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MAY/JUNE 1994

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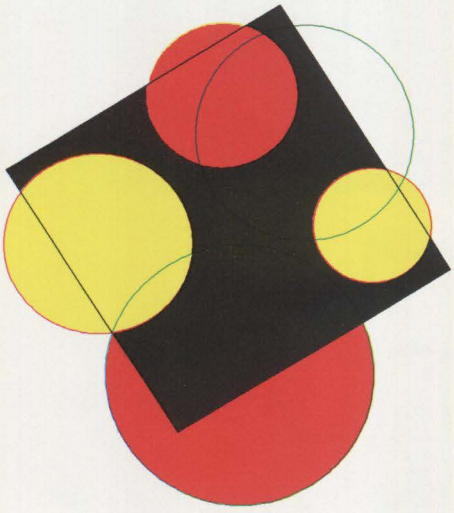

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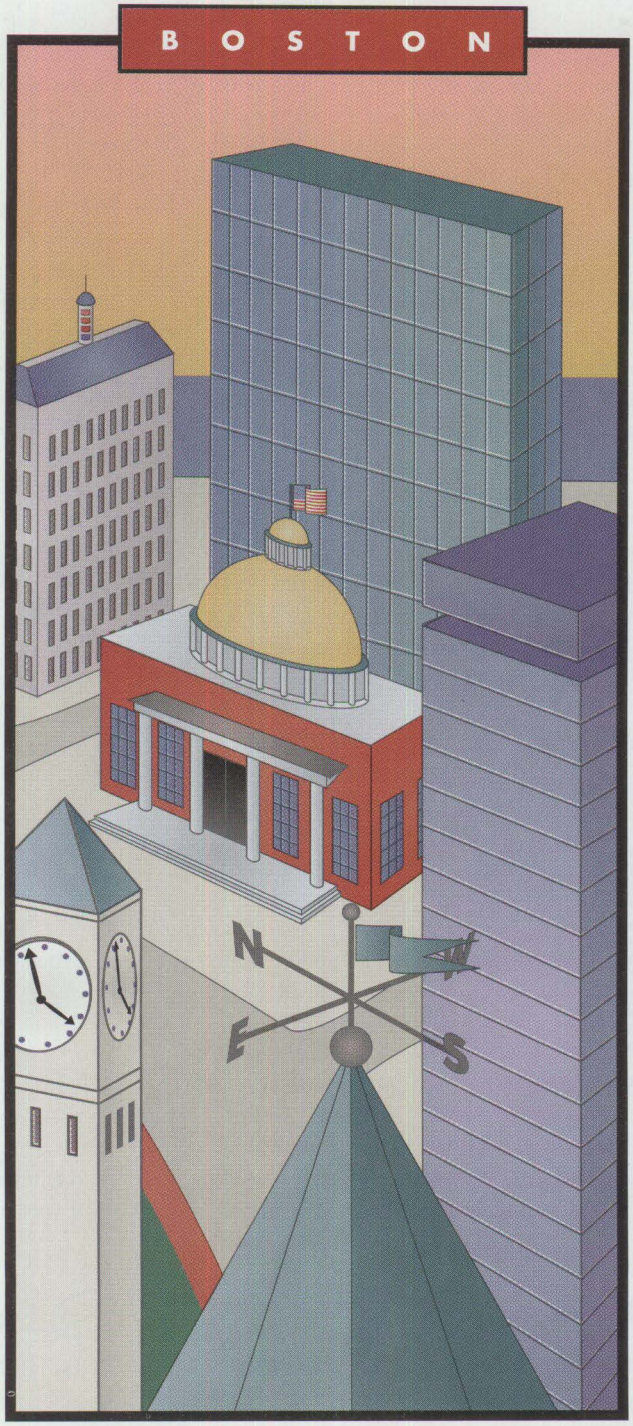

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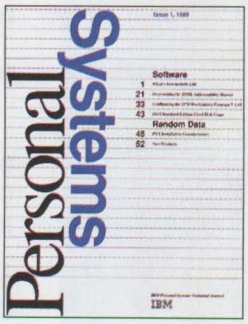
Where We've Been and Where We're Going

If you've read *Personal Systems* for very long, you've noticed how rapidly we're changing–both in appearance and in content. That's the nature of the personal computer business. If you stand still very long, you're left choking on your competitors' dust.

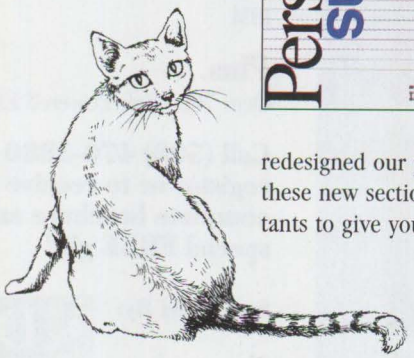
Change has come often for *Personal Systems*. Just one year ago we were a quarterly technical journal. If in-depth, 15-page technical articles on busmaster design didn't float your boat, we weren't the magazine for you! Now we believe we have something for everyone–at least everyone who uses a personal computer.

Indulge me for a moment while I take a trip down memory lane. In 1985, we began to deliver technical information to members of IBM's Technical Coordinator Program, a new program (in 1984) to channel technical support directly to the support providers in large organizations. It was a newsletter and it was primitive!

When we became a real magazine in 1989, our lead article was DOS 4.00! Look at that 1989 cover! It was good information in a plain journal format.



But you told us you needed a wider variety of information: new products, application reviews, tips and techniques. So we redesigned our publication last year to include these new sections. We invited industry consultants to give you their opinions. And we added advertising to keep you up-to-date on the latest products. OK, OK, so advertising also helps us recover costs–the better to keep the magazine coming to you!



"The more things change, the more they remain the same."

In late 1989, we added the considerable talents of Dallas artist Bill Carr for a touch of levity in *Personal Systems'* sometimes weighty articles. Bill recently told me that "there are only six core ideas in the universe–everything is just a variation of those six ideas!" During a nostalgic thumbing of the first issue Bill illustrated, I ran across this cartoon:

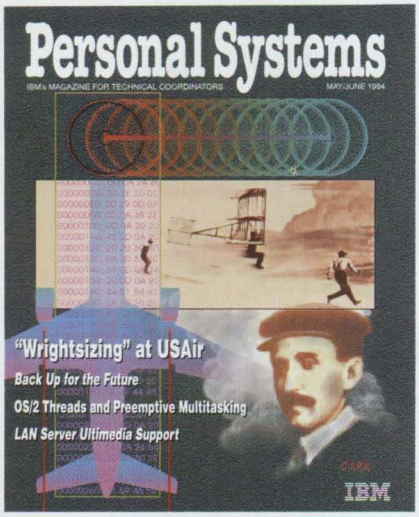
Now look at the cartoon in Todd Watson's "Lost in Cyberspace" article! See what Bill means?

Well, enough from memory lane. How did we know where to make our enhancements? We asked you. And we continue to ask.

Every issue of *Personal Systems* has a postage-paid editorial evaluation card. Use one to get your vote in!

Betty Hawkins

Betty Hawkins, Editor



ABOUT THE COVER

"Wrightsizing at USAir," a feature story on that airline's implementation of an OS/2 client/server solution, serves as the impetus for Dallas artist Bill Carr's cover mosaic featuring bicycles and hex code, glider test flights, and Orville's searching gaze into the clouds and beyond.

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"Wrightsizing" at USAir

Orville and Wilbur Wright never set out to build an airplane. In fact, had they never gotten wind of European experiments with sustained flight, history might have fated them to become the architects of the first powered bicycle.

But destiny is not so easily trifled with, and history wouldn't have it any other way. After more than 700 successful experimental test flights using kites and gliders, the two determined brothers sought out an engine that was both light enough and powerful enough to send their Flyer I (as *Kitty Hawk* was originally called) soaring into the sky. When refused by every automobile manufacturer they asked, they built their own.

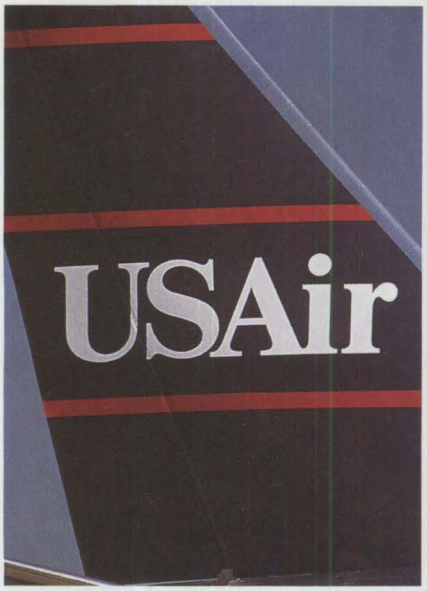
Like the Wright brothers, major air carriers over the past decade have faced their own hurdles as they encountered increased competition, rising labor and administrative costs, and ongoing fare wars, forcing management to search vigorously for more cost-effective ways of doing business.

At Arlington, Virginia-based carrier USAir, this quest kindled the three-year development of an airport information system (IS) at the Greater Pittsburgh International Airport, a major USAir hub that was undergoing a $1 billion construction effort. When the airline went shopping for proposals for a new IS solution, they made it known they wanted a client/server system that was easy to use and that would provide their customer service representatives with access to mission critical, host-based legacy information that was both timely and accurate.

The airline also wanted to build what it considered to be the "airport of the future," complete with bar-coded baggage tags. With automation being the order of the day, technology that could address some of these issues had to be implemented, and it all had to be completed on time, as the new terminal's opening date was written in stone.

IBM Client/Server Specialist Glen Jackson and IBM Systems Engineer Jim Gomola were involved with the USAir project from the outset. They say that this new

Aerial View of USAir's New Midfield Terminal at the Pittsburgh International Airport



network was a prototype for what would later become a model client/server system. Jackson notes that the challenges of making such a momentous transition were enormous.

"Before, USAir was using Airline Link Control (ALC) with Telex controllers running off the host, so there was limited local processing," says Jackson. "It was all running off controllers linked back to the mainframe host." This meant that gate agents had access to, at most, two screens of information at a time.

USAir IS executives outlined several goals that would be key to the success of their future information network and of the new terminal. First and foremost, USAir wanted to improve its customer service, which meant the company had to provide its employees with a system that would be user friendly as well as provide simultaneous access to multiple applications. The ability to multitask was crucial to providing improved customer service, according to Alex Schaefer, manager for Advanced Systems Technology at USAir.

"We needed to have protection from one task to the other, as well as be able to provide several host sessions that had the same touch and feel as the old system," explains Schaefer.

The company demanded that the new platform have scalability, providing easy annexation of new applications and functions and having at least the same response time as the previous system. They also wanted to be able to port old applications and write new ones that could be blended, helping to integrate the entire airport, including everything from curbside check-in to gate control to the airline's mail/cargo operations.

The Flight Plan

After reviewing proposals from companies such as AT&T and United Airlines' Covia, USAir decided to partner with IBM on this unique client/server systems integration. The next order of business was to select an operating system to serve as the foundation of this new enterprise.

Since the company was looking far into the future, it was in its best interest to incorporate a robust operating system that included preemptive multitasking and "crash protection." They also wanted both servers and workstations to have the same operating system for seamless integration.

Since these specifications would entail heavy memory requirements, IS concluded that a DOS/Windows solution would not be an appropriate one. After also considering an AT&T solution offering a UNIX server with DOS clients as well as AIX (IBM'S flavor of UNIX), they decided that a UNIX solution was cost prohibitive for the desktop environment in which they were working. USAir's IS management decided that the company's best course would be to choose IBM's Operating System/2 (OS/2).

Up and Away

Planning for the changeover took three years and began in November of 1989. The system was founded using OS/2 1.3. While the workstations and servers still remain at 1.3, the backoffice workstations as well as the five database servers have been upgraded to OS/2 2.1. Other select applications have been migrated to 2.1 to take advantage of its improved memory management, and USAir is currently evaluating the reduced memory version of OS/2, to which it may migrate the rest of the system.

The client/server model that developed out of the extensive planning was driven by a variety of technical objectives established by USAir's IS management team. USAir started their improvements from the ground up, going to where the small but important decisions are made by involving employees from the rank and file: asking the gate agents and baggage handlers what kinds of tools they needed to improve assistance to customers. With committees of end users and management working together, extensive prototyping and testing was done at both the Pittsburgh and Philadelphia airports to eliminate potential bugs before the system went online. Only then did IS management set about creating their client/server solution.

The "Airport of the Future"

USAir's State-of-the-Art Baggage Handling System

The developing network infrastructure demanded two key requirements: a growth path and fault tolerance. Part of the growth path entailed incorporating the original system's locus, the IBM Enterprise System/9000 (ES/9000) mainframe, which would continue to act as the transaction processing facility (TPF) PACER (USAir's reservation system) server. This alone was a large part of the challenge, as USAir replaced ALC and relied solely on a Systems Network Architecture (SNA) network.

With the mainframes acting as the heart of USAir's new airport platform, IS began constructing the various arteries that would form the rest of the client/server configuration. Over 650 IBM PS/2 Model 70s, 80s, 90s, and 95s, connected through OS/2 LAN Server, serve as the base operating hardware. A variety of new technologies and original equipment manufacturers' (OEM's) products also had to be evaluated and eventually incorporated into the system over the three-year planning period.

The new middleware, or application connectivity software, included A²DS, IBM's Advanced Application Development System (used for application development); A²CS, IBM's Advanced Application Communication System (provided the SNA printer sessions); IBM's OS/2 Database Manager (which has since evolved into DB2/2); Communications Manager/2; Miltope and Datamax ticket and boarding pass printers; and a 100 megabit (Mbit) per second Fiber Distributed Data Interface (FDDI) network.

OEM products such as Fluke touchscreens and Cherry keyboards with integrated credit card readers, in conjunction with the airline-specific OS/2 applications developed by USAir and IBM, helped provide a foundation for the system. To augment its fault tolerance, CORE DB RAID-5 servers and Best uninterruptible power supply (UPS) systems were installed, and the three client workstations at every gate were wired to two servers so that entire gates would not be brought down in case of a server failure.

Making the Connection

The most crucial element of the airport's new system was the network itself. Throughout the airport, USAir formed 60 16 megabyte (MB) token-ring local area networks (LANs) connected using a 100 Mbit Fibronics FDDI backbone (see Figure 1). Each of these LANs was connected to the backbone with 30 FX8210 hubs made by Fibronics International. In turn, the LANs were connected to the ES/9000 host through two IBM 3745 high speed communication controllers, both of which were designed to take over in case the other failed, which is exactly what happened a few days after the network made its debut.

"The system was designed to operate on one 3745 controller, and on several occasions the system has proven itself because we've had outages without inconveniencing the agents," says Schaefer.

Network management duties are handled by OS/2 LAN Network Manager, Systems Performance Monitor/2 (SPM/2), and Distributed Console Access Facility

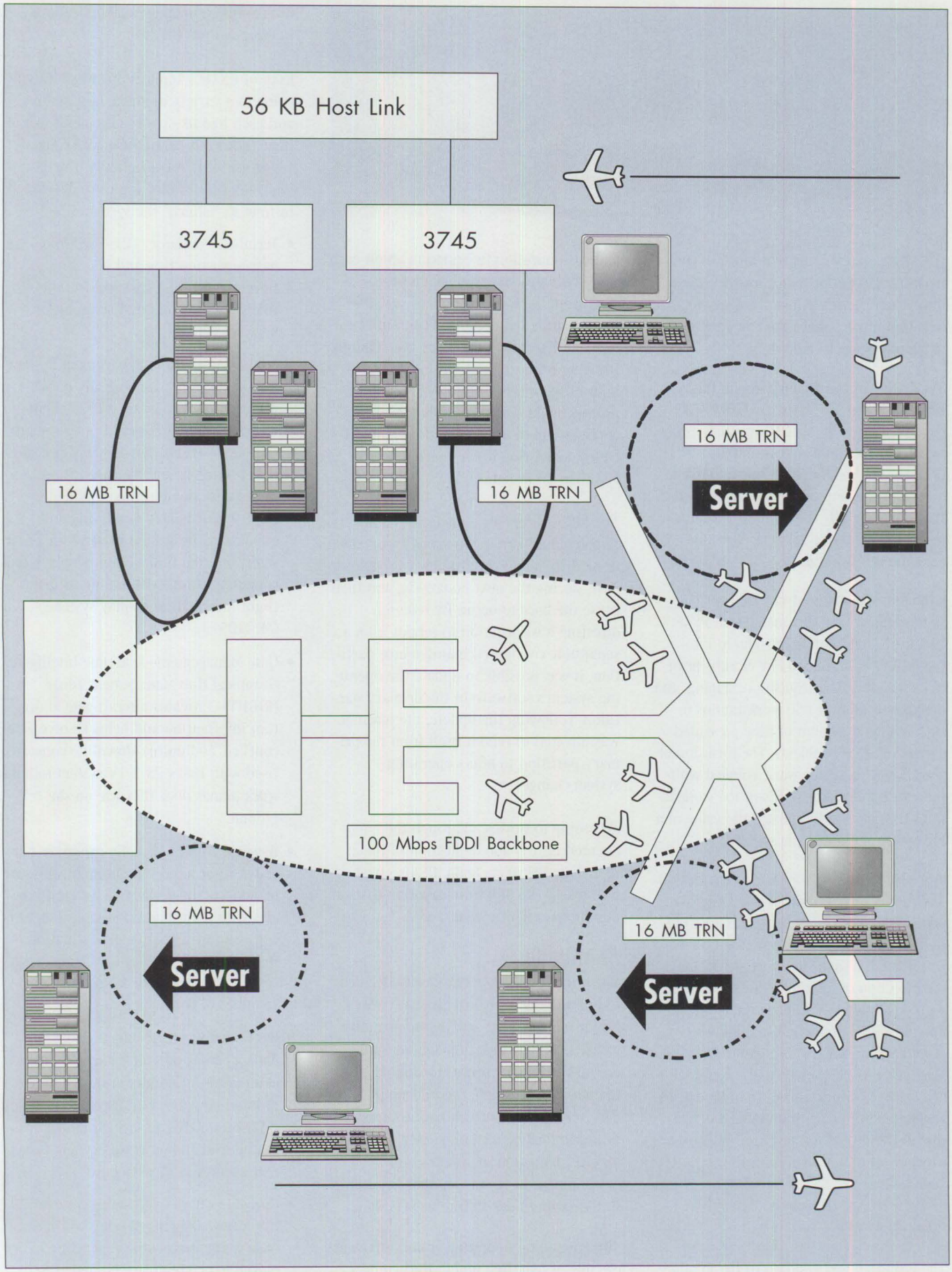


Figure 1. Overview of USAir's FDDI Backbone That Connects 60 Token-Ring LANs

(DCAF). Gomola notes that much of the network and performance monitoring is done from USAir's Winston-Salem, North Carolina office, where the company's mainframes are located.

The LANs are connected through the fiber backbone using the two IBM 3745 controllers by way of IBM's virtual telecommunications access method (VTAM). Six 56-kilobit-per-second circuits complete the loop between the 3745s and the IBM ES/9000s, allowing for instantaneous data transfer between Winston-Salem and Pittsburgh.

Limitations stemming from the construction of the new airport meant that PS/2 hardware could not be introduced into the facility more than a few months prior to its opening. The acquisition, staging, and deployment of over 650 workstations in such a limited amount of time presented severe logistical problems. The inclusion of the A^2DS/A^2CS middleware, coupled with the VTAM-addressing needs of the workstations themselves, diminished the value of a pre-configured operating system.

Since IBM's products for code distribution and remote installation of OS/2 and associated software were not available at the time of this implementation, the USAir Distributed Systems Support group under the direction of Randy Boyles was charged with developing an in-house remote code downloading application that allows programmers to load OS/2, Communications Manager, LAN Requester, and other code across the network, rather than having to shuffle them to each individual workstation at the Pittsburgh terminal. Changes in workstation configuration files, such as `CONFIG.SYS`, `IBMLAN.INI`, `STARTUP.CMD`, etc., can be deployed remotely as well.

The group's effort resulted in the Remote Installation System (RIS), a VM-based repository of configuration, addressing, and customization information about each workstation to be installed, and the Intelligent Workstation Source, a VM-based flatfile database that contains location and hardware inventory information. Drawing from this repository and a prebuilt image of systems software, the RIS process could simultaneously load and configure up to 30 workstations connected via token ring to an image server in less than 20 minutes.

The RIS was further enhanced to allow a remote administrator to specify workstations that should receive new configurations during the next boot cycle, and then cause the boot to occur. By remotely directing a workstation to reboot from a separately configured maintenance partition, it was possible to update the operating system's software in the primary partition. Following the update, the machine was directed to reboot itself from the primary partition to effect operating system changes.

According to Boyles, "Through the talented efforts and dedication of the Distributed Systems team, USAir saved well over $100,000 in installation costs at the Pittsburgh airport alone."

At Altitude

When the local airport authority decided to build the new airport facility, USAir's senior management saw the opportunity to use the latest in technology to build the airport of the future. To complement the network redesign, the Information Services department saw this as an opportunity to include a client/server design for the planned local systems. This development issue was another key factor in the airline's decision to use OS/2.

"We wanted an operating system that was capable of handling many concurrent tasks without programmers worrying about non-preemptive multitasking," says Greg Satusky, manager of Applications Development at USAir.

Each of USAir's applications was idiosyncratic to a variety of airport operations, and each had its own requirements. All of them, however, derived from a USAir "wish list" that was originally over 30 items long. The following were developed in time to "launch" the system:

- Terminal Emulator (TE)—Used for passenger ticketing and boarding. Developed to USAir's specifications by IBM's Boca Raton End-User Solution Services (EUSS).
- Flight Information Management System (FIMS)—Used for viewing any public information display on a PS/2 client workstation and controlling light emitting diode (LED) sign displays at USAir ticket counters and baggage claims. Initial development was provided by EUSS. USAir is now modifying and enhancing the system to drive all USAir signs, internal information displays, and communications with the municipal flight information display systems (MUFIDS).
- Gate Management—Real-time Intelligent Graphical Hub Management Tool (RIGHT)—Provides aircraft gate allocation information and helps resolve gate conflicts and upline/downline concerns. Used with IBM's PS/2 TV system to help track planes once they are on the ground.
- Baggage Sorting—Locally processes bar-coded information to automatically sort passengers' baggage. The system interacts with a mechanical system that sorts bags, supplying the final destination information as well as confirming successful completion of a bag's trip over six miles of conveyors.
- Bar-Coded Bag Tag System—Generates bar-coded bag tags for passenger baggage at all USAir locations worldwide. Adheres to International Air Transport Association (IATA) standards, ensuring that bag tags can be read and processed by any system that adheres to this standard.
- Curbside Check-In—Installed in over 70 U.S. cities, allowing skycaps to check bags at the curb while generating online bar-coded bags. A single OS/2 server drives up to four touch screens and printers, exchanging information

with a host system. The system virtually eliminates mischecked bags at the curb while ensuring that passenger bags can be handled by other automated systems.

- Data Collection Facility–Acts as the "traffic cop" for schedule information from a host computer to local systems. Builds daily schedules, applies real-time updates, interacts with local DB2/2 databases, and distributes information to local applications in real time.

Several of these applications are already being migrated to USAir terminals at airports in Philadelphia and Charlotte, North Carolina, and plans are underway to automate USAir's systemwide reservation offices using OS/2. Most of the airline's distributed applications already run on OS/2 and OS/2 LAN Server.

Future development plans include creating applications for self-service ticketing, cargo tracking, mail processing, magnetically encoded documents, voice applications, and enhanced passenger handling in airports.

The Descent

The success of any effective computer system can be measured by answering a few elementary questions: Does it work? Do things happen faster? Is the system reliable? Are the people who use the system more productive and more responsive to customers?

For USAir's new network at its Pittsburgh hub, the answer is "yes" on all counts. Since the airport's SNA network with OS/2 client/server technology went online in October 1992, Customer Service Representatives, everyone from gate agents to baggage handlers, have become more responsive to customers, reflected both in positive customer service feedback and improved employee morale.

Although USAir's new hub is now one of the most automated airports in the world, the company does not let that deter it from pursuing grander visions. Just as Wilbur Wright's mental gears must have started whirling as soon as he watched his brother Orville soar triumphantly over the landscape of Kitty Hawk, North Carolina, for what must have seemed a marathon 12 seconds, USAir foresees its computer network growing along with evolving IBM technology.

Says IBM's Jackson, "There was a lot of uncharted territory for IBM and USAir when we started this venture."

But as IBM's Workplace OS rolls out, and as the evolution of OS/2 and AIX continues to allow the two operating environments to complement one another, USAir can be assured of having the growth path it wants, helping the company secure its continued success as one of America's most efficient airlines.

Todd Watson has worked for IBM since 1991 as the editorial assistant for */AIXtra: IBM's Magazine For AIX Professionals* and will soon complete his master's degree in Mass Media Studies at the University of North Texas at Denton. He received his BA there in 1991, concentrating in composition and literature.

Getting the Word Out at Chemical Banking Corporation

It's hard to remember how we conducted business before everyone had a fax machine!

At Chemical Banking Corporation, we've been faxing policy changes and other vital, timely information to our remote branches and sites[1] since fax machines were available. Before our widespread use of fax machines and vendor fax services, remote communication was time consuming and inefficient.

Rapid and accurate distribution of information became even more important in July 1991, when Chemical Banking Corporation and Manufacturers Hanover announced a merger of equals to form the new Chemical Banking Corporation. After the two organizations consolidated, Chemical Banking Corporation became the largest consumer branch banking network in the greater New York metropolitan area with more than 300 branches and 460 sites.

As part of the merger integration, the Branch Operations Department, responsible for supporting branches and related district, divisional, and executive offices, identified a third-party fax vendor to deliver documents to all the sites.

The Old Way

Initially, a third-party fax vendor was a suitable solution to the problem of disseminating information to hundreds of remote locations. The vendor provided the necessary number of phone lines to transmit documents to our numerous locations in a short period of time.

The Bank's documentation process is very controlled to ensure that each location receives the right information without being inundated with unnecessary data. After a memo is initiated, it goes through several reviews and, finally, must be approved by the "Gatekeeper," one of the administration's top managers. Once the Gatekeeper approves the document, it is certified with a rubber stamp; the receiving sites will ignore any document without the Gatekeeper's stamp.

Once stamped, the document is faxed to the third-party vendor with transmission instructions such as the time requirements for transmission, the distribution list to be used, etc. When the transmission is complete, the fax vendor faxes an exception report back to Branch Operations so that sites with fax errors (e.g., voice line, busy, no paper, paper jam, etc.) can be handled manually.

The average cost for a month's fax service ranged between $7,000 and $8,000.

Searching for a Solution

As with most businesses in the '90s, cost-cutting measures are encouraged, welcomed, and eagerly investigated. In the summer of 1993, a large local area network (LAN) installation project was undertaken by the Connectivity Design Group of Retail Banking Systems (RBS), the systems and planning area of Chemical that supports the branch network and related departments. It seemed appropriate at this time to also investigate alternatives to the third-party fax vendor.

The industrywide cliché "Keep it simple, stupid" is often a guiding principle for many technology solutions to real business problems. That phrase certainly described our original fax solution: fax documents to the vendor for distribution and pay the bill at the end of the month. It couldn't get much simpler than that. But it also described our philosophy for any replacement solution we might consider.

Before we could decide on a new process, we thoroughly analyzed the old way, including the step-by-step process, the costs involved, and the work flow for a given document.

Once the process was understood, we gathered parameters, such as the number of documents and the number of pages to properly size the system. The fax vendor had approximately 1,200 telephone lines, far more than we needed or could afford. We decided our peak condition, or target capacity, would be the transmittal of a 30-page document during a 14-hour window (overnight, 7:00 p.m. to 9:00 a.m.) to 540[2] sites. Figure 1 details the calculations we used in determining the number of channels (phone lines) needed.

The estimate of 1.2 minutes per page was a conservative average based on fax machine tests. It was clearly indicated, within a 14-hour window, that even very large documents could be handled with a maximum of 24 lines. After revising our original estimate of 540 sites to the current number of 460, we found that the 14-hour window could decrease to 12 hours or the document size could increase to 36 pages. Figure 2 shows the parameters based on 460 sites.

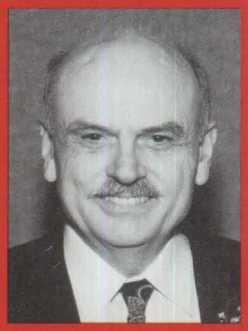
The Software

As we had discovered in our sizing project, our foremost requirement was a

[1]The term *sites* includes branches, district offices, divisional offices, back office areas, and executive offices. "Sites" is used throughout the rest of this article as a generic term. During testing and early production, Chemical Bank had more branches. The figure of over 300 is more accurate for the time of publication.

[2]While we stated earlier that we fax to 460 sites, our evaluation estimate was based on a higher number of sites.

Learn The Future Of Database Management From The Class Of '94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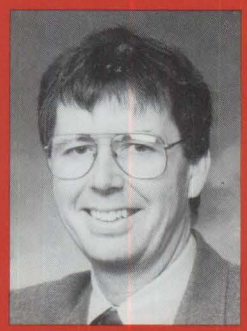
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Highlights of RM 25:

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Pages to Fax per Document	Time per Page (in minutes)	Total Time (in minutes)	Total Time (in hours)	Available Hours	Phone Lines Required*
2	1.2	1296	21.6	14	2
3	1.2	1944	32.4	14	3
6	1.2	3888	64.8	14	5
8	1.2	5184	86.4	14	7
10	1.2	6480	108.0	14	8
13	1.2	8424	140.4	14	11
15	1.2	9720	162.0	14	12
20	1.2	12960	216.0	14	16
30	1.2	19440	324.0	14	24

* Rounded to the next highest whole number

Figure 1. Parameters Used to Size Channels for 540 Sites

Pages to Fax per Document	Time per Page (in minutes)	Total Time (in minutes)	Total Time (in hours)	Available Hours	Phone Lines Required*
2	1.2	1104	18.4	14	2
3	1.2	1656	27.6	14	2
6	1.2	3312	55.2	14	4
8	1.2	4416	73.6	14	6
10	1.2	5520	92.0	14	7
13	1.2	7176	119.6	14	9
15	1.2	8280	138.0	14	10
20	1.2	11040	184.0	14	14
30	1.2	16560	276.0	14	20

* Rounded to the next highest whole number

Figure 2. Parameters Used to Size Channels for 460 Sites

system that could support *at least* 24 channels or phone lines (see Figure 3). We also determined that we needed excellent multi-channel support plus the ability to expand the initial configuration of simultaneous channels. LAN access to the device was not considered essential but was desirable.

