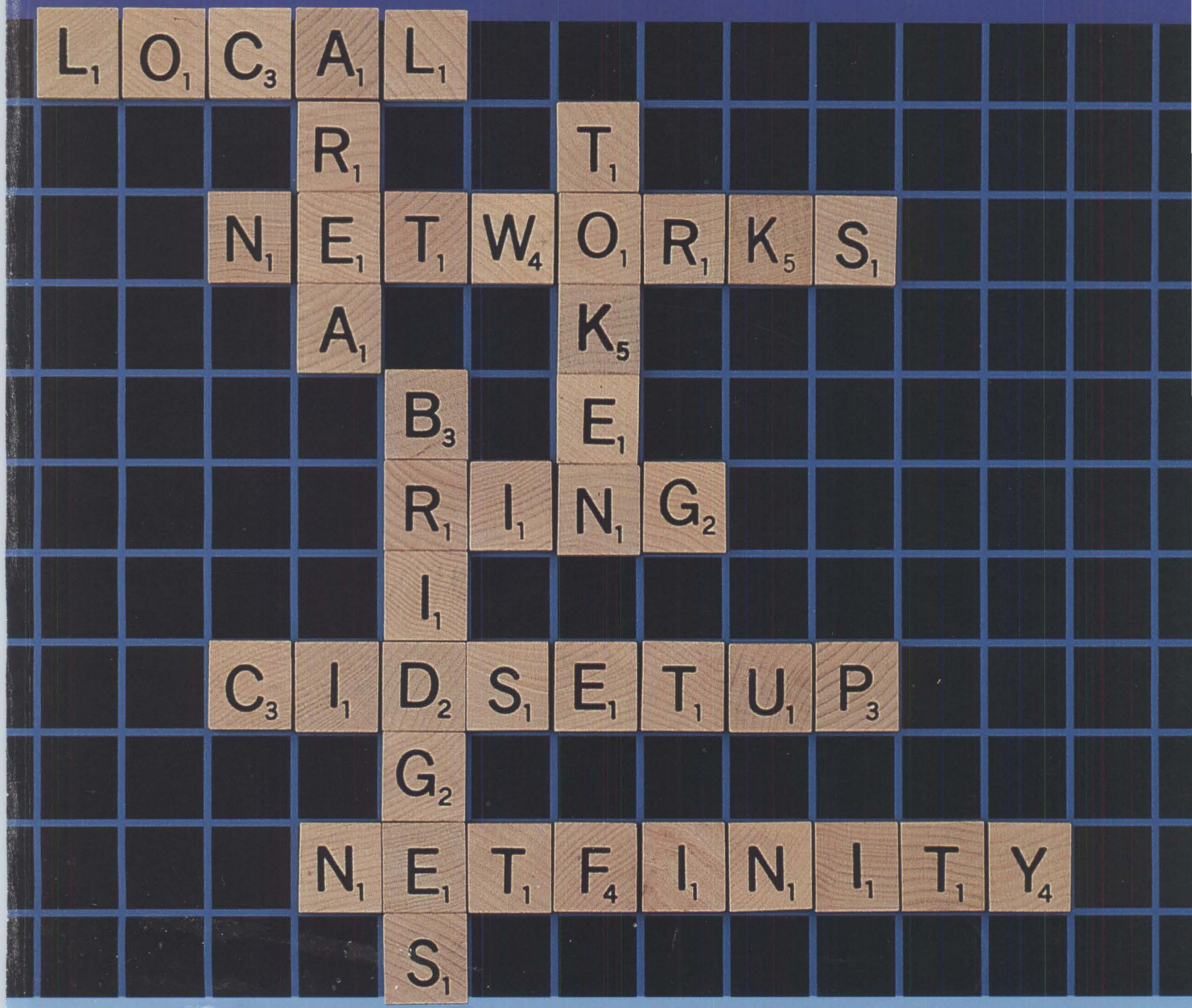
Plan, Plan, Plan Your NetWare 4.01 Network...See page 22

Personal Systems

IBM PERSONAL SYSTEMS TECHNICAL SOLUTIONS

JANUARY/FEBRUARY 1994



Managing Token-Ring Bridges...See page 44

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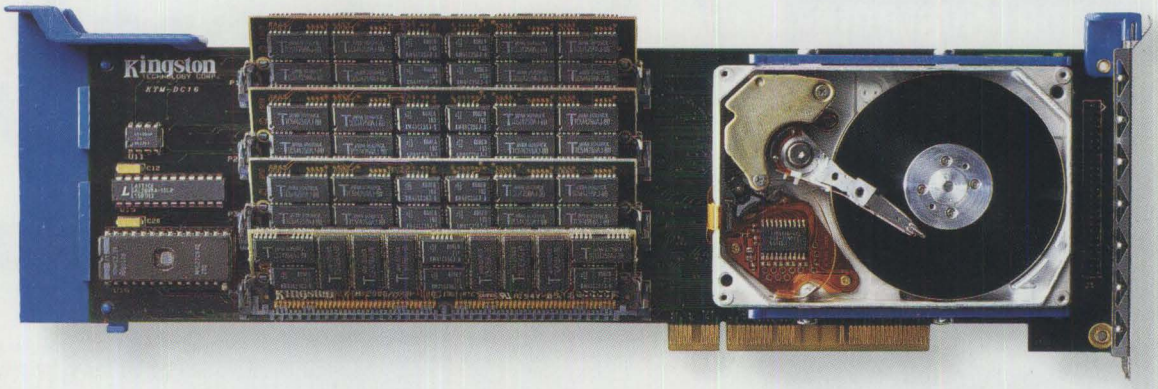

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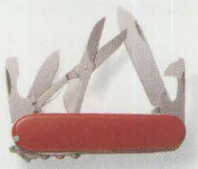

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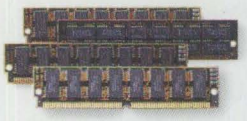

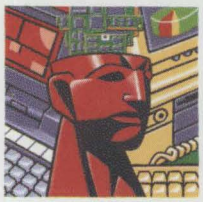

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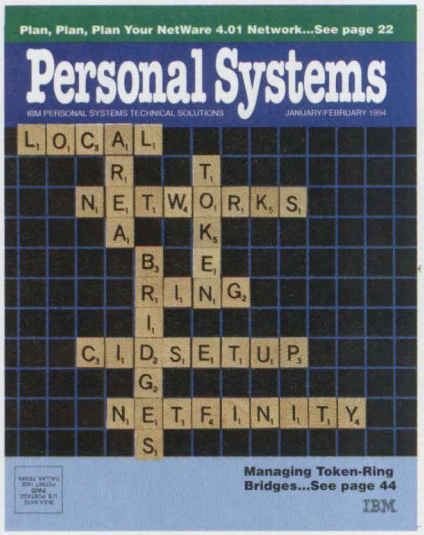

ABOUT THE COVER

How many ways can something be connected? Tiles from Milton Bradley's ever-popular, generation-spanning Scrabble® Brand Crossword Game are used on the cover to illustrate the wealth of networking solutions articles contained in this issue of Personal Systems.

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Much Ado About Multimedia

Why has the release of OS/2* 2.1 done so much to popularize such multimedia buzzwords as frames per second, animation quality video, and scalable resolution? It's because OS/2 2.1 is bundled with an add-on module called Multimedia Presentation Manager/2* (MMPM/2*). MMPM/2 controls and maximizes the allocation of resources such as sound cards, CD-ROM drives loaded with visual images, video cassette recorders (VCR), and high-resolution monitors.

To effectively use MMPM/2, it helps to understand how MMPM/2 addresses the requirements to store and play back multimedia elements such as audio and video clips. This article provides a primer on multimedia and clarifies the capabilities and limitations of MMPM/2 so that you can productively use the new multimedia features in OS/2 2.1.

The Business Case for Multimedia

Multimedia combines the interactivity of a computer with a natural user interface that includes audio, full motion video, and images. Many companies believe that combining multimedia elements with personal computers will help them more efficiently create higher quality communications.

For multimedia to reach its fullest potential within an organization, it must move beyond the limits of stand-alone technology. Multimedia should be considered a corporate asset and a vital competitive edge–both of which may be maximized when multimedia is shared throughout an organization. To reach this level of cooperatively sharing multimedia-enhanced communications, a solid framework is required. OS/2 2.1 is the first operating system designed for personal computers to provide such a foundation. Before describing OS/2's multimedia technology, I'll first outline some background information about the storage requirements for multimedia's audio and video elements so you can better appreciate OS/2's multimedia features.

Multimedia's Big Appetite

Exploiting multimedia's contribution to traditional application software has become possible with the combination of fast microprocessors, high capacity/high speed hard disks and CD-ROM drives, and image compression techniques. All these new technologies are necessary to store and manage large multimedia objects such as sound and video. For example, a 500-page textbook requires 1 MB of storage. Ten fax-quality images require 640 KB, whereas 10 detailed or color images require 75 MB. Five minutes of uncompressed voice quality audio requires 2.4 MB of storage; the same quantity and length of premium quality audio such as compact disc or digital audio requires 52.8 MB.

Multimedia should be considered a corporate asset. . .

Digitized video requires the greatest storage capacity of all data forms. Without compression techniques, practical storage of digital video is impossible. For example, animation quality video requires 147 MB per minute for a one-quarter size video. But with today's compression techniques, this animation quality video can be compressed to 1.44 MB (one 3.5-inch diskette). A two-hour television quality movie can be compressed to about 2 GB of storage. NOTE: Television and high quality videos run at 24 frames per second. There is no significant increase in motion above 30 frames per second (just a perception of greater details such as color). Generally, the minimum speed at which humans can perceive full motion is 15 to 16 frames per second.

Most solutions for delivering large amounts of data, video, and sound to the desktop PC have centered on hardware solutions such as specialized video adapters for playing back the compressed video images. While many of today's popular software-only techniques for compressing and decompressing video may be attractive because of their low cost, the video quality of these algorithms is typically lower than the hardware-based algorithms. Digital video producers have struggled with trading off lower quality and cost of software-only techniques for the higher quality and cost of hardware-assisted video. However, the software-only algorithm landscape has significantly changed with the introduction of the Ultimotion* technology in MMPM/2.

Ultimotion

Ultimotion is IBM's software-only solution for playing back compressed video data. While a video image's frame rate, output resolution, and color characteristics are determined when the video is created, the characteristics of how the video is presented to the viewer depend on the capabilities of the playback platform. In turn, playback capabilities depend on several factors such as the type of microprocessor, display driver, video adapter, and data bandwidth available during playback.

Ultimotion compression algorithms organize the data in a video file so that it can be easily scaled up or down by factors of two as it is decompressed. Furthermore, as the data is decompressed, a sufficiently powered playback system can duplicate the data during output and display the video at four times its original size. This results in an effective output size larger than the input size. In this way, Ultimotion can be scaled down on systems incapable of processing the authored video resolution and scaled up on systems

OS/2 and OS/2

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with more processing capability than the authored video requires.

For example, when using IBM's Ultimotion compression techniques, MMPM/2 provides a standard resolution of 320 x 240 at 15 frames per second. This is currently four times the resolution of typical software-only video solutions such as Video for Windows* from Microsoft*. This minimal Ultimotion movie can be played on at least a 25 MHz 80386* microprocessor and a SuperVGA adapter. Computers with a 33 MHz 80486* microprocessor can display 320 x 240 resolution at 24 frames per second or 640 x 480 resolution at 15 frames per second.

While Ultimotion is scalable at playback time (from 15 to 24 frames per second or higher and from 320 x 240 to 640 x 480 resolution), the amount of information encoded in the data stream (file) when it is created determines scalability. The amount of data initially captured in the data stream determines the maximum playback characteristics that a particular stream can achieve. In turn, the processing capabilities of the playback system determine how much of the data can be processed and presented during playback.

The speed of CD-ROM drives and the amount of data that can be transferred over a local area network (LAN) cable (the network bandwidth) often constrain the playback platform. Full motion video at 15 frames per second seems to be the current limit of popular CD-ROM and LAN technology. The current speed of most CD-ROM drives limits the frames-per-second speed; therefore, it is generally preferable to display smaller frames with lower resolutions as they contain less data than larger frames with higher resolutions.

Since most corporations will probably store video and audio objects on a main file server for delivery through LANs to individual users at their own workstations, the average speed of 15 frames per second for full motion video is consistent with the speed of many current LAN adapters and wiring installations.

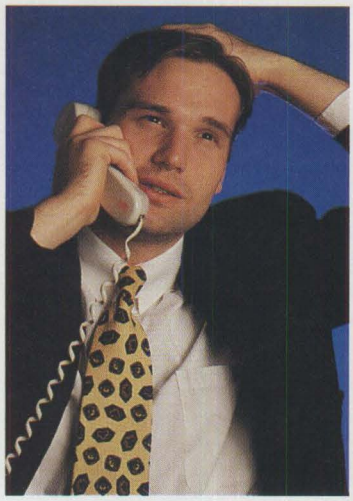
Ultimotion's approach to adapt what the viewer sees during playback to the power of the playback system is a reasonable approach, given the limits of current technology. Furthermore, Ultimotion gives priority to the audio data to ensure that it stays in sync with the video; if necessary, it will decrease the frames-per-second speed.

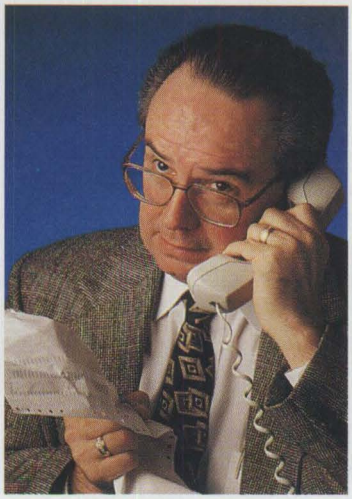
The above-mentioned requirements for effectively using video, sound, images, and text in multimedia systems of the 1990s are well beyond anything ever imagined during the 1980's design of DOS and Microsoft Windows.

Word processors, spreadsheets, and most other popular application software must patiently wait until another application has yielded control of the CPU.

Multimedia applications generally cannot wait for the CPU because the longer the wait, the lower the quality of the multimedia presentation. It would probably be very disconcerting if the sound of a

"I'm still having problems printing mainframe output on my LAN printers."





"Don't tell me I've got to change your printer definitions again."

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tennis racket hitting a ball could not be heard at the same time as the video clip displaying the racket hitting the ball–even if the delay was only a few seconds. The DOS operating system just cannot support this need for multitasking and priority scheduling.

OS/2 is Well Suited to Multimedia

Currently, MMPM/2 is not integrated within OS/2 2.1 in the same way that Windows* 3.1 support is integrated. The main installation procedure for OS/2 2.1 lets you choose whether or not to install Windows 3.1 support along with many other options. However, the installation of MMPM/2 is not managed by the main OS/2 2.1 setup program. A separate multimedia install program, titled `MINSTALL`, must be used. In fact, during the first production run of the OS/2 2.1 retail package, the MMPM/2 extensions to OS/2 2.1 were packaged on diskettes with different colored labels.

MMPM/2's superiority over other multimedia environments is largely derived from several of OS/2's advanced memory management features, described below. These features combine to provide audio and video lip sync, for example, in a manner that surpasses other desktop operating environments.

OS/2 2.1 uses pre-emptive multitasking to simultaneously play back video clips and sound bites, thereby emulating the lifelike quality of TV shows and movies. Pre-emptive multitasking enables the CPU–such as an Intel* 80386 or 80486 chip–to effectively manage playing back both a video segment on the graphics card and a sound segment on the sound card simultaneously. In contrast, cooperative multitasking techniques used by systems such as Microsoft Windows assume that software developers (or video image and sound bite providers) will adhere to the same set of rules for sharing the CPU. Multimedia applications cannot wait patiently on line for their turn to move through the CPU to reach the sound or graphics card.

Protected memory prevents system failures that result when one application corrupts the memory space used by another application. Flat memory addressing allows OS/2 to handle the many megabytes of data that compose the graphic and sound objects associated with multimedia applications. System performance is significantly enhanced when the operating system can juggle large files in one step rather than in smaller chunks.

The OS/2 2.1 environment enables new features, devices, and data objects to be added to the MMPM/2 environment as new hardware and software products come to market.

MMPM/2 Features

MMPM/2 features and functions are categorized in the following three groups: device drivers, mini-applications, and multimedia subsystems.

Device drivers control add-on hardware products such as CD-ROMs or sound and graphic adapters. OS/2 2.1 contains drivers for popular products such as the Creative Labs Sound Blaster*, the Media Vision Pro Audio Spectrum 16* sound cards, and the Hitachi*, NEC*, Sony*, and Toshiba* CD-ROM drives.

MMPM/2's *multimedia mini-applications* allow you to immediately experience some of the potential offered by adding sound, video, and audio to your computer systems. For example, the CD Player enables standard audio compact discs to be played on supported CD-ROM players. The Digital Audio Player allows digitally recorded audio, such as the Sound Bites included in MMPM/2, to be played through one of the supported audio cards.

The *multimedia subsystem* functions provide common services needed by a range of multimedia applications such as those in which you need to ensure that video or audio data is reproduced smoothly on the screen or speaker. One such component is the Media Control Interface (MCI), an easy-to-use description language that allows you to take even more control of multimedia hardware (such as CD-ROM players) than is available through using the mini-applications described above.

Conclusion

In both corporations and homes, multimedia computing is fast becoming an integral part of the everyday desktop computing environment. OS/2 currently provides the best solution for meeting the demanding storage and playback requirements of multimedia on personal computers.

Steven Levenson, a consultant to software and hardware vendors in the LAN and multimedia markets, is a 10-year veteran of the computer industry. He holds a PhD in Instructional Technology from New York University and has written several books on networking and OS/2, including *Now That I Have OS/2 2.1 On My Computer, What Do I Do Next?*

PERFORMANCE 2.1, A Tuning Kit for OS/2 2.1— A Clear and Simple Solution to Your OS/2 Tuning Needs

Clear and Simple's PERFORMANCE 2.1, A Tuning Kit for OS/2 2.1, guides users (both novice and advanced) through OS/2 tuning procedures with an instructional book and a diskette containing 30 helpful REXX utilities. This kit demystifies the task of optimizing your system by not only showing you which commands and parameters you can change to enhance your OS/2 performance, but also providing utilities to help you do it.

Are you a novice?

If you're a novice, the book's Basic section is written just for you. It clearly describes the OS/2 concepts you need to fine tune your system. You'll read about "32-bitness," multitasking, multithreading, virtual memory, FAT vs. HPFS, thrashing, and disk fragmentation.

Are you an advanced user?

If you're an advanced user, refer to the book's Detail section for tips, techniques, parameters, and commands you'll use to tune your system. Some Detail topics

OS/2 Vendor Council

Tony Pereira, developer of Clear & Simple, Inc.'s PERFORMANCE 2.1, A Tuning Kit for OS/2 2.1, recently devised a way to gain exposure for his OS/2 application. He formed the OS/2 Vendor Council, a group of OS/2 developers who want to promote their products. The group intends to increase the exposure their applications receive in software and computer retail stores and mail order outlets through cooperative advertising with retailers.

To help fund the campaign, Tony has joined forces with IBM's Personal Software Products group to split the cost of a six-month ad campaign that will feature OS/2 Shopper Pages in several major computer magazines. The ads will describe the OS/2 Vendor Council products and list the names of retailers and mail order outlets that carry the suite of OS/2 products. Retailers have agreed to create OS/2 shelf space in return for a mention in the ads.

Vendors interested in joining the OS/2 Vendor Council must be currently shipping a horizontal OS/2 application. For more information, contact Tony Pereira by phone at (203) 658-1204 or by fax at (203) 651-0354.

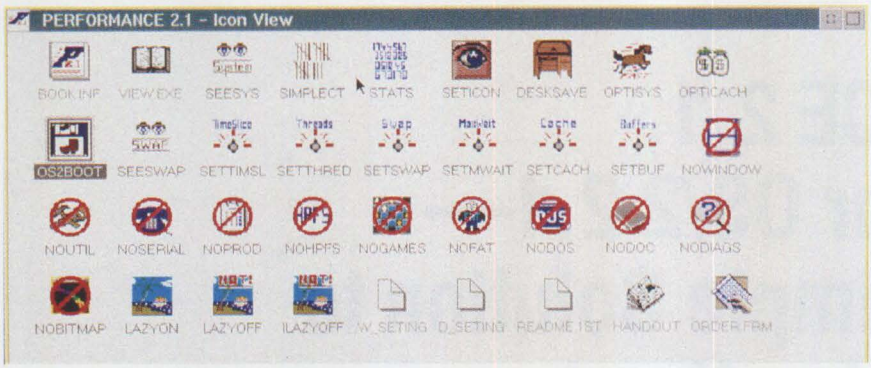

Figure 1. PERFORMANCE 2.1 Icon View Window

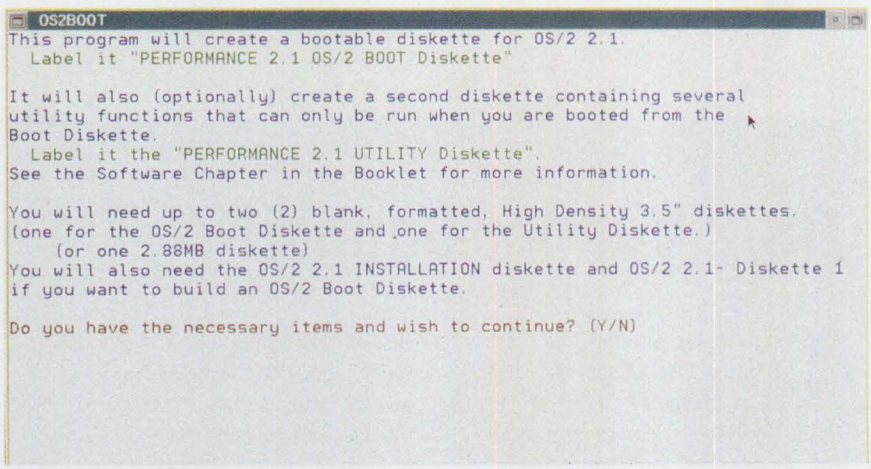

Figure 2. OS2BOOT Initial Screen

include caching, buffering, timeslicing, thread priority, task switching, fragmentation, and more.

How can you simplify your tuning efforts?

Simplify your tuning efforts with the 30 utilities that come with PERFORMANCE 2.1. These utilities, written in the easy to learn and modify REXX language, provide you with source code sample programs that access and manipulate OS/2 objects. Figure 1 shows all 30 program icons contained in PERFORMANCE 2.1's Icon View window.

Even the PERFORMANCE 2.1 Setup program is a valuable REXX program example for creating folders, shadows, and program objects for your Workplace Shell* desktop environment. Plus, these utilities come with over 3,000 OS/2 format icons as an added bonus.

The utilities that come with PERFORMANCE 2.1 include the following:

Optimizer routines assess your system and recommend `CONFIG.SYS` parameters, then optionally update your settings.

Eliminators relieve fixed disk space. Save up to 15 MB of disk space for those OS/2 features you don't use or need.

Tools update individual `CONFIG.SYS` parameters accurately to help you tune individual parts of your system. Some tools provide information; others perform specific tasks.

Performers include `OS2BOOT`, an object that creates a diskette containing a minimal OS/2 system you can use to boot OS/2, allowing for disk checking plus backup and recovery. Figure 2 shows the first screen you see when you activate this program. Other Perfomers include programs that measure and report on your tuning progress, back up your OS/2 Workplace Shell desktop, and reset icon associations. As an added bonus, the package includes over 3,000 public domain OS/2 format icons.

You can purchase PERFORMANCE 2.1 from Clear & Simple for only $29.95. They accept VISA, MasterCard, and Discover credit cards, plus company purchase orders. PERFORMANCE 2.1 can also be ordered as an IBM publication (SR28-4641).

For more information about PERFORMANCE 2.1, contact
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P.O. Box 130
West Simsbury, CT 06092

Ph. (203) 658-1204
Fax (203) 651-0354

Point of View

Some Enthusiastic Users Speak Out About OS/2

The OS/2 Bulletin Board System (BBS) has become a favorite meeting place for proponents of OS/2 (see sidebar). The following quotes are from OS/2 BBS participants who have agreed to share their favorite OS/2 features in this issue's "Point of View."

Workplace Shell—A Good Decision

The WPS [Workplace Shell] is what I like best about OS/2 2.1. It lets me be me and not some propeller head, command-line jockey. And furthermore, the Workplace Shell is based on the SOM [System Object Model], making it easy either to use WPS methods as-is or to modify WPS methods in your application to tailor the behavior of WPS to fit your requirements.

IBM made a very risky decision to include WPS in OS/2 2.0. This decision is really paying off now. While the recently released 32-bit operating system competitor is very good for a first release and is bound to get even better, the competition will be hard pressed to match WPS and SOM in the next 18 to 24 months. And OS/2 won't be standing still during this time. – Bob Holmes

Making Believers Out of Doubters

Back when the WPS was introduced during the early OS/2 2.0 beta cycle, many, many people were screaming (myself included, I'm afraid) about what a stupid move this was on Boca's [Boca Raton, Florida is the site of IBM's OS/2 development team] part and asking how we get back the 1.3 desktop and performance.

Can anyone imagine OS/2 2.x without WPS? The thought makes my skin crawl. Talk about boring, hamstrung, and brain dead! – Dick Kurtz

Programs Run Better Under OS/2

The thing I like about OS/2 is that I don't have to give up all my existing programs in order to run it. What's more, my programs generally run better under OS/2 than they do natively (go figure. . .). I use a mix of DOS, Windows, and OS/2 stuff every day–and, by gosh, it all works. In fact, I did away with my Boot Manager DOS partition a long time ago. I still have a DOS floppy for when I want to run Mathcad* 4.0, but that's about the only thing I use it for any more.
– Bob Beilstein

. . .OS/2 increases my productivity by at least 25%. . .probably more.

True Multitasking

I'll agree the WPS is probably the neatest thing since beer. It really makes it easy to work. For me, the best feature of OS/2 is its true multitasking ability. For example, I was working at home on an OS/2 application I'm developing for our operations staff (I can't get an upgrade to my work machine approved, so I'm being graciously allowed to write at home).

I had one modem hooked up to work for E-mail (windowed session); the other was tied into the IBM OS/2 BBS picking up a file I needed. I also had a background compile going on, an editor session in a foreground window, and the last two sessions that were open were for creating the help and INF [information] documents to go with it. Flitting around working on different things as I need to or while a long task is running saves me time and just makes my life easy!

Then, too, when the usual happens and my son comes downstairs with a floppy in his hand because he needs to print a file, he doesn't have to wait and I don't have to quit OS/2–the only way to go!
– Harold Clitheroe

Increases Productivity

As a corporate user, I can honestly say that OS/2 increases my productivity by at least 25%, very probably more. I need to multitask between many applications (DOS, Windows, native OS/2, host, X Windows*, and network) in order to perform my job, and OS/2 allows me to do this without wasted effort and time. Just as with voice mail and E-mail before it, I didn't think that using OS/2 would be a very big deal. But now it wouldn't be pleasant to contemplate attempting to do my job without it. – Lee Butkiewicz

Genuine New Technology

OS/2 represents "genuine" new technology, especially in SOM and WPS.

OS/2 runs nearly all DOS and Windows software as well or better than DOS and Windows themselves.

CUA* '91 is far more flexible than the Windows interface and its many imitators (from Microsoft Word* 5.5 to the Norton Utilities*)–no wonder, seeing that the Windows interface hasn't changed materially since 1985. (Program Manager is much more advanced than `MSDOS.EXE`, but that's not the same thing.)

The OS/2 applets are genuinely usable. So far I haven't seen any need to invest in

Bulletin Boards: An IBMer's Point of View

There are only two types of people in this world: those who use the OS/2 Bulletin Board System (BBS) and those who don't!

According to a report on National Public Radio's program "All Things Considered," over a million people in the United States log on to electronic bulletin board systems every month. No question about it, these BBSs have arrived with a vengeance. You can find BBSs for social mingling, for industry experts, for political preferences–if you have an interest, there is probably an electronic BBS where you can "meet" with fellow devotees.

So it comes as no surprise that there would be an OS/2 BBS. The only surprises might be how inexpensive it is, how useful it is, and how much fun it is!

On the first point, the OS/2 BBS is available for a low $18 a month for TalkLink users, no matter how many times you call or how long you stay connected.

As for usefulness, consider this: how useful is it to ask for OS/2 tips and techniques from the most knowledgeable people in our industry, both inside and outside of IBM? I continue to marvel at the number of quality responses BBSers get when they ask: "Has anyone tried. . .?" or "What happens when I. . .?"

While not a true service or support offering, it is not unusual to get a reply from a developer who is actively working in the area about which a BBS user is inquiring. BBSers also benefit from sharing information with their peers around the world–people running the same kind of application, using the same equipment configuration.

As an IBM employee, one of the things that pleases me about the OS/2 BBS is the improved flow of communication between IBM and our customers. Before I begin a project, through completion, and on into the evaluation process, I can maintain a dialog with customers. This dialog helps me determine requirements, then understand how well my programs support the intended audience. Without question, the quality of my work has improved because of improved communication with my customers!

IBM participation on the OS/2 BBS goes beyond that of developers and technical staff. Recently a customer noted that his company had a meeting to discuss information technology strategy. There was a point of confusion regarding IBM's position on an issue. That question received a response from Jim Cannavino, IBM vice president and general manager, who presides over the IBM PC Company and the IBM Personal Software Products Division, stating IBM's position and offering to help clear up the matter. Because Cannavino's reply, "The IBM Corporation definitely has OS/2 as part of our long term strategy," was posted on the OS/2 BBS, customers and IBMers alike were able to quickly understand IBM's strategy and share his comment with others.

The fun of being on the OS/2 BBS comes from the folks who use and support the bulletin board. The BBS is a community of people dedicated to helping each other exchange information and solve problems. This means people get to know each other–to form friendships. And they electronically share their jokes and sense of humor!

BBSers have a language all their own. A short while ago, a typo received acceptance as a new word describing an activity, a skill, or, for some devotees, even a hobby. The typo occurred when BBSers were discussing *watchers*, or people who read the bulletin boards but never participate. After the typo incident, it was not unusual to read someone asking, "Exactly what is a 'wather'?"

A new family of acronyms, sort of a BBS shorthand, has evolved. IMHO (in my humble opinion), OTOH (on the other hand), and BTW (by the way) are some of the most frequently used abbreviations.

BBSers have also invented a new series of abbreviations and illustrations to apprise the reader of the state of mind of the author. To warn readers that what has just been said is tongue-in-cheek, an author may terminate a thought with "G," "BG," "VBG," or even "VVBG" to indicate "grin," "big grin," "very big grin," and so on.

Victor Borge gave us "spoken punctuation," but BBSers have given us horizontal happy faces:

:-)	grin
:->	big grin
8-)	grin with sunglasses
:-(	sad
;-)	grin with "knowing wink"

So, as promised, BBSs provide information, help, and fun–all for the monthly cost of a movie for two (that is, unless you are like me and frequent the $1 movie–G)! This thing can't miss! When you get on the OS/2 BBS, don't forget to say hello to all the wathers and lurkers. I'll be looking for you! TTFN (ta ta for now), Bob.

Bob St. John is a long-time IBMer and member of the Technical Coordinator Program staff in IBM's Personal Computer Competency Center in Dallas. He provides an important link between customers and the Technical Coordinator Program, gathering requirements and reviewing proposed offerings.

a PIM [personal information manager], a terminal program, or a text editor–although all these categories are well-represented in OS/2.

REXX is a joy to use. A fully functional programming language that serves as the system batch language, REXX automates much system customizing (this could be better, though), and easily becomes the macro language of any application. It's almost impossible to live without once you have it.

As a computer programmer and system programmer since 1965, I know from experience that the basic design of OS/2 is right, whereas the basic designs of DOS and Windows 3.1 are wrong. (UNIX* and Windows NT* share this with OS/2, of course.)

Over against UNIX, my main points (apart from WPS and REXX) would be that OS/2 is better suited, both in scale and in user interface, to a personal computer, that UNIX is being architected only after the fact, and that, in large part, OS/2 can be described as a single-user UNIX designed with hindsight.

Over against Windows NT, my main points (apart from WPS and REXX) would be better DOS and Windows 3.x support, OS/2 1.x PM [Presentation Manager*] and OS/2 2.x application programs, better price, and better performance.
– John W. Kennedy

Good Corporate Applications Available

OK, here's my "top of my head" list:

- Excellent backwards compatibility (both DOS and Windows)
- Ability to run multiple protocol stacks (and to easily install them)
- Object-oriented desktop
- Good support
- CID [configuration, installation, distribution]
- REXX (especially now with the V-REXXs [visual REXXs] out there)
- Capable desktop and server operating system–makes building client/server applications easier
- Many good corporate applications available (i.e., ImagePlus*, etc.). Admittedly, we could use a few more "personal" applications, but the first point helps a lot here

There's my two minutes worth.
– Erik Vander Ahe

Making Computing More Fun and Productive

Multitasking. Hands down. I went from DOS 3.21 on an XT to OS/2 1.1 on an AT, skipping Windows completely. The thing I remember most about DOS is waiting: printing, downloading, formatting, etc. The first time I sat down at a machine running Windows, I had been using OS/2 2.0 for about six months. Imagine my surprise when Windows couldn't run two DOS programs simultaneously! Until then, I saw Windows as a competitor to OS/2; after that, I saw it as just another pretty interface. Today, not only am I happily multitasking among my programs; I now have programs that multitask within themselves, making sitting at the computer much more fun and productive.
– Gerald Meazell

Database Manager for the Non-Database Person

I've been using Database Manager (now DB2/2*) for a couple of years now at home. I had no background in relational databases before, but I can tell you that I think it's fantastic. Every friend of mine who has seen it in action has switched from other SQL products. With the Query Manager, I put together a rather complicated database for an international ski race that we held early this year in Germany in a matter of a few days. I can really recommend it, especially because of the ease in which a non-database person can put together professional applications in a very short time. – Tom Clark

Just Plain Fun

I'll give you my two favorites and two or three bonuses.

The Workplace Shell

I love it. A friend received a new computer the other day for his son who is going off to college. Of course this clone came with Windows on it, but he wanted me to help him check it out. When I booted it up, there was Windows 3.1. Ten minutes later I realized two very important things:

- First, Windows programs have much, much better interfaces than does Windows itself; and,
- Second, it takes trying to check out a system under the Windows interface to realize just how great the WPS truly is. I kept clicking that right mouse button to see what something was and kept getting nothing in return.

Of course, there is a downside to the simplicity and power of the WPS. My wife is ready for a new computer, and she has

told me not to even think of getting anything that won't run OS/2. And her reason isn't stability, multithreading, or multitasking. It is the WPS. She says it's the only thing about computers she ever saw that made any sense to someone who doesn't love computers.

Multitasking

I'll just echo what everyone else says: until you've had the ability to multitask, you can't possibly appreciate what marvelous ways it will change the way you use your computer. Maybe this little anecdote will be illuminating.

I just set up my sister, the math professor, with a new 486 running OS/2 2.1. She has written a couple of math texts, actually understands the definition of "limit," and teaches the mathematics of programming languages. On the other hand, she is having a hard time remembering that she has a right mouse button.

The other day we were checking out her modem and new OS/2 communications software. As she only has one line, we were in chat mode, going over what she needed to do to download some files from my computer. On my suggestion, she had configured the package to put downloaded files into `F:\transfer`. Suddenly she types: "Oh, no! I forgot to create the directory. I'll have to log off, and. . ."

It took a bit of typing over her explanation before I got her attention. "You're multitasking now, dear," I said. "Just go make your directory. It's no problem. I'm reading my E-mail now anyway."

Later she called me back. "What's all this killer app stuff?" she wanted to know. "Who needs it? There are lots of nice applications. Now there is a great operating system to run them." I agreed with her. The last thing she said was, "Why would anyone not run OS/2? It's amazing." My sentiments exactly.

The Third Thing

Well, those are my two favorite things about OS/2. My third favorite is something I've almost forgotten about: I don't need to try to use and configure memory managers like QEMM. I love the way OS/2 handles printers, runs DOS apps, lets me use the mouse in a DOS window, handles icons, MMPM/2, and on and on and on. Heck, I've even gotten so that I like Drives! Oh yeah, there's one other thing. OS/2 2.1 is just plain fun to use.
– Stan Hawkins

Team OS/2—A Groundswell of Support for OS/2

You may have heard of Team OS/2, but you might not fully understand what it's all about. Don't feel bad–I started it, and I still don't think I fully understand the phenomenon. I'm certain I don't know everything about every Team OS/2 activity. Literally thousands of enthusiastic volunteers are now part of this "happening." I do know, however, that Team OS/2 has been fueled by the creativity and imagination of many thousands of OS/2 enthusiasts in their pursuit of quality, synergy, and positive relationships. That's worth trying to understand, and I think you'll find it's also worth getting involved.

The Beginning

Team OS/2 has been around, in spirit at least, from the time OS/2 was first conceived by teams of IBM and Microsoft visionaries and programmers looking to replace DOS with a far more capable operating system. It wasn't until February 12, 1992 that it took a recognizable form when I created TEAMOS2 FORUM on IBM's internal bulletin board. I dedicated the forum to "the discussion of those things that empowered IBMers, working as a team, can do to promote the success of OS/2. The focus here is, through teamwork, creating synergy and combining talents to achieve results greater than the sum of individual efforts."

The only requirement for membership has been that an individual "make a personal sacrifice, however small, to help others recognize that OS/2 can be the foundation for the next generation of personal computing." At the time Team OS/2 began, OS/2 2.0 was available as beta code in a limited release, enabling a lot of people to experience some of the features that have since made OS/2 such a hit:

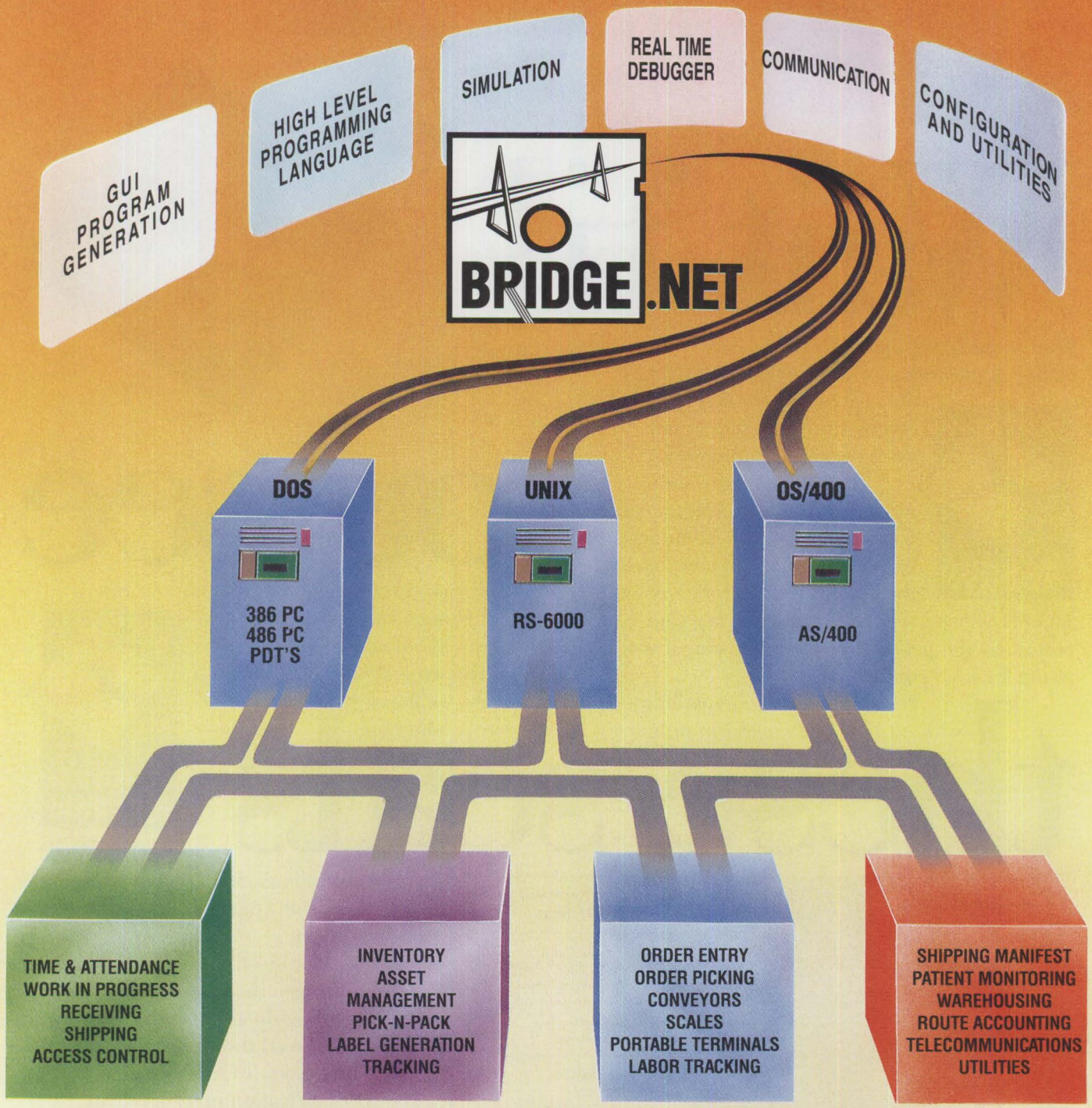
- Multitasking that really works
- The powerful but easy Workplace Shell user interface
- The ability to run more PC applications than any operating system or environment in the industry

OS/2 users knew that OS/2 was the underdog in what many perceived as a "war" between OS/2 and DOS/Windows, even though anyone who bought OS/2 got DOS and Windows as well. These users wanted to share their love of OS/2 with others, and that's how Team OS/2 got started.

The Concept

Since the beginning, Team OS/2 has gone wherever Team members have taken it and has become whatever Team members want it to be. Throughout the world there are thousands of Team members from a wide variety of OS/2 user communities–both within and outside of IBM. Many of us have found that using OS/2 and computer communications networks has helped us make friends we might otherwise not have made. It has also given us an opportunity to actually put into practice such ideals and principles as a respect for others and a willingness to help others. We don't expect anything in return beyond the intrinsic satisfaction that comes from sharing what we value.

