The Guide to Open Systems

VOL. 6 NO. 1
ISSN: 0887-3054
JANUARY 1991

PATRICIA SEYBOLD'S

UNIX IN THE OFFICE

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By David S. Marshak

MULTIMEDIA: THE NEXT STEP IN THE EVOLUTION OF COMPUTING

WITHIN FIVE YEARS, we will no longer be talking about "multimedia." This is not to say that the emerging integration of multimedia technologies—specifically animation, audio, still video, and full-motion video—will cease to be important. Rather, the opposite is true: Within five years, these technologies will be fully integrated into *(continued on page 3)*

• E D I T O R I A L •

A Clean Slate for the New Year

Unix Is Becoming Robust Enough to Handle the Politics

By Judith S. Hurwitz

THE OTHER DAY, I got a call from a distressed user. His company was planning to implement a Unix-based system. But, before proceeding, management decided to call in a consulting firm (one of the big-six accounting firm types) to make sure that they weren't making a bad move. Much to my caller's distress, the consultant warned that Unix is not a stable operating system and therefore should not be used in commercial applications development.

My caller wanted to know what he could do. Was this true? Was Unix unsafe?

I assured the caller that Unix was being successfully implemented in many commercial organizations. I also told him that this was not the first time I'd heard the claim that Unix was unstable. It comes up repeatedly among consultants who, because they are unfamiliar with Unix, base their judgement on rumor rather than research. Some of these consultants are caught off guard when customers start asking them about environments and operating systems they are unfamiliar with. They become uncomfortable. It is a psychological truism that people are uncomfortable with change. Most would prefer to remain with the systems and technology they have used for years than to learn something new.

I'd like to set the record straight. All our modern operating systems have some bugs—Unix, VMS, VM, MVS, OS/2, to mention a few. Every operating system has some problems in some areas. Do IS professionals shy away from MVS because of some anomalies? No. Users simply find work-arounds and get on with the job. So why all the fuss? I believe that it may be the result of the politics of computer technology at work.

Over the past six months, we've been finding that the Unix operating system is becoming much more stable and robust. AT&T has done an excellent job of improving the quality and reliability of System V.4. Open Software Foundation (OSF) members are working feverishly to bring OSF/1 to market. Activity has never been so intense. The competition for the hearts and minds of users has driven both organizations to try to outdo each other. The same cannot be said of proprietary operating system efforts—with the notable exception of OS/2.

These are transitional, and therefore difficult, times for the computer industry or users of technology. Users are confused about the myriad of technology coming at them from every angle. When they see a technology they love, they are often at a loss to understand how they would implement it. Computer vendors are eager to prove they are really open, but they only want to sell their higher margin products. While users want the most advanced technology, they are frightened off by the price tag and base requirements (memory, etc.).

The bottom line is that users should not just accept the old myths about Unix. This second year of the '90s is a good time to ask for proof. When consultants, vendors, or developers make claims about how the world really is, be skeptical. Make them prove their points. Make vendors show you how their technology will take you out of the mess you're in today and move you into a more efficient mode. Make developers show you how their tools and applications will solve your problems. When vendors talk about interoperability and heterogeneous computing environments, make them show you how these technologies will work together. Make consultants deal with the facts, not the legends. Let's make 1991 the year when the user takes the lead. All players in the industry will benefit. ◐

PATRICIA SEYBOLD'S
UNIX IN THE OFFICE

Editor-in-Chief
Judith S. Hurwitz
MCI: 3538836@mci.com
Internet: hurwitz@dcm1tp.das.net

Analysts and Editors
JUDITH R. DAVIS
DAVID S. MARSHAK
RONNI T. MARSHAK
MICHAEL D. MILLIKIN
LAURE B. ROWAN
JOHN R. RYMER

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Sales Director
RICHARD ALLSBROOK JR.

Circulation Manager
DEBORAH A. HAY

Customer Service Manager
DONALD K. BAILLARGEON

Patricia Seybold's Office Computing Group 148 State Street, Suite 612, Boston, Massachusetts 02109
Telephone: (617) 742-5200 FAX: (617) 742-1028 MCI: psocg / 312 2583
Internet: psocg@dcm1sg.das.net TELEX: 6503122583

Patricia Seybold's UNIX in the Office (ISSN 0887-3054) is published monthly for $495 (US), $507 (Canada), and $519 (Foreign) per year by Patricia Seybold's Office Computing Group, 148 State Street, Suite 612, Boston, MA 02109. Second-class postage permit at Boston, MA and additional mailing offices. POSTMASTER: Send address changes to *Patricia Seybold's UNIX in the Office*, 148 State Street, Suite 612, Boston, MA 02109.

• MULTIMEDIA •

(continued from page 1) our standard personal workstations, into our standard applications, and, in fact, into our standard way of doing business. In 1996, the term multimedia will have become an anachronism, just as today no one talks about the "graphics PC" as we did in 1985.

Hotbed of Activity

Today, multimedia is hot. It is hot not only because some vendors see it opening up new markets, as the growth of the computer industry slows. It is also hot because users are beginning to see the promise that the new forms of media hold for dealing with the ever-growing amounts of increasingly complex information that we must deal with on a daily basis.

Why Multimedia?

ASSIMILATION OF INFORMATION. As new types of information presentation, particularly audio and video, are integrated into our day-to-day business activities, our ability to receive, process, and act on the tremendous amount of information that we currently have to deal with will be significantly enhanced. We see the addition of audio and video having much the same effects as the addition of graphs and charts to a 1-2-3 spreadsheet—both increasing understanding and enabling more people to use the information. Likewise, the proper use of audio and video will enable a greater understanding of information for our current users, and, at the same time, open up that information to a large number of people who do not have access to it.

Multimedia applications, to reach their full potential, will have to be built for the workgroup and the enterprise.

Why Unix?

WORKGROUP APPLICATIONS. However, this general use of multimedia will not happen as long as multimedia applications are confined to single users in training or presentation situations. Multimedia applications, to reach their full potential, will have to be built for the workgroup and the enterprise. It is there that Unix applications are taking the lead, particularly in areas such as banking, financial services, and health care (see "Advanced Applications," page 4).

UNIX ADVANTAGES. The use of Unix workstations as a key platform for the initial development of advanced applications is being driven by the power and flexibility of Unix workstations. The specific advantages offered include:

- Multitasking operating systems
- Advanced windowing systems
- High-level graphics support
- High performance

These features provide power to run applications that have multiple, simultaneous processes, all of which can be viewed (or listened to) by the user. They also provide a flexible architecture that allows developers choices in the way technologies are implemented—for example, single video-frame compression, based on the Joint Photographic Experts Group (JPEG) standard, can be implemented in either software on the RISC CPU (à la Sun) or as a separately addressed chip (à la NeXT).

Equally important as the Unix workstations themselves is the built-in support for networking and the client/server model. And Unix workstations will be the first desktops to support FDDI 100 Mbps fiber-based networks. In addition, Unix provides extensible support for a large variety of input and output devices. And, of course, Unix gives the promise of application portability across platforms.

Finally, in our view, the adoption cycle for advanced multimedia applications will closely follow the adoption cycle for Unix workstations. These applications will be initially introduced into high leverage situations—financial trading, insurance, banking, airlines—the very areas where Unix workstations have had their initial commercial success.

UNIX DISADVANTAGES. Multimedia developers (software, hardware, tools), when deciding whether and when to enter the Unix market, cite three drawbacks: market size, market confusion and fragmentation, and the lack of a standard, real-time Unix.

Market Size. Many companies that are currently developing multimedia applications and tools for Macs and PCs are concerned about whether the Unix desktop market will grow big enough to support an active multimedia market—or, more specifically, to support their development costs in moving to Unix. Many see the Mac, and particularly the DOS Windows markets, as providing infinitely more opportunity.

At this time, most players in the multimedia world have plans to move their applications and technologies to Unix, though we are aware of only one, OWL International (see "Tools to Take Advantage of Multimedia Opportunities," page 12), that has committed to a timeframe—first quarter 1991.

Market Confusion and Fragmentation. Many of these same developers, here joined by those for whom Unix is already the most strategic, such as BBN, are greatly concerned over the confusion caused by the multiple versions of Unix, with multiple windowing systems, running on multiple platforms.

Many developers see the market confusion as a key limiter on the growth of the desktop Unix market and thus on their own

Advanced Applications

We are beginning to see some advanced multimedia applications being built on Unix workstations. These applications tend to be highly customized and frequently aimed at particular vertical industries. They also tend to be very complex, with multimedia being only one element. Other components usually include databases, expert systems, imaging, and group conferencing.

These applications can range from personal productivity tools for financial traders, to multimedia conferencing among doctors, to assistance in finding homes for real estate buyers.

TRADER'S WORKSTATION. One of the key early adopters of advanced technologies is the financial or commodities trader. Because of the highly leveraged work traders do, where a single decision could affect millions of dollars, they have been very receptive of technology that assists in their information-gathering and decision-making. Thus, this market segment has been among the first to adopt fast Unix workstations, using their multiwindowing capabilities to simplify the view of information while integrating various data sources with powerful workstation analysis tools.

In this type of setting, the trader is likely to have one or more windows dedicated to real-time datafeeds such as stock or commodities quotes. The quotes may also be fed into an analysis tool such as a spreadsheet, where figures such as an up-to-the-minute value of a client's holdings would be instantly available. Another window might be dedicated to the price of gold or the current Dow-Jones average.