When beginning our search for the software platform, we revisited two products already installed at Chemical. The one that supported only four channels was quickly eliminated.

The second solution could support 24 channels but only through a T-1 connection to the central office. This connection would have to be broken into 24 channels in the PC by using daughter cards connected to the T-1 interface.

This second approach was eventually rejected by the corporate telecommunications group as too expensive and too complex for our relatively simple and straightforward fax requirements. Additionally, this product required a LAN connection. (We were advised that we could configure the system without a file server, but it would require at least a fax server station and a user station–additional, unnecessary expense.)

Once we rejected our in-house products, we began researching what was available in the fax software market. After carefully evaluating the available products, we chose FaxWorks OS/2 LAN from SofNet, Inc.

Since FaxWorks supports up to 32 channels per fax server using traditional copper circuits, it certainly covered our requirement for 24 channels. Multiple servers can be installed in either standalone or networked environments. While our need was for only outbound fax facilities, FaxWorks also supports inbound communications with routing capabilities, including support for a direct inward dialing (DID) service.

The underlying operating system for FaxWorks is OS/2. While Chemical's Retail Banking Systems group has not standardized on OS/2 at the desktop, we have used it extensively for several telecommunications and database applications. We felt much more comfortable with the multitasking, multithreading capabilities of OS/2 than with our other in-house solution, DOS/QEMM. We felt, from our experience and the information we had, that the OS/2 world would be more robust for this application.

The Hardware

SofNet told us that work was underway for FaxWorks to support 4-channel, 16-bit industry standard architecture (ISA) bus cards from Brooktrout Technologies, a fax hardware vendor specializing in multichannel fax cards for PC systems. We contacted a Brooktrout representative and decided to construct our test system using the 2-channel cards, even though we would be limited to testing a 12-channel system.

We wanted the hardware system we used for the test to ultimately become our production system, so we needed a PC that could accommodate eight 16-bit ISA cards: six for the initial fax cards, one for an additional fax card, and one for either further fax-card expansion or a token-ring card, should this system end up on the network. After checking with our local vendors and searching product information on CompuServe/ZiffNET, we chose

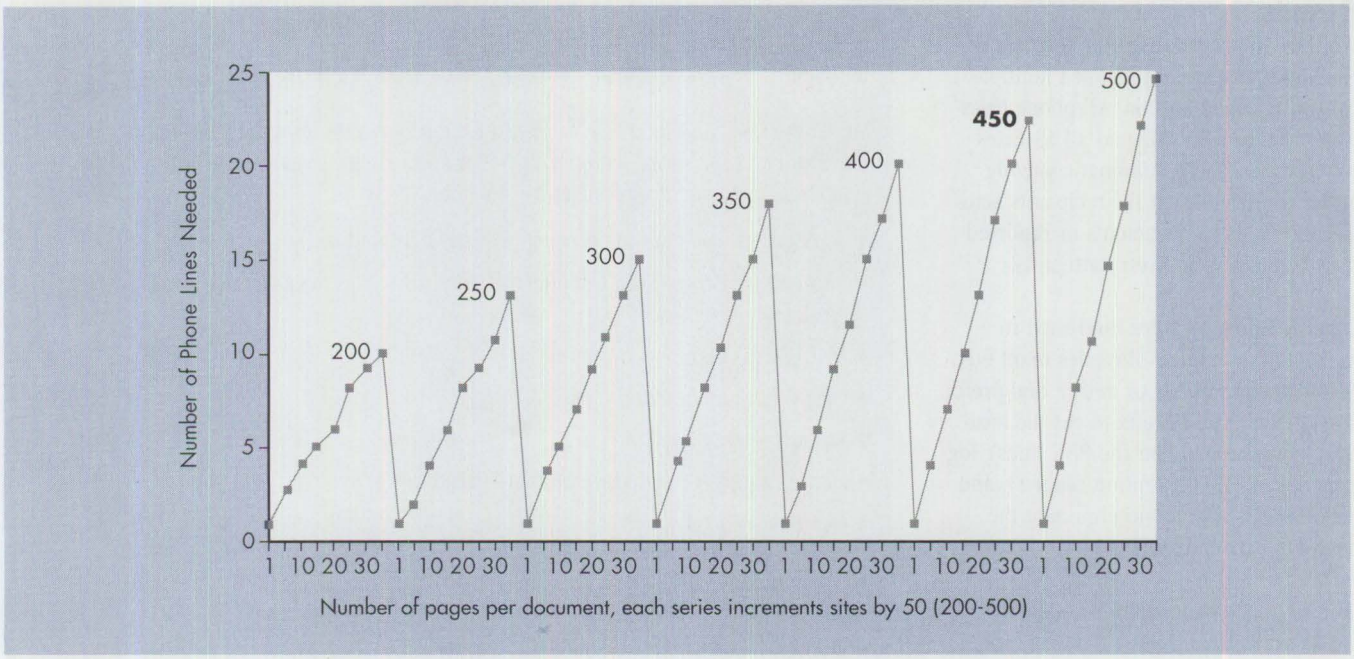

Figure 3. Chemical's Peak System: 30 Pages to 450 Sites, Requiring 22 Lines

the Hewlett-Packard NetServer LM/66 with 16 MB of random access memory (RAM) and a 500 MB small computer system interface (SCSI) hard disk.

The test system we received was configured with a 1 GB array (two 1 GB SCSI drives, mirrored from one controller) and, therefore, had only seven open ISA slots (the special RAID [redundant array of independent disks] controller used one slot). We were assured by HP and our hardware vendor that we could get a system with eight open slots when we implemented our production system. We installed the test system with 12 channels, more to test the functionality of the system than its capacity.

We considered, and rejected, the need for splitting the fax load between two PCs for a possible throughput gain and fault-tolerance-like redundancy. The performance gain did not seem to justify the purchase of another 486/66 PC. As for redundancy, our original third-party fax vendor, who was willing to work on an as-needed basis, was our contingency plan.

Our test system, when completely configured, contained the following elements:

- Hewlett-Packard NetServer LM/66 with 16 MB RAM and 1 GB hard disk
- IBM OS/2 2.1
- SofNet FaxWorks OS/2 LAN, 24-line version
- Six Brooktrout 2-line fax cards

Installation

Installing the Brooktrout cards went fairly smoothly, considering DIP switches had to be reset for each board's unique set of I/O addresses. The documentation spelled out most of the information we needed, but we still had to call Brooktrout's technical support to verify some software driver parameters. Technical support was very helpful and soon we had a properly configured OS/2 system that recognized 12 fax ports and was ready for installation of the fax application.

The FaxWorks application installed easily with the exception of some difficulty recognizing the Brooktrout cards. After further contact with both Brooktrout and SofNet technical support, we had a fully functional 12-channel fax system. The system was installed in RBS's End User Computer Lab, where we perform all PC and LAN testing and staging because of its abundance of phone lines.

Testing

All the hardware and software was loaned to us for a two-week evaluation period, so we had only limited time to perform the required tests. Our original plan was to test using the phone book of locations and fax numbers from Branch Operations. The phone book was in dBASE format, which was easily converted to FaxWorks using a comma-separated-value (CSV) format. Everything was set to test documents up to eight pages long, a conservative number since we were testing with only 12 channels rather than 24.

Unfortunately, the timing of our test did not work for Branch Operations; they were involved with sending many documents to the new branches, and they didn't want to confuse the recipients by sending duplicates. Instead, we chose to run a few tests to other fax sites to help us extrapolate data that we could then evaluate.

We created a second phone book containing several local fax machine numbers, some numbers to our existing fax gateway product, and a fax machine in another area code (to ensure that area codes were handled properly). We had at least 13 numbers in the phone book to ensure that the system would roll over to the first line after the first 12 lines were in use.

We ran some simple send tests, experimented with busy conditions, and studied other general features of FaxWorks. The system performed as expected. We had no problems with any fax requests.

Results

We were impressed with the features of FaxWorks. The system handled multiple calls in a logical fashion. All phone lines were used as available and all 13 faxes were properly sent. Automatic logging either confirmed that the recipients actually received the documents or reported busy conditions and retry attempts.

Other features we were interested in included the number of retries upon busy (we wanted to do six or more), dial prefix (we needed 9 as a prefix to get the local telephone company on the PBX lines), logging options (for exception reports), and page header options (to eliminate the need for a cover sheet).

Overall, our testing showed the features of FaxWorks to be robust. The log reported time used per job at an average of 45 to 55 seconds per page, better than our original assumptions. We were also pleased with the excellent telephone technical support we received from SofNet. By this time, SofNet and Brooktrout told us that the 4-channel boards were ready, tested, and being used by other customers.

We presented our test results to Branch Operations, discussed concerns, and submitted formal proposals to approve the purchase and installation of the system. The users felt the solution was solid, and they couldn't ignore the potential cost savings. With a capital cost of $31,950 and an operation cost of $25,000 per year, the minimum savings per year to Chemical Bank will be $45,000.

Today

The actual system went into production in January 1994. Branch Operations is using the system for during-the-day alerts, which recently included issuing bulletins to allow branches to close during some of the New York area's severe snowstorms. They are also sending documents overnight as planned, and are phasing out their third party fax service.

Branch Operations reports fewer exceptions from a broadcast than those reported by the fax vendor. Because the system is internal to Chemical, we have full control for retry counts and other parameters.

The local departmental LAN/PC administrator has enhanced the reporting functions and automated certain tasks using REXX for OS/2. He has also replaced the monochrome monitor with a color VGA monitor to take advantage of FaxWorks' color-coded log entries, allowing for easy error recognition.

Future

Microsoft Word for Windows has been installed on the fax system so diskettes can be brought to the machine and "printed" from Word to the FaxWorks print driver. Other enhancements include a token-ring card so the system can be accessed across the LAN.

Currently the system is designed for broadcast only, with the exception of two channels set for send/receive so the rubber-stamped paper documents can be faxed from approval locations to the sending machine. In the event of modified business requirements, the fax system can be reconfigured to support the standard functions of a fax server for routed inbound and outbound fax service to all users on the LAN. Since the boards and software support these functions with DID service from the telephone company, only the phone line configuration would have to be changed.

This broadcast fax system has reaped major benefits for the daily dissemination of information throughout the Chemical Bank branch network. The flexibility of OS/2 and FaxWorks–together with the support for the 4-channel cards from Brooktrout–led us to an excellent configuration and installation of a fax broadcast system.

Martin Lewitter is a systems specialist for Chemical Bank in the Retail Banking Systems Group. His primary duties include designing connectivity solutions for business users in the Retail Bank. Martin holds CNE certification from Novell, Inc. and is currently working toward Enterprise CNE status.

FaxWorks OS/2 LAN Features

FaxWorks OS/2 LAN is a full-featured desktop facsimile program that allows any OS/2 workstation or an optional DOS/Windows client to send and receive faxes quickly and simply. Product features include:

- Annotation tool bars for cutting, pasting, freehand drawings, and text insertions
- Support for Brooktrout, GammaLink, Intel CAS, and most Class 1 and Class 2 fax modems
- Multiple fax channel configuration
- Group fax broadcasting
- Enhanced gray scale viewing
- Image import for signature and letterhead merge
- OCR and PCL options
- Public and private phone books
- ATM and TrueType font support
- With optional Windows client: FaxTracker fax management system for archiving, finding, logging, indexing, and assembling multiple faxes into one document–all from one dialog screen
- With optional Windows client: custom cover sheet creator with logos, graphics, and scanned images

For additional information, contact SofNet, Inc. directly.

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Back Up for the Future

In view of recent disasters both natural and political, we must all understand the necessity of backing up data and making sure that we use a valid backup method. To help you decide which backup software is most suitable for your environment, this article evaluates several available backup software products written for OS/2.

Backing Up Data Is NOT an Option: It's a Must

"Why do I need to back up my data?" you ask. Think about that report you just finished for your boss, the one you worked on all weekend. It caused you to miss your child's first soccer game and Aunt Sally's 88th birthday party. Then this morning, your hard drive went south with no way to recover the report. Wouldn't it be easier to spend a short time recovering the report's backup than spend next weekend recreating the report while missing your child's second soccer game and Cousin Fred's backyard BBQ?

Many of us, having experienced something similar, can relate very well to the above scenario. This article, therefore, emphasizes that you can avoid losing data and work time if you have a backup solution in place.

Since the operating system and applications are replaceable, data is the most critical information on your hard disk to back up. It may be time consuming to reinstall OS/2 and all your applications, but you can recover these things. Lost data is lost forever.

Backup Plan

A backup plan can help you protect your system from permanent data loss. Develop an appropriate backup plan now—and use it regularly. The plan could, for example, be based on how often you use your system and which files you update most frequently.

Here's an example of a backup plan:

1. Once a week, back up your entire system.
2. Every other weekday, back up any files that you have modified or created.
3. Use a new media for the next week's backup so that you can keep a couple of weeks' worth of backups before reusing the media.

   Note: You may want to keep some weeks' backups permanently.

Backup Issues

When evaluating an OS/2 backup solution, you'll have several backup issues to consider, including how often you will perform the backup and whether or not it will be automatic or manual. You must also decide what backup media you will use, how you will label and store that media, how you'll back up a workstation on a LAN, and how you'll ensure your backups are valid. The following paragraphs cover these backup issues in detail.

You may want to keep some weeks' backups permanently.

Choosing Automatic or Manual Backup

You can either back up your data manually or you can automate the process. Since many backup programs allow you to do both, you must decide which method you need. For example, when you want to perform the backup during the night while you're away from the office, you would choose the automatic method.

Selecting Backup Media

Regardless of whether you decide on automatic or manual backup, you must select the media on which to store your data. Options include:

- Floppy diskette
- Hard drive
- Tape
- Optical disk

Note: For an automated process, ensure that the data being backed up will fit on the media used; otherwise, the process will require user interaction, thus defeating the purpose.

Labeling Backup Media

No matter what media you use to store your data, be sure to properly label it. That way, if you ever have to restore it, you'll know exactly which version of the backup to use. If the backup takes more than one diskette, for example, make sure that you label the diskettes in the proper order for the restore process.

Understanding Network Options

If your workstation is connected to a network, you can back up your data to a redirected drive. Remember, however, that this backup is guaranteed only if the network drives are also backed up to another media. If you back up your data to a redirected drive, that drive could also crash. Therefore, make sure that your LAN administrator implements valid network backups. (Here *valid* means that you are backing up the network drives to some other media.)

Validating Backups

If you are going to take the time to back up your data, take the time to ensure that your backup works by restoring your data, then checking it.

OS/2 Backup and Restore Software Options

Do you know what options are available in OS/2 backup software packages? The following product reviews define the characteristics of each software package. Figure 1 provides you with a chart comparing the features of each backup product discussed in this article.

This list of reviewed software is not exhaustive but represents several major packages found on the market today. With all the excellent solutions out there, I challenge you to investigate each available avenue.

Characteristics of Backup and Restore Software

Presentation Manager (PM) application: In contrast to character-based applications, an application based on the concept of graphical windows. It takes advantage of OS/2's graphical look with folders, buttons, scroll bars, and so on.

Data compression: Reduces file size during backup so you can store more data on the backup media.

Automated backups: A backup scheduled to run at a certain time without user interaction.

Extended attributes: Ability to back up extended attribute information.

Note: Extended attributes are file properties associated with files under OS/2 1.2 or higher.

FAT support: Backs up data stored on drives that are partitioned as file allocation table (FAT).

HPFS support: Backs up data stored on drives that are partitioned as high-performance file system (HPFS).

System files: Files that are installed by the OS/2 operating system.

Tape support: Supports backing up data to tape.

Floppy support: Supports backing up data to floppy diskette.

System restore: Restores the full system without having to reinstall OS/2 first.

	PM Application	Data Compression	Automated Backups	Extended Attributes	FAT Support	HPFS Support	System Files	Tape Support	Floppy Support	System Restore
OS/2 Backup and Restore Commands				✓	✓	✓			✓	
BackMaster 1.01	✓	✓	✓	✓	✓	✓	✓	✓		✓
Sytos Plus	✓	✓	✓	✓	✓	✓	✓	✓	✓	*
Back in a Flash!	✓	✓	✓	✓	✓	✓	✓		✓	✓
Novaback for OS/2		✓	✓	✓	✓	✓	✓	✓		**
FileSafe for OS/2			✓	✓	✓	✓	✓	✓		
Parallel Storage Solutions	✓	✓	✓	✓	✓	✓	✓	✓		✓

*With Rebound
**With Novaboot

Figure 1. Comparison Chart

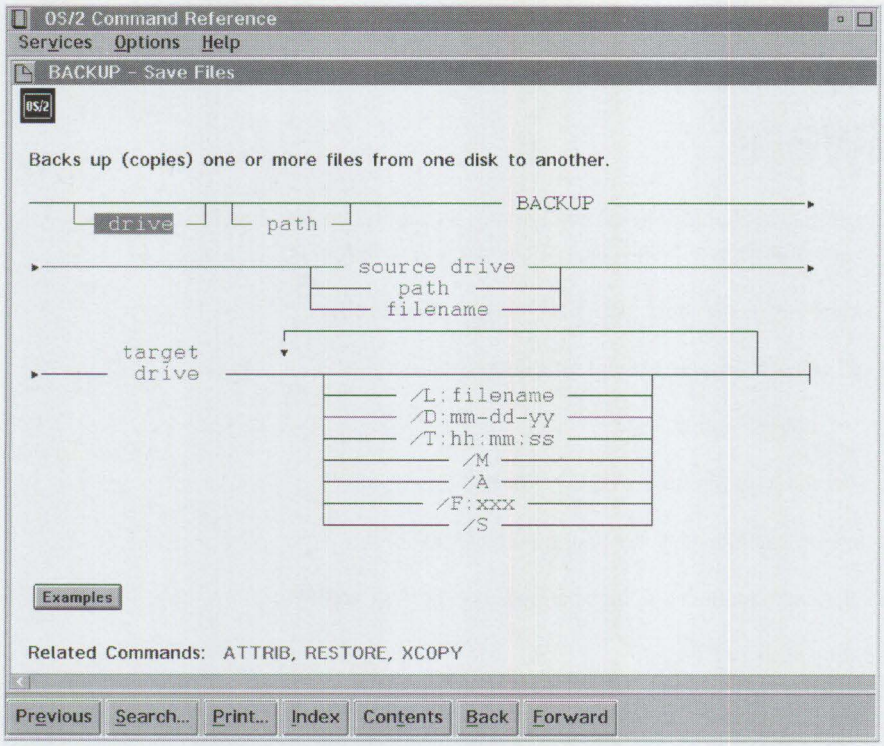

Figure 2. OS/2 Online Command Reference

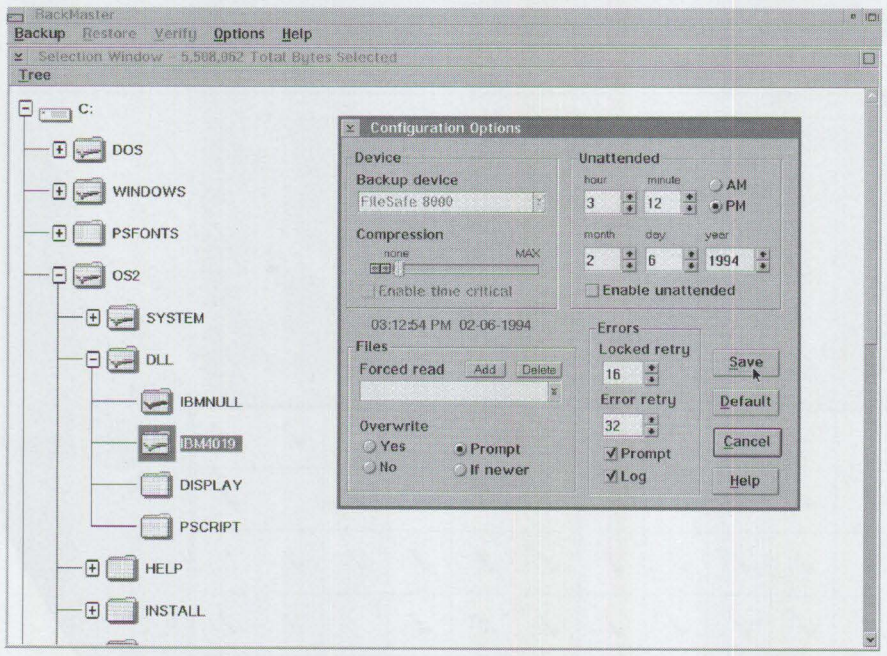

Figure 3. BackMaster's Easy-to-Use PM Interface

Native OS/2 Backup and Restore Commands

Does OS/2 have built-in backup and restore function? Yes. Using OS/2's character (text)-based BACKUP and RESTORE commands, you can back up limited amounts of data. (Future releases of OS/2 may contain a more robust–and intuitive–backup/restore utility.)

Although OS/2 BACKUP.EXE backs up one or more files from your hard drive to floppy diskette or to another hard drive, it does not back up to tape or optical drives. BACKUP simply copies files from one disk to another without compressing them. You cannot view the backed-up files because they are contained within one of two files created on the target disk: BACKUP.XXX and CONTROL.XXX. BACKUP.XXX contains all of the backed-up files, and CONTROL.XXX saves the paths, file names, and other controlling information needed for RESTORE. With RESTORE, you can view which files are backed up without restoring them.

BACKUP does not back up either system files or open dynamic link library (DLL) files. If you are sharing files, you must be able to access those files for BACKUP to work with shared files.

Use OS/2's BACKUP and RESTORE when you need to back up a few files and restore those files to the same location. To make regular backups of large amounts of vital, irreplaceable data, use another backup solution with functions such as data compression, support for more reliable media, greater speed, and automation. The products reviewed below provide these added functions. For complete information on BACKUP and RESTORE, see the OS/2 Online Command Reference (Figure 2).

BackMaster 1.01 from MSR Development

BackMaster for OS/2 2.1 is a 32-bit backup solution for OS/2 with an easy-to-use intuitive PM interface (Figure 3). BackMaster supports both FAT and HPFS as well as extended attributes and system files. The OS/2 user can work and share information with DOS and Windows users as well.

BackMaster is easy to install. The one-diskette installation program copies the needed files to the path you provide, updates the CONGIF.SYS file, and adds a group object containing the program objects to your desktop.

You can do either total or partial backups, both manually or automated–transparently. (This means that they execute in the background without disturbing the windows where you are working in the foreground.) In addition, the text-based disaster recovery tool lets you restore your system without having to reinstall OS/2. Just boot OS/2 from diskette, then run the BMREST utility. BackMaster supports backing up to a variety of QIC-40/80 tape drives, both name brand and generic.

Depending on the type of data being backed up, the data compression function can double the amount of information stored on the backup media. You can further protect your data with the optional password function. A user must know the password to be able to restore the backup.

BackMaster provides a free demo on its MSR BBS so that you can see for yourself what BackMaster can do. To download the demo:

- Dial (409) 560-5970
- Identify yourself
- Go to File Area 6
- Download BMDEMO1D.ZIP

Sytos Plus File Backup Manager 1.38 for OS/2 from Sytron Corp.

Sytos Plus File Backup Manager for OS/2's easy-to-follow installation program allows you to choose the disk and path on which to install the Sytos PM application code, choose both a default backup device and default volume name, automatically update `CONFIG.SYS`, and add a group object to your desktop.

In addition, when you perform a backup you can choose whether or not to compress your data. You can back up FAT, HPFS, extended attributes, and system files—either automatically or manually—to numerous tape drives and to floppy diskette. Figure 4 shows one of the first screens you'll see when using Sytos Plus to back up your data.

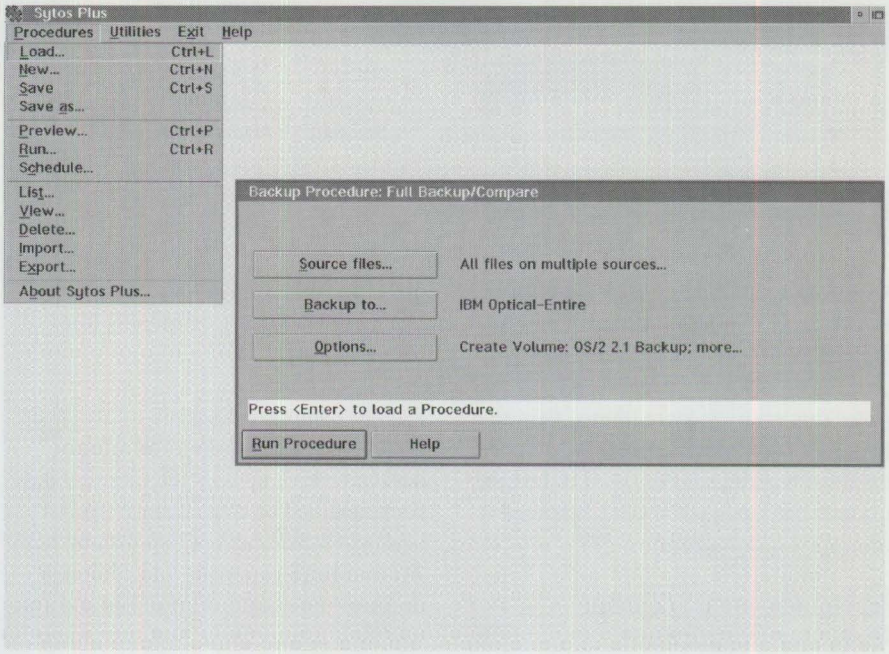

Figure 4. Sytos Plus File Backup Manager

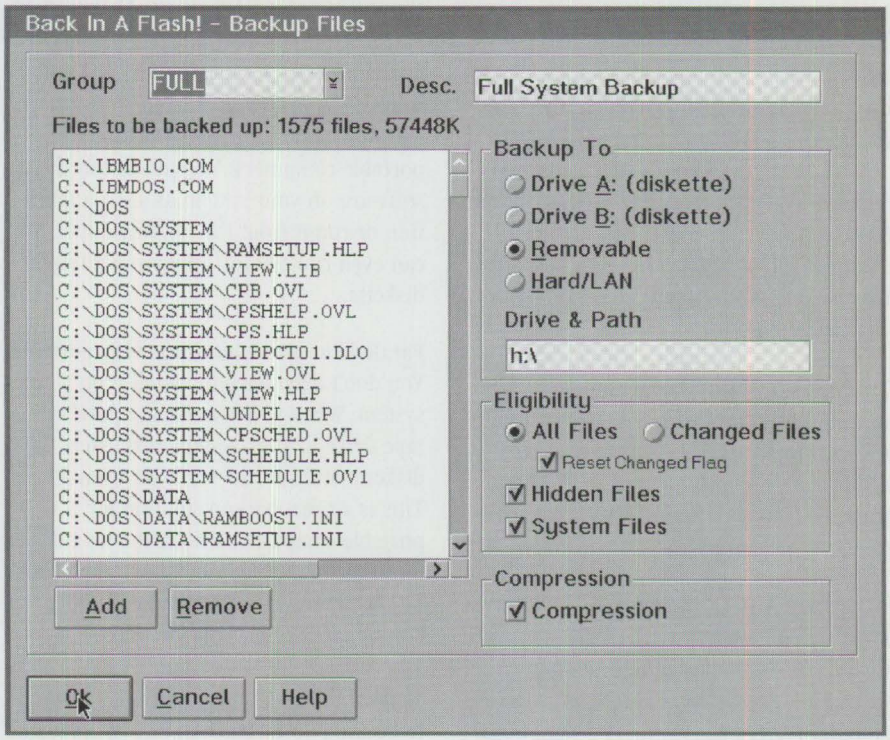

Figure 5. CTT Back in a Flash!

Sytos Rebound 1.20 for OS/2 from Sytron Corp.

Sytron's Sytos Rebound 1.2 add-on can be used in conjunction with Sytos Plus to perform full system restores without having to reinstall OS/2. Sytos Rebound must be configured prior to system failure and requires a full system restore created by Sytos Plus.

Back in a Flash! from CTT, Inc.

Back in a Flash! 1.00 is an easy-to-use, 32-bit backup solution for OS/2 2.1. The multithreaded PM application supports both FAT and HPFS as well as extended attributes, system files, and open files. The program backs up to floppy disk, hard drive, and any other logical file system device attached to your system. The data compression option increases file storage space about 50 percent. Figure 5 shows a typical screen from Back in a Flash!

The one-diskette installation program is easy, allowing you to choose the drive and path on which to install the code. It creates a group object on the desktop containing the program object, the `README` file, and a user's guide.

You can do total or partial backups either manually or automated—and do them transparently. You can choose to compress your data about 50 percent when backing it up.

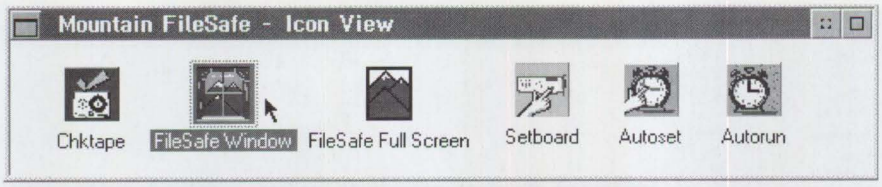

Figure 6. Mountain FileSafe Icon View Window

With Back in a Flash!'s text-based utility CCTREST.EXE, you can restore your system without having to reinstall OS/2.