Team OS/2 volunteers have done some amazing things and have a lot to show for their enthusiasm:



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Tested and Approved™ for LAN Systems

Program Overview	Ready! for LAN Server	Tested and Approved for LAN Systems
What's Tested	Your product with LAN Server	Your product with LAN Server, NetWare,® CM/2, DCE, LAN NetView,® etc...
Who Performs	You	IBM Integration Test Lab personnel
How Measured	Ready! for LAN Server Certification Guidelines	Comprehensive test suites
Where Tested	Your lab, or the Mini-LAN lab in Austin, Texas	Integration Test Lab in Austin, Texas
Technical Support for Your Customers	You provide support	A cooperative support arrangement with IBM is automatically available

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- Organizing user group demonstrations
- Adopting software stores (explaining OS/2 to dealers and sales personnel)
- Setting up booths at fairs
- Demonstrating OS/2 to college professors and classes
- Organizing roving OS/2 help squads to assist vendors in booths at COMDEX*, PC EXPO*, and other trade shows
- Working with PRODIGY* and IBM to improve the presence of OS/2 on PRODIGY
- Setting up a Team OS/2 echo on FidoNet
- Writing shareware or other application software for OS/2
- Negotiating the terms under which IBM employees can release their personally developed OS/2 software for general use
- Helping members of the media understand OS/2
- Getting together with others who use OS/2 to trade tips and experiences
- Starting, supporting, and joining OS/2 user groups and special interest groups
- Participating in and running OS/2 bulletin boards and online conferences
- Demonstrating OS/2 to new users and encouraging others to try OS/2
- Writing letters to magazines to correct misunderstandings

There have been some exciting times and great moments for Team OS/2. At the first Team OS/2 party at COMDEX in April, 1992, the key developers of OS/2 got together with independent software vendors (ISVs), OS/2 customers, marketing personnel, and others to share the excitement of the long-awaited release of the 32-bit OS/2. IBM executive John Soyring, an inspiration to many Team OS/2 members, said it was the first reception he had ever attended that gave him goose bumps. The Chicago jazz band members were so impressed by what they saw happening that they stood in line with everyone else to get their Team OS/2 and "ibm/2" T-shirts.

The T-shirt was inspired by TEAMOS2 FORUM participants who asked for a T-shirt they could wear to identify themselves as empowered members of Team OS/2. The "ibm/2" logo suggests a "new IBM" that respects "the little guy" as well as individual empowerment and initiative. The "/2" emphasizes the ties between OS/2 and this new IBM.

The Commitment

Today, Team OS/2 is open to anyone who wants to be a part of all of this, whether you work for IBM or not. IBM Personal Software Products executives (who also claim membership in Team OS/2) have agreed to support Team OS/2 activities, including occasional Team OS/2 recognition receptions (usually at Fall COMDEX). IBM has a department to respond to requests for assistance from Team OS/2 members and to support these grassroots marketing efforts, which have been such a key part of OS/2's success.

Team members are familiar with the delightful presence of Vicci Conway and Janet Gobeille, two members of IBM's grassroots support department, on the electronic forums and at Team OS/2 hospitality suites at trade shows and conferences. Many of the customers featured in this issue's "Point of View" article are enthusiastic members of Team OS/2.

IBM recognizes that all association with Team OS/2 is purely voluntary and that there are no mutual expectations or future dependencies. IBM and other companies or individuals with an economic interest in OS/2 are part of Team OS/2 under the same terms as all members–with no strings attached and with complete respect for the freedom of others and their right to choose their level of commitment and participation.

At the foundation of Team OS/2 are the concepts of quality, imagination, respect, relationships, and teamwork. We don't bash DOS or Windows or other companies or individuals. We understand and appreciate the uniqueness of each individual. We don't take ourselves or OS/2 so seriously that we become fanatics. And, finally, we try to maintain a sense of humor and balance about what we do.

Becoming a Team OS/2 Member

To let others know you are part of Team OS/2 and to have your name included in the list we maintain, contact one of the following:

- CompuServe*: Vicci Conway at 76711, 1123
- Internet*: teamos2@vnet.ibm.com
- FidoNet: Janet Gobeille at 1:109/347.3479
- IBMMAIL: USIB45RN at IBMMAIL
- Fax: Team OS/2 Support at (512) 823-3252

Please include your name, mailing address, phone number, E-mail address, and a one-line description of your ties to and interest in OS/2. (Your mailing address and phone number will not be published on any distribution list.) Please include your experiences with OS/2 and your successes in sharing OS/2 with others, plus anything else you want to share relating to your OS/2 "qualifications."

We will put your name, city, state, E-mail address (of whatever system you include in your application), and description in the public Team OS/2 list, available on the electronic bulletin boards. Your address and phone number will be added to our Team OS/2 database and used only for any necessary future contact, such as Team OS/2 mailings.

If you choose to become a Team OS/2 member, your participation can take whatever form you choose, consistent with the above concepts. You are free to use the words "Team OS/2" to let others know you are part of this worldwide team. When you say you are a part of Team OS/2, you signal to others that you are willing to help them understand and use OS/2 better. As a Team OS/2 member, you agree not to detract from or dilute the name Team OS/2 by using it in conjunction with activities that disparage or embarrass others.

Thanks for your interest and participation. Here's to a bright future with OS/2, you, and Team OS/2!

Dave Whittle, located in Austin, Texas, not only represents IBM Personal Software Products (PSP) on the networks and bulletin boards, but also represents the interests of those on the networks and bulletin boards to PSP. He is the author of *PS/2 Reference Tables* and co-author of *Dvorak's Guide to OS/2 Version 2.1*. He has a BS in accounting and an MBA, both from Brigham Young University.

Manage Your LAN Systems More Effectively with IBM NetFinity

Your local area network (LAN) is a formidable asset. A well organized and managed LAN enables you and your staff to quickly and efficiently exchange data and information. By combining the power of your individual systems, your LAN can greatly enhance your workforce's productivity and performance.

However, if the individual systems that make up your LAN are not managed effectively, the performance of your entire LAN can be compromised. How can you ensure that your LAN systems are operating at peak efficiency? How can you maximize your workstations' power? How can your LAN administrator detect and resolve problems on individual workstations quickly, without wasting money in downtime?

The solution is NetFinity*. NetFinity is a complete hardware management environment designed with the user in mind. Combining system monitoring and management features previously found only in costly and complicated products with the intuitive graphical interfaces popular today, NetFinity simplifies the most sophisticated system management tasks (Figure 1).

NetFinity Services for OS/2 V1.1 provides the foundation for the NetFinity solution by greatly enhancing the local system management capabilities for both LAN-attached and stand-alone systems.

NetFinity Services for OS/2 provides you with:

- Powerful local system management capabilities
- Useful utilities for LAN-attached and stand-alone systems
- Easy-to-use graphical interfaces
- Extensive online helps

NetFinity Services also provides the framework for remote system access and management with NetFinity Manager for OS/2 V1.1. NetFinity Manager builds on the power of the NetFinity Services, adding new utilities that enable you to effectively manage systems on your LAN from your own local system.

NetFinity Manager for OS/2 provides you with:

- Powerful remote system management capabilities
- Utilities to organize and access individual systems and servers on your LAN
- Remote access to the NetFinity Services installed on systems and servers within your network
- Easy-to-use graphical interfaces
- Extensive online helps

NetFinity enables you to fully support your network. It can be used in a wide variety of network environments, using one or more of these common communication protocols:

- NetBIOS
- Transmission control protocol/internet protocol (TCP/IP)
- Internet packet exchange (IPX)

Power and Flexibility

NetFinity's powerful information gathering, monitoring, and management utilities can also be used with IBM-compatible systems from a broad variety of manufacturers. And, as your network expands, NetFinity's system management capabilities can be combined with a network management system such as IBM LAN NetView* for a comprehensive network management solution.

Powerful and reliable system management utilities are not a luxury—they are critical for saving time and money. The Gartner Group, a respected technical consultant, estimates that the cost of owning and managing a computer system over five years is nearly six times greater than its original purchase price.[1] The vast majority of these additional costs are generated by the time and effort spent on system administration, technical support, and asset management.

With NetFinity, you can tip this equation in your favor. By using NetFinity's powerful remote and local system management capabilities, your LAN administrator can troubleshoot users' workstations,

[1]Gartner Group, 1993.

distribute information and software, identify problems proactively, audit network assets, and determine how best to deploy equipment—all from his or her own workstation and in a fraction of the time it would have taken without NetFinity.

NetFinity is both cost effective and easy to use, a pleasant change from most system management products available today. NetFinity's intuitive graphical interfaces enable your LAN administrator to intelligently monitor and manage your networked systems, eliminating the long learning curve often associated with such powerful functionality. With NetFinity's sophisticated utilities, a LAN administrator can access workstations on the network to monitor performance, update code, view the screen display, and even run other programs from a command line.

NetFinity's graphical user interface displays each NetFinity system in your network as an individual icon on the LAN administrator's screen. An administrator can access any NetFinity service available on a system by simply pointing and clicking on the system's icon. With NetFinity, you can collect system information, start applications, transfer files, and more with just a few simple actions. It's that easy.

NetFinity Services' flexible, modular architecture allows for a variety of system specific configurations, installing only the program files necessary for the individual system's designated function within a network environment or as a stand-alone system. NetFinity's modularity also enables you to update the base product and add new services without reinstalling the entire product. In short, NetFinity combines the power and flexibility you want today with the expandability you'll need in years to come.

System Management Applications

NetFinity Services forms the foundation of the NetFinity solution. NetFinity Services consists of seven powerful system management applications, each one providing sophisticated local and remote system management functions. NetFinity Services can be installed on stand-alone systems, can be used strictly as a base program that enables a network administrator to remotely manage the system, or can

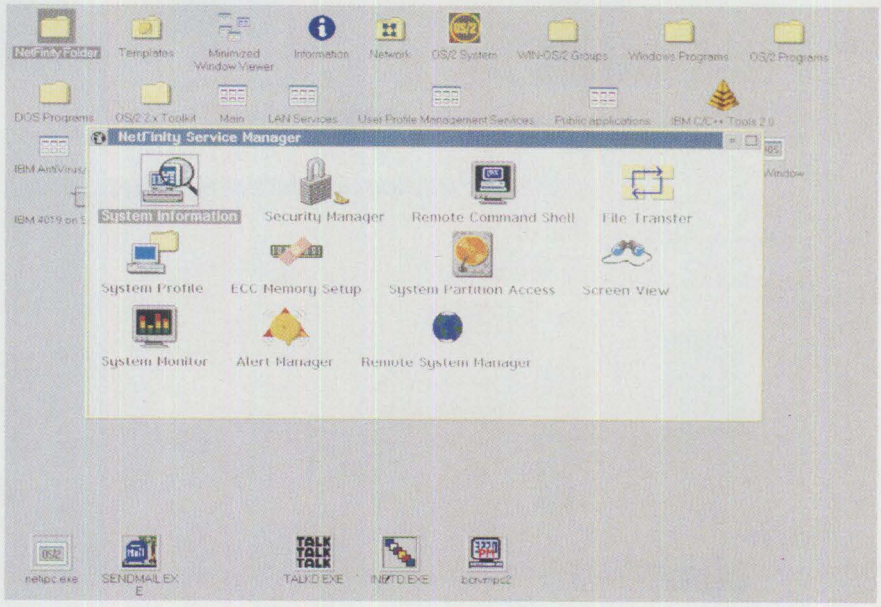

Figure 1. NetFinity Service Manager

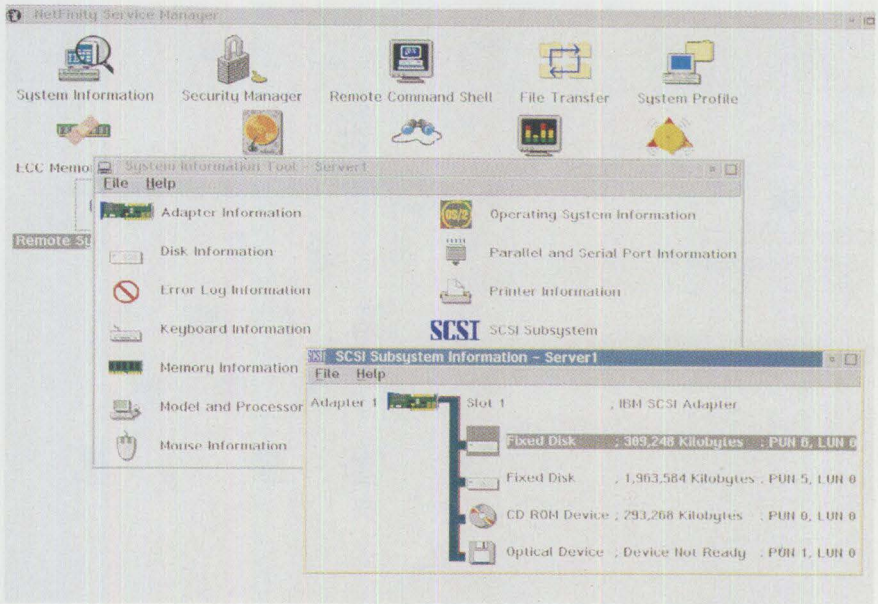

Figure 2. NetFinity System Information Tool

enable the local user to perform many system management functions locally as well as enabling the administrator to remotely manage the system.

The NetFinity Services include:

- **System Information Tool**
  Use the System Information Tool to detect the status of system component and environment variables. The tool reports detailed information on a wide variety of the systems on your LAN, including adapters, SCSI configuration and devices, disk drives, PCMCIA devices, memory, I/O devices, and much more (Figure 2).

- **System Profile**
  System Profile is a fully customizable user- and system-information facility. Use System Profile to track user-specific system information to more efficiently audit and manage assets. A customizable template helps you get started.

- **System Monitor**
  System Monitor displays line graphs and real-time graphical monitors for a variety of system resources including

Figure 3. NetFinity System Monitor Service

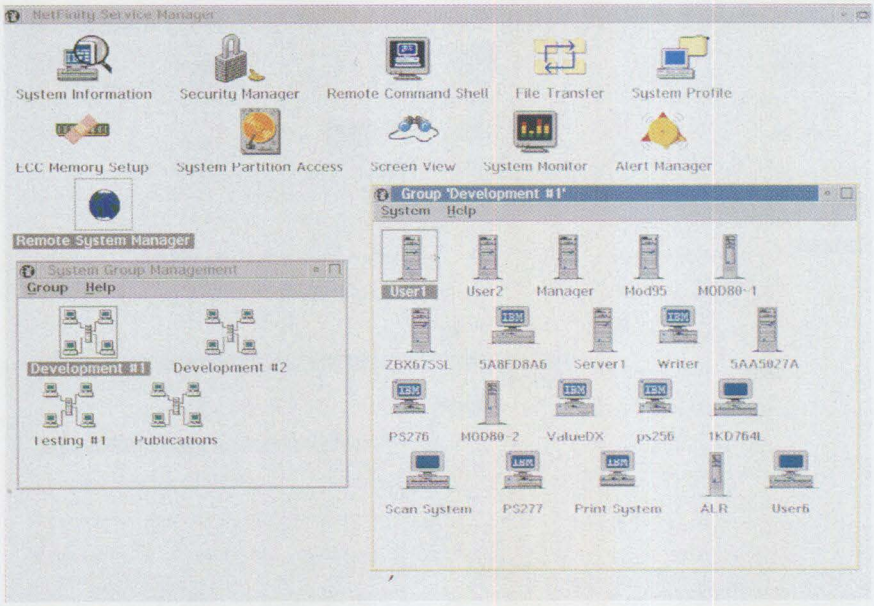

Figure 4. NetFinity Remote System Manager

microprocessor, disks, and memory usage. It also generates alerts in response to user- or administrator-specified thresholds to help proactively identify problems (Figure 3).

- **Security Manager**
  Security Manager prevents unauthorized access to your NetFinity Services. Select which Services to make available to which remote users or restrict access altogether. It generates alerts in response to access violations by remote users, enabling you to track attempts to access NetFinity Services.

- **Alert Manager**
  Alert Manager receives and processes application-generated alerts (such as the alerts generated by the System Monitor and Security Manager Services) and enables the user or administrator to specify actions to be taken in response to the alert. Actions include logging the alert, pop-up notification, forwarding the alert to another user, and executing commands. The alert log can be examined, edited, and printed for use in reports.

- **ECC Memory Setup**
  Error Correcting Code (ECC) Memory Setup enables the user or LAN administrator to control the ECC memory features on many IBM or IBM-compatible systems. It also records the number of single-bit errors, enables or disables single-bit error correction, and more.

- **System Partition Access**
  System Partition Access is a powerful access tool for IBM systems with built-in system partitions. The system partition is a group of pre-installed utility programs found on many PS/2* systems. System Partition Access enables you to update, back up, even delete your system partition, all without having to use a reference diskette to restart your system.

NetFinity Manager for OS/2 V1.1

NetFinity Manager for OS/2 builds on the power of the NetFinity Services to provide you with powerful remote system management capabilities, including access to all NetFinity Services installed on systems within your network, bi-directional file and directory transfers, remote command line OS/2 sessions, and remote screen captures.

The NetFinity Manager includes:

- **Remote System Manager**
  Remote System Manager enables your LAN administrator to access and control all NetFinity Services installed on the remote systems in your network. Remote System Manager also features a keyword-based discovery process that enables you to automatically search for and group NetFinity systems on your LAN for easier LAN organization and management (Figure 4).

- **File Transfer**
  File Transfer enables your LAN administrator to easily send, receive, or delete single files, multiple files, or entire directories locally or remotely.

- **Remote Session**
  Remote Session enables you to establish a fully active OS/2 window session on a

remote system. Use Remote Session to help determine problems and troubleshoot efficiently.

- **Screen View**
  Screen View takes a "snapshot" of a selected remote system's screen display. Use Screen View to help view and fix problems remotely. Screen shots can be saved as bitmaps and reloaded using Screen View for future reference and analysis.

System Requirements

The minimum system requirements for NetFinity client or manager systems are:

- OS/2 2.0 (with Customer Service Diskette) or 2.1
- 6 MB memory
- Approximately 4 MB hard disk space for NetFinity Services for OS/2 (does not include Remote System Manager, File Transfer, Remote Session, or Screen View)
- Approximately 6 MB hard disk space for NetFinity Manager for OS/2 (4 MB for the NetFinity Services for OS/2 plus an additional 2 MB for the NetFinity Manager's additional services and features)
- i386SX* processor or higher
- LAN adapter cards and one or more of the following communications protocols:
  - TCP/IP
  - NetBIOS
  - IPX

IBM NetFinity is available in both administrator (IBM NetFinity Manager) and client (IBM NetFinity Services) packages. Ask your IBM representative for further details, or call (800) IBM-CALL (426-2255) and ask for networking products information.

Gregg Primm is currently working on the next release of NetFinity with the NetFinity development team in Boca Raton, Florida. In addition to a strong creative writing background, Gregg has written a number of technical documents, including the online and hard documentation for the NetFinity products. He has a BA degree in English from the State University of New York at Buffalo.

Plan, Plan, Plan Your NetWare 4.01 Network

The introduction of the NetWare* 4.01 network operating system into the PC networking arena brings with it many new and advanced features, such as security and administration, that are designed to improve performance. Planning your NetWare 4.01 network is fundamental to its successful implementation. This article provides some guidelines for planning your network–specifically in relation to NetWare 4.01's NetWare Directory Services.

Lionel Kidd
IBM Corporation
Roanoke, Texas

The core of NetWare 4.01 is NetWare Directory Services (NDS). NDS is a global, distributed, replicated database that maintains information about every resource on the network, such as users, groups, printers, volumes, and computers. With NDS, a distributed network database serves as a directory for all nodes on a local network or on an internetwork, which is a larger network (such as Internet) that extends beyond a local network.

NDS is a single, logical database. All users, applications, and servers can access this database for information. This implementation differs from previous versions of NetWare in that users formerly had to know the location of each resource, how to access the resource, and the permissions necessary to use the resource. Now, access to any resource or user on the network is done through NDS.

With NDS, a user connects through a single login, sharing the network without having to understand its complexities. NDS hides the network topology, protocols, media, and communication links by handling these things behind the scenes. The result is that a large, diverse network of users is simplified into a single, easy-to-use environment.

The NetWare Directory

In NetWare 4.01, all network resources are set up as objects in a distributed database called the *NetWare directory* database. This database organizes resources in a hierarchical tree structure, independent of location. Users and administrators can access network services without having to know the physical location of the server.

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

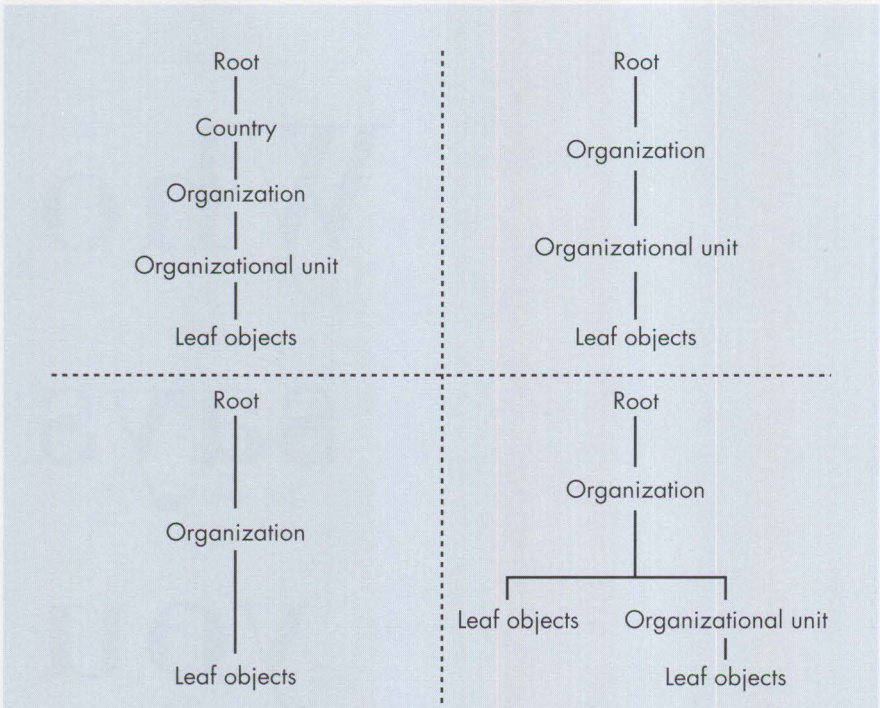

Figure 1. Possible Configurations for a Directory Tree

Bindery Objects	Changed To
Users	NDS user objects. Properties of user objects become login restrictions.
File system trustee assignments	Same as in NetWare 3.11
Groups	NDS group objects (same trustee assignments and security equivalences are carried over)
Default account restrictions	Carried over from NetWare 3.11
Print queues	Same as in NetWare 3.11
Console operator	Becomes the operator property of the server object
Security equivalence	Becomes the security equivalence property in the user object

Figure 2. Changes to Existing Bindery Objects in NDS

The directory replaces the bindery, which served as the system database for previous versions of NetWare. The bindery contained all of the information about the services provided by a single server. In contrast, NetWare Directory Services supports an entire network of servers.

Information about the network is stored on more than one server, eliminating the risk of a single point of failure.

For users who are non-NetWare 4.01-compliant, there is bindery emulation. With bindery emulation, the NetWare 4.01 server looks like previous versions of NetWare servers. These users do not have the benefit of NDS. Since the structure of the file system has not changed, file sharing remains the same.

Instead of logging in or attaching to individual servers, NDS users log into the network. Users enter their passwords only once to gain access to all network resources available to them.

Network-wide access control allows a user who has logged into the network to access all servers, volumes, printers, and so on that the user has the right to access. User trustee rights restrict the user's access within the network.

Objects

The NDS object contains a kind of information called *properties*. Properties contain information such as telephone or fax number, address, and physical location. This information is entered into the data fields for each property. Object properties are stored in the directory database.

Some objects can represent physical entities such as printers (printer objects) or NetWare servers (server objects), while other objects represent logical entities, such as groups and print queues.

When a request for information about an object is received, NDS does a search based on the property selected. For example, you may only know a user's telephone number, but you want to find the user's name. You can search the database using the telephone-number property to find the object associated with the telephone number. That object will contain the name of the user. You can also search through all the properties for a single object.

The Directory Tree

NDS operates in a logical organization called a *directory tree*. In a directory tree, objects are stored in a hierarchical tree structure, starting with the root and branching out.

Two types of objects make up the directory tree: *container* objects and *leaf* objects. A branch of the directory tree consists of a container object and all the objects it holds, which can include other container objects. At the ends of the branches are leaf objects, which do not contain any

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other objects. Figure 1 shows some possible configurations for a directory tree.

Thoughtful planning of the directory tree will:

- Provide fault tolerance on the network
- Decrease traffic on the network
- Enable users to easily access information
- Enable network supervisors to easily administer the network

There is no single way to design your directory tree. Following are some guidelines to prepare your company for installing NetWare 4.01.

From Here to There

The binderies in previous versions of NetWare must be upgraded to NDS. Each user, printer, computer, file server, etc. is an object in the directory tree. Figure 2 shows the changes that are made to existing bindery objects.

The Standard Is . . .

Over time, changes will occur in your network. Adding users, providing access to the objects, and adding function are some changes that will occur. *Standards* govern how these changes should happen. Figure 3 gives an example of a standard. In Figure 3, all the entries collectively form a single standard.

Who's on First?

The directory tree should reflect the structure of your company. Before you install NDS, decide how to organize your directory tree. Meet with department managers to determine what kind of directory tree organization best suits your company's needs, then customize the tree to each department's or group's needs. The physical and logical locations of the objects in your environment affect the layout of the

Identification Property	Value
Title	Enter the user's current job title.
Department codes	Use company department.
Default server	Use the server from which the user gets SEND messages.
Network address	No standard.
Login name	Enter the first and last name of user. Capitalize all letters.

Figure 3. Sample NDS Standards for Object Properties

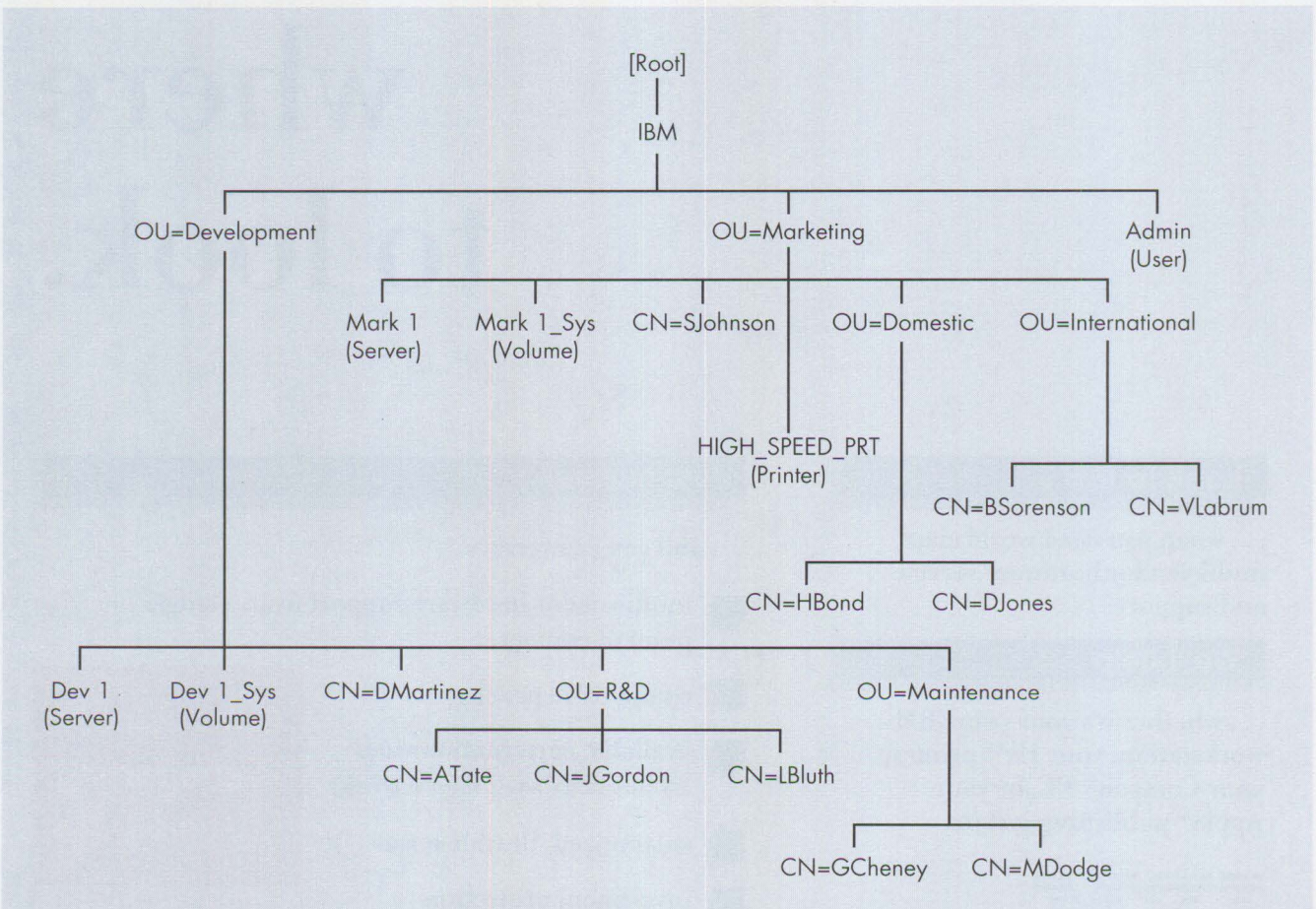


Figure 4. Sample of Full NDS Directory Tree

Container Object	Abbreviation	Description
Country	C	One level below the root object, the country object designates the countries where your network resides and organizes other objects within the country object. For example, you could use a country object for the country where your organization headquarters resides or, if you have a multinational network, for each country that is a part of your network. *Note*: The country object is not part of the NetWare 4.01 default server installation; that is, NetWare 4.01 does not prompt you for a country object during installation, but you can create one. Using a country object in NDS is not a requirement for interoperability with other X.500-compliant directory services.
Organization	O	One level below the root object (unless you use the country object, in which case the organization object must be one level below country), the organization object helps you organize other objects in the directory tree and allows you to set defaults for user objects that you create in this container. You can use an organization object to designate a company, a university with various departments, or a department with several project teams. The organization object is mandatory. The directory tree must contain at least one organization object.
Organizational Unit	OU	One level below the organization object, the organizational unit object helps you to organize leaf objects in the directory tree. You can also set defaults in a login script and create a user template for user objects that you create in this container. For example, you could use an organizational unit object to designate a division, a business unit, a project team, or a college or department within a university.

Figure 5. Types of Container Objects

Leaf Object	Description
AFP Server	Represents an AppleTalk* Filing Protocol (AFP)-based server that is operating as a node on your NetWare network (and is probably also acting as a NetWare router to, and the AppleTalk server for, several Macintosh* computers). Create this object when you have an AFP server that you need to represent on the network. Use it to store information about this server, such as its operators, users, and network address. This object has no effect on network operations; it only stores information about resources on the network.
Alias	Refers to another object in the directory tree, and makes it appear as though the object that it names actually exists in the directory tree where the alias is created. Although an object appears both where it was first created and where an alias referring to it was created, only one copy of the object really exists, and changes made to either object affect what appears in both locations.
Bindery	Represents an object placed in the directory tree by an upgrade or migration utility, but which cannot be identified by NDS. This object exists for backward compatibility with bindery-oriented utilities.
Bindery Queue	Represents a queue placed in the directory tree by an upgrade or migration utility, but which cannot be identified by NDS. This object exists for backward compatibility with bindery-oriented utilities.
Computer	Represents a non-server computer, such as a workstation or a router, on the network. Use this object to store information such as the computer's network address, serial number, or the person to whom the computer is assigned. This object has no effect on network operations; it only stores information about resources on the network.

Figure 6. Types of Leaf Objects

Leaf Object	Description
Directory Map	Represents a particular directory in the file system. Directory map objects can be used in lieu of login scripts by pointing to directories that contain applications or other frequently used files. The MAP command is a DOS command that uses a DOS drive letter as a redirector for a directory or subdirectory. The drive letter represents the directory or subdirectory. A *search drive* is a mapped drive of a directory or subdirectory that is searched any time a command is executed from the command line. Mapped drives and search drives can be executed from login scripts, which are similar to batch files. The executables in the login scripts apply to each user, or groups of users, as designated within the login script. There can be one or several login scripts. If there is a change in the directory or subdirectory, each login script must be changed. For example, if you have a directory that contains DOS 5.x, you will probably map a search drive to that directory in any login scripts you create. Later, if you upgrade to DOS 6.x and rename the directory, you will have to change the mapping in every login script where that search mapping appears. When you use the directory map object, however, the mapping applies to all users who have rights to the object; therefore, changes are made to the object rather than to several different login scripts, and changes can be managed more easily.
Group	Assigns a name to a list of user objects located anywhere in the directory tree. Use a group object when you want to assign rights to a group as a whole, instead of to individual users. The rights you assign to a group object are transferred to individual users who are members of the group, wherever they are located.
NetWare Server	Represents a server running NetWare on your network. Store information about the server in the NetWare server object's properties. This is information such as the server's location on the network wire, the physical location of the server, which services it provides, and so on. In addition to storing information about the NetWare server, the NetWare server object affects the network because several other objects refer to it. For example, the directory map object points to the NetWare server object to find the directory it needs; the volume object points to the NetWare server object to find the physical volume of the particular NetWare server. Use the NetWare server object to tie the physical server on the network to the directory tree. Without this object, you cannot access file systems that are on the server's volumes. If you have a non-NetWare 4.01 server, you must create this object to be able to access those non-4.01 volumes. When you create a server object for a non-4.01 server, you enter the IPX address of the server and then create volume objects that refer to that server object. A physical volume name on the non-4.01 server is placed by default into the volume object's properties when you name the host server to which this physical volume is attached.
Organizational Role	Defines a position or role within an organization. Create an organizational role object so that you can assign rights to a particular position, in which the person who occupies that position (the occupant) may change frequently but the responsibilities of that position do not. For example, you may want a Print Manager for Sales. You create an organizational role object called Print Manager and grant that object all object rights to the printer, print queue, and print server objects in that part of the directory tree. You may also grant the Print Manager object the property rights to the print job configuration property of users. The organizational role object Print Manager can now manage all printing in the Sales container. You can assign any user to be an occupant of the organizational role object, because every occupant receives the same rights that you granted to the organizational role object.
Print Server	Represents a network print server. You must create a print server object for every print server on the network.
Printer	Represents a physical printing device on the network. You must create a printer object for every printer on the network.
Profile	Contains a profile script (login script). The profile object listed as a property in a user object is executed when that user object logs in, after the system login script and before the user login script. Create a profile object for a set of users who need to share common login script commands, but who are not located in the same container in the directory tree or are a subset of users in the same container.
Print Queue	Represents a print queue on the network. You must create a print queue object for every print queue on the network.

Figure 6. Types of Leaf Objects - Continued

Leaf Object	Description
User	Represents a person who uses the network. You must create a user object for every user who must log in to the network. When you create a user object, you can create a home directory for that user, who will have default rights to that home directory. You can also choose to apply a template to that user, which will provide defaults that you have already set up. Objects for users with NetWare 4.01 workstations can be created anywhere in the directory tree, but users must know their context in order to log in. When their 4.01 workstations are installed, you can enter their context into the NET.CFG file, which places them in the correct context when they log in. Objects for users with non-4.01 workstations must be created in the container in which the bindery emulation context is set for the server that users need to log in to. (Bindery emulation is set by default for every NetWare 4.01 server that is installed.) Non-4.01 users do not need to know their context, because they log in to the server rather than the directory tree.
Unknown	Represents an NDS object that has been corrupted and cannot be identified as belonging to any of the other object classes.
Volume	Represents a physical volume on the network. You must create a volume object for every physical volume on the network. You are prompted to create volume objects for every physical volume on a server on which you install NetWare 4.01. In the volume object's properties, you must store information about which NetWare server the physical volume is located on and the name of the volume that is recorded when the volume is initialized at the server (such as SYS:). If you create the volume object during installation, this information is placed in the volume object's properties by default. In the volume object, you also set restrictions for use of the volume, such as setting an owner. In the NetWare administrator graphical utility, you can use the volume object to display information about the directories and fields on that volume.

Figure 6. Types of Leaf Objects - Continued

directory tree. Uniformity in the directory tree ensures smoother network operations.

Can You Be Specific?

Design your directory tree to reflect how your company shares resources. Place NDS objects commonly shared by a single group together. For example, if you have a high-speed printer that everyone needs to access, place the printer object for that printer in a container above the containers where you place the user objects. Then you can assign rights to the lower containers to give everyone in those containers access to that printer object.

Figure 4 contains a sample of a full NDS directory tree in which the high-speed printer is placed as a printer object in the marketing organizational unit.

It is easier to grant rights at the container level than it is to give everyone rights to access a particular object. Objects can always be added, deleted, or moved once the directory tree is installed. Figure 5 lists the types of container objects, and Figure 6 describes each kind of leaf object.

Over and Over Again

To be more scalable and reliable, the NDS database is divided into smaller portions called *partitions.* Partitions are created by default when you install NetWare 4.01 on a server in a new context in the directory tree.

Each partition consists of a container object, all objects contained in it, and data about those objects. Partitions do not include any information about file systems or the directories and files contained there.

The tree of partitions is transparent to directory users (unless they are running Partition Manager); users usually see only a global tree of directory objects.

To optimize access to different areas of the directory, each partition can be replicated and stored at many locations.

Divide the NDS database at logical boundaries. For NDS to be distributed across a network, the database must be stored on many servers. Rather than copying the entire database onto the server, replicas of the partitions of the database are stored on servers throughout the network.

A *replica* is a copy of a partition. You can create an unlimited number of replicas and store them on any NetWare 4.01 server on the network.

Carefully placed replicas of the partitions decrease traffic and access time on the network, because the information comes from the nearest available server. This is particularly helpful for users who have to gain information about the network across a wide area network (WAN) link. You can place a replica containing needed information on a local server.

It's a Matter of Time

Crucial for operating NDS, the time synchronization feature establishes the order of events between the servers. Events such as password changes are time-stamped to enable NDS to determine which replicas to update and in what sequence. Several types of time servers can be strategically placed throughout the network; however, the most important one is the single-reference time server.

The single-reference time server sets the correct time for the entire network. The network administrator determines which server will be the single-reference time

server, based upon the physical layout of the network. It is best to establish this server on the first NetWare 4.01 server installed, and also at the primary location for network administration.

You Have the Right . . .

In previous versions of NetWare, you could assign directory and file rights. With NetWare 4.01, you can also assign rights to objects and to object properties. Directory and file rights apply only to the file system.

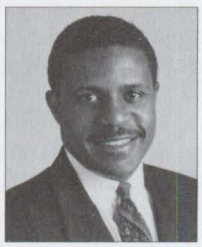
When you plan your directory tree, consider how to control access to objects in the tree. You can control access by using the hierarchy of the tree itself because of the way rights flow down through the tree. Use the following methods to control access to objects within the tree:

- Granting trustee assignments to any object for any other object
- Creating group objects to give groups of users limited or unlimited access to particular objects in the directory tree
- Creating an inherited-rights filter for an object to limit access to that object (The inherited-rights filter is a part of the properties of the object that prevents rights from filtering from one object to another. In some situations, a user object can automatically receive, or inherit, rights from another object. The inherited-rights filter can block any of those inherited rights so that the user object does not receive them.)
- Making a user object the security equivalent to any other object

Summing It Up

NetWare 4.01 is an ideal solution for companies with numerous protocols, topologies, operating systems, and workstations. For the user, today's complex networks can be simplified into one single, logical, integrated view of network resources. Information can be stored on several different servers, and you can find the desired information without having to search throughout the network. At the workstation, information that appears to be within your location may actually be many miles away.

Planning your network with NDS is very important. Consult with department heads and network administrators when you are preparing to install your NetWare 4.01 network. Detailed preparation and planning will ensure a smooth installation and an information network suited to your company's needs.



Lionel Kidd is a marketing support representative in the IBM Personal Systems Competency Center in Roanoke, Texas. He provides technical marketing support on systems that use NetWare and IBM LAN Server. Lionel has six years of experience with Novell* NetWare; he is a Novell CNE and has been the program coordinator for the NetWare 4.0 beta program within IBM United States. He joined IBM in 1991.

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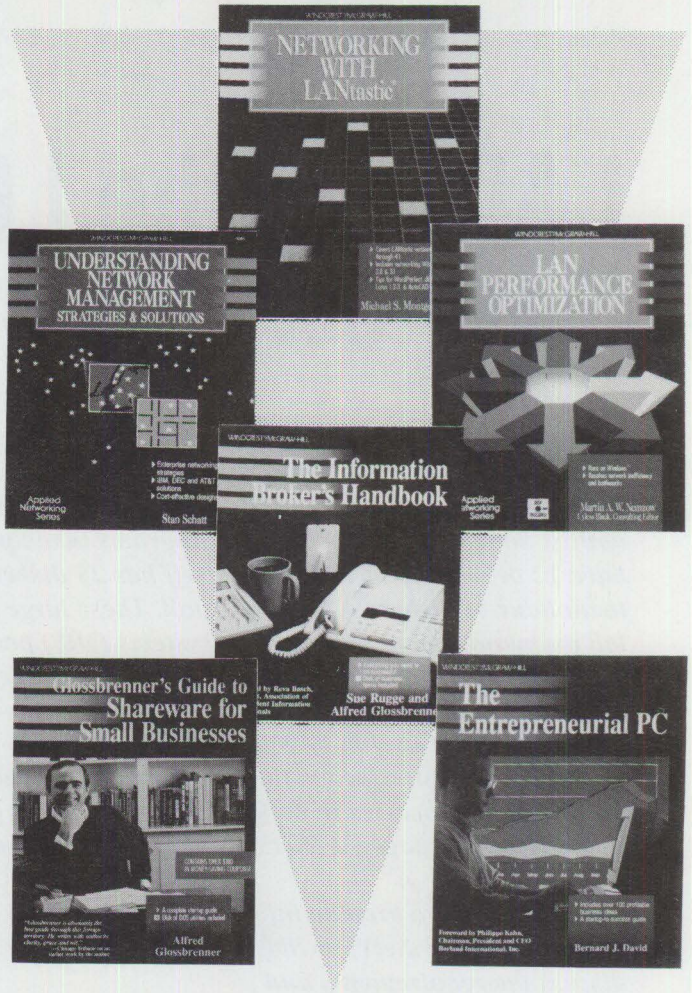

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LAD/2 in the LCU and NetView DM/2 Environments

The advent of graphical user interface (GUI) operating systems has spawned a flood of easy-to-use, powerful applications. This power, however, comes at a price: disk drive space requirements and maintainability. Some Windows and OS/2 programs take up to 30 MB and may have 12 or more diskettes! OS/2 itself has 25 diskettes and can take up to an hour of disk swapping to install. These large programs can take a toll on management information systems (MIS) personnel who have several hundred workstations to install or upgrade. This is where an installation and management tool like LAN Automated Distribution/2 (LAD/2) is most useful. LAD/2 provides an easy-to-use Presentation Manager (PM) interface to the configuration, installation, and distribution (CID) processes in both the LAN CID Utility (LCU) and NetView Distribution Manager/2 (NetView DM/2) environments.