The introduction of multimedia technologies has begun to enhance the utility of these workstations. Now, some of the multiple windows are being used for live feeds from video news services such as CNN and FNN. In addition, voice annotation is used both for increased personal productivity—as personal reminders—and to pass information to colleagues. The latter is particularly necessary with 24-hour-per-day trading. At the end of each trader's shift, he or she must "pass the book" to the person responsible for the accounts during the trader's off hours.

MEDICAL MULTIMEDIA CONFERENCING. NYNEX has embarked on an aggressive program to develop and demonstrate the possibilities of using the phone network to create advanced multimedia, imaging, and workgroup applications within metropolitan and wide area networks. The first result is a development agreement between NYNEX, Sun Microsystems, and four Boston-based hospitals. Under the agreement, a system is being developed that connects health care professionals at various locations. This system allows the medical professionals, many of them using Sun workstations, to work together, simultaneously viewing the same medical data—including still medical images (such as X-rays) and moving images such as sonograms and Magnetic Resonance Imaging (MRI).

This is part of a three-year trial of what NYNEX is terming the world's first multimedia conferencing service called Media Broadband Service (MBS). The other participants in the trial are Brigham and Women's Hospital, Children's Hospital, Massachusetts General Hospital, New England Medical Center, and the Christian Science Publishing Society.

Applications being developed include:

- At Brigham and Women's Hospital, hospital personnel treating an emergency patient can reach a doctor at home—including sending X-rays and patient history electronically—so that the doctor can specify treatment before leaving for the hospital.

- At Children's Hospital, medical personnel create and share multimedia packages of images, data, text, and voice annotations to be used as patient reports. More than one doctor can view these reports simultaneously. They can also be annotated by imaging specialists, referring physicians, and hospital staff. If the appropriate people are not available on site, the reports will be electronically mailed to the appropriate expert.

opportunities. In addition, the market fragmentation makes it very difficult to develop applications, which must be built or ported to multiple operating systems, windowing environments, and processors, as well as to multiple audio and video systems. The cost factor can be daunting, particularly when compared with the Mac, which has created a fairly standard development environment, and with DOS Windows, where Microsoft is actively pushing multimedia standards.

Finally, the lack of standards is making users wary of jumping into multimedia until they see interoperability of multimedia applications across platforms. In today's environment, for example, a company could standardize on BBN's Slate office system, which supports voice and video annotations. Furthermore, the same company could standardize on Sun equipment. And sure enough, Slate runs on Sun3s, 386is, and SPARCstations. However, since the audio support on these platforms is different, voice annotations of documents or mail created on one system-type cannot be listened to on another.

- At Massachusetts General Hospital, the Picture Archiving and Communication Systems (PACS), which enables the transmission, archiving, and manipulation of radiological images within the hospital's main campus, has been in use for the past five years. With the new service, personnel located in hospital buildings in Boston, Charlestown, and Somerville can view images simultaneously. Initial tests on this service have reduced the time to receive an X-ray reading from six to two hours.

- At New England Medical Center, a cardiologist at the hospital and a referring physician at a suburban hospital will simultaneously view moving images of a patient's heart catheterization and decide together on an appropriate course of action.

There is also an effort to link these multimedia applications with transaction-oriented applications such as records retention, accounts payable, and claims processing with an interface that has been developed to Probity (from LaPook Lear Systems), a physician's total practice management system that includes insurance claims processing and accounts payable functions.

Publishing Application. In addition to these medical applications, NYNEX is working with the Christian Science Publishing Society—publisher of the *Christian Science Monitor* and the producer of the Christian Science television and radio programs—to enable remote layout and editing of the print publications and to move pictures easily between the print and broadcast media and vice versa.

The front ends of many of these applications will be built on Sun workstations. In addition, Unix servers are used on the network to handle the routing, session management, and security on the network. The network consists of broadband switches and dedicated fiber lines running among the hospitals and publisher and the New England Telephone central offices. This traffic will use the new Switched Multimegabit Data Service (SMDS) when it becomes available. Within the local networks, both Ethernet and FDDI are in use.

For NYNEX, these trials will help establish SMDS as the method for businesses to easily send and receive voice, data, images, and video, individually or in combination. Ultimately, however, NYNEX and all of the regional operating companies are aiming SMDS at the vast consumer/entertainment market.

POINT-OF-INFORMATION: REAL ESTATE AND TRAVEL. Informix is demonstrating how multimedia and database technology can be used together to create a point-of-information application, in this case, in the real estate business. The application runs as follows:

A customer (or more likely a couple) comes into a real estate office with some idea of the type of house desired. The significant details—price, style, number of bedrooms, school district, etc.—are entered into a form that creates a query on a relational database. The query returns a number of houses that meet the criteria, with a picture of each house appearing on the workstation screen.

The user can then look at the pictures and choose which ones to get more specific information about, or can click on a video button and get a video walk-through tour of the house.

In this particular application, the video is stored on a laser disk connected to the workstation (the pictures were stored as BLOBs in the database—see "Databases to Support Multimedia"). With compression such as DVI, the video could be stored on CD-ROM or transmitted across a network. As compression technology gets better, the video itself will be able to be stored in the database.

Point-of-information applications are hot prospects for multimedia, with travel services being one of the chief targets. Technology similar to the Informix real estate application will enable prospective travelers to walk though cruise ships (including the pools, lounges, and casinos), view a hotel's rooms and its location in a city, and compare the whiteness of resort beaches.

No Real-Time Unix. Lack of a standard real-time Unix has made it difficult for some developers to create applications that require such features as synchronization of audio and video displays. To solve this problem, a number of vendors have created extensions to the kernel or substituted their own scheduler to optimize these capabilities. The real-time Unix issue is one, at least, that should be resolved fairly soon, with System V.4 supporting the substitution of preemptive schedulers and the Posix P1003.5 Committee working on an industry-wide real-time standard.

What Will It Take?

There are two essential checkpoints on the road to this multimedia world: compelling applications that excite users, and a set of standards and standard APIs that enable developers to build these applications to be portable and interoperable.

VICIOUS CIRCLE: LACK OF STANDARDS/LACK OF APPLICATIONS. For the past year or so, the road to multimedia has been more of a circle than a direct path. Users who need to see

Multimedia: Definitions and Technologies

DEFINITIONS. To us, multimedia is the integration and use of motion video, audio, and animation with the traditional computer data types of text, graphics, and image. Thus, in one sense, today's multimedia is like yesterday's graphics, just another data type that is added to our current mix.

Multimedia technologies, on the other hand, can be specifically distinguished from our previous data types. Motion video, audio, and animation are differentiated by the fact that they cannot be reproduced on paper. Unlike text, graphics, and image, which bring printing and paper paradigms to the screen, these multimedia technologies have the computer screen as their integrating and ultimate presentation vehicle.

This means that, although many of the issues of adding multimedia are similar to adding previous new data types, there are some significant differences in their integration. For example, if your word processor or monitor cannot display a graphic, you can always put in a "place holder" in the document and see the graphic in its proper place when the document is printed. This luxury is not available when the document and the display are the ultimate target for the information. If you want video to be part of the application, the user's workstation must support video.

MULTIMEDIA TECHNOLOGIES. Generally, three aspects of the audio and video technologies make up multimedia:

- Capture
- Storage
- Display

Capture. The first step in the creation of multimedia objects or applications is capturing the audio or video signals from their originating point. This can be done via an internal device, such as the audio chips standard with Sun and NeXT workstations, or using specific audio or video capture boards, such as those from RasterOps and Parallax, which can be added on to virtually any system.

There are two types of capture: analog and digital. Analog merely uses the computer to play the audio and video that comes from somewhere else: videodisk, tape, CD-ROM, television signal. The workstation essentially becomes a player, much like a TV monitor or speaker.

Digitizing allows the audio or video to be manipulated with various types of tools. Individual images and audio cuts can be enhanced, or can be combined with other objects to create new objects. Digitizing also allows the objects to be saved and retrieved on standard computer media—magnetic or optical disks.

Storage. There are two ways to store digitized objects: compressed or uncompressed. Uncompressed audio and

compelling applications before making the necessary platform and development investments have not been overwhelmed so far. While they have shown some interest in training and presentation applications, they have not yet been convinced that having multimedia capabilities on all of their desktops is important to how well they do business.

And even when users see something that excites them, such as the voice annotation capabilities of BBN's Slate office environment, they are frustrated by the incompatibilities we noted above. (And users don't want to hear about the lack of standards and interfaces that make porting applications so difficult and interoperability nearly impossible.)

The lack of standards, both within a single platform and, more importantly, across platforms, has significantly delayed the movement towards widespread development and deployment of multimedia media applications outside the traditional training/presentation markets. The past year or so, while showing some exciting technology breakthroughs, has also shown mostly "me-tooism," with developer innovation and user interest apparently stagnating.

DEVELOPER'S NEEDS. In order to create compelling applications, developers need four conditions:

- Standard APIs that hide the various underlying devices
- Easy portability across platforms
- Assurance of interoperability across devices and platforms
- Confidence that users will have multimedia-capable desktops

I/O APIs For Ease Of Development. The first condition—standard APIs to devices such as CD-ROMs, video- and audiotape players, and laser disk players—would make it much easier and quicker (and less expensive) to build the applications and would assure that users could add new devices as they need to. The set of high-level APIs will let applications call multimedia devices with standard commands such as Play, Record, Fast Forward, Rewind, and Stop—rather than knowing the specific, low-level calls for each brand and each model machine.