Note: This utility is more limited than the Back in a Flash! program because its intended environment causes it to be used in character mode when OS/2 is booted from OS/2 install diskettes.

Novaback for OS/2 from Novastor Corporation

Character-based Novaback for OS/2's easy installation is compatible with OS/2 1.3 and 2.x. Novaback supports backing up both HPFS and FAT, extended attributes, and system files, plus manual and unattended backups. You can back up to hundreds of small computer system interface (SCSI), QIC-80, or QIC-36 tape drives.

Support for Quick File Access (QFA) allows Novaback to access any file in under 60 seconds. This is important when considering the amount of time it takes to restore a backed-up file.

The Novastor utility Novaboot allows you to completely restore your system without first reinstalling OS/2. Instead, you create a single boot diskette for OS/2. Just boot from the floppy diskette that brings up OS/2 and perform your restore.

FileSafe for OS/2 from Mountain Network Solutions

Character-based FileSafe, written for OS/2 1.x and used in conjunction with Mountain Network tape drives, can be run either as an OS/2 full screen or windowed application. (Mountain Network Solutions provides several top-of-the-line tape drives for your system.) Figure 6 shows Mountain FileSafe's user-friendly icon view window.

FileSafe's automated backup utility AUTORUN will either do a full selective backup or back up only the files that have been modified or created since the last backup. FileSafe can back up data on both FAT and HPFS partitions. In addition, it backs up the extended attributes and system files. If you choose, you can protect your files with a password.

Portable Tape Backup System from Parallel Storage Solutions

Parallel Storage Solutions provides a parallel tape drive hardware and OS/2 software solution that is ideal for routine backups on desktop, network, and portable computers. You can install the software on your system as a PM application or run it from the command line. You can even run the software from a floppy diskette.

Parallel Storage Solutions is very portable. You don't even have to install it on your system. When you connect the parallel tape drive to your system, just insert the diskette and run the software from it. This is a great backup solution for portable computers. I hook the tape drive up to my laptop's parallel port, then back up my laptop with the Parallel Storage Solutions' OS/2 backup software.

Most laptop users I know are not currently backing up their data. All it takes is one second for a hard drive to crash, wiping out everything. The excuse I hear most often is that it would take too long and is too much trouble to back up all of the data to diskette. Don't let that excuse cause you to lose your data!

The OS/2 software that comes with Parallel Storage Solutions' portable tape backup system supports backing up both FAT and HPFS file systems, OS/2 system files, and extended attributes, both manual and automatic methods, and data compression. The Parallel Storage Solutions OS/2 backup software allows an OS/2 system to be fully restored from the second OS/2 installation diskette.

Summary

Backing up your data is not just important. It is vital. You risk losing your valuable data and your even more valuable time if you do not put a backup solution in place for your system.

When developing your backup plan, consider manual or automatic backups, the type of media you are going to back up to, and how you will validate your backup. Make sure that you understand the features offered by different software vendors so that your purchase will fit into your environment. Then test your backup choice.

Now that you have finished reading this article, go back up your system!

Additional Information

Contact the software vendors listed in Figure 7 for information about the reviewed products. For information on supported backup hardware for each software package, please contact the software vendor.

Tyra Steil is an Associate Marketing Support Representative working in the IBM Personal Systems Competency Center (PSCC) in Roanoke, Texas. In her fourth year at IBM, and with three years of OS/2 experience behind her, she currently supports OS/2 in the OS/2 Systems Support and Services Group. Tyra has a BS in mathematics and computer science from East Texas State University.

Correction

In the "LAN Analysis Using IBM's Datag*LANce* Network Analyzer" article in the March/April issue of *Personal Systems*, the phone number to contact for additional information on the product was incorrect. Please call the Datag*LANce* hotline at (919) 254-1364 for information on the product.

Product	Company	Address	System Requirements
BackMaster 1.01	MSR Development	P.O. Box 632070 Nacogdoches, TX 75963 Voice: (409) 564-1862 Fax: (409) 560-5868 BBS: (409) 560-5970	OS/2 2.1 8 MB RAM
Sytos Plus File Backup Manager 1.38 for OS/2	Sytron Corp.	134 Flanders Rd. PO Box 5025 Westboro, MA 01581-5025 Voice: (800) 877-0016 Voice (508) 898-0100 Fax: (508) 898-2677	OS/2 1.2 or higher Recommended RAM: Operating system requirements plus 1 MB IBM PC or PS/2, Compaq, or compatible Fixed disk Backup device Mouse is optional but recommended
Sytos Rebound 1.20 for OS/2	Sytron Corp.	134 Flanders Rd. PO Box 5025 Westboro, MA 01581-5025 Voice: (800) 877-0016 Voice: (508) 898-0100 Fax: (508) 898-2677	OS/2 1.2 or higher Recommended RAM: Operating system requirements plus 1 MB Sytos Plus for OS/2 IBM PC (or 100 percent compatible) or PS/2 Hard disk Backup device
Back in a Flash!	CTT, Inc.	Suite 290 111 Third Avenue South Minneapolis, MN 55401 Voice: (612) 339-5870 Fax: (612) 339-5965	OS/2 2.1 386SX-based PC 4 MB RAM (6 MB recommended) 0.5 MB free on hard drive Floppy diskette drive
Novaback for OS/2	Novastor Corporation	30961 Agoura Road Suite 109 Westlake Village, CA 91361 Voice: (818) 707-9900 Fax: (818) 707-9902 BBS: (818) 707-9797	OS/2 1.3 or higher
FileSafe for OS/2	Mountain Network Solutions	360 El Pueblo Rd. Scotts Valley, CA 95066-4268 Voice: (800) 458-0300 Voice: (408) 438-6650 Fax: (408) 438-7623 Direct Sales: (800) 241-3937 Technical Support: (408) 438-7897	OS/2 1.2 or higher Mountain FileSafe tape backup system
Portable Tape Backup System	Parallel Storage Solutions	116 S. Central Ave. Elmsford, NY 10523 Voice: (800) 998-7839 Voice: (914) 347-7044 Fax: (914) 347-4646	OS/2 1.3 or higher

Figure 7: Backup Product Contacts and Requirements

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Lost in Cyberspace

With all this talk lately about Al Gore's vision for the "information superhighway," I've been feeling like a hitchhiker stranded out in the middle of the cyberspace desert. Call me the Robinson Crusoe of the island that has become modern communications technology, but I don't know the first thing about getting "connected" to the rest of the world and am not sure I want to be. Heck, I don't even know my next door neighbors.

Working for a high tech magazine at IBM, I've already contracted a deadly case of information overload. I get more press releases, computer magazines, faxes, e-mail announcements, *et cetera, et cetera, et cetera* across my desk everyday than I have time to sift through. And now they want me to communicate with the rest of the globe?! When?! During REM sleep with little electrode gizmos taped to my brain?

I can see into the future, and I can assure you, it's not a pretty sight. I envision gargantuan floating electron traffic jams as people attempt to send out that nice electronic Christmas letter to Aunt Edna in Cincinnati and instead accidentally select their worldwide Internet Bowling Pointers Discussion Group distribution list. (A coworker made a similar mistake recently and spent the entire day deleting acknowledgments from IBMers around the globe.) Aunt who?

Okay, I'll confess, I have used CompuServe and PRODIGY, but I'm no downloading, forum-searching, mail-sending, technopunk whiz kid hacker. If it weren't for PRODIGY's intuitive GUI (graphical user interface) or CompuServe's brilliantly designed WinCIM, I'd probably have ended up like Alice in Wonderland–stuck in a hole somewhere without the right pill to get me back to level ground.

To me the word "Internet" has always sounded awfully intimidating. I'm not quite sure what it means. The name "CompuServe" is so user-friendly–it's there to *serve* you and your computer. With the name "PRODIGY," you're already feeling smart before you've even logged on. But the Internet? Is that like some intergalactic tennis net used to fend off ominously unconstrained asteroids, or what?

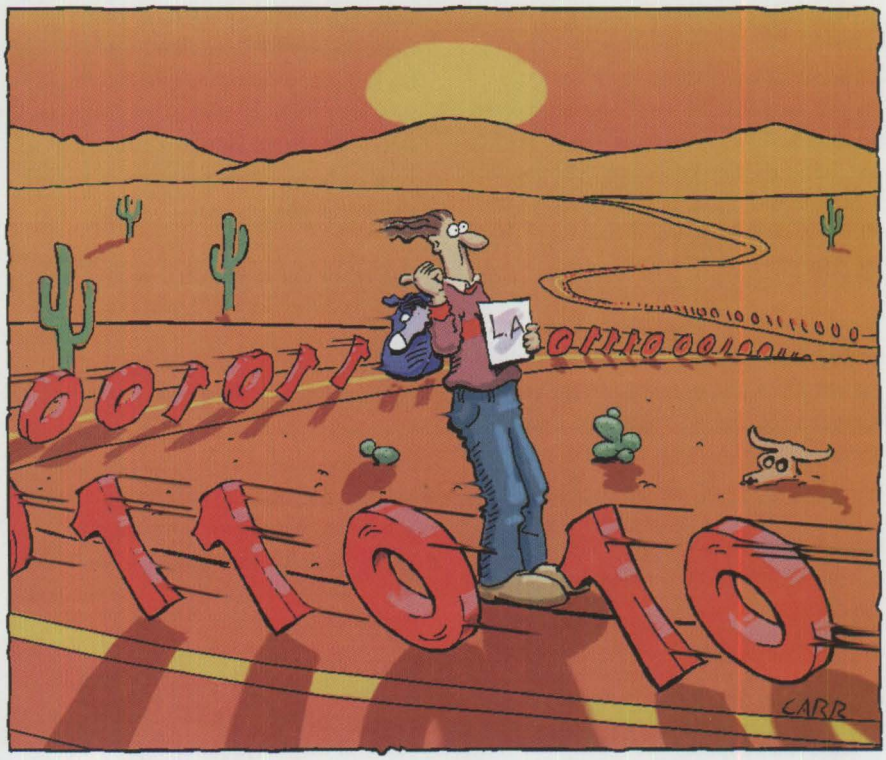
Or what, indeed. So it was with great trepidation that I began my first journey on the Internet. As I trudged off into the inner confines of cyberspace, I immediately began praying to the great computer gods on Mount Computus to help lead me to the Golden Fleece of Internetdom. I needed a muse for guidance and wisdom to help me begin my journey. (Before it was all said and done, I just needed a drink.)

Little did I know what obstacles would throw themselves in my every path (pun intended). Listen, I know *basic* DOS. `CD backslash, CD dot dot, DIR, COPY, DELETE, AUTOEXEC.BAT`–it all starts to make sense after a while. And I don't want to hear another person say they prefer using a Macintosh–I work for IBM, people. And anyway, I'm comfortable using these terms. They bring back fond memories of college chemistry.

But the syntax used to navigate the Internet? FTP? TELNET? GOPHER? SWAIS? *Oui, je parle francais. Mais les langues de l'Internet? Non, non, c'est trés compliqué!* Have they yet sent linguistic anthropologists into the field to study this exotic tongue? And they thought transcribing the language of the native highlanders of New Guinea was a chore!

I had no more puttered up the Internet on-ramp than I had to turn around and ask for directions to UNIX language school. (Keep in mind that, being a man, asking directions was a very difficult thing for me to do.) I tried to learn the basic grammar, but after studying some of the commands (and there are thousands of them) for weeks, I concluded that UNIX definitely wasn't written by somebody on this planet. But I wasn't about to allow technology to leave me behind, babbling in its cyberdust.

So I developed my UNIX skills to where I was the equivalent of the classic, clueless American tourist speaking Texas French in Paris *(Garson, je dayzeer une Coke, see*



voo play...Mercy bo coo, pardner.) and decided it was time to make a move. The Internet express was leaving the station, and if I was going to have even a slim chance of hitching a ride on the caboose, some serious short cuts would be in order.

(WARNING: The use of hardcore Internet "lingo" is imminent and will continue throughout the rest of this article. Parental discretion is advised.)

Too impatient to spend the necessary decade needed for learning UNIX's *vi* text editor (as opposed to an actual word processor), I almost decided I would skip using mail and go straight to the good stuff. Though everybody talks up e-mail on the Internet, as I said before, I get the stuff out the wazoo here at work, not to mention truck loads of "snail mail," so the last thing I want to do is send notes back and forth to the rest of the world. (I'll leave that to Al Gore, who can be reached at `vice.president@whitehouse.gov`).

But getting on the Internet without learning how to send and receive mail is like going to North Dakota and blowing by Mt. Rushmore without taking a picture of Abe Lincoln's crumbling nose. So when I finally figured out how to send a note to my editor, I asked her to please establish a credit line in my name at Domino's–I was on the Internet and I was going to be awhile.

Suffice it to say that once you've deciphered the ancient Sanskrit code used for Internet addresses, you can indeed send love notes to your sweety in the opposite hemisphere in nothing flat. Question is, what's your sweety doing over there in the first place?

Which brings me to the Three Commandments of the Internet. If you learn nothing else from this minor masterpiece of computer journalism, memorize these maxims. As far as I'm concerned, you could cruise the Autobahn of bits and bytes from here to eternity and learn how to do nothing but the following and the trip would have been well worth the effort:

- Thou shalt telnet.
- Thou shalt ftp.
- Thou shalt gopher.

Allow me to explain that all of these terms are verbs posing as nouns and that there is a certain grammatical etiquette that must be followed when using these commands. For example, you never say, "Use telnet." Rather, you say, "Telnet to such and such computer."

Telnetting is similar to logging into your server at work, except that when telnetting, the server very well could be a BBS located in some remote village in Zimbabwe. The remarkable difference, however, is that there really isn't any difference. Instantly connecting to a host computer halfway around the world is a feat unmatched since the first overnight delivery made by the Pony Express (and this without having to change horses or stop for water).

Even more remarkable is the variety of souvenirs up for grabs upon your arrival. Cyberspace is like one big Stuckey's (minus the pralines) filled with loads and loads of the cyberspace equivalent of neat stuff like Velvet Elvi (that's plural for Elvis) and plastic deities that you'd never admit wanting to buy to your friends. But on the Internet, you don't have to confess to anyone your appetite for chintz, and what's even better, it's all free!

I'll never forget *my* first successful telnet. It was a very special experience. I connected to the Library of Congress Online Catalog System. I don't know how I got there and probably couldn't find my way back, but hey, how many people can say they've visited the Library of Congress Online Card Catalog? That's almost as good as being able to say you've visited the World's Biggest Ball of Twine.

To FTP, or not to FTP, that is the question. And the answer is yes, if owning a full ASCII compendium of Shakespeare's complete folio is what all you closet tragedians out there desire. Simply `ftp ocf.berkeley.edu`, enter the subdirectory `pub/Library/Shakespeare`, `get` the file, and the bard's compilation will be sitting in your host computer within a matter of minutes. What to do with it once it has arrived is another question entirely.

You say you're looking for more contemporary souvenirs? There's always the Grateful Dead archives. Simply `ftp gdead.berkeley.edu` and look in the `/pub/gdead` directory to find out everything you ever needed to know about the band that *refuses* to die. Or `ftp ftp.rahul.net` into the `/pub/atman/UTLCD-preview/mind-candy/acidwarp.arj` directory for Acid Warp, a program that displays psychedelic graphics. What a long, strange trip it'll be, I'm sure. And whose life would be complete without obtaining the first 1.25 million digits of pi? FTP to `wuarchive.wustl.edu` and you'll find it in the `/doc/misc/pi/*` directory. And hey, don't spend it all in one place.

On to the final, and probably most important, commandment–gophering. Gophering is much akin to going through the drive-through at your local McDonald's. You drive in, check out the menu, give your order, then feast like a pig without ever having to get out of your car. If you're able to work those old-fashioned jukeboxes you used to see in greasy spoons, you'll be a gophering fool in no time.

The term was coined after Minnesota, the Gopher State, where Gopher was developed at the Univesity of Minnesota in 1991. Like the little, furry *gopher,* Internet gophering will take you down into places you probably didn't even know you wanted to go–and it's as easy as driving an automatic. In fact, it's the closest thing I've found to cruise control on the Internet.

Heck, I'd even go so far as to say it's better than shopping at Wal-Mart, because with gophering, everything you need *is* under one roof. Gopher servers (the noun) are all connected to one another, allowing you to go from one to another with the push of a menu button. So while it may be easy to get lost maneuvering your way through other parts of the Internet maze, if you find yourself having a difficult time gophering, you should probably consider a less intellectually taxing pastime–like watermelon seed spitting.

Which brings me to the downside of Internetdom. You thought you'd lost your kids to the electronic universe when Nintendo came out? Ha! Think again. Someone had better develop a 12-step program for compulsive Internuts and

fast, or we're gonna have ourselves a country full of wide-eyed monitor monkeys with constant busy signals sooner than we'd like. Do Bill Clinton and Al Gore realize the kingdom of computing hobos their information highway is liable to spawn? Traveling aimlessly from one node to the next with nothing but the clothes on their back? Somebody had better call Oliver Stone–I think there's a CIA conspiracy afoot.

Conspiracies notwithstanding, you'd think there was a K-Mart blue light special run on Tonya Harding voodoo dolls the way people are stampeding over one another in an attempt to get "connected." The yearning for global connectivity makes the Oklahoma Land Rush look like a friendly trip down the block to your local 7-11 store, and I'll have none of it.

Far as I'm concerned, how you get there from here isn't nearly as important as what you see along the way. I don't even care if I stop and smell the roses–a whiff of freshly burned diesel will do me just fine.

While I'm sure that for those in a hurry, the "information superhighway" is a blessing in disguise, I figure the odds are that I am going to get left behind no matter how hard I try to keep up. Doesn't hurt my feelings none. To quote that recent and telling IBM ad slogan, "I don't just have a computer, I have a life."

So I'm gonna take my life, hop on my Harley-Davidson Sportster, grab a six-pack of Bud and a pack of Marlboros, and do the best *Easy Rider* imitation I can muster in the midst of this turbulent techno-generation.

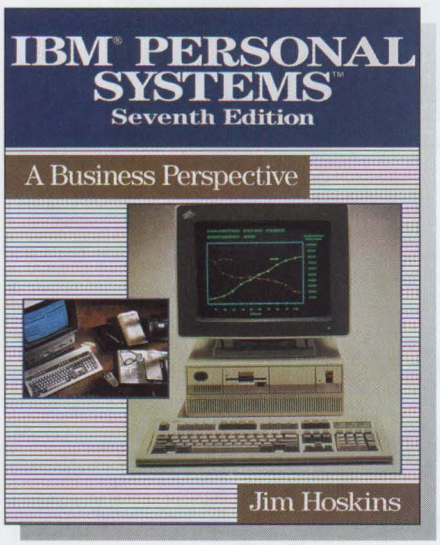
As for Al Gore, he can have his information superhighway, 'cause I'm taking the backroads. If for some reason he needs to reach me, tell him he can always send a note to `radar@vnet.ibm.com`. I'll be checking in now and again.

Todd Watson has worked for IBM since 1991 as the editorial assistant for */AIXtra: IBM's Magazine For AIX Professionals* and will soon complete his master's degree in Mass Media Studies at the University of North Texas at Denton.

The Book Shelf

IBM Personal Systems: A Business Perspective, 7th Edition
By Jim Hoskins

Jim Hoskins' *IBM Personal Systems: A Business Perspective* is the seventh edition of the book that Hoskins has written about IBM's evolving personal computer products. Whether you're a corporate executive who, as a result of "downsizing," has just had your secretary replaced by this unfriendly-looking, non-responsive personal computer or you're a technical coordinator responsible for evaluating the personal computing requirements for a nationwide organization, this is the book for you.



Let's assume you're the corporate executive newly initiated into the computing world. Sit down at your new IBM Personal System/2, pick up Hoskins' book, and turn to Chapter 3: Using Your Personal System. In plain, easy to understand language, you'll learn about POST, menu options, BIOS, software–just the basics you need to know. Then move on to Chapter 4: Application Programs. This chapter describes the things you'll most likely be using your PS/2 for: word processing, spreadsheets, database management.

Or you're the technical coordinator and you're looking for an encyclopedia of every feature and option on all four "brands" of IBM Personal Systems, including PS/1, PS/ValuePoint, PS/2, and ThinkPad. Chapter 1 takes you through an overview of each model while Chapter 2 looks at all the hardware options. Then turn to Chapter 5 to decide which operating system or systems you need to satisfy all your users' needs.

The last two chapters work for both of you. These chapters relate hardware and software options to businesses–small, medium, and large.

Robert J. Corrigan, president of IBM's PC Company, says in his foreword to *IBM Personal Systems: A Business Perspective*, "This seventh edition of Jim Hoskins' book gives you an in-depth look at each of the IBM PC Company brands, along with useful technical information on the variety of products within each brand segment."

New in this edition:

- PS/2 Server Family
- ThinkPad 500 and 700 Series
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- New Multimedia Options
- OS/2 2.1
- OS/2 for Windows
- Windows NT

Jim Hoskins certainly has the credentials to write this book. A former IBMer with 10 years experience as a design engineer, Jim was part of IBM's original PS/2 development team. He wrote the first edition of *IBM Personal Systems: A Business Perspective* while still on the design team. It immediately became a best seller and has since been translated into 11 foreign languages.

To order this book, call Maximum Press toll free at (800) 989-6733 (source code 339), fax to (615) 254-2408, or write to Suite #339, 1501 County Hospital Road, Nashville, TN 37218.

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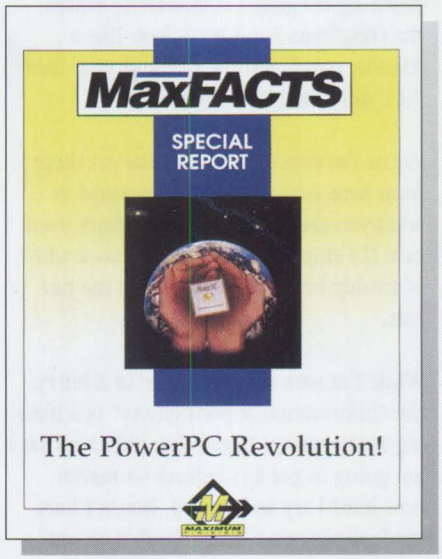
New York, New York
ISBN Number 0-471-59930-1

The PowerPC Revolution! A MaxFacts Special Report
By Jim Hoskins

In early March, the PC wars heated up with the introduction of Apple's new PC line designed around the PowerPC microprocessor. The March 9 *Wall Street Journal* reported that "computer users are the only sure winners in the growing battle over the PowerPC."



Thus the revolution begins: the PowerPC alliance of IBM, Apple, and Motorola takes on the Intel/Microsoft "duopoly." May the best microprocessor win!

Best-selling author Jim Hoskins has published this MaxFacts report describing the new joint venture with IBM, Apple, and Motorola. It takes an in-depth look at the reasons behind this groundbreaking alliance that astounded the industry, including an examination of the independent and often surprising strategies–and the resulting PowerPC-based products.

Six sections cover the following topics:

- Introduction to PowerPC, including a glance backwards and an examination of the big three in the alliance
- A closer look at PowerPC architecture, microprocessors, memory management, and performance

- PowerPC software basics and challenges plus the PowerOpen Association
- Apple's, IBM's, and Motorola's visions for the PowerPC (separate sections)

Separate sidebars include a table comparing other chips and an examination of Workplace OS.

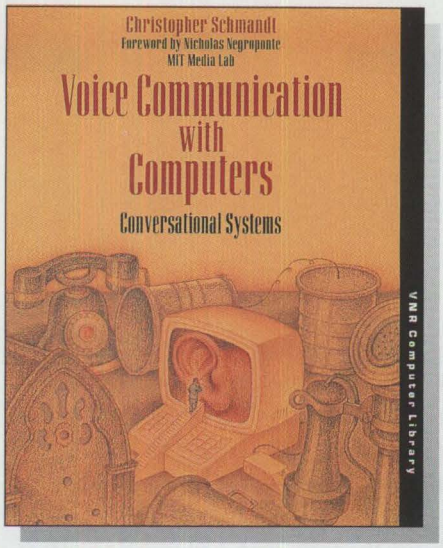
To order this book, call Maximum Press toll free at (800) 989-6733 (source code 339), fax to (615) 254-2408, or write to Suite #339, 1501 County Hospital Road, Nashville, TN 37218.

Published by Maximum Press
Nashville, Tennessee
ISBN Number 0-9633214-9-8

Voice Communication With Computers/Conversational Systems
By Christopher Schmandt

In the March/April issue of *Personal Systems*, we examined IBM's speech recognition products in detail, describing the technology behind this innovative, futuristic process of "talking" to your computer. Christopher Schmandt, director of the Speech Research Group and a principal research scientist at the Massachusetts Institute of Technology (MIT) Media Laboratory, takes you a step farther in his new book, *Voice Communication with Computers*.

"Unlike other books, this one explains speech recognition, coding, and synthesis in a way that can be understood by a



broad audience," says Schmandt. "Furthermore, it provides practical guidance in how to use speech technologies."

I certainly found that to be true as I reviewed the book. I was captivated by the foreword, "Speaking of Talk," written by Nicholas Negroponte, also from the MIT Media Lab. Demonstrating the value of speech, Negroponte points out, "Speech works in the dark. It allows you to communicate with small objects. It lets you transmit a message beyond arm's reach and around corners."

Negroponte concludes *Voice Communication with Computers* is not just a textbook or tutorial; it is a perspective. Its point of view underscores the need to interact and communicate with computers in much the same way we communicate with human beings. Only when we are able to talk to machines the way we talk to people will the concept of "ease of use" be seriously addressed.

The book begins with a comprehensive discussion of speech operation theory, including the interactive and expressive role of voice communication. After building a basis for understanding, Schmandt provides a wealth of information for readers primarily interested in user interface design issues as well as for those who want to know about system architectures and support for voice in multimedia computing environments.

Although at times weighty with technical terms and deep analysis, Schmandt's book provides an excellent foundation for appreciating the emerging technology of speech recognition in the computer world. As Negroponte says, "[T]here is little question of where we are headed. Talk will be the most common means of interaction with all machines, large and small."

Take advantage of the information available in *Voice Communication with Computers* to ensure you can talk back! The year 2001 will be here before you know it.

To order this book, call Van Nostrand Reinhold toll free at (800) 842-3636.

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IBM Pub Order SR28-4412

Reviewed by Betty Hawkins, Editor, *Personal Systems*

Threads

Threads give OS/2 its high-performance multitasking ability. By assigning different priorities to different threads and preempting when needed, OS/2 is capable of doing a wide variety of concurrent tasks. This architecture makes it possible to run communications, LANs, user interfaces, and multimedia simultaneously–without losing a beat.

This article outlines the concepts behind threads and preemptive multitasking. It also explores OS/2's powerful interprocess communications and coordination mechanisms that keep things moving efficiently.

Most OS/2 users are impressed with its ability to run more than one program at a time. An even more impressive fact is that none of these concurrent applications drops information, even under the most severe computational load. All of this magic is the result of the multithreaded architecture of OS/2.

Priority-Based Preemptive Multitasking

The OS/2 kernel performs multitasking using an algorithm known as *priority-based preemptive multitasking*. OS/2's architecture gives developers the ability to break their applications into different dispatchable units of code known as *threads* or tasks. To the developer, each thread appears to be a separate processor. Developers assign different priorities to different threads, then the operating system keeps everything going, based on thread priorities and events.

Philip Lieberman
Lieberman and Associates
Beverly Hills, California

Figure 1 depicts multitasking by showing how each thread runs as though it were the only one on the physical processor, because OS/2 switches between threads transparently.

Since there is normally only one physical processor in a PC, multitasking is accomplished by switching the processor's attention from one piece of code to another. The portion of OS/2 that does the switching is known as the *dispatcher*. The part of OS/2 that decides which thread to switch in or out is called the *scheduler*.

The scheduler can be thought of as the brains of the operating system, deciding what to do when faced with competing threads. The dispatcher represents the hands of the operating system, in that it physically preempts one thread, saves its

Who says you can't find good help these days?

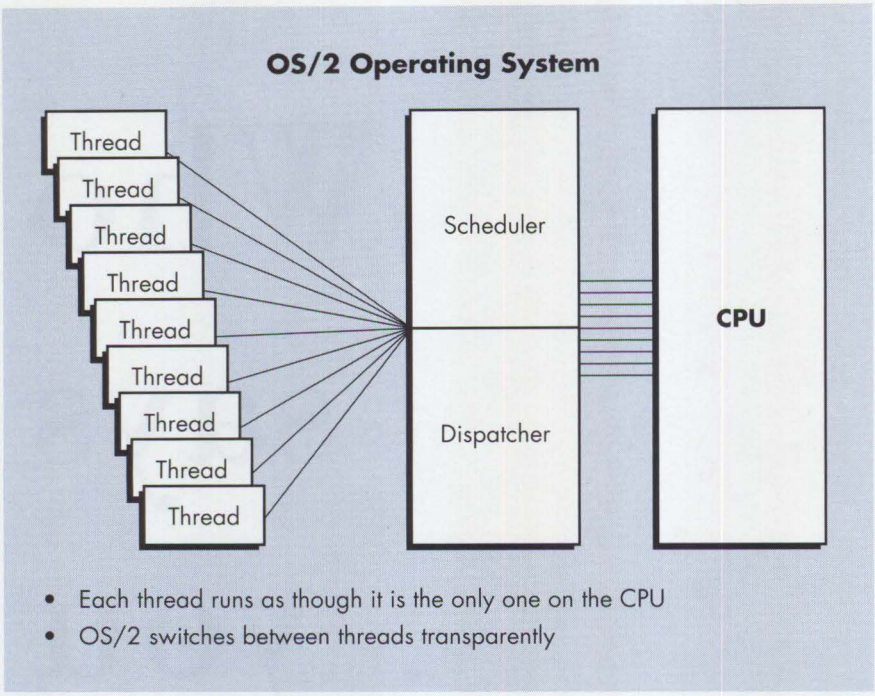

Figure 1. Multitasking

state, and switches in another thread as fast as it can.