In this article, we provide information to help you decide which environment–LCU or NetView DM/2–better meets your requirements. We discuss the requirements and advantages of each of these environments as well as the added value that LAD/2 provides to each environment. We then present an installation and configuration scenario that shows how LAD/2 simplifies the CID process.

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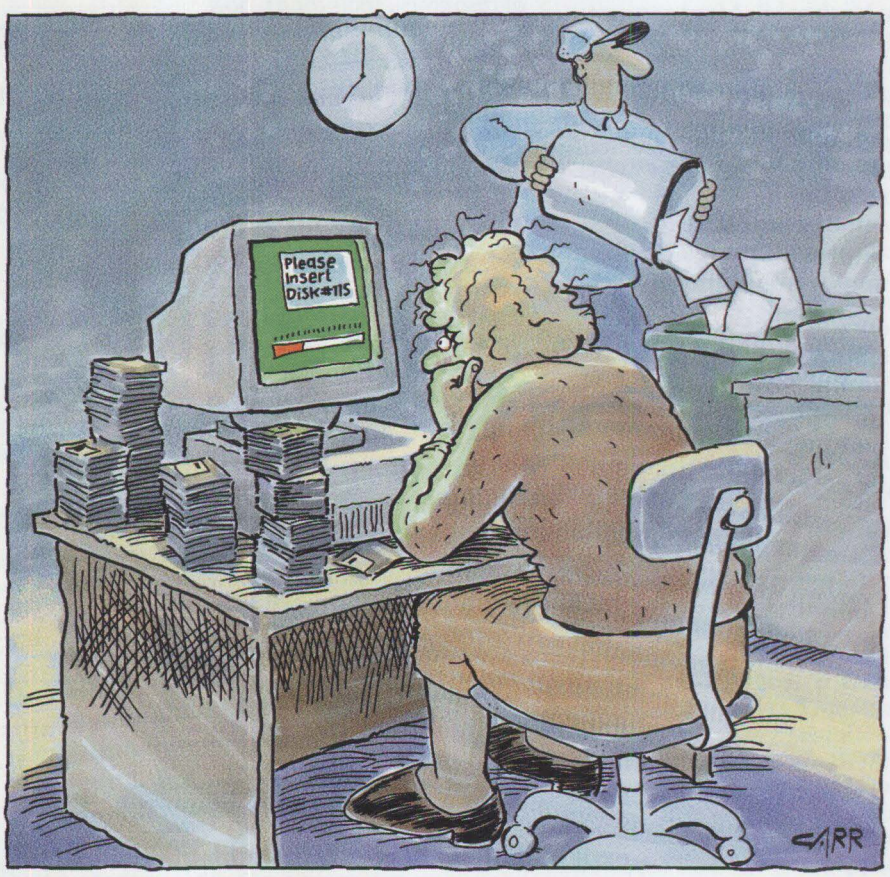
Peter Escue,
Tom Lambert, and
Avalyn Pace
IBM Corporation
Roanoke, Texas

Suppose you have 100, 500, or maybe 1,000 or more workstations to install and maintain. What is the best way to accomplish your task? Which available products or programs can assist you in performing these tasks? How much time will it take to configure and install the software? How much training or knowledge will you need to accomplish your goal?

Obviously, installing diskettes manually is the most straightforward method, requiring no additional programs or products. Unfortunately, it also requires a lot of time and is impractical for more than a few workstations, because manual installation requires that a skilled user at each workstation insert and remove diskettes and enter the required parameters.

There are many variables to consider, and as many solutions, depending on a given set of variables. We attempt to identify the more important variables and to offer a few solutions to this complex, time-consuming effort of software installation and maintenance.



CID

IBM has developed a process that simplifies installing and maintaining software in a LAN environment; it's called *configuration, installation*, and *distribution* (CID). In general, the CID process enables you to install and configure software without shuffling diskettes, and it does not require a user at each workstation to enter the installation and configuration parameters.

Products that implement the CID process are called CID-*enabled*. CID-enabled products can be installed using images installed on a redirected drive located on a CID code server.

A CID code server is an OS/2 workstation that stores the product images, response files, logs, and any other required data. The CID code server also contains the necessary software (LAN transport, redirected drive support, and controlling mechanism) to support CID installations. The CID strategy has also defined a standard subdirectory structure for the code server.

CID-enabled products can also process their installation and configuration parameters from an ASCII text file (called a *response file*) that can also be located on the CID code server.

Two IBM solutions provide the necessary support for CID installations: LAN CID Utility (LCU) and NetView DM/2 2.0.

LAN CID Utility

LCU is a component of the Network Transport Services/2 (NTS/2) 1.0 product. NTS/2 is shipped with the LAN Server 3.0 product but can also be purchased separately. The other components of NTS/2 are the server installable file system (SRVIFS) and LAN adapter and protocol support (LAPS).

All three components are necessary to support CID installations in *lightly attended* mode. LCU installations are said to be lightly attended because they require each workstation to be booted from diskette to initiate the installation. Because the client starts the installation process, an LCU installation is also called a *pull* solution.

SRVIFS provides the redirected drive support that allows the client workstations to access files located on the CID code server. LAPS provides the LAN transport support (NetBIOS). LCU provides CASAGENT support, which controls the CID installation process.

LCU	NetView DM/2
Installation	Installation Distribution
Stand-alone workgroup	Stand-alone workgroup Enterprise network
No status reporting	Status reporting and tracking
OS/2 support	OS/2 support DOS support
CID installation	CID installation
Lightly attended	Unattended Replicated installation
Pull	Push

Figure 1. LAN CID Utility and NetView DM/2 Positioning

Redirected Response File Installation	NetView DM and NetView DM/2 Interface
OS/2 2.0 and 2.1 OS/2 2.0 ServicePak Extended Services for OS/2 LAN Server 3.0 (servers and requesters) Network Transport Services/2 (NTS/2) Communications Manager/2 (CM/2) DATABASE2 OS/2 (DB2/2) NetView DM/2 2.0 (clients and servers) CID-enabled applications	Automatically generate NetView DM/2 change file Install unattended Create change files Create installation control procedures Read and update NetView DM/2 workstation table Provide host distribution support
Application Distribution	**DOS Distribution**
OS/2, DOS, and Windows applications Novell NetWare requesters	IBM PC DOS 6.1 IBM PC/3270 IBM LAN Support Program IBM DOS LAN Requester IBM DOS Database Requester Microsoft Windows 3.1
Additional Features	
Automated response file generation Automated LCU command file generation Centralized configuration Automated partitioning and formatting	Boot Manager installation Boot diskettes creation Customized desktop distribution Virus scan before installation

Figure 2. LAD/2 Version 4.0 Features and Capabilities

LCU requires that you define an LCU command file, which is a REXX command procedure specifying which products to install, in which order to install them, and the required parameters (target directory, location of the images, response file,

and so on) for invoking the product installation. You must also build the response files required to install each product on each client, and you must store the response files in the appropriate directories on the server.

LCU is supported only in the OS/2 environment; it does not support installations to DOS clients. Furthermore, it is a LAN solution; LCU does not support installations or distributions in a wide area network (WAN). In LCU, while updates are being made to the client, the workstation is not available to the user. Finally, there is no tracking of the change management other than in the LCU and product logs, which record the installation and are stored on the CID code server.

NetView DM/2 2.0

NetView DM/2 2.0 Extended also implements the CID process. NetView DM/2 provides its own redirected drive support and controlling mechanism for the CID process.

Each client workstation and server must have a copy of NTS/2 for the LAN transport support (NetBIOS) provided by LAPS.

NetView DM/2 supports CID installations in *unattended* mode, meaning that you do not need boot diskettes to install at client workstations. There is an exception, however: the pristine installation of new workstations. For a new workstation, you must initially boot the computer with the two boot diskettes created by the LAD/2 code server. After the computer is booted, the installation runs unattended, installing all selected products.

NetView DM/2 provides an agent, which is constantly running at the client workstation, that waits for installation commands from the NetView DM/2 server (which is also the CID code server). Because the server initiates the installation, this process is called a *push* solution.

All change management processes (installations, updates, etc.) are recorded in a database and can be tracked by client and by product. You can schedule NetView DM/2 installations for specific times, such as during off peak hours or overnight.

NetView DM/2 lets you define the information needed to build change profiles, which define the product installation commands, target directory, response files, source image location, and so on. The profiles are then built into change files, which are database objects. You can then select these objects for installations on selected clients. You must also build the response files that you require to install each product on each client, and you must store the response files in the appropriate directories on the server.

Which Solution Meets Your Requirements?

Figure 1 presents the information you should use to decide which solution best meets your requirements. As you read the information, ask yourself the following questions: Do I need a tracking process for software installed on my clients? Do I require unattended installations? Do I need DOS support? What does my budget allow for? Choose the solution you need, and then see how LAD/2 simplifies the process.

LAD/2

LAD/2 simplifies the CID process by helping you set up the code server, providing centralized configuration, automating response file generation, and building the procedures necessary to control the installation. In addition, LAD/2 supports non-CID-enabled application distribution and configuration for both OS/2 and DOS.

LAD/2 provides a PM interface to the CID process. LAD/2 depends on the CID functions (redirected drive support, CID control procedures, and NetBIOS support) provided in either the LCU or NetView DM/2 environment. Upon that base, LAD/2 builds an interface to help you centrally configure and automate the CID tasks that you normally do manually.

LAD/2's CID code server setup procedure creates the proper CID code directory structure and helps you load the product images on your server. Without this function, you would have to be familiar with each product's image loading procedure and the CID code server directory setup. (See the related article in this magazine, "Easy Setup of CID Code Servers.")

In both the LCU and NetView DM/2 environments, LAD/2 allows you to select the products to install on a set of clients. LAD/2 then provides a PM interface that lets you to define the products' installation and configuration parameters.

LAD/2 also allows you to configure parameters at the client level for each client-specific product, such as locally administered addresses (LAAs), machine names, node ID, and CP names. LAD/2 also provides special functions for partitioning, formatting, and creating Boot Manager partitions. Using this information, LAD/2 generates a client-specific response file for each product selected and stores the response files on the code server, where clients can access them during installation. If all this were done manually, it would be a very tedious, time-consuming process!

In the LCU environment, LAD/2 generates the LCU REXX command procedure, which defines which products to install, the parameters necessary to invoke the installation, and the order of the installation. This procedure is based on the products that were selected for installation through the LAD/2 product screen, on the CID requirements for controlling the flow of the installation, and on the product definitions for each product. Normally, you have to manually create this procedure.

In the NetView DM/2 environment, LAD/2 generates the change profiles and change files for the products being installed. LAD/2 also generates a REXX command procedure that invokes the installation of the products on the selected clients. Without LAD/2, you would not only have to know the CID definition requirements for each product, but also know how to create change profiles and change files within NetView DM/2.

LAD/2 updates `CONFIG.SYS`, `STARTUP.CMD`, and the desktop on client workstations. LAD/2 has a special function to send customized desktops to client workstations.

In addition to supporting CID installations, LAD/2 also supports the distribution of OS/2, DOS, and Windows applications to an OS/2 client. The scenario below discusses how LAD/2 handles these applications. Figure 2 lists LAD/2's features and capabilities.

Scenario

Let's look at a scenario in which LAD/2 could be used.

Joe owns an industrial rock gravel pit, and business is booming. Joe realizes that his

old computer systems are not solid enough for the 1990s, and he must upgrade his existing computers with a more robust operating system. Joe decides to upgrade to an OS/2 platform on all of his new and existing workstations.

Joe's biggest concern is providing a smooth transition from the existing DOS platform to the new OS/2 platform. He needs to ensure that all workstations maintain connectivity to his IBM AS/400*, IBM LAN Server, and Novell NetWare 3.11 systems. The order-takers in his company require a special ordering and inventory application that resides on both the Novell NetWare server and their personal workstations.

Most of Joe's 90 workstations are IBM PS/2s, but some are Compaq* workstations and others are Dell* workstations. All of the workstations are connected to the LAN via the token-ring topology.

Joe wants to install the following products on the workstations:

- OS/2 2.1
- NTS/2 LAPS
- Communications Manager/2 1.01
- Novell NetWare Requester for OS/2
- Inventory Plus (on order-takers' workstations only)

Joe has three choices for migrating his 90 workstations from DOS to OS/2 2.1: He can (1) install from diskettes, (2) perform a native CID installation, or (3) perform a LAD/2 CID installation. After evaluating the options, Joe decides to purchase LAD/2 to perform his current and future installations over the LAN.

By selecting LAD/2 as his installation tool of choice, Joe can select and install additional products as his business grows. For instance, when a new version of Inventory Plus is released, Joe can install the application on his code server and send the application down to all of his order-takers' machines in a matter of hours.

LAD/2 provides a PM interface for the configuration, installation, and distribution from a LAD/2 CID code server to client computers. Once the client computers start the installation process, Joe can go home and return the next morning to find all of his computers installed and configured the way he defined them in the LAD/2 PM interface.

He can specify whether to install or migrate to OS/2 via the LAD/2 interface. If Joe selects to install his workstations, he can:

- Partition and format the clients' hard drives
- Install Boot Manager on the client computers

If Joe selects to migrate his workstations, he can:

- Migrate to OS/2 from DOS and give his employees the option of booting in DOS or OS/2
- Migrate the existing configuration files on each workstation

Communications Manager/2 (CM/2) is Joe's choice for installing 5250 connections to the AS/400. Through LAD/2's ability to centrally configure workstations, Joe can define several parameters–such as the number of sessions, session names, host name, and PU name for each client–all at the LAD/2 code server.

Currently, Joe's company uses Novell NetWare for its LAN solutions; however, Joe wants to migrate from NetWare to IBM's OS/2 LAN Server 3.0. He is nervous about abruptly switching from one LAN operating system to another, so both servers will run until he is comfortable with the conversion. Because of the dual-server environment, Joe needs to install LAN Requester, as well as Novell NetWare Requester for OS/2, on all clients.

Furthermore, Joe also wants to remotely install and tune his LAN Server 3.0 Domain Controller. He can enter all of the definitions for the Domain Controller, IBM LAN Requester 3.0, and NetWare Requester for OS/2 (including `NET.CFG`) into the LAD/2 interface, and all of the products will be installed as defined.

Joe also wants to remotely install two applications. The first is IBM LAN Network Manager, which will be installed on his workstation so that he can manage the LAN. LAN Network Manager is CID-enabled. The second is Inventory Plus, which will be installed on all of the order-takers' workstations. Inventory Plus is not CID-enabled.

For CID-enabled applications, Joe must input the installation parameters to remotely install these products. For non-CID-enabled applications, he must change the `CONFIG.SYS` and `STARTUP.CMD` files. He must also enter a definition into the LAD/2 interface for placing an object on the Workplace Shell for non-CID-enabled applications.

A final requirement is that the OS/2 desktops must be configured the same way on all the computers. LAD/2 can handle this! To take advantage of this function, Joe must install an OS/2 computer via diskette or LAD/2; configure the Workplace Shell exactly as he wants it replicated throughout his company; then use LAD/2 to copy the Workplace Shell for the configured computer to the LAD/2 code server. After performing these steps, Joe can specify in LAD/2 to copy this desktop to any or all of his client computers.

Working with LAD/2

LAD/2 organizes information into groupings called customers and work groups. *Customers* are the highest level of the hierarchy and can have several work

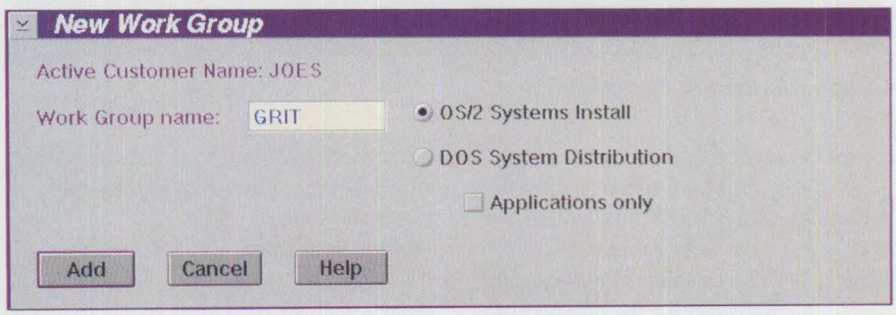


Figure 3. New Work Group Screen

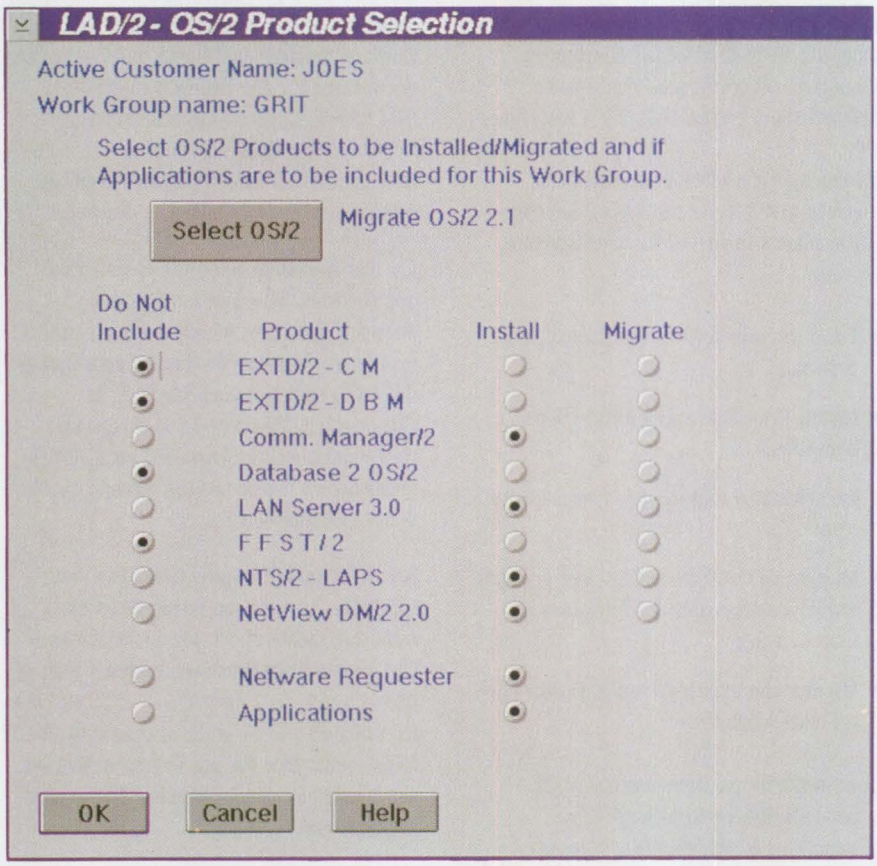


Figure 4. LAD/2 - OS/2 Product Selection Screen

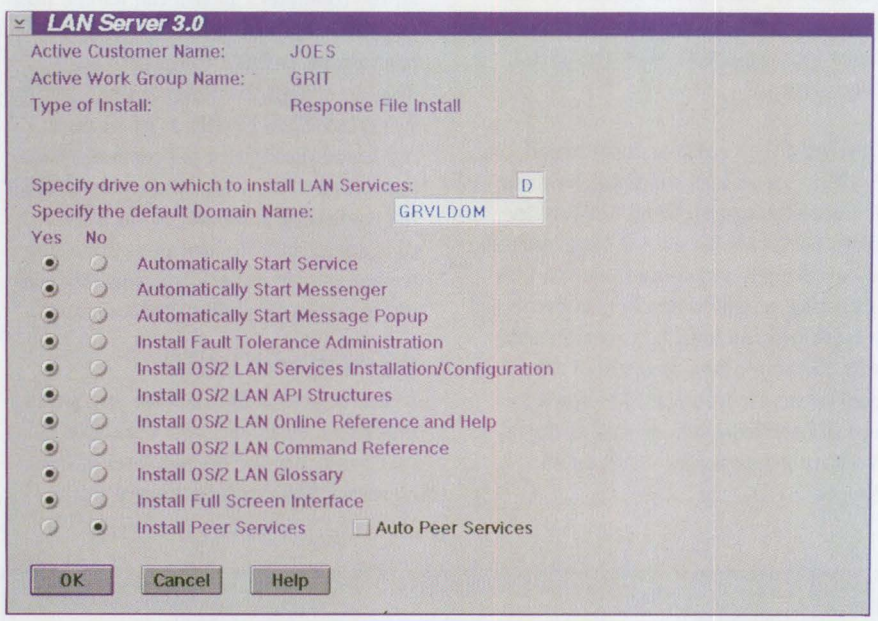


Figure 5. LAN Server 3.0 Screen

groups. A *work group* is a logical grouping of clients that have similar base configurations. Basically, all the clients in a work group have all of the same products installed and use the same type of adapter. Nearly all parameters for the products can be configured at a client level.

To start the LAD/2 process, Joe must create the following customer and work group:
Customer Name: JOES
Work Group Name: GRIT

Figure 3 shows the LAD/2 screen to add a new work group.

After a new customer and work group are defined, LAD/2 presents Joe with the main screen for configuring his clients. At first, this screen has only a single button other than the standard OK, Cancel, and Help buttons. This button is labeled Products. By selecting the Products button, Joe can define which products to install on the clients in this work group. Figure 4 shows all of the available options on this screen.

Since, however, Joe does not need all of these products for his GRIT work group, he selects the following:

- OS/2 2.1 (install)
- NTS/2 LAPS (install)
- Communications Manager/2 (install)
- LAN Server 3.0 (install)
- NetWare Requester for OS/2 (install)
- Applications (install)

After selecting the above products, Joe presses OK and returns to the main configuration screen, where an additional button, called the Work Group button, now appears. This button leads to a set of screens that enables Joe to define all of the default client parameters for every product selected for this work group.

For Joe's GRIT work group, buttons appear for OS/2, LAPS, Communications Manager/2, LAN Server 3.0, NetWare Requester, and Applications. Joe can enter any of these screens to define the common configurations of each product for all of the clients in the GRIT work group. For instance, he can configure OS/2 parameters such as default printers, fonts to use, type of mouse support, display, DOS/Windows support, and so on. Everything that Joe can configure during a diskette installation, he can also configure at the LAD/2 code server.

If Joe selects to install OS/2 instead of migrating, the Partition/Format button appears. This button allows Joe to partition two `C:` primary drives (only one of which can be seen at a time, hence only one `C:` reference), and three extended drives (`D:`, `E:`, `F:`). The first primary drive and all of the extended drives can be formatted as either HPFS or FAT, in any combination.

For the LAN Server 3.0 product, Joe needs to define the default parameters for the GRIT work group. The domain name to which Joe wants all of the clients to attach is LADDOM. In addition, on the D: drive, Joe wants to install the requester code and the following components:

- Fault Tolerance Administration
- LAN Services Installation/Configuration
- LAN Online Reference and Help
- LAN Command Reference
- LAN Glossary
- Full-Screen Interface

Joe also wants to automatically start the requester, messenger, and pop-up services. Figure 5 shows one of LAD/2's LAN Server 3.0 screen.

NTS/2 LAPS must also be configured for this work group. Since Joe's company uses the token-ring topology for its system connectivity and uses IBM's token-ring adapter cards, Joe must configure LAPS to use the proper protocol. Upon entering the LAPS screen, Joe must define whether to use locally administered addresses (LAAs) or universally administered addresses (UAAs). Joe must also select to use the token-ring card, and he can edit the NetBIOS, IEEE 802.2, and NTS/2 protocol support within the LAPS screen. Figure 6 shows the LAD/2 interface for defining LAPS.

Once Joe has configured LAPS, he can continue to the NetWare Requester panels. Joe has the option of selecting the target drive, the network interface card to use, SPX (sequence packet exchange) support, NetBIOS support, support for DOS/Windows, source routing, and support for named pipes. In addition, Joe can also create a NET.CFG that all clients in the GRIT work group can use and distribute. Joe selects to install the NetWare code on the C: drive, to use the ODI2NDI driver, to install Source Routing support, and to provide a NET.CFG file.

From the Applications screen, Joe can connect to a computer that has the customized desktop that he wants to replicate on all of his clients. Once connected, Joe uses LAD/2 to copy the desktop to the LAD/2 directory structure. In addition to selecting the desktop configuration, Joe

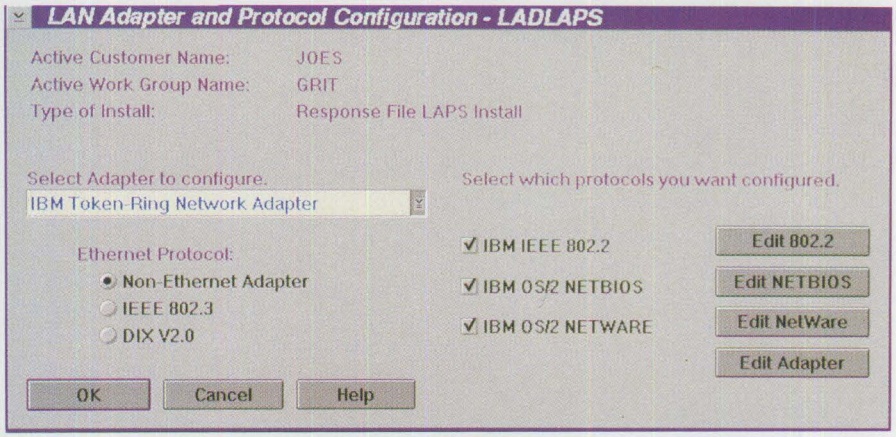


Figure 6. LAN Adapter and Protocol Configuration Screen

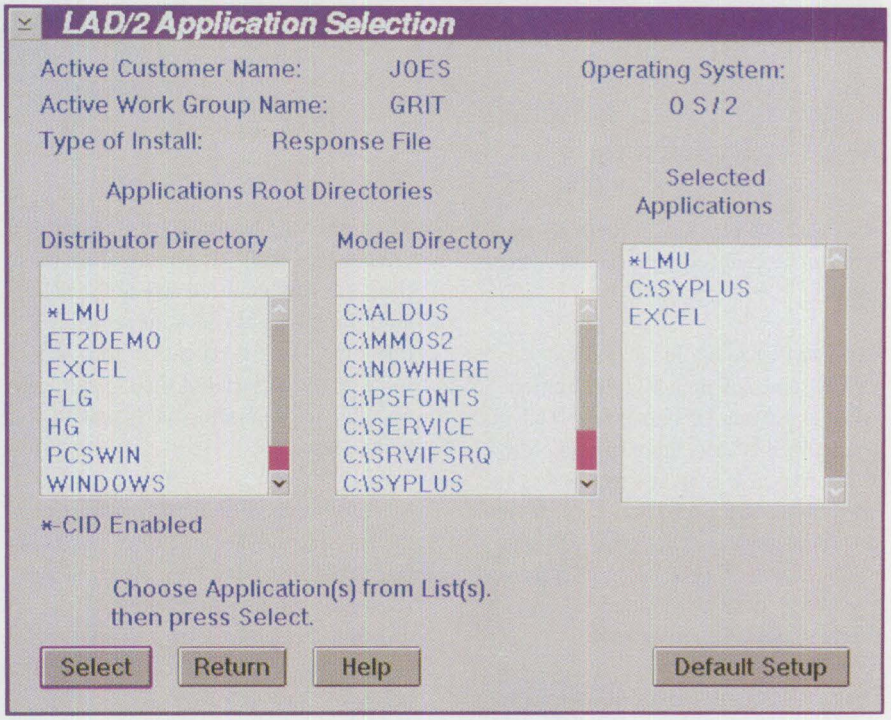


Figure 7. LAD/2 Application Selection Screen

can add the CID-enabled and non-CID-enabled applications on this screen for all clients to use (see Figure 7). To install the applications, Joe must go through the application screens to define LAN Network Manager as a CID-enabled application and Inventory Plus as a non-CID-enabled application.

Finally, Joe needs to define the Communications Manager/2 defaults and the 5250 and APPN parameters. Once he defines this information, he can continue to the client portion of LAD/2.

This concludes Joe's configuration at the work group level.

By pressing OK on the Work Group screen, Joe again sees the main configuration screen, which now displays the Clients button. Before entering the Clients screen, Joe must specify the number of clients (from 1 to 75) he wants defined in his GRIT work group. After he specifies this number, Joe must move to the client screen. At this time, default parameters are being generated for each client, based on information presented in the work group screens and pre-defined defaults.

If Joe specifies that he wants to automatically start the LAN Requester 3.0 service in the LAN Server 3.0 screen, this value is automatically given to each client. Within

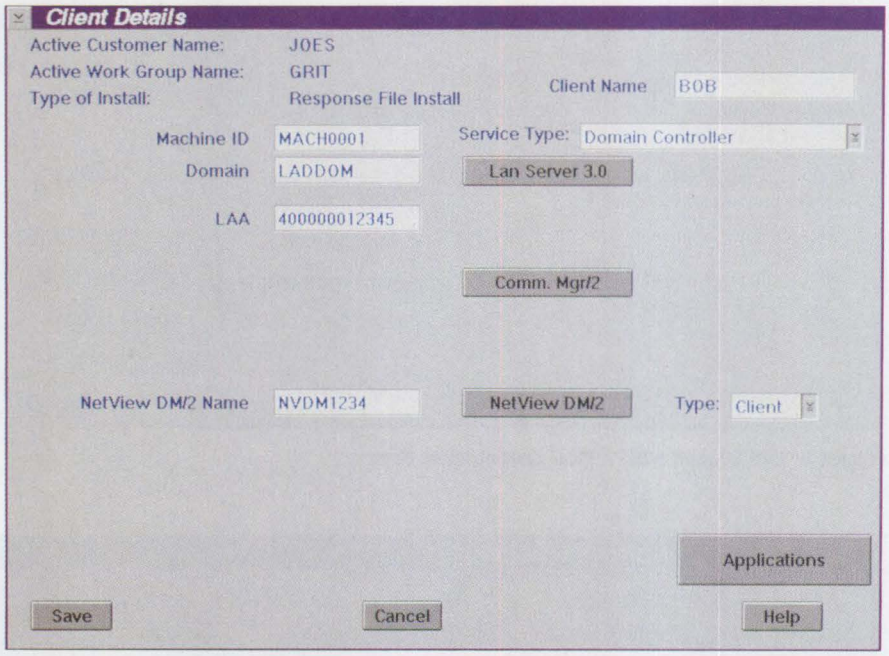


Figure 8. Client Details Screen

the client screens, any of these parameters can be changed on a client-by-client basis.

On the other hand, Joe may decide to define some common 5250 definitions (such as Partner LU name) for all clients to use. In this case, more information such as Local LU name is required at the client level. Since the Local LU name must be unique for each client, LAD/2 generates a default of A0001 to A0075 for each client. Any of these parameters can also be changed at the client level.

Figure 8 shows the kinds of information that can be modified at the client level within LAD/2.

When all of the client configurations are complete, Joe must create two OS/2 boot diskettes for each client. LAD/2 provides an interface to do this. Based on the version of OS/2 being installed and the type of LAN adapter selected from the LAPS screen, Joe can create the OS/2 installation disk and a modified diskette #1 by pressing the Create button on the Client Boot Diskette screen.

After all of the boot diskettes are created, Joe must press the Generate button on the main configuration screen to create all of the necessary files for remotely installing all of the clients in the GRIT work group. After all of the files are generated, LAD/2 presents the Install/Distribute screen.

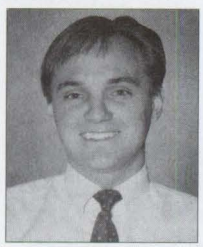
By entering the Install/Distribute screen, Joe can start the LAD/2 CID code server. Once the CID code server is started and active, Joe can use the client boot diskettes created by LAD/2 to boot his client computers and start the installation process.

From this point, Joe does not need to touch any client computers until the installation process is complete. Then all he needs to do is retrieve the diskettes from each client workstation.

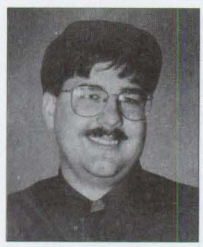
How to Order LAD/2

You can order LAD/2 through IBM's As-Is Software Products and Offering (AISPO) program, by contacting your IBM representative, or by calling (800) 547-1283. Ask for program number 5764-031. Optional installation and/or technical support services are available.

Bob Bush is a senior marketing support representative in the IBM Personal Systems Competency Center in Roanoke, Texas. Since joining IBM in 1966, Bob's positions have included finance industry specialist and AS/400 conversion specialist. Bob joined the LAD/2 group in 1991.



Peter Escue is an associate marketing support representative in the IBM Personal Systems Competency Center in Roanoke, Texas. He joined IBM in 1993 to become part of the team developing LAD/2.



Tom Lambert is an associate marketing support representative in the IBM Personal Systems Competency Center in Roanoke, Texas. He is responsible for developing CID-SETUP and LAD/2. He joined IBM in 1991 after earning a bachelor's degree in business administration from the University of North Texas.

Avalyn Pace is a marketing support representative in the IBM Personal Systems Competency Center in Roanoke, Texas. She is a member of the team developing LAD/2. Avalyn joined IBM in 1983.

frugal (fro͞o'gəl) *adj*. Economical, thrifty.

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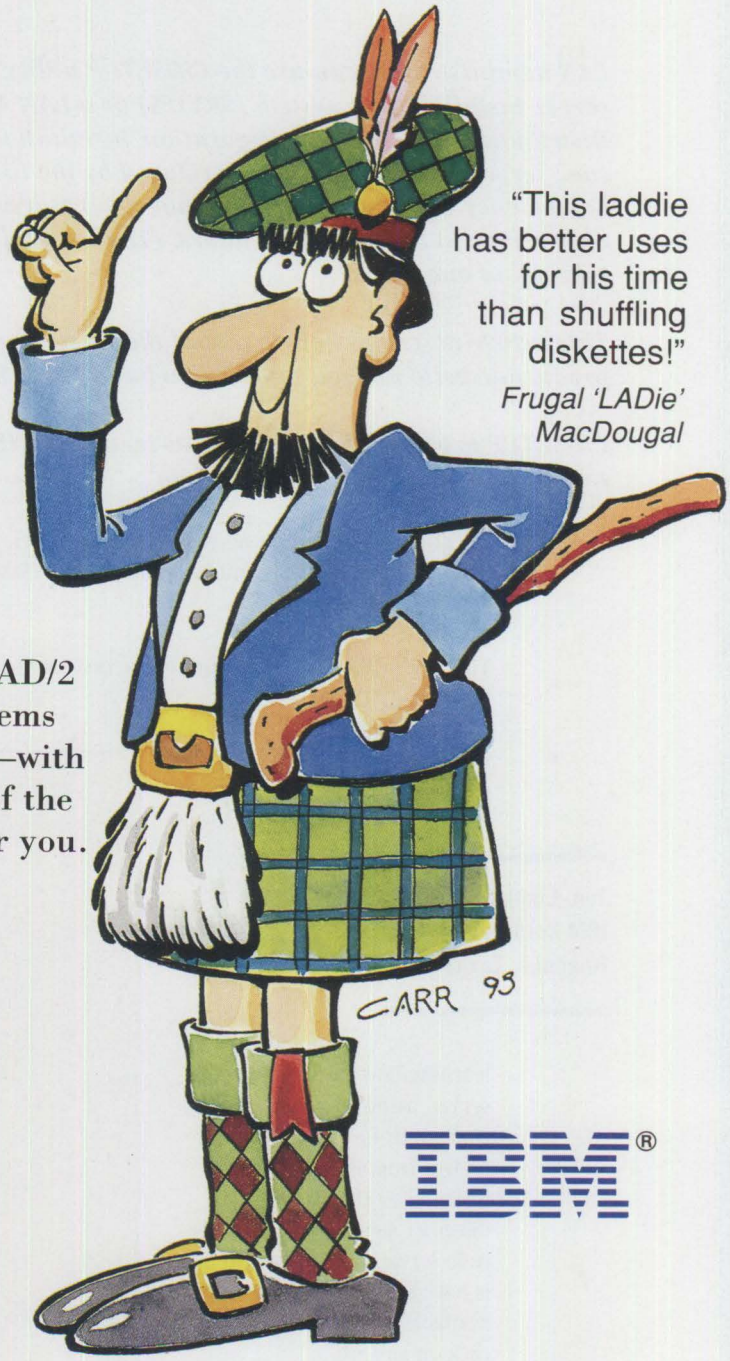

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Easy Setup of CID Code Servers

LAN administrators can use the CIDSETUP utility to set up either a server installable file system (SRVIFS) or a LAN Automated Distribution/2 (LAD/2) configuration/installation/distribution (CID) code server. CIDSETUP, a tool developed by the IBM Personal Systems Competency Center (PSCC) in Roanoke, Texas, enables you to set up a code server in less than four hours. (The manual setup method would take about one week.)

This article describes how to install the server code, how to apply the product diskette images, and how to build client boot diskettes.

CIDSETUP is offered to customers as-is, with no IBM support either expressed or implied.

You're ready to set up your CID code server. You have this new utility called CIDSETUP. You have the product diskettes ready. You click on an icon.

That's all! CIDSETUP takes care of the rest for you. It even creates your `SRVIFS.INI` files and your two client boot diskettes for OS/2 2.x (Figure 1).

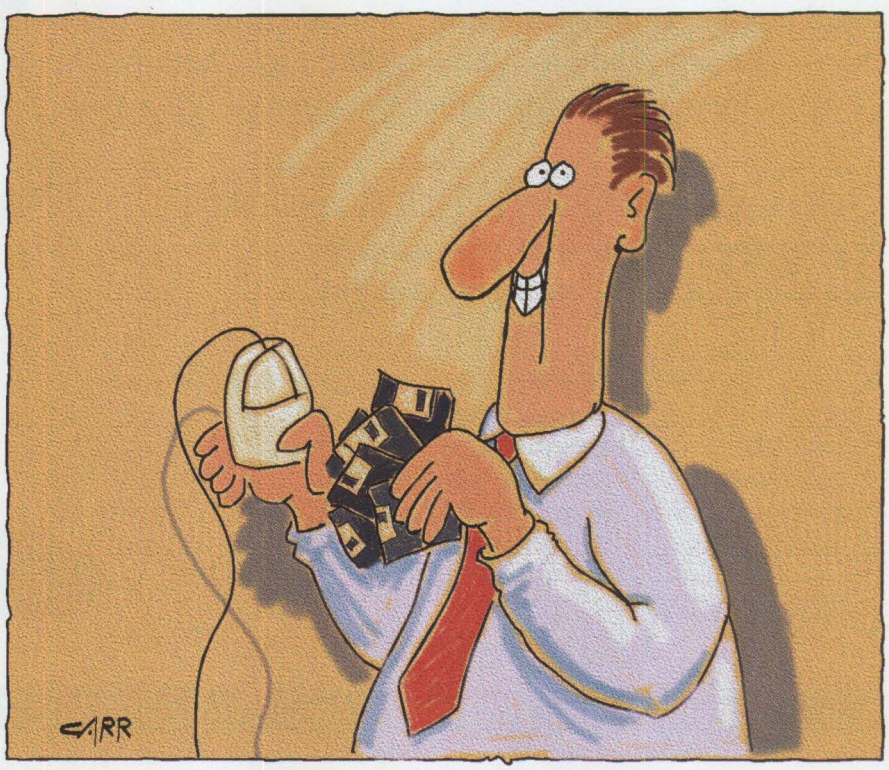
Tom Lambert
IBM Corporation
Roanoke, Texas

How can this tool save you so much time? It's because the PSCC has already invested the time and effort in learning how to set up a code server, using all of the right commands for copying the images from the product diskettes to the proper CID directory structure on your code server. All you have to do is have the product diskettes available during setup, then click on an icon.

CIDSETUP can currently install SRVIFS and LAD/2 code servers. In the future, CIDSETUP will be able to install CID code servers on top of Novell NetWare, transmission control protocol/internet protocol (TCP/IP), and NetView Distribution Manager/2 (NetView DM/2) servers. CIDSETUP is constantly being updated to support all IBM CID-enabled products. Figure 2 shows the products that are currently supported via CIDSETUP.

Building Servers

Currently, CIDSETUP can define and install both LAD/2 and SRVIFS CID code servers. This program not only installs and configures the required files, it also creates the required CID directory structure. The directory structure that CIDSETUP creates is the same for both LAD/2 and SRVIFS code servers. To be specific, CIDSETUP creates a `\CID`



directory as the root directory of all files accessible by the client machines. The response file, log file, command file, product image, executable, dynamic link libraries (.DLLs), applets, and sample directories are created under \CID for the clients to share.

If you are installing a LAD/2 code server, CIDSETUP calls the LAD/2 installation program. (LAD/2 is not included with CIDSETUP, so make sure that you have the LAD/2 installation diskettes before using CIDSETUP.) The LAD/2 program installs all the LAD/2 files, modifies the system configuration files, and places LAD/2 icons on the desktop. While defining your code server, keep in mind that you must install LAD/2 on the same drive as the product images. (See the LAD/2 article in this issue of *Personal Systems* for more information.)