Portability for a Larger Market. Portability across platforms is necessary to create a large enough market to make it worth-

particularly video take a tremendous amount of storage space. One second of uncompressed full-motion video (full-motion is defined as 30 frames per second) can take as much as 30MB of storage space—1 minute of video would then take almost 2 Gigabytes. Thus, much of the focus in the video area has been on developing compression technologies to enable the storage of sufficient amounts of video to make video applications feasible.

The first and most important attempt in this technology was made by the GE/RCA David Sarnoff Labs, which produced Digital Video Interactive (DVI). DVI, since acquired and produced by Intel, enables the storage of over 50 minutes of high-quality, full-motion video on a single CD-ROM—similar to the common audio CD. In addition, DVI enables the storage of an equal amount of CD-quality audio and thousands of high-resolution images in the same format. DVI is currently supported only on DOS and OS/2, though Intel has opened up its architecture (see "Intel—Opening Up DVI") and is actively pursuing partners to help bring DVI to additional platforms. Olivetti and AT&T have both publicly stated their interest in working with Intel to bring DVI to Unix.

Other compression technologies have since been introduced, including CD-XA for audio compression and JPEG for still image, which can be played fast enough to simulate motion video. In addition, an international motion video standard—from ISO's Moving Pictures Experts Group (MPEG)—has been proposed, though it has not yet been completely defined.

All of this activity has led to great confusion over what is the standard way to compress and decompress multimedia objects, confusion which has tended to delay development in this area. We discuss the standards debate as one of the key issues in the section "What Will It Take?"

Display. Displaying multimedia objects involves a number of enablers. First, the correct display device must be present—the proper video board (with or without decompression), the proper audio board, etc. As with capture technologies, these can either be part of or add-ons to workstations, and, generally, the same device can handle capture and playback.

However, the ability to display multimedia also means determining when the object should be displayed. This is the province of authoring and scripting tools, which determine that, when I push a certain button, I will get a certain effect. This effect may very well involve the synchronization of various types of media, so that the proper audio, video, images, and text play together correctly. The availability of tools for multimedia is discussed in the section "Tools to Take Advantage of Multimedia Opportunities" on page 12.

while for developers to commit significant resources to building multimedia applications.

Interoperability for Group Applications. Interoperability is essential for addressing the heterogeneous platform—the major platform that users currently have. The ability to assure that multimedia objects can be easily exchanged is probably the single most important gating factor for both the development of these applications and their acceptance by users.

The key to interoperability is the agreement on standard file formats to run across applications and across platforms. A standard set of file formats will enable applications to exchange multimedia objects, without regard to which particular system or peripheral created the object. This interchange is a particularly thorny issue with multimedia objects, as they frequently must be compressed for storage or transmission and decompressed for display—and compression/decompression algorithms comprise one of the more proprietary areas of the industry.

Standard Target Desktop for Assurance of Mass Participation. The availability and user adoption of standard multimedia desktops is certainly a prerequisite for a large market for multimedia applications, particularly applications where users have to share information.

A PUSH FROM MICROSOFT AND IBM. Recently, however, some events have occurred that may push this situation off center. Most notably, IBM and Microsoft have decided that it is essential to give multimedia a kick. This has been done in two ways.

Rallying Around Multimedia. First, the companies have, for the past year, talked a lot about the importance of multimedia and have created and presented demonstrations of how this multimedia might look. "The past year" is a precise term, measured from IBM VP George Conrades's Fall Comdex 1989 keynote emphasizing multimedia to Bill Gates's Fall Comdex 1990 keynote talking about the vision of "Information at Your Fingertips." These multimedia demonstrations have not been limited to the traditional training and presentation areas, but have included information access, individual and workgroup productivity, publishing, point-of-sale, and educational applications.

Multimedia Extensions and Cross-Platform Specifications. This year of talk has now been followed by some action aimed specifically at meeting the needs of developers. At the end of November, Microsoft held a multimedia developers conference (over 600 developers attended) at which both Microsoft and IBM announced extensions to DOS Windows 3.0 and OS/2 to support multimedia. We expect that IBM will take these extensions to AIX.

Draft platform-independent specifications that address both file format interchange standards and a set of APIs to multimedia devices were presented (for more on these specifications, see "Microsoft/IBM Specifications: A Possible Solution?" on page 10). In addition, Microsoft and several hardware vendors, including AT&T, NEC, Olivetti, Tandy, and Zenith, proposed a set of capabilities that describe a standard multimedia desktop. The hardware vendors announced that products based on these specifications will be delivered in 1991. Microsoft also announced a multimedia toolkit for developing Windows applications. Suddenly, the multimedia road seems to be straightening out again.

How Will Unix Vendors Respond? While it is clear that most ISVs will jump on the DOS Windows-OS/2 standards, it remains to be seen whether the specifications will be supported by Unix platform providers such as Sun and NeXT, and on the Macintosh. These players may be reluctant to support proposed "standards" coming out of a Microsoft/IBM environment. However, in the long run, it is essential that they either directly support these specifications, or at least support translations from their systems. If this happens, the potential for a cross-platform multimedia environment is likely to become a reality. If the vendors choose to battle each other for dominance, the multimedia market could remain a niche for longer than necessary.

In the long run, it is essential that Unix players either directly support these specifications, or at least support translations from their systems.

BUILDING THE ROAD TO AN OPEN MULTIMEDIA WORLD

Although it looks as if multimedia technology is again moving forward, it still has a way to go before it can really take off. The two steps that have to be taken to get to an open multimedia world are: (1) overcoming the obstacles created by the lack of standards (or, equally, the plethora of "standards"), and (2) building the infrastructure to support the creation, storage, transmission, sharing, and management of multimedia objects.

Removing the Roadblocks

THE MULTIMEDIA STANDARDS MOVEMENT. As we have discussed above, standards are essential for developers to build applications that will have wide appeal and wide implementation. The types of standards needed include file interchange formats, compression/decompression algorithms, and APIs to multimedia devices. The most important areas that have to be addressed are:

- Still images
- Moving images
- Audio
- Animation
- Compound documents

The current standards situation is a confusing picture. Within each of these categories, there is currently activity on some, if not all, of the following: de jure standards, de facto standards, and partnerships and individual companies trying to gain enough market share to become the de facto standard.

Still Images. The most progress has been made on a standard for high-resolution color images. The International Standards Organization's (ISO's) Joint Photographic Experts Group (JPEG) has issued a draft standard that has received virtually universal support. One company, C-Qube, has released a compression/decompression chip based on the draft standard. NeXT is using the C-Qube chip in its multimedia board, while Sun is using JPEG compression in software (on the SPARC CPU) for its image compression. We are not aware of any compatibility tests between the two companies, although, theoretically, an image compressed on a NeXT should be able to be decompressed on a Sun. JPEG images, if pulled quickly enough off a hard disk, can simulate motion video.

Moving Images. While JPEG deals strictly with the compression of single images, other standards are emerging that compress both individual images and the flow of images—in other words, video. The video standards movement has its origins in two distinct industries: videoconferencing and digital storage of video for later playback. While the two have a lot in common (we believe that they will eventually merge—with agreements between companies such as Intel and PictureTel leading the way), they have different requirements. Videoconferencing, by its nature, requires real-time compression and decompression, while digital storage can be done in non-real-time mode.

Videoconferencing, being real-time, can only compress the video by looking at the frame itself and the previous frames, sending only the changes between frames. Non-real-time compression can be much more effective because it can look at the frame itself, the previous frames, and the following frames, thus optimizing how much of the frame has to be stored.

The CCITT has taken the lead in the videoconferencing area, and release of the final draft of Px64 standard is imminent. Px64 allows the transmission of real-time images to be scaled in increments of 64 Kbps, depending on available bandwidth. Most players in the videoconferencing business are now showing Px64-compliant products.

On the desktop (i.e., digital storage and exchange of video), two standards are emerging. Intel's Digital Video Interactive (DVI), though proprietary, is considered the de facto standard, and is the only technology available today that permits storage and retrieval of significant amounts of full-motion video on a CD-ROM (at 1.2 Mbps). DVI has support from IBM and Microsoft, being a key technology in both companies' multimedia plans. And though it is a proprietary technology, Intel is moving to open it up, both by making it platform independent and by committing to have its chips support the standard compression techniques simultaneously with its own (for more on Intel and DVI, see "Multimedia and Unix: Vendor Strategies" on page 13).

Much of the industry is looking towards ISO's Moving Pictures Experts Group (MPEG) to define an open standard for digital video compression. MPEG's charter is to create this standard, which would enable decompression and transmission of full-motion video at 1.2 to 8 Mbps. MPEG has wide support in the computer industry, including Apple, IBM, AT&T, Bellcore, and Sun, as well as the consumer electronics giants Sony and JVC. However, even a draft standard has been very slow in coming, both because of the difficulty of the problem and because of the inherently different agendas of the computer and consumer electronics companies. The consumer electronics companies are really more interested in establishing standards that can be used in camcorders and intelligent TVs than in workstations and PCs.