Figure 2 illustrates preemptive scheduling according to thread priority. In Figure 2, the low-priority thread A is twice preempted, once by medium-priority thread B, and again by high-priority thread C.

Preemption Versus Cooperative Scheduling

In preemptive multitasking, the operating system can take control away from a thread whenever it desires and return control when appropriate. In OS/2, preemption is based on thread priorities. This design is one of the major distinctions between OS/2 and DOS/Windows. Because Windows under OS/2 (Win-OS/2) is just another thread, OS/2 can break out of it to schedule other activities. In contrast, DOS/Windows has no priority system and no preemption between Windows 3.1 applications.

Another distinction between OS/2 and DOS/Windows is in the kinds of multitasking they do. In OS/2, applications running concurrently do not have to cooperate with each other to share the processor's time. However, in DOS/Windows, if a Windows 3.1 application does not voluntarily give up control, all other concurrent applications must wait until it does–*if* it gives up control. Unless its applications cooperate with each other, Windows cannot multitask. The distinction, therefore, is that Windows does cooperative multitasking, whereas OS/2 does preemptive multitasking.

In Figure 3, which demonstrates cooperative multitasking, two programs (A and B) are running concurrently, and each one yields to the other so that multitasking can take place. If either A or B does not yield, there can be no multitasking.

The threading feature is also the reason that OS/2 can kill errant applications at

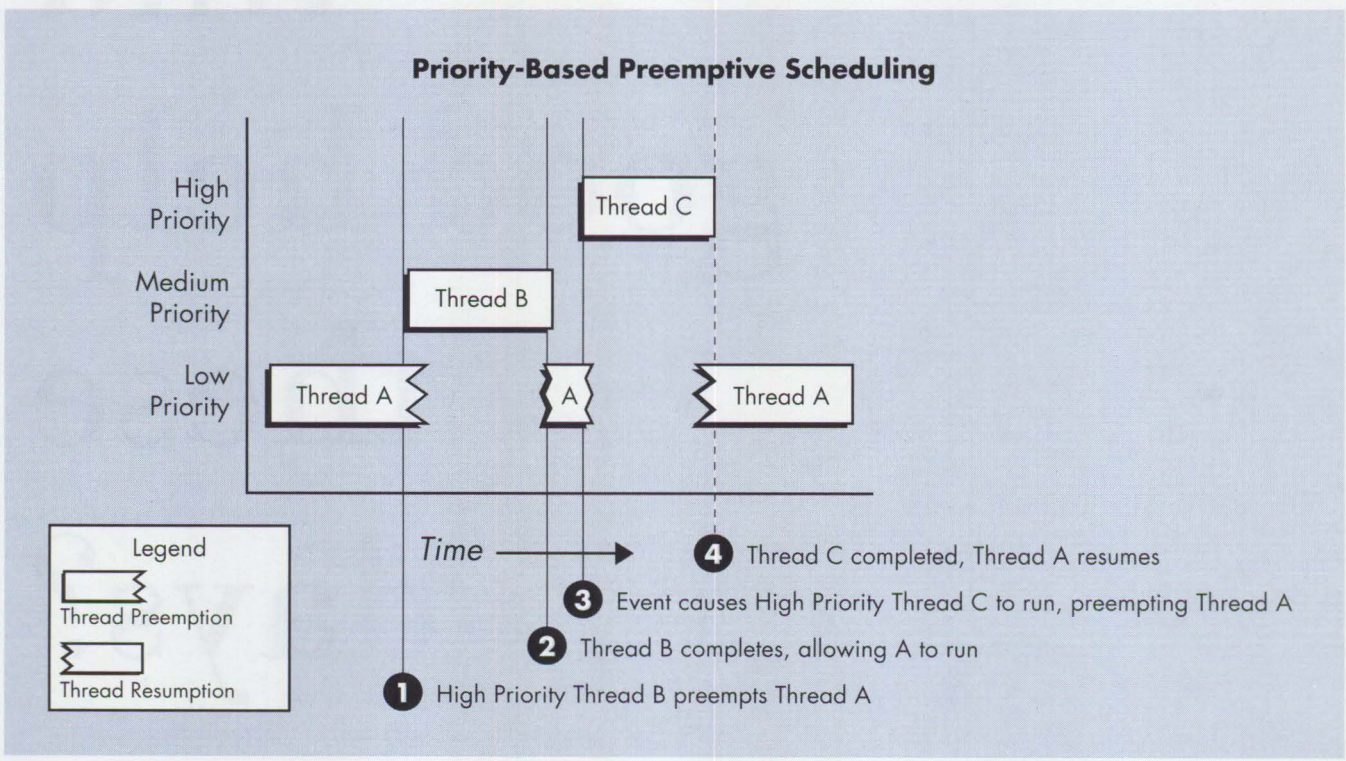

Figure 2. Priority-Based Preemptive Scheduling

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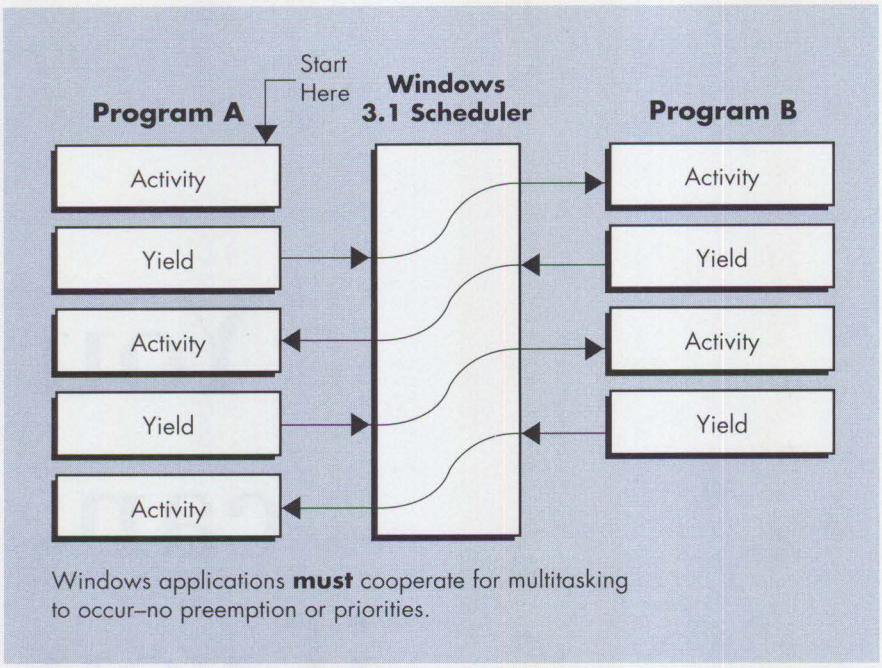

Figure 3. Cooperative Multitasking Within DOS/Windows 3.1

will without affecting other running applications.

Tuning DOS/Windows in OS/2

Users can schedule DOS and Windows application threads within OS/2 via the `DOS_BACKGROUND_EXECUTION`, `IDLE_SENSITIVITY`, and `IDLE_SECONDS` settings within each application's Settings notebook. Because DOS applications and Windows applications do not cooperatively schedule thread execution, modifying these settings can improve performance up to 25 percent over their default settings (compromise values).

For instance, the degree of preemption can be reduced by these settings, resulting in smoother operation. For DOS-based multimedia applications, OS/2 also provides an additional setting, `INT_DURING_IO`, which spawns a thread dedicated to handling interrupts for the DOS application.

Thread Details

So that it can preempt each thread, the operating system maintains storage areas for each task or thread. Each thread has a *context area* for saving and restoring the processor's registers, as well as thread parameters such as priority.

When you increase the value of the `THREADS=` parameter within the OS/2 `CONFIG.SYS` file, you are reserving more space for contexts (also known as *thread/task control blocks* [TCBs] or *task state segments* [TSSs]). Most workstations reserve only 256 threads, which is more than adequate, but in many servers this value may be raised to over 1024 (the maximum is 4095).

Each thread also has its own unique *stack* area for calling subroutines and passing parameters within each thread. It is the programmer's responsibility to set the size of the stack for each application, as well as to assign stacks for new threads that are spawned from the original application (if it is a multithreaded application). Although OS/2 provides a default stack size, more than one programmer has worked long hours searching for phantom bugs, only to discover that the default stack was too small.

Figure 4 illustrates the information that goes into a thread's stack.

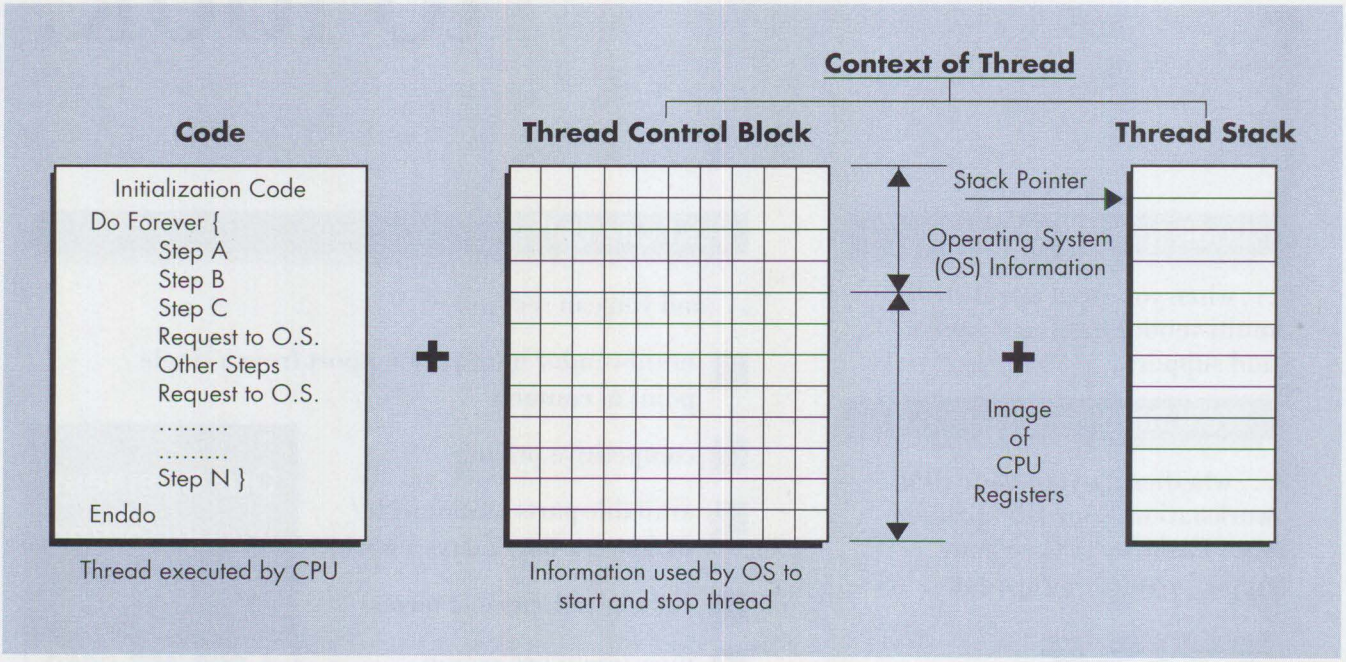

Figure 4. THREADS= Parameter Reserves Context Storage Space for Thread/Task Control Blocks (TCBs)

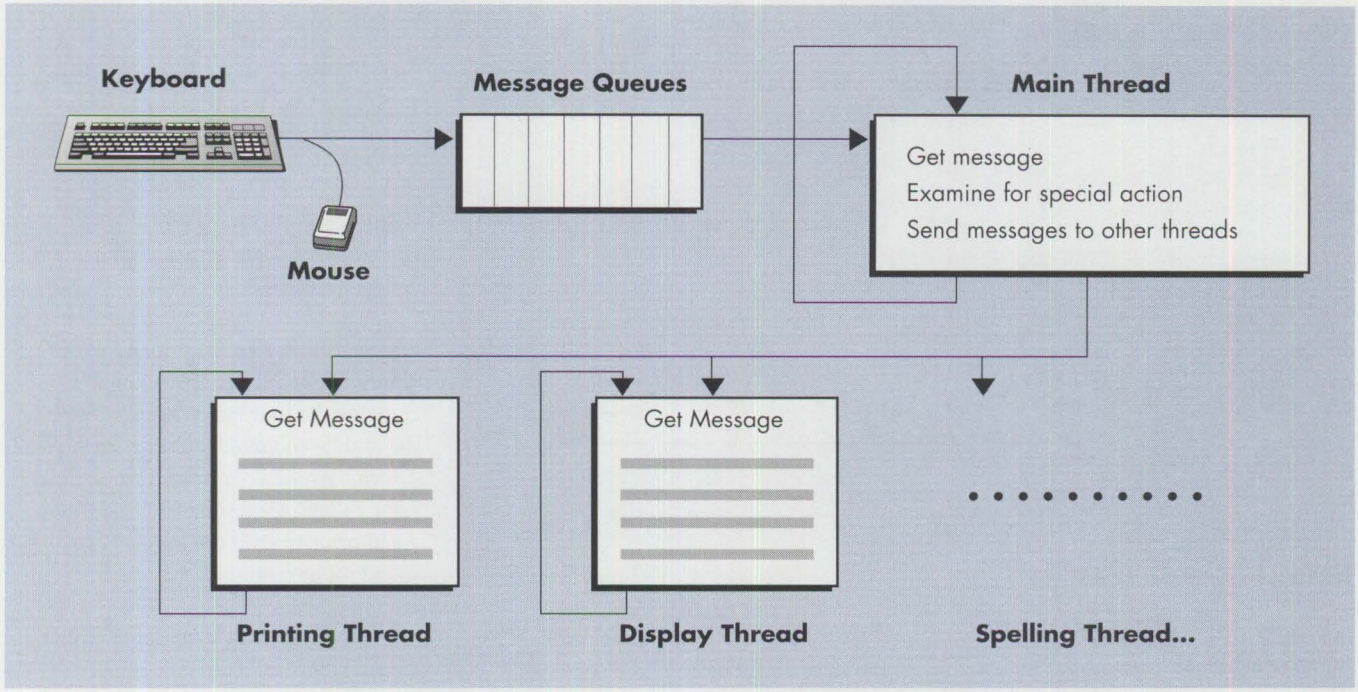

Figure 5. Multithreaded Word-Processing Package

Why Use Threads?

Threads are important to programmers because they allow an application to be broken down into independent pieces of work, each performing a different job. A frequently used example is a word processor. In this case, the primary thread does nothing other than respond to commands (messages) from the user. Meanwhile, the other threads within the application are in a blocked state (consuming no processor cycles), waiting for messages telling them to do something. The primary thread looks at the incoming messages from the user and sends outgoing messages to the other threads. When the primary thread sends a message to one of these threads, it is unblocked and begins to print, display, update, or spell-check.

Because each of the preceding activities is independent of the others, they are all candidates for different threads. The key point about activity threads is that they all have a lower priority than the primary thread that handles the user's messages. The activity threads have lower priority so that the primary message thread can better respond to the user, who always seems to want the application to respond immediately, no matter what other activity is running or how long it takes.

Figure 5 diagrams this word-processing example. Along the top row, the user sends a message to the main thread, which analyzes the message to determine which activities to notify. The main thread then sends messages to the activity threads along the bottom row. The activity threads receive the messages and become active. They can be concurrently active because of OS/2's preemptive multitasking.

Thread Priorities

The OS/2 operating system uses a simple rule to decide which program runs: the thread with the current highest priority runs as long as necessary. If a thread of higher priority becomes ready to run, it preempts any lower priority thread. When the highest-priority thread either terminates or blocks (suspends) itself, control is passed to the next highest-priority thread that is ready to run.

In normal situations, only one thread is requesting the use of the processor, so there is no need for the operating system to prioritize. Only when two or more threads compete for the processor's attention will the scheduler decide which thread goes first, second, and so on—all based on their respective priorities.

Equal Priorities

A special case exists when the operating system must handle two or more threads of equal priority. Since no thread is the "highest priority," the scheduler runs the equal-priority threads in a round-robin manner. The `TIMESLICE=` parameter in `CONFIG.SYS` determines the amount of time given to each equal-priority thread.

Figure 6 illustrates the round-robin scheduling of three equal-priority threads (A, B, and C). Thread A receives the first timeslice of about 240 milliseconds, then thread B gets a timeslice of the same length, then thread C, then thread A again, and so on.

Priorities

OS/2 is an event-driven system. *Event-driven* means that the operating system determines what to do next based on events that occur within the application programs and external sources. These are known, respectively, as *synchronous* and *asynchronous* events.

Application programs cause synchronous events when they set semaphores, post to queues, or do anything that might result in task rescheduling (e.g., preemption or task switching). This is known as *task-level scheduling*.

Asynchronous events, also called external events, are caused by hardware interrupts generated by the computer's internal timer (periodic interrupts) and by peripherals that require attention (random

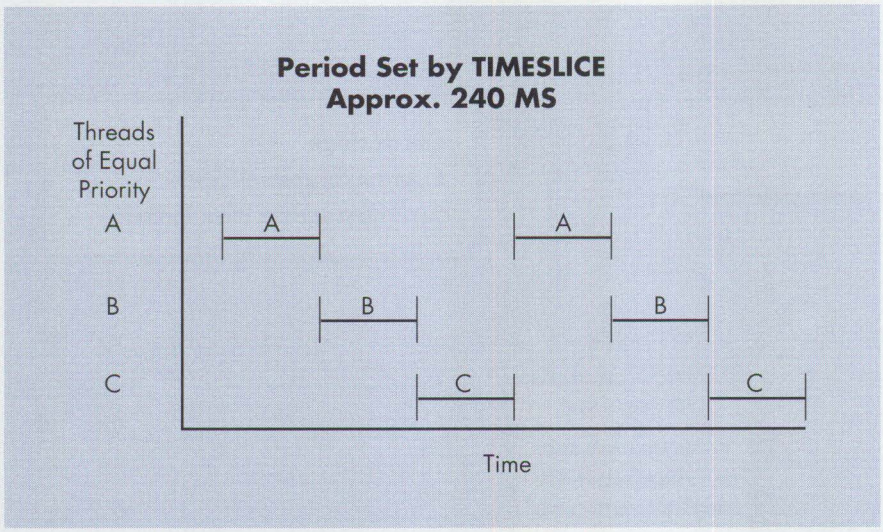

Figure 6. Round-Robin Scheduling

interrupts). The software that handles these asynchronous events is contained in device drivers referenced by the OS/2 `CONFIG.SYS` file.

Hardware-generated asynchronous events always have a higher priority than program-generated synchronous events. The processor and the external interrupt controllers on the computer's motherboard determine the priority of hardware interrupts. Hardware interrupts are dispatched immediately using tables referenced by the processor's low-level microcode. This immediate dispatch, known as *hardware-level scheduling*, ensures rapid processing of hardware interrupts, with few or no software decisions required for interrupt dispatching.

Below the interrupt priority level, OS/2 divides thread priorities into four classes, listed from highest to lowest:

- Time-Critical
- Fixed-High
- Regular
- Idle

Within each of these levels are 32 sub-levels for more accurate arbitration between threads.

Figure 7 illustrates the priority levels within OS/2 2.x. The left column contains the four major priority levels; the middle column shows that each major priority level has 32 sub-levels; and the right column shows that threads of an equal priority level are executed in a round-robin fashion.

These four major priority levels are discussed below in detail.

The Time-Critical Class—Critical Response Times

Threads that have a very short execution time (they get their work done immediately) and that have very limited time to respond to events before data or control would be lost, use the time-critical class. Examples of applications likely to have

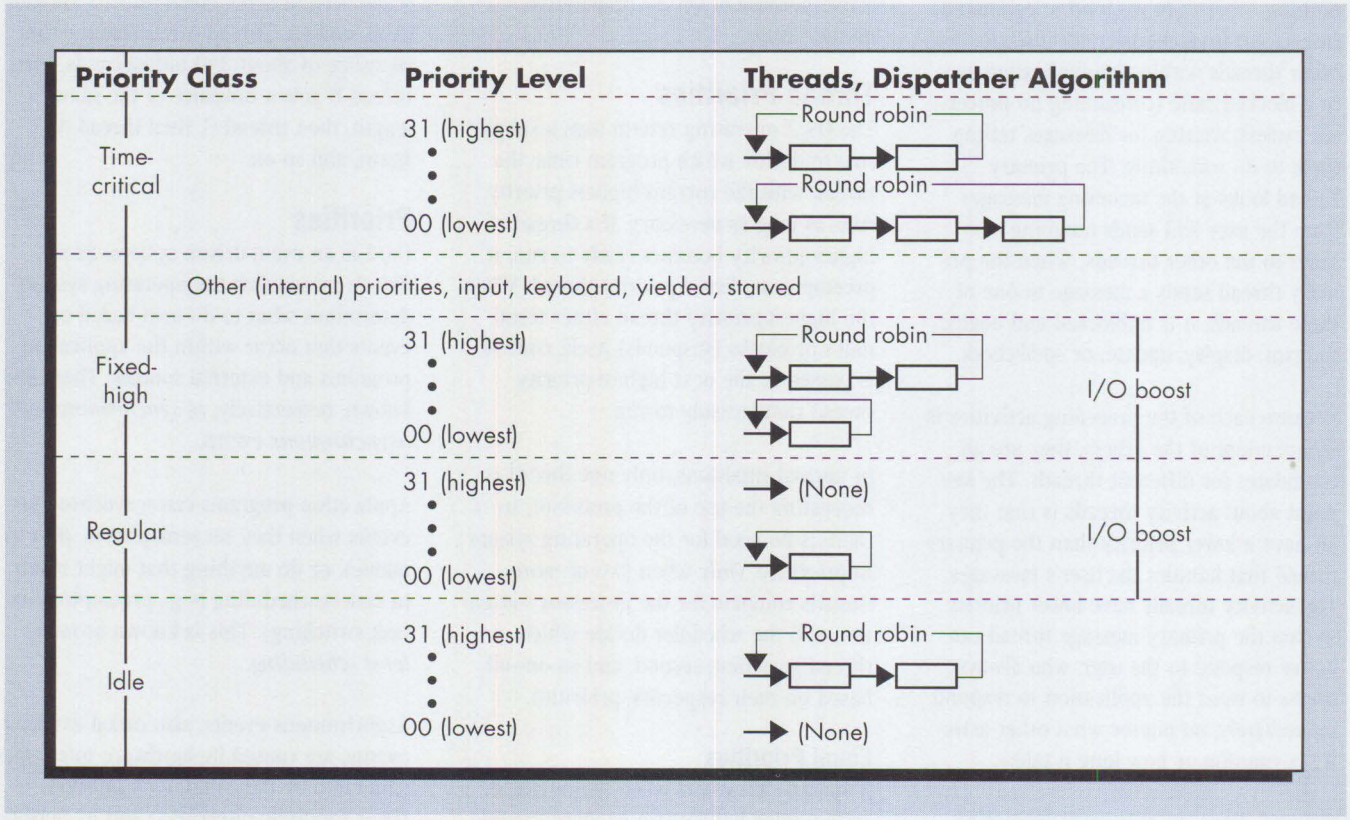

Figure 7. Priority Levels Within OS/2 2.x

time-critical threads include process control and telecommunications.

Another use of the time-critical class is to build supervisory code to gain control over errant threads. This feature is used within OS/2 itself to detect applications that have stopped responding to the mouse and/or keyboard and to give the user the option of terminating them. Application developers can exploit the time-critical class by establishing a supervisory thread that can take control of the application and terminate threads without being preempted from within the application.

The Fixed-High Class—Servers and Daemons

The fixed-high class is used by background server applications (daemons) that provide services to client systems on the local machine as well as client computers on the network. Because the server threads are executing on the workstation at a higher priority than the user application threads, which run at the regular priority level, the response time for client users is not affected by applications that the user executes locally. This is what enables a workstation to also be a network server.

As in the time-critical case, server applications do not normally interact directly with the user, but instead communicate via interprocess mechanisms such as pipes, queues, and remote procedure calls (RPCs). These interprocess mechanisms distribute function across the network and efficiently multitask on the computer on which the function is running.

The Regular Class—Application Level

Normal DOS and OS/2 applications execute at the regular class. OS/2 implements a form of fairness scheduling at this level to ensure that no application is totally starved for processor time.

Applications normally start at the regular priority level, then break into multiple threads, each of which is promoted or demoted in priority, depending on its function and its time criticality.

The Idle Class—Lowest Priority

The last class, known as the idle class, is used for applications that can be deferred indefinitely without losing data or control. This is the priority level used by screen-savers and performance-measurement utilities like `PULSE.EXE`. Applications that soak up any available processor cycles are located at this priority level. You must be careful about running more than one idle-class application at a time, because each idle application may assume that it is the only one getting the remaining processor cycles. If you try to run the `PULSE.EXE` program and a screen-saver application at the same time, you will normally see 50 percent activity all the time in pulse, while the animation appears jerky in the screen-saver. The solution is simple: stop one of the idle-level applications.

Thread Communication and Coordination

The programmer using threads within OS/2 must ensure that threads communicate and coordinate within a single application as well as between multiple applications. One frequently used mechanism is semaphores. Semaphores are flags that are set, cleared, and tested for their state via application program interface (API) calls to OS/2.

Although it is tempting to use queues and pipes for passing all information, shared memory is significantly faster.

At the local application level, the programmer must ensure that threads use shared resources (such as memory and the screen) one at a time until the task is complete. A special mechanism known as a mutual exclusion (MUTEX) semaphore is provided to ensure that one and only one thread can use a resource at a time. Other semaphores are provided to signal when a thread should continue. (An example of a semaphore would be to signal to a thread that data has been placed in its buffer for processing.) This kind of signalling is typically done by a device driver.

Using semaphores as well as other OS/2 mechanisms is more efficient than having an application constantly poll for the existence of data because polling is inefficient. Using the described mechanisms, a thread checks a semaphore and immediately goes into a blocked or suspended state if the semaphore is not ready. OS/2 records the thread's request for the semaphore and frees the thread when another application or device driver sets the semaphore flag via the operating system. This design completely eliminates polling and exemplifies a well-designed operating system.

Looking into the Brain of OS/2: PSTAT

OS/2 includes a utility known as `PSTAT.EXE` (process status). `PSTAT` takes a snapshot of the threads, processes, sessions, DLLs, and semaphores within OS/2 to obtain a list of normally invisible background processes. Since applications only show up in the Window List (task list) if they register themselves at run time, and detached processes don't register at all, `PSTAT.EXE` provides the only way to see whether what is running is a detached process or an application that is just hiding!

If you want to run the `PSTAT` utility, start an OS/2 full-screen or OS/2 window session, then type the command:

```
PSTAT | MORE <Enter>
```

This command shows you the status information page by page. The priorities are shown as four-digit hexadecimal numbers in which the first two digits are as follows:

- 04 – Time-Critical
- 03 – Fixed-High
- 02 – Regular
- 01 – Idle

The remaining two digits indicate on which of the 32 sub-levels the thread is running.

Pitfalls

Potential threads users can become so enamored with them that they overuse them. Developers must keep in mind that there is a fixed overhead time when switching from one thread to another. In addition, interprocess communication mechanisms that use blocking also consume significant amounts of processing time to arbitrate control.

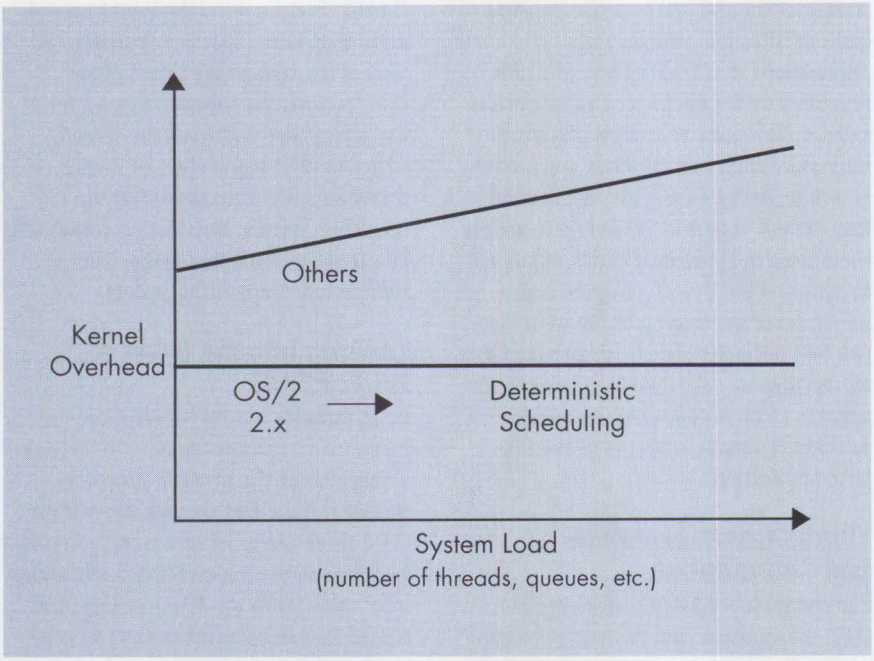

Figure 8. Deterministic Scheduling Within OS/2 2.x

OS/2 designers have made significant strides in reducing the scheduling time to a fixed amount (known as *deterministic scheduling*) irrespective of the number of threads within the system. Even with this technology, there is a fixed price for each call to the operating system that causes rescheduling.

Figure 8 shows how OS/2 uses sophisticated scheduling algorithms that do not slow down when there are many tasks to be scheduled. These scheduling algorithms enable OS/2 to handle up to 4095 separate threads without balking.

The key to successfully using threads is to keep in mind that they are intended for high-level control of the application. Do not use thread-switching as a substitute for a subroutine call. Although it is tempting to use queues and pipes for passing all information, shared memory is significantly faster.