If you are installing a SRVIFS code server, CIDSETUP helps you define your SRVIFS.INI file and builds your client boot diskettes. CIDSETUP's PM interface supports virtually all configuration information for the SRVIFS.INI file. Figure 3 illustrates which values you can define.

Don't worry if you are not familiar with the values in Figure 3. CIDSETUP provides defaults that work for most installations; however, if you would like more information about the configuration parameters in Figure 3, refer to the *IBM Network Transport Services/2 Redirected Installation and Configuration Guide* (S96F-8488).

After specifying the SRVIFS information in Figure 3, you can specify which redirected drive the clients can use to access the aliases defined in the SRVIFS.INI file. Using the above information, CIDSETUP creates two OS/2 2.x client boot diskettes. There is one exception, however; if your code server's operating system is OS/2 2.1, then CIDSETUP cannot create OS/2 2.0 boot diskettes.

Creating Product Images

As product images are added to the server, CIDSETUP creates a \CID directory structure. In general, each product has an image directory, a response file directory, and a log directory. For example, if you choose to install the Communications

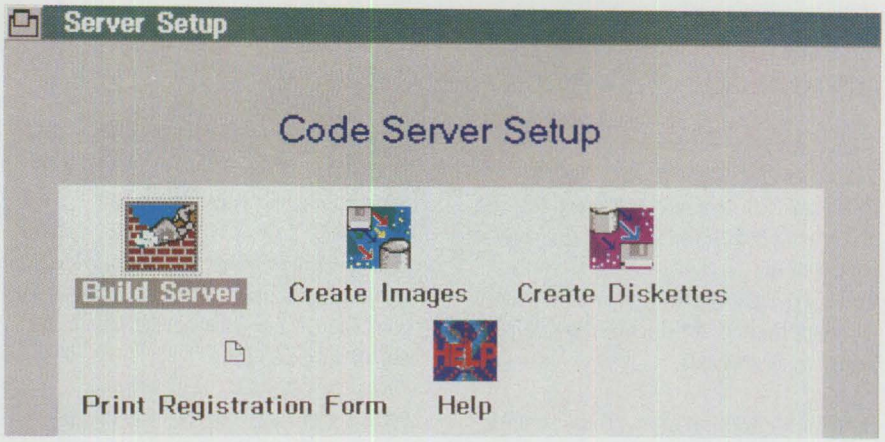


Figure 1. Code Server Setup

Product	Command to Install	Storage Location
OS/2 2.0	SEIMAGE	\CID\IMG\OS2V20 \CID\EXE\OS2V20 \CID\DLL\OS2V20
OS/2 2.0 ServicePak 1	XCOPY	\CID\CSD\OS2V20\WR6055 \CID\EXE\OS2V20 \CID\DLL\OS2V20
OS/2 2.0 ServicePak 2	XCOPY	\CID\CSD\OS2V20\XR6100 \CID\EXE\OS2V20 \CID\DLL\OS2V20
OS/2 2.1	SEIMAGE	\CID\IMG\OS2V21 \CID\EXE\OS2V21 \CID\DLL\OS2V21
NTS/2	LAPSDISK	\CID\IMG\LAPS \CID\IMG\SRVIFS \CID\IMG\LCU \CID\SAMPLE \CID\APPLETS \SERVER
Extended Services	ESAIMAGE	\CID\IMG\ES10
DB2/2 Single User	XCOPY	\CID\IMG\DB22\DB2SU
DB2/2 Client/Server	XCOPY	\CID\IMG\DB22\DB2CS
DB2/2 Client-Enabler	XCOPY	\CID\IMG\DB22\DB2CE
Communications Manager/2 1.0	CMIMAGE	\CID\IMG\CM10
Communications Manager/2 1.01	CMIMAGE	\CID\IMG\CM101
LAN Server 3.0	LANINST	\CID\IMG\LS30
NetView DM/2 Extended	NVDMCOPY	\CID\IMG\IBMNVDM2
NetView DM/2 Entry	NVDMECPY	\CID\IMG\NVDMENTY

Figure 2. Supported Products in CIDSETUP

Manager/2 (CM/2) 1.0 product images, CIDSETUP creates the directories shown in Figure 4.

The CMIMAGE command places all of CM/2's product files in \CID\IMG\CM10 (see Figure 2). If any sample response files are provided with the product, they are copied to the \CID\RSP\productname directory. This directory structure is created when the CM/2 1.0 icon, shown in Figure 5, is pressed.

Figure 2 shows that most products store their files in the directory \CID\IMG\productname, where productname is a one- to eight-character name. For instance, productname CM10 represents Communications Manager/2 1.0.

Figure 2, however, also shows that there are some exceptions to this rule. OS/2 2.0, OS/2 2.0 ServicePaks, OS/2 2.1, DATABASE 2 OS/2 (DB2/2), and Network Transport Services/2 (NTS/2) have unique requirements that CIDSETUP handles for you. The next several paragraphs point out these exceptions.

OS/2 2.x not only creates the image, response file, and log directories, but each version of OS/2 also creates \CID\EXE\OS2V2x and \CID\DLL\OS2V2x. The \CID\EXE\OS2V2x directory stores all of the executable files required by the client machines during the installation process. Likewise, the \CID\DLL\OS2V2x directories store all of the .DLL files required by the client machines. Figure 6 lists the contents of each of these directories.

ServicePaks are also exceptions to the rules. All Corrective Service Diskettes (CSDs) are stored in the \CID\CSD\productname\csdversion directory, where csdversion is the one- to eight-character representation of the CSD level. The response files and the log files are stored in \CID\RSP\CSD\productname\csdversion and \CID\LOG\CSD\productname\csdversion directories respectively. For example, the OS/2 2.0 ServicePak XR06100 is stored in the \CID\CSD\OS2V20\XR6100 directory; its response files are located in \CID\RSP\CSD\OS2V20\XR6100; and its log files are located in \CID\LOG\CSD\OS2V20\XR6100.

DB2/2 requires just a slight modification to the rules. Because DB2/2 comes in different varieties, CIDSETUP creates a \CID\IMG\DB22 directory as the root directory. Then each version of DB2/2 is placed in a subdirectory under \CID\IMG\DB22. For instance, DB2/2 single user images are stored in \CID\IMG\DB22\DB2SU. The response file and log file directories follow the same scheme.

NTS/2 is the final product with exceptions to the rule. CIDSETUP creates a \CID\IMG\LAPS directory to store the NTS/2 images that are used to install LAPS on the client machine. CIDSETUP also creates \CID\IMG\SRVIFS and \CID\IMG\LCU directories to store the SRVIFS and LCU files that the client accesses throughout the installation process. In addition, CIDSETUP creates two directories for storing sample NTS/2 files and NTS/2 applets: \CID\SAMPLE and \CID\APPLETS.

While the above exceptions may appear confusing–and they are–don't worry; CIDSETUP handles them all. All you have to be concerned about is providing the product diskettes and selecting the right icon!

You can modify the following parameters with CIDSETUP:
Server Name
Group Name
Path
Log File Drive
Response File Drive
Command File Drive
Adapter
Maximum Number of Threads
Maximum Number of Concurrent Installs
Maximum Number of Open Files
Alias Name
Type of Share (either Per-Client or Single) for Alias
Read/Write for Alias
Server Path to Alias

Figure 3. SRVIFS Server Configuration Keywords

Images	\CID\IMG\CM10
Response File	\CID\RSP\CM10
Log File	\CID\LOG\CM10

Figure 4. \ CID Directory Structure for Communications Manager/2 1.0

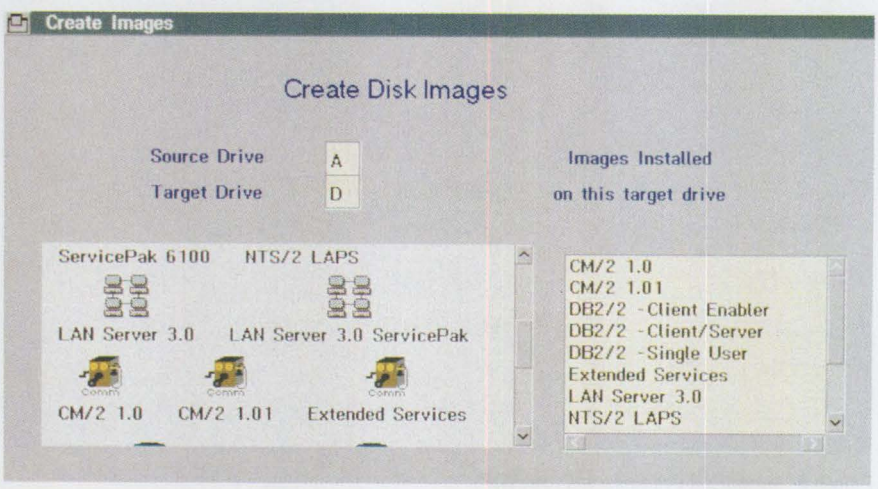


Figure 5. Create Disk Images

Building Client Boot Diskettes

Using the OS/2 images stored on your code server, CIDSETUP can create your client boot diskettes. CIDSETUP fills in the A: default target drive with "A," the default server name as defined in CIDSETUP during the SRVIFS code server installation, and a default adapter type of IBM token-ring. You can change any of these default values. In addition, CIDSETUP prompts you to furnish the client name and to select which version of OS/2 diskettes you wish to create. Figure 7 shows the CIDSETUP interface for creating client boot diskettes.

Once you give CIDSETUP all of the required information, the utility executes SEDISK to create your two client boot diskettes. After SEDISK completes, THINLAPS, THINIFS, and CASINSTL are executed to store the LAN transport on your diskettes.

Editing the LAN CID Utility Command File

The default LAN CID Utility (LCU) command file provided with CIDSETUP acts as a template file. You must edit it to suit your requirements. For instance, at a minimum, you must change the server name parameter in the THINIFS section. You must also make sure that you include only the products that you want to install. For more information about modifying the LCU command file, refer to the *IBM Network Transport Services/2 Redirected Installation and Configuration Guide.*

Future Enhancements

IBM programmers are working on three major enhancements to CIDSETUP in 1994. With these enhancements, you will be able to install a NetWare code server, a TCP/IP code server, and a NetView DM/2 code server. In addition to the three major enhancments to CIDSETUP, new product images will be supported when they become CID-enabled.

How to Obtain CIDSETUP and Support

CIDSETUP is distributed via IBM's OS/2 Bulletin Board System (BBS) and the IBM PC Company Bulletin Board System. The name of the package is CIDSETUP.

OS/2 2.0		OS/2 2.1	
\CID\EXE\OS2V20	\CID\DLL\OS2V20	\CID\EXE\OS2V21	\CID\DLL\OS2V21
SEIMAGE.EXE	UHPFS.DLL	UNPACK2.EXE	UHPFS.DLL
SETBOOT.EXE	REX.MSG	SEIMAGE.EXE	REXX.DLL
SEINST.EXE	REXH.MSG	XCOPY.EXE	REXXAPI.DLL
SEDISK.EXE	REXX.DLL	SETBOOT.EXE	REXXUTIL.DLL
XCOPY.EXE	REXXAPI.DLL	SEMAINT.EXE	REXH.MSG
RSPINST.EXE	REXXINIT.DLL	SEINST.EXE	RXQUEUE.EXE
SEMAINT.EXE	REXXTRY.CMD	SEDISK.EXE	RXSUBCOM.EXE
	REXXUTIL.DLL	RSPINST.EXE	REXXTRY.CMD
	RXQUEUE.EXE		REX.MSG
	RXSUBCOM EXE		REXXINIT DLL

Figure 6. \ EXE and \ DLL Directory Contents

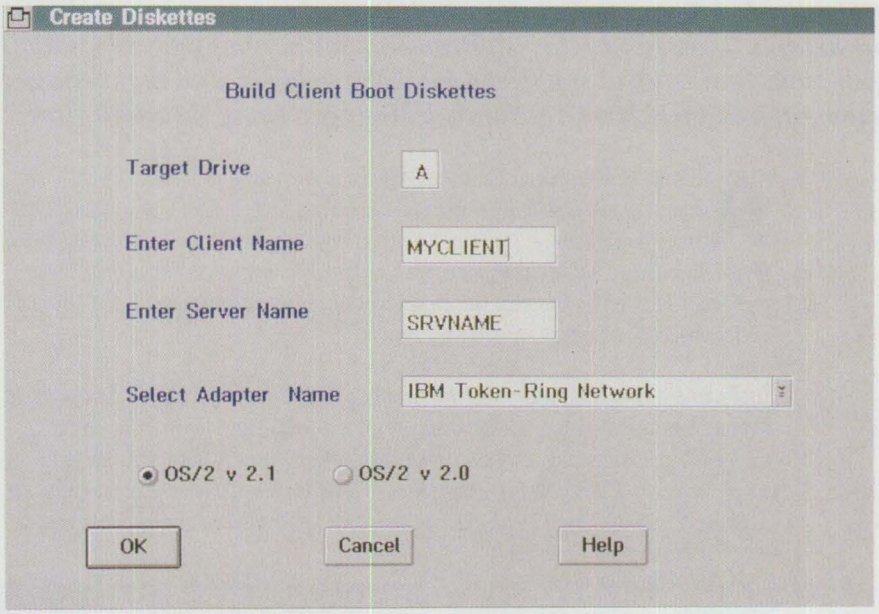
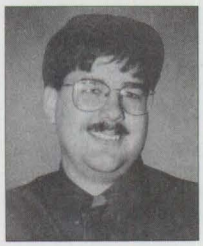


Figure 7. CIDSETUP Client Boot Diskettes Creation Screen

Support for CIDSETUP is provided on a best-effort basis via the OS2INST CFORUM on the OS/2 BBS. Phone support is not currently provided.

For more information about CIDSETUP or any of the other products or programs available from IBM's PSCC, call (800) 547-1283.



Tom Lambert is an associate marketing support representative in the IBM Personal Systems Competency Center in Roanoke, Texas. He is responsible for developing CIDSETUP and LAD/2. He joined IBM in 1991 after earning a bachelor's degree in business administration from the University of North Texas at Denton.

Managing Token-Ring Bridges with IBM's LAN Network Manager

This article offers a technical overview of token-ring management by bridges. It discusses the requirements for managing bridges, the functions and control supported by IBM's bridges, and the management offered by IBM's LAN Network Manager using this data flow.

Although an essential characteristic of a local area network (LAN) is sharing a common medium such as token-ring or Ethernet*, control of LAN traffic is distributed among the participating devices. Each station performs significant self-management and network monitoring functions; therefore, in a LAN environment, the first level of network management is provided by the LAN adapters in each station.

IBM's token-ring adapter cards inherently provide greater control and management at the Medium Access Control (MAC) level than is provided by a Carrier Sense Multiple Access with Collision Detection (CSMA/CD) access protocol adapter. (Ethernet, for example, uses the CSMA/CD access protocol.) Although various intelligent hubs in the CSMA/CD environment provide a level of management roughly equivalent to that provided by token-ring adapters, this level of management is not provided at the workstation level.

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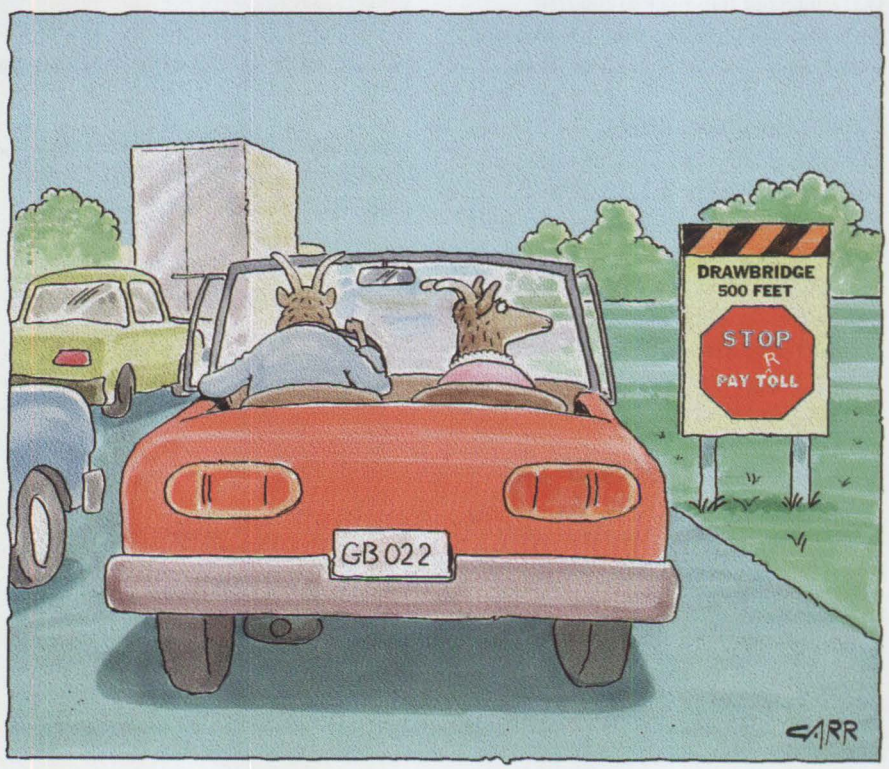
Research Triangle Park, NC

The token-passing ring protocol concepts are implemented in the adapters themselves and contribute to the availability, performance, and manageability of a token-ring LAN. Implementing IEEE* 802.5 standards supports this high level of management intelligence. Token-ring stations act as segment monitors (either active or standby) for functions such as:

- Detecting and recovering a lost token or frame
- Detecting and recovering multiple tokens
- Controlling timing
- Detecting and recovering a circulating priority token or frame
- Detecting and recovering multiple active monitors

Token-ring stations can also take actions to perform ring purging, neighbor identification and notification, beaconing, and soft-error management. For more information about these token-ring



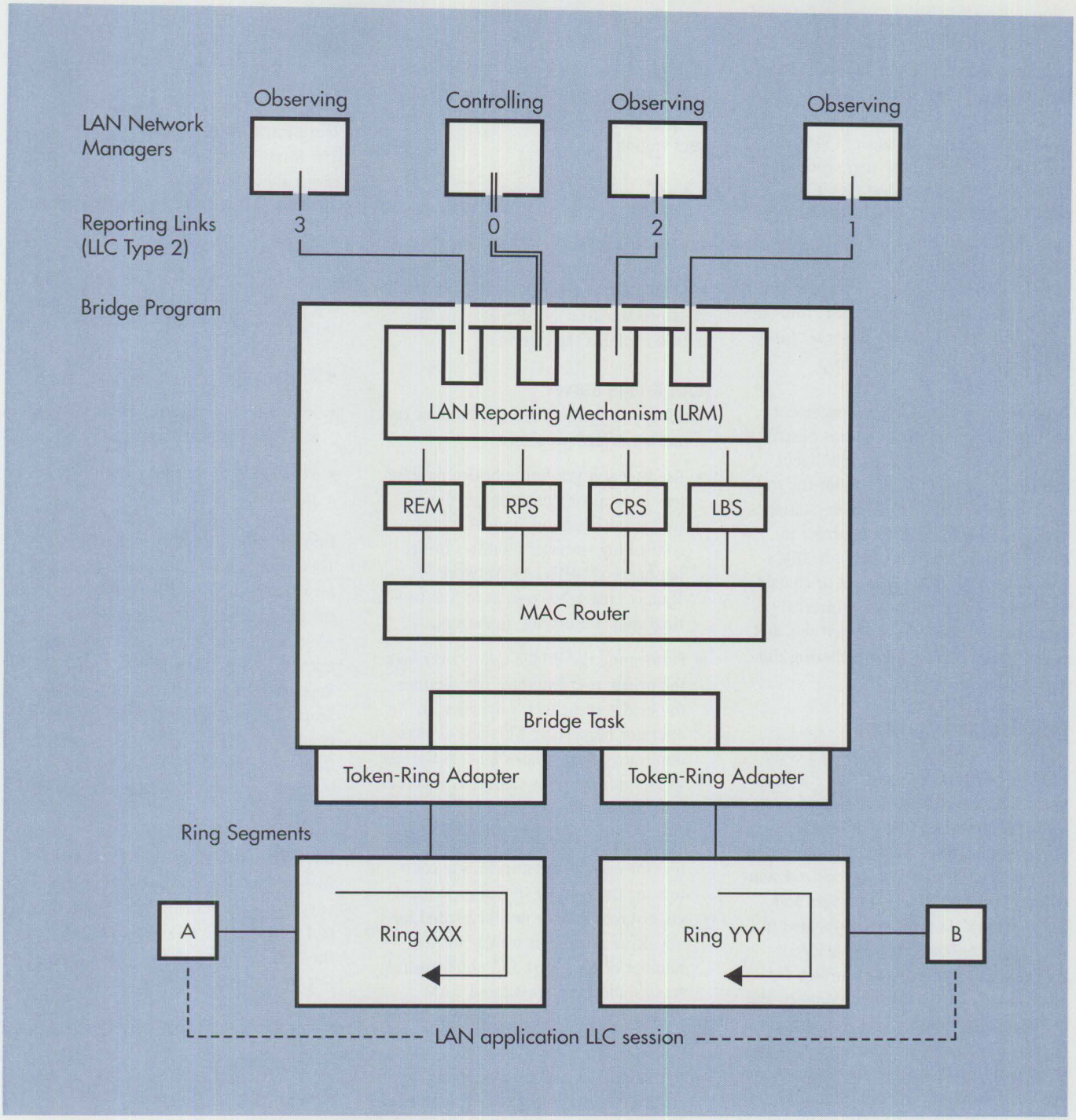


Figure 1. Internal Communication Structure of Bridge Management Agents

management concepts, refer to the IBM red book titled *Local Area Network Concepts and Products* (GG24-3178).

The IBM token-ring network implementation uses IEEE 802.2 logical link control-level information frames (I-frames). IBM designed additional control frames for managing bridges, encapsulating this information in the I-frames. These control frames are documented in the *IBM Token-Ring Network Architecture Reference* manual (SC30-3374).

IEEE 802.5 is designed around the premise that MAC frames are single-segment flows ("LAN-locked"). In fact, it is architecturally illegal to route MAC frames outside their local segment. For this reason, IBM introduced the management server concept that gathers, diagnoses, and forwards information about the local segment to a remote manager.

A LAN Error Monitor (LEM) function collects and analyzes error information generated at the LAN MAC protocol level for a given LAN segment. On an IBM token-ring LAN segment, this server function is called Ring Error Monitor (REM).

IBM has designed other management servers that support the MAC frame handling. These other servers include the LAN Parameter Server (LPS or RPS on a token ring), Configuration Report Server

(CRS), LAN Bridge Server (LBS), and LAN Reporting Mechanism (LRM). Figure 1 diagrams the internal communications structure of these bridge management agents.

IBM's LAN Network Manager (LNM) supports the server in receiving, processing, and reacting to the Logical Link Control (LLC) management flow of token-ring stations on the segment local to the LNM workstation. If a LAN network management station is to manage segments outside its local connection, it must "link" to a bridge that provides these server functions for the remote segments.

In addition to containing management servers to support the functions described above, a bridge can also be intelligent enough to gather statistics about the traffic flow across the bridge. These statistics can be used by a network manager to monitor performance of the LAN. IBM's LAN Network Manager can set or change the Performance Notification Interval (as supported by the bridge), which sets and controls the frequency for gathering this information.

IBM Bridge Offerings

IBM token-ring bridges act as agents for LAN Network Manager, offering the functions of LAN Reporting Mechanism, LAN Bridge Server, Ring Error Monitoring, Ring Parameter Server, and Configuration Report Server. Today, the specialized communications between IBM bridges and LAN Network Manager are supported in the IBM Token-Ring Network Bridge Program, the IBM 8209 LAN bridge for token-ring and Ethernet interconnect, and the Peer Communications Bridge option of the 3174 controller. In the near future, IBM intends to release other products containing this support. Recent announcements include the IBM 8250 Intelligent Hub with a bridge module containing support similar to IBM's token-ring bridge programs and the IBM DOS Local and Remote Token-Ring Bridge Programs.

LAN Reporting Mechanism

The LAN Reporting Mechanism handles the LLC Type 2 sessions between the manager (such as IBM's LAN Network Manager) and the appropriate server function (request or command) within the bridge. On the ring-segments side, management requests or commands are translated into the appropriate MAC frames for execution on one of the two attached ring segments. Responses provided by the appropriate server are directed to the LRM, which packages them into an LLC frame addressed to the originating manager station.

A bridge can support management functions for segments on both sides of the bridge. IBM bridges currently support one "controlling" manager and up to three "observing" managers. (The "IBM LAN Network Manager" section later in this article explains these terms.)

LAN Bridge Server

The LAN Bridge Server (LBS) handles the following bridge processes:

- Reading and validating bridge parameters from a configuration file during bridge initialization, and whenever a controlling manager modifies bridge parameters. IBM's LAN Network Manager uses the concept of "controlling" and "observing" managers.
- Performing the bridge self-test through the bridge user interface when either the bridge initializes it or when an operator requests it. This test detects duplicate parallel paths and invalid network configurations caused by inconsistent ring numbering.
- Maintaining a set of performance counters for each adapter, including counters for the number of frames discarded, not received, or not forwarded for any other reason, as well as for the number of broadcast and non-broadcast frames and bytes forwarded. LAN Bridge Server will also report accumulated values on request.
- Accumulating path trace information for frames carrying a system path trace bit that is set to on in the routing information control field.

Ring Error Monitor

The bridge's Ring Error Monitor (REM) server function compiles error statistics from received `Soft_Error_Report` MAC frames, and selectively generates reports for the manager, depending on the soft error reporting mode–normal or intensive–set by the manager.

The second major function provided by the REM server is beacon processing. This includes watching the timing of beacons, distinguishing between temporary and permanent beaconing states, and knowing when an adapter has been kicked off the ring.

Ring Parameter Server

The Ring Parameter Server (RPS) is the target for all `Request Initialization` MAC frames sent by ring stations while attached to the ring segments. In response to the `Request Initialization` MAC frame, the RPS function makes the following parameters available to all ring stations:

- Ring number
- Ring Station Soft Error Report Timer value (default of 2 seconds)
- Physical location (not currently implemented in all bridges)

Configuration Report Server

The Configuration Report Server (CRS) forwards configuration notifications to the manager(s). After receiving a MAC level configuration notification, it transmits the information via the LAN Reporting Mechanism to the manager(s). From the manager(s), CRS executes such commands as `Query Adapter`, `Remove Adapter`, and `Set Station Parameters` on a bridge-attached LAN segment.

Bridge Configuration Support

IBM's token-ring bridge offerings support varying levels of bridge configuration control settings. The following list describes the options supported by IBM's LAN Network Manager:

- Percent Frames Lost Threshold
- Bridge Number
- Automatic Bridge Link
- Frame Forwarding Active
- Single-Route Broadcast Mode
- LAN Segment
- Single-Route Broadcast
- Hop Count
- Largest Frame Size
- LAN Segment Number(s)

Some bridge types, specifically the IBM 8209, require unlinking and relinking the bridge before any bridge configuration changes take effect.

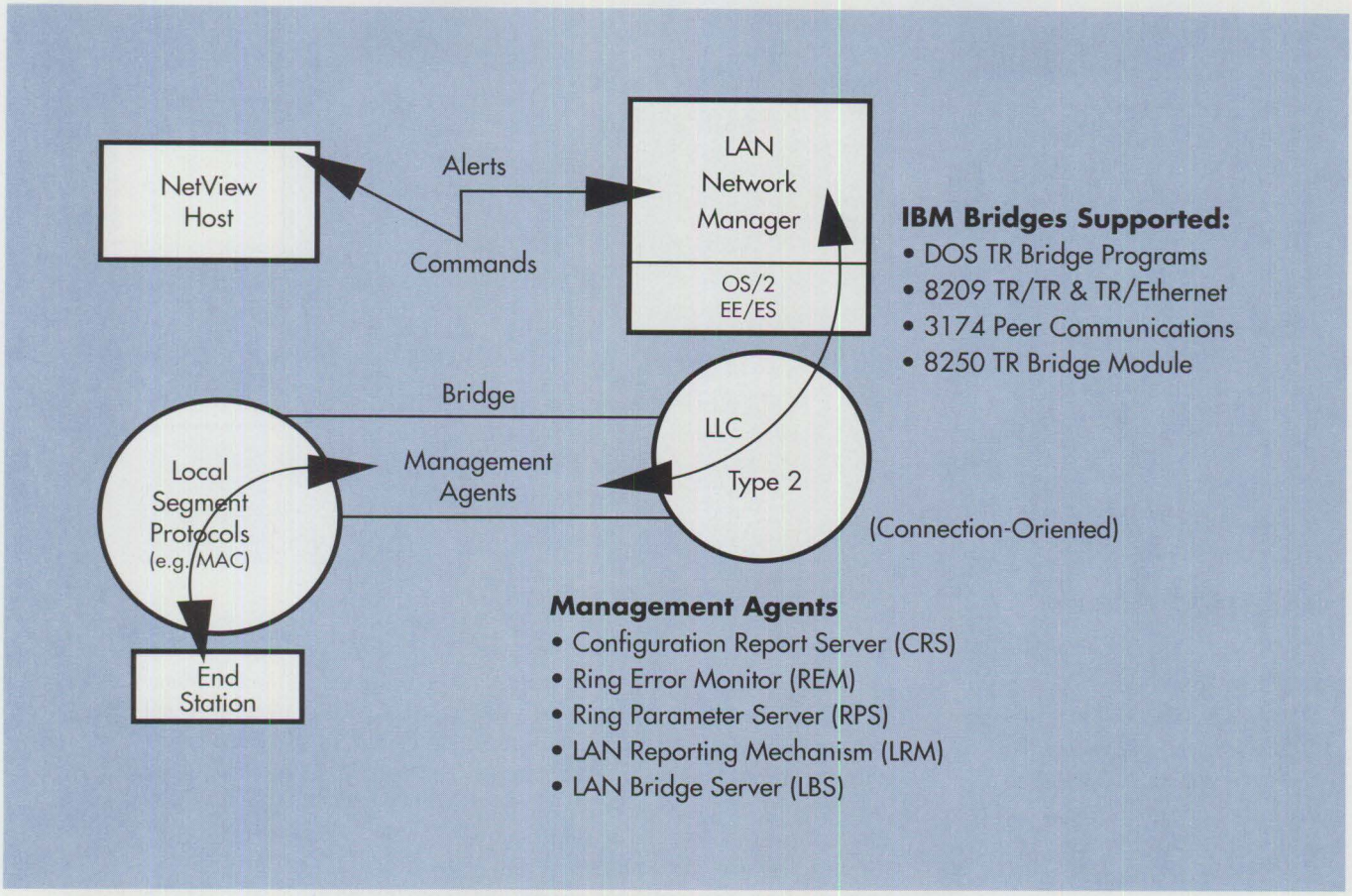


Figure 2. Bridge Management Agents in a LAN Network Manager Environment

Performance Data

The various traffic statistics reported by IBM bridges are also useful for analyzing potential traffic bottlenecks and helping network administrators reconfigure their LAN and applications to improve overall performance. Bridges can report this information at given performance intervals, storing the data in a network management application for later reporting and analysis. IBM token-ring bridges report the following information:

- Bridge Name
- Percent Frames Lost Threshold
- LAN Type
- LAN Segment
- Broadcast Frames/Bytes
- Non-Broadcast Frames/Bytes
- Inoperative Target LAN Segments
- Adapter Congestion
- Number of Frames Not Passed Due to Invalid Frame
- Telecommunication Link Errors

IBM's LAN Network Manager

IBM's LAN Network Manager is the premier product for managing the physical media in the IBM token-ring LAN environment. In addition to taking advantage of the intelligence found in IBM's token-ring cards, LAN Network Manager is supported by special bridge management code in various IBM and OEM hardware and software products. These bridges act as "agents" for the token-ring and Ethernet segments–collecting configuration, fault, and performance information. Supplemented by the information interchange and remote-control capabilities provided by IBM's 8230 Controlled Access Unit, LAN Network Manager has no peer in managing the physical layer's token ring.

IBM token-ring bridges have built-in server components used for management, as discussed previously. These server components can use another component, the LAN Reporting Mechanism, to establish a reporting link with up to four IBM LAN Network Managers. Each reporting link is an IEEE 802.2 logical-link control Type 2 (connection-oriented) link, dedicated to transporting network management information in either direction. Figure 2 diagrams the network management flow between LAN Network Manager and a bridged token-ring segment.

Although the *IBM Token-Ring Network Architecture Reference* manual documents some of the information flow between IBM's LAN Network Manager and the supporting bridge programs, the interface is basically proprietary. OEM vendors have implemented some of the bridge server functions as described above, but some installations have reported LNM's failure to link to or manage these bridges. IBM does not support these environments; it is the responsibility of the OEM vendors to test and verify their products and releases.

Future directions for IBM indicate that this bridge interface will be supported by LAN Network Manager under the newly accepted IEEE 802.1B and 802.1k standards for Common Management Information Protocol over LLC Type 1

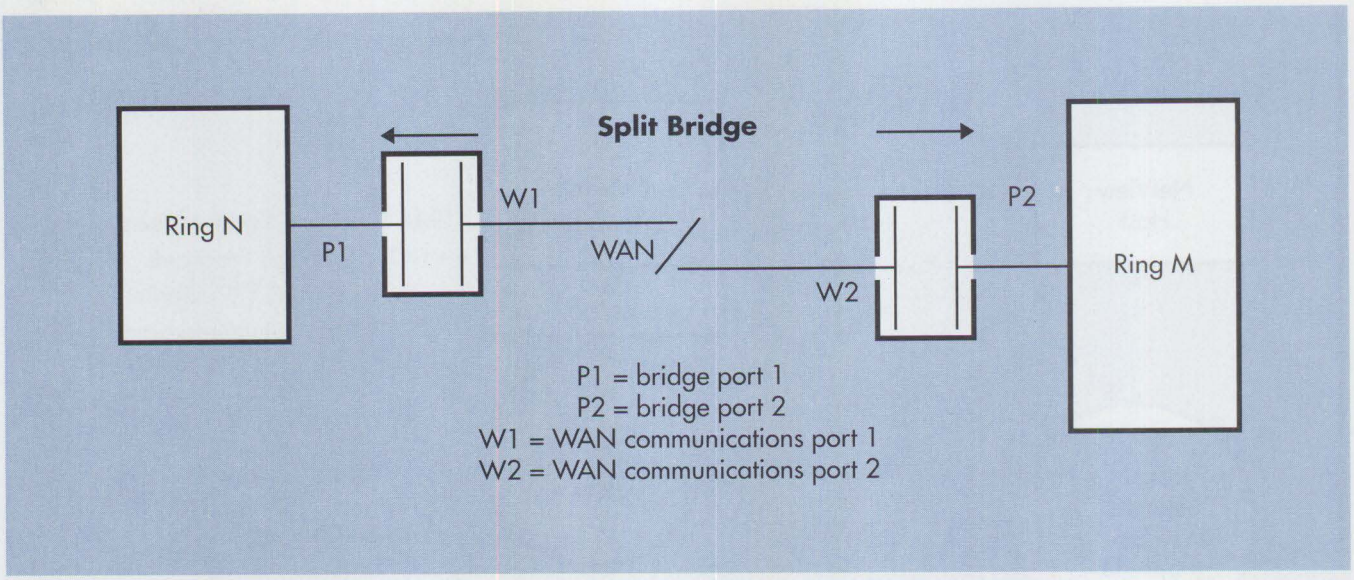


Figure 3. Remote Bridge Concept

(CMOL). This standardized Heterogeneous LAN Management (HLM) protocol enables CMIP Management Information Bases (MIBs) to be shipped over CMOL to describe the bridge information gathered, and allows LAN Network Manager to change control variables within the bridges. OEM vendors will be able to implement this interface.

A single LAN Network Manager can link to 255 two-port bridges, thereby managing up to 256 token-ring segments. This product can automatically attempt to re-link lost bridges, to provide notification when bridges become linked, and to issue messages when bridges have become decongested and are able to pass traffic efficiently. Of course, all of these functions must be supported by the bridge.

A LAN Network Manager supports two configurations: controlling mode or observing mode. In a network there can be multiple controlling LAN Network Managers, but each bridge can only be linked to a single manager running in controlling mode. Up to three managers can be linked to that same bridge in observing mode. The main functional difference between the two configuration types is that a LAN Network Manager running in observing mode is restricted to query and status operations and cannot influence or alter the function of the remote LAN segments.

All of the functions and capabilities discussed previously and offered by IBM's token-ring bridges are supported by LAN Network Manager. The graphical network picture displayed by LNM can optionally identify bridges within the domain by a user-selected unique icon. By navigating through the windows, the network administrator can view bridge profiles, performance information and error reports, and can change bridge configurations. Database tables are maintained for bridge performance statistics, and all bridge information is (optionally) available to a host-connected mainframe running IBM's NetView. The IBM NetView Performance Monitor is another product that accesses bridge performance statistics (through the NetView/LAN Network Manager interface), generating reports and graphs to assist in analyzing this data.

Managing Remote Bridges

A *remote bridge*, also called a *split bridge*, interconnects LAN segments using a telecommunication link for transmitting frames between bridge ports. Physically, a remote bridge consists of two halves on each side of the communications link. Figure 3 shows the physical configuration of the remote bridge concept.

In a normal or local bridge, regular frame forwarding is done from one LAN adapter to the other. In a remote bridge, however, a frame is copied in one station from the LAN adapter to the communications adapter, adding source routing information as required. This communications adapter sends the frame across the communications link to the peer communications adapter in the other half of the bridge where the LLC frame is copied to the second LAN adapter and transmitted on its LAN segment. Part of this transfer's controlling process is routing the frames designated for the remote ring; not all frames are copied.

Functionally, a remote bridge provides logical-link control level end-to-end connectivity between LAN stations on either side of the bridge, supporting any higher-level protocol carried over the LLC link. IBM supports remote bridges in the IBM Token-Ring Network Bridge Program and the new DOS Remote Token-Ring Network Bridge Program.

These bridges not only support management identical to that offered in the local bridging environment, but also report error conditions on the communications link between the two pieces of the bridge.

Managing Token Rings Through the IBM 6611

Today IBM offers a Program Temporary Fix (PTF - UR37051) for the IBM Token-Ring Network Bridge Program Version 2.2 to provide bridge-server functions for a segment connected to LAN Network Manager through the IBM 6611 Multi-Protocol Router. The supported configuration requires attaching the 6611 to the local segment of the LAN Network Manager workstation and attaching a dedicated PC workstation acting as the second half of a remote bridge to the 6611. This remote workstation would have the token-ring bridge program as well as the PTF installed.

LAN Network Manager links to the far adapter instead of to the 6611 side of the bridge and manages the bridged segment. This management is for the token-ring bridge side only, not for the 6611-to-bridge connection. MAC frames supporting management for the remote segment must flow successfully through the remote segment and back to the bridge program for reporting to LAN Network Manager.

This implementation presents two limitations when compared to the standard remote or split bridge management capabilities:

- A beaconing state on the far ring cannot be specifically identified.
- A loss of the TP link connecting the bridge and the 6611 cannot be determined.

Basically, if a hard error disconnects the remote segment, the only notification that LAN Network Manager receives in this configuration is the loss of the link to the remote bridge.

Other than the limitations just stated, this special support provides a rich set of management capabilities, including:

- Full Configuration Reporting and Ring Parameter Services (RPS)
- All token-ring soft errors and temporary beacons reported to LNM through the Ring Error Monitoring server function
- Performance counters for the remote ring sent to LNM and made available for viewing on the bridge performance screen of LNM
- "Bridge performance threshold exceeded" alerts sent to LNM (These often work as early warnings that you may lose the LNM link.)
- LNM used to configure both bridge performance thresholds and bridge performance notification intervals (LNM cannot be used to reset adapters and ports.)
- Support of 8230s, 8220s, and trace and performance tools on a remote segment.

This remote bridge management is supported through IBM's 6611 Multi-Protocol Router, which can pass LLC Type 2 bridge management frames through its bridging interface.

Future Directions

Although the purpose of this article is to explain the current bridge management support offered by IBM's LAN Network Manager and IBM's token-ring bridge products, the following list denotes some of the evolving areas of change:

- LNM will offer an "open" protocol for bridge management based on CMOL (HLM).
- The 6611 will add native bridge-server functions, removing the need for the separate token-ring bridge program running on a PS/2.
- LNM will manage multi-port bridges, recognizing protocols other than token-ring on remote segments.
- A new LAN media management application, AIX* LAN Network Manager/6000, will run on IBM's NetView/6000*, offering the interconnect of SNMP (simple network management protocol)-managed bridges with the LAN subnets within the typical LAN Network Manager domain.

References

Some of the information provided in this article was derived from the following IBM International Technical Support Center documents:

- *Local Area Networks Concepts and Products* (GG24-3178)
- *LAN Network Manager V1.0, IBM 8230 Controlled Access Unit and LAN Management Utilities/2* (GG24-3754)

Both are recommended reading for further clarification of this article.
An additional source of technical detail on the interconnect between IBM's LAN Network Manager and IBM's token-ring bridge programs is the *IBM Token-Ring Network Architecture Reference* (SC30-3374).

Sallie Matlack is a consulting marketing support representative in IBM's Networking and Systems Management Services and Support, Networking Support Center in Research Triangle Park, North Carolina. She provides marketing technical support for IBM's network management products, focusing on the future of network management—customer requirements, market trends, and their implementation into IBM products. Sallie holds a BS degree in mathematics from the University of South Carolina.

Correction

Figure 1 and Figure 4 were inadvertantly transposed in the "Advanced Client/Server Computing Using the IBM ThinkPad" article in the November/December 1993 issue of *Personal Systems*. Please note that Figure 1, Personal Application System/2 should reflect the screen capture shown in Figure 4. Figure 4, Host and LAN Applications on a ThinkPad Client, should reflect the screen capture shown in Figure 1.

IBM DCE for OS/2 Multiuser Application Performance

This article responds to the question, "How well does Distributed Computing Environment (DCE) for OS/2 perform?"

We in the IBM Personal Systems Programming Center in Austin, Texas, have developed three benchmarks to help determine DCE's performance, and we present the results in this article. We discuss, at the application level, the performance characteristics and resource requirements of multiuser applications running in DCE for OS/2. We describe our three workgroup environment benchmarks, and we give their baseline performance results and resource requirements, using measurements chosen in response to questions we received. We mention several variables that affect performance, and we discuss selected DCE APIs in the appropriate contexts. This information may help you make decisions while designing your DCE application.