The likely result will be multiprotocol chips, such as those proposed by Intel. Information between systems will be exchanged at the highest level of compression that both support, with MPEG or Px64 being a lowest common denominator fallback. This will be accomplished though a hand-shaking protocol, similar to the way modems currently decide at which speed and with what type of compression to communicate with each other.

Audio. While a lot of work has been done in the image and video area, standards are lacking in audio, particularly digitized audio. In addition, audio has raised a number of jurisdiction issues. Those working on Px64 and MPEG feel that audio should be in their respective bailiwicks—although, thus far, neither group has been able to deal successfully with the audio issue.

On the desktop, audio is divided into two types: CD-quality stereo audio and digitized audio. Some standards for CD audio (collectively known as the Red Book) come out of the consumer CD industry. In addition, Sony has taken the audio component out of Philips's consumer-oriented proprietary multimedia format for CDs (CD-I, or Compact Disc-Interactive) and opened it up as a de facto standard called CD-ROM XA ADPCM (Adaptive Delta Pulse Code Modulation) or, to many, just XA. XA is supported most strongly by Sony, Meridian Data, Philips, and Microsoft, although, at this point, nearly every company interested in CD-quality audio has at least expressed future support for XA.

There are currently no standards for digitized audio. File formats and compression (if any) vary across platforms and products—to the point where, as we noted above, the same product (BBN Slate) can run on the same vendor's hardware (Sun SPARCstation and Sun 386i) and not be able to exchange digitized voice annotations.

The digitized audio arena is currently a battle to create enough market share to become a de facto standard. The contenders include Sun—which includes an audio chip on every SPARCstation and licenses it to every SPARC-compatible manufacturer, Apple—which now has added built-in audio support to every new Mac, and Natural Microsystems—with the lion's share of PC audio boards, particularly in the area of voice/telephone processing.

The digitized audio arena is currently a battle to create enough market share to become a de facto standard.

With this confusion, the audio area could be the one most affected by the Microsoft specifications, which do specifically address audio with Microsoft's Waveform Audio File Format (WAVE).

Animation. Up to now, there have been no standards for animation. Whatever product is dominant on a particular platform (such as MacroMind Director on the Mac) has become the de facto standard. MacroMind, with its addition of DOS Windows products, has moved to consolidate its position as the cross-platform standard. Even more important, The Microsoft/IBM specifications (see page 10) define a Multimedia Movie File Format (MMM) for animation, which, in all likelihood, will come from MacroMind's work.

Compound Documents. Another type of standard defines how multimedia objects will interact with other objects. The two leaders in defining architectures to support mixed data types are IBM (in its Mixed Object Document Content Architecture, or MO:DCA), and Digital (in its Compound Document Architecture, or CDA), whose architectures are both supersets of the international standard Office Document Architecture (ODA). Each plans to include audio and video objects in its architecture, enabling the transmission and exchange of complex, multiple-media objects across a network via the mail system.

Another approach is being taken by a group that plans to base multimedia standards on the Standardized Generalized Markup Language (SGML) publishing standard. The new standard is to be called HyTime (Hypermedia Time-Based Structuring Language). It would add the idea of time in music notation, such as beats per measure, rests, etc. This will allow previously "timeless" information—graphics, sounds, pictures—to be displayed "in time," as animation, music, and video.

MICROSOFT/IBM SPECIFICATIONS: A POSSIBLE SOLUTION? The publishing of the Microsoft/IBM multimedia specifications may be a watershed in the movement towards a standard development environment for multimedia applications. While initially announced to take advantage of multimedia extensions for DOS Windows (by Microsoft) and OS/2 (by IBM), these specifications have the possibility of becoming standards in the Unix and Mac worlds as well (with politics and parochial interests rather than technology being the major inhibitors). At the very least, the specifications could serve as the basis for creating multimedia objects that will be displayable across platforms.

The specifications cover two areas: standard file formats for storing and exchanging multimedia objects, and a standard set of APIs to run across multimedia peripherals from different vendors.

The Microsoft/IBM multimedia specifications may be a watershed in the movement towards a standard development environment for multimedia applications.

File Interchange Formats. The standard file format, called RIFF (Resources Interchange File Format), describes, but is not limited to, the following formats:

- Bundle (BND) File Format—a file format for a group of files, each of which could stand on its own
- Device Independent Bitmap (DIB) File Format—a format that contains bitmap, color, and color palette information
- RIFF DIB (RDIB) File Format—a DIB file enclosed in a RIFF "wrapper," or a set of bitmaps more complex than is possible with DIB
- Musical Instrument Digital Interface (MIDI) File Format—the standard computer-to-musical instruments interface
- RIFF MIDI (RMDI) File Format—a MIDI file with a RIFF "wrapper"
- Palette File Format (PAL)—a logical palette of 1 to 256 colors represented as RGB values
- Rich Text Format (RTF)—text formatting and graphics format support in Microsoft products, such as Word
- Waveform Audio File Format (WAVE)—representation of digital sound
- Microsoft Windows Metafile Format (WMF)—a vector graphic format used as an interchange format by Microsoft Windows
- Multimedia Movie Format (MMM)—a format that handles animation files

Missing from this list is a file format for full-motion video, though it is likely that DVI support will be added in a future version.

APIs to Multimedia Devices. The second part of the specifications concern the Media Control Interface (MCI), which will be a high-level command control interface to multimedia devices and resource files. The aim of MCI is to provide device independence for applications that need to control audio and visual peripherals, such as devices for audio playback, audio recording, and animation playback, as well as videodisk and videotape players.

MCI has been set up to act as a platform-independent layer that sits between multimedia applications and the underlying system software, thus freeing developers from needing to know the low-level instructions for each possible device and enabling the applications to be portable across all platforms supporting the MCI command set.

As with RIFF, MCI will be extensible. Microsoft will serve as a clearinghouse to register new types of commands, files, or devices.

Are These Specifications a Panacea? It is still too early to determine whether the specifications are technically complete and robust enough for advanced multimedia applications. It is clear, however, that most developers (at least those in the DOS and OS/2 environments) are ready to jump on the bandwagon, focussing their current attention on developing for these specifications.

The issue is whether these specifications will be embraced across platforms other than DOS Windows and OS/2. While initially the DOS Windows market may appear large enough to support its own standards, we will soon find that users' inability to run their applications in heterogenous enviroments will quickly retard market development even in this sector.

Ultimately, it is up to both the Unix and Macintosh players to constructively deal with these specifications and the Windows and OS/2 players to push them onto the other platforms, rather than be tempted to keep the "standard multimedia platform" for themselves.

We see the multimedia applications developers, many of whom started on Macs and have added DOS Windows products,

to be the primary drivers of cross-platform mulitimedia specifications. And since these developers all seem to be writing to the Microsoft/IBM specifications, it is unlikely that we will see the successful emergence of an alternative approach.

BUILDING THE TECHNOLOGY INFRASTRUCTURE

The underlying requirement for building advanced multimedia applications is the infrastructure to support the multiuser access, exchange, and management of multimedia objects. The key elements of this infrastructure are a standard multimedia desktop, networking, databases, object management, and tools to develop multimedia applications.

Proposed International Video Compression Standards

Type	Name	Compression	Organization	Due
Video-conference	Px64	DCT (interframe interpolation)	CCITT	draft 1988 final 1990
Color Still Pictures	JPEG	DCT (adaptive—intraframe)	ISO	draft 1989 final 1991
Full Motion Video	MPEG	DCT (interframe)	ISO	draft 1990

JPEG = Joint Photographic Experts Group
MPEG = Moving Pictures Experts Group
DCT = Discrete Cosine Transform

Illustration 1. There has been lots of activity on compression-standards definition for still images, video, and interleaved video. But the picture is far from complete.

Multimedia to Come Standard on the Desktop

Developers need to be able to assume a certain level of multimedia support on every target desktop. At the same time, users need these capabilities to be inexpensive (or preferably free) and, more importantly, to be integrated into their desktop platforms. Users do not want to have to add on new boards and peripherals continually when the additional cost factor is generally exceeded only by the hassle factor.

There are a number of movements toward integrating the technologies into the standard desktops, making them cheaper and simpler to deal with. For example, companies such as Sun, Sony, NeXT, and Apple have audio processing chips integrated into their workstations. Intel is working with a number of leading PC makers to integrate DVI chips onto the motherboards, reducing by about half the incremental price of adding DVI on a board. And, at the Microsoft multimedia conference, AT&T, CompuAdd, Fujitsu, NEC, Olivetti, Tandy, and Zenith (but neither IBM nor Compaq) announced that, this year, they will deliver machines based on the minimum multimedia hardware configuration designated by Microsoft. This configuration does not include support for motion video, which will be supported in the next-level multimedia machine, due to appear, according to Microsoft, in 1992-93. Currently, the specifications for this level machine include support for DVI.

Today, most platforms require additional hardware to support audio and particularly video. In the Unix workstation arena, most video boards are from third parties such as RasterOps, Parallax, and New Media Graphics, while third-party board makers on the PC and Mac, such as VideoLogic and TruVision, are working on Unix versions of their products. The exceptions currently include NeXT, with its NeXT Dimension board due to ship first quarter 1991, and Sony, which plans to announce its own video capture board this month. We expect this trend to continue, and we should see board-level products from other Unix workstation vendors very soon.