If you find that your application is constantly switching from thread to thread and that performance is affected, you might consider consolidating related functions and providing your own (simpler) scheduling and dispatching.

OS/2—A Base for Building Applications

Threads represent a powerful, flexible way to write applications that remain responsive, yet time-efficient. With preemptive multitasking, users no longer have to be concerned about losing data or control, because the parts of a program that need immediate attention get it.

OS/2 thus provides a base for building just about any application, from real-time multimedia to telecommunications, eliminating worry about scheduling or dispatching–functions best left to the operating system.

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Redirected Installation of OS/2 2.x

This article, part 1 of 2, explains how to manually construct an OS/2 Remote Installation Code Server and the client boot diskettes for redirected installation of five OS/2 2.x products. Part 2 will describe a CID installation procedure.

In today's diverse OS/2 environments, the need for distributed computing is rapidly increasing. Configuration, installation, and distribution (CID) provides a facility for automated installation of OS/2 and its many subsystems. CID strives for three objectives: eliminate end-user involvement, consolidate configuration, and automate distribution.

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IBM offers tools to build a CID environment:

- CASSETUP, provided with the Network Transport Services/2 (NTS/2) Utilities diskette.
- SRVSETUP, provided with the IBM International Technical Support Organization's (ITSO's) Redbook, *Automated Installation for CID-Enabled OS/2 V2.x* (order number GG24-3783).
- CIDSETUP, developed by Tom Lambert of the IBM Personal Systems Competency Center in Roanoke, Texas. To acquire CIDSETUP, call (800) 547-1283. (See "Easy Setup of CID Code Servers" in the January/February 1994 issue of *Personal Systems*.)

None of these tools gives an administrator or end user an "under-the-covers" view of an OS/2 remote installation server setup. Note that here the term *server* does not apply to a computer running LAN Server software but to a computer running OS/2 2.1 (recommended) and LAN

Adapter and Protocol Support (LAPS). This article offers an OS/2 administrator or end user a step-by-step procedure for building a generic OS/2 remote installation server. The methods described in this article are not the CID procedures but rather a redirected installation of OS/2. *Redirected* refers to a dialog-driven or response file-driven method for remotely installing a single OS/2 product, whereas the LAN CID Utility uses a set of REXX procedures for installing multiple CID-enabled products.

This article is a prerequisite for Part 2, which will describe CID procedures. This article describes how to build your code server with one or all of the following OS/2 products:

- OS/2 2.0 Corrective Service Facility (CSF), ServicePak II, Service Level XR06100
- OS/2 2.1 Corrective Service Facility (CSF), ServicePak I, Service Level XR06200
- OS/2 2.1 (salmon-colored diskettes only)
- OS/2 for Windows
- OS/2 2.11

Figure 1 lists the required hardware and software for the code server and its clients.

Building Your Code Server

The procedure described below shows an administrator or end user how to build a remote installation server containing any or all of the OS/2 products listed above. This procedure includes both dialog-driven and response file-driven installation methods. In dialog-driven installation, the client drives the installation by answering the dialog boxes. In response file-driven installation, the contents of a response file drive the installation process.

Figure 2 lists the naming convention used for the five OS/2 2.x products you can install.

Building a remote installation server:

1. Create a 60 MB primary FAT partition on drive `C:` for OS/2 2.1 and LAPS, plus create an HPFS extended logical partition on drive `D:` for your code server.

Server Hardware/Software Requirements:	Client Hardware/Software Requirements:
80386 or greater processor 8 MB RAM (16 MB recommended) 1.44 MB diskette drive Token-ring network 16/4 Token-Ring Adapter (ISA or Micro Channel) 320 MB hard disk (recommended) OS/2 2.1 NTS/2 LAN Adapter and Protocol Support (LAPS) with `NTS2FIX.ZIP`.[1] NTS/2 Utilities diskette[2]	80386 or greater processor 6 MB RAM (8 MB or greater recommended) 1.44 MB Drive A: (bootable) 16/4 Token-Ring Adapter (ISA or Micro Channel) Minimum OS/2 hard-disk requirements (60 MB)

[1]This ZIP file provides the fix to `LAPSCID.DLL` and `LAPSPM.DLL`. To order, call (800) 992-4777. It also comes with the LAPS product, service level WR07020. It is not part of OS/2 LAN Server 3.0.

[2]The two NTS/2 products listed above come with OS/2 LAN Server 3.0 Entry and OS/2 LAN Server 3.0 Advanced.

Figure 1. Code Server and Client Hardware/Software Requirements

Product	Size of Diskette Images on Server	Description
XR06100	31 MB	OS/2 2.0 CSF, ServicePak II (XR06100)
XR06200	28 MB	OS/2 2.1 CSF, ServicePak I (XR06200)
OS2V21S	26 MB	OS/2 2.1, salmon (pink) diskettes
OS2V21D	29 MB	OS/2 2.11, dark blue diskettes
OS2V21G	30 MB[1]	OS/2 for Windows, green diskettes

[1]The 30 MB size of the diskette images for OS/2 for Windows includes Microsoft Windows 3.1 diskette images.

Note: This figure refers to 3.5" diskettes only.

Figure 2. Five OS/2 Products Installable Through Redirected Installation

```
* d:\server
* d:\cid
  d:\cid\csd
  d:\cid\csd\os2v20
  d:\cid\csd\os2v21
  d:\cid\csd\os2v20\xr06100
  d:\cid\csd\os2v21\xr06200
* d:\cid\exe
  d:\cid\exe\csd
  d:\cid\exe\csd\os2v20
  d:\cid\exe\csd\os2v21
  d:\cid\exe\csd\os2v20\xr06100
  d:\cid\exe\csd\os2v21\xr06200
  d:\cid\exe\os2v21d
  d:\cid\exe\os2v21g
  d:\cid\exe\os2v21s
* d:\cid\img
* d:\cid\img\laps
  d:\cid\img\os2v21d
  d:\cid\img\os2v21g
  d:\cid\img\os2v21s
* d:\cid\img\srvifs
* d:\cid\rsp
  d:\cid\rsp\csd
  d:\cid\rsp\csd\os2v20
  d:\cid\rsp\csd\os2v21
  d:\cid\rsp\csd\os2v20\xr06100
  d:\cid\rsp\csd\os2v21\xr06200
  d:\cid\rsp\os2v21d
  d:\cid\rsp\os2v21g
  d:\cid\rsp\os2v21s
```

*Required directories

Figure 3. Directory Structure for Drive D: on Code Server

For OS2V21S:

1. Insert Diskette 7 into drive A:
2. Type: `unpack2 a:\cid d:\cid\exe\os2v21s`
3. Type: `unpack2 a:\required d:\cid\exe\os2v21s /n:rspinst.exe`
4. Insert Diskette 11 into drive A:
5. Type: `unpack2 a:\required d:\cid\rsp\os2v21s /n:sample.rsp`
6. Type: `copy d:\cid\rsp\os2v21s\sample.rsp d:\cid\rsp\os2v21s\default.rsp`

For OS2V21D:

1. Insert Diskette 7 into drive A:
2. Type: `unpack2 a:\cid d:\cid\exe\os2v21d`
3. Type: `unpack2 a:\required d:\cid\exe\os2v21d /n:rspinst.exe`
4. Insert Diskette 11 into drive A:
5. Type: `unpack2 a:\required d:\cid\rsp\os2v21d /n:sample.rsp`
6. Type: `copy d:\cid\rsp\os2v21d\sample.rsp d:\cid\rsp\os2v21d\default.rsp`

For OS2V21G:

1. Insert Diskette 5 into drive A:
2. Type: `unpack2 a:\required d:\cid\rsp\os2v21g /n:sample.rsp`
3. Type: `copy d:\cid\rsp\os2v21g\sample.rsp d:\cid\rsp\os2v21g\default.rsp`
4. Insert Diskette 7 into drive A:
5. Type: `unpack2 a:\cid d:\cid\exe\os2v21g`
6. Type: `unpack2 a:\required d:\cid\exe\os2v21g /n:rspinst.exe`

Figure 4. UNPACK Instructions for Three Versions of OS/2 2.1

2. Install OS/2 2.1 and LAPS on your primary partition. Choose the appropriate token-ring device drivers and OS/2 NetBIOS.
3. On drive D:, create the directories shown in Figure 3. If you don't want to build your code server with all of the products in Figure 2, choose only the products you want to install based on the naming convention used in Figure 2. The directories preceded by an asterisk (*) are required directories.
4. Insert the NTS/2 Utilities diskette into drive A: and type the following commands:

```
copy a:\srvifs d:\cid\img
  \srvifs
copy a:\sample\service.*
  d:\server
copy d:\cid\img\srvifs\xi*.*
  d:\server
copy d:\cid\img\srvifs
  \service.exe d:\server
```

5. Insert the NTS/2 LAPS diskette into drive A: and type the following command to copy it to your code server:

```
a:\lapsdisk a: d:\cid\img\laps
```

6. This step unpacks some files necessary to set up your code server. Figure 4 gives the UNPACK instructions for the three OS/2 products.
7. Install your OS/2 images on your code server. Refer to Figure 5 for each OS/2 image and its corresponding installation instructions.
8. Now build your SRVIFS configuration file using the parameters below.

Chapter 6 of *NTS/2 Redirected Installation and Configuration Guide* (S96F-8488) describes these parameters; refer to this manual to tune your SRVIFS configuration file for your environment.

In Step 4, you copied SERVICE.INI (SERVICE.*) to D:\SERVER. Using an ASCII editor, edit D:\SERVER\SERVICE.INI to reflect the statements shown in Figure 6.

9. To install SRVIFS on the code server type the following:

```
cd\cid\img\srvifs
thinsrv /r:d:\server
  \service.ini /s:d:\cid\img
  \srvifs /t:d:\server
  /tu:c:
```

THINSRV.EXE accomplishes three tasks:

- It creates or modifies your STARTUP.CMD with statements necessary to start your code server
- It appends path information in your CONFIG.SYS.
- It adds IFSDEL.EXE to D:\SERVER. You'll need IFSDEL.EXE for CID in Part 2 of this article.

10. Shut down the system and reboot. Figure 7 shows what you see when your code server successfully starts.
11. Now create your LAN Transport (LT) client boot diskettes. This step has many substeps, only some of which you will use, depending on whether you are building dialog-driven diskettes or response file-driven diskettes.

Figures 8, 9, 10, and 11 list these substeps as 11A, 11B, 11C, and 11D, respectively.

Notice that substep 11A is the only substep shared by both dialog-driven and response file-driven methods.

To build a set of **dialog-driven installation diskettes** for OS2V21@ (where you replace @ with the letter d=dark blue, g=green, or s=salmon), follow substeps 11A and 11B.

If you are building dialog-driven installation diskettes for *all* of the above products, follow substeps 11A and 11B three

OS2V21S	Type: `cd\cid\exe\os2v21s` `seimage /s:a: /t:d:\cid\img\os2v21s`
OS2V21D	Type: `cd\cid\exe\os2v21d` `seimage /s:a: /t:d:\cid\img\os2v21d`
OS2V21G	Type: `cd\cid\exe\os2v21g` `seimage /s:a: /t:d:\cid\img\os2v21g`
XR06100	Insert each diskette into drive A: and type the following to install XR06100 to the code server: `xcopy a:\*.* d:\cid\csd\os2v20\xr06100 /s`
XR06200	Insert each diskette into drive A; and type the following to install XR06200 to the code server: `xcopy a:\*.* d:\cid\csd\os2v21\xr06200 /s`

Figure 5. Installation Instructions for OS/2 Images

```
# SRVIFS Configuration file
Adapter=0       /* assumes one token-ring adapter in server */
MaxClients=5
MaxFiles=102
Name=IMAGESRV   /* code server name */
GroupName=No
ClientWorkers=6
Path=d:\CID
PerClient=No
PermitWrite=No
alias=readonly,single,csd,d:\cid\csd
alias=readonly,single,exe,d:\cid\exe
alias=readonly,single,img,d:\cid\img
alias=readonly,single,rsp,d:\cid\rsp
```

Figure 6. Editing D:\SERVER\SERVICE.INI

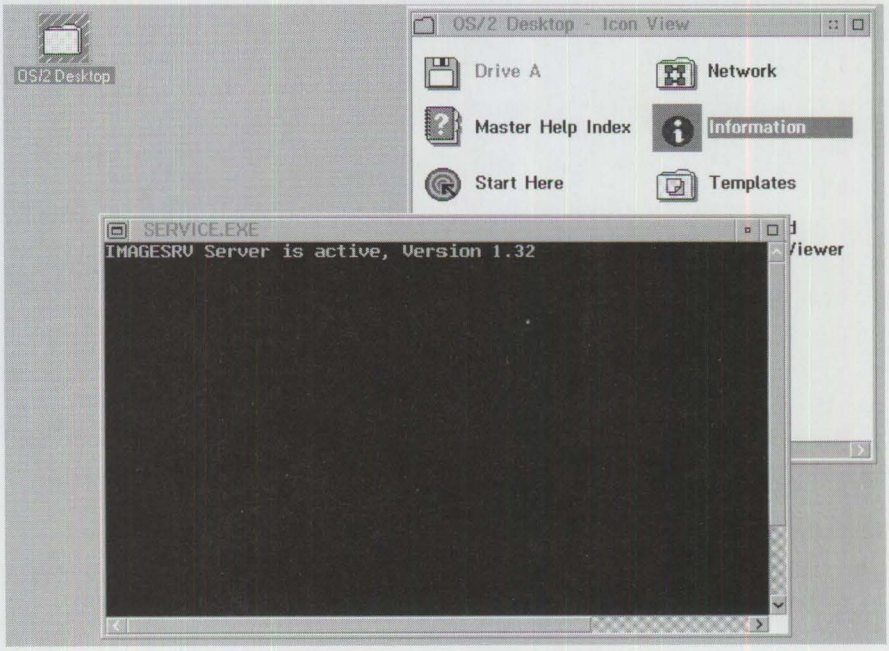


Figure 7. Message Screen Indicating Successful Code Server Start

Substep 11A

1. Type: `cd\cid\exe\os2v21@`
2. Type: `sedisk /s:d:\cid\img\os2v21@ /t:a:`

   (`SEDISK` prompts you for two formatted diskettes: the first is the installation diskette; the second is Diskette 1 of your LT boot diskettes).
3. Type: `cd\cid\img\laps`
4. Type: `thinlaps d:\cid\img\laps a: ibmtok.nif`

   (It is very important to leave a space between `a:` and `ibmtok.nif`! If you are using a Token-Ring Bus Master Adapter, use `ibmtrbm.nif` in place of `ibmtok.nif`.)

Figure 8. Substep 11A: Creating Both Dialog-Driven and Response File-Driven LAN Transport Client Boot Diskettes

Substep 11B

1. Insert Diskette 1 from substep 11A into drive `A:`
2. Type: `cd\cid\img\srvifs`
3. Type: `thinifs /t:a: /s:d:\cid\img\srvifs /tu:a: /req:* /d:x: /srv:\\imagesrv\img /w`
4. Edit the `CONFIG.SYS` file on Diskette 1 as follows:

   a. Change `set os2_shell = cmd.exe` to `set os2_shell=x:\os2v21@\disk_1\sysinst2.exe`

   b. Add `set sourcepath=x:\os2v21@` at the end of the `CONFIG.SYS` file

Figure 9. Substep 11B: Creating Dialog-Driven LAN Transport Client Boot Diskettes

Substep 11C

1. Insert Diskette 1 from substep 11A into drive `A:`
2. Type: `cd\cid\img\srvifs`
3. Type: `thinifs /t:a: /s:d:\cid\img\srvifs /tu:a: /req:* /d:x: /srv:\\imagesrv\img /w`
4. Type: `thinifs /t:a: /s:d:\cid\img\srvifs /tu:a: /req:* /d:y: /srv:\\imagesrv\exe /w`
5. Type: `thinifs /t:a: /s:d:\cid\img\srvifs /tu:a: /req:* /d:z: /srv:\\imagesrv\rsp /w`
6. Edit the `CONFIG.SYS` file on Diskette 1 as follows:

   a. Change `set os2_shell = cmd.exe` to `set os2_shell=y:\os2v21@\rspinst.exe z:\os2v21@\default.rsp`

   b. Add `set sourcepath=x:\os2v21@` at the end of the `CONFIG.SYS` file

Figure 10. Substep 11C: Creating Response File-Driven LAN Transport Client Boot Diskettes

separate times with three sets of LT boot diskettes.

To build a set of **response file-driven installation diskettes** for `OS2V21@` (where you replace `@` with the letter d=dark blue, g=green, or s=salmon), follow substeps 11A and 11C.

If you are building response file-driven installation diskettes for *all* of the above products, follow substeps 11A and 11C three separate times with three sets of LT boot diskettes.

To build a set of **ServicePak diskettes** for XR06100 and XR06200, follow substep 11D.

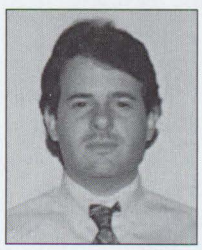
References

This article was compiled using the following:

- ITSO's Redbook *OS/2 V2.0 and V2.1 Remote Installation and Maintenance* (GG24-3780),
- *NTS/2 Redirected Installation and Configuration Guide* (S96F-8488)
- *NTS/2 LAN Adapter and Protocol Support Configuration Guide* (S96F-8489). The NTS/2 references come with IBM's OS/2 LAN Server 3.0.

Acknowledgments

The author thanks the CID team in the OS/2 Service and Support organization–Ahmad Ali, Steve Cunningham, Jack Leung, and Sean Osborne–for helping to create this article.



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Substep 11D

Follow this step once for XR06100, then repeat this step for XR06200, each time replacing % with OS2V20\XR06100 or OS2V21\XR06200. It is not necessary to run SEDISK for the ServicePaks. Diskette 1 of each ServicePak serves as the installation diskette, and Diskette 2 serves as Diskette 1 of your LT boot diskettes. To create your LT boot diskettes, modify Diskette 2 using the steps below. Note that a redirected installation of a ServicePak is response file-driven; there is no dialog-driven method.

1. Make a backup copy of Diskette 1, which will serve as the installation diskette of your LT boot diskettes
2. Insert Diskette 2 into drive A:
3. Type: `diskcopy a: a:` (to create a backup copy of Diskette 2, which will serve as Diskette 1 of your LT boot diskettes)
4. Insert the backup copy of Diskette 2 into drive A:
5. Type: `copy a:\fservice.* d:\cid\exe\csd\%`
6. Type: `del a:\fservice.*`
7. Type: `del a:\fix\os2`
8. Type: `cd\cid\img\laps`
9. Type: `Attrib a:\config.sys -r` (taking off read-only `attrib` on `CONFIG.SYS` if it exists)
10. Type: `thinlaps d:\cid\img\laps a: ibmtok.nif`

    (It is very important to leave a space between `a:` and `ibmtok.nif`! If you are using a Token-Ring Bus Master Adapter, use `ibmtrbm.nif` in place of `ibmtok.nif`.)
11. Type: `cd\cid\img\srvifs`
12. Type: `thinifs /t:a: /s:d:\cid\img\srvifs /tu:a: /req:* /d:x: /srv:\\imagesrv\csd /w`
13. Type: `thinifs /t:a: /s:d:\cid\img\srvifs /tu:a: /req:* /d:y: /srv:\\imagesrv\exe /w`
14. Type: `thinifs /t:a: /s:d:\cid\img\srvifs /tu:a: /req:* /d:z: /srv:\\imagesrv\rsp /w`
15. Use an editor to create a response file containing these statements:

```
**** Default Response File ****
:service
:dirlist c:\os2\install\syslevel.os2
c:\
c:\os2\*
:enddirlist
:flags replace_newer <ems>
```

    Name this response file `DEFAULT.RSP` and copy it to `D:\CID\RSP\CSD\%`. This response file will migrate your current version of OS/2 on your primary partition (drive C:) to the ServicePak level (XR06100 or XR06200). See Chapter 8 in ITSO's Redbook *OS/2 V2.0 and V2.1 Remote Installation and Maintenance* (GG24-3780) for a list of Corrective Service Facility response file keywords.
16. Edit the `CONFIG.SYS` file of Diskette 1 (LT boot diskette) as follows:

```
os2_shell=y:\csd\%\fservice.exe /s:x:\% /r:z:\csd\%\default.rsp
```

Figure 11. Substep 11D: Creating ServicePak XR06100 and XR06200 LAN Transport Client Boot Diskettes

LAN Server Ultimedia 1.0 Performance and Tuning

Distributed multimedia, the next generation of information-sharing technology, significantly improves the efficiency, effectiveness, and quality of communications. Multimedia applications are real-time applications with strict demands on timely delivery and guaranteed bandwidth. Also, networking multimedia-enabled systems and transporting multimedia traffic are becoming significant requirements for the client/server environment.

IBM LAN Server Ultimedia 1.0 supports both data and multimedia applications simultaneously, with guaranteed Quality of Service (QoS) for multimedia. This article describes how the LAN Server Ultimedia 1.0 product achieves this objective and how to optimize your system.

Victoria L. Humphrey
Carol A. McKinney
IBM Corporation
Austin, Texas

Multimedia has gained popularity as a new form of more natural and effective information because text, image, audio, and video can be presented simultaneously. By sharing, distributing, and collaborating through this new form of information and communication, users become more productive.

Since multimedia requires a strict data arrival rate, transporting multimedia traffic is very challenging. For example, full-motion video with production-level video (PLV) quality requires 150 kilobytes (1.2 megabits) per second, which lets you view 30 video frames per second.

Transporting multimedia traffic becomes more complicated when non-multimedia traffic coexists on the same network as the multimedia traffic. An overloaded network with traffic that comes in bursts can cause transient delay for multimedia traffic, which results in jerky video or audio. LAN Server Ultimedia 1.0 beats this challenge and guarantees the quality of multimedia in a token-ring network environment.

LAN Server Ultimedia 1.0 is built on LAN Server 3.0 Advanced, which has become the best performing network server as reported by LanQuest and NSTL (independent test labs). You can install LAN Server Ultimedia 1.0 on top of your current LAN Server 3.0 Advanced, and you can expect to fully enjoy both data applications and multimedia applications. This coexistence satisfies one of our most important customer requirements: multimedia applications that integrate easily into an existing LAN environment. LAN Server Ultimedia 1.0 solves the challenge of

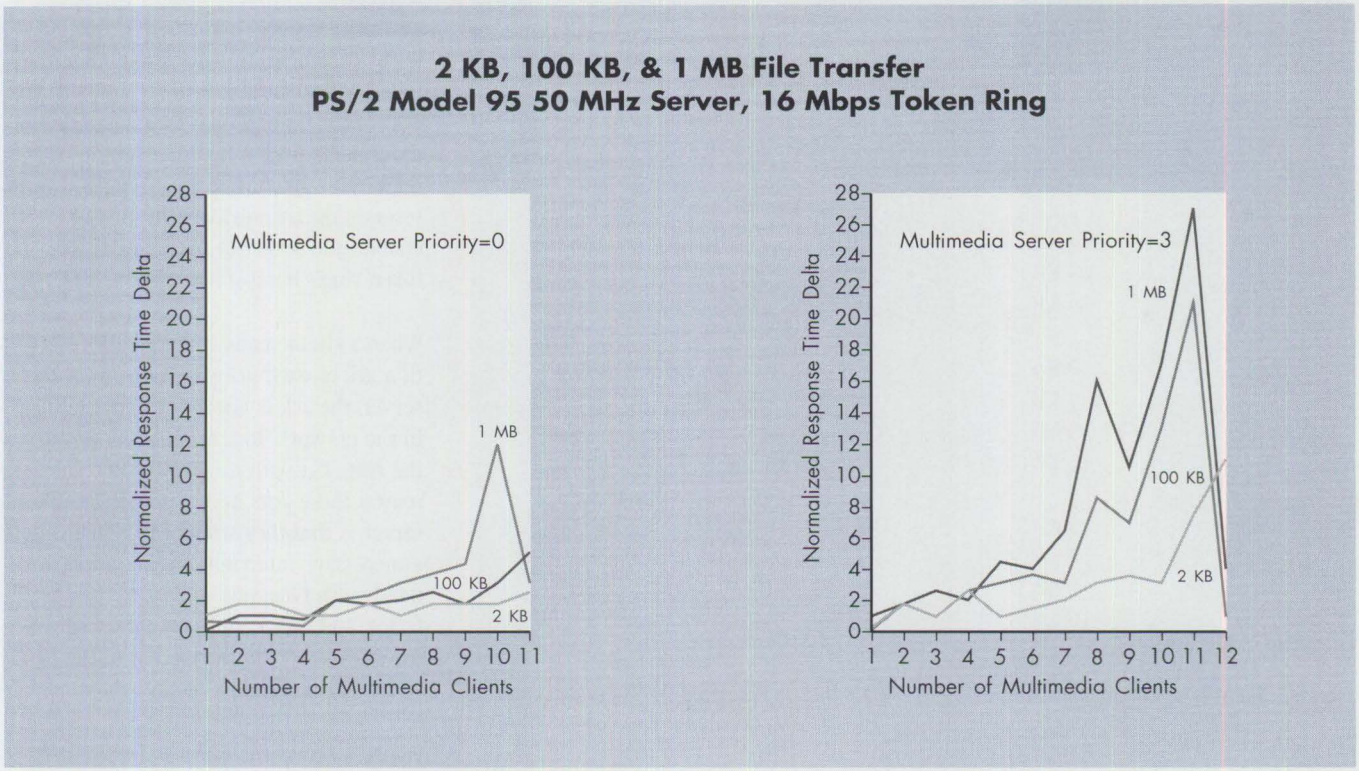

Figure 1. Effect of Token-Ring Priority on Multimedia Performance

transporting multimedia traffic by taking advantage of token-ring priority architecture, and the enhancements to the HPFS386 file system in LAN Server 3.0 and to NetBIOS.

Token-Ring Priority Architecture

The token-ring priority mechanism operates in such a way that all stations within a priority level maintain equal access to the ring. A ring can transmit a frame at a given priority, using any available token with a priority less than or equal to that of the frame. If an appropriate token is not available, the ring station may reserve a token of the required priority in a passing token.

This feature makes the IBM token-ring topology very suitable for carrying multimedia traffic. By giving priority to multimedia traffic over data traffic, multimedia traffic can be delivered on time, even when there are transient delays in the network.

Figure 1 shows the effect of priority multimedia traffic versus regular file copy over the network. Multimedia files were stored in one server, and files that are being copied over the network were stored in another server.

Multimedia files are stored in the multimedia server. From a multimedia client, you can "play" any multimedia files on the server. Playing files is akin to playing a movie clip or videotape. It is customary to say that you play these clients or that these clients are playing files.

As shown in Figure 1, with a priority multimedia server (priority=3), you can play more quality multimedia clients than you can play on a non-priority multimedia server. Here, quality means no discontinuities during multimedia playbacks. A discontinuity occurs when one or more deadlines are missed while transferring a multimedia file from the server to the clients.

On the other hand, copying data files takes longer with a priority multimedia server, because multimedia traffic gets priority over non-multimedia traffic in the limited bandwidth. As a result, file-copy time is slower when multimedia traffic gets priority on the same network.

Note in Figure 1 that file-transfer response times improve at the 11th multimedia client (multimedia server priority=0) and 12th multimedia client (multimedia server priority=3). Response times speed up because multimedia playbacks start to break–that is, discontinuities occur in multimedia playback files. These breaks leave more network bandwidth for file transfers.

Fifty-Percent Rule

Even with a priority scheme, multimedia traffic delivery cannot be guaranteed in a heavy data-traffic environment. As we experienced in our lab, a single multimedia server has trouble reserving more than 50 percent of bandwidth when there are one or more active data sources on the ring. Most token-ring adapters release a token after each frame is transmitted, rather than transmitting as many frames as possible during the token-holding timer (THT), as specified in the IEEE 802.5 Token-Ring Standard. This scheme gives data stations more time to grab the token and to lower its priority for sending data frames. This scheme occurs particularly when the data source is using large frame sizes (4 KB or above) because of its longer transmission time.

The 50-percent rule states that an IBM-style token-ring adapter can never capture more than 50 percent of the tokens when there is contention for the token on the ring. The following

Multimedia Client Frame Size	Data Frame Size	Number of Quality Multimedia Clients Predicted by 50-Percent Rule	Actual Number of Quality Multimedia Clients
4 KB	2 KB	8.9	9
	4 KB	6.7	7
	8 KB	4.4	4
	16 KB	2.7	2
8 KB	2 KB	10.7	10
	4 KB	8.9	9
	8 KB	6.7	7
	16 KB	4.4	5
16 KB	2 KB	11.9	10
	4 KB	10.7	10
	8 KB	8.9	9
	16 KB	6.7	7

Figure 2. Number of Quality Multimedia Clients: Actual Versus Predicted by 50-Percent Rule

bandwidth estimator expression was derived from the 50-percent rule:

$$Smax = \frac{P}{P + D}$$

where Smax is the maximum proportion of the ring bandwidth that a single priority server can reserve, P is the average size frame sent by the priority server, and D is the average size frame sent by the stations sending frames at a lower priority than the server.

Figure 2 shows how the real environment measurements compare with the 50-percent rule in various multimedia frame sizes and data traffic frame sizes. In Figure 2, the maximum number of clients for the actual measurements was 10. All the measurements were done on a 16 Mbps token-ring network.

Applying the 50-percent rule, the P/(P+D) bandwidth estimator matches the actual result very well. For example, when running 4 KB multimedia frames with 4 KB data frames, P/(P+D) = 4/(4+4) = 0.5. Since the ring is configured at 16 megabits per second, 0.5 * 16 = 8 Mbps. Looking at the "actuals" column, the actual number of quality multimedia clients is 7, and since the video that was running has a data rate of 1.2 megabits per second, 1.2 Mbps * 7 = 8.4 Mbps.