Benetta Perry and Bob Russell
IBM Corporation
Austin, Texas

The LAN Systems Performance Workgroup Environment team provides support and consultation for Distributed Systems Services (DSS). Our team consults with vendors and customers about designing and tuning the new applications they are developing. From consulting with customers who use IBM OS/2 Extended Edition 1.x and IBM OS/2 Extended Services* 1.0, and from our experience with DCE beta customers, we have amassed a substantial base of knowledge about applications.

Multiuser Benchmarks

Using this knowledge base, we devised three multiuser benchmarks as our tools for evaluating DCE performance and system resource requirements. Following are descriptions of three workgroup environment benchmarks conducted in our multiuser, homogeneous Workgroup Environment Lab.

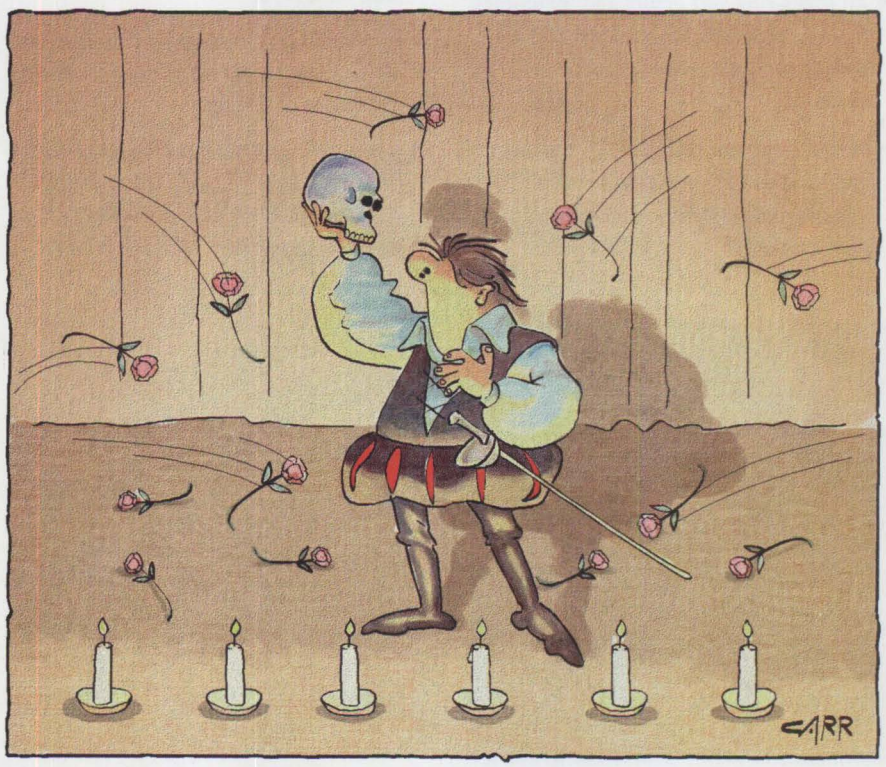
Remote Procedure Call Data-Transfer Benchmark

This benchmark demonstrates DCE performance in a CPU-intensive environment. It is based on an existing Remote Procedure Call (RPC) sample program. The client sends a random-sized data packet, from 1 to 8,192 bytes, to the server in a variable-length array. The server returns an array containing one byte.

The RPC data transfers are authenticated by DCE Security; our baseline is call-level authentication. Information about the packet, packet integrity, and packet privacy levels are also included in this article.

Point-of-Sale DCE Benchmark

Point-of-Sale (POS) is a composite of highly visible activities gleaned from our



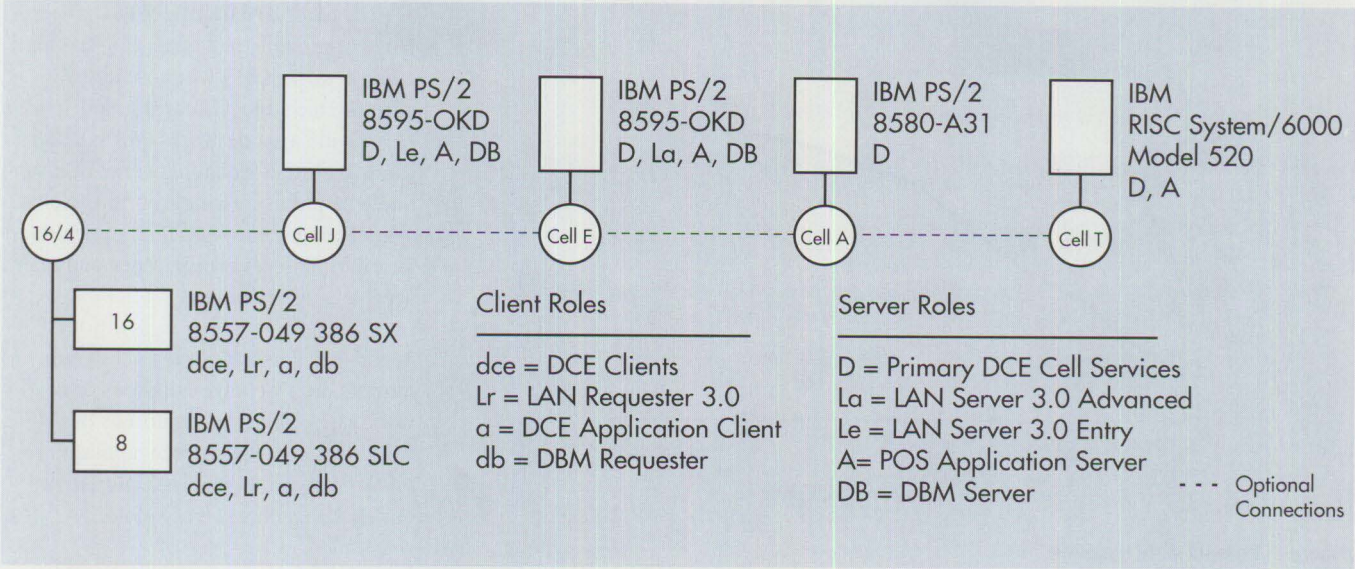


Figure 1. Lab Topology

application consultations with IBM customers.

The POS scenario involves a retail showroom or parts store with terminals throughout the store. Either store personnel or customers can place orders, which are immediately filled from back-room stock. The POS scenario has the following chronology:

1. The POS application user randomly chooses a 16 KB bit-image of a catalog page from one of five catalog repositories.

2. The POS application user randomly selects one to four items from the catalog page. A 168-byte price and inventory record is returned for each item.

3. Using the customer's area code and phone number, the program returns a 512-byte customer information record.

4. When the order is complete, the POS DCE application sends all information about the customer, items, and payment method to the back-room repository so that a parts puller can prepare an invoice and fill the order.

According to the benchmark data, the average customer sale consists of 5.5 authenticated RPC transactions. The average POS data size is nominally 3,250 bytes. The POS data is stored in eight OS/2 flat-file repositories and is accessed by IBM C Set/2* library calls.

Our throughput calculations include the times that the client takes to display the answer sets for these POS transactions (except bit images).

Database Manager Online Transaction Processing Benchmark

An IBM OS/2 Extended Services 1.0 Database Manager (DBM) Online Transaction Processing (OLTP) benchmark compares the transaction-oriented packaging provided by DCE RPC with the native DBM Application Remote Interface (DARI). RPC and DARI are product-specific interfaces that package one operation or several associated operations as a single unit of work in a single remote call. Here, we define a *unit of work* as a sequence of statements and operations that can be performed without user intervention. For example, some industry-standard database benchmarks consist of four or five Structured Query Language (SQL) statements and several intervening C statements packaged into a single remote procedure with a single remote invocation across the wire.

In a single call to a server, DCE RPC and DBM DARI's equivalent packaging and transport services support the scope of a transaction.

Simulated Workload Descriptions

This report's results are based on simulated workloads. Each PS/2 client can simulate the system load of one or many physical workstations. We varied the number of physical workstations and the arrival rates appropriately for each benchmark.

We used the following workload assumptions to determine the number of simulated clients:

- One terminal can submit one POS customer sale (5.5 transactions) in one minute.
- One terminal can submit one DBM OLTP transaction every ten seconds.
- One terminal can submit one RPC data transfer every ten seconds.

Workgroup Environment Performance Lab Topology

Although the topology of the Workgroup Environment Lab allows a variety of homogeneous connectivities and workstation roles (as indicated in Figure 1), the scope of this article is limited to the OS/2-to-OS/2 connectivities.

Our definitions of server and client include all the products and services indicated in Figure 1, installed and started.

Some graphs in this article may have a zigzag pattern that appears ill-behaved. This sawtooth appearance is due to the different processor characteristics of the 386SX and 386SLC* clients interspersed in the test cells. These results are consistently reproduceable.

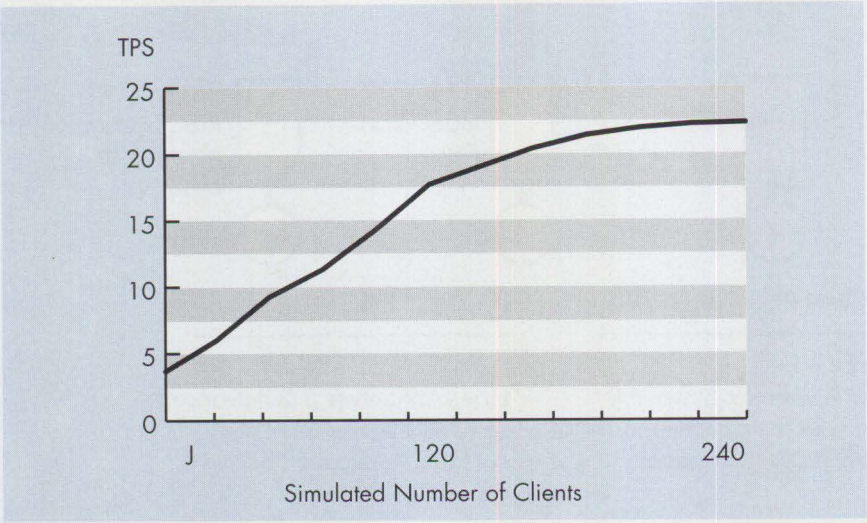


Figure 2. Point-of-Sale Baseline

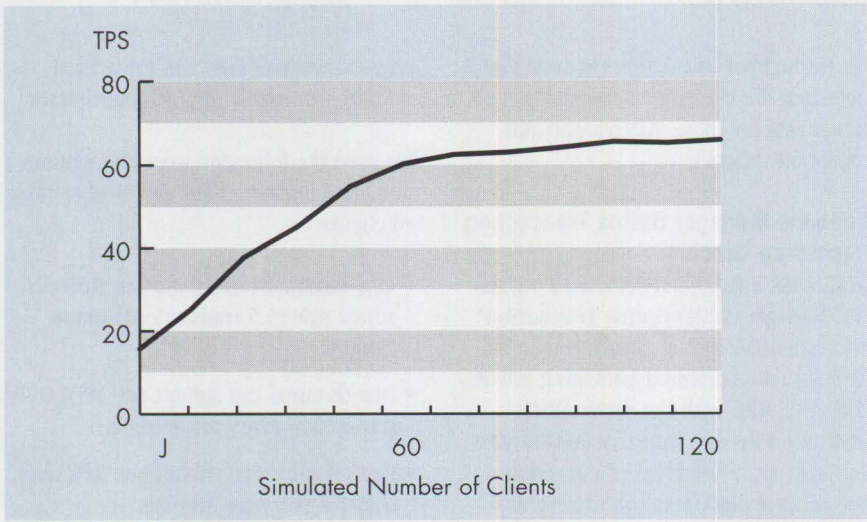


Figure 3. Data-Transfer Baseline

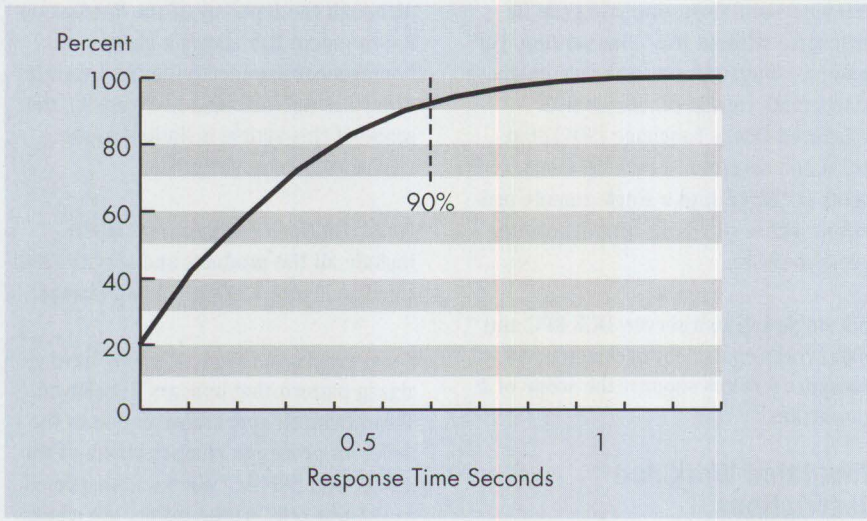


Figure 4. Response-Time Distribution

The DCE Paradigm Shift

Why is the industry reinventing the local area network (LAN) when we already have the technology to bridge and splice LANs, wide area networks (WANs), and gateways into a global network? DCE supplies the pieces missing from this global web of copper wire and fiber-optic cable: location/platform transparency and manageable administration.

At the IBM Personal Systems Programming Center, we have hundreds of network users connected to dozens of network domains. We put new applications on the network every week. Heretofore our challenge has been twofold:

Challenge 1: We must know where the application is, so we can find it. (A familiar analogy is that we need to know how to spell a word before we can look it up in a dictionary.)

Eventually we would discover—on scraps of paper taped to the wall—a new network path to add to our already long list of `NET USE/MOUNT` instructions. Another obstacle was security; more often than not, the server didn't know who we were. Thus, our second challenge:

Challenge 2: We must have identities in the remote domain to use it.

A few phone calls to the appropriate LAN administrators, an exchange of notes, and we were ready to begin.

DCE is an industry-wide effort to provide transparent interoperability for the computing environment. The Open Software Foundation* (OSF)* DCE architecture is currently being implemented on many major hardware and software platforms. No longer are we limited to OS/2-to-OS/2 or IBM-to-IBM; distributed computing is a completely new paradigm.

Now, some of us are DCE converts. We don't need to know if the DCE application server is located in Austin or Timbuktu; DCE Directory Services knows where it is. We don't need to know its logical path or to `NET USE/MOUNT` a network drive to access it. With a single DCE login to our local DCE cell, DCE Security and Directory Services will handle our connection with, and authentication of, remote DCE applications. When all or part of a DCE server

application is moved to another part of the network, or onto a different platform, we don't need to know, nor do we care.

Location transparency, once a buzzword, is now a reality. We routinely move all or part of the POS DCE application between our OS/2 and AIX platforms during performance testing. Balancing the POS load between OS/2 and AIX, or providing multiple application servers on both platforms, is completely transparent to the client. The client is totally unaware of which server or platform is processing any given transaction.

Performance Results

This section presents performance results of DCE for OS/2 in the areas of Point-of-Sale (POS) and Online Transaction Processing (OLTP).

Baseline Tests

We ran baseline tests with a variety of simulated workloads to assure that the POS application server was sufficiently busy to make the results interesting. Considering the results of the baseline tests, we elected to show only the workload ranges in Figures 2 and 3.

In Figure 2, POS throughput begins to flatten at about 23 transactions per second (TPS). An increased workload does not drive any more work through the server. The resource boundary that POS encounters is hard-disk access.

Figure 3 illustrates the data-transfer benchmark throughput. The same flattening is observed at about 67 transfers per second. Additional workload does not drive any more work through the system.

The data presented in this article may be for either Cell E or Cell J. The main difference in how the two cells behave is the server's file system. The server for Cell E uses the HPFS386 file system, which is tuned for file-sharing. The server for Cell J uses the standard HPFS file system, which is tuned to local input/output (I/O). Because the baseline measurements may vary slightly, the graphs refer to the appropriate baseline or control group.

Distribution of Response Times

Each client records a histogram of response-time distributions during POS tests, then combines the histograms into a single aggregate. The histogram granularity

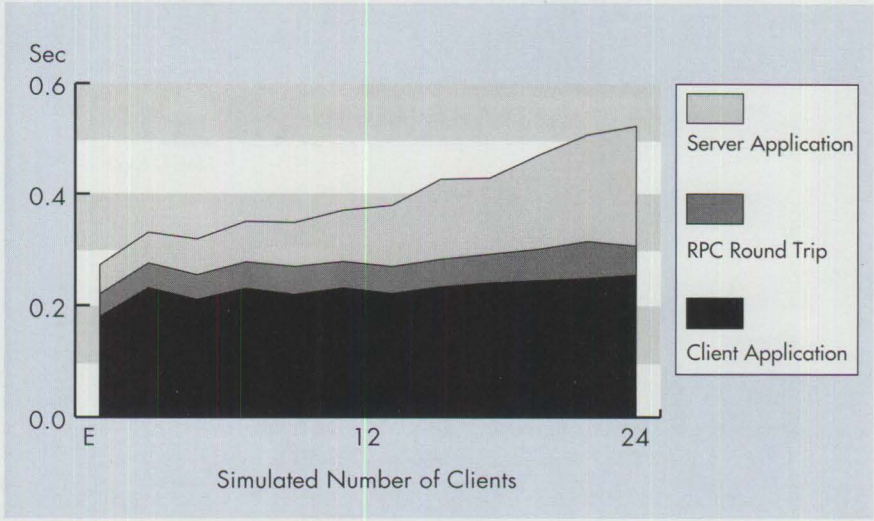


Figure 5. POS Response-Time Proration

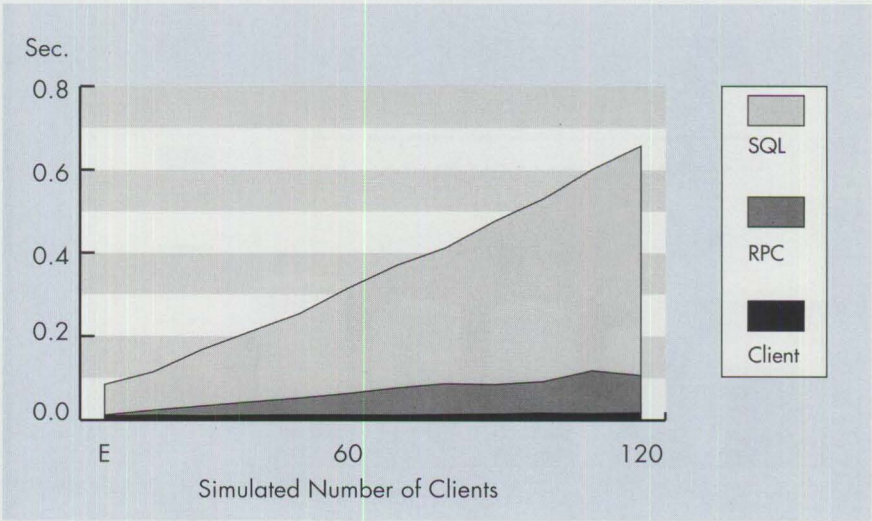


Figure 6. OLTP Response-Time Proration

	Minimum	Recommended
DCE server RAM	16 MB	18 - 22 MB
If IBM LAN Server 3.0 is also installed on the DCE server	18 MB	20 - 24 MB
Minimum DASD	90 MB	
DCE client RAM	10 MB(*)	12 - 14 MB
If IBM LAN Requester 3.0 is also installed	12 MB	12 -14 MB
Minimum DASD	85 MB	

(*) The OS/2 DCE announcement recommended 14 MB of RAM for acceptable steady-state performance. We are revising the client's minimum RAM requirement downward from 14 MB to 10 MB. Extensive additional testing has shown that 10 MB sustains acceptable steady-state performance with minimum swapping. A DCE client can be configured and run with as little as 8 MB of RAM; however, at 8 MB, the performance of many ordinary tasks would be unacceptable.

Figure 7. Minimum Recommended RAM for DCE Servers and Clients

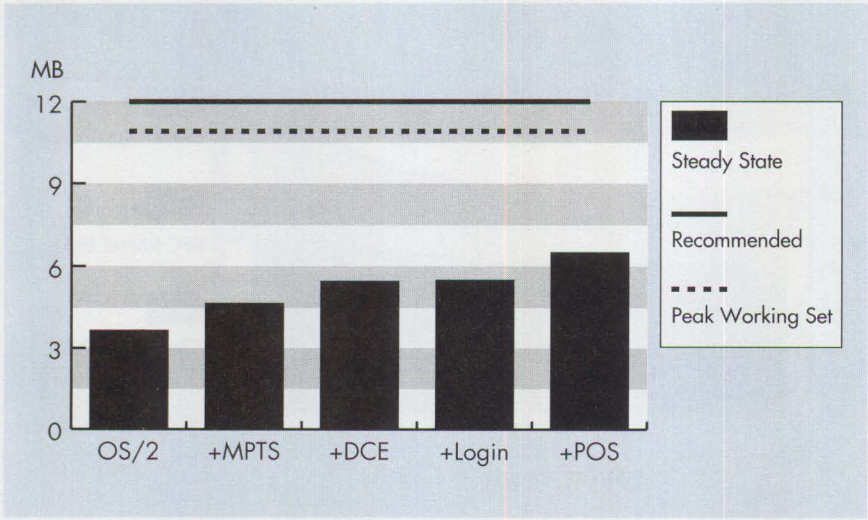


Figure 8. Client RAM Requirements

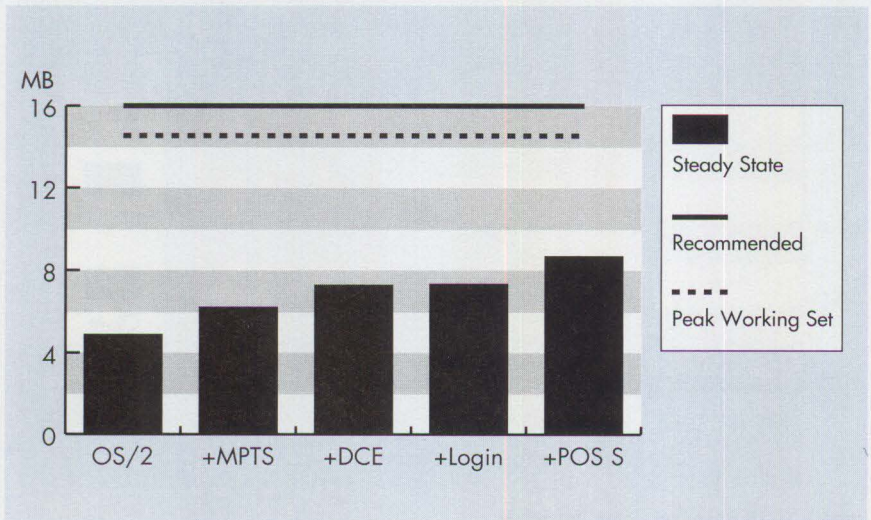


Figure 9. Server RAM Requirements

DASD	Server 2.0	Server 2.1	Client 2.0	Client 2.1
OS/2	44.0	51.0	44.0	51.0
SWAPPER.DAT	16.0	16.0	16.0	16.0
MPTS	1.1	1.1	1.1	1.1
DCE	10.0	10.0	8.4	8.4
Total	71.1	78.1	69.5	76.5
Recommended	90.0	90.0	85.0	85.0

Figure 10. DCS DASD Requirements

in Figure 4 is 0.1 seconds. All transactions were completed in less than 1.2 seconds, with 90% being completed in less than 0.6 seconds.

POS Response-Time Proration

Figure 5 shows the proration of the response time charged to the POS client application, the RPC remote call, and the POS server application. The time spent in the POS client is the greatest portion, and remains somewhat flat at all user levels. The POS server application is the second-largest portion, and is the most varied due to queueing of disk I/O requests. Under full client load, the disk is nearly 100% utilized. The middle area is attributed to the RPC call, and remains somewhat constant at all load levels.

Figure 6 shows the proration of response time for the DBM OLTP benchmark using DCE RPC as the transport package.

Figures 5 and 6 suggest that most of the elapsed time is in either the client or server application, and very little time is required by the DCE services. This is generally true for many applications.

Resource Requirements

Most questions we get about DCE concern memory (RAM) and hard-disk (DASD) requirements. In Figure 7, we spell out the minimum requirements for RAM on a DCE server and on a DCE client, and we give our recommended amounts of RAM.

We used IBM System Performance Monitor/2 (SPM/2) THESEUS2 Memory Analysis Tool to collect the RAM usage data given in Figures 8 and 9. The indicated minimum values have been verified in physical RAM configurations. We can characterize the system performance at the minimum configurations thus:

- During initial startup, performance degrades somewhat due to swapping activity.
- After startup, the steady-state application performance is satisfactory with some swapping activity.

The POS application has a relatively small RAM working set. We recommend using the minimum values as a base, with the target application's RAM requirements added to this base when estimating the total RAM required.

We set the following parameters for measurements affecting the RAM working set: 64 KB in the client; 1 MB in the server HPFS cache; and `DISKCACHE` in `CONFIG.SYS`. The IBM AnyNet/2* Multi-Protocol Transport Services (MPTS) `MBUFS` were set at 512/64 in the client and 640/120 in the server. (See the section on MPTS under Performance Sensitivity Studies for more information about tuning `MBUFS`.)

Figure 10 lists the DASD requirements, including the recommended minimum,

for each system component. Figure 10 represents a full installation of OS/2; the DASD required for OS/2 can be reduced to less than 40 MB by choosing the minimum OS/2 installation options.

Performance Sensitivity Studies

In this section, we discuss what happens to DCE performance by using different levels of authentication and by optimizing the number and sizes of send/receive buffers.

RPC Authentication Levels

DCE RPC provides six levels of authentication and transaction security. Assuming that most applications require some level of security, we present only the four highest levels—call authentication, packet, packet integrity, and packet privacy. The performance of the two lower levels, none and connection, is equivalent to the performance of the call level.

Call authentication validates the client's security credentials each time an RPC request is received by the application server. Subsequent data packets associated with the current call are not reauthenticated.

Packet authenticates each data packet sent and received.

Packet integrity authenticates each data packet and verifies the packet's content with a check-sum.

Packet privacy uses the client's key to encrypt each packet. This, therefore, is the slowest performer.

Figure 11 shows the throughput for the POS application at the four authentication levels. Very little difference is noted between call and packet because the average send/receive for POS is about 3,250 bytes and is often a single packet.

Since the DCE RPC proration of time for POS is only a small part of the total transaction time, the throughput cost of authentication is not as dramatic as it would be in a data-transfer-intensive application.

The cost of the higher authentication levels is more noticeable in the data-transfer benchmark in Figure 12. The DCE RPC proration of the response time is about

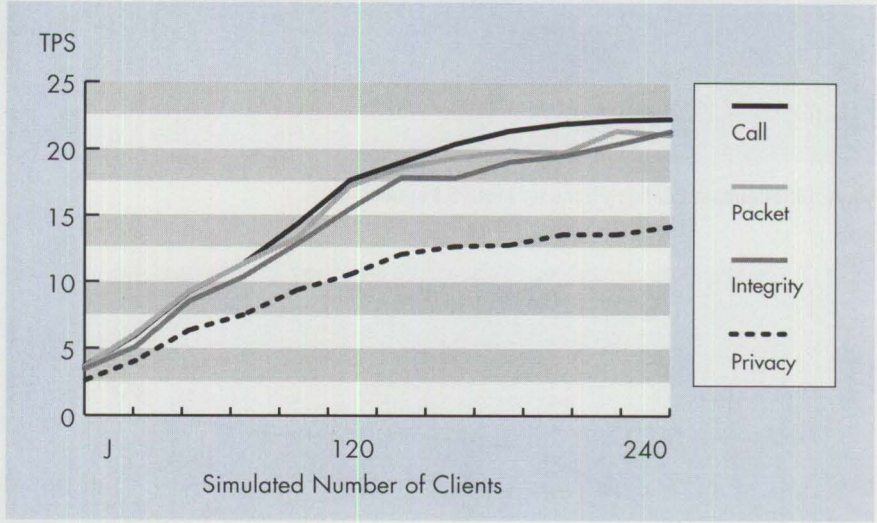


Figure 11. Point-of-Sale Authentication Levels

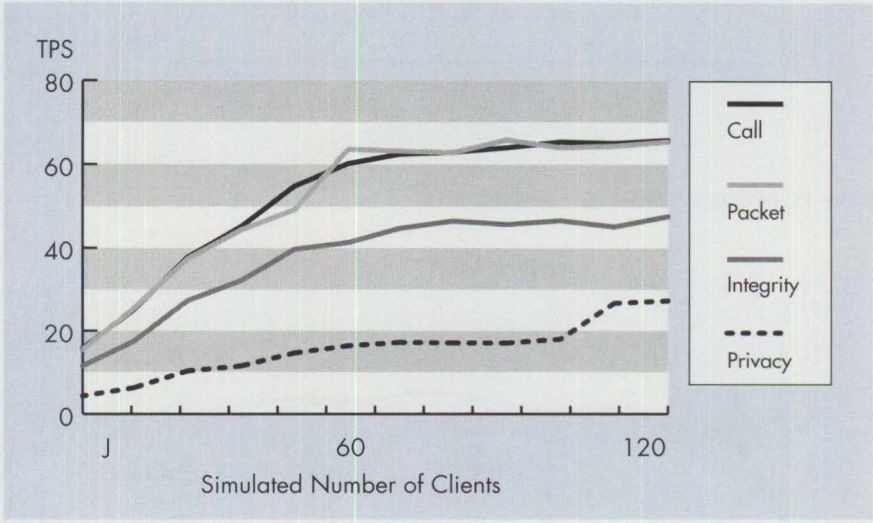


Figure 12. RPC Data Transfer Authentication Levels

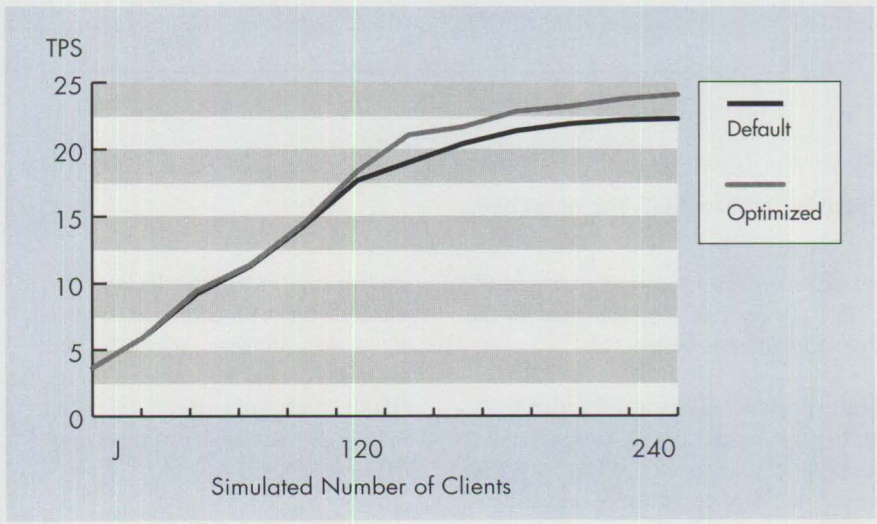


Figure 13. MPTS MBUFS Optimization

For a DCE client	/SM 512 /LM 64
For a DCE server	/SM 640 /LM 64
For the POS application server	/SM 640 /LM 120

Figure 14. Minimum Configurations for MBUFS Parameters

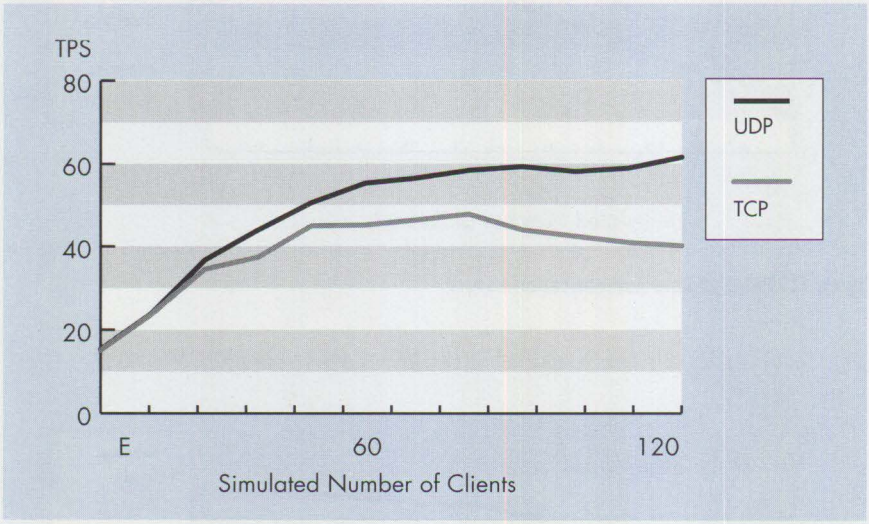


Figure 15. RPC Data Transfer, TCP Versus UDP

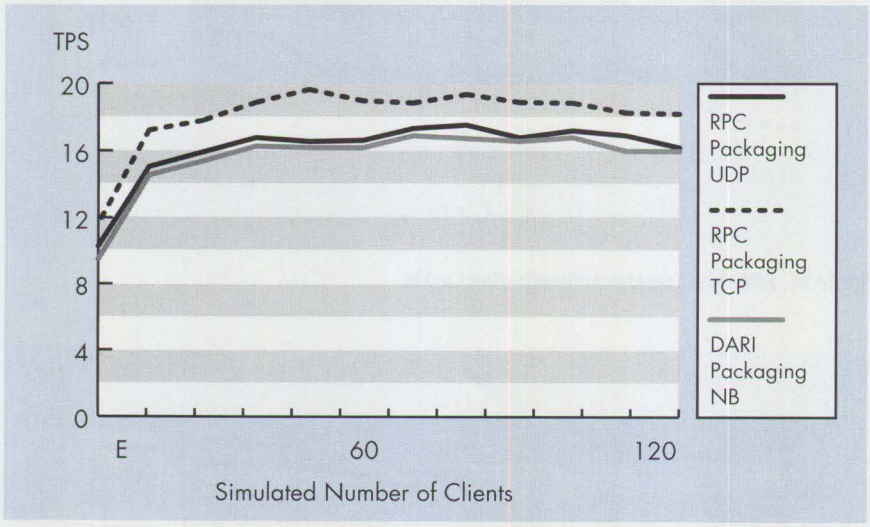


Figure 16. Database OLTP, TCP Versus UDP

90%. The system throughput overhead of packet privacy is 60% greater than for the POS application in Figure 11.

Multi-Protocol Transport Services

MPTS provides the TCP/IP, Sockets, and NetBIOS services for DCE. MPTS MBUFS is one of the more performance-sensitive parameters.

CNTRL.EXE allocates a pool of send/receive buffers during initialization. There are two sizes of buffers: the large MBUFS (clusters) are 4 KB each, and the small MBUFS are 256 bytes each. MPTS MBUFS are in fixed, non-swappable memory. The default number of large MBUFS is 144, and the default number of small MBUFS is 1024.

Figure 13 shows that reducing the number of MBUFS can speed up performance by making more memory available to the system. Having fewer fixed-memory pages enables OS/2 memory management to function more effectively.

We suggest the MBUFS parameters shown in Figure 14 as the minimum configurations. To monitor MBUFS usage, MPTS provides a tool: just enter MPTSTAT -M on the command line. MPTSTAT reports the current usage and indicates whether any buffers have been dynamically allocated. Initial MBUFS values are parameters for C:\MPTN\BIN\CNTRL.EXE and are specified in C:\MPTN\BIN\MPTSTART.CMD.

Using these minimum settings, rather than the defaults, reduces the amount of fixed memory for MBUFS from between 182 KB to 448 KB.

The optimum values for the application server vary with individual application design. Because the POS application server transfers several 16 KB packets, we had to increase the large MBUFS value to 120 to avoid dynamic allocations.

Cautions:

- Avoid under-configuring. Values lower than these recommendations can cause DCE to hang during initialization. MPTS will not dynamically allocate MBUFS while DCE daemons are initializing. Configuring too few buffers can also cause MPTS to dynamically allocate more MBUFS at run time. Dynamic allocation carries a moderate performance penalty.
- Configure a DCE server with 16 MB of RAM with fewer MBUFS than the defaults; otherwise, the server may hang during DCE initialization. Too many non-movable memory pages can interfere with OS/2 memory management in a 16 MB server. Too much disk cache can also create memory-management problems; we recommend no more than 640 KB total disk cache for this configuration.

MPTS Protocols

DCE optionally uses two TCP/IP protocols: transmission control protocol (TCP) and user datagram protocol (UDP). Since TCP delivers a higher level of verification, it takes longer to respond. TCP is slightly faster than UDP when the packet size is less than 2 KB.

The data-transfer benchmark sends random-sized packets of between 1 and 8,192

bytes; the average transfer is about 4 KB. Figure 15 shows UDP to be the faster performer.

Figure 16 compares the DBM OLTP benchmark using DCE RPC with UDP and TCP, versus using the native DBM DARI on NetBIOS. The packet sizes for the OLTP benchmark are 16 bytes in and less than 100 bytes out; therefore, in this application with small packet sizes, RPC using TCP performs noticeably better than UDP or DARI on NetBIOS.

Name-Service Binding Import

In our discussions with IBM DCE customers, we have become aware of the performance concerns for making frequent inquiries to DCE Cell Directory Services (CDS) to obtain a binding handle to a server application. Generally, the customers indicate that a CDS Binding Import could be part of every call to an application server.

Figure 17 illustrates the cost of the `RPC_NS_BINDING_IMPORT_NEXT` call for one to 24 clients concurrently, after forcing a refresh of the client's local CDS cache. The graph's sawtooth appearance reflects the intermixed 386SX and 386SLC client processors.

The POS benchmark can also be run with a cached binding import call before every customer sale. Figure 18 compares the throughput of the POS benchmark, with and without binding import and rebinding, before each customer sale (every 5.5 transactions).

Most of the other APIs used by these benchmarks completed in less than the OS/2 timer resolution of 32 milliseconds and have not been discussed.

Client and Server Hardware

The Austin Workgroup Environment Lab is equipped with PS/2 Model 95 servers (486, 33 MHz) and PS/2 Model 57 clients (386, 20 MHz). In many cases we found that most of the CPU cycles were occurring on the client for the DCE services. Figures 19 and 20 illustrate the response times of `DCELOGIN` and `RPC_NS_BINDING_IMPORT_NEXT` as the client and server hardware changes. The binding import forces a CDS cache refresh.