Networking to Support Multimedia

Although moving large images, audio, and especially motion video around LANs and WANs is a daunting task, it is essential for sending both multimedia documents and objects among users. It is also critical for building client/server applications, where the multimedia objects can be stored on a server for retrieval, sharing, and management, and can be viewed by users in client applications running at their workstations.

The feasibility of networked delivery of full-motion video is gated by two factors: the amount of information that has to be sent—up to a megabyte per frame for color images—and the speed at which the images must be displayed to appear to be in motion—30 frames per second. This translates into roughly a 30 megabyte per second throughput (240 Mbps), a bandwidth unlikely to be commonplace during the first half of this decade.

SQUEEZING THE DATA. The alternative to using this much bandwidth is to compress the images before transmission and decompress them on the receiving end. Thus, compression techniques such as Intel's DVI, originally developed to fit about

an hour of full-motion video on a CD-ROM, enable video transmission on LANs supporting a real throughput of greater than 1.2 Mbps. IBM, for example, has demonstrated client access to DVI compressed video on a server over a 16 Mbps Token-Ring network.

ENTER THE RBOCS. The tradeoffs between bandwidth, compression, and video quality (see Illustration 2), are creating a number of opportunities for computer companies, particularly the wide area voice/data network providers, i.e., AT&T, MCI, the Regional Bell Operating Companies (RBOCs), etc. The latter group will be concentrating on developing high-bandwidth services to support multimedia applications.

The telecom networking companies are about to enter the multimedia world in a big way. The RBOCs, for example, are targeting point-of-sale and point-of-information applications such as video ATMs, remote real estate sales, travel and tourism, and remote convict-booking systems. These are areas where still images will be moved from a central or remote location to a desktop or kiosk. In addition, these carriers see videoconferencing as a potentially lucrative revenue source.

CAN WE USE X? Research into extending X Window may prove crucial in enabling both client/server multimedia applications and the interoperability of these applications across platforms. This research is examining the possibility of using the X Window protocol to carry full-motion video. One approach would be to extend X to include video compression/decompression services. This would allow video to be compressed at the server or a compressed video be retrieved from a storage device. It could then be shipped to the workstation, where it would be decompressed into an X Window by an extended X server.

If such extensions could be made to X, multiple users could have access to video objects on a given server. These users could be running on any desktop that supports an X display server.

Databases to Support Multimedia

Over the past year, a lot of progress has been made in enabling Unix relational database managers to handle nonstandard data types, such as those which make up multimedia. One of the leaders in this area is Informix, with its Informix-OnLine product.

BLOBS. Informix-OnLine uses BLOBs (binary large objects) to define fields that will hold multimedia (or very large text) objects. The database does not know the contents of the BLOB. A companion field in the record can be used to define the contents—digitized audio, digitized photograph, or (eventually) compressed video—and what device to use to display it.

In its support of BLOBs, Informix-OnLine handles such issues as shared memory, logging and recovery, disk-mirroring, and archiving differently from the way it handles those issues for other data types. This minimizes the affect of the size of a BLOB on the performance of the database in general.

An example of a multimedia database application is the real estate example described in the box "Advanced Applications" on page 4. In this application, digitized, color photographs of houses are stored as BLOBs, while the video is accessed from a laser disk via a pointer in the database. The database does not manage the video, only the links. However, with compressed video, such as on a DVI-based CD-ROM, the video could also be managed as a BLOB.

MOVING PAST BLOBS. The use of BLOBs is an interim step. As the relational database vendors move towards including the ability of the database to understand multimedia content, they will be nearing the object-oriented database developers. Object databases handle each item as an independent object. These developers argue that only by storing the object's behaviors with its data will true multimedia databases be possible.

Systems to Support Multimedia Object Management

Vendors have barely begun to address the issue of managing shared multimedia objects. Hewlett-Packard's NewWave begins to do this by allowing objects to be shared among applications on a single DOS workstation (see HP's multimedia strategy in "HP—Riding on the NewWave" page 15). However, NewWave is not yet multiplatform or distributed. The HyperDesk technology might hold some promise (see News and Analysis Department, page 17). Unfortunately, we have heard little from the Object Management Group (OMG) about multimedia objects.

A critical factor in the successful implementation of multimedia applications will be solving basic object management issues such as access and security. However, the management issues for networked multimedia objects will be even more complex. In a client/server environment, decisions affecting performance, such as where objects are stored and where they are displayed, will be equally important. Also, how do we handle updating and changing multimedia objects when more than one application may use those objects? And how do we avoid multiple copies and multiple versions of the same object?

Object management may also help solve the interoperability problem. In an object-based implementation, objects would get enough information from the object management system about the target platform to know how to display themselves.

Tools to Take Advantage of Multimedia Opportunities

The absence of development tools for multimedia is a major gap, particularly in the Unix arena. Vendors are unable to find all of the required tools to make development easier. And tools to create cross-platform applications are only just beginning to appear for Mac and DOS Windows.

The wish list of tools is long, as exemplified by the following, which is what Intel's DVI team considers a full multimedia

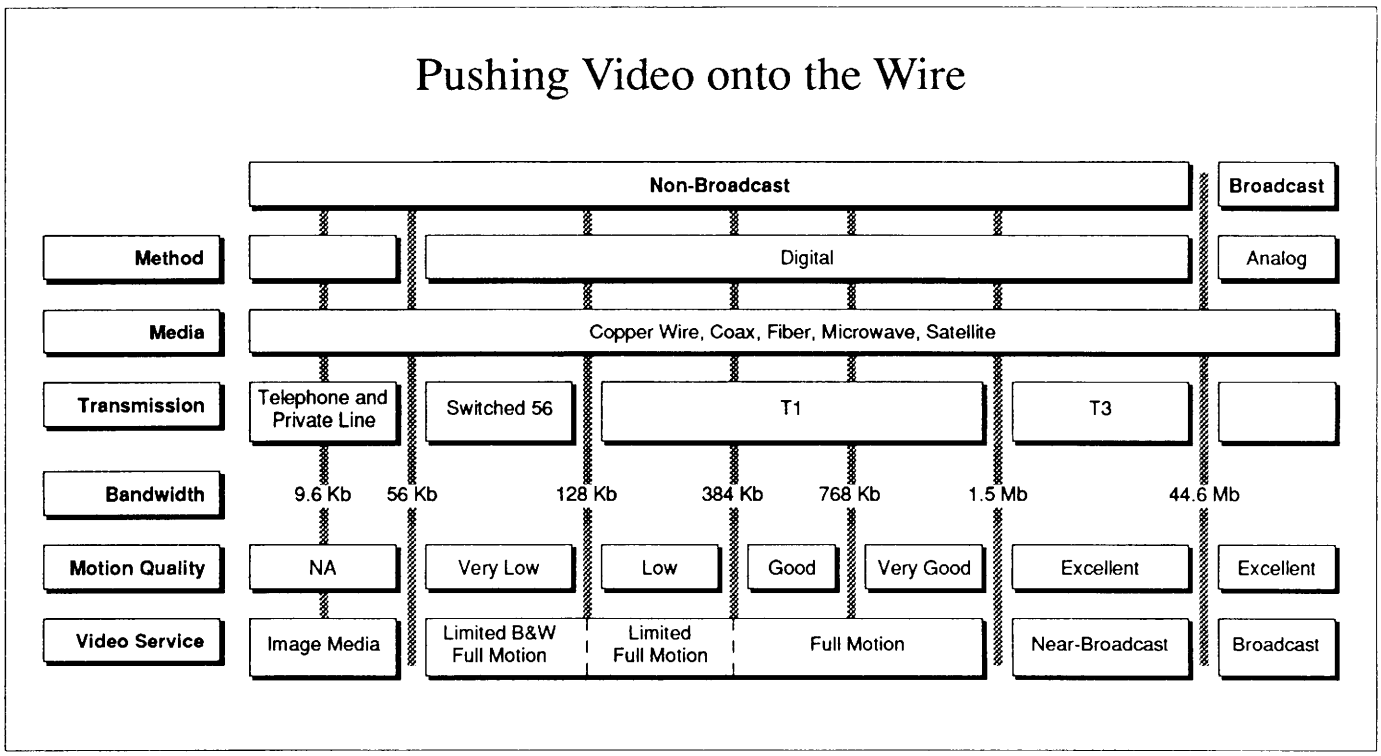

Illustration 2. Charts, such as this one from NYNEX Computer Services, help emphasize the direct relationship between network bandwidth and video quality. Though the terms "good," "very good," "excellent," etc. are subjective, it is clear that T1 speeds or better are required to provide acceptable video quality over a wide area network.

development environment:

- Video editor
- Audio editor
- Graphics library
- Paint package
- Fonts
- Animation package
- Database
- File conversion
- Clip art
- General authoring
- Hypermedia authoring
- Business presentation product
- I/O drivers
- Network

Today, there is no environment which provides all of these tools. Most current activity is concentrated in the area of tools for producing multimedia presentations and training applications on the Mac and DOS PC. These tools are being developed by companies such as MacroMind, Authorware, AutoDesk, OWL, Authology, Asymetrix, Farallon, IBM, and Apple. Most of them are first-generation tools and are difficult for end users to master.

