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INSIDE

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Guide to Open Systems

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Can Digital Become an Open Software Company?

By Judith S. Hurwitz

IN BRIEF: We believe that Digital Equipment Corporation is at a crossroads. To thrive, it must first demonstrate the benefits of its standards-based infrastructure. Next, it has to provide a visual front end to that infrastructure. Digital has to stop acting like an engineering company and start focusing on marketing open systems solutions and applications. Ironically, Digital has more of the components of an open infrastructure than most of its competitors. However, until Digital learns to market its NAS infrastructure in terms customers can understand, the company's technology will be neither appreciated nor used.

Report begins on page 3.

Open Systems: Confusion Abounds

Customers and Suppliers Need an Active Dialogue

JUST A YEAR AGO, users across the globe breathed sighs of relief that, at last, someone had listened to their concerns. Open systems answered so many problems. After all, what users really want is freedom of choice so they won't be locked into one implementation of technology. To the credit of many quick marketing managers, open systems became the battle cry of any computer vendor worth its hype.

But when users started looking beyond the overblown marketing messages, they began to realize that there was no clear definition of open systems. Now reality is setting in, and everyone involved is feeling uncomfortable. Users are becoming increasingly angry at the vendors they once trusted to provide them with the "right" technology when they needed it. Vendors are trying to make them happy by vowing to conform to any standard they come across. But these systems suppliers are increasingly worried by the prospect of commodity-based computing, where profits are scarce.

It is little wonder that vendors are increasingly unhappy. At the same time that they are promising standards-based systems, they just happen to notice that IBM has sold more than $14 billion worth of AS/400 systems—and they're not open at all! That makes IBM's AS/400 business alone one of the biggest computer companies in the world.

Why is the AS/400 so popular? Not because of its inherent technical capabilities, but because IBM aggressively courted as many vertical application developers as it could. The result is that the AS/400 fills a key user requirement: It provides a solid engine for critically needed applications that solve business problems.

Does this mean that vendors should abandon their quest for "open systems" and duplicate what IBM has done? Yes and no. Yes, system suppliers need to be just as aggressive about getting key applications onto their systems as IBM has been with the AS/400. No, vendors need not assume that a proprietary system technology is the answer. (A footnote: Even AS/400 customers are strongly encouraging IBM to make the AS/400 more "open." This won't be easy, given the fact that the AS/400 operating system and database are embedded in the hardware.)

The lack of packaged solutions makes it especially hard for smaller organizations to move strategically to open systems. In contrast, large organizations can usually afford to write their own applications and customize an open systems environment. But even then, some special considerations are required. Foremost is that management must require programmers to write disciplined code—that is, programs that do not use "cleaver" programming techniques that tie those programs to a hardware architecture, an operating system, or an underlying application (most notably, database).

At this juncture of the open systems movement there is great danger—not from outside forces, like OS/2 or Microsoft or the AS/400, but from within. The systems suppliers must make sure that the applications their customers need to run their businesses—big and small—are available. They must make sure that, when they market concepts like "open systems," they define their terms carefully. Vendors must work more closely than ever before with their customers to understand their requirements and to help them to cost-justify the move to open systems.

The customers of open technology have a responsibility too. They no longer have the luxury of being passive. They must define for themselves how open systems will benefit them and work with their suppliers to make these benefits concrete. They must be proactive in explaining their business requirements.

Only through this active dialogue will open systems become a mechanism that protects customers of technology from the inevitability of change.

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Can Digital Become an Open Software Company?

An Open Systems Strategy Unfolds

Digital is at a critical juncture in its 34-year history. Digital's strength has always been its identity as an engineering company that understands the importance of infrastructure and strong networking underpinnings. Over the years, Digital proved that it could take the bold moves needed to move forward. For example, in the late 1970s, it discontinued its DEC10 and DEC20 mainframe systems in order to forge a single computing architecture that could carry the company into the next decade. The VAX became the cornerstone of Digital's architecture and, for many years, provided a consistent, scalable platform to which software developers and users flocked.

SUCCESS FACTORS. Historically, networking and infrastructure have been success factors for Digital. DECnet, and its ability to cluster systems efficiently, offered local networking strength unmatched in the industry. Digital also proved that it understood the importance of software infrastructures by implementing its All-In-1 office platform as a framework for integrating its vertical business applications.

Can Digital Do It Again?

But Digital seems to have forgotten the lesson of the DEC10 and 20. Instead, it hugs architectural trees and refuses to understand that it has to leave the past behind. Companies that attribute their success to a certain product or direction cannot easily turn away from those strategies in favor of the unknown. Had Digital not abandoned the DEC10 and DEC20 systems in the '70s, it might not have achieved its success in the '80s. Now, Digital is at another decision point.

ABANDON THE VAX ARCHITECTURE? The company must seriously consider turning away from its proprietary architecture—the VAX.

NEW RISC CHIP IN THE WINGS. Indeed, Digital intends to extend the current VAX line with its own RISC architecture, known as the Alpha project. However, we feel that Digital should only attempt a new proprietary RISC architecture if it can offer users sufficient competitive advancements in terms of functionality, price, and performance. Digital's intent with RISC is to provide its VAX customers with a software-compatible upgrade path for customers wanting the power of RISC but the same VAX/VMS environment. Digital does not envision this RISC system as a merchant chip but simply as an enhancement to its traditional VAX line. Given this thinking, it is not surprising that Digital intends to upgrade VMS for Alpha rather than selling Alpha on the open market as another RISC Unix box.

DIRECTION: OSF/1 ON ALPHA RISC? There is an ongoing debate within Digital whether or not to port OSF/1 to the Alpha chip. David Stone, vice president of software, for one, is interested in promulgating the technology to a wider audience. Stone contends, for example, that if Alpha is a "world class" chip, it could be licensed to others, and it will run OSF/1.

Both perspectives make sense. Digital's dilemma has more to do with the state of an industry that associates RISC with Unix. Therefore, an effort by Digital to introduce a general purpose RISC platform with a proprietary operating system will be viewed as a sign that Digital is not an open systems company.

Why It Makes Sense For Digital to Focus on Software

Overall, we strongly urge Digital to concentrate its engineering, technical, and marketing resources on becoming a superb open systems infrastructure and application software company. In theory, this is precisely what Digital's marketing folks are planning—a renewed emphasis on Digital as a software and services company. Digital has begun to understand that it can make money from its R&D efforts by selling more software on more platforms. But before customers will accept this as "truth rather than marketing hype," Digital's management has to make some radical changes in the way it views the world.

Potential Liability: Love of Hardware and Engineering

This will not be an easy decision for Digital. The company has no intention of walking away from what it knows and loves best—proprietary technology that it develops, designs, and controls. Its engineering-driven corporate culture is too inbred to walk away from hardware design.

CONTINUE WITH PROPRIETARY HARDWARE? For example, when Digital announced that it would license massively parallel technology based on the VAX architecture from Maspar (a company founded by former Digital engineers), Digital was quick to mention that it might also develop its own massively parallel systems sometime in the future. Does this strategy make sense at a time when companies like Digital desperately need to focus on meeting day-to-day problems of technology users? We think not.

Engineering Hubris vs. Customer Benefits

What's so bad about being an engineering-driven company? Nothing—as long as you keep your perspective. Well-crafted technology cannot be an end in itself; it should be a vehicle for solving users' problems. Digital's engineers seem to have lost sight of this key concept. We have watched over the years as Digital implemented ambitious technology many years ahead of the competition. In fact, at times, its technology was so much ahead that users could not understand the benefit of advanced networking management such as Enterprise Management Architecture (EMA) or a compound document architecture such as CDA.

SOFTWARE ADVANCES DRIVE STANDARDS. Digital's strategy has typically been to offer its advanced engineering efforts to the standards bodies both as *de facto* and *de jure*, and then become the standards leader. Sometimes this has benefited Digital in its ability to get standard technology to the market faster. In other cases, it has backfired. When a technology other than Digital's is selected, Digital must take the additional time to retrofit its existing implementations to fit the standards. Therefore, although Digital's X-Window toolkit was selected as part of Motif, Digital is still working to change existing DECwindows applications to be Motif compliant. It now has to worry about both Motif-based DECwindows and older applications written to the non-Motif DECwindows.

CUSTOMERS SKEPTICAL ABOUT STANDARDS COMMITMENT. Digital's policy of pushing hard to get its own technology approved has added to customer perception that Digital cares more about its proprietary implementation of technology than about standards.

OVEREMPHASIS ON TECHNOLOGY. This concentration on engineering excellence has caused Digital to lose sight of the reason that such technology was developed in the first place—to solve computing problems. Instead, Digital emphasizes the technical details of its implementations rather than their purposes and benefits.

Digital's New Business Model

Digital is trying to figure out how to change its fortunes. It has lost the confidence of many of its traditional customers and is desperately looking for a way to become a highly profitable business. It is afraid to let go of its older VAXs because of their higher profit margins. Yet, customers are clearly interested in more cost-effective platforms. So, as counter-measures,

Digital's New Business Model

Digital emphasizes the robustness of its proprietary technology. It is looking to the ACE initiative to have a commodity platform to leverage its technology for the high-volume market. At the same time, it is hoping to grow its service and support businesses. Another facet of Digital's emerging business model is the role of software as a revenue generator in all aspects of the business.

Digital is beginning to reorganize its corporation around five areas: Software, as a horizontal, cross-platform business, and four core businesses (Commodity, VAX/VMS, Systems Integration, and Service/Support).

Software As a Business

Since David Stone came on board as the driver of Digital's software strategy, there has been a noticeable change in the way Digital views software. Now, Digital intends to make money by licensing its software for as many platforms as possible. Stone's objective is to make a profit after one year of software availability. The average in the industry today ranges from 4 to 10 years. Why should Digital license everything from its Rdb relational database to its Network Application Support (NAS) services to the VMS operating system? Obviously, to gain a wider distribution of its research and development efforts.

A second and less obvious reason is the increasing demand for open systems. Users simply feel safer if the technology they commit to is widely available on multiple platforms. This provides leverage against being locked into a single vendor. Therefore, if users perceive Digital software as safe because it is widely implemented, they perceive the hardware as safe, too. Digital's first action was to provide its implementation of Motif (DECwindows), its Motif Visual User Interface Tool (VUIT), and SQL Services for Sun's SPARC systems.

DIGITAL'S SOFTWARE STRATEGY. We expect that this is just the beginning of a strategy of cross-platform software implementation. For example, when Digital announces its next-generation office software, we expect that part of the plan will be to make it available on a broad base of Unix platforms. Our concern, however, is Digital's time-to-market. Digital's tendency to wait for technical perfection before showing product direction makes sense in terms of making sure the engineering is complete and not subject to "the vaporware syndrome." However, Digital is taking so long that customers are not considering Digital as a serious contender in the software market.

David Stone's assertiveness has given Digital's software strategy a shot in the arm. Stone's goal is to help Digital make money from software. This is laudable, and, if Digital can realize Stone's vision, it will become an important enterprise-computing player. To achieve this goal, Digital will begin to package NAS so that its strengths are visible to, and therefore appreciated by, customers. The company has spent the last five years engineering, developing, and implementing NAS. Now it has to wrap application technology around these sophisticated underpinnings so that customers can see how they impact productivity. We anticipate Digital's forthcoming office software announcements as the opportunities to do this.

The Information Utility

When Stone explains open systems in relationship to Digital's software strategy, he shows a picture of his "applications machine." This is part of Stone's strategy of having Digital offer the information utility: a set of invisible infrastructure components (i.e., NAS). In establishing this direction, Stone has come up with the idea of a meter for this functionality. In other words, how much of this open utility are you willing to pay for? As indicated in Illustration 1, the user sets a series of dials indicating the degree of functionality needed. Dials are included for such characteristics as reliability, standard compliance, security, interoperability, portability, scalability, etc. Stone points out that each of these components has an associated cost factor. So, if a user takes all components and says they must be as high as possible, the cost meter will increase in proportion to the level of functionality. At this point, Stone would expect the user to scale back on the features that are less important in order to get the cost meter back into the range he is willing to pay. What does this mean? Digital intends to provide incremen-

tal levels of functionality according to the value a customer places on a certain function. For example, does the user really need B1 security, or will a lower level of security meet his requirements? The same can be said of distributability. Does the user really need a full DCE environment, or is it enough to have applications cleaved between a front and back end?

In theory, this is an excellent model. It may, though, get Digital into trouble in a highly competitive market, where competitors may offer users more functionality at a lower cost in order to gain market share.

Digital's Information Utility

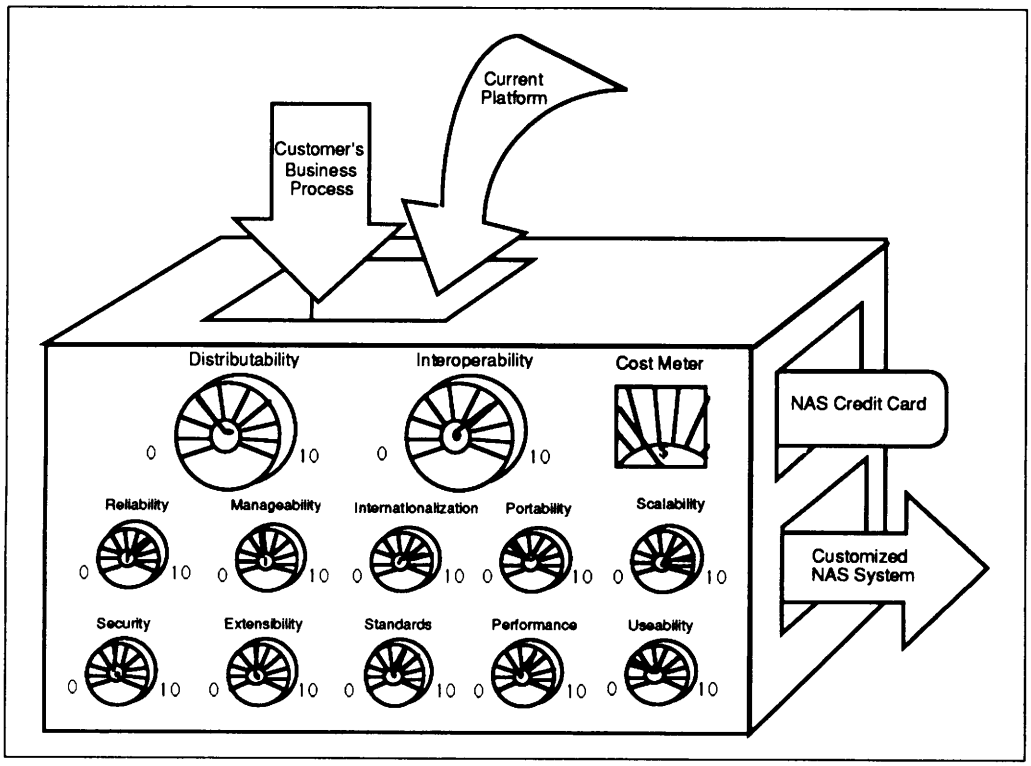

Illustration 1. The user inserts a "credit card" and tunes the engine in terms of how much functionality he needs versus how much he can afford to pay.

The Core Horizontal Software: Network Application Support

Network Application Support (NAS) is the foundation for Digital's open systems infrastructure. It is a strong set of services intended to provide flexibility to customers by supporting multiple clients and servers. Ironically, NAS was announced around the same time as IBM's proprietary infrastructure, SAA (Systems Application Architecture). Therefore, users assumed that NAS was simply the Digital equivalent to SAA—a proprietary infrastructure. While SAA was intended to mask the differences among IBM's proprietary operating systems, it is evolving into an integrating environment because of changing user requirements. Ironically, NAS was developed as an infrastructure for integrating a variety of clients and servers into a seamless environment, as indicated in Illustration 2. To its credit, Digital has put in the time and work to make NAS a sophisticated set of offerings. However, it hasn't spent enough time explaining to customers that NAS is a standards-based infrastructure. This becomes a special problem for non-technical management because there is no user view of NAS. NAS, by its very nature is an invisible, underlying series of interfaces. How, then, would a salesperson demonstrate this to management? Not easily.

The Core Horizontal Software: Network Application Support

NAS as Integrator

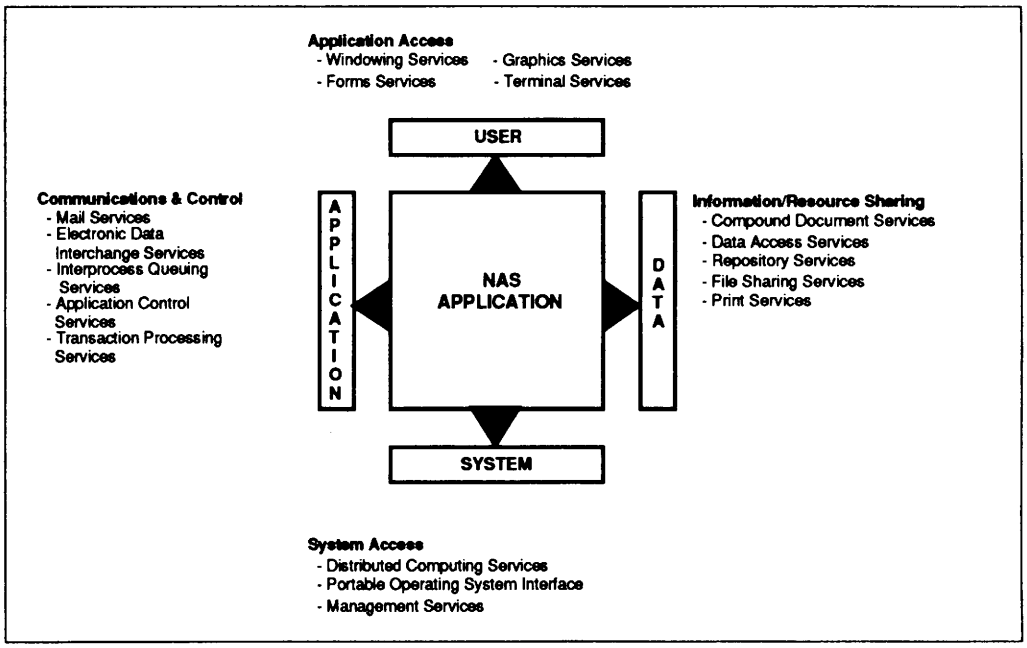

Illustration 2. Digital views NAS as an integration framework.

NAS: A Standards-Based Infrastructure

NAS is a network computing architecture intended to deliver services and an applications environment for a heterogeneous computing environment. As shown in Illustration 3, Digital intends to focus on a host of environments beyond its own. In every area where international standards have been defined, Digital has made them part of NAS. Only in areas where no definitive standards exist does Digital innovate. To Digital's credit, it tries to implement these innovations so that they match as much as possible the direction of emerging standards.

NAS on Multivendor Platforms

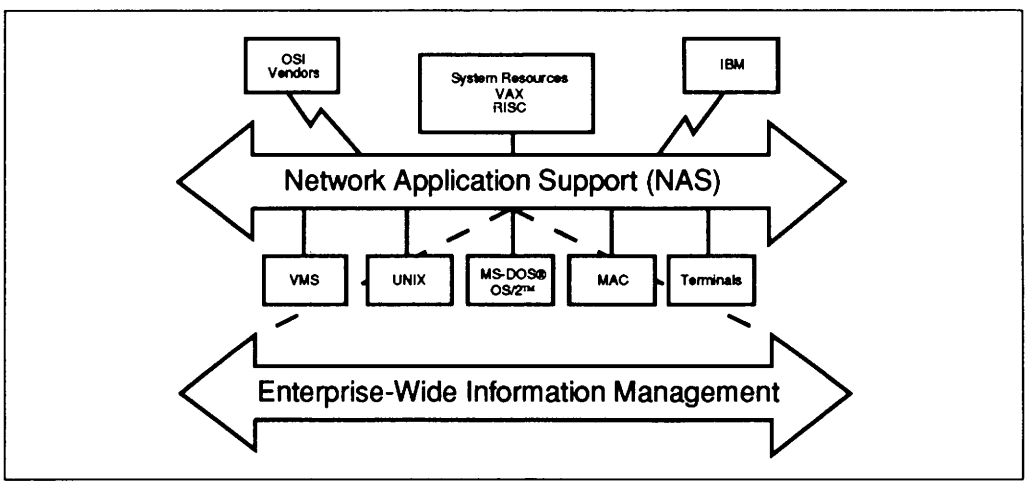

Illustration 3. NAS will be ported to an assortment of environments.

NAS includes four levels of services: Application Action Services, Information and Resource Sharing Services, Communications and Control Services, and System Access (see Illustration 4). How does this fit in with implementing an open systems infrastructure? NAS standardizes only the Application Programming Interfaces (APIs). The APIs specify platform-independent calls, freeing the developer from writing to platform-specific details. In the following section,

we will look at the components of NAS and at which *de facto* and *de jure* standards are included.

NAS Services

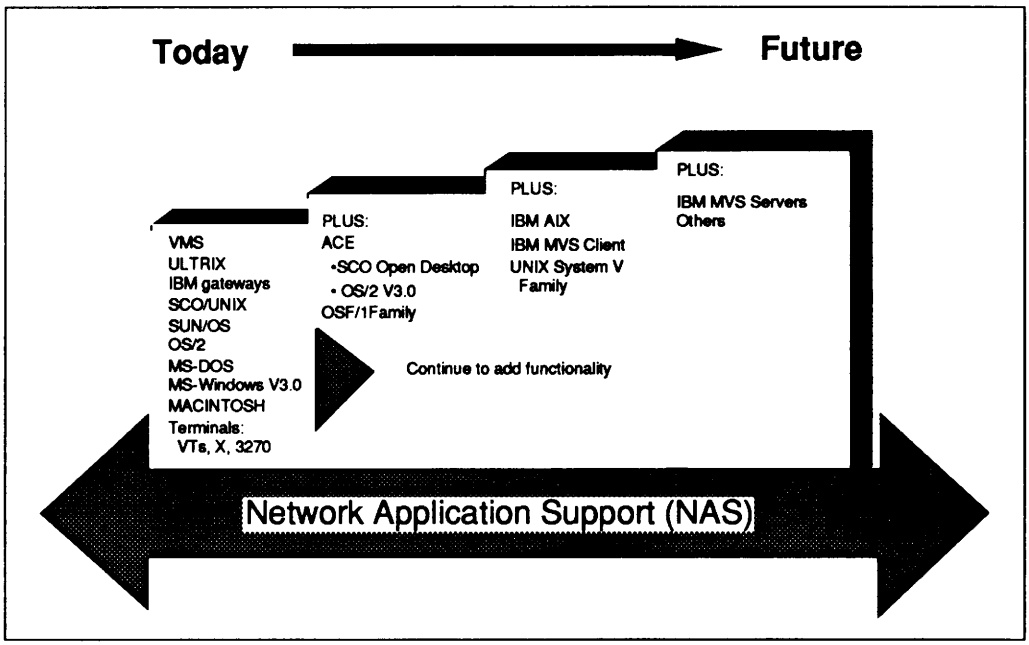

Illustration 4. An Overview of NAS Services.

Application Access Services

Included in Application Access Services are four product areas: windowing services, forms services, graphics services, and terminal services.

WINDOWING SERVICES. Windowing services are based on the X Window system and Motif. Since X Window has been sanctioned by the IEEE as a *de jure* standard and Motif has become the OSF *de facto* standard, NAS windowing services are standards based. One consequence of being early to market is that Digital still has to move away from its DECwindows product based on its proprietary X User Interface toolkit (XUI). This toolkit is incompatible with the Motif toolkit.

Another problem that hampers more transparent interoperability with other environments is the fact that OpenLook-based systems use a different toolkit and different API set. Digital does not yet provide interoperability with the OpenLook toolkit. To accommodate non-Unix-based clients, the NAS windowing service includes X Servers for DOS and the Macintosh. In the future, Digital will offer an X Server for OS/2.

FORMS SERVICES. DECforms is a service for helping users to develop a forms-based interface that integrates text and graphics into simple forms and menus. This is an area where Digital does not have a standards-based solution. In fact, DECforms is currently only available for VAX/VMS as part of Digital's ACMS, a Transaction Processing (TP) monitor for Digital's proprietary Rdb relational database management system. DECforms won't be available for Ultrix until the end of 1992. On the other hand, Digital is moving in the right direction with DECforms because it is the first vendor to implement the ANSI and ISO (International Standards Organization) proposed Forms Interface Management System (FIMS) standard.

GRAPHICS SERVICES. Digital supports *de jure* industry graphics standards including GKS, GKS-3D, and PHIGS and the PHIGS extension for X-11 called PEX, across VMS, Ultrix, OS/2, MS-DOS, and Macintosh.

TERMINAL SERVICES. Terminal services allow older, character-based applications to be linked into a distributed networked environment. Digital offers VT emulation on VMS, Ultrix, DOS, OS/2 and Macintosh. Since VT terminal emulation has become a *de facto* standard and since terminal services connect to a heterogeneous environment, Digital's services fit into an open systems environment.

Information and Resource Sharing Services

The Information and Resource Sharing Services break down into five categories: compound document services, data access services, repository services, file-sharing services, and print services.

COMPOUND DOCUMENT SERVICES. The Compound Document Architecture (CDA) components of NAS support the creation, display, printing, storage, retrieval, processing, and distribution of revisable compound documents. Initially, Digital had resisted implementing a pure Office Document Architecture (ODA) as defined by the International Standards Organization (ISO). Given the low-level functionality of this immature standard, Digital made the right decision: to provide its own implementation of a compound document architecture. ODA's problems include its lack of flexibility and its support for a limited number of data types. Digital did retain the ability to interchange documents with ODA but was able to far surpass its functionality. The company is now reaping the benefits of its decision. It has recently joined forces with IBM, ICL, Unisys, Siemens Nixdorf, and Groupe Bull in forming the ODA Consortium (ODAC) with the goal of promoting the development and use of ODA software. Each founding member has offered technology that will be jointly developed under the auspices of ODAC and then licensed through ODAC to the user community. Digital is supplying a key component—the foundation for the ODA toolkit. Digital was in position to gain acceptance of its toolkit based on its experiences with CDA and the development of its own ODA-CDA gateway. This gateway provides a high-fidelity, bidirectional interchange between ODA and CDA environments.

Digital is one of the earliest vendors to begin developing end-user applications based on a compound document architecture. These include DECwrite, DECchart, DECdecision, DECpresent, DECpaint, DECimage, VAXnotes conferencing, and VAX VTX videotex. As one of the earliest vendors to implement technology on an ODA superset, Digital is ahead. As the ODA consortium moves forward, the fact that Digital will have products based on a standard will be in its favor.

Components of CDA include base services such as base converters, documentation, viewers, invokers, and run-time libraries; and CDA Viewers, which display documents on both terminals and windowing devices. Another CDA product, DECimage Application Services, includes interfaces and libraries for building image applications and using images in Digital Document Interchange Format (DDIF). CDA Converter libraries are critical because this component is intended to support market-driven standards such as IBM's DCA, Digital's own DDIF, Lotus WK1, DIF, CGM, GKS, MacPaint, and CALCGRD (DECcalc). Because of the design of CDA, the Converter Libraries are extensible, so Digital can add other data types such as audio (announced this past April), NDimensional tables (announced in June), and video (a future prospect). In all, there are more than 170 applications from Digital and third-party software developers that conform to the CDA specification.

DATA ACCESS SERVICES. Digital includes three SQL-based services for data access: VAX SQL, Ultrix/SQL, and SQL/Services. The SQL base is a good start. However, we believe that Digital puts too much emphasis on interoperability between SQL and its proprietary Rdb database. SQL is available in so many incompatible varieties, which makes it difficult for this

NAS service to be truly open. The work of the SQL Access Group may help Digital. On the negative side, we believe that over-reliance on Rdb is hampering Digital's ability to become a more open software company.

REPOSITORY SERVICES. CDD/Repository is Digital's facility for defining and accessing data. While the product was initially introduced for VMS, this summer, CDD/Repository will be made available under Ultrix. The repository contains information about application design, configuration management, and development. It is also a key component in Digital's CASE strategy. Another component of this strategy is A Tools Integration Standard (ATIS), a software backplane technology developed by Atherton Technology and a proposed standard. Open CASE and repository standards remain quite immature. Therefore, this NAS standard simply reflects the industry.

FILE-SHARING SERVICES. File-sharing is still an evolving area in which only *de facto* standards exist. Even these are in transition. For example, Network File System (NFS) from Sun is the *de facto* standard. NAS supports this. In addition, NAS includes various VMS-and Ultrix-specific services for printing, file management, file transfer, and network management and control. Digital also supports a variety of PC and Macintosh client services via its Pathworks program. Digital intends to pick up the Andrew File System (AFS), which is a component of OSF's Distributed Computing Environment (DCE). We expect that DCE components will emerge as critical *de facto* standards for users.

PRINT SERVICES. DECprint is a strong distributed print service based on a client/server relationship between applications and printers. DECprint will translate ANSI files for printing on PostScript printers and PrintServers. Digital also intends to make the Palladium distributed print service software from Project Athena available for Ultrix. The industry does not yet have *de jure* or *de facto* standards for print services in a heterogeneous environment. Therefore, the fact that Digital translates files to accommodate heterogeneous environments helps Digital achieve some degree of openness in this key area.

Communications and Control Services

Our definition of open systems hinges on the ability of users to access and use data, no matter what application created it and no matter where it resides. Therefore, the fact that Digital has a series of NAS services geared to provide transfer and integration of different data types through a variety of communications mechanisms is critical. Digital has implemented four different NAS services intended for communications and control. These include Messaging Services, Electronic Data Interchange (EDI) Services, Application Control Architecture (ACA) Services, and Interprocess Message Queuing. Digital's newest NAS services in this area include Transaction Processing software.

MESSAGE SERVICES. Digital's MAILbus is a family of message transfer services, distributed directory services, message management services, and multivendor connectivity services. Digital provides electronic mail gateways, including an X.400 gateway and gateways to VMS, Unix, and IBM mail systems. Digital provides a programmer's toolkit for third parties to add other gateways. By supporting X.400 and providing gateways to proprietary mail systems, Digital has made good progress at implementing open systems in this area.

EDI SERVICES. Electronic Data Interchange (EDI) Services allow for transparent interchange of specially formatted, mail-based business transactions such as purchase orders and invoices. EDI NAS Services include gateways through X.40, X.25, or 2780; and translation services that convert internal data formats to the industry standard EDIFACT and X12 standards. Another facility, Application Service, provides a set of documented interface routines facilitating the integration of applications with the EDI delivery system. A major drawback to this NAS service is that it is only available on VMS. Over the next six months, we expect that EDI Services will migrate to Unix.

ACA. Application Control Architecture (ACA) is one of the most complex and, in the long term, most important NAS services. ACA allows users to link and embed objects and applications within documents of various types. Digital has implemented ACA in its DECdecision Builder and its DECwrite LiveLink facilities. There are no standards in this technology area. It's just too early. However, Digital has offered ACA to the Object Management Group for its Object Request Broker (ORB) RFT. ACA is an object-oriented facility that can be used to define an object-oriented class hierarchy and to allow for attributes and behavior to be inherited among related applications. The ACA API will provide access to a common model for application interaction, registration, and communication across multiple platforms. Digital intends to layer ACA on top of DCE from OSF in order to help customers implement a distributed applications environment.

To understand the significance of ACA, it is important to comprehend its three dimensions: control, command, and communication. ACA implements control by locating and linking remote applications within the structure of the existing user interface. Command provides a high-level, object-oriented application interface to the RPC mechanism. The power of this mechanism is that it allows applications to communicate with each other in a heterogeneous environment. It accomplishes this by providing a series of services including a database that defines classes of objects, messages, methods, and attributes; a Naming and Registration Service that keeps track of information about the application and where it resides on the network; and Invocation and Communication services that use peer-to-peer communications to invoke remote methods. ACA can also dynamically load an application component at run time. This is a capability that no other system vendor yet offers. It becomes especially important when large objects, such as an image, must be loaded.

Digital published the architectural specification for ACA in January and intends to make the services and developer tools (including a high-level API and scripting tools) available later in 1991. By publishing the specification, Digital is taking the first step towards opening its technology. Even if the Object Management Group (OMG) does not select ACA, the modular and object-oriented design of ACA will allow Digital to modify its service in order to conform to the OMG's Object Request Broker specification.

ACA is very similar to the concept behind Microsoft's highly touted OLE (Object Linking and Embedding) for its MS Windows environment. The difference is that OLE provides linking only within a local environment, while ACA links across multivendor environments. Therefore, ACA is much more sophisticated. This is symbolic of Digital's inability to sufficiently market its engineering sophistication. It could take a lesson from Microsoft on this one. We expect developers will use OLE in the local MS Windows environment, but Digital had the foresight to incorporate a bridge between ACA and OLE.

INTERPROCESS MESSAGE QUEUING. To accommodate systems that do not rely on Remote Procedure Calls (RPCs), Digital has implemented a queued message system. This is an alternative model used in operating systems such as MVS running CICS or IMS. It is most applicable to a transaction processing, batch-oriented environment. This service is aimed at providing additional services that address the needs of high-volume transaction processing environments. It will provide an integrated communication facility for VMS, Ultrix, DOS, and OS/2 as well as for IBM hosts running the LU6.2 communications option.

Transaction Processing Services

Transaction Processing (TP) is one of the key target areas for VMS. Under pressure from the growing interest in open systems, Digital is expanding the scope of Application Control and Management System (ACMS), its client/server transaction processing environment, to encompass Unix clients and servers. For example, Digital announced its intention to provide NAS TP software for Ultrix without providing a delivery date. In addition, a series of ACMS desktops are available for MS-DOS, MS Windows, VMS, and Macintosh.

The Core Horizontal Software: Network Application Support

Distributed Computing Environment

The Distributed Computing Environment (DCE) from the Open Software Foundation is a strategic component of NAS. Initially, Digital will implement the four DCE technologies it contributed on VMS. Digital has committed to implementing all seven components for Ultrix. Here is an instance when Digital's strategy of pushing its advanced technology through a standards organization works brilliantly. More than half the components of DCE come from Digital or though Digital's collaboration with other vendors. These include the NCS RPC which resulted from joint development between Digital and Hewlett-Packard. Digital added wide area networking components to HP's RPC technology. DECdns (Distributed Name Service) and X.500 were both proposed to OSF by Digital. OSF used the X.500 technology from Siemens and the DECdns as the cell name service from Digital. Digital changed its X.500 service to conform to Siemen's implementation. OSF also adopted DECdts, a Distributed Time Service, and the Concert MultiThreaded Architecture was designed by Digital as a client-space support for multithreading. Services not developed by Digital include the Security service called Kerberos based on work by MIT's Athena project with HP extensions; the distributed file system based on Transarc's Andrew File System; and LAN Manager/X support for PC integration developed by Microsoft.

System Access

System Access includes operating system-level services. These include Posix P1003.1, .2 and, in the future, .4; Concert MultiThreaded Architecture; and Portable Core services which include C-ISAM, ISO/OSI, and multinational text string support. All of these components fit well into an open systems infrastructure since they conform to IEEE, ISO, and X/Open standards.

Assessment of NAS

As Illustration 5 indicates, most NAS services are available for both Ultrix and VMS. In fact, there are only two services not yet available under Ultrix: Forms Services and EDI Services. These services are important, and we would be disappointed if Digital failed to deliver these to Ultrix quickly. Too much delay would foster doubt about Digital's commitment to Unix. It would reinforce the presumption that VMS always will come first with Digital.

Meeting Users' Integration Requirements

If Digital can begin to market NAS as an open infrastructure that supports not only Unix and VMS but also DOS, MS Windows, Macintosh, SAA, and OS/2, it will provide the type of technology that meets the open systems requirements of commercial users. Commercial users that have begun to roll their own open systems architectures are becoming increasingly frustrated at the complexity of integrating various Unix and non-Unix platforms together into a coherent environment. For most, it is simply proving too complex. If Digital can convince these users that they can keep their mix-and-match purchasing approach and still buy into NAS, the company could win the distinction of being the only systems integrator with the engineering know-how and technology to solve users' real problems with open systems.

But there is a marketing problem that Digital will have to solve before it can begin to have a win with NAS. First, Digital has to be able to demonstrate the strengths of NAS to nontechnical management. The ironic part of NAS is that it serves as a non-intrusive infrastructure. How can Digital demonstrate something that can't be seen? Not easy, is it? We therefore urge Digital to make its DECwindows environment the basis of a window into NAS so that it becomes more than a series of acronyms.

Release a NAS-Based Software Environment

Digital could learn some important lessons from the way NCR introduced its software strategy. Rather than spending time taking users through an exhaustive exploration of architectural underpinnings, NCR unveiled its strategy through a software implementation of its OCCA platform. This is precisely what Digital needs to do. Until Digital has a comprehensive open software environment that is aimed at users and not engineers, it will not attract the imagination of corporations that are planning their internal applications environment for the future.

DECnet: Based on OSI

DECnet has been Digital's strategic networking infrastructure for 16 years. What is most impressive about Digital's networking strategy is its implementation of OSI standards. Ironically, in order to keep its VMS customers comfortable, Digital continued to use the DECnet name, which implies that it is based on proprietary technology. In fact, had Digital understood the market power of standards, it might have added OSI to the DECnet name. This would have reassured customers that Digital was a standards-based networking organization. Recently, Digital renamed DECnet Advantage Networks as a way to focus attention on its standards conformance. Digital is now focused on positioning Advantage Networks as conforming to *de facto* TCP/IP and *de jure* OSI standards.

Digital's Open CASE Strategy

Digital has developed some interesting technology for CASE in the Unix environment. Digital's emphasis with Cohesion, the name for its CASE environment, is on its repository and tool integration. In the past, most of the work Digital has done in this area has been in VMS. It is just beginning to put more emphasis on a standards approach to CASE. Initially, it has adopted the European Community Manufacturers Association (ECMA) model. We believe that the ECMA model as an open CASE framework will become an industry standard. Therefore, Digital's adoption of it is a step in the right direction. In addition, Digital has made CASE a NAS service. We think this direction also makes good sense.

However, our one area of concern is Digital's overall approach, which is heavily oriented towards promoting its own set of tools (especially in the Unix arena) rather than integrating third-party tools. For example, in the Unix environment, Digital has a version of Cohesion called FUSE (Friendly Unified Software Environment). This programming environment is intended to integrate commonly used Unix tools, including editors, debuggers, program builders, profilers, cross-referencers, and code managers. Digital has licensed two tools from Brown University: a call graph browser and an annotation editor. It supports C, Fortran, and Pascal. These tools are integrated via the Multicast Message Server (MCMS), which maintains a list of messages that the tools send and receive. The user interface for FUSE is based on Motif. FUSE, therefore, offers several of the services defined in the ECMA model, including task and process management, message services, and user interface to support Digital's own tools. Digital's general Cohesion product offering puts considerably more emphasis on integrating a host of third-party tools. Later this year, Digital intends to offer this type of tools integration for FUSE.

Core Businesses: Targeting Customer Requirements

Digital is trying to understand its own business better by dividing its focus into four areas:

- Commodity
- VAX/VMS
- Systems Integration
- Service and Support

Commodity: The ACE Factor

Digital considers its commodity business to mean one where "price is the key factor." This incorporates all PCs, RISC workstations, servers, and all of its Unix business. While it may be true that Unix has many of the characteristics of a commodity business, this characterization is misleading. It underrates how critical these Unix technologies are becoming to customers and implies low levels of support and customization. In fact, we suspect that Digital hopes to build a considerable business from PCs and RISC systems. This strategy depends on the success of the ACE initiative to create the commodity market for its hardware and software.

NAS Software and Standards Conformance

Category	Standards
Applications Access	
Windowing Services	X Window System (endorsed by X/Open), ANSI X3H3.6 (in process)
OSF/Motif	de facto
Forms Services System	Forms Interface Management (proposed ISO SC22/WG 18)
Terminal Services	ANSI X3.64
Graphics Services	GKS; ISO 7942, ANSI X3.124; PHIGS; ANSI X3.144
Communications and Control	
X.400 Mail Services	CCITT X.400
EDI Services	ANSI X12, EDIFACT
Interprocess Queuing Services	
Application Control Services	RPC (OSF, DCE, ECMA 127, ISO DIS 10148, ANSI X3T5); IEEE 1003.4
Transaction Processing	X/Open, MIA, STDL
Information/Resource Sharing	
Compound Document Services	ODA/ODIF (ISO 8613); SGML (ANSI X3.143, ISO 8879); Abstract Syntax Notation (ASN.1)—ANSI X3T2, ISO 8824-5
Data Access Services	SQL (ISO, ANSI X3.135)
Repository Services	Information Resource Dictionary Services—ANSI X3.138, ISO TC97
File Sharing Services	NFS (de facto; IEEE 1003.8 in process); AFS (OSF DCE)
Print Services	ISO SPDL; ISO/ECMA DPA; PostScript (de facto); MIT Palladium
System Access	
Distributed Computing Services	OSF DCE
Operating System Interface Services	Posix (IEEE 1003.1, .2, .3, .4)
Management Services	CMIS (ISO 9595), CMIP (ISO 9596), SNMP (IETF 1098), CMOT (IETF 1095), MIB-I (ETF 1066), MIB-II (IETF 11nn), and "Internet Structure of Management Information" (IETF 1065)

Table 1.

PLAYING THE ACE CARD. How does Digital gain credibility in the open systems market? It is looking to the newly announced ACE (Advanced Computing Environment) initiative as a way to gain both credibility and market share. In fact, it will turn over a commercial version of its OSF/1 development (much of which it has already completed) to Santa Cruz Operations (SCO). Therefore, if ACE is very successful, Digital will be well-positioned because of the huge service and support infrastructure it offers compared to the other ACE players. However, if ACE is only marginally successful, Digital will have to move fast to reposition itself. By then, the company may not have much maneuvering room.

ACE: BUILDING A HIGH-VOLUME BUSINESS. The ACE initiative was MIPS's way of trying to insure that its RISC processor could win the desktop RISC workstation war. But the rationale for ACE goes well beyond MIPS. It is an attempt on the part of key computer industry forces

to recreate the DOS-PC world to gain the volume market that will reinforce their positions for the future. The ACE initiative is as much about power politics as it is about technology. As the power structure of the industry begins to shift away from both "commodity" personal computers and proprietary technology, two forces are at play. First, the traditional PC power players such as Compaq are trying to find a new way to regain clout in an increasingly low-margin PC market. Second, traditional minicomputer vendors, such as Digital, are looking for a way to gain wide acceptance in the high-volume desktop market which has evaded them for so long. All of the players in this ACE poker game are also looking for a powerful platform that will provide longevity. They are looking for protection from the growing power of IBM and the continued strength of Sun Microsystems in the Unix/RISC marketplace.

DIGITAL'S STRONG HAND. In its initial days, Digital has won some political points. First, it was able to convince the group of 19 MIPS OEMs to accept its "Little Endian" byte-ordering. Second, the group accepted the fact that the new operating system kernel will have Ultrix compatibility. One area where Digital was forced into compromise was with the bus architecture. Digital had wanted its TurboChannel bus accepted as the ACE standard, while Compaq wanted EISA. In the end, a compromise was agreed upon—both buses would be offered. The other compromise is on the operating system front. Microsoft's NT (New Technology) kernel will be the alternative to the SCO/Digital OSF/1-based operating system. We suspect that players such as Compaq will be more interested in a Microsoft operating system than an SCO offering. But until NT is delivered, all bets are off.

BENEFITS FROM ACE. There are some subtle benefits that Digital gains from the ACE initiative. The company can thrust its Ultrix operating system into the public domain. This could convince skeptical customers that Digital's operating system strategy is indeed open after all. Second, it provides the impression that Digital is part of the mainstream. Digital will also be able to bring its 2200 Ultrix-based applications forward. Digital is wasting no time flaunting the ACE architecture. When it announced its latest R3000 workstations in May, it stated that they were the first ACE-compatible workstations. In addition, because of Digital's prominent role within the initiative, it is in the position to thrust much of its infrastructure technology as a key component for ACE. If Digital's NAS becomes a standard, then Digital becomes a safe open systems player. (See Illustration 5.)

RELATIONSHIPS RESULTING FROM ACE. Digital faces some serious potential liabilities from the ACE initiative. The biggest risk is potential competition from both Compaq and Microsoft.

Competition from Compaq. Compaq's greatest strengths are its ability to package technology, its understanding of marketing, and its distribution channels. All of these components bode well for its success with the ACE initiative. There is the possibility that both Compaq and Digital will make operable ACE systems and will compete with each other for business. Because of Compaq's marketing savvy and its distribution channels, it could underprice and out-market Digital, leaving Digital at a disadvantage.

Relationship with Microsoft. Like its competitors in the PC business, Microsoft is trying to make the transition into enterprise computing. The ACE initiative offers two key benefits to Microsoft. First, it gives Microsoft leverage over Intel, up to now its sole hardware platform. Second, it gives Microsoft a more powerful platform for its power-hungry software programs. Underlying these concrete requirements is the thirst for dominance. Microsoft dreams not only of controlling the PC desktop market with Intel-based MS Windows, but also of replacing Unix as the key RISC operating system. One stumbling block for Microsoft is networking. Microsoft's LAN Manager program has not captured market share from Novell on the LAN front. Microsoft also recognizes that it needs to understand wide area networking as well if its NT kernel is to succeed. This is especially important since Microsoft wants to downplay the importance of the OS/2 3.0 operating system it jointly developed with IBM.

Digital's View of ACE Market Opportunities for ISVs

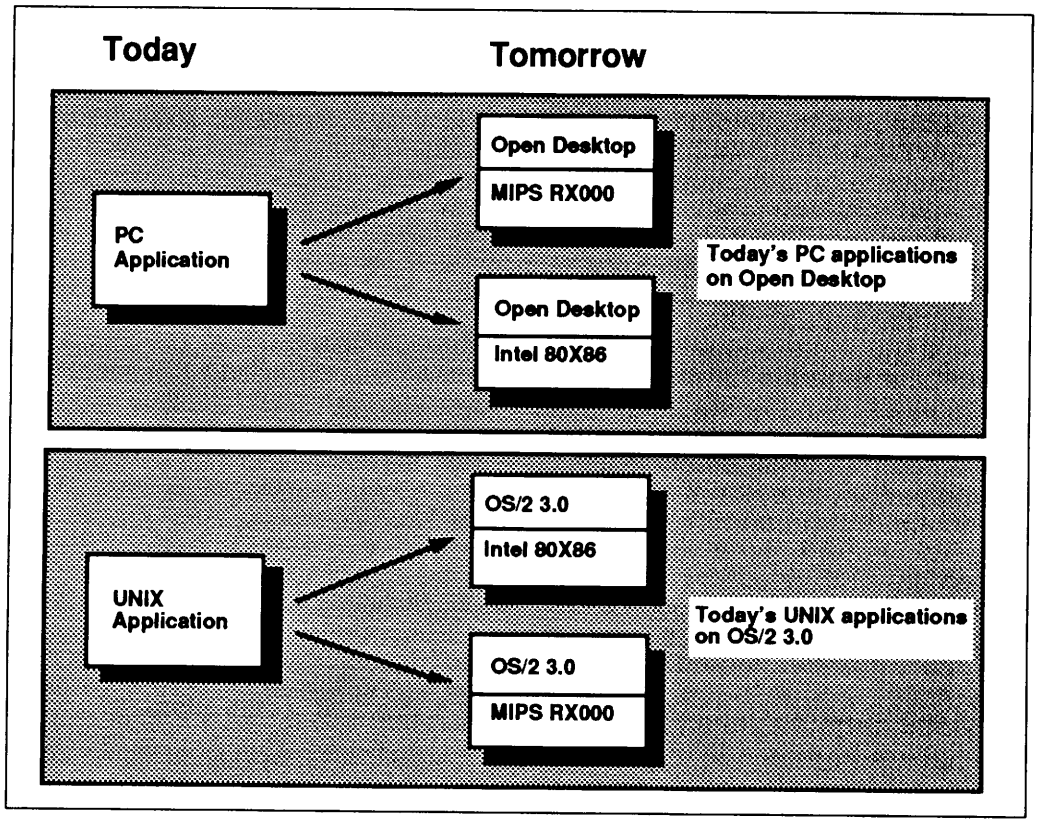

Illustration 5. Digital's perspective on the role of ACE in defining future platforms on the desktop.

Where can Microsoft gain this expertise? From Digital. Part of Digital's strategy with ACE is to offer both the Unix-based operating system and the NT-based operating system. In addition, there are indications that Digital intends to use the NT operating system for its proprietary RISC system. Therefore, Digital and Microsoft have formed a close alliance: Digital gets an NT operating system, and Microsoft gets assistance in developing wide area, distributed networking. On the surface, this is an equitable alliance. However, we suspect that Microsoft may have the better part of the deal. Microsoft has a reputation for taking more than it gives. Therefore, one scenario would have Microsoft learning all it needs to know about developing complex networking technology from Digital and implementing it as part of its NT platform. If Microsoft were to prove its ability to learn from the master, adopt Digital's technology, and become the premier supplier of distributed computing technology, Digital would be left in a weakened position.

Relationship with SCO. Santa Cruz Operations (SCO) is another linchpin in Digital's open systems strategy. The continuing relationship between Digital and SCO began a few years ago with their collaboration on Open Desktop as an alternative to IBM's OS/2EE (Extended Edition). Therefore, Open Desktop was a Presentation Manager-like interface (i.e., Motif) with a built-in database (Ingres, a close business partner with Digital) and communications via TCP/IP, LAN Manager for Unix (LM/X), and NFS. (In Open Desktop's original iteration, Digital was to have been more visible because it intended to provide DECwindows as the user interface. However, shortly before announcement, OSF announced Motif. Thus, Digital remained in the background, letting SCO take center stage.) Over the last year, Digital's relationship with SCO has grown closer. SCO has access to the low end of the market and to the distribution channels that Digital desperately needs to access the small- to medium-sized business marketplace. Because of SCO's growing success in selling Unix on the desktop,

Digital is increasingly relying on SCO's expertise to help Digital's credibility in the Unix market. It has, in fact, turned over its work with the OSF/1 kernel, including Ultrix compatibility, to SCO so that it can become one of the two operating systems for ACE. An interesting footnote is that Microsoft owns 20 percent of SCO.

Is it wise for Digital to turn over its Unix operating system kernel to a third party? If Digital turns its operating system business over to SCO and Microsoft, where will it concentrate its future resources? These are key issues that Digital needs to consider. We concur with Digital's decision to turn its operating system kernel work over to SCO. We believe that if Digital is to be successful in the future, the company must concentrate on systems integration and software and spend less time engineering those components that will become commodity.

THE MIPS PLATFORM. Digital has made some critical platform choices over the last few years. Initially, the company planned to develop its own RISC architecture as a Unix platform. It decided, instead, to use the MIPS architecture. With the forthcoming R4000 MIPS architecture, Digital has a 64-bit architecture that it should be able to grow with for a considerable time. The trick for Digital will be to add enough value on the software side to differentiate itself from quick-on-their-feet marketing competitors such as Compaq.

VAX/VMS: Technology Edge?

In contrast, Digital perceives that VAX/VMS makes it unique. Digital is fond of its 12-year-old operating system. VMS has accumulated more than 10,000 applications and some 10 million users. Management believes that VMS is still "the most modern operating system because it was designed for worldwide networking." Digital points to all of the advanced technology it developed on VMS that was adopted by OSF. Will this competitive advantage be sustained? We believe that once OSF/1 is widely available, it will present a substantial challenge to the technology available in VMS.

Digital's forthcoming VAX Alpha RISC-based Chip will be available within 10 months to developers and within two years to customers. The new operating system development will clearly be oriented towards maintaining the VMS software base. Digital needs to be very specific. Alpha is intended to meet the future requirements of its installed base that demand more price-competitive technology while maintaining software compatibility.

The most problematic aspect of this strategy is that it assumes that customers will deal with Digital in the way that Digital wants to deal with them. But it isn't so simple. A traditional VAX/VMS customer may want to implement similar technology but on a commodity platform. Will Digital's sales force learn to be objective enough about the VAX to listen to customers that want a different hardware platform?

Systems Integration: Leveraging NAS

The integration business has become very important to Digital. The company is counting on being able to use its NAS services as an ideal open systems integration framework. If Digital is able to proliferate NAS, the company will be in an ideal position to become a key factor in systems integration. But before customers will flock to Digital, it will have to start sounding less religious about its own engineering and its own technology.

Service and Support: Differentiator?

Digital views service and support as key elements in leveraging its customer base. This could be an opportunity to support heterogeneous systems environments. However, Digital faces the same challenge in service and support as it does in its systems integration business. Customers have to believe that Digital can deliver on its promise.

The Way Digital Sees Its Business

A Mixed Message

Digital considers itself to be a standards-driven company, an idea that will come as a surprise to many avid Digital watchers. Digital often gives users the impression that it is dedicated to having its own way. For example, when the rest of the non-PC world adopted the Big-Endian

byte-ordering for hardware, Digital insisted on adopting Little-Endian because it matched the VAX byte-ordering. (Little-Endian was adopted early on by the academic world because the algebra is slightly simpler. Because Digital had such a large presence early on in academic and scientific computing, it adopted this approach. This is also the byte ordering adopted by Intel.) When most Unix vendors were moving their operating systems to AT&T's System V, Digital stuck with a Berkeley implementation that was so different that ISVs had trouble porting to Ultrix. These details, combined with the fact that Digital's sales force concentrated on selling VAXs rather than its DECsystems based on the MIPS architecture, caused customers to suspect that Digital was, in fact, not an open systems company at all.

Digital was further impaired by the way President Ken Olsen carried on philosophical discussions with the industry about his concerns over Unix. In fact, Olsen is one of the strongest advocates of Digital's open system strategy. He makes some very key and insightful points about Unix: We agree with his assertions that Unix is not a *de jure* standard; it is a proprietary operating system owned by one company, AT&T's Unix Systems Laboratories. We also agree that some aspects of Unix are inferior to an operating system designed for commercial computing like VMS or MVS. However, in spite of these statements, Olsen does not mean that Digital intends to ignore its Unix implementation or that it won't work towards implementing more robust non-VMS based platforms. But the problem for Olsen—and thus for Digital—is that Olsen never had the first part of this philosophical discussion with the industry (i.e., standards are important to Digital, and Unix is a strategic platform). Olsen also unabashedly loves the VAX/VMS. It was his first love, and he thinks that it remains the best architecture and operating system the industry has to offer. This only added to the confusion and distrust. It is time for the industry to begin to move beyond discussions of operating systems. More fundamental to the future are technologies like NAS that transcend operating systems.

Open to the Hilt!

Digital is making a new aggressive marketing push towards open systems via a campaign with the slogan, "Digital...The Open Advantage." How does Digital define open systems? As leader Ken Olsen states, "You meet all the standards." Not a bad start. In addition, Olsen stresses the discipline required to create systems that strictly adhere to standards in order to ensure portability. An excellent point. But we'd like to see Digital take this definition a little further by emphasizing the user perspective: transparent access to the data, no matter where it is and no matter what form it resides in. We would also like to see Digital's entire organization internalize a working definition of open systems. This hasn't happened yet. Using "open" many times in each marketing presentation is not enough. Digital's definition must come from a well-understood and well-articulated corporate philosophy.

IMPORTANCE OF Posix. Digital is trying to have it both ways with its precious VMS. It is trying to add Posix interfaces to this proprietary operating system so that users will perceive it as an open system. In fact, Digital has made Posix 1003.1 (System Interface) and P 1003.2 (Shell command language) part of the NAS specification. Digital also intends to implement P 1003.4 (real time) within this calendar year. Digital is not alone in pursuing this direction for a proprietary operating system. For example, Hewlett-Packard and IBM are both making their proprietary operating systems conform to the Posix specification. The difference is that Digital's marketing force has convinced itself that Posix conformance makes VMS equivalent to a standards-based operating system and therefore acceptable to a customer who demands an open systems environment.(See Illustration 6.) We don't believe this is true. Posix is an interface definition to many of the key elements of an operating system. However, it does not include all the required components. Even with Posix interfaces, VMS is still tied to the VAX hardware architecture. Even if Digital ports VMS to other platforms, it is still controlled by a single vendor. Therefore, users may not achieve the degree of portability they seek with open systems. Posix conformance will simply make it easier for Digital to move applications from Unix to VMS. For the sales force, it will be easier to hold onto what it knows how to sell—VMS. This approach tends to undercut the good work that Digital has done to engineer an open systems strategy that could actually benefit users. Digital has not told its sales force or

its customers when VMS is appropriate and when Unix is appropriate. The closest the company has come to positioning its two operating systems is making statements that equate VMS with innovation and Ultrix with standards. We hope that, in the future, Digital will position VMS for manufacturing and high-volume online transaction processing (OLTP) environments.

Digital's Standards Strategy

Digital, like many of its competitors, is searching for a way to make money while adhering to standards. Digital's formula is first to conform to base-level standards such as the X/Open Portability Guide and next to implement the Open Software Foundation's Applications Environment Specification (AES). Then Digital adds value to these standards by building functionality on top of *de jure* (i.e., ISO) and *de facto* standards. Once Digital has added this value, it pumps enhanced functionality back into the standards committees with the anticipation that its richer technology will become standard. Digital, having developed the enhanced technology, will be in the best position to get it to market faster and help customers implement it more effectively. Digital believes that it can stay at least two years ahead of the competition. Therefore, it will innovate first on VMS and then pump this innovation back into the standards process. This means that its own proprietary platform is worth the additional dollars to customers. Then, if Digital can license its implementation of standards-based technology to the rest of the industry, it can make money in the commodity business, too.

Digital Open Systems: VMS and Ultrix

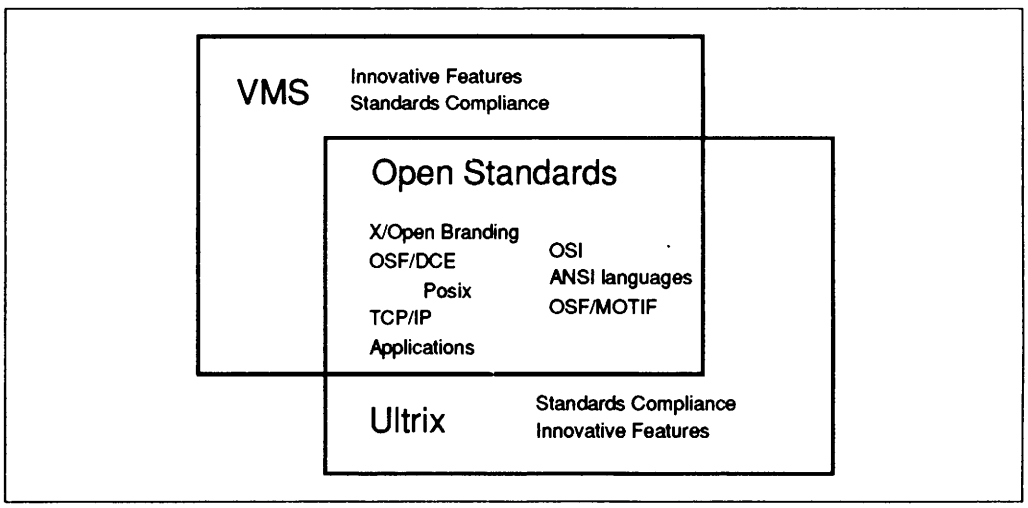

Illustration 6. Digital's view of the intersection between VMS and Ultrix.

Short Term vs. Long Term

In theory, Digital will have the ability, based on its engineering prowess, to satisfy the requirements of commercial open systems customers. But Digital the company has to overcome a short term problem: to convince customers, tired of hearing about the virtues of VAX/VMS and how "standard" it is, that Digital is serious about open systems. Digital has begun to make many of the "correct" statements about the value of open systems and its own commitment to it. However, at the same time, the company is planning its own proprietary 64-bit RISC line. This will give existing customers an upgrade path, although Digital intends to continue to sell and support its 32-bit VAX line. Digital management is not uniformly convinced that it should run Unix on this forthcoming architecture. This sends a contradictory message to the market.

Role of Desktop in Digital's Overall Strategy

Digital is putting a lot of its development dollars behind creating a desktop software environment. The foundation of this environment will be SCO's Open Desktop. However, we expect that Digital will create desktop software environments for a variety of platforms, including MS Windows, Macintosh, Unix, and OS/2. Its philosophy will be to preserve the native interface for each environment in which it develops software. Therefore, Macintosh front-end software will look like a Macintosh application while software for Unix will look like Open Desktop.

Opportunities and Challenges

The coming year will be a difficult one for Digital. It must find ways to articulate its vision of open systems without sounding false. It must prove to customers that all of the excellent work it has done in engineering robust underpinnings will make a difference and will not lock customers into a one-vendor environment. We don't expect users or the financial markets to be kind to Digital. Therefore, it will have to go it alone to prove that it understands user requirements enough to articulate the benefits of its infrastructure. If it can convince a skeptical user community that NAS is open and that it is based on industry standards, Digital has a chance. If it can convince customers that it can be trusted to create excellent and usable software that makes the benefits of NAS more easily understood, it has a chance. Digital should not assume that ACE will be the magic potion that will make commodity-based open systems a reality. If ACE is incredibly successful, it will simply level the hardware playing field and make it harder for Digital to compete on hardware alone. It could, however, make it easier for DIgital to win points with software, service, and support.

If Digital can meet these challenges, it will emerge as one of the key industry leaders in the coming decade. It will have learned to keep its love of engineering in perspective and to make its technology accessible. We think Digital does understand what the concept of open systems is all about. Now, it has to explain what it knows to a hungry and anxious user community. ◐

Next month's *Unix in the Office* will address
Interbase's Object-Oriented Database.

For reprint information on articles appearing in this issue,
please contact Richard Allsbrook at (617) 742-5200, extension 116.

Open Systems: Analysis, Issues, & Opinions

OBJECT WATCH

Finally, HP, Sun, and Digital Get Together on a Unified ORB

Two groups of vendors fighting to provide the first standard framework for communicating objects have called off their battle and gone to the negotiating table to work out their differences. The vendors—Hewlett-Packard, Sun Microsystems, and NCR in one camp and Digital Equipment and HyperDesk in the other—have agreed to create a single specification for an Object Request Broker by August 20, 1991. The result should be a coherent interface specification for a vital new systems-integration and distributed applications development technology.

The two camps represent the two finalists among the technology submissions in the Object Management Group's year-long search for a standard approach to messaging among objects in distributed environments. Their agreement came just before the OMG's June 3rd deadline to select its ORB standard. The OMG gave the two sides until August 20th to create a combined technology submission, and the OMG also agreed that, if the talks fail, it will launch a new selection process with a new RFP.

We do expect the two sides to overcome their differences. All parties have too much at stake to fail. Failure would seriously wound the OMG as well as postpone the day when the vendors can get the independent ORB standard they all want.

Why All the Fuss about ORB?

Distributed object management is a hot technology area because it promises to simplify greatly the integration of applications and the creation of new applications for use in distributed systems.

In distributed object management, an object is defined as any element in an information system: applications, databases, back-end services, files, shell scripts, object classes created with object-oriented programming languages, even protocols. This is accomplished by recording in a special interface the basics of how, why, and where each element is used. Other elements in the environment can then pass messages to these interfaces to request services, data, or actions and receive responses via their own interfaces.

For example, distributed object management technology can be used to give a single Microsoft Windows desktop application access to an Oracle database running on a Unix server, VSAM files on an IBM mainframe, and an Rdb database running on a Digital VAX under VMS—without expensive custom gateways. In the same way, the ORB will use object-oriented concepts to lash together diverse applications and services across networks. It turns existing applications and services—even ancient ones—into building blocks for new software systems by defining interfaces through which they can communicate and interact. These interfaces are a way to "encapsulate" applications and services, allowing objects to interact with them without knowing the details of their implementations.

We believe there is a critical need for this kind of integration in many application domains that require integration of diverse pieces of software—computer-aided software engineering (CASE), computer-integrated manufacturing (CIM), and office systems, to name three.

Two Competing Approaches to ORB

The two vendor groupings endorse different approaches to distributed object management: the language-based approach and the API-based approach.

THE LANGUAGE-BASED APPROACH. The HP/Sun/NCR camp endorses a language-based submission. This approach gives developers a language—HP/Sun's Class Definition Language (CDL)—with which to define objects. The language definitions are then compiled into remote procedure call stubs, which actually conduct the interactions between objects.

The HP/Sun/NCR language-based proposal has two distinguishing characteristics.

First, it is a minimalist approach to object management. The submission specifies how developers describe objects, leaving details such as how messages are packed for transmission, how their delivery is managed, and how objects are named to individual ORB implementors.

Second, the HP/Sun/NCR submission is designed primarily to support static environments. That is, when a new object is added to a network, all existing objects on that network must be redefined to accommodate its presence. Thus, all of the stubs in a particular environment have to be modified and recompiled. HP/Sun/NCR believe they can support the dynamic addition of new objects to an environment, but their primary goal is static distributed object management.

THE API-BASED APPROACH. Digital and HyperDesk, through their "HyperDEC" submission, endorse an API-based approach. This design specifies a set of message-delivery and remote operation invocation services, accessible via an API by multiple languages.

The HyperDEC API-based approach has two distinguishing characteristics.

First, the API-based approach specifies a user-definable extension to operating systems. It is a software framework that governs how objects are defined, how messages are delivered to them, and how objects are identified.

Second, the API-based approach is primarily designed to support dynamic environments. That is, new objects can be added to a network (or existing objects redefined) without requiring changes in the definitions of existing objects. The API-based approach includes an object-definition repository that allows objects to learn what they need to know to interact with new objects. No recompiling is required.

A Unified Approach to the ORB

Both the language- and the API-based approaches to distributed object management have technical advantages and disadvantages. The biggest issue is that ORB users will require support for *both* dynamic and static environments. Thus, neither approach, alone, satisfies all user requirements.

The negotiations between the two camps are an acknowledgement of this fact. All vendors involved realized that to create a standard that was meaningful to a wide swath of users, they'd have to work together. The resulting solution may look something like Illustration 1.

We Can Only Hope the Vendors "Do The Right Thing"

We have long believed that, ultimately, the best Object Request Broker would combine the best of the language- and API-based approaches. Thus, we applaud the commitment of the two camps to work out their differences.

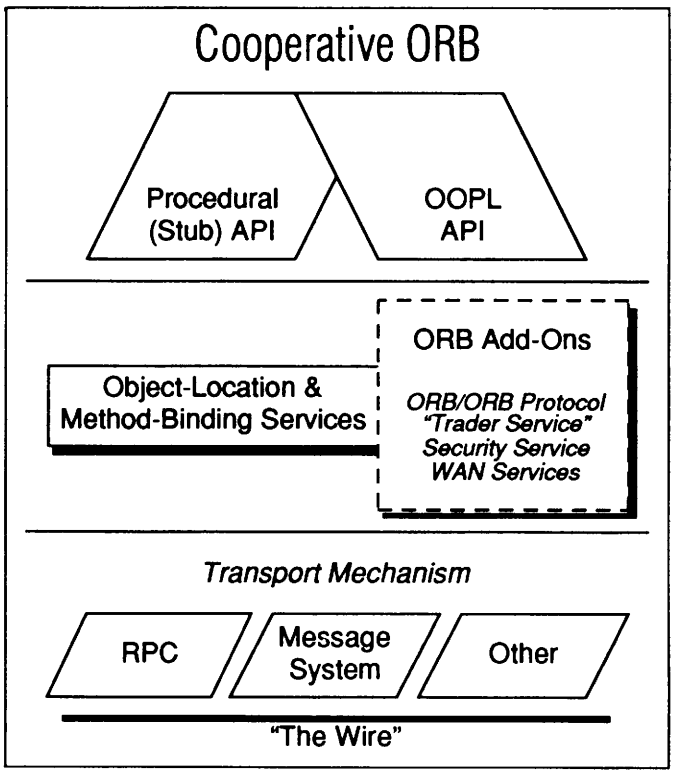

Illustration 1. During late March 1991, the seven original submitters of technology for consideration as the a standard Object Request Broker presented their cases to the Object Management Group. During that three day meeting, it became obvious that none of the submitters satisfied the full range of needs for ORB technology, but, that by working together, they might. The above graphic is one perspective on how the submitters could have crafted this "Cooperative ORB," including the sources of the various components.

The new ORB deadline will put the OMG three months behind schedule in its efforts to broker a broad set of cross-vendor and cross-platform object technology standards. But the delay is worth the reward of a single, coherent approach to object management that users and vendors can begin using immediately. —*J. Rymer*

WANG LABORATORIES

Wang and IBM: Strange Bedfellows

IBM Looks to Wang for Imaging Software

Had anyone suggested five years ago that IBM and Wang would announce a strategic relationship, they would have been immediately sent for therapy. But these are strange times for the computer industry. In an announcement that

stunned many industry observers, IBM and Wang announced that Wang will resell IBM's RS/6000, AS/400, and PS/2 lines. The RS/6000 RISC systems and the PS/2s will be sold under the Wang logo while the AS/400 will retain the IBM name. In exchange, IBM will provide initial financing of $25 million (debt that will be converted into Wang Class B common shares). In the long term, IBM could provide an additional $75 million.

A Reaction to ACE?

What does IBM get for its investment? We think it is a complex deal. The least important aspect of the deal is that IBM gets an alternative channel of distribution for its technology. We think the announcement was also timed to dampen the potential power of the ACE initiative. (The ACE initiative is an effort on the part of companies including MIPS, Digital,Compaq, Santa Cruz Operations (SCO), and at least a few dozen other computer suppliers to create a RISC version of the DOS-PC mass market.) ACE threatens to create a RISC PC standard that has the potential to dominate the market.

Relationship to Rumored Apple Deal

Another reason for IBM to make a deal with Wang at this time could be directly related to a rumored IBM/Apple deal. If IBM also decides to sign an agreement with Apple, the Wang deal will help blunt the negative perception of a close relationship between the two competitors. Instead, IBM will be able to state that Apple's licensing of its RS/6000 technology is simply another step in its plan to make its technology widely available. We also hear rumors that IBM has been talking to Data General about yet another licensing agreement.

RS/6000 Positioning: An Imaging Engine?

Most strategic for IBM is its need for applications software. If IBM can purchase office and imaging software for its Unix product line, it would be worth the $100 million investment in Wang. We suspect that Wang's imaging software is of key interest to IBM. The RS/6000 with its awesome floating point performance would be an ideal imaging engine. Another interesting twist could be the work that Wang has been doing on Freestyle, its user interface that encompasses text, graphics, image, and pen-based annotation that it never successfully marketed. With IBM's understanding of marketing, it might be able to reengineer Freestyle into an advanced user interface technology for both the PS/2 and the RS/6000.

AS/400 Positioning: VS Replacement

What about the AS/400? The AS/400 has become a successful applications box for IBM, resulting in $14 billion in revenue. Wang is particularly interested in reselling this system because the Wang VS installed base has been defecting to the AS/400 en masse. Being able to offer the AS/400 could stem this tide.

PS/2 Positioning: Low-End Credibility

What about the PS/2? Wang has been moderately successful in selling PCs to its installed base; in 1990 Wang shipped 78,000 of its own 386-based desktop units. (By way of comparison, Digital Equipment sold 87,000.) While this is nowhere near Compaq's 820,000 1990 shipment level, it is a reasonable starting point. Wang will have to be aggressive in promoting its software as a reason for customers to purchase PS/2 systems from Wang rather than from IBM or a clone maker. It won't necessarily be an easy transition for Wang.

Conclusion: A Long Struggle Ahead

Wang is struggling for survival in a market place that is changing faster than the one-time industry leader was able to comprehend. The VS minicomputer that made a name for itself as the ideal front end to an IBM mainframe went the way of many traditional minicomputers. Users were moving rapidly to more flexible PC LANs and more price-competitive Unix systems. It simply took Wang too long to come to the realization that its love affair with the VS would have to end. By the time Wang was ready to surrender, it had nothing solid to replace it—especially on the software front.

Had Wang moved aggressively five years ago and moved its office, imaging, and database technology to Unix, it might have been able to reposition the company as a leading software company. In a sense, the relationship with IBM gives Wang a second chance to prove its viability. Wang is now ready to begin selling Unix software on multiple platforms. It may be able to convince a wary customer base that it is again safe to buy Wang. Wang's other challenge will be to reposition itself as a service and support company. It will have to compete with a myriad of systems integrators. It is unclear at this juncture whether or not Wang will have the talent in place to move forward in this competitive market.

IBM could be the biggest winner in this joint venture. It will gain solid applications software that it hasn't been able to write itself. IBM would be wise to search through Wang's research and development labs for additional goodies. Ironically, Wang has done credible work in the software research arena. It has simply failed to understand the realities of the marketplace. IBM is a master of marketing technique but has been unable to become the type of software innovator that these times call for. The new arrangement could prove more successful than anyone would have dreamed. —*J. Hurwitz*

OBJECT WATCH

ToolTalk: Sun's First Step Toward Distributed Object Management

The new ToolTalk service from SunSoft (the Sun Microsystems subsidiary) provides Sun's first high-level applications-integration facility, filling a key void in Sun's support for distributed computing.

Protocols and services such as ToolTalk meet an important set of user requirements for distributed computing. These products allow applications to call upon and use data files, *in whole or in part*, that have been created and managed by other, independently-developed applications. The result is a method of linking applications that is flexible and allows for a fine degree of control over the interaction.

For example, a document application can reference the relevant part of a spreadsheet file to obtain data from a package such as Lotus 1-2-3. For the individual user, this is far more efficient than referencing the entire file, loading its contents into their application, and then cutting out irrelevant data.

For groups and users who want to automate procedures or tasks that involve multiple applications, interapplication communications protocols are essential. If users must manage the transfer of information from one application to another, there can be no automation of those transfers. Interapplication communication lays the groundwork, then, for one application to tap another application's data without overt involvement by the user.

TOWARD OBJECT MANAGEMENT. What are these parts of data files that ToolTalk is designed to identify and access? In a broad sense, they are *objects* because they have independent identities within the system. Thus, interapplication communications protocols and services are the first step toward the management of objects in a distributed environment, a set of technologies called distributed object management.

Until now, most of the work in this area has taken place outside of Unix. Unix has never had a single standard (such as Microsoft's Dynamic Data Exchange in the PC world) with which one application can reference data in another application without requiring systems programming. Rather, in the Unix world, developers have been forced to integrate applications at a much lower level, using, for example, TCP/IP sockets to set up a communications channel between two processes.

Sun's ToolTalk addresses the issue for SunOS users. Digital also has a solution, called Application Control Services (ACS), that works across its Ultrix Unix variant and its VMS operating system. Both vendors are working to craft a single distributed object management standard for *all* operating systems under the auspices of the Object Management Group (Framingham, Massachusetts).

ToolTalk Is Interapplication Communications Protocol and Service for Unix Applications

ToolTalk is a messaging protocol and message-delivery service. In structure, it is similar to the Object Management Facility (OMF) in Hewlett-Packard's NewWave. The ToolTalk service is responsible for delivering messages to targets; message delivery is not left to the vagaries of a broadcast protocol such as DDE. ToolTalk can start an application to satisfy a request for an object, if required. Also, like NewWave, ToolTalk requires developers to write to an API to make use of the facility. (See Illustration 1.)

The ToolTalk message protocol provides a way for two Unix processes to communicate. The protocol defines the set of messages a group of processes can exchange and the content of those messages required to define when messages are sent and how they are processed by receiving process. The service ensures that any message from a sending process is delivered to the proper target process without the sender having to know the target's physical location or the internal implementation of the application or task running in it.

MESSAGING PROTOCOL. The ToolTalk protocol defines a simple structure for interapplication messages. Messages contain fields for the address of the sending application, the subject of the message, and the three or four other pieces of information required to deliver it. For example, the protocol says whether the message is a request, which requires a response, or a notice, which doesn't.

ToolTalk supports two modes of messaging: multicast and object-oriented messaging.

Multicast Messaging. In the multicast messaging mode, a self-contained application sends and receives messages to and from another application. Through this mechanism, for example, a document-processing application could call on a spreadsheet application to perform a set of calculations on a set of numbers and return the results for incorporation into the document.

To use the multicast messaging feature of ToolTalk, developers must add the ToolTalk calls for sending and receiving messages to their applications.

Object-Oriented Messaging. In the object-oriented messaging mode, an application sends and receives messages to and from objects, as opposed to other applications. Objects, in this sense, are segments of an application that have their own identity. This mode of messaging gives developers a finer grain of control over interapplication communications than does the multicast option.

TOOLTALK SERVICE. The ToolTalk Service runs on network servers, acting as a broker between clients and message recipients. It appears to be straightforward to use and flexible enough to support a variety of applications needs.

For example, developers register applications or objects with the ToolTalk Service by defining which messages they can *receive* and *process*. The ToolTalk Service then matches the attributes of messages to its registered receivers to determine which applications or objects should receive a particular message. This mode of operation allows new applications or services to be added to a ToolTalk network without having to modify existing applications, a key requirement.

In addition, ToolTalk can deliver messages to either processes or objects within processes. Finally, SunSoft built in two mechanisms—file scoping and process scoping—to help focus messaging activity, preventing long searches by the ToolTalk Service for recipients.

THE TOOLTALK API. The ToolTalk API is a set of C function calls.

ToolTalk Enjoys Early Industry Support

Lotus Development Corporation (Cambridge, Massachusetts), Cadence Design Systems Incorporated (San Jose, California), Valid Incorporated (San Jose, California), Cadre Technologies (Beaverton, Oregon), Saber Software Incorporated (Cambridge, Massachusetts), Interactive Development Environments (San Francisco, California), and Clarity Software (Mountain View, California) have endorsed ToolTalk as a mechanism for integrating diverse Unix applications.

Note that most of these vendors hail from Sun's traditional applications strongholds in computer-aided design and computer-aided software engineering. These are the first applications in which we expect ToolTalk to be used. Indeed, the CAD Framework Initiative (CFI), a consortium of CAD vendors and users, sponsored a demonstration of ToolTalk to integrate software running on platforms from IBM, Digital Equipment, Hewlett-Packard, Integraph, and Sun at the Design Automation Conference in San Francisco during mid-June 1991.

We expect ToolTalk's use in office applications to be slower in coming. Lotus, for example, has endorsed ToolTalk only as a means to integrate the various platform versions of its 1-2-3 spreadsheets. Lotus has not yet signed on to use ToolTalk in its Notes product, for example. As a Unix-only solution, ToolTalk's applicability to many office users will be limited. Most have huge investments in PCs and either DOS or MS Windows applications and are only beginning to consider Unix desktops as an alternative.

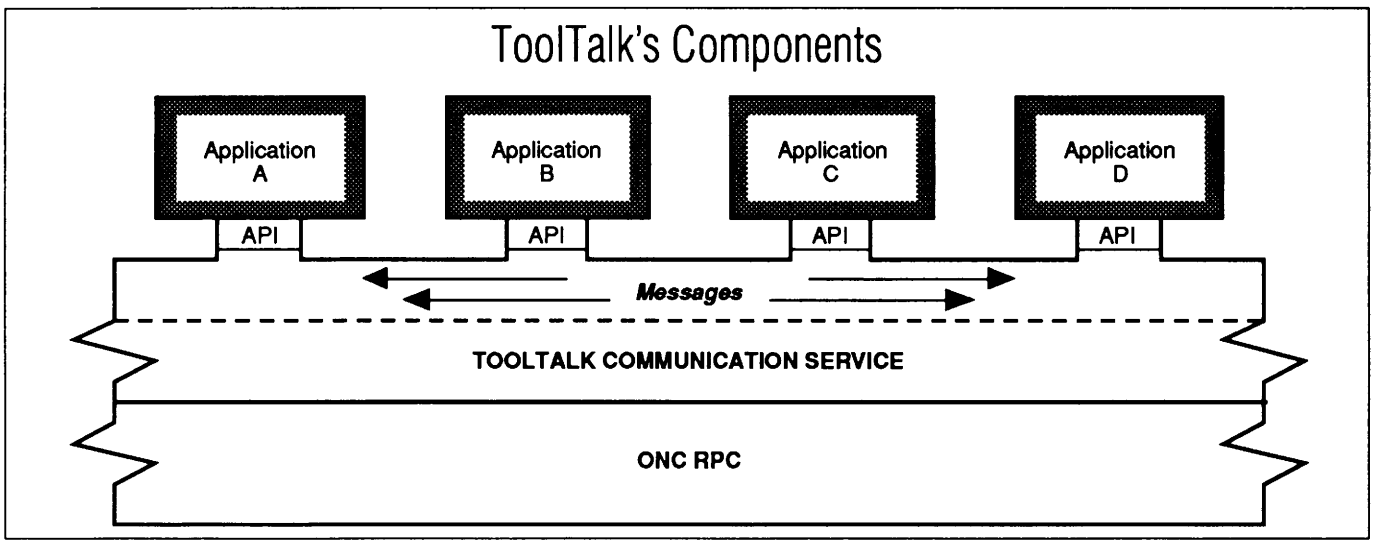

Illustration 1. ToolTalk is a messaging protocol and message-delivery service. The ToolTalk service is responsible for delivering messages to targets; message delivery is not left to the vagaries of a broadcast protocol. ToolTalk requires developers to write to an API to make use of the facility.

ToolTalk Is a Transitional Step toward the HP/Sun Distributed Object Management Environment

Sun began developing ToolTalk well before allying itself with Hewlett-Packard to develop distributed object management technology jointly. Sun's interest in working with HP to create distributed object management system software appears to have been driven by its experience with ToolTalk. First, Sun recognized that ToolTalk was a step toward distributed object management, but only a step. Second, Sun was apparently worried that it would become embroiled in yet another fight over technology standards if it proposed its own distributed object management solution.

So, Sun and HP are jointly developing a distributed object management solution called the Distributed Object Management Facility (DOMF), which they proposed as a standard to the Object Management Group. Development of ToolTalk began before Sun's agreement to work with HP to create a distributed object management environment based on a single interface definition language and architecture.

Sun is committed to rolling ToolTalk forward into its larger ORB-based environment. It is positioning ToolTalk's object-oriented messaging mode as a transitional step toward the distributed object management and object-oriented development supported by DOMF. (See Illustration 2.)

We accept this positioning. ToolTalk is a tactical solution that users and ISVs can begin using in SunOS and Open Network Computing (ONC) environments today. We expect most developers to begin by using multicast messaging and gradually phasing in ToolTalk's object-oriented messaging mode to gain finer-grained control over object interactions.

This experience will help prepare users and developers for DOMF. With DOMF, users and developers will get not only the ability to reference a piece of an application or data file from within another application, but also basic object-oriented programming facilities supporting features such as inheritance and data abstraction, and dynamic binding of operations to objects. DOMF dramatically expands the range of interactions between objects available to developers.

The issue for users of ToolTalk is whether and how SunSoft will protect their investments in DOMF environments. Why should developers learn one protocol only to have to switch to another?

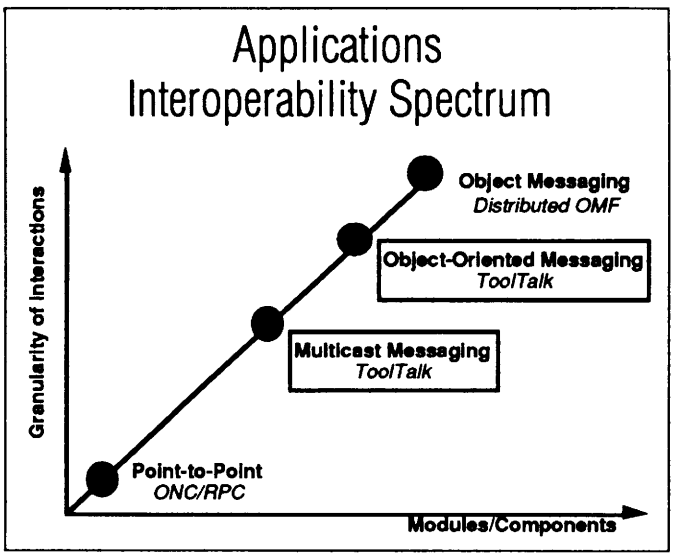

Illustration 2. SunSoft is positioning ToolTalk as a transitional step toward the distributed object management and object-oriented development supported by the Distributed Object Management Facility (DOMF) Sun is jointly developing with Hewlett-Packard. In the above spectrum, RPCs represent a static point-to-point communications mechanism with no independent management of communications. DOMF represents the state of the art in flexible communications mechanisms between objects. ToolTalk's two modes of communications are intermediate steps.

Fortunately, ToolTalk appears to be the kind of protocol that Sun will be able to accommodate in its DOMF environment. The viability of this concept has already been proven once—by Digital. Digital has "encapsulated" Microsoft's DDE to operate within its Application Control Architecture (ACA) environment. Digital transforms DDE calls into ACA messages for transmission and management in the ACA environment. We see no reason why Sun should not be able to do the same with ToolTalk messages.

Platforms and Availability

ToolTalk will be generally available on SunOS platforms during the fourth quarter of 1991, although software developers can buy copies of the environment today.

Sun will obviously provide the ToolTalk service on its SPARC-based workstations, but it also plans to license it to other vendors with Unix and ONC implementations. An obvious source of early support is Hewlett-Packard, although HP has not announced any plans to adopt ToolTalk. —*J. Rymer*

ACE INITIATIVE

The ACE Initiative Talks ARC

The ACE initiative, with its goal of bringing the power of the Intel PC market to RISC, is beginning to provide some details on its Advanced RISC Computing (ARC) specification. This specification is intended to provide a way to isolate hardware dependencies, such as device drivers and special purpose hardware components, thus leaving the base platform untouched. In the ARC specification, this is accomplished by defining a set of standard programmatic interfaces both in firmware, the hardware abstraction layer, and device driver modules. This concept of isolating hardware value-added features is critical to the success of shrink-wrapped software.

Avoiding Confusing ISVs

Another success factor is the operating system. Because of the political nature of the ACE initiative, it was important to please the DOS, OS/2, and Unix camps. Therefore, the specification allows for two different operating system binaries. This is risky. There is the chance that ISVs will be confused about which operating system to write to.

ARC Promotes Shrink-Wrapped Software

However, if ACE companies explain the concept to ISVs they can avoid some of the confusion. The concept behind ARC is that an ISV should be able to write the application once and simply recompile it for either Unix or Microsoft's NT kernel. This is an excellent solution to a potentially difficult problem. If ACE participants conform to the specification, the goal of shrink-wrapped software, for at least one architecture, could be achieved.

At stake is the ability of a non-PC player to gain a portfolio as large as the 40,000 PC applications that have largely driven the success of PCs and PC LANs. This is not a problem when a single vendor controls the hardware specification and implementation (such as Intel). It has proven to be virtually impossible in the RISC/Unix business environment where there are no standards for interfaces between hardware components and software. Some vendors like Sun are betting on a common application binary interface to achieve standardization. Others are waiting for OSF's ANDF to provide an architecture-neutral distribution format.

Will Most Hardware Vendors Play?

The ACE consortium, on the other hand, is betting on its ARC specification approach as the formula that will lead software suppliers to rush to write software for its environment. ACE secretary, Jim Billmaier (vice president, software marketing at MIPS) predicts that within 18 months a "majority of the 77 largest computer manufacturers will be ACE members." He eagerly predicts that by the mid-'90s ACE members will dominate system shipments.

History May Not Repeat Itself

We think it is simply too early to make such an optimistic prediction. As we've said before, it is impossible to recreate history. While it is possible to plan based on a successful model (i.e. the DOS PC), those making those plans need to remember that unexpected events can change the best laid plans. For example, now that IBM appears ready to license the RS/6000 widely, the balance of power at the low end of the RISC market could be impacted dramatically. —*J. Hurwitz*