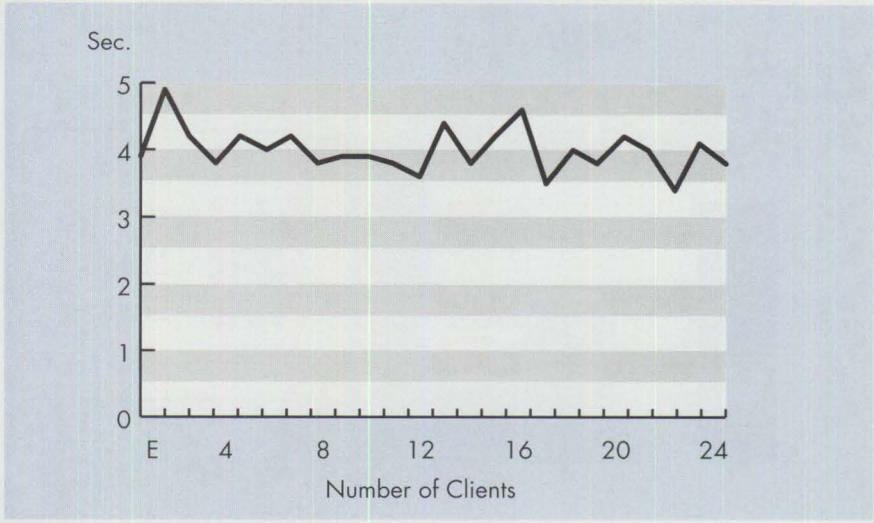


Figure 17. Binding Import with Flush

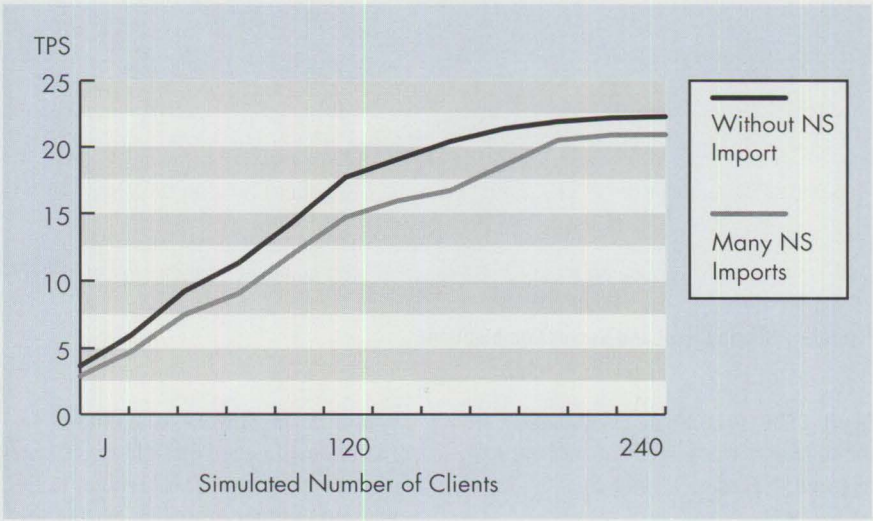


Figure 18. Binding Import, None Versus Many

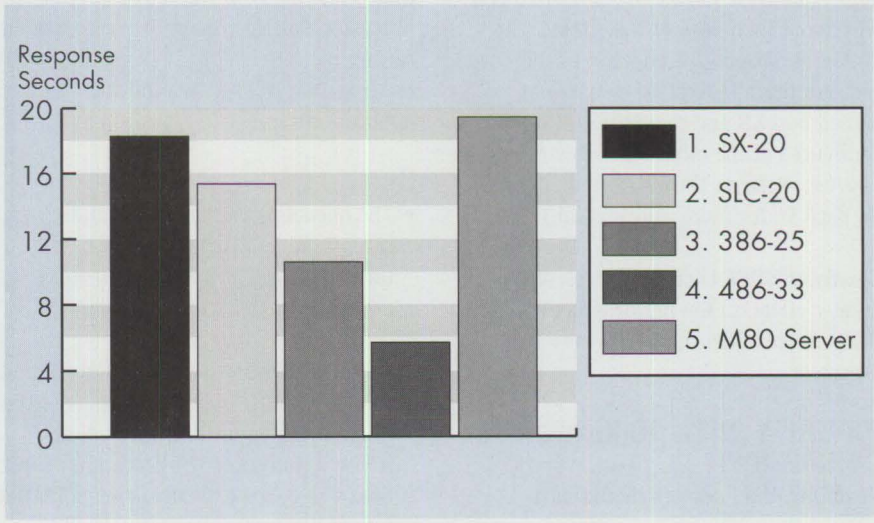


Figure 19. Hardware Sensitivity - DCELOGIN

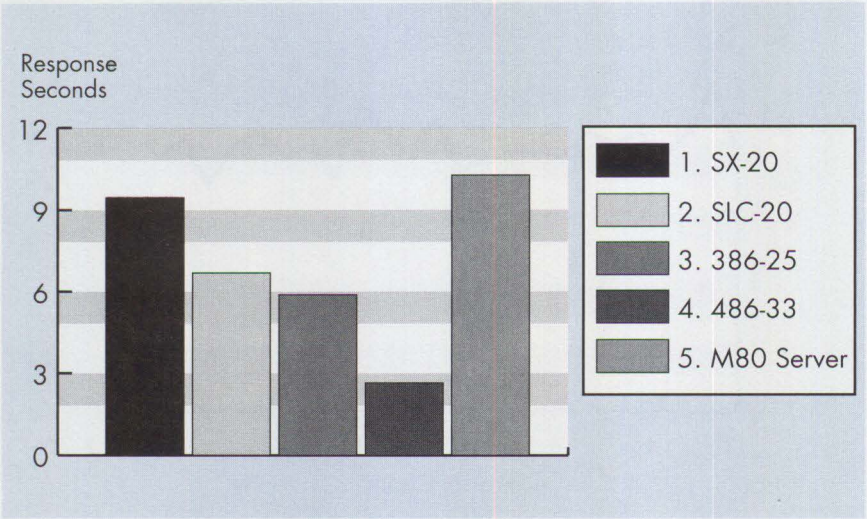


Figure 20. Hardware Sensitivity - Binding Import

Server	Client
PS/2 Model 95 (486, 33 MHz)	PS/2 Model 57 (386SX, 20 MHz)
PS/2 Model 95 (486, 33 MHz)	PS/2 Model 57 (386SLC, 20 MHz)
PS/2 Model 95 (486, 33 MHz)	PS/2 Model 80 (386, 25 MHz)
PS/2 Model 95 (486, 33 MHz)	PS/2 Model 95 (486, 33 MHz)
PS/2 Model 80 (386, 25 MHz)	PS/2 Model 57 (386SX, 20 MHz)

Figure 21. Single Client and Server Combinations

Figure 21 lists the single client and server combinations whose performances are reported in Figures 19 and 20.

The PS/2 Model 80 server performs quite well as a DCE server; however, we have not evaluated a 386-based server in a cell with more than 26 physical clients. The 16 MB real-memory limitation of the 386 requires that the total disk cache not exceed 640 KB and that MPTS `MBUFS` be configured at the minimum value of 640/64. (Refer to the MPTS tuning section on page 56 for more information.)

Clearly, the DCE client processor has a greater effect on the performance of these DCE services than the DCE server processor.

PRIORITY_DISK_IO Keyword in CONFIG.SYS

Generally, OS/2 servers should have `PRIORITY_DISK_IO=NO` in their `CONFIG.SYS` files. The keyword `PRIORITY_DISK_IO` selects one of two disk I/O queueing algorithms. Setting this keyword to `YES` invokes a multilevel priority-oriented queue that can aggressively favor the foreground OS/2 session to the exclusion of other processes. Setting this keyword to `NO`, however, invokes a modified first-in-first-out (FIFO) queue that is less likely to starve background processes. For this reason, we recommend setting the `PRIORITY_DISK_IO` keyword to `NO` in DCE cell servers and DCE application servers.

Summary

- The queueing characteristics and response-time distributions of these three DCE applications in this multiuser environment are well-behaved.
- The actual DCE proration of the elapsed time represents only a small part of the total for the applications tested. In a robust application, the proration of DCE time will be even smaller; therefore, the cost of RPC authentication should be less of a factor than in these tests, which were designed to stress the system.
- Frequent calls to CDS for binding information from the client's local cache are relatively inexpensive. Under maximum load, the client's response time increased by 26%, while the server's throughput degraded less than 7%.
- The performance of RPC as a Database Manager transport compares favorably with the DBM DARI using NetBIOS. Integration of DBM into a DCE application should provide equal or better performance.
- The speed of the client workstation hardware is a major factor in the end-user response time of DCE functions.
- Several other DCE APIs were measured in the multiuser application tests. Most of these completed faster than the OS/2 timer resolution of 32 milliseconds, so they were considered instantaneous.

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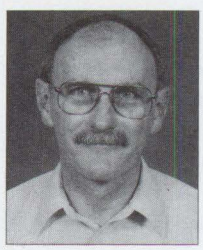

Bob Russell is an Advisory Programmer and team leader for the Workgroup Environment Team. He recently marked 30 years with IBM, which includes Electric Typewriter Division customer engineer in Las Vegas; Office Products Division administrator in Riverside, California; systems analyst for the Installed Machine Inventory System in Franklin Lakes, New Jersey; and performance analyst for DisplayWrite, OS/2 Database Manager, and Distributed Systems Services products in Austin, Texas.

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Performance of Key Functions in DCE for OS/2

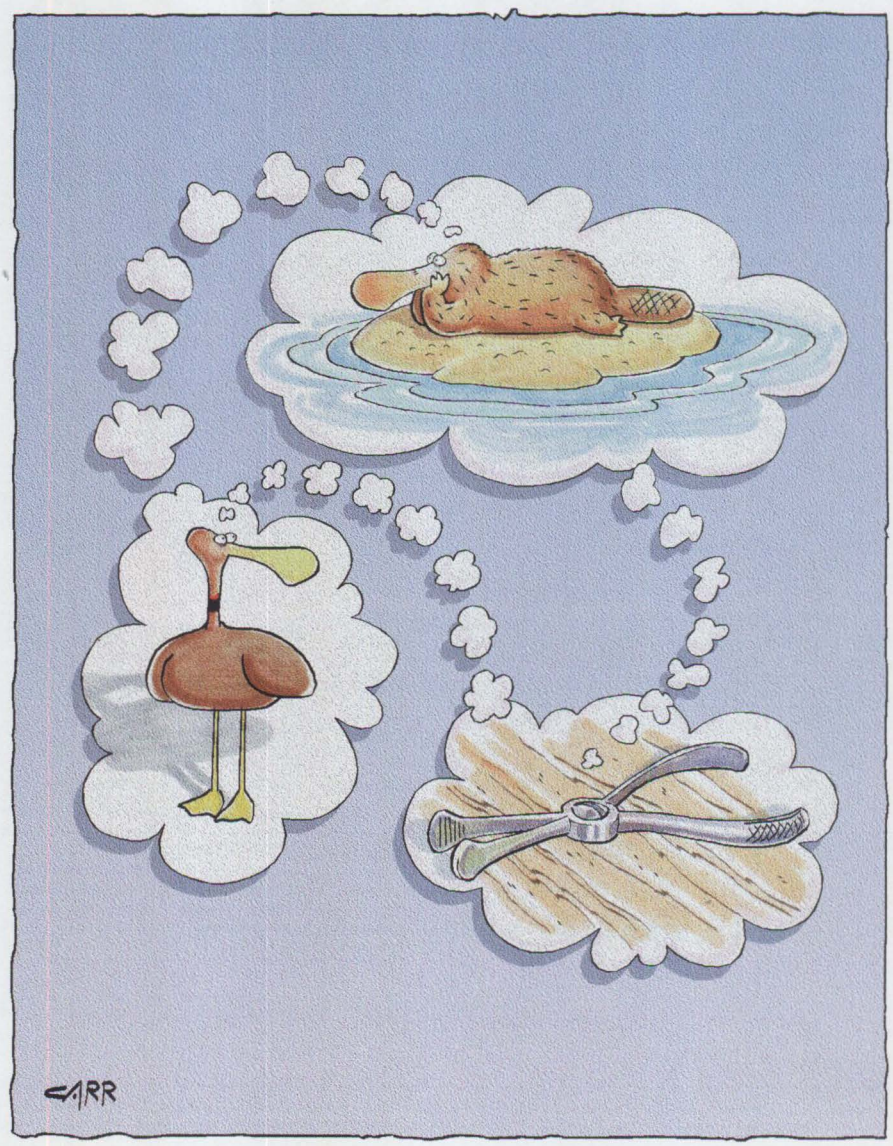
This article is intended to help users efficiently configure and use IBM Distributed Computing Environment (DCE) for OS/2. It describes some basic performance characteristics of DCE for OS/2. It gives insights into the performance of different core components–in particular, Remote Procedure Call, Cell Directory Services, and Security Services–through various benchmarks and what-if scenarios. The article focuses on a set of the most important basic functions of DCE and gives some tips and helpful hints for performance improvements.

Cindy Corn,
Tim Li,
Ray Pekowski, and
Bob Santeford
IBM Corporation
Austin, Texas

IBM Distributed Computing Environment (DCE) for OS/2 is a fundamental building block for distributed computing in an open systems environment. DCE provides services and tools that support the creation, use, and maintenance of distributed applications in the PC local area network (LAN) environment. The current implementation of IBM DCE for OS/2 is based on the Open Software Foundation (OSF) DCE 1.0.2.

This article addresses some performance characteristics of key basic functions in various core components of DCE:

- Remote Procedure Call (RPC), which extends the typical procedure call model by supporting direct calls to procedures on remote systems
- Cell Directory Services (CDS), which defines a naming model that allows users to identify resources by name without knowing their location
- Security Services, which encrypts and authenticates client/server transactions to ensure their privacy and authenticity



- Threads, which creates, manages, and synchronizes multiple threads of control within a single process
- Distributed Time Services (DTS), which synchronizes time on the computers participating in a distributed computing environment

For each of these components, this article first provides a simple tutorial, then gives performance information, and finally offers tips or helpful hints.

System Configuration

The hardware configuration used for this article is:

- DCE Server: IBM PS/2 Model 95 (33 MHz 486) with 16 MB of memory and a 320 MB hard disk
- DCE Client: IBM PS/2 Model 80 (25 Mhz 386) with 16 MB of memory and a 320 MB hard disk

Server and client are connected by a 16/4 token-ring adapter set at 16 Mbps.

The software configuration used is IBM OS/2 2.1 plus the IBM Distributed Computing Environment Software Developer's Kit for OS/2, Version 1.0.

Remote Procedure Call

The distributed communications model used by DCE is the *procedure call*. In this model, the client makes what looks like a procedure call. The procedure call is translated and communicated to a server routine, making the server routine believe it has been called locally. When the server returns, the results are communicated back to the client.

The DCE component that implements this model is the Remote Procedure Call. All other components of DCE use RPC for their communication needs; therefore, RPC plays an important role in DCE performance.

The client and server programs usually reside on two separate machines with possibly differing architectures. RPC runtime handles marshalling (copying input and output parameters to communication buffers), manages the communications link, and translates any architectural differences (such as byte reversal) between the client and server machines.

Level of Security	Function
Connect	Perform protection only when the client establishes a relationship with the server.
Call	Perform protection only at the beginning of each Remote Procedure Call when the server receives the request.
Packet	Ensure that all data received came from the expected client or server.
Packet integrity	Ensure and verify that none of the data transferred between client and server has been modified.
Packet privacy	Perform protection as specified by all of the previous levels and encrypt each Remote Procedure Call argument value.

Figure 1. RPC Security Levels

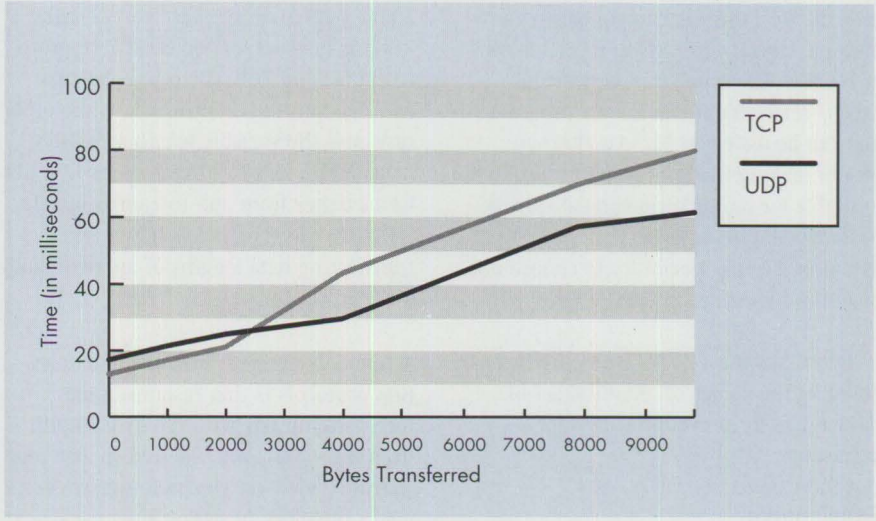


Figure 2. RPC (UDP Versus TCP)

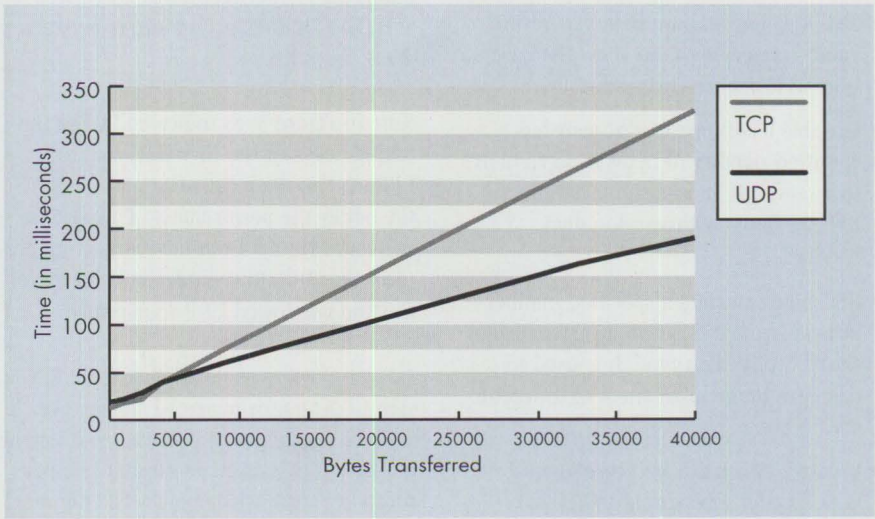


Figure 3. RPC (UDP Versus TCP)

OS/2 DCE RPC operates over the transmission control protocol/internet protocol (TCP/IP) communications service and supports both of its underlying transports: transmission control protocol (TCP) and user datagram protocol (UDP). TCP provides a connection-oriented service, while UDP provides a datagram service. Despite the differences between these two transports, RPC performs the same level of function (the same semantics) over each of them. RPC function compensates for any lack of function in a transport.

RPC is integrated with other DCE components and uses them to provide services such as finding servers (through the directory services) and providing security (through authentication and encryption) over the communication network. RPC uses the DCE threads component to allow multiple concurrent calls to the same server routine. The number of concurrent calls is selectable by the server program and can be as few as "1." An alternate way of making the same server routine available for multiple concurrent calls is to implement multiple server processes. RPC provides the flexibility to choose one or both of these techniques.

DCE RPC supports a rich set of data types, enabling the choice of a natural set of parameters for procedure/interface definition.

Benchmarks

The following benchmarks are used to evaluate RPC performance:

- Null RPC has no parameters or return value. Its purpose is to show the baseline performance cost of an RPC.
- Variable length array RPC transfers a specified number of bytes from a client to a server. It is used to observe how RPC performs with varying data lengths.
- RPC pipe transfers a specified number of bytes from a client to a server, using the RPC pipe data type. It is used to compare the performances of different data types.
- Security RPC has a null case and a data-transfer case (client to server), both with a specified level of security. It is used to observe the performance cost of security. The level of security is selected from the choices in Figure 1.

In addition to the RPC benchmarks, another test is used to evaluate the underlying transport:

- TCP/IP Sockets consists of socket send and receive commands to transfer a specified number of bytes between a client and server. It is used to observe the base cost of doing a TCP/IP transfer for various data lengths. This benchmark provides a good estimate of the TCP/IP overhead in an RPC transaction.

Performance Data

The following sections show measurements taken in the steady-state environment and do not include load and initialization times.

Base RPC with TCP Versus UDP. Figures 2 and 3 compare the base cost of using RPC for the two supported TCP/IP protocols: UDP and TCP. The zero-bytes case uses the null RPC benchmark, while other cases use the variable length array RPC benchmark. The TCP protocol for RPC performs better from null to approximately 2 KB. UDP RPC performs better when transferring data lengths of approximately 2 KB or greater.

A common characteristic of communication protocols is that response time increases linearly with the data length, from zero to a point where response time sharply increases. This point approximates the block or packet size–the size at which the protocol breaks up the data. Figures 2 and 3 imply that the TCP RPC packet size is between 2 KB and 4 KB, and the UDP RPC packet size is between 4 KB and 8 KB.

Note in Figure 3, as indicated by the flattening curve of the UDP line, for UDP RPC, the more data sent in a single RPC, the better the performance. This flattening curve results from the windowing protocol that DCE RPC implements on top of the non-windowed UDP transport.

The windowing protocol gives UDP RPC a significant performance advantage over a simpler stop-and-wait protocol by allowing multiple RPC packets to be sent before receiving acknowledgments. The number of packets sent between acknowledgments is called the *window count*. RPC renegotiates a window count on each RPC. The RPC packets sent during this negotiation do not benefit as greatly from the windowing protocol as those packets sent after the negotiation. For this reason, as the amount of data increases, greater benefits of the windowing protocol are realized.

For TCP RPC, beyond approximately 8 KB of data, it does not matter whether the data is sent as a single RPC or blocked into multiple RPC requests; the linear nature of the TCP line indicates the performance is about the same. This information implies that the window count within the TCP transport is maintained across RPCs rather than renegotiated on each RPC.

RPC Versus TCP/IP Sockets. Figures 4 and 5 compare RPC with TCP/IP sockets for the UDP and TCP transports. The TCP/IP socket measurements approximate the amount of time that RPC spends in the TCP/IP protocol. The percentage of the total RPC time that this represents is approximately 42% to 62% for UDP RPC and 53% to 68% for TCP RPC. The contribution of the TCP/IP protocol increases as the data size increases for UDP RPC and decreases as data size increases for TCP RPC.

For comparison purposes, the socket measurements are taken with a 4 KB block size; that is, if more than 4 KB of data is sent, it is blocked into multiple data sends of 4 KB or less.

Pipes Versus Arrays. Are all data types treated alike from a performance perspective? Two data types are examined here: variable length arrays and pipes. One difference between the two is the interface used to program to them. They both start out as the standard procedure call model, but pipes have an additional callback mechanism for getting at the pipe data. The callback consists of one or more calls from the RPC runtime back to an application routine. Through these callbacks, the RPC runtime requests the addresses and sizes of the data to be transferred. A possible disadvantage of the callback model is that it might be more difficult to program to–it breaks up the sequential programming flow of the client application.

Pipes have a performance advantage over arrays because the RPC data does not have to be immediately available at the

start of the RPC. The data can be sent via the callback mechanism as it becomes available. A new RPC does not have to be initiated for each amount of data to be sent.

Figure 6 compares RPC pipes versus variable length arrays for various block sizes. *Block size* refers to the amount of data passed to RPC at any single time. For the variable length array RPC benchmark, block size refers to the amount of data passed on each RPC call. For the RPC pipe, the block size refers to the amount of data passed during each callback. For example, sending 32 KB of data blocked at 8 KB requires four RPC calls using the variable length array RPC, but only one RPC call with four callbacks using the RPC pipe case.

Note that pipes and arrays perform at the same level if all the data for the array case is sent in a single RPC call (not blocked). When using pipes, even if the data is blocked (at 16 KB in these measurements), performance remains constant; however, when using arrays, if the data is blocked into multiple RPCs, performance degrades. The amount of degradation depends upon the block size.

These conclusions are based on the UDP RPC. Similar results, on a different scale, were found for TCP RPC.

Figure 6 reinforces the implied RPC packet size seen in Figure 2. Notice that for UDP RPC, 8 KB blocking is not much greater than 4 KB. The cost of sending the extra packet offsets the gain for sending more data per RPC.

Why choose pipes over arrays? If the data is not immediately available, and if obtaining the data can be overlapped with sending it, we recommend using pipes.

Local Versus Remote. What is the performance difference of an RPC to the same (local) machine versus to another (remote) machine? Figure 7 compares local RPC to remote RPC for various machine speeds. Local RPC is equal to or faster than remote RPC for data lengths up to approximately 40 KB. For larger data lengths, remote RPC is faster, and the windowing protocol in RPC or TCP/IP enables the send and receive processing

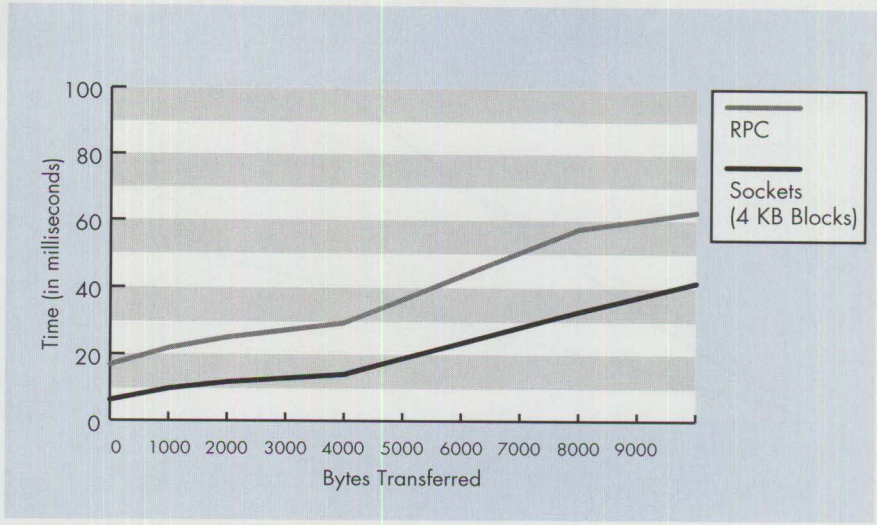


Figure 4. RPC Versus TCP/IP Sockets (UDP)

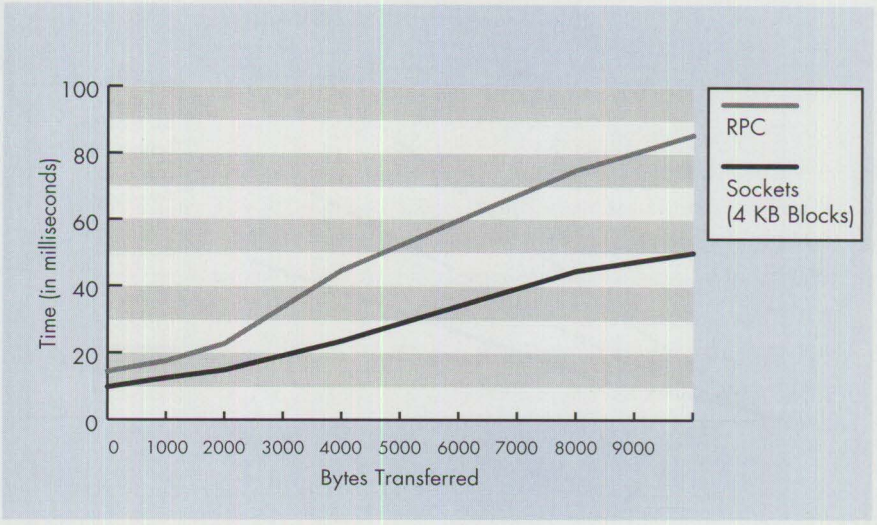


Figure 5. RPC Versus TCP/IP Sockets (TCP)

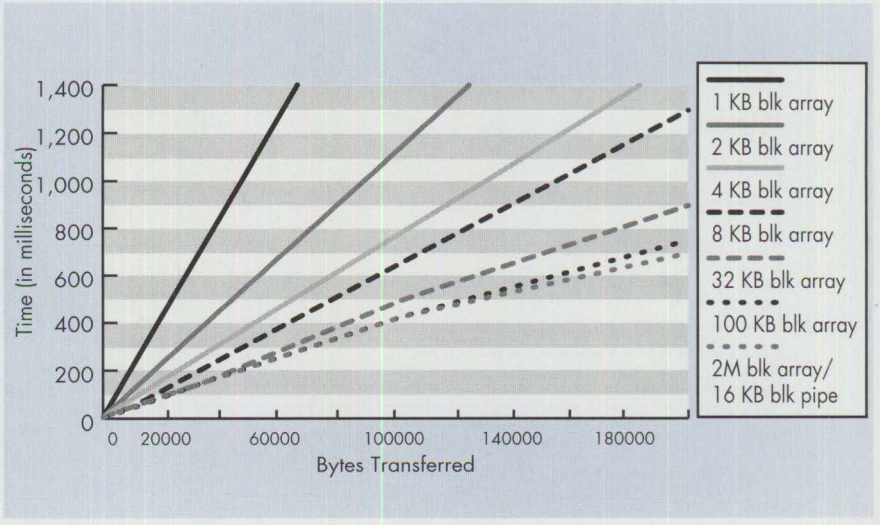


Figure 6. RPC Pipes Versus Blocked Arrays (UDP)

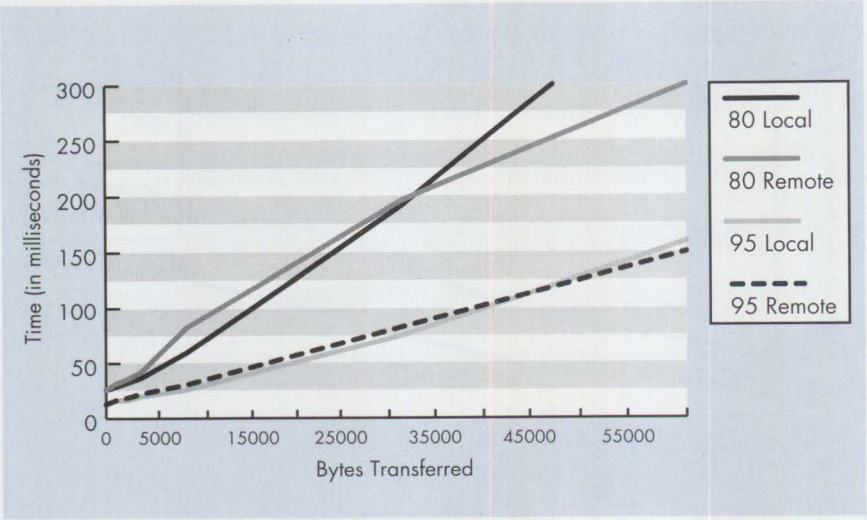


Figure 7. Local Versus Remote RPC (UDP)

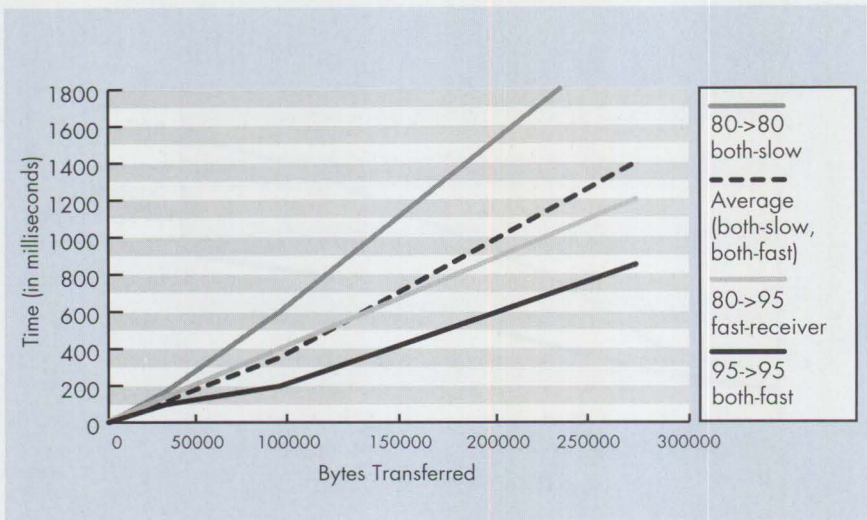


Figure 8. RPC Machine Speed Sensitivity (UDP)

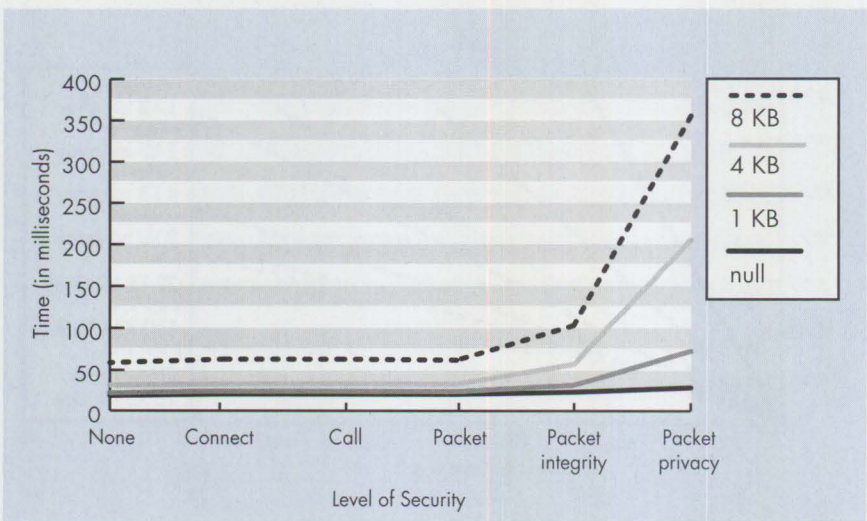


Figure 9. RPC With Security (UDP)

of the data to execute concurrently. A local RPC cannot take advantage of this concurrence and is no better off than if the windowing protocol were not there.

RPC Machine Speed Sensitivity. How does the machine speed of the client and server affect RPC performance? Figure 8 compares RPC performance for three combinations of PS/2 client and server models, classified as 80->80, 80->95, and 95->95. In Figure 8, for data lengths greater than about 100 KB, the performance of the 80->95 combination tends toward the performance of the 80->80 combination. For data lengths greater than about 100 KB, the performance of the 80->95 combination tends toward the performance of the 95->95 combination.

This comparative performance information on RPC over various combinations of machine speeds can be used to determine whether the receiver or the sender in the transfer is the bottleneck that most affects performance. As an example, the 95 in the 80->95 combination performs the role of the receiver for data lengths greater than about 100 KB. The 95 is also the bottleneck, as shown by the fact that the 80->95 line tends toward the 95->95 line.

In this example, to improve the performance of the RPC transfer for large data lengths, the best place to make hardware performance improvements is in the receiver. However, there is a crossover point at which the receiver is so improved that the sender becomes the bottleneck.

RPC with Security

What is the performance cost of doing a secure RPC? Figure 9 compares RPC at various levels of security. The security levels connect, call, and packet perform similarly, but a large performance degradation exists for packet integrity and an even larger one for packet privacy. The overhead for security–the additional time to provide the service–is about the same for TCP as UDP.

Tips and Helpful Hints

- Use TCP RPC for less than 2 KB of data and UDP RPC for more than 2 KB. For varying amounts of data, use UDP RPC. With UDP, the more data per RPC, the better.
- Use RPC pipes if the data to be transferred is not immediately available and

if the data being sent and received can overlap.

- Try to avoid local RPCs, especially with large amounts of data. Why do an RPC if it is local? Consider implementing a check for the local case and using a fast path (perhaps by making the server routine a DLL).
- If trying to improve the performance of large data transfers, be aware of which machine–sender or receiver–is the bottleneck. Replacing the wrong machine may not improve performance much, although its capacity to do more concurrent work might increase.
- Where possible, minimize the use of RPCs that have security levels of packet integrity and packet privacy (encryption).

Cell Directory Services

A cell comprises a collection of users, computers, and resources that share a common set of DCE services. The cell is the primary unit of administration in DCE and is usually defined such that control is focused around a common purpose, perhaps an organization within a company.

At a minimum, the cell configuration must contain one Security Server, one cell directory server, and one distributed time server. These servers may be contained in one or more machines. Currently, DCE for OS/2 supports multiple networks only through a global directory agent that must be provided by a non-OS/2 machine in the cell. The network topology may be quite varied within a single cell, ranging from a small local area network (LAN) to an extensive set of LANs and wide area networks (WANs).

Overview

Cell Directory Services looks up and manages names of resources in a cell. The names are specified in a hierarchical arrangement that defines the cell's namespace. A CDS directory appears very much like the familiar file system directory, particularly for UNIX users, or like the OS/2 and DOS path name without the drive letter and ":" prefix. A directory resides on a CDS server in a clearinghouse. The clearinghouse can be thought of as a database that stores directory information.

There are essentially three kinds of entries in a CDS directory: a directory entry, (also called a child pointer), an object entry, and a soft link.

- A *directory entry*, or *child pointer,* connects the upper levels of a directory to another directory immediately beneath it in the cell namespace.
- An *object entry* represents a resource or entity of some sort. It is the end point, or *leaf node*, of the directory. Another kind of end point is a junction. A *junction* provides a connection to special services, such as security and the distributed file system, independent of the directory service.
- A *soft link* is a pointer that provides an alternate name (alias) for a directory, an object, or another soft link.

The CDS server responds to namespace requests from client applications, which includes the other DCE components: RPC, security, and DTS. DCE applications use CDS for locating its servers and clients. Every client has a CDS advertiser and at least one CDS clerk. A *clerk* initiates CDS operations and stores the directory data it retrieves in a local memory cache. The CDS *advertiser* starts clerks as required, locates the CDS servers in a cell, and caches their locations for later use. Caching allows fast retrieval of previously acquired directory information, bypassing repeated lookups by the server. Periodically, the cache is written to disk so that it can survive system crashes. The cache is also written to disk when the CDS advertiser is stopped.

CDS Performance Measurements

The CDS control program (CDSCP) is used by a cell administrator, or other users with the appropriate permissions, to manipulate and manage CDS directories. This tool is the basis for the CDS performance measurements. The measurement cases are defined as follows:

- Specific commands have been timed by repeated execution in a batch program. The times obtained are fairly representative of the response times obtained for a manual entry from the keyboard after the CDSCP has been loaded.
- The CDSCP commands selected for measurement are `CREATE`, `SHOW`, `LIST`, and `DELETE`. `CREATE` and `DELETE` are self-explanatory. `LIST` simply lists the entries at a particular directory level. `SHOW` displays detailed information about the entity and its attributes.
- The commands are timed for directory entries and for object entries.
- The commands are executed at high levels of the directory hierarchy.

Figure 10 shows the base set of measurements for the aforementioned CDSCP commands. Directory operations, in particular `CREATE` and `SHOW`, are generally more time-consuming.

Figure 11 explores the effects of repetitive execution of the `SHOW` command for directories and objects. Varying the number of entries from zero to 50 indicates a highly linear relationship. Figure 12 depicts similar measurements using the `LIST` command. It, too, shows a fairly high linearity but with much smaller times.

Figure 13 shows the effect of concurrent workloads on throughput and response time. The workload is represented by the CDSCP `SHOW DIRECTORY` command, repeated one after another, with no delay between executions. Concurrence is achieved by adding more machines that generate this command stream. The throughput saturation occurred at about 146 `SHOW` commands per minute. Thereafter, the response time increased with no gain in throughput. The server CPU utilization was well-behaved as the load increased, and it was near 100% at the throughput saturation point.

Caching effects on response times for CDSCP `SHOW DIRECTORY` commands, each showing four directory entries, were measured utilizing the `SET CDSCP CONFIDENCE` command. There are three levels: high, medium, and low. A confidence setting of *high* causes the clerk to obtain information from only master replicas. (Only one master replica–the base directory–exists in this test.) A setting of *medium* causes the clerk to get information directly from a CDS server. (This is the same as the master replica in our test setup.) A setting of *low* means the clerk should obtain the information from the cache or from the most convenient server.

Response times for the high and medium levels reflect the time required to access the server directly for the directory information–23.1 and 13.0 seconds,

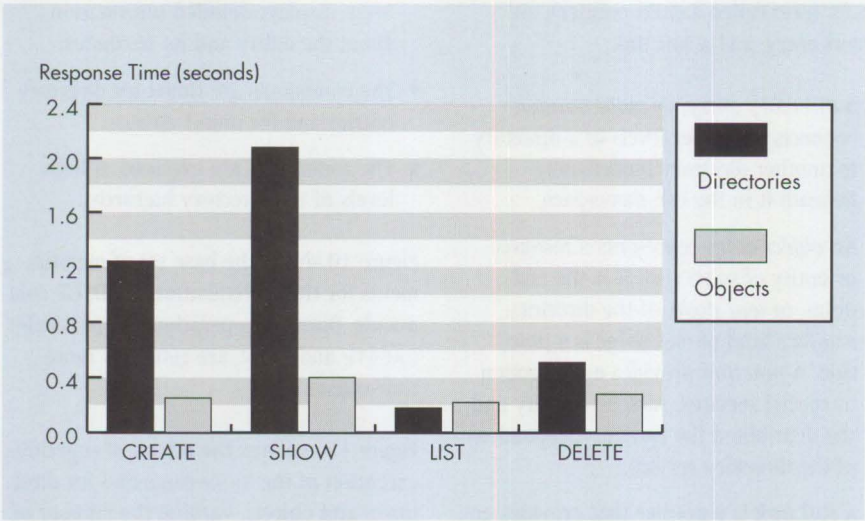


Figure 10. CDS Control Program Base Commands

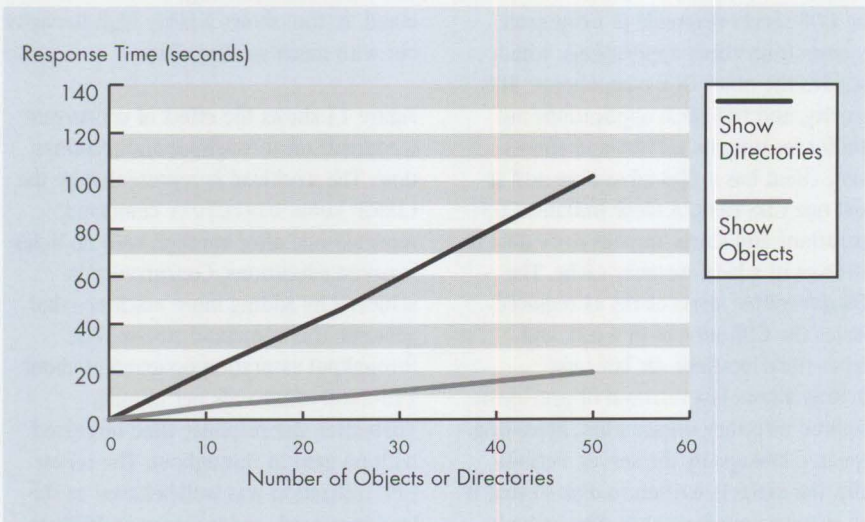


Figure 11. CDS Control Program SHOW Command

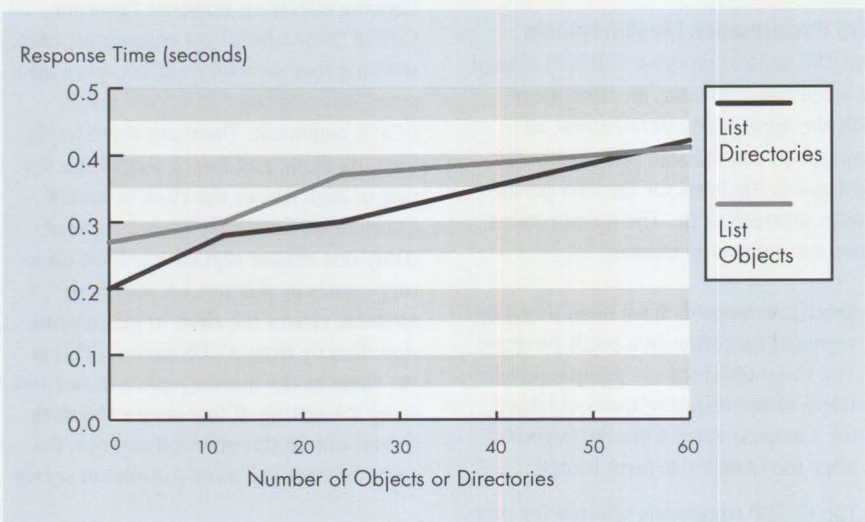


Figure 12. CDS Control Program LIST Command

respectively. Response time for the low level is only 11.4 seconds because the directory data is accessed in the local cache.

Tips and Helpful Hints

Although the CDS directory looks like a normal file system directory, it is much more than that; consequently, the response time of directory lookups is significantly greater in CDS. Thus, CDS should be used for its primary purpose of providing resource location information and should not generally be used for data that is more suitable for a file or a database. In particular, CDS is designed for frequently read information that does not change often, so that its caching capability is exploited. It is not designed to be used by applications that need to frequently write data.

`SET CDSCP CONFIDENCE LOW` can be valuable for processing large amounts of repetitive information by a CDS administrator. It is not useful for applications, since it only has a lifetime of the CDSCP context.

Security Services

DCE Security Services enables clients and servers to prove their identities to each other, offers integrity and privacy of communications, and controls access to resources.