LACK OF UNIX-BASED TOOLS. In the Unix arena, the picture is even bleaker. For example, a company called Tiger Media (Los Angeles, California), which was porting its CD-ROM-based entertainment applications to the SPARC platform, had to build its own authoring tool. Tiger Media now markets this tool as CATS CD Manager. Another company, Market Focus (Carlsbad, California), has produced a high-end multimedia front-end development system with database and expert system back ends. Market Focus's product runs on almost all versions of Unix. The company plans an OS/2 port in the future.

Thus far, only a few Mac and DOS developers have committed to produce Unix multimedia tools. Among these, OWL, with its hypermedia management system (called Guide), and Cognition Technology, with its multimedia front end to an expert system (called MacSMARTS on the Mac), are close to completing Unix ports.

Developers continually cite the lack of a single standard Unix platform and windowing system as the cause of their delay. We expect most tools developers will continue to sit on the sidelines for a while longer, particularly as the MS Windows platform takes virtually all of their attention.

MULTIMEDIA AND UNIX: VENDOR STRATEGIES

Sun—Multimedia for the Workgroup

Sun's approach to multimedia has two themes: distributed network computing and powerful, low-cost desktop workstations. Sun perceives that the presentation of information in multiple media types is essential for a high-quality workgroup computing environment in the 1990s.

Sun's initial target is office applications that leverage speech,

telephony, fax, and scanner technologies in a distributed manner. By the mid-1990s, however, Sun expects to implement real-time digital video across local and wide area networks. For LANs, Sun is counting on FDDI to the desktop; for WANs, Sun is particularly interested in ISDN.

FOCUS ON THE PLATFORM. Sun generally considers itself a platform company, not an applications vendor. It intends to leave much of the multimedia development, particularly the "content," to third parties. All SPARCstations come with built-in audio processing. Currently, video can be played in a window of Sun workstations using boards from companies such as RasterOps and Parallax Graphics.

NeXT—A Prototype Multimedia Workstation

NeXT is targeting its workstations both as delivery vehicles for high-end information applications and development platforms for creating advanced applications to be delivered on multiple platforms. Multimedia capabilities were very important to NeXT from the outset. NeXT machines include a built-in Digital Signal Processor (DSP) to handle graphics and CD-quality sound, and voice and music integration tools. Its Mach kernel supports real-time synchronization. With these funtions, the NeXT workstation is the prototypical multimedia workstation.

Developers continually cite the lack of a single standard Unix platform and windowing system as the cause of their delay.

NeXTDIMENSION. NeXT recently announced an add-on video board—NeXTdimension—which transforms the NeXTcube into any multimedia buff's wildest fantasy. The board adds 32-bit color, a 64-bit RISC graphics coprocessor (the 33 MHz Intel i860), video capture and display, and a JPEG compression/decompression processor from C-Qube.

The jury on NeXT is still out. While the NeXT workstation has capabilities that no other workstation has implemented, the market reality is that this workstation has yet to find anything other than small niches, and it is in danger of being lumped with the Commodore Amiga, rather than with the SPARC or RS/6000.

Sony—Consumer First

Taking a very narrow view, Sony is a Unix workstation vendor that is quickly adding multimedia capabilities to its NEWS workstations—including built-in audio, a Sony video capture board, and CD-ROM support. Multimedia is one of the areas that Sony hopes to use as a differentiator to gain market share in the United States.

Taking a broader view, Sony is a worldwide consumer electronics giant that has a comprehensive agenda when it comes to multimedia. Sony's general interest in multimedia is twofold. First, the company makes many of the peripherals that are used in multimedia—CD-ROMs, video- and audiotape recorders, and laser disk players.

Second, and much more important, Sony is a major power in the consumer multimedia market. It has been agressively acquiring consumer media companies such as Columbia Pictures and CBS Records.

OTHER PLAYERS GO AFTER THE CONSUMER. Sony's dominant position in consumer media is being challenged by another Japanese consumer electronics giant, Matsushita—better known in this country as Panasonic—which recently purchased MCA, another major U.S. entertainment company. We don't hear a lot about Matsushita in the computer arena. However, the company has a majority equity position in Unix workstation-maker Solbourne Computer. Earlier this year, it acquired OWL International. OWL's product, Guide (now available on Mac and DOS and being ported to Unix), was the first desktop hypertext tool and is now becoming a major player in multimedia tools. And Matsushita also recently announced an agreement with Sun to license SPARC chips to use in consumer products such as High-Definition Television (HDTV).

The whole business/consumer cross-over is very interesting, with new players appearing on the scene. For example, Kodak is also looking at a consumer/business market surrounding images and photograph manipulation. Bill Gates is apparently also looking into this area, as he is currently trying to acquire the rights for electronic publication and display of museum masterpieces for eventual educational and home use.

IBM—Leveraging the MicroChannel

IBM is making multimedia a major focus of its desktop strategy. The company is writing multimedia extensions to OS/2, which will be compatible with Microsoft's multimedia extensions for DOS Windows. We predict that IBM will try to bring these same extensions to AIX.

On the hardware side, IBM offers the widest range of multimedia add-ons of any platform for the PS/2s. These include its Audio-Visual Connection (AVC) boards and authoring system, which allow users to create presentations that include text, graphics, audio, and still image; its M-Motion Video Adapter, which supports the inclusion of analog video pulled in off a videodisk, videotape, or live broadcast; and the ActionMedia board, which is the first OEM product to support Intel's DVI compression standard. In the near future, we expect IBM to

introduce DVI as an on-board capability in a number of PS/2s. IBM has also demonstrated client/server access to video on a Token-Ring network, using DVI.

As to Unix, IBM has not yet made public its multimedia strategy. However, since the RS/6000 is built on the MicroChannel, support for the current set of PS/2 boards will be forthcoming.

HP—Riding On The NewWave

Hewlett-Packard's multimedia strategy is directly tied to promulgation of its NewWave environment across multiple platforms. The object-oriented nature of the NewWave environment promises to make the integration of the new media types much easier.

BENEFITS OF AN OBJECT-ORIENTED ENVIRONMENT. NewWave provides applications with access to multimedia facilities without having to "know" anything about them. For example, a NewWave document created in the AMI Professional word processor (from Samna, which was recently acquired by Lotus) can have a piece of full-motion video "dropped" right into it. The word processor does not have to know anything about displaying video. This is handled by the video application. Likewise, voice annotation can easily be added to an AMI document without AMI having to know anything about voice as a data type or about voice processing boards. This is possible only if AMI and the video or voice applications are fully compliant NewWave applications.

The object-oriented nature of the NewWave environment promises to make the integration of the new media-types much easier.

In object-oriented terms, each object—video, audio, text, graphic, etc.—has certain methods, one of which is how to display itself. Each object also can send messages to other objects, such as the message that AMI might send to a video object to display itself at a certain place on the screen. Other methods for multimedia objects include compression and decompression, location of the proper video or audio board, and such traits as volume and speed of playback.

The NewWave environment encourages developers to build objects that can be used by many other objects. For example, one developer could build an audio object that can be used for both voice annotation of documents and music accompaniment to an interactive presentation. Both Macintosh and NeXT use this approach to audio.

NewWave does not provide all of the answers to the multimedia questions. For example, multimedia objects created on one system may be viewed only on another NewWave system. Developers must still implement bilateral import and export of files from one format to another, as there is not yet a common standard to write to or a common interchange format, though the MS Windows extensions may serve this purpose. NewWave can help applications find the appropriate conversion or interchange specification, as the environment is aware of each object's methods. Eventually, there may be conversion objects in the NewWave environment, which would act as intelligent black boxes.

NOT YET CROSS-PLATFORM. HP has not yet delivered NewWave on any platform other than DOS Windows. The first developer release of NewWave for Unix will be sometime this year.

Apple—To Be or Not to Be [Open]

Though many would immediately associate multimedia with Apple, and certainly much of the leading work in graphics and animation currently takes place on Macs, the company has tended to lag behind IBM and some Unix workstation vendors in areas such as full-motion video and video compression. Apple's lead has been an outgrowth of its strength in the desktop publishing arena, with desktop publishing becoming a more generalized presentation area.

The Mac boasts a large number of multimedia tools, though most of the tools that a year ago could only be found on the Mac are now on the PC.

Apple is working to enhance the Mac's multimedia capabilities by adding standard audio capabilities in each new Mac and supporting 32-bit color graphics. We expect to see support for video devices in the near future.

While Apple has expressed support for international standards, particularly MPEG, it seems to have been left out of the current standards momentum led by Microsoft and IBM. While many would believe it is in Apple's interest to look seriously towards adopting these specifications, it is highly unlikely, given Apple's view that the Mac is the only proper multimedia platform.

Therefore, interoperability is left for third parties to handle by moving their applications across platforms. One approach towards interoperability for Apple would be to reach some bilateral agreements with other platform vendors. For example, it would make sense for Apple and Sun to assure transference across their platforms for documents that contain audio.

While Apple has made some small inroads in Unix with A/UX, the commitment remains small. Not surprisingly, Apple has no plans to promote A/UX as a major multimedia platform.

Intel—Opening Up DVI

The introductions of Digital Video Interactive (DVI) was one of the first events that opened people's eyes to the possibilities of

using multimedia, specifically full-motion video, to create advanced applications. Developed by the GE/RCA Sarnoff Labs in Princeton, New Jersey, DVI technology was acquired in 1989 by Intel.

DVI was developed as two proprietary compression/decompression technologies—PLV (Production-Level Video) and RTV (Real-Time Video). Intel has been criticized for developing proprietary technologies, rather than waiting for the standards (namely MPEG) to catch up.

SUPPORT FOR STANDARDS. Intel intially responded to the critics in two ways. First, it continued developing its products, and entered important partnerships with companies such as IBM and PictureTel, with the aim of establishing DVI as the de facto standard for full-motion video. Second, it committed its next generation of DVI chips to support all of the proposed standards—MPEG, JPEG, Px64—in addition to its two proprietary algorithms.

PORTABLE DVI. Intel recently took another step to open up DVI. It announced that it was making the DVI software portable and licensing it to other manufacturers. Intel is achieving portability by dividing DVI into three layers:

- Player level—the user interface
- Kernel—containing the compression/decompression algorithms
- Drivers—handling the hardware interface

While the Player level has to be written to each windowing system and the Drivers must be specific to each hardware platform, the Kernel, written in ANSI C, can be recompiled for each platform.

Using this portable DVI, Intel is working with companies such as AT&T and Olivetti to bring DVI to Unix, and with a company called New Video to bring DVI to the Mac.

These moves assure both portability and interoperability over multiple platforms, and support exchange with standards-based systems. Intel also recently announced a dramatic drop of DVI chip prices. These two factors, combined with the Microsoft/IBM strategic commitment to DVI in the next generation of specifications, may enable Intel to achieve its objective of a DVI chip on every desktop in this decade.

Using this portable DVI, Intel is working with companies such as AT&T and Olivetti to bring DVI to Unix.

Conclusion: Will We Get There?

The answer to the question, "Will we get to a multimedia world?" is an (almost) unqualified "yes." We will because we have to. In order for our businesses to survive and flourish, we need to be able to deal with information and with each other in multiple dimensions.

How quickly we get there depends on how soon users begin demanding advanced multimedia applications. We are optimistic that they will. The demand will slowly build over the next two years—with the main impetus coming from highly customized vertical applications such as medical, publishing, and point-of-information.

By 1996, the standards and infrastructure will be in place so that virtually all horizontal applications will take advantage of multimedia. The path to this acceptance will be difficult. We predict that the road to multimedia may well take the same twists and turns suffered on the way to Windows acceptance. Microsoft spent years proselytizing among developers and users. This was followed by stagnation and even paralysis caused by inadequte hardware platforms and immature software. Finally, the arrival of adequate hardware and software unleashed the pent-up demand.

If this road is the one we actually travel, developers beware! Just ask those developers who jumped on the Windows 1 and Windows 2 bandwagons, or those who were assured that all important applications would be built on OS/2. Many of these vendors didn't make it.

For users, the next five years will involve a revolution in mindset. While we will have more capabilities and tools at our disposal, we will have to become more creative to give our information substance. Flash and dazzle just won't make it when everyone can do it. We will all be called upon to use many more of our talents to create and use multimedia information objects that are essential to understanding and communicating the complexity of information. We are confident that the technologies will be there. It is up to all of us to use them effectively.

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Lust for Enterprise Computing

Since AT&T was first allowed to enter the computer business, its management dreamed of dominating the industry. Over the years, AT&T has made some progress, albeit slow, in becoming a player in this high-risk business. Still, the company continues to lose money and cannot seem to push hard enough to propel itself into the limelight.

Ironically, AT&T's computer business has been growing at a rate of 30 percent per year—much more than most of its competitors. (Some of this growth can be attributed to dramatic hardware discounting.) But AT&T management has come to realize that, even at its current growth rate, it will not become a major player. Management keenly feels the pressure of time as major corporations begin to select their enterprise architectures for the next 5 to 10 years. AT&T realizes that it most likely will not be in the running as a competitive architecture provider.

The company had a choice—to remain a first-tier telecommunications company and a second- or third-tier computer vendor. The alternative was to make some sort of dramatic move.

MAKING A MOVE. AT&T has made its move by making a bid for the acquisition of industry sleeper NCR.

You see, NCR has the strategy, and, more important, the implementation that AT&T has hoped to achieve. NCR has developed and introduced a scalable architecture that will connect the desktop to parallel processors. It has developed robust network management software and is prepared to deliver a sophisticated integrated computing technology called Cooperation that outstrips anything that AT&T has achieved so far. For example, while AT&T's Rhapsody includes some sophisticated components for workflow automation, it is not yet distributed nor does it provide published APIs. AT&T's product is designed as a programmer's tool. In contrast, NCR's approach to workflow will include a distributed processing underpinning and offers facilities that allow non-programmers to modify workflows. Cooperation adds more server-based functionality than AT&T has been able to deliver. From a marketing perspective, AT&T lacks the penetration in two of its key target markets: retail and financial services. These are the two areas where NCR has thrived.

OS/2 SUPPORT. One blind spot for AT&T has been OS/2. As a result of its ownership of Unix, it has been reluctant to embrace OS/2. Thus, when the company initially announced Rhapsody, it had no immediate plans to offer an OS/2 version of the product. If AT&T is successful in buying NCR, it would gain access to the in-depth work NCR has already done with OS/2.

BENEFITS TO AT&T. In many respects, the AT&T acquisition of NCR is logical. The technological approaches of both companies are synergistic in terms of architecture, operating system, networking, and even workflow strategies. In some cases, NCR has been able to deliver technology that AT&T still has on the drawing board.

Therefore, AT&T views NCR as a natural next step towards its aim of achieving dominance as a computer and communications giant. So why not simply OEM the software infrastructure and hardware platforms from NCR? Because AT&T also realizes that it desperately needs the ongoing expertise in systems support and service that NCR has become known for. It also needs the visionary management team that NCR has built up over the past several years. In fact, AT&T is so convinced that NCR knows what it is

doing that it plans to turn its computer business over to NCR.

IMPLICATIONS FOR NCR. While AT&T sees the acquisition of NCR as the magic formula for quick success, NCR views the hostile approach as a threat to its survival. An important factor in NCR's remarkable productivity is the trust between management and employees. Both Chuck Exley and Gil Williamson are strong leaders and have personally pushed NCR's engineers and architects to move forward with their vision of computing. The organization responsible for developing Cooperation is highly motivated. The company was pragmatic enough to avoid the temptation of trying to do all the development alone. Instead, it leveraged the strength of many partners and acted as an architectural systems integrator.

The primary danger in this hostile takeover attempt is that upper management will simply quit. If this happens, then the focus and inspiration to move forward will also disappear. As the enthusiasm drops, the most able programmers, architects, and marketers will take their skills to a more friendly environment. AT&T's culture of multiple layers of management where few feel able to make decisions might well supersede the NCR culture.

CONCLUSION. While AT&T seems determined to capture this jewel, we are pessimistic about the outcome. If AT&T is successful, we do not believe it will have an easy time merging the two companies' product lines. There are many issues to be addressed—some more complex than others. For example, NCR is a member of the Open Software Foundation, while AT&T is the leader of the opposition camp, Unix International. AT&T has a well-developed mail system (AT&T Mail) and office infrastructure (Business Orchestration). How would these products merge with the NCR offerings? Even if this turns out to be an easy task, how long would it take? Six months or two years? Even when companies merge gladly (like Apollo and HP), the transition is much more difficult than either party could have imagined.

Because of AT&T's financial clout, it may be able to pull off its plan. Will it make AT&T the major computer and communications force it hopes to become? This is technically feasible, but it will be difficult task. We predict that, in the end, such a merger won't benefit either company.

—J. Hurwitz

·OMG·

Users Win Out as the Object Industry Forges Key Link

When to compete, and when to cooperate? Vendors of object-oriented technologies have been grappling with this question for the last year, with the Object Management Group (OMG) struggling to get key industry subgroups to say *yes* to cooperation.

Last month, the effort was on the brink of collapse. The vendors of object-interchange environments, such as Hewlett-Packard and Digital Equipment, and vendors of objectbase management technologies, primarily Object Design, Ontologic, Versant Object Technologies, and Servio, were ready to go their separate ways.

Then, at a key Object Management Group meeting in December, the two sides gritted their teeth and decided to work out a peaceful solution. Some say cooler heads prevailed, as small vendors realized they had more to lose from a fight than they could hope to gain. We believe users forced the issue by "voting with their checkbooks" in favor of interoperability in this infant set of technologies.

The rapprochement reached by the two sides of the industry virtually assures the development of a common basis for objects to send messages to other objects in either distributed object-oriented environments such as HP's NewWave or in objectbase management systems. Applications written to each platform will be able to use the other's object-messaging structures. There's plenty of room for competition atop this standard.

The basis for this significant standard will be the Object Management Group's Object Request Broker (ORB), due in July 1991. The OMG will continue in its role as the object industry's key standards consortium. After seeing its existance threatened, OMG emerged from the December battles stronger than ever.

A TURNING POINT. The December meeting of the OMG's Technical Committee, which took place in Chicago, was a turning point for the object industry at large and the OMG as its primary standards body. Prior to this meeting, OMG nominally represented all vendors of object-oriented products, as well as users of the technology. However, the most active participants in the OMG's work were Hewlett-Packard, Sun, AT&T, and other large systems vendors. Vendors of languages, development tools, and object-oriented databases remained on the sidelines. The few users OMG had managed to sign up as members barely participated at all.

The skew in the OMG's position was revealed by the eight responses to its Request for Information for its ORB technology during the fall of 1990. The ORB allows objects to request services of other objects and to respond to requests for services in a distributed environment. The ORB processes requests and responses. Components of the ORB include name services, a request dispatch function, parameter-encoding facilities, a delivery mechanism, synchronization facilities, activation/deactivation facilities,

exception handling, and security mechanisms.

In the OMG's selection process, the technology of one or more vendors will be selected as a standard, with all members presumably migrating their products to conform to its interfaces. The OMG received ORB responses from Hewlett-Packard, Digital Equipment Corporation, HyperDesk (the former Data General group–see related story), Apple Computer, AT&T, ANSA, and DSET.

These submissions are each slanted toward message exchange technologies. Missing was any involvement by the object database companies—Itasca, Object Databases, Object Design, Objectivity, Ontologic, Servio, and Versant—or the big relational DBMS companies—Informix, Ingres, Oracle, and Sybase. Indeed, as the OMG's ORB selection process rolled toward a January 2, 1991, deadline for technology submissions, an OMG task force charged with finding the place of object-oriented databases in an overarching object-oriented environment was just forming. Just before the Chicago meeting, a top executive at an objectbase company told a trade newspaper that the objectbase vendors would go it alone.

Another cause for concern among some members was the failure of the OMG's ORB selection process to stimulate creation of alliances among vendors. In contrast, the Open Software Foundation's technology selections have prompted vendors to cooperate to create submissions.

As January 2 approached, the OMG faced failure. Its selection process had split, rather than united, the industry.

THE OBMS VENDORS WEIGH IN. In Chicago, the objectbase management system (OBMS) vendors got involved in the OMG's ORB definition and selection process. These vendors set down two conditions for their involvement.

First, they demanded that the OMG's subcommittee defining a data model standard be re-formed into an Object Model Subcommittee. This committee is now charged with defining a single structure for both the ORB and objectbases. The new chair of the committee is John Schwartz of Mentor Graphics, a *user* of object technologies. Tim Andrews, chief architect at Ontologic, viewed Schwartz's selection to head the Object Model subcommittee as pivotal.

The objectbase vendors also won more time to submit technologies to be considered in the ORB process. Vendors can now submit letters of intent to submit ORB technologies by year-end 1990. The January 2, 1991 deadline for technology submissions was split and pushed back. Now, participants must submit an overview and object model description by January 14. The full submission is due by February 18.

Presentations to the OMG's Technical Committee will take place on March 19 and 20. The OMG still intends to select ORB technology in late July; that deadline hasn't changed.

THE NEXT CHALLENGES. Having decided to cooperate, the rising object industry must now make it work. Few of these vendors have been through a technology selection process before. Most are fighting for their lives in a crowded industry that still serves a small marketplace.

The next round of submissions to the OMG's ORB technology selection process will be key. We hope to see alliances between vendors of object-messaging frameworks and objectbases emerging without the overt help of the OMG process. This will be a true indication that these vendors are willing to cooperate to serve the demands of users. One way or another, users will be served. —*J. Rymer*

•HYPERDESK•

ASCII Snaps Up DG's Distributed Object Environment

When Data General (DG) decided to get out of the advanced applications-environment business this fall, Japan's ASCII Corporation was there to pick up DG's work. Data General had been talking for two years about an advanced distributed object management framework called 902—without ever introducing products based on the project.

This spring, we'll finally see the fruits of Data General's work—under the name of HyperDesk, a startup primarily funded by ASCII. Given everything we've seen and heard about the 902 technology, we like HyperDesk's chances of succeeding.

DISTRIBUTED OBJECT MANAGEMENT. HyperDesk's software is an environment that allows applications and devices to interact across operating environments and networks. The environment is based on a server that stores data as objects—datafiles bound to applications and defined by individual characteristics—in a relational DBMS. The software is portable across operating systems.

For those familiar with Hewlett-Packard's NewWave environment, HyperDesk's software would allow NewWave users to access and work with objects across a network and despite operating system differences. Thus, the environment extends the same ease of use and application-integration benefits NewWave offers in a standalone DOS environment to a distributed environment.

The most important aspects of HyperDesk's environment are:

- It supports multiple clients—DOS, Unix, OS/2, terminals, and, ultimately, Macintosh. Supported clients can all view and manipulate the same objects on a server.

- The HyperDesk server can be an active process in a distributed environment. It can spawn messages or start applications based on preset conditions in objects it stores.

EXIT DG, ENTER ASCII. As Data General struggles to survive—in December, the company's board fired founder Edson DeCastro—management didn't view the 902 project as being strategically important. We doubt the wisdom of this decision. No matter: Data General's loss is the gain of a company called ASCII.

ASCII Corporation was founded by Kazuhiko (Kay) Nishi after his acrimonious split with Microsoft founder Bill Gates during the mid-1980s. Nishi had helped Gates build Microsoft in its formative years. After the split, he retired to Japan in order to build his own microcomputer powerhouse. He succeeded.

Now, Nishi is competing with Gates in one of the hottest new technologies in the industry. Microsoft is slowly rolling out its own object management technology. The first evidence of Microsoft's strategy was the extended file-attributes feature of OS/2 1.2. More recently, Microsoft announced Object Linking and Embedding (OLE) protocols for Windows. OLE for OS/2 and the Macintosh will follow within six months. Based on Microsoft's clipboard and Dynamic Data Exchange (DDE), OLE was born with the support of Lotus Development Corporation, WordPerfect, Aldus, Ashton-Tate, and other major PC software vendors.

Microsoft's approach leaves many details of a full distributed object management framework for later. Still, you can't underestimate the ability of Bill Gates's crew to both develop advanced technologies and *sell* them.

HYPERDESK'S PLANS. HyperDesk's first move as an independent company will be to submit its technology for consideration in the OMG's selection of an Object Request Broker (see related story). The deadline for submissions is February 18, 1991.

One of OMG's requirements is that a submitted technology be available in a product. This requirement will force the HyperDesk team's hand in finally telling the world what it has been working on for the last three years.

HyperDesk will first attempt to sell its software to systems vendors seeking better application integration technologies than they have today. Systems integrators will also be a primary target.

HyperDesk will be a privately held company headquartered in Westboro, Massachusetts. —*J. Rymer*

•VISIONWARE•

MS Windows and Unix Integration

Although being able to open a DOS application from within a Unix system was a big deal a few years ago, we predict that the hot topic for users will be connectivity between Unix and MS Windows. We have only seen one of these products so far, but we expect to see a flurry of them within the coming year or two. As commercial users begin to select Unix as a server environment, many want the flexibility to use their client of choice locally. For example, users may want to run their database engines on Unix boxes and be able to query and access information from PS/2 machines running MS Windows. Because of this user requirement, we were particularly impressed with the tactic taken by a small British company called VisionWare.

In essence, VisionWare offers a series of products that allow users to make use of back-end Unix functionality. VisionWare's products span interfaces ranging from DOS, MS Windows, Presentation Manager, VMS, and X Window.

VisionWare's primary focus is MS Windows. Its product is the first we've seen that takes this approach. Given the growing user acceptance of MS Windows, it is a smart choice. And given the fact that company chairman and founder David Fraser was founder and former managing director of Microsoft U.K., this approach seems to be no accident. Thus far, VisionWare has released three products: PC Connection, SQL-Connect, and XVision.

PC-CONNECT. PC-Connect is an X server for MS Windows. However, unlike some X servers we've seen, it does not make the connection between Windows and Unix through terminal emulation. Instead, VisionWare has written a version of Microsoft's Dynamic Data Exchange (DDE) protocol API for Unix. (The company wrote a C library with calls that mirror the DDE library of MS Windows.) The benefit of the DDE API is that users can cut and paste information between MS Windows applications and Unix applications without using a clipboard. Therefore, one could take information from a Unix database and plug it into a Windows-based spreadsheet in a single step. In addition, a user can launch an X Window application from the PC desktop. For those users who are already becoming comfortable with MS Windows as a desktop manager, this approach could make Unix applications more approachable.

VisionWare has done this by providing a toolkit environment above the API. In this way, C programmers can take advantage of DDE. This same toolkit allows users to print both DOS and Unix files remotely.

PC-Connect also provides terminal emulation so that a user can access up to seven Unix applications per host and can connect to up to 14 hosts. Connectivity can be either via an asynchronous connection or via TCP/IP, Token-Ring, or OSI networks.

SQL-CONNECT. SQL-Connect allows PC users to make SQL requests to host databases. It uses the DDE protocol to pass data between MS Windows 3.0 and Unix databases. It will support any windows application that is "DDE aware." Thus far, the company has provided connectivity to Oracle, Informix, and Ingres. VisionWare takes full advantage of some of the macro languages available in MS Windows applications such as Excel, Word, Superbase, and Toolbook. Therefore, it allows users to use these applications as front ends into Unix databases.

XVISION. XVision is an X Window display server for MS Windows 3.0. It provides support for all Windows display devices and an X font compiler. It is compatible with the company's other products.

CONCLUSION. We think VisionWare is doing some interesting work that should be very beneficial to users concerned with integrating Unix into their existing DOS and MS Windows installations. Clearly, MS Windows is gaining strength. Microsoft sold 1.5 million copies in the first three months of Release 3.0. And Microsoft claims that 7 out of every 10 new software applications are designed for Windows. We are also encouraged that VisionWare's next target will be Hewlett-Packard's NewWave desktop.

—J. Hurwitz

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