Personal Systems

IBM'S MAGAZINE FOR TECHNICAL COORDINATORS NOVEMBER/DECEMBER 1995

GETTING CONNECTED WITH OS/2 WARP CONNECT

Infrared: LANs Without Wires

LAN Server: Security and Auditing

Plug & Play in PC DOS 7

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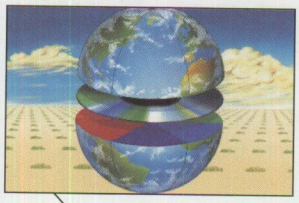
IBM®

JBA Guidelines.

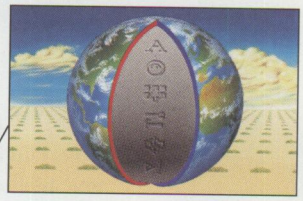
The Application Generator for people who use C++ AND those who don't want to.

Database Connectivity

Access to simultaneous, multiple databases is transparent through JOT. Supported databases include: DB2, DB2/2, DB2/400, DB2/6000, Oracle, Lotus Notes Server, and 20 more through native ODBC.



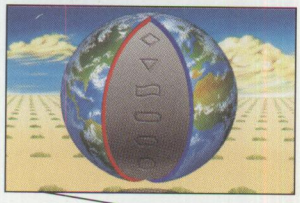
Graphical User Interface

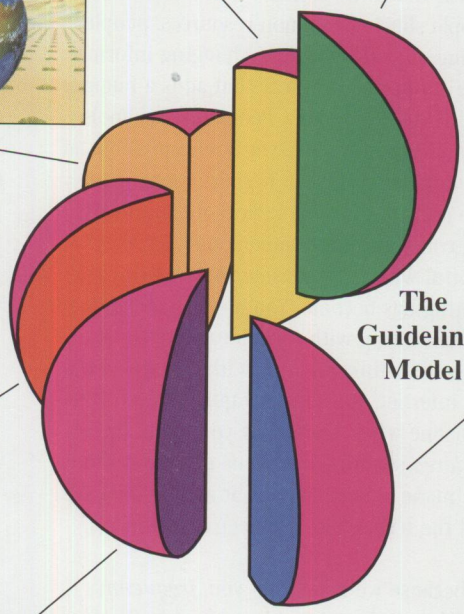


An intuitive and natural interface for the direct manipulation of on-screen design for OS/2 and Windows, with over 30 powerful controls for the professional developer. Includes all the standard controls plus Gauge, Button Bar, Grid and Graph.

Logic, Language, and Compiler

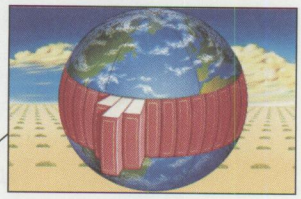
A platform-independent high-level language, JOT combines the RAD features of a 4GL with the generation of native code (C++ and RPG) for the Client **AND** Server. Existing legacy 3GL code can be directly interfaced. And CORBA-compliant objects can replace logic at any time in the future.





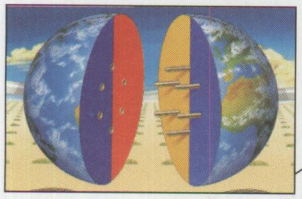
The Guidelines Model

The Repository



The repository supports and surrounds the entire programming environment with the facilities for teamwork development. Databases can be created on multiple hosts from a single definition. Data definitions can be directly imported into a GUI program.

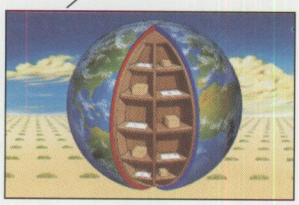
Network Connectivity



By mixing the connectivity components as required, applications can be built as thin clients, thick client/server with application partitioning, and fully distributed Object-Oriented. Supported hosts are: OS/2, AS/400, UNIX, MVS.

Object Messaging

The Message layer is fully compatible with all current Object Request Broker (ORB) standards. JOT verbs provide a single interface to current technology and the OO of tomorrow. Guidelines provides CORBA IDL and IBM SOM support.



Constructed on a six-segment development model, JBA Guidelines has been built to answer the needs of developers who wish to produce software capable of addressing heterogeneous computer networks from one single development point.

Guidelines is available in option packs to serve the needs of single PC developers right up to enterprise-wide development teams.

Call for an evaluation CD-ROM.

Available from Indelible Blue
1-800-776-8284

Available and Ready™ for OS/2

JBA International
1-800-JBA-INTL
In Europe: (44) 1789-400212
Internet: http://www.jba.co.uk
Compuserve: Go Guidelines

JBA™

JBA-161

Please circle #22 on reader service card.

The Human Link

Connectivity. What image does the word conjure in your mind? Do you imagine machines? Cold, unfeeling, lifeless boxes of circuitry connected by wires? Probably. But connectivity can mean more than that. The concept of connectivity transcends hardware.

It's what these machines connect that's important. People—people sharing common resources, people sharing common goals, people exchanging information—people connected in a way that adds a human element to lifeless technology. People use technology to communicate in ways never before possible, at speeds only imagined just a few short years ago. Some argue that these technological advancements are making communication impersonal. Are they? That's doubtful when you consider how much easier communicating has become. You use this technology daily—communicating with those near and far at dizzying speeds. Think about it. With the speed and ease of the Internet, you can now quickly fire off a note to someone when previously you might have only *considered* sending a letter or placing a phone call. You've made a connection that may never have existed had the technology not been available.

We know—because we hear from you, *frequently*. And that's what we want! Just last issue we had a resounding response to our editorial "Is Hype Hip?" We saw different viewpoints expressed, some a little more vehemently than others, but we appreciated all of them. Keeping the lines of communication open is important to us.

We must be *connected* to you, our readers, to continue to provide a publication that serves your needs. It's gratifying to know that many of you take the opportunity and deem the magazine important enough to let us know what you like about *Personal Systems* and to share your ideas on how to improve it. I'll share with you what one reader said about the magazine, "I pore over a lot of journals as I strive to keep up with the changing technological landscape. Many leave me feeling like I know less after I've read them than before. I come away from *Personal Systems* feeling like I've just finished a fine dinner—full, contemplative, and satisfied."

Great! That's what we want to do. Another reader told us, "What you say may be true about Windows 95 being more hype than fact, but don't start feeling sorry for yourself and IBM. OS/2 is not the end-all you make it out to be. . . ." Great! We want to hear both sides of every story.

Your comments arrive from many sources: e-mail, snail mail, faxes, phone calls. One of the most efficient ways to voice your opinion is to fill out and mail the evaluation card located in the magazine. We guarantee that we read and consider each and every evaluation. Please take advantage of this postage paid card to send your comments and/or to rate our articles, or use our new "Fast Fax Feedback" form on page 52. Remember, the communication channels run both ways. We also strive to provide you with quick and easy ways to receive information. The Reader Service Card is one of the best ways to quickly obtain information about products or services you read about in *Personal Systems*. You'll find it between pages 56 and 57. Whatever methods you use, let's stay connected!

This issue's connectivity topics have widespread appeal. If you're interested in using OS/2 Warp Connect, the network version of OS/2 Warp, you will find a wealth of information in part one of "Getting Warped and Connected Too!" Edward Duhe and Bret Curran lay the foundation for installing this version of Warp and introduce you to its connection capabilities. If you're administering a LAN, you know the importance of security. "Security and Auditing in IBM LAN Server" overviews LAN Server's security and auditing architecture. If you're interested in adding "roaming office" capability to your business environment, don't miss "Infrared: LANs Without Wires."

Personal Systems is connecting you—to the world and to the world of connectivity.

Lia Wilson

Lia Wilson, Assistant Editor

New Multimedia Sound Card for Micro Channel

New Product

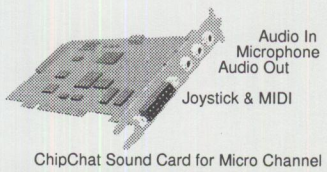
Innovative 'ChipChat Sound Card' provides state-of-the-art multimedia audio for Micro Channel computers. Supports DOS, Windows, OS/2, and AIX . . .

INTRODUCING THE ChipChat® Sound Card, an exciting new product that provides state-of-the-art multimedia audio for Micro Channel computers.

Add this sound card to your PC and hear CD quality audio from your favorite multimedia programs.

The ChipChat Sound Card fits into a full or half sized slot on a Micro Channel® computer. It's hardware compatible with just about every DOS game and educational software out there, including those that require SoundBlaster® compatibility.

The ChipChat Sound Card comes with it's own high performance software drivers with 16-bit audio for Windows® and for OS/2®. It also "works like a charm" with the 8-bit audio SoundBlaster drivers which are shipped as standard with OS/2.



ChipChat Sound Card for Micro Channel

State of the Art Music Synthesis

The ChipChat Sound Card provides state-of-the-art music synthesis in two forms: FM and WaveTable.

FM uses mathematical formulas to emulate the sound of musical instruments. FM synthesis provides good quality sounds and is economical.

WaveTable synthesis stores 128 actual musical instrument samples on a tiny chip, so it makes music that sounds great - just like the actual instrument! WaveTable is truly state-of-the-art, and is the "method of choice" of the music industry.

Exceptional Product

The ChipChat Sound Card comes in two different models: The ChipChat Sound-16 with FM for $199, and the ChipChat Sound-32 with FM and WaveTable for $259. If you buy the Sound-16 and later decide you want WaveTable, an upgrade is available.

The ChipChat Sound Card is designed and manufactured in the USA and has been subjected to rigorous tests to guarantee a solid and exceptional product.

The ChipChat Sound Card will upgrade your Micro Channel computer to the latest in multimedia audio. They're available direct from ChipChat Technology Group (313-565-4000) and come with the protection of the 30-day moneyback ChipChat Guarantee. Ordering information is found at the bottom of this page.

Send messages to wireless pagers from the Web

Technology Update

ChipChat Wireless Communicator lets your Web Server act as a Paging Server . . .

YOU CAN NOW 'Page-Enable' your World Wide Web site with the ChipChat® Wireless Communicator.

The ChipChat Wireless Communicator is a software product for OS/2 which sends text messages to wireless pagers. It includes an easy to use object interface and a command line interface which is easily called from other programs, including Rexx.

Works with IBM GoServe

ChipChat also has the ability to be called from the IBM® GoServe Gopher/Web server software. Using ChipChat and GoServe, a web author can embed the ability to send instant wireless messages in their web documents.

One exciting application of this is for a company to offer 'Premier Support Services'. Password-filtered customers can fill out forms on web pages and have the text transmitted

immediately to a pager. A technician receiving the message could call back with a rapid response.

Versatile, Easy, Reliable. $79

ChipChat can also send pager messages from other applications, including Rexx, and the command line!

ChipChat has an easy-to-use, workplace shell interface. You simply drag a ChipChat Pager object out of a template, configure the settings, and start sending messages!

ChipChat is advanced multi-threaded 32-bit object software based on IBM's SOM technology. It's been "through the wringer" with extensive corporate beta testing and has passed a suite of rigorous tests set by IBM.

Join thousands of customers who are successfully using ChipChat for their OS/2 wireless paging needs!

ChipChat Wireless Communicator is available direct from ChipChat Technology Group for only $79 and comes with the protection of the 30 day moneyback ChipChat Guarantee.

The ChipChat Guarantee

If you're dissatisfied with a ChipChat product for any reason, if it isn't everything we say it is and more, then return it within 30 days for a prompt, cheerful refund.

How to Order a ChipChat

Phone 313-565-4000, Fax 313-565-4001, or Web http://www.ChipChat.com

- ❑ **ChipChat Sound-16 Card** with advanced FM music; DOS, Windows, and OS/2 support (AIX drivers are optional); CD quality 16-bit sound; 12-channel audio mixer; MPU-401 MIDI; Dual joystick port. (Can be upgraded to include WaveTable). **$199.**
- ❑ **ChipChat Sound-32 Card** - all the features of the ChipChat Sound-16 *PLUS* Incredible WaveTable music. **$259.**
- ❑ **ChipChat Wireless Communicator** software with the easy-to-use workplace shell interface, powerful command line interface, ability to 'Page-Enable' your applications, and ability to 'Page Enable' your Internet WWWeb site. **$79.**

We accept Visa, MasterCard, and American Express. Add $10. for shipping.

 ChipChat Technology Group, 24224 Michigan Avenue, Dearborn, Michigan 48124 USA
ChipChat-Japan, Koga, Fukuoka Japan, phone: 81-(092)-943-0798 fax: 81-(092)-944-2253

ChipChat Cawthon Software®

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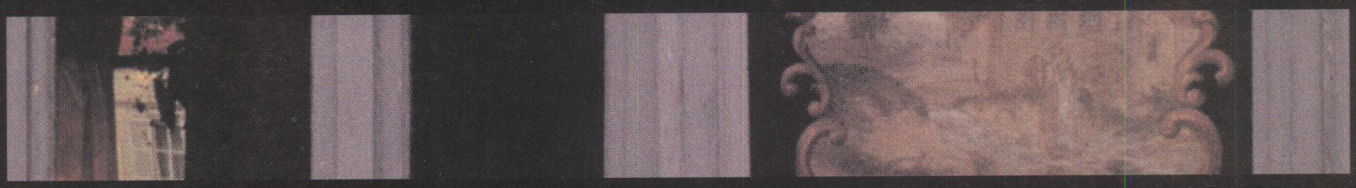
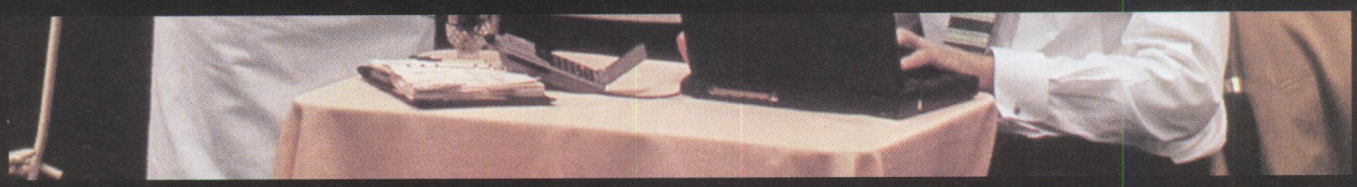


You're finishing a presentation

on Lotus Freelance Graphics,

printing a report on your boss' desk,



and browsing the Internet

all at the same time.

Is it the espresso or OS/2 Warp Connect?

While OS/2® Warp Connect may not come with a twist of lemon, it can do something that's nothing less than extraordinary.

It will let you access multiple servers on multiple networks at the same time, wherever you might happen to be.

Just make one phone call and enter your password. That's all it takes to connect into Internet, NT,® UNIX®, NetWare®, Windows® for Workgroup and IBM servers. And that's all it takes to share drives and printers, graphics files and databases. Even applications. It's amazing, really.

Can your software do this?

And because there are separate memory address spaces built in, it's crash-protected. So a problem with one program won't crash everything you're running.

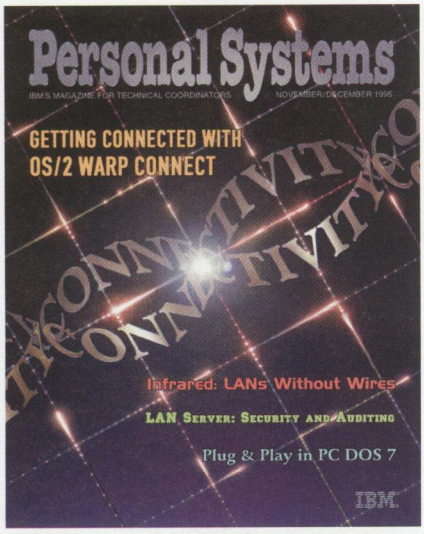
With OS/2 Warp Connect, you can create Person to Person™ connections with up to eight people, whether they're four floors away or four time zones. So you can conference by video. Collaborate by chalkboard. Communicate.

And you can do it all with the speed and reliability of OS/2, the software that readers of *InfoWorld* voted Product of the Year for three consecutive years. If you're looking for network connectivity, compatibility and true multitasking, you should remember one important thing: It's not only where the working world is headed, it's where it is right now.

To find out how OS/2 Warp Connect can help your business, call us at 1 800 IBM-3333, ext. EA100. Or visit our web site at http://www.austin.ibm.com/pspinfo/os2.html. You'll find it quite stimulating.

IBM

Solutions for a small planet™



ABOUT THE COVER
Noted Dallas artist Bill Carr's highly effective use of visual imagery perfectly depicts the idea of connectivity on this month's cover.

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What's New?

WipeOut for Warp

BocaSoft, author of the ***BocaSoft WipeOut*** screen saver for OS/2, has a new version that includes significant new features for OS/2 Warp and OS/2 users. These new features include green monitor support, System Object Model (SOM) compliance, enhanced password function, and an easy-to-use interface designed as a notebook with 3-D custom controls. ***WipeOut 2.0*** provides full screen saver support for OS/2, DOS, and the WIN-OS2 environments. Full screen monitoring scans both mouse and keyboard to determine if user activity is occurring within any open session.

Password protection is part of the screen saver and lets you set up a system password when the system is started, requiring a password to access the timed-out or rebooted system. The system boot portion of the password enforces security at a very low level, long before the OS/2 Workplace Shell is started.

For more information, circle 1 on the Reader Service Card.

LAN Server Administrator Utilities

Creative Assistance Software offers a comprehensive set of utilities for LAN Server 3.0 and 4.0 administrators: WhoAmI/PM, NetPM, CapWatch, and WatchLogon.

WhoAmI/PM, an inexpensive tool using a Presentation Manager notebook, helps LAN Server help-desk personnel to determine problems by providing information about the requester and user account configuration.

NetPM 2.0 provides LAN Server administrators with new management capabilities including the following:

- Multidomain management
- Auto-configuration
- Multiple graphs
- Statistics logging
- LAN configuration and activity reports
- Group alias and group application assignments
- Directory space limitation management

The varied demands placed on network servers by multitasking operating systems such as OS/2 make tracking server utilization critical. ***CapWatch*** tracks server utilization against configured capacity parameters.

WatchLogon provides password error monitoring for LAN Server 3.0 and 4.0 domains with user account disabling, administrator notification, and a configurable time to automatically enable the affected accounts.

For more information, circle 2 on the Reader Service Card.

Program Manager on OS/2 Desktop

MKWINOS/2 is a commercial OS/2 program from C F S Nevada, Inc. that will create the equivalent of your Windows Program Manager object as an OS/2 desktop folder named "Program Manager Desktop Equivalent." All of the Windows group objects, along with all of the program entries within each group object, are also created as OS/2 objects with the Program Manager Desktop Equivalent.

MKWINOS/2 is significantly different from the Add Programs or Migrate Programs facility in OS/2; it creates program objects for only those applications that you have set up under Windows. MKWINOS/2 does not search your drives looking for possible candidates. Those previously created OS/2 Windows-related objects remain unchanged and can be removed at your discretion. Beyond simply creating OS/2 objects, MKWINOS/2 merges Windows files and properties into WIN-OS2 on an OS/2 fullpack system. A backup facility is provided to restore the WIN-OS2 files and directories if necessary.

Each OS/2 folder (the desktop folder as well as the group folders) will be the same size and in the same relative screen position as they were on your Windows system. Each `.GRP` folder will contain the same Windows programs as the original with each program set up as a seamless WIN-OS2 object. The characteristics for each seamless program object include the default settings established for your system with the OS/2 WIN-OS2 Setup facility and adjusted for the particular program with the settings found in `MKWINOS2.DBX`—an updated version of the `DATABASE.TXT` file provided with OS/2.

MKWINOS/2 works with all versions of OS/2 2.1 and above, including both the "blue box" and "red box" versions of OS/2 Warp, as well as Warp Connect.

For more information, circle 3 on the Reader Service Card.

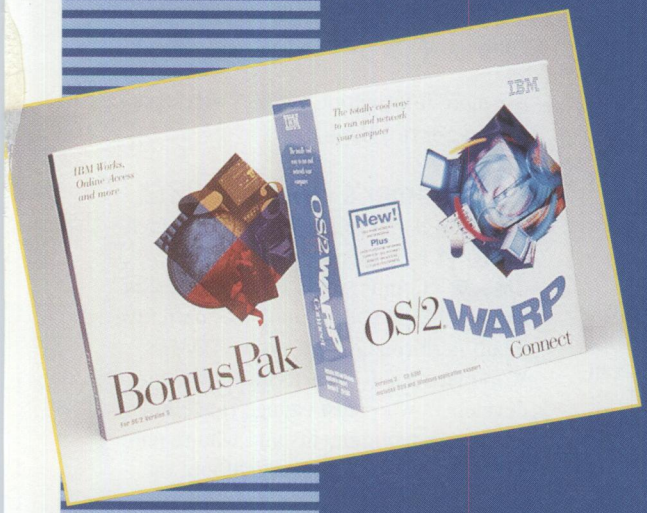
Optical Storage and Retrieval System

SPOOLVIEW 4.4, DataTrade's optical storage and retrieval system for computer generated reports (C.O.L.D.), contains significant enhancements:

- *Support for advanced function print (AFP), PCL5, and PostScript files*—Advanced data streams that include graphics can be stored in their native formats. SPOOLVIEW's engine dynamically decodes and creates bitmapped images to view, print, or fax.
- *Support for native OS/2 client and server*—The addition of the OS/2 platform completes SPOOLVIEW's support of primary operating systems.

NOW YOU CAN GET "WARPED" AND "CONNECTED!"

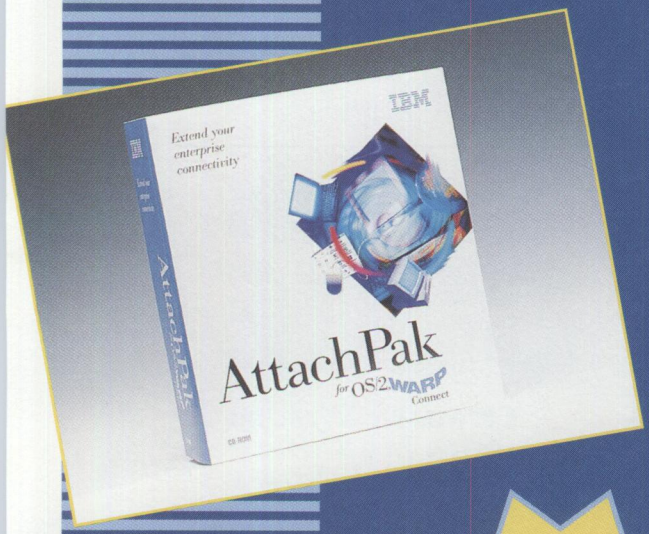
OS/2® Warp Connect and AttachPak. Your links to a new world of connectivity



IBM® OS/2 Warp Connect. Your complete connectivity solution. It gives you a comprehensive desktop environment that links you to colleagues–and the information resources and services you rely on–via a host of network functions. And it's packaged with OS/2 Warp, ready to go to work when you open the box

Connect delivers peer networking, access to the Internet, easy integration with all LAN servers (local or remote) and more! OS/2 Warp Connect also includes BonusPak – a powerful set of full-function applications.

The bottom line? It's the most productive way to run and network your computer!



AttachPak–The Perfect Partner for OS/2 Warp Connect. AttachPak has been designed as a complementary product that offers business customers advanced connectivity features, including: additional networking, groupware, communications, and systems management functions for the enterprise environment.

Add AttachPak to OS/2 Warp Connect and you have the ultimate connectivity solution for larger networks.

Super Softmart® Prices Thru 12/31/95

Softmart Codes	Product Description	Medium	Price
OSIBM1328	OS/2 Warp Connect w/WIN-OS/2	CD	$165.00
OSIBM1348	OS/2 Warp Connect w/WIN-OS/2	LP	$159.00
OSIBM1349	OS/2 Warp Connect w/WIN-OS/2	AL	$159.00
OSIBM1347	OS/2 Warp Connect	CD	$126.00
OSIBM1346	OS/2 Warp Connect	LP	$121.00
OSIBM1356	OS/2 Warp Connect	AL	$121.00
COIBM 892	AttachPak for OS/2 Warp Connect	CD	$164.00

Call Softmart® toll free today: 800-328-1319

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We Sell Productivity

IBM Business Partner
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IBM Software Advantage Provider
Call Softmart for details on this new program.

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- *Complete module for authoring CD-ROM media*–CD-ROM has become a viable, acceptable, cost effective replacement media for microfilm and microfiche, as well as an alternative to WORM (write once, read many) and rewritable optical disks.
- *Advanced caching routines*–SPOOLVIEW uses a combination of C.O.O.L. and C.O.L.D. magnetic caches to achieve the fastest possible retrieval time. Automatic cache purging is based on retrieval activity and retention time.
- *Enhanced application programming interfaces* (APIs)–Many entry and exit points allow software manufacturers, resellers, and integrators to easily integrate SPOOLVIEW C.O.L.D. with any document imaging system.
- *Enhanced report viewer*–This new viewer incorporates a multiple document interface with full graphics capabilities.

For more information, circle 4 on the Reader Service Card.

Speech Recognition Bundle

Dragon Systems, Inc. has bundled their speech recognition technology with Novell Inc.'s ***WordPerfect 6.1*** and ***PerfectOffice 3.0***. Integrated within the Novell applications is ***DragonDictate Talk⇒To PerfectOffice***, a speech recognition application that lets you control WordPerfect and the PerfectOffice suite, the Windows environment, and most other Windows applications completely by voice. Included are 2,000 new productivity macros, customized for Novell, that simplify controlling PerfectOffice applications. These applications include WordPerfect, ***QuattroPro***, ***Groupwise, InfoCentral, Presentations, DAD,*** and ***Envoy***.

With DragonDictate Talk⇒To PerfectOffice, you can talk to WordPerfect, PerfectOffice, and other Windows applications. You can open files, format, print, or fax documents, navigate within the Windows environment, and control and launch any Windows application just by talking. You can add complete dictation functionality by simply upgrading to ***DragonDictate for Windows Starter Edition 1.1***, a special 5,000-word system designed especially for Novell. This version contains all of Talk⇒To PerfectOffice's functionality.

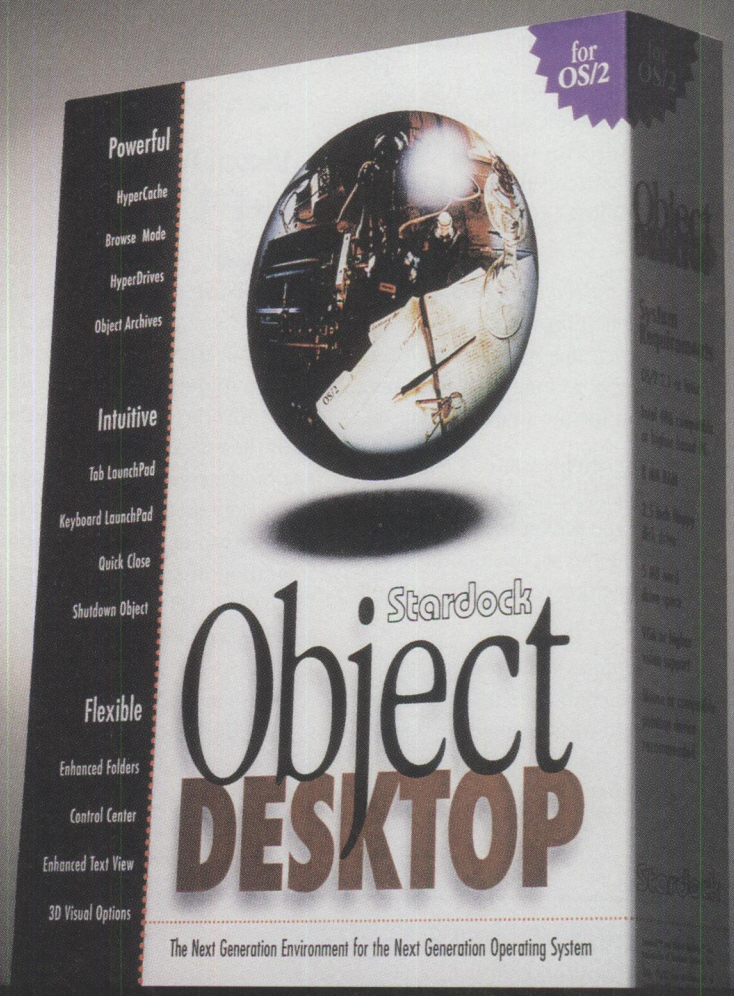
DragonDictate Starter is ideal for users who create numerous documents on a specific topic, for those who want an efficient alternative to the keyboard when cost is a key consideration, and for people with repetitive stress injuries or other disabilities. The system lets you navigate and control any Windows application without building any special macros.

For more information, circle 5 on the Reader Service Card.

Programmer's Editor for OS/2

If you refuse to be constrained by inflexible editors, Compuware's ***PREDITOR/2*** is for you. PREDITOR/2 capitalizes on native 32-bit performance and exploits OS/2's Workplace Shell. This technology is for developers who must change capabilities to fit their requirements and who require extended editing functions without the delays associated with rigid programming environments.

Version 2.1 contains the following enhanced features:



"Something Wonderful is About to Happen."

...Years Ahead of Its Time

Your personal computer is faster and more powerful than yesterday's mainframe.
So why are you still struggling to get to your programs, find your data, or simply organize your work?
Now Object Desktop truly delivers on the promise of speed, ease of use, and flexibility, with powerful features like HyperCache, Object Navigator, HyperDrives, Object Archives, Tab and Keyboard LaunchPads, and a multifunctional Control Center. Object Desktop makes your computer more productive, more intuitive, and simply more enjoyable. Object Desktop is the most advanced desktop environment ever created, marking the dawn of a whole new era in personal computing.

Stardock™
Object
DESKTOP
The Next Generation Environment for the Next Generation Operating System

for OS/2

Phone: 313-453-0328
WEB: http://oeonline.com/~stardock
Email: stardock95@aol.com.

Please circle #20 on reader service card.

- *Detached window mode*–Lets you freely move toolbars and windows anywhere on the display, while it maximizes the use of valuable screen space.
- *Color syntax highlighting*–Lets you quickly target and eliminate bad code and keywords with color highlighting, plus it has built-in support for languages including C/C++, COBOL, REXX, and PASCAL.
- *C and C++ source browsing*–Contains more hypertext browsing power for C and C++ programs with a new CTags Make dialog box along with incremental compilation for the source database.
- *Hex editing*–Helps you edit files containing non-text characters. When in hex mode, the screen contains two columns: the hex characters on the left and the matching ASCII characters on the right.
- *Smart templates*–Lets you quickly expand two characters into multiple lines of code with a single keystroke, eliminating the time-consuming drudgery of typing the same code over and over.
- *Line drawing*–Lets you redefine the arrow keys on the number pad to draw lines in four different styles.

For more information, circle 6 on the Reader Service Card.

Visual Development Tool

Template Software, a provider of advanced object-oriented (OO) visual development tools for distributed systems, has released ***SNAP*** and the ***Workflow Template*** on OS/2 Warp. Template Software's family of advanced development tools exploits the architecture and the inherent scalability of the entire IBM Power line. An application generated with a Template product for networked Warp supporting a few users can be scaled to operate in a configuration of networked Warp and AIX PowerPC servers or on POWERparallel SP2s supporting thousands of users.