DCE Security Services maintains its own namespace to ensure that the DCE cell remains secure. Clients of the Security Services query CDS for binding information that enables them to find the Security Server. This article concentrates on the key security commands, detailed below.

DCELOGIN

The `DCELOGIN` command authenticates the user to the Security Services by means of the user's password, thereby establishing an authenticated network identity. The Security Server knows the name entered on the `DCELOGIN` command is the name of a principal (user) who is registered in the security part of the namespace.

RGY_EDIT

The `RGY_EDIT` command edits the registry database, which contains information about principals, groups,

organizations, accounts, and administrative policies. The subdirectories PRINCIPAL, GROUP, ORG, and POLICY compose the registry space. For example, the /.:/SEC/PRINCIPAL directory contains all the principals that have been defined.

ACL_EDIT

The ACL_EDIT command manages access control lists (ACLs) for all namespace objects. An ACL contains a list of entries that tell the object with which the ACL is associated about the permissions granted to a user. The ACL entries collectively determine which principals can use the object and which operations they are allowed to perform on it. Since each ACL manager defines the permission tokens and appropriate meaning for the objects it controls, the actual tokens and their meanings vary.

DCELOGIN Automation

The DCELOGIN command acquires a DCE identity and creates a subshell in which that DCE identity can be used when executing DCE programs. To automate the performance measurements for the login function, a less well-known feature, DCELOGNE, is used. Although DCELOGNE is not shipped with the product, you can create it by copying the DCELOGIN.EXE file to DCELOGNE.EXE. The code behaves differently, depending on the program name invoked.

The DCELOGNE command does not spawn a new shell, as does DCELOGIN; both commands, however, create credential files. DCELOGNE emits the name of this file and then returns; however, the environment variables that are automatically set by DCELOGIN must be manually set when using DCELOGNE. For performance measurement automation, it was shown that the manual DCELOGIN from the command line takes roughly the same amount of time as the sample commands in Figure 14 take using DCELOGNE.

In Figure 14, note that the CELL_ADMIN principal is used. To obtain the values for DCEUSRID and DCEGRPID, the RGY_EDIT program was used to view the accounts.

Figure 15 is an example showing output from the RGY_EDIT program to obtain the DCEUSRID and DCEGRPID for the accounts CELL_ADMIN and PRINC1. For CELL_ADMIN, the DCEUSRID is 100 and DCEGRPID is 12. For the account PRINC1, the DCEUSRID is 455 and the DCEGRPID is 226.

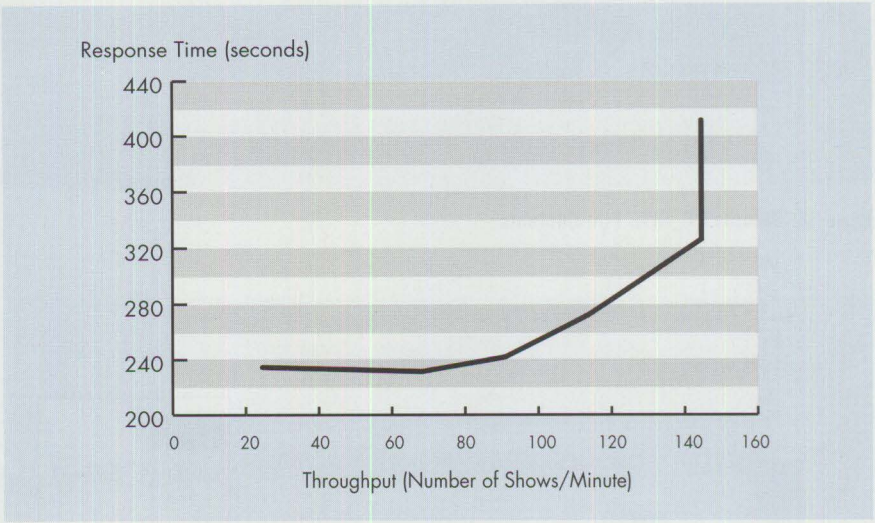


Figure 13. CDSCP Show Response Time Versus Throughput

```
rem Assume that "e:" is the drive DCE is installed on
e:
cd \opt\dcelocal\bin
copy dcelogin.exe dcelogne.exe
rem Begin "dcelogin" function using "dcelogne" for automation <--
SET DCEUSRNAME=cell_admin
SET DCEUSRID=100
SET DCEGRPID=12
dcelogne cell_admin -dce- > dcelogne.out
rem Setup pointer for security credentials cache
rem SET KRB5CCNAME=
rem FILE:E:/OPT/DCELOCAL/var/security/creds/<alphanum>
rem KRB5NAME.SET contains the text "SET KRB5CCNAME="
copy KRB5NAME.SET+dcelogne.out KRB5SET.CMD
call KRB5SET
rem End "dcelogin" function using "dcelogne" for automation <--
```

Figure 14. DCELOGIN Function Using DCELOGNE for Automation

```
Current site is: registry server at /.../cindysworld
   /subsys/dce/sec/master
.
cell_admin [none none]:*:100:12::/::
.
princ1 [group1 org1]:*:455:226::/::
```

Figure 15. Sample RGY_EDIT View Account Output

BIND_PE_SITE Environment Variable

In release 1.0 of DCE for OS/2, the README file suggests that BIND_PE_SITE may be set to a non-zero value to improve the performance of some security functions in a single-cell environment. BIND_PE_SITE is an environment variable used by Security Services to determine whether to use CDS to locate the Security Server. Its default value is zero, which indicates that CDS should be used. If changed to a non-zero value, Security Services uses a file named PE_SITE to locate the Security Server. The

```
/.../cindysworld 008f6ec0-139b-1ca3-831c-10005aa85815
   @ncacn_ip_tcp:129.35.64.148[]

/.../cindysworld 008f6ec0-139b-1ca3-831c-10005aa85815
   @ncadg_ip_udp:129.35.64.148[]
```

Figure 16. Sample PE_SITE File Contents

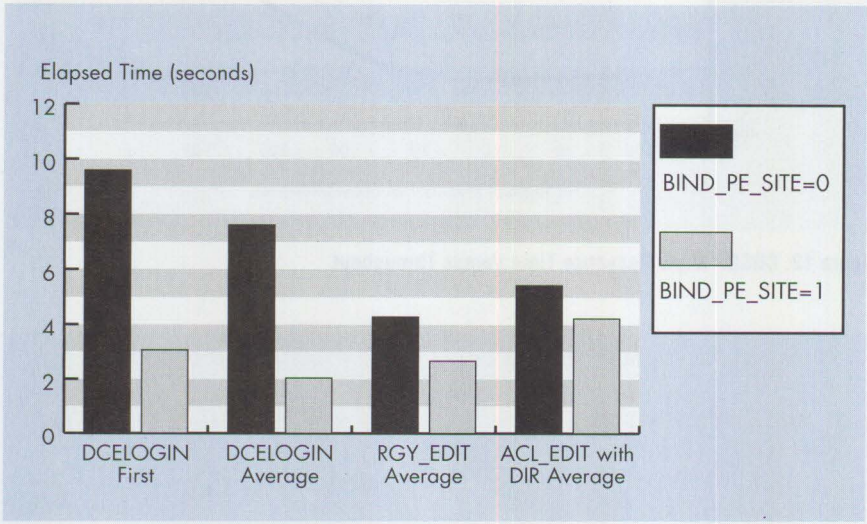


Figure 17. Key Functions of Security Services

```
1. acl_edit /.:/sec/principal/princ1

2. acl_edit -addr 008f6ec0-139b-1ca3-831c-10005aa85815
      @ncacn_ip_tcp:129.35.64.148[] principal/princ1

3. acl_edit -addr 008f6ec0-139b-1ca3-831c-10005aa85815
      @ncadg_ip_udp:129.35.64.148[] principal/princ1
```

Figure 18. ACL_EDIT a Principal with Different Binding Examples

configuration program (MKDCEPM) creates this file and stores it in the /OPT /DCELOCAL/ETC/SECURITY directory. Figure 16 shows two lines from one PE_SITE file. In Figure 16, the first item is the cell name, followed by the binding information for the Security Server. An entry is included for each of the supported transport protocols. This information is also used to bind to the Security Server when the BIND_PE_SITE is set to zero and the CDS server is unavailable.

Performance of Key Security Commands

Figure 17 illustrates the performance differences obtained by varying the value of BIND_PE_SITE. Statistics are shown for both the first and average login time, although most users will log in only once. The RGY_EDIT and ACL_EDIT measurements indicate the average entry time to begin using these control programs.

Figure 18 illustrates three different binding methods that can be used with ACL_EDIT.

Figure 19 shows the performance of doing ACL_EDIT on a registry server object. It compares the three different binding methods, as well as the effect of varying the value of BIND_PE_SITE.

In the first example shown in Figure 19, no address is specified in the ACL_EDIT command. If BIND_PE_SITE is zero, CDS is used to locate the object. If BIND_PE_SITE is non-zero, the first entry of the PE_SITE file is used to locate the object.

In the second example, the TCP address is specified, indicating that the RPC TCP protocol should be used to bind to the object.

In the third example, the UDP address is specified, indicating that the RPC UDP protocol should be used to bind to the object.

Regardless of the BIND_PE_SITE value, using the -ADDR option with the RPC UDP string binding resulted in the best performance for the conditions tested. Note that using the -ADDR option eliminates the use of /.:/SEC when specifying the object name.

The disadvantage of using BIND_PE_SITE set to non-zero, together with the ACL_EDIT -ADDR option, is that they require hardcoded information. If the location of the Security Server changes, the configuration program must be used to correctly update the PE_SITE file and the new information used for the -ADDR option. While performance is improved, usability is somewhat reduced.

Another disadvantage of setting BIND_PE_SITE to non-zero is that it might cause functional problems when replicated Security Servers are used. Currently, replication of the security database and daemon is not supported in OS/2 DCE 1.0 but may be available on other platforms.

RGY_EDIT Subcommands

The BIND_PE_SITE variable has no significant effect on the RGY_EDIT commands once the control program is started. Figure 20 shows performance measurements for some common administrative RGY_EDIT operations using the RGY_EDIT control program. Note that repetitive operations are considerably faster than first-time operations. For this reason, it is a good idea to organize a large administrative workload by grouping similar operations.

The RGY_EDIT VIEW command is used by administrators and other users to view accounts, principals, organizations, and groups. Figure 21 shows the performance for view accounts based on a variable number of accounts.

ACL_EDIT Subcommands

Once the ACL_EDIT object is bound, the actual commands within the ACL_EDIT program perform similarly, regardless of the method of binding. For the interactive ACL_EDIT operations measured–ASSIGN, GET, HELP, LIST, MODIFY, DELETE, PERMISSIONS, SUBSTITUTE, and TEST–all performed in under a second for most elementary cases.

The ACL_EDIT LIST command is used by administrators and other users to view ACLs for a particular object. It was determined that the response time measurements for LIST, based on a variable number of ACL entries, was a highly linear relationship.

Tips and Helpful Hints

- Use DCELOGNE, as shown in the sample command sequence in Figure 14, to automate the DCELOGIN function.
- Use BIND_PE_SITE<>0 in a single Security Server, single-cell, stable environment to improve DCELOGIN, RGY_EDIT entry, and ACL_EDIT entry performance.
- Use the -ADDR option on the ACL_EDIT command where appropriate.
- Group similar RGY_EDIT operations. For example, if creating multiple accounts, first create all the principals, then all the groups, then all the organizations, then all the accounts.

Threads

The DCE threads facility provides multiple sequential paths of execution within a process, as opposed to a single path of execution available in the traditional UNIX model of programming. DCE threads is based upon POSIX draft standard 1003.4a. Other components of DCE use threads because of its functionality and portability.

OS/2 has its own threading facility. OS/2's DCE implementation is a mapping of the DCE threads APIs to the corresponding OS/2 APIs.

DCE threads APIs and OS/2 threads APIs can coexist within the same process, but they cannot interoperate. That is, both APIs can be used within the same process, or even the same thread; however, one set of APIs cannot be used to wake up a thread that is blocked in the other set of APIs.

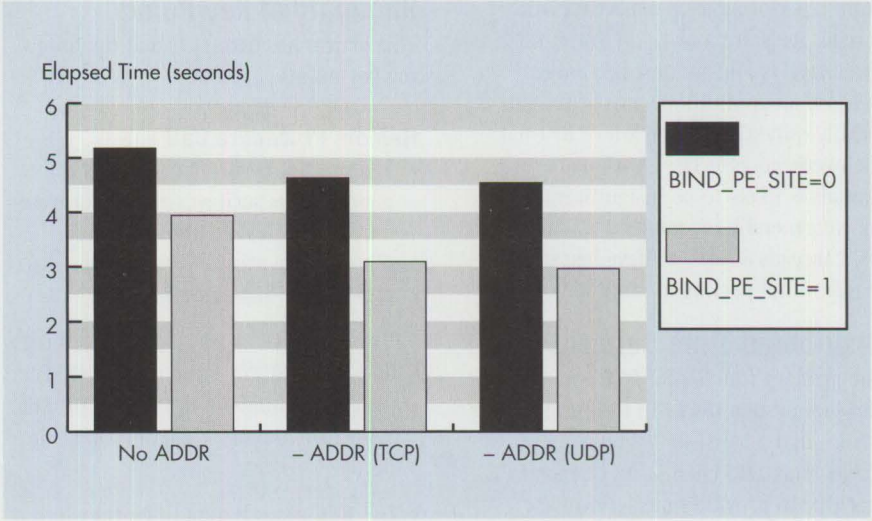


Figure 19. ACL_EDIT a Principal with Different Binding Performance

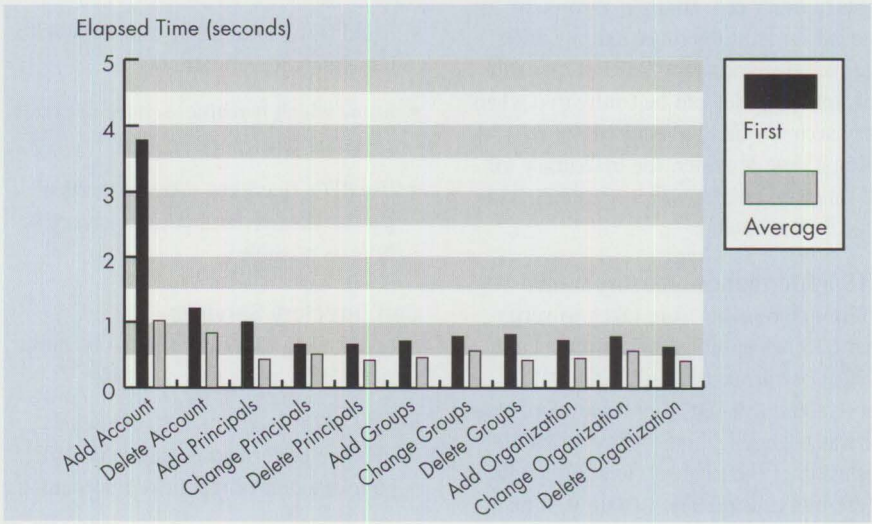


Figure 20. Common RGY_EDIT Operations

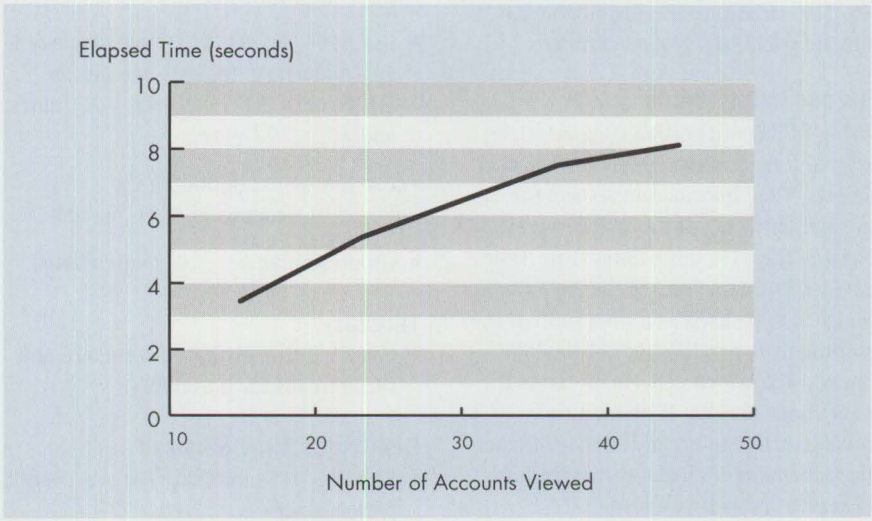


Figure 21. View Account for RGY_EDIT

From a performance perspective, DCE threads APIs are a layer on top of OS/2's threads APIs and so must be slower. Because an application's use of threads is usually only a small portion of its total, the overhead associated with using DCE threads is likely to be insignificant. Even so, we generally recommend using the OS/2 threads APIs to achieve better performance, if not porting to other platforms.

Distributed Time Services

The primary function of DTS is to synchronize system clocks in the cell to ensure that a consistent time is used throughout. DTS clients run in each DCE machine to provide time services for applications and timestamps for RPCs, security entities, and CDS object/directory creations. At least one DTS server must exist in every cell. Multiple servers are needed for fault tolerance and for utilizing the DTS inaccuracy feature. An external time provider can be configured when very accurate time is required. When using a time provider, the inaccuracy for all time servers becomes very small, and time drift is small.

DTS Performance Measurements

DTS measurements were taken to verify that DTS has minimal impact on overall system performance. With three DTS servers and five DTS clients, network traffic was negligible, both before and after inclusion of the time services. Although there was considerable variation in many measurements using the component benchmark test cases, the overall average was about the same, with and without DTS. The variations are attributable to normal system background activity.

Tips and Helpful Hints

During DCE configuration (`MKDCEPM`), an external time provider should be selected from the Time Information section for one, and only one, of the DTS servers. Selecting the `DTS_NULL` entry from Time Provider Hostname causes the PS/2's system clock to be used as a time source. The resulting drift parallels that of the PS/2 system clock, which is normally around two seconds per day. Without a time provider, drift can occur at a much higher rate, depending on many things, including server and network loads.

Summary of Key Points

This article has demonstrated the following key points:

Remote Procedure Call

- Realize that performance varies by many factors such as size of data transfer, security levels, transport used, pipes versus arrays, local versus remote, and hardware used.
- Use TCP RPC for less than 2 KB of data and UDP RPC for more than 2 KB. For varying amounts of data, use UDP RPC. With UDP, the more data per RPC, the better.
- Use RPC pipes if data to be transferred is not immediately available and if obtaining it can be overlapped with sending.
- Avoid using local RPCs, especially with large amounts of data.
- Know which machine–sender or receiver–is the bottleneck.
- Use RPCs that have security levels of packet integrity and packet privacy as little as possible.

Cell Directory Services

- Avoid using CDS for data that is more suitable for a file or a database.
- Set CDSCP `CONFIDENCE` to low to improve performance when processing large amounts of repetitive information.

Security Services

- Use `DCELOGNE` to automate the `DCELOGIN` function.
- Use `BIND_PE_SITE<>0` in a single-cell environment to improve the performance of `DCELOGIN`, `RGY_EDIT` entry, and `ACL_EDIT` entry.
- Use the `-ADDR` option on the `ACL_EDIT` command when possible.
- Group similar `RGY_EDIT` operations.

Threads

- Use OS/2 threads for performance and DCE threads for portability.

Distributed Time Services

- Running DTS minimally impacts overall performance.
- Configuring with an external time provider improves accuracy and minimizes drift.

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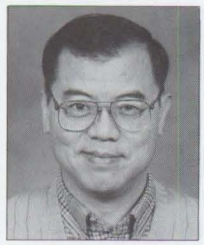
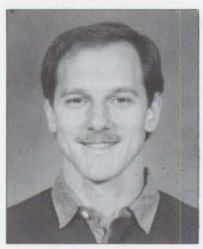
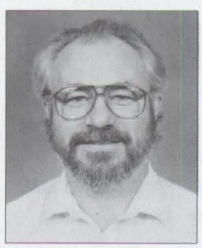


Tim Li is a senior programmer in IBM's Personal Software Products Division, focusing on performance analysis of Distributed Systems Services. He joined IBM in 1969 as an engineer in system reliability. He has since been involved with performance analysis in communications systems, 5520, office systems, and strategic planning for OS/2 EE Communications Manager. Tim holds a BS degree in electrical engineering from National Taiwan University and a PhD degree in electrical engineering from Purdue University at West Lafayette, Indiana.



Ray Pekowski is a staff programmer in the IBM Personal Software Products Division and is responsible for OS/2 DCE RPC and threads performance analysis and Windows DCE performance analysis. He has worked on the development and performance of communications programs since joining IBM in 1981. His past projects include 3270 and asynchronous emulators and LAN transports. Ray holds a BA degree in computer science from the University of Texas at Austin.



Bob Santeford is an advisory programmer in IBM's Personal Software Products Division. His current responsibilities include performance analysis for CDS, GDS, and DTS for Distributed Systems Services. Bob joined IBM in 1969 and has worked on software development for the Safeguard ABM system and Ground-Based Shuttle System; systems analysis and performance analysis for the Ground-Based Shuttle System; and, more recently, PC and PS/2 communications products. He holds a BS degree in mathematics from the University of Houston at Clear Lake City, Texas.

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VisualAge: Its Features and Virtues

This article describes the overall capabilities of VisualAge, IBM's recently announced client/server application development tool. VisualAge gives its users a powerful new way to create applications that run either on stand-alone systems or in a distributed environment.

This article describes the basic principles of client/server computing and visual programming in the context of how the VisualAge tool supports these philosophies and features.

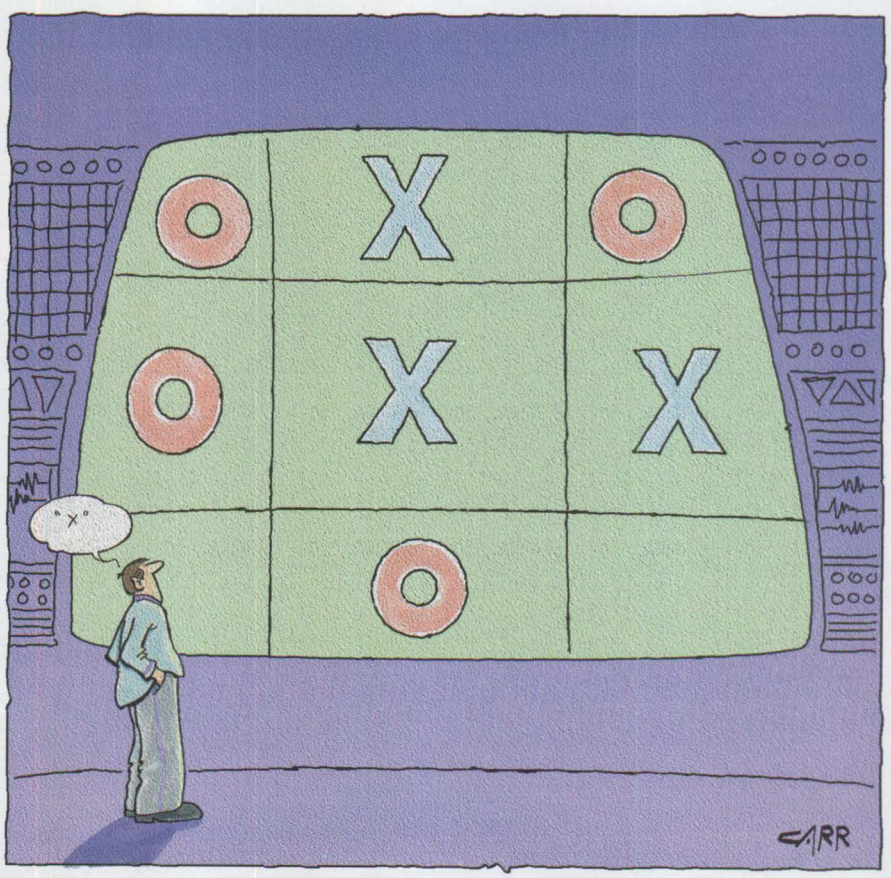
This article was written during beta testing of the product and may describe features not included in the released product, which is scheduled for release in early 1994. Additionally, features not mentioned in this paper may be included in the generally available product. Screen images may also have changed between beta testing and general availability. Consult the product announcement for exact details of the offering.

Tony Colle
Skill Dynamics
(an IBM company)
Research Triangle Park, NC

This is the era of fourth-generation computing languages. People get excited about advances in technology. You might be one of them. On the other hand, you may be asking "What is a fourth-generation language? What were the first three?"

Modern computer programming began in the late 1940s and 1950s with specially trained scientists who knew the intimate details of the computers on which they worked. At first, they literally wired the binary instructions and data directly into the computer circuitry. This "hard-wiring" was the first generation of programming. Using devices that read the binary data did not help much, because calculating absolute jump and data addresses consumed a great amount of time and effort. It was very difficult to create and change these programs.

Second-generation programming languages were symbolic macro assemblers. Although assemblers freed the programmers from tedious address assignment chores, the tedium remained. Programmers still had to calculate storage requirements and make sure that the machine



could properly address the data and programs. In addition, each architecture not only had its own machine language, but also needed its own assembler and assembly language. Moving to another system usually meant rewriting all of the code.

The need for a higher-level program representation led to the third-generation programming languages, the compiler languages. These languages use general algebraic or English-like statements to represent operations. The compiler converts these statements into the actual machine-language code. It also lays out the data and ensures proper addressability of all program and data blocks.

Even with third-generation languages, programmers still needed specialized skills. They had to understand the computer and its languages. They needed to use complex macro or utility programs to do even the simplest business functions. They found that accessing data in a database was not a trivial matter.

Programmers still coped with high levels of frustration, because the computer did only what it was told to do. Indeed, the eternal hope of programmers was that the next language release would contain the "do-what-I-mean" instruction or utility.

Business Logic

With the advent of third-generation languages, businesses started to appreciate the value of the computer. No longer was it a tool just for the scientists and academicians.

Many parts of a business are repetitive, predictable, and heavy in calculations or data movement. These pieces of the business are perfect for computer automation.

In analyzing a business, it is important to extract the essential business processes, separating *what* the business does from *how* the business does it. The presentation of data, the medium of data storage (tape versus disk, for example), and the communications media are "how" processes that change rapidly as technology advances. In contrast, the business logic pieces–"what" the business does–change very little, if at all. Tools that capitalize on maintaining stable business logic while accommodating the ever-changing presentation and storage technology give a distinct advantage to the businesses that use them.

Fourth-Generation Languages

Enter fourth-generation languages. Some fourth-generation languages are "non-programming" languages that let the average user set up business logic situations without doing any programming. For example, using a spreadsheet, a user can do a what-if analysis simply by changing some numbers and requesting a recalculation. Using visual programming tools, a user can lay out the interface for a complex application, all the while being able to see what it will look like. Using composition tools, users can define how business logic components interact with each other to perform critical business functions.

It is in this fourth-generation language arena that VisualAge steps in as an application builder. VisualAge helps users and development professionals alike create better applications faster through new technology we will describe below.

VisualAge—What Is It?

VisualAge is an object-oriented, visual-programming, client/server application builder. Using the concepts of team programming and rapid prototyping in an iterative development cycle, VisualAge can help your organization produce a stand-alone or networked application. It is built upon the powerful object-oriented environment provided with the IBM Smalltalk* language. VisualAge lets you either build your applications from the ground up, extend an existing application, or take an existing application and build a daughter application that is like the old application, but with some differences.

VisualAge uses an object-oriented base for application development; however, it shields new users from needing to be proficient, or even conversant, in object-oriented technology until they need to develop more complex applications.

This all sounds great if we understand the jargon. But what does it all mean? Let's see how VisualAge incorporates these concepts.

Object-Oriented Technology

Traditional programming forced programmers to think in terms of what they wanted computers to do. This activity-oriented philosophy sees programs as one big algorithm analogous to a recipe: the program's inputs are the ingredients, and the program describes how these inputs should be separated, sifted, beaten, folded, mixed, and baked (sometimes only halfway) to produce the desired output.

On the other hand, object-oriented technology changes this philosophy by allowing users and programmers of the system to think in terms of the things, or *objects*, that the business uses and how they interact.

Each object has its own behavior and characteristics. An object can be a report, a customer, or even an integer–almost any person, place, thing, or concept that can be described by a noun or a short phrase.

By looking at similarities between different classes of objects, a system designer can hierarchically organize the objects in your system according to their similarities. For example, the 90-Day-Late Report may be almost exactly like the standard Accounts Receivable Report, but limited to certain data.

Object-oriented technology allows designers to define one class of objects, such as reports, as being similar to another, but with some differences. Then implementers only need to program those differences while the technology handles the similarities. Because of this focus on similarities and differences, object-oriented programming is often called "programming by differences." Figure 1 shows a sample hierarchy of reports.

In Figure 1, the top of the hierarchy defines a report's characteristics. The report defined at the top would reflect the general layout for company reports. The items (classes) under it describe specific reports. Notice also that the hierarchy shows that the 90-Day-Late Report is like the Accounts Receivable Report.

As a starting point, VisualAge gives you a rich set of pre-defined classes of objects. You can either build classes that you tailor from the ones that come with the system, or you can start from scratch to define classes for your unique business objects. Should a vendor make a library of object classes available to you, VisualAge

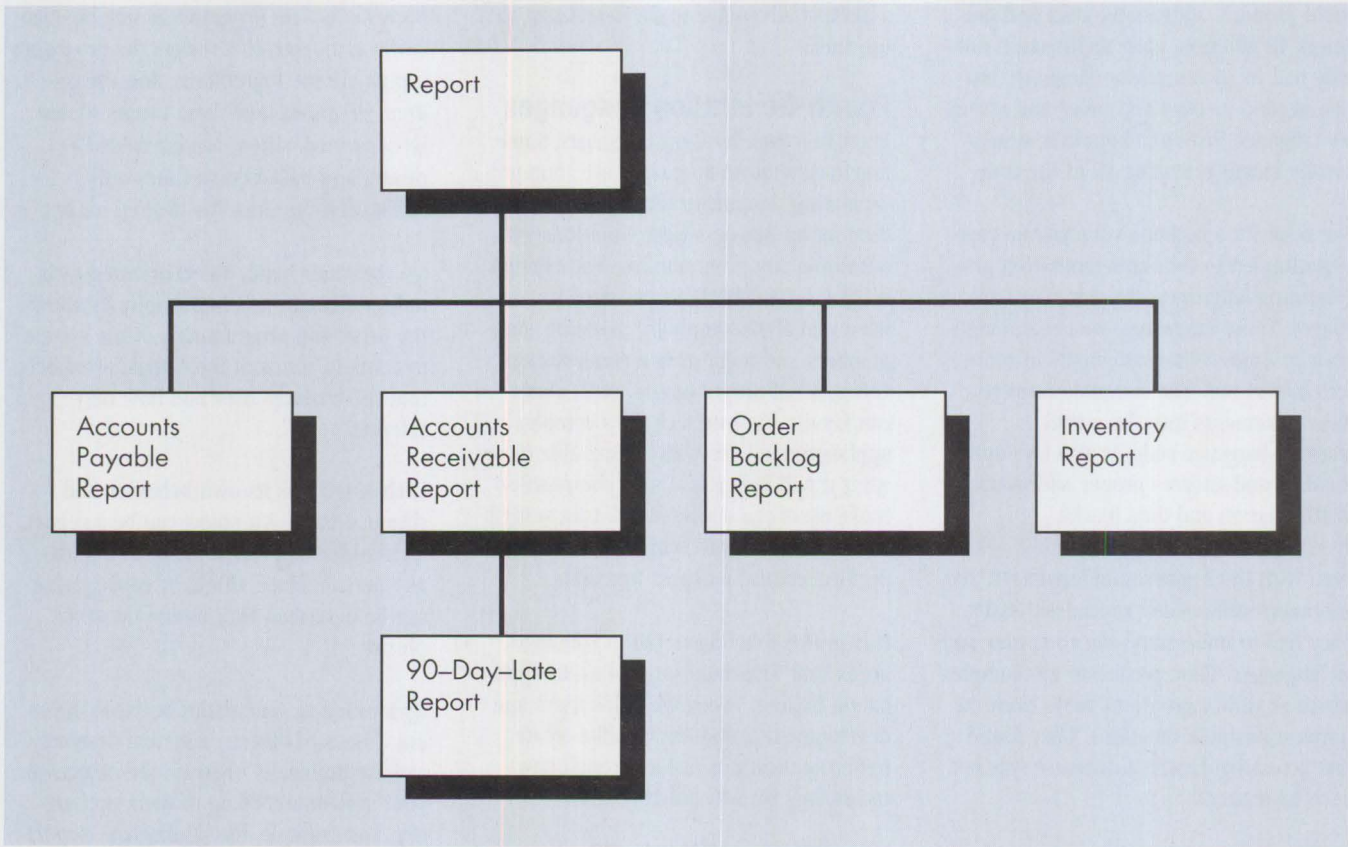


Figure 1. Part of a Sample Object Class Hierarchy

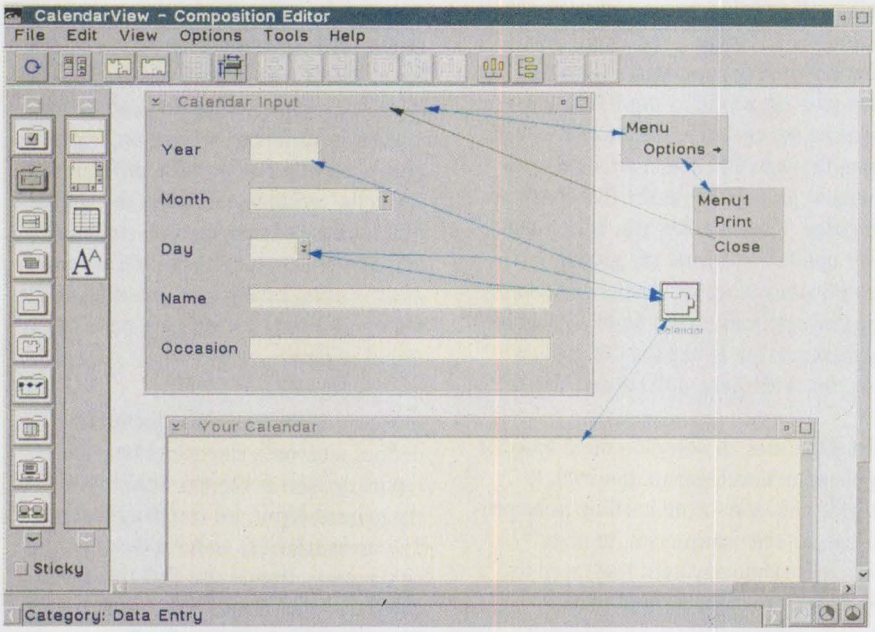


Figure 2. Sample Visual Programming Layout Using VisualAge

lets you easily incorporate those classes into your environment and, therefore, into your applications.

Visual Programming

If you want to write your own code (and sometimes code is required), VisualAge uses the scripting language provided by IBM Smalltalk. The real power of VisualAge, however, comes from its ability to describe a business application, not by writing code, but rather by visually connecting the pictures, or icons, that describe the parts of your business.

VisualAge gives you a layout surface that looks like an empty canvas or piece of drawing paper. You construct your application by placing your icons on this surface.

VisualAge allows you to connect the icons by drawing lines. You draw the lines as you tell it which components are related and how they are related. For example, you may draw a line showing that the "name" of the employee object is also a part of the W-2 tax form. While drawing these lines, VisualAge keeps the name of the employee and the name on the W-2 synchronized. Other connection requests might cause some kind of action to occur in your application, such as storing data to a file.

You can select standard components from a parts palette and then graphically describe your application, the screens that the application will display, and the business logic that it will use. Figure 2 shows a sample layout surface for an application being developed using VisualAge.

Programmers may be involved in writing business logic, such as a COBOL dynamic

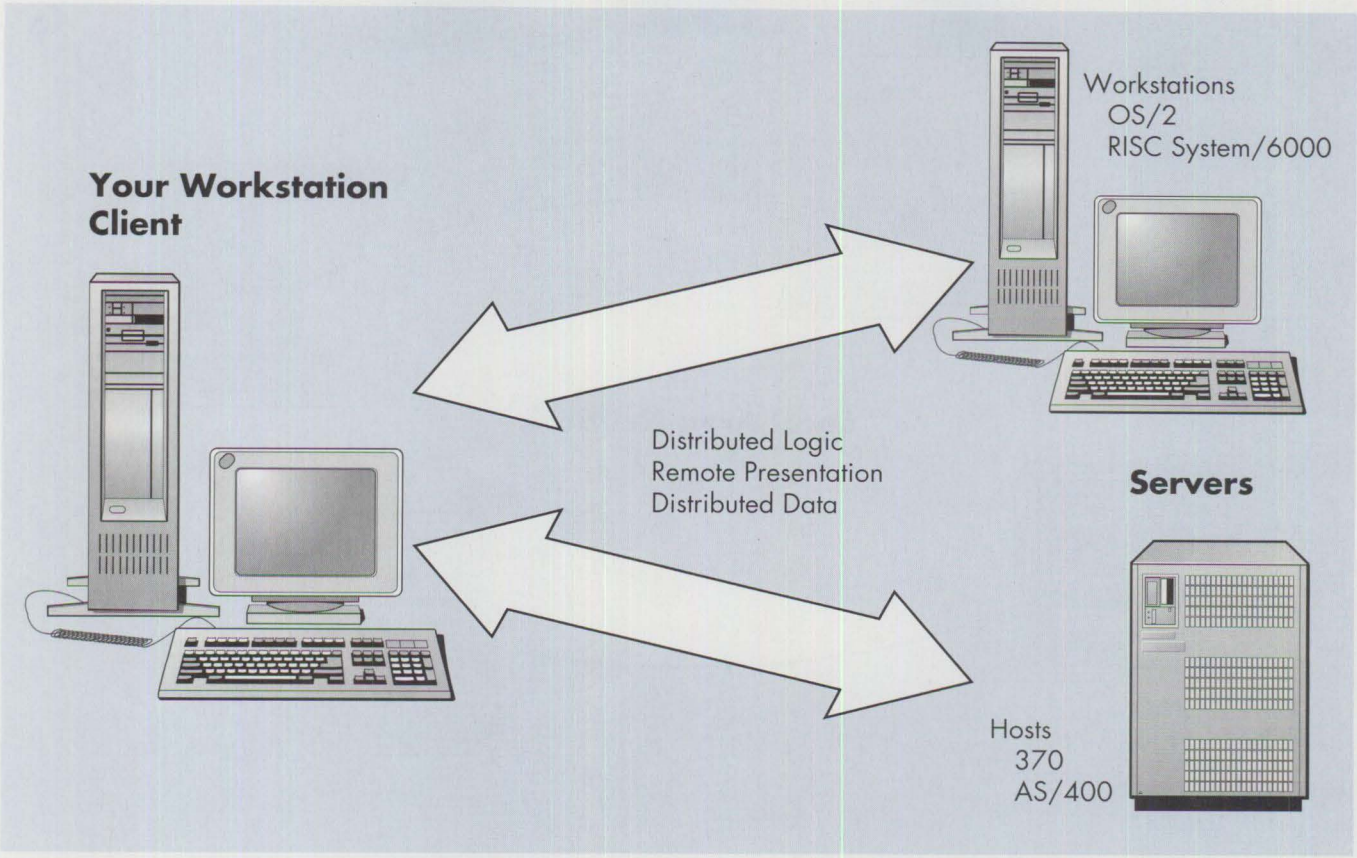


Figure 3. Sample Client/Server Environments

link library (DLL), or in building a remote database. Using VisualAge connections between these components that programmers provide, you can build your application in the VisualAge development environment. You graphically describe how the new components relate to each other and to other components, sometimes without ever touching any code.

While the databases or programs are being developed, you can use the Smalltalk scripting language to build a *code stub*–code that emulates the not-yet-written functions for prototyping or testing purposes. Once you are ready to incorporate the new components, simply remove the stub and connect the real components.

Client/Server

Building a stand-alone application for a workstation that uses only locally available functions and data may satisfy many needs, but usually a time comes when you need data from another system to be available on the local area network (LAN) or on a remote host.

This is when VisualAge seems like a knight in shining armor. Supporting a number of databases with equal ease, both locally and remotely over several different kinds of networks to any number of host systems, VisualAge makes it almost effortless to build an application in which your workstation client communicates with a remote server.

Client/server (sometimes called *requester/broker*) is a term used frequently today. In the VisualAge context, if your workstation needs to access data or function that resides on another system, your application is the client of that server. Each application may require a different server on a different host, but VisualAge handles the transaction with minimal user involvement. Figure 3 shows some possible client/server environments.

Team Programming

VisualAge can be used by an individual describing a single application, or by a group of people sharing development responsibility over a LAN. VisualAge uses a library registration and management process. It ensures that only certain people can modify specific parts (components) of the application, that no two people can simultaneously modify the same copy of a part, and that when you start developing a part, the cleanest, most up-to-date parts are available for your use. Figure 4 shows one possible team environment.

Rapid Prototyping and Iterative Development

Your organization can quickly prototype an application so that users can see and understand its presentation, function, and products *before* the formal development process starts by bringing together application users, system designers, and business logic specialists.

As users of the application describe what they need, business logic specialists analyze the current set of components available through VisualAge, noting which ones to enhance, which to copy and modify, and which to create. Then system designers, who understand the business operating environment, can temper expectations as they collect requirements for new hardware and software components. The result is a better understanding of the business needs and more realistic expectations of what the system can provide for everyone concerned.