Similarly, when running 8 KB multimedia frames with 4 KB data frames, 8/(4+8) = 2/3 * 16 Mbps = 10.6 Mbps, whereas 1.2 * 9 = 10.8 Mbps.

The 50-percent test also shows that the frame size for multimedia traffic needs to be at least 8 KB to withstand at least a 2 KB frame size of data traffic, and it needs to be 16 KB to withstand up to a 16 KB frame size of data traffic.

However, using large frames for multimedia traffic makes each station take too long to free the token. If each station is not able to get a new token quickly enough before it depletes its playout buffer, the station will incur multimedia breaks. Large networks with multimedia clients that use large frames are likely to encounter this problem. To address the problem, *bandwidth reservation ack* was invented.

Bandwidth Reservation Ack

As we saw from the 50-percent rule, P/(P+D), to increase the amount of reservable bandwidth for a single multimedia server, we must either increase P or decrease D. Even when we increase P to 16 KB, a corresponding increase in D reintroduces the problem: the server can get only about half the bandwidth.

If, in response to each priority frame received from the server, the client sends small (e.g., 64-byte) "acknowledgments" at a priority higher than a data frame but lower than a multimedia frame, then the token will remain at priority and will give the server enough time to send a burst of multimedia frames before a station with a data frame gets the token. This bandwidth reservation acknowledgment or *ack* enables the server to use more of the token ring's bandwidth.

When a client sends a bandwidth reservation ack to each priority frame from the server, the ack is not sent to any station in the network. Instead, it is put out to the ring, but with no destination. The reason these acks do not go back to the server is that they would cause many unnecessary interrupts in the server. Bandwidth reservation acks reduce the D factor, and they enable the server to reserve more than 50 percent of the bandwidth for multimedia traffic.

Figure 3 shows the effect of bandwidth reservation acks. A priority server with bandwidth reservation ack on the clients supports up to 10 clients on a 16 Mbps token-ring network regardless of the data frame size. Without bandwidth reservation ack, the priority server alone cannot withstand data traffic of any frame size. In Figure 3, the maximum number of multimedia clients used was 10.

HPFS386 File System Enhancements

LAN Server Ultimedia 1.0 further enhanced the HPFS386 file system in LAN Server 3.0 Advanced so it can process multimedia requests more effectively. HPFS386 uses the Strat2 extended interface to the disk device driver. In the normal configuration of LAN Server 3.0, the HPFS386 file system interfaces with `OS2DASD.DMD` (which exports Strat2) to do disk I/O.

Strat2 supports multi-priority operation. `OS2DASD.DMD` uses an elevator-seek algorithm within a priority queue to decide which Strat2 requests to dequeue first. LAN Server Ultimedia 1.0 enhanced this Strat2 feature to extend the priority scheme to include multimedia file reads. This enhancement ensures that multimedia requests are processed ahead of data requests.

In LAN Server Ultimedia 1.0, the HPFS386 file system processes at most two read

requests at a time between the small computer system interface (SCSI) adapter device driver and OS2DASD. Processing at most two read requests at a time minimizes the delay of multimedia reads. Even though multimedia data was processed on priority at OS2DASD, it can be placed behind regular data traffic at the SCSI adapter device drivers, since the SCSI adapter device driver does not have the concept of priority. This change in placement may cause slight delays on non-multimedia data when the multimedia server is also used as a data-file server, but the difference should not be noticeable in most cases.

Another difference between LAN Server 3.0 and LAN Server Ultimedia 1.0 is in HPFS CACHE. LAN Server Ultimedia 1.0 does not use HPFS CACHE. Instead, the server allocates a 64 KB "big buffer" for each open of a multimedia file. (Refer to the "Performance Tuning" section below for more information about setting the cache size on your server when the multimedia server is used as a data file server.) In essence, the FSPREALLOC parameter in the CONFIG.SYS file preallocates these "big buffers." For example, add the parameter /FSPREALLOC:42 to the IFS= statement to allocate 42 big buffers for 40 clients (two extra).

Another enhancement to the HPFS386 file system is the disk-read size. In LAN Server Ultimedia 1.0, the server uses 63.5 KB disk reads. This change in disk-read size was made to optimize the file streaming of multimedia playbacks. As a result, Ultimedia 1.0 gives you a larger disk capacity than normal LAN Server 3.0 Advanced provides.

NetBIOS Enhancements

The NetBIOS enhancements in LAN Server Ultimedia 1.0 consist of transport enhancements that take advantage of new token-ring adapter features and the bandwidth reservation ack.

When a server is used as a multimedia server as well as a data-file server, LAN Server Ultimedia 1.0 requires LANStreamer cards to guarantee Quality of Service (QoS) of multimedia playback. QoS denotes a set of parameters that define the performance requirements of an application or the guaranteed performances provided by a system.

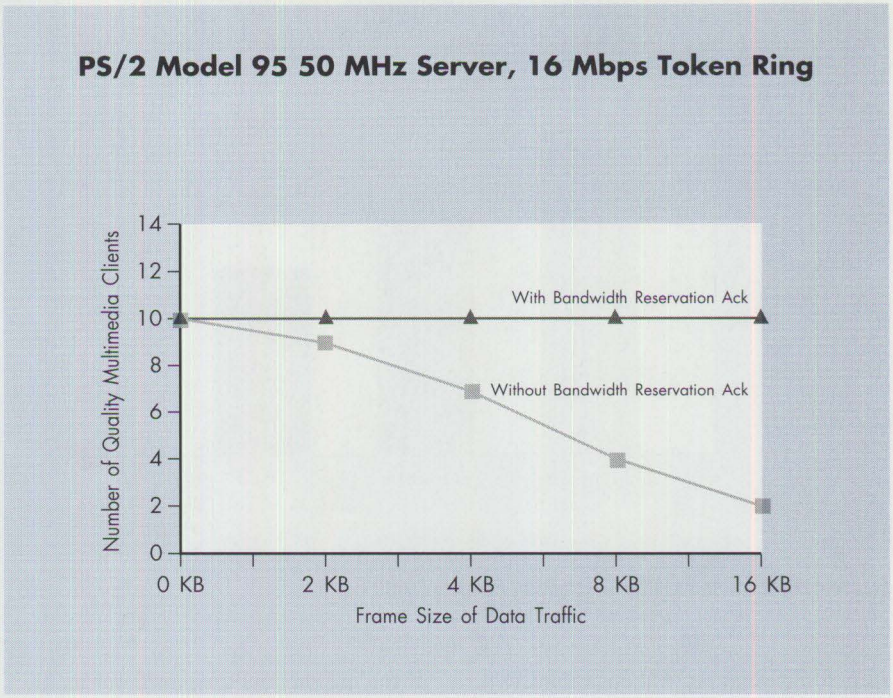

Figure 3. Effect of Bandwidth Reservation Ack on Multimedia Performance

LANStreamer adapter cards are the first token-ring cards that support dual queues—one for high-priority frames and the other for regular-priority frames. This dual-queue support prevents high-priority frames from getting stuck behind regular-priority frames, which is unavoidable in single-queue adapter cards without a software implementation of dual queues. Also, LANStreamer adapter cards perform better than the previous token-ring adapter cards.

Figure 4 illustrates the difference in the capacities of IBM LANStreamer cards, IBM Token-Ring Network Busmaster Server cards, and IBM Token-Ring 16/4 Adapter cards. All clients are playing unique 1.2 Mbps files. The maximum number of multimedia clients that a 16 Mbps token ring can carry on the network bandwidth is 13.

LAN Server Ultimedia 1.0 supports up to 10 1.2 Mbps streams on a 16 Mbps token-ring, which puts the network utilization at 75 percent. This utilization is calculated as follows: The number of multimedia streams (10) * the data rate of the files (1.2 Mbps) = 12 Mbps. Then 12 Mbps divided by the speed of the ring (16 Mbps) = 0.75, or 75 percent.

We generally recommend that token-ring utilization should not exceed 80 percent for a sustained period of time, since 20 percent of bandwidth should be reserved for messages being exchanged between network adapters.

Figure 4 shows that because of their performance, it is a good idea to use LANStreamer cards even with a dedicated multimedia server. LANStreamer cards support more quality multimedia clients than other token-ring adapter cards support.

NetBIOS enhancements also include the bandwidth reservation ack, which was discussed previously.

Figure 5 shows the LAN Server Ultimedia 1.0 flows between a server and a client that are both running OS/2. Due to dynamic windowing and bandwidth reservation ack, the flow may vary slightly from playback to playback.

Performance Tuning

Several system components such as CPU, disk controller and hard drives, and network adapters affect LAN Server Ultimedia 1.0 performance and capacity, so planning for the right system and selecting the appropriate system components are important for optimizing performance. After selecting the right system components, you can tune your LAN Server Ultimedia 1.0 system to your

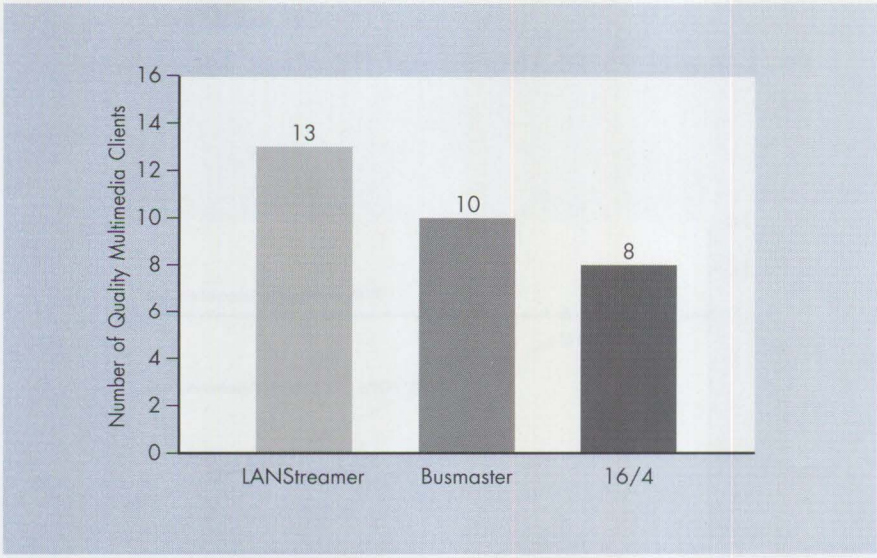

Figure 4. Comparison of IBM Token-Ring Adapter Cards

specific environment. Although the LAN Server Ultimedia 1.0 product is designed to operate with little or no tuning, some performance tuning may be necessary in a busy network environment.

Application-specific factors such as the size of read operations and how they are performed are crucial to good multimedia performance, but neither the LAN Server Ultimedia 1.0 product nor the customer can control them. Applications that have an arbitrary read size (less than 63.5 KB) and inadequate buffering may not port well to a client/server environment.

Capacity Tuning

Capacity tuning is important in LAN Server Ultimedia 1.0. Capacity determines the maximum number of multimedia clients that LAN Server Ultimedia 1.0 can support. LAN Server Ultimedia 1.0 supports up to 40 unique 1.2 Mbps multimedia streams coming from a server, in addition to any existing data traffic on the LAN. Figure 6 shows the recommended configuration of a 40-client system with LAN Server Ultimedia 1.0.

The following system components should be considered when planning the capacity of a LAN Server Ultimedia 1.0 system.

System

You need at least a 486, 50 MHz processor to support 40 clients on the server. Figure 7 shows the number of quality multi-media clients on various server machines, along with CPU utilization.

If you are running three or fewer multimedia full-motion video clients, a 20 MHz 386 computer will suffice as the server. However, a 486-based computer provides superior performance and capacity as a multimedia server. For up to 27 full-motion video clients, a 33 MHz 486 suffices. Keep in mind that if you are playing lower data-rate multimedia files (i.e., sound), the capacity will be larger than when playing full-motion videos.

PS/2 Model 80 386 20 MHz computers were used as hardware-assisted multimedia clients in our lab, and they performed sufficiently. You may want to use 486-based computers for clients when running DOS/Windows multimedia applications or software-only-option multimedia applications.

With the LAN Server Ultimedia product, you should be able to increase the number of quality multimedia clients on 50 MHz 486 servers in the future.

Memory

For 40 clients, 32 MB of memory is recommended on the server. In client computers, the memory requirements are the same as the memory requirements for a LAN Server requester or your multimedia application. In our test lab, the 12 MB of memory used for OS/2 clients got good results.

Network Adapter Cards

Please refer to the NetBIOS section under the "Token-Ring Priority Architecture"

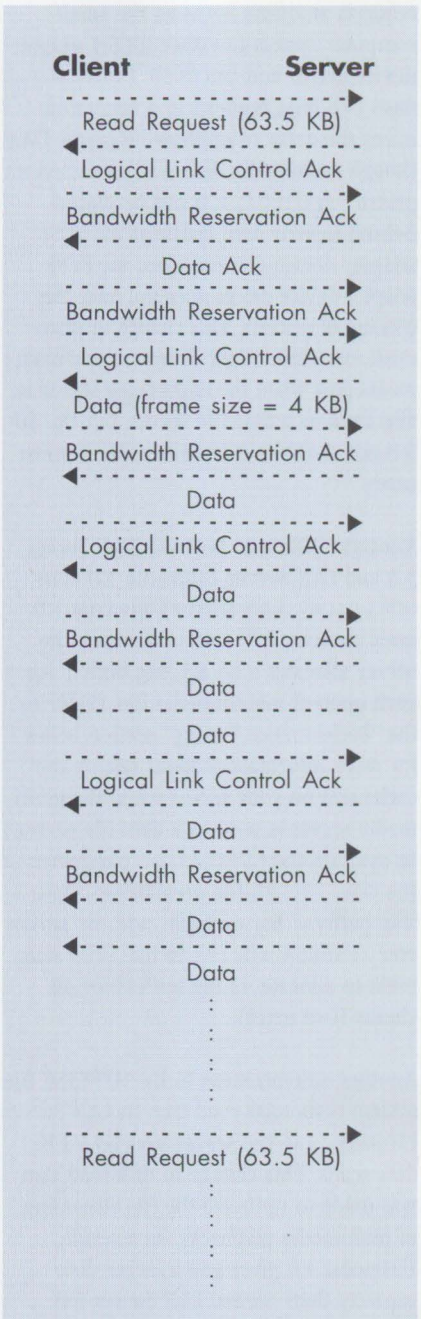

Figure 5. LAN Server Ultimedia 1.0 Data Flows

heading earlier in this article for information on token-ring network adapter cards.

For a 40-client system, four network adapter cards are needed, where each network adapter supports 10 multimedia clients. The network adapter cards on the client are not as important as the network adapter card on the server.

For an Ethernet network, 3Com 3C523 EtherLink MC 32 adapter cards and IBM EtherStreamer cards were used, and they performed well on the server. 3Com 3C503 EtherLink II (and higher) adapters

were used with LAN Server Ultimedia 1.0 on an Ethernet network on the clients, and they provided good results as well.

IBM Token-Ring 16/4 Adapter cards were used in client systems and provided good results in a token-ring network.

An important configuration parameter in the client system is either "shared RAM" in Token-Ring 16/4 Adapter cards or "Adapter Work Area" in Ethernet cards.

Shared RAM contains overhead for link stations, control blocks, transmit buffers, and receive buffers.

In token-ring adapters (except IBM Token-Ring Network Busmaster Server adapter cards and IBM LANStreamer MC 32 cards), shared RAM is physically located on the adapter card. For IBM Token-Ring 16/4 Adapters, to make sure the adapter can use the full 64 KB of memory, set the adapter's paging size to 64 KB or to 16 KB if paging is enabled. Use the reference diskette to set the adapter's paging size.

For Ethernet adapters, shared RAM resides in system memory rather than on the adapter card, so it is referred to as the Adapter Work Area. Because it resides in system memory, the paging size becomes configurable from the reference diskette regardless of the adapter hardware.

For both token-ring and Ethernet adapters, set the adapter's paging size to 16 KB. This size provides almost the same performance as a 64 KB page size while using less of the shared RAM address space or Adapter Work Area.

Note: IBM Token-Ring Network Busmaster Server adapters and LANStreamer MC 32 adapters do not have shared RAM. They provide 64.5 KB of memory for buffers, a value that is not changeable.

Disk Controller and Hard Disks

Disk controllers and hard disks are the two system components likely to become bottlenecks when running 40 clients.

Figure 8 presents LAN Server Ultimedia 1.0 disk calibration results using various combinations of SCSI adapters and hard disks. The LAN Server Ultimedia 1.0 disk-calibration algorithm assumes that the other multimedia disks using the same disk controllers are running at full capacity.

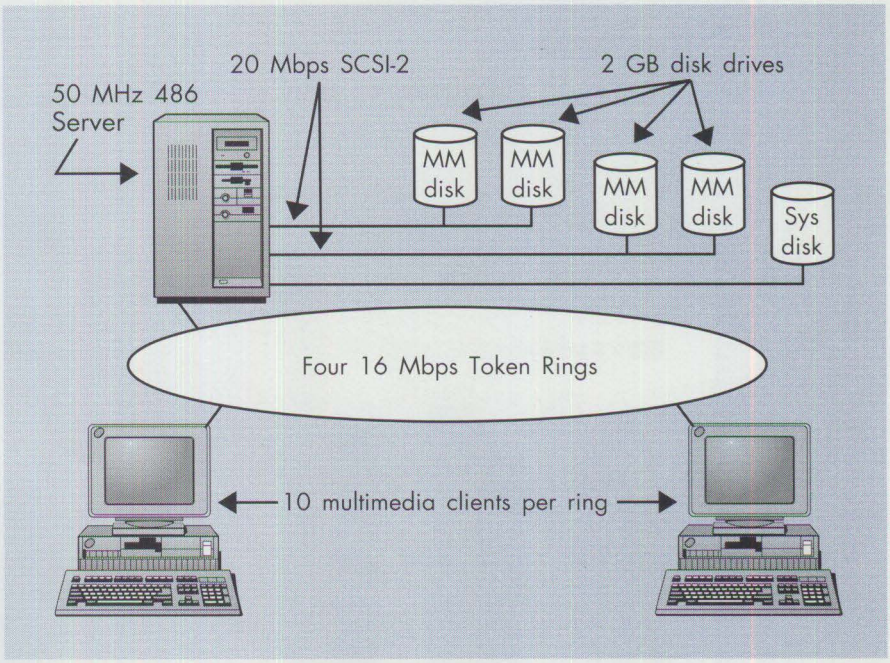

Figure 6. Hardware Configuration for 40 Clients

Server System	Number of Quality Multimedia Clients	CPU Utilization
20 MHz 386	3	80 percent
33 MHz 486	27	75 percent
50 MHz 486	40	40 percent

Figure 7. Comparison of Server Systems

When running more than 10 clients on a 486 server system, the first bottleneck will likely be the SCSI adapter cards. Figure 8 shows you how many multimedia clients you can run. For example, with one 2 GB disk attached to a SCSI with Cache adapter, you will be able to play seven video clips from multimedia clients at a data rate of 1.2 Mbps. If the data rate is 0.9 Mbps, you will be able to play 10 video clips from multimedia clients.

A SCSI-2 adapter has up to 54 percent more capacity than a SCSI with Cache adapter. Therefore, in comparison, you will be able to play twelve 1.2 Mbps video clips with one 2 GB disk on a SCSI-2 adapter.

Sharing SCSI-2 adapter cards slightly reduces disk throughput from each disk, but increases the total throughput from the adapter. If you have a SCSI-2 adapter, we recommend sharing the adapter to increase its capacity.

In Figure 8, you see that using a 2 GB disk on a SCSI with Cache adapter does not gain much more throughput than a 1 GB disk or a 400 MB disk. If you have a SCSI with Cache adapter, do not use a disk larger than 1 GB, and do not attach more than one disk to the adapter. Doing so will not increase the total throughput of the adapter, and you will waste valuable resources.

Having multiple SCSI adapter cards in a server helps the throughput. We can safely assume that each additional adapter on the server will have a similar linear relationship:

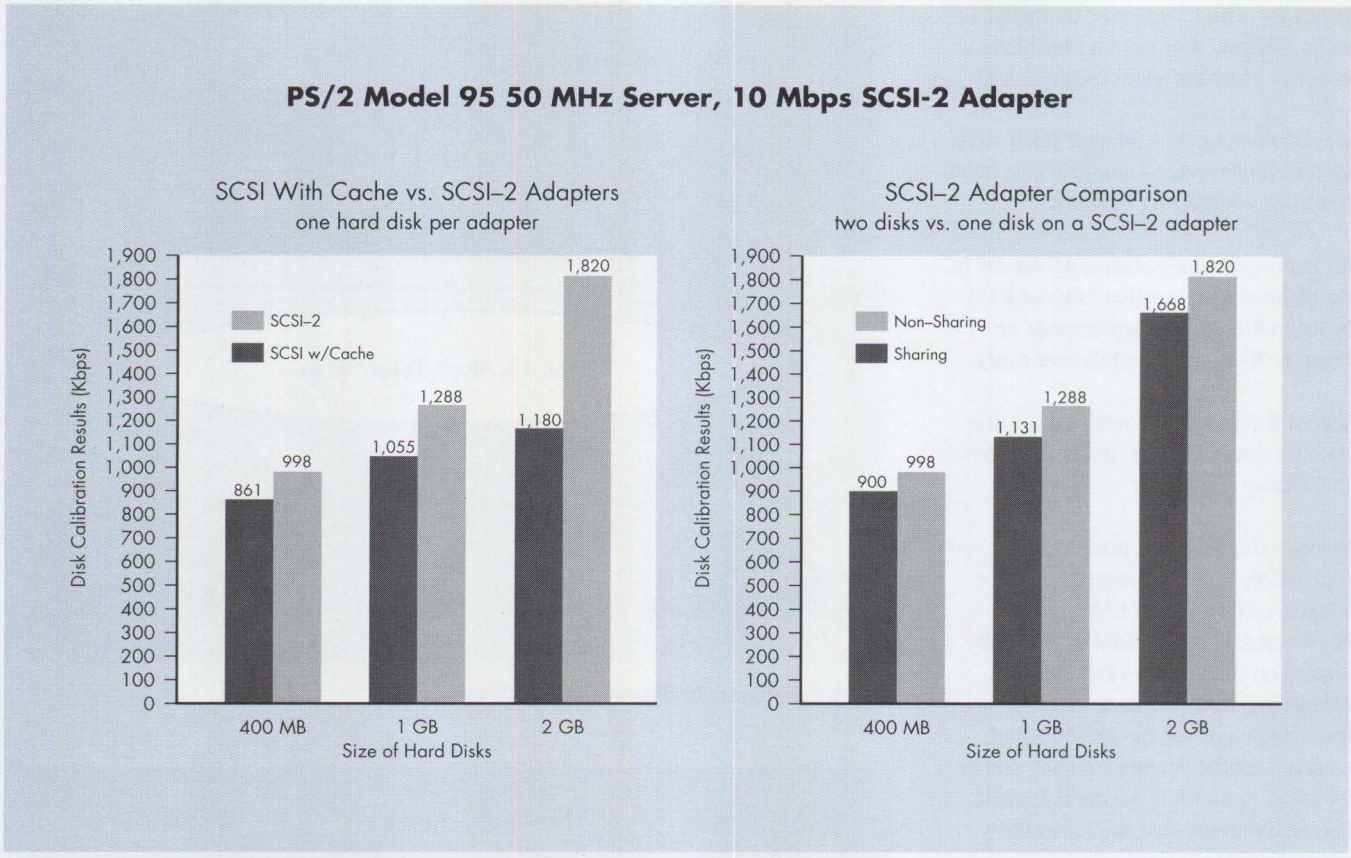

Figure 8. Comparison of SCSI Adapter and Hard Disk Calibrations

Number of adapter cards * throughput from one adapter = total throughput

As noted earlier, a 50 MHz 486 server will not become a bottleneck for 40 clients.

For optimum performance, the hard disks for multimedia files should be connected to a controller that is separate from the controller for the hard disk's operating system. For a 40-client system, we recommend two SCSI-2 adapters with four 2 GB hard disks, where two hard disks are connected to each adapter.

We expect SCSI adapter capacity to improve in the future, so that users should be able to play even more multimedia streams that come from a hard disk.

Cache

LAN Server Ultimedia 1.0 does not use the HPFS386 file system cache to read reserved multimedia files. On a data-file server, the bigger the cache size, the better. When a multimedia server is also used as a data-file server, you want to have enough RAM for cache plus the multimedia big buffers. In this case, the following formula is useful:

Total RAM - RAM for system (8 to 10 MB) - (FSPREALLOC * 64 KB) >= Cache

For example, if you have 32 MB of memory, your cache size should be no larger than 19 MB (/C:19456). This was calculated as follows:

Total RAM = 32 MB
System RAM = 10 MB

For the 40-client system that we have been discussing, FSPREALLOC = 42. (Recall that FSPREALLOC preallocates memory for the "big buffer" that LAN Server Ultimedia 1.0 uses to process multimedia files.) Therefore,

32 MB - 10 MB - (42 * 64 KB) >= Cache
19.31 MB >= Cache

Cache can be allocated in integers, so the result is an HPFS cache size of 19 MB.

To summarize this discussion about cache: If you have a dedicated multimedia server, use the small (default) cache, but if you have a combined multimedia plus data-file server, use the formula to calculate cache size.

Network Tuning

To maintain multimedia quality, the LAN Server Ultimedia 1.0 product supports real-time applications in which data must be delivered to each client within a limited period of time.

You can estimate the maximum number of clients that can exist on a LAN by knowing the delivery rate and the network characteristics. For example, up to 13 video clients can be supported on a 16 Mbps token-ring network and up to eight on an Ethernet network where multimedia traffic has a data rate of 1.2 Mbps. Only three multimedia clients running at 1.2 Mbps can be supported on a 4 Mbps token-ring network. Because of this capacity difference, a 16 Mbps token ring is recommended for a multimedia network.

Network capacity becomes unpredictable when both multimedia and non-multimedia traffic exists on the network. LAN Server Ultimedia 1.0 supports up to 10

1.2 Mbps multimedia clients on a 16 Mbps token-ring network, regardless of the non-multimedia traffic. Without LAN Server Ultimedia 1.0, multimedia clients will have jerky video or broken audio when transient delay occurs in the network, due to the strict delivery requirement mentioned earlier.

Network Parameters

Several network parameters are important in LAN Server Ultimedia 1.0. These parameters are found in the NetBEUI section of the PROTOCOL.INI file, which can be configured using the LAN Transport Configuration feature in the IBM LAN Server 3.0 Advanced product.

MAXDATARCV

The MAXDATARCV parameter specifies the maximum frame size, in bytes, that the protocol layer NetBEUI can receive as data. The size specified in MAXDATARCV is used to negotiate frame size with other sessions during session setup.

For performance tuning, the correct size for MAXDATARCV depends on the environment, particularly on the size of the file-access requests to the server. If most of the requests are a certain size, you should probably set the size of MAXDATARCV to this request size, plus include some space for the Server Message Block (SMB) header. Since the SMB has variable length, no single value can be specified for the maximum header size. A good value is 72 bytes.

The default value, minimum value, and maximum value of MAXDATARCV are:

Default value	4168
Minimum value	512
Maximum value	16384

In most environments, the default value of 4168 bytes (4096 bytes for data plus 72 bytes for the SMB header) is sufficient. In environments where the network traffic consists mostly of large file transfers or large data requests (as in multimedia), it might improve performance to increase the size of MAXDATARCV.

However, increasing the size of MAXDATARCV in a multimedia LAN means it takes longer for each station to free the token. Therefore, if you have a lot of multimedia sessions, they will probably begin to break up if they are not able to get a token quickly enough before depleting their playback buffers.

When playing up to 10 multimedia sessions, increase MAXDATARCV to 16384 to help multimedia performance. When there are more than 10 multimedia sessions, or when there is any latency-sensitive application traffic on the ring, leave this value at its default of 4168.

Also, set the frame size of the non-multimedia application at 4 KB or lower if it is configurable. This will ensure the multimedia quality of service. If you are running fewer than 10 multimedia sessions and the frame size of your non-multimedia applications is larger than 4 KB, set the MAXDATARCV value to a value larger than the frame size of the non-multimedia applications.

When setting the value for MAXDATARCV, consider the capabilities of the requester. If the requester can receive a frame of only a certain size (either because of the limitation of the network adapter being used or because of requester memory constraints), then larger values for MAXDATARCV will not help performance.

PIGGYPACKACKS

The PIGGYPACKACKS parameter specifies whether the NetBIOS protocol sends and receives acknowledgments piggybacked with incoming data. If this parameter is set to 1 (the default value), the workstation sends and requests piggybacked acknowledgments. If this parameter is set to 0, the workstation neither sends nor requests piggybacked acknowledgments.

Set this value to 0, because leaving it at 1 noticeably degrades the performance of LAN Server Ultimedia 1.0.

PRIORITY SETTING

The PRIORITY SETTING parameter in the PROTOCOL.INI's adapter section specifies the frame-priority setting (the access-priority field in the token-ring header) for reserved multimedia session traffic on a token-ring network. This parameter also sets the frame-control field in the token-ring header. The frame-control field is used by the IBM LANStreamer MC/32 adapter driver to determine high-priority transmit channel access.

PRIORITY SETTING parameter values are:

Default value	5
Minimum value	0
Maximum value	5

Set PRIORITY SETTING to 5 for the LANStreamer adapter driver. For earlier token-ring adapter drivers, such as the Busmaster and the 16/4, set this value to 3.

Ethernet Considerations

With Ethernet, the quality of video and audio can vary because, unlike token ring, Ethernet does not have priority architecture. This makes multimedia quality on an Ethernet network difficult to predict when there is both multimedia and non-multimedia traffic. Figure 9 shows the number of quality multimedia clients when running with 100 KB file-copy. The maximum number of multimedia clients used was eight.