SNAP and the Workflow Template are architected to exploit OS/2 Warp's new power and functionality. Applications built with Template technology using Windows or Motif are automatically portable to native Presentation Manager. Template's tools provide inherent support for multitasking, multiprocessing architectures. As a result, you can take advantage of OS/2's full preemptive multitasking to simultaneously perform multiple activities, making it possible to deliver even the most complex applications in less time with fewer people.

For more information, circle 7 on the Reader Service Card.

Bulletin Board Software

AdeptSoft is now shipping ***AdeptXBBS***, an OS/2, 32-bit, Internet friendly, multithreaded, multiuser, multilingual, Presentation Manager bulletin board system (BBS) software with a user interface that is totally customizable. The package includes ***AdeptREXX*** and lets the system operator control a BBS without having to be an experienced C or C++ programmer or having to learn a new BBS-specific language.

AdeptXBBS's addition of the AdeptREXX programming language brings a proven programming language standard to BBS system operators. REXX is the default batch/programming language for IBM's DOS 7.0, OS/2, AIX, and mainframe computers. AdeptREXX enhances the base REXX language with more than 150 BBS-specific functions, giving you almost 300 available REXX functions. Additionally, there are thousands of pre-existing REXX programming modules available, including complete database subsystems, control over OS/2's Workplace Shell, and program management facilities.

AdeptXBBS includes support for visual REXX environments such as VisPro REXX and VX-REXX. It also allows multithreading of REXX programs, letting you start multiple, simultaneous REXX programs from within the same program–even passing data cleanly from one thread to another.

For more information, circle 8 on the Reader Service Card.

New Development Systems from Watcom

Powersoft, Watcom Products Division, has announced a new release of its high-performance, multiplatform development system, ***Watcom FORTRAN*** 77 version 10.5. This version delivers improved productivity with a graphical integrated development

environment (IDE) designed to develop both character-mode and graphical user interface (GUI) applications on a wide variety of platforms.

With Watcom FORTRAN 77, you can exploit the performance of 486 and Pentium machines and the power of OS/2 and Windows in your applications. Version 10.5 increases performance with improved optimization technology such as recursion elimination and floating-point scheduling. Its new graphical IDE gives you a suite of multiplatform development tools including an advanced GUI debugger, text editor, and profiler.

Watcom FORTRAN 77 delivers the advantages of 32-bit performance. Powerful 32-bit instruction processing gives you a significant speed advantage–typically a minimum 2x processing speedup over 16-bit environments. On 32-bit systems, Watcom FORTRAN 77 exploits the 32-bit flat memory model to allow applications to address up to 4 gigabytes of memory. Together, Watcom FORTRAN 77's 32-bit power and Intel's x86 32-bit processors provide a desktop platform capable of handling many mainframe FORTRAN applications.

Watcom C/C++ also has a new version 10.5, which now includes ***Visual Programmer*** by Blue Sky Software, enabling rapid 16- and 32-bit Windows development. Watcom C/C++'s cross-platform capabilities let you develop programs for a wide variety of environments, including OS/2 Warp, OS/2 1.x, extended DOS, 16-bit DOS, most Windows platforms, and Novell NLMs.

For more information, circle 9 on the Reader Service Card.

Disk Installation Utility

Disk Manager 7.0, from Ontrack Computer Systems, incorporates several new advances that maximize the performance and capacity of IDE and Enhanced IDE hard-disk drives. The package also extends its platform support beyond DOS and Windows to include OS/2 Warp, plus Windows NT and Windows 95.

Disk Manager helps you overcome the BIOS limitations common in older computers that restrict usable hard-disk drive capacity. Typically, BIOS limitations are encountered when you attempt to install a new drive on an existing computer. If the new drive has a storage capacity of more than 528 MB, older BIOSs that are unable to translate the hard drive to less than 1024 cylinders will restrict usable capacity to 528 MB.

Disk Manager also eliminates the need to manually select drive models and parameters. This technology ensures that drives are automatically configured for the highest performance setting allowed by the disk controller. It simplifies installation and maximizes performance by performing a DOS pre-boot translation that defines disk parameters without the need for device drivers.

Ontrack's popular ***Drive Rocket*** acceleration software is incorporated into Disk Manager's Dynamic Drive Overlay, thus enabling IDE disk drives to read and write multiple sectors of data at one time. Without this feature, ordinary IDE drives can read and write only one sector at a time.

For more information, circle 10 on the Reader Service Card.

DeskMan/2 Productivity Pack

This powerful new package, ***DeskMan/2 Productivity Pack***, gives you a wide selection of OS/2 productivity products. The DeskMan/2 Productivity Pack includes DevTech's DeskMan/2 1.51b, plus leading-edge software from Proportional Software Corporation, Sundial Systems Corporation, WarpSpeed Computers, and BonAmi Software. The OS/2 community is calling this package of five powerful OS/2 utility and productivity tools the "OS/2 survival kit."

DeskMan/2 lets you install, configure, back up, secure, and manage desktops and objects locally and remotely. A simple drag-and-drop, point-and-click interface makes DeskMan/2 easy to use for novice OS/2 users, while its application programming interface (API) and full configuration/installation/distribution (CID) enablement provide powerful command and control of the OS/2 operating environment for corporate administrators.

Proportional Software Corporation's ***DCF/2 Lite*** is an "on the fly" data

compression package for OS/2 that lets you create multiple, High-Performance File System (HPFS)-formatted virtual disks on top of your existing File Allocation Table (FAT) or HPFS-formatted partitions, network drives, even floppy disks. DCF/2 is online backup without an expensive tape unit or individually archived files.

Relish, from Sundial Systems Corporation, is a personal time manager whose flexible scheduling functions combine with the Workplace Shell drag-and-drop environment. It has an intuitive approach to personal calendaring, using a multitasking, multithreading design.

WarpSpeed Computers' ***The Graham Utilities*** is a comprehensive suite of disk, file, and general utilities specially designed for OS/2. Combined with networking options, HPFS utilities, and system diagnostics, the limited edition of The Graham Utilities contains 15 powerful functions from the full version.

CPU Monitor Plus, from BonAmi Software Corporation, is a complete package of advanced performance and analysis tools. Use CPU Monitor Plus to continuously monitor and display CPU, RAM, disk, COM port activity, as well as dynamically monitor and control your OS/2 programs. The powerful analysis engine goes through raw system data and gives you graphs or text percentages, ratios, bytes, or seconds.

For more information, circle 11 on the Reader Service Card.

New Language Toolkits

Abraxas Software, developer and publisher of language development and analysis tools, has introduced two new packages: ***PCYACC/HYPERTEXT 2000*** and ***PCYACC/MIL-LANG 6.0***.

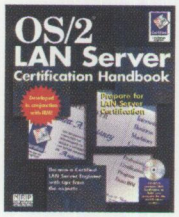
PCYACC/HYPERTEXT 2000 includes language engines for abstract syntax notation (ASN.1), hypertext markup language (HTML), rich text format (RTF), PostScript, HyperTalk, and structured generalized markup language (SGML), all of which provide software developers with a new and more rapid way to generate hypertext systems. These languages make up the foundation of the hypertext data model that will be used to store and retrieve information into the next century.

PCYACC/HYPERTEXT 2000 incorporates significant advanced error processing features for building robust hypertext systems. You can customize error handling and recovery and tailor error reporting to better fit project complexities and requirements for changing environments. HYPERTEXT 2000 will generate object-oriented C++ hypertext applications for OS/2, DOS, Windows, UNIX, and Macintosh.

PCYACC/MIL-LANG 6.0, a new set of tools to help develop military language systems, provides mechanisms to quickly integrate ADA, VHDL, and FORTRAN-90 language systems into defense products. This will make it easier to generate field programmable systems by using standard language environments, adapting to the military applications for hard-wired military equipment. This product is available for OS/2, Windows, UNIX, Macintosh, and MVS/VM/VME.

Our bookstore doesn't offer coffee, scones or biscotti, but we do have plenty of food for thought.

You can now order the following popular and self-study books by phone or fax from IBM's Education and Training Bookstore.



OS/2 LAN Server Certification Handbook
New Riders Development Group

This book is a self-study tutorial covering the courses required to become a Certified LAN Server Engineer.

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Inside OS/2 Warp, Version 3
Mark Minasi, New Riders

This tutorial and reference provides users with complete, step-by-step instructions and details, which the OS/2 manuals lack.

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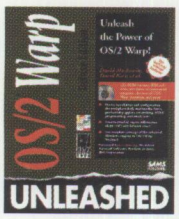

OS/2 Warp Unleashed, Deluxe Edition
David Maskowitz, David Kerr, et al.

This updated bestseller is the most complete cradle-to-grave OS/2 reference and tutorial available today.

$39.99 USA SR 28-4318-02 1,205 pp.
Casual-Accomplished-Expert

OS/2 Certification Handbook
New Riders Development Group

This guide is a self-study tutorial covering the four courses required to become a Certified OS/2 Engineer.

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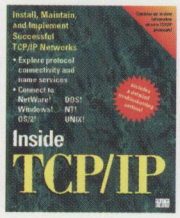

Inside TCP/IP
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This tutorial walks administrators through all the steps required to install and maintain a TCP/IP network. It is the only book which includes up-to-date information on new TCP/IP protocols and NetWare.

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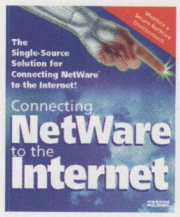

Connecting Netware to the Internet
Paul Singh

A complete guide on how to get Netware online with the Internet. It not only explains how to do it, but also the benefits to the Internet-connected company.

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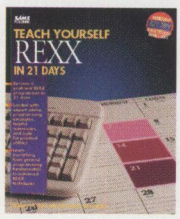
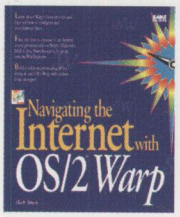


Teach Yourself REXX in 21 days.
William F. Schindler & Esther Schindler

Arranged in an easy-to-follow format, users will become proficient with REXX in just 21 daily lessons and will enjoy programming in the OS/2 environment.

$29.99 USA SR 28-5734-00



Navigating the Internet with OS/2 Warp
Herb Tyson

The most complete guide to getting the most out of OS/2 Warp's Internet and communication tools. It provides a quick introduction to the Internet while explaining how to configure and effectively use the tools.

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For more information, circle 12 on the Reader Service Card.

Sending Pager Messages

With RICOMM Systems, Inc.'s announcement of ***EZ-Page***, you now have a client/server, PC-based way to send pager messages to groups or individuals with one keystroke. You can send pre-defined or ad hoc messages. Frequently used messages can be stored and sent automatically–there is no need to repeatedly type or dictate the same message.

You can eliminate monthly messaging service subscription rates and 800 number charges by using your PC, running under OS/2, DOS, or Windows, to page your personnel. EZ-Page can automatically administer your "on-call, rotating" schedules. Hospitals, help desks, and service departments whose staff rotate shifts can now page a scheduled person or group automatically.

EZ-Page offers numeric or tone paging, alphanumeric paging, automatic broadcast to individuals or groups, speed dialing, history logs, full client/server design and implementation, and contact list maintenance.

For more information, circle 13 on the Reader Service Card.

New Digital Camera Systems from Electrim

The Electrim Corporation of Princeton, New Jersey, recently announced three additions to its line of digital cameras:

- ***EDC-1000M***–features low noise and medium resolution
- ***EDC-1000L***–features very low noise and high resolution
- ***EDC-1000D***–features high speed, very low noise, and 24-bit color

These cameras use low dark current, frame-transfer CCD detectors and allow for software control of contrast, brightness, and color balance. All three cameras share the following features:

- 8 bits per pixel gray scale (more with signal averaging or color images)
- Exposure time ranging from 1 millisecond to 10-20 seconds
- Sub-array scanning with software control
- Compact size and light weight
- Anti-blooming and interlace mode control
- Software control using DOS or Windows
- ISA bus interface cards
- Data collection rate up to 2 MB per second (2 megapixels per second)
- High quantum efficiency (50-70 percent peak)

When connected to a PC, these new cameras, and the other four in the Electrim line, have imaging applications in many fields, including security, process control, teleconferencing, astronomy, robotics, and factory automation. All Electrim cameras

come complete with camera head, cable, interface hardware, software, manual, and a one-year warranty.

The EDC-1000M features a medium resolution, square pixel CCD (324 X 484 pixels) with low noise (60 electrons r.m.s.), and a very small camera head (1.95-inch-square cross section). This camera cost-effectively converts a PC into an image processing and analysis workstation. Like other Electrim cameras, it features fixed pixels (direct mapping between pixels and memory bytes) and a spectral range from 0.4 microns to 1.1 microns.

The EDC-1000L features very low noise (35 electrons r.m.s.) and 753 X 484 resolution. The low noise, high quantum efficiency, and long exposure times offer dramatic improvements in low light level imaging compared with standard video cameras.

The EDC-1000D is a significantly improved color camera system for PC use, replacing the earlier EDC-1000C. The new camera, which includes a redesigned PC interface card, has twice the speed and one quarter the noise of its predecessor. The EDC-1000D uses a 1/2-inch format frame transfer CCD and retains the software features and low level clocking and scanning control found on all Electrim cameras. This camera is an excellent choice when you want Super VGA resolution and 24-bit or 16-bit color images. Its low noise and long exposure time allow its use within light levels that are one to two orders of magnitude lower than a standard video camera. Additionally, a high-speed live imaging mode is available through sub-array scanning.

For more information, circle 14 on the Reader Service Card.

New Transient Voltage Suppressors

Superior Electric has introduced two new 19-inch rack mount STABILINE Power Quality Interfaces (transient voltage suppressors/RFI filters) that divert and attenuate all modes of power disturbances before they reach computer circuitry and other sensitive electronic equipment.

Their unique, performance-proven multistage suppression and filtration design is state-of-the-art and utilizes MOVs, gas tubes, inductors, and filter capacitors. The hybrid design technology offers superior performance and the circuit allows bi-directional protection from source or load power disturbances. Both are compact, lightweight, quiet, and require only plug-in connection. With a panel height of 1U (1.75-inch space), they conform to ANSI standards for 19-inch rack mounting. Both are covered by a full 10-year warranty.

Model PQI-2115R is designed for 120 VAC, 60 Hz, single-phase operation. Loads up to a unit maximum of 15 amperes can be connected to six conditioned output receptacles. ***Model PQI-2310R*** is designed for 220/240 VAC, 50 Hz, single-phase operation. Loads up to a unit maximum of 10 amperes can be connected to any of the six conditioned output receptacles.

For more information, circle 15 on the Reader Service Card.

IBM Power Series: A Business Perspective

IBM Power Series: A Business Perspective, written by Jim Hoskins and David Bradley and published by Maximum Press, is a comprehensive, easily understood book about the IBM Power Series. The book provides a historical review of the PowerPC project and introduces the IBM Power Series architecture and models. It offers a closer look at the elements giving these unique systems their "zing," including microprocessors, disk drives, multimedia components, software technology, graphics circuitry and more. It also examines the many new options and peripherals available–disk and memory expansion, CD-ROM, video add-ons, PCI adapters, displays, printers, etc. *IBM Power Series* reviews the alternative operating systems available, including OS/2 Warp, Windows NT, AIX, and Solaris, to help you make the best choice.

A "hands-on" section helps new users get started, and a chapter on communications helps business users ease Power Series systems into their existing networks. To help you plan how to best deploy these systems, *IBM Power Series* explores issues such as software compatibility, emulation, performance, migration planning, lease versus purchase, maintenance, technical support, and more. The authors outline the appropriate Power Series systems for three hypothetical businesses (small, medium, and large).

IBM Power Series: A Business Perspective: ISBN 0-9633214-5-5. For more information, circle 16 on the Reader Service Card.

Exploring the PowerPC Revolution!

Exploring the PowerPC Revolution!, another PowerPC title from Maximum Press, tells the whole PowerPC story, from the events that led to the formation of the landmark IBM-Apple-Motorola alliance to the most recent PowerPC products and business strategies.

Written by Jim Hoskins and Jack Blackledge, this fully illustrated book begins with an historical overview of the PowerPC project, then takes a closer look at the new PowerPC architecture and at each of the new PowerPC microprocessors (601, 602, 603, 603E, 604, 620, and more). It details the new PowerPC-based personal computers from IBM, Apple, Motorola, and Bull. The book also examines operating system alternatives, compatibility challenges, emulation techniques, and other software issues. It includes the latest information from all PowerPC fronts, including industry consortia, adopting manufacturers, operating system alternatives, application software, human-centered computing, and the latest shifts in IBM's, Apple's, and Motorola's strategies.

Exploring the PowerPC Revolution! ISBN 1-885068-02-6. For more information, circle 16 on the Reader Service Card.

The OS/2 Warp Survival Guide

The OS/2 Warp Survival Guide, published by John Wiley & Sons, Inc. and written by Doug Azzarito, advisory programmer for IBM'S Personal Products Software division in Boca Raton, and David W. Green, technical author and editor, promises to "give you all the tips, tricks, and techniques you need to survive in a Warped world." The authors fulfill this promise by providing a book to help anyone moving to OS/2 Warp—regardless of the level of experience with personal computers and operating systems.

If you're new to OS/2, this book will introduce you to the Workplace Shell, present you with the concepts of an object-oriented graphical user interface, show you how to access and use the many programs that come with OS/2 Warp, teach you how to customize the Workplace Shell, and provide exercises to help you get more out of OS/2 Warp.

Even if you are already familiar with OS/2, you'll benefit from reading about OS/2 Warp's new tools and features and learn how to exploit OS/2's object-oriented advantages.

You're an advanced OS/2 user, you say? Increase your skills with the chapters covering low-level OS/2 commands and parameters (all of which are unique to OS/2 Warp) and advanced topics such as the print spooler, video device drivers, and system configuration. There's also a chapter on REXX, complete with a sample REXX program, for those who need a little helpful programming knowledge.

Users migrating from DOS or DOS and Windows to OS/2 Warp will find the chapter designed specifically for them particularly useful. This chapter details OS/2's DOS and Windows sessions and provides advice on tuning parameters for the DOS and WIN-OS2 settings to help you get the best performance from your DOS and Windows programs.

This well-organized book has several features readers of any experience level can appreciate. One of the most helpful is the use of "icons" or symbols next to bits of information that pertain to different users' needs. For instance, the symbol containing the `C:>` prompt alerts DOS users that the accompanying information is particularly relevant to them, while the window-bearing symbol denotes information Windows users should read. There's even a symbol attached to information that you won't find documented in any of the OS/2 manuals. These symbols serve as useful "road signs" to help you quickly navigate the book's contents to find the information you need.

The book's readable style and complete explanation of terms and concepts make it a valuable tool for learning and effectively using OS/2 Warp and its BonusPak applications.

The OS/2 Warp Survival Guide: ISBN 0-471-06083-6. For more information, circle 17 on the Reader Service Card.

Developing Multimedia Applications Under OS/2

Written by members of IBM's Multimedia Presentation Manager/2 (MMPM/2)

development team, Bill Lawton, Brad Noe, and Marcelo Lopez, John Wiley & Son's ***Developing Multimedia Applications Under OS/2*** provides a comprehensive look at MMPM/2 and how to program powerful multimedia applications.

Written for anyone who wants to learn to develop OS/2 multimedia applications using MMPM/2, this book gives insight, tips and techniques, and samples of MMPM/2 application development. It also describes the uses of multimedia for general Presentation Manager applications and provides programming details of MMPM/2 programming not found in the MMPM/2 toolkit manuals.

It also covers:

- Hardware supported under OS/2 Warp
- How to program the media control interface (MCI)
- I/O procedures
- How to access individual track headers
- Audio playback, record, musical instrument digital interface (MIDI), and direct interface video extensions (DIVE)
- The digital video device interface
- How to capture digital video
- MMPM/2 window controls
- Updated and corrected reference to the application programming interface (API) and command set
- Step-by-step instructions for putting together a sample multimedia application with all code on disk

Developing Multimedia Applications Under OS/2: ISBN 0-471-13168-7. For more information, circle 17 on the Reader Service Card.

Designing High-Powered OS/2 Warp Applications

Published by John Wiley & Sons and written by long-time IBMer and contributor to *Personal Systems* and *OS/2 Developer*, David Reich, ***Designing High-Powered OS/2 Warp Applications*** is a total "A-to-Z guide" to designing powerful and efficient OS/2 applications.

This book contains insider tips and techniques for designing powerful, efficient applications that are easy to code, test,

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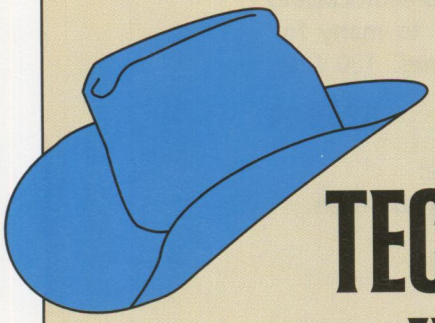
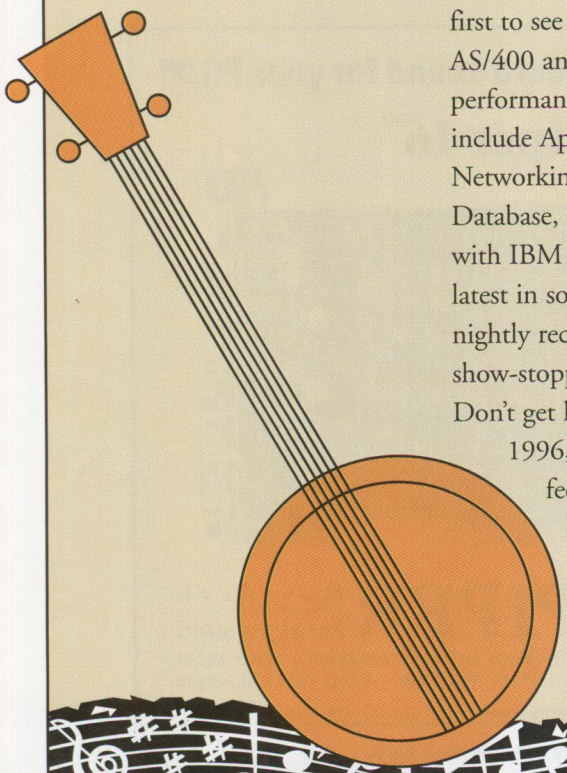
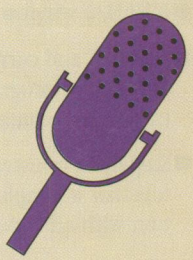




The Opryland Hotel in Nashville, Tennessee is setting the stage for the 1996 IBM Technical Interchange on April 22-26. Be the first to see next year's hottest rising stars, featuring OS/2, AIX, AS/400 and S/390. Look forward to spectacular, star-studded performances highlighting hundreds of elective sessions. Tracks include Application Development, Object-Oriented Technology, Networking, Client/Server, Open Systems, Multimedia, Database, Device Driver Development and more! Hands-on labs with IBM developers and an extensive exhibit hall showcase the latest in software technology. Best of all will be the ever-popular nightly receptions which will go down in history as the hottest show-stoppers to hit Nashville!

Don't get left out in the barn! Register on or before March 8, 1996, for just $895. That's $200 off the regular registration fee of $1,095. For more information and to receive a brochure, call (800) 872-7109 in the U.S. and Canada, or (508) 443-4990 if calling from outside the U.S. and Canada.



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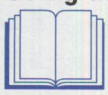
and maintain. Reich introduces you to all the features available in OS/2 Warp, tells you how they work, and, with the help of numerous real-life examples and scenarios, shows you how to make optimal use of them. He covers the intricacies of:

- The Workplace Shell and object-oriented programming in OS/2
- Client/server, multithreading, memory management, help facilities, and running Windows applications in OS/2
- Compilers, tree structures, and module structures that make your applications easier and less expensive to maintain
- CASE tools that help you structure your program and prototype functions quickly
- Developing versions of your code that work in languages other than English, using only one source code tree

Designing High-Powered OS/2 Warp Applications: ISBN 0-471-11586-X. For more information, circle 17 on the Reader Service Card.

Using the OS/2 Warp BonusPak



Using the OS/2 Warp BonusPak is a fast-paced, hands-on guide to exploiting the power of the many applications in the Warp BonusPak. While you might be familiar with a variety of third-party applications, this suite of feature-rich applications from IBM includes many new programs native to OS/2. Published by Abacus and written by Alexander Hoff, this book examines the following areas:

- Multitasking with IBM's Workplace Shell
- Using Warp's desktop productivity tools: word processor, spreadsheet, charting tool, database, report writer, and personal information manager
- Data communications including FaxWorks and Person to Person desktop conferencing in the office
- Multimedia viewer and Photo CD
- The IBM information superhighway

Using the OS/2 Warp BonusPak: ISBN 1-55755-285-1. For more information, circle 18 on the Reader Service Card.

Stepping Up to OS/2 Warp

If you are planning to move up to IBM's advanced OS/2 Warp operating system, Abacus' ***Stepping Up to OS/2 Warp*** will give you a step-by-step guide to easily install OS/2 Warp without the hassles.

Installing a new operating system is seldom fun–it includes some measure of risk and produces a good deal of frustration. *Stepping Up to OS/2 Warp* is a hands-on guide that shows you how to avoid the problems that you typically encounter. Authors Robert Albrecht and Michael Plura point out the "do's and don'ts" of OS/2 Warp installation.

You'll see how to set up and use your DOS and Windows applications, take advantage of the multitasking features, adjust the look and feel of OS/2 objects using notebook settings, learn dual boot procedures, and install and use the BonusPak applications.

Stepping Up to OS/2 Warp: ISBN 1-55755-269-X. For more information, circle 18 on the Reader Service Card.

Road Trip! Shopping the Internet

By Van Landrum

In Van Landrum's latest Road Trip, he provides us an alternative to the crush of holiday crowds–shopping on the Internet. Settle into your easy chair, grab your mouse, and display your fondest gift selections.

It's November, and it's time to think about what to get Aunt Millie and the rest of the extended family for the holidays. But if you're like me, your time is constrained and you just can't seem to face the crowded malls. So let's jump into the WebExplorer for a road trip to the mall on the Internet.

Shopping on the Internet has received a lot of press lately, both good and bad. Much has been said about security issues and whether or not shopping on the "net" will survive. A lot of work is being done now to find ways to make it safe to use your credit card on the Internet. While you wait for these security issues to be resolved, shop for what you want on the Internet, then order by phone. You should, however, know something about the company before placing your order.

Let's look at a few of the World-Wide Web (WWW) shopping sites available today.

Branch Mall at `http://cybershoppe.com/` has good variety in its retail selection. Categories offered include flowers and plants, food, books and magazines, music and videos, cosmetics, and home products. An education section offers toys, books, and other products for sale, all designed to bring science to life.

In Branch Mall's "hobbies, toys, and novelties" section you will find the Santa Letter. On this page, you can fax or mail a letter with a North Pole postmark from Santa to a child (or adult) on your Christmas list.

For the adults on your list, a two-bottle package of Forest Hill Chardonnay might be the perfect gift. Forest Hill is produced in the Napa valley by vintners David and Kathy Manace and was featured in the April issue of *Smart Money* and the *Wall Street Journal Magazine of Personal Business*. Check out the wine selections at `http://cybershoppe.com/wine/wine.html`.

For your cyberspace friends, you might choose the Cyberspace Navigator hat–a black baseball cap with a five-color logo embroidered on the front (`http://cybershoppe.com/cybernav/cybernav.htm`).

The **Internet Shopping Network** (ISN) at `http://shop.internet.net` was bought by the Home Shopping Network in September 1994. The products are primarily technology items, but a wider variety of choices (home and office, flowers, specialty stores, gourmet foods) is being added. You must first be a member of ISN to buy from them. Membership, however, is free and only a phone call away.

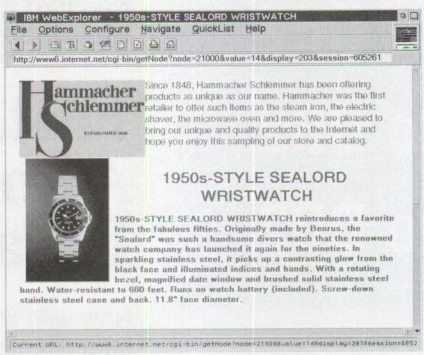


Figure 1. Hammacher Schlemmer on the Internet

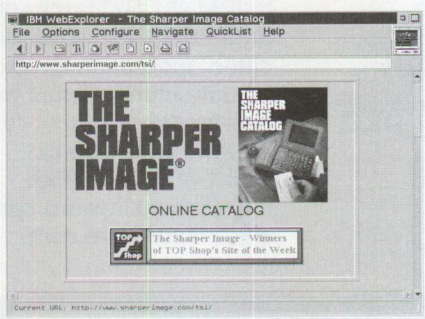


Figure 2. Sharper Image on the Internet

Hammacher Schlemmer (see Figure 1) offers many unique products through ISN, including items for the home, travel, and collectibles. They offer a nice layout, effective graphics, and extensive product descriptions.

Spiegel has a Web site called "dotSpeigel" at `http://www.spiegel.com/spiegel/`. This high tech, trendy site uses the latest hypertext markup language (HTML) technology. While Spiegel's site doesn't offer a lot of products online, there are some interesting articles. In fact, they call their site a "'magalog'–a 21st century, interactive magazine where you can get great ideas on fashion, entertaining, and home decorating; give us immediate feedback and tips about how we can serve you better; and buy everything you can see (with online ordering coming soon)."

The **Sharper Image** (see Figure 2) has an online catalog at `http://www.sharperimage.com/tsi/` that is also quite trendy. Their product categories include

Quick Tip!

You can find this article on the Internet at `http://pscc.dfw.ibm.com/psmag/` with links to all the addresses I've talked about. Just click on the highlighted addresses and ride the information highway straight to your shopping destination.

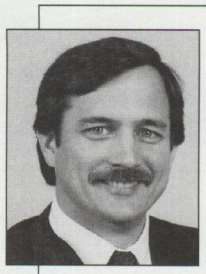
Check out *Personal Systems*' whole Web site for current and previously published articles as well as ordering information for back issues and subscriptions. You'll also find information about other magazines we publish: *SQ: IBM's Magazine of Software Technologies* and */AIXtra: IBM's Magazine For AIX Professionals*.

automotive, electronics and gadgets, great gifts, health and massage, home and safety, outdoor and garden, and travel and luggage. Good graphics, complete product descriptions, and a secure ordering system make shopping at the Sharper Image easy.

Eddie Bauer is at `http://www.pathfinder.com/@@Y866BQAAAAAAAlb*/Catalog1/Eddie.index.html`. Whew! I know it is a long address, but try it out anyway to access the fine products Eddie Bauer has to offer. Eddie Bauer provides nice color photos of its products and complete descriptions. To order, call their 800 number.

MecklerWeb has an Internet Mall at `http://www.mecklerweb.com/`. As of this writing, there were 3,281 companies listed in the Internet Mall. Unlike the other malls, these are listings of other WWW sites. If you have a particular company in mind, you can look it up at this Web site to see if it is on the Web.

These are just a few of the retail malls you can access via the Web. Search MecklerWeb to find more online stores or use the WebCrawler at `http://webcrawler.com` to search the Web for your favorite store. By "Web-shopping" online, you can find gift ideas or purchase gifts and then have the gifts sent to your friends and relatives. After shopping the "net," you can go to your local mall to listen to the music, watch the shoppers, and enjoy the atmosphere–knowing your holiday shopping is done!