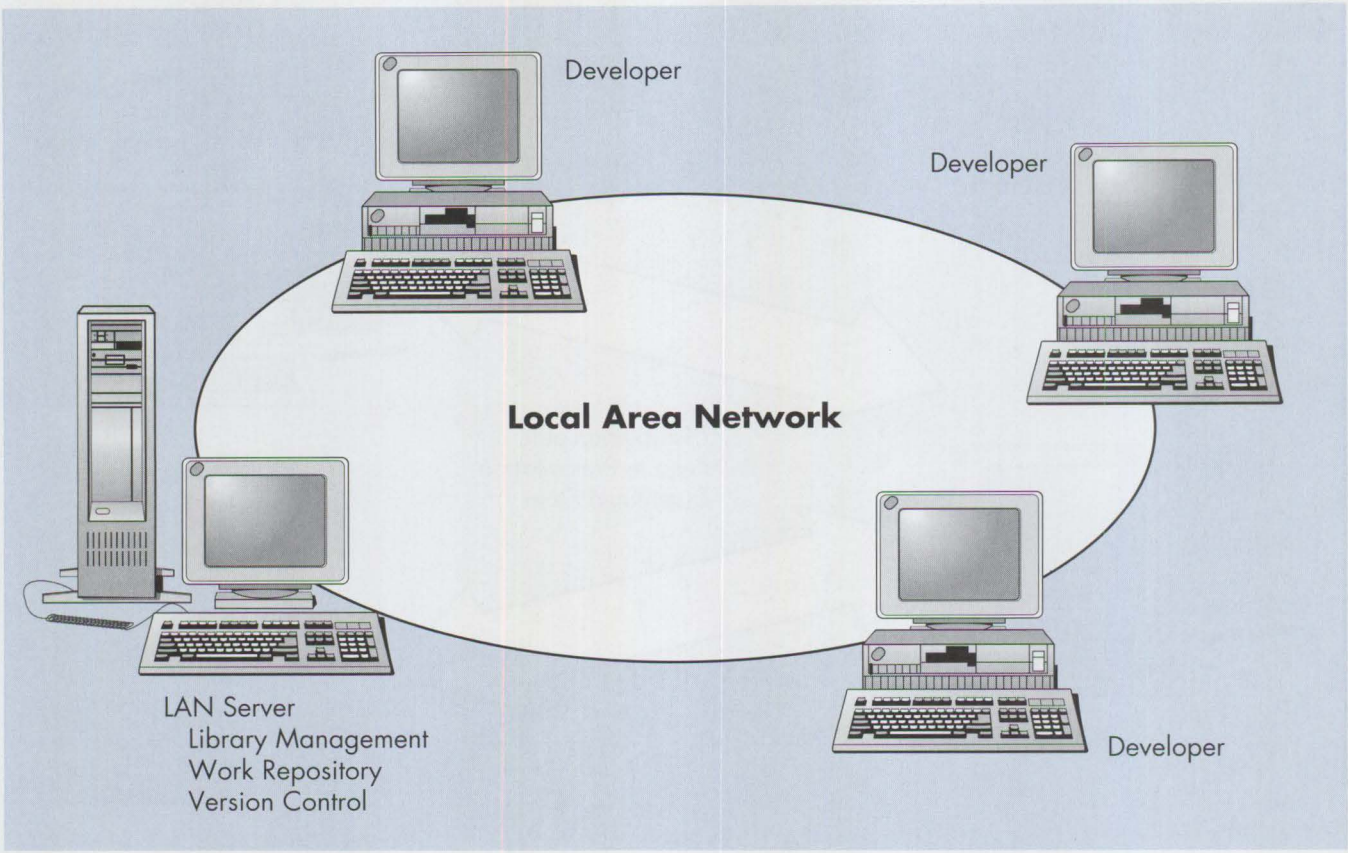


Figure 4. Team Programming Environment

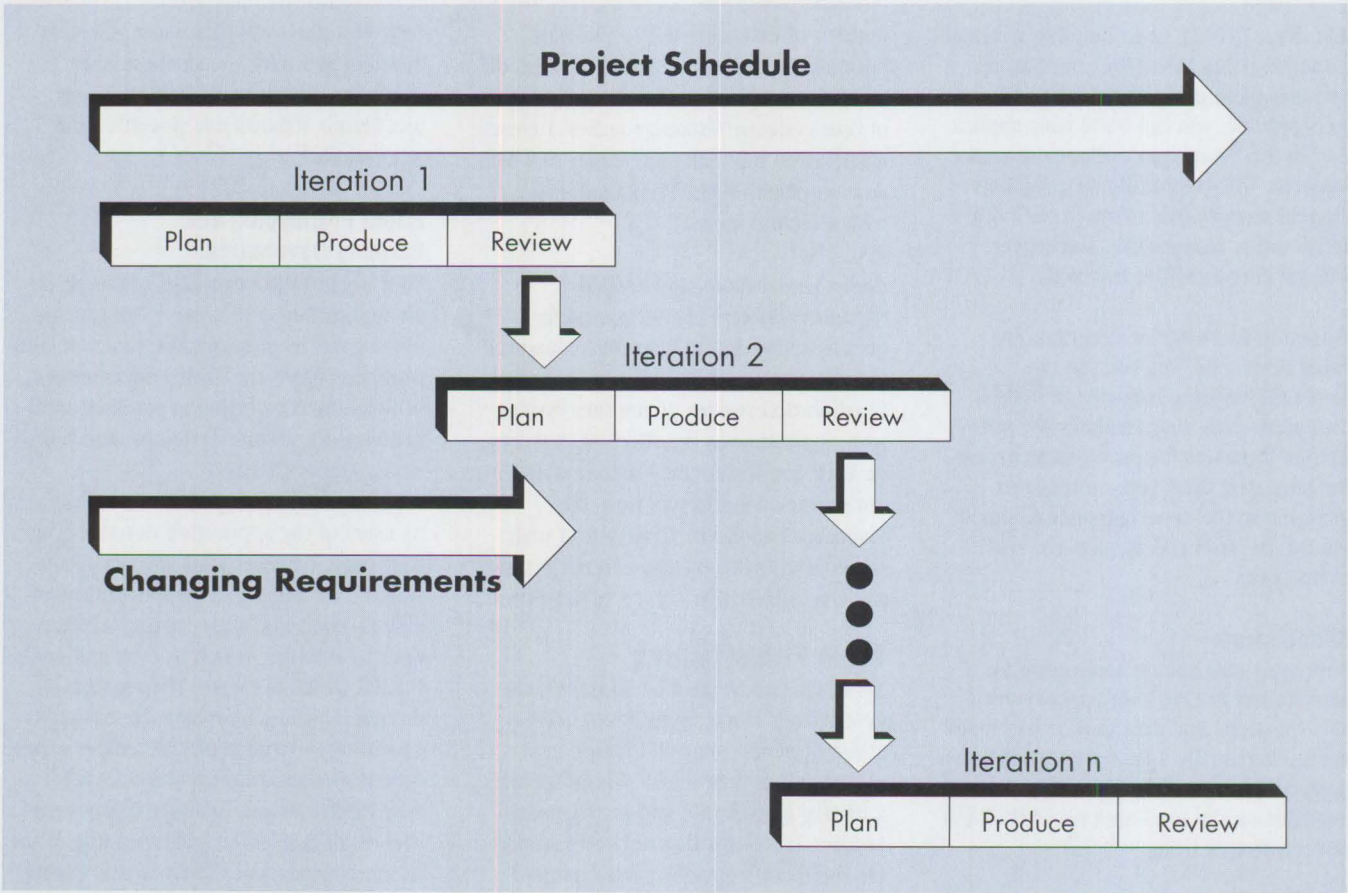


Figure 5. Iterative Development

Working within this framework, you can model the system using VisualAge, then test it by using dummy parts to emulate function that must be created. You can center the development process around a set of these planning, producing, and reviewing iterations. As each iteration brings in newly created parts to test for compatibility, this process verifies the functions of the system from the business perspective. As the system grows, everyone gains experience with its functions while quickly incorporating changes based on human factors and business needs.

When the cycles are finished, the end product meets the users' requirements. You've successfully completed an application!

Figure 5 shows how a project loops through planning and producing phases to create the end product.

VisualAge Concepts

VisualAge builds its visual programming development and run-time environment on object-oriented (OO) technology. For non-object-oriented development shops, the good news is that VisualAge can ease the transition into object technology. But people who know OO can easily unleash the full power of this technology with VisualAge.

Object-oriented technology encourages, and in some cases even enforces, good software engineering development practices. The foremost of these practices is encapsulation.

Encapsulation allows software objects to be used freely in a development or run-time environment, while protecting the integrity of the data associated with the object. As almost any software developer knows, data corruption, either accidental or through poor design, is one of the major causes of software problems. Encapsulation protects the data from accidental destruction or improper modification by providing a well-defined interface to the data. It is only through this interface that you can access the data, either for view or modification. By preventing the person who is using the object from directly modifying the data, data integrity is virtually guaranteed, and problems are reduced or even eliminated.

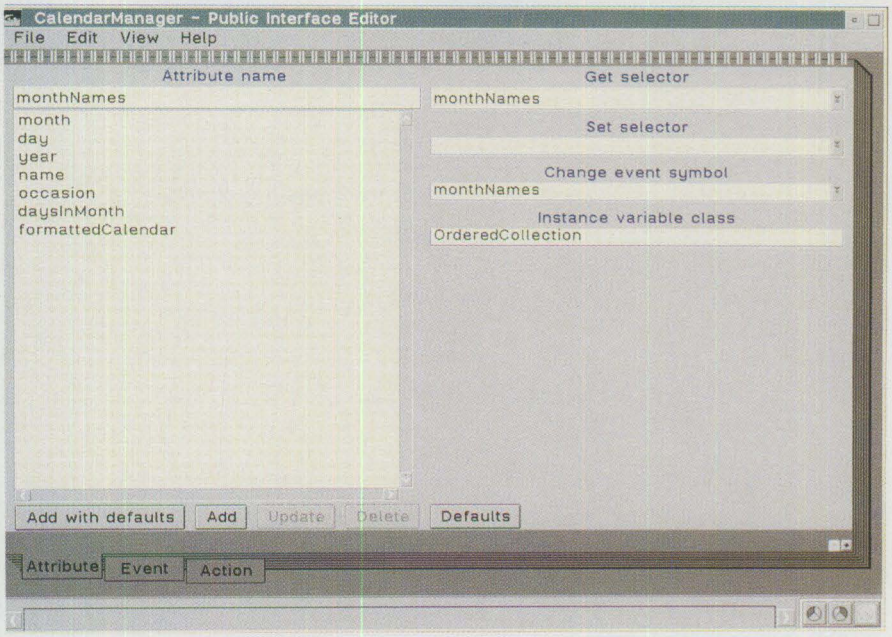


Figure 6. Public Interface Editor Screen

Building on the concept of an encapsulated object, VisualAge adds a well-defined, standard public interface that all VisualAge components understand. When the person building an application accesses a standard component or builds a new component for the system, VisualAge uses its standardized public interface for all communication with the object. This interface consists of publicly available attributes, actions that the component can be asked to perform, and events by which the object can tell the other objects that some specific thing has happened.

By recognizing an object's public interface, objects in the system can access another object's attributes, request the object to perform some action, or respond to an event that occurred in some other object. Other objects that were waiting for the event to happen can then act appropriately. Figure 6 graphically shows a component's public interface.

You can access an object's attributes to either set or get the value; therefore, each object has "get" and "set" functions for each publicly available attribute. Although this may sound like a violation of encapsulation, this access actually goes through the encapsulated interface. It has all of the protections that the system automatically provides (such as synchronizing data types), plus it enables you to add anything you may wish (such as range-checking and data validation).

If you must define a component's behavior to a degree not possible by simply describing its constituent components and their relationships, VisualAge provides an editor that allows you to describe behavior using its scripting language, IBM Smalltalk. Smalltalk, a pure object-oriented language, is the underlying language in the VisualAge environment (which is discussed in the next section). Using Smalltalk when necessary, you—the VisualAge component builder—can describe behavior anywhere. By using built-in Smalltalk features to let objects communicate among each other, and by directing data movement and manipulation, you can work with data any way you want or need.

Even though VisualAge lets you drop down into the IBM Smalltalk language when you need to, it is not always necessary to write code. You can describe many applications by using pre-built parts and describing their relationships to one another. If your business logic is already written in a different, third-generation language, you can easily incorporate those DLLs into your application.

You can access logic and data that reside on a different host by using standard VisualAge components. This simplifies the client/server application in a VisualAge environment; accessing a database on a remote host, for example, becomes as easy as accessing data on your workstation.

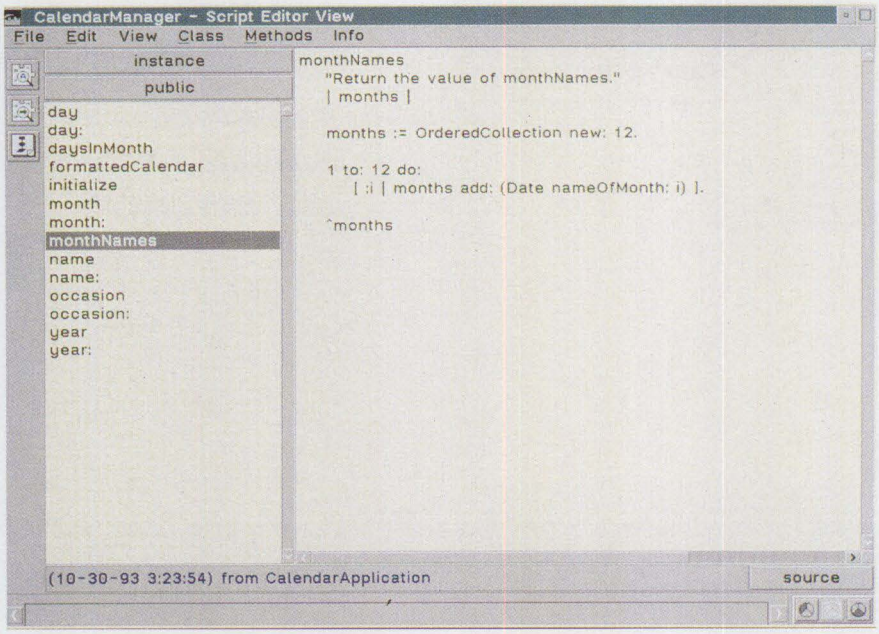


Figure 7. Script Editor Sample

The VisualAge Environment

VisualAge comes in two flavors: standalone and team. Both environments have the same development features. In addition, the team edition provides version and release control, making application packaging easier than with the standalone version. The team edition also supports, as its name implies, a group of people working on the same application at the same time.

VisualAge lets you define your applications and their various parts. Once you have chosen names for these visual and non-visual components, you may use one of three standard editors that VisualAge provides to create and subsequently modify the components.

Composition Editor

The Composition Editor lets you visually create the components of the application by describing the sub-components and their relationships. It is the heart of VisualAge development. You create all visual components with the Composition Editor by selecting standard Common User Access (CUA) parts (such as panes and buttons) and business logic components from menus, then organizing them on a layout surface, as shown previously in Figure 2.

Public Interface Editor

The Public Interface Editor lets you define the publicly available attributes that other components can access, the actions another part can ask this part to perform, or an event that this component will report. Frequently, the actions and events you define here will be expanded and given their behavior using the Script Editor (discussed next). A sample definition appears in Figure 6.

Script Editor

The Script Editor lets you define any needed Smalltalk code. For example, it is useful for defining VisualAge scripts that can cause the workstation to beep when a user presses a button or exceeds a limit. Additionally, you can use the Script Editor to define the complete behavior for any part that you create in Smalltalk. These parts might be business logic or prototype emulations of future components. Figure 7 shows a sample of the Script Editor. The IBM Smalltalk language was written to conform to the proposed ANSI standard for Smalltalk. This standard provides portability of Smalltalk code across multiple platforms.

VisualAge Components

VisualAge comes with a rich set of ready-to-use components. Earlier, it was mentioned that VisualAge has a wide variety of CUA components. For convenience, and to reduce the number of things you must remember at one time, VisualAge categorizes all components. The CUA categories provide buttons, data entry fields, lists, menus, notebooks, and other types of windows.

VisualAge also arranges components in other categories that provide local and remote database access to:

- A variety of database managers such as the IBM DATABASE2* (DB2) family, as well as non-IBM database managers like Oracle* and Sybase*
- Third-generation language (such as C and COBOL) DLLs
- Communication, through advanced program-to-program communication (APPC), transmission control protocol/internet protocol (TCP/IP), CICS* ECI, NetBIOS, and emulator high-level language application programming interface (EHLLAPI)
- Models for standard Smalltalk components–so you don't need to know how to use them directly (multimedia components are also available)

In addition to the components that come with the product, VisualAge has a very easy mechanism that lets you create your own categories and add components to them. You can easily incorporate components created by one segment of an enterprise, or purchased from a vendor, into the VisualAge environment.

VisualAge Virtues

VisualAge is a complete application development and run-time environment. Unlike other visual programming tools, VisualAge provides the full power of object-oriented technology to its users. Although experience with this technology and the Smalltalk language is most helpful, if your shop is not fully versed in this technology, VisualAge can ease your application developers into using the technology's concepts and avoiding many of the perceived complexities. If your organization is capable of exploiting object technology, however, every feature is readily available.

Because application users can build all or most of the business application themselves, sometimes with no additional programming, they are ensured that they have the applications they want and need. Rapidly prototyping applications can provide useable and efficiently laid-out user interfaces early in the development cycle. Since layouts are easily changed with VisualAge, it becomes an easy task to try different input fields or button types, then play around with their locations.

Prototyping also lets the people who will use the final product get a feel for the actual functions they will use. Training becomes easier, because the users now know what it takes to use the new system.

Freeing up highly trained programming personnel to focus on programming instead of building user interfaces can affect resources positively. Since VisualAge's technology allows you to create applications simply by selecting components and defining the relationships between them, you don't have to be a highly skilled programmer to define how an application is put together or what the user interfaces look like.

Compared to most languages and development environments, laying out a GUI or application flow with VisualAge is almost trivial. Many tasks that can take several days with traditional programming languages take, with some practice, only minutes to a few hours with VisualAge. Even beginners can be quickly productive using VisualAge. As a result, I/S shops can focus scarce programming resources on the more complex tasks such as creating databases, database views, or complex business logic components that require traditional programming.

But the greatest benefit is an increase in the quality of the end products. Everyone profits when the users quickly get a system that performs the business tasks and presents the data in a useable format. VisualAge development in conjunction with good design practices helps ensure your organization gets the robust applications it needs in a timely manner.

VisualAge today is a very useful product, and much more will become available in the future.

Additional Information

If you want to learn more about how to use the VisualAge product, Skill Dynamics, IBM's education company, has an entire suite of courses that do everything from introducing you to the product to making you a proficient user. Object technology and Smalltalk programming courses are also available. In the US, contact Skill Dynamics at (800) IBM-TEACh (426-8322) for information.

Technical and product information is also available on TalkLink from Advantis. In the US or Canada, call (800) 547-1283 for information on TalkLink. CompuServe users can enter GO VISUAL.

Definitions

Object-Oriented Technology

A technology that focuses on how the data and processes within a system or an application relate to each other. Traditional programming tends to focus on one or the other, but rarely on both. Object-oriented programming (OOP) treats data, plus the processes that work on or with the data, as a unit called an *object*; and models the way that objects interact.

Visual Programming

A method of constructing a program or application by selecting pre-defined components (the pieces that make up the program) and graphically describing the way the components interact, using some kind of "What You See is What You Get" (WYSIWYG) editor.

Client/Server

A form of distributed computing that allows one system to send a request to another, possibly different, system and receive a response that can be understood and processed by the first system. Logically, the process appears to the user or to the application as a single system.

Team Programming

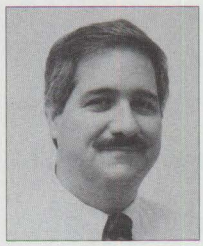
A concept wherein several people can simultaneously work on one project. Although not new in the realm of host-based computing, personal computer-based program development was, due to a lack of communication capability between systems, a single-person activity. In a team programming environment, people pool their independent work efforts as an integrated unit, complete with library management, to accomplish the group objective of a working system.

Rapid Prototyping

Using the visual interfaces and possibly the skeleton code behind the interfaces, a working prototype of a system is constructed quickly to show the user community the look and feel of a new application.

Iterative Development

A process of specifying and building parts of a large project by breaking the project into smaller pieces and iterating through planning, production, and evaluation phases. Each iteration refines the process, exploits new knowledge of the changing business environment, and uses feedback from earlier iterations to produce a better product.



Tony Colle currently leads the development and delivery effort for Skill Dynamics' VisualAge education. He has been developing and teaching object-oriented and software engineering courses for over three years. Before joining IBM's education group, Tony spent 16 years as an application and system developer with various IBM units. He has a BA in applied mathematics from the State University of New York at Binghamton and an MS in biomedical computer science from The Georgia Institute of Technology.

Little Solutions

Creating a Scrollable OS/2 Window

While entering commands in an OS/2 window, have you ever wished you could see what has just scrolled off the screen? The information below explains how to set up an OS/2 window you can scroll. You can create either a permanent one or a temporary one.

Setting Up a Permanent Scrollable Window

1. Select an OS/2 command window icon
2. Press your right mouse button to open the Settings Notebook
3. Enter the following information in the Parameters field of the Settings Notebook:
   `/K mode 80,100`
4. Close the Settings Notebook

Testing

1. Open the OS/2 command window that you have just modified
2. Type several commands (a few `DIR` commands will do)
3. Place your pointer on the scroll bar to scroll up. You now have a scrollable window.

You can also set up a scrollable window to use temporarily. You do this by creating a command file. Once you've created it, run the command file and a scrollable window will be created. When finished, close the OS/2 window.

Setting Up a Temporary Scrollable Window

1. Use an editor like EPM (enhanced editor) or E to open a window
2. Enter the following information into your document:
   `MODE 80,100`
3. Save the document as `M.CMD`

Testing

1. From an OS/2 command line, enter `M`
2. Use the window
3. When you are done, just close the window.

—Mike Ponce de Leon, IBM's Personal Systems Competency Center Roanoke, Texas

Automating NetWare Login with OS/2 2.x

As a NetWare Q&A responder, I often see questions from customers who want to log in to a NetWare server before the Workplace Shell is running. Usually, they want to do this so that icons for programs residing on the server will appear when the desktop starts. Unless they have logged in before the Workplace Shell starts, these icons will revert to the default program icon.

Provided that you wait for the NetWare Requester to initialize, you can log in from the `CONFIG.SYS`. Figure 1 shows a small `CMD` file to do this.

NOTE: before modifying your configuration, you should save your existing configuration files (i.e., `CONFIG.SYS`, `OS2SYS.INI`, and `OS2.INI`).

To activate this program, add the following line to your OS/2 `CONFIG.SYS` after the NetWare Requester statements:

```
CALL=D:\OS2\CMD.EXE /K D:
   \NETWARE\L.CMD
```

This assumes you have named the file `L.CMD` and placed it in your `NETWARE` directory. Replace `D:` with the drive where you have installed OS/2.

NOTE: Using this configuration, you will not be able to execute `CAPTURE` statements from a login script. Attempting to do so can lock up your machine.

The sample program in Figure 1 assumes that the OS/2 utilities exist on the server. If they do not, you can change the `IF` statement to look for `L:\LOGIN.EXE` and change the actual `LOGIN` statement to `D:\NETWARE\LOGIN`. If you are using the NetWare 4.x version of `LOGIN`, but are a bindery client, be sure to use the `/B` option with `LOGIN`.

When OS/2 is starting, you will see the message `Waiting for L: drive...` This message may be displayed for a minute or more, depending on the speed of your machine and the speed of the

```
@ECHO OFF
@ECHO Waiting for L: drive.....
:START
IF EXIST L:\OS2\LOGIN.EXE GOTO MIDDLE
GOTO START
:MIDDLE
@ECHO Logging in...
REM Replace 'd:' below with your boot drive
d:
L:
CD OS2
REM Replace 'server/user' with your server and user name
L:LOGIN server/user
IF ERRORLEVEL 1 GOTO MIDDLE
:ENDIT
EXIT
```

Figure 1. NetWare Login Program: L.CMD

network. Normally, the requester finishes its initialization during the startup of the Workplace Shell; however, for this process, you have to wait for it to finish.

—Aubrey Turner, IBM's Personal Systems Competency Center
Roanoke, Texas

Changing the Resolution in WIN-OS/2 Full-Screen Sessions (SVGA and XGA)

For those of you using Windows applications under OS/2 2.1, I have discovered an easy way to change the resolution for your WIN-OS/2 full-screen sessions. If you have attempted this before, you know that it involves swapping diskettes and rebooting. The procedure below, however, describes how to change the resolution by editing only one or two lines of the WIN-OS/2 `SYSTEM.INI` file.

To begin, open your WIN-OS/2 `SYSTEM.INI` file using the OS/2 system editor (or another editor). The `SYSTEM.INI` file is located in the `\OS2\MDOS\WINOS2` subdirectory. If you have installed WIN-OS/2 in your `D:` partition, go to an OS/2 command line (full screen or windowed) and type the following:

```
[D:\]E D:\OS2\MDOS\WINOS2
   \SYSTEM.INI
```

You should now have the `SYSTEM.INI` file in the OS/2 system editor.

XGA

First, scroll down to the bottom of the `SYSTEM.INI` file. Near the bottom, you should see the following section:

```
[XGA_Display]
XGA_Resolution=2
```

Here comes the easy part.

For 1024 x 768 resolution, the line `XGA_Resolution` should look like:

```
XGA_Resolution=2
```

For 640 x 480 resolution, the line

`XGA_Resolution` should look like:

```
XGA_Resolution=1
```

SVGA

I have tested this procedure on an IBM ValuePoint* 433DX, which has the TSENG chipset. For other SVGA adapters, the procedure should be similar, but testing is recommended. Before you begin this procedure, make sure you have installed either the SVGA device drivers that came with OS/2 or the ones provided by your adapter vendor.

Scroll down to about the middle of the `SYSTEM.INI` file. At the bottom of the `[boot.description]` section, you will see the following two lines, which provide 1024 x 768 x 256 resolution:

```
display.drv=1024x768x256 Large
   fonts 1M ET4000
sdisplay.drv=1024x768x256 Large
   fonts 1M ET4000
```

NOTE: The initial OS/2 2.1 installation of SVGA does not install full SVGA support, but rather installs VGA support at 640 x 480 x 16 resolution. This happens because the initial installation phase does not support MVDM DOS. This support is needed to run the DOS SVGA query program, which establishes the capabilities of the display adapter and monitor. To install full SVGA support, including the higher SVGA resolutions, you must install the SVGA display drivers once you've installed OS/2 2.1. To do this, run `DSPINSTL` from an OS/2 command prompt. `DSPINSTL` is a special install procedure much like `Selective Install`, but `DSPINSTL` installs only video adapters.

To repeat, for 1024 x 768 x 256 resolutions, the lines should look like this:

```
display.drv=1024x768x256 Large
   fonts 1M ET4000
sdisplay.drv=1024x768x256 Large
   fonts 1M ET4000
```

For 800 x 600 x 256 resolution, change the lines to:

```
display.drv=800x600x256 Large
   fonts 1M ET4000
sdisplay.drv=800x600x256 Large
   fonts 1M ET4000
```

And for 640 x 480 x 256 resolution, change the lines to:

```
display.drv=640x480x256 Large
   fonts 1M ET4000
sdisplay.drv=640x480x256 Large
   fonts 1M ET4000
```

If you have a different chipset for your SVGA adapter, you may have to alter the lines described above. Just ask your adapter vendor for the proper settings to change resolutions.

For the changes to take effect, you will need to close down and restart your full-screen WIN-OS/2 session. The great thing is that the changes will not affect your windowed/seamless WIN-OS/2 session (the one on the OS/2 desktop). This means that you can have a full-screen WIN-OS/2 session running at one resolution while the windowed WIN-OS/2 session runs unaffected on the OS/2 desktop.

—Tim Burleson, IBM's Personal Systems Competency Center
Roanoke, Texas

How to Access Memory Above 16 MB on an OS/2 2.1 LAN Server 3.0—Advanced Platform

To tell IBM LAN Server to use the memory above 16 MB, you must put a line in your `CONFIG.SYS`. It's the `USEALLMEM` command that lets LAN Server 3.0–Advanced use the memory above 16 MB. (NOTE: The following sample line is for either the IBM Token-Ring 16/4A adapter or the IBM LAN Streamer* 32 adapter. Be sure that your adapter will support memory above 16 MB.)

```
IFS=C:\IBM386FS\HPFS386.IFS
   C:\IBM386FS\HPFS200.386
   /I:D:\IBMLAN /USEALLMEM
```

—Marty Dee, IBM's Personal Systems Competency Center
Roanoke, Texas

Questions and Answers

NetWare

I recently installed a PS/2 195 server with NetWare 3.11, 64 MB of memory, a 32-bit streaming token-ring adapter, and Sybase SQL server NetWare loadable module (NLM). NetWare was accessing memory only to the 16 MB line, so we put the AUTO REGISTER command in the AUTOEXEC.NCF. That helped, but we still can't access all of the 64 MB of memory.

What should the AUTO REGISTER command look like? Why do we have to use the AUTO REGISTER command at all on a 195? I thought Micro Channel* machines didn't need the AUTO REGISTER command to access memory above 16 MB.

With Micro Channel machines, you should not use the AUTO REGISTER MEMORY ABOVE 16 MEGABYTES parameter. You should use the REGISTER MEMORY parameter, which is a server console command with the following format:

```
REGISTER MEMORY start length
```

"Start" is the starting hexadecimal address where the memory beyond 16 MB begins, and "length" is the hexadecimal length of the memory beyond 16 MB. For example, you might use this command:

```
REGISTER MEMORY 1000000
   3000000
```

You may add this line to the AUTOEXEC.NCF file to have the memory registered automatically when the file server boots.

This parameter is documented in the *NetWare 3.11 System Administration* manual (included with NetWare 3.11) on pages 216 through 218. The AUTO REGISTER MEMORY ABOVE 16 MEGABYTES parameter is documented on page 216 of the same manual.

We are receiving the following error message when we perform a directory search on a mapped NetWare drive:

```
Network Broadcast Message 1.1.90
   You exceeded your outstanding
   NCP directory search
```

Please tell me how to correct this.

This message is often caused by applications that do not handle directory searches according to Novell's recommendations. There are two ways to resolve this problem:

1. Rewrite the application according to Novell recommendations.

2. Type the following command at the file server console (also add this command to the AUTOEXEC.NCF):

```
SET MAXIMUM OUTSTANDING
   NCP SEARCHES = 100
```

Please note that this set parameter requires 24 bytes per directory per user. For example, if you have 250 users and 100 directories, the file server will require 600 KB just for the search tables.

For more information on how to rewrite your application, please call Novell at (800) RED WORD (733-9673).

When I try to run Lotus 1-2-3* 3.1 on an OS/2 2.1 NetWare requester from a Novell 3.11 server, I get this message: Cannot run in OS/2 compatibility box. Is there any way to get Lotus 1-2-3 3.1 to run from the file server on the requester, or do I need to make Lotus 1-2-3 3.1 a local application on all the machines?

You must create a program object with specific DOS settings to run Lotus 1-2-3 3.1. You must also create a batch file called LOTUS.BAT that sets up an environment in which to run Lotus 1-2-3 3.1. The LOTUS.BAT file should read as follows:

```
@ECHO OFF
CLS
PROMPT $P$G
PATH=C:\123R3 (or appropri-
  ate path)
SET 123MEMSIZE=2048
123.EXE (last line of file)
```

Enter C:\123R3\LOTUS.BAT in the "Path and file name:" field for your Lotus program object. Specify the DOS settings shown in Figure 1 for this object:

Also in the "Path and file name:" field, specify the path to the LOTUS.BAT file that is located on the server. For example,

DOS_UMB	ON
DOS_HIGH	ON
DOS_VERSION	INSTALL.EXE,3,40,255 123.EXE,3,40,255 LOTUS.EXE,3,40,255 123DOS.EXE,3,40,255 ZAP.EXE,3,40,255 INS.EXE,3,40,255
DPMI_MEMORY_LIMIT	4 OR HIGHER

Figure 1. DOS Settings

Disk System Limits:
64 volumes per file server
Maximum of 32 hard disks per volume (gives a maximum of 2,048 hard disks)
2,097,152 directory entries per volume
32 Terabyte maximum volume size
32 Terabyte maximum addressable disk storage
File System Limits:
100,000 concurrent open files per server
4 GB maximum file size
Other Limits:
4 GB addressable RAM

Figure 2. NetWare File Serve System Limits

if Lotus 1-2-3 3.1 is installed on the server's D: drive, which is seen by the client as the K: drive, then specify the following in the "Path and file name:" field:

```
K:\123R3\LOTUS.BAT
```

We want to put an 8 GB to 20 GB file under dBase III* running on a NetWare server. Is this file size advisable?

We also have LANRES/MVS. Do file restrictions, if any, apply when the direct access storage device (DASD) is actually host DASD?

The maximum file size for a NetWare server is 4 GB. An 8 GB to 20 GB database might work, provided none of the database files are larger than 4 GB; however, an 8 GB to 20 GB single file will not work.

Figure 2 shows the system limits for a NetWare file server (3.11 or 4.0).

Because of the way NetWare accesses files, the restriction applies even if it is on host DASD. Its access method is very much like AIX in that it uses a set of pointers to disk blocks that are stored in the directory entry for each file. While this implementation imposes a limit of 4 GB on a file, it also allows for very efficient file storage (especially for sparse files).

We are going to migrate from OS/2 2.0 to OS/2 2.1. We are running NetWare Requester 2.0 right now to access a 3.11 server. Will NetWare Requester 2.0 work with OS/2 2.1, or do we have to use NetWare Requester 2.01 in the OS/2 2.1 environment? If we must have NetWare Requester 2.01, does it come with new utility diskettes? The 3.11 server already has the utility diskettes' files that were copied from the utility diskettes that came with NetWare Requester 2.0.

You must use NetWare Requester 2.01 with OS/2 2.1. The older version of the Requester does not work reliably and is not supported with OS/2 2.1.

There are no new utility diskettes for the new requester. The version you are using now will work fine.

What are the software and hardware requirements, in addition to NetWare 3.11, for FLeX/IP*?

Hardware requirements include a Novell-certified 80386- or 80486-based server with at least 4 MB of RAM plus at least 3 MB of free space on the system volume where NetWare FLeX/IP is to be installed. The software requirement is NetWare 3.11 or above.

NetWare FLeX/IP is a set of TCP/IP utilities implemented as NLMs. These modules must be loaded on a NetWare 3.11 or above server. The TCP NLM included in NetWare 3.11 and above must also be loaded and running on the server. The client UNIX system must support TCP/IP, FTP (File Transfer Protocol), LPD (Line Printer Daemon), and the X Window system.

We are going to install NetWare 3.11 on a DOS machine. We are going to have OS/2 workstations. What software is necessary to make the OS/2 machines be workstations? We have OS/2 2.0 with Network Transport Services/2 (NTS/2) with the OS/2 Requester software in it.

You will need the NetWare Requester for the version of OS/2 you are using. The requester for OS/2 2.1 is NetWare Requester 2.01. The other requester versions correspond to the other OS/2 versions.

To install the NetWare requester on a machine with NTS/2:

1. Run LAN Adapter and Protocol Support (LAPS) again and enable NetWare support.
2. Install the NetWare Requester for OS/2 2.x. Choose the native LAN adapter driver (TOKEN for token-ring).
3. Run NWFIXUP (located in the IBMCOM subdirectory). This will arrange some of the drivers in the CONFIG.SYS. (It will REM out the native LAN adapter driver and put in the ODI2NDI driver).

We just ordered NetWare for SAA* 1.3 and would like to have a list of PS/2s that support the product. Can you help?

According to the *NetWare for SAA 1.3 Rules of Thumb* manual (part of the NetWare documentation), the following machines have passed Novell's in-house testing:

PS/2 70 386
PS/2 70 486
PS/2 80-071
PS/2 80-111
PS/2 Model 95

While NetWare for SAA will generally run on any machine that supports NetWare 3.11, you should contact (800) NETWARE (638-9273) for the most current list of supported machines.

Corrective Service Information

Figure 1 shows maintenance release levels for the listed products. This information is effective as of December 3, 1993. To order all service packages–except for the OS/2 2.0 and OS/2 2.0 Toolkit ServicePaks*–call IBM Software Solution Services at (800) 992-4777. For the OS/2 2.0 ServicePak (XR06100) 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.

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 Operating System Presentation Manager REXX User Profile Management Communications Manager Database Manager LAN Requester LAN Server	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 Toolkit	2.0	XR06110	XR06110	9-1-93	
	1.3	XR05053	XR05053	3-23-92	
OS/2 LAN Server/Requester ServicePak Service/Requester	2.0	IP06030	IP06030	4-25-93	
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.

Figure 1. Maintenance Release Levels

Product/Component	Release	CSD Level	PTF Number	Change Date	Comments
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.
OS/2 Extended Services Database Manager ServicePak	1.0	WR06035	WR06035	11-18-93	Supersedes WR06001, WR06002, WR06003, WR06004, WR06014, and WR06015.
Database Manager Engine DB2/2	1.0	WR07010	WR07010	8-23-93	Diskettes not available. Download from one of the BBSs.
Database Manager DB2/2 Query Manager	1.0	WR07012	WR07012	8-23-93	
DDCS/2	2.0	WR07011	WR07011	8-23-93	
Extended Services Communication Manager ServicePak 3270, 5250 Emulation CM SNA	1.0	WR06025	WR06025	11-29-93	
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		XR06150	6-29-93	
Workstation Program (WSP)	1.12		UR23217	1-14-89	

Figure 1. Maintenance Release Levels (Continued)

IBM Personal Systems Technical Solutions

These back issues of *Personal Systems Technical Solutions* 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.

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IBM 486SLC2: System Performance Implications
Micro Channel Developers Association
Trackpoint II: The In-Keyboard Pointing Device
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OS/2 Distributed Systems Management
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Start/2: Putting the Configuration into CID
LAN Server 3.0: New Thresholds in High-Performance Network Software
The Future of IBM LAN Network Management
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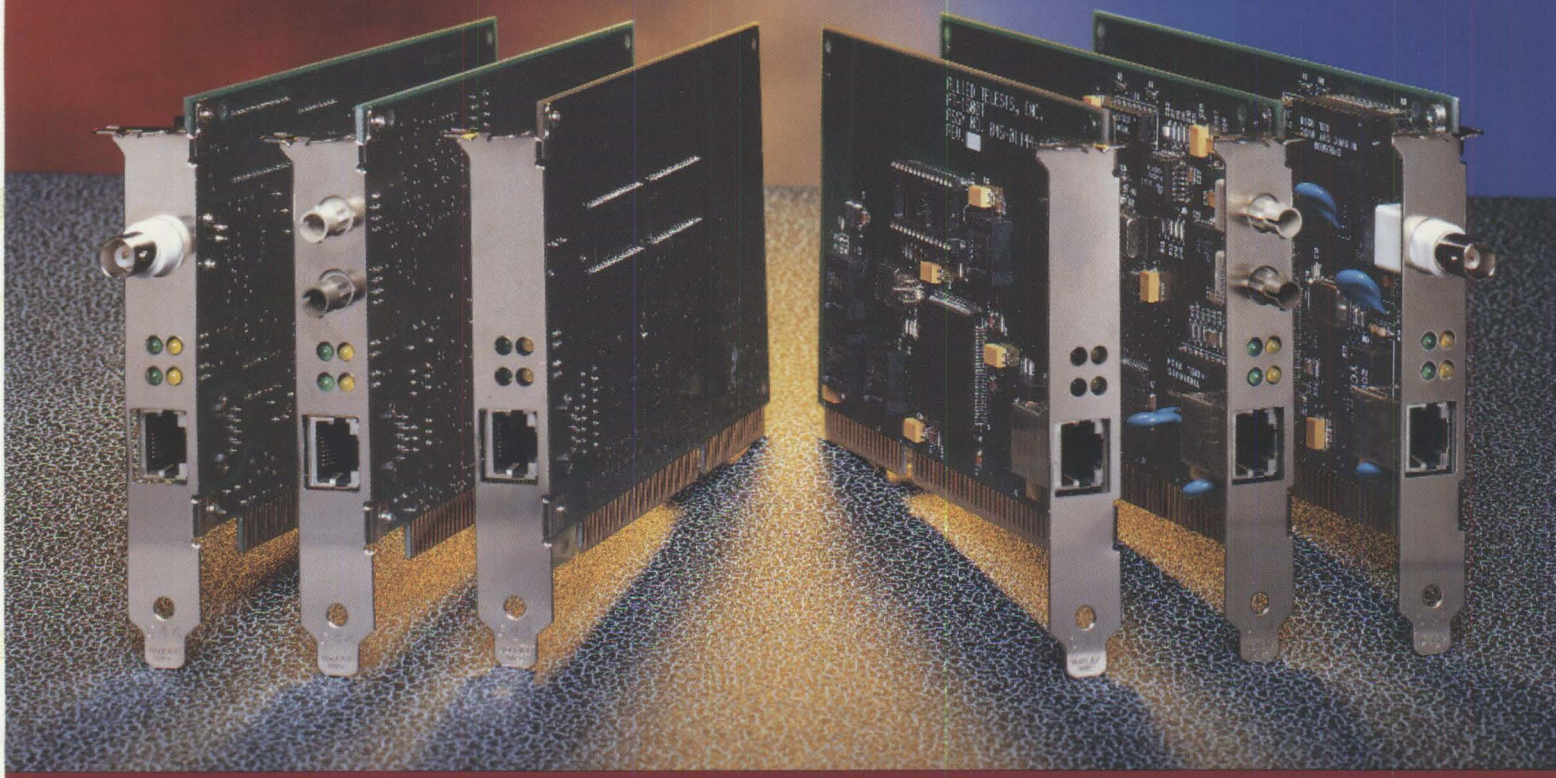

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How to Look a Gift Horse in the Mouth

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.

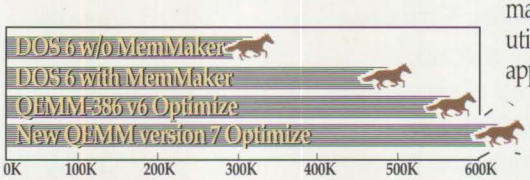
Instant Riches

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

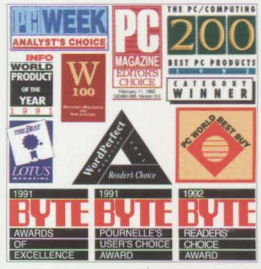


We tested DOS 6 with and without MemMaker and with QEMM 6 and our new QEMM 7 runs away from all of them. See details of test conditions listed below.

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.

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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.

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