We also tested 1 MB file-copy and found that one 1 MB file-copy limited the number of quality multimedia clients to five. The results demonstrate the unfairness of the bandwidth allocation when running multimedia traffic with 1 MB file-copy. In this case, while multimedia paced its traffic at a sustained 1.2 Mbps rate, the data client sent its frames as fast as it could (at about 4 Mbps) and grabbed all the free bandwidth, which was about 40 percent of the total bandwidth.

File-copy of 100 KB pauses more frequently than 1 MB file-copy to do setup processing between files. Because no data frames are transmitted during setup, more bandwidth is available to multimedia clients.

File-copy of 100 bytes had minimal effects on multimedia traffic, because a single frame of 100 bytes can run while multimedia clients are idle.

Because an Ethernet network does not have a priority scheme, the only way to protect multimedia traffic is to throttle data traffic so that multimedia clients have more chances to get attention and gain their fair share of bandwidth. Throttling the data traffic helps the quality of multimedia, but it may noticeably degrade the performance of non-multi-media applications. Use throttling only when you are having a problem

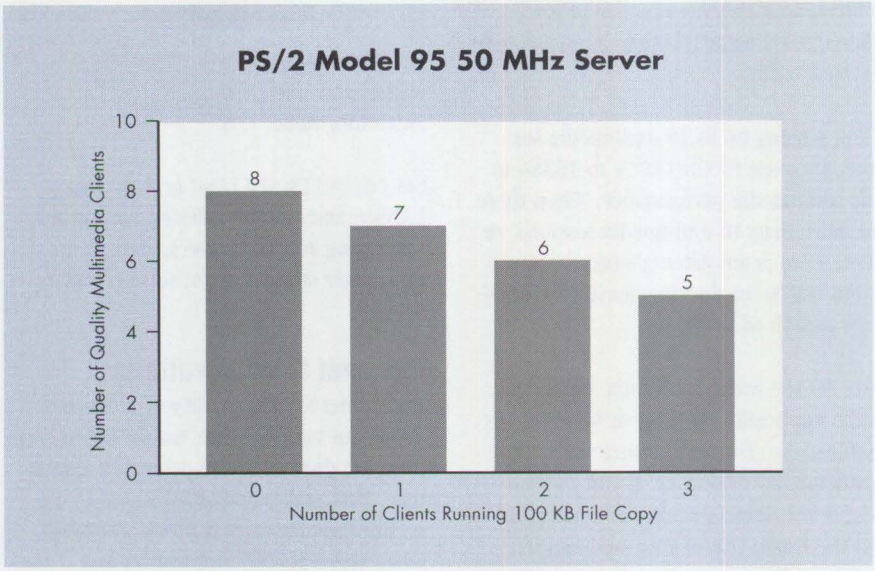

Figure 9. Multimedia Performance on an Ethernet Network

running multimedia applications with non-multimedia traffic on a separate server. Do expect degraded performance for non-multimedia applications.

The parameters to implement throttling depend on the client/server application. The following recommendations are for an OS/2 LAN client/server application. All parameters are adjusted at the NetBIOS protocol level except where otherwise specified.

Pacing-Window Parameters

The following parameters can be used to increase the time between each frame sent by delaying the client acknowlegement.

MAXIN and MAXOUT

MAXIN allows you to select the size of the Receive Window used by NetBIOS. Acknowledgments will be deferred until the T2 timer expires or the specified number of frames is received.

MAXOUT specifies the number of NetBIOS message packets that can be sent before an acknowledgment must be received.

You can tune these parameters automatically by using Adaptive Windowing. Refer to the Adaptive Widowing Interval parameters below for more information.

Values for MAXIN and MAXOUT are:

Default value	1
Minimum value	1
Maximum value	127

Leave your non-multimedia server's MAXOUT at the default and set your non-multimedia client's MAXIN to 2. This delays the client's ack to match the T2 (acknowledgment) timer value.

ADAPTRATE

The ADAPTRATE parameter specifies the time in milliseconds between runs of the Adaptive Window algorithm. For each link, NetBIOS uses the Adaptive Window algorithm to change the MAXIN and MAXOUT parameter values to match the values set on the remote workstation. When no dropped packets are detected, the Adaptive Window algorithm increases the MAXOUT parameter value. If the number of dropped packets detected is more than the Window Errors parameter value, the Adaptive Window algorithm decreases the MAXOUT parameter value. The Adaptive Window algorithm changes the MAXIN parameter value based on the time-out expiration specified by the T2 parameter value.

Values for ADAPTRATE are:

Default value	1000
Minimum value	0
Maximum value	65535

Set ADAPTRATE to 0. This ensures that the MAXIN and MAXOUT values are left as is and turns off adaptive windowing.

Frame-Queue Parameters

Use these parameters to limit the number of frames waiting to be sent in data traffic.

PIPELINE

The PIPELINE parameter specifies the number of NetBIOS message packets that are pre-built and waiting in a pipeline for each session. Set this value to 1. This limits to 1 the number of frames that are pre-built and waiting in the pipeline for each session.

MAXTRANSMIT and MINTRANSMIT

These parameter changes apply to both the NetBIOS and Adapter levels. Refer to the "Network Parameters" section for information about these parameters.

Set these values to 1. This keeps, at 1, the number of frames that are sent to the adapter at once. These changes minimize the number of frames that are queued and waiting to be sent in data traffic.

Frame-Size Parameters

As seen from the 50-percent rule discussion above, frame size plays an important role in the mixing of multimedia and non-multimedia traffic. Reducing the frame size will help pace the non-multimedia traffic.

MAXDATARCV

Refer to the "Network Parameters" section for information about this parameter. The minimum value is 512 bytes. The default and maximum for Ethernet is 1500 bytes.

Playout Buffer Parameters

Playout buffers are defined by the multimedia application. Refer to your application documentation for information on its buffering.

Multimedia Clients

Increasing the multimedia clients' playout buffer size will delay multimedia breakdown. In token ring, a large playout buffer smooths out short-term fluctuations in the data rate. In Ethernet, if the average multimedia data rate is less than the required data rate for that specific file (e.g., 1.2 Mbps), a large playout buffer simply delays, but does not prevent, multimedia breakdown.

The Only Product That Guarantees QoS

LAN Server Ultimedia 1.0 is the only product that guarantees the quality of multimedia playbacks in an environment in which both multimedia and non-multimedia applications exist. LAN Server Ultimedia 1.0 achieves this objective not

only by enhancing the industry-leading IBM LAN Server 3.0 Advanced and robust NetBIOS, but also by taking advantage of the token-ring priority architecture. It supports up to 40 multimedia clients, which is the industry's best capacity.

This "future" technology is available today and more enhancements are planned.

Today, you can integrate IBM LAN Server Ultimedia 1.0 into your current network environment. In the future, you can expand your network to accommodate environments such as high-speed FDDI, 100 Mbps Ethernet with priority channels, and B-ISDN ATM local area networks.

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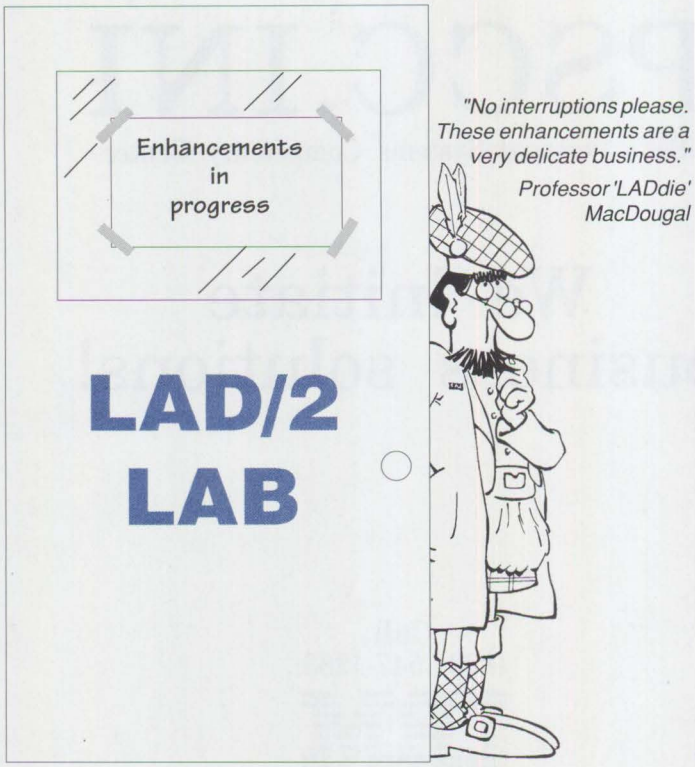

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Little Solutions

Top Tips for LAN Server 3.0 Performance

A number of the major factors affecting LAN Server (LS) 3.0 performance are reviewed in the following little solutions. Although a few parameters are discussed, most of the tips are aimed at getting you to think about your particular environment in relation to LAN Server's system resources.

Because there will always be a bottleneck in any computer system, the objective of performance tuning is to remove the current bottleneck. Hopefully the resulting system performance has its new bottleneck at an operating point outside normal operating conditions!

LAN Server 3.0 Configuration Tool (CNFGLS30)

CNFGLS30 is an IBM tool that uses spreadsheet software so you can input key server environment information. The tool uses that information to calculate resources and subsequently recommend parameters to be tuned in the servers' `CONFIG.SYS`, `IBMLAN.INI`, and `PROTOCOL.INI` configuration files. It has been very popular with LAN Server administrators as an aid in configuring large environments as well as improving performance.

This tool is available on the OS/2 BBS and CompuServe. You can find it as CNFGLS30.ZIP on the OS/2 BBS under OS2BBS Software Library, OS/2 Tools. On CompuServe, look for "Tuning Spreadsheet for LS 3.0" under GO IBMOS2, Developer 2 Forum, LAN Server Library. Ask your IBM representative to help you use this tool in your environment.

Entry vs. Advanced Server

If your LAN Server is to share file or application services, you should be using LAN Server 3.0 Advanced to take advantage of its outstanding performance. In many environments LS 3.0 Advanced provides up to two times better performance and three times more capacity than LS 1.3, LS 2.0 Entry, or LS 3.0 Entry.

Note: To gain the performance advantage of the Advanced version, your applications and data files must reside on an HPFS386 partition, not on a FAT partition. Neither OS/2 2.1 nor LS 3.0 have to be installed on an HPFS386 partition because accesses to system software are infrequent after initial loading. LS 3.0 Entry is a less expensive solution if your server is used only as a print server or a domain controller (with no shared files, applications, or home directories) and you don't require the fault tolerant features of the Advanced server.

Cache Size

If you select the Basic Installation option when you install LS 3.0 Advanced, the HPFS386 cache size is purposely set to a less than optimal value to leave sufficient system memory for other applications to run on the server. You can check your cache size by entering `CACHE386 /STATS:D` at an OS/2 command line on your server. If you have a dedicated server, you should use the available memory for cache; e.g., try a cache size of 7 MB if your system has 16 MB of memory or as much as 20 MB on a 32 MB machine. (The current version of the spreadsheet tool, CNFGLS30, calculates a recommended value for you.) To assign 7 MB for the HPFS386 cache, change the `IFS` statement in the `CONFIG.SYS` file to read as follows:

```
IFS=C:\IBM386FS\HPFS386.IFS
 C:\IBM386FS\HPFS.386 /C:7168
 /USEALLMEM /I:C:\IBMLAN /A:*.
```

Note: `/USEALLMEM` is required only if the system has more than 16 MB of memory and you want to make memory above 16 MB available for HPFS386 cache. In addition to this parameter, your network adapter (if a busmaster) and fixed disk subsystem (because it does direct memory access [DMA]) must also be capable of supporting memory above 16 MB (32-bit addressability). The original IBM 16/4 Token-Ring Busmaster has only 24-bit addressability and does not support this function. Other Original Equipment Manufacturers' (OEMs') disk adapters with 24-bit addressability will not support this function either.

Fixed Disk Utilization

The disk subsystem, an electromechanical device, can often be the system bottleneck even though the system provides a lot of memory for caching files. If you have observed that your fixed disk activity indicator (the little light that flashes when the hard disk is in use) is on more than it is off for long periods of time, you probably have a disk bottleneck. Your options for improving performance include:

- Distribute the disk-intensive workload from a single physical disk drive to multiple disk drives, enabling concurrent disk seeks and read/writes.
- Off-load some users, files, or applications to another server.
- Install the fault tolerance feature of LAN Server to enable disk mirroring. This not only protects your data by backing up your disk but also improves performance since the additional disk drive will also be used to read data (split reads).
- Adding fixed disks and striping data across them (redundant array of independent disks [RAID] architecture) will sometimes improve performance as well as enhance data integrity in an environment where data is predominantly looked up (read) without a subsequent update (write); for example, databases used for price lookup, part number information, etc.

CPU Utilization

Server performance can degrade when the computer's (CPU's) ability to process incoming instructions is overtaxed.

If there are many users (usually hundreds) with high interaction rates to the server, a CPU performance bottleneck may occur (the Advanced server CPU efficiency is several times greater than the Entry server). You may see a lot of fixed-disk activity and suspect the disk subsystem; but this may be lazy-write activity, which is not necessarily the system bottleneck. To check CPU utilization, you can use System Performance Monitor/2 or LAN NetView Monitor for a detailed analysis.

To get a rough idea of how your server uses the CPU, start the Pulse applet from the OS/2 Workplace Shell Productivity folder and observe its display during a heavy server workload period. If the CPU utilization level is 80 percent or greater for much of the time, performance is being impacted by the CPU's ability to satisfy its workload demands. Replacing standard network interface cards (NICs) with busmaster NICs will provide additional CPU power and usually improve server performance. Another remedy is to offload some of the users, files, applications, or functions (e.g., domain controller or print server) to another server or to upgrade to a more powerful hardware system.

Network Interface Cards

Let's assume that your fixed disk activity is not excessive and that your CPU utilization is generally less than 30 to 40 percent, but you still feel that your server could respond more quickly. Your network interface card is analogous to a nozzle that physically limits the amount of traffic flowing to and from the server. Depending on the number of users, speed of the client machines, type of data transactions, etc., server performance can be NIC-limited. NICs come in 8-bit, 16-bit, and 32-bit bus widths. Some 32-bit NICs are busmasters, which means they can handle most data transfers with their built-in processors, relieving the server CPU of this task.

You can improve a NIC-limited condition by changing to a faster NIC and/or adding additional NICs to your server. As you add additional NICs, your server CPU utilization will increase as the server will be busier than before servicing the additional traffic coming through the NICs (nozzles). If you add busmaster NICs, the increase in server CPU utilization will be less significant, as you might expect.

When you initiate a session, LS 3.0 will automatically load-balance sessions across all NICs. When using standard 16/4 token-ring NICs, we recommend that you use a 16 KB shared RAM size for best performance and memory utilization.

Network Media Utilization

The physical media over which network traffic flows has a finite capacity. The Ethernet bandwidth limit today is usually 10 megabits per sec (Mbps); token rings today are running at 4 Mbps or 16 Mbps. It is quite possible that with powerful servers and hundreds of clients, LANs can almost saturate the physical media providing interconnection. This is much more likely to occur in Ethernet networks due to the broadcast/collision detection/re-broadcast nature of that architecture.

In large networks interconnecting many clients and servers, the level of network traffic on the wire can impact token-ring network performance. A simple (but not always viable) remedy is to change your network topology. You could add NICs to your server and separate and isolate clients into LAN segments so that all network traffic is not passing through all machines. The net effect is that the server with two Ethernet NICs now has a greater potential bandwidth (20 Mbps) plus a lower collision level on each of the two segments than on a single Ethernet segment.

This solution is not viable if the machines on the two isolated segments must communicate, since LS 3.0 does not internally route the NetBIOS protocol. More sophisticated ways to reduce network utilization include using the traditional backbone rings and bridges plus the new intelligent switches, hubs, and routers now becoming available.

DOS LAN Requester 3.0 Performance Hints

LAN Server 3.0 improved the performance of its DOS NetBIOS. In some application environments, performance is improved as much as two times over the earlier version. However, it's possible that your DOS LAN Requester (DLR) clients are not enjoying this performance enhancement. If your DLR clients are running an application that requires the IEEE 802.2 interface support, as do most 3270 emulation products, then the improved NetBIOS was not installed by `DXMAID` (the LAN Support Program [LSP] installer).

The Install program did this because compatibility between the 802.2 support (`DXMEOMOD.SYS`) and the improved NetBIOS (`DXMJOMOD.SYS`) had not been verified at the time LSP was shipped. Additional modification to the LAN Support Program is available as a program temporary fix (PTF) through the IBM support organization. Call your IBM software service support number, ask for support for LAN Support Program, then ask for PTF UR40349, a diskette image of LSP 1.35.

Although the softcopy user's guide shipped with the PTF will not be updated, `README` files on the diskette will provide instructions.

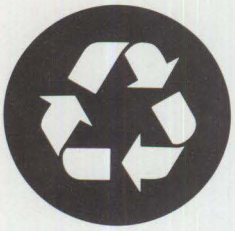
Large Domain Tuning Update

CNFGLS30 recommendations for tuning large domains caused problems in some customer shops, which has since resulted in new recommendations for some LS 3.0 parameters. Version 1.08 of the CNFGLS30 spreadsheet updates these parameters. If you need it, a tuned value for `SESSIONS`, used below, can be calculated using the CNFGLS30 spreadsheet. The new recommendations are:

- Set `NUMREQBUFS` to three times the number of `SESSIONS` (`x1` in the `NETX` line of `IBMLAN.INI`) up to a maximum value of 350. If you have multiple adapters in your server, use the sum of the `x1`s from `NET1`, `NET2`, etc.
- Set `COMMANDS` (`x2` in the `NETX` line of `IBMLAN.INI`) to two times the number of `SESSIONS` up to a maximum value of 700 (assumes multiple adapters). These `COMMANDS` should be distributed equally over the multiple adapters (`x2`s in the `NETX` lines). See the *LAN Server 3.0 Network Administrator Reference, Volume 2: Performance Tuning* (S96F-8429), page 3-5 if these terms are unfamiliar to you.

These changes provide balanced memory usage in the processing of network requests and should provide better performance.

– Ken Whitfield, LAN Systems Performance, Austin, Texas



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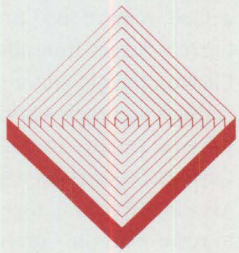

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Questions and Answers

OS/2

How do I specify another editor as the default editor for OS/2 2.x Workplace Shell objects? I would like to have the Enhanced Editor (with its wider array of features including printing and vertical column cut-and-paste) instead of the OS/2 System Editor come up when I double-click on the `CONFIG.SYS` icon from the Drives icon view.

Change the settings for the new editor's icon, using the following steps:

1. Click with the right mouse button on the icon for the Enhanced Editor (or any other editor you choose to use), then click on Open, then Settings.
2. Click on the Association notebook tab to bring up the list of file types to display when using the new editor.
3. Click on the appropriate file type in Available Types to highlight the file type(s) you want to work with, then click on the Add button to add them to the Current Type list.

It's a good idea to add a list of appropriate extensions to use with the file types you added (`*.BAT`, `*.CMD`, `*.DOC`, `*.TXT`, `*.SYS`, etc.). This allows you to double-click on the file icon from its folder and automatically load that file into the default editor. Type the appropriate extension name(s) in the New Name field, then click on Add to add the extensions to the Current Names list.

Note: For the new editor to become the default, remove the Current Types and Current Names from the default editor. Click on the old editor's icon and go into Settings and then Association, as above. Click on Remove to remove all the Current Types at the top of the Association screen, then click on Remove to remove all the Current Names at the bottom of the Association screen.

What can I do when users I support forget their OS/2 Lockup passwords? When the machine is rebooted, it boots back to Lockup, even if the user hasn't chosen this option in the desktop's Settings notebook.

Rebooting to Lockup was an added security feature with OS/2 2.1. You can boot with the OS/2 installation diskette and use the `MAKEINI OS2.INI LOCK.RC` command to resolve this problem.

1. Place the Installation Diskette in drive `A:`.
2. Turn on your computer or press Ctrl + Alt + Del to restart the system.
3. When you see the OS/2 logo screen, remove the Installation Diskette and place Diskette 1 into drive `A:`.
4. Press Enter.
5. When you see the Welcome screen, press Esc to display the command prompt, then remove the diskette from the drive.
6. Change directories to the OS2 directory on the drive where your OS/2 installation resides.
7. Reset the Lockup password by modifying the existing user `INI` file (no other customization will be altered) by typing `MAKEINI OS2.INI LOCK.RC`.
8. Press Enter, then wait for the successful completion message.

   Note: If you get an "`Invalid OS2.INI file`" or "`Error in INIfile`" error, don't panic. Remove the read-only attribute from the `OS2.INI` file by typing `ATTRIB OS2.INI -R` and pressing Enter. Then repeat step 7. You can reset the `OS2.INI` file to read-only by typing `ATTRIB OS2.INI +R` and pressing enter.
9. Restart your system.

I received the following message after I clicked on the Edit tab in the Icon Editor:

"`C:\WP!I.ICO is bad, all data is lost, set your TEMP or TMP environment variable to an appropriate directory for icon editing to write TEMP files.`"

What happened?

This message appears when the `\OS2\WP!I.ICO` file has been corrupted or deleted. You will need to do a Selective Install of Personal Productivity, using the following steps:

1. Double-click on the OS/2 System icon.
2. Double-click on the System Setup icon.
3. Double-click on the Selective Install icon.
4. Click on the OK tab.
5. Click on the box next to Tools and Games, then click on More.
6. Click on Personal Productivity to place a check mark in the box. This should be the only box with a check mark in it. Remove all other check marks by clicking on the boxes.
7. Click on the OK tab.
8. Click on Install.

This will begin the Selective Install process. Follow the prompts to insert installation diskettes.

Can I have the icons on my OS/2 desktop sort automatically instead of my having to click on Arrange all the time?

You can have the icons automatically sorted by activating a feature called "Always maintain sort order."

1. With the left mouse button, click on a blank spot on your desktop to display the desktop pop-up menu.

2. Open the Settings notebook and click on the Sort tab.
3. Click on the box next to "Always maintain sort order" to put a check mark in the box.

Your desktop icons will now be automatically sorted any time a change is made.

My OS/2 system booted to a blank screen (no desktop). I need to edit the CONFIG.SYS file, but with no desktop, there is no editor available. How can I edit the CONFIG.SYS file?

Insert the OS/2 Installation Diskette into drive A: and turn on the computer (use Ctrl + Alt + Del if your computer is already turned on). When prompted, remove the Installation Diskette and insert Diskette 1. Press the Esc key when the Welcome screen appears. At the command prompt, type the following command:

```
COPY C:\AUTOEXEC.BAT C:
  \STARTUP.CMD
```

Remove Diskette 1 and press Ctrl + Alt + Del. When the STARTUP.CMD window appears, place the mouse pointer anywhere in the STARTUP.CMD window and click once with the left mouse button (ignore any SYS error in the STARTUP.CMD window).

Now you can type E CONFIG.SYS to bring up the editor program and make your changes to the CONFIG.SYS file.

Note: This procedure only works if you are able to get past the OS/2 logo screen.

I would like to open more than one session of my applications (e.g., Word for Windows or PageMaker) without having to make a copy of that application's program icon. Is that possible?

Yes, this can be done by adjusting one setting in the Settings notebook for your application. Click on the Window tab in the Settings notebook. Under the "Object open behavior" box, click on "Create new window." Now, if that application is running, you will be able to start a second application from that same icon.

I keep getting the following three error conditions. Please help!

- "SYS1477: Warning! The partition containing the SWAPPER.DAT file is full. You may lose data. Do not ignore this message!" **(This message appears when I try to open an application.)**
- "Disk Error: The INI file cannot be written to disk. The updates are being held to automatically retry the operation but will be lost if the system is shut down before correcting the problem." **(This message appears on my desktop.)**
- **A message box full of binary symbols and garbage appears on my desktop.**

These messages are caused by a full OS/2 partition on the hard drive. Remove any unnecessary files to make room on the drive and/or relocate the SWAPPER.DAT file to another partition.

1. To move the SWAPPER.DAT file to another partition, edit the SWAPPATH= line in the CONFIG.SYS file to change to a path and partition with more available space.
2. Close all applications and perform a proper shutdown.
3. Reboot from the OS/2 Installation Diskette.
4. When prompted, insert Diskette 1 and press Enter.
5. At the Welcome to OS/2 screen, press Esc.
6. Switch to the OS/2 partition on the hard drive.
7. Find the original SWAPPER.DAT file (it should be in the OS2\SYSTEM\ subdirectory) and delete it by typing DELETE SWAPPER.DAT. Then press Enter.
8. Reboot the system. A new SWAPPER.DAT file is created in the new location.

When I type MAKEINI OS2.INI INI.RC or MAKEINI OS2SYS.INI INI.RC, I get an "Error in INI File" message. What is happening?

This problem occurs because the read-only bit on the INI file is not being correctly switched off during shutdown. The next time you receive this error, type ATTRIB -R OS2.INI and press enter. Then rerun the MAKEINI commands.

When I try to access an OS/2 window or full screen session, I get the following message:

"Cannot start OS/2 window (full screen)...Make sure the path for the program is correct and the file is an OS/2 or DOS file. There might not be enough memory available to run the program or the file may be locked by another process. Do you wish to modify the settings for the object?"

What can I do to fix this?

This problem seems to be caused by duplicate OS2_SHELL statements in the CONFIG.SYS file. The problem is generally solved by removing the duplicates from the CONFIG.SYS file and rebooting.

1. Make a copy of your current CONFIG.SYS file as a backup by typing COPY CONFIG.SYS CONFIG.BAK.
2. Open the System Editor in the Productivity folder.
3. Bring in the CONFIG.SYS file from the root directory.
4. Using the Edit tool, choose the Find utility and search on OS2_SHELL.
5. Leave the first SET OS2_SHELL=X:\OS2\CMD.EXE line in the file but remove all following SET OS2_SHELL= statements.
6. Save the modified CONFIG.SYS.
7. Shut down the system and reboot.

I installed an S3-based video board on my system. Since then, when I open a DOS window, it opens to the normal size, but then shrinks down to about a quarter of the regular size and stays completely black. What's causing this problem and how can I fix it?

You need to change the DEVICE= statement in your CONFIG.SYS file from VVGA.SYS to VSVGA.SYS.

1. Open an OS/2 full-screen session.
2. Type E CONFIG.SYS, then press Enter to edit the file.

3. Change `DEVICE= C:\OS2\MDOS\VVGA.SYS` to `DEVICE= C:\OS2\MDOS\VSVGA.SYS`.
4. Save the `CONFIG.SYS` file and restart your system.

Can I navigate in OS/2 without a mouse?

OS/2 can be navigated using the keyboard. Each key has a particular function, allowing you to fully operate OS/2 without a mouse. However, we highly recommend you use a mouse. See Figure 1 for a list of keystrokes and the resulting functions.

Keystroke	Function
Alt + Backspace	Reverse the most recent action requested and performed.
Alt + down arrow	Display a hidden list in a field that has a down arrow key in a box at the right. Or, in a notebook, move the cursor to the notebook page from either the notebook tab or either arrow at the bottom of the page.
Alt + Esc	Switch a DOS program between a window and a full screen.
Alt + Home	Switch a DOS program between a window and a full screen.
Alt + Insert	Create a new object and place it in the OS/2 clipboard.
Alt + Page Down	In a notebook, move the cursor to the next page.
Alt + Page Up	In a notebook, move the cursor to the previous page.
Alt + up arrow	In a notebook, move the cursor from the notebook page to either the notebook tab or as an arrow at the bottom of the page. Also, display the pop-up menu for the desktop by pressing Alt + up arrow, releasing both keys, then pressing Shift + F10.
Alt + F4	Close the active window.
Alt + F5	Return the window to the size and location it was before you hid or maximized the window.
Alt + F6	Move the cursor between windows that are associated; e.g., move between an active program window and the help window for that program, or between the Master Help Index and the help window.
Alt + F7	Move the active window to a different window.
Alt + F8	Move the active window with the arrow keys.
Alt + F9	Remove the active window and all windows associated with it from the screen (the windows are hidden).
Alt + F10	Enlarge the active window to its largest possible size.
Arrow keys	Move the cursor left, right, up, or down to the next choice.
Backspace	In an entry field, delete one character to the left of the cursor.
Ctrl + End	Move the cursor to the bottom right position in the field in which the cursor is located.
Ctrl + Home	Move the cursor to the top left position in the field in which the cursor is located.
Ctrl + Insert	Place a duplicate of the selected text or graphic into the OS/2 Clipboard (copy).
Ctrl + left arrow	Move the cursor to the beginning of the word to the left of the cursor.
Ctrl + Page Down	Scroll the contents of a window right one page to display information to the right of the visible window area.
Ctrl + Page Up	Scroll the contents of a window left one page to display information to the left of the visible window area.
Ctrl + right arrow	Move the cursor to the end of the word to the right of the cursor.
Ctrl + Tab	In a notebook or from an entry field, move the cursor to the next field.
Ctrl + / (forward slash)	Select all items.
Ctrl + \ (backward slash)	Deselect all items.
Delete	In an entry field, delete the character to the right of the cursor.
Down arrow	Move the cursor down (if possible).
End	Move to the last choice in a menu. In an entry field, move the cursor to the end of the line.
Enter	Perform the default action that applies to cursor location. In text, start a new line. You can use Enter on the numeric keypad to perform the default action but not to start a new line.
Esc	Remove the window without sending any changes. Stop a direct manipulation operation. Remove a menu that is displayed below the menu bar choice, but keep the menu bar choice selected.
First letter	Move to and select (from a list) the next choice that starts with the letter you type. The cursor or mouse pointer must be within the boundaries of the list.
F1	Display specific help for the active window. The help is related to the position of the cursor or the action you can perform in the window.

Figure 1. OS/2 Keystrokes and Resulting Functions

Keystroke	Function
F5	Update the contents of the active window (refresh).
F6	Move from one window panel to another in a window that is split to display more than one view of an object.
F10	Move the cursor to or from the menu bar.
Home	Move the cursor to the left choice in a group of choices. In an entry field, move the cursor to the beginning of the line.
Left arrow	Move the cursor left, if possible.
Page Down	Scroll the contents of a window down one page to display information below the visible window area.
Page Up	Scroll the contents of a window up one page to display information above the visible window area.
Print Screen	Print the contents of the window in which the mouse pointer or cursor is located.
Right arrow	Move the cursor right, if possible.
Shift + Delete	Remove the selected text or graphics from the active window and place it in the OS/2 clipboard (cut).
Shift + down arrow	Extend selection from the current character position to the same position on the line below.
Shift + left arrow	Extend selection one character to the left of the cursor.
Shift + right arrow	Extend selection one character to the right of the cursor.
Shift + up arrow	Extend selection from the current position to the same position on the line above.
Shift + End	Select from the cursor position to the end of the field.
Shift + Esc	Switch to or from the title bar icon.
Alt + spacebar	Switch to or from the title bar icon.
Shift + Home	Select from the cursor position to the beginning of the field.
Shift + Insert	Copy the contents of the OS/2 clipboard into an object at the specified location (paste).
Shift + Page Down	Extend the selection down one page.
Shift + Page Up	Extend the selection up one page.
Shift + Tab	In a notebook, move the cursor to the previous field. In an entry field, move the cursor to the previous tab position.
Shift + F8	Start or stop selecting more than one object.
Shift + F10	Display the pop-up menu for the object on which the cursor is located. Display the pop-up menu for the desktop by pressing Alt + up arrow and releasing both keys. Then press Shift + F10.
Spacebar	Select or deselect the choice on which the cursor is located.
Tab	Move the cursor to the next field (entry field, check box, list spin button, slider, first radio button, or first push button). In an entry field, move the cursor to the next tab stop.
Underlined letter	Move the cursor to and select a choice by typing the underlined letter, e.g., in the menu bar or a pop-up menu.
Up arrow	Move the cursor up, if possible.
Alt + Esc	Switch to the next open window or full screen session.
Alt + Home	Switch a DOS program between a window and a full screen.
Arrow keys	Move the cursor left, right, up, or down to the next object.
Ctrl + Alt + Del	Restart the operating system.
Ctrl + Esc	Display the window list.
Enter	Perform the default action, according to where the cursor is located.
Print Screen	Print the contents of the screen when the mouse pointer or cursor is in an area of the screen that is outside all windows and icons and no object is selected. To remove the selection of all objects on the screen, click the mouse button in an area of the screen that is outside all windows and icons.

Figure 1. OS/2 Keystrokes and Resulting Functions (continued)

USE A LITTLE RESTRAINT WITH YOUR KIDS.

Sometimes you just gotta put kids in their place. And when you're on the road, that place is buckled in their own safety belts, and firmly. Do this, and your kids will be more than ready for the long road ahead of them.

YOU COULD LEARN A LOT FROM A DUMMY.
BUCKLE YOUR SAFETY BELT.

For more information, call the Airbag & Child Safety Hotline: 800-424-9393 (in the U.S.) or 202-366-0123 (in Washington, D.C.)

Corrective Service Information

Figure 1 shows maintenance release levels for the listed products. This information is effective as of March 31, 1994. To order all service packages–except for the OS/2 2.0, OS/2 2.1, and OS/2 2.0 Toolkit ServicePaks–call IBM Software Solution Services at (800) 992-4777. For the OS/2 2.0 ServicePak (XR06100), OS/2 2.1 ServicePak (XR06200), or the IBM Developer's Toolkit for OS/2 2.0 ServicePak (XR06110) on diskettes or CD-ROM, call (800) 494-3044. Most OS/2 service packages are also available electronically from the following sources:

- **OS/2 Bulletin Board Service (BBS)**: Once connected, select Option 2. (Corrective services are also listed under the General category on the IBMLink BBS.) To subscribe to the OS/2 BBS, call (800) 547-1283.
- **IBM Personal Computer Company (PCC) BBS**: Call (919) 517-0001. Service packages are located in Directory 4.
- **CompuServe**: Download service packages from the IBM OS2 FORUM library (GO IBMSERV).
- **Internet**: Do an anonymous FTP from software.watson.ibm.com. Service packages are located in the `/PUB/OS2` directory.

–Arnie Johnson, IBM Corporation, Austin, Texas

Product/Component	Release	CSD Level	PTF Number	Change Date	Comments
OS/2 Standard Edition	1.3	XR05150	XR05150	2-10-93	
OS/2 Extended Edition	1.3	WR05200	WR05200	5-12-93	WR05200 replaces WR05050, which can no longer be ordered on diskette.
OS/2	2.0	XR06100	XR06100	9-1-93	XR06100 replaces XR06055.
OS/2 2.10 ServicePak	2.1	XR06200	XR06200	3-1-94	This package is not for OS/2 2.1 for Windows.
OS/2 Toolkit	2.0	XR06110	XR06110	9-1-93	
	1.3	XR05053	XR05053	3-23-92	
OS/2 LAN Server/Requester ServicePak	2.0	IP06030	IP06030	4-25-93	
Service Requester Fault Tolerance User Profile Management (UPM)	3.0	IP07001	IP20086	10-7-93	
LAN Server/DOS LAN Requester SelectPak	3.0	IP07003	IP07003	7-28-93	Diskettes not available. Download from one of the BBSs.
LAN Server HPFS	3.0	IP07005	IP07005	11-2-93	IP07005 requires IP07001 be applied to system. IP07005 is not for LAN NetView users. Diskettes not available. Download from one of the BBSs.
LAN NetView Prerequisite	1.0	IP07006	IP07006	11-8-93	IP07006 is a prerequisite before applying LAN NetView. It contains IP07005 plus fixes for OS/2 2.x and DB2/2. Requires WR07010 applied with DB2/2 and XR06100 applied with OS/2 2.0. Diskettes not available. Download from one of the BBSs.
OS/2 Network Transport Services/2 SelectPak	1.0	WR07020	WR07020	10-11-93	Diskettes not available. Download from one of the BBSs.
OS/2 LAN Adapter and Protocol Support SelectPak	2.0	WR07020	WR07020	10-11-93	Diskettes not available. Download from one of the BBSs.

Figure 1. Maintenance Release Levels

Product/Component	Release	CSD Level	PTF Number	Change Date	Comments
OS/2 Extended Services Database Manager ServicePak	1.0	WR06035	WR06035	11-18-93	Supersedes WR06001, WR06002, WR06003, WR06004, WR06014, and WR06015.
Database Manager DB2/2	1.0	WR07015	WR07015	1-19-94	Supersedes WR07010 and WR07012. Diskettes not available. Download from one of the BBSs.
DDCS/2	2.0	WR07016	WR07016	1-19-94	
Extended Services Communication Manager ServicePak 3270, 5250 Emulation CM SNA	1.0	WR06025	WR06025	11-29-93	
System Performance Monitor (SPM/2) ServicePak	2.0	WR06075	WR06075	12/10/93	
Communications Manager/2 Version 1.01 ServicePak	1.00	WR06050	WR06050	6-11-93	Available only on diskette.
DOS	4.0, 4.01	UR35284	UR35284	9-26-91	
	5.0	UR37387	UR37387	9-22-92	
PC/3270	1.01	2012	IP00832	11-21-91	
PC/3270 (DOS)	2.0	3005	IP00874	3-29-93	
	3.0	7002	IP20006	9-27-93	
PC/3270 (Windows)	2.0	4002	IP00841	4-17-92	
	3.0	6004	IP20014	10-22-93	
PC/3270 Emulation, Entry	1.22	2201	UR29500	3-16-90	
	2.0	N/A	N/A	N/A	
PC LAN Program	1.33	3301	IP00249	5-15-90	
	1.34		IP00755	6-26-91	
C Set/2 Compiler	1.0	CS00050	XR06150	6-29-93	
C Set C++ Compiler	2.0/2.01	CTC0002	XR06102	12-15-93	
Workstation Program (WSP)	1.12		UR23217	1- 14- 89	
TCP/IP for OS/2 Base Kit	2.0	UN50382	UN50382	12-31-93	
TCP/IP for OS/2 Applications	2.0	UN52840	UN52840	12-31-93	
TCP/IP for OS/2 DOS Box Kit	2.0	UN50383	UN50383	12-31-93	
TCP/IP for OS/2 Extended Networking	2.0	UN52906	UN52906	12-31-93	
TCP/IP for OS/2 Programmer's Toolkit	2.0	UN54155	UN54155	12-31-93	
TCP/IP for OS/2 Domain Name Server	2.0	UN54143	UN54143	12-31-93	
TCP/IP for OS/2 Network File System	2.0	UN52386	UN52386	12-31-93	
TCP/IP for OS/2 X-Windows Server	2.0	UN52841	UN52841	12-31-93	
TCP/IP for OS/2 X-Windows Client	2.0	UN52842	UN52842	12-31-93	

Figure 1. Maintenance Release Levels (continued)

Product News

IBM Advanced Server for Workgroups

If you need a low-cost introduction into workgroup computing for departments or workgroups in a local area network (LAN) environment, supporting a server node and six client workstations running either OS/2 2.x or DOS/Windows 3.0 or later, consider the IBM Advanced Server for Workgroups product.

Advanced Server for Workgroups contains the following software components:

- IBM OS/2 2.11–The industry's leading 32-bit, multitasking operating system
- IBM OS/2 LAN Server 3.0 Advanced–A comprehensive server that provides industrial strength LAN capabilities
- Lotus Notes 3.0–The number one groupware application that allows users to collect, organize, and share information over LANs and dial-up lines
- IBM System Performance Monitor/2 2.0–An integrated set of performance data collecting, reporting, and analyzing functions that enable performance management.

An easy-to-use installation guide gives administrators and end users a step-by-step approach for installing and running the components on the LAN. Use either the pre-configured defaults or choose selected options for a custom installation.

Advanced Server for Workgroups offers exceptional price performance by combining the industry's leading PC information-sharing technologies and products with LAN resource sharing, management, and control. It also provides a powerful collaborative client/server installation for distributed document sharing, messaging, and application integration/development in either desktop or mobile environments.

IBM Ultimedia Mail/2 Kit for TCP/IP 2.0 for OS/2

The IBM Ultimedia Mail/2 Kit (UltiMail) for TCP/IP 2.0 for OS/2 is IBM's new standards-based OS/2 multimedia electronic mail product for transmission control protocol/internet protocol (TCP/IP) networks, including Internet.

UltiMail is an OS/2-based multimedia authoring, sending, and receiving electronic mail system that includes audio, images, video, and binary attachments for TCP/IP networks.

With UltiMail, users can create, receive, and send a rich set of media, including:

- Text
- Enriched text (bold, underline, italics, etc.)
- Images (BMP, GIF)
- Audio (Wave, MIDI)
- Simple video clips (TV commercial-length)
- Binary attachments (programs, spreadsheets, word processor documents, other files)

Highlights

- Provides access from anywhere through object-oriented client/server programming
- Enables scalability from LAN to WAN without costly gateways
- Supports native networking transport across heterogeneous TCP/IP networks
- Uses Multipurpose Internet Mail Extensions–RFC 1521 (MIME) protocols to assure interoperability with other MIME and non-MIME packages
- Interfaces with IBM Speech Client/2 to convert dictated messages into standard text that can be sent using UltiMail
- Contains an easy-to-use graphical user interface to implement mail objects (folders, address books, and envelopes) which behave like and resemble objects that exist in the more traditional paper world
- Automates mail processing through REXX macro extensions

IBM NetView Network Planner/2

This OS/2 planning tool manages enterprise-wide inventory and assets of networks, systems, and the resources with them. NetView Network Planner/2 includes:

- Data model support for software, equipment, features, locations, circuits, organizations, people, and financial information using SQL database technology
- An easy-to-use tool for displaying and changing planning information
- Graphical support for easily visualizing complex logical and physical relationships

IBM NetView Network Planner/2 also provides a facility for exchanging information with the Resource Object Data Manager (RODM) of NetView Version 2 to more effectively manage the network from a single point and to supply data to Trouble Ticket/6000, reducing duplicate data entry. Samples are provided to prime the IBM NetView Network Planner/2 database from the databases of products such as IBM LAN Network Manager and IBM LAN NetView Management Utilities.

Highlights

IBM NetView Network Planner/2 allows users to:

- Define network and system resources, storing them on an administrative database to track inventory and assets

- Collect and store resources' connectivity data and viewing attributes
- Accept data from and share data with other databases using standard SQL import and export functions
- Generate a file to load the NetView RODM
- Import data from existing RODM load files to reduce redefinition of existing RODM objects
- Manipulate and visualize resource information (network and system) using a graphical user interface

Screen Magnifier/2

Screen Magnifier/2 is a software product that lets visually impaired users interact more easily with personal computers.

Screen Magnifier/2 enlarges applications running under IBM's powerful OS/2 2.1 operating system. Now users can magnify OS/2, DOS, and Windows applications running under OS/2 2.1. The magnification level ranges from two to 32 times the normal size, so users can make the words and images on the screen the exact size they need.

Screen Magnifier/2 has other special features, including:

- A "reading mode" that pans the cursor along the lines of magnified text. The reading speed can be controlled with the touch of a finger
- Screen colors that can be reversed for greater contrast
- Focus tracking to ensure that the mouse pointer always moves to the area of interest; if an error message pops up on another part of the screen, users will see it immediately
- A locator that lets users see just where the magnified window is on the system

Screen Magnifier/2 is the latest addition to the IBM Independence Series of products providing solutions for those with a wide range of disabilities.

IBM Auto LANStreamer MC 32 Adapter

IBM Auto LANStreamer MC 32 Adapter is a high-performance token-ring adapter designed to operate with any personal computer that supports the Micro Channel (MC) bus interface. Featuring a new, performance-enhanced LANStreamer chip set coupled with an MC chip, the Auto LANStreamer MC 32 Adapter expands the LANStreamer family and exploits the high-throughput performance to provide media-speed capabilities for MC products.

This adapter is particularly well suited for servers and high-end workstations, especially workstations running I/O-intensive applications on a network. The Auto LANStreamer MC 32 Adapter supports 32-bit streaming data, uses a 32-bit MC bus slot, and requires a full slot in the MC machine.

Additional features and support include:

- Operation at either 16 million or 4 million bits per second (Mbps) over unshielded twisted pair (UTP) or IBM Cabling System media via a single connector
- External LEDS that provide the user with a visual ring status without interruption to normal operation.
- New usability enhancements, including automatically determining and setting the correct ring speed with minimal user intervention
- Onboard UTP filters coupled with the shielded twisted pair (STP) connection that improve usability (with UTP) without requiring an external filter and allow easy movement within the customer's environment to adapt to either UTP or STP wiring schemes
- Device drivers for many of today's leading network operating systems, including OS/2 LAN Server and NetWare
- Network Device Interface Specification (NDIS) capabilities provided by the device drivers to simplify migration of new applications
- Driver support for addressing above the 16 MB range to allow support for applications in growing customer environments

The IBM Auto LANStreamer MC 32 Adapter provides hardware support for full-duplex token-ring technology. Software support for full-duplex requires no hardware modifications to the IBM Auto LANStreamer MC 32 Adapter.

IBM Token-Ring 16/4 Credit Card Adapter II

The IBM Token-Ring 16/4 Credit Card Adapter II is the next generation of IBM's Personal Computer Memory Card International Association (PCMCIA) Type II adapters for token-ring networks. The Credit Card Adapter II complies with PCMCIA standards release 2.1 and offers users the LAN attachment and performance capabilities of standard-sized adapters. The device drivers that operate with PCMCIA card and socket services support OS/2, DOS, and a wide range of network operating systems, LAN transport services, and machines.

The significantly enhanced adapter continues to be compatible with the original adapter's software and hardware.

Highlights

- Single 3-meter cable directly attaches to UTP and STP wired networks, resulting in cost savings and a convenient connection directly into the wall outlet.
- UTP support has an on-card filter that eliminates the cost and hassle associated with ordering and using a special cable with a filter.
- Remote Program Load (RPL) enables users to centrally maintain software and to secure LAN access.
- Suspend/resume support by the adapter's OS/2 NDIS driver eliminates the time and inconvenience of doing a power-on OS/2 reboot sequence instead of the simple suspend/resume operation.
- A new native mode driver equivalent to LAN Support Program (LSP) support for IEEE 802.2 and NetBIOS applications is provided at no extra cost and can reduce DOS conventional memory requirements.
- The adapter connector is more rugged, easier to insert, and locks securely.
- Improved documentation and a new install program help users install the adapter more easily into their hardware and software environment.
- A new multiple packaging offering (five adapters with one copy of supporting material) provides an appealing price alternative for users ordering larger quantities.

IBM RouteXpander/2 Product Family

The IBM RouteXpander/2 family and IBM X.25 Xpander/2 Version 1.0 are new LAN/WAN programs that run on OS/2. The RouteXpander/2 family consists of two versions of the RouteXpander software plus three optional support packages which operate with RouteXpander Version 2 only. Version 1.0.1 supports both transparent and source-route bridging; Version 2 supports source-route bridging only. The optional packages are:

- RouteXpander LNM Support/2, which allows the LAN Network Manager to manage the RouteXpander/2
- RouteXpander X.25 Support/2, which allows the RouteXpander/2 to use up to 200 X.25 virtual circuits over a physical link
- RouteXpander Multiport Support/2, which can support up to two local area and eight wide area connections in varying combinations

RouteXpander/2 is a low cost, 2-port multi-protocol router and bridge running as communication software on a standard OS/2 system, supporting frame relay and point-to-point connections. It can support either Ethernet or token-ring LANs and uses a high-speed serial adapter to connect to frame relay networks or the other partner in a point-to-point connection.

RouteXpander/2 transports TCP/IP, SNA/APPN, NetBIOS, and IPX protocols. It uses standard frame formats and supports RFC 1294 to internetwork other RouteXpander/2 systems: IBM 6611, IBM 3745/NCP, IBM 3172, IBM Frame Relay Token-Ring Bridge, and other routers that support RFC 1294 (such as Wellfleet routers). It can route to multiple destinations using a single physical link to a frame relay network.

The RouteXpander/2 is best suited for small sites needing low-cost routing and bridging, having OS/2 installed, and using frame relay at medium speeds (56 Kbps to 128 Kbps). Both NetWare and LAN Server configurations are supported. In these configurations, the RouteXpander/2 can provide the total routing and bridging function, internetwork with other routers and bridges, or connect into a hierarchy of routers by acting as a "feeder node" to a larger router.

With the new X.25 Xpander/2 program, you can expand existing X.25 networks or build new ones at a low cost. Working in tandem with existing OS/2 products (such as TCP/IP for OS/2), the X.25 Xpander/2 can transport existing OS/2 protocols across public or private X.25 networks. It features:

- X.25 switching/routing at speeds up to 1.544 Mbps
- Support for up to 2000 virtual circuits over a physical link
- Application-level data compression
- Address substitution/resolution among dissimilar X.25 networks
- Support for up to 32 physical links
- SNMP network management

The X.25 Xpander is best suited for small sites that want low-cost routing and bridging over an X.25 network and that have OS/2 installed.

IBM Personal Systems

These back issues of *Personal Systems* are available to provide valuable information. Indicate the desired quantity for the issues you want to order and complete the information on the following page.

___ March/April 1994

If I Only Had a Brain
Speech Recognition Products Untie Your Hands
Telecommuting in the '90s
Point of View: Not Just Another Database Article
Professional Certification Program from IBM
Celebrate the Past on Your Trip Back to the Future!
OS/2 2.1 Performance Tuning Tips–Part II
PC File Systems
NetWare 4.01 for OS/2: Features and Installation
NetWare Requester for OS/2, V2.01: Features and Installation
What's New in Novell NetWare 3.12?
LAN Analysis Using IBM's Data*LANce* Network Analyzer
NetWare Questions and Answers

___ January/February 1994

Plan, Plan, Plan Your NetWare 4.01 Network
LAD/2 in the LCU and NetView DM/2 Environments
Easy Setup of CID Code Servers
Managing Token-Ring Bridges with IBM's LAN Network Manager
IBM DCE for OS/2 Multiuser Application Performance
Performance of Key Functions in DCE for OS/2
VisualAge: Its Features and Virtues

___ November/December 1993

IBM PC-DOS 6.1: More Features than MS-DOS 6.0
SystemView Information Warehouse DataHub
Developing DataHub Tools
Using MMPM/2 to Create Multimedia Applications
Advanced Client/Server Computing Using the IBM ThinkPad
Communications Manager/2: A New Look
Overview of IBM NetWare 4.01
OS/2 2.1 Performance Tuning Tips

___ September/October 1993

IBM PSP's LAN Systems Solutions
An Introduction to PCMCIA
PCMCIA Software: The Key to Compatibility
OS/2 Support for PCMCIA Memory Cards
Improving Remote Initial Program Load Performance
Installing and Configuring CM/2 1.0
Writing CID-Enabled Applications
Integrating LAD/2, CM/2, and DB2/2 with IBM LAN NetView Start
DB2/2–DB2 Comes to the Desktop

___ July/August 1993

OS/2 2.1–Everything You Wanted It to Be and More
Using REXX to Customize the Workplace Shell–Part II
Client/Server Application Development with OS/2 and CICS/ESA
Upgrading to OS/2 LAN Server 3.0–Advanced
Developing OS/2 LAN Server Services
PCMCIA PC Cards Provide Expandability and Network Interfacing
Using the IBM ThinkPad with OS/2 and CM/2

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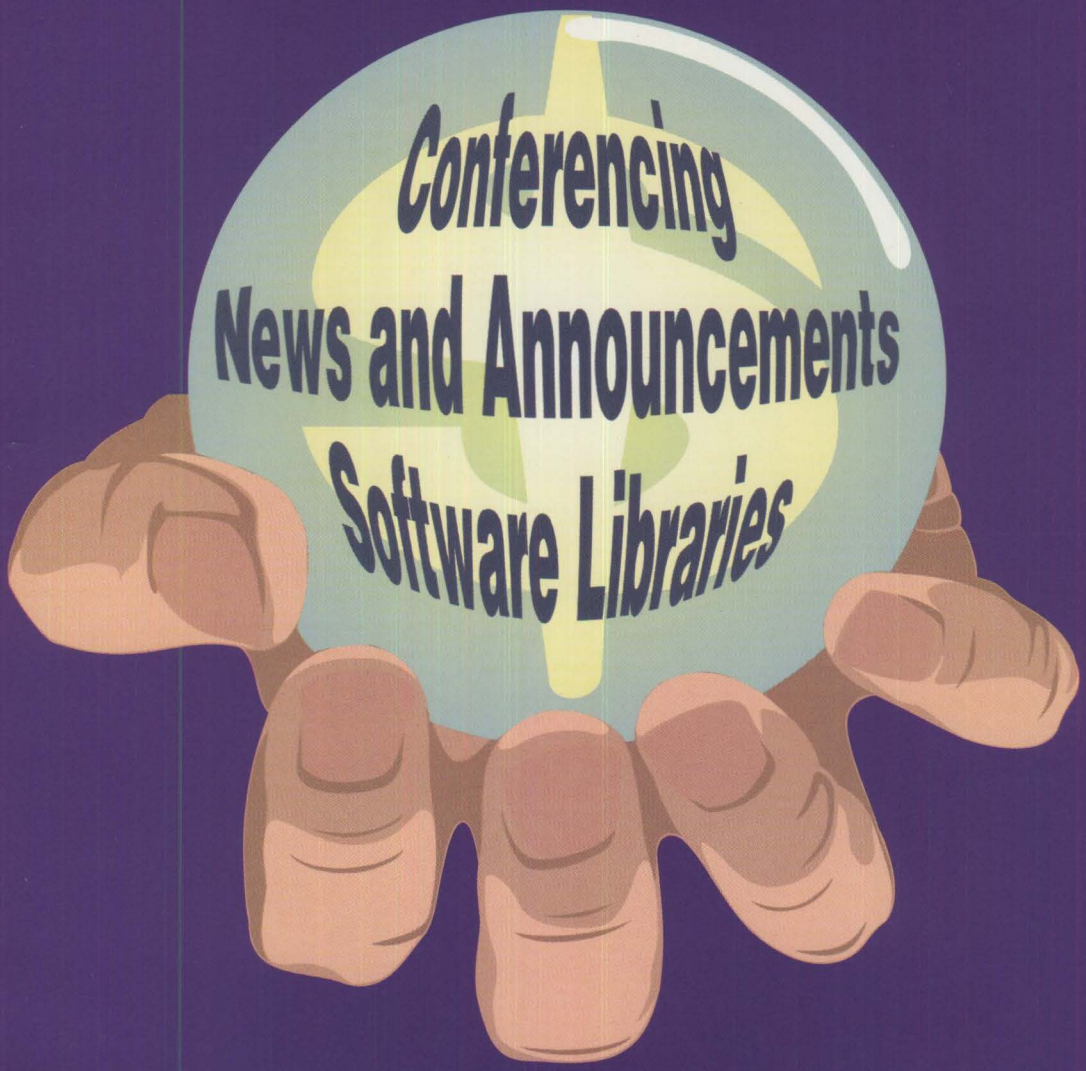

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Even a *free* memory manager may not be a bargain—especially if it can't give you all the memory you need.

Introducing QEMM 7 The Memory Manager Worth Paying For

The newest version of QEMM, version 7, pioneers new ways of using the critical area between 640K and 1024K. It optimizes this area, taking into account the many drivers that need more memory at start-up than when running; instantly calculating millions of possible memory configurations to find still more memory for your applications, TSRs and utilities to use.

Instant Riches

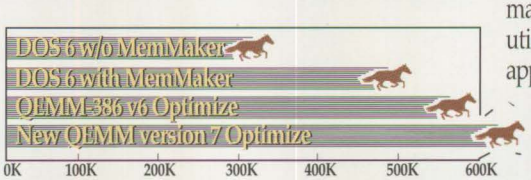
What does more memory mean in a practical sense? Simply that your DOS and MS Windows programs run faster, smoother and more reliably. It means you can continue to add valuable utilities, drivers, TSRs and new capabilities to your PC. Whether it's workhorse drivers like LAN utilities and fax drivers; productivity-enhancers like disk caches and disk compressors; or fun and exciting capabilities like sound boards, CD ROM drivers, graphics tablets, etc. The better your memory is managed, the more versatility and flexibility your PC will have. QEMM 7 lets you have it all without fear of 'out of memory' messages or crashes.

DOS 6 Giveth; DOS 6 Taketh Away

The best feature of new DOS 6 is the stable of utilities it includes. Trouble is, they all eat up memory. DoubleSpace file compression needs 43K, Vsafe anti-virus needs 7-45K, Smartdrv disk cache needs 28K and even Undelete takes 10-14K as a resident program. Using MemMaker, you could easily lose—not gain—available 'conventional' memory in DOS 6.

New QEMM 7 takes the best of the new multiple configurations gives you the flexibility and ease of setup that you expect. (MemMaker doesn't work well with this important DOS 6 feature.)

How to Look a Gift Horse in the Mouth



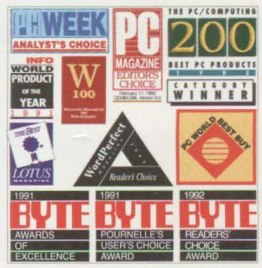
We tested DOS 6 with and without MemMaker and with QEMM 6 and our new QEMM 7 runs away from all of them. See details of test conditions listed below.

DOS 6 features into account, finding ways to cut memory demands for these utilities by up to 80%, ensuring that the all-important memory below 640K is free for your programs. And QEMM 7's seemingly small feature of supporting DOS 6's

Page Frame: the Key to Your Future

There's been a lot of jealous talk about our patent-pending Stealth technology. Nobody else can duplicate its 48-115K gains.

The key to Stealth is its use of a 64K reserved area above 640K called the page frame. Besides being used by Stealth, the page frame lets Lotus 1-2-3 r2.x run larger spreadsheets and WordPerfect 5.x larger documents. It's also used by DESQview for multitasking, Novell NetWare, IBM LAN Server and DECnet for reducing the network driver memory footprint, plus games for fast action. You sacrifice all this when other memory managers turn off the page frame.



Prior versions of QEMM won just about every competition in sight, as well as remaining the #1 best-selling memory manager 5 years straight.

Stealth saves you room to set up your PC with a mouse, CD ROM, sound board, a network such as Novell NetWare, create 8-24K of extra memory for optimal MS Windows performance, use all of DOS 6's memory-hungry utilities and still have more than 630K to run applications smoothly and safely.

Put Your Money on a Winner—QEMM 7

The new and ever more exciting capabilities coming to your PC will all compete for memory with your favorite applications, TSRs and drivers. And that makes QEMM 7 the most vital utility you can own.

Our seventh-generation memory manager is a thoroughbred that helps you get the most out of your PC today and tomorrow.

Quarterdeck

QEMM Users: Low-cost upgrades available from your dealer.

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How we got the chart numbers CPU—486/33 ALR Power/business VEISA machine equipped with 16 megs of RAM and running MS-DOS 6. Comparisons were done using the following memory managers: QEMM 7, QEMM 6.02, MS-DOS 6 MemMaker. In addition to the driver (or drivers) required by each memory manager, the following drivers, DOS resources and programs were loaded for all comparisons: in the CONFIG.SYS file: SETVER.EXE, DOS=HIGH, FILES=20, BUFFERS=10, STACKS=0,0, MVSOUND.SYS, SNDBK12.SYS, SLCD.SYS, DOS SHELL=statement, in the AUTOEXEC.BAT file: VSAFE, MSCDEX, UNDELETE, LSL.COM, NE2000.COM, IPXODI.COM, NETX OR EMSNETX, MOUSE.COM, SMARTDRV.COM, PRTSCCAP.COM.