Van Landrum, a marketing support representative in the IBM Personal Systems Competency Center in Roanoke, Texas, is both business manager and circulation manager for *Personal Systems* magazine. He is also responsible for the *Personal Systems* magazine Home Page on the World-Wide Web (`http://pscc.dfw.ibm.com/psmag/`). Van has a BBA degree in Business Computer Information Systems from the University of North Texas in Denton. His Internet ID is `vlandrum@vnet.ibm.com`.

Command-Line Commando

By Todd Watson

There's a trend in computing that scares the "techno-jeebers" out of me, if I may be allowed to write so explicitly in the soon-to-be forbidden language of primitive ASCII Sanskrit, and I must do everything in my worldly powers to head off its eventuality.

This is actually a prospect most recently analyzed in the pages of this fine publication's previous issue. It's called human-centric computing.

My heart sank, and my outlook grew grim when I realized its chances for success—this fast-approaching trend—but I've convinced my editor to allow me sufficient soybean-based ink to explicate upon this devastating likelihood, as I'm certain there are others in the vast wasteland of post, post-modern information technology of my ilk who share my trepidation.

My friends, we are about to witness the death of the DOS prompt as we know and love it.

Yes, I know it's a difficult prospect for many of you to contemplate—that your beloved `COPY *.*`, `FORMAT C:`, and `DIR /S` commands could be eradicated forever. With one fell keystroke of a single programmer's passionate display of his or her GUI-based, icon-centric powers, you are dealt a fate worse than having a power outage with no UPS (the power supply, not the freight company) to save your DOS prompt-dependent hide.

`*.COM`rades, I share in your distress.

But glance through any technology industry trade publication and you'll see techno-babbling journalists (traitors, one and all) defining the rules of the road for future personal computing, and nowhere do they seem to include the possibility of navigational keystroking via the ASCII command set.

Somebody call the disk-operating-system cavalry, and fast!

Allow me a moment to position my position, as it were.

I still keep a Remington Noiseless typewriter, circa 1907, ensconced upon my copywriting desk for the rare (but inevitable) moments when my beloved ThinkPad decides to head south during the writing of my nonsensical columns. It requires no RAM, no electricity, no monitor, no hard drive, and never, ever, presents me with a "general protection fault." Barring that, I've got my Model # 2 L.E.A.D. word processor and the OS/2 Warp journalist's notebook that I swiped from the press room at last year's bizarre Comdex—the Neanderthal's ThinkPad, if you will.

Understand that this is less a sentimental idiosyncrasy than a mandatory necessity (that's redundancy, as in oxymoronic parlance, not RAID). As with any electron-dependent wordsmith, I've been burned on more than just a few occasions. If it's not the flying squirrel attempting a brave, but unsuccessful, landing on the transformer outside the building, it's me accidentally placing my clumsy left foot on the bright, red beacon of the power strip that sits awkwardly under the Formica surface of my veal-fattening pen (that's Generation X slang for cubicle). If it's not the issue of fluctuating AC/DC electrical current, it's a floppy drive that suddenly decides not to cooperate when I'm on deadline.

But let me not stop there.

I don't just live in the past. I'm talking severe, high technology, neo-Ludditism here. Despite the fact that OS/2 Warp is ground zero for the start of my computing day, know that I've eschewed GUI-interfaced word processors in favor of my cherished, "pry-my-cold-dead-fingers-from-the-keyboard" WordPerfect 5.1, going on five years now. I can do in WordPerfect 5.1 what most mere mortal PC wizard "wannabes" wouldn't dream of doing in their most fantastical byte-bitten fantasies. I've created style sheets that would make Gutenberg salivate, macros that could place the information superhighway permanently under construction with less than a three finger salute, and mail-merges that could put Fingerhut out of the catalog shopping business.

And hey, I have nothing against flowery little icons giving you warm fuzzies when you click on their whimsical little "have a nice day" happy faces, depending upon your particular multimedia setup, with giggling little Star Trek-ian sounds emerging as the application launches into its blissful productivity mode, alerting you that all is right with the world. That's all fine and dandy, and it plays particularly well to the techno-phobic set, a mammoth market at this point in time.

I'm talking about something much more serious, about technology reversion, about taking one giant step backwards into the future of byte straggling as we know it. Which brings me to the fundamental and underlying issue of this fervent commentary.

Rule # 1: Computers weren't created in order for us to have fun.

Blame the original GUI tinkerers at Xerox PARC or the core constituency of Apple's researchers on the Mac OS; heck, blame Bill Gates for all I care, or even our own warped minds in Boca Raton—blame them all! But don't blame Howard Aiken, whose 1937 Automated Sequence Controlled Calculator, better known as the Harvard Mark I, designed in conjunction with IBM, was 51 feet long, eight feet high, two feet deep, with some 750,000 parts. This baby was a hummer. Guided by a strip of

punched paper tape, the Harvard Mark I was designed to solve non-linear, differential equations and ended up calculating ballistics tables during World War II. Now that's a computer.

Or how about the vacuum-tubed ENIAC? It was programmed using plug wires and switches by men and women in white suits who thought object-orientation meant remembering where they'd stashed their lunch pails.

These machines were created for the sole purpose of hastening the business of the day which was–believe it or not–doing business. They were complicated, mammoth, convoluted contraptions that would have sent Leonardo da Vinci running out of his lab, screaming for the mid-millennium equivalent of Freudian psychotherapy. Many an engineer drove himself mad pondering the logic behind these gargantuan number-crunchers, later realizing as he was dragged off to the sanitarium, that there was no logic. They were as complex and user-*un*friendly as man-made machines could possibly be, and rightfully so.

Computing was, in its purest conception and form, never meant to be a pastime. Thomas Watson, Sr., my long-lost virtual grandfather, didn't name it "International Business Machines" so that we could envision "interfacing" with our PCs someday while playing the latest version of DOOM, or so we could completely space-out midday in front of our silly little screen saver, scattered with throwaway photos from last year's *Sports Illustrated* swimsuit edition. The summary reckoning of zeros and ones was meant to be difficult, time-consuming, and frustrating. If you're not completely frustrated by these machines on a regular basis, you're probably doing something wrong.

I'm firmly convinced we've entered the age of "WIMP" computing, where WIMP doesn't stand for "Where is my prompt?" or "What is my password?" but rather suggests the more infantile "Where is my Pacifier?"–with a capital "P." The latest manifestations of WIMP computing can be seen in the likes of Microsoft's Bob or Computer Associates' Simply Village, with their hand-holding cast of friendly characters who help novice users take that first, unsure step into the digital domain.

During my first jaunt to the cafeteria at the IBM facility in lovely Somers, New York–a walk whose duration even Henry David Thoreau would have envied–I stopped dead in my tracks at the sight of the huge and glorious IBM 701 pre-mainframe computer, resting silently off to one side of the hallway. The majesty of this machine nearly took my breath away. Its grandeur seems unthinkable today.

Indeed, many would now laugh at its outdated infrastructure and immense proportions. At seven feet tall and six feet wide, I can just imagine it sitting on my desk. Need to reboot? Fine, get bipartisan approval from the 104th Congress and it's a done deal. RAM? Who needs memory when you got rows and rows of vacuum tubes? Icons? We don't need no stinkin' icons!

The ThinkPad on which I write this article has umpteen more times the MIPS than the 701 designers ever dreamt about. But I still can't help wondering if the champions of human-centric computing are barking up the wrong tree. Such naysayers would probably also fail to see the beauty and engineering brilliance–nay, the entirely awesome ingenuity–behind such breakthrough human inventions as the atlatl, which brought roaming mammals to their knees with the equivalent of a Nolan Ryan fastball; the featherweight flight taken by the mammoth Hindenburg dirigible, whose promise was outweighed only by its ballast; or the sheer elegance of the eight-track player, whose short-lived existence could not be outweighed by its ability to play the entire Captain and Tennile "Love Will Keep Us Together" album in perpetuity.

Perhaps I'm just an unacknowledged technology Luddite in my own right, afraid that the rapid advances of cartoon computing will soon leave me in harm's way. The sky is falling, Chicken Little, and there's no place left to hide.

We've been found out.

The day will soon come when I know I'll be terrified to click on that cute little quacking duck in order to retrieve my daily dose of e-mail. When I'll have to point at the blabbering Max Headroom-like, animated icon in order to surf the "net," the one that simply won't shut his trap, but behind which lay the secrets to digital bliss. When I'll be forced to sing an aria from *La Traviata* in perfect pitch just to turn on my computer!

A self-admitted command-line commando, maybe I'm destined to be relegated to the DOS 3.3 retirement home, babbling off in one corner about CD backslash or renaming directories or, heaven forbid, `EDLIN AUTOEXEC.BAT` like some Rainmanish, information age idiot savant. A blast from the warped past. A washed up has been.

But fear not! They'll drag me kicking and screaming away from my beloved keyboard, they will. With the permanently implanted memory of accidentally erasing my first hard drive screaming through my neurons, with the glee of setting my first field aflame using an outlawed bottle rocket, I'll eschew their mandated conversion to Daffy Duck computing and continue to blather away, fingers scurrying across the keyboard in a Beethoven-like frenzy.

As the ramparts we watch, and the buffalo roam, I'll look for the whites of those beady little eyes as the troops march up the pastures of Somers looking for me, and I swear by my DOS prompt to fight the good fight • • • ——— • • •

"Turbo"Todd Watson currently serves as electronic media communications specialist and editor of *Software Quarterly* on the Internet for the IBM Software Solutions Division in Somers, New York. With Big Blue since 1991, he holds a BA degree in English and an MA in Mass Media Studies from the University of North Texas in Denton. He can be reached via the Internet at `radar@vnet.ibm.com`.

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Getting Warped and Connected Too!

OS/2 Warp's superior 32-bit multitasking, crash protection, object-oriented user interface and full-function applications make it the most robust 32-bit operating system on the market today. OS/2 Warp is the totally cool way to run your computer!

Now you can get Warped and connected too! OS/2 Warp Connect builds on OS/2 Warp's foundation by adding network components to connect you to the most popular network resources found today. OS/2 Warp Connect's extensive networking software connects to OS/2 LAN servers, NetWare servers, Lotus Notes servers, transmission control protocol/internet protocol (TCP/IP) hosts, the Internet, and more. OS/2 Warp Connect also provides you with full OS/2 Peer-to-Peer networking that interoperates with Windows for Workgroups, OS/2 LAN Server, and many others. With all these features, OS/2 Warp Connect is the new 32-bit, multitasking, multimedia, Internet-accessed, crash-protected, Windows-friendly, totally cool way to run **and network** ***your computer!***

This article is the first of a two-part article that will look at the networking components in OS/2 Warp Connect. In part one, we will look closely at OS/2 Warp Connect's installation as well as the connection capabilities it provides. In part two, we will investigate OS/2 Warp Connect's connection applications and take a close look at the new OS/2 Peer.

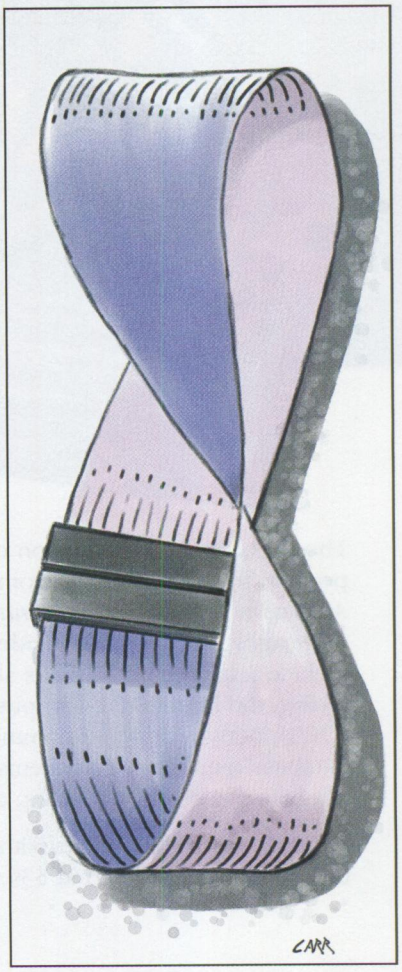
OS/2 Warp Connect is based on the two previous Warp products—OS/2 Warp Version 3 and OS/2 Warp Version 3 with WIN-OS2. OS/2 Warp Connect combines these products with several networking components that provide local area network (LAN) and wide area network (WAN) connectivity, making OS/2 Warp Connect a super client.

Edward Duhe'
IBM Corporation
Roanoke, Texas

Bret Curran
Curran Consulting
Denton, Texas

The following components have been added to OS/2 Warp to create OS/2 Warp Connect:

- *OS/2 LAN Requester 4.0:* Provides access to LAN resources such as files, printers, applications, and modems in an OS/2 LAN Server or OS/2 LAN Server-compatible network environment.
- *IBM Peer for OS/2:* Enables clients to share local devices with other users, as well as to access resources on other peer networks or on IBM or Microsoft networks.
- *Novell NetWare Client 2.11 for OS/2:* Provides the NetWare requester for native Novell servers.
- *IBM TCP/IP for OS/2 3.0:* Provides the necessary components to participate in an IP network environment. It also lets you simultaneously connect to a serial line internet protocol (SLIP)- or point-to-point protocol (PPP)-accessed IP network and a LAN IP network.
- *Network SignON Coordinator/2:* Provides a productivity aid that lets you log on, log off, or change passwords on multiple IBM servers, Novell servers, local UPM accounts, and an IBM 3270/5250 host.
- *LAN Distance Remote 1.11:* Allows you to dial another machine running



LAN Distance Remote to create a "LAN over a phone line" or to dial a LAN Distance Connection server to remotely access LAN resources.

- *Multiple Protocol Transport Services (MPTS):* Provides support for LAN adapters and protocols, including NetBIOS, TCP/IP, NetBIOS over TCP/IP, and NetBIOS over IPX.
- *Lotus Notes Express:* A Lotus Notes client that includes a collection of communication and collaboration applications.
- *AskPSP:* Provides answers to questions and problems concerning OS/2 Warp, LAN Requester, LAN Distance, and NetWare Client. It is a personal help desk that helps you solve problems.

All of these components and capabilities in one package demonstrate OS/2 Warp Connect's industrial-strength networking power.

A New Warped Install That Works with CONNECTions!

You may think that installing all of these products individually may be frustrating. Not to worry! One of the most significant applications in the OS/2 Warp Connect package is its integrated and flexible install program.

OS/2's base operating system install process was much improved in OS/2 Warp; problems are far fewer than before. OS/2 Warp Connect continues this installation improvement.

Let's take a closer look at the OS/2 Warp Connect install process. First, we'll cover some pre-installation issues to make sure you have the resources to install OS/2 Warp Connect, then we'll focus on the OS/2 Warp Connect installation itself. We'll concentrate on the new parts of the installation.

Pre-Installation Issues

As with any software, you need to consider several things before installation—possibly even before purchasing the software. The three main issues to examine are migration considerations, hardware requirements, and installation methods.

Migration Considerations

The biggest migration consideration is which OS/2 operating system you have now.

Product Name	Amount of Disk Space in MB
OS/2 Warp base operating system	43.0
BonusPak	30.0
Multiple Protocol Transport Services (MPTS)	4.5
IBM OS/2 Peer 1.0	8.0
IBM OS/2 LAN Requester 4.0	12.0
Novell NetWare Requester 2.11	3.0
IBM LAN Distance Client 1.11	5.0
IBM TCP/IP for OS/2 3.0	20 to 30
Network SignON Coordinator/2	1.0
First Failure Support Technology/2	1.0
Lotus Notes Express	38.2
AskPSP	1 to 4

Figure 1. Disk Space Needed for OS/2 Warp Connect Components

OS/2 Warp Connect continues the practice of packaging the two versions in two differently colored product boxes, one with a red spine and the other with a blue spine. The blue-spine box includes IBM's WIN-OS2 support; the red-spine box does not include WIN-OS2 and depends on Windows 3.1 to be present for OS/2 Warp Connect to support Windows applications.

Since OS/2 Warp Connect is basically a packaging of OS/2 Warp with networking products, the same migration rules apply: If you currently have an OS/2 version that has WIN-OS2 (for example, OS/2 2.x), then you need to migrate with the blue-spine box. If you have an OS/2 version that does *not* have WIN-OS2 (for example, OS/2 for Windows), then you need to migrate with the red-spine box.

If you currently have a version of either NetWare Requester or LAN Distance, your installation will proceed much easier if you remove those products before installing OS/2 Warp Connect. If you do not remove them, the installation program will detect them, abort the install, and ask you to remove them.

Hardware Requirements

Three main hardware considerations when moving to OS/2 Warp Connect are memory, CD-ROM, and hard-disk space.

Memory—Because the OS/2 Warp component in OS/2 Warp Connect is much the same code as in the stand-alone operating system, it takes about the same amount of memory; however, the networking applications can take quite a bit more.

Of course, your memory requirement depends upon which applications you run and, to an extent, how you run the applications (e.g., the number of protocol stacks, the number of requesters, and so forth). To use the Remote Installation service, we recommend 8 MB of memory on the client and 16 MB on the server.

In general, 8 MB is the minimum for most OS/2 Warp Connect installations; 12 MB or 16 MB is better.

CD-ROM—OS/2 Warp Connect comes only on a CD-ROM. To install the product, you need to have either a local CD-ROM drive or one that you temporarily attach via a network.

Technically, it is not mandatory to have a CD-ROM drive to install OS/2 Warp Connect; there are other ways, some of which I'll discuss later. But we highly recommend using a CD-ROM drive; you'll be much happier than if you use other ways.

Hard-Disk Space—OS/2 used to take a relatively high amount of disk space. Two things have changed to lessen the impact; hard-disk prices are much cheaper now, and most major software applications are huge—50 to 100 MB.

Nonetheless, you'll need a significant amount of free hard-disk space to install OS/2 Warp Connect, especially if you want to install everything that comes with it. Figure 1 estimates what to expect in disk space usage. Figure 1 doesn't include space for the swapper and spool files or the general increase in the size of your operating system partition.

Component	Number of Diskettes
OS/2 Warp base operating system	21 without WIN-OS2 25 including WIN-OS2
LAN Distance Remote	3
LAN Requester	8 (includes MPTS)
Multiple Protocol Transport Services	3
NetWare Client for OS/2	7
Network SignON Coordinator/2	1
IBM Peer for OS/2	7
TCP/IP for OS/2	8
BonusPak	6

Although you can make four additional diskettes for the Internet Connection in the BonusPak, IBM strongly recommends that you use the Internet access provided by TCP/IP for OS/2 3.0 because of the fixes and enhancements that are in TCP/IP for OS/2 3.0.

Figure 2. Number of Diskettes Required to Back Up OS/2 Warp Connect Components

LAN Adapter–To round out the hardware discussion, let's discuss the LAN adapter. You probably have a LAN adapter that works fine already, and it will continue to work well under OS/2 Warp Connect.

Even though OS/2 Warp Connect is a networking package, you do *not* need a LAN adapter to install or even to use the networking products. If you do not have a LAN adapter, the install program will, by default, install the parallel port network driver interface specification (NDIS) driver. This means that you can use your parallel port as though it were a LAN adapter (albeit much, much slower).

Do you have a laptop computer without a LAN adapter? If so, go to your friendly computer store, pay about $8 for a LapLink-style cable, and walk home with your new network. It's that easy. The transfer speed using the cable is very slow, so don't plan on transferring large files across the link. But it is an excellent medium for casual file transfer, as well as for sharing resources such as that 28.8 Kbps modem on your desktop machine!

You will probably use OS/2 Warp Connect without a LAN adapter from home or on the road to connect back to the office. Using LAN Distance, you can establish your "virtual" LAN connection, then use the networking products on your system as though you were directly attached to a LAN.

Installation Methods

Another pre-installation task (besides reading the manuals) is to learn about all the installation possibilities, then decide which is the most appropriate for you.

Preloaded–Getting your system preloaded with OS/2 Warp Connect is a possibility if your machine is preconfigured and set up specifically for you. But there are disadvantages to having it preloaded, especially from the corporate perspective. Generally, the hard disk, no matter how large it is, will be partitioned as one big logical drive. Since many corporations have a standard system desktop that requires multiple drives–one drive for the operating system, one for data, and perhaps a backup or an applications drive–they tend to erase the entire preload and reload with their software.

Installing from Diskette–OS/2 Warp Connect is available only on CD-ROM; however, it is possible to create diskettes for all the products (except for AskPSP) that are on the CD-ROM. You can make diskettes to back up the CD-ROM, but it will require more than 70 diskettes, and you probably won't want to install OS/2 Warp Connect from those diskettes. However, if you want to head down that road, several tools are available to help you make diskettes.

`MAKEDSKS.CMD` and `MAKEDSKS.BAT`, found in the OS/2 Warp Connect CD-ROM root directory, are identical batch programs, with one version for OS/2 and one for DOS. `MAKEDSKS` makes the entire set of OS/2 Warp diskettes. For the base OS/2 Warp operating system without WIN-OS2, you need 21 diskettes; for the base OS/2 Warp including WIN-OS2, you need 25 diskettes.

`CDINST` lets you make the two installation diskettes if the ones that came with your CD-ROM are damaged or lost. `CDINST` makes the default diskettes, so if you added anything to your original installation diskettes, such as device-driver support for RAID, small computer system interface (SCSI), CD-ROM or other devices, make sure you have backups of those diskettes.

`PRODINST` is an easy-to-use interface that lets you install individual products or make diskettes.

Figure 2 shows the number of diskettes required for each OS/2 Warp Connect component.

Installing from Local CD-ROM–If you install OS/2 Warp Connect from the CD-ROM, you will be much happier with the installation speed.

Figure 3 lists the 50 CD-ROM drives supported by OS/2 Warp and OS/2 Warp Connect. This list can also be found in OS/2 Warp Connect's `\OS2\INSTALL\CDROM.TBL` file.

Installing from Remote CD-ROM–One of the coolest of the cool features in OS/2 Warp Connect is that the install program can be run across a network. This capability was added because not every computer system has a local CD-ROM drive. Installing OS/2 Warp Connect from a remote CD-ROM drive is relatively simple, giving you and your users the flexibility to install across the LAN.

What's New in the OS/2 Warp Connect Install

Except for the installation of the base OS/2 Warp operating system, the entire OS/2 Warp Connect install process is new and, I'm pleased to say, quite easy to use. The integrated install process is simply fantastic, and the remote install has received rave reviews from users as well.

Integrated Install

Integrated with OS/2 Warp install: The OS/2 Warp Connect install is very well integrated into the overall installation process. Immediately after you finish answering the questions about your selections at the beginning of phase 2 of the OS/2 Warp install, the OS/2 Warp Connect install process begins. It is designed to enable you to answer all the necessary questions up front; then you are free to

leave the computer. The installation continues on its own, including the necessary reboots, until it completes. At the end, a message displays, indicating that the installation was successful and asking you to perform the final reboot.

Integrated networking products: The networking products in OS/2 Warp Connect that are part of the integrated install (shown in Figure 4) are:

- LAN Requester or IBM Peer (mutually exclusive)
- NetWare Requester
- TCP/IP
- LAN Distance
- MPTS
- Network SignON Coordinator/2 (NSC/2)

Note: MPTS and NSC/2 are part of the integrated install but are not shown in the dialog box since the installation program automatically installs them.

The integrated install not only integrates the disparate installation programs into one, it also minimizes the amount of information you need to supply to get the products installed.

The ability to fill in one Settings notebook (Figure 5) with all of the information needed to install all of your networking products is very appealing. But the biggest benefit of OS/2 Warp Connect installation is the integration logic built into the install process. Previously, you had to install the operating system followed by each of the networking products individually. It wasn't uncommon to spend considerable time to get them to work together, especially when using multiple protocol stacks and requesters. But now, in OS/2 Warp Connect, all you have to do is answer some basic questions via the integrated install's Settings notebook.

Aztech CDA-268-03I-SE
CD Technology T3301, T3401
Chinon 525I
Chinon 431, 435
Chinon 535
Compaq Tray Load
Compaq Dual Speed
Creative Labs OmniCD
Goldstar GCD-R520B
Hitachi 1650S,1750S,3650
Hitachi 1950S,3750,6750
IBM CD-ROM I
IBM CD-ROM I rev 242
IBM CD-ROM II, Enhanced CD-ROM II
IBM ISA, Panasonic 562,563
Lion Optics XC-200AI,200EI
Mitsumi CRMC-LU002S,Tandy CDR-1000
Mitsumi CRMC-LU005S
Mitsumi CRMC-FX001
Mitsumi CRMC-FX001D
Mitsumi CRMC-FX001DE,FX300,FX400
NEC Intersect 25,36,37,72,73,74,82, 83,84
NEC MultiSpin 4Xe,4xi,3Xi,3Xe, 3Xp,38,74-1,84-1 NEC 2vi,260
Optics Storage 8001 IDE
Panasonic CF-41
Panasonic 501,LK-MC501S
Panasonic 521,522,523
Panasonic 571
Philips LMS CM-205,CM-225
Philips LMS CM-205MS,206,225MS,226
Philips LMS CM-215
Philips LMS CM-207
Pioneer DRM-600
Pioneer DRM-604X
Plextor DM-3028,DM-5028,4PLEX
Sanyo CRD-450P
Sony CDU-31A,33A,7305,7405
Sony CDU-531,535,6150,6201, 6205,6251,7201,7205CDU-535
Sony CDU-55D,55E,76E
Sony 541,561,6211,7211,7811
Sony 6111
Texel 3021,5021
Texel 3024,3028,5024,5028
ThinkPad 755CD, Teac CD-40E
Toshiba 3201
Toshiba 3301,3401,4101,3501,5201
Toshiba 5302B
Wearnes CDD-120
Non-listed IDE CD-ROM

Figure 3. CD-ROM Drives Supported by OS/2 Warp and OS/2 Warp Connect

Easy versus Advanced Paths

As you know, OS/2 Warp has both *Easy* and *Advanced* install paths. OS/2 Warp Connect adds to that with its own Easy and Advanced install paths. How do the Easy and Advanced paths fit together?

If you do an Easy install of OS/2 Warp Connect, it performs an Easy install of OS/2 Warp, then lets you install one or more of the following:

- IBM Peer for OS/2
- NetWare Client for OS/2
- Internet Connection Kit (modem)

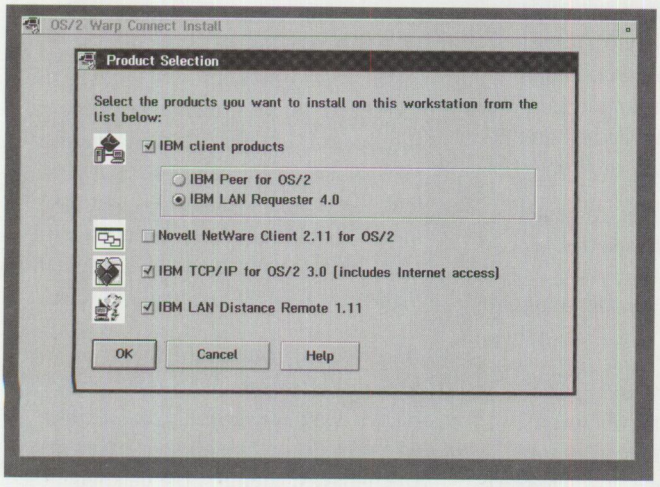


Figure 4. Integrated Install Product Selection

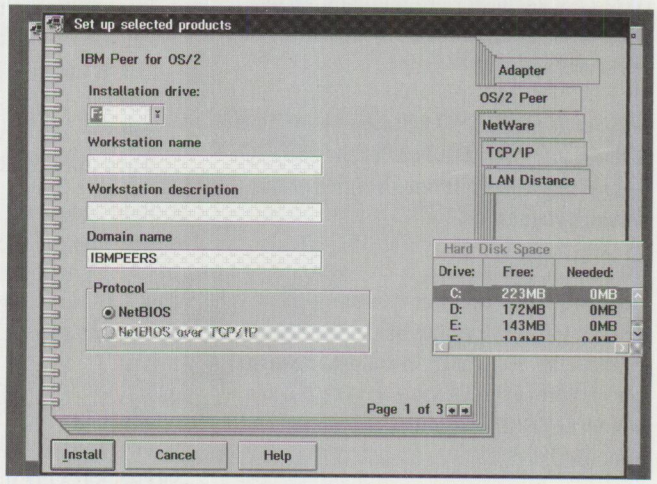


Figure 5. OS/2 Warp Connect Network Product Setup Notebook

```
;SRVIFS INI file for GRPWARE - BFPKKYA3
Name = BFPKKYA3
GroupName = NO
Adapter = 0
MaxClients = 1
MaxFiles = 9999
ClientWorkers = 6
Path = G:\
Alias = ReadOnly,Single,CDROM,G:\
Alias = ReadWrite,Single,STATUS,D:\GRPWARE\CLIENTS\LADCLT
```

Figure 6. Contents of \GRPWARE\CLIENTS\GRPWARE.INI

If you want to install some of the other networking products, or if you need to install to a partition other than the C: drive, you'll have to do an Advanced install. But if you're looking for the simplest way to get OS/2 Warp Connect onto your computer, choose the Easy installation path.

OS/2 Warp Connect's Advanced install first installs OS/2 Warp, then allows you to selectively install remaining OS/2 Warp Connect products from the same CD-ROM. (Lotus Notes Express and the BonusPak, for example, are on separate CD-ROMs, so they are not part of the integrated install.)

You can choose to install any or all of the following products:

- IBM networking software (LAN Requester or Peer)
- NetWare Client for OS/2
- TCP/IP for OS/2 (LAN or modem)
- LAN Distance Remote

Once again, IBM Peer for OS/2 and IBM OS/2 LAN Requester are mutually exclusive, so the install process asks you to select only one.

The Network SignON Coordinator product installs automatically, behind the scenes, whenever you install one or more of the network requesters.

Remote Install

The OS/2 Warp Connect Remote Installation service, one of the best new features, allows you to install OS/2 Warp Connect from the LAN on the OS/2 Warp Connect CD-ROM with a network-attached computer.

When you examine the Presentation Manager (PM) program, which is written mostly in VX-REXX, you'll find that it is simply an automated and simplified configuration/installation/distribution (CID) process. The OS/2 Warp Connect Remote Installation process hides CID complexities, so that you won't even know you're working with CID processes unless you want to dig deeper to expand some of the capabilities.

To remotely install, you need two computer systems–one acting as the server and the other as your client or target system. Once you connect the two, the installation process is the same as if you were installing it from a local CD-ROM drive.

It is very easy to prepare for the remote install. From an OS/2 Warp Connect system that still has the OS/2 Warp Connect Install/Remove folder on it, you'll need to:

1. Create remote boot diskettes, which will be unique according to the type of adapter (e.g., IBM Ethernet/A is different from an SMC card).
2. On the system you will be installing *from*, initiate the Warp Connect Remote Installation Service. *Note:* "Warp Connect Remote Installation Service" is the screen caption that you will see when you double-click on the Warp Connect Remote Install object.
3. Boot the client, or target, computer with the remote boot diskettes.

That's all it takes to get up and going in no time at all!

Again, the install process is still CID under the covers. The "server" is an SRVIFS server. The redirection is an SRVIFS SRVATTCH going across a NetBIOS connection. The install, whether local or remote, is a hybrid redirected install. Your entries in the Settings notebook are inputs into the process creating the response files to install the products. All told, it does a nice installation job.

Providing automation and simplification usually comes at the expense of customization and flexibility. While you can ignore the entire integrated install to regain flexibility, a few things are designed into the installation process to allow you to customize it somewhat.

Customizing Installation: Multiple Installs

In its default configuration, remote installation allows you to install only one client at a time. It was a good idea to limit it to one client in the default configuration, because the CD-ROM would really become a bottleneck if you were to try to install more–it would probably get even slower if you were to install five clients at the same time versus serially installing five.

There is a simple way to raise the limit of concurrent installs. Your \GRPWARE\CLIENTS\GRPWARE.INI file, shown in Figure 6, is just a standard SRVIFS INI file.

To raise the limit, modify the MaxClients parameter. But be aware that if you are still using the CD-ROM as the source, your CD-ROM will quickly begin "thrashing." (*Thrashing* is a condition in which most of the CD-ROM activity consists of scanning the CD rather than actually transferring data.) There's an easy fix for that, too!

Notice that the CD-ROM alias in the INI file points to G:\, which is my CD-ROM drive. If you have approximately 110 MB of free disk space, just copy the \CID, \OS2IMAGE, \GRPWARE, VROBJ.DLL, and OS2SE20.SRC files to another directory, such as C:\SOMEDIR. Then change your alias statement in the GRPWARE.INI to look like Alias = ReadOnly,Single, CDROM,C:\SOMEDIR. Do not put a backward slash (\) at the end of the directory name; if you do, SRVIFS will not start.

Once you are reading the files from your hard-disk drive, you'll be able to install many clients concurrently; the number will vary depending on your hardware. One hundred clients is the maximum theoretical limit that SRVIFS will allow. From

past experience, 30 is the point where diminishing returns occur, but we have seen cases of approximately 70 clients attached at the same time.

Extending the OS/2 Warp Connect Install

How do you extend the installation process to include custom routines? The DEFAULT.LCL program includes the code shown in Figure 7 that allows you to easily extend the installation process to meet your needs.

As you probably see in Figure 7 (from the comment line rather than the code), there is a user exit, which runs a file called USER.CMD if it is present in the \GRPWARE\CLIENTS\LADCLT directory on the target computer. If present, the command file will run at the end of the installation process, near the cleanup process. If you run a command file that requires user intervention, whether it's a question or an error, your system will appear hung. This is because the OS/2 Warp Connect install panel is shown full-screen, while the actual program is being run from an OS/2 Window behind the install panel. Press the keystroke combination Alt+Shift+F3 to see both your desktop and the running program.

One of the tricky parts is to get the USER.CMD onto the target system. One way to do that is to put the USER.CMD file in your server's \GRPWARE\CLIENTS\LADCLT subdirectory. Then you can insert the following line of code at the end of the CONFIG.SYS file on your second boot diskette (the LAN transport diskette): CALL=\OS2\CMD.EXE /Q /C COPY W:\USER.CMD\GRPWARE\CLIENTS\LADCLT.

This line is copied to the CONFIG.SYS file on the hard-disk drive during the installation process. Your USER.CMD file, if it exists, will run at the end of the install process. Therefore, when you run your USER.CMD file, it will need to remove the above line from the CONFIG.SYS file. If it remains in your CONFIG.SYS file, you will get an error message when you boot.

When Not to Use the Parallel Port

The parallel port NDIS driver that is new with OS/2 Warp Connect can come in handy if you are stuck in a situation where you don't have a network connection. As long as you are not transferring

```
/* Run user.cmd, if it exists */
if stream('&Y_D&ladclt\User.cmd','C','query exists') \= ''
then do call '&Y_D&ladclt\User.cmd'
end
```

Figure 7. How USER.CMD is Called

huge files, it performs well enough to use occasionally or to share resources such as a modem.

I tested an OS/2 Warp Connect installation using the parallel port NDIS driver. I created the diskettes, altered some of the timing parameters on the server, and was off and crawling–not much faster than my infant daughter!

To provide a reference point, I did some timings for the OS/2 Warp Connect install. If you are doing a single install, my tests show that there is no significant time difference in the following scenarios:

- Local CD-ROM install (single-speed CD-ROM)
- Remote install from 2x CD-ROM
- Remote install from hard disk

Roughly speaking, it takes about an hour to install OS/2 Warp Connect and the networking products. This is the same equipment used to install the parallel port, so it provides a valid reference.

When installing via the parallel port, it took 3 hours 35 minutes just to get to the end of phase 1 of the base OS/2 Warp install. This was equivalent to installing the first six or seven diskettes in that amount of time. Now, extrapolate to the 70 or so diskettes that comprise the OS/2 Warp Connect CD-ROM, and. . .no, I didn't let it take the estimated 36 hours to finish!

So I would not recommend using the parallel port as a way to install. If you happen to have a PC that has no LAN adapter, no CD-ROM, and no diskette drive, you might consider it–but before doing that, consider buying a SCSI parallel port CD-ROM and saving yourself some time!

OS/2 Warp Connect Install Conclusions

Overall, the OS/2 Warp Connect developers have created an excellent installation program. Most users' experiences have been very positive, especially those who have had to "battle" with previous versions.

Is there still room for improvement? Of course. For example, now that the installation is more automated and simplified, there will be occasions where an advanced configuration is desired but impossible. Adding the automation sacrificed the ability to fully customize each of the products' features.

Basing the installation on CID is the right idea. Unfortunately, it appears that if you move OS/2 Warp Connect into a CID configuration, you cannot use the entire integrated install process–you'll have to rely on the products' individual install programs and your expertise.

CONNECTing to the Rest of the World

Several components of OS/2 Warp Connect actually provide some type of connection capability.

TCP/IP

TCP/IP for OS/2 3.0, included with OS/2 Warp Connect, provides access to TCP/IP networks, including the Internet, the most popular TCP/IP network today. TCP/IP for OS/2 gets you connected by providing an implementation of the TCP/IP protocols and application suites to communicate over a LAN via Token Ring or Ethernet, and async via SLIP or PPP.

Before OS/2 Warp Connect was available, the TCP/IP functions for the LAN were available by installing a separate product called TCP/IP for OS/2 2.0 base kit. Enhancements and fixes were applied to the 2.0 base to create the TCP/IP 3.0 base. TCP/IP for OS/2 3.0 is not available as a separate product; it is available only in the OS/2 Warp Connect package.

TCP/IP for OS/2 3.0 provides a superset of function above that provided by the Internet Connection for OS/2 in the OS/2 Warp BonusPak and by TCP/IP for OS/2 2.0. The Internet Connection for OS/2 was designed to provide access to the Internet via a SLIP or PPP connection; it did not provide any TCP/IP support for a LAN

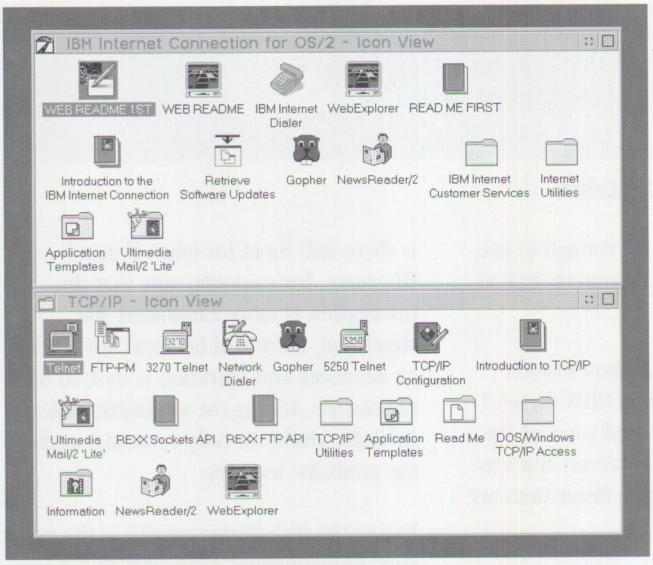


Figure 8. Contents of the IBM Internet Connection and TCP/IP Folders

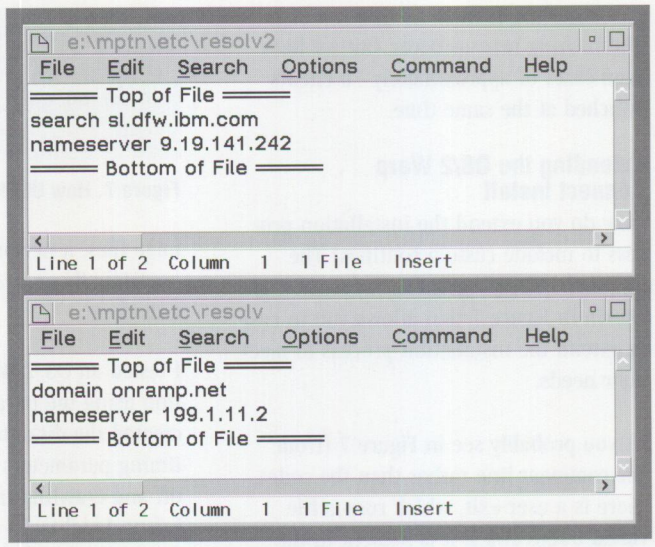
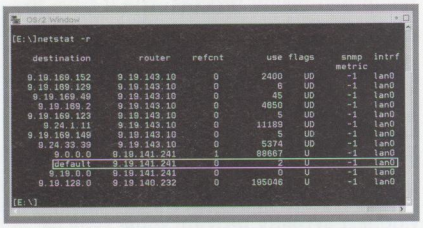
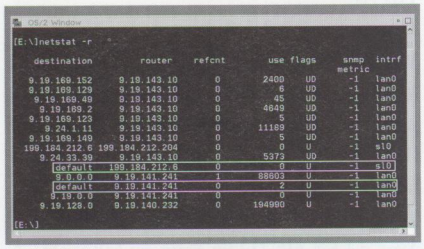


Figure 9. The RESOLV and RESOLV2 Files



```
[E:\]netstat -r
   destination        router      refcnt      use flags    snmp  intrf
                                                          metric
9.19.169.152     9.19.143.10          0     2400    UD      -1   lan0
9.19.169.129     9.19.143.10          0        6    UD      -1   lan0
 9.19.169.49     9.19.143.10          0       45    UD      -1   lan0
   9.19.169.2    9.19.143.10          0     4650    UD      -1   lan0
9.19.169.123     9.19.143.10          0        5    UD      -1   lan0
   9.24.1.11     9.19.143.10          0    11189    UD      -1   lan0
9.19.169.149     9.19.143.10          0        5    UD      -1   lan0
 9.24.33.39      9.19.143.10          0     5374    UD      -1   lan0
     9.0.0.0     9.19.141.241         1    88667    U       -1   lan0
     default     9.19.141.241         0        2    U       -1   lan0
     9.19.0.0    9.19.141.241         0        0    U       -1   lan0
  9.19.128.0     9.19.140.232         0   195046    U       -1   lan0
[E:\]
```

Figure 10. LAN Default Route



```
[E:\]netstat -r
   destination        router      refcnt      use flags    snmp  intrf
                                                          metric
9.19.168.152     9.19.143.10          0     2400    UD      -1   lan0
9.19.169.129     9.19.143.10          0        6    UD      -1   lan0
 9.19.169.49     9.19.143.10          0       45    UD      -1   lan0
   9.19.169.2    9.19.143.10          0     4649    UD      -1   lan0
9.19.168.123     9.19.143.10          0        5    UD      -1   lan0
   9.24.1.11     9.19.143.10          0    11189    UD      -1   lan0
9.19.169.149     9.19.143.10          0        5    UD      -1   lan0
199.184.212.6 199.184.212.204         0        0    U       -1   sl0
 9.24.33.39      9.19.143.10          0     5373    UD      -1   lan0
     default     199.184.212.6        0        2    U       -1   sl0
     9.0.0.0     9.19.141.241         1    88803    U       -1   lan0
     default     9.19.141.241         0        2    U       -1   lan0
     9.19.0.0    9.19.141.241         0        0    U       -1   lan0
  9.19.128.0     9.19.140.232         0   194980    U       -1   lan0
[E:\]
```

Figure 11. Internet Default Route

environment. If your environment also required access to a TCP/IP network over a LAN connection, you had to install TCP/IP for OS/2 2.0. Unfortunately, these two products did not coexist well. You could install both products and gain some functions from both, but this environment was not officially tested or supported.

One of the problems in this environment was that objects in the Internet Connection for OS/2 folders were configured for a dial connection. You had to create new objects to use the applications that were supplied with the Internet Connection for OS/2 over a LAN connection.

TCP/IP for OS/2 3.0 fixed this problem by including all of the applications that come with the Internet Connection for OS/2 and all of the applications that come with TCP/IP 2.0. These applications' objects are configured both for LAN access in the TCP/IP folder and for dial access in the IBM Internet Connection for OS/2 folder. Figure 8 illustrates both TCP/IP folders and Internet Connection folders.

Ultimedia Mail/2 Lite was another source of problems. It was configured for an Internet mailbox server, not a LAN-based mailbox server. TCP/IP 3.0 now lets you configure your mail for LAN only, Internet only, or LAN and Internet. You can also enable Ultimedia Mail/2 Lite to support multiple users' mail on one workstation.

Other problems arose when users tried to simultaneously use the LAN TCP/IP network and the Internet TCP/IP network. Once dialed into the Internet, your name resolution (looking up host addresses based on a nickname) was performed by your Internet name server, not your LAN name server. The Internet name server had no knowledge of your LAN hosts and, therefore, could not resolve any request for those hosts.

To overcome this problem, you could create a HOSTS file that contained your LAN host's address, or you could access your LAN hosts by their IP addresses instead of using nicknames.

The name-resolution problem occurred because both the Internet dial connection and the TCP/IP 2.0 LAN connection used the same RESOLV file to identify the domain name server. This RESOLV file was re-created with the Internet domain name server information every time you connected via your SLIP or PPP connection, thereby removing the LAN name server information.

TCP/IP 3.0 corrected this problem by implementing a RESOLV2 file. This file is used when LAN-based domain name resolution queries take place. The Internet dialer still uses the RESOLV file to query domain name servers. If you are connected to both the Internet and the LAN, the name servers in the RESOLV file and RESOLV2 file are queried simultaneously. Figure 9 shows an example of file contents of both RESOLV and RESOLV2.

Another coexistence problem between the Internet Connection for OS/2 from the BonusPak and TCP/IP 2.0 occurred if your network was a "routed" network–a network with multiple LAN segments that have IP routers forwarding traffic to different segments. In this case, you would lose your default LAN router definition when you dialed the Internet. When you connected to the Internet, your default route would change to the router on the Internet, thereby losing the capability to access the LAN host through your LAN router. You could overcome this situation by creating host, network, or subnet routes for TCP/IP hosts that you access through your LAN routers.

TCP/IP 3.0 addressed this problem by creating two default routes. Assuming

you are configured for both LAN and Internet access, you will have an initial default route for your LAN, as shown in Figure 10. Once you connect to the Internet, a second default route is added that refers to your Internet router (see Figure 11). Because this new default route definition is first in the list, it will be used to route traffic. Once you terminate the Internet connection, the new default route definition goes away, and you are back to using your original default route definition.

A possible security exposure exists when you use the Internet Connection for OS/2 with TCP/IP for OS/2 2.0. When TCP/IP 2.0 is configured with two interfaces, the default action is to route traffic between the interfaces. This means that in the environment where you are connected to the Internet and have LAN access (so that you have two interfaces, a SLIP interface and a LAN interface), traffic can be routed to and from the Internet over your LAN. Though this exposure is small, someone could gain access to your network and resources via your dial-up connection to the Internet. Avoid this by issuing the `IPGATE OFF` command on the OS/2 command line. The `IPGATE` command enables or disables IP forwarding when TCP/IP is acting as an IP router. To correct the problem, TCP/IP 3.0 has changed the default to be `IPGATE OFF`.

With OS/2 Warp Connect, your TCP/IP connections can be over the LAN, phone lines, or even both simultaneously. That's what I call getting TCP/IP-connected with OS/2 Warp Connect!

MPTS, the True Connector

Of all the products included with OS/2 Warp Connect, Multiple Protocol Transport Services (MPTS) is what really puts the "Connect" into the package.

Each of the networking products included with OS/2 Warp Connect can use one or more protocols to communicate: NetBIOS, TCP/IP, and IPX. MPTS makes it possible to enable all of these protocols on a single system at the same time and to have all of the protocols share the same physical network adapter.

You may be familiar with MPTS from OS/2 LAN Server or the IBM AnyNet/2 product. OS/2 Warp Connect's MPTS is enhanced over these earlier versions; it combines the capabilities of both into one converged MPTS. One enhancement is that OS/2 Warp Connect's MPTS is compatible with the AnyNet/2 product. AnyNet/2 is an implementation of the sockets interface that permits non-native protocols on a LAN. For example, you may want to use OS/2 Peer, which is a NetBIOS application, over your SNA network. With OS/2 Warp Connect and AnyNet/2, your OS/2 Peer workstation can communicate via NetBIOS over SNA to other resources in your network.

MPTS is made up of two components: LAN Adapter and Protocol Support (LAPS) 2.60.5 and Sockets/MPTS 2.0. LAPS provides the support for your LAN adapters and protocols. Sockets/MPTS enables applications written to the sockets interface to utilize the NetBIOS, TCP/IP, or Local IPC Driver transports. You will also find some new drivers in OS/2 Warp Connect MPTS, including a NetBIOS for IPX protocol, a driver for the IBM Wireless LAN Adapter, and an NDIS driver that turns your parallel port into a virtual LAN Adapter.

NetBIOS for IPX is very useful for running NetBIOS applications in an environment that utilizes IPX routers to interconnect different LAN segments. MPTS's implementation of NetBIOS over IPX uses the Novell NetBIOS emulator (IPXNB) that comes with the NetWare Client for OS/2 2.11. You install this emulator by selecting Optional Protocols when installing the NetWare Client 2.11 software.

Although NetBIOS over IPX provides a good solution for running NetBIOS applications in an IPX environment, there are a few things to keep in mind. An application using NetBIOS emulation over IPX (IPXNB) cannot talk to an application that uses native NetBIOS. If you are using IPXNB for an application, the target system for that application must also be using IPXNB. The IPXNB does not actually transmit NetBIOS traffic on the LAN, but encapsulates it in IPX packets. This encapsulation will impact performance over native NetBIOS. However, in situations where IPX routing is required, a little slower performance should be better than none at all.

The Parallel Port NDIS MAC driver allows two machines connected via parallel ports to operate as though the two machines were on a LAN. To connect the machines' parallel ports, you can use one of the following cables:

- LAPLINK/INTERLINK cable
- JFACOMM half-duplex cable
- PPLINK full-duplex cable

The parallel port driver is configured through MPTS like any other LAN card driver. However, this is not a fast LAN. This connection is viable for small file transfers between machines and for sharing modems, but you don't want to use this connection for loading applications from a network or for distributing software.

LAN Distance Remote: Connecting You From Wherever

We have talked about great ways to get connected on the LAN, even if that LAN is utilizing parallel ports. What about getting connected to the LAN when you and the LAN are not physically in the same place? In this situation, LAN Distance Remote provides a valuable service.

LAN Distance connects you to your office LAN via some type of wide area network connection. This is usually a dial-up connection where you can operate essentially as though you were physically attached to the office LAN. LAN Distance uses *remote-node* technology and is best compared to another popular technology known as *remote control*.

In a remote control environment, a workstation at the office is physically connected to the LAN, with a modem attached and running the remote control server software. On the remote side, there is a workstation, with a modem, running the remote control client software. When the client side connects to the server side, the client takes control of the server workstation. All screen updates on the server are displayed on the client, and the client's keyboard supplies input to the server. In this environment, programs actually run on the server machine. Only the screen and keyboard are on the remote.

In contrast, remote node technology actually extends the LAN, not just the screen and keyboard, to the remote client. By extending the LAN, your remote machine operates much like the one that

is physically connected to the network. Each remote access method has pros and cons; however, remote node technology can provide the best of both worlds.

Many remote control applications, such as PC Anywhere, Carbon Copy, and DCAF, can also provide remote control function over a LAN. With remote node technology, your connection essentially is a LAN, and, therefore, you can take advantage of these remote control products over your remote node connection.

One thing to understand about remote node technology, and, therefore, about LAN Distance, is that this product creates the LAN connection just as though you had put two Ethernet or Token-Ring cards into two machines and wired them together. Once connected, you have a LAN connection.

You must then run a network application over this connection. For example, after the LAN Distance connection is made, you can run OS/2 Peer to access resources of another OS/2 Peer or LAN Server machine.

To understand LAN Distance's full capabilities, you should first understand all of the product's components. The LAN Distance family of products consists of:

- LAN Distance Remote for OS/2 (supplied with OS/2 Warp Connect)
- LAN Distance Remote for Windows
- LAN Distance Connection Server (8-port)
- LAN Distance Connection Server

LAN Distance Remote for OS/2 enables a workstation that is not physically connected to a LAN to dial in and operate as though it were on a LAN. To become a remote node on a network, the LAN Distance Remote client must dial into a LAN Distance Connection Server. (More about this below.) LAN Distance Remote can also dial into another LAN Distance Remote workstation. In this environment, you have created a virtual point-to-point LAN over your dial-in connection. Actually, a LAN Distance Remote workstation can support two concurrent connections to create a three-way virtual network.

LAN Distance Connection Server, an OS/2 application, is purchased separately from OS/2 Warp Connect. If you want your remote workstations to dial in on your network and actually be a node on the network, you will need LAN Distance Connection Server. The Connection Server is attached to your LAN, manages the incoming calls from the remotes, and routes network traffic between the remote and the LAN. In effect, the LAN Distance Connection Server bridges the remote workstation into the LAN environment. In addition, LAN Distance Connection Server provides extensive security to protect your LAN from unauthorized access.

LAN Distance Connection Server comes in two flavors–the 8-port version and the full version. The 8-port version allows only up to eight simultaneous connections, while the full version is limited only by the hardware you are using.

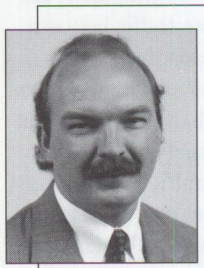
LAN Distance supports connections via async, ISDN, X.25, and synchronous adapters. By far the most popular method at this time is async. The minimum modem speed supported in an async environment is 9600 bps, but 14.4 Kbps or above is recommended. The LAN Distance Connection Server also attaches to Ethernet or Token-Ring networks. Be sure that you are using a LAN Distance-supported adapter on your Connection Server, because not all adapters will work.

LAN Distance supports NDIS-compliant protocols (NetBIOS, TCP/IP, 802.2, and IPX via the NDI2ODI driver) and the applications using them. This means that all the products included with OS/2 Warp Connect can run over a LAN Distance connection. There is one possible configuration with OS/2 Warp Connect that will not operate over LAN Distance: NetBIOS over TCP/IP. TCPBEUI is not compatible with LAN Distance.

CONNECTed and Cool!

So far we have looked at the major improvements of the OS/2 Warp Connect installation and how OS/2 Warp Connect actually gets you connected. In the next step, which we will cover in part two, we will look at the different applications that OS/2 Warp Connect provides to make use of your connections. These applications include the TCP/IP suite of applications and the new Peer applications.

OS/2 Warp Connect is the 32-bit, multitasking, multimedia, Internet-accessed, crash-protected, Windows-friendly, totally cool way to run and NETWORK your computer!



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Infrared: LANs Without Wires

Imagine creating an instant, moveable, wireless computer network in the most important place in your organization–"the meeting room." Imagine that those attending your strategic planning session or team meeting increase their interaction using the most advanced laptop computers. Imagine every computer tied by a meeting-room server–instantly, easily, and completely–to every other computer in your business.

Create this powerful business environment by simply plugging in a small, pocket-sized, infrared LAN adapter card. It can cost less than one computer consultant working a day to install a traditional wired local area network in your meeting room.

This article discusses how infrared technology can power your business environment.

Wireless communications is usually referred to as wide area wireless or even metropolitan area wireless. (Common examples of these communications are paging systems and cellular phones.) Now, however, wireless communications can include local area communications or "in-building" communications.

Workers spend most of their time in just a few building locations, such as private and open office areas, conference rooms, or classrooms. Opportunity for communication advances lies within building walls. Traditionally, this has been the role of wired networks and, more specifically, wired local area networks such as Ethernet or Token-Ring.

Wired networks have several important advantages. They provide high data throughput, low data-transport error rates, and usually low cost per byte transported. Wired networks, however, are inherently inflexible because they require fixed wiring and therefore restrict network usage to a single location. Sometimes wiring is impossible, or cost-prohibitive, and if users require data while away from their network connection, wires are useless.

Wireless Applications

Both traditional corporate enterprises and vertical industries, such as medical or education, will find the flexibility of wireless LAN extensions an aid in re-engineering their business processes.

"Roaming office" capability can be added to existing wired LANs quickly and easily. Roaming is transparent to the existing network operating system and supports existing LAN-based applications without change. Roaming may occur in three scenarios:

- Within a single wireless LAN
- From one wireless LAN segment to a second segment while both are connected to the wired LAN
- From one wireless LAN segment (node) within a wired network to another wireless LAN segment within a second wired network

Wireless roaming provides the ultimate flexibility for local area networks.

TECHNICAL

Ad Hoc Networks

A spontaneously created, temporary LAN is called an *ad hoc* LAN. You may require such a network simply to meet the needs of a specific situation, or you might use it to solve the needs of your "frequent movers."

Specific examples of ad hoc LANs include:

- Wireless conference rooms
- Special task forces
- Wireless classrooms or decision support centers
- Shows and special events

In all of these examples, current groupware (group conferencing software and group decision-making software, for example) that is supported by a network operating system can be supported for a wireless ad hoc LAN. Such a network requires no LAN administration—only a need for the participants to link together and the availability of common software.

Wiring Replacement

Many businesses prefer to invest in the business itself rather than in building infrastructure. In fact, many businesses rent the premises they use. In other situations, for health and safety reasons, wiring may not be feasible (for instance, older buildings may have asbestos in ceilings and walls). In some areas, the sheer cost of pulling wire to install wired networks may make infrared LANs practical.

Serial Connectivity

Many businesses have highly mobile professionals, such as marketing personnel or consultants, using portable computers away from the office. The portable may be their only PC, and when they return to their home base, they want to re-integrate into their office systems with minimum hassle.

Other professionals may require powerful workstations, perhaps with specialized peripherals such as publishing-quality printers, very large storage devices, or simply very fast processors. These same workers may also be mobile or may perform significant parts of their jobs at home on a portable or less powerful system. In these cases, the power of a personal local area network can be a real advantage. These workers can share files between the portable and the power workstation without worrying about intermediate transfer media such as diskettes, route applications to the faster processor, and enjoy the benefits of device sharing without having to "rewire."

Wireless Versus Wired

In general, wireless local area networks make sense when:

- Traditional wiring is difficult or expensive
- There is a need for in-building mobility
- Businesses are migrating their workforce out of the office
- There is a need to create small and changing workgroups
- There is a high rate of change in workers' locations
- Savings can be found in shared network resources

. . .the wireless network's throughput will be better than a wired LAN.

Marketplace Perceptions

Businesses have been slow to accept wireless LAN technology despite the predictions of the industry's most knowledgeable consultants. Still, the predictions remain solid and show a growing marketplace. Two questions remain: When will wireless LANs take hold in businesses? What has impeded their acceptance?

Function and Economics

Before 1994, it was arguable that no single vendor had a complete wireless LAN offering, and those that had offerings were priced beyond most businesses' implementations. As the market matures, many providers are approaching a comprehensive product offering at an affordable price.

We define the minimum solution for a mobile office as an offering that includes:

- Personal Computer Memory Card International Association (PCMCIA) and industry standard architecture (ISA) adapters
- Access point units
- Ethernet and/or Token-Ring LAN access
- Roaming capabilities

Adapter pricing may still be an issue for some businesses, but when analyzed from a systems perspective (factoring in support services savings and productivity gains), wireless networks can be more cost-effective than wired LANs, and they can provide a competitive advantage. (See the "Evaluating Wireless LANs" section later in this article for comparisons.)

Wireless LAN Trade-Offs

Another hurdle many businesses may face is the perception that function and performance must be sacrificed for a wireless LAN's flexibility and convenience. These businesses may have adopted a wait-and-see attitude before considering wireless LANs. They are waiting for wireless LANs to provide throughput and reliability equivalent to wired LANs.

There is no need to wait. IBM's infrared wireless LAN can offer comparable user performance at a cost that is easily justified through added productivity associated with constant access to LAN-based resources and data. To better understand this claim, you need to look at data throughput available to the user instead of the total system throughput.

We assume that the mobile office customer is using wireless LANs to connect to wired LAN-based resources from various locations within the company's building. The key to understanding the wireless performance issue is not in comparing the LAN's theoretical or effective speeds but in determining whether or not the wireless LAN is capable of supporting a business's daily activities.

LAN throughput must be divided between the number of users in each LAN segment. So, to determine whether or not a wireless network will become a bottleneck in daily activities, you must understand how much throughput each user can expect to have in normal operations.

Within each segment a maximum, minimum, and an average throughput is available to the individual user. Maximum user throughput is achieved when no one else in the segment is trying to use the LAN. Minimum user throughput is achieved when all users are trying to concurrently

access the LAN. The average throughput happens when some number of users try to concurrently use the network.

Each installation, as well as each LAN segment within an installation, will have its own average, depending upon the type of business and size of the LAN. Figure 1 models some typical environments that would benefit from mobile office capabilities and shows what type of average throughput can be expected by comparing that throughput to the throughput from the wired LAN backbone. While the average user throughput values vary depending upon the environment, it is clear that, in most cases, IR wireless LAN communications will not be a bottleneck for the mobile user. In some situations the wireless network's throughput will be better than a wired LAN.

LAN Characteristics	Number of Users per Segment	LAN's Theoretical Maximum Throughput	Average Number of Concurrent Users	Average User Throughput
Ethernet (high usage)	25	10 Mbps	15	0.67 Mbps
Ethernet (low usage)	25	10 Mbps	5	2.00 Mbps
Token Ring (high usage)	40	16 Mbps	24	0.67 Mbps
Token Ring (low usage)	40	16 Mbps	8	2.00 Mbps
IR Wireless (office)	2	1 Mbps	1	1.00 Mbps
IR Wireless (meeting room)	6	1 Mbps	1	1.00 Mbps
IR Wireless (bullpen)	20	1 Mbps	3	0.33 Mbps
RF Wireless (office)	15	2 Mbps	10	0.20 Mbps
RF Wireless (warehouse)	10	2 Mbps	5	0.40 Mbps

Figure 1. LAN Characteristics

IR Versus RF

The wireless LAN marketplace is predominantly characterized as a radio frequency (RF) LAN opportunity. Infrared opportunity is most often inaccurately defined as in-room only and often as line-of-sight. The fact that RF's range is typically measured in the tens or hundreds of meters is held as an advantage in performance. Neither perception accurately depicts the function or performance of IBM's infrared wireless LAN adapters nor any advantage of RF range.

IR LAN is an in-building solution that can provide wireless connectivity for multiple IR cells that are connected via a wired network. It is not a solution for a completely wireless LAN, because it requires a mechanism for moving data between wireless cells bounded by walls. This is not often an issue, because the usual requirement is to extend the mobile users' access to data and resources to areas other than their own offices.

Given that the LAN exists, IR is a cost-effective solution to extend connectivity to other areas within building walls. There is little need to create wireless cells that go beyond (or through) walled areas (offices, meeting rooms, bullpens), because the roaming and bridging functions that come with every IR adapter allow you to gain access to all your corporate resources as you move between these areas.

Although RF can transmit through walls, most RF LANs are not suited to creating entirely wireless networks. They are limited by the number of users that they can effectively support on their medium (which is 1 Mbps for most vendors) and therefore must create several RF segments to guarantee an acceptable average user throughput rate. These segments must be linked together to allow all the users in the company to communicate and share resources and data. This connection requires another LAN card (whether it is wireless or wired) to accomplish this bridging. Assuming that most companies interested in mobile office applications already have a wired LAN installed, it makes sense that the linkage be on the wired network.

Another potential issue with the RF range is that it can cause cells to overlap and interfere with each other, effectively diminishing the throughput of each overlapping cell. This means that, in most situations (except the large physical cell with few users), IR and RF LANs will require a comparable number of connections to the wired LAN. IR and RF LANs can be positioned in a simplistic four-cell grid, as shown in Figure 2.

The inherent simplicity in IR technology (just like a TV remote control), the ability to partition wireless cells (to avoid overlap and throughput degradation), and the price differential compared to RF adapters brings up a question: Why haven't you considered IR?

Infrared is Easy

Infrared light is the same technology used to remotely control a variety of consumer

Explanation of Terms

LAN segment: A physical partition of the LAN. Common resources between bridges and/or routers. In an Ethernet LAN, this equates to an Ethernet segment; in a Token-Ring LAN, this equates to a ring; and in a wireless network, this equates to a cell or basic service area (BSA).

Theoretical throughput: The total number of bits that can be carried by the medium within a LAN segment.

Effective throughput: The total number of bits of user data that can be carried by the medium within a LAN segment–the theoretical limit minus all protocol overhead.

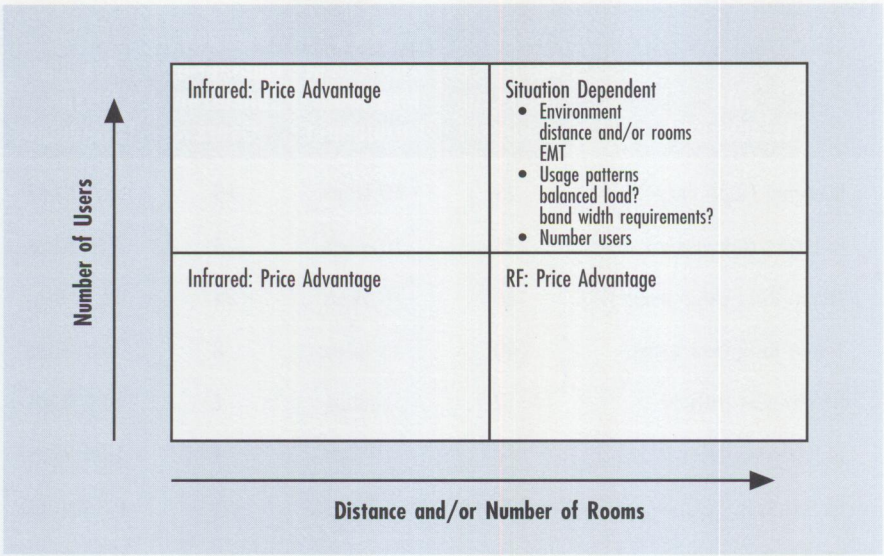


Figure 2. Wireless Products Positioning

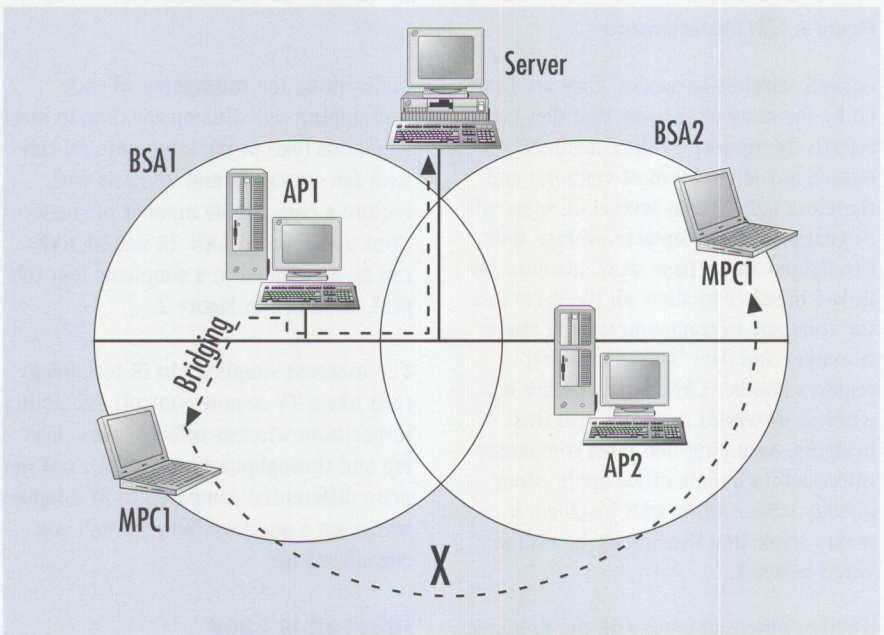


Figure 3. Roaming

devices such as televisions and stereos. However, the IR light used to change TV channels is typically directed (it requires an unobstructed line of sight), and it doesn't have the bandwidth to transfer more than simple commands.

A few companies, including IBM, have pioneered the use of this same part of the light spectrum to provide robust connectivity associated with typical wired LANs. This technology uses multiple light-emitting diodes (LEDs) and various light-modulation techniques simultaneously to transmit high volumes of information throughout a room. These diffused light pulses bounce off walls and ceilings, such that users located throughout the room can receive the same signals. Thus, IR is a suitable medium for transmitting data signals throughout a room without the need for aiming or a complicated setup. It's as simple as turning on your computer!

To ensure this simplicity, even in crowded rooms with several users trying to communicate with each other, a communications protocol (much like that used in traditional wired LANs) is required. This protocol, referred to as the *media access control* (MAC), has to share the available bandwidth efficiently among users, recover errors (in such a flexible environment, it is possible that, either initially or periodically, a specific user's transceiver may be "hidden" from others), bridge wireless users to wired networks, and allow the user to roam between connected wireless cells.

IBM's infrared wireless LANs use a MAC that is CSMA/CA (carrier sense multiple access/collision avoidance)-based, with a medium reservation mechanism. On top of this MAC, IBM has implemented extensions that provide MAC-level wireless bridging and roaming.

Wireless Bridging and Roaming

Wireless bridging and roaming allow users of IBM's infrared wireless LAN adapters to truly become mobile within their building while remaining connected to an Ethernet LAN and any shared resources on the LAN. A machine that is infrared-enabled is referred to as a *mobile* PC (MPC).

Bridging and roaming require at least one infrared-enabled computer (specifically, bridging requires one or more, and roaming requires two or more) that is also connected to a wired LAN (Ethernet or Token Ring). These machines that have both wireless and wired access are called *access points* (APs). An access point unit is assumed to be in a fixed position, because it must maintain its access to the wired LAN. Each access point also has a range in which it is able to communicate wirelessly, limited by the type of wireless adapter used and its technology. The coverage area of an access point is referred to as a *basic service area* (BSA). In Figure 3, BSA1 and BSA2, denoted by the circles, indicate the range limits of AP1 and AP2 respectively.

Both bridging and roaming require that each participating mobile PC and access point communicate using the same protocol. In the infrared wireless LAN adapters, this protocol is built into each mobile PC's adapter and its associated device drivers. A separate program is also included for the supervisory functions performed by the access point.

Bridging

Bridging is the term used to describe a mobile PC's ability to seamlessly connect, without special software, to an existing

Ethernet wired LAN through an access point. It makes the mobile PC appear as a regular wired node on the network. It ensures that any data on the wired LAN that is destined for a mobile PC within an access point's basic service area is forwarded to that mobile PC, from the access point, through an infrared transmission. Likewise, it also ensures that any data from the mobile PC that is destined for a node not within the basic service area is forwarded on the wired LAN.

In Figure 3, the bridging function shows mobile PC1 (MPC1) accessing resources on the server node, which is part of the wired LAN. All of this happens without intervention from the users of either the mobile PC or the wired LAN node. Neither mobile PC1 nor the server knows that they are communicating through AP1.

Roaming

Roaming is the term used to describe a mobile PC's ability to remain connected to a wired LAN and continue to access its shared resources as it moves between the basic service areas of different access points. This is very similar to the way cellular phone systems switch callers between cells. When a mobile PC is roaming, the access points use the communication protocol to sense when the mobile PC moves out of range of one access point and into the range of another. At this point, the second access point assumes responsibility for the mobile PC's communications. All the function is built into the access point and mobile PC protocol. Roaming is completely transparent to mobile PC users as long as the basic service areas overlap.

In Figure 3, mobile PC1 roams between AP1 and AP2. When it moves out of BSA1, it automatically looks for another access point to support its transmissions. When mobile PC1 reaches the position marked by X, it is in an area that is not serviced by either of the access points–a dead zone. While in the dead zone, it is unable to access any of the LAN services; it is still connected but unable to communicate with wired LAN-based resources. Once it moves into BSA2, it will be able to communicate with those resources on the LAN through AP2. If it remains in the dead zone for an extended period of time (several minutes–a time limit that the LAN administrator sets), it will lose its connection.

Assumptions		IR	RF
Adapter		350	700
Access Point		1,150	1,300
+Cable Drop		300	300
Roaming/Bridging Support			1,000
Bandwidth		1	1
Access Point			
Coverage Area		900	22,500
Maximum Number of Users		15	15
Scenarios		**IR**	**RF**
Conference Room		0.81	0.42
Number of Users	10		
Area	400		
Access Points Required		1	1
Bull Pen Office		14.33	11.01
Number of Users	50		
Area	10,000		
Access Points Required		12	4
Small Office (Open Area + Offices)		2.95	2.29
Cubicle Area			
Number of Users	20		
Area	1,600		
Access Points Required		2	2
Offices			
Number of Users	4		
Area	500		
Access Points Required		4	
Corporate (Open Area + Offices)		9.84	8.3
Cubicle Area			
Number of Users	50		
Area	5,000		
Access Points Required		6	4
Number of Users	10		
Area	2,250		
Access Points Required		10	
Warehouse		5.68	24.59
Number of Users	10		
Area	30,000		
Access Points Required		34	2

Figure 4. Sample Scenarios for WLNI Calculations

Wireless bridging and roaming will become catalysts for quicker and more efficient operations within regular business processes. Decisions can be made immediately, since all the required information is now with the mobile user–not locked up back at the user's desk.

If you have already moved to portables and laptops, the bridging and routing functions can provide you with a cost-effective solution to move entirely onto the portable machine without having to maintain a desktop machine. Roaming lets you continually access data and information required to run your business at all times and all locations–not just in your office. Its simplicity and transparency allow for easy adoption and use.

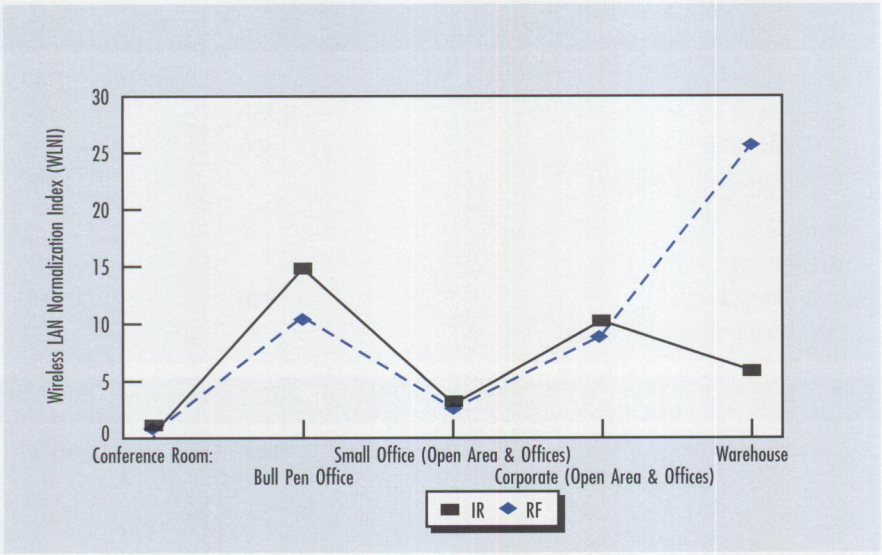


Figure 5. Wireless LAN Comparison—Normalization Index

Evaluating Wireless LANs

The marketplace for wireless LANs is just starting to mature technologically, but it is still in its infancy with respect to user knowledge. How do you compare and decide on which offering is best for your business? You must ensure that you consider your business's needs today as well as tomorrow.

The first level of decision-making should be functional and should be used to limit the number of solutions. Consider the following:

- Operating systems supported
- Bus/interface required (e.g., ISA, Micro Channel architecture, PCMCIA)
- Network operating systems supported (e.g., Novell, Lantastic, LAN Manager)
- Mobility
  - Bridging and roaming capabilities
  - Physical form factor (integrated versus tethered units)
- Environmental/usage issues
  - Electromagnetic interference (EMI)
  - Security
  - Worldwide availability
  - Sufficient user throughput

It is important to understand that cost of a solution is different from its price. Price is a one-time outlay, whereas cost includes the initial price plus the continuing expense to support the solution over time.

Once you create a list of vendors, you need to compare vendor claims and values. The first step is to understand the cost of the system to be installed. This includes adapter costs, central control units (if any), access points (if any), and infrastructure costs (wiring and support costs) that can be predicted over the company's normal planning period.

One way to compare the various solutions is to normalize the differences of each solution's key differentiating factors into a single value. Figure 4 shows some typical scenarios which might require a wireless LAN. Figure 5 uses a wireless LAN normalization index (WLNI) to help you better understand each wireless offering's value in the various scenarios. The actual numbers are not as important as the relative difference of the numbers calculated for various solutions. No single measurement can answer all questions, but you can use it to position various offerings against each other. What it does show is that for most situations, IR and RF LANs are comparable solutions from a cost perspective. In many situations, IR is the most cost-effective solution when the simplicity of the solution is considered.

In this article, we calculate a WLNI using:

- Total network cost
- Solution coverage area
- Number of users to be connected
- Bandwidth available

The WLNI is computed as the inverse function of cost/ft²/user/bandwidth. The higher the WLNI value, the better the solution. Logically, this appears to be a good measure: the less expensive the solution with all other attributes held constant, the larger the index value. Similarly, the greater the area covered by the solution with all other attributes held constant, the larger the index value. An increase in the number of users or bandwidth will also increase the index value.

To better understand how this index might be used, refer to the assumptions and calculations in Figure 4. Each scenario is described in terms of the number of users requiring wireless LAN connections and the area that must be enabled for wireless communication. This is the area that must be serviced by access points to provide access to the wired LAN and/or linkages for separate wireless cells.

The number of access points is calculated for each scenario as the maximum value of either:

- The area divided by the access point coverage area, rounded up to the nearest integer, or
- The number of users divided by the maximum number of users that an access point can effectively serve, rounded up to the nearest integer

For example, in the IR bullpen scenario, this value is computed as follows:

$$Max\left(\frac{\overline{10{,}000}}{900}, \frac{\overline{50}}{10}\right) = 12$$

The actual index value is computed as the total system cost, divided by the number of users, divided by the area covered, divided by the available throughput. Total system cost is the sum of all adapters, plus all access points (including LAN cable drops), plus roaming support (if not provided as part of adapter), plus an estimate of ongoing support costs. In our example, we have not tried to estimate the value of support, because it depends almost entirely on the user environment and usage patterns; however, it is an extremely important value, and you must include its estimate in your calculation. In general, you can assume that IR will be much cheaper to support, because the technology is inherently less complex than RF.

Then, using the IR bullpen example, the equation looks like the following:

$$\left(\frac{((50 \bullet 350)+12 \bullet (1{,}150+300)+0+0)}{(50 \bullet 10{,}000 \bullet 1)}\right)^{-1} = 14.326$$

IR Advantages

IR LANs are meant for in-room and in-building communications. In this area, the infrared technology provides some significant advantages for wireless LANs. Environments such as personal offices, open office areas, conference rooms, classrooms, doctors' offices, and health clinics are ideally suited for an infrared network.

IR channels are available worldwide and are always consistent (i.e., IR is always in the same spot in the light spectrum). IR is not a regulated part of the spectrum and is not licensed in any country. IR creates no electromagnetic interference with other devices. IR is inherently secure, since IR signals stay within the room and are reflected off walls and ceilings. In-room LANs don't need to worry about security issues, since the users in the network are visible and presumably known. Since in-room LANs are limited by room size, IR LANs don't typically need to worry about compression technologies to improve bandwidth. In fact, IR LANs have excellent available bandwidth, limited only by the designer's ability to switch light on and off faster.

When compared to RF, IR is typically lower cost, provides higher throughput potential, has lower power requirements (making it very suitable for battery-powered devices), has no licensing costs or regulatory issues, has no EMI concerns, has no health and safety concerns, and provides inherently secure and easily partitioned service areas.

Growth and the Future

Wireless communications in general is at the heart of a communications revolution being driven by business needs for productivity and competitive advantage provided by both mobility and increased flexibility in work processes. While wide area wireless is in the vanguard, it really deals with 10 percent of the wireless opportunity. Local area wireless deals with the other 90 percent of the opportunity. IR is the only wireless technology that has the potential to become pervasive as the worlds of consumer products, computers, and communications collide to change our lives.

IR can change channels, handle high volumes of information, and provide interfaces between any and all devices and appliances, easily and economically, without wires. The spectrum is consistent worldwide, unregulated, safe, and secure. The potential for increased speed and bandwidth is very high. The distinction between directed or line-of-sight IR communications and diffuse IR communications will blur. Finally, IR offers a familiar paradigm that can substantially reduce complexity and allay the fears of the non-computer-literate.

For more information about IBM's infrared products, contact your local IBM representative.

Security and Auditing in IBM LAN Server

If you administer an IBM LAN Server domain, you want to sleep well at night knowing that your server resources are protected and fully audited. This article provides an overview of LAN Server's security and auditing architecture.

Controlling access to a LAN Server domain requires that resources be accessible only to authorized users. Also you must have the ability to audit or track usage, changes, and unauthorized access attempts. Both of these requirements are easily accomplished with LAN Server's built-in security and auditing features.

At the core of LAN Server's security model are the concepts of privilege levels, access controls, and user policies. *Privilege levels* control the administrative functions that an account can perform. *Access controls* provide programmable limits (based on the user's identity and group memberships) to the LAN resources. *User policies* control the overall password handling in the system.

LAN Server provides three general levels of privilege: Administrator, user, and guest.

Philip Lieberman
Lieberman and Associates
Beverly Hills, California

Administrator Privilege—Top of the Heap

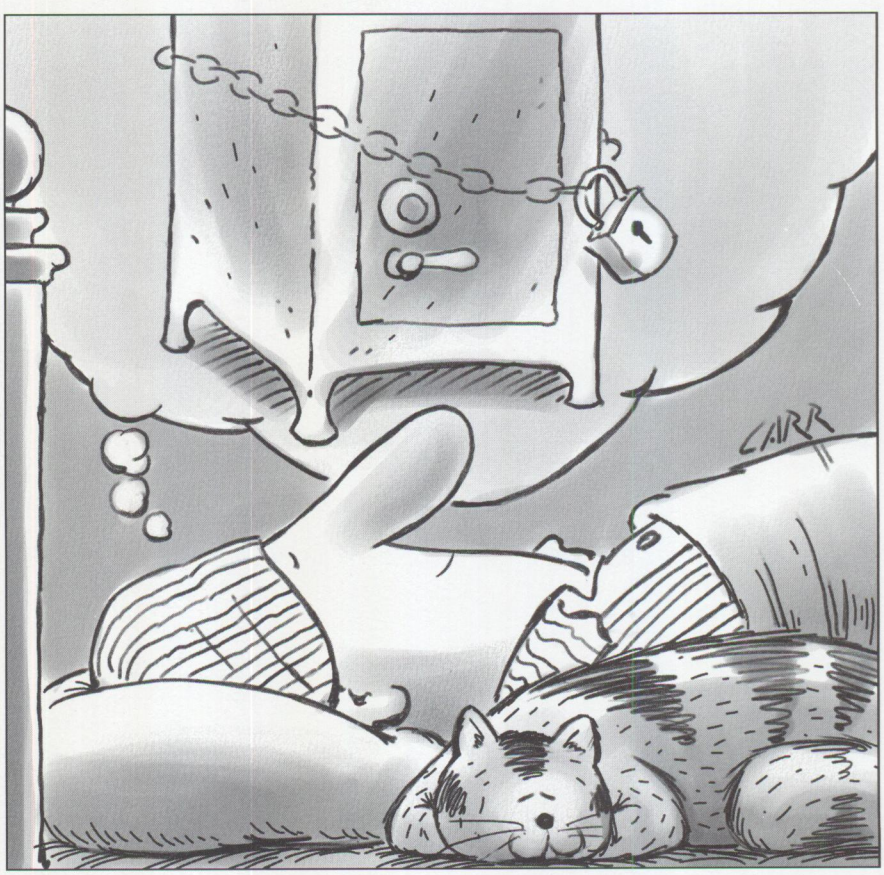
An account with *administrator* authority has full access to all directories and files. Access control systems are not enforced for users with administrator authority. Administrators have virtually unlimited access to everything in the system and can change anything they wish. Consequently, you should be careful about granting this authority.

Administrators can:

- Add or delete user accounts
- Set the account privilege level
- Set/reset passwords or implement password requirements
- Disable/enable user accounts
- Add, delete, and modify groups and their membership lists
- Set permissions on resources based on users and groups

User Privilege Level

Most accounts are created with *user* authority. At this level, accounts can't do



much more than use the resources set in place by an administrator. The privileges granted to an ordinary user account include:

- Log on/off domain
- View user profile (logon assignments, name, privilege level)
- Change own password
- Add comments
- Send messages

Administrators can grant a user account with privileges known as *operator rights*. These are extra rights and include one or more of the following: *accounts, server, print*, and *comm*. Each of these rights increases a user's capabilities but never grants the user the unimpeded access of an account with administrator privilege. Figure 1 summarizes the extra privileges granted with each right.

Operator	Privilege
Accounts Operator	A user with *accounts* operator privilege can manage users and groups within the domain. This user can add, modify, or delete users and groups but cannot create or modify user accounts with administrative or operator privilege. The user with accounts operator privilege can manage user and group accounts from UPM or from the command line.
Server Operator	A user with *server* operator privilege can manage aliases and other shared resources and view network status within the domain. This user can create, modify, or delete aliases or other shared resources. The user with server operator privilege can manage shared resources and view network status from the command line.
Print Operator	A user with *print* operator privilege can manage print queues and print jobs. This user can create, modify, or delete print jobs or queues on servers within the domain and can share print queues and manage remote jobs on shared queues. The user with print operator privilege can manage queues and print jobs from either Print Queues (printer objects) or the command line.
Comm Operator	A user with *comm* operator privilege can manage serial devices. This user can share serial devices and manage remote jobs on shared serial devices from the command line.

Figure 1. Privileges Granted with Operator Rights

Adding Operator Privileges to a User's Account

Adding operator privileges to a user-level account can be done from the command line using the following one-line command (separating multiple arguments by commas):

```
NET USER USERNAME
  /OPERATOR:{ACCOUNTS,
  COMM,PRINT,SERVER} <Enter>
```

Another, easier method of adding operator privilege is to use the LAN Server 4.0 graphical user interface (GUI). This user account property can be brought up by using the following sequence:

1. Open the LAN Server Administration icon.
2. Open the domain icon (the icon with the name of the domain).
3. Open the User Accounts folder.
4. Open the icon for the user account to receive operator privileges.
5. Select the Privileges tab.
6. Select the added/removed operator privileges.

Figure 2 shows the LAN Server Settings page for operator privileges.

Tip! Never grant operator rights to an administrator, because it will remove his or her full administrator privilege permanently. If you accidentally do grant operator rights to an administrator account, you will have to delete the account and recreate it to restore its capabilities.

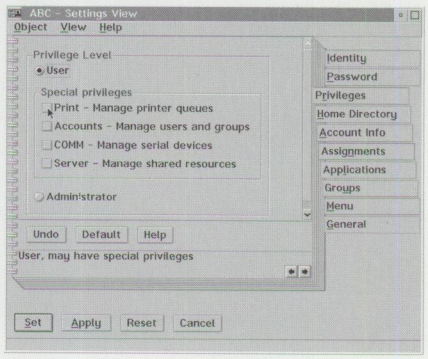


Figure 2. Operator Privileges Settings Page

Guest Privilege—Visitors Only

The *guest* operator privilege is a special account type that is normally reserved for users who attempt to use a server within a domain but who don't have an account on that machine. There is normally only one guest account (called Guest) on a LAN Server domain. The guest account may be totally disabled, or a required password can be supplied to improve the security of your system.

Although the GUI does not allow it, you can have multiple accounts with guest privilege. To create an account with guest privilege, use the following command:

```
NET USER USERNAME /PRIVILEGE:GUEST
```

Having multiple guest accounts might be used to provide more than one type of limited guest access.

How Privileges Affect Permissions

We will look at the access control list system later in this article, but it is important to know at this point that special groups are created based solely on privilege.

The default groups based on security level are *users, admins,* and *guests.*

All users, including administrators, are members of the admins group. You cannot add a user to this group or delete a

Command	Description
/FORCELOGOFF:minutes|NO	Causes all user sessions with the specified account to be forced off the network after the period of time specified by minutes has passed following an account expiration or a logon time that is not valid. See the /TIMES parameter described in the NET USER command for information about how to specify valid logon times. The NO option prevents FORCELOGOFF from working. The /FORCELOGOFF parameter disconnects all the user's sessions at the server but does not log off the user. The sessions are disconnected and automatically reconnected when the user's next logon time frame occurs. For example, if a user can log on only between 8 a.m. and 5 p.m., /FORCELOGOFF:10 disconnects the user's sessions at 5:10 p.m., but the user's sessions are reconnected at 8 a.m.
/MAXPWAGE:days|UNLIMITED	Sets the maximum time (in days) that a password is valid. The UNLIMITED option means there is no maximum time. Conversely, /MINPWAGE:days sets the minimum time (in days) that must pass before a user can change a password.
/MINPWLEN:length	Sets the minimum number of bytes for a user account password. The range is 0 to 14, and the default is 4. A zero-length password means that a user can be defined without a password. User Profile Management accepts passwords up to 8 bytes for the minimal character set and up to 14 bytes for the extended character set. The restrictions to the password length entered here control the passwords allowed in the NET PASSWORD and NET USER commands.
/UNIQUEPW:number	Sets the number of old passwords stored by the system for each user. The range is 0 to 8. This number specifies how many unique passwords must be used before one can be reused.

Figure 3. NET ACCOUNTS Command Arguments

member from this group except at initial account creation. By default, admins group members have access to everything in the system.

The users group is received by all accounts that are neither administrators nor guests. Even servers themselves are members of the users group. You must be careful not to inadvertently grant access to the users group, because it will grant universal access to all non-guest users.

One security hole that should be closed during setup is to turn off all of the privileges granted to the guests group, except those that are specifically desired.

User Modals—Security Policies

One misunderstood LAN Server area is its domain security policies, also known as *user modals*. LAN Server provides an adjustable set of policies for both workstations (used in peer-to-peer) and for a LAN Server domain as a whole. These settings can be changed from the command line using the NET ACCOUNTS command and via C and REXX programs using the LAN Server application programming interfaces (APIs).

To change a domain's security policy, you must use the NET ACCOUNTS command at the domain controller console or via remote execution using the NET ADMIN command with the NET ACCOUNTS command as the command argument. If you attempt to use the NET ACCOUNTS command at a requester workstation, the security policy of only that workstation will change, but it will really have no effect unless there is a peer-to-peer access of the workstation.

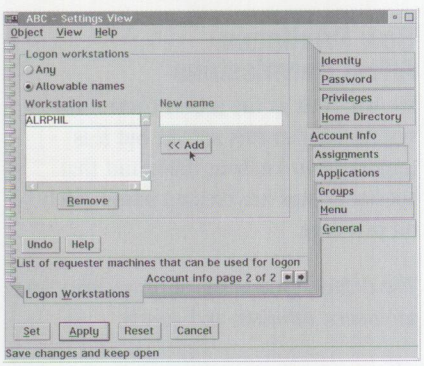


Figure 4. Account Info: Logon Workstations

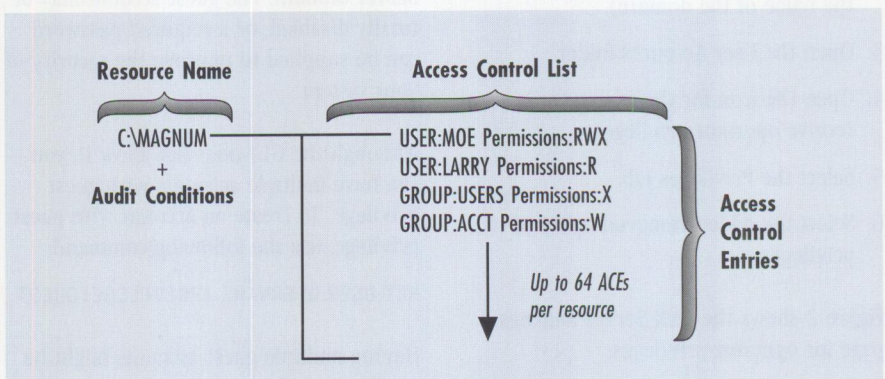


Figure 5. Structure of an Access Control List (ACL)

Figure 3 describes the arguments for the NET ACCOUNTS command.

Logon Hours

One of LAN Server's least used features is the logon hours feature, which allows you to restrict the hours any specific account uses. You can set the allowable logon hours and days with a one-hour granularity.

The logon hours restriction is controlled via the command: NET USER USERNAME /TIMES:ALL | Days,hours. This command must be executed for each user to enforce the logon hours restriction.

Limiting User Access to Certain Workstations

Another rarely used feature is workstation restriction. You can limit a user account to specific workstations with the NET USER USERNAME /WORKSTATIONS:* | NAME1,NAME2... command. It can also be set via the LAN Server 4.0 GUI using the following sequence:

1. Open the LAN Server Administration icon.
2. Open the domain icon (the icon with the name of the domain).
3. Open the User Accounts folder.
4. Open the icon for the user account that is to receive operator privileges.
5. Select the Account Info tab, and go to the second page.
6. Add the workstation names via the dialog page.

Figure 4 shows the Account Info page for logon workstations.

Access Control Lists

Access controls let you control access to resources on the server. The implementation of the system is simple. You can grant permissions to both users and groups. You can have up to 64 permission entries (called *Access Control Entries* [ACEs]) per resource. This restriction of 64 permissions per resource is removed when using 386HPFS.

Resources that have permissions include serial ports, printer queues, disks, directories, and files. The most common level of permission is the directory for disk devices. Figure 5 illustrates the relationship between resources and permissions, and Figure 6 outlines the different permissions and their functions.

Permission	Description
Delete (D)	Permits deleting subdirectories and files.
Attributes (A)	Permits changing OS/2 file attributes such as A (archive), R (read only), and related file information such as the time and date the file was updated. Also, some applications may require attributes permission to copy files.
None (N)	Denies access to the resource.
Execute (X)	Permits running (not copying) program or command files such as .EXE or .COM files. *Note:* Read permission, in addition to execute permission, is required for users to run .BAT files, .CMD files, and DOS applications.
Read (R)	Permits reading and running files in a directory plus copying files from a directory but not writing to (modifying) files. Lets users view file names in a shared directory. Used alone, read lets users view or run programs only.
Write (W)	Permits writing to (modifying) a files resource in a shared directory. Used alone, write lets users modify files but not read, run, create, or delete them. Use write with read permission in most cases; always use the combination when editing files. Files resources with write permission also need attributes permission if they are used in applications that change file attributes.
Create (C)	Permits creating subdirectories and files in a shared directory. Used alone, create lets users create a file in a directory and modify the file during its creation. Once a file is created and closed, however, the same user cannot modify it again. To write to a serial device, users must have both C and W permissions.
Permissions (P)	Permits changing resource access permissions, giving a user limited administrator authority over the resource. A user, however, cannot create an access control profile.

Figure 6. Access Control Permissions

Permission	Files	Printers	Serial Devices	Named Pipes
None (N)	X	X	X	X
Execute (X)	X			
Read (R)	X		X	X
Write (W)	X		X	X
Create (C)	X	X	X	X
Delete (D)	X			
Attributes (A)	X			
Permissions (P)	X	X	X	X

Figure 7. Access Permissions Applicable to Resource Types

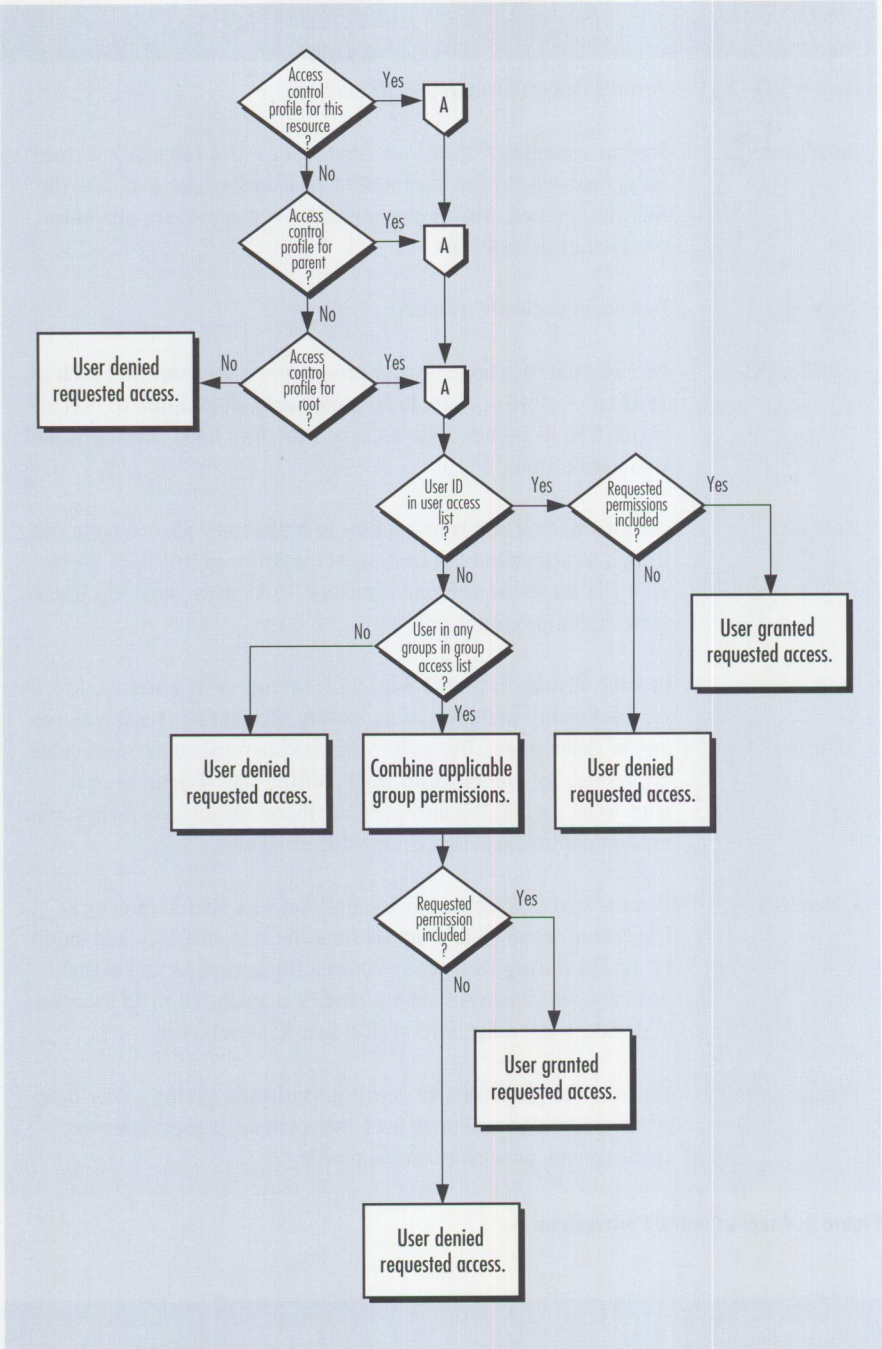


Figure 8. How a User is Granted Access to a Files Resource

As you look through the different permission types, you can see that some of the permissions do not apply in all cases. For example, it makes no sense to give a printer or a serial port execute permission (no, you cannot execute a print job!). Figure 7 outlines the different permissions that can be applied to the different resource types.

The hardest task for the access control system is determining whether a user has enough permission to do what he or she needs to do. What makes this difficult is the logic behind the accumulation of permissions. Three rules are used to determine whether or not a user will have access to a resource:

- Permissions begin with the parent directory and accrue to the files within that directory if there are no specific permissions on the file.
- If a user, or a group that the user belongs to, has a specific lock out of a resource (`Permission=NONE` or `=N`), then all bets are off for that user–no permission is granted to the resource.
- A special case exists for the root of the drive. If you erase all of the permissions on a drive and place permissions on the root of the drive (i.e., `C:` [not `C:\`]), then all of the directories within that drive will receive the permissions of the root. This is a common trick used to share a CD-ROM drive without having to worry about its subdirectory structure.

The flowchart in Figure 8 describes the internal logic within LAN Server that determines whether access is granted to a file.

Adding/Deleting Access Controls

You can add permissions to a resource with either the GUI or via the command line (or you can write a program to handle permissions). The one-line command for controlling permissions is:

```
NET ACCESS RESOURCE ACTION
   USER/GROUP:Permissions <Enter>
```

For example, to add a new access control list to the resource `MAGNUM`, and also add the access control entry for Phil with read and write permission, use the following command:

```
NET ACCESS C:\MAGNUM /ADD PHIL:RW
```

To add another user to this resource, you can use the `/GRANT` action. For example, let's add Fred as a user with read authority:

```
NET ACCESS C:\MAGNUM /GRANT FRED:R
```

It is normal to have additional subdirectories below the one to which you have assigned permissions. These lower subdirectories, however, are not notified of your new users or groups unless you propagate the access control entries down the directory tree using the `APPLY` action. For example, to apply the permissions of Fred and Phil to all of the subdirectories below `C:\MAGNUM`, use the command:

```
NET ACCESS C:\MAGNUM /APPLY
```

To get an idea of the different actions that are possible with the `NET ACCESS` command, refer to Figure 9.

Using the GUI to Apply Permissions

The `NET ACCESS` command is very

powerful but is a bit intimidating to new LAN Server administrators. The easier method (in my opinion) is to use the GUI.

Using the GUI, modifying existing access control lists is pretty simple:

1. Open the LAN Server Administration icon.
2. Open the domain icon (the icon with the name of the domain).
3. Open the Resource Definitions folder.

At this point, you see existing permissions for aliases. When you double-click on this icon, you are presented with a notebook similar to that in Figure 10. By clicking on the Manage access button, you can bring up another notebook that holds the permissions for the resource, as shown in Figure 11.

In Figure 11, the first tab holds the identity of the resource and is not modifiable. The second tab, Permissions (see Figure 12), is where all of the action is. On this page, you can add users and groups, as well as set the permissions for the user/group.

When you have completed updating the members and their permissions in the access control list, you may want to switch to the Auditing tab and enable the appropriate auditing for this resource (see the Auditing section below for more details).

Once you are happy with the access control profile settings, click on the Set button. After pressing the Set button, you will be asked if you want to propagate the permission to all of the subdirectories. Before you click on OK, remember that this may be a lengthy process. Also, automatically applying permissions to subdirectories may overwrite permissions that you want to retain.

Tip! You can propagate the permissions of an alias by clicking on the Apply button at the bottom of the alias definition.

Problems with Access Control Lists

If you have been following along so far, you may be wondering how you modify the permissions of the files and subdirectories that are not aliases. Well, the answer is not in the LAN Administration objects at all (surprise!). Access control lists are controlled using the Drives object. Here's how you do it.

Action	Description
/TREE	Reports access control profiles with associated permissions for the specified resource and all its subdirectories.
/ADD	Creates an access control profile with associated permissions for users and groups to use the resource specified. You must create an access control profile before you can modify it. If access was previously given to a resource, use the /GRANT parameter to add more users.
/CHANGE	Changes the permissions of users or groups for a resource.
/GRANT	Adds new user names or group names, as well as corresponding permissions, to an existing access control profile. If access has not previously been given to a resource, use the /ADD parameter to add users.
/REVOKE	Removes the permissions granted to users or groups to use a resource.
/APPLY	Applies the access control profile of the specified directory to all the subdirectories under it.
/DELETE	Removes the access control profile for a resource from the access control database.

Figure 9. NET ACCESS Actions

First, open up the Drives object and locate a drive that is shared on the network (these are the drives with PCs behind them), as shown in Figure 13.

Open any network drive, and right-click on any subdirectory (or folder, to be more accurate). You will see a new option on the object menu: Manage access. Select the Manage access option, then complete the dialog as described previously. Simple? Indeed. Obvious? Maybe not.

Tip! Regular users cannot create access control profiles. Modifications of permissions should be left to administrators, because they are never restricted.

Auditing

Until now, we have looked at the mechanisms to control different users' access. Another, equally important function is resource usage monitoring, which is accomplished via the auditing functions built into LAN Server.

Events that are audited are:

- Service Status Changes
- Session Begins
- Session Ends

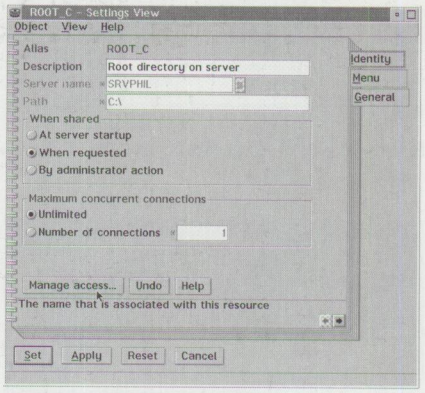


Figure 10. Alias Notebook

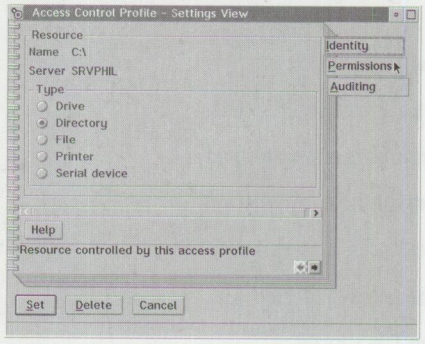


Figure 11. Resource Permissions Notebook

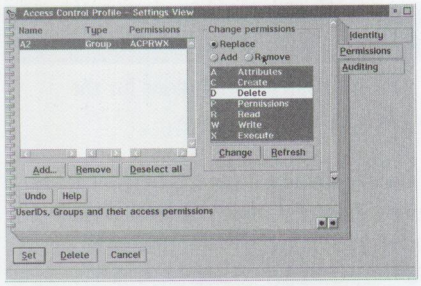


Figure 12. Access Control Profile Permissions

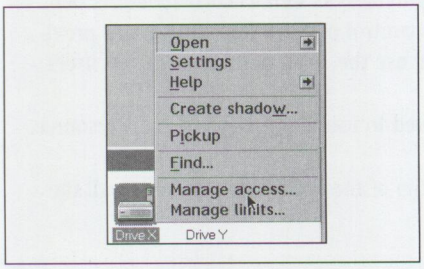


Figure 13. Example Network Drives Object

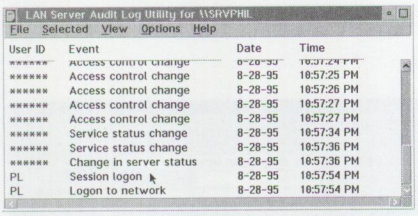


Figure 14. Audit Log—Main Screen

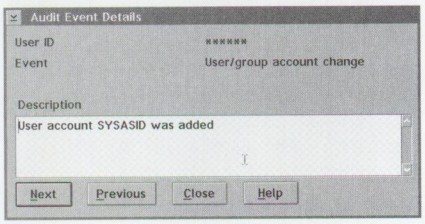


Figure 15. Audit Log—Details

- Password Error
- Connection Started
- Connection Stopped
- Connection Rejected
- Access Granted
- Access Rejected
- File Closed
- Service Status Code or Text Changed
- Access Control List Modification
- User Account Subsystem Modification
- Network Logon Record
- Network Logoff Record
- Network Logon Denied
- Account Limit Exceeded

The auditing information is kept in an audit log that defaults to 100 KB. The audit log is a circular list of events; when the log becomes full, the oldest entries are reused. You can change the audit log size in the `IBMLAN.INI` file by modifying the `maxauditlog=` parameter. You can also change the audit log size when you start the domain controller via the `NET START SERVER MAXA(UDITLOG):n` command (where `n` denotes the maximum size, in KB, of the audit log file).

Auditing is normally turned off. You can enable it either by starting the server with the command `NET START SERVER /AUDIT:YES` or by changing the parameter `AUDITING=NO` to `AUDITING=YES` in the `IBMLAN.INI` file.

Tip! To turn on auditing, you must issue a `NET STOP SERVER` command, followed by a `NET START SERVER /AUDIT:YES` command.

To review the contents of the audit log, you can use either the `NET AUDIT` command, or you can use the GUI interface to the audit log. If you are not running at the domain controller, you will need to use the `NET ADMIN` command to remotely run the `NET AUDIT` command.

The GUI Audit program will inform you about its inability to run from the requester and then offer to run remotely from the domain controller.

To use the GUI interface, double-click on the Audit Log icon. If the audit function was started, you should see a screen similar to the one in Figure 14.

Notice that the list in Figure 14 breaks down the entries by user ID, event, date, and time. To get the specifics of a particular audit log entry, you can double-click on the entry. For example, by double-clicking on the User/group account change, you can see the details, as shown in Figure 15.

Tip! One of the reasons that administrators turn auditing off is because of the extra overhead and the lack of tools to deal with the audit log information. You have two operations, though, in LAN Server. First, you can select the events that go into the audit log by modifying the parameter to the right of the `auditing=` in the `IBMLAN.INI` file or on the `NET START SERVER AUDIT:event` command line. The audit event options are summarized in Figure 16.

The syntax of the one-line command is:

```
NET START /AUD(ITING):
  YES|NO|event(,...) <Enter>
```

When you set the `/AUDITING` parameter with the `YES` option, the audit log records information about all of the event types represented by the options shown in Figure 16. If you specify `NO` with this parameter, auditing is stopped (this is the default). To record information about specific event types, you can set the `/AUDITING` parameter with one or more of the following event options.

Tip! The audit logs are normally not used for anything other than error tracing because of the unusable format of the data presented via the Audit Log utility. A new program from Lieberman and Associates, called Intensive Care Audit for IBM LAN Server, runs on the server to collect the audit data and feed it into a relational database of your choice. The program breaks down each event type into a separate database table and provides a summary database format. With the Intensive Care Audit tool, audit log rollovers are eliminated, since the data is captured before the data is lost. Reports can then be prepared using the reporting tools of the database chosen. Details about the product can be obtained from this article's author (see biography at the end of the article).

Auditing Resources

The auditing just described provides events filtering; however, you can also control which resource access will generate audit events at the same time you add the permissions to a resource (described previously). You can also modify resource auditing via the `NET ACCESS` command with the parameters listed below.

`/TRAIL:YES|NO`—Turns auditing on or off for a resource. If the `/TRAIL` parameter is not specified, all successful and unsuccessful resource access attempts are audited.

Do not use the /TRAIL parameter with the /SUCCESS or /FAILURE parameters.

/FAILURE–Audits failed resource access attempts. Specifies the type of information being audited by using one or more of the following values, separated by semicolons:

- OPEN–Audits failed attempts to open shared files
- WRITE–Audits failed attempts to write to shared files
- DELETE–Audits failed attempts to delete shared files
- ACL–Audits failed attempts to change permissions for a shared resource

The following /FAILURE parameter values cannot be used with any other value:

- ALL–Audits all failed resource attempts
- NONE–Disables failure auditing

/SUCCESS–Audits successful resource access attempts. Specifies the type of information being audited by using one or more of the following values, separated by semicolons:

- OPEN–Audits successful attempts to open shared files
- WRITE–Audits successful attempts to write to shared files
- DELETE–Audits successful attempts to delete shared files
- ACL–Audits successful attempts to change permissions for a shared resource

The following /SUCCESS parameter values cannot be used with any other value:

- ALL–Audits all successful resource attempts
- NONE–Disables success auditing

Controlling and Monitoring Your LAN

As you have seen, LAN Server provides a rich set of protection and audit mechanisms. The trick is enabling the appropriate functions (and now you know where they are). Using these control and auditing features, you can control and monitor your LAN to your heart's content!

Option	Description
Logon	Includes Netlogon and Sesslogon. Records each time a user starts or stops one of the server's services. Logon is a superset of Netlogon and Sesslogon.
Logonlimit	Records each time a user exceeds logon hours for the user account.
Netlogon	Includes Badnetlogon and Goodnetlogon. Records each time a user logs on to the network. Netlogon is a superset of Badnetlogon and Goodnetlogon.
Badnetlogon	Records each time a user fails in an attempt to log on to the network.
Goodnetlogon	Records each time a user successfully logs on to the network.
Permissions	Records each time a user makes changes to the list of permissions for a file.
Resource	Records each time a user accesses a resource in a way that is defined in the auditing options for the resource.
Service	Records each time a user starts or stops one of the server's services.
Sesslogon	Includes Badsesslogon and Goodsesslogon. Records each time an attempt is made to start or end a session with the server. Sesslogon is a superset of Badsesslogon and Goodsesslogon.
Badsesslogon	Records each time a user fails to start a session with the server.
Goodsesslogon	Records each time a user starts a session with the server.
Use	Includes Baduse and Gooduse. Records each time a user uses a shared resource. Use is a superset of Baduse and Gooduse.
Baduse	Records each time a user fails in an attempt to use a shared resource.
Gooduse	Records each time a user successfully uses a shared resource, except where the resource allows for an unlimited number of uses.
Userlist	Records each time a user makes changes to the user accounts database.

Note: It is not valid to include two options together when one implies the other (for example, Use and Gooduse).

Figure 16. Audit Event Options

Philip Lieberman is a well-known author, lecturer, and consultant. Mr. Lieberman is also the owner of Lieberman and Associates, which produces the LAN Intensive Care Utilities for IBM LAN Server and Intensive Care Audit for IBM LAN Server products. His organization also provides end-user support, corporate software development, and all types of training services for OS/2 and OS/2 products. Mr. Lieberman can be reached at:

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Road Trip! Shopping the Internet	❑	❑	❑	❑	❑
Command-Line Commando	❑	❑	❑	❑	❑
Technical					
Getting Warped and Connected Too!	❑	❑	❑	❑	❑
Infrared: LANs Without Wires	❑	❑	❑	❑	❑
Security and Auditing in IBM LAN Server	❑	❑	❑	❑	❑
Multi-User Performance Testing in a Client/Server Environment	❑	❑	❑	❑	❑
DCE Cell Performance: High Water Marks	❑	❑	❑	❑	❑
Plug & Play in PC DOS 7	❑	❑	❑	❑	❑
Little Solutions					
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Multi-User Performance Testing in a Client/Server Environment

This article discusses an often overlooked but critical ingredient of developing a client/server environment–the need to conduct a multi-user performance test before putting the client/server system into production. The author cites cases in which failure to implement this test caused significant problems and expenses after rollout.

Client/server computing growth continues to accelerate at an enormous rate, bringing with it complex technical challenges to the entire systems management process. Companies start client/server system development projects to provide better quality, efficient, and user-friendly systems. However, once their systems roll out, many companies find that their technical support desks are swamped with performance problems and availability complaints. Why does this happen? What goes wrong?

Bruce Huang
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A decade of experience with client/server performance issues has taught me that the common mistake is failing to conduct a multi-user performance test prior to the product rollout. Implementing a multi-user performance test is an essential step toward minimizing potential business risks, and it should be built into all client/server system development projects.

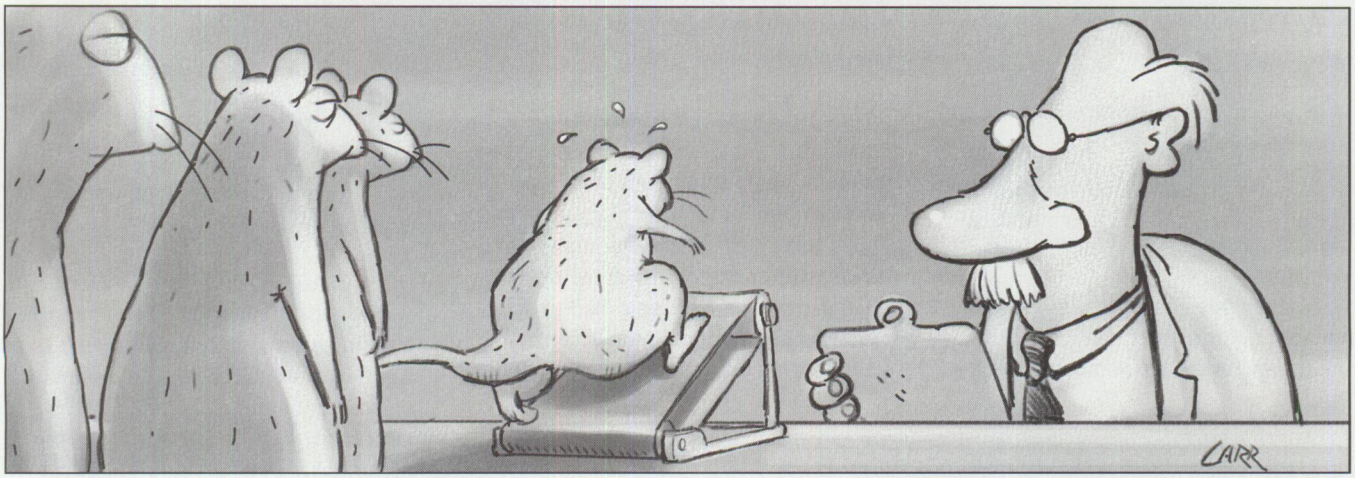
A multi-user performance test validates the entire client/server system under a stress environment in which multiple client workstations simultaneously send different requests to the server to simulate an actual production workload. This time-consuming test requires skills and resources, but it is essential to achieve the following key management objectives:

- Satisfying end users
- Improving overall user performance
- Maximizing return on investment

Multi-User Performance Test Components

The three key components of a multi-user performance test are to validate:

- Repetitive end-user scenario
- Product integration
- End-user performance/capacity



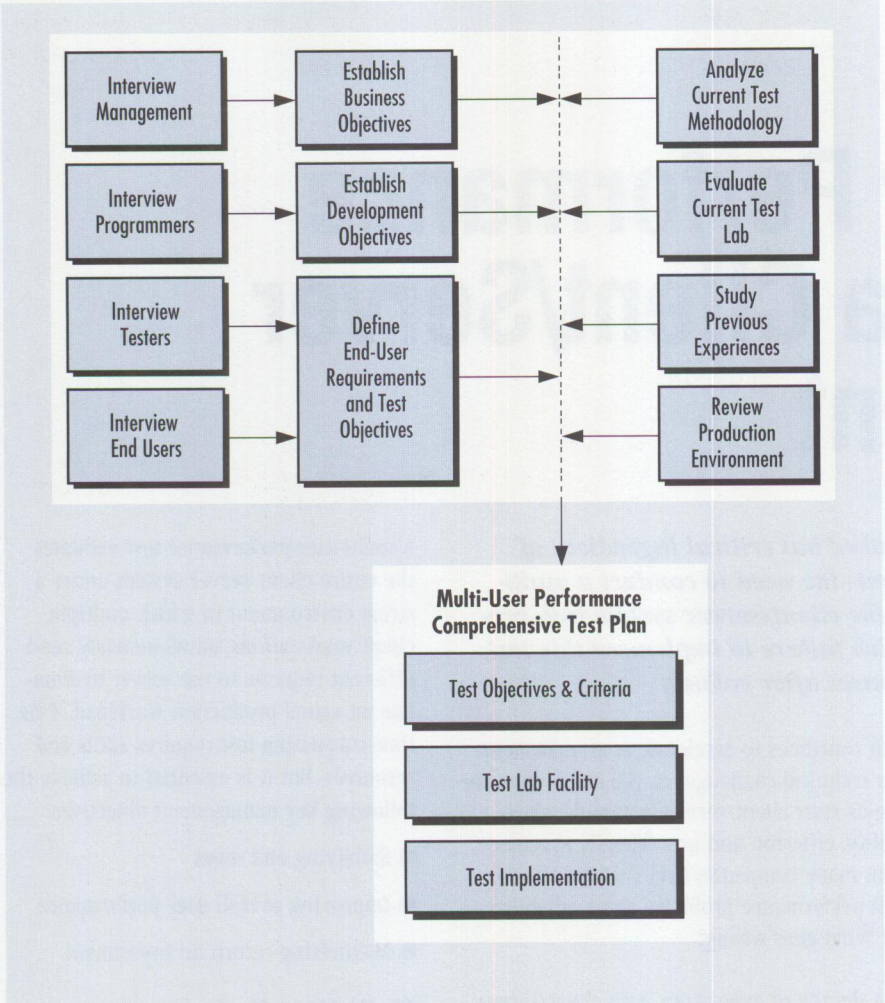


Figure 1. Methodology for Developing a Multi-User Performance Test Plan

Repetitive End-User Scenario Validation

With an automated, non-intrusive client/server test tool such as the IBM Solutions Evaluation Tool (SET)[1], you can drive an end-user scenario repeatedly to test for the following potential problems:

- Interrupt conflicts
- Memory address conflicts
- Memory leakage
- Inefficient system resources allocation and de-allocation
- Excessive dynamic resources allocation (common in graphical user interface [GUI] applications)

A recent engagement with a major life and casualty insurance company illustrates how serious these problems can be. The company was unable to duplicate a field-reported error until we tested the application in the manner just described. We found that, under certain circumstances, the system always hung at the 54th invocation. It was very expensive to correct this type of problem in a production environment. If the problem had been discovered before the rollout, the correction cost could have been 80 percent less.

Product Integration Validation

A complex client/server system runs more than one application. For example, an office system for an insurance company might include an insurance claims application, a word processor, a spreadsheet, a calendar, and an electronic mail package. Will the insurance claims application cause any systems conflicts or capacity or performance problems, running concurrently on the same client workstation?

Only testing can tell prior to putting the system into production. In one case where the client skipped multi-user testing, we encountered numerous system and application traps while running multiple applications concurrently.

We have also found that the recommended network optimization parameter value for an application can be a bottleneck for other applications executing concurrently.

End-User Performance/Capacity Validation

Key factors dictating client/server system capacity are:

- System and network resources availability
- End-user perceived response time

In complex client/server environments, having a fast CPU with the maximum installable amount of system memory and disk storage does not always translate into the best system performance and capacity. Sometimes it can actually become a bottleneck, due to system overhead required for excessive system resources management. It is more efficient to determine the system requirements with real data prior to spending a fortune on unnecessary hardware. A multi-user performance test provides an in-depth view of the system's characteristics, and the data collected can be used to determine:

- CPU, system memory, and disk storage requirements
- Server placement and network topology requirements
- Number of users per server and, therefore, the number of servers required
- An optimal network and system configuration for maximizing performance
- End-user perceived response time and server transaction rate

Often we concentrate only on understanding the capacity of a server system, ignoring potential performance issues on client workstations. As the complexity of workstation programming environments grows, the possibility of finding performance bottlenecks on the client

[1] *The IBM Solutions Evaluation Tool is a hardware driver designated to simulate end-user activities and to monitor system responses in a multi-user environment.*

workstation increases. A multi-user performance test exercises the entire client/server system in an end-to-end environment, validating the server, the client workstation, network infrastructure, system software, and end-user applications.

The performance benefits gained from performance testing can be great. For instance, in an engagement with a major information processing company, we found a client workstation performance bottleneck after excessively allocating and de-allocating unnecessary system resources. Correcting this error with a change in the program implementation resulted in a 75 percent performance improvement in end-user response time.

Multi-User Performance Test Planning

Careful planning is the key to a successful multi-user performance test project. A comprehensive test plan is a document that describes the results of the planning. The three major components of a comprehensive test plan are:

1. *Test objective and criteria planning.* The first step toward a successful performance test project is to clearly understand your:
   - Overall test environment
   - Test objectives and methodology
   - Production workload
   - Success criteria for test entry and exit
   - Project deliverables
2. *Test lab facility planning.* Rapid changes in computer technology make it difficult for any test lab to have a comprehensive facility set up to respond to every test requirement. Therefore, it is essential to establish an alternate plan for acquiring all the necessary hardware, software, tools, and skills requirements.
3. *Test implementation planning.* Performance testing is a time-consuming process. All specific work items, daily schedules, and individual responsibilities must be well defined prior to the test.

A Proven Methodology

Figure 1 shows a proven methodology for developing the comprehensive multi-user performance test plan just described. This methodology was developed by the Solutions Validation Lab, an IBM integrated services offering to assist customers in all phases of client/server performance test and analysis. For more information about Solutions Validation Consulting Services or client/server performance, contact Bruce Huang at (817) 961-6407 or via the Internet at bkh@vnet.ibm.com.

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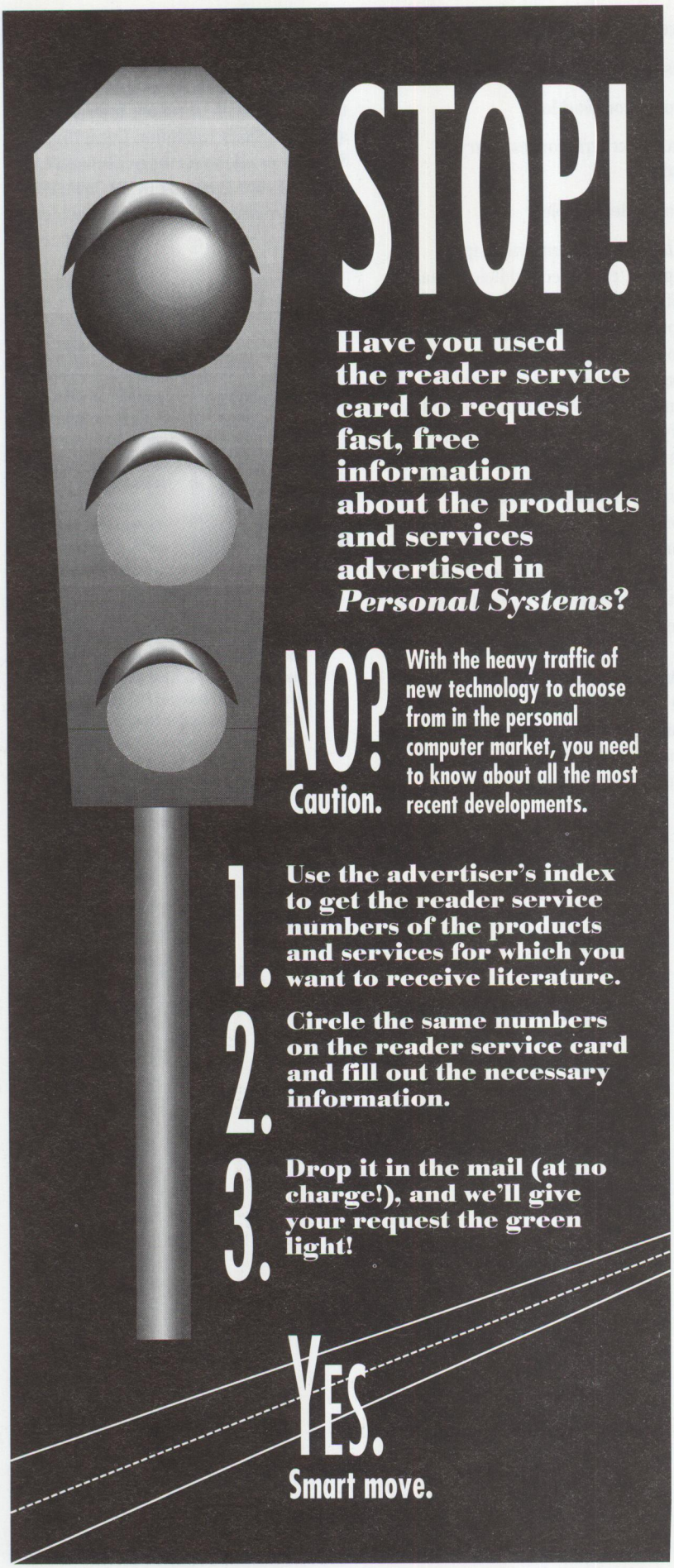

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DCE Cell Performance: High Water Marks

Will DCE Security and Cell Directory Services handle the needs of a 10,000-user enterprise? This article discusses the tests and environments designed to address this performance and capacity question. This study yields some hardware and configuration high water marks that can be helpful in planning large-scale cell topologies.

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Many large businesses are preparing to consolidate their corporate networks into a single Distributed Computing Environment (DCE) cell, some under the administration of OS/2 Warp Server, which is optionally supported by DCE Directory and Security Services (DSS). OS/2 Warp Server plus DSS is based on Open Software Foundation (OSF) DCE 1.1. It entered beta testing in September with general availability planned for December. The DSS-enabled OS/2 Warp Server client is being shipped at the same time.

Recently, a large IBM customer, which I will call BigCo, decided to consolidate its enterprise under OS/2 Warp Server with DSS. BigCo has a 10,000-user LAN environment, however, and the capacity and performance limitations of the current LAN Server 4.0 (LS4) domain control and administration subsystems prevented it from expanding to a 10,000-user domain.

With OS/2 Warp Server and DSS, the domain security and directory functions will be replaced by DCE Directory and Security Services. BigCo's LS4 domain control database (DCDB) and `NET.ACC` will be migrated into the DCE Cell Directory Service (CDS) namespace and the DCE Security registry. Existing clients don't need to be upgraded, because the replacement of BigCo's current LS4 subsystems will be transparent to existing local area network (LAN) requesters.

This study evaluates the capacity and performance of the underlying DCE services OS/2 Warp Server uses relative to BigCo's planned 10,000-user environment.

Customer Requirements

BigCo, like many enterprises, is preparing to consolidate a large corporate network, consisting of several LAN Server domains, into a single DCE cell.

The core of BigCo's network is a 16 Mbps Token-Ring backbone with several local departmental LAN segments. A larger fiber-optic network ties the metropolitan area's LAN segments and several remote offices through 56 KB and T1 wide area networks (WANs).

At the heart of BigCo's network is a LAN segment containing the LAN Server domain controllers, database, print, file, and Lotus Notes servers. BigCo gave me transactional and network utilization data about its current server LAN segment, which helped me to structure a meaningful workload and lab environment.

BigCo Statistics

The following BigCo statistics are interesting in the context of this study.

BigCo provided graphs of daily LAN Server domain logon activity. The aggregation of the peak-hour activity for each of BigCo's five major LS4 domains is 1,534 logons per hour.

The Sniffer analysis of BigCo's 16 Mbps server LAN segment shows its network is 43 percent utilized, with 1,453 frames per second and 587 bytes per frame. There were 922 active network addresses.

To populate the DCE Security registry and CDS namespace, I used statistics from other LS4 customers. These statistics indicate an average of 50 users per domain in the LS4 security database (`NET.ACC`). The average population of the DCDB is eight shared resources per domain and one subdirectory per user.

Considering these populations and BigCo's requirements, the initial population of the DCE test cell for each 1,000 users will be 1,000 accounts. Principals will be divided into 20 groups in the DCE Security registry. The DCE Cell Directory namespace will contain 900 directories and 100 objects.

In reality, a pure OS/2 Warp Server environment will have a much different mixture of DCE directories and objects. Each OS/2 Warp Server domain controller will create only nine CDS directories, and all aliases, names, and resources will be stored in these directories as DCE objects. Therefore, these tests were conducted under the worst-case assumptions for memory, disk, and performance.

The DCE configuration program for DCE clients and DCE-enabled OS/2 Warp Server clients creates one directory and four objects on behalf of each configured client. Some hints for managing the resources and `/.:/hosts` directory tree performance will be discussed in the "DCE Cell Directory Services Performance" section later in this article.

Testing Approach

To make these tests interesting, I chose to measure the system in its fully loaded condition, running a modified version of our point of sale (POS) benchmark application.

It was necessary to reduce the average POS Remote Procedure Call (RPC) data size of 3,250 bytes to keep from exceeding the 16 Mbps Token-Ring capacity at throughput levels consistent with 10,000 users. I reduced the size by eliminating the POS Catalog RPC, which transfers 16,384 bytes of data. This also reduced the average number of RPCs per customer sale from 5.5 to 4.5 and reduced the data size to 329 bytes, which is more consistent with BigCo's 567 bytes per frame on the network. The network utilization in my tests ranged between 25 percent and 40 percent, which is consistent with the utilization reported by BigCo.

An optional function of the POS benchmark is to periodically perform a DCE Login. For these tests, the frequency was set at one randomly distributed DCE Login for every 15 customer sales. Each time a DCE Login was performed, a different principal name was used from the full population of the DCE Security registry. In a one-hour test of the 90 MHz Pentium DCE Security server, 25,920 DCE Logins were performed with a population of 10,000 principals, thus providing full coverage of the DCE Security registry.

The POS benchmark performs one CDS namespace lookup of a CDS object for every customer sale. Since POS does not perform CDS directory lookups, I created a script to randomly list directories and subdirectories from the full CDS population in order to avoid artificially efficient caching by the CDS primary and secondary servers.

Cell Population

In a DCE cell of 10,000 users, the memory and disk sizes of DCE Security and CDS databases become quite large and must be considered when planning hardware and system needs.

DCE Security accounts and principals require 1 KB each, or 10 MB for 10,000. Therefore, for these tests, a 32 MB DCE Security server is sufficient–16 MB for OS/2 and DCE plus 10 MB for the registry.

There are two types of DCE CDS entities: objects and directories. Objects, which include exported programs, aliases, names, and resource definitions, require 1 KB each, or 10 MB for 10,000. Directories require 14.2 KB each, or 142 MB for 10,000.

When the namespace is distributed across several CDS replicas, the memory requirement for each replica needs to be just enough to contain the directories assigned to that CDS replica. For example, for one CDS primary server and nine CDS secondary servers with 10,000 subdirectories distributed evenly on the 10 replicas, only 14.2 MB are required for the CDS namespace on each replica.

Note: A DCE cell has one primary CDS server and may have one or many secondary servers. All CDS primary and secondary servers are referred to as replicas. Each replica contains the cell root directory and may contain all or some of the directories that make up the total CDS namespace.

The root directory for the cell is replicated on all the servers. Therefore, memory adequate for the root contents also needs to be considered. In these tests, 1,000 CDS objects were added to the root directory, placing a 1 MB additional requirement on all 10 CDS replicas. For example, 16 MB for OS/2 and DCE plus 1 MB for the root directory plus 142 MB for 10,000 directories equals 159 MB. If the namespace is distributed across 10 replicas, then the 142 MB can be divided by 10; therefore, 14.2 MB plus 17 MB equals a 31.2 MB memory requirement for each replica.

The `/.:/hosts` directory tree created by DCE configuration was moved to a dedicated CDS replica.

Due to the available memory on our test hardware, I ran some of the tests with a full population of 10,000, while others ran with a reduced population of 1,000. I performed sufficient testing to quantify the performance difference between the two population levels and to provide a simple algorithm to bridge them.

In the tests with a CDS primary and some number of CDS secondary servers, half the number of directories and subdirectories were created on each server, and each server's top directory was replicated on one other CDS server. By having the top directory replicated on another server, DCE automatically maintains its contents on the second replica.

For example, in the test with one CDS primary and eight secondaries (described in

the "CDS Performance without CDS Client Cache Refresh" section later), each CDS replica contains one top directory, `/.:/TestDir0` to `/.:/TestDir8`. Each of these directories contains 500 subdirectories, `/.:/TestDir0/D1000` to `D1499`. Also, each CDS replica contains a read-only copy (replica) of the tree from one other server. Finally, each replica has a copy of the 1,000 objects in the root directory, `/.:/TestObject000` to `TestObject999`.

The total CDS population was 1,000 objects and 9,000 directories.

Because I used IBM DCE 1.2 for OS/2 and AIX for these tests, replication of the DCE Security server is not yet available. I used a single DCE Security server in all the configurations tested. In the first release of OS/2 Warp Server, security replication will be supported; it is currently available on DCE/6000 for AIX 1.3. Also, in the first release of OS/2 Warp Server, at least one OS/2 DCE Security replica will be required to support the function required by LS4 legacy servers and clients.

Initial DCE Security replication tests have been conducted on the OSF 1.1 base currently available for AIX and in beta testing for OS/2. These tests indicate that the scale-up characteristics of DCE Security replication will be similar to the CDS replication characteristics presented in this article.

I used a variety of OS/2, AIX, and Windows DCE clients to drive the workload for these tests. In all, 56 physical clients were used, and each client ran one or more client processes. There were 200 logical sessions. The combined horsepower of these clients was sufficient to drive about 8,500 POS customer sales per minute. This was enough to fully utilize the lower-horsepower DCE server configurations but not some of the high-end RISC System/6000 configurations.

Measurement Methodology

My methodology in the following tests was to measure the system performance in a busy state. In addition to the metrics shown in Figures 2, 5, 6, and 7, other performance factors, which occur while the tests are running, must be considered. Figure 1 is a conversion table to determine the other workload factors from the metric of interest in Figures 2, 5, 6, and 7.

Customer Sales per Minute	RPC Calls per Second	CDS Lookups per Second	DCE Logins per Second	Percent 16 Mbps Network Utilized
8,000	933	139	8.9	80%
7,000	817	117	7.8	70%
6,000	700	100	6.7	60%
5,000	583	83	5.6	50%
4,000	467	67	4.4	40%
3,000	350	50	3.3	30%
2,000	233	33	2.2	20%
1,000	117	17	1.1	10%

Figure 1. Workload Conversion Table

DCE Security Performance

Three different OS/2-based DCE Security servers were measured: 486-33 MHz, 486-66 MHz, and a Pentium 90. I have not reported on any RISC System/6000 models due to insufficient client hardware to drive an interesting workload.

The DCE Security server performance, expressed as DCE Logins per second, is shown in Figure 2. The measurements were taken in a steady state while the DCE Security server was nearly 100 percent utilized. The DCE Logins per second in Figure 2 are based on a registry population of 1,000 accounts and principals. When the population was increased to 10,000, the throughput decreased by 18 percent, suggesting a 2 percent reduction in maximum performance for each additional 1,000 accounts and principals above the base of 1,000.

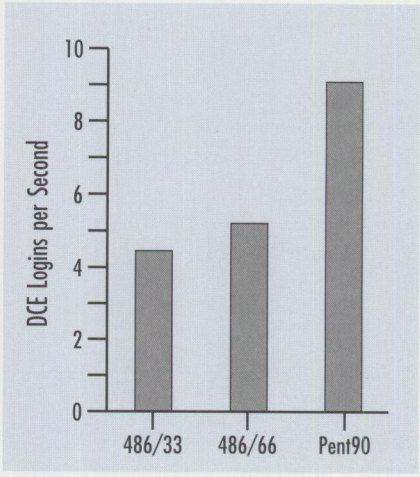


Figure 2. DCE Security Server Performance

DCE Login and other functions contacting the DCE Security server have two options for obtaining the network address of the DCE Security server. (The performance of both options for a 386-25 MHz client is shown in Figure 3.)

The first option (the default) is to look up the address of the DCE Security server from CDS. The DCE Security server location is stored in the CDS namespace as an object in the CDS root directory.

Using CDS to locate the CDS Security server every time it is needed has two negative performance impacts:

- The response time for the client is more than two times longer than when CDS is not used (see option 2 in Figure 3).
- The load on the DCE CDS server is quite high. For example, using a RISC System/6000 Model 570 CDS server with a DCE Login rate of 8,000 DCE Logins per hour, the DCE CDS server is 40 percent utilized with no other CDS activity.

The second option is to allow the DCE client to store the DCE Security server's address in a file, called `PE_SITE`, on the client's hard disk. The `PE_SITE` option is activated in the client's `CONFIG.SYS` file with a `SET BIND_PE_SITE=1` statement for IBM DCE for OS/2 1.2. In the OS/2 Warp Server product using OSF DCE 1.1, the statement will be `SET TRY_PE_SITE=1`; the installation default will be `1`.

The OS/2 Warp Server domain controller acts as the DCE client on behalf of any

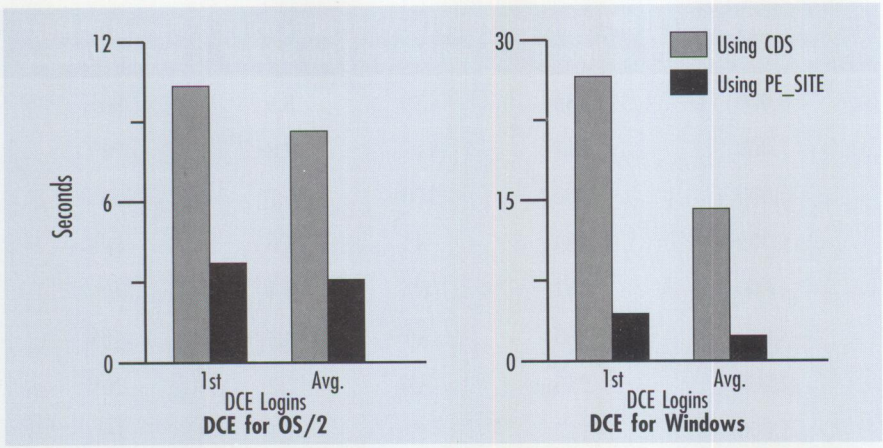


Figure 3. Performance Improvement with the PE_SITE File

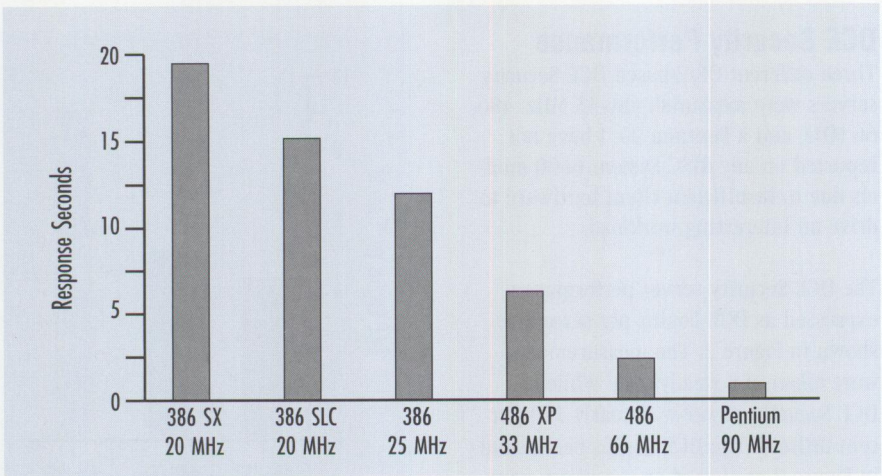


Figure 4. DCE Logins Not Using PE_SITE

legacy (LS4 and below) LAN requesters and additional servers.

In the next section, "DCE Cell Directory Service Performance," the results reflect option 2, using PE_SITE. If option 1 is used, 15 percent must be subtracted from the maximum "CDS Lookups per Second" reported in Figures 5, 6, and 7.

The peak DCE Login activity reported by BigCo was 1,534 LAN logons per hour, or 0.426 logons per second. Since the three OS/2-based DCE security servers tested can support 3.7 to 7.2 DCE Logins per second, I can assert that DCE meets BigCo's DCE Login requirements.

DCE Login's user response time depends upon the processor speed of the DCE client. Figure 4 shows the response times for a range of DCE for OS/2 hardware platforms. These measurements were made without using the PE_SITE file. If PE_SITE is used, the improvement would be consistent with Figure 3.

DCE Cell Directory Service Performance

The performance of the following DCE CDS configurations were tested:

- A stand-alone, single, primary CDS server
- A primary CDS server with three 486-66 MHz secondary servers
- A primary CDS server with one RISC System/6000 Model 990 secondary server
- A primary CDS server with six 486-33 MHz secondary servers
- A primary CDS server with eight 486-33 MHz secondary servers

The primary CDS servers studied were 486-66 MHz, Pentium 90 MHz, and RISC System/6000 Models 570, 580, and 990.

Each client has a local CDS cache containing some part of the CDS namespace on the client's hard disk.

DCE clients look up objects and directories in the CDS namespace in two ways:

- *Resolve the lookup in its local cache.* If the client fails to find the object/directory in its local cache, the client then calls the CDS server to request a new copy of some portion of the CDS namespace.

  In these tests, all requests were satisfied by the client's local CDS cache. This raises the question of why the CDS server is busy, since the client is satisfying the requests locally. Even though the client has the information in its cache, it must get permission from the CDS server to use the cached information.
- *Force the client to request a new cache from the CDS server.* This occurs when either the local cache does not contain the requested information, or the cache becomes too old and a refresh is forced. I forced the CDS refresh in these tests by setting the client's cache expiration age to 0 (zero) seconds.

The main difference between the two methods for DCE clients to look up objects and directories is that the first way doesn't retrieve any data from the server's namespace.

The CDS performance data is presented in both ways, "with CDS refresh" and "without CDS refresh."

General Observations on CDS Performance Results

In the following observations of performance results:

- The throughput shown in Figures 5, 6, and 7 reflects nearly 100 percent CPU utilization of the primary CDS server.
- In each configuration, the Primary CDS server was the first to reach 100 percent CPU utilization, except as noted by an *.
- If the DCE Security PE_SITE (described earlier) is not used, subtract an additional 15 percent from the CDS lookups per second.

CDS Performance with CDS Client Cache Refresh

Figure 5 reflects a CDS population of 1,000 CDS objects and directories. For each additional 1,000 entries, subtract 2 percent from the CDS lookups per second.

For a stand-alone primary CDS server:

- Figure 5 shows the maximum CDS lookups per second for the five CDS server machine types tested. (The total height of the center bar of the "cactus" is the throughput for this configuration.)

For a primary CDS server with three 486-66 MHz secondary servers:

- The right branch of the "cactus" in Figure 5 shows the performance increase when three 486-66 MHz secondary servers are added to the primary CDS server.
- In the RISC System/6000 Models 570 and 580 tests, the three secondary CDS servers constituted the bottleneck. This bottleneck can be relieved by either adding more replicas or changing to faster replicas. The CDS lookup requests are randomly distributed among all CDS primary and secondary servers. Therefore, if there is a great difference in horsepower, this type of bottleneck might occur. A test described later (in Figure 7) with eight CDS secondary servers demonstrates how adding more replicas can distribute the load across more low-horsepower servers.

For a primary CDS server with one RISC System/6000 Model 990 secondary server:

- The left branch of the "cactus" in Figure 5 shows the performance increase when one RISC System/6000 Model 990 secondary server is added to the primary CDS server. This configuration demonstrates that having a single high-horsepower CDS secondary can be less effective than having more replicas to distribute the randomly assigned workload.
- For the 486-66 MHz and the Pentium 90 primary CDS servers, the single RISC System/6000 Model 990 secondary did not do as well as the three 486-66 MHz secondaries. This is due to the random distribution–half the requests caused the primary CDS server to reach 100 percent, while the 990 was underutilized.
- In the RISC System/6000 Model 570 test, the single 990 looks much better, at nearly twice the stand-alone, as expected. Remember that the three 486-66 MHz secondaries were the bottleneck in these two configurations.

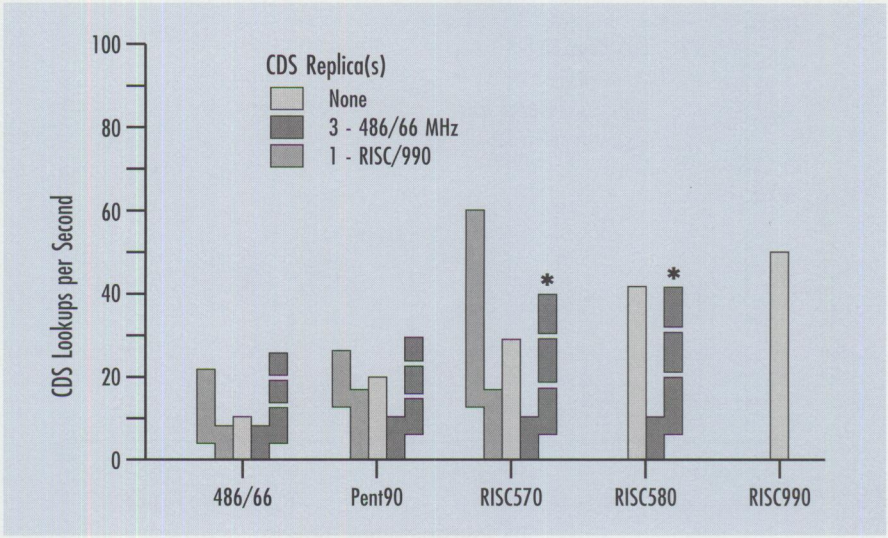


Figure 5. Performance with CDS Client Cache Refresh

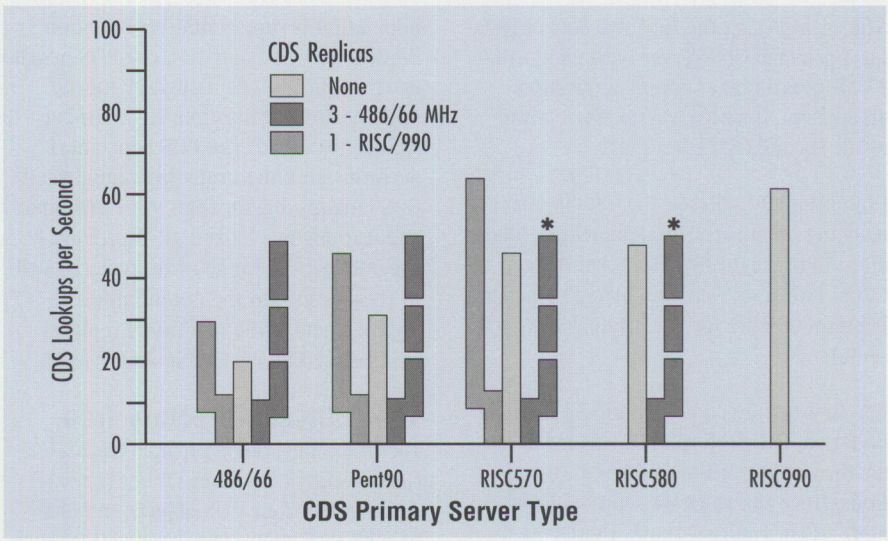


Figure 6. Performance without CDS Client Cache Refresh

CDS Performance without CDS Client Cache Refresh

For each additional 1,000 CDS entries, subtract only 1 percent from the CDS lookups per second. There is less degradation for additional entries than in the "with CDS refresh" case.

Figure 6 shows the performance of the same configurations shown in Figure 5. The difference is that the clients are allowed to use their local CDS client cache.

The above comments for Figure 5 also apply to the configurations shown in Figure 6.

Since there is less interaction with the CDS servers when the CDS client cache is not refreshed, each configuration's performance is higher. In real life, there will be a mixture of lookups with and without refreshing the CDS client cache; therefore, the correct answer lies somewhere in between.

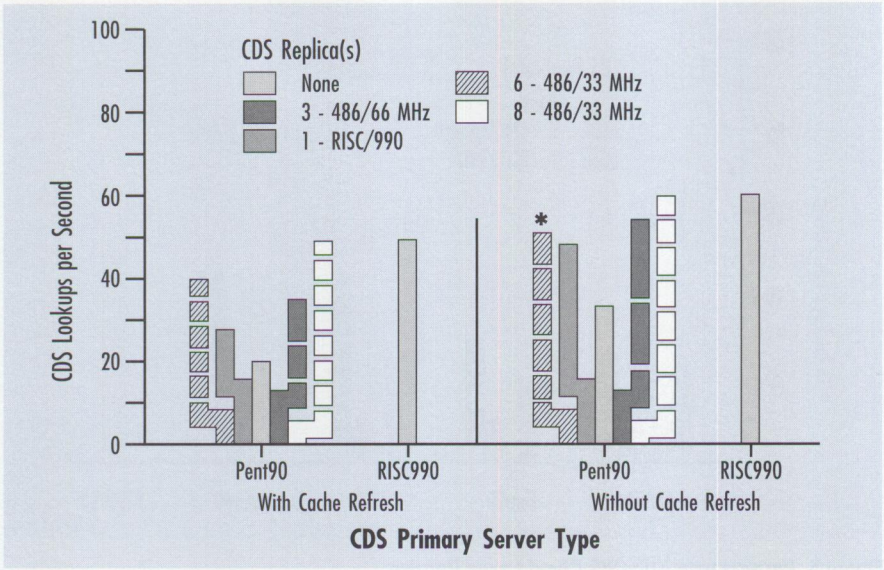


Figure 7. Performance with Eight CDS Secondary Servers

After completing the first two sets of tests for a primary CDS server with eight 486-33 MHz secondary servers, a question arose about quantity versus horsepower of the secondary CDS servers.

I intentionally selected the 486-33 MHz machine for this test to demonstrate that more CPUs might be better than bigger CPUs. Two tests were conducted using the Pentium 90 MHz for the primary CDS server.

The first test was with six 486-33 MHz secondaries. The performance was much better than either of the earlier configurations, since the work was spread across more CPUs. Figure 7 shows there was noticeably more benefit with cache refresh than without cache refresh.

The second test was with eight 486-33 MHz secondary (replica) servers. This configuration's performance is equivalent to the stand-alone RISC System/6000 Model 990, also shown in Figure 7.

Results from the six and eight CDS secondary server tests indicate that more is better. Adding more CDS replicas to absorb additional workload and CDS namespace population will increase the DCE cell's performance and capacity limits.

Satisfying CDS Lookup Needs

Since BigCo did not provide specific requirements for object and directory populations and performance objectives, I can only conclude from the populations of other LAN Server customers that BigCo's population is representative. Based on BigCo's network statistics, our POS benchmark application generated about the same network utilization, suggesting a similar workload. The POS benchmark performs an unnaturally high number of CDS lookups, higher than other customer applications I've looked at. Therefore, I suggest that the range of results achieved in these tests and the potential for improvement using additional replicas will satisfy BigCo's CDS lookup needs.

The /.:/hosts Directory Tree

The DCE configuration program creates one CDS directory (`/.:/hosts/<hostname>`) and three or four CDS objects on behalf of each DCE client. In a large system such as BigCo, this will require an additional 150 to 180 MB of disk space for the CDS namespace. The `/.:/hosts` directory is created when the primary CDS server is configured and is located by default on the primary CDS server. Due to the namespace disk requirement and potential degradation in CDS lookup performance, it is desirable to move this directory to a dedicated CDS secondary server.

The `/.:/hosts` directory entries are accessed during DCE initialization and by some of the management tools such as the DCE graphical user interface (GUI) configuration tools. Otherwise, there is very little access to this directory tree. Since the performance of this replica is not critical, the memory size on this server need not be large enough to contain the full namespace database.

Immediately after creating my DCE test cell, I deleted the `/.:/hosts` tree from the primary CDS server and re-created it on a replica. I continued configuring the other servers and clients. No other directories or objects were replicated on this secondary server.

For a 10,000-client DCE cell, I recommend 1 GB of disk space for the `/.:/hosts` directory and OS/2 `SWAPPER.DAT` file. The `SWAPPER.DAT` file can grow to three times the size of the local CDS namespace. During periodic CDS server daemon maintenance, the CDS namespace files can occupy up to 2.5 times the actual size of the namespace.

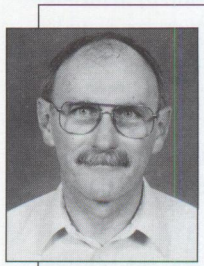
The existence of `/.:/hosts/<hostname>` and its objects is a dependency of all OSF DCE platforms. Furthermore, the literal CDS path name is hard-coded in the OSF source and cannot be distributed across multiple replicas without causing a compatibility problem with other DCE platforms.

High Performance with Ample Capacity

The DCE services supporting OS/2 Warp Server can support workloads consistent with BigCo's security and directory needs.

Through replication, DCE Cell Directory Services' scalability can support populations and arrival rates well above the levels measured in this study.

IBM's OS/2 Warp Server with DSS will exploit DCE technology; it is a large step forward in consolidating administration and interoperability in large enterprise environments.



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Plug and Play in PC DOS 7

Plug and Play technology lets you install and configure peripheral devices in a computer system. This article first covers Plug and Play components, then details how PC DOS 7 implements Plug and Play support.

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IBM Corporation
Boca Raton, Florida

Configuring a device in a computer can be a complicated task. Installing a card can be a time-consuming, technical process. You might have to configure the system by setting hardware jumpers to rearrange interrupt request (IRQ) lines, direct memory access (DMA) channels, base I/O, memory address space, and communication ports. In addition to making these manual changes to the hardware, you might also have to edit system software files. Mobile systems, in particular, demand greater hardware and software integration in order to dynamically insert and remove devices and docking support.

To address these problems, the Plug and Play (PnP) architecture has been defined by a group of companies including Compaq, Intel, Microsoft, and Phoenix Technologies. Plug and Play defines a way for peripherals to communicate with a machine's BIOS and operating system and to resolve resource conflicts with little user intervention. You don't need to be concerned about DMAs and IRQs; device installation is automatic–just plug the device in, turn on the system, and it works.

Architecture and Components Overview

Figure 1 shows the general structure of the Plug and Play architecture.

Plug and Play BIOS

System BIOS addresses two key areas to furnish plug and play capabilities: resource management and runtime configuration.

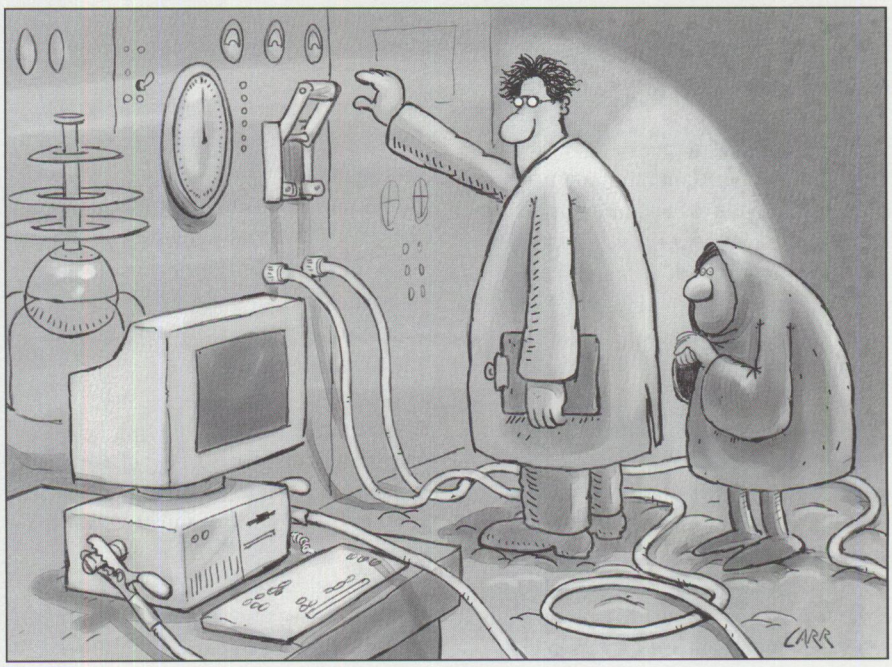
Resource management provides the ability to manage system resources, which include direct memory access, interrupt request lines, and I/O and memory addresses. After the power-on self-test (POST) process ends, the BIOS, which maintains a list of system board device configuration information, communicates this information to the operating system. Each device is associated with a unique identification code that the operating system recognizes.

The BIOS also provides configuration services, known as runtime services, for system board devices even after the POST process is complete. The BIOS must be able to notify the operating system of dynamic configuration events, such as removing or inserting a PCMCIA card or docking and undocking a notebook in a docking station. The Plug and Play BIOS specification provides a mechanism whereby a Plug and Play operating system can allocate resources during runtime.

Plug and Play Operating System

To provide complete Plug and Play functionality, the operating system requires the following components:

- *Configuration manager*–The configuration manager is the software that controls the configuration process and



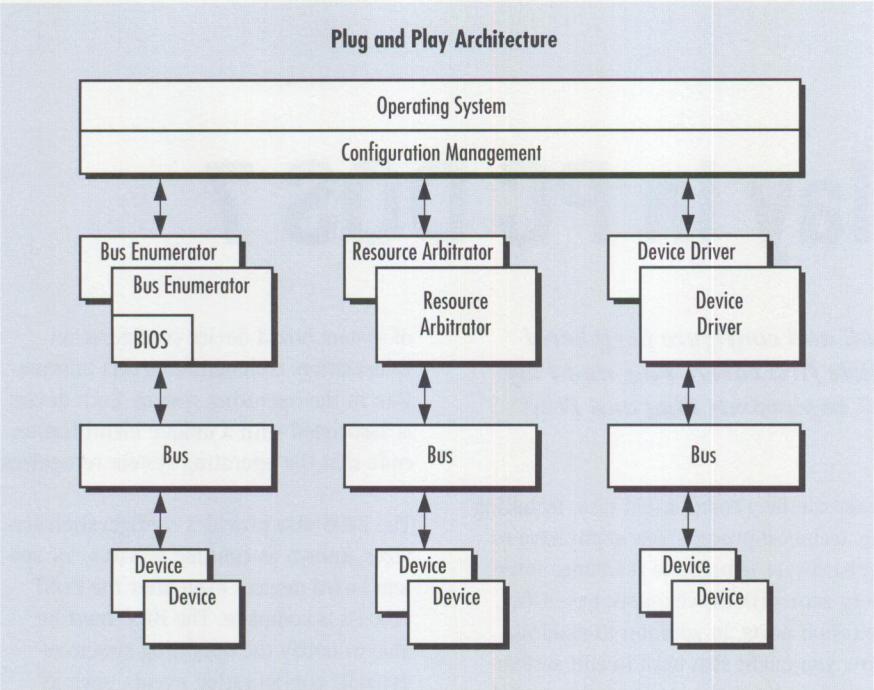


Figure 1. Plug and Play Components

communicates with all components involved in that process.

- *Hardware tree*–The hardware tree contains a database of information used to configure the system.
- *Bus enumerators*–The bus enumerator identifies all the devices on a particular bus and their resource requirements.
- *Resource arbitrators*–The resource arbitrator allocates resources among all devices.

Each of these components is now discussed in turn.

Configuration Manager

The configuration manager starts the configuration process upon receiving either the system board device configuration list from the BIOS or a notification of a dynamic configuration event from either the BIOS or from one of the bus enumerators.

To establish a working configuration for the system, the configuration manager coordinates the communication among the bus enumerators, hardware tree, device drivers, and resource arbitrators. For each device, the configuration manager loads a driver and instructs it to await assignment of specific resources. In case of a conflict, the configuration manager performs an interactive process of reconfiguration until a working configuration is determined. The configuration manager also informs the device drivers and applications of any pending or present changes in the system layout.

Hardware Tree

A record of the current system configuration, known as the *hardware tree*, is stored in the random access memory. This record is created every time the system boots or a runtime change occurs to the system configuration.

A central database, from which the tree information is drawn, contains configuration information for all devices, whether or not they are currently installed. From the central database, applications and drivers can get the information about alternate configurations, software required to operate these devices, and user-defined settings.

Bus Enumerators

The bus enumerator is a type of driver required for each specific bus type and is responsible for building the hardware tree.

A bus enumerator identifies the devices on that bus by assigning a unique identification code to each device. It also reads the devices' resource requirements, retrieves the device configuration information either directly from the device or from the central database, and configures the devices as instructed by the configuration manager.

Resource Arbitrator

The resource arbitrator allocates specific types of resources to devices and resolves conflicts between devices that request identical resource assignments. The resource arbitrator interacts with the configuration manager by assigning resources both at system startup and during dynamic configuration events.

Device Drivers

Plug and Play device drivers register with the configuration manager when they are initially loaded. They remain inactive until they are given their resource assignments; then they are able to communicate with applications and respond to dynamic configuration events.

Plug and Play SCSI

Plug and Play small computer system interface (SCSI) host adapters will configure like any other board, but configuring the individual devices on the SCSI chain requires an extension to the basic Plug and Play scheme.

Microsoft and SCSI adapter vendors have collaborated to produce such an extension, which is called SCSI Configuration Auto Magically (SCAM). SCAM requires additional firmware on SCSI adapters and devices. During the boot process, a SCAM-compliant SCSI subsystem allocates SCSI addresses to avoid conflicts. SCAM also handles SCSI termination (indicating which devices are at the ends of the SCSI chain). Older, non-SCAM-compliant devices still must be configured with software updated to handle SCAM devices.

Plug and Play ISA

The Plug and Play industry standard architecture (ISA) specification, developed jointly by Intel and Microsoft, allows software configuration of add-on ISA boards, eliminating the need for hardware jumpers or DIP switches.

Plug and Play ISA boards have unique 72-bit serial IDs that differentiate one PnP ISA board from another. The serial ID contains a manufacturer ID, a product ID, and a serial number.

Interrupt Function	Description	Called with	Returns
INT 2Fh Function 2000h Check DOSDOCK Installation	This function allows the caller to determine whether the DOSDOCK program is resident.	AX = 2000h	AL = 00h DOSDOCK program not installed AL = FFh DOSDOCK program resident
INT 2F Function 2001h Get Docking Event	This function allows the caller to determine if a docking event has occurred. An application can use this interrupt to determine if a docking event has occurred, rather than polling the PnP BIOS. After making this call, the event flag is reset to 0.	AX = 2001h	AL = 00h no event AL = 01h docking event occurred AL = 21h undocking event occurred
INT 2F Function 2002h Get Current Dock Status	This function returns the current dock state (docked or undocked). An application can use this interrupt to determine the current dock state of the machine. When a docking or undocking event occurs, this flag is modified to the new dock state.	AX = 2002h	AL = 00h machine is not docked AL = 01h machine is docked

Figure 2. PC DOS 7 APIs for Docking Support

PnP ISA boards are placed in an isolation state during power-up. The PnP ISA boards arbitrate for the bus, and the board with the largest ID wins. Once a PnP ISA board has won isolation, the other PnP ISA boards drop off.

The system then assigns a card select number (CSN) to the newly isolated board. The CSN is used to single out individual boards later, without performing the isolation sequence again. Once a board has been assigned a CSN, it no longer participates in the isolation sequence, and isolation of PnP ISA boards with lower serial IDs proceeds.

Backward Compatibility

The Plug and Play architecture must provide compatibility with the installed base of existing (non-PnP) systems and peripherals. PnP components must be able to accommodate the lack of device-reporting mechanisms for non-PnP devices. Information about such devices must be stored in the system, and devices that cannot be software-configured must receive first priority in resource allocation. When unresolvable conflicts occur, the system should guide you through device-configuration options.

Plug and Play devices will work on current systems that do not have either a Plug and Play BIOS or a Plug and Play operating system. A configuration utility separate from the operating system must be installed. When the Plug and Play device and its new driver are installed, the system will be able to automatically configure the new device.

Plug and Play Support in PC DOS 7

The rest of this article details Plug and Play support in PC DOS 7.

Docking Support

Docking is the process of connecting a mobile computer to a docking station and subsequently accessing the additional docking station system resources such as CD-ROMs and hard disks. *Undocking* is the process of disconnecting the mobile computer from the docking station. To perform docking and undocking events, both the docking station and the mobile computer must be Plug and Play-enabled.

PC DOS 7 provides cold, warm, and hot docking support for mobile users who have Plug and Play-enabled hardware. Depending on what is connected to the docking station, PC DOS 7 docking support may eliminate the need to reboot the docking station when the mobile PC is docked.

In *cold* docking, the system must be rebooted when a mobile PC is docked so that it can recognize its newly associated peripherals. PC DOS 7's cold docking support is enhanced with the multi-configuration support implemented in PC DOS 6.x.

During *warm* docking a mobile PC is in a suspended state, and many, if not all, of the associated peripherals are recognized and activated.

In *hot* docking, a mobile PC is fully active when docked, and many, if not all, peripherals are recognized and activated.

DOSDOCK

The DOSDOCK utility enables mobile computer users to use either hot or warm docking. Executed at the DOS command line, the DOSDOCK utility loads and remains resident, waiting for a docking or undocking event. When the event occurs, DOSDOCK examines the environment for the parameters and (depending upon the plug and play interrupt received) tells DOS to dock or undock.

Docking support cannot be activated while running Windows. However, PC DOS 7 notifies you, in a pop-up Windows message, that you must shut down Windows to allow DOSDOCK to begin.

INT 2Fh API

To provide communication between the PC DOS 7 docking support programs,

some new multiplex interrupt functions are defined. The application programming interfaces (APIs) in Figure 2 are defined and used for docking support in PC DOS 7.

DYNALOAD

The DYNALOAD command allows you to dynamically load a device driver from the DOS command prompt without modifying the `CONFIG.SYS` file and restarting the computer. The DYNALOAD utility does not run under Windows virtual DOS machine (VDM) mode or while a task swapper is active.

The PC DOS 7 *Command Reference* lists the drivers shipped with PC DOS 7 that are supported by DYNALOAD. However, DYNALOAD may work with other device drivers. Because there are no standards for loading DOS device drivers after the `CONFIG.SYS` file is processed, the only way to know if DYNALOAD works with a particular device driver is to try loading that driver. If it is not compatible, you will get an error message.

DYNALOAD cannot load block device drivers or drivers that require DOS system initialization or execution via the `CONFIG.SYS` file.

DDPOPUP

The DDPOPUP program provides DOS docking support under Windows. When Windows is running and DOSDOCK is loaded, a pop-up Windows message notifies you that the dock or undock event has occurred and instructs you to shut down Windows to allow DOSDOCK to function.

DDPOPUP uses the standard Windows user interface to display the pop-up message under Windows. The DDPOPUP program executes as a command-line parameter passed to Windows through the Windows Startup group or by executing it via the RUN option.

Hardware Requirements

To provide complete Plug and Play functionality, a system must incorporate all three Plug and Play system components: BIOS (motherboard), devices (buses), and operating system. However, partial Plug and Play functionality can be provided in systems that include one or two of these components.

Plug and Play expansion cards require a special programmable logic device (PLD) or modifications to an existing application-specific integrated circuit (ASIC) to support basic handshaking functions. The PLD or ASIC lets the device communicate a unique identification number and list the resources it requires and can support.

The major incremental benefit of having a system with complete Plug and Play components is the ability of that system to dynamically respond to configuration events.

Future of Plug and Play

The goal of Plug and Play architecture is to easily install and configure new devices. With a PnP system, inserting and removing certain devices such as PCMCIA cards or connecting and disconnecting from a docking station is simplified without restarting the system.

Plug and Play will eventually provide a mechanism for hardware to communicate configuration changes to device drivers and then to application software. Forcing a notebook computer to save a file before it is removed from a docking station is an example of this capability.

Plug and Play shows great potential. It is compatible with existing hardware, and if all the pieces come together in the future, expanding your system may indeed become as simple as plugging in a card and turning on the machine.

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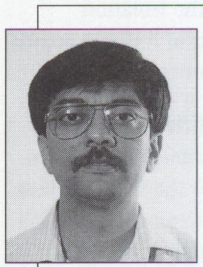

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Questions and Answers

I have 23 LAN Server domain controllers running LAN Server 3.0 Advanced without 386HPFS installed. The hard drives have been formatted as HPFS partitions. I want to add 386HPFS and keep the DCDB intact. I attempted to follow the instructions in the *Network Administrator Reference* but have not had complete success. Please give me detailed instructions on the sequence of tasks I need to perform.

To add 386HPFS support, perform the following seven steps:

1. Open the LAN Services folder from your desktop.
2. Start the OS/2 LAN Services Installation/Configuration utility.
3. Choose the Advanced installation path.
4. Choose to Install or Configure Workstation.
5. Select the type of machine (DC, AS, or BDC).
6. Select to Install or Remove a Component.
7. Select 386HPFS from the list, then click on the Install button.

This is all you need to do to install 386HPFS on your server.

I have Compaq SMP computers, and I want to evaluate LAN Server 4.0 for SMP. Can I simply install OS/2 Warp before LAN Server, or do I need OS/2 SMP 2.11? Is LAN Server SMP-enabled without OS/2?

To take advantage of SMP, you will need to install the OS/2 SMP 2.11 operating system. LAN Server is not SMP-enabled without OS/2 SMP.

The following information from a LAN Server 4.0 white paper may be helpful to you.

"LAN Server 4.0 has been tested with and shown to support symmetric multi-processor (SMP) machines running under OS/2 for SMP. LAN Server 4.0 Advanced does not gain additional performance benefits from SMP machines. Its architecture has been optimized to the point where most requests are processed 'on interrupt' when received from the network component. The queuing time for a request to be processed is usually extremely short, since there are rarely instances when a file/print server's CPU approaches 100 percent utilization. Under these conditions, it would not be expected that an additional CPU would improve response time to the requester.

"There are some situations in which LAN Server 4.0 support of SMP does lead to an improvement in total system throughput performance. Since OS/2 is a multitasking operating system, other applications can run on the same machine as LAN Server. For other applications which make extensive use of the CPU (e.g., Lotus Notes), additional processors may make sense. Whenever the CPU workload approaches 100 percent, the additional processor can make a significant difference in the system throughput. LAN Server 4.0 Advanced accommodates the use of the additional processor unless its own workload is unusually high, in which case it takes precedence over other applications. LAN Server 4.0 Entry runs with the same privilege as other OS/2 applications and does not take precedence in an SMP environment."

We are running OS/2 2.11 and are using 386HPFS with LAN Server 3.0 Advanced. I would like to know how LAN Server handles access control profiles, where this information is stored, and how it gets there.

An individual access control profile is created for each resource that is protected. Each access control profile defines the users and groups that have been granted access to the resource, as well as the access permissions. All of the access control profiles make up the access control list. This list is continually updated as access control profiles are added, deleted, or modified.

In the File Allocation Table (FAT) file system and in High-Performance File System (HPFS) on LAN Server 3.0 Entry, the access control information is stored in the `NET.ACC` file. In LAN Server 3.0 Advanced (with 386HPFS), the access control list is stored as part of the file system. This means:

- Every file or directory on an HPFS volume is anchored on a fundamental file system object called `Fnode`. The `Fnode` is the first sector allocated to a file or directory.
- Each `Fnode` contains control and access history information used internally by the file system.
- The `Fnode` contains allocation information for the access control list.

I have several questions about setting passwords on LAN Server 3.0. If the `/MINPWAGE` parameter is set to a value of 1 or higher with the `NET ACCOUNTS` command, can the system administrator, with an administrator ID, change a user password at any time? As an example, can the administrator change any password soon after the user changes it in the event the user forgets the new password?

Does the `/MAXPWAGE` count cause administrator IDs to expire as well as user IDs?

Can the default guest user ID be given a password and be treated like any other user ID?

An administrator can change any user's password at any time.

The `MAXPWAGE` parameter also applies to the administrator's IDs. The `MINPWAGE`

parameter applies only to users trying to change their own password, whereas MAXPWAGE applies to all passwords on the domain.

The purpose of the guest ID is to allow users to connect to resources on any number of servers (both in and outside the user's domain). For users to log on to a server in another domain, they must have the same ID and password that they have on their logon domain, or they can access that resource as a guest (assuming that the guest account has access to the requested resource). Assigning a password to the guest ID would defeat the purpose of having the guest ID. If, for security reasons, you are required to have passwords for all IDs, it is probably wise to delete the guest ID and create identical IDs and passwords for users who need to access resources on multiple domains.

I have an OS/2 LAN Server 4.0 Entry server with LAN Distance attached to remote OS/2 Warp requesters. What is the impact on the active, logged-on requesters when the server unexpectedly goes down? In particular, after the server comes back up, will the requesters have to log on again to re-establish their LAN Server sessions?

When a requester performs an OS/2 shutdown (without logging off LAN Distance first), will the user automatically be logged off the LAN Server domain?

If the server unexpectedly goes down, the users will not be logged off; however, the resources that they are using will be disconnected. They can reconnect to those resources when the server comes back up. The LAN Distance users will need to redial to re-establish the LAN Distance connection once the server is back up.

Users who don't log off prior to shutting down their computers will be automatically logged off when the server notices that the workstation is no longer on the ring. When they restart their computers, they will be prompted to log on.

Does LAN Server 4.0 give any type of disk limit notification? For example, if I have a disk limit of 10 MB on a subdirectory, will I receive an alert when it's 80 percent full? Can both the user and the administrator receive the alert? Can the alert be received at both the OS/2 and DOS requesters?

Yes, LAN Server does provide disk full messages. You can specify a threshold limit of, for example, 80 percent, which can generate an alert when the disk is 80 percent full. You can specify all the IDs to which the alert is sent, so that both users and administrators will receive the message. Both OS/2 and DOS requesters can receive the alert. For more information, read chapter 6 of the *Network Administrator's Reference Volume 3: Network Administrator Tasks* (S10H-9682).

Does LAN Distance support the internal modem that comes in the new IBM ThinkPad 755CX?

Yes, LAN Distance supports the internal modem that comes in the ThinkPad 755. To use this modem with LAN Distance, however, you will need to perform the following steps:

For OS/2 2.11 and LAN Distance:

1. Install OS/2 2.11.
2. Install MMPM for OS/2 (*Note*: Install only the Software Motion Video feature.) Shut down and reboot.
3. From an OS/2 window or full screen (on this and all subsequent steps), run `a:setup` from Diskette 1 of the MWAVE for OS/2 diskettes to install MWAVE for OS/2. Shut down and reboot.
4. Run `a:setup` from Diskette 3 of the MWAVE for OS/2 diskettes to install the MMPM extensions for OS/2. Shut down and reboot.
5. Run `ddinstal` from the `OS2\install` directory with the ThinkPad 755CE/CD utility disk in drive `A:`. Select Install to install the ThinkPad System Management Device Driver. Shut down and reboot.
6. Edit the `CONFIG.SYS` file to change the following:

   ```
   DEVICE=C:\OS2\COM.SYS (2,2F8,3)
   ```

   The `2,2F8,3` parameter is necessary for OS/2's COM driver to recognize the DSP modem, which is normally COM2.
7. Install LAN Distance, but do not configure the port or mode.
8. Copy `WINDSURF.PIF` to `TPMWAVE.PIF`, edit `TPMWAFE.PIF` to change `WINDSURF` to `TPMWAVE`, change the Title to differentiate this new PIF from the `WINDSURF.PIF`, then add `PCMCIA = YES` as a new line after the title line.

   ```
   [TPMWAVE]
   DLL = WCLVPCM
   Entry = StartVPCM
   Autostart = YES
   PIF = TPMWAVE.PIF
   Title = "IBM MWave TP755 14400
    Modem"
   PCMCIA = YES
   ```

   Note: This is a temporary workaround until we determine why LAN Distance is not able to recognize the COM port where the `WCLCPMAC.OS2` file is loaded.
9. Click on the LAN Distance Settings notebook, define COM2 as a port, and assign the TPMWAVE modem type to COM2. Shut down and reboot.
10. Turn on the MWAVE modem by double-clicking on the MWAVE Modem icon. Then start LAN Distance and dial the modem.

For OS/2 Warp and LAN Distance:

1. Install OS/2 Warp (MMPM installs automatically).
2. Follow steps 3 through 5 above.
3. Apply the MWAVE CSD for Warp and download the `THKPDWP1.EXE` disk image from the PC Company BBS at (919) 517-0001.

We have been using LAN Server 4.0 for about two months and have noticed that the graphical user interface (GUI) doesn't display the domain users in alphabetical order, making it very hard to find a particular user. Is there any way that we can make the default display in alphabetical order?

Yes, you can change the view so that it always maintains a sorted order. Open the Settings folder for the User Accounts folder in the GUI under the domain that you want to change. Click on the Sort tab, then click on "Always maintain sort order." This will make the User Accounts folder always display the users in alphabetical order.

Corrective Service Information

Figure 1 shows maintenance release levels for the listed products. This information is effective as of October 6, 1995. CSDs may have been updated since press time.

To order all service packages–except for the OS/2 2.0, OS/2 2.1, OS/2 2.1 for Windows, and OS/2 2.0 Toolkit ServicePaks–call IBM Software Solution Services at (800) 992-4777. For the OS/2 2.0 ServicePak (XR06100), OS/2 2.1 ServicePak (XR06200), OS/2 2.1 for Windows ServicePak (XR06300), 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)**: In Software Library, 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 IBMOS2 IBM DF2).
- **Internet**: Do an anonymous FTP from `ps.boulder.ibm.com` at `/ps/products/`. TCP/IP packages are located at `software.raleigh.ibm.com` at `OS2\V20`.

–Arnie Johnson, IBM Corporation, Austin, Texas

Product/Component	Release	CSD Level	PTF Number	Change Date	Comments
OS/2 Standard Edition	1.3	XR05150	XR05150	02-10-93	
OS/2 Extended Edition	1.3	WR05200	WR05200	05-12-93	WR05200 replaces WR05050, which can no longer be ordered on diskette
OS/2	2.0	XR06100	XR06100	09-01-93	XR06100 replaces XR06055.
OS/2 2.10 ServicePak	2.1	XR06200	XR06200	03-01-94	This package is not for OS/2 2.1 for Windows.
OS/2 2.11 for Windows ServicePak	2.11	XR06300	XR06300	05-24-94	
OS/2 Toolkit	2.0	XR06110	XR06110	09-01-93	
	1.3	XR05053	XR05053	03-23-92	
OS/2 LAN Server/Requester ServicePak	2.0	IP06030	IP06030	04-25-93	
OS/2 LAN Server/Requester ServicePak	3.0	IP07060	IP07060	05-10-95	Supersedes IP07045.
IBM LAN Server/Requester OS/2 Warp Connect LS 4.0 ServicePak	4.00	IP08150	IP08150	9-29-95	Supersedes the following LS 4.0 FixPaks: IP08003, IP08005, IP08011, IP08012, IP08036, IP08037, IP08038, IP08039, IP08040, IP08041, and IP08042.
OS/2 Extended Services Database Manager ServicePak	1.0	WR06035	WR06035	11-18-93	Supersedes WR06001, WR06002, WR06003, WR06004, WR06014, and WR06015.
DB2/2 SelectPak	1.0	WR07030	WR07030	02-26-95	
DDCS/2 ServicePak	2.0	WR07031	WR07031	02-06-95	
Database Manager DB2/2	1.2	WR07047	WR07047	06-06-95	
DDCS/2	2.0	WR07046	WR07046	06-06-95	
Client Application Enabler/2 (CAE/2)	1.2	WR07043	WR07043	06-06-95	
Software Developers Kit/2 (SDK/2)	1.2	WR07048	WR07048	06-06-95	
Extended Services Comm Mgr ServicePak	1.0	WR06025	WR06025	11-29-93	
System Performance Monitor (SPM/2) ServicePak	2.0	WR06075	WR06075	12-10-93	

Figure 1. Maintenance Release Levels **(continued on next page)**

Product/Component	Release	CSD Level	PTF Number	Change Date	Comments
LAN Distance ServicePak	1.1	IP07050	IP07050	10-18-94	
OS/2 Network Transport Services/2 SelectPak	2.00	WR07060	WR07060	05-10-95	Must be LAPS 2.11 or above. If not, order WR07045 first.
OS/2 LAN Adapter and Protocol Support SelectPak	2.20.2	WR07060	WR07060	05-10-95	Must be LAPS 2.11 or above. If not, order WR07045 first.
Communications Manager/2 Version 1.01 ServicePak	1.01	WR06050	WR06050	06-11-93	Available only on diskette.
CM/2 Version 1.11 ServicePak	1.11	WR06150	WR06150	05-31-94	Available on diskette and CD-ROM.
DOS	4.0, 4.01	UR35284	UR35284	09-26-91	
	5.0	UR37387	UR37387	09-22-92	
C Set/2 Compiler	1.0	CS00050	XR06150	06-29-93	
C Set C++ Compiler	2.0/2.01	CTC0002	XR06102	12-15-93	
C Set C++ Compiler	2.0/2.01	CTC0010	XR06190	09-15-94	
C Set C++ Utilities	2.01	CTM0006	XR06196	09-15-94	
C Set C++ Utilities	2.00	CTL0007	XR06197	09-15-94	
TCP/IP for OS/2 Base and Application Kit	2.0	UN64092	UN64092	08-24-94	
TCP/IP for OS/2 DOS Access	2.0	UN57546	UN57546	08-24-94	
TCP/IP for OS/2 Extended Networking	2.0	UN60005	UN60005	06-21-94	
TCP/IP for OS/2 Programmer's Toolkit	2.0	UN57887	UN57887	06-21-94	
TCP/IP for OS/2 Domain Name Server	2.0	UN60004	UN60004	08-24-94	
TCP/IP for OS/2 Network File System	2.0	UN57064	UN57064	06-21-94	
TCP/IP for OS/2 X-Windows Server	2.0	UN68122	UN68122	01-20-95	
TCP/IP for OS/2 X-Windows Client	2.0	UN59347	UN59374	08-24-94	

Figure 1. Maintenance Release Levels

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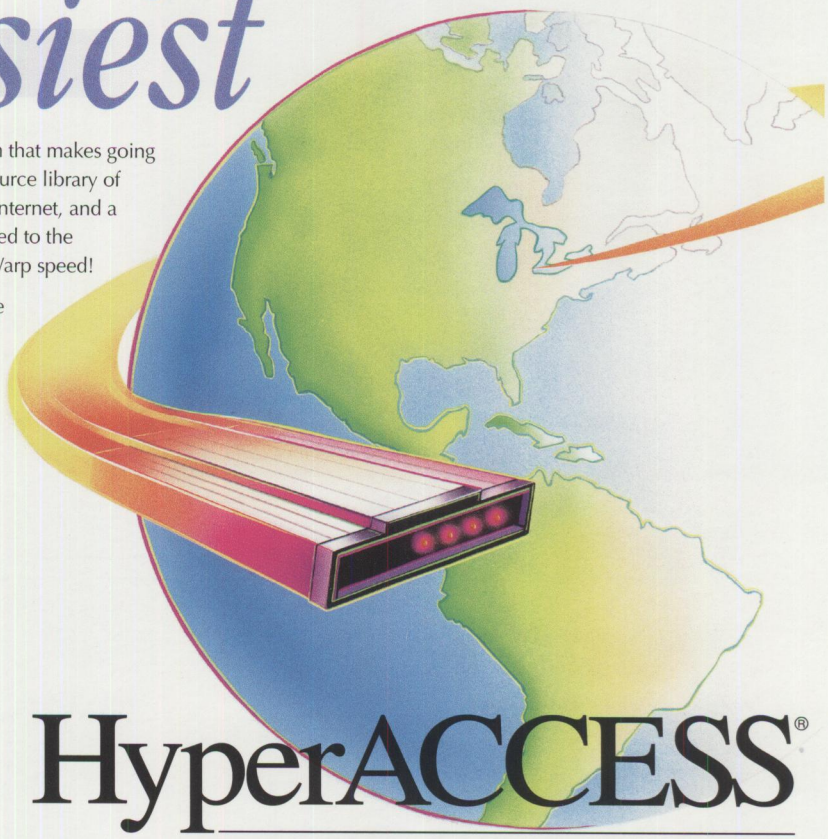

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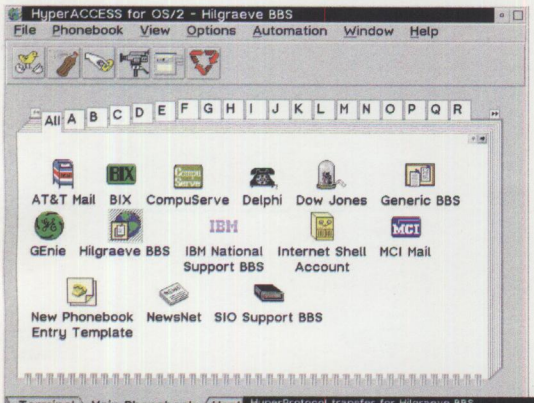

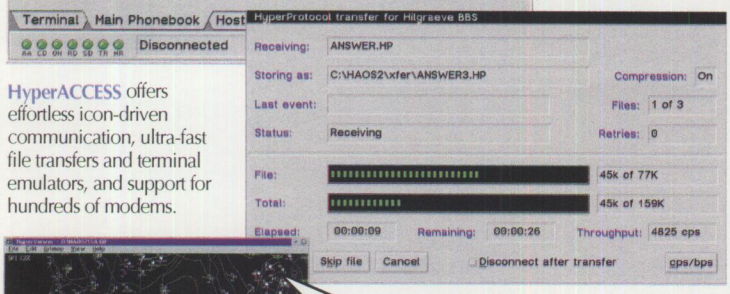

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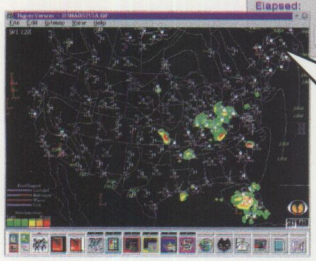

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