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INSIDE

PRODUCTS • TRENDS • ISSUES • ANALYSIS

Data General's Unix

A New Beginning

By Judith S. Hurwitz

DATA GENERAL (DG) is a company in transition. It is in the process of making the most dramatic shift in direction in its history. The stakes are high. If DG is able to make the move from its proprietary hardware and software to standard hardware and software, it could propel itself into a strong position. But DG is playing catch-up, so it must also develop superior technology to be considered a contender in an increasingly competitive marketplace. To make the challenge even more difficult, DG must find a way to aggressively market its future strategy while assuring its existing customer base. *(continued on page 3)*

• E D I T O R I A L •

Thriving on Chaos

(to borrow a phrase from Tom Peters)

By Judith S. Hurwitz

THERE IS something about the control of Unix (should we say Open Systems?) that brings out the fight in folks. Just when you thought it was safe to think that there would be a single version of Unix, enter "the alliance"—or perhaps we should say Unix, Inc. The Archer Group has rallied around AT&T's System V.4 version of Unix. While the group's official statement says that it will continue to have an open dialogue with OSF (Open Software Foundation), the intent is clear: AT&T and its partners aren't so sure that they want to see an IBM-originated operating system dominate open systems.

The pessimist can bemoan the fact that we were so close to having one standard version of Unix, with OSF and AT&T joining forces. And look what has happened now! Commercial users who were finally convinced of the merits of open systems will be frightened off. The standards movement will again be thrown into chaos.

The optimist might look at things another way. Is chaos such a bad thing? In his popular management text, *Thriving on Chaos*, Tom Peters advocates a method of management that encourages organizations to always prepare for and react to change. He recommends viewing change or chaos as a positive motivator.

This philosophy applies quite well to Unix these days. Yes, the industry is in chaos. But its effect has been to thrust Unix and open systems into the limelight. Who would have thought, only two years ago, that events related to Unix would make headlines in *The Wall Street Journal*?

It was inevitable that AT&T (along with its most ardent supporters) would not relinquish Unix without a fight. AT&T's negotiating position has been that it is willing to turn Unix System V over to OSF with the condition that OSF give up on IBM's AIX as a kernel. OSF is in a tough spot. By agreeing to take over System V and give up AIX, it, in effect, gives credence to the rumor that it selected AIX to induce IBM to join OSF (although certain commercial aspects of the AIX kernel, such as its use of Mach, are several years ahead of System V.4). By insisting that at least parts of AIX must remain in the new operating system, OSF takes the risk that AT&T might just take its marbles and go home.

If these two industry forces cannot come to terms, we will end up with two distinct versions of Unix: the OSF brand and the AT&T System V brand. Which would we like? Our feelings are mixed.

On one hand, a single operating system would be beneficial to users. It would indeed simplify the process of creating software and porting it from one environment to the next. On the other hand, this strength of the single operating system is also its drawback. A single operating system would slide out of the spotlight into the back room. It becomes simply the engine that those dedicated programmers quietly plug away at.

Something positive happens when competitors face off against each other. Chaos in the form of competition turns up the heat on innovation. (What about the notion of dueling operating system gurus?) If OSF and AT&T begin to compete, each might just try to outdo the other to win the hearts and minds of the commercial Unix applications developers.

A split in an industry composed of two operating systems is not untenable. Both operating systems will be Posix compliant. We would also expect that a new industry would emerge to create bridges between the two operating systems.

As much as we like OSF and its goals and objectives, we suspect that, in the end, this two-operating-system scenario will become reality. The dream of one standards organization leading the charge may be too much to hope for in this hotly competitive marketplace. We may have to be content to thrive on chaos.

Nevertheless, we are disturbed that these warring factions might, inadvertently, hurt the standards movement. When confronted with such chaos, a somewhat conservative MIS director might decide to wait until the industry leaders come to their senses. We therefore urge both sides to swallow their pride and remember why open systems are so important. ◐

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•DATA GENERAL•

(continued from page 1)

Under the circumstances, DG cannot simply move to standards. It has to go one step further. DG seems to understand how high the stakes are. Technologically, the company seems to be well positioned. Therefore, it is pushing technology in three directions:

- It is developing a next-generation, object-oriented office system that runs under Unix.
- It has written a sophisticated, commercial version of Unix that supports fully symmetric multiprocessing, real-time functions, and a commercial grade file system.
- It has adopted the Motorola 88000 RISC technology and promises to design a high-end version.

Data General, the aggressive spin-off of Digital Equipment, has always had a reputation as an engineering company. Over the years, it has been able to respond swiftly to technological shifts. To its credit, DG has always understood the advantage of allowing customers the ability to migrate software from one hardware platform to the next. Achieving this was not always easy, but it did provide an early marketing edge. Another early edge for Data General was its understanding of channels of distribution. It experimented with using VARs, OEMs, industrial distributors, and computer stores. However, as the company experienced more and more success, it began to believe that a strong dedicated sales force was most important. Therefore, over time, DG spent fewer resources wooing these alternative channels of distribution. Reductions in marketing channels combined with the increasingly competitive environment have taken their toll. But DG has always been a fighter. Company management has taken stock, is building a stronger base, and is staking its future on open systems.

This will not be an easy transition for DG or for most of the traditional minicomputer companies. Nonproprietary systems must seem almost sacrilegious. Therefore, companies like DG seem a little schizophrenic these days. On the one hand, the sales and marketing folks feel most comfortable with those systems that have brought them to their current market position. They understand their proprietary hardware and software and their traditional way of selling. They are leery of change when they listen to existing customers who are fearful of losing support for their installed systems. On the other hand, potential customers are afraid to install systems for which they may not be able to find software or support. As a result of these two conflicting positions, it is little wonder that the messages coming out of DG and others sound confusing.

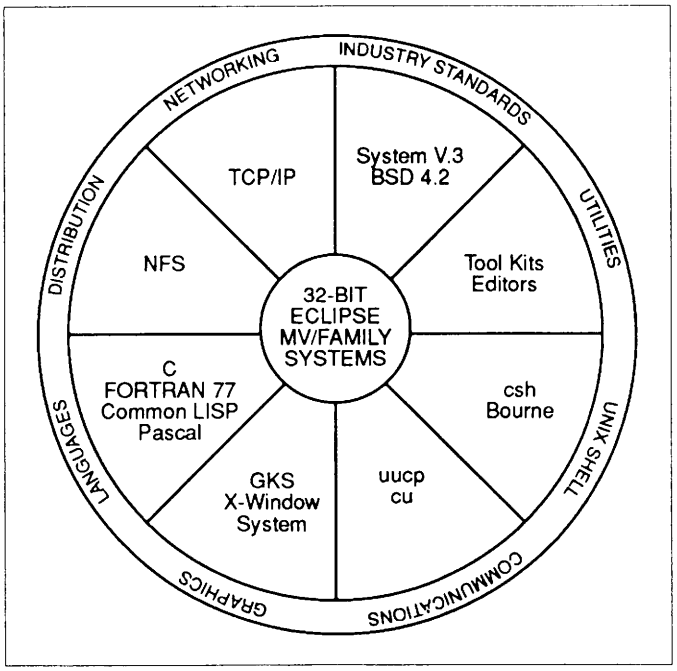
ON THE ROAD TO UNIX. It comes as a surprise to many in the industry to learn that Data General has offered Unix since 1983. This first system was a hosted version of System V.2. In 1985, DG offered its first native implementation based on System V Releases 2.0 and 4.1 of BSD. DG/UX 1.00 also included 4.2 BSD file system and supported TCP/IP. By 1987, DG had added support for Sun's Network File System (NFS) and X-Window. It is fair to say that DG/UX wasn't setting the world on fire. Clearly, DG didn't want this "other" operating system to overshadow its prized operating system, AOS/VS.

But given market realities and slower-than-acceptable growth, DG has decided to embrace standards. How, then, will DG try to regain its former luster? There are four key components to its strategy:

- Develop and market a commercial-grade Unix operating system that will provide value added
- Take advantage of the existing company strengths in networking, service, and support
- Develop and introduce leading-edge Unix-based, object-oriented office software that will attract a new VAR and customer base
- Adopt industry standard hardware that scales from DOS PCs, OS/2 systems, and Intel 386 platforms, to large multiprocessor systems based on the Motorola 88000 RISC processors

The Operating System

DG has been doing a lot of soul-searching lately. Despite its three years of work on its Unix operating system, the company would have to start from scratch if it hoped to be a major player. Its first problem was that its operating system was nothing spe-



The Data General DG/UX operating system.

cial. Second, its proprietary hardware was not powerful or flexible enough to compete with next-generation RISC systems.

When DG developed DG/UX Version 4, it went all out. Taking its traditional engineering approach, it examined the BSD system and decided it could do better. DG software engineers enjoy comparing diagrams of the BSD file system (below) to their own file system. DG's own file system, as shown in the diagram (next page), is radically different.

Two years ago, a prime consideration in designing DG/UX Release 4 was to make it suitable for future, undefined architectures and for multiprocessors systems (such as the MV20000 Model 2, which was still on the drawing board). Scalability was another important requirement. DG has done the job exceedingly well.

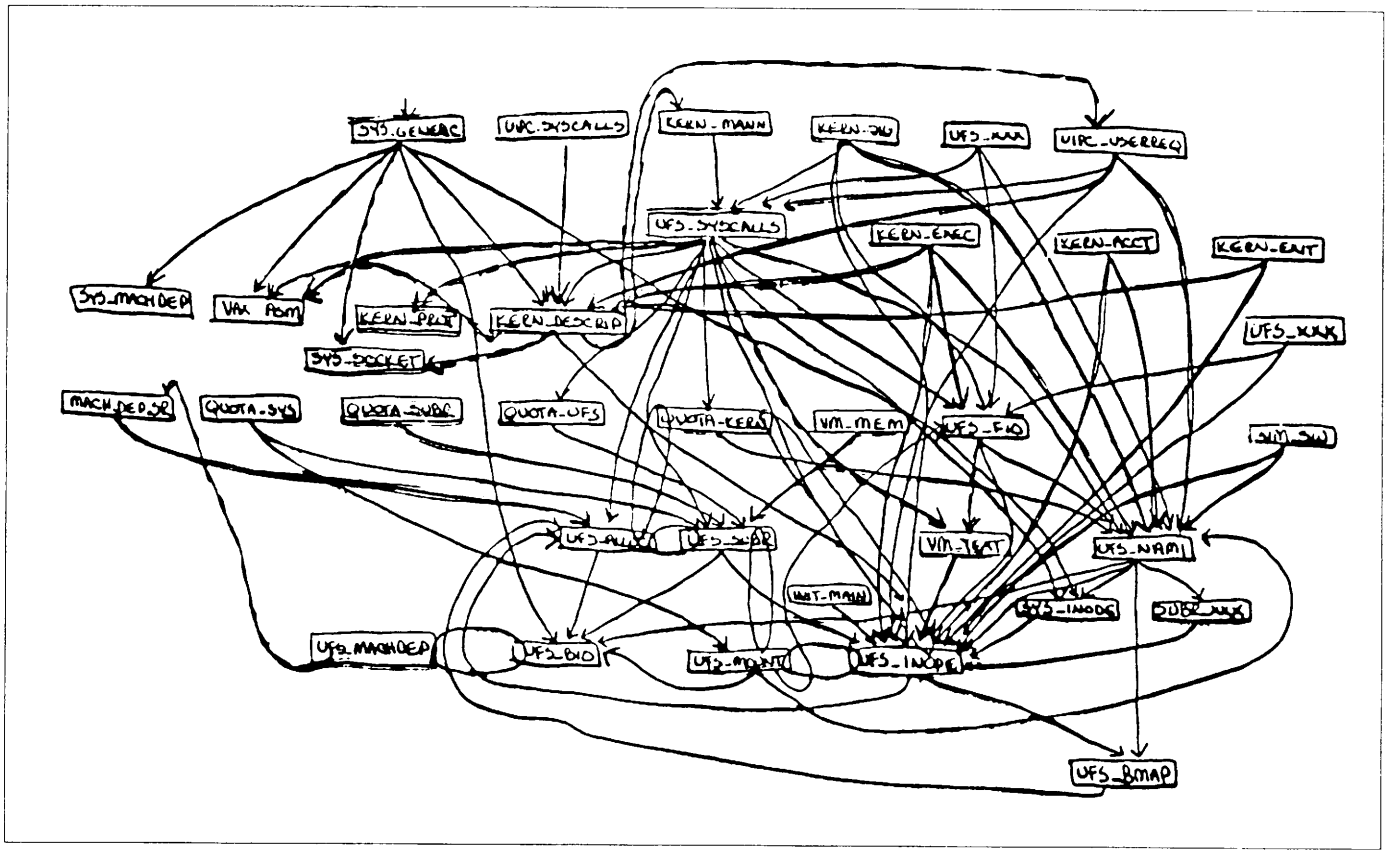
In essence, DG has reengineered the kernel and the filing system. Some of the designing is reminiscent of what IBM has done with AIX. DG has created a modularized version of Unix. A modular operating system is easier to change than one that has many interdependencies. (This was precisely why OSF chose AIX as the base of its future operating system). Therefore, DG could take out the virtual memory manager, for example, and replace it with another without restructuring the kernel. In addition, modularity means that hardware dependencies can be isolated, making porting easier. This will become especially important in the future when software designers begin to port the same software to different-sized RISC processors. A third benefit of modularity is that it provides a framework for future releases of the operating system.

The New Filing System

A critical component of the redesign is the filing system. Its design is based on the managerial concept of discrete control of a set of related functions. Therefore, DG has incorporated a channel manager that controls the actions of a variety of object managers including sockets, pipes, and files. A Virtual File Manager controls various file systems. A special file manager interface allows the kernel to be independent of the specific type of file system. A device driver interface allows the kernel to be independent of the specific type of device (printer, workstation, etc.). DG has also implemented a remote procedure call (RPC/XDR) to transport services that is independent of protocols or specific transport implementation.

FILE SYSTEM DESIGN. Like the rest of the kernel, the file system has been redesigned. The file system includes three enhancements over conventional Unix file systems:

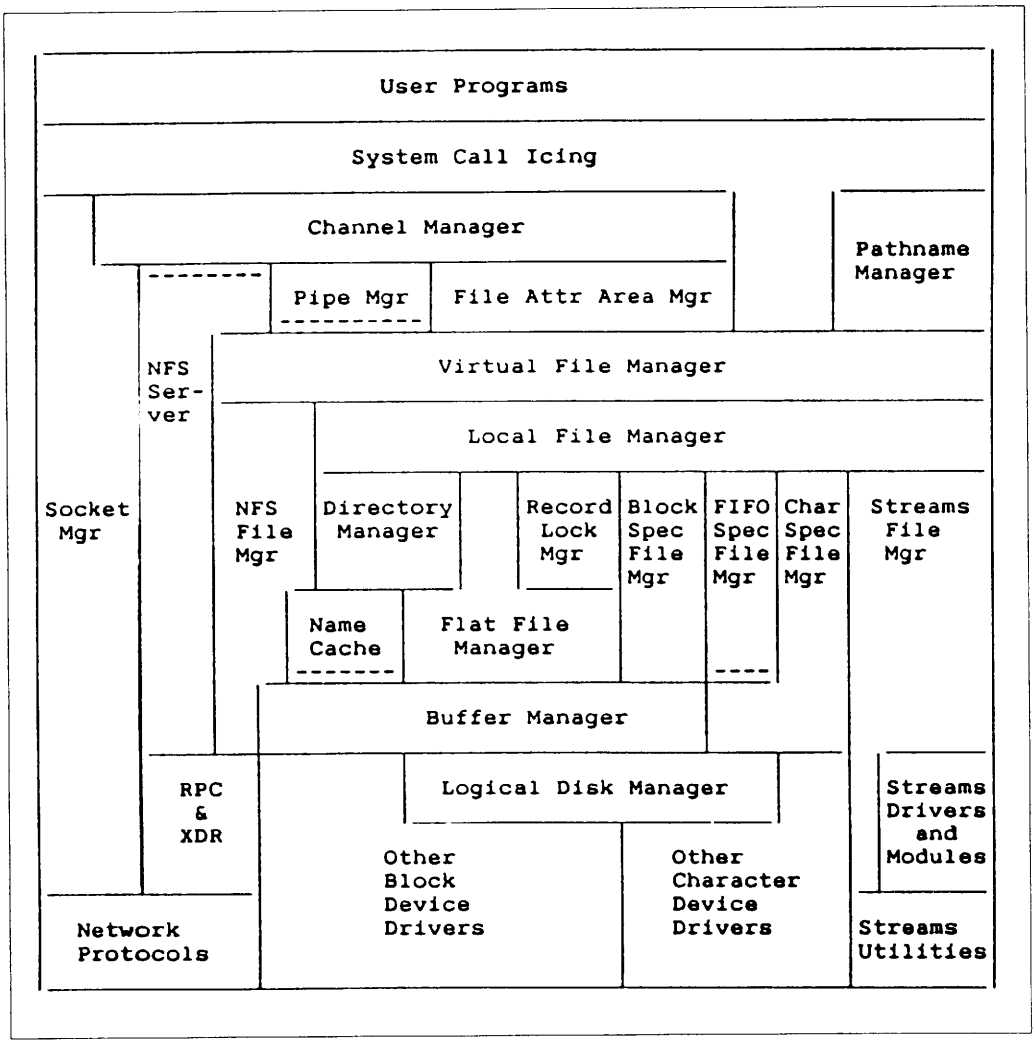
- Symbolic links, which allow a user to create a directory entry that is a pathname of another file and actually serves as an indirect pointer to that file. The symbolic link is part of the BSD.



DG's rendition of BSD 4.2 File System and its dependencies.

- Logical disks, which allows a user to spread files onto multiple physical disks. In traditional Unix operating systems, a file cannot be larger than a physical disk drive. The logical disk overcomes this Unix restriction. This logical disk is a key requirement for implementing distributed network computing (DNC).

- Reliability, which has been improved by replicating crucial file system databases. In a future revision, the kernel will contain support for disk mirroring at the user level. Replication of the system database through disk mirroring is essential to creating a commercial-grade operating system. Replication is also important in a DNC environment, where, for efficient retrieval, data needs to be replicated to several different processors. DG considers this replication capability a prerequisite to providing fault tolerance. Although DG says it is not after the high-volume OLTP market, it is eager to sell this capability for low-volume transaction processing.



DG's redesigned file system.

In addition to these enhancements, system data blocks have been given identification labels to help detect and isolate errors. Dynamic bad-block remapping was implemented to isolate and recover from new media defects. A menu-driven disk management system is intended to make it easier for an administrator to create and manage file systems and to install systems software.

The Re-Engineered Kernel

DG's goals for its redesigned kernel were to add standard Unix functionality, implement support for multiprocessing, ensure applications portability, make the operating system reliable and maintainable, and enhance speed. At the same time, DG felt it had to maintain compatibility with its latest release of DG/UX (Release 3.10). DG engineers also had to support System V, which translates into compliance with AT&T's System V Interface Definition (SVID) and the System V Verification Suite (SVVS, Release 3); include BSD calls (98 percent of these calls); and support Sun's NFS. While DG/UX Release 4.0 is compatible with AT&T's System V.3 and is SVID compliant, it does not implement shared libraries (which are not part of the SVVS test suite). These engineers also took the pledge of allegiance to Posix (hasn't everyone?). While DG/UX 4.0 has most of the specifications of Posix, it lacks a few features that DG will add in subsequent releases.

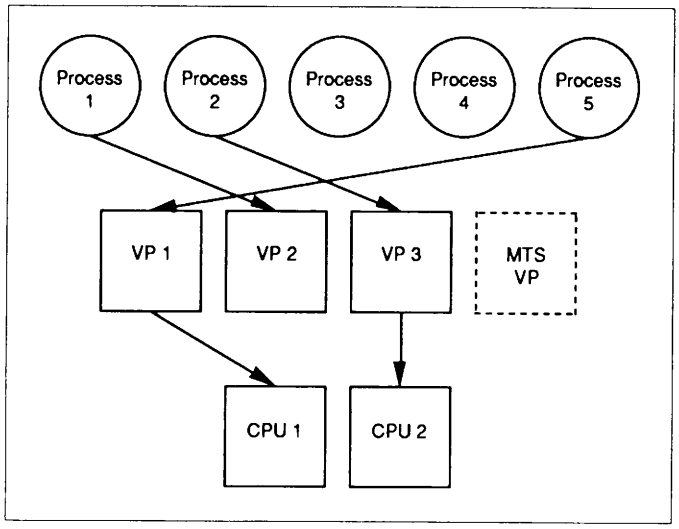
The new kernel includes such features as:

- Isolating machine-dependent code into separate modules.

- Redesigning communications device drivers around the Streams concept. This allows for user-supported protocols.

- Support for fully symmetric N-processor systems.

- Demand-paged memory management on a per page basis.



The Virtual Processor Model.

SYMMETRIC MULTIPROCESSING. To support a scalable, multiprocessor architecture, DG added symmetric multiprocessor support to the kernel. Each physical processor schedules its own tasks from a global queue of eligible tasks. All parts of the kernel can operate on any processor. This is intended to eliminate bottlenecks in the kernel code paths. From a technical perspective, this virtual processor architecture is the most significant element in the redesigned Unix kernel.

Another important technical issue to overcome with multiprocessor systems is I/O. Traditional multiprocessor systems require one processor to control I/O for the others. Therefore, although users have access to more processors and more power, the effectiveness of the system is slowed by the need to go through one of the processors for all incoming and outgoing work. DG had to overcome this problem in order to base its future products solely on multiprocessor implementations. It solved the I/O problem by going to the virtual processor architecture. The virtual processors put a layer of software above the physical processors that takes control of all I/O. An I/O completion interrupt can be processed by any processor, not just the one that initiated the I/O (see illustration above). A two-layer scheduler controls when and how processes gain access to physical resources. The short-term scheduler, called the dispatcher, multiplexes virtual processors onto the system's physical processors. Another scheduler, called the medium-term scheduler, determines the scheduling policies and actually schedules user processes to run virtual processors. These scheduling algorithms incorporate some of the real-time features that need to be added to Unix.

Communications Strategy

DG's communications strategy is three-fold: providing de facto TCP/IP, industry standards, ISO and SNA/SAA support. It is relying on industry standard TCP/IP as the primary communications with other Unix systems, and it also supports NFS. For LANs, DG supports TCP/IP over Ethernet and has implemented the sockets interface. For asynchronous communications, DG supports Unix to Unix Copy (uucp). We also expect support for an SQL interface. Given some of the underpinning in its filing system for DNC, we urge DG to license Apollo's NCS and aggressively implement and market this technology.

X-Window has also been implemented under DG/UX 4.0. With X-Window's strength as a de facto industry standard, could DG have done anything else? DG has implemented X.10.4. It will move to X.11 Release 3 on its 88K platform. We expect that, since the company has become a member of OSF, it will implement whatever user interface this organization puts forth.

As DG's new office platform rolls out, the company will move more aggressively to support the client/server model. DG intends to provide for interconnectivity to DOS, the OS/2 environment, and Presentation Manager. DG has plans to support 386s as servers via Hewlett-Packard's/Microsoft's LM/X (LAN Manager for Unix). To support the increasing cross-systems communications requirements within Unix, DG intends to support key communications standards already implemented under its proprietary operating environment, such as X.400 for message transfer, X.500 for directory services, gateways to PROFS, DISOSS, Facsimile, and Electronic Data Interchange (EDI) for application-to-application communication.

DG has proven over the years that it knows how to implement an impressive communications strategy. For example, it was one of the earliest implementors of X.25 networks. Most recently, it implemented a TCP/IP bridge based on the (Simple Mail Transfer Protocol) between CEO and Unix mail. We would anticipate that, as DG moves into the Unix marketplace, it will create more and more communications bridges between its proprietary systems and its Unix systems. Proprietary system users will thus have a smoother migration path from the old to the new.

Graphics Support

DG is supporting industry-standard GKS (Graphical Kernel Interface) under Unix. In addition, for workstations, DG is supporting X-Window, and planning support for Sun Microsystems NeWS, PHIGS, and CGI.

Migration Strategy

The migration from DG's MV hardware and AOS/VS operating system will be slow and painful. While DG's technical staff is clearly excited and enthusiastic about the move to the new generation of hardware and software, the marketing staff is cautious. Marketing defensively extols the virtues of the MVs, insisting that there's still gold in them thar hills. Marketing personnel are quick to point out that DG is still making some big sales with its proprietary gear. They insist that their existing

VARs are happy enough with MVs. At DG's annual consultants briefing, top management went to considerable lengths to impress upon the consultant community how important the MVs were to the company. It's little wonder that we use the term schizophrenic to describe DG.

It will take many years before DG will be able to move its existing customer base from its proprietary machines to its standards platforms. In the interim, DG hopes to lure a new customer base for its standards-based platform.

How is DG dealing with this dichotomy? In the short term, it will be uncomfortable. The company is making some small moves, such as building porting bridges between the proprietary MVs and standards platforms like the 88K and the 386. DG will also create bridge software between its proprietary CEO and its new Unix office product.

DG intends to provide a rich set of connectivity and interoperability tools to ease the move between AOS/VS and Unix. If the 88K takes off as a key RISC technology, applications suppliers will be lured by the potentially large number of 88K-based systems. 88K Open Consortium members have formed a Binary Compatibility Standard (BCS) Committee, chaired by DG. A draft standard has already gone out for review. DG also supports Posix source level compatibility.

DG is betting its future on RISC technology, a wise move given RISC's increasingly important role in the future of computing.

Opening New Markets

DG's rationale for offering a standards-based platform is similar to that of most traditional minicomputer vendors: the anticipation of finding new customers. The three markets DG is hoping to attract are new VARs, the government, and end-user organizations.

BUILDING THE VAR BASE. One key challenge for DG will be to build its VAR base. Given the fact that all current Unix box suppliers and many traditional minicomputer makers are all targeting VARS, it will be a competitive arena. DG intends to set up a porting center to work with key third-party applications suppliers to encourage as many as possible to move their applications to the new operating system. Eventually, as the 88K-based RISC machines roll out, DG intends to provide loaner systems to applications vendors as well as dial-in support services. While these are valid and necessary moves, DG will be faced with an extremely competitive marketplace. DG's marketing staff intends to target vertical niches in broad segments, such as finance, manufacturing, education, medicine, and, of course, government. The company must realize, however, that these are the same niches that most Unix hardware vendors have already targeted.

THE GOVERNMENT MARKET. Huge U.S. government bids worth billions, like AFCAC 251, have whetted the appetites of most minicomputer vendors. As the government bureaucracy moves to Unix, every vendor will want a Unix option—just in case.

THE END-USER CHALLENGE. If traditional data processing organizations within large companies begin to implement Unix systems, no vendor will be able to afford to offer only proprietary systems. DG anticipates that, because it has met so many of the requirements of traditional data processing organizations with its new Unix kernel and file system, it has the chance to capture a piece of a potentially huge market.

Hardware Strategy

Scalability has become the new watchword around Data General. In the future, we expect that DG will have a good story to tell. It will support systems at every level: the low-end DOS PCs, and the server and workstation level of the Intel 386 processor. DG hopes to lure low-end VARs with a 386 product running 386/ix, which will also support DOS under Unix. It is also promising source-level compatibility with the Motorola 88K.

DG is betting its future on RISC technology, a wise move given RISC's increasingly important role in the future of computing. DG has been aggressive in embracing the Motorola 88K chip technology. The initial implementation, a CMOS version of the 88K, will start at speeds ranging from 14 to 17 MIPS. The first 88K products—including workstations, servers and multiuser systems—will be introduced sometime next year. DG's multiprocessor implementation will support up to 16 processors. In fact, it is working with Motorola to build the future generation of the 88K based on Emitter Coupled Logic (ECL) semiconductor technology that, according to DG, will run at speeds of up to 100 MIPS. DG hopes to have ECL 88K products by 1991. It already has considerable experience implementing ECL technology on its proprietary machines. In fact, DG owns six of the basic patents.

Unix in the Office

Data General understands that it cannot hope to capture a secure place in the Unix market without some value-added. The company realized just how important a piece of software can be once it began selling CEO, its proprietary office system. CEO development had been a grassroots effort, with very little top management support. However, when DG recognized that CEO, once introduced, was responsible for a large number of

Minicomputer Vendors in Transition

THE MINICOMPUTER INDUSTRY is going through a lot of soul-searching these days. The conventional wisdom of four years ago, which dictated tying slick, fast hardware into the best operating system a company could make, has dissolved. Yes, the good old days are gone forever. At the center of this raging storm are the traditional mid-tier computer vendors. These vendors emerged in the heady days of the 1980s, when users began to distribute their computing power away from the mainframe and away from service bureaus.

The potential for automating American industry was so vast that companies like Digital Equipment, Wang, Prime, Datapoint, NCR, Hewlett-Packard, and Data General thrived (there were many others whose names we can't remember anymore). Margins on hardware were high enough (remember the days when these vendors expected 50 or 60 percent profits?) that software was a give-away. Third-party applications software could be purchased, but many organizations preferred to write their own. Turnkey vendors were the key distribution channel for most of the specialized software that niche markets required.

Ironically, the more things change the more they stay the same. We still have at least a hundred minicomputer vendors, many of whom sell through VARs and system integrators. These vendors still sell to industries with the overriding need to distribute their computing outside the central mainframe. So what has changed? In a word: competition. Some vendors in this market segment began to realize that what potential users really cared about was software. It may sound obvious, but, over and over again, sales personnel made or lost a sale on the availability of a certain third-party software package. There are many large companies that have five different minicomputers installed because key packages were available on those platforms. At the same time, these companies increasingly have become frustrated trying to maintain hardware and software support for systems that have passed their prime—not to mention the fact that it is expensive to try to support five different operating systems.

Some of these vendors discovered that, with an industry standard operating system, they could quickly port hundreds of key packages to their hardware platforms. End users liked the idea of being able to move their software from one hardware platform to another without the hardship of hundreds of thousands of hours of software rewrites.

For the myriad of vendors that had already discovered the joys and profits in selling "hot boxes," Unix was a good match (Altos, NCR, Plexus, Arix, etc.). Since these vendors sold on the secondary market, they did not have to worry about the complex service and support issues that traditional minicomputer vendors did. As the upstart minicomputer vendors of the 1980s grew up and became the establishment, the new crop of hot box vendors slowly began to erode some of their traditional bases.

Under these circumstances, it is not surprising that minicomputer vendors have begun to suffer. The rapid and unexpected influx of personal computers into corporations didn't help these vendors, either. Unfortunately, the solution to their woes is not an easy one. On one hand, these vendors have an existing customer base that depends on the proprietary hardware and software. On the other hand, they are beginning to see the handwriting on the wall: The only hope for survival may be to adopt an open systems platform.

MV system sales, the company continued to pour resources into the product. DG will not port CEO to Unix, partly because the code is so tightly connected to the AOS/VS operating system that porting would take too long. More importantly, however, DG management understands that, to secure a place of importance in this competitive market, it has to go at least a step further. Therefore, it is taking a bold and aggressive stance and moving to its next-generation office product.

Object-Oriented Approach to the Office

The next generation of applications will be object oriented, an approach based on the concept of manipulating objects rather than files. This was first put forth (albeit in a simplified structure) in the Xerox Star and was popularized by the Apple Macintosh. A user manipulates an encapsulated icon that represents all the attributes and behaviors of the software that created the file. For example, a word processing document encapsulated as a paper icon understands all the word processing commands. It can also include references to other documents and programs. Therefore, for example, a user could insert a part of a chart or a spreadsheet into that document, the spreadsheet can be "live," and the chart's characteristics can be manipulated. To print a document, the user simply places the document icon on top of the printer icon.

While this type of object orientation has the potential to make complex tasks easier to implement, it also has revolutionary implications for the Unix system. With object orientation, the argument that Unix is a difficult environment for users melts away.

When DG began some two years ago to work on its next-generation office system, it had first thought of porting CEO to

Unix. However, the company began to realize that Unix would be ideal for introducing the notion of an object-oriented office environment that would be completely different from CEO and competing products.

In addition to designing a product that is object oriented, DG also intends to expand the concept of distributed systems approached with CEO and base it on the client/server model exemplified in Apollo's Network Computing System (NCS).

DG envisions an object-oriented database providing services in an integrated system, including software distribution, network management, replication, directory services, system management, and security. The database would also manage objects: the items stored in file cabinets, in-boxes, out-boxes, calendars, and print queues. While an office system based on a relational database is not new, most are built directly on an operating system's file system or associated simple file system. DG's database concept has its own file system that is separate from the underlying Unix file system. The database would be used to ensure consistency across applications. It would also be designed to allow many users in a network to access the same stored objects. Therefore, the object-oriented database mediates these multiple requests and supports locking objects when, for example, a user needs to update and file, and thus locks others out when a file is being edited.

The other reason for creating an object-oriented office environment is flexibility. DG will be able to add new modules and components without rewriting. In many conventional integrated office systems, code is so tightly interwoven that it is impossible to take something out or add something new without rewriting large sections. The object-oriented design will allow DG to add third-party applications that will appear as part of the integrated product. An example of the power of this type of service is that it automatically knows about underlying system services, such as mail directories and calendaring.

As more applications are written that encompass the concept of CSCW, the distributed architecture that DG is implementing will be crucial.

NewWave Support

WORKGROUP SOFTWARE. As more applications are written that encompass the concept of Computer-Supported Cooperative Work (CSCW), or workgroup software, the distributed architecture that DG is implementing will be crucial. CSCW applications are those where several different individuals work jointly on a single project. The software is designed so that all individuals contribute their parts without interfering with anyone else. At the same time, everyone has access to the information that should be shared. An example of a CSCW application would be a strategic plan. In most instances, a project of this magnitude requires input from individuals throughout an organization. Some individuals may write different parts of the plan, while others may be called upon to comment on segments. CSCW software would keep track of who wrote which pieces and who commented on those pieces. This type of software is also designed so that a group can be created on an ad hoc basis. Therefore, as a task force is assembled, a CSCW application can be used to coordinate the work of the new group.

TIMING. DG intends to have the product in the hands of its customers by the first quarter of 1990.

Conclusion: Will the Strategy Work?

Data General is at a crossroads in its 20-year history. The challenges are great—and so are the opportunities. From a technology perspective, DG has done a lot of things right. Its new version of Unix is well conceived and executed. It answers many of the concerns that commercial customers have had about Unix for many years. In addition, the move to an open architecture based on both Intel 386 technology and Motorola 88K RISC technology are sound. At the same time, DG has not neglected the DOS systems and applications already in place in most organizations. It is also looking to the future and making OS/2 a component in its strategy.

DG will be perceived as a prime mover (along with Motorola) of future 88K technology. This is both an opportunity and a risk. If the 88K wins wide industry and user acceptance, DG will be in an excellent position to exploit its leadership position. However, if the 88K becomes an obscure technology, superseded by other RISC processors, DG needs to be open to change. It needs to keep a close watch on Intel's 80960 RISC chip as well as Sun Microsystems' SPARC.

DG has designed an operating system that can be ported to other architectures. Its strategy has also been to use third-party VME-based I/O controllers on its multiuser server systems to minimize costs and marketing. Most of these controllers could be used on other architectures. Therefore, technically, DG is in a good position.

The move to a client/server architecture is wise, given the direction of technology in general. By implementing cooperative applications such as the new Unix office product, DG will be well positioned to be viewed as a leader.

DG's new object-oriented office product may be the key to its success or failure in the Unix market. If the product is as good as it sounds (we haven't yet had a look at it), it will change the marketplace perception of the company. This product embodies most of the attributes that we consider critical for future

office systems. It will have a graphical user interface, will allow VARs and end users to tightly integrate third-party software packages into the environment, and will have relational database underpinnings. This is the stuff that can propel a company into the spotlight. But, of course, timing is everything.

As in any well thought out plan, however, the test is in implementation and marketing. One of DG's problems is, ironically, the source of its strength. Because DG is an engineering-oriented company, it tends to take its technological achievements for granted. For example, although the company has included real-time capabilities in its kernel, it will not market real-time. Why? Because it is not real-time in the pure sense. Ironically, other vendors with similar real-time functionality eagerly market their systems as real-time Unix. Therefore, we see a danger that DG will undermarket its technology. This scenario is analogous to one where a worker silently invents a new methodology that makes his work easier to accomplish, but does not bother to tell his boss about it. He assumes that everyone approaches work the same way.

SELLING UNIX. Now that DG has committed its future to Unix, can the company sell it? Perhaps. DG's best hope for making new sales will be based on the acceptance and success of its Unix office product. However, there are several key ifs: If the product is well designed, if it works without major bugs, and if it comes to market in the time that DG projects, VARs and end users could be drawn to the software and to DG. If, on the other hand, the product delivery slips, other Unix vendors will have similar products to market. Once this happens, DG will no longer have the advantage of being first off the mark.

The success or failure of DG's Unix strategy will rest with sales and marketing. Top management must instill excitement into the sales force, to encourage them to change their focus away from the proprietary systems and onto standards and Unix. We think that this will be the challenge—even more than technology. Once the sales and marketing staffs are firmly behind Unix, then DG will have an easier time convincing its existing and future customers that it is a company that is not only following the industry move towards standards but also sharing in the leadership.

Data General is at the same crossroads of its existence as are many other minicomputer vendors. The writing is on the wall—but making the transition is not always easy. Those vendors that read the signs and do make the transition will at least have the opportunity to be in the race. For DG, the movement to a standards-based platform was inevitable. It can hold onto its proprietary installed base for a few more years, but it has witnessed these customers slowly defecting to safer systems from IBM and Digital. Unix is DG's last hope to continue running with the pack.

•INTERVIEW•

AT&T Comes Out Fighting

Kavner strives to fill James Olsen's desk and Cassoni's shoes.

By Judith S.Hurwitz

In Bob Kavner's New Jersey office is a grand desk. Inside, an inscription notes that this desk belonged to James Olsen, former president of AT&T. When visitors enter his office, Kavner points out his trophy with some pride. Does this verify the rumors that Kavner is the heir apparent to Olsen? He obviously would like us to think so.

We met with Kavner a few weeks ago as the storm of controversy pitted AT&T against the band of renegades of OSF. Kavner took on his role as president of AT&T's Data Systems Division under a cloud. He was the successor to the charismatic Vittorio Cassoni, and he was put in the position to solve one of the young data systems division's biggest challenges: the control of Unix. It didn't help that he was perceived as a newcomer, a beancounter. The snickering could be heard all the way to Sun Microsystems' California headquarters.

Kavner is an impressive man. He is low key, yet shows a determination and, yes, some vision. He is determined to turn AT&T's computer business around and make it into a profit center for the communications giant. This won't be an easy achievement, given the state of AT&T's business.

Despite rumors that AT&T plans to get out of the computer business, Kavner is adamant that this is the furthest thing from his mind. He did admit that if there were a way that he could attain his goals of systems integration and leveraging the telephone network without having a computer business, he would do it in a minute, but he sees no alternative. So it looks as if AT&T will continue to try to make a go of its computer business. How does Kavner characterize the computer business? As an engine of growth and a "good cultural infusion." Kavner confesses that staying in the computer business and, more importantly, thriving in it, will not be easy for AT&T. "Our management has been humbled. It has been four rough years," he says.

He also concedes that "the PR has been more highly developed than our capabilities." Historically, Kavner perceives, AT&T made some classic mistakes. "We went after anything that seemed like competition," he says, and thus company resources were spread too thin. So what are Kavner's next steps? His first challenge will be to convince a troubled company that "the safety net is gone" and then turn up the heat. "At first, it was frightening. Then we became driven," says Kavner about his management team.

To gain some successes, Kavner intends to concentrate on certain vertical industries "where our successes have been." While this does not have the ambitious tones of Cassoni's grand vision for AT&T, Kavner is a pragmatist. "We tried to run. Now, I'm going to walk and give focus to the business."

Kavner intends to leverage what he sees as the company's strength: brand recognition, which "is no small thing." However, he concedes, "We hurt the brand name." To gain back some of the lost luster, Kavner will emphasize service and support, Unix extensions, development tools, graphical user interface, and systems integration.

Unfortunately, Kavner has chosen the same areas of differentiation that every other vendor trying to gain market share has addressed. In addition, these are areas where AT&T has not been especially successful in the past.

Kavner's intent is to take advantage of AT&T's reputation for computer networks. How will he accomplish this? He looks at two areas, first, the value-added that AT&T could gain when ISDN (Integrated Systems Data Network) becomes widely available.

Kavner is pinning a lot of hopes on ISDN. Once these high-bandwidth systems are implemented, they will allow for high-speed transmission of voice, image, and data. AT&T, therefore, plans to spend vast resources developing applications that leverage the potential for image. (Remember the picture phone?) While other companies are also planning to build future strength from the growing importance of image, Kavner thinks

he has a better idea. He plans to approach the corporate CIO with what he needs: solutions. Kavner is looking to two emerging technologies, neural networking and speech recognition, as important AT&T strengths that he will leverage in the future. "We've got to be seen as unique and an innovator," Kavner says. At the same time, he is realistic. He understands that he needs to purchase outside technology, rather than make everything himself. Again, these are good points, but AT&T's competitors will also approach the same CIO with the same applications and technology.

The first great test of Kavner's mettle will be how well he is able to resolve the impasse between AT&T (and the newly formed consortium of supporters) and OSF.

If Kavner succeeds in turning AT&T around, he will indeed be one of the first of a new breed of computer industry managers. Traditionally, top management has risen from technical ranks. Kavner's pragmatism and business savvy may be typical of the new generation of managers. He is a leader worth watching.

The first great test of Kavner's mettle will be how well he is able to resolve the impasse between AT&T (and the newly formed consortium of supporters) and OSF. Kavner has entered into talks from a pragmatic perspective. He concedes that AT&T "blew it" relative to control of System V, and he is ready to spin the operating system business into a separate business unit. While neither of these moves requires genius, both are, at least, based on reality.

Kavner seems encouraged by the professionalism and goals of OSF. In fact, we believe that if Kavner had been in charge when the Hamilton Group was meeting with AT&T demanding that it put System V in the public domain, OSF would not have formed. The idea of a standard version of Unix based on a non-AT&T base would never have gotten off the drawing board. But, given the string of events, Kavner was stuck dealing with the situation. OSF did form, and a kernel based on an IBM design was selected as the kernel base.

Ironically, the tables have been turned. Now, we hear AT&T bemoaning the fact that IBM's sales force is touting AIX as the industry standard and thus a strategic advantage. In fact, AT&T's battle cry has become that IBM will have a six-month head start over the rest of the industry since it owns AIX (if this argument worked once, why not again?)

Therefore, AT&T has entered into negotiations with OSF with some preconceived notions that have made resolution difficult. First, Kavner, as chief negotiator, wants OSF to switch from an AIX to a System V.4 kernel. Kavner feels he is on solid ground because he had Bill Joy, System V.4 guru, review AIX Version 3. Joy's assessment was extremely negative. However, the point Kavner is missing is that Joy has a lot of his reputation and his pride wrapped up in the work he had done on operating systems over the past 10 years. To concede that IBM's work was superior would have been a very difficult admission. Second, IBM's kernel is geared to commercial users' needs. Traditional Unix operating systems have never possessed enough commercial characteristics to win wide acceptance. These commercial characteristics may have appeared inelegant to Joy.

Another sticking point that may be dooming negotiations is that Kavner is not ready to concede that AT&T will no longer control Unix. AT&T is now being buoyed up by the group of computer vendors that see themselves as protectors of the order. This initial group of 18 vendors includes Unisys, Unisoft, Amdahl, Control Data Corporation, Fujitsu, Gould, HCR, ICL, Informix, Intel, Lachman Associates, Micro Focus, Motorola, NCR, Olivetti, Prime, Sun Microsystems, and Toshiba. Ironically, a few of these vendors are also members of OSF. Why are these vendors aligning themselves with AT&T at this juncture? They have all staked their products and reputations on System V, and they are wary about what would happen to their investment if AT&T's System V suddenly lost its market position. They are also nervous about OSF's ability to create a viable new operating system within the next two years. Even if System V isn't perfect, it is a known quantity.

In the press release announcing the formation of an industry association based on support of System V, there was a quote from Cassoni, now managing director of Olivetti: "We must not forget that it is proprietary systems that are the real competitors to Unix systems." His statement can be interpreted in several ways, whether or not he intended to be ambiguous. If no compromise between OSF and AT&T is reached, then this innocent statement may ring truer than Cassoni intended.

Kavner has taken the reins of AT&T at a crucial point. He has made many excellent moves, including opening the dialogue with System V vendors and negotiations with OSF. But his next moves will be a test of just how much of a leader he is.

Can It Work? Kavner's ambitions are as great as his challenges. No matter what happens between AT&T and OSF, the fact remains that AT&T's computer business is not in good shape. We think it would be a big mistake for AT&T to continue funneling vast amounts of money into its own operating system when it needs to concentrate on becoming competitive. Ironically, it is in AT&T's and Kavner's best interest to join forces with OSF. Whether AT&T continues to develop System V with its group of friends or moves to OSF as a base, the story will be the same. An operating system alone is not enough to give AT&T its differentiation in the marketplace.

Kavner's greatest challenge will be to turn AT&T around. AT&T's culture needs to change dramatically if it is to become competitive in this world of standards. Coming up with some good ideas about leveraging technology will not be enough; most major vendors intend to do the same thing. If Kavner is to earn Olsen's title and not just his desk, he will have to prove to be not only pragmatic but visionary.

NEWS ANALYSIS

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HP/Microsoft Brings Presentation Manager to Unix

The idea of having one user interface across platforms is becoming attractive to both users and vendors. Hewlett-Packard has taken this concept a step further by announcing the availability of Presentation Manager for Unix. But PM/X is just the first step in this staged introduction that also calls for the underpinnings of NewWave to be ported to Unix. With the full plan to be unleashed over the next several years, the power for creating a graphical, distributed environment under X-Window has the potential to change the way Unix applications act.

Porting Presentation Manager and NewWave to Unix is a further sign that Unix may actually become commercial. It will also strengthen the links between the DOS environment, with its MS-Windows user interface and version of NewWave, and OS/2, with its Presentation Manager interface and its version of NewWave.

Hewlett-Packard's long-term plans are ambitious and difficult to implement. In order to get product to market fast, it is beginning by porting the look and feel of Presentation Manager to Unix running under X-Window. This is relatively easy to achieve because of the characteristics of X-Window. However, this implementation is limited. It will only enable users to exchange information between X-Window applications; it cannot transcend environments. HP promises to make the ability to transcend environments available by mid-1989.

The second phase of HP's plan is more difficult. It calls for HP and Microsoft to develop a PM Applications Programming Interface (API) called PM/X. This API allows applications written for Presentation Manager to be ported from OS/2 to Unix by simply recompiling the applications code. Unlike Phase 1, where PM is tied directly to X-Window, the new PM/X API is independent. The downside of this is that these applications can only run locally. But, if developers simply want a fast way to port OS/2 applications to Unix, PM/X will solve the problem nicely.

Perhaps the most interesting and significant aspect of PM/X is that HP and Microsoft are rewriting PM code from assembler to C. Once the code is written in C, an independent software vendor can easily implement PM/X across a large number of operating systems. It could, for example, be made to run under Digital's VMS, Wang's VS, or any other proprietary operating system.

NEWWAVE: UNIX STYLE. In addition to PM/X, HP is porting its NewWave environment to Unix. NewWave embodies the notion of procedural automation, object orientation, and distributed processing. This technology can be used to proceduralize routine business tasks. For example, it could allow a manager to review the revenue production of sales personnel and automatically generate electronic mail messages when exceptions appeared in the system. Using object orientation in this context, users can complete tasks by manipulating icons rather than typing complex commands. In the next few years, HP will be developing the technology that will allow NewWave objects to be distributed throughout a network through a distributed Object Management Facility (OMF).

MOVING TO A COMMON API. At present, HP and Microsoft construct a single API that can run distributed applications in a variety of environments: X-Window for Unix, OS/2 under PM (and, of course, SAA), DOS running MS-Windows, and any other key proprietary operating system, such as Digital VMS.

The combination of Presentation Manager and NewWave are indicative

of the new breed of interfaces and applications environments that will be cropping up in Unix over the next few years. The potential that these next generation applications and graphical user interfaces provide the end user is exciting. Distributed versions of PM/X and NewWave have the potential to revolutionize the way we use technology in the workplace. —*J. Hurwitz*

•X TERMINALS•

New Options for Distributed Graphics

The combination of the X-Window standard and Distributed Network Computing (DNC) is about to bring forth a new class of desktop stations: the X Terminals. These new inexpensive terminals will enable more and more users to play in a world which has up to now been limited to those with access to high-powered technical workstations. At the same time, they will allow developers of X-Window-based applications to address a potentially much wider market.

Two companies that we are aware of, Visual Technologies and Acer Counterpoint, have recently announced "terminals" that include X Server and networking software in Read-Only Memory (ROM). Both enable the user to run an X-compliant application on a processor anywhere on the network, providing the X server component of that application. Although they differ in some specifics, both allow the user to take advantage of distributed network applications with a much less expensive box on the desk.

X + Distributed Network Computing (DNC). One of the keys to this new type of product is the growing acceptance of the X-Window distributed graphics standard. "X" (as it is fondly termed) is a standard for separating an application into its processing and display functions. The processing function, which in a networked environment does not necessarily run on the user's workstation, is called the Client, while the user interface and graphics management function that sits on the user's workstation is called the Server. In this reverse client/server architecture, a client application running on any processor in the network can call on the server on a particular workstation to handle the user interface function. The X Server also allows users to run multiple applications simultaneously, displaying them in overlapping windows.

Distributed Network Computing is an architecture which allows applications to run on a number of discrete processors on the network. Examples of multivendor DNC standards include Apollo's Network Computing System (NCS) and Sun's Network File System (NFS). The client/server model, with the server handling network resources (including file and compute services) and the client handling user interface, is central to DNC.

The combination of DNC and the X architecture requires only two areas of processing to take place on the workstation: X services (user interface) and network connectivity. These are precisely the capabilities of the new X terminals.

X DISPLAY STATION. Visual Technologies claims to be the first to introduce an X terminal, called the 640 X Display Station (640 XDS). The 640 XDS implements X Version 11.2 and runs on any system running Ethernet with TCP/IP protocols. It has a 1024x800 bit-mapped display on its standard 14" monochrome monitor. The 640 XDS runs on a Motorola 68000, with 1MB RAM, expandable to 4MB. It also includes a keyboard, optical mouse, and serial port (for VT 100 compatibility).

The Visual 640 XDS is currently shipping in small numbers. It is list priced at $1,995, with quantity shipments due in January. The company is currently negotiating a large OEM agreement with a major Japanese computer company.

We expect that Visual will expand its XDS line by adding alternate networking capabilities, more memory, larger screens, and color.

ENTER THE XEBRA. Acer Counterpoint (the result of the acquisition of Counterpoint Computers, a vendor of Unix multiprocessing systems, by Acer Incorporated, the Taiwanese computer company) has followed with the announcement of its Xebra family of X terminals. At the low end, the Xebra 100 runs on a 10 MHz Intel 8086, with 640KB RAM and 512KB ROM, which contains the X server and networking software. It supports both thin and thick Ethernet running TCP/IP protocols. The standard 14" monochrome monitor has a resolution of 640x480. It also includes a keyboard, mouse, and serial port (for VT 100 compatibility).

Acer Counterpoint is initially directing the Xebra series toward the OEM market. The Xebra 100 is priced at $995 in small OEM quantities. As with the Visual XDS line, the Xebra series will be expanded to include more memory, larger screens, and color.

THE X TERMINAL IMPACT. As X-based applications begin to proliferate, we will see a rapidly expanding market for X terminals, which will have significant impact in two areas. The first area to feel the effects will be current workstation installations where X terminals allow the extending of X applications, which would otherwise run only on expensive workstations, to a new set of users who can gain entry to this world at one tenth of the price. A good example of this might be brokerage or commodities traders who sit in front of multiple-windowed screens that track minute-to-minute changes in the markets. This type of application requires no local processing other than window management and communications facilities, both provided by an X terminal type of station. While we do not expect many of those currently using workstations to trade them in for X

terminals, we do expect the application to be utilized by more and more users who cannot justify the workstation investment.

The second area that will be affected is a whole set of terminal-based applications that have not yet penetrated the workstation environment. Specific applications include office automation (OA) packages, relational databases, and desktop publishing. Lowered entry costs and greater numbers of users with the ability to access distributed applications will bring more of these types of applications to the distributed environment, particularly (we believe) those OA applications that require most or all of an organization's users to participate.

As an additional result of the increased proliferation of X users via the X terminals, we expect developers will have greater and greater incentive to develop new X-based distributed applications.

QUESTIONS? The introduction of the X-terminal concept raises two questions. First, when will a critical mass of X applications be reached that will extend the advantages of X terminals beyond particular niches (such as the commodity trader example)? Second are the questions that relate to performance: How will the relatively unsophisticated 68000 and 8086 processors perform in their X Server and networking functions? How different will the response in a distributed application appear to the X terminal user as opposed to the technical workstation user? ◐

—D. Marshak

•ORACLE•

Oracle Adds Accounting Solutions

Oracle Corporation recently ventured into new territory with its announcement of Oracle Financials, a suite of accounting application software packages based on the Oracle relational database management system (RDBMS). According to Jeffrey Walker, senior vice president and chief financial officer (CFO) for Oracle, Oracle Financials is the first step in the company's strategy to move beyond providing application development tools and to head in the direction of offering the customer full business solutions. A precursor of this strategy was the establishment of Oracle's consulting services group (Oracle Complex Systems Group).

Another interesting facet of this announcement is the high-profile involvement of Walker. As the company's CFO, he is both the chief user and chief architect of the product. Walker has also played a major role in introducing Oracle Financials. Prior to joining Oracle three years ago, he was founder and chief executive of Walker Interactive Products, a financial applications software company.

COMPONENTS. Oracle Financials is a family of four products: Oracle General Ledger, Oracle Accounts Payable, Oracle Purchasing, and Oracle Assets. They can be installed separately or used together as an integrated system. (The Oracle RDBMS must also be installed on the system.) Current platforms for Oracle Financials include Digital's VAX/VMS and Sequent under Unix (Sequent Computer Systems, Incorporated was the first outside beta test site for the general ledger module). Oracle plans to port these products to other platforms on which the Oracle RDBMS runs. One exception will be DOS. Since these products require a multitasking operating environment, Oracle has no plans to move the full set to the PC. However, the front-end processing pieces will be distributed to DOS so that PCs can participate in a distributed accounting environment. The company has not yet done any testing on an OS/2 network.

OBJECTIVES. Oracle Financials is a response to customer demands for applications software that supports the growing trend toward decentralized management structures and distributed processing, and that runs across the wide range of heterogeneous hardware platforms that are often found in individual business units within a large organization. It is also a response to the need for flexible, customizable accounting software.

Oracle has designed Oracle Financials to be portable, functionally rich, and easy to learn. Oracle Financials was developed using the company's own CASE tools, with some parts written in C. The company has been using Oracle Financials internally for over a year as a replacement for a homegrown accounting system that could not keep up with the company's rate of growth and change.

Ease of Use. Oracle Financials offers the user a choice of two interface styles: Lotus-like ring menus or more graphical Macintosh-like menus. The products also make use of on-line help, pop-up menus and windows, and power options for sophisticated users, including macros. Walker also stresses that users do not need to read the documentation in order to get up and running.

Customization. An important aspect of a packaged accounting system is the ability for the user to customize the system to meet the organization's specific needs and requirements. The user does this in Oracle Financials without programming. The customization process allows users to define their own database definitions, menus, security rules, on-line help text, and error messages.

FINANCIAL UPDATE. And speaking of financials, Oracle continues to grow like Topsy. Revenues for the first quarter of fiscal 1989 (period ending August 31) were $90.6 million, an increase of 120 percent over the same quarter last year. Net income was up 124 percent to $7.1 million. ◐

—J. Davis

•APPLIX•

The Oracle Connection

Applix Incorporated finally got its hands on a relational database management system (RDBMS) for Alis, its Unix office system. In September, Applix announced an interface that lets users run Oracle database queries via SQL from within the Alis environment.

We've been waiting for a move like this from Applix. What with its compound documents, networking, and slick windowing capabilities, Alis has always made a good first impression, even if its functionality was disappointing. But Applix gave the product a real functional boost last spring with Release 2.0 (see Vol. 11, No. 3). The Oracle connection is another boon for Alis—every good office system should support a good relational database, and Oracle is one of the more widely used packages.

You query the database from within the Alis environment, but the queries themselves take place in the background, so you can work with any Alis application while they're going on. Alis lets you know when the search is finished and asks you what you want to do with the results: paste them into a spreadsheet or text file, or store them as an OS file. Alis also lets you view and edit query results from an open window before you import them, but at that point you're working with dead text. You can't open a live window into the Oracle database, which is a capability we'd like to see.

The joint venture comes with a joint marketing agreement between Applix and Oracle that provides for cooperative promotions and customer referrals. This, too, should benefit Applix. Oracle has been successful in its sales and marketing. Applix has yet to prove its ability in this area.

—L. Brown

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