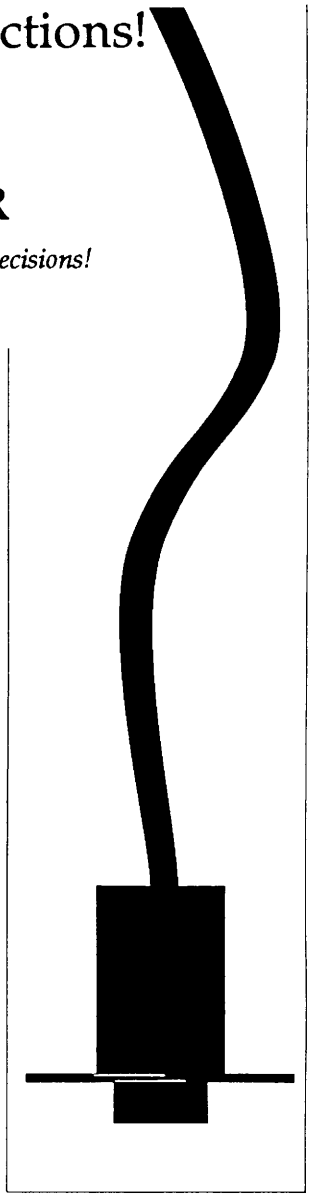

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Alis 2.0

Worth the Wait?

By Ronni T. Marshak

BLOW THE TRUMPETS, crash the cymbals, let merriment ring throughout the land. At long last, Release 2.0 of Alis, Applix's Unix- and DOS-based integrated office system, has arrived. But wait. There is a dark cloud on the horizon. It is, alas, the competition! Is Release 2.0 too late to save the day?

UNEVEN BEGINNINGS. From its introduction in 1984, Alis has been hailed as a superior office system for technical workstations. With its windowing environment, compound document architecture, and networking capabilities, the product gained many admirers—and value-added resellers (VARs)—in its early days. But Alis had many deficiencies in functionality that made it inappropriate for many business applications (see "Unix Office Roundup," Vol. 2, No. 12). And there has not been a major upgrade in the software since its release. To compete in this rapidly changing industry, a four-year-old product should be far beyond Release 2.0.

But enough of reprimands; on to the good news.

IMPRESSIVE IMPROVEMENTS. Alis Release 2.0 is very impressive. According to President John Butler, Applix has been "listening to its customers and making changes based on their feedback." Customer input has led to a myriad of small tweaks to the system. For example, there is now a monospace mode for filling in pre-printed forms or lining up tabular tables; more status information is displayed (such as status of text attributes); and many features have been made easier to use, such as style-guide creation and the "GOTO" function.

Other major enhancements include the following:

- Icon-based user interface option. Users can choose between using the new graphic icons (à la Macintosh) or maintaining the old character-based interface. A single command toggles between the two.
- Improved WYSIWYG. New bit-mapped fonts exactly match 300 dpi laser printers.
- Novice, intermediate, and advanced interface modes.
- Support for color, including color-fill patterns and lines in the graphics editor.
- More fonts, font sizes, and text attributes.
- Remote logon.
- Improved performance. (To be honest, the demo we saw was very slow, but it was on a test system that may have had debugging code on it. We cannot, therefore, evaluate the performance.)
- Access to Alis group services for files created under DOS. This includes importing DOS files from PC Alis cabinets for storage, mailing, etc.; sharing DOS files in shared cabinets; and converting DOS files to Alis files.
- Support for large documents. Large documents can be broken

into smaller divisions, each acting as a separate file but maintaining consecutive numbering of pages, footnotes, table of contents, etc., across the multiple files.

- Generation of footnotes and endnotes, table of contents, and index.
- Mail merge using the Alis database for field variables.
- IBM DCA RFT import/export.
- Scanned image capability. The ability to scan images into the graphics editor as a new object type. Images can be edited with a pixel editor. Graphics objects can be converted to pixel images to allow rotation of text.
- Support for simple graphics on character terminals.
- WKS import into spreadsheet.
- Increased record limit within database from 2,000 to 10,000 records.
- Print form displays. Data-entry forms may now be printed as report formats, including lines and boxes.
- Standing meetings. The calendar can accommodate regularly scheduled meetings.
- Keyword document-retrieval. Keywords may be specified separately or marked within the text of a document.
- Larger number of shared-cabinet users. An increase to 70 users per group from a maximum of 12.
- The ability to mail any Unix file.
- The ability to file phone messages into a database.

The most exciting of the improvements in Alis is the command feature, a superduper global macro facility.

And there are others! As you can see, a lot has been done to improve Alis.

OH BOY! MACROS! But the most exciting of the improvements in Alis is the command feature, a superduper global macro facility. The facility works across all Alis applications, any applications ported to run in an Alis window, and even (if you learn one Basic-like command) across any Unix applications on the host system.

The macros can be as simple or as complex as you would make them. Simple macros are keystroke-captured sequences. You tell the system to start remembering what keys you press, and, when you're done, you tell it to stop. The captured keystrokes create a command document that can be edited, filed, or mailed to other users for their use. Pretty nifty, huh?

Sophisticated users with some programming background can create command files directly using a Basic-like command syntax. The macros are fully programmable, including prompts, conditional testing, branching, nested loops, etc.

Most sophisticated users will probably choose to capture a keystroke sequence and then edit it to eliminate redundancies and include advanced statements like conditional phrases. A novice, or indeed any nonprogramming user, would be hard pressed to edit the macro files. They look like any program—which puts them out of reach for the average user. But as long as you can achieve the result some way and record the entire thing, who needs the command language?

OUR SCENARIO. In the December issue (Vol. 2, No. 12), we ran Alis, among others, through a real-life scenario. It didn't do too well. We recently ran Alis 2.0 through the same scenario with vastly improved results.

The scenario was as follows:

> Four managers are to be scheduled for a meeting in a specific conference room. The meeting will review the performance of each of their sales staffs. Each manager oversees three sales reps. A report noting whether each sales rep reached quota will be delivered to each manager before the meeting. Individual letters are to be generated for all salespeople either congratulating them or castigating them for their performances. A carbon copy of each letter is to be sent via E-mail to the proper manager.

Alis Release 1.17 failed in the task, mostly because it did not include a mail merge facility, so the letters to the sales reps could not be generated. There was also no link between the spreadsheet and database nor any calculated fields within the database, so we had to manually calculate whether quotas had been met or not.

Release 2.0 still does not provide the links or the calculated fields. However, the macro facility allows various ways around the problem.

For sophisticated macro users, the process is simple. A macro was written commanding the spreadsheet to compare its sales information against the quota information in the database. If the result is greater than zero, send letter 1; else, send letter 2. The macro went on to send a copy of each letter to the proper manager via E-mail. Once the macro was written, any user, no matter how green, could apply it.

The keystroke-capture method is a bit more baroque. You had to move the quota information into the spreadsheet, calculate the difference between actual sales and quota, and then move the

resulting information back into the database (after creating a new field to handle the data). It was tedious, but it was captured, and one keystroke (mouse click) could rerun the operation.

The mail merge facility is very simple to use. Within the form letter, you indicate the insertion of a field. The system automatically pulls in the proper syntax; you need only supply the field name. Alis can only merge in variables from the database (as opposed to a quick word processing-generated list of variables). But Alis provides a "quick and dirty" database-creation facility that allows you to enter data without specifying field type and length.

CONCLUSIONS. So Alis has redeemed itself. It performed yeoman service on the scenario. The new enhancements are on target, and the macro facility adds much to both functionality and attractiveness of the product.

Our only concern is whether it's too late. Many users and VARs have gotten tired of waiting for Applix to come out with a new release, and they have gone with other OEMs, mainly Quadratron and Uniplex. And there is newer competition. WordPerfect is offering a complete suite of office applications within Unix, which is fully compatible with the DOS and Mac versions of its word processor. Informix's (formerly Innovative Software's) Smart Series also offers compatibility of its Unix office applications and its DOS products. Applix has a marketing job ahead to recapture some of the market and to ensure that Release 3.0 will be as impressive as 2.0 and much more timely.

Alis 2.0

INTERFACE ISSUES	
Windowing environment	yes
Menus	command line menus
Soft keys	no
Expert/command mode	yes
ELECTRONIC MAIL	
Interface with Unix Mail	yes
Full text editor available	yes
Create multiple mailboxes	ability to create multiple views of the mailbox
Sort messages in mailbox	yes
Circulated delivery (message sent sequentially to a routing list of users)	no
Delegating (routing a message to someone else to handle)	yes, but only to users who give permission
Encrypted messages	no
Forwarding	yes
Message length	"quick message" approximately 500 characters; "regular message" unlimited
Blind carbon copies	yes
Immediate notification of mail	yes
Distribution lists	yes
Aliases (nicknames)	yes
Registered mail (notification that mail has been received)	yes
Certified mail (notification that mail has been opened)	yes
Prioritized mail	may be marked "urgent"
Timed delivery	yes
Message file and recall	yes

Attachments	yes, including compound documents
CALENDARING	
Daily display	yes
Weekly display	yes
Monthly display	yes
Calendar length	perpetual
Meeting scheduler	yes, works across network
Resource calendars (conference rooms, A/V equipment, etc.)	yes
Scheduling groups	yes
Automatic rescheduling of appointments	yes, and regular appointments
Public/private calendars	yes
Copy appointments	yes
Reminders	yes
RECORDS PROCESSING/DATABASE MANAGEMENT	
Relational capability	no
Sort records	yes
Selection criteria	all
Maximum field length	256 characters
Maximum fields per record	30
Calculated fields	no
Date fields	yes
Forms package	print data-entry form, monospacing for pre-printed forms
On-the-fly datafiles (require little preparation and provide default record format)	yes, query by example
Report writer	yes
Create forms in WP	no
Import forms into WP	yes
Interactive screen builder	yes

Use multiple input files	no
ELECTRONIC ROLODEX	
Auto-dialing	no
Sound-alike search	no
Merge data from phone messages into phone list	no, can create database file of phone log
Merge data into calendar	yes
Merge data into WP document	no, phone log file
Phone message form	yes
WORD PROCESSING	
Document windows	up to 20
Multiple columns	yes
Table formats	yes
Outline numbering	up to 6 levels
Index generation	yes
Table of contents generation	yes
Footnotes	yes, auto-numbers and automatically continues long footnote onto next page, also endnotes
Headers/footers	yes
Non-printing notes	no
Security	yes
Mail Merge	yes
Express cursor movement	yes; mouse-supported
Search and replace	30-character string, options for case sensitivity and whole words only, wild cards
Spelling	corrector with word lookup capacity
Hyphenation	automatic, using dictionary
Glossary	yes
Macros	yes

Voice annotation	no
Graphics insertion	yes, also spreadsheet and database
Compound documents	yes
Style sheets	yes, prototype documents
Document assembly	yes
Math	spreadsheet and calculator
Text enhancements	bold, italics, underline, double underline, strikethrough
Types of tabs	decimal, left, centered
Dot leaders	in TOC facility only
Indents	both margins
Revise and redlining	no
Widow/orphan control	yes
Bookmarks	no
Change language (causes spelling corrector to change to foreign dictionary)	6 language dictionaries per document
Super/subscript	yes
Redo/undo	yes
Upper/lowercase conversion	yes
Justified margins	left, center, right, and both
Font control	yes
Typeset output	yes
Miltilingual input	yes
Copy or move text with formats	yes
DCA RFT and FFT conversion	yes

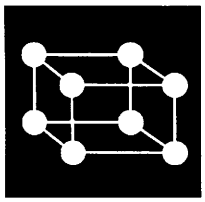
The 1988 Technology Forum:
Distributed Network Computing: Supporting the Cooperative Process

The Program: The advent of distributed network computing wil tap the latent power of PCs, workstations, and minicomputers; its effect on the marketplace will be as radical and profound as that of the PC invasion five years ago. At the 1988 Technology Forum, attendees will learn how key vendors are planning to leverage distributed network computing. In planning future technology directions, you will need to understand the implications of distributed network computing.

The Format. All Office Computing Group forums are characterized by a highly interactive format and provide lively arenas for the exhange of ideas between computer users and industry decision-makers.

Day 1

Laying the Technical Foundations



On the first day of the Technology Forum, speakers will explore the concept of distributed network computing. Vendor representatives will present their interpretations of the basic concept, describing various models for distributed networking. They will also discuss product plans and long-term research and development strategies.

Schedule:

Apollo Computer
Herrick Johnson,
Sr. Product Manager
"The NCS Model"

Digital Equipment Corporation
"DECnet System Services"

IBM
Larry Loucks,
Sr. Technical Staff Member
"IBM's Distributed Services"

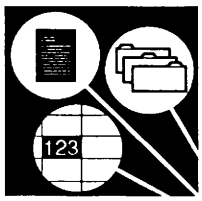
Sun Microsystems
Larry Garlick,
VP, Distributed Systems
"Open Network Computing"

3Com
Robert Bressler,
VP, Corporate Development
"The Role of LANManager in Distributed Computing"

Soft•Switch
Michael D. Zisman,
Chairman
"Mail Enabled Applications and Requirements"

Day 2

Applications within the Distributed Network



The second day of the conference will be devoted to applications which run on distributed networks in both vendor and user communities. Each panel session will consist of four brief presentations revolving around network-based applications currently in use, and each will be followed by a question-and-answer period involving all four speakers.

Schedule:

Authoring & Document Production Systems

Network Technologies
Larry Brilliant,
Chairman
"DocuForum: Co-Authoring Today & Tomorrow"

Context
Ken Carraher,
Director of Engineering
"Technical Documentation: Controlling the Process"

Camex
Richard S. Bucheim,
VP, Technology
"Image Integration in a Distributed Environment"

Distributed Databases

Pyramid Technology
Stephen Tolchin,
VP, Software Development
"How Soon Will We Get There?"

Sybase
"The Client/Server Model"

Relational Technology
Dr. Robert E. McCord,
Project Manager, INGRES/STAR Development
"Beyond Star Topology"

Oracle
Jerry Baker,
Director, Product Line Development
"Building Cross-Vendor Distributed DBMSs"

Computer-Supported Cooperative Work

Lotus Development Corp.
Irene Greif,
Manager, Advanced Technologies
"CSCW on PC LANs: Architectural Issues"

Data General Corporation
Christopher M. Stone,
Manager, Office Systems Software
"Computer-Assisted Meetings"

Digital Equipment Corporation
Skip Walter,
Manager,
Business Office Services & Applications
"Beyond the Boundaries"

The 1988 Technology Forum:
Distributed Network Computing: Supporting the Cooperative Process

Day 3

Experimentation: Piloting for the Future

On the last day of the Forum, representatives of academic and corporate research groups will have an opportunity to share their visions of the future. Speakers will describe pilots of experimental applications which could become product offerings in the next decade and which illustrate the long-term possibilities of distributed network computing.

Schedule:

MIT
Thomas W. Malone,
Associate Professor,
Information Systems
"Beyond Electronic Mail"

Apple Computer
Alan Kay, Apple Fellow
"CSCW in the '90s"

Xerox PARC
John Seeley Brown,
VP, Advanced Research
"Collaborative Tools as Productivity Enhancers"

Carnegie Mellon University
Alfred Spector,
Director,
Information Technology Center
"Camelot: Distributed Transaction Processing"

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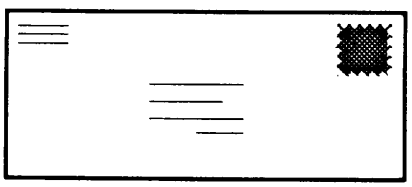

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NEWS ANALYSIS

PRODUCTS • TRENDS • ISSUES • ANALYSIS

• INSIDE •

•UNIFORUM•

UniForum Means Business

UniForum was big business. It also felt like a generalized computer conference rather than the specialty conference it actually was. In fact, if you were beamed onto the show floor without any background information, you would probably have thought that it was an old, albeit small, National Computer Conference (NCC). The exhibitors represented a cross-section of the computer industry. Just a few years ago, executives from these same companies would have laughed at the notion that Unix would become strategically important. No one is laughing anymore.

HAWKING STANDARDS. Signs abounded that the computer industry is beginning to realize that "there's money in them thar' standards." The middle-tier computer vendors, such as Hewlett-Packard (HP), Wang, and Data General (DG), were out in force to show that they are indeed committed to standards in general and Unix in particular. These companies are beginning to realize that, to remain competitive, they will have to move towards standards. We are particularly impressed with HP's approach (See "Hewlett-Packard at UniForum," Page 28).

We are beginning to see that users will accept only so much proprietary gear—and only those systems that happen to carry IBM, DEC, or Apple logos. However, even the current crowd of industry heavyweights—IBM, Digital, and Apple Computer—were acting like born-again Unix devotees. Listening to them, you'd be convinced that Unix has always been a key ingredient in their strategies; they just never bothered to tell anyone.

WHO OWNS UNIX, ANYWAY? If one word could exemplify UniForum, it would be marketing. Few technological leaps were demonstrated at the show. What you heard were positioning statements and heated arguments over exactly which companies will control Unix. At several junctures, it was not clear whether or not battle would break out between warring factions: Would the so called Hamilton Group (see below) declare war on Sun and its ally, AT&T? Would Sun and Apollo ever be friends? For those of you who missed the fun and excitement, let us recap the happenings.

It seems that AT&T is currently beginning work on the latest release of System V (.4). AT&T and Sun intend to blend System V and SunOS, and they are working together to develop the latest release of System V. In addition, the operating system will be developed first for the Scalable Processor Architecture (SPARC) chip that both companies are committed to. And here is where the group of vendors calling itself the Hamilton Group became unglued. These vendors, including Digital and Apollo, informally got together at UniForum to come up with a common list of complaints to present to AT&T. Nicknamed the Hamilton Group (for the street name of the hotel where they met), this group declared that such an alignment would have negative consequences for Unix as a standard operating system. The members, in fact, declared that Sun's and AT&T's intent was to make Unix proprietary. They were upset that Sun would have a technical advantage because it would have access to beta code before any other vendor did. (This is especially bothersome to Apollo.) In addition, they fear that, because the operating system would be written for SPARC, it would not be as efficient on other platforms. In summary, their view is that Unix would become a proprietary operating system written for proprietary hardware. Seeing the brewing storm, AT&T stepped in to try to calm fears. AT&T spokesmen promised that it was not the intent to make System V proprietary and that all vendors would have equal access to Unix.

OPENING WINDOWS. Windowing

software was everywhere at the conference. While X-Window clearly surfaced as the Unix windowing standard, Sun's NeWS is beginning to emerge as another de facto standard. This is indeed being helped by AT&T's promise to include NeWS on top of X-Window as part of the next version of Unix. However, not all parties were thrilled. Apollo loudly voiced its discontent with NeWS, which it considers a proprietary windowing system being made part of Unix. As far as Apollo is concerned, X-Window is the only de facto standard. Even IBM has indicated that it will consider putting Presentation Manager on top of X-Window.

IBM SPEAKS...DIGITAL TALKS. When IBM starts to say the word Unix loudly enough, people listen—at least to find out why. It doesn't take a marketing genius to notice that, as the government begins to require Unix for its requests for proposals (RFPs), even companies the size of IBM will pay attention. (Seventy percent of government RFPs require Unix). Yes, Unix is becoming big business.

IBM made its presence felt at the show. In fact, Big Blue had two booths, one upstairs and one downstairs. The company held a press conference to detail its version of Unix, AIX, for the PS/2 Model 80. It also indicated that it now has Network File System (NFS), Transmission Control Protocol/Internet Protocol (TCP/IP), and X-Window. In one briefing we attended, we heard Bill Lowe, president of Entry Systems Division of IBM, proclaim, "We have it now." Seems that some other computer vendors have been using that same phrase lately. And, speaking of Digital, it had a sizable presence at the show, even though it had no specific announcements to make. To listen to the DEC folks talk, you'd think that Unix is of equal importance to VMS. We see this as a definite change in strategy or, at least, of emphasis.

SUN MARKETS. Sun Microsystems, which had a booth directly across the path from Apollo, made its presence felt strongly. (Sun just posted second-quarter earnings that were double those of the same quarter the previous year.) It held a value-added reseller (VAR) mini-exposition one evening which was so well attended that customers with invitations were turned away. On the other hand, Apollo's hospitality suite the same night was sparsely attended. Just shows what happens when a company is a strong marketeer. It's an interesting comparison. While Apollo has introduced some sophisticated technology, including its Network Computing System (NCS) and its new Unix operating system, it still doesn't understand marketing as well as its rival.

MAKING ALLIANCES. UniForum was a show about alliances. Sun, AT&T, and Amdahl got together to create a standard Unix from the workstation through the mainframe. IBM joined with Locus for its X-Window product. Pyramid joined forces with Apollo, opting for the NCS model.

On the other hand, we didn't notice a lot of new converts to Sun's attempt to make SPARC a hardware standard. Vendors with specialized Reduced Instruction Set Computer (RISC) chips did not seem interested in moving to SPARC.

PROMOTION OF THE YEAR. The winner for the most innovative attention-grabber has to go to Informix/Innovative Systems, with its WingZ product and its nifty demonstration. Participants waited as long as 40 minutes to enter a mock spaceship and watch Leonard Nimoy talk about a new spreadsheet product with nice modeling characteristics. WingZ runs under A/UX. Which brings us to our next topic.

PICKING THE APPLE. Apple Computer certainly made its presence felt at the show. Now that Apple is a convert to Unix, it's hoping to make a big splash. Apple made sure that no one would leave UniForum without hearing its story. John Sculley, as keynote speaker, took a rather unorthodox approach (for a Unix conference, anyway) and showed videos of the Mac user interface. He talked about bringing power to the people. Indeed, it must have been somewhat of a shock to old-time Unix junkies to see Sculley on the podium talking about Macs and Unix.

How well was Apple received into the fold? Pretty well, from all appearances. However, it is clear that Apple still has work to do before its vision of accessible Unix becomes a reality. We ran into one of the few pony-tailed developers at the show who had spent some time with the operating system. His impression was that there were still plenty of bugs to fix. At the same time, he planned to spend a lot of time and energy writing for A/UX. (See "A Bite into Unix," Vol. 3, No.1.)

SIGN OF THE TIMES. Another sign of the times was the appearance of two laptop Unix boxes. Both Grid Systems and Toshiba are betting that Unix will become so popular that it will be carried around.

BACK TO STANDARDS. X/Open was there in force to remind vendors and users alike what is really important: open systems with a Unix underpinning. The organization seems to be gaining momentum as it picks up a variety of new vendor members, including Sun and NCR. In addition, it has wisely added a user council to gain insight into the requirements from the user perspective.

CONCLUSION. There is little doubt after this year's UniForum that Unix is indeed on its way to becoming a critical environment. No longer will Unix be thought of as the operating system for scientific and engineering users; it has gone commercial. Unlike OS/2, which is in its infancy, Unix is well established. Vendors and users alike are beginning to view Unix as a way to implement distributed network computing now—not only when OS/2 comes of age.

This is a turning point for Unix. As more of the leading vendors begin to

standardize on Unix, we will see more Unix applications than ever before. We applaud Hewlett-Packard for moving its NewWave to Unix. We hope this is the beginning of a flood of innovative applications for Unix users.

—J. Hurwitz

Hewlett-Packard at UniForum

This year's UniForum saw substantive announcements from three companies affecting different aspects of the Unix market: Apple, AT&T, and Hewlett-Packard (HP).

For sheer spectacle, it was hard to beat Apple's splashy announcement heralding the shipment of its Unix variant, A/UX. Attendees were stacked six flights up around the atrium in Dallas's Infomart to hear—although "experience" might be a better word—John Sculley's keynote address, complete with a video mock-up of computing in the 21st century.

AT&T spent half of the show talking about Converged Sun/AT&T Unix and Unix System V.4, the other half trying to calm conspiracy theorists worried about Sun/AT&T hegemony.

But Hewlett-Packard, with characteristic self-effacement, made a series of announcements that were, from our perspective, among the most significant in the show.

- First came the announcement of LAN Manager/Unix (LM/X), developed in conjunction with Microsoft. LM/X implements the OS/2 LAN Manager protocols under Unix, enabling Unix boxes to function as servers in PC LANs based upon LAN Manager protocols. (HP also announced that it would be licensing the OS/2 LAN Manager for its OS/2 networking solution—the first major minicomputer vendor to do so.)

- Next, HP announced that it is porting its office productivity software over to run on HP-UX, its Unix platform.

- HP is also implementing its NewWave architecture, released earlier this year for the DOS environment, onto its Unix workstations. Unix boxes will also function as NewWave servers in a networked environment.

NewWave offers an intelligent agent capability to automate tasks (intelligent cross-application macros) as well as an object-oriented architecture.

With these three announcements, HP has not only committed itself to a major application shift to Unix, it is also taking the lead in developing and supporting standard application platform products (LM/X, NewWave) that should benefit the Unix industry as a whole.

LM/X. Unix boxes running LM/X will be able to service requests from workstations running DOS or OS/2. Initially ported to run on 80386 systems using the converged Xenix/Unix System V product (Microsoft Unix System V/386, Release 3.2), LM/X will also be ported over to run on different implementations of Unix. HP-UX is a given, of course. Other OEMs that have announced support for LM/X include Apricot, NCR, Nixdorf, Olivetti, Pyramid, Siemens, Wyse, and the Santa Cruz Operation (SCO).

The first implementation of LM/X will use the Server Message Block (SMB) protocol defined by Microsoft, Intel, and IBM. (SMB is the current foundation for a variety of DOS-based networking products, including IBM's PC LAN, as well as the OS/2 LAN Manager from 3Com and Microsoft.)

LM/X can coexist on the same server with other networking subsystems, such as Network File System (NFS) and Remote File System (RFS). Other implementations of LM/X using a variety of transports (such as TCP/IP and OSI) are in the works. Microsoft has stated that LM/X will be ported to transport-level interfaces such as Berkeley Sockets and System V Transport Level Interface (TLI).

LM/X offers compatibility with the OS/LAN Manager Application Programming Interfaces (APIs), providing interprocess communications among the various systems. Current IPC mechanisms supported include the LAN Manager Named Pipes API and mail slots. Support for other interprocess communications protocols, such as IBM's Advanced Program-to-Program Communications (APPC), is also possible. 3Com has announced it will provide APPC support in its 3+open product, which it is building atop OS/2 LAN Manager.

What Does LM/X Offer Users? If compared with OS/2 as an Intel-only solution, the future of LM/X doesn't appear especially bright. Yes, LM/X will let you run Unix applications concurrently, thus supporting both PC workstations and terminals from the same box. But clearly the OS/2 networking product will be the dominant Intel server solution.

But LM/X offers PC LAN users something they really haven't had before: scalability. Because the Unix server is embracing the PC LAN protocols, the insertion of an LM/X server into an existing network is transparent for the user. Investment in existing LAN solutions will be preserved. This means that you could drop a Pyramid into a LAN to function as a back-end database server for high-performance requirements. (Remember that Microsoft recently announced a Sybase server for the OS/2 network, and that Pyramid also offers Sybase.)

This scalability will not become a broad-based phenomenon. You won't see the majority of LAN users going out to buy a minicomputer to function as a server. But in those cases where a higher-performance specialty server is required (database engines, expert systems servers, etc.), LM/X will provide a splendid solution.

LM/X will also provide larger systems vendors with a way to co-opt existing PC LANs. For example, HP will be able to go out into the field with its LM/X solution and sell to users of 3Com networks who need to grow but don't want to scrap their existing networks in favor of something else.

(Digital obdurately insists that PC LAN users do just that.) This capability will allow vendors to sell not only a higher-performance server solution, but a different networked application solution as well.

PORTING OFFICE TO UNIX. HP is tackling the massive task of porting its key office-systems products over to Unix in three parallel phases.

First, HP will port its Personal Productivity Center applications over to HP-UX. HP has already committed to the use of PCs as the desktop workstation of choice in the office. Once the port is complete, a PC will be able to use an HP-UX 3000 as a server just as well as a 3000 running MPE. HP hasn't decided whether or not to provide a bundled Unix-based office configuration comparable to its Business Solutions package, which offers a Micro 3000 running MPE and the Productivity Center software. We highly recommend that it do so.

Second, HP will provide an X-Window interface for DOS and OS/2 to access Unix applications.

Third comes the porting of NewWave over to the Unix workstations.

NEWWAVE. Announced in 1987 for DOS, NewWave is a strategic architectural enhancement for HP. Built atop industry-standard platforms (DOS and Windows 2.0, OS/2, and Presentation Manager), NewWave offers an open, integrated, and consistent systems environment that is task-oriented rather than application- or tool-oriented. Its attributes include:

- A consistent, graphic interface across all applications
- Support for standards
- Object orientation
- Support for true compound documents with bi-directional hot links
- Instant and seamless integration of applications through the combining of objects
- Integration of existing applications
- Use of existing hardware and systems resources
- Agents or personal assistants

The last item is one of the most exciting attributes of the entire environment. Personal assistants are, in effect, cross-application macros that can perform routine tasks for the end user. NewWave agents already have more intelligence than other macro environments. You can schedule an agent task by time or event. In other words, NewWave can be event driven to take specific, learned actions. This capability provides the basis for procedural automation.

Support for agents and the object orientation is at an architectural level. For DOS, HP created new APIs on top of Windows and an Object Management Facility to handle the manipulation of objects.

Although it can function in a stand-alone environment, NewWave will be at its best in a network. By allowing Unix to function as the foundation for a NewWave server, HP is helping to broaden the market appeal for NewWave and enhancing the applications capability available to users on the Unix side. NewWave on a technical workstation should be a sight to see. (For a detailed write-up of NewWave, see *Office Computing Report*, Vol. 10, No. 12.) —*M. Millikin*

•IBM•

Pushing AIX

IBM wants to make sure the industry knows that it is indeed serious about Unix. Not that the company is hedging its bets on the OS/2 operating system; IBM just wants to be ready with a two-operating-system strategy. Then it can sit back and let the marketplace decide. It's called covering your bases.

In essence, IBM is adding the same functionality and support for the PS/2 Model 80 and for the PC/RT. Along with this support comes a new version of AIX, IBM's Unix. The new version is intended to turn both machines into multiuser systems that can support up to 16 concurrent users. AIX Version 2.2, which will be available in September, includes some utilities not included in previous versions, such as Unix-to-Unix Copy Program (UUCP). This utility allows users to move files between Unix systems that are asynchronously connected—as long as their versions of UUCP are compatible. Other extensions enable tasks to be remotely executed to another AIX-based system. This capability is critical to distributed network computing.

IBM is becoming aware of the growing importance of user-oriented tools. Therefore, the company is emphasizing that it provides a menu-driven interface to many of the PS/2 AIX operating system functions. Other additions include text-formatting features that allow for word processing functions, such as spelling verification. Other enhancements include an applications development kit and support for languages including Fortran, Pascal, and C. A new version of distributed services has added Transmission Control Protocol/Internet Protocol (TCP/IP) support, intended to allow the PS/2 and RTs to share files. These systems can also be connected via Systems Network Architecture (SNA), LU6.2, or Synchronous Data Link Protocol (SDLC). IBM has also licensed Sun's Network File System (NFS).

IBM is being careful to protect its users' investments in DOS PCs by allowing them to participate in RT or PS/2 server-based networks. At the same time, both the RT and PS/2 running AIX can act as file servers for DOS Version 3.0 systems that execute the IBM AIX access for DOS users. IBM has also licensed the DOS Merge product from Locus. This will allow DOS and AIX applications to run under the same system. Interestingly, another Lo-

cus product, called the AIX/RT Personal Computer AT Simulator, allows the RT to run many DOS 3.3 applications without additional hardware. Another AIX/RT program, WHIP (Workstation Host Interface Program), allows an RT or the PS/2 to run in 3270 emulation mode.

IBM is indeed trying to cover all the bases. For the academic community, it has announced 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 Micro-Channel. Because the 6152 is intended for the academic community, its operating system is based on Berkeley Software Distribution (BSD) 4.3 which is popular in research circles.

CONCLUSIONS. IBM is working very hard to convince the industry that Unix is a critical part of its overall strategy. In 1987, it quadrupled the number of personnel supporting AIX. In 1988, the size of the investment in the PS/2 and its OS/2 operating system will be equal to the amount being spent on AIX. The company is also aggressively recruiting technical as well as commercial remarketers, and is trying to smooth the way by porting popular databases like Ingres and Oracle. It is interesting how often IBM is linking the PS/2 and the PC/RT in terms of applications and connectivity. What's more, IBM will implement Systems Application Architecture (SAA) on top of AIX, but there will be some areas of noncompliance. For example, graphics standards in the two environments are different: SAA presumes the Graphical Data Display Manager (GDDM) while the Unix world is leaning towards Programmers Hierarchical Interactive Graphics Standard (PHIGS) and the Graphics Kernel System (GKS) as graphics standards. IBM also distinguishes between Presentation Manager for SAA and X-Window for Unix. However, the company has indicated that it is investigating ways to incorporate at least the look of Presentation Manager under X-Window.

IBM is also pushing its adherence to industry standards. It is trying to show that it is in the vanguard of the Posix movement by offering its conformance tests to the National Bureau of Standards. IBM would like to see this test suite become part of the Posix effort.

All the announcements and activities point to a company in transition. Both OS/2 and Unix are new territories for IBM, and the company is watching industry reactions to both. ◐

—J. Hurwitz

• APOLLO •

Apollo moves to Unix

For years, Apollo stubbornly insisted that its proprietary operating system, Aegis, was superior to Unix, and the company, therefore, would not migrate. Over time, however, Apollo became aware, as did other vendors, of the importance of having a Unix Operating System. Apollo's new product, called Domain/OS, is finally out. Like many of Apollo's efforts, the product has some sophisticated built-in capabilities. For example, Domain/OS supports three environments: System V.3, which is System V Interface Definition (SVID) compliant; BSD 4.3; and Apollo's Ageis operating system. It is not a native Unix port.

Apollo insists that its new operating system is superior to other versions of Unix. "Unix is missing functionality that it needs," notes Barbara Shelhass, marketing manager of Domain Software Products. She points to the fact that, unlike most versions of Unix, Apollo's Domain/OS provides support for bit-mapped graphics. Also, Apollo has incorporated sophisticated network management software. With this operating system, an administrator can look at all printers on the network to see what is queued. The administrator can also change printing priority and even assign files to other printers.

Apollo has taken the concept of a kernel and stripped it down to what it calls a common nucleus, which includes only those functions that are dependent on the architecture. Functions that change with each hardware platform, like device drivers, are outside the nucleus. This concept is intended to make porting easier. Apollo claims some other firsts, also. For example, Domain/OS is the first implementation of global shared libraries in Unix, and it has also implemented dynamic linking. The OS is designed to allow the registry to be distributed across CPUs. To aid in distributed computing, Apollo has implemented a consistent name space and path-name files. Apollo contends that these features make Domain/OS the first "true distributed Unix." In fact, the Network Computing System (NCS) architecture is integrated into the OS design.

CONCLUSION. Apollo has included some impressive characteristics into its new operating system. We are pleased that Apollo has set its sights on System V Unix, rather than concentrating resources on its own operating system, but we would rather have seen Domain/OS without Ageis. However, we applaud the fact that distributed network computing features are even more integral to this operating system than ever before. ◐ —J. Hurwitz

• AT&T •

Promising Open Unix

UniForum was not all fun and games for AT&T. The Unix operating system owner had to smooth a lot of ruffled feathers. In fact, the company spent much of its time and effort at the show explaining how System V.4 would un-

fold and that it would not become a proprietary operating system.

At a combined party and announcement, Jack Scanlon, group vice president of product development for AT&T's Data Systems Group welcomed everyone "to an open Unix and an open bar." He went on to glory in the proliferation of Unix licenses. For example, he noted that the installed base of System V computers exceeded 600,000 in 1987. Of these, 250,000 were shipped during 1987—a 60 percent increase over 1986. Scanlon also noted that today AT&T has 1,700 Unix source licensees compared to 1,100 in 1986. He quoted some industry predictions that Unix shipment would grow at a 30 percent annual rate between now and 1991. He also noted that, while Unix has a 6 percent share of the worldwide system shipment in 1987, it could exceed 20 percent by 1991. Therefore, by 1991, the Unix market could be worth about $21 billion (compared to a value of $5 billion in 1987).

Getting down to business, Scanlon directly addressed the uproar over a potentially closed Unix. "The idea that AT&T would abandon its Unix openness would be pure folly...The only way AT&T can succeed in this marketplace is by a continued open-license policy, and that's just what we intend to do." As a gesture in this direction, AT&T announced that it would form a Unix licensee user group that "will convene periodically to get the latest information on Unix features." The first meeting is scheduled for this summer.

So, what will be in the latest release of System V? As indicated at last year's UniForum, the new version will incorporate Microsoft's Xenix. In addition, it will incorporate Sun Microsystems' SunOS, and BSD 4.2 and 4.3 systems. Other features that will be added include some real-time capabilities; improved system administration (backup and restore, configuration management, software installation and distribution, and a message-handling facility); networking features including NFS, Remote Procedure Call (RPC), and some additional RFS enhancements; and features intended for the international market. It should be no surprise that Release 4.0 will conform to SVID. As with earlier releases, AT&T will develop Release 4.0 for its 3B2 computers first. Next, the company will port to Intel's 80386, and then to Sun's Scalable Processor Architecture (SPARC). Beta versions will be available in 1989.

The open question in the minds of many Unix vendors remains "What's next?" Will AT&T continue to develop Unix on all three platforms? Or will future versions be restricted to development only on SPARC? We'll stay tuned for updates. —*J. Hurwitz